Climate Change Evaluation – Upper Missouri River Basin Mountain Snowpack - Accumulation and Runoff

Final Report
July 2014

Sun River in the Upper Missouri River Basin, Montana photo by Kevin Stamm

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I. Purpose and Scope

The purpose of this pilot research study was to assess the impact of climate change on mountain snowpack accumulation and runoff in the upper Missouri River Basin (Basin). The study included a sensitivity analysis of drivers associated with mountain snowpack and subsequent runoff as listed in Table 1.

Table 1. Snowpack Behaviors and Climatological Drivers

Snowpack Behaviors	Climatological Drivers
- date snowpack begins accumulating (DSBA) - peak SWE*(PS) - date of peak SWE (DPS) - melt rate (MR) - date of melt-out (DMO) *snow water equivalent	- precipitation - air temperature - relative humidity - soil moisture - potential evapotranspiration (evapotranspiration) - El Niño Southern Oscillation (ENSO) / North Atlantic Oscillation (NAO) climate patterns

This study is part of the fiscal year 2011 U.S. Army Corps of Engineers Responses to Climate Change Program. The Responses to Climate Change Program's purpose is to develop and begin to implement practical, nationally consistent, and cost-effective approaches and policies to reduce potential vulnerabilities to the Nation's water infrastructure resulting from climate change and variability, in partnership with other Federal science and water management agencies, and other stakeholders.

II. Research Questions

The research questions addressed by this study are: "Are snowpack behaviors changing due to changes in the means and variances of the drivers as the amount of energy stored in the atmosphere increases? If this is the case, is the upper Basin, specifically the reaches above Fort Peck and Garrison reservoirs, more susceptible to changes in the amount of runoff and runoff variability during May, June, and July (MJJ), based on climate change projections?" Specifically, the following questions were addressed for historical and projected trends:

a. Is the mountain snowpack beginning to accumulate sooner or later?
b. Is the mountain snowpack peak SWE accumulation increasing or decreasing?
c. Is the mountain snowpack peaking sooner or later?
d. Is the mountain snowpack melting faster or slower?
e. How strong and significant is the correlation between the drivers versus snowpack behavior trends and variability?
f. Is there a trend and a change in variance in MJJ runoff from mountain snowpack?

III. Limitations and Application to Missouri River Basin

This study is largely limited to discussions of mountain snowpack behavior and MJJ runoff and streamflow. Care should be taken in regards to extrapolating conclusions and findings of this study to plains snow behavior or the total annual runoff in the upper Basin. The findings of this study and statistical models cannot and should not be applied to plains snowmelt and rainfall, the other two runoff components in the upper Basin. In addition, the climate model projections used in this study only reflect a small sample of the climate projections available. As further described in this report in Section VII.E.1.b., climate model simulations of near-surface temperatures are more accurate than simulations of precipitation. Finally, the list of drivers in Table 1, while comprehensive, is not exhaustive. For example, it does not include solar radiation, which is an important driver by adding energy to the snowpack. However, due to the limited availability of historical and projected solar radiation data, and because solar radiation and air temperature are closely related, solar radiation was not included in the analysis.

IV. Study Team

The study team comprised hydraulic (civil) engineers, hydrologists, meteorologists, and climatologists from the U.S. Army Corps of Engineers, Northwestern Division Missouri River Basin Water Management Division (Corps-MRBWM), the U.S. Geological Survey South Dakota Water Science Center (USGS-SDWSC), the National Weather Service (NWS Omaha/Valley, NWS Hastings), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) National Water and Climate Center, and the State of South Dakota:

Kevin Grode, hydraulic engineer, Corps-MRBWM, study manager
Bill Doan, hydraulic engineer, Corps-MRBWM
Kevin Stamm, hydraulic engineer, Corps-MRBWM
Dr. John Stamm, hydrologist, USGS-SDWSC, Rapid City, South Dakota
Barbara Mayes Boustead, meteorologist, NWS Omaha/Valley, Nebraska
Shawn Rossi, meteorologist, NWS, Hastings, Nebraska
Tom Perkins, hydrologist, NRCS, Portland, Oregon
Dr. Dennis Todey, climatologist, South Dakota State University, Brookings, South Dakota

V. Background

The Missouri River Basin has an area of 529,000 square miles, including about 9,700 square miles located in Canada. The basin spans 29 tribal nations and 10 states (Figure 1). The Missouri River is the longest river in North America, extending 2,321 miles from Three Forks, Montana, to the mouth near St. Louis, Missouri, and 2,619 miles from the utmost source to the mouth. The Missouri River Mainstem Reservoir System (System) comprises six dams: Fort Peck, Garrison, Oahe, Big Bend, Fort Randall, and Gavins Point, which are located in Montana, North Dakota, South Dakota, and Nebraska. The System is managed by the Corps-MRBWM and is regulated using guidelines published in the Missouri River Mainstem Reservoir System Master Water Control Manual (Master Manual/ U.S. Army Corps of Engineers 2006). The combined storage capacity of the six mainstem dams, 73.1 million acre-feet (MAF), makes it the largest reservoir system in North America. The System is regulated to serve the eight

Congressionally authorized purposes of flood control, water supply, water quality control, navigation, hydroelectric power generation, irrigation, recreation, and fish and wildlife, including threatened and endangered species. This pilot research study considers mountain snowpack runoff contributed by the two uppermost reservoir reaches, Fort Peck and Garrison in the upper basin.

Figure 1. Fort Peck and Garrison reservoir reaches.

A. Mountain Snowpack

Runoff derived from the melting of mountain snowpack generally occurs from May through July. For the Fort Peck and Garrison reservoir reaches, the mountain snowpack accumulates in the mountain areas of western Montana and north central Wyoming. The runoff from these areas drains into either the Missouri River directly or major Missouri River tributaries, such as the Yellowstone River. During this 3-month period, almost half of the total annual runoff is conveyed through the System (U.S Army Corps of Engineers 2006).

B. Current Climate

Because of its mid-continent location, the Basin experiences large temperature fluctuations and extremes. Winters are relatively cloudy and cold over much of the basin, while summers are fair and hot. Temperature extremes range from winter lows of -60 degrees Fahrenheit (ºF) in Montana to summer highs of 120 ºF in the lower basin. The basin regularly experiences maximum temperatures above 105 ºF in parts of Kansas, Nebraska, and South Dakota in the summer and minimum temperatures below -30 ºF in the Rocky Mountains and on the plains of Montana and North Dakota in the winter (U.S. Army Corps of Engineers 2006).

C. Basin Runoff

The upper Basin experiences tremendous year-to-year variability in runoff. During 1898-2011, the MJJ incremental reach runoff into Fort Peck and Garrison ranged from a low of 3.4 MAF in 1919 to a high of 24.5 MAF in 2011. Since 1898, the annual runoff into the upper Basin above Sioux City, Iowa, ranged from a low of 10.7 MAF in 1931 to 61.0 MAF in 2011. Over the last 113 years, the Basin has been affected by four prolonged droughts: 1930-1941, 1954-1961, 1987-1992, and 2000-2007. In contrast to those drought periods, the basin experienced periods of extremely high runoff: 1907-1909, 1975-1978, 1993-1997, and 2008-2011. Most recently, the basin was dramatically impacted by the 2012 fast-occurring flash drought ("flash" as defined by Svoboda et al. 2002) directly following the 2011 record runoff year. This variability requires a water control plan that is very flexible for the Corps to meet its water resources mission and regulate the System to meet the operational objectives (i.e. Congressionally authorized purposes).

VI. Methodology

The methodology of this pilot study included seven major steps (A through G), designed to quantitatively compare historical trends to future climate change-affected trends of driver data statistics, while also considering ENSO and NAO climate patterns, as they relate to snowpack behaviors and MJJ runoff. Figure 2 graphically presents the seven major steps used in the analysis.

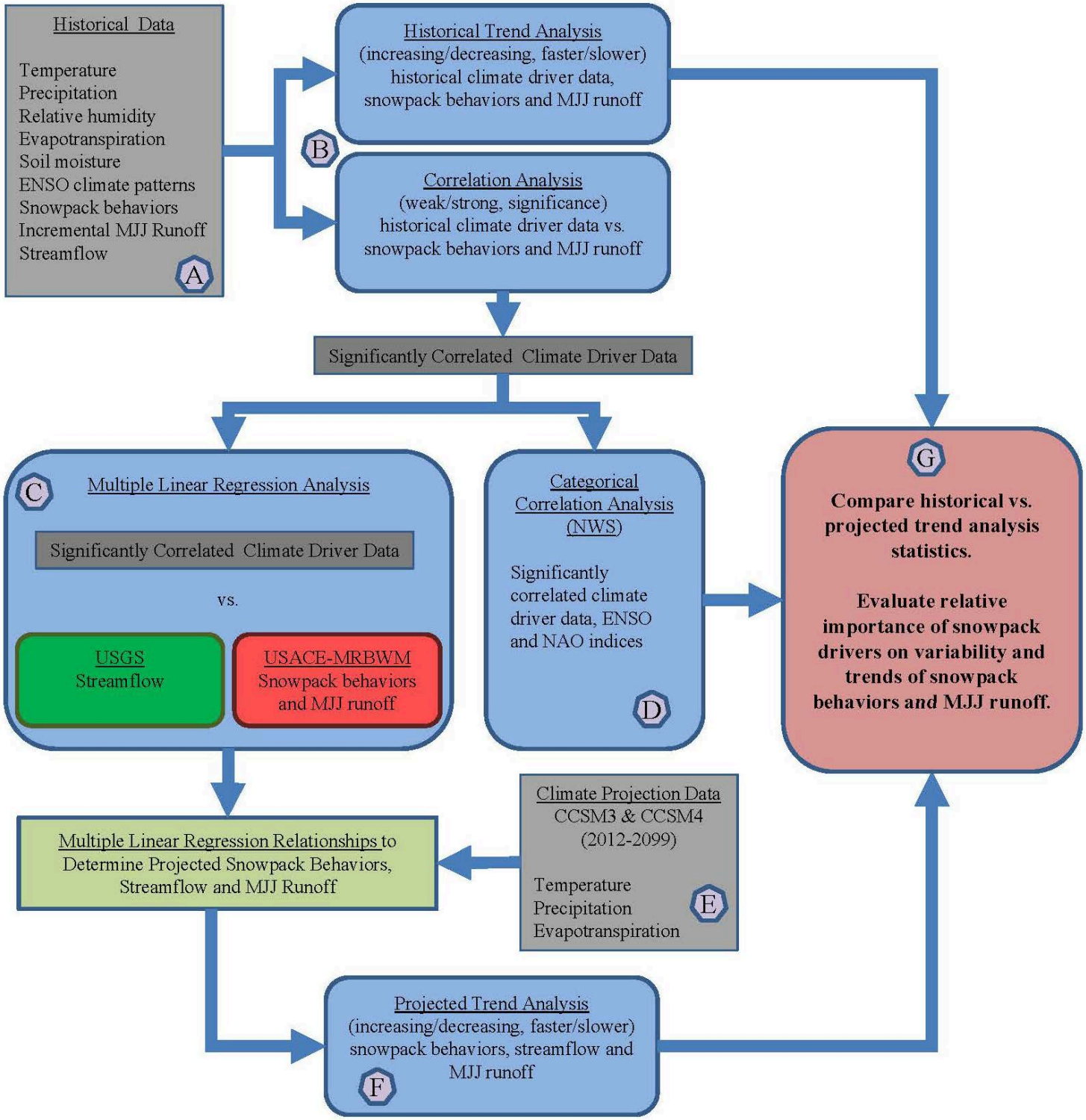


Figure 2. Flowchart of methodology.

VII. Initial Work and Findings

The seven major steps, as outlined in Section VI and Figure 2, include the development of a quantitative, statistically based model to estimate runoff and streamflow in the Fort Peck and Garrison reaches. Given empirical relations of runoff and streamflow, response to projected climate was estimated based on output from global climate models.

A. Historical Data

Figure 3 graphically represents the site locations of all station data used in the analysis. A summary listing of all available historic climate driver data is shown in Table 2, and a detailed listing is presented in Appendix A.

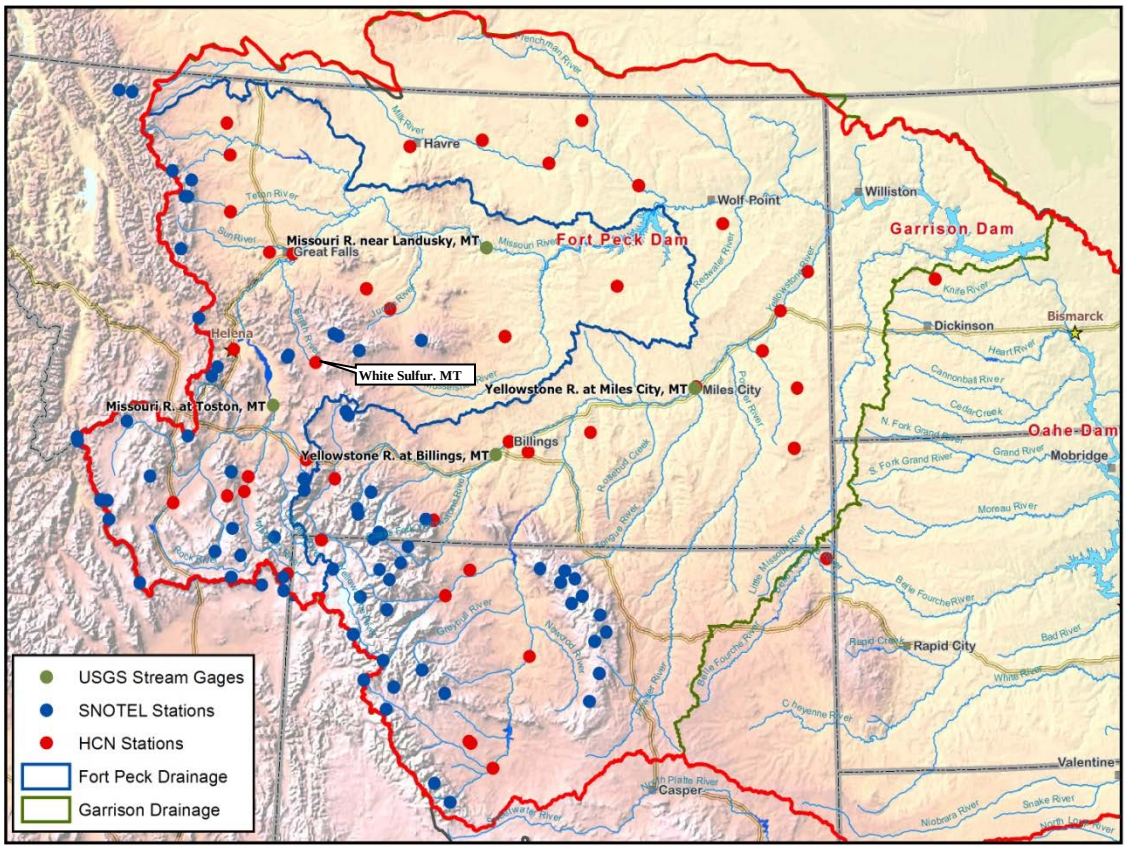


Figure 3. Historical data site locations.

1. Basin Aggregations

To evaluate relations among meteorological data, SWE, and runoff by the two reservoir basins, all data were aggregated into the two separate reservoir basins based on location of each station within the basin or close proximity to the basin. This step was necessary to simplify the analysis, since the ultimate purposes of the study were to (1) develop relations between meteorological driver data, snowpack behaviors, and runoff for the Fort Peck and Garrison reservoir reaches, and (2) project future basin SWE and runoff using climate projection datasets.

2. Elevation Stratification

The SWE, temperature, and precipitation records from NRCS SNOwpack TELemetry (SNOTEL) stations (Table A-1) were stratified by station elevation to represent orographic effects on the climatology of SNOTEL stations. Elevation stratification was used primarily for the correlation and regression analyses discussed later in this report, although not for trend analyses. Because the SNOTEL stations were somewhat uniformly located at elevations ranging from 7,000 feet above mean sea level (ft msl) and 10,000 ft msl, three station strata were developed: stations at elevations below 7,000 ft msl (el7), stations between 7,000 and 8,500 ft msl (el785), and stations above 8,500 ft msl (el85). Station data were averaged for each elevation stratum.

3. Seasonal Time Scale

Monthly reservoir reach runoff represents the volume of water that would naturally flow into the incremental reservoir drainage areas without any upstream flow regulation (e.g. tributary reservoirs and/or diversions). Runoff from mountain snowpack generally occurs during the May through July period due to seasonal climatology patterns; thus, seasonal averages of the evaluated parameters were developed. Seasonal averages were used primarily for the correlation and regression analyses discussed later in this report. Monthly and annual averages were used for the trend analysis. Seasonal time scales included averages or summations of the parameters over four periods: January-February-March (JFM), April-May-June (AMJ), July-August-September (JAS), and October-November-December (OND). The mountain snowpack runoff season was defined as May-June-July (MJJ).

4. SNOTEL Records

Daily and monthly SWE, precipitation, and average temperature from SNOTEL stations (Table A-1) were aggregated into reservoir basin and elevation strata by determining the average of each parameter. The resultant categories included average Fort Peck and Garrison datasets of all stations and subsets of the three elevation strata, or a total of four categories per reservoir reach.

Stations also were stratified by elevation, as previously discussed. The period of record for the analysis categories was determined by the availability of data for each parameter in the stations provided by the NRCS. The most complete data with an adequate number of stations to characterize SWE began in 1982 using 34 stations above Fort Peck and 33 stations from Fort Peck to Garrison for a total of 30 years (1982-2011). Using these same stations for precipitation, the record also began in 1982. Temperature records began in 1991, for a total of 21 years (1991-2011).

5. HCN Records

Monthly temperature and precipitation records from U.S. Historical Climatology Network (HCN) stations (Table A-2) were averaged for the Fort Peck and Garrison reservoir reaches. The period of record extends from 1895 to 2011. Fort Peck average monthly temperature and precipitation were determined using 19 stations. Garrison average monthly temperature and precipitation were determined using 27 stations. Because of their location, two stations, Glasgow Intl AP and Ft. Assiniboine, were used in both Fort Peck and Garrison averages. All

HCN stations are below an elevation of 7,000 ft msl; therefore, no stratification by elevation was necessary.

6. Soil Moisture Computations

Simulated soil moisture data were obtained from the National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center (CPC). Monthly soil moisture data beginning in 1932 were used to compute Fort Peck and Garrison reach averaged soil moisture.

7. Evapotranspiration Computations

The South Dakota State Climatologist's office computed monthly evapotranspiration (ET) for all HCN station locations using daily HCN data for the 1895 to 2011 period. Potential ET was computed using the Hargreaves-Samani equation (Hargreaves and Samani 1985), which uses minimum, maximum, and average daily temperature. Monthly potential ET was computed from daily potential ET (Snyder and Eching 2002) and averaged by reservoir reach.

8. Relative Humidity Records

The South Dakota State Climatologist's office provided average monthly relative humidity from the NOAA National Climatic Data Center (NCDC) for four locations that coincided with four HCN stations within the Fort Peck and Garrison reservoir reaches. The availability of data, however, was sparse, with a full record length of 1971 to 2012 available at only one of the four locations. Due to the lack of relative humidity data, the parameter was dropped from the analysis.

9. ENSO/NAO Climate Patterns

The ENSO climate pattern is a variation in the sea surface temperatures (SST) in the equatorial Pacific Ocean (ENSO 3.4 region). Warm (El Niño) and cold (La Niña) SST anomalies, through tropical convective activity, cause shifts in the subtropical and polar jet streams, which causes downstream impacts in the continental United States (Bigg 1990). As shown in Figure 4, during El Niño, there is a higher probability of warmer and drier conditions in the tier of northern states; during La Niña, there is a higher probability of cooler and wetter conditions in the tier of northern states. These conditions are strongest in the winter season.

The NAO climate pattern is an atmospheric pressure signal, rather than an SST forcing signal, that is tied closely to the Arctic Oscillation (AO). As it relates to the study area, during the negative phase of the NAO, there is a higher probability for colder and wetter than normal conditions. In a positive NAO phase, there is a higher probability for warmer than normal conditions. In this study, NAO was investigated using a seasonal (December-January-February-March, or DJFM) average available from the National Center for Atmospheric Research.

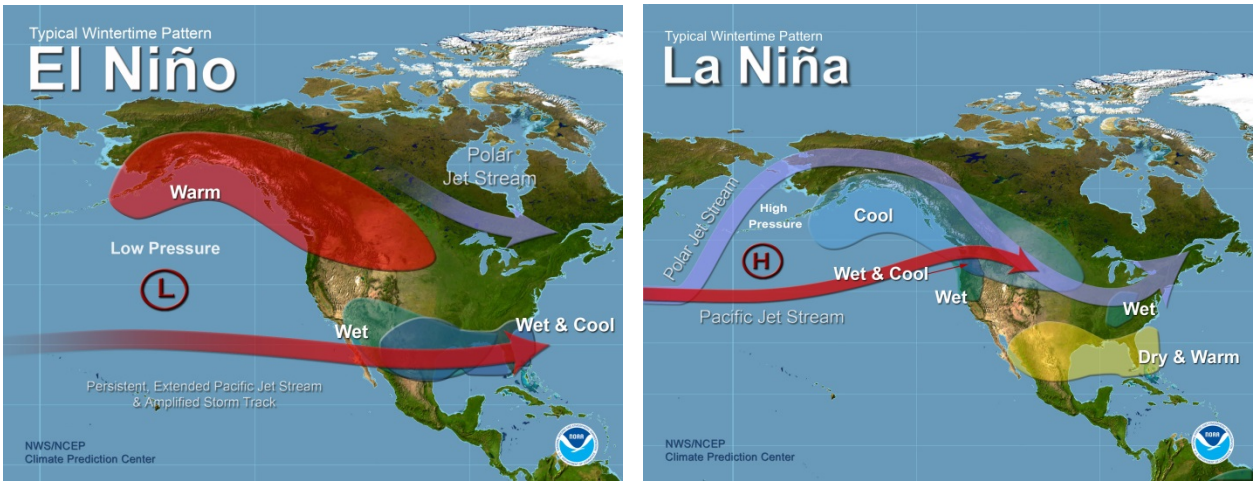


Figure 4. El Niño and La Niña typical wintertime climate patterns.

10. Streamflow Records

Records from four U.S. Geological Survey (USGS) streamgages (Table A-3) were evaluated for analysis of trends in the two reservoir reaches. Streamflow is reported in units of cubic feet per second (cfs) in contrast to MJJ runoff, which is reported in units of thousand acre-feet (kAF). The USGS streamflow records contain continuous daily records from 1961-2011. Streamflow records were obtained from the USGS National Water Information System at http://waterdata.usgs.gov/nwis. From these streamgages, four were selected for trend analysis and projections of runoff to 2100: two streamgages are on the Missouri River upstream from Fort Peck and two are on the Yellowstone River, which is upstream from Garrison.

11. Reservoir Runoff Records

Monthly runoff has been computed for the 1898-2011 period of record and adjusted to the 1949 level of depletion development. All runoff records are adjusted to a common level of basin development, which has been selected as 1949. The 1949 development year is the most recent year that is not affected, to a great extent, by water resource development in the Basin. By adjusting runoff volumes to the common level of development, a consistent historical runoff dataset has been created by river reach (U.S. Army Corps of Engineers 2006). For the purposes of this study, "runoff" refers to natural (1949 level of depletion development) monthly reservoir reach runoff.

Table 2. Historical Climate Driver Records

Parameter	Source	Interval	Units	Period
SWE	NRCS SNOTEL	daily	inches (millimeters)	1982-2011
Precipitation	NRCS SNOTEL	daily	inches (millimeters)	1982-2011
	HCN	monthly	inches (millimeters)	1895-2011
Temperature	NRCS SNOTEL	daily	degrees Fahrenheit (Celsius)	1991-2011
	HCN	monthly	degrees Fahrenheit (Celsius)	1895-2011
Soil Moisture	CPC	monthly	inches (millimeters)	1932-2011
Evapotranspiration	computed	monthly	inches (millimeters)	1895-2011
Relative Humidity	NCDC	monthly	Percent	1971-2011
ENSO	CPC	seasonal	degrees Celsius	1950-2011
NAO	CPC	seasonal	not applicable	1950-2011
Streamflow	USGS	daily/monthly	cubic feet per second (cfs)	1961-2011
Reservoir Runoff	USACE-MRBWM	monthly	acre feet (ac-ft)	1898-2011

B. Trend Analysis and Correlation Analysis of Historical Records

1. Trend Analysis - Methodology

Three statistical methods were used in the analysis of trends in the mountain snowpack and runoff historical driver data: (1) least-squares linear regression, (2) Kendall's tau rank correlation, and (3) Breusch-Pagan test for heteroscedasticity. Heteroscedastic data have a trend in the magnitude of variance (increasing or decreasing). Hypothesis testing was used as a tool to identify trends at three statistical confidence levels, i.e., 90%, 95%, and 99%. Respective confidence levels are presented in Tables 3 through 5 and Tables 11 through 14 by "*", "**", or "***". For example, in Table 3, the Kendall tau z-value of 2.87 for the mean trend for SNOTEL temperature is significant at the 99% confidence level, and is noted with "***". The Breusch-Pagan chi-squared value of 0.15 for the trend in variance for SNOTEL temperature is not significant at any of the three confidence levels. For the purposes of this study, a "significant trend" was defined as having a confidence level of 95% or greater.

a. Trendline and Statistical Parameters

The method of least squares was used to compute the slope of a simple linear-regression model applied to all mountain snowpack and driver data over time. The statistical significance of the linear-regression slope can be used to determine an increasing, decreasing, or indeterminate trend in the data with time. In addition to slope of the least squares linear regression trend line, the mean, standard deviation, and skew of the driver data also were computed (assuming a normal distribution).

b. Kendall Rank Correlation

The Kendall's tau test for rank correlation was used to determine if trends in time exist with mountain snowpack and runoff driver data. The Kendall rank correlation coefficient (Kendall's tau) is a statistic that measures the association or correlation between two variables (Kendall 1938). Based on a normal distribution, the level of significance for the Kendall tau z-value is:

90% = z greater than 1.64 or less than -1.64;
95% = z greater than 1.96 or less than -1.96;
99% = z greater than 2.57 or less than -2.57.

c. Breusch-Pagan Test for Variability

The Breusch-Pagan test for variability was used to determine if the variability of the mountain snowpack and runoff driver data exhibited trends in time. The Breusch-Pagan test is a statistical test for heteroscedasticity or variability in a linear regression model (Breusch and Pagan 1979). In a heteroscedastic dataset, the variance from the mean of the dependent variables would appear to change in relation to the independent variables. Based on a chi-squared distribution (X^2), the level of significance for the Breusch-Pagan X^2 value is:

90% = X^2 greater than 2.706;
95% = X^2 greater than 3.841;
99% = X^2 greater than 6.635.

2. Driver Data Trend Analyses

Trends in driver data were determined by computing the slope based on linear regression and the Kendall's tau non-parametric statistic to test for trend significance. The Breusch-Pagan statistical was used to test for a significant trend in the variance of the historical data (independent variables). Results of the historical data trend analyses are shown in Table 3. The historical data trend analyses are shown in Appendix B; results of some trend analyses were converted to different units (Fahrenheit for SNOTEL temperature and inches for evapotranspiration) for table 3.

Table 3. Driver Data Trend Analysis

Parameter	------- Fort Peck -------				------- Garrison -------			
	Mean	Annual Trend	Significance		Mean	Annual Trend	Significance	
			Trend[1]	Variance[2]			Trend[1]	Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level							
SNOTEL Temperature (deg F)	35.7	0.18	2.87***	0.15	33.7	0.20	2.99***	0.01
HCN Temperature (deg F)	42.0	0.02	4.72***	0.13	43.0	0.02	4.51***	0.23
SNOTEL Precipitation (inches)	35.0	-0.02	-0.25	0.27	31.2	-0.04	-0.73	0.19
HCN Precipitation (inches)	13.9	0.00	0.42	0.66	12.5	0.01	1.20	0.00
Evapotranspiration (inches)	37.6	0.03	1.24	010	39.4	-0.01	-0.60	0.03
Soil Moisture (inches)	7.78	0.01	1.67	1.67	7.35	0.00	0.66	0.82

[1]Refer to Section VII.B.1.b.
[2]Refer to Section VII.B.1.c.

Average basin temperature data from SNOTEL and HCN sources had significant upward trends in annual temperatures at the 99-percent confidence level. Average basin precipitation from SNOTEL and HCN sources, however, did not have significant trends during the historical period. Furthermore, evapotranspiration and soil moisture did not have significant trends. Trends in variance were not significant, based on the Breusch-Pagan statistical test.

3. Mountain Snowpack Trend Analysis

Trends in snowpack behaviors were determined using the same methods described in Section VII.B.2. Results of the analysis in Table 4 include the snowpack behavior period mean, the annual trend, and whether or not the trends in the snowpack behaviors were significant. The trend in variance was tested for peak SWE only (Appendix B).

Table 4. Snowpack Behavior Trend Analysis

Parameter	------- Fort Peck -------				------- Garrison -------			
	Mean	Annual Trend	Significance		Mean	Annual Trend	Significance	
			Trend[1]	Variance[2]			Trend[1]	Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level, -- is not analyzed							
Date Snowpack Begins Accumulating (DSBA)	Oct 2	0.39	0.98	--	Sep 26	0.54	2.51**	--
Peak SWE (inches)	18.23	-0.01	-0.46	0.39	17.27	-0.03	-0.50	0.00
Date of Peak SWE	Apr 18	0.13	0.46	--	Apr 26	-0.01	0.09	--
Melt Rate (inches/day)	0.23	-0.00	-0.43	--	0.26	0.00	0.43	--
Date of Melt-Out	Jul 6	0.25	0.66	--	Jul 2	-0.15	-0.61	--

[1]Refer to section VII.B.1.b.
[2]Refer to section VII.B.1.c.

There was no significant trend in DSBA upstream from Fort Peck, but DSBA did have a significant upward trend in the Garrison reach at the 95-percent confidence level. Peak SWE had a downward trend in both the Fort Peck and Garrison reaches, but the trends were not significant. Regarding the date of peak SWE, neither basin had significant trends. There were no significant trends in the melt rate and date of melt-out. Due to time constraints, trends in variance were evaluated only for peak SWE.

4. Runoff and Streamflow Trend Analysis

Trends and trend significance in annual and MJJ runoff (1898-2011) into Fort Peck and Garrison were determined; statistical analyses are presented in Appendix B. Results of the analysis in Table 5 include the annual and MJJ runoff and MJJ streamflow for four USGS streamgages in the upper Basin (as described in Appendix B).

Table 5. Runoff and Streamflow Trend Analysis

Parameter	------- Annual -------				------- May-June-July -------			
	Mean (kAF)	Annual Trend (kAF/yr)	Significance		Mean (kAF)	Annual Trend (kAF/yr)	Significance	
			Trend[1]	Variance[2]			Trend[1]	Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level							
Fort Peck Runoff	7254	-1.9	-0.70	2.00	3561	-5.5	-1.64	1.23
Garrison Runoff	10730	-23.2	-3.06***	8.07***	5803	-12.6	-2.91***	10.19***
	Mean (cfs)	Annual Trend (cfs/yr)	Significance		Mean (cfs)	Annual Trend (cfs/yr)	Significance	
			Trend[1]	Variance[2]			Trend[1]	Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level							
Missouri R at Toston, MT	5063	-24	-1.68*	0.59	8550	-29	-0.72	0.43
Missouri R near Landusky, MT	9237	-62	-2.83***	0.35	14478	-92	-1.58	0.16
Yellowstone R at Billings, MT	7187	-23	-1.55	0.99	17923	-35	-1.12	1.16
Yellowstone R at Miles City, MT	11490	-39	-1.83*	0.97	23769	-43	-1.07	1.34

[1]Refer to Section VII.B.1.b.
[2]Refer to Section VII.B.1.c.

Annual and MJJ runoff into Fort Peck and Garrison had downward trends over the period of record; however, only Garrison's downward trend in annual and MJJ runoff is significant at the 99-percent confidence level. Likewise, Garrison's downward trend in the variance is significant at the 99-percent confidence level. Trends in monthly and annual flows at these stations are tabulated in Appendix B.

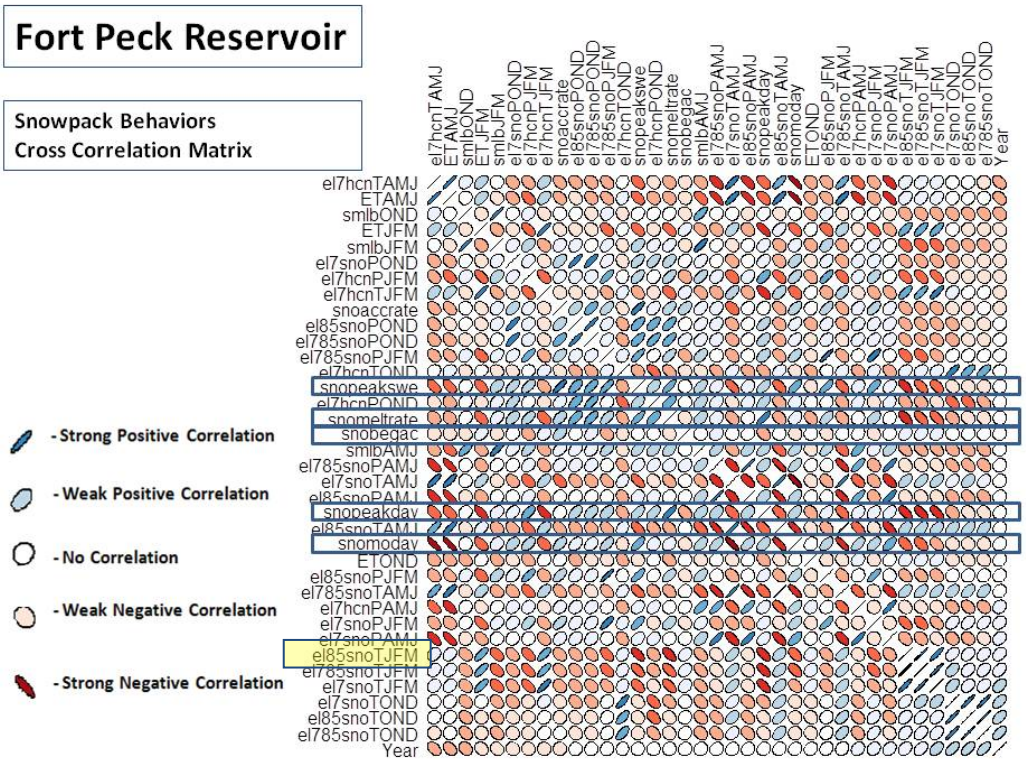
Of the streamgages, one of the four had a significant downward trend for annual streamflow, but none had a significant trend for MJJ streamflow. None of the four streamgages indicated a significant trend in variance.

5. Correlation Analysis

The correlation analysis was used to (1) determine the driver data parameters that had the highest level of correlation with mountain snowpack behaviors, runoff, and streamflow by reservoir basin, and (2) examine the inter-dependencies of the meteorological drivers. The correlation analysis was performed by computing the Pearson correlation coefficient, *r*, for all combinations of driver data variables and snowpack behaviors that were tested using the "R" statistics program. The highest correlated parameters were chosen as independent variables for the multiple linear regression analysis to predict the dependent variables: peak SWE, start of accumulation, date of peak SWE, melt rate, melt-out date, runoff, and streamflow. A total of 84 independent parameters (42 per reservoir basin) were analyzed in the correlation analysis. One example of a parameter that was analyzed for correlation with the dependent variables is el785snoPJFM, which is average SNOTEL precipitation for all stations between 7,000 and 8,500 ft msl during the January-February-March 3-month period. Another example of a parameter is el7hcnTAMJ, which is the average HCN temperature for all stations during the April-May-June 3-month period.

Cross-correlation matrices for meteorological driver data, snowpack behavior, and MJJ runoff were developed using "R". An example (Fort Peck snowpack behaviors) is shown as Figure 5, and all matrices are shown in Appendix D. The matrices present a graphical representation of the correlation coefficients between the respective parameter on the vertical alignment versus the respective parameter on the horizontal alignment. Correlation coefficients can range from -1 to +1. Graphically, the correlation coefficients range from a backwards leaning red straight line (-1), indicating a negative "tight" scatter between the two parameters to a forward leaning blue line, indicating a positive "tight" scatter. Based on review of the correlation results, the top seven highest correlated parameters were selected from the correlation analysis for each snowpack behavior and MJJ runoff.

For peak SWE, precipitation parameters had strongly positive correlations, whereas temperature parameters had strongly negative correlations. Peak SWE had the strongest individual parameter correlation to MJJ runoff.



Note: el785snoTJFM = SNOTEL temperature data for the January-February-March time period for stations between elevations 7000 and 8500 feet above mean sea level.

Figure 5. Cross-correlation matrix of Fort Peck snowpack behaviors.

C. Multiple Linear Regression Analysis

1. Regression Data

From the correlation analysis, the most strongly correlated driver data parameters were selected for each snowpack behavior and MJJ runoff to be included in the multiple linear regression (MLR) analysis. The period of record analyzed was 1992-2011 because SNOTEL temperature records were limited to this period.

2. Regression Method

The MLR analyses were performed on the driver data (independent variables) versus the snowpack behavior, runoff, and streamflow data (dependent variables) to develop relations that could be used to predict projected snowpack behaviors, runoff, and streamflow based on projected driver data. Regression analyses were performed using the "R" software package using the method of least squares (Appendix F).

In addition, the step-wise regression function in "R" software package was used to select the most important variables to predict each dependent variable. The step-wise algorithm in "R" works by repeatedly adding or removing independent driver data variables from the regression model. During the iterations, the algorithm seeks to improve the model at each step until it can

no longer improve the model, while balancing the number of variables. For all MLR equations shown in Tables 6 through 9, the final number of variables chosen for the regression model was smaller than all of the variables initially provided in the analysis. For example, for Fort Peck peak SWE (PS) in Table 6, of the seven highest correlated parameters selected, four were used in the final equation.

3. Regression Analysis Results

The inputs, final MLR equations, and coefficients of determination (R^2) for snowpack behaviors, MJJ runoff, and streamflow are summarized below in Table 6 through Table 9, respectively.

Table 6. Fort Peck Snowpack Behaviors – Final MLR Equations

Fort Peck Snowpack Behaviors	Largest Individual Correlation Parameters	Final MLR Equation	MLR R^2
Date Snowpack Begins Accumulation (DSBA)	ETJFM+el85snoTJFM+el785snoPOND+el785snoTJFM+el7snoTJFM+el7hcnPJFM+el785snoPJFM	DSBA=196+2.543*el785snoPOND+6.143*el785snoTJFM-3.179*el7snoTJFM	0.2742
Peak SWE (PS)	el785snoPJFM+el85snoPJFM+el7snoPJFM+el785snoPOND+el85snoTJFM+el85snoPOND+el7snoTAMJ	PS=31.0+0.9070*el85snoPJFM+0.7482*el785snoPOND-0.3124*el85snoTJFM-0.4961*el7snoTAMJ	0.8793
Date of Peak SWE (DPS)	ETJFM+el7snoTJFM+el7hcnTJFM+el785snoTJFM+el85snoTJFM+el7hcnPJFM+el85snoPOND	DPS=152-0.9600*ETJFM+3.009*el85snoPOND	0.6545
Date of Melt-Out (DMO)	ETAMJ+ el7snoTAMJ+ el7hcnTAMJ+ el785snoTAMJ+ el85snoTAMJ+ el7snoPAMJ+ el785snoPAMJ	DMO=404-8.227*ETAMJ-2.344*el85snoTAMJ+1.930*el7snoPAMJ-2.949*el785snoPAMJ	0.7457
Melt Rate (MR)	el785snoPOND+el85snoPOND+el7hcnPOND+el85snoTJFM+el785snoPJFM+el7hcnPJFM+el85snoPJFM	MR=0.188+0.0076*el785snoPOND+0.031*el7hcnPOND-0.009*el85snoTJFM+0.010*el85snoPJFM	0.6537

Table 7. Garrison Snowpack Behaviors – Final MLR Equations

Garrison Snowpack Behaviors	Largest Individual Correlation Parameters	Final MLR Equation	MLR R^2
Date Snowpack Begins Accumulation (DSBA)	ETAMJ+el785snoTOND+el7hcnTOND+el7hcnTAMJ+el85snoTOND+el785snoPOND+el785snoTJFM	DSBA=382+el7hcnTOND-2.42*el7hcnTAMJ-el785snoPOND	0.2493
Peak SWE (PS)	el785snoPOND+el85snoPOND+el785snoPJFM+el85snoPJFM+el785snoTAMJ+el85snoTAMJ	PS=22.47+0.8940*el85snoPOND+0.8592*el85snoPJFM-0.5414*el85snoTAMJ	0.9052
Date of Peak SWE (DPS)	el85snoPAMJ+el7hcnPAMJ+smlbAMJ+el785snoTAMJ+ETAMJ+el7snoTAMJ+el7hcnTAMJ	DPS=212+4.899*el7hcnPAMJ-3.049*el785snoTAMJ	0.4501
Date of Melt-Out (DMO)	el785snoTAMJ+ el7snoTAMJ+ el85snoTAMJ+ el7hcnTAMJ+ ETAMJ+dataset$el85snoPAMJ+ el785snoPAMJ	DMO=370-1.9015*el85snoTAMJ-8.1947*ETAMJ-6.2349*el85snoPAMJ-6.2349*el85snoPAMJ+7.5537*el785snoPAMJ	0.7980
Melt Rate (MR)	el785snoPOND+el85snoPOND+el785snoTAMJ+el7snoTAMJ+el7snoPJFM+el7hcnTAMJ	MR=0.857+0.018*el785snoPOND-0.013*el7hcnTAMJ	0.3551

Table 8. MJJ Runoff – Final MLR Equations

Reservoir	Largest Individual Correlation Parameters	Final MLR Equation	MLR R^2
Fort Peck May-July Runoff (FPRO)	el7snoPAMJ+ETAMJ+el7hcnPAMJ+el785snoPAMJ+el85snoTAMJ+el7snoTAMJ+el7hcnTAMJ+SWEEst	FPRO=2.71^(0.4996+1.5529*ln(SWEEst)+1.2720*ln(el7snoPAMJ))	0.8394
Garrison May-July Runoff (GARO)	ETAMJ+SWEest+el85snoPAMJ+el7hcnPAMJ+el7hcnTAMJ+el785snoPAMJ+el7snoTAMJ	GARO=2.71^(3.0327+1.3765*log(SWEest)+0.9490*log(elhcnPAMJ))	0.9260

Table 9. Streamflow – Final MLR Equations

Streamgage	Largest Individual Correlation Parameters	Final MLR Equation	MLR R^2
Missouri River near Landusky, Montana (LANQ)	SWEest+el85snoTAMJ+ETAMJ +el7snoPAMJ+el785snoTAMJ +el7snoTAMJ+el785snoPAMJ	LANQ=exp(14.0375+0.0024*SWEest-0.6753*el85snoTAMJ -0.0034*ETAMJ+0.0016*el7snoPAMJ +0.5822*el785snoTAMJ)	0.8602
Yellowstone River at Mile City, Montana (MCQ)	SWEest+smlbAMJ+ETAMJ +el85snoPAMJ+el785snoPAMJ +el85snoPOND+el85snoTAMJ	MCQ=exp(13.661+0.0028*SWEest-0.0012*ETAMJ +0.0004*el85snoPOND+0.0028*el85snoPAMJ +0.027*el85snoTAMJ)	0.9412

D. Categorical Correlation Analysis of ENSO and NAO

The most significantly correlated driver data parameters also were analyzed to determine any statistical significance to ENSO or NAO climate patterns. Table 10 indicates the variables that had significant (90-percent confidence level or greater) relations with either ENSO or NAO. In table 10, "B" indicates the below normal category was significant, whereas "A" means that the above normal category is significant. The + and – signs indicate the direction of the change in odds, with "+" indicating an increased chance compared to ENSO or NAO climate patterns, and "-" indicating a decreased chance. A blank cell indicates no significant relation.

Table 10. ENSO and NAO Categorical Correlation Analysis.

Parameter	ENSO						NAO					
	El Niño		Neutral		La Niña		Positive		Neutral		Negative	
Fort Peck												
< 7000 HCN Precip, JFM	B+		B-							A+		A-
ET, JFM	B-			A+	B+	A-		A+				
< 7000 SNOTEL Precip, AMJ					B+							
SWE, JFM						A+						
> 8500 SNOTEL Temp, JFM	B-		B+									
< 7000 SNOTEL Temp, AMJ	B+											
Garrison												
< 7000 SNOTEL Precip, JFM					B-	A+						
7000-8500 SNOTEL Precip, JFM						A+						
< 7000 HCN Precip, AMJ										A-		
7000-8500 SNOTEL Precip, AMJ							B-	A+	B+			
> 8500 SNOTEL Precip, AMJ							B-	A+		A-		
7000-8500 SNOTEL Precip, OND										A-		

For example, consider "ET, JFM" in the Fort Peck Basin and corresponding JFM ENSO status. There is a higher than usual chance for low evapotranspiration when there is a La Niña in JFM, with both an increased chance for ET in the lowest third of the record (B+) and a decreased chance for ET in the highest third of the record (A-). There is a corresponding lower than usual chance for ET in the lowest third of the record during El Niño (B-), as well as a higher than usual chance for ET in the highest third of the record (A+) during ENSO-neutral conditions. Additionally, there is a higher than usual chance for ET in the highest third of the record when the JFM averaged NAO is in the positive phase.

The results allow us to determine the variables that are affected by ENSO and NAO. The role of ENSO in future climate scenarios is not considered in this report, but knowing that some forcings exhibit tendencies during El Niño or La Niña will allow for both anticipation of possible

seasonal deviations from normal as well as long-term tendencies should climate models better clarify if El Niño or La Niña is favored to occur more often in a changing climate. NAO is less predictable on a seasonal scale than ENSO, though ongoing research is investigating possible precursors to both AO and NAO variability (Cohen and Jones 2011). The impact of NAO on forcing factors for runoff may be more useful in a diagnostic than long-term predictive capacity.

Statistical output for each driver data parameter was analyzed as in Figure 6 to create the results in Table 10. In the example in Figure 6, there is a significantly low probability that JFM ET above Fort Peck will be in the lowest third (Below) of climatology during an El Niño phase. In a La Niña phase, there is a significantly high chance that JFM ET will be in the lowest third of climatology and a significantly low chance JFM ET will be in the highest third (Above). Furthermore, during a neutral ENSO phase, there is a significantly high chance that JFM ET will be in the highest third of climatology. With regard to NAO, Figure 7 illustrates that during a high or positive phase of NAO, there is a significantly low chance that SNOTEL precipitation in the 7000-8500 ft msl elevation band in AMJ (el785snoPAMJ) above Garrison will be in the lowest third of climatology, whereas there is a significantly high chance that el785snoPAMJ will be in the highest third. Furthermore, during a neutral phase of NAO, there is a significantly high chance that el785snoPAMJ will be in the lowest third of climatology.

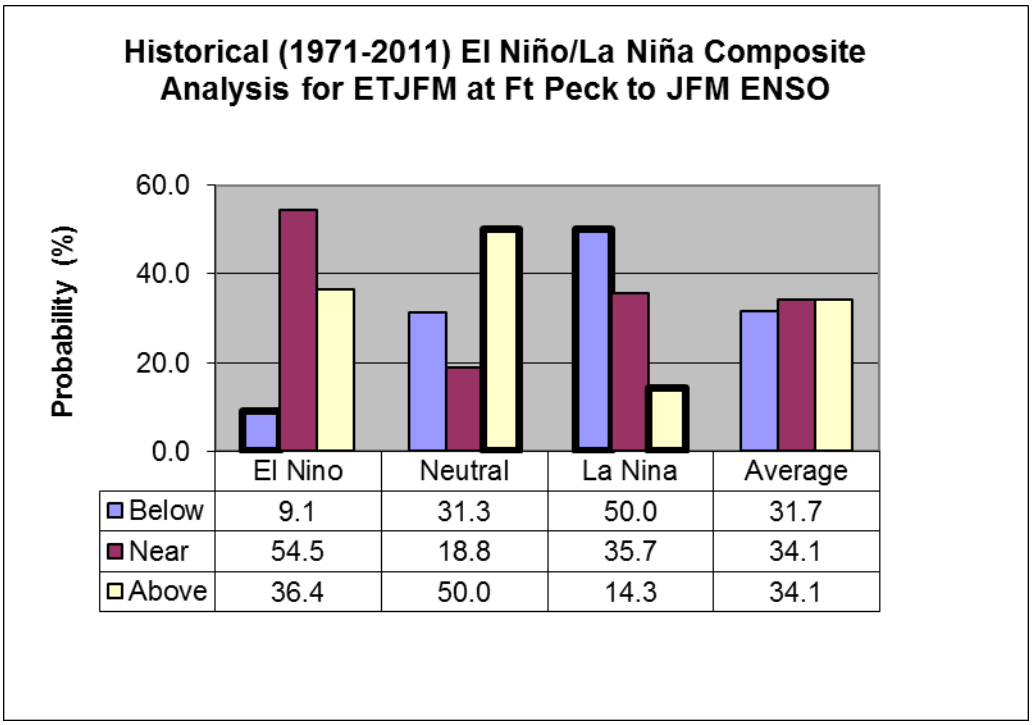


Figure 6. Example of categorical correlation of Fort Peck ETJFM to JFM ENSO. Bold outlines on bars indicate a statistically significant (90% confidence) deviation from the average distribution.

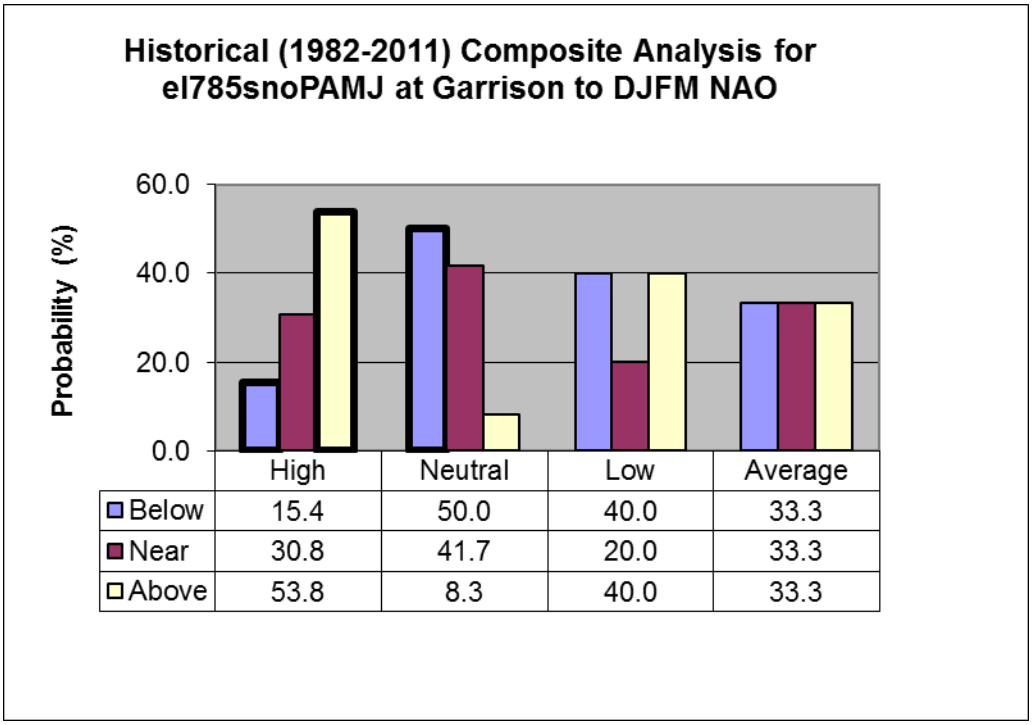


Figure 7. Example of categorical correlation of Garrison el785snoPAMJ to DJFM NAO. Bold outlines on bars indicate a statistically significant (90% confidence) deviation from the average distribution.

E. Application of Climate Projection Data

1. Climate Scenarios and Projections

Climate model output used included simulations of climate of the 20th century and projections of climate to 2099 from the Community Climate Systems Model, Version 3.0 (CCSM3) and Version 4.0 (CCSM4) Atmosphere-Ocean General Circulation Models (AOGCM). Herein, "CCSM" will be used if referencing both CCSM3 and CCSM4. CCSM simulations, averaged over the Fort Peck Basin and Garrison Basin (excluding Fort Peck Basin), are discussed more fully in Appendix G.

CCSM3 projects climate from 2000 to 2100 on the basis of the A2 emissions scenario, which is described by Nakićenović and Swart (2000). In brief, the A2 emission scenario represents a world that emphasizes the importance of economy ("A" scenario) over the environment ("B" scenario), with more regional responses ("2" scenario) than global cooperation ("1" scenario). The A2 b30.042e ensemble was selected because output archives have the finest temporal resolution (6 hours), which allows for estimates of daily variability in climate. In both CCSM3 and CCSM4, ensemble differences are based on the variations in pre-industrial climate (middle to late 1800s) from which simulations of 20th century climate simulations are initialized. Climate projections to 2100 are continuations from, and are initialized by, 20th century simulations.

Greenhouse gas concentrations used in the CCSM4 (Sillman et al. 2013) and reported in upcoming Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Reports were based on Representative Concentration Pathways (RCP; vanVuuren et al. 2011). Projected climate from CCSM4 is based on RCP 8.5, in which the radiative forcing of greenhouse gases increase from observed conditions in 2005 to 8.5 watts per meter squared (W m^{-2}) by 2100. This scenario is similar to the A2 scenario, but differs by including effects of high population growth and lower incomes in developing countries. RCP 8.5 Ensemble #2 of CCSM4 was selected because archives of output are available for both daily and monthly averages.

a. Temperature and Precipitation Adjustments

Grid spacing for CCSM3 is 1.4 arc-degrees of latitude and longitude, and grid spacing for CCSM4 is 0.94 arc-degrees of latitude and 1.25 arc-degrees of longitude. The CCSM output of daily precipitation and average surface (2 m height) air temperature are interpolated to the location of weather stations using a distance-squared weighting of the four grid points surrounding the station. Once interpolated to the location of the weather station, CCSM outputs were adjusted such that average monthly precipitation and air temperature for 2001-2010 ("calibration period") match that from weather station data for the same period. For air temperature, the adjustment is a constant applied to all CCSM daily output (shift up or down). For precipitation, the adjustment is a constant applied only to days in which CCSM simulated precipitation is greater than zero. If an adjustment is a downward shift to CCSM precipitation, adjusted daily values that are less than 0.01 inches (sensitivity of a tipping bucket) are set to zero. Examples of CCSM3 bias-adjusted monthly precipitation and average temperature for the White Sulfur, Montana (Figure 3), weather station are shown in Figure 8 and 9, respectively.

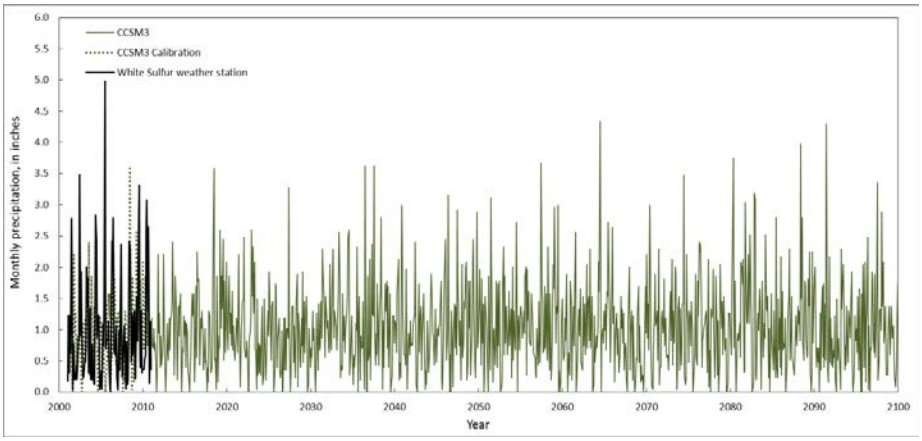


Figure 8. Bias-adjusted precipitation for the White Sulfur, Montana, weather station. Calibration period is 2001-2010.

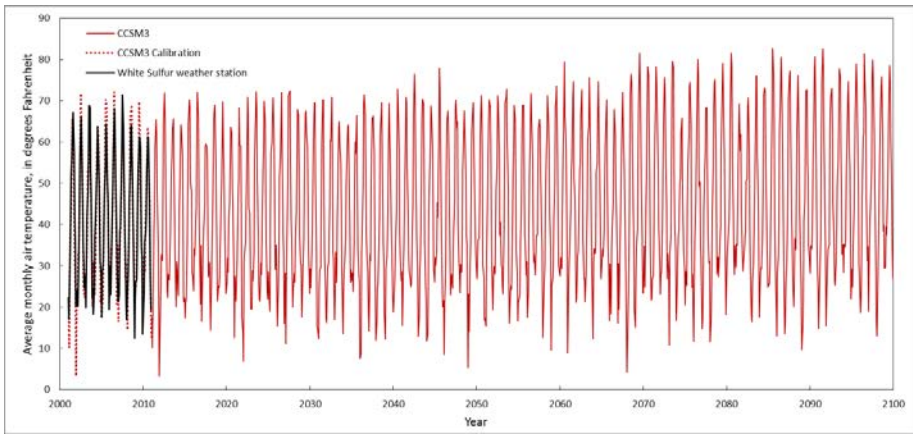


Figure 9. Bias-adjusted temperature for the White Sulfur, Montana, weather station. Calibration period is 2001-2010.

b. Temperature and Precipitation Uncertainty

Climate model simulations of near-surface temperature are more accurate (typical correlation of 95% between models and observations) than simulations of precipitation. Climate model simulations of precipitation have improved but remain problematic (typical correlation of 50 to 60%; Bader et al. 2008). Coupled global climate models include a component that simulates ocean circulation and water temperature. CCSM3 and CCSM4 have identified biases in sea surface temperatures (SST), particularly in areas of upwelling (as quantified by ENSO), which translate to biases in precipitation on land (Gent et al. 2011). Uncertainties in precipitation also are related to the necessity to parameterize sub-grid scale processes, such as convective precipitation.

2. Assumptions and Prediction Methods

Major assumptions used in this analysis are that (a) derived MLR relations do not change into the future (time-invariant), and (b) potential non-linear relations can be approximated by linear relations (MLR equations).

3. Projected Snowpack Behaviors

Figures 10a-b and 11a-b show the simulated and projected snowpack behaviors for Fort Peck and Garrison, respectively, with additional data in Table 12. Also refer to Table 15 for further discussion. Detailed discussion description of observed data regarding Figures 10 through 15 can be found in Appendix B.

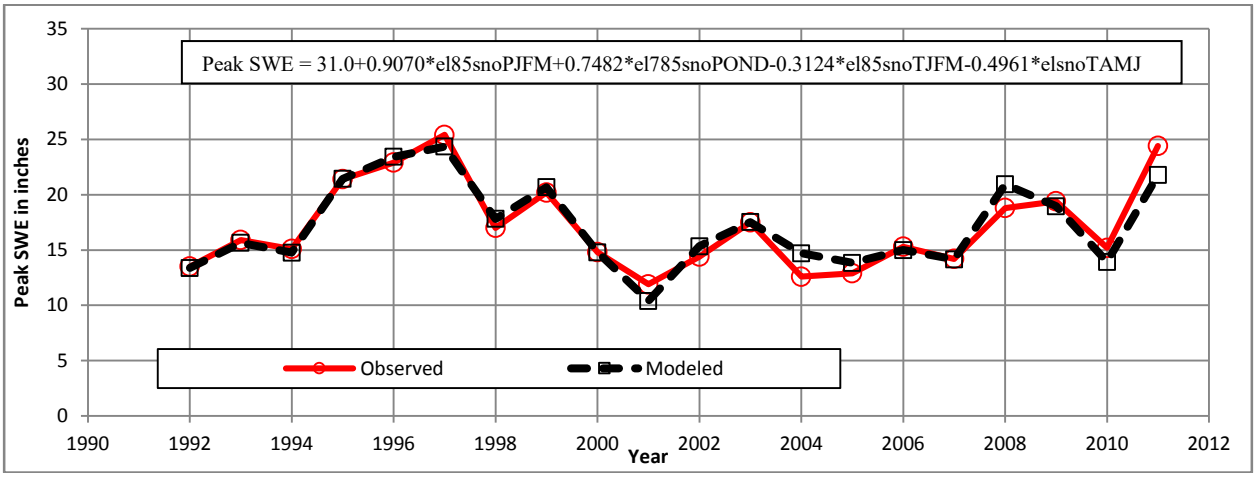


Figure 10a. Modeled historical Fort Peck Peak SWE.

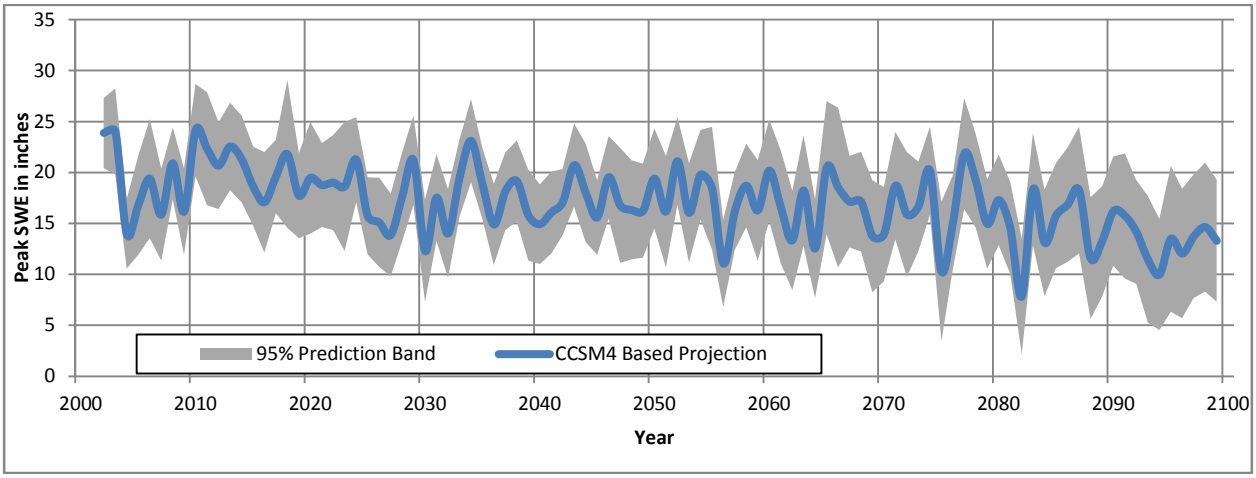


Figure 10b. Projected Fort Peck Peak SWE with 95% prediction band.

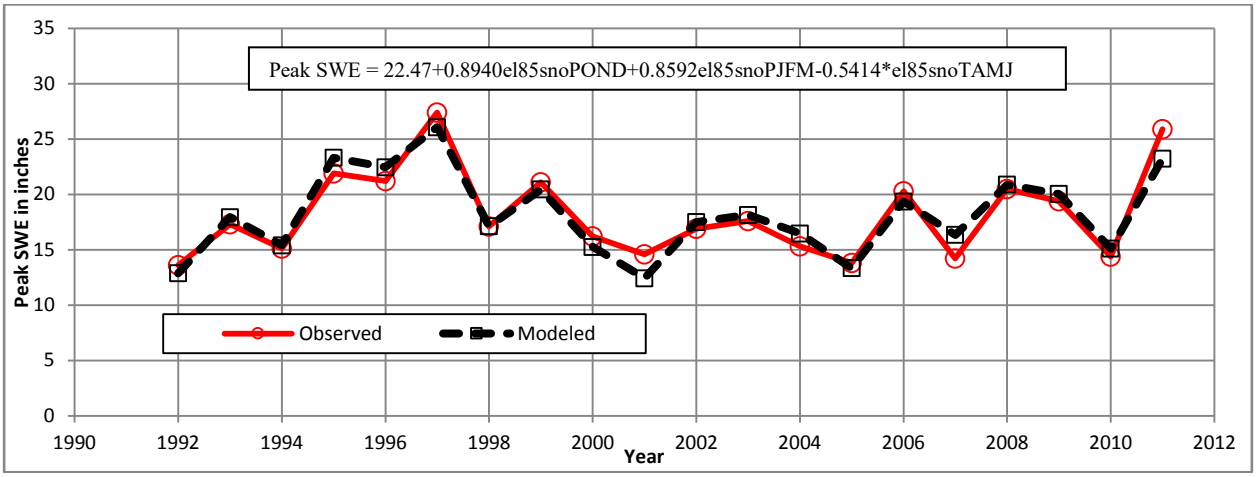


Figure 11a. Modeled historical Garrison Peak SWE.

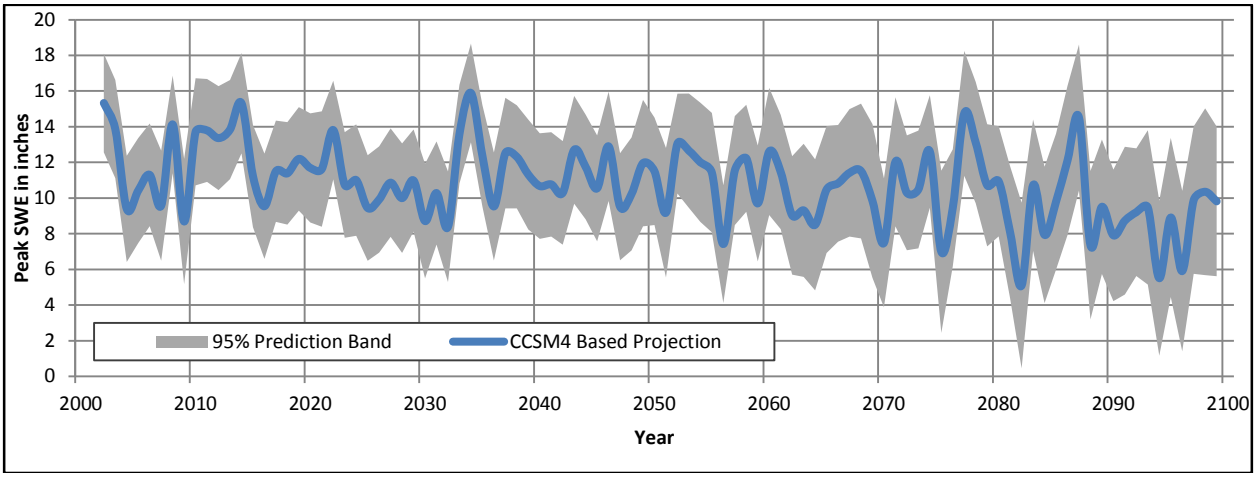


Figure 11b. Projected Garrison Peak SWE with 95% prediction band.

4. Projected MJJ Runoff

Figures 12a-b and 13a-b show the projected MJJ runoff for Fort Peck and Garrison, respectively, with additional information in Table 13 and Appendix C. Also refer to Table 15 for further discussion. The observed maximum and minimum MJJ runoff volumes (1898-2011) are shown on the projected runoff graphs for Fort Peck and Garrison on Figures 12b and 13b, respectively. In addition, a frequency analysis of the projected MJJ runoff revealed that the percentage of years that had below average runoff volumes (1898-2011), based on a moving 20-year average, increased for both reservoir reaches. At Fort Peck the average frequency of years in which MJJ runoff was below the historical average MJJ runoff volume increased from 50% (2002-2021) to 95% (2080-2099), and at Garrison the average increased from 75% (2002-2021) to 100% (2080-2099). In other words, in the 2080-2099 20-year period, the projected Fort Peck MJJ runoff would be below the 1898-2012 average MJJ volume of 3,558 kAF for 19 of 20 years, and the projected Garrison MJJ runoff would be below the 1898-2011 average MJJ volume of 5,786 kAF for 20 of 20 years.

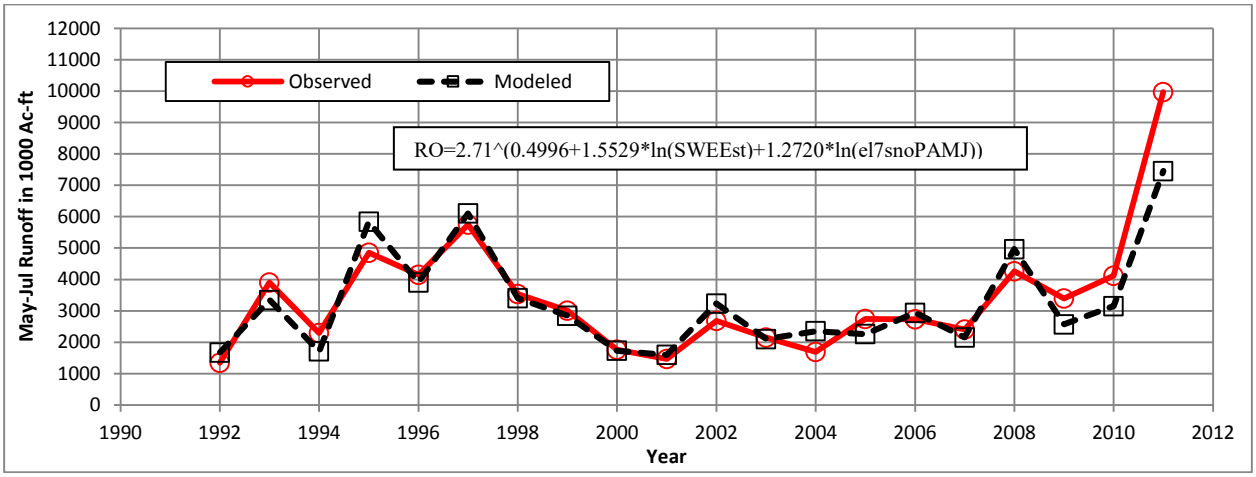


Figure 12a. Modeled historical Fort Peck MJJ runoff.

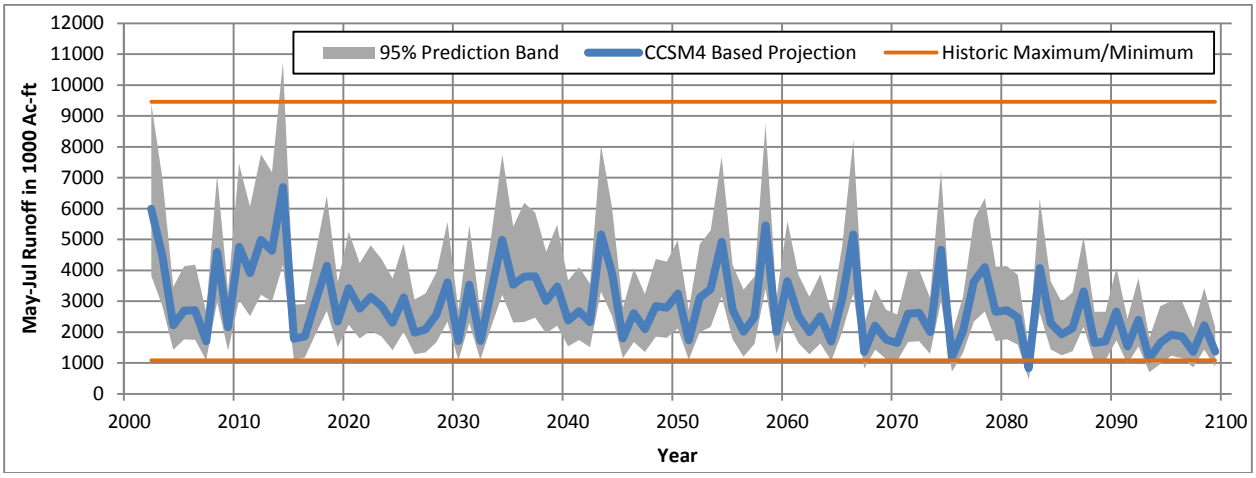


Figure 12b. Projected Fort Peck MJJ runoff with 95% prediction band.

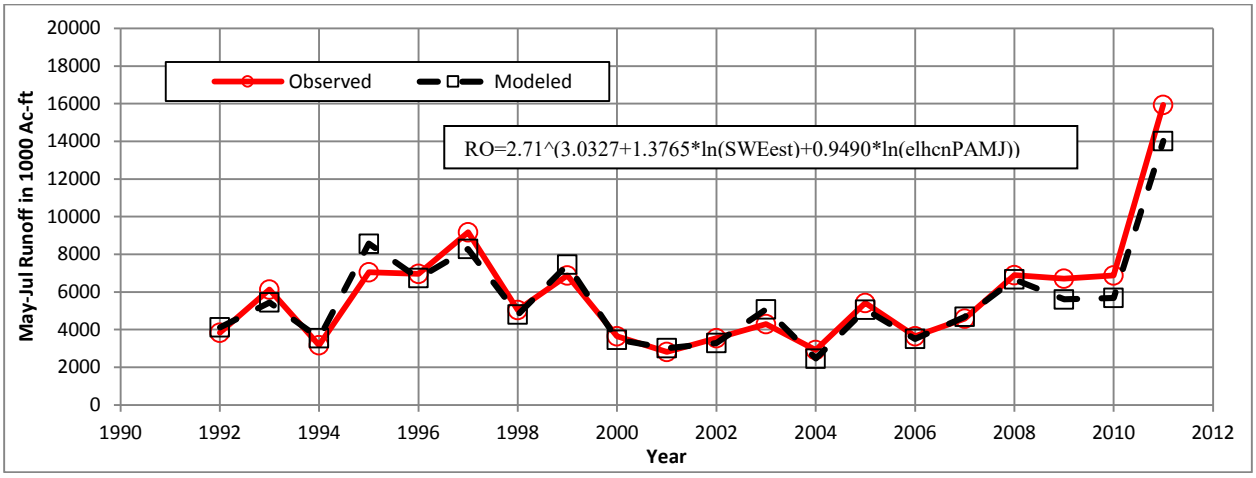


Figure 13a. Modeled historical Garrison MJJ runoff.

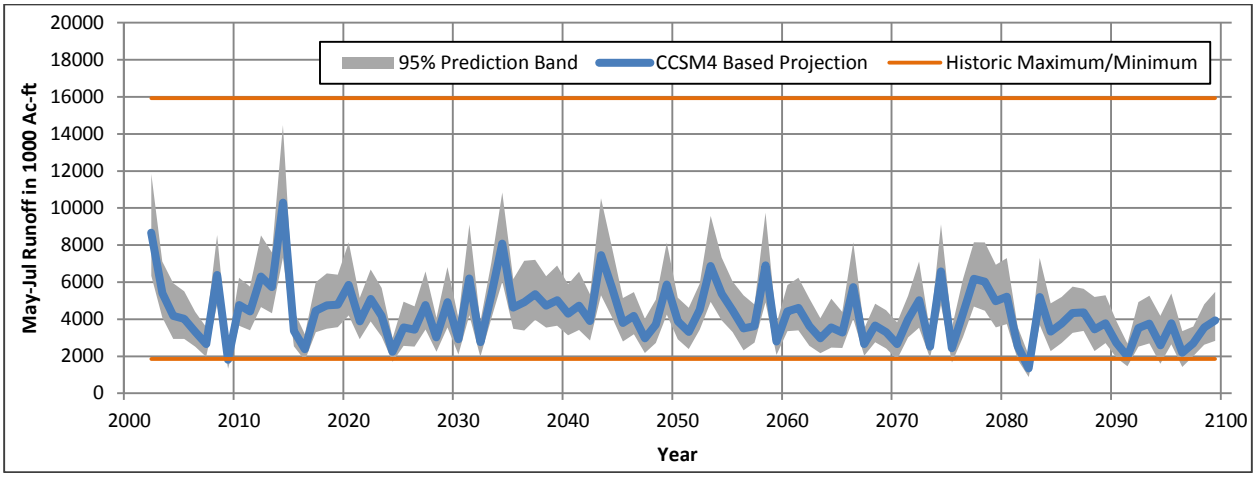


Figure 13b. Projected Garrison MJJ runoff with 95% prediction band.

5. Projected Streamflow

Figures 14 and 15 show the observed and projected MJJ streamflows with regulation upstream from Fort Peck and Garrison, respectively, with additional information in Table 14.

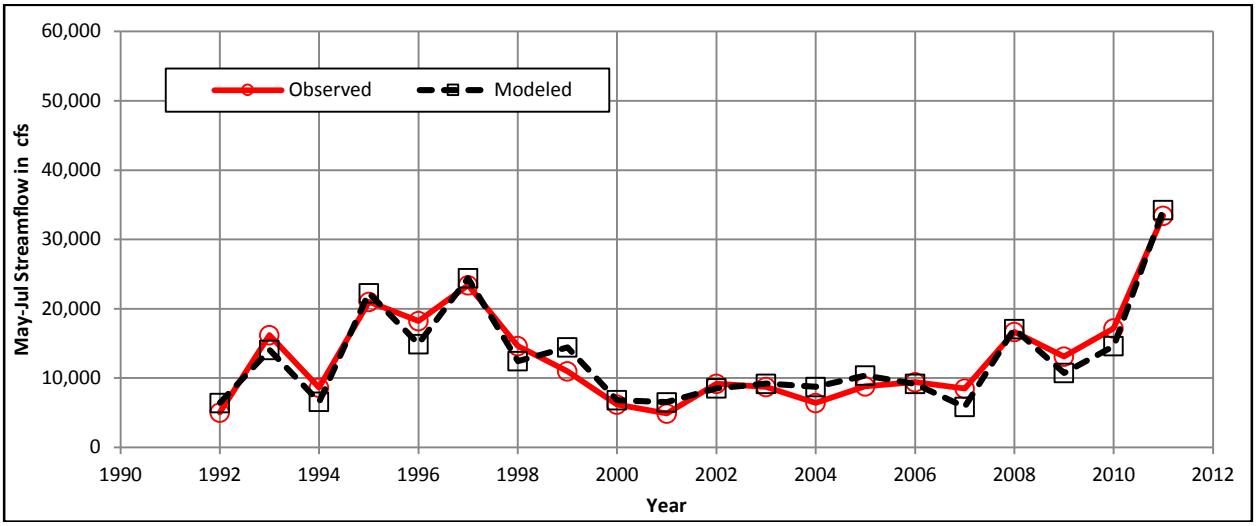


Figure 14a. Modeled historical regulated streamflow for Missouri River near Landusky, Montana (upstream from Fort Peck).

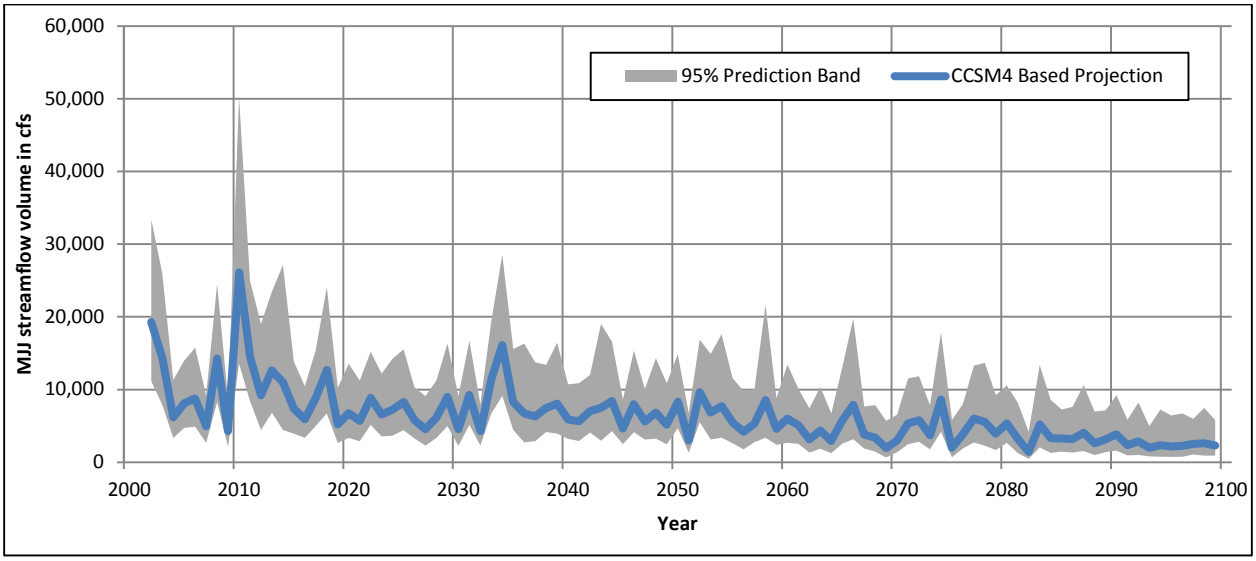


Figure 14b. Projected regulated streamflow for Missouri River near Landusky, Montana (upstream from Fort Peck) with 95% prediction band.

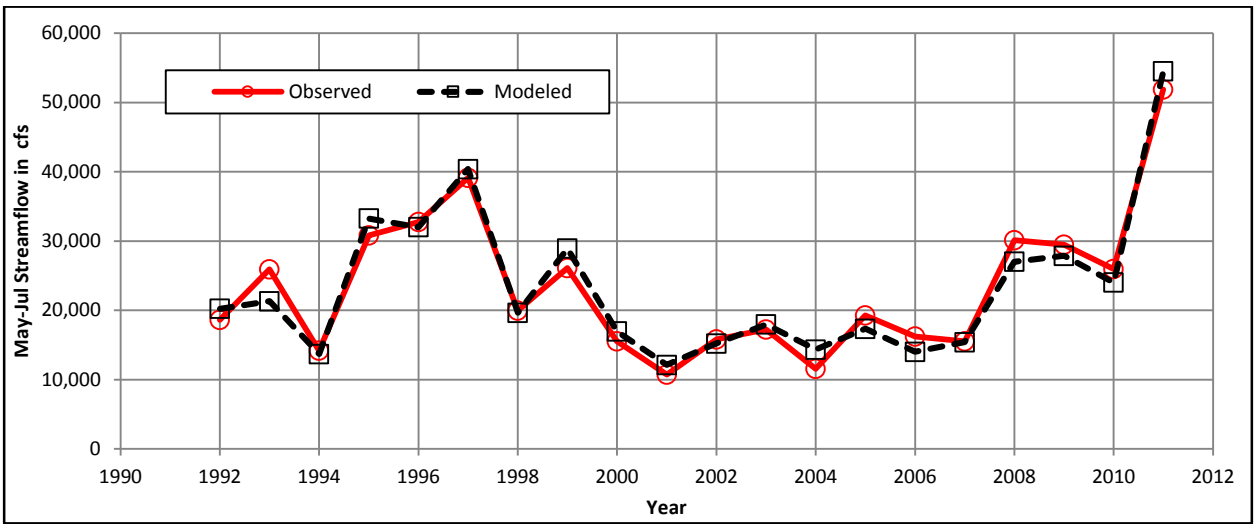


Figure 15a. Modeled historical regulated streamflow for Yellowstone River at Miles City, Montana (upstream from Garrison).

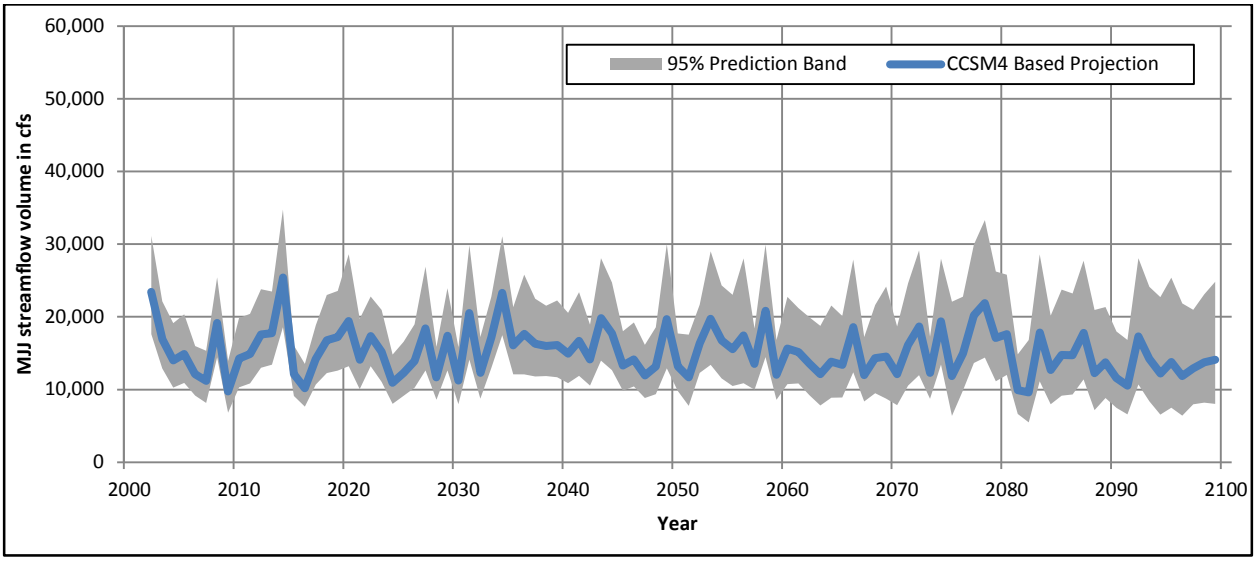


Figure 15b. Projected regulated streamflow for Yellowstone River at Miles City, Montana (upstream from Garrison) with 95% prediction band

F. Trend Analysis to 2100

Trends in future projected snowpack behaviors were computed and tested for statistical significance using the Kendall tau statistic and the Breusch-Pagan test.

1. Trends in Drivers

Significant trends are indicated for projected temperatures and evapotranspiration, but no significant trend in indicated for in projected precipitation for both CCSM3- and CCSM4-driven simulations (Table 11).

Table 11. Projected Driver Trends Based on CCSM3 and CCSM4 Climate Projections

Parameter	---------- Fort Peck ----------				---------- Garrison ----------			
	Annual Slope	Change over Period	Significance Trend[1]	Significance Variance[2]	Annual Slope	Change over Period	Significance Trend[1]	Significance Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level							
CCSM3								
SNOTEL Temperature (degrees F)	0.10	9.9	9.47***	1.49	0.10	9.9	9.43***	0.51
HCN Temperature (degrees F)	0.10	9.9	9.10***	1.68	0.10	9.9	9.17***	1.17
SNOTEL Precipitation (inches)	-0.01	-0.99	-0.32	0.14	-0.01	-0.99	0.60	0.03
HCN Precipitation (inches)	0.01	0.99	1.02	0.21	0.01	0.99	1.26	0.10
Evapotranspiration (inches)	0.09	8.91	8.09***	2.19	0.09	8.91	7.87***	1.16
CCSM4								
SNOTEL Temperature (degrees F)	0.10	9.9	9.77***	1.12	0.10	9.9	9.85***	1.82
HCN Temperature (degrees F)	0.10	9.9	9.53***	0.65	0.10	9.9	9.54***	0.75
SNOTEL Precipitation (inches)	-0.01	-0.99	0.82	1.71	-0.00	-0.99	0.67	1.26
HCN Precipitation (inches)	0.01	0.99	1.62	3.07	0.01	0.99	0.98	1.31
Evapotranspiration (inches)	0.09	8.91	9.79***	1.83	0.09	8.91	9.65***	1.64

[1]Refer to Section VII.B.1.b.
[2]Refer to Section VII.B.1.c.

2. Snowpack Behavior Trends

Significant trends for four snowpack behaviors are indicated at the 99-percent confidence level (Table 12), and significant trends are indicated for all snowpack behaviors at the 90-percent

confidence interval. Only the Fort Peck CCSM3 projections indicate significant trends in variance for DSBA and DPS, based on the Breusch-Pagan test.

Table 12. Projected Snowpack Behavior Trends Based on CCSM3 and CCSM4 Climate Projections

	---------- Fort Peck ----------				---------- Garrison ----------			
	Annual Slope	Change over Period	Significance Trend[1]	Significance Variance[2]	Annual Slope	Change over Period	Significance Trend[1]	Significance Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level							
CCSM3								
Date Snowpack Begins Accumulating (DSBA)	0.313	27.54	5.40***	4.62**	-0.161	-14.17	-4.47***	2.02
Peak SWE (inches) (PS)	-0.072	-6.34	-4.68***	0.38	-0.055	-4.84	-4.66***	1.74
Date of Peak SWE (DPS)	-0.172	-15.14	-3.18***	4.12**	-0.327	-28.78	-5.23***	0.53
Melt Rate (MR)	-0.001	-0.09	-1.81*	0.89	-0.001	-0.09	-5.54***	0.37
Date of Melt-Out (DMO)	-0.390	-34.32	-5.95***	0.73	-0.492	-43.30	-6.38***	1.60
CCSM4								
Date Snowpack Begins Accumulating (DSBA)	0.272	23.96	4.33***	0.28	-0.157	-13.80	-5.01***	0.36
Peak SWE (inches) (PS)	-0.062	-5.97	-4.85***	0.51	-0.034	-3.01	-3.87***	2.23
Date of Peak SWE (DPS)	-0.158	-13.90	-3.12***	0.03	-0.267	-23.49	-5.52***	0.07
Melt Rate (MR)	-0.001	-0.09	-1.88*	0.01	-0.001	-0.09	-6.46***	2.20
Date of Melt-Out (DMO)	-0.378	-33.30	-7.73***	0.34	-0.472	-41.54	-8.52***	0.44

[1]Refer to Section VII.B.1.b.
[2]Refer to Section VII.B.1.c.

3. MJJ Runoff Trends

Significant downward trends in MJJ runoff are indicated for both Fort Peck and Garrison, with Garrison only showing significant trend in variance for CCSM4, but not for CCSM3, while Fort Peck did not shows significant trend in variance for either climate projections. (Table 13). Trends in annual runoff were not computed because future projected annual runoff was not computed in this study.

Table 13. Projected Runoff Trends Based on CCSM3 and CCSM4 Climate Projections

	---------- Fort Peck ----------				---------- Garrison ----------			
	Slope (Kaf/yr)	Change over Period (Kaf)	Trend Significance Mean[1]	Trend Significance Variance[2]	Slope (Kaf/yr)	Change over Period (Kaf)	Trend Significance Mean[1]	Trend Significance Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level							
CCSM3 MJJ Runoff	-16.1	-1417	-3.91***	0.89	-16.7	-1470	-2.86***	3.04*
CCSM4 MJJ Runoff	-17.0	-1496	-3.95***	3.37*	-15.8	-1564	-2.95***	8.11***

[1]Refer to Section VII.B.1.b.
[2]Refer to Section VII.B.1.c.

4. Streamflow Trends

The results of projected runoff and streamflow trends upstream from Fort Peck (Table 13 and Table 14) match fairly well, except at the Landusky streamgage as it relates to variance. The Miles City (Garrison) trend is not significant at the 90% confidence level, although a downward trend is indicated. Streamflow was included in this analysis as methodology verification. If the streamflow results were opposite of runoff, then that would indicate problems with the overall methodology. Although there are some differences in the runoff and streamflow results, natural runoff and regulated streamflow are not directly comparable.

Table 14. Projected Streamflow Trends Based on CCSM3 and CCSM4 Climate Projections

	Missouri River near Landusky, Montana				Yellowstone River at Miles City, Montana			
	Mean (cfs)	Trend (cfs/yr)	Trend Significance		Mean (cfs)	Trend (cfs/yr)	Trend Significance	
			Mean[1]	Variance[2]			Mean[1]	Variance[2]
	* is 90% confidence level, ** is 95% confidence level, *** is 99% confidence level							
CCSM3 MJJ Streamflow	6362	-79	-7.84***	6.81***	18042	-21	-1.29	0.14
CCSM4 MJJ Streamflow	6378	-90	-8.04***	9.14***	15228	-19	-1.55	3.42*

[1]Refer to Section VII.B.1.b.
[2]Refer to Section VII.B.1.c.

G. Trend Comparison

Table 15. Research Answers

Question	Historical	Projected
Is the mountain snowpack beginning to accumulate sooner or later?	There is no significant change in DSBA for Fort Peck. DSBA is significantly later for Garrison.	Results indicate there is a significant trend that Fort Peck mountain snowpack begins to accumulate later and Garrison mountain snowpack begins to accumulate earlier. It should be noted that the coefficient of determination (R^2) is low (0.25-0.27) for the method to project the day snowpack begins accumulating; therefore, the results of the analysis should be interpreted with low confidence.
Is the mountain snowpack peak SWE accumulation increasing or decreasing?	Neither. Snowpack accumulation trend is fairly steady. No significant trend in variance.	Both basins show a significant trend for decreasing peak SWE. Neither shows a significant trend in variance. Based on climate change projections and shown in Table 12, peak SWE is decreasing at a rate of 0.07 inch per year at Fort Peck and 0.03 inch per year at Garrison.
Is the mountain snowpack peaking sooner or later?	Neither. No significant change. Snowpack peaks near April 15.	There is a significant trend toward earlier date of peak SWE at Fort Peck and Garrison.
Is the mountain snowpack melting faster or slower?	Neither. The number of days from peak SWE to melt-out is decreasing, but not significantly. Melt-out period is about 80 days upstream from Fort Peck and 67 days upstream from Garrison.	Both basins show a significant trend of fewer days from peak SWE to melt-out date. As shown on Table 12 (CCSM3 and CCSM4, DPS and DMO) by 2099, Fort Peck's melt period is 19 days shorter (for both) and Garrison's is 15 and 18 days shorter.
How strong and significant is the correlation between the drivers versus snowpack behavior trends and variability?	Precipitation, temperature, and soil moisture showed the strongest correlation for all snowpack behaviors (e.g. total accumulation, date of peak, melt rate, melt-out date) as well as MJJ runoff. Temperature and precipitation variability is influenced by ENSO and NAO as well as trends.	The historically derived correlations, except for soil moisture*, were applied to the regression relations to determine projected SWE and MJJ runoff. Climate projections may not account for the full impact of ENSO and NAO on climate drivers, and therefore on mountain snowpack behaviors and runoff. *AOGCMs do not provide an accurate representation of soil moisture at the scale required for this analysis.
Is there a trend and a change in variance in MJJ runoff from mountain snowpack?	Fort Peck does not show a significant trend for MJJ runoff. Garrison does show a significant decreasing trend for MJJ runoff. Fort Peck shows a constant variance, while Garrison shows a significant increasing variance.	Both Fort Peck and Garrison show a significant trend for decreasing MJJ runoff. Garrison shows a significant trend in variance.

VIII. Application of Results

The purpose of the pilot research study was to ascertain the sensitivity of mountain snowpack behaviors and MJJ reservoir runoff to climate variability and projected change based on AOGCM output. The study results indicate the following:

1. Projected snowpack behaviors in the Fort Peck reach indicate at a 99% confidence level that the date snowpack begins accumulating will be later, date of peak SWE and date of melt-out will be earlier, and peak SWE has a downward trend (Table 12).

2. Projected snowpack behaviors in the Garrison reach indicate at a 99% confidence level that the date snowpack begins accumulating will be earlier, date of peak SWE and date of melt-out will be earlier, peak SWE has a downward trend, and the melt rate will be accelerated (Table 12).

3. Projected runoff into Fort Peck and Garrison indicate significant downward trends (Table 13, Figures 12b and 13b, and Section VII.E.4.). Regarding runoff projections for the second half of the century, the increased frequency of low runoff years, as well as the downward trend in runoff, is notable. No trends are indicated in runoff variability.

This study used projection data from only two climate change models. The ENSO and NAO climate patterns are not included in the climate model projections, and those signals will create year-to-year variability in the snow behaviors and runoff. Finally, use of this study should look at overall trends and longer-term changes and not focus on individual years.

IX. Lessons Learned

One logistical lesson is to begin the contracting process as early as possible. The contracts to the USGS and the South Dakota State Climatologist took three and four months, respectively, to complete. Study progress was affected dramatically because the acquisition of some relevant driver data could not begin until the contracts were completed.

Future studies should address factors not considered in the scope of this study. The impacts of antecedent conditions from previous fall precipitation or longer term periods of wet or dry conditions, particularly in the plains areas of the Basin, are well understood, but were not addressed here. During extended wetter periods, the soil moisture content in the plains tends to result in large volumes of direct runoff because of the lower infiltration capacity of wet soils as well as the reduced capacity of already-full surface water bodies (e.g. wetlands, ponds, streams). This situation contributed to record runoff observed during 2011, which followed the high runoff years of 2009 and 2010, both of which experienced wet winters and springs. In contrast, the runoff during spring of 2013, which experienced a wet spring similar to 2011, was significantly less than 2011 mainly because it was preceded by 2012, a year that brought significant drought conditions throughout the entire basin. At the beginning of spring in 2013, soil moisture profiles were depleted from the 2012 drought and surface water bodies had ample storage to store excess runoff. If the methodology of this analysis is extended to the plains area of the upper Basin, it is strongly recommended that antecedent soil moisture conditions be considered.

In addition to the MLR methodology used in this study, future studies may want to consider using non-linear relations, auto-regressive (linear) models, and/or artificial neural (non-linear) networks.

Statistical analyses presented did not split available data into calibration and validation data sets, and as such the MLR may have been over-fitted to modern climate (due to only using 20 years of historical data for calibration purposes.) Future studies should expand the input data set or apply techniques to increase sample size, such as bootstrap or jackknife techniques. This will allow for a separate calibration and validation data set and a more complete assessment of uncertainty in the approach and methodology.

X. References

Bader, D.C., C. Covey, W.J. Gutowski Jr., I.M. Held, K.E. Kunkel, R.L. Miller, R.T. Tokmakian, and M.H. Zhang, 2008: Climate models, an assessment of strengths and limitations. U.S. Climate Change Science Program Synthesis and Assessment Product 3.1, 124 p. Available online at http://www.climatescience.gov/Library/sap/sap3-1/final-report/sap3-1-final-all.pdf

Bigg, G.R., 1990: El Niño and the Southern Oscillation. *Weather*, 45, 2-8.

Breusch, T.S., and A.R. Pagan, 1979: Simple test for heteroscedasticity and random coefficient variation. *Econometrica (The Econometric Society)*, **47**, 1287-1294.

Cohen, J., and J. Jones, 2011: Tropospheric precursors and stratospheric warmings. *J. Climate*, **24**, 6528-6539.

Daly, C.D., W.P. Gibson, G.H. Taylor, G.L. Johnson, and P. Pasteris, 2002: A knowledge-based approach to the statistical mapping of climate. *Climatic Research*, **22**, 99–113.

Daly, C.D., R.P. Neilson, and D.L. Phillips, 1994: A statistical-topographic model for mapping climatological precipitation over mountainous terrain. *J. Appl. Meteor.*, **33**, 140–158.

Gent, P.R., G. Danabasoglu, L.J. Donner, M.M. Holland, E.C. Hunke, S.R. Jayne, D.M. Lawrence, R.B. Neale, P.J. Rasch, M. Vertenstein, P.H. Worley, Z.-L. Yang, and M. Zhang, 2011: The Community Climate System Model Version 4. *J. Climate*, **24**, 4973-4991.

Hargreaves, G.H., and Z.A. Samani, 1985: Reference crop evapotranspiration from temperature. *Appl. Engineering in Agriculture*, **1**, 96-99.

Kendall, M.G., 1938: A new measure of rank correlation. *Biometrika*, **30**, 81-93.

Nakićenović, N., and R. Swart (Eds.), 2000: *Special report on emission scenarios: A special report of Working Group III of the Intergovernmental Panel on Climate Change*. Cambridge University Press, 570 p.

Sillman, J., V.V. Kharin, X. Zhang, F.W. Zwiers, and D. Bronaugh, 2013: Climate extremes indicies in the CMIP5 multimodel ensemble: Part 1. Model evaluation in the present climate. *J. Geophys. Res.: Atmos,*, **118**, 1-18.

Snyder, R.L, and S. Eching, 2002: Penman-Monteith daily (24-hour) reference evapotranspiration equations for estimating ET_o, ET_r, and HS ET_o with daily data. Regents of the University of California. Available online at http://biomet.ucdavis.edu/Evapotranspiration/PMdayXLS/PMdayDoc.pdf

Svoboda, M., D. LeComte, M. Hayes, R. Heim, K. Gleason, J. Angel, B. Rippey, R. Tinker, M. Palecki, D. Stooksbury, D. Miskus, and S. Stephens, 2002: The Drought Monitor. *Bulletin of the American Meteorological Society*, **83**, 1181-1190.

U.S. Army Corps of Engineers, 2006: Master Manual: Missouri River Mainstem Reservoir System Master Water Control Manual, p. III-5, Section 3-05.2; p. VI-12, Section 6-04.1.1.

vanVuuren, D.P., J. Edmonds, M. Kainuma, K. Riahi, A. Thomson, K. Hibbard, G.C. Hurtt, T. Kram, V. Krey, J.F. Lamarque, T. Masui, M. Meinshausen, N. Nakicenovic, S.J. Smith, and S.K. Rose, 2011: The representative concentration pathways: an overview. *Climatic Change*, **109**, 5-31.

Climate Change Impact Evaluation – Upper Missouri River Basin

Mountain Snowpack - Accumulation and Runoff

Appendices A Through I

Sun River in the Upper Missouri River Basin, Montana photo taken by Kevin Stamm

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Climate Change Impact Evaluation – Missouri River Basin
Mountain Snowpack - Accumulation and Runoff
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Appendix A – Historical Data Sources

Table A-1 – SNOTEL Station Information.
Stations in gray text were not used in the analysis.

SNOTEL Station	Reservoir Reach	Longitude	Latitude	Elevation (ft MSL)
Stations below 7,000 ft MSL				
BADGER PASS	FTPK	-113.0166	48.1333	6900
CALVERT CREEK	FTPK	-113.3333	45.8833	6430
CRYSTAL LAKE	FTPK	-109.5166	46.7833	6050
DEADMAN CREEK	FTPK	-110.6833	46.8000	6450
DUPUYER CREEK	FTPK	-112.7500	48.0666	5750
FLATTOP MTN.	FTPK	-113.8500	48.8000	6300
FROHNER MEADOW	FTPK	-112.2000	46.4333	6480
LICK CREEK	FTPK	-110.9666	45.5000	6860
MANY GLACIER	FTPK	-113.6666	48.8000	4900
MOOSE CREEK	FTPK	-113.9500	45.6666	6200
MOUNT LOCKHART	FTPK	-112.8166	47.9166	6400
PICKFOOT CREEK	FTPK	-111.2666	46.5833	6650
PORCUPINE	FTPK	-110.4666	46.1166	6500
WALDRON	FTPK	-112.7833	47.9166	5600
WHISKEY CREEK	FTPK	-111.1500	44.6166	6800
WOOD CREEK	FTPK	-112.8166	47.4500	5960
BOX CANYON	GARR	-110.2500	45.2666	6670
Stations between 7,000 and 8,500 ft MSL				
BASIN CREEK	FTPK	-112.5166	45.8000	7180
BLACK BEAR	FTPK	-111.1333	44.5000	8170
BLOODY DICK	FTPK	-113.5000	45.1666	7600
BOULDER MOUNTAIN	FTPK	-111.2833	46.5666	7950
DAISY PEAK	FTPK	-110.3333	46.6666	7600
DIVIDE	FTPK	-112.0500	44.8000	7800
LAKEVIEW RIDGE	FTPK	-111.8166	44.5833	7400
LEMHI RIDGE	FTPK	-113.4500	45.0000	8100
LOWER TWIN	FTPK	-111.9166	45.5166	7900
MULE CREEK	FTPK	-112.9666	45.4166	8300
NEVADA RIDGE	FTPK	-112.5000	46.8500	7020
ROCKER PEAK	FTPK	-112.2666	46.3500	8000
SADDLE MTN.	FTPK	-113.9666	45.7000	7940
SHOWER FALLS	FTPK	-110.9500	45.4000	8100
SPUR PARK	FTPK	-110.6166	46.7833	8100
TEPEE CREEK	FTPK	-111.7166	44.7833	8000
WHITE ELEPHANT	FTPK	-111.4166	44.5333	7710
BEAR TRAP MEADOW	GARR	-107.0666	43.8833	8200
BURGESS JUNCTION	GARR	-107.5333	44.7833	7880
CANYON	GARR	-110.5166	44.7166	7870
COLE CREEK	GARR	-109.3500	45.2000	7850
HANSEN SAWMILL	GARR	-106.9833	44.2500	8360

Table A-1 – SNOTEL Station Information. Stations in gray text were not used in the analysis.				
MIDDLE POWDER	GARR	-107.1833	43.6333	7760
NORTHEAST ENTRANCE	GARR	-110.0166	45.0000	7350
S FORK SHIELDS	GARR	-110.4333	46.0833	8100
SYLVAN LAKE	GARR	-110.1500	44.4833	8420
WOLVERINE	GARR	-109.6500	44.8000	7650
YOUNTS PEAK	GARR	-109.8166	43.9333	8350
Stations above 8,500 ft MSL				
BEAGLE SPRINGS	FTPK	-112.9833	44.4666	8850
CARROT BASIN	FTPK	-111.3000	44.9666	9000
CLOVER MEADOW	FTPK	-111.8500	45.0166	8600
DARKHORSE LAKE	FTPK	-113.5833	45.1666	8600
BALD MTN.	GARR	-107.8500	44.8000	9380
BEARTOOTH LAKE	GARR	-109.5666	44.9500	9360
BLACKWATER	GARR	-109.8000	44.3833	9780
BONE SPRINGS DIV	GARR	-107.5833	44.6833	9350
BURROUGHS CREEK	GARR	-109.6666	43.7000	8750
CLOUD PEAK RESERVOIR	GARR	-107.0666	44.4000	9860
DOME LAKE	GARR	-107.3000	44.5666	8880
EVENING STAR	GARR	-109.7833	44.6500	9200
FISHER CREEK	GARR	-109.9500	45.0666	9100
HOBBS PARK	GARR	-109.1000	42.8666	10100
KIRWIN	GARR	-109.3166	43.8666	9550
LITTLE WARM	GARR	-109.7500	43.5000	9370
MONUMENT PEAK	GARR	-110.2333	45.2166	8850
OWL CREEK	GARR	-109.0166	43.6666	8975
PARKER PEAK	GARR	-109.9166	44.7333	9400
PLACER BASIN	GARR	-110.0833	45.4166	8830
POWDER RIVER PASS	GARR	-107.1333	44.1666	9480
SHELL CREEK	GARR	-107.4333	44.5000	9580
SUCKER CREEK	GARR	-107.4000	44.7166	8880
TOGWOTEE PASS	GARR	-110.0500	43.7500	9580
TOWNSEND CREEK	GARR	-108.9000	42.7000	8700
TWO OCEAN PLATEAU	GARR	-110.2166	44.1500	9240
WHITE MILL	GARR	-109.9166	45.0500	8700

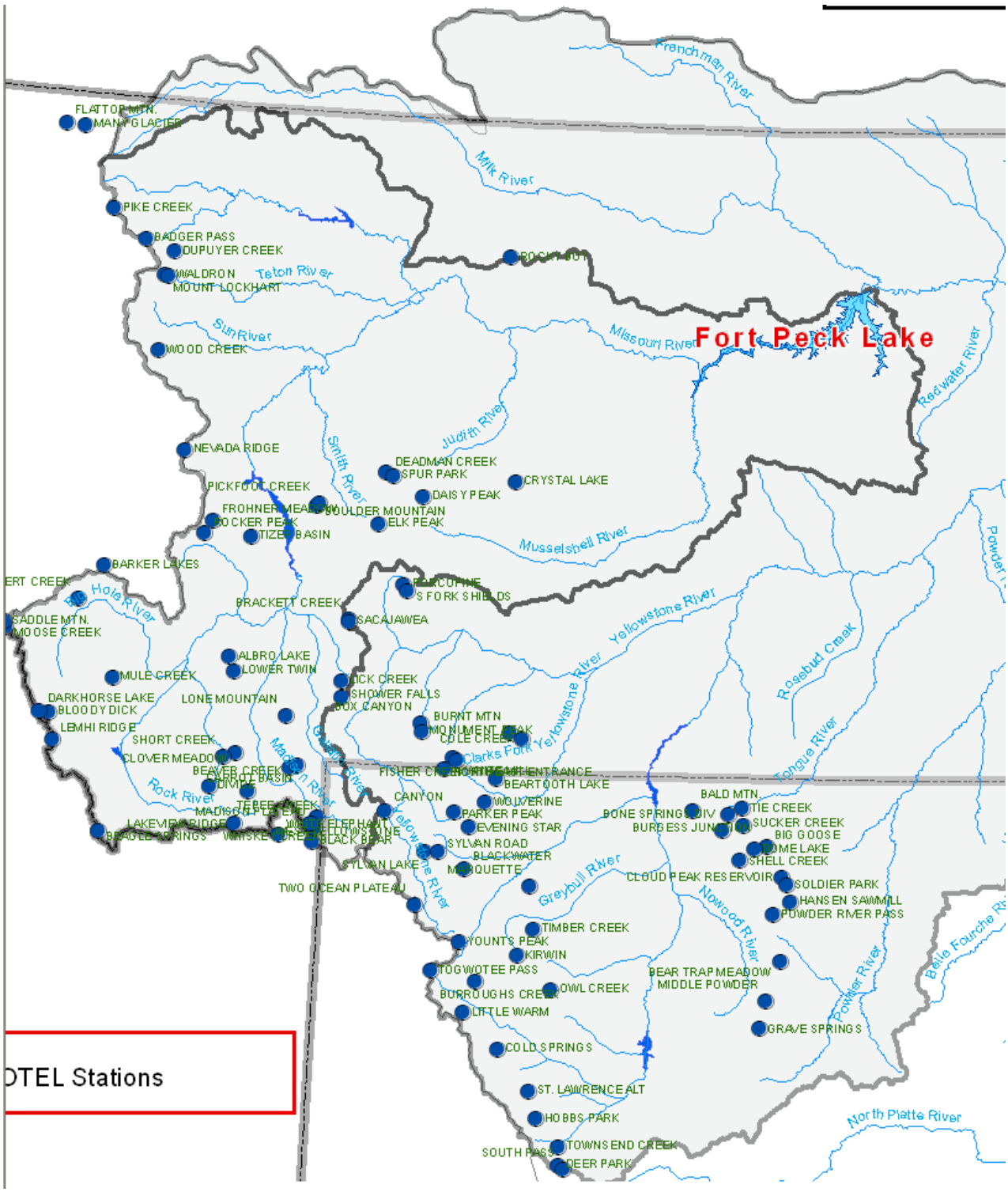

Fort Peck Lake
Frenchman River
Milk River
Teton River
Sun River
Missouri River
Redwater River
Judith River
Smith River
Musselshell River
Hole River
Yellowstone River
Rosebud Creek
Rock River
Madison River
Gallatin River
Clarks Fork Yellowstone River
Tongue River
Greybull River
Nowood River
Powder River
Belle Fourche River
North Platte River
FLATTOP MTN.
MANY GLACIER
PIKE CREEK
BADGER PASS
DUPUYER CREEK
WALDRON
MOUNT LOCKHART
WOOD CREEK
NEVADA RIDGE
PICKFOOT CREEK
FROHNER MEADOW
ROCKER PEAK
TIZER BASIN
BOULDER MOUNTAIN
ELK PEAK
DEADMAN CREEK
SPUR PARK
DAISY PEAK
CRYSTAL LAKE
BARKER LAKES
BRACKETT CREEK
SADDLE MTN.
MOOSE CREEK
PORCUPINE
SACAJAWEA
ALBRO LAKE
LOWER TWIN
MULE CREEK
DARKHORSE LAKE
BLOODY DICK
LEMHI RIDGE
LONE MOUNTAIN
SHORT CREEK
CLOVER MEADOW
BEAVER CREEK
SHOWER FALLS
BOX CANYON
BURNT MTN
MONUMENT PEAK
COLE CREEK
FISHER CREEK
BEARTOOTH LAKE
CANYON
WOLVERINE
PARKER PEAK
EVENING STAR
SYLVAN ROAD
BLACKWATER
MARQUETTE
SYLVAN LAKE
TWO OCEAN PLATEAU
BALD MTN.
BONE SPRINGS DIV
BURGESS JUNCTION
TIE CREEK
SUCKER CREEK
BIG GOOSE
DOME LAKE
SHELL CREEK
CLOUD PEAK RESERVOIR
SOLDIER PARK
HANSEN SAWMILL
POWDER RIVER PASS
TIMBER CREEK
YOUNTS PEAK
KIRWIN
TOGWOTEE PASS
BURROUGHS CREEK
OWL CREEK
LITTLE WARM
BEAR TRAP MEADOW
MIDDLE POWDER
GRAVE SPRINGS
COLD SPRINGS
ST. LAWRENCE ALT
HOBBS PARK
TOWNSEND CREEK
SOUTH PASS
DEER PARK
OTEL Stations

Table A-2 – HCN Station Information.					
HCN Station	State	Reservoir Reach	Longitude	Latitude	Elevation (ft MSL)
Augusta	MT	FTPK	-111.6167	47.4833	4070
Bozeman Montana St U	MT	FTPK	-110.9500	45.6667	4862
Cascade 5 S	MT	FTPK	-110.2833	47.2167	3390
Choteau	MT	FTPK	-112.1828	47.8167	3812
Cut Bank AP	MT	FTPK	-112.3253	48.6000	3839
Dillon Wmce	MT	FTPK	-112.6367	45.2000	5233
Ennis	MT	FTPK	-111.7289	45.3500	4954
Flatwillow 4 ENE	MT	FTPK	-108.4000	46.8500	3143
Ft. Assinniboine	MT	FTPK/GARR	-109.7917	48.5000	2687
Glasgow Intl AP	MT	FTPK/GARR	-106.6361	48.2167	2284
Great Falls AP	MT	FTPK	-111.3000	47.4833	3688
Helena AP ASOS	MT	FTPK	-112.0000	46.6000	3828
Jordan	MT	FTPK	-106.9094	47.3167	2592
Moccasin Exp Stn	MT	FTPK	-109.9500	47.0500	4304
Norris Madison PH	MT	FTPK	-111.6908	45.4833	4734
Valier	MT	FTPK	-112.2489	48.3167	3812
Virginia City	MT	FTPK	-111.9453	45.3000	5853
West Yellowstone	MT	FTPK	-111.1033	44.6500	6670
White Sulphur Springs 2	MT	FTPK	-110.9014	46.5333	5203
Big Timber	MT	GARR	-108.0500	45.8333	4104
Chinook	MT	GARR	-108.8000	48.5833	2411
Ekalaka	MT	GARR	-104.5522	45.8833	3432
Forks 4 NNE	MT	GARR	-107.4300	48.7833	2602
Glendive	MT	GARR	-104.7119	47.1000	2080
Huntely Exp Stn	MT	GARR	-108.3008	45.9167	2992
Hysham 25 SSE	MT	GARR	-107.2336	46.0167	3002
Livingston 12 S	MT	GARR	-110.5603	45.5167	4692
Malta 7 E	MT	GARR	-107.8736	48.4000	2231
Mildred 5 N	MT	GARR	-104.9600	46.7500	2629
Miles City AP	MT	GARR	-105.8400	46.4333	2631
Plevna	MT	GARR	-104.5000	46.4167	2772
Red Lodge	MT	GARR	-109.2461	45.1967	5850
Savage	MT	GARR	-104.3360	47.4500	1975
Vida 6 NE	MT	GARR	-105.4833	47.8800	2284
Dunn Center 1E	ND	GARR	-102.6200	47.3500	2192
Basin	WY	GARR	-108.0314	44.3789	3837
Cody AP	WY	GARR	-109.0558	44.5333	4984
Colony	WY	GARR	-104.1552	44.9000	3524
Diversion Dam	WY	GARR	-108.6659	43.2333	5574
Pavillion	WY	GARR	-108.6894	43.2500	5443
Powell FLD STN	WY	GARR	-108.7567	44.7667	4383
Riverton	WY	GARR	-108.3794	43.0167	4954
Worland	WY	GARR	-107.9547	44.0167	4062
Yellowstone PK Mammoth	WY	GARR	-110.6900	44.9667	6243

Table A-3. USGS Stream Gage Locations			
LOWER GAGES			
Gage No	Latitude	Longitude	Description
06115200	47.63082	-108.68765	Missouri River near Landusky, MT
06130500	46.99471	-107.88900	Musselshell River at Mosby, MT
06309000	46.42167	-105.86111	Yellowstone River at Miles City, MT
06326500	46.43000	-105.30998	Powder River near Locate, MT
UPPER GAGES			
Gage No	Latitude	Longitude	Description
06054500	46.14604	-111.42052	Missouri River at Toston, MT
06214500	45.79995	-108.46736	Yellowstone River at Billings, MT
06294500	46.12471	-107.46896	Bighorn River above Tullock Creek near Bighorn, MT

Appendix B - Historic Data Trend Analysis

SNOTEL Temperature

Fort Peck

Analysis of Monthly Time-Series Data

Output File: FTPK-SNOTEL.OUT
DSS File: NRCS-PT.DSS

/FTPK/SNOTEL/TMEAN(C)/01JAN1991/1MON/OBS/
First Year: 1991
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1991	-9.85	-3.12	-5.21	-1.75	2.53	7.42	13.64	14.27	7.61	0.59	-6.39	-6.28	1.12
1992	-6.05	-3.49	-0.79	1.66	6.44	9.81	9.98	11.47	6.51	2.87	-6.17	-10.92	1.78
1993	-10.31	-9.89	-2.67	-0.88	6.04	6.42	7.50	9.06	5.88	1.48	-7.67	-7.06	-0.18
1994	-5.81	-9.40	-2.77	0.39	5.88	9.31	12.95	13.66	9.76	0.08	-7.83	-7.54	1.56
1995	-7.17	-5.76	-5.03	-1.70	3.05	6.95	11.63	11.99	7.12	-0.57	-2.83	-7.53	0.85
1996	-10.59	-8.06	-6.09	-0.17	1.72	9.58	13.79	13.09	6.11	0.96	-4.87	-8.72	0.56
1997	-9.05	-7.70	-3.86	-3.01	5.00	8.75	11.87	11.90	8.66	1.03	-3.80	-6.91	1.07
1998	-7.02	-5.54	-4.15	0.61	5.14	5.80	14.62	14.07	10.78	2.54	-2.18	-8.46	2.18
1999	-5.41	-4.94	-2.50	-0.51	3.76	8.03	12.86	13.28	6.80	3.95	1.29	-4.55	2.67
2000	-6.32	-3.58	-2.35	2.35	5.12	9.54	14.70	14.18	7.20	2.25	-7.06	-6.73	2.44
2001	-5.33	-7.82	-1.85	0.22	6.69	9.36	13.39	15.33	10.52	2.30	-0.19	-7.04	2.96
2002	-7.05	-6.41	-6.16	-0.41	4.12	9.51	15.19	11.00	8.27	-0.26	-1.91	-4.46	1.79
2003	-3.04	-7.15	-2.38	1.31	5.06	9.56	16.62	15.40	8.45	4.62	-5.95	-4.98	3.13
2004	-6.68	-5.15	0.20	2.36	4.22	8.58	13.54	11.83	7.06	2.82	-2.09	-4.27	2.70
2005	-5.28	-4.12	-2.06	1.14	5.01	8.15	14.88	12.59	8.36	4.18	-2.55	-6.44	2.82
2006	-3.90	-7.49	-3.59	2.40	6.75	11.27	16.51	13.15	8.70	1.63	-2.93	-4.99	3.13
2007	-8.10	-4.52	0.55	1.68	6.61	11.41	17.95	14.11	8.23	2.85	-2.31	-7.72	3.39
2008	-8.42	-4.71	-4.47	-1.36	4.75	8.92	14.39	13.60	8.07	3.27	0.05	-9.34	2.06
2009	-5.47	-4.55	-4.28	0.41	5.97	8.45	13.08	12.73	11.44	-0.93	-1.47	-10.23	2.10
2010	-4.40	-4.99	-0.86	0.76	2.69	8.62	13.03	11.91	8.83	5.22	-4.59	-5.90	2.53
2011	-6.21	-8.38	-2.57	-1.43	3.56	7.98	14.16	14.48	10.94	3.66	-3.88	-5.50	2.23
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-6.74	-6.04	-2.99	0.19	4.77	8.73	13.63	13.00	8.35	2.12	-3.59	-6.93	2.04
SD	2.05	1.99	1.88	1.52	1.47	1.39	2.27	1.53	1.60	1.74	2.58	1.87	0.94
Skew	-0.35	-0.39	0.10	-0.27	-0.44	-0.15	-0.73	-0.66	0.44	-0.11	-0.05	-0.48	-0.72
Analysis of Trend in Mean (95% SL):													
Slope	0.16	0.04	0.08	0.06	0.02	0.07	0.20	0.06	0.13	0.12	0.20	0.06	0.10
KendSum	66.	18.	40.	44.	0.	18.	78.	30.	76.	70.	66.	32.	96.
KendTau	0.31	0.09	0.19	0.21	0.00	0.09	0.37	0.14	0.36	0.33	0.31	0.15	0.46
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.96	0.51	1.18	1.30	0.00	0.51	2.33	0.88	2.26	2.08	1.96	0.94	2.87

Trend?	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	Trend	Trend	Trend	No Trend	Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.1655	2.9140	0.0116	0.0052	0.3945	0.0442	0.1614	1.4636	0.1319	1.6679	0.0473	0.4178	0.1502
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	4.21	3.98	3.53	2.31	2.17	1.93	5.13	2.33	2.57	3.04	6.67	3.49	0.88
Res Var	3.28	3.93	3.27	2.15	2.15	1.75	3.56	2.20	1.94	2.50	5.15	3.34	0.50
Tnd Var	22.11	1.28	7.45	6.77	0.54	9.31	30.66	5.68	24.50	17.69	22.74	4.36	43.13

Garrison

Output File: GARR-SNOTEL.OUT
DSS File: NRCS-PT.DSS

/GARR/SNOTEL/TMEAN(C)/01JAN1991/1MON/OBS/
First Year: 1991
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1991	-11.23	-5.06	-6.21	-3.34	2.14	7.91	12.43	11.94	6.15	-0.29	-8.02	-8.03	-0.13
1992	-7.78	-5.22	-3.01	0.86	4.92	7.52	8.86	10.31	5.98	1.76	-7.81	-10.79	0.47
1993	-10.27	-10.29	-4.14	-2.59	4.23	5.48	7.44	8.62	4.67	-0.27	-8.68	-8.65	-1.20
1994	-8.16	-10.02	-4.52	-1.28	5.49	9.08	11.51	12.21	7.77	-0.88	-8.83	-8.05	0.36
1995	-8.78	-7.02	-6.11	-3.49	1.24	6.20	10.80	12.44	5.84	-1.82	-4.47	-8.77	-0.33
1996	-11.34	-8.93	-6.65	-1.86	1.26	9.11	12.40	12.03	4.87	0.05	-5.22	-9.31	-0.30
1997	-9.87	-10.23	-4.88	-4.55	3.59	8.58	10.80	10.97	7.52	0.43	-5.82	-8.21	-0.14
1998	-7.54	-7.28	-5.69	-1.19	4.06	4.44	13.62	12.32	9.24	1.55	-3.38	-9.38	0.90
1999	-6.71	-6.15	-3.33	-1.92	2.65	7.33	12.82	12.36	5.18	3.22	0.53	-6.32	1.64
2000	-7.45	-4.31	-3.64	1.28	4.65	8.65	13.93	13.51	6.83	1.54	-8.65	-7.77	1.55
2001	-7.02	-8.47	-3.19	-0.26	5.38	9.46	13.69	13.92	9.08	1.35	-1.71	-8.00	2.02
2002	-8.98	-7.54	-6.71	-1.04	3.33	9.48	14.47	10.58	7.30	-1.53	-4.05	-6.16	0.76
2003	-3.93	-9.15	-3.50	0.76	4.42	7.59	15.34	14.23	6.55	3.61	-7.04	-5.86	1.92
2004	-7.33	-6.89	-1.04	0.92	3.85	7.43	11.89	10.11	6.59	1.73	-3.54	-5.66	1.50
2005	-5.64	-5.85	-3.76	0.06	3.72	8.00	14.12	11.29	7.75	3.14	-3.28	-7.64	1.83
2006	-5.41	-8.68	-4.75	1.70	5.58	10.88	15.23	12.20	6.88	0.56	-3.36	-6.31	2.04
2007	-9.61	-5.75	-0.51	0.60	5.73	11.04	15.76	13.10	7.83	2.05	-2.96	-9.62	2.31
2008	-9.93	-6.63	-6.14	-2.29	3.50	7.94	13.81	12.92	6.58	2.14	-1.46	-9.29	0.93
2009	-6.39	-5.82	-4.41	-0.21	4.99	7.28	11.74	11.31	9.68	-2.27	-2.19	-11.36	1.03
2010	-5.81	-7.54	-2.44	-0.52	1.63	8.11	12.60	11.73	8.72	4.14	-4.82	-6.46	1.61
2011	-7.43	-9.09	-3.51	-2.23	2.16	7.87	13.94	13.27	9.09	2.64	-4.89	-7.18	1.22
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Basic Statistics:

Mean	-7.93	-7.42	-4.20	-0.98	3.74	8.07	12.72	11.97	7.15	1.09	-4.75	-8.04	0.95
SD	1.98	1.79	1.71	1.72	1.43	1.56	2.08	1.36	1.46	1.82	2.64	1.59	0.96
Skew	-0.01	-0.09	0.38	-0.31	-0.39	-0.23	-0.90	-0.56	0.08	-0.23	-0.07	-0.32	-0.59

Analysis of Trend in Mean (95% SL):

Slope	0.16	0.02	0.10	0.10	0.02	0.07	0.20	0.07	0.14	0.12	0.23	0.06	0.11
KendSum	78.	13.	44.	50.	14.	34.	95.	46.	84.	72.	84.	40.	100.
KendTau	0.37	0.06	0.21	0.24	0.07	0.16	0.45	0.22	0.40	0.34	0.40	0.19	0.48
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.33	0.36	1.30	1.48	0.39	1.00	2.84	1.36	2.51	2.14	2.51	1.18	2.99
Trend?	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	Trend	Trend	Trend	No Trend	Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.3361	2.2149	0.4898	0.1313	0.0046	0.0102	0.2105	0.3648	0.3136	1.7828	0.1087	2.3095	0.0086
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	3.91	3.21	2.91	2.97	2.05	2.45	4.34	1.85	2.13	3.31	6.98	2.52	0.92
Res Var	2.97	3.20	2.53	2.55	2.04	2.23	2.74	1.67	1.43	2.78	4.90	2.40	0.47
Tnd Var	24.15	0.56	13.13	14.25	0.57	8.69	36.81	9.78	32.98	16.14	29.86	4.76	48.36

HCN Temperature

Fort Peck

Analysis of Monthly Time-Series Data

Output File: FTPK-HCN.OUT
DSS File: NRCS-PT.DSS

/FTPK/HCN/TMEAN(F)/01JAN1895/1MON/OBS/
First Year: 1895
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1895	13.75	17.31	29.02	44.31	50.13	54.81	63.21	62.84	51.45	45.06	28.98	21.74	40.22
1896	18.79	28.92	25.42	37.40	46.22	60.63	66.32	62.48	49.89	45.25	14.54	31.98	40.65
1897	17.32	20.88	19.16	43.57	58.40	58.00	63.15	66.02	57.14	44.15	24.37	21.35	41.13
1898	21.22	28.82	21.06	42.91	48.60	57.29	63.57	66.29	53.28	37.60	26.52	19.78	40.58
1899	18.76	7.53	19.30	37.36	45.42	55.77	64.44	59.11	56.14	39.59	38.02	21.97	38.62
1900	28.12	17.95	33.70	44.93	54.08	64.49	64.71	61.69	51.16	43.81	27.07	29.99	43.47
1901	20.20	17.94	32.60	40.44	55.53	52.67	68.21	66.16	47.91	47.99	35.93	25.02	42.55
1902	20.24	24.52	29.50	39.52	51.78	55.05	61.45	62.22	51.97	45.25	28.66	18.88	40.75
1903	24.74	17.37	25.38	39.26	47.73	60.49	61.36	62.22	51.10	47.06	27.23	27.39	40.94
1904	22.31	14.94	22.88	42.57	49.68	57.22	64.03	63.32	54.86	46.08	39.29	25.34	41.88
1905	15.90	15.73	36.33	40.80	46.65	54.68	64.34	65.63	56.68	38.46	32.35	24.42	41.00
1906	23.97	26.26	22.66	44.48	47.82	54.71	66.06	62.26	55.93	45.70	27.97	23.91	41.81
1907	5.16	26.29	30.60	37.40	46.01	54.75	61.88	59.32	51.84	47.98	34.73	26.68	40.22
1908	24.49	24.00	28.51	44.16	47.82	54.76	66.55	61.13	55.18	40.28	33.36	23.63	41.99
1909	12.60	22.69	30.67	34.02	47.22	58.25	64.03	64.37	55.44	44.13	31.91	13.07	39.87
1910	19.57	14.40	41.97	48.92	51.60	60.77	67.46	60.32	51.44	47.38	31.42	24.30	43.30

1911	14.16	15.39	36.09	38.52	48.26	60.41	61.71	59.03	50.37	40.07	23.36	20.96	39.03
1912	17.31	25.55	18.09	42.20	49.28	60.08	60.77	60.10	47.00	40.43	36.60	26.25	40.31
1913	14.45	14.77	23.51	42.73	49.34	60.21	62.34	64.45	55.04	38.99	35.20	24.48	40.46
1914	25.04	18.65	32.81	41.90	51.04	57.03	67.57	62.14	54.06	43.78	36.78	14.72	42.13
1915	20.05	26.91	31.47	49.31	49.12	53.57	59.43	65.61	49.37	47.36	30.97	24.16	42.28
1916	-2.52	20.97	34.87	41.90	45.42	55.17	65.00	61.82	52.53	38.98	28.87	12.92	37.99
1917	15.08	15.40	21.45	36.56	47.63	56.12	69.17	63.01	55.34	41.61	40.02	19.32	40.06
1918	15.30	19.76	35.73	38.20	47.18	63.89	63.98	61.50	53.24	47.03	29.28	26.37	41.79
1919	29.83	17.52	25.52	44.09	52.01	63.97	69.18	66.52	54.75	33.02	23.52	16.35	41.36
1920	20.14	23.38	27.10	33.42	48.35	56.84	66.87	64.12	54.83	42.46	29.08	24.16	40.90
1921	25.00	28.65	31.34	39.36	49.61	62.12	66.12	64.86	49.20	48.18	28.65	20.40	42.79
1922	14.17	8.90	27.89	38.53	49.51	61.74	63.80	66.37	58.10	46.84	28.90	14.25	39.92
1923	23.09	15.92	28.73	39.44	50.27	57.86	67.69	61.92	55.48	40.15	36.01	23.01	41.63
1924	15.31	30.02	26.50	39.01	50.64	55.44	64.61	61.63	54.16	44.73	29.48	10.90	40.20
1925	21.84	28.83	32.14	43.90	52.57	57.98	66.97	62.45	51.92	33.40	32.15	29.06	42.77
1926	24.95	31.04	33.23	43.72	52.40	59.06	67.46	62.51	45.83	45.95	30.84	20.08	43.09
1927	17.83	21.47	31.40	38.54	44.58	58.27	64.34	60.95	52.53	46.42	26.68	9.32	39.36
1928	21.96	23.06	34.18	37.60	55.53	54.47	64.90	60.77	53.37	41.54	32.53	23.41	41.94
1929	6.47	12.19	32.77	37.38	48.37	57.75	67.56	68.64	49.34	45.60	29.33	21.56	39.75
1930	1.95	31.34	28.28	48.12	50.40	58.74	68.14	67.22	54.94	38.58	30.89	27.14	42.15
1931	28.08	30.58	31.52	41.99	51.96	62.69	66.88	65.73	55.03	45.02	26.36	24.25	44.17
1932	16.78	23.55	22.81	42.53	52.15	59.68	66.50	64.42	54.52	40.96	33.90	15.60	41.12
1933	21.94	14.66	32.99	38.13	48.19	64.24	69.28	63.67	53.69	45.25	35.69	22.76	42.54
1934	29.03	30.49	34.64	46.69	58.20	58.06	67.57	65.59	49.66	47.38	37.05	22.93	45.61
1935	17.71	28.73	26.56	34.60	47.28	57.79	67.81	63.76	56.57	42.60	26.52	25.53	41.29
1936	15.80	-1.83	29.34	40.53	57.60	62.74	73.18	65.98	55.21	45.98	31.70	21.82	41.50
1937	-0.97	17.17	29.25	41.59	53.71	58.98	68.33	64.98	56.33	47.21	30.66	22.56	40.82
1938	24.50	17.68	31.10	41.43	48.49	59.51	65.37	63.74	61.15	45.56	27.50	25.69	42.64
1939	26.87	14.30	32.10	44.36	54.44	54.51	68.39	65.06	56.37	43.84	38.60	31.35	44.18
1940	12.87	21.80	34.21	39.51	54.47	61.34	67.88	66.57	58.82	48.44	24.22	28.00	43.18
1941	23.94	25.55	33.18	41.72	53.07	59.23	67.52	64.73	49.21	42.54	34.65	24.28	43.30
1942	20.32	16.97	30.36	43.90	47.27	54.49	65.89	63.94	54.27	45.45	29.54	24.35	41.40
1943	9.80	25.73	22.43	46.43	47.27	54.33	65.61	64.49	55.57	47.05	34.33	26.56	41.63
1944	25.54	22.07	24.30	42.90	53.18	55.36	63.62	61.49	55.22	49.52	29.03	21.75	42.00
1945	24.04	23.14	32.77	36.21	48.17	54.07	67.00	65.18	51.54	47.23	29.05	19.96	41.53
1946	25.02	26.10	37.00	46.41	48.02	58.06	67.12	63.45	53.56	37.91	26.30	24.27	42.77
1947	20.54	21.65	27.52	42.05	52.12	55.17	68.82	64.24	53.95	48.10	26.55	25.69	42.20
1948	23.94	18.25	24.68	40.71	51.55	59.01	63.55	64.56	56.44	45.69	30.53	14.28	41.10
1949	4.63	14.08	28.65	47.20	53.64	58.83	65.43	66.94	54.48	39.12	41.32	17.70	41.00
1950	-0.06	28.04	26.14	38.36	47.29	56.10	62.94	61.79	52.76	46.13	28.07	27.47	39.59
1951	14.59	22.02	19.53	38.48	51.24	52.32	65.61	61.02	50.50	39.53	30.15	13.91	38.24
1952	14.03	22.75	24.13	46.22	51.65	59.13	63.58	63.85	57.96	46.69	28.31	25.76	42.01
1953	29.61	26.95	33.34	36.05	46.47	56.84	66.98	65.77	57.63	49.12	38.23	27.81	44.57
1954	12.05	34.95	24.04	38.05	50.25	54.75	68.16	62.71	53.85	42.68	39.95	27.36	42.40
1955	19.31	17.55	21.73	38.32	48.28	57.27	64.67	66.73	53.35	46.75	18.79	18.55	39.28
1956	17.51	18.27	30.62	39.32	51.78	61.57	65.87	62.13	55.90	44.68	31.96	26.02	42.14
1957	6.13	21.45	30.73	39.27	52.81	58.64	67.46	63.98	55.16	40.14	30.44	31.14	41.45
1958	28.66	24.32	26.58	40.37	58.21	57.39	61.77	67.37	55.01	47.16	30.22	25.78	43.57
1959	19.20	14.78	33.59	40.40	46.04	60.48	66.28	63.29	52.37	41.70	26.59	29.32	41.17
1960	17.23	19.38	28.69	40.01	49.30	59.07	70.17	62.61	55.94	45.86	31.07	24.10	41.95
1961	26.57	32.20	35.23	38.26	51.68	65.81	67.94	69.50	48.22	43.28	28.33	18.81	43.82
1962	16.47	20.95	25.38	45.13	49.63	59.17	62.83	63.24	53.80	47.98	36.16	28.62	42.45
1963	10.17	32.33	35.20	40.02	50.69	58.23	65.68	65.60	60.63	50.61	33.90	20.14	43.60
1964	23.18	26.91	25.34	39.85	50.88	57.71	68.15	61.60	51.33	47.67	29.63	14.12	41.36
1965	21.55	22.91	19.10	41.01	48.09	56.96	65.19	63.62	43.78	49.98	32.45	25.33	40.83
1966	14.81	22.47	33.45	38.30	53.51	57.33	67.90	62.78	59.44	44.27	28.95	23.44	42.22
1967	24.13	28.08	26.83	34.64	48.33	56.60	67.15	67.04	60.13	45.89	31.52	17.81	42.35
1968	17.97	27.59	37.44	38.36	47.43	57.10	65.72	60.94	54.06	44.40	31.48	14.80	41.44
1969	4.47	17.64	24.57	45.92	52.89	56.24	64.50	67.40	57.16	37.04	35.43	26.22	40.79
1970	16.44	29.64	27.19	35.45	50.89	62.31	67.36	67.08	51.09	40.97	29.16	19.81	41.45
1971	15.98	25.32	29.19	41.12	51.19	58.27	64.00	70.63	51.25	41.55	32.36	15.63	41.37
1972	11.97	22.75	35.93	40.20	50.40	61.48	61.85	66.00	50.43	41.15	31.85	15.03	40.75

1973	20.12	25.17	34.58	38.12	51.14	59.69	66.48	66.38	53.60	46.11	25.14	25.95	42.71
1974	17.17	29.59	31.42	43.90	46.98	63.02	68.42	60.71	53.28	47.49	33.94	26.37	43.52
1975	20.17	15.44	26.51	31.52	47.51	56.32	68.42	61.04	54.10	43.27	29.58	26.94	40.07
1976	23.79	28.72	28.57	42.60	53.80	56.94	66.90	64.10	57.38	43.49	32.52	27.56	43.86
1977	16.04	33.23	31.22	45.96	50.58	62.92	65.07	60.87	53.54	44.95	28.14	18.25	42.56
1978	12.30	18.17	32.94	42.22	49.34	59.49	64.14	62.47	55.77	46.24	22.81	13.81	39.97
1979	4.33	16.88	31.82	38.58	49.51	60.07	66.27	65.16	59.40	46.98	28.33	29.77	41.42
1980	13.59	25.16	29.12	46.83	53.46	58.73	66.12	60.28	55.30	45.67	34.44	25.12	42.82
1981	29.51	27.77	36.20	44.16	50.85	56.53	65.33	66.89	57.09	42.47	36.56	23.23	44.72
1982	9.83	19.68	28.94	36.70	47.57	57.84	64.42	65.37	53.00	43.36	26.80	22.98	39.71
1983	28.09	32.12	34.37	39.02	49.02	58.08	64.60	69.52	52.61	46.33	32.13	5.22	42.59
1984	24.60	31.57	32.90	40.92	50.33	57.78	67.28	67.83	49.76	38.96	31.67	14.18	42.31
1985	16.73	19.02	30.58	45.48	54.79	59.42	69.96	60.83	47.54	41.96	13.34	20.92	40.05
1986	30.72	20.67	41.39	41.12	51.46	64.07	62.65	65.56	48.78	45.66	28.15	26.23	43.87
1987	25.20	30.77	33.90	48.77	54.83	62.30	64.20	60.01	57.32	45.63	35.65	25.02	45.30
1988	19.01	26.26	34.15	44.90	54.50	67.33	68.33	65.58	54.33	48.09	31.50	24.10	44.84
1989	22.70	9.81	27.68	41.71	50.03	59.42	68.82	62.75	54.69	43.97	34.55	22.69	41.57
1990	26.24	25.10	34.04	43.27	49.09	59.23	65.99	66.19	61.06	44.34	34.73	14.37	43.64
1991	17.48	35.83	32.56	40.96	49.72	58.03	67.00	69.10	56.60	42.01	28.66	28.50	43.87
1992	29.00	33.27	39.92	45.37	54.58	61.40	60.67	62.13	54.62	45.92	30.91	15.73	44.46
1993	12.98	15.96	35.36	42.08	54.34	56.46	57.27	59.73	52.52	44.23	26.15	28.10	40.43
1994	24.79	16.76	37.42	43.12	53.97	59.72	66.54	67.07	59.26	43.17	27.97	25.45	43.77
1995	23.42	28.63	30.56	39.18	48.68	57.74	64.34	64.34	54.90	42.24	33.37	22.47	42.49
1996	12.43	23.65	25.34	43.04	46.66	60.85	66.59	66.52	53.26	43.10	23.15	16.62	40.10
1997	15.93	27.56	33.58	36.62	52.21	60.47	64.48	64.84	58.42	44.07	31.42	26.10	42.97
1998	20.56	30.50	30.67	43.74	53.14	54.75	68.79	67.91	61.40	44.42	33.92	22.08	44.32
1999	24.50	31.22	35.86	39.74	49.05	57.69	64.05	66.88	52.16	46.14	40.16	30.02	44.79
2000	23.28	28.14	35.90	44.22	52.24	58.77	68.66	67.01	54.93	43.37	22.82	17.74	43.09
2001	25.26	17.52	34.68	41.43	54.57	59.27	67.36	68.93	59.18	44.49	37.88	23.11	44.47
2002	23.68	27.09	19.73	38.38	48.68	59.51	69.48	60.94	55.93	37.43	34.35	27.59	41.90
2003	26.98	22.23	31.28	44.13	50.65	59.34	70.91	69.95	55.45	48.34	25.32	26.83	44.28
2004	18.11	25.72	39.00	44.71	48.49	56.74	66.62	62.88	54.23	43.86	34.22	28.47	43.59
2005	18.85	29.69	34.58	42.75	49.63	57.56	68.15	64.32	55.71	46.65	34.50	21.36	43.65
2006	32.31	24.72	31.08	45.40	53.57	61.75	71.28	65.26	55.19	41.61	30.67	27.19	45.00
2007	22.40	23.42	39.87	41.85	52.83	61.21	73.76	65.79	55.20	45.46	32.48	22.98	44.77
2008	19.18	26.29	32.16	37.54	50.20	57.36	66.82	65.82	53.95	44.90	37.20	14.95	42.20
2009	23.23	26.98	29.15	39.98	51.24	57.02	65.21	63.83	61.18	37.04	35.83	13.51	42.02
2010	22.28	23.59	37.48	41.38	46.18	57.56	64.57	63.69	54.84	48.54	26.86	20.65	42.30
2011	21.06	17.92	30.28	37.94	47.80	56.51	66.53	66.96	58.97	46.36	30.78	26.65	42.31
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	18.96	22.88	30.24	41.18	50.51	58.49	65.97	64.20	54.21	44.10	30.84	22.42	42.00
SD	7.06	6.43	5.16	3.49	2.94	2.84	2.64	2.58	3.33	3.40	4.84	5.25	1.61
Skew	-0.79	-0.57	-0.30	0.00	0.47	0.45	-0.17	0.14	-0.27	-0.82	-0.58	-0.70	-0.02
Analysis of Trend in Mean (95% SL):													
Slope	0.03	0.05	0.05	0.00	0.01	0.01	0.02	0.02	0.03	0.01	0.01	0.00	0.02
KendSum	604.	1254.	1469.	253.	750.	703.	1042.	1270.	1175.	229.	347.	110.	2005.
KendTau	0.09	0.18	0.22	0.04	0.11	0.10	0.15	0.19	0.17	0.03	0.05	0.02	0.30
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.42	2.95	3.46	0.59	1.76	1.65	2.45	2.99	2.77	0.54	0.82	0.26	4.72
Trend?	No Trend	Trend	Trend	No Trend	No Trend	No Trend	Trend	Trend	Trend	No Trend	No Trend	No Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.9236	0.7579	1.4784	0.7333	3.0618	2.4771	1.3805	1.5718	0.3392	2.7073	0.3347	0.3442	0.1256

Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	49.82	41.30	26.58	12.21	8.66	8.08	6.97	6.66	11.11	11.59	23.45	27.52	2.59
Res Var	48.74	38.05	23.83	12.19	8.53	7.87	6.59	6.07	10.24	11.49	23.39	27.51	2.11
Tnd Var	2.16	7.87	10.32	0.22	1.61	2.59	5.35	8.99	7.87	0.82	0.25	0.02	18.45

Garrison

Analysis of Monthly Time-Series Data

Output File: GARR-HCN.OUT
DSS File: NRCS-PT.DSS

/GARR/HCN/TMEAN(F)/01JAN1895/1MON/OBS/
First Year: 1895
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1895	8.10	12.43	28.52	48.14	52.33	57.83	67.24	65.81	54.45	44.22	26.98	20.85	40.58
1896	14.49	25.24	24.01	40.65	51.21	64.07	69.36	65.64	52.06	44.20	12.61	28.34	40.99
1897	13.35	16.55	16.90	44.19	59.18	61.47	67.50	67.54	61.70	45.40	23.77	19.10	41.39
1898	19.03	24.56	21.25	43.12	50.94	61.16	67.76	68.87	55.93	38.51	25.98	17.06	41.18
1899	14.87	4.23	15.59	39.19	49.11	59.68	68.16	64.78	58.06	41.46	37.76	18.91	39.32
1900	24.14	15.28	31.76	47.18	58.40	68.86	69.48	67.76	54.71	46.60	26.20	26.98	44.78
1901	18.02	16.18	32.45	44.23	60.33	58.11	67.29	69.26	52.03	48.70	34.30	21.34	43.52
1902	18.24	21.18	30.52	41.70	55.36	59.02	66.47	66.35	54.61	46.10	29.50	14.84	41.99
1903	20.53	11.90	26.95	42.55	50.82	62.89	66.33	65.70	53.08	47.48	28.39	24.07	41.72
1904	17.41	13.31	23.54	43.22	52.47	60.29	67.35	66.19	56.73	47.16	37.71	22.28	42.31
1905	12.69	13.66	37.37	42.42	49.15	59.28	67.67	69.94	60.03	40.45	33.25	20.60	42.21
1906	19.96	23.58	22.96	47.12	50.76	59.29	68.56	66.49	59.71	46.52	28.40	21.14	42.87
1907	4.20	21.95	31.74	37.92	46.91	59.30	66.31	64.79	54.97	48.51	33.24	23.07	41.08
1908	22.80	21.80	28.32	45.97	50.63	58.85	70.14	64.34	58.77	41.97	32.96	20.39	43.08
1909	11.61	20.27	30.53	35.96	50.23	62.62	68.80	70.08	58.84	44.80	32.25	9.69	41.31
1910	15.98	11.39	43.85	51.44	53.18	65.22	71.47	63.90	55.78	48.96	31.07	21.97	44.52
1911	13.13	14.94	37.53	41.50	53.13	65.73	65.84	62.73	55.42	42.14	22.60	17.99	41.06
1912	11.31	21.51	17.60	43.59	51.43	62.46	65.23	63.66	49.00	42.60	35.59	25.08	40.76
1913	13.07	14.46	23.36	45.67	51.67	64.34	66.17	68.27	56.87	40.04	34.84	21.77	41.71
1914	22.37	15.60	32.59	43.66	53.69	61.53	71.57	65.49	57.40	46.58	36.11	12.73	43.28
1915	15.04	23.70	28.32	51.92	51.19	56.47	62.45	67.03	52.59	48.40	32.31	22.53	42.66
1916	-2.88	19.14	33.94	42.93	49.05	58.78	70.96	65.48	55.23	40.45	28.84	9.11	39.25
1917	11.42	12.20	22.32	38.36	49.46	59.05	72.61	65.77	57.38	41.33	39.63	14.98	40.38
1918	10.46	17.63	37.04	39.44	51.31	67.32	67.52	65.65	54.89	48.23	28.56	25.04	42.76
1919	26.57	17.49	26.73	44.79	55.83	68.40	72.42	68.92	58.37	33.57	21.57	13.17	42.32
1920	17.13	21.82	27.86	35.09	52.45	61.26	70.65	68.69	57.88	45.55	28.33	21.52	42.35
1921	24.08	28.76	32.54	41.52	52.58	67.16	70.67	68.36	54.31	49.04	28.46	19.69	44.76
1922	10.99	6.68	27.74	40.96	52.90	65.35	67.45	70.97	61.07	47.40	29.64	14.02	41.26
1923	22.19	14.22	28.18	41.27	53.74	63.04	72.46	65.20	57.97	42.07	35.58	22.30	43.19
1924	10.80	27.35	25.96	41.21	50.92	59.38	67.42	64.96	55.91	47.45	31.82	10.10	41.11
1925	17.84	28.06	33.27	47.19	55.02	61.80	69.38	66.94	56.48	34.07	31.22	24.81	43.84
1926	21.42	29.54	32.94	45.42	56.59	62.59	71.40	66.58	50.66	46.91	29.94	16.97	44.25
1927	15.61	21.11	32.19	41.42	48.58	61.14	67.29	63.63	55.29	47.81	27.57	5.52	40.60
1928	18.66	21.18	34.41	39.66	58.30	57.34	67.77	64.33	55.28	43.20	32.03	20.14	42.69
1929	4.83	9.27	33.39	40.78	50.34	61.07	71.43	71.21	52.33	46.90	26.91	19.25	40.64

1930	1.37	30.71	29.92	50.69	52.51	62.50	72.44	70.03	56.78	40.16	30.86	24.20	43.51
1931	24.99	31.44	31.00	44.55	54.19	67.67	71.12	68.63	59.21	46.30	28.50	20.58	45.68
1932	12.88	20.66	23.53	45.42	55.30	63.73	70.58	68.46	56.69	40.46	32.12	14.22	42.00
1933	19.11	13.48	34.62	40.60	51.71	68.83	73.51	67.13	58.64	46.31	35.24	20.96	44.18
1934	25.79	28.92	34.39	47.10	62.60	62.96	72.33	68.18	52.05	49.59	36.12	21.13	46.76
1935	14.90	27.61	29.34	39.10	49.06	61.37	72.94	66.93	58.28	44.42	25.55	23.33	42.74
1936	11.76	-3.43	30.97	41.01	60.24	67.24	77.67	69.44	58.35	45.38	31.35	20.32	42.53
1937	-2.60	15.50	29.92	43.24	56.95	62.74	71.70	70.12	59.55	48.02	30.49	19.90	42.13
1938	21.49	17.14	33.42	43.93	51.71	64.25	69.37	67.65	63.04	48.97	27.35	24.10	44.37
1939	24.71	10.62	31.66	45.93	58.04	58.43	71.92	67.03	58.50	44.84	36.59	30.03	44.86
1940	8.61	21.22	33.81	40.78	56.81	64.50	71.80	69.49	62.55	50.31	23.69	25.26	44.07
1941	20.48	24.70	32.18	43.24	57.34	62.72	70.77	68.01	52.64	43.59	33.85	24.60	44.51
1942	17.49	16.93	31.73	46.66	50.11	58.63	69.08	67.06	56.04	46.33	29.94	21.95	42.66
1943	9.13	25.36	23.40	49.37	50.19	59.02	69.69	68.41	56.96	48.89	33.63	24.92	43.25
1944	22.29	19.66	24.49	43.91	56.30	58.64	66.67	64.96	56.89	49.51	27.82	19.02	42.51
1945	19.27	21.89	33.91	38.51	50.24	56.33	69.29	67.25	53.41	47.84	28.12	16.20	41.85
1946	21.85	23.74	38.95	49.78	49.94	61.84	70.90	65.71	55.61	40.44	27.74	22.35	44.07
1947	20.33	19.02	25.94	42.38	52.87	57.99	71.11	68.79	56.79	50.20	26.14	23.18	42.90
1948	20.89	16.54	26.08	44.27	55.06	62.06	67.83	68.24	60.87	46.55	30.71	14.01	42.76
1949	3.38	10.86	28.84	49.06	56.73	61.96	69.13	70.13	55.97	41.14	41.31	15.91	42.03
1950	0.20	23.19	25.71	38.98	48.64	59.48	65.33	64.03	55.22	48.07	27.43	23.47	39.98
1951	13.10	21.00	20.37	39.29	54.17	55.66	68.10	64.63	52.00	42.01	28.39	12.96	39.31
1952	11.76	22.32	23.32	48.24	54.55	63.41	66.75	67.23	60.34	46.47	28.88	23.63	43.08
1953	26.63	26.38	33.43	37.49	48.93	61.74	70.19	68.04	58.69	50.14	37.55	26.65	45.49
1954	12.36	35.04	25.07	40.77	51.76	59.19	71.91	66.50	56.86	44.34	39.36	26.90	44.17
1955	18.87	16.26	24.21	43.06	53.28	60.24	69.70	70.35	55.97	48.00	19.35	15.97	41.27
1956	14.90	16.68	31.28	39.47	54.23	66.73	68.00	65.34	57.38	47.36	31.47	24.31	43.10
1957	6.34	21.35	31.49	39.93	54.14	60.78	71.40	67.82	55.71	43.42	30.44	30.41	42.77
1958	26.60	22.22	28.31	42.60	59.94	59.84	64.61	69.82	58.05	47.49	30.64	21.45	44.30
1959	14.72	12.83	34.41	41.77	49.59	65.04	69.38	67.81	54.88	42.00	25.37	27.58	42.12
1960	16.33	18.46	28.55	42.83	53.67	62.50	72.64	66.56	58.36	47.18	30.43	20.94	43.20
1961	22.46	29.49	36.80	39.89	54.08	68.14	70.14	71.54	50.35	44.14	28.09	16.45	44.30
1962	12.66	19.75	26.11	46.59	52.83	62.57	65.91	66.24	55.86	49.28	36.81	26.69	43.44
1963	7.31	28.91	36.64	42.02	53.46	62.40	69.92	68.83	62.49	53.03	34.25	17.76	44.75
1964	21.73	25.70	26.82	43.36	54.78	60.90	72.03	64.93	53.81	48.01	28.04	11.74	42.65
1965	17.87	19.06	17.39	42.74	51.23	60.83	68.80	66.28	46.05	50.55	32.80	24.78	41.53
1966	10.37	17.96	34.00	39.01	55.71	61.72	72.62	65.62	61.02	45.40	27.97	21.40	42.73
1967	21.02	24.03	29.40	39.34	50.30	59.37	69.51	68.76	60.85	46.95	31.27	17.12	43.16
1968	14.66	24.35	38.04	40.52	50.35	60.34	68.50	63.81	56.64	46.33	31.65	13.29	42.37
1969	5.05	18.42	25.44	48.19	55.32	58.24	67.82	71.34	60.43	38.28	34.41	24.06	42.25
1970	14.15	26.20	26.72	37.31	53.47	65.00	70.66	70.32	53.81	41.75	29.21	17.01	42.13
1971	13.66	21.39	29.88	42.72	53.44	63.21	66.80	73.07	54.22	42.62	31.36	15.13	42.29
1972	10.18	20.06	35.56	42.80	53.15	64.42	64.56	68.04	53.39	42.46	30.41	12.09	41.43
1973	17.39	22.99	35.54	39.38	52.81	63.10	68.21	69.72	54.70	47.85	26.30	22.63	43.38
1974	15.34	28.59	32.40	45.20	49.88	64.66	71.74	62.63	54.11	47.75	32.89	24.19	44.12
1975	19.36	15.93	27.40	35.38	50.38	59.74	71.60	64.63	55.55	44.88	29.46	22.41	41.39
1976	18.28	28.76	30.01	45.43	55.85	61.29	70.79	67.74	59.16	42.98	30.15	23.39	44.49
1977	10.35	30.32	33.44	47.83	56.74	66.53	69.99	63.26	56.45	46.50	28.24	16.44	43.84
1978	7.90	14.06	31.49	44.47	52.83	62.45	67.58	65.84	58.70	46.69	22.33	10.72	40.42
1979	0.41	12.57	30.72	40.37	51.56	63.15	69.83	67.34	61.65	48.73	27.69	26.96	41.75
1980	12.59	23.06	30.06	48.28	56.88	63.82	70.79	63.80	57.60	46.07	35.00	24.42	44.36
1981	28.22	26.84	38.16	47.32	53.86	60.75	69.89	69.29	59.66	43.38	36.76	22.08	46.35
1982	6.79	18.69	30.03	39.78	50.87	59.97	67.96	68.64	55.13	44.17	27.19	21.43	40.89
1983	25.83	30.67	34.96	40.42	50.13	61.24	70.02	73.29	55.93	46.99	31.72	2.11	43.61
1984	20.95	30.31	32.69	43.17	53.27	61.81	70.92	71.32	51.72	41.21	31.53	13.18	43.51
1985	13.69	17.84	32.38	47.65	58.31	61.26	71.70	64.54	51.33	43.82	14.47	16.80	41.15
1986	26.23	19.25	42.28	43.43	53.33	67.27	67.10	67.61	51.90	46.16	27.61	24.85	44.75
1987	22.89	30.61	34.04	50.80	58.32	65.65	68.22	63.78	58.57	45.46	35.64	24.33	46.53
1988	15.66	23.34	34.98	46.76	58.73	73.51	72.65	68.62	56.22	48.03	31.45	22.22	46.01
1989	19.61	8.81	28.51	44.08	53.89	62.20	72.92	67.46	57.22	45.51	33.95	17.29	42.62
1990	25.50	24.96	35.20	44.78	52.25	63.42	69.15	69.48	62.80	45.35	34.70	12.61	45.02
1991	14.12	34.23	34.81	43.34	53.54	63.34	69.88	71.41	57.89	42.53	27.43	25.90	44.87

1992	27.11	32.92	40.30	46.47	56.81	63.32	63.07	64.15	56.77	46.49	30.63	15.37	45.28
1993	10.79	13.41	35.22	43.92	56.03	59.09	61.31	63.16	54.12	44.25	26.45	26.27	41.17
1994	19.28	14.85	37.54	44.99	57.77	63.73	68.76	69.68	60.65	45.01	29.63	24.94	44.74
1995	20.41	29.12	31.96	40.34	50.61	62.13	67.89	69.33	56.73	44.04	32.00	20.84	43.78
1996	10.63	23.27	24.39	43.96	49.50	64.90	69.27	69.92	55.56	44.22	23.08	14.51	41.10
1997	12.42	26.54	33.96	38.77	53.88	65.73	68.26	67.99	60.82	45.92	30.84	24.93	44.17
1998	18.42	31.55	28.70	46.00	56.21	57.34	72.62	71.02	64.30	46.27	34.54	22.09	45.76
1999	21.35	31.97	37.98	42.50	52.43	61.38	68.62	69.50	53.77	46.65	40.80	29.42	46.36
2000	22.50	28.06	38.01	45.22	55.31	61.44	72.37	70.40	57.70	46.04	20.47	13.91	44.29
2001	22.64	15.04	34.94	44.85	56.62	62.78	71.93	71.70	61.08	45.06	36.90	22.43	45.50
2002	22.19	26.63	20.95	40.44	50.81	64.14	73.77	65.07	58.76	38.21	33.73	25.23	43.33
2003	23.01	20.13	30.57	47.89	53.69	61.21	73.61	73.41	56.43	49.98	24.27	25.24	44.95
2004	14.68	22.39	38.78	46.60	51.62	59.44	68.99	64.65	57.94	45.47	34.35	27.31	44.35
2005	17.00	29.13	36.46	45.66	51.64	62.27	71.71	66.78	58.84	46.92	35.09	19.60	45.09
2006	31.73	24.14	32.50	47.72	56.17	65.70	74.90	69.21	56.22	42.02	32.33	24.97	46.47
2007	20.05	21.33	40.73	43.19	55.77	64.70	75.98	69.30	58.75	46.87	33.56	19.91	45.85
2008	16.68	23.04	33.08	40.45	52.18	60.40	70.47	69.27	55.46	44.94	36.37	13.62	43.00
2009	19.65	24.60	29.74	42.08	53.64	59.55	67.17	65.38	62.77	37.63	36.27	10.31	42.40
2010	16.96	17.70	36.46	44.29	49.12	61.52	68.58	67.97	56.96	49.72	28.22	18.13	42.97
2011	17.52	15.17	29.56	40.85	49.17	60.55	71.45	70.03	60.19	48.81	31.14	25.07	43.29
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	16.21	20.98	30.70	43.28	53.34	62.17	69.55	67.51	56.73	45.28	30.55	20.20	43.04
SD	6.78	6.78	5.46	3.50	3.07	3.04	2.66	2.46	3.17	3.38	4.84	5.36	1.69
Skew	-0.51	-0.41	-0.39	0.16	0.50	0.62	-0.18	0.10	-0.24	-0.86	-0.67	-0.68	0.06
Analysis of Trend in Mean (95% SL):													
Slope	0.03	0.06	0.06	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02
KendSum	695.	1439.	1645.	337.	568.	526.	968.	1029.	794.	136.	379.	414.	1914.
KendTau	0.10	0.21	0.24	0.05	0.08	0.08	0.14	0.15	0.12	0.02	0.06	0.06	0.28
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.63	3.39	3.87	0.79	1.34	1.24	2.28	2.42	1.87	0.32	0.89	0.97	4.51
Trend?	No Trend	Trend	Trend	No Trend	No Trend	No Trend	Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.2886	0.0905	2.7359	1.6052	2.3302	1.0357	1.4185	3.8071	0.1585	2.0626	0.3909	0.8219	0.2296
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	45.95	45.90	29.82	12.25	9.43	9.23	7.10	6.03	10.08	11.40	23.38	28.72	2.85
Res Var	44.61	41.36	26.29	12.20	9.35	9.15	6.85	5.70	9.75	11.33	23.22	28.67	2.35
Tnd Var	2.91	9.89	11.85	0.37	0.83	0.90	3.48	5.39	3.21	0.63	0.68	0.16	17.45

SNOTEL Precipitation

Fort Peck

Analysis of Monthly Time-Series Data

Output File: C:\Climate\Precip\outFTPK.txt
DSS File: C:\Climate\NRCS-PT.DSS

/FTPK/35-STA AVG/PRECIP-INC/01JAN1970 - 01JAN2010/
First Year: 1982
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1982	5.12	3.58	4.88	3.64	4.01	3.25	2.14	0.94	3.41	2.35	2.78	4.26	40.36
1983	2.55	2.87	3.98	2.25	3.12	3.99	3.39	2.12	2.62	2.25	4.60	3.44	37.18
1984	2.62	1.96	4.11	4.43	3.76	4.05	1.61	2.25	2.58	3.49	3.75	3.27	37.88
1985	1.35	3.04	2.87	1.95	3.05	1.27	1.06	3.19	5.19	3.68	3.63	1.50	31.78
1986	2.70	5.53	2.67	3.78	4.14	2.79	2.49	2.31	3.60	1.12	4.30	1.08	36.51
1987	2.34	1.85	3.01	1.39	4.52	1.79	4.97	2.07	0.56	0.39	1.66	3.30	27.85
1988	2.98	2.72	3.98	3.99	3.32	1.31	0.66	0.52	1.97	1.63	4.74	2.57	30.39
1989	4.35	2.01	4.77	2.93	3.44	2.90	2.31	3.05	1.91	2.59	3.79	3.15	37.20
1990	5.06	2.56	2.53	2.88	4.45	2.51	1.51	2.55	0.63	3.65	3.96	3.24	35.53
1991	2.69	1.40	4.01	5.41	5.29	3.66	0.85	1.27	2.08	2.71	4.41	2.68	36.46
1992	1.74	2.05	1.55	3.30	2.19	5.05	2.22	1.00	2.28	2.48	2.83	4.29	30.98
1993	2.49	1.83	2.79	4.49	3.62	5.14	4.92	3.76	1.58	2.09	2.09	2.61	37.41
1994	2.84	3.35	1.99	3.32	3.20	2.16	1.80	0.57	0.53	4.71	3.89	3.07	31.43
1995	3.61	2.07	4.45	4.58	4.67	5.00	3.13	1.35	1.99	3.39	6.02	3.09	43.35
1996	4.38	3.92	3.16	3.70	5.50	1.63	0.68	0.75	1.86	2.63	4.23	8.32	40.76
1997	4.51	2.73	4.01	4.17	3.32	4.63	2.22	2.72	2.08	3.30	1.95	1.82	37.46
1998	4.17	1.63	2.89	3.23	4.02	6.14	2.32	0.90	1.50	1.10	4.75	4.45	37.10
1999	4.26	4.66	2.04	2.88	3.97	2.98	0.49	2.52	1.00	1.68	2.73	3.85	33.06
2000	3.54	2.85	2.94	2.28	3.73	2.60	0.79	1.13	2.68	2.60	1.81	2.23	29.18
2001	1.16	1.99	2.38	4.33	1.53	4.34	1.96	0.39	1.53	3.24	2.19	2.69	27.73
2002	3.69	2.54	3.63	3.25	3.94	3.99	1.31	2.04	1.98	1.36	1.85	2.37	31.95
2003	3.90	2.88	5.00	4.16	2.86	1.87	0.59	1.33	1.48	2.20	3.47	4.42	34.16
2004	2.94	2.20	2.29	2.44	5.06	3.02	1.61	2.93	2.37	2.84	1.77	3.08	32.55
2005	2.14	1.09	3.43	3.21	5.19	5.00	0.86	1.75	2.23	2.55	4.57	3.53	35.55
2006	4.82	2.71	3.07	4.09	2.27	3.57	1.16	1.03	2.07	3.64	4.74	2.77	35.94
2007	2.41	3.51	2.21	2.76	3.67	2.15	0.83	1.18	2.80	3.21	2.47	4.48	31.68
2008	4.67	3.29	2.87	2.84	5.76	3.97	0.64	1.61	1.19	2.32	3.35	4.72	37.23
2009	2.91	1.88	5.13	3.94	2.51	3.53	2.54	2.00	0.82	4.21	1.91	2.53	33.91
2010	2.09	1.19	2.08	4.70	5.26	4.84	1.24	3.02	2.05	2.31	4.29	3.76	36.83
2011	3.98	3.13	4.61	5.59	5.99	4.44	1.44	0.81	1.01	3.40	3.32	2.55	40.27

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	3.27	2.63	3.31	3.53	3.91	3.45	1.79	1.77	1.99	2.64	3.39	3.30	34.99
SD	1.11	0.99	1.01	0.99	1.11	1.28	1.16	0.92	0.98	0.97	1.17	1.31	3.89
Skew	-0.01	0.95	0.26	0.01	-0.01	0.02	1.38	0.36	1.12	-0.19	0.08	1.85	-0.05
Analysis of Trend in Mean (95% SL):													
Slope	0.01	-0.02	-0.01	0.03	0.02	0.04	-0.05	-0.01	-0.04	0.02	-0.03	0.02	-0.02
KendSum	29.	-27.	-38.	46.	58.	71.	-107.	-35.	-92.	47.	-54.	29.	-15.
KendTau	0.07	-0.06	-0.09	0.11	0.13	0.16	-0.25	-0.08	-0.21	0.11	-0.12	0.07	-0.03
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	0.50	-0.46	-0.66	0.80	1.02	1.25	-1.89	-0.61	-1.62	0.82	-0.95	0.50	-0.25
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410

BP RSS	0.2252	0.4289	0.5486	0.1577	4.3860	0.2298	3.0537	0.1328	5.3012	1.0087	0.1053	0.1124	0.2652
Trend?	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	1.22	0.98	1.02	0.98	1.23	1.65	1.34	0.84	0.96	0.94	1.36	1.70	15.11
Res Var	1.21	0.95	1.01	0.92	1.18	1.54	1.14	0.82	0.83	0.90	1.31	1.67	15.08
Tnd Var	0.81	2.41	1.17	5.76	3.69	6.96	14.49	2.08	13.75	4.02	3.56	1.73	0.18

Garrison

Analysis of Monthly Time-Series Data

Output File: C:\Climate\Precip\outGARR.txt
DSS File: C:\Climate\NRCS-PT.DSS

/GARR/35-STA AVG/PRECIP-INC/01JAN1970 - 01JAN2010/
First Year: 1982
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1982	4.15	1.92	4.30	3.49	3.00	3.65	2.14	1.38	3.90	2.56	2.32	2.71	35.52
1983	2.27	2.02	3.03	2.73	3.79	2.89	2.06	1.43	2.61	2.61	4.04	3.19	32.67
1984	1.58	1.46	3.40	4.65	3.95	2.71	2.24	1.56	3.03	2.23	2.83	2.39	32.03
1985	1.33	2.28	2.61	2.01	3.00	2.07	2.09	1.60	3.83	2.12	3.58	2.11	28.63
1986	2.48	6.13	2.65	4.00	2.73	2.07	2.77	1.85	3.03	1.98	3.90	0.63	34.22
1987	2.10	1.69	2.54	1.35	4.39	2.23	3.72	2.16	0.89	0.69	1.83	2.71	26.30
1988	2.67	2.60	3.05	3.92	3.81	1.16	0.50	0.43	1.39	0.89	4.15	1.73	26.30
1989	3.29	2.07	4.49	2.98	3.89	2.68	1.94	1.61	2.09	2.61	2.93	3.23	33.81
1990	3.23	1.70	2.17	4.21	3.86	2.00	2.45	1.69	1.31	3.86	2.47	2.27	31.22
1991	1.89	1.70	3.89	5.30	4.75	1.95	1.09	1.27	2.84	2.56	4.05	1.84	33.13
1992	0.98	1.22	1.97	3.97	3.46	6.15	3.20	1.05	1.97	1.65	2.32	3.37	31.31
1993	1.73	1.47	2.44	4.35	3.94	4.15	3.64	1.73	1.09	2.19	1.78	1.93	30.44
1994	3.16	2.77	2.25	2.67	2.07	2.09	2.01	1.06	1.47	4.75	2.87	2.09	29.26
1995	2.86	1.83	3.67	4.36	4.64	3.23	2.22	1.24	2.45	3.08	5.39	2.43	37.40
1996	3.88	2.93	3.65	3.59	5.04	1.15	0.82	0.76	2.67	2.47	3.89	6.89	37.74
1997	4.13	2.11	2.95	4.23	2.60	3.76	3.30	2.38	2.49	3.21	1.78	2.02	34.96
1998	3.67	1.52	2.76	2.81	1.89	5.23	2.11	1.77	2.12	2.25	3.45	3.11	32.69
1999	3.75	3.73	1.96	4.66	3.57	2.95	0.75	1.99	2.07	1.00	2.07	2.76	31.26
2000	3.29	2.68	2.61	2.69	4.37	2.66	0.77	0.97	2.24	1.69	1.35	2.31	27.63
2001	0.76	1.74	2.12	3.17	2.14	2.60	1.43	0.62	1.64	2.94	1.86	1.85	22.87
2002	2.48	1.40	3.47	3.63	2.99	1.87	1.85	1.52	2.01	1.92	2.10	1.47	26.71
2003	3.58	2.58	5.04	2.72	2.86	2.35	0.56	1.20	1.57	2.00	2.62	3.38	30.46
2004	1.57	2.23	1.49	2.70	3.17	3.07	2.16	2.31	2.81	3.00	1.38	2.23	28.12
2005	1.67	1.29	2.81	2.75	5.54	3.02	1.34	1.97	1.82	2.32	3.94	2.74	31.21
2006	2.79	1.97	2.15	2.45	2.31	1.31	1.26	0.74	2.69	3.13	2.43	2.19	25.42
2007	2.01	2.74	2.52	2.83	3.17	2.05	1.83	1.75	2.05	4.29	2.14	3.04	30.42
2008	3.04	2.60	3.65	2.52	6.07	3.13	0.65	1.33	1.47	2.27	2.82	3.87	33.42
2009	3.12	1.88	3.86	3.71	2.64	4.46	2.05	1.68	1.14	3.50	1.23	1.66	30.93
2010	1.48	1.33	2.57	3.68	5.51	4.23	1.11	1.99	0.89	2.29	3.67	3.39	32.14
2011	3.27	2.29	4.35	5.48	7.09	2.34	1.11	0.83	0.67	3.65	3.05	2.32	36.45

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	2.61	2.20	3.01	3.45	3.74	2.84	1.84	1.46	2.08	2.52	2.81	2.60	31.16
SD	0.95	0.94	0.87	0.96	1.25	1.15	0.90	0.50	0.82	0.93	1.02	1.07	3.61
Skew	-0.18	2.69	0.53	0.15	0.80	1.03	0.41	-0.19	0.36	0.28	0.48	2.17	-0.22
Analysis of Trend in Mean (95% SL):													
Slope	0.00	-0.01	0.00	0.00	0.03	0.01	-0.04	0.00	-0.05	0.03	-0.03	0.01	-0.04

KendSum	9.	7.	-21.	-23.	33.	26.	-134.	6.	-148.	89.	-75.	38.	-42.
KendTau	0.02	0.02	-0.05	-0.05	0.08	0.06	-0.31	0.01	-0.34	0.20	-0.17	0.09	-0.10
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	0.14	0.11	-0.36	-0.39	0.57	0.45	-2.37	0.09	-2.62	1.57	-1.32	0.66	-0.73
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.0771	6.8124	0.6987	0.1485	7.9204	0.0101	1.0146	0.4801	2.7862	0.0958	0.0184	0.0384	0.1865
Trend?	No Trend	Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	0.91	0.89	0.75	0.93	1.55	1.33	0.81	0.25	0.68	0.86	1.03	1.14	13.02
Res Var	0.91	0.88	0.75	0.93	1.47	1.32	0.65	0.25	0.51	0.79	0.96	1.12	12.88
Tnd Var	0.12	1.14	0.01	0.02	5.33	1.04	18.79	0.00	24.66	8.67	7.01	1.18	1.02

HCN Precipitation

Fort Peck

Analysis of Monthly Time-Series Data

Output File: C:\Climate\HCN-Met\outFTPKPrecip.txt
DSS File: C:\Climate\Month-Met.DSS

/FTPK/ALL/PRECIP(IN)/01JAN1890 - 01JAN2010/1MON/OB
First Year: 1895
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1895	1.29	0.58	0.62	0.71	0.96	2.26	0.91	0.46	0.87	0.30	0.76	0.79	10.51
1896	0.61	0.44	0.94	1.32	3.30	1.61	1.22	0.89	1.98	0.42	1.81	0.19	14.73
1897	0.57	0.89	1.02	1.00	1.30	3.68	1.78	0.27	0.73	1.22	1.48	0.55	14.49
1898	0.43	0.41	1.74	0.87	3.46	3.30	1.44	0.75	0.98	1.23	0.74	0.29	15.64
1899	1.06	0.84	1.04	1.10	2.77	1.77	1.14	1.21	0.68	1.39	0.20	0.68	13.88
1900	0.10	0.58	0.85	1.87	2.47	0.56	0.51	1.11	1.18	0.96	0.68	0.35	11.22
1901	0.49	0.38	0.64	1.06	3.26	2.38	0.75	0.42	2.17	0.17	0.33	1.00	13.05
1902	0.27	0.61	0.80	1.02	3.66	2.11	1.49	0.65	0.58	0.15	0.72	0.56	12.62
1903	0.44	0.26	0.70	1.53	1.93	1.66	2.41	0.98	0.93	0.33	0.89	0.52	12.58
1904	0.47	0.97	1.51	0.59	1.22	1.21	1.00	0.62	0.15	0.22	0.06	0.59	8.61
1905	0.28	0.27	0.84	0.89	2.10	3.48	1.22	0.80	0.64	0.58	0.57	0.17	11.84
1906	0.50	0.52	0.70	1.01	4.00	3.35	0.65	2.10	0.81	0.54	0.86	0.93	15.97
1907	1.07	0.41	1.33	0.90	2.08	4.90	2.28	1.68	0.77	0.34	0.10	0.38	16.24
1908	0.45	0.58	1.18	0.56	5.49	3.72	0.66	1.27	1.50	1.53	0.12	0.32	17.38
1909	1.14	0.33	1.11	1.27	2.64	3.21	3.34	0.77	2.49	0.39	1.08	0.75	18.52
1910	0.52	0.77	0.30	0.83	2.05	1.53	0.88	0.90	1.99	0.92	1.04	0.29	12.02
1911	1.02	0.62	0.27	0.90	2.59	3.07	0.88	1.92	2.04	1.35	0.85	0.46	15.97
1912	0.54	0.29	0.96	1.42	3.18	1.25	1.86	2.12	1.54	1.26	0.25	0.38	15.05
1913	0.90	0.26	0.72	0.88	1.97	3.47	1.96	1.02	0.94	1.86	0.64	0.16	14.78
1914	0.42	0.62	0.50	1.19	2.12	3.75	0.79	0.70	1.46	1.69	0.19	0.29	13.72
1915	0.56	0.33	0.85	1.02	2.52	3.89	3.62	1.01	2.27	0.48	0.68	0.77	18.00
1916	1.29	0.62	0.84	1.01	2.66	3.99	2.23	1.02	1.61	1.45	0.51	0.89	18.12
1917	0.62	0.98	0.74	1.50	2.51	1.72	0.50	0.53	2.01	0.49	0.16	1.31	13.07
1918	1.17	0.55	0.53	0.93	1.36	1.32	1.89	1.67	1.40	0.74	0.68	0.29	12.53

1919	0.24	0.72	0.53	0.54	1.29	0.72	0.51	0.57	1.00	1.57	0.63	0.94	9.26
1920	0.50	0.53	0.91	2.19	2.10	2.41	1.07	0.98	0.82	1.01	0.31	0.49	13.32
1921	0.35	0.23	0.95	1.22	2.76	2.26	1.45	0.56	1.20	0.12	1.08	1.03	13.21
1922	0.57	0.66	0.57	1.89	2.51	2.02	1.87	1.47	0.49	0.30	0.69	0.76	13.80
1923	0.45	0.57	0.54	1.10	2.28	4.68	2.33	1.69	0.68	1.28	0.27	0.64	16.51
1924	0.54	0.57	1.18	0.95	0.90	2.77	1.26	0.99	1.41	1.16	0.77	0.75	13.25
1925	0.50	0.46	1.14	1.90	1.26	3.11	0.99	1.23	2.81	1.55	0.25	0.71	15.91
1926	0.27	0.53	0.43	0.43	1.88	2.34	1.14	1.46	2.33	0.26	1.21	0.69	12.97
1927	0.71	0.61	0.62	1.24	5.76	1.86	1.79	1.95	1.01	0.87	1.58	0.95	18.95
1928	0.93	0.33	0.59	0.67	0.76	3.40	1.83	1.55	0.28	0.83	0.25	0.79	12.21
1929	0.98	0.53	1.02	1.04	1.33	1.99	0.69	0.42	1.62	0.86	0.63	1.34	12.45
1930	0.56	0.39	0.97	1.09	1.04	1.21	1.16	1.17	1.35	1.54	0.62	0.17	11.27
1931	0.30	0.35	0.50	0.71	0.98	1.27	2.09	0.46	1.61	0.29	0.86	0.48	9.90
1932	0.63	0.41	1.14	1.58	1.19	3.24	1.64	2.01	0.14	1.12	0.58	0.58	14.26
1933	0.58	0.45	0.38	1.43	2.14	1.40	0.36	3.26	0.86	0.97	0.51	0.92	13.26
1934	0.33	0.38	0.94	0.37	0.77	3.47	0.90	0.33	1.34	1.03	0.24	0.67	10.77
1935	0.43	0.25	1.40	1.23	1.63	1.40	0.88	0.47	0.21	1.06	0.45	0.17	9.58
1936	0.69	1.08	0.48	0.96	1.07	1.95	0.52	1.38	0.74	0.53	0.23	0.67	10.30
1937	0.69	0.49	0.87	0.83	0.38	2.98	1.74	0.42	1.54	0.62	0.45	0.80	11.81
1938	0.38	0.48	1.43	0.78	3.54	3.02	1.79	0.83	0.80	2.08	0.65	0.26	16.04
1939	0.45	0.47	0.43	0.69	1.80	3.04	0.73	0.59	1.07	1.05	0.09	0.52	10.93
1940	0.65	0.85	1.04	2.26	1.19	2.11	1.41	0.27	2.26	1.09	0.71	0.34	14.18
1941	0.27	0.36	0.46	1.75	2.05	3.27	1.16	1.53	2.93	0.76	0.99	0.90	16.43
1942	0.59	0.72	0.62	0.63	3.69	2.89	1.10	0.70	1.22	0.88	0.99	0.40	14.43
1943	1.24	0.46	0.64	1.96	1.55	4.33	1.12	1.01	0.51	1.10	0.31	0.25	14.48
1944	0.11	0.66	0.98	0.53	2.23	5.75	1.02	1.39	1.00	0.21	0.69	0.36	14.93
1945	0.31	0.37	0.87	0.74	2.13	3.35	0.81	0.97	1.78	0.66	0.56	0.84	13.39
1946	0.39	0.41	0.94	0.59	2.00	2.05	1.88	0.75	2.16	1.97	0.90	0.72	14.76
1947	0.36	0.39	1.05	0.84	0.81	4.58	0.71	1.46	2.20	0.55	0.93	0.36	14.24
1948	0.62	0.34	0.85	0.94	2.96	4.89	1.76	0.78	0.59	0.17	0.65	0.72	15.27
1949	0.82	0.61	0.63	0.71	2.02	1.71	1.34	0.59	1.17	0.98	0.20	0.58	11.36
1950	0.62	0.22	1.35	0.90	1.01	3.19	1.94	1.57	1.40	0.44	0.75	0.52	13.91
1951	0.46	0.58	0.89	1.31	1.46	2.27	1.66	2.58	1.27	1.50	0.35	1.02	15.35
1952	0.65	0.76	0.66	0.41	2.53	1.87	1.33	0.96	0.43	0.18	0.67	0.31	10.76
1953	0.45	0.87	0.59	1.56	4.12	3.38	0.52	0.57	0.64	0.50	0.33	0.55	14.08
1954	0.83	0.27	0.97	0.82	1.37	2.89	0.70	2.37	1.31	0.69	0.12	0.24	12.58
1955	0.45	0.56	0.68	1.89	2.60	1.77	2.53	0.27	0.50	0.60	0.91	1.21	13.97
1956	0.58	0.25	0.32	0.92	1.99	1.76	1.68	1.66	0.60	0.66	0.29	0.46	11.17
1957	0.87	0.49	0.79	1.20	2.59	3.43	0.78	1.23	0.95	1.29	0.47	0.29	14.38
1958	0.34	0.74	0.98	1.22	0.83	3.94	2.55	0.86	0.88	0.39	1.16	0.78	14.67
1959	0.76	0.93	0.47	0.88	2.64	2.75	0.65	0.77	1.68	1.24	0.99	0.26	14.02
1960	0.47	0.51	0.53	1.55	1.62	0.89	0.43	1.85	0.34	0.38	0.51	0.36	9.44
1961	0.11	0.41	0.85	1.15	2.14	0.68	1.11	0.77	2.34	1.20	0.68	0.31	11.75
1962	0.72	0.76	0.66	0.65	3.86	2.54	2.26	1.61	0.54	1.01	1.03	0.23	15.87
1963	0.70	0.41	0.46	1.38	1.98	3.72	1.05	0.87	1.26	0.55	0.38	0.68	13.44
1964	0.44	0.35	0.79	1.62	3.49	4.41	1.21	1.72	0.37	0.45	0.82	1.13	16.80
1965	0.81	0.44	0.53	1.63	2.31	3.86	1.51	1.93	1.88	0.16	0.59	0.40	16.05
1966	0.59	0.31	0.57	0.79	1.55	2.09	1.38	1.02	0.67	0.94	0.94	0.56	11.41
1967	0.76	0.35	1.59	1.81	1.94	3.53	1.09	0.24	1.19	1.36	0.66	0.97	15.49
1968	0.70	0.23	0.73	0.89	2.35	2.97	0.65	2.44	2.20	0.46	0.83	0.70	15.15
1969	1.49	0.34	0.34	1.24	1.25	4.37	1.65	0.59	0.53	1.16	0.36	0.43	13.75
1970	0.61	0.47	0.84	1.55	2.63	2.57	2.12	0.62	1.27	0.71	0.66	0.59	14.64
1971	1.10	0.49	0.54	1.17	1.99	1.86	0.44	1.23	1.18	0.72	0.38	0.89	11.99
1972	0.93	0.43	0.72	0.88	1.74	2.43	1.63	2.11	1.20	1.04	0.25	0.66	14.02
1973	0.34	0.19	0.68	1.71	0.99	2.54	0.48	1.32	1.81	0.82	1.17	0.86	12.91
1974	0.57	0.29	0.86	0.90	2.62	0.87	1.04	2.53	0.64	0.79	0.38	0.47	11.96
1975	0.87	0.52	0.93	2.39	3.41	3.65	2.59	1.75	0.57	2.56	0.80	0.53	20.57
1976	0.40	0.37	0.52	1.81	1.41	3.26	1.61	1.63	1.36	0.47	0.31	0.23	13.38
1977	0.63	0.12	1.11	0.34	2.46	1.52	1.48	1.81	2.35	0.54	0.57	1.26	14.19
1978	0.90	0.80	0.30	1.20	3.48	1.88	2.56	1.01	2.96	0.28	1.06	0.76	17.19
1979	0.57	0.64	0.75	1.71	1.27	1.98	0.62	1.00	0.24	0.83	0.34	0.32	10.27
1980	0.68	0.87	0.93	0.75	3.87	3.07	0.85	1.10	1.49	1.41	0.40	0.42	15.84

1981	0.21	0.45	1.22	0.59	5.21	2.00	1.38	0.74	0.62	1.30	0.55	0.45	14.72
1982	0.89	0.61	1.40	1.01	2.85	2.56	1.25	0.98	2.17	0.78	0.46	0.97	15.93
1983	0.17	0.32	0.87	0.61	1.55	2.19	2.50	1.22	1.68	0.97	1.06	0.72	13.86
1984	0.37	0.48	0.92	1.32	1.30	2.04	0.83	1.30	1.17	0.87	0.53	0.69	11.82
1985	0.21	0.34	1.03	0.67	1.93	0.65	0.80	2.95	2.86	1.05	0.91	0.32	13.72
1986	0.45	1.05	0.62	1.55	1.99	2.11	1.66	1.61	2.88	0.58	0.70	0.23	15.43
1987	0.21	0.25	1.17	0.56	3.27	1.40	3.55	1.95	0.59	0.03	0.27	0.34	13.59
1988	0.47	0.42	0.66	1.19	2.21	1.45	0.73	0.35	1.66	0.47	0.72	0.50	10.83
1989	1.08	0.65	1.21	1.73	2.22	1.91	1.69	2.68	0.76	1.14	0.60	0.89	16.56
1990	0.58	0.27	1.06	1.07	2.31	1.34	1.04	1.80	0.18	0.43	0.60	0.52	11.20
1991	0.39	0.24	0.90	2.03	2.75	3.90	0.60	1.09	1.21	0.80	0.75	0.33	14.99
1992	0.26	0.25	0.46	1.24	1.52	3.46	2.25	0.88	0.69	1.41	0.55	0.67	13.64
1993	0.70	0.59	0.72	1.85	2.28	3.22	5.03	2.91	1.19	1.02	0.49	0.34	20.34
1994	0.46	0.60	0.35	1.71	1.93	1.92	0.97	0.51	0.26	1.74	0.75	0.75	11.95
1995	0.70	0.22	1.16	1.93	3.00	3.50	2.75	1.15	1.21	1.01	0.59	0.47	17.69
1996	0.72	0.48	0.94	1.14	3.26	1.52	0.47	0.41	1.37	0.58	1.04	1.30	13.23
1997	0.82	0.35	0.63	1.16	2.63	3.13	2.41	1.82	0.85	0.98	0.40	0.32	15.50
1998	0.76	0.36	0.93	0.98	1.96	4.44	1.51	0.84	0.81	1.00	1.10	0.65	15.34
1999	0.63	0.58	0.38	1.27	2.37	2.42	0.60	2.19	0.92	0.58	0.42	0.40	12.76
2000	0.52	0.57	0.66	0.74	2.13	1.88	1.01	0.37	0.94	1.57	0.59	0.45	11.43
2001	0.29	0.41	0.32	1.19	0.51	3.27	1.90	0.20	0.98	0.66	0.30	0.30	10.33
2002	0.47	0.37	0.62	0.76	1.88	3.95	1.37	1.92	1.48	0.50	0.22	0.33	13.87
2003	0.52	0.67	0.74	2.40	1.65	1.90	0.39	0.76	0.83	0.64	0.39	0.85	11.74
2004	0.56	0.39	0.37	1.20	2.79	1.91	1.06	1.73	1.19	1.11	0.19	0.43	12.93
2005	0.37	0.11	0.92	1.37	1.51	4.78	0.46	1.30	1.08	1.45	1.05	0.56	14.96
2006	0.55	0.39	0.80	2.17	1.78	2.49	0.77	0.74	1.24	1.76	0.41	0.47	13.57
2007	0.22	0.83	0.44	1.75	3.46	1.92	0.59	0.62	1.53	1.34	0.51	0.44	13.65
2008	0.60	0.49	0.49	1.03	3.80	2.28	0.99	0.89	1.22	0.59	0.75	1.10	14.23
2009	0.43	0.30	1.23	2.02	0.85	2.06	1.99	1.55	0.63	1.47	0.41	0.46	13.40
2010	0.65	0.29	0.47	1.82	2.91	3.36	1.09	2.17	1.52	0.60	1.26	0.80	16.94
2011	0.53	0.62	0.61	1.74	3.99	3.25	0.98	0.62	0.31	1.27	0.56	0.37	14.85
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.59	0.49	0.80	1.19	2.25	2.64	1.38	1.20	1.22	0.88	0.62	0.59	13.85
SD	0.27	0.20	0.30	0.48	1.01	1.07	0.77	0.66	0.67	0.48	0.33	0.28	2.29
Skew	0.83	0.72	0.56	0.53	0.87	0.32	1.50	0.79	0.69	0.58	0.74	0.67	0.28
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KendSum	-104.	-841.	-606.	1098.	194.	61.	-291.	702.	-226.	513.	-66.	-103.	178.
KendTau	-0.02	-0.12	-0.09	0.16	0.03	0.01	-0.04	0.10	-0.03	0.08	-0.01	-0.02	0.03
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	-0.24	-1.98	-1.43	2.58	0.45	0.14	-0.68	1.65	-0.53	1.21	-0.15	-0.24	0.42
Trend?	No Trend	Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	3.9585	0.0146	0.7988	1.3434	1.2476	0.6056	2.9833	2.5677	0.1189	0.6963	8.2590	0.3547	0.6624
Trend?	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	0.07	0.04	0.09	0.23	1.02	1.14	0.60	0.44	0.45	0.23	0.11	0.08	5.25
Res Var	0.07	0.04	0.09	0.21	1.02	1.14	0.60	0.43	0.45	0.23	0.11	0.08	5.23

Garrison

Analysis of Monthly Time-Series Data

Output File: C:\Climate\HCN-Met\outGARRPrecip.txt
DSS File: C:\Climate\Month-Met.DSS

/GARR/ALL/PRECIP(IN)/01JAN1890 - 01JAN2010/1MON/OB
First Year: 1895
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1895	0.89	0.50	0.61	1.02	1.35	3.15	0.90	0.63	0.54	0.31	1.00	0.54	11.44
1896	0.79	0.47	1.10	1.59	3.68	2.50	1.29	0.44	1.27	0.39	1.65	0.15	15.32
1897	0.80	0.55	0.90	0.78	0.74	2.07	1.27	0.46	0.29	0.92	1.15	0.36	10.29
1898	0.24	0.41	1.54	1.03	2.57	2.87	1.05	0.53	0.97	1.57	0.45	0.31	13.54
1899	0.91	0.78	0.95	0.88	2.47	1.91	1.51	1.08	0.25	0.99	0.16	0.57	12.46
1900	0.25	0.54	0.83	2.16	1.02	0.50	0.53	1.21	1.17	0.69	0.41	0.30	9.61
1901	0.32	0.30	0.52	0.71	1.52	2.75	1.33	0.59	1.32	0.29	0.37	0.88	10.90
1902	0.24	0.59	1.30	0.83	2.62	1.91	1.12	0.81	0.39	0.21	0.52	0.51	11.05
1903	0.41	0.34	0.32	0.92	2.05	1.19	1.95	1.43	0.99	0.21	0.35	0.37	10.53
1904	0.55	0.50	1.41	0.99	1.53	1.78	0.64	0.74	0.24	0.34	0.03	0.53	9.28
1905	0.36	0.29	0.59	0.66	2.39	3.20	1.73	0.61	1.03	0.80	0.50	0.12	12.28
1906	0.45	0.34	0.61	1.11	3.54	3.08	0.64	1.97	0.81	0.42	0.43	0.72	14.12
1907	0.89	0.43	0.81	0.63	2.40	2.69	1.61	1.13	0.89	0.30	0.13	0.27	12.18
1908	0.34	0.56	0.95	0.93	3.33	2.38	0.81	1.18	1.17	1.60	0.16	0.29	13.70
1909	0.61	0.28	0.44	0.68	2.53	2.66	1.83	0.89	1.33	0.29	0.56	0.64	12.74
1910	0.50	0.46	0.51	0.97	1.59	1.42	0.88	1.05	1.47	0.71	0.48	0.23	10.27
1911	0.75	0.43	0.21	0.86	2.15	1.78	0.96	1.41	1.73	0.85	0.61	0.35	12.09
1912	0.39	0.23	0.63	1.48	2.63	1.21	2.08	2.11	1.63	1.82	0.18	0.17	14.56
1913	0.59	0.15	0.71	0.59	1.74	2.14	1.54	1.07	1.18	1.56	0.34	0.10	11.71
1914	0.28	0.36	0.47	1.12	1.51	3.36	0.77	1.04	1.05	0.94	0.11	0.27	11.28
1915	0.42	0.26	0.48	0.67	2.53	3.72	3.00	1.00	1.96	0.51	0.67	0.43	15.65
1916	0.88	0.39	0.74	0.78	1.84	2.86	1.92	1.25	1.05	1.34	0.41	0.78	14.24
1917	0.52	0.50	0.60	1.53	1.81	1.43	0.41	0.54	1.25	0.48	0.16	1.16	10.39
1918	0.93	0.41	0.69	1.45	1.36	1.09	1.54	1.81	1.54	0.72	0.65	0.35	12.54
1919	0.14	0.47	0.40	0.79	1.06	0.89	0.75	0.48	0.94	1.72	0.66	0.52	8.82
1920	0.64	0.50	0.67	1.62	2.10	2.11	1.14	1.15	0.76	1.00	0.30	0.32	12.31
1921	0.27	0.16	0.91	1.03	2.58	3.07	1.48	0.43	1.00	0.12	0.91	0.54	12.50
1922	0.52	0.65	0.31	1.64	2.63	2.18	1.79	1.09	0.57	0.59	0.99	0.59	13.55
1923	0.47	0.34	0.50	1.32	1.60	3.58	2.27	1.71	3.02	1.41	0.42	0.41	17.05
1924	0.41	0.55	1.21	0.95	1.35	2.81	1.41	0.82	0.76	1.77	0.40	0.67	13.11
1925	0.29	0.33	0.66	1.60	1.38	2.99	1.07	0.63	1.84	1.36	0.24	0.49	12.88
1926	0.52	0.29	0.28	0.39	1.82	1.74	1.13	1.49	1.72	0.48	0.98	0.45	11.29
1927	0.40	0.33	0.42	1.75	4.23	2.09	2.05	1.76	1.44	0.73	1.14	0.85	17.19
1928	0.63	0.28	0.44	0.67	0.78	3.28	2.74	1.32	0.32	1.06	0.35	0.43	12.30
1929	0.60	0.50	0.94	0.98	2.28	1.76	0.61	0.39	1.37	0.79	0.69	0.75	11.66
1930	0.36	0.37	0.52	1.12	1.33	1.63	1.09	1.82	1.06	1.29	0.42	0.19	11.20
1931	0.13	0.34	0.61	0.59	1.18	1.37	1.61	0.65	1.26	0.60	0.41	0.27	9.02
1932	0.54	0.28	0.87	1.79	1.54	3.12	1.14	1.26	0.40	1.60	0.47	0.25	13.26
1933	0.56	0.36	0.52	1.56	2.58	1.28	0.61	2.41	0.53	0.63	0.47	0.65	12.16
1934	0.19	0.14	0.76	0.78	0.49	2.08	0.83	0.40	0.90	0.36	0.18	0.44	7.55
1935	0.37	0.25	1.01	1.10	2.48	1.52	1.87	0.63	0.24	0.42	0.55	0.33	10.77
1936	0.58	0.70	0.51	0.67	0.57	1.44	1.03	1.14	0.62	0.73	0.31	0.44	8.74
1937	0.34	0.30	0.67	0.71	0.87	2.72	1.98	0.29	1.06	1.10	0.30	0.43	10.77

1938	0.38	0.36	0.96	0.70	2.68	2.60	1.96	1.00	0.91	1.38	0.64	0.28	13.85
1939	0.38	0.32	0.41	0.72	2.00	3.44	0.90	1.00	0.55	0.46	0.03	0.41	10.62
1940	0.42	0.47	0.60	2.34	1.10	2.47	1.70	0.50	1.40	1.28	0.57	0.19	13.04
1941	0.16	0.21	0.55	1.79	1.54	3.40	1.46	1.79	3.05	0.97	0.66	0.48	16.06
1942	0.28	0.46	0.57	1.18	3.24	3.10	1.00	0.97	1.31	1.13	0.91	0.31	14.46
1943	0.88	0.28	0.65	1.11	1.38	3.55	0.98	1.42	0.34	1.12	0.33	0.24	12.28
1944	0.38	0.35	0.79	1.45	1.90	5.66	1.01	1.30	1.21	0.20	0.83	0.33	15.41
1945	0.41	0.29	0.96	1.08	1.88	2.99	0.84	1.13	1.61	0.49	0.61	0.52	12.81
1946	0.27	0.25	0.94	0.43	2.36	2.24	1.79	0.65	2.26	2.10	0.49	0.55	14.33
1947	0.23	0.37	0.73	1.43	1.30	4.25	0.93	1.78	1.12	0.65	0.76	0.36	13.91
1948	0.68	0.49	0.47	1.10	1.73	3.22	2.46	0.97	0.52	0.19	0.67	0.48	12.98
1949	0.82	0.39	0.57	0.53	1.64	1.43	1.22	0.49	0.76	1.60	0.08	0.46	9.99
1950	0.61	0.31	0.99	1.29	1.27	2.77	1.29	1.08	2.38	0.42	0.53	0.34	13.28
1951	0.40	0.37	0.47	0.94	1.30	2.09	1.40	1.92	1.22	1.27	0.28	0.66	12.32
1952	0.34	0.64	0.57	0.52	2.17	1.69	1.46	0.95	0.42	0.11	0.32	0.12	9.31
1953	0.43	0.57	0.57	1.92	3.15	2.58	0.74	1.28	0.60	0.90	0.28	0.45	13.47
1954	0.61	0.25	1.15	0.78	1.34	2.14	0.63	1.84	1.14	0.65	0.11	0.14	10.78
1955	0.25	0.61	0.60	1.45	2.72	1.86	1.88	0.29	0.69	0.47	0.70	0.79	12.31
1956	0.31	0.17	0.33	0.72	2.11	1.15	1.43	1.29	0.43	0.34	0.57	0.31	9.16
1957	0.42	0.31	0.56	1.80	2.59	3.16	1.02	1.40	1.03	0.94	0.75	0.09	14.07
1958	0.18	0.46	0.58	1.27	0.70	2.75	2.24	0.79	0.30	0.65	1.04	0.44	11.40
1959	0.49	0.65	0.33	1.02	1.56	2.19	0.58	0.54	1.46	0.91	0.74	0.15	10.62
1960	0.32	0.35	0.37	0.93	1.22	1.75	0.52	1.25	0.34	0.51	0.53	0.30	8.39
1961	0.09	0.43	0.40	1.14	1.62	1.27	1.04	0.57	2.68	0.86	0.46	0.20	10.76
1962	0.63	0.37	0.55	0.64	3.62	2.37	2.84	1.21	1.03	0.83	0.57	0.17	14.83
1963	0.69	0.41	0.46	2.13	1.59	3.82	1.31	0.99	1.19	0.29	0.20	0.42	13.50
1964	0.31	0.31	0.39	1.58	2.01	3.61	0.94	1.78	0.31	0.49	0.59	0.78	13.10
1965	0.60	0.37	0.49	1.19	2.62	3.09	1.83	1.55	1.68	0.11	0.28	0.28	14.09
1966	0.37	0.24	0.52	1.20	1.17	1.98	1.70	1.16	1.05	0.66	0.59	0.37	11.01
1967	0.63	0.54	0.98	1.92	1.64	3.91	0.91	0.23	2.10	0.87	0.50	0.73	14.96
1968	0.62	0.26	0.54	0.89	1.69	3.50	0.75	2.74	1.17	0.45	0.67	0.72	14.00
1969	0.92	0.23	0.36	1.73	1.19	3.66	1.95	0.41	0.34	1.05	0.25	0.43	12.52
1970	0.53	0.27	0.75	2.27	2.68	2.38	1.45	0.34	1.61	0.66	0.74	0.39	14.07
1971	1.05	0.49	0.50	1.63	1.90	2.17	0.44	0.70	1.66	2.86	0.50	0.47	14.37
1972	0.88	0.47	0.71	0.83	2.57	2.15	1.46	1.91	1.13	0.96	0.23	0.60	13.90
1973	0.19	0.25	0.82	2.22	1.12	2.45	0.95	0.86	2.84	0.65	0.65	0.65	13.65
1974	0.26	0.21	0.76	1.22	3.06	1.16	1.46	1.79	0.63	1.19	0.38	0.27	12.39
1975	0.65	0.31	1.06	2.00	3.38	2.93	1.92	1.18	0.51	1.70	0.81	0.66	17.11
1976	0.37	0.29	0.48	1.72	1.25	3.51	1.26	1.39	0.89	0.58	0.31	0.24	12.29
1977	0.67	0.14	0.85	0.37	2.26	1.50	1.19	1.50	1.75	0.84	0.58	1.03	12.68
1978	0.55	0.90	0.25	1.05	4.59	1.57	1.99	0.69	2.32	0.30	1.12	0.69	16.02
1979	0.39	0.58	0.44	1.08	1.59	1.21	1.28	1.06	0.35	0.65	0.27	0.19	9.09
1980	0.63	0.42	0.72	0.51	1.66	2.07	0.62	1.90	1.08	1.45	0.39	0.44	11.89
1981	0.15	0.24	0.51	0.51	3.23	1.79	1.37	1.00	0.55	1.23	0.35	0.39	11.32
1982	0.77	0.33	1.24	0.83	3.17	2.75	1.46	1.27	2.06	1.60	0.29	0.77	16.54
1983	0.23	0.18	0.87	0.57	2.01	1.64	1.88	0.86	1.13	0.63	0.71	0.52	11.23
1984	0.43	0.27	0.61	1.35	0.76	2.53	0.78	1.04	1.15	0.53	0.34	0.53	10.32
1985	0.22	0.15	0.88	0.78	1.56	1.15	1.22	1.80	1.66	0.71	0.84	0.45	11.42
1986	0.42	0.68	0.44	1.34	2.70	1.94	1.42	0.62	3.36	0.77	0.93	0.06	14.68
1987	0.21	0.31	0.98	0.30	2.78	1.39	2.64	1.56	0.81	0.11	0.21	0.19	11.49
1988	0.31	0.43	0.45	0.73	1.90	1.11	0.60	0.32	1.27	0.37	0.42	0.46	8.37
1989	0.61	0.39	0.97	1.96	2.25	1.64	1.10	1.45	0.64	1.10	0.56	0.83	13.50
1990	0.32	0.12	0.53	1.35	1.74	1.36	1.39	0.91	0.38	0.70	0.42	0.36	9.58
1991	0.30	0.35	0.44	2.51	2.68	3.44	0.88	0.66	2.24	0.68	0.67	0.12	14.97
1992	0.14	0.08	0.75	1.61	1.53	3.07	2.52	0.99	0.60	0.85	0.68	0.49	13.31
1993	0.47	0.33	0.58	1.34	1.54	3.70	4.69	1.37	0.53	1.04	0.49	0.28	16.36
1994	0.54	0.48	0.49	1.25	1.21	2.05	1.27	0.50	0.79	2.35	0.51	0.27	11.71
1995	0.45	0.30	1.09	1.39	2.77	2.75	1.92	1.15	1.07	1.25	0.58	0.33	15.05
1996	0.73	0.31	1.01	0.70	2.83	1.33	0.87	0.50	1.63	0.64	0.87	0.67	12.09
1997	0.51	0.19	0.50	1.31	1.53	2.36	3.04	1.27	0.76	0.99	0.30	0.27	13.03
1998	0.52	0.60	1.00	0.83	0.91	3.49	1.47	1.12	1.01	2.19	0.86	0.43	14.43
1999	0.55	0.35	0.28	2.00	2.39	2.09	0.94	1.48	1.25	0.41	0.30	0.23	12.27

2000	0.33	0.57	0.46	0.95	1.82	1.76	1.76	0.28	0.98	0.80	1.01	0.35	11.07
2001	0.17	0.36	0.36	1.03	0.77	3.56	2.53	0.20	0.83	0.49	0.29	0.16	10.75
2002	0.36	0.26	0.63	1.13	1.37	1.96	1.65	1.27	1.00	0.80	0.34	0.24	11.01
2003	0.48	0.57	1.15	1.01	2.05	2.26	0.51	0.72	0.86	0.82	0.31	0.63	11.37
2004	0.44	0.54	0.22	0.81	1.71	1.47	1.80	1.18	1.24	1.37	0.21	0.22	11.21
2005	0.31	0.08	0.64	1.51	3.19	3.56	0.68	1.03	0.72	1.61	0.82	0.43	14.58
2006	0.26	0.30	0.61	1.94	1.22	1.21	0.46	0.62	1.74	1.41	0.29	0.30	10.36
2007	0.22	0.59	0.95	1.27	3.34	2.00	0.95	0.88	0.82	1.24	0.23	0.28	12.77
2008	0.32	0.34	0.32	0.46	4.06	1.88	1.01	0.70	1.47	1.33	0.64	0.69	13.22
2009	0.36	0.24	0.83	1.58	0.94	2.57	1.67	1.41	0.36	1.54	0.13	0.47	12.10
2010	0.42	0.26	0.37	1.21	3.60	2.54	1.22	1.54	1.33	0.49	1.04	0.50	14.52
2011	0.65	0.49	0.64	1.58	5.88	2.15	1.20	0.68	0.39	1.25	0.45	0.25	15.61
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.46	0.38	0.66	1.17	2.05	2.36	1.38	1.07	1.12	0.88	0.52	0.42	12.48
SD	0.21	0.15	0.27	0.49	0.91	0.87	0.66	0.50	0.64	0.52	0.28	0.21	2.05
Skew	0.60	0.60	0.78	0.57	1.05	0.52	1.51	0.53	1.13	0.96	0.89	0.77	0.07
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
KendSum	-588.	-819.	-459.	768.	319.	-150.	158.	73.	111.	763.	195.	-264.	509.
KendTau	-0.09	-0.12	-0.07	0.11	0.05	-0.02	0.02	0.01	0.02	0.11	0.03	-0.04	0.08
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	-1.38	-1.93	-1.08	1.81	0.75	-0.35	0.37	0.17	0.26	1.80	0.46	-0.62	1.20
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	1.7086	1.7072	1.4755	1.5835	6.1722	0.1590	5.8877	0.0502	0.4846	0.1173	5.2917	0.4858	0.0000
Trend?	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	0.04	0.02	0.07	0.24	0.83	0.76	0.44	0.25	0.41	0.27	0.08	0.04	4.22
Res Var	0.04	0.02	0.07	0.23	0.82	0.76	0.43	0.25	0.41	0.26	0.08	0.04	4.17
Tnd Var	2.62	2.17	1.62	2.58	1.36	0.03	0.71	0.00	0.17	2.48	0.00	0.37	1.23

Computed Evapotranspiration

Fort Peck

Analysis of Monthly Time-Series Data

Output File: C:\Climate\ET\outFTPK_ET.txt
DSS File: C:\Climate\Month-Met.DSS

//Fort Peck/Evapotranspiration/01JAN1970 - 01JAN20
First Year: 1971
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1971	0.43	0.80	1.60	3.09	4.94	5.76	7.08	7.02	3.44	1.91	0.83	0.36	37.26
1972	0.31	0.82	2.10	3.13	4.86	6.25	6.44	5.92	3.34	1.97	0.76	0.30	36.20
1973	0.51	0.94	1.94	2.71	5.21	6.02	7.41	6.32	3.43	2.07	0.61	0.51	37.68
1974	0.42	0.95	1.72	3.38	4.28	6.81	7.53	5.42	3.84	2.36	0.87	0.53	38.11
1975	0.47	0.58	1.37	2.12	4.21	5.35	6.98	5.43	3.91	1.89	0.83	0.54	33.68
1976	0.62	0.95	1.68	3.18	5.44	5.56	7.25	5.73	4.05	2.08	0.95	0.59	38.08
1977	0.46	1.13	1.67	3.96	4.62	6.50	6.88	5.46	3.59	2.06	0.76	0.38	37.47
1978	0.34	0.64	1.97	2.96	4.34	6.23	6.62	5.84	3.71	2.30	0.67	0.30	35.92
1979	0.18	0.65	1.77	2.88	4.81	6.33	7.22	6.02	4.44	2.29	0.75	0.63	37.97
1980	0.37	0.88	1.58	3.86	5.01	5.80	7.05	5.37	3.56	2.18	0.90	0.52	37.08
1981	0.78	0.93	2.12	3.38	4.34	5.47	7.09	6.60	4.17	1.84	1.02	0.48	38.22
1982	0.32	0.71	1.51	2.79	4.48	5.68	6.60	6.37	3.57	1.88	0.69	0.45	35.05
1983	0.70	1.08	1.82	3.04	4.78	5.71	6.77	6.47	3.56	2.07	0.82	0.16	36.98
1984	0.56	1.06	1.73	3.04	4.94	5.67	7.23	6.39	3.29	1.84	0.81	0.34	36.90
1985	0.45	0.68	1.71	3.59	5.53	6.34	7.83	5.46	2.78	1.85	0.43	0.43	37.08
1986	0.73	0.73	2.37	3.09	5.01	6.72	6.51	6.24	2.78	2.15	0.73	0.55	37.61
1987	0.63	1.05	1.80	4.13	5.23	6.51	6.47	5.46	4.20	2.39	0.98	0.52	39.37
1988	0.50	1.05	1.88	3.62	5.59	7.25	7.62	6.42	3.76	2.35	0.76	0.52	41.32
1989	0.57	0.42	1.55	3.21	4.67	6.08	7.48	5.57	3.80	1.92	0.86	0.48	36.61
1990	0.58	0.89	1.99	3.36	4.51	6.04	7.17	6.14	4.54	2.01	0.94	0.36	38.53
1991	0.45	1.22	1.90	2.86	4.56	5.60	7.41	6.67	3.91	2.16	0.71	0.59	38.04
1992	0.73	1.29	2.49	3.70	5.72	6.22	6.00	5.97	3.72	2.17	0.72	0.36	39.09
1993	0.40	0.57	1.96	3.01	5.29	5.28	5.20	5.17	3.54	2.07	0.70	0.56	33.75
1994	0.65	0.66	2.24	3.37	5.22	6.27	7.35	6.53	4.35	1.84	0.70	0.53	39.71
1995	0.59	1.00	1.75	2.83	4.47	5.66	6.60	6.26	3.76	1.83	0.86	0.50	36.11
1996	0.34	0.83	1.44	3.24	4.00	6.35	7.32	6.55	3.55	2.07	0.65	0.35	36.69
1997	0.42	0.85	1.99	2.75	5.09	5.72	6.54	5.97	4.10	1.93	0.84	0.55	36.75
1998	0.53	1.03	1.78	3.41	5.39	4.97	7.16	6.49	4.34	2.07	0.77	0.47	38.41
1999	0.60	0.98	2.21	2.97	4.63	5.54	7.12	6.16	3.59	2.19	1.17	0.60	37.76
2000	0.59	1.01	2.03	3.65	4.88	6.02	7.59	6.57	3.67	1.90	0.59	0.41	38.91
2001	0.62	0.64	1.93	3.13	5.70	5.95	7.14	6.87	4.20	2.02	1.09	0.49	39.78
2002	0.55	0.94	1.19	2.96	4.70	5.96	7.50	5.51	3.79	1.79	0.89	0.58	36.36
2003	0.70	0.70	1.82	3.24	4.85	5.99	8.05	6.74	3.80	2.39	0.68	0.57	39.53
2004	0.46	0.92	2.44	3.69	4.41	5.54	7.09	5.65	3.53	2.02	0.94	0.61	37.30
2005	0.56	1.16	1.96	3.27	4.67	5.42	7.59	6.19	3.86	2.12	0.91	0.42	38.13
2006	0.74	0.85	1.79	3.47	5.38	6.18	7.97	6.30	3.81	1.88	0.84	0.58	39.79
2007	0.59	0.77	2.36	3.21	5.22	6.37	8.26	6.40	3.85	2.00	0.90	0.47	40.40
2008	0.50	0.96	1.76	3.01	4.59	5.83	7.41	6.36	3.67	2.08	0.97	0.38	37.52
2009	0.61	0.93	1.71	2.93	5.17	5.73	6.97	5.84	4.55	1.48	0.99	0.32	37.23
2010	0.55	0.79	2.22	3.14	4.13	5.42	6.81	5.78	3.58	2.36	0.78	0.43	35.99
2011	0.54	0.60	1.63	2.68	4.11	5.42	7.37	6.49	4.33	2.05	0.82	0.56	36.60

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.53	0.87	1.87	3.20	4.85	5.94	7.11	6.10	3.79	2.04	0.82	0.47	37.58
SD	0.13	0.19	0.29	0.39	0.46	0.46	0.56	0.47	0.40	0.19	0.14	0.11	1.60
Skew	-0.31	-0.09	0.21	0.11	0.10	0.50	-0.87	-0.20	-0.22	-0.17	-0.03	-0.74	-0.17
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.01	0.00	0.00	-0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.03
KendSum	179.	2.	122.	-2.	1.	-145.	140.	136.	150.	-44.	112.	76.	111.
KendTau	0.22	0.00	0.15	0.00	0.00	-0.18	0.17	0.17	0.18	-0.05	0.14	0.09	0.14
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.00	0.01	1.36	-0.01	0.00	-1.62	1.56	1.52	1.67	-0.48	1.25	0.84	1.24
Trend?	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	2.5410	0.0252	1.3508	3.3179	0.4900	0.8505	0.5930	1.2219	0.3035	1.3970	0.0343	0.8258	0.1038
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	0.02	0.04	0.08	0.15	0.21	0.22	0.32	0.22	0.16	0.04	0.02	0.01	2.57
Res Var	0.02	0.04	0.08	0.15	0.21	0.20	0.30	0.21	0.15	0.04	0.02	0.01	2.44
Tnd Var	12.61	0.04	4.33	0.02	0.01	6.56	6.22	4.16	6.96	1.40	5.55	2.35	5.10

Garrison

Analysis of Monthly Time-Series Data

Output File: C:\Climate\ET\outGARR_ET.txt
DSS File: C:\Climate\Month-Met.DSS

//Garrison/Evapotranspiration/01JAN1970 - 01JAN201
First Year: 1971
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1971	0.40	0.70	1.68	3.26	5.33	6.39	7.40	7.20	3.75	1.94	0.84	0.37	39.26
1972	0.29	0.74	2.14	3.37	5.03	6.51	6.78	6.23	3.69	2.04	0.77	0.28	37.87
1973	0.50	0.83	2.06	2.88	5.36	6.50	7.40	6.68	3.54	2.30	0.71	0.47	39.23
1974	0.42	0.99	1.84	3.59	4.63	7.02	7.85	5.74	3.89	2.45	0.90	0.55	39.87
1975	0.50	0.60	1.47	2.43	4.60	5.91	7.46	6.04	4.03	2.13	0.91	0.48	36.56
1976	0.50	1.03	1.83	3.55	5.79	6.10	7.61	6.31	4.38	2.09	0.93	0.54	40.66
1977	0.30	1.01	1.95	4.15	5.71	6.99	7.57	5.72	3.84	2.17	0.83	0.34	40.58
1978	0.21	0.46	1.83	3.14	4.88	6.48	7.02	6.29	4.14	2.27	0.71	0.26	37.69
1979	0.07	0.48	1.69	3.01	4.96	6.77	7.44	6.12	4.56	2.36	0.77	0.65	38.88
1980	0.34	0.84	1.76	4.10	5.84	6.63	7.89	5.75	3.97	2.21	0.99	0.60	40.92
1981	0.75	0.98	2.36	3.89	4.94	6.13	7.71	6.74	4.45	2.01	1.11	0.52	41.59
1982	0.28	0.72	1.64	3.19	4.67	5.92	7.08	6.61	3.83	2.00	0.74	0.45	37.13
1983	0.65	1.07	1.84	3.21	4.85	6.36	7.60	7.08	3.94	2.21	0.89	0.10	39.80

1984	0.51	1.09	1.81	3.40	5.49	6.31	7.71	6.74	3.51	2.01	0.87	0.32	39.77
1985	0.36	0.66	1.91	3.91	5.99	6.45	7.91	5.88	3.22	2.03	0.48	0.38	39.18
1986	0.65	0.64	2.49	3.31	5.27	7.02	7.04	6.44	3.03	2.13	0.73	0.55	39.30
1987	0.60	1.03	1.76	4.43	5.70	6.95	6.92	5.72	4.22	2.34	1.05	0.56	41.28
1988	0.47	0.97	2.14	4.08	6.24	8.17	8.12	6.71	3.95	2.44	0.86	0.51	44.66
1989	0.54	0.38	1.64	3.35	5.13	6.50	7.87	6.32	4.08	2.16	0.88	0.39	39.24
1990	0.63	0.95	2.13	3.53	4.96	6.62	7.45	6.54	4.62	2.22	1.02	0.35	41.02
1991	0.38	1.14	2.09	3.04	4.85	6.14	7.46	6.72	3.91	2.21	0.71	0.59	39.24
1992	0.76	1.32	2.50	3.74	5.90	6.38	6.13	6.04	3.98	2.25	0.71	0.35	40.06
1993	0.32	0.45	1.98	3.35	5.49	5.66	5.67	5.59	3.72	2.13	0.75	0.55	35.66
1994	0.52	0.55	2.19	3.63	5.75	6.55	7.46	6.67	4.34	1.92	0.80	0.56	40.94
1995	0.54	1.07	1.86	2.93	4.65	6.10	7.06	6.71	3.98	2.00	0.87	0.50	38.27
1996	0.29	0.85	1.32	3.37	4.21	6.70	7.45	6.86	3.75	2.16	0.63	0.35	37.94
1997	0.34	0.84	2.08	2.96	5.25	6.57	6.85	6.18	4.30	2.23	0.89	0.55	39.04
1998	0.51	0.99	1.60	3.59	5.64	5.26	7.60	6.60	4.57	2.06	0.82	0.50	39.74
1999	0.54	1.03	2.36	3.11	4.85	5.96	7.43	6.39	3.61	2.29	1.28	0.65	39.50
2000	0.61	1.04	2.28	3.65	5.30	6.14	7.78	6.75	3.99	2.07	0.54	0.33	40.48
2001	0.57	0.51	1.96	3.41	5.77	6.07	7.37	6.99	4.25	2.11	1.15	0.51	40.67
2002	0.55	0.95	1.17	3.15	4.95	6.52	7.99	5.91	4.07	1.76	0.95	0.57	38.54
2003	0.62	0.66	1.78	3.70	5.04	5.91	8.14	6.92	3.95	2.52	0.67	0.55	40.46
2004	0.39	0.79	2.38	3.80	4.86	5.84	7.16	5.73	3.91	2.10	1.00	0.60	38.56
2005	0.49	1.08	2.08	3.53	4.64	5.86	7.82	6.25	4.14	2.13	0.95	0.38	39.35
2006	0.76	0.81	1.78	3.76	5.51	6.75	8.23	6.56	3.75	1.89	0.93	0.56	41.29
2007	0.53	0.72	2.47	3.26	5.27	6.52	8.07	6.42	4.12	2.11	0.98	0.45	40.92
2008	0.46	0.86	1.91	3.32	4.68	5.92	7.52	6.52	3.69	2.05	0.98	0.34	38.25
2009	0.51	0.83	1.73	3.06	5.29	5.76	6.98	5.88	4.59	1.45	1.11	0.21	37.40
2010	0.40	0.58	2.07	3.39	4.35	5.81	7.06	6.23	3.77	2.45	0.83	0.42	37.36
2011	0.43	0.48	1.53	2.89	3.94	5.72	7.38	6.51	4.34	2.24	0.87	0.54	36.87
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.48	0.82	1.93	3.42	5.16	6.34	7.43	6.37	3.98	2.14	0.86	0.46	39.39
SD	0.15	0.23	0.31	0.40	0.51	0.51	0.51	0.42	0.35	0.20	0.16	0.13	1.67
Skew	-0.26	-0.17	-0.08	0.23	-0.08	0.96	-1.23	-0.16	-0.30	-0.87	0.08	-0.71	0.34
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.00	0.00	-0.01	-0.02	0.00	0.00	0.01	0.00	0.00	0.00	-0.01
KendSum	140.	-19.	45.	-11.	-112.	-247.	44.	26.	95.	-62.	120.	56.	-54.
KendTau	0.17	-0.02	0.05	-0.01	-0.14	-0.30	0.05	0.03	0.12	-0.08	0.15	0.07	-0.07
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.56	-0.20	0.49	-0.11	-1.25	-2.76	0.48	0.28	1.06	-0.69	1.34	0.62	-0.60
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	1.3107	0.0114	1.8764	3.4161	0.1161	0.1524	0.6318	1.0721	0.3343	6.6510	0.6938	0.1375	0.0286
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	0.02	0.05	0.10	0.16	0.26	0.26	0.26	0.18	0.12	0.04	0.03	0.02	2.77
Res Var	0.02	0.05	0.10	0.16	0.25	0.22	0.26	0.18	0.12	0.04	0.02	0.02	2.75
Tnd Var	7.65	0.11	0.54	0.13	5.42	15.33	0.37	0.22	2.94	3.08	4.91	0.93	0.83

Soil Moisture

Fort Peck

Analysis of Monthly Time-Series Data

Output File: FTPK-SM.OUT
DSS File: NRCS-PT.DSS

/FTPK/ALL/SOIL MOISTURE//1MON/OBS/
First Year: 1932
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1932	145.70	143.40	162.30	178.40	183.60	224.10	210.50	211.00	182.20	189.90	189.90	188.90	184.16
1933	189.30	185.00	176.80	194.00	217.60	207.00	166.40	200.40	187.50	189.00	183.30	194.40	190.89
1934	186.60	178.80	186.30	171.60	154.60	210.10	180.10	152.90	162.70	165.40	156.50	161.70	172.27
1935	161.50	152.70	172.40	186.50	198.20	186.80	169.90	147.90	129.20	141.20	139.60	132.40	159.86
1936	139.90	155.00	154.20	160.00	154.90	170.20	146.00	146.80	143.90	138.70	133.90	141.10	148.72
1937	147.20	149.40	159.10	160.30	142.50	181.70	184.30	159.30	171.90	165.40	164.00	172.10	163.10
1938	169.10	169.70	190.50	185.50	236.80	264.50	253.00	222.00	196.30	224.30	223.10	212.10	212.24
1939	205.80	200.40	197.60	188.50	197.20	237.50	200.60	172.70	170.20	174.00	158.80	160.20	188.63
1940	161.60	171.60	180.30	211.40	201.10	205.50	194.20	159.00	186.70	188.60	191.80	183.20	186.25
1941	173.80	166.80	162.80	177.90	195.00	234.00	209.00	207.50	246.90	235.10	239.10	240.90	207.40
1942	232.30	227.20	224.50	210.80	262.70	284.50	248.80	215.70	205.00	198.70	207.50	201.40	226.59
1943	213.70	207.70	204.70	218.90	223.10	273.50	232.20	208.60	184.00	186.00	176.00	165.90	207.86
1944	154.20	155.60	163.60	157.40	179.80	270.60	237.80	226.90	211.00	186.70	186.30	179.80	192.48
1945	174.00	168.70	171.20	172.70	197.10	236.10	197.90	178.00	192.00	183.30	181.00	185.40	186.45
1946	178.80	172.10	177.10	164.40	189.10	198.20	196.60	175.40	202.10	229.50	232.50	230.50	195.52
1947	218.60	209.60	212.10	205.30	187.30	246.60	207.30	195.00	220.20	207.10	213.70	205.10	210.66
1948	202.40	195.00	193.80	192.00	223.20	283.70	271.20	235.00	208.50	186.70	189.20	191.80	214.38
1949	193.90	196.30	195.30	181.20	201.90	205.80	187.00	159.70	158.70	166.00	153.90	156.80	179.71
1950	162.20	154.20	173.90	177.30	174.20	207.20	209.70	200.40	200.80	188.40	193.10	191.00	186.03
1951	188.00	187.40	194.10	197.90	206.70	226.90	210.60	230.80	225.90	237.40	227.60	239.10	214.37
1952	235.00	231.20	228.50	206.60	233.80	233.60	212.60	191.00	170.30	151.60	155.10	149.90	199.93
1953	154.30	162.70	162.50	183.50	252.90	280.80	228.50	194.20	175.20	158.90	152.40	156.60	188.54
1954	168.20	162.90	175.10	178.90	178.40	224.90	190.90	201.20	204.10	196.80	180.70	170.60	186.06
1955	167.00	168.00	172.80	200.80	236.50	237.10	249.70	200.90	183.40	173.10	185.10	200.60	197.92
1956	198.40	188.60	183.20	183.20	197.60	197.10	186.30	183.00	166.60	163.90	156.30	155.40	179.97
1957	163.00	162.20	165.80	175.60	206.60	237.30	201.60	187.10	181.60	194.50	189.80	181.30	187.20
1958	173.10	179.60	186.50	191.70	176.20	228.40	228.10	196.50	183.60	173.00	188.70	192.90	191.52
1959	194.50	200.90	192.90	192.30	222.30	242.70	201.50	179.70	193.00	203.10	212.80	199.60	202.94
1960	194.90	190.70	185.80	203.80	211.00	192.80	156.80	170.80	151.00	141.60	142.50	139.80	173.46
1961	130.90	130.60	137.70	151.70	176.10	156.40	148.00	131.00	165.80	170.20	172.30	168.20	153.24
1962	170.90	174.90	175.30	165.80	228.80	237.80	237.60	227.40	203.00	202.30	207.50	196.60	202.32
1963	199.30	194.50	185.80	192.70	205.00	248.10	218.50	190.50	186.40	175.30	169.30	172.00	194.78
1964	171.00	165.20	168.30	182.20	231.30	285.90	246.30	238.90	214.40	194.70	196.60	212.60	208.95
1965	215.80	207.20	202.10	215.80	228.00	277.90	253.00	242.00	265.30	231.90	225.30	214.00	231.52
1966	211.10	201.50	196.20	196.10	195.50	213.10	193.50	177.40	161.70	163.50	172.90	174.20	188.06
1967	179.20	174.80	195.40	221.20	233.90	270.60	231.20	186.50	185.80	201.30	199.50	211.50	207.57
1968	210.60	200.20	195.50	194.20	221.60	251.60	210.00	225.80	243.80	226.20	226.40	223.50	219.12
1969	246.30	233.30	221.40	215.20	209.10	266.10	241.90	200.80	180.90	192.60	184.60	179.80	214.33
1970	186.20	183.30	192.50	213.90	237.10	248.80	237.70	200.90	203.20	199.90	200.60	197.90	208.50
1971	213.00	207.70	204.00	207.10	217.90	223.80	185.70	170.70	172.80	171.30	165.90	174.20	192.84
1972	185.30	183.50	186.20	184.20	194.20	197.30	195.30	199.10	194.80	194.00	183.80	183.40	190.09
1973	175.70	165.80	164.10	186.50	178.20	201.00	168.20	160.70	175.30	172.70	186.20	189.40	176.98

1974	187.90	178.90	191.60	186.00	232.70	201.70	182.90	211.20	192.70	182.70	176.30	173.30	191.49
1975	181.40	178.80	189.70	233.30	269.50	305.30	290.20	280.10	249.50	275.50	272.90	264.00	249.18
1976	250.50	239.10	230.10	241.50	228.20	262.60	234.10	221.90	219.20	204.30	195.80	185.50	226.07
1977	186.20	173.20	183.50	165.80	198.80	193.70	188.30	194.90	215.70	203.40	201.40	219.20	193.68
1978	226.70	227.50	214.50	223.40	264.80	252.50	259.00	236.60	263.60	236.50	242.00	240.70	240.65
1979	234.80	230.80	229.90	242.80	232.70	227.50	196.30	183.10	157.00	154.40	149.10	145.80	198.68
1980	152.20	158.00	166.70	163.80	224.20	249.20	214.30	202.50	203.90	208.50	200.70	196.70	195.06
1981	185.80	182.00	194.90	185.70	282.90	279.60	250.90	213.60	192.50	201.60	197.20	193.00	213.31
1982	199.20	198.00	216.50	221.00	263.60	272.60	248.20	218.10	232.60	224.90	216.50	221.50	227.73
1983	209.10	198.40	205.00	197.40	204.40	219.80	238.80	215.90	220.50	214.10	218.40	217.70	213.29
1984	211.20	203.20	209.00	214.70	211.10	222.90	189.00	179.90	185.60	188.40	185.20	187.30	198.96
1985	189.60	183.30	193.20	183.30	196.90	173.90	149.30	188.80	236.50	233.20	237.20	224.20	199.12
1986	215.50	223.40	212.20	217.00	239.80	234.30	223.20	209.60	257.80	237.50	237.60	221.50	227.45
1987	207.20	196.90	207.60	188.50	222.60	210.20	244.00	237.30	208.90	183.30	172.20	168.30	203.92
1988	166.70	163.20	167.00	171.80	190.30	178.40	155.40	131.00	149.50	142.40	147.50	148.80	159.33
1989	161.90	164.10	178.40	199.00	222.40	224.70	211.10	230.30	213.70	213.70	214.30	220.40	204.50
1990	216.40	202.80	208.40	210.10	238.70	223.70	202.70	202.70	170.50	163.80	165.70	163.30	197.40
1991	159.00	150.10	161.30	189.10	228.90	271.50	225.30	199.60	196.00	192.90	200.60	191.60	197.16
1992	181.50	171.20	162.80	170.80	172.40	212.80	224.30	202.50	190.10	200.30	198.30	200.50	190.63
1993	199.50	196.10	196.60	213.40	224.50	264.40	329.10	329.30	304.30	289.10	276.60	262.70	257.13
1994	252.80	245.00	227.30	239.30	240.60	239.30	210.60	175.90	151.70	173.40	178.60	178.20	209.39
1995	174.50	166.00	179.00	201.30	233.70	283.50	285.40	252.20	239.60	240.40	240.00	231.70	227.27
1996	232.40	225.10	229.90	224.40	261.10	242.60	201.20	169.50	176.50	169.20	178.80	193.40	208.68
1997	193.40	183.80	182.60	190.50	220.10	255.90	252.70	238.90	217.60	216.90	207.80	196.60	213.07
1998	196.90	186.10	193.60	194.40	206.70	264.10	243.70	213.40	192.70	185.50	191.90	193.70	205.23
1999	193.50	189.80	182.80	192.40	213.80	228.40	192.90	193.90	185.60	175.30	168.80	162.30	189.96
2000	160.50	160.20	160.70	159.70	178.50	181.20	164.30	136.40	141.30	159.10	158.50	154.70	159.59
2001	148.00	143.50	139.40	150.30	137.10	181.40	186.20	150.50	143.60	141.60	136.80	130.90	149.11
2002	131.40	130.90	135.40	137.90	160.10	216.70	194.60	203.40	201.10	192.00	181.90	172.10	171.46
2003	170.40	174.70	180.30	211.00	219.00	215.40	173.50	150.90	146.70	146.00	142.10	153.50	173.63
2004	155.20	150.80	142.20	147.20	196.20	206.10	185.70	189.70	187.50	189.70	177.60	173.40	175.11
2005	167.30	155.10	166.70	179.30	192.00	261.50	213.80	201.00	195.10	204.30	214.20	209.70	196.67
2006	205.30	196.50	200.50	225.40	226.70	241.20	197.20	172.60	175.30	200.40	196.50	188.60	202.18
2007	178.60	186.00	178.30	197.90	237.90	230.40	190.40	165.80	176.50	184.00	181.60	174.80	190.18
2008	173.70	169.70	165.20	168.70	226.90	242.20	208.90	184.50	187.10	178.70	182.90	192.60	190.09
2009	189.40	180.50	189.00	210.70	196.20	207.80	205.80	199.20	177.50	197.40	185.60	183.10	193.52
2010	184.60	175.80	166.30	188.30	227.80	262.90	233.10	236.60	234.50	215.70	230.60	235.60	215.98
2011	231.20	230.80	230.80	246.10	301.00	319.40	270.60	226.80	194.40	202.00	202.20	195.10	237.53
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	187.55	183.57	186.24	192.73	212.79	233.36	212.54	197.64	194.15	191.95	190.71	189.30	197.71
SD	27.48	25.59	22.62	23.36	30.66	33.61	34.46	32.91	31.76	29.30	29.84	28.66	21.57
Skew	0.29	0.38	0.08	0.11	0.07	0.08	0.53	0.70	0.74	0.62	0.45	0.32	0.09
Analysis of Trend in Mean (95% SL):													
Slope	0.14	0.09	0.04	0.16	0.34	0.16	0.19	0.18	0.14	0.16	0.17	0.14	0.16
KendSum	273.	189.	163.	422.	539.	198.	215.	250.	189.	317.	276.	245.	404.
KendTau	0.09	0.06	0.05	0.13	0.17	0.06	0.07	0.08	0.06	0.10	0.09	0.08	0.13
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.13	0.78	0.67	1.75	2.24	0.82	0.89	1.03	0.78	1.31	1.14	1.01	1.67
Trend?	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.2011	0.7706	3.2905	6.9933	1.5549	0.0258	1.1029	2.9290	1.7889	0.5421	0.1876	0.0730	1.6656
Trend?	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	755.07	654.94	511.82	545.47	939.93	1129.69	1187.18	1083.39	1008.57	858.28	890.45	821.22	465.39
Res Var	744.04	650.41	511.11	531.19	879.18	1116.38	1168.30	1065.25	998.72	843.94	874.39	811.14	451.82
Tnd Var	1.46	0.69	0.14	2.62	6.46	1.18	1.59	1.67	0.98	1.67	1.80	1.23	2.92

Garrison

Analysis of Monthly Time-Series Data

Output File: GARR-SM.OUT
DSS File: NRCS-PT.DSS

/GARR/ALL/SOIL MOISTURE//1MON/OBS/
First Year: 1932
Last Year: 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1932	136.60	132.00	143.50	171.10	183.20	214.40	194.00	178.50	159.80	186.80	179.80	173.30	171.08
1933	174.20	168.80	169.70	195.20	227.60	197.10	170.40	175.20	160.10	153.20	151.30	156.10	174.91
1934	149.40	142.20	148.10	151.70	132.60	153.90	140.50	123.20	129.60	123.10	118.40	119.80	136.04
1935	117.00	115.00	128.80	148.70	194.80	194.30	196.50	175.50	154.60	145.20	148.10	144.10	155.22
1936	148.50	156.00	163.00	163.30	148.10	147.90	138.90	133.80	129.40	132.70	130.70	129.70	143.50
1937	127.50	129.00	136.00	147.60	150.00	185.70	195.40	161.70	161.70	168.70	166.60	171.30	158.43
1938	171.50	166.00	175.80	178.50	215.20	222.60	226.60	202.90	181.50	188.70	196.10	188.70	192.84
1939	184.80	181.30	179.10	178.80	193.90	229.10	198.70	183.40	166.60	159.60	144.70	141.20	178.43
1940	141.50	148.10	152.40	194.70	196.20	206.80	200.20	171.30	175.60	178.90	182.80	174.10	176.88
1941	164.40	156.40	161.70	198.40	211.20	240.80	226.10	227.80	262.20	258.70	252.80	244.50	217.08
1942	230.70	221.10	219.80	225.30	263.80	263.40	228.30	206.20	205.90	209.70	218.80	212.10	225.43
1943	221.80	211.70	217.60	221.30	232.40	268.10	234.20	220.40	194.30	193.80	189.30	181.20	215.51
1944	176.90	173.30	180.30	199.80	215.40	318.80	271.90	244.70	235.20	210.80	217.30	207.50	220.99
1945	199.60	192.20	203.50	210.80	222.40	259.50	226.80	211.30	218.90	202.80	204.90	201.90	212.88
1946	193.50	185.30	193.80	176.40	202.20	214.00	204.80	184.80	199.30	230.60	221.50	218.40	202.05
1947	208.40	201.50	201.40	213.20	217.30	278.10	236.70	223.30	213.20	204.30	210.80	202.40	217.55
1948	203.30	202.70	199.00	212.00	208.70	230.30	231.50	206.30	182.90	170.00	179.60	180.40	200.56
1949	188.30	183.90	187.20	177.10	188.60	196.40	181.70	152.10	148.00	171.50	158.10	157.70	174.22
1950	164.00	158.30	169.50	188.10	201.00	221.00	209.30	191.00	213.20	196.90	196.00	189.60	191.49
1951	188.00	185.40	185.80	187.90	186.40	204.20	192.80	202.20	203.80	209.00	198.10	197.80	195.12
1952	191.10	190.90	189.20	176.10	193.30	197.40	191.50	182.30	159.80	142.70	136.90	131.10	173.52
1953	135.70	140.50	143.90	174.40	219.40	242.70	204.50	188.60	171.10	172.40	164.90	162.40	176.71
1954	166.20	159.00	175.70	177.00	180.90	200.20	172.70	171.60	178.80	173.10	159.40	150.00	172.05
1955	144.70	150.10	153.10	170.80	199.40	206.00	192.60	163.90	158.60	152.60	161.00	172.20	168.75
1956	169.00	159.50	161.20	166.60	187.10	178.60	178.60	174.10	155.50	145.70	150.90	147.50	164.52
1957	143.60	139.60	140.80	174.10	204.70	234.80	208.30	194.20	185.20	186.90	188.30	177.50	181.50
1958	167.10	166.50	165.00	178.50	165.60	196.10	206.30	176.30	154.80	150.70	164.40	160.90	171.02
1959	156.80	159.90	157.00	160.40	177.80	190.10	158.80	139.40	164.00	171.70	176.90	166.30	164.93
1960	161.10	155.90	152.30	155.50	161.20	167.50	141.70	150.60	133.40	129.40	131.70	128.60	147.41
1961	118.80	126.10	124.20	138.20	155.60	141.20	135.10	117.90	168.10	171.80	166.40	161.10	143.71
1962	164.20	163.80	163.90	157.60	219.20	238.20	244.50	227.40	211.50	204.30	198.50	186.60	198.31
1963	186.50	181.70	176.00	218.30	227.20	267.90	239.50	214.50	206.20	184.50	174.40	170.90	203.97
1964	167.50	162.90	162.10	186.90	203.40	259.10	219.60	209.40	186.20	173.60	177.30	185.40	191.12
1965	188.90	179.40	173.80	179.00	224.00	238.60	224.60	213.40	231.30	202.20	190.20	181.70	202.26
1966	173.30	164.60	163.20	176.60	172.90	181.70	167.70	166.50	165.10	161.90	160.30	157.50	167.61
1967	162.60	163.10	167.10	196.60	202.00	246.00	210.20	176.70	185.80	188.70	184.10	187.80	189.23

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1968	187.00	177.80	173.20	174.40	193.50	236.50	206.90	241.70	229.20	212.50	210.30	210.30	204.44
1969	214.70	205.80	195.50	206.80	196.50	247.60	240.30	196.90	172.80	178.40	171.50	168.90	199.64
1970	168.10	161.30	169.30	209.00	238.60	235.10	221.20	180.60	192.20	188.70	191.30	186.80	195.18
1971	193.40	189.80	190.20	212.20	225.40	221.20	190.90	162.30	178.70	232.10	222.70	214.80	202.81
1972	218.20	213.90	211.80	209.30	229.10	231.50	218.80	217.50	210.90	211.20	200.80	200.40	214.45
1973	190.50	178.70	181.50	213.90	203.70	213.20	194.90	173.80	214.20	203.60	202.60	200.20	197.57
1974	191.80	183.60	186.50	201.70	229.80	205.80	186.10	188.50	174.00	184.40	178.50	173.10	190.32
1975	176.10	170.20	181.70	219.00	251.80	274.30	246.40	219.40	205.50	220.20	220.90	219.10	217.05
1976	212.80	204.10	201.40	221.40	214.20	247.30	210.30	194.80	185.80	180.30	172.40	163.70	200.71
1977	164.70	156.10	165.40	154.80	179.80	181.00	171.50	173.80	191.30	186.00	186.00	194.90	175.44
1978	195.60	198.60	188.20	195.60	282.10	264.50	248.30	214.40	233.70	211.80	222.30	224.80	223.32
1979	215.70	212.10	208.10	212.40	219.10	201.30	185.10	172.20	150.00	146.00	140.80	134.90	183.14
1980	142.00	142.00	148.80	141.90	160.90	166.40	147.90	167.60	171.40	182.80	179.40	175.80	160.57
1981	166.50	161.70	160.40	152.60	202.90	215.70	203.60	182.30	168.40	173.30	169.30	167.20	176.99
1982	171.50	166.30	178.90	183.20	209.80	235.90	221.90	205.00	222.80	243.40	230.30	231.80	208.40
1983	218.00	203.60	206.20	197.70	206.30	202.50	192.20	171.30	172.40	172.70	179.90	178.30	191.76
1984	173.60	164.80	167.70	196.20	185.10	203.00	177.10	160.60	169.40	168.20	165.60	162.20	174.46
1985	155.10	147.30	155.70	154.00	168.70	170.80	160.40	165.20	179.90	179.10	186.10	180.80	166.93
1986	177.30	186.00	176.10	194.60	212.50	207.60	206.00	182.00	220.40	214.10	222.60	204.90	200.34
1987	194.60	189.80	201.00	177.30	208.70	196.10	226.30	216.20	196.70	176.10	169.40	160.50	192.73
1988	155.70	152.00	153.50	152.40	170.40	156.40	132.60	112.40	121.10	115.60	120.90	122.90	138.82
1989	128.80	127.60	139.90	161.20	185.90	186.50	167.20	156.40	149.70	159.70	158.00	162.30	156.93
1990	156.70	147.10	149.60	165.80	180.70	188.60	184.20	169.50	153.80	152.70	149.80	146.50	162.08
1991	141.00	136.70	138.70	181.30	213.60	239.70	209.60	182.70	200.70	198.60	199.90	187.60	185.84
1992	175.50	163.20	167.20	182.10	187.80	221.20	225.20	204.70	187.00	177.20	178.80	177.40	187.27
1993	174.00	167.10	167.00	180.40	195.00	241.90	301.70	274.20	242.30	236.30	230.00	219.30	219.10
1994	216.30	212.30	203.00	204.70	201.20	210.80	192.00	164.00	157.70	206.40	205.80	198.60	197.73
1995	195.20	186.10	198.40	212.80	244.30	249.50	241.20	214.50	206.20	207.00	206.10	196.60	213.16
1996	199.20	190.90	202.40	197.90	232.90	218.90	196.90	166.60	175.60	174.70	183.30	188.60	193.99
1997	189.30	182.90	181.20	196.10	197.80	206.30	235.30	215.40	198.00	199.20	187.80	184.60	197.82
1998	181.30	186.60	192.10	186.60	174.50	221.40	204.20	193.80	185.10	218.60	221.20	212.60	198.17
1999	209.50	200.60	189.60	216.40	247.60	243.60	215.30	207.30	207.10	190.00	176.20	170.90	206.18
2000	167.70	169.50	166.50	175.60	198.70	210.40	195.90	171.90	167.00	169.40	182.40	176.60	179.30
2001	166.20	161.80	155.80	166.00	158.40	197.00	201.50	161.60	152.80	149.60	144.80	139.40	162.91
2002	137.40	132.80	140.40	152.90	159.60	171.10	166.20	167.90	162.40	168.30	162.70	155.50	156.43
2003	154.00	156.70	173.50	176.80	202.50	212.10	179.10	155.10	154.60	154.40	150.30	154.00	168.59
2004	152.30	154.10	148.10	150.30	167.90	177.00	177.70	172.80	173.20	183.90	172.60	164.80	166.23
2005	161.60	151.20	153.40	168.70	224.10	264.30	225.00	206.10	188.80	205.80	209.30	201.60	196.66
2006	191.00	182.40	182.60	198.60	195.50	180.70	152.20	139.30	157.90	171.60	165.90	160.00	173.14
2007	153.10	156.50	165.80	173.60	229.00	228.90	198.40	176.10	165.30	181.10	170.70	167.00	180.46
2008	163.30	157.80	154.50	150.60	214.30	222.60	197.10	174.40	181.70	193.90	193.00	198.30	183.46
2009	198.10	191.70	199.50	212.60	201.80	221.00	215.60	208.80	184.10	208.30	192.30	188.30	201.84
2010	185.20	177.20	171.70	186.20	246.60	257.20	230.60	218.70	213.10	199.90	208.70	212.20	208.94
2011	213.40	209.20	215.10	228.80	330.30	311.90	272.10	233.20	206.80	212.80	210.40	203.30	237.27

Basic Statistics:													
Mean	174.75	170.51	173.02	184.16	203.29	217.86	202.18	185.95	183.04	183.84	181.94	178.27	186.57
SD	25.74	23.79	22.18	22.77	30.99	34.84	32.31	29.55	27.98	27.70	27.55	26.53	22.12
Skew	-0.03	0.04	0.10	0.01	0.84	0.30	0.12	0.08	0.32	0.01	-0.02	-0.01	-0.15

Analysis of Trend in Mean (95% SL):													
Slope	0.14	0.11	0.07	0.03	0.24	0.05	0.09	0.04	0.05	0.17	0.15	0.15	0.11
KendSum	236.	234.	150.	42.	231.	38.	54.	-48.	134.	350.	306.	273.	160.
KendTau	0.07	0.07	0.05	0.01	0.07	0.01	0.02	-0.02	0.04	0.11	0.10	0.09	0.05
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	0.98	0.97	0.62	0.17	0.96	0.15	0.22	-0.20	0.55	1.45	1.27	1.13	0.66
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	1.3958	0.9292	0.4639	0.0169	2.7654	0.5899	0.1100	0.0003	2.2725	1.9678	2.1084	1.5530	0.8189
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	662.78	565.77	492.07	518.66	960.52	1213.94	1043.80	872.97	782.85	767.10	758.86	703.67	489.22
Res Var	652.79	558.86	489.10	518.31	929.23	1212.84	1039.21	871.92	781.68	751.79	746.34	692.08	483.03
Tnd Var	1.51	1.22	0.60	0.07	3.26	0.09	0.44	0.12	0.15	2.00	1.65	1.65	1.27

Snowpack Behaviors – Peak SWE, Day Begin Accumulation, Peak Date, Melt Rate, Day of Melt Out

Fort Peck

DSS-SNOTEL- For historic daily SWE POR,determines the

Peak SWE, days to Peak Accumulation, days to melt
Melt Rate, etc. Determines time-series slope

/FTPK/34-STA/SWE//1DAY/SNOTEL/

Data From HEC-DSS:

Beginning Date: 01JAN1982
Ending Date: 31DEC2011
Start of Period: 01JAN
End of Period: 31DEC

Results from reading DSS:
-All the data was retrieved from DSS

Statistical Analysis:

Year	Num Days in Year	Peak Accum	Date Begin Accum*	Day of Year Begin Accum*	Accum Rate (in/day)	Date Peak Accum	Day of Year Peak Accum	Date Melt	Day of Year Melt	Melt Rate (in/day)
1982	365	25.4				19APR1982	109	21JUL1982	202	0.27
1983	365	19.3	08SEP1982	251	0.09	13APR1983	103	10JUL1983	191	0.22
1984	366	18.2	16SEP1983	259	0.08	07MAY1984	128	10JUL1984	192	0.28
1985	365	17.3	10OCT1984	284	0.10	05APR1985	95	27JUN1985	178	0.21
1986	365	17.4	05SEP1985	248	0.07	14MAY1986	134	25JUN1986	176	0.40
1987	365	12.9	08SEP1986	251	0.06	29MAR1987	88	12JUN1987	163	0.17
1988	366	15.7	06NOV1987	310	0.10	09APR1988	100	19JUN1988	171	0.22
1989	365	19.2	15OCT1988	289	0.11	06APR1989	96	04JUL1989	185	0.21
1990	365	16.8	30SEP1989	273	0.09	28MAR1990	87	10JUL1990	191	0.16
1991	365	20.9	02OCT1990	275	0.09	10MAY1991	130	22JUL1991	203	0.28
1992	366	13.6	16OCT1991	289	0.09	21MAR1992	81	23JUN1992	175	0.14

1993	365	17.3	03OCT1992	277	0.08	30APR1993	120	10JUL1993	191	0.24
1994	365	15.1	02OCT1993	275	0.08	08APR1994	98	24JUN1994	175	0.19
1995	365	21.9	29SEP1994	272	0.10	07MAY1995	127	18JUL1995	199	0.30
1996	366	21.2	17SEP1995	260	0.09	05MAY1996	126	17JUL1996	199	0.29
1997	365	27.4	13OCT1996	287	0.14	02MAY1997	122	16JUL1997	197	0.36
1998	365	17.1	02OCT1997	275	0.09	17APR1998	107	12JUL1998	193	0.20
1999	365	21.1	01OCT1998	274	0.11	10APR1999	100	23JUL1999	204	0.20
2000	366	16.2	24SEP1999	267	0.08	03APR2000	94	04JUL2000	186	0.17
2001	365	14.6	19SEP2000	263	0.07	21APR2001	111	20JUN2001	171	0.24
2002	365	16.9	04OCT2001	277	0.09	19APR2002	109	19JUL2002	200	0.18
2003	365	17.6	26SEP2002	269	0.09	07APR2003	97	02JUL2003	183	0.20
2004	366	15.3	28OCT2003	301	0.11	18MAR2004	78	29JUN2004	181	0.15
2005	365	13.8	10OCT2004	284	0.07	21APR2005	111	01JUL2005	182	0.19
2006	365	20.3	01OCT2005	274	0.10	18APR2006	108	27JUN2006	178	0.29
2007	365	14.2	06OCT2006	279	0.07	21APR2007	111	29JUN2007	180	0.20
2008	366	20.5	18SEP2007	261	0.09	25APR2008	116	15JUL2008	197	0.25
2009	365	19.4	09OCT2008	283	0.09	08MAY2009	128	04JUL2009	185	0.34
2010	365	14.4	29SEP2009	272	0.07	14APR2010	104	15JUL2010	196	0.15
2011	365	25.9	16OCT2010	289	0.13	01MAY2011	121	01AUG2011	213	0.28

Basic Statistics:

Mean	18.23	274.76	0.09	107.97	187.90	0.23
Stand Dev	3.7	14.3	0.02	15.1	11.8	0.06
Skew	0.8	0.2	0.48	-0.1	0.0	0.84

Regression Analysis of Parameters:

Int	38.4	-499.1	-0.4	-160.8	-313.6	1.5
Slope	-0.0101	0.3877	0.0000	0.1346	0.2512	-0.0006

Analysis of Trend in Mean (95% SL):

K Tau	-0.0621	0.1305	0.0493	0.0621	0.0874	-0.0575
KendS	-27.	53.	20.	27.	38.	-25.
INormValI	1.9600	1.9600	1.9600	1.9600	1.9600	1.9600
KendZ	-0.4639	0.9754	0.3564	0.4639	0.6601	-0.4282
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Analysis of Trend in Variance of Peak SWE (95% SL):

ChiVal	3.8410
BP RSS	0.3885
Trend?	No Trend

Garrison

DSS-SNOTEL- For historic daily SWE POR,determines the

Peak SWE, days to Peak Accumulation, days to melt
Melt Rate, etc. Determines time-series slope

/GARR/33-STA/SWE//1DAY/SNOTEL/

Data From HEC-DSS:

Beginning Date: 01JAN1982
Ending Date: 31DEC2011
Start of Period: 01JAN
End of Period: 31DEC

Results from reading DSS:
-All the data was retrieved from DSS

Statistical Analysis:

Year	Num Days in Year	Peak Accum	Date Begin Accum*	Day of Year Begin Accum*	Accum Rate (in/day)	Date Peak Accum	Day of Year Peak Accum	Date Melt	Day of Year Melt	Melt Rate (in/day)
1982	365	21.9				19APR1982	109	21JUL1982	202	0.23
1983	365	18.6	07SEP1982	250	0.07	19MAY1983	139	22JUL1983	203	0.29
1984	366	19.3	16SEP1983	259	0.08	06MAY1984	127	06JUL1984	188	0.31
1985	365	14.5	20SEP1984	264	0.07	07APR1985	97	22JUN1985	173	0.19
1986	365	20.7	17SEP1985	260	0.09	13MAY1986	133	29JUN1986	180	0.43
1987	365	12.9	08SEP1986	251	0.06	13APR1987	103	12JUN1987	163	0.21
1988	366	14.9	27SEP1987	270	0.07	08MAY1988	129	02JUL1988	184	0.27
1989	365	17.1	15OCT1988	289	0.10	09APR1989	99	04JUL1989	185	0.20
1990	365	15.8	30SEP1989	273	0.08	14APR1990	104	07JUL1990	188	0.19
1991	365	19.8	02OCT1990	275	0.09	06MAY1991	126	01JUL1991	182	0.35
1992	366	13.5	13SEP1991	256	0.06	23APR1992	114	23JUN1992	175	0.22
1993	365	15.9	18SEP1992	262	0.07	05MAY1993	125	15JUL1993	196	0.22
1994	365	15.1	06OCT1993	279	0.08	14APR1994	104	11JUN1994	162	0.26
1995	365	21.4	01OCT1994	274	0.10	13MAY1995	133	17JUL1995	198	0.32
1996	366	22.9	18SEP1995	261	0.10	05MAY1996	126	09JUL1996	191	0.35
1997	365	25.4	14SEP1996	258	0.11	02MAY1997	122	08JUL1997	189	0.37
1998	365	17.0	06OCT1997	279	0.09	20APR1998	110	12JUL1998	193	0.20
1999	365	20.2	01OCT1998	274	0.09	16MAY1999	136	12JUL1999	193	0.35
2000	366	14.8	24SEP1999	267	0.08	07APR2000	98	23JUN2000	175	0.19
2001	365	11.9	19SEP2000	263	0.06	23APR2001	113	09JUN2001	160	0.25
2002	365	14.4	03OCT2001	276	0.07	11MAY2002	131	27JUN2002	178	0.30
2003	365	17.5	25SEP2002	268	0.09	08APR2003	98	30JUN2003	181	0.21
2004	366	12.6	09OCT2003	282	0.08	17MAR2004	77	29JUN2004	181	0.12
2005	365	12.9	10OCT2004	284	0.06	12MAY2005	132	27JUN2005	178	0.28
2006	365	15.3	02OCT2005	275	0.08	07APR2006	97	22JUN2006	173	0.20
2007	365	14.2	15SEP2006	258	0.06	23APR2007	113	18JUN2007	169	0.25
2008	366	18.8	29SEP2007	272	0.09	26APR2008	117	10JUL2008	192	0.25
2009	365	19.4	05OCT2008	279	0.09	08MAY2009	128	05JUL2009	186	0.33
2010	365	15.2	30SEP2009	273	0.07	12MAY2010	132	01JUL2010	182	0.30

2011	365	24.4	07OCT2010	280	0.11	10MAY2011	130	21JUL2011	202	0.33

Basic Statistics:

Mean	17.27	269.34	0.08	116.73	183.40	0.26
Stand Dev	3.6	10.1	0.02	15.4	11.6	0.07
Skew	0.6	-0.2	-0.05	-0.6	-0.2	0.30

Regression Analysis of Parameters:

Int	85.6	-808.3	-0.3	135.4	477.4	0.3
Slope	-0.0342	0.5399	0.0000	-0.0093	-0.1473	0.0000

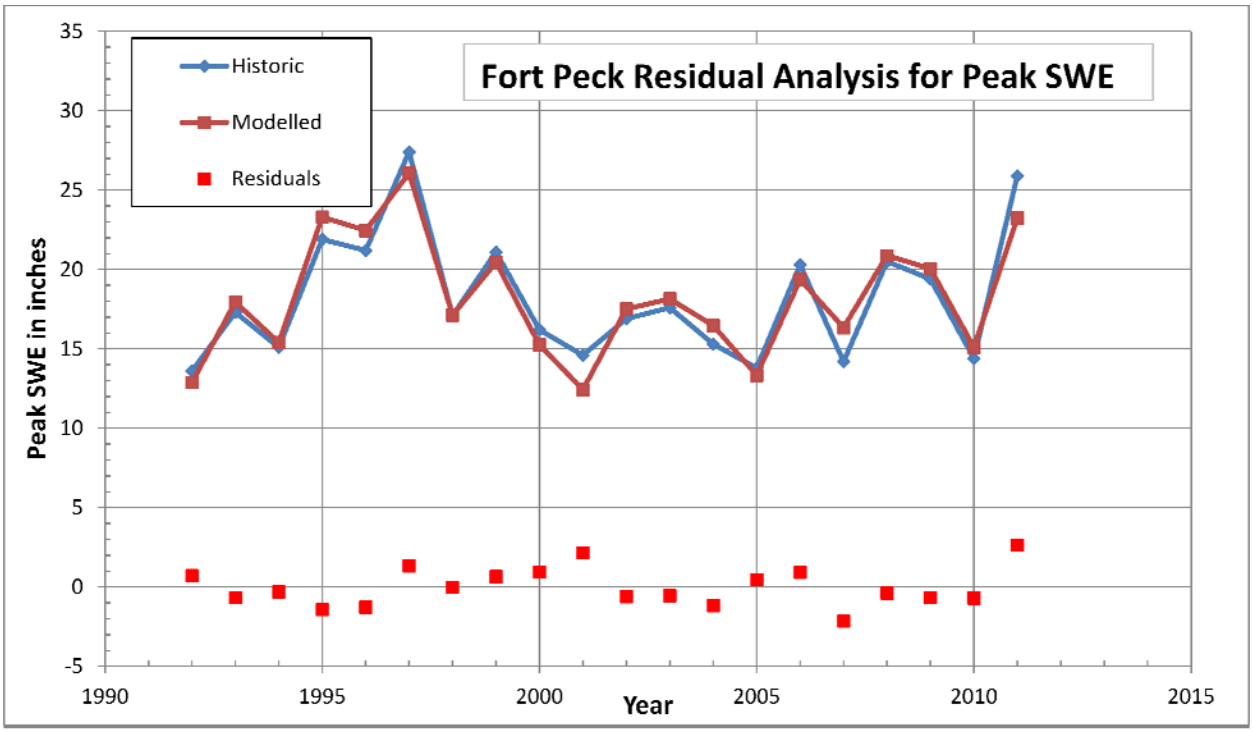
Analysis of Trend in Mean (95% SL):

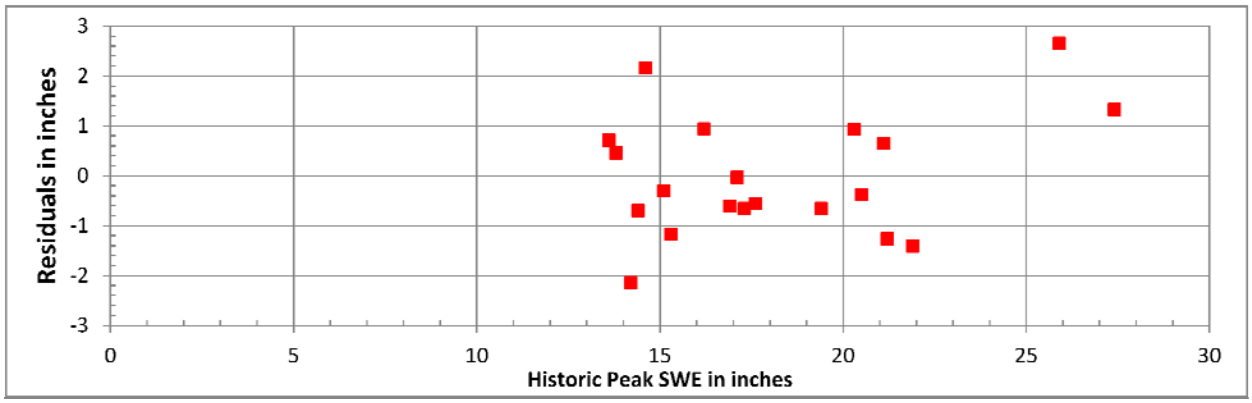
K Tau	-0.0667	0.3325	0.0739	0.0138	-0.0805	0.0575
KendS	-29.	135.	30.	6.	-35.	25.
INormValI	1.9600	1.9600	1.9600	1.9600	1.9600	1.9600
KendZ	-0.4995	2.5136	0.5440	0.0892	-0.6066	0.4282
Trend?	No Trend	Trend	No Trend	No Trend	No Trend	No Trend

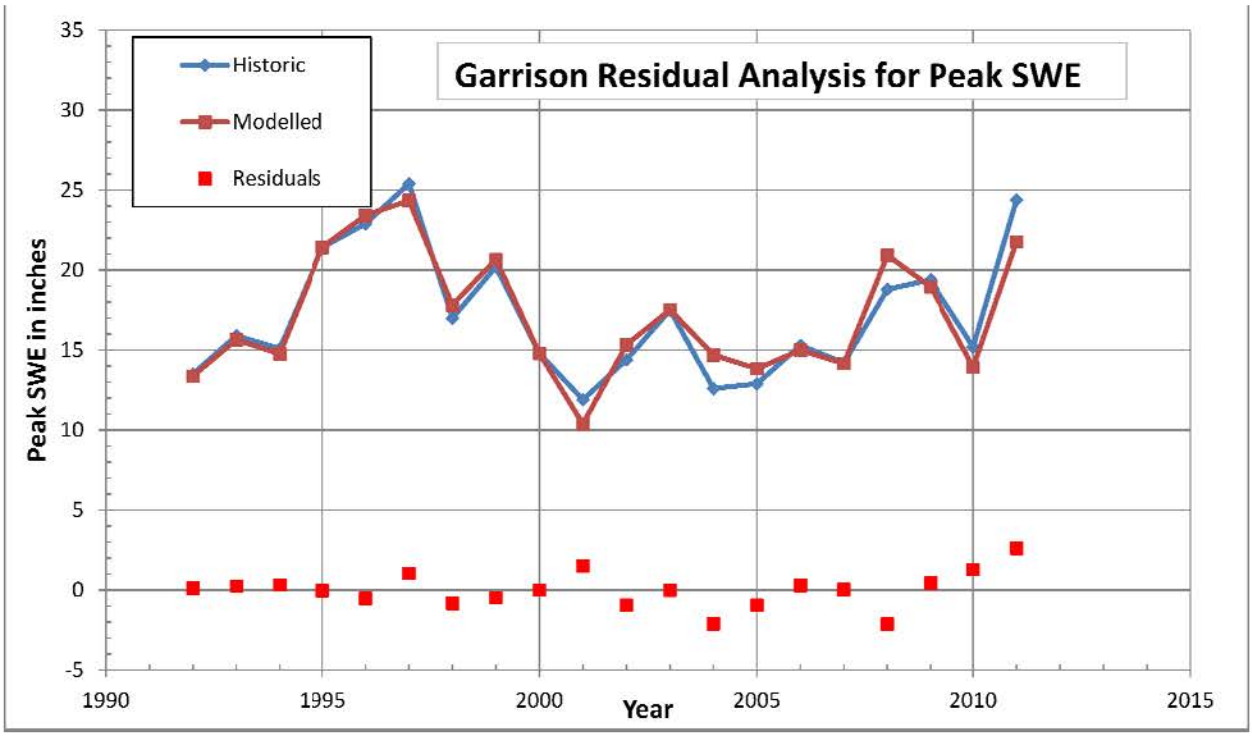
Analysis of Trend in Variance of Peak SWE (95% SL):

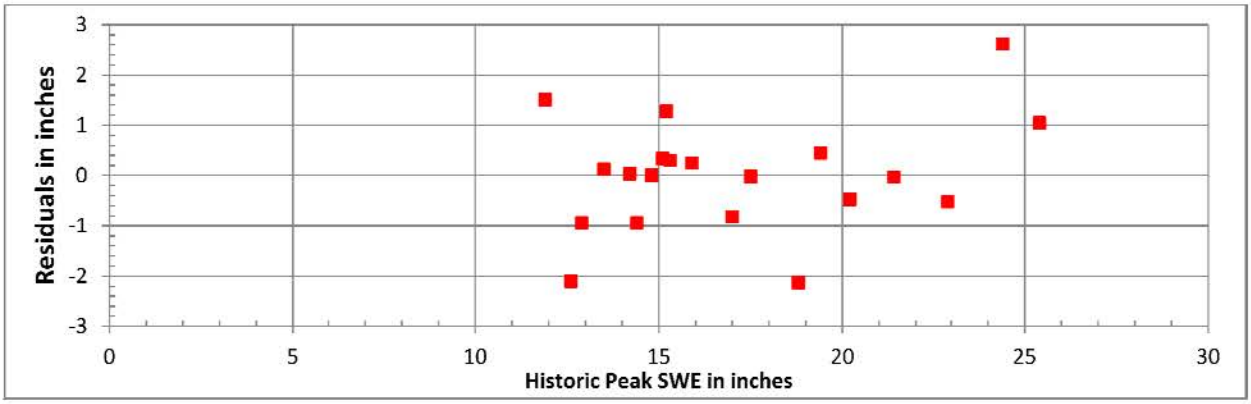
ChiVal	3.8410
BP RSS	0.0033
Trend?	No Trend

Snowpack Behaviors – Peak SWE – Residual Analysis






Garrison Residual Analysis for Peak SWE
Historic
Modelled
Residuals
Peak SWE in inches
Year
35
30
25
20
15
10
5
0
-5
1990
1995
2000
2005
2010
2015


Residuals in inches
Historic Peak SWE in inches
3
2
1
0
-1
-2
-3
0
5
10
15
20
25
30

Reservoir Runoff Analysis

Fort Peck Annual:

Analysis of Monthly Runoff

Input File: ftpk.prn
Output File: out

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1898	313.	278.	419.	776.	1436.	2668.	1176.	216.	244.	353.	339.	313.	8531.
1899	232.	232.	413.	746.	1323.	2456.	2027.	528.	345.	413.	480.	298.	9493.
1900	309.	315.	504.	730.	1732.	1379.	335.	79.	194.	333.	294.	349.	6553.
1901	270.	226.	371.	464.	1857.	1339.	454.	67.	147.	274.	284.	262.	6015.
1902	240.	220.	264.	331.	1182.	1644.	873.	171.	179.	288.	311.	268.	5971.
1903	296.	236.	339.	676.	968.	1936.	877.	248.	214.	375.	339.	411.	6915.
1904	355.	329.	672.	768.	1325.	1765.	825.	248.	196.	286.	309.	353.	7431.
1905	300.	296.	500.	323.	405.	863.	696.	284.	167.	234.	284.	274.	4626.
1906	272.	290.	381.	668.	728.	1386.	605.	216.	248.	288.	260.	260.	5602.
1907	222.	296.	506.	819.	1133.	2412.	2220.	645.	387.	460.	367.	357.	9824.
1908	335.	298.	456.	895.	1176.	4140.	1722.	563.	468.	575.	587.	440.	11655.
1909	363.	365.	538.	676.	1119.	2938.	1071.	436.	567.	623.	462.	317.	9475.
1910	327.	301.	910.	1351.	1847.	1384.	470.	311.	365.	341.	377.	379.	8363.
1911	248.	270.	720.	589.	893.	2152.	805.	353.	383.	395.	411.	333.	7552.
1912	296.	311.	282.	704.	1396.	2249.	893.	492.	379.	545.	526.	379.	8452.
1913	256.	266.	345.	1111.	1654.	3140.	1232.	553.	305.	633.	520.	347.	10362.
1914	337.	347.	680.	867.	1597.	2003.	591.	240.	315.	494.	407.	339.	8217.
1915	315.	422.	335.	916.	1148.	1751.	1010.	591.	413.	474.	452.	303.	8130.
1916	315.	488.	799.	712.	1307.	2612.	1847.	545.	474.	409.	381.	347.	10236.
1917	375.	373.	480.	655.	1914.	3055.	1325.	383.	298.	321.	395.	411.	9985.
1918	395.	347.	492.	607.	1085.	1503.	551.	371.	270.	377.	337.	351.	6686.
1919	383.	413.	672.	559.	781.	520.	216.	93.	169.	194.	161.	220.	4381.
1920	228.	385.	553.	551.	1549.	1819.	776.	325.	280.	319.	393.	325.	7503.
1921	294.	296.	436.	704.	1303.	1857.	583.	242.	260.	282.	309.	345.	6911.
1922	282.	238.	415.	666.	1321.	2249.	454.	307.	309.	278.	317.	321.	7157.
1923	298.	270.	428.	726.	1214.	1593.	918.	452.	309.	341.	357.	347.	7253.
1924	305.	399.	391.	647.	1440.	996.	399.	260.	252.	282.	305.	319.	5995.
1925	309.	321.	484.	914.	1353.	1642.	750.	317.	359.	486.	490.	421.	7846.
1926	343.	456.	452.	851.	1279.	589.	438.	325.	337.	393.	339.	351.	6153.
1927	395.	303.	659.	492.	1771.	3904.	1250.	518.	545.	567.	508.	421.	11333.
1928	333.	502.	966.	724.	1924.	1436.	1396.	432.	377.	369.	357.	298.	9114.
1929	280.	250.	391.	466.	946.	1208.	498.	294.	290.	317.	288.	200.	5428.
1930	300.	444.	407.	863.	867.	555.	300.	218.	236.	301.	298.	303.	5092.
1931	248.	317.	557.	387.	432.	424.	230.	224.	210.	220.	179.	157.	3585.
1932	196.	157.	303.	532.	825.	1406.	516.	422.	240.	260.	218.	194.	5269.
1933	222.	212.	488.	434.	908.	1412.	430.	270.	256.	226.	339.	177.	5374.
1934	315.	450.	516.	722.	781.	811.	290.	141.	137.	204.	256.	210.	4833.
1935	198.	236.	309.	428.	593.	819.	409.	228.	228.	262.	182.	190.	4082.
1936	179.	167.	613.	430.	823.	569.	264.	230.	220.	246.	244.	196.	4181.
1937	169.	145.	341.	383.	385.	577.	343.	182.	184.	260.	163.	137.	3269.
1938	186.	204.	599.	327.	756.	1682.	1349.	298.	317.	272.	327.	272.	6589.
1939	254.	208.	891.	585.	871.	863.	311.	208.	210.	238.	244.	222.	5105.
1940	198.	246.	399.	415.	619.	619.	236.	192.	212.	246.	186.	262.	3830.
1941	226.	230.	359.	327.	335.	613.	347.	228.	305.	411.	347.	349.	4077.
1942	282.	298.	629.	825.	1131.	2061.	599.	329.	282.	331.	357.	301.	7425.
1943	325.	633.	785.	1117.	1115.	2892.	1002.	426.	317.	399.	375.	335.	9721.
1944	301.	290.	678.	456.	565.	1740.	914.	375.	309.	339.	327.	270.	6564.
1945	375.	343.	492.	353.	613.	1275.	569.	262.	292.	345.	288.	242.	5449.
1946	351.	413.	450.	514.	710.	855.	540.	258.	359.	385.	303.	399.	5537.

1947	415.	422.	1226.	960.	1547.	1500.	659.	272.	361.	524.	407.	381.	8674.
1948	367.	351.	504.	879.	1654.	3255.	1309.	541.	405.	422.	417.	256.	10360.
1949	325.	294.	849.	803.	1150.	1012.	440.	290.	208.	323.	384.	232.	6310.
1950	236.	347.	554.	804.	739.	1711.	1092.	556.	440.	483.	409.	436.	7807.
1951	427.	360.	680.	971.	1366.	1500.	921.	440.	516.	573.	512.	370.	8636.
1952	340.	484.	606.	1773.	1587.	1148.	598.	394.	355.	326.	304.	297.	8212.
1953	307.	358.	477.	366.	872.	3880.	922.	372.	371.	334.	361.	312.	8932.
1954	186.	414.	411.	510.	776.	1142.	791.	409.	288.	381.	406.	247.	5961.
1955	187.	241.	310.	662.	824.	1284.	899.	324.	265.	291.	196.	292.	5775.
1956	296.	263.	541.	628.	1075.	1591.	481.	354.	308.	336.	407.	316.	6596.
1957	208.	286.	595.	521.	1005.	1449.	579.	268.	334.	390.	456.	382.	6473.
1958	299.	284.	525.	516.	854.	1330.	711.	349.	319.	386.	420.	395.	6388.
1959	323.	322.	1324.	657.	835.	1510.	876.	303.	314.	505.	545.	663.	8177.
1960	337.	516.	877.	714.	1010.	888.	363.	264.	295.	280.	331.	313.	6188.
1961	311.	323.	358.	242.	331.	902.	283.	187.	243.	388.	443.	240.	4251.
1962	285.	446.	423.	577.	1178.	1720.	801.	381.	336.	414.	391.	315.	7267.
1963	258.	616.	503.	351.	627.	1326.	724.	319.	353.	338.	373.	275.	6063.
1964	304.	370.	364.	387.	1327.	3233.	1234.	375.	392.	418.	420.	354.	9178.
1965	518.	568.	664.	1168.	1683.	2229.	1713.	604.	585.	726.	621.	489.	11568.
1966	389.	401.	828.	638.	806.	762.	586.	254.	288.	324.	438.	381.	6095.
1967	322.	622.	729.	574.	1141.	3336.	1426.	398.	506.	469.	563.	261.	10347.
1968	448.	486.	752.	543.	880.	1928.	1016.	474.	589.	574.	557.	374.	8621.
1969	410.	432.	1035.	1264.	1392.	1161.	1548.	494.	405.	443.	497.	377.	9458.
1970	278.	451.	608.	531.	1902.	2479.	1147.	469.	451.	535.	477.	400.	9728.
1971	409.	872.	790.	763.	1550.	1865.	1108.	464.	458.	517.	474.	312.	9582.
1972	392.	476.	1169.	682.	1088.	1988.	771.	570.	426.	492.	566.	342.	8962.
1973	364.	350.	484.	492.	796.	822.	507.	292.	329.	406.	427.	410.	5679.
1974	410.	435.	489.	567.	1121.	2015.	977.	525.	462.	393.	448.	396.	8238.
1975	258.	289.	563.	923.	2647.	3257.	2528.	788.	609.	667.	666.	643.	13838.
1976	553.	603.	688.	816.	2147.	1919.	1076.	562.	566.	587.	557.	452.	10526.
1977	277.	444.	422.	455.	559.	592.	349.	265.	344.	434.	336.	402.	4879.
1978	312.	370.	1899.	1508.	1803.	1727.	1489.	542.	810.	638.	447.	423.	11968.
1979	373.	408.	1913.	1222.	1430.	1292.	564.	273.	329.	311.	415.	352.	8882.
1980	278.	328.	542.	608.	959.	1750.	802.	282.	371.	474.	464.	377.	7235.
1981	445.	392.	522.	473.	1659.	2404.	775.	323.	251.	492.	471.	370.	8577.
1982	284.	612.	841.	766.	1075.	2498.	1605.	433.	400.	566.	508.	502.	10090.
1983	441.	468.	550.	471.	858.	1215.	1079.	419.	426.	579.	560.	321.	7387.
1984	468.	543.	514.	609.	1054.	1510.	1025.	479.	422.	527.	535.	340.	8026.
1985	397.	320.	609.	703.	771.	645.	201.	288.	340.	668.	476.	431.	5849.
1986	481.	385.	1288.	654.	1157.	1395.	560.	289.	931.	588.	431.	418.	8577.
1987	271.	378.	481.	503.	516.	511.	405.	403.	345.	287.	346.	273.	4719.
1988	220.	335.	425.	387.	645.	454.	253.	115.	144.	239.	284.	302.	3803.
1989	241.	214.	840.	713.	1094.	869.	438.	315.	386.	388.	491.	344.	6333.
1990	454.	269.	531.	601.	804.	1097.	548.	294.	272.	262.	363.	246.	5741.
1991	285.	345.	393.	418.	1128.	1991.	931.	291.	238.	326.	372.	343.	7061.
1992	252.	330.	377.	363.	358.	384.	598.	240.	204.	322.	356.	200.	3984.
1993	201.	270.	721.	530.	1017.	1328.	1557.	981.	690.	550.	533.	535.	8913.
1994	361.	331.	1006.	638.	1194.	780.	313.	216.	180.	272.	339.	298.	5928.
1995	257.	330.	467.	505.	1256.	2155.	1443.	537.	412.	504.	578.	502.	8946.
1996	381.	818.	947.	995.	1210.	2174.	768.	306.	290.	377.	362.	424.	9052.
1997	512.	582.	717.	631.	1500.	3023.	1231.	586.	472.	458.	491.	394.	10597.
1998	278.	458.	458.	528.	792.	1300.	1447.	469.	335.	379.	413.	293.	7150.
1999	441.	418.	504.	416.	764.	1472.	766.	312.	292.	269.	353.	373.	6380.
2000	248.	319.	417.	417.	473.	737.	549.	207.	164.	276.	253.	237.	4297.
2001	313.	234.	395.	313.	432.	574.	460.	256.	150.	156.	243.	213.	3739.
2002	206.	230.	262.	412.	403.	1467.	812.	336.	228.	199.	258.	237.	5050.
2003	200.	290.	596.	481.	689.	1029.	435.	266.	146.	166.	204.	252.	4754.
2004	210.	247.	577.	346.	392.	759.	535.	243.	227.	238.	274.	219.	4267.
2005	209.	310.	319.	295.	637.	1357.	750.	327.	228.	228.	326.	202.	5188.
2006	413.	223.	446.	702.	861.	1340.	534.	275.	175.	289.	347.	258.	5863.
2007	256.	362.	627.	498.	826.	1114.	460.	265.	171.	218.	232.	208.	5237.
2008	200.	246.	393.	315.	867.	2236.	1155.	388.	335.	288.	332.	196.	6951.
2009	359.	339.	514.	514.	1130.	1411.	849.	397.	350.	385.	360.	300.	6908.
2010	330.	319.	582.	395.	892.	1975.	1253.	459.	425.	353.	329.	334.	7646.
2011	431.	580.	1049.	895.	2871.	4035.	2093.	538.	260.	405.	414.	428.	13999.
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Basic Statistics:

Mean	312.	360.	598.	643.	1091.	1636.	834.	355.	332.	383.	382.	328.	7254.

SD	82.	126.	281.	261.	466.	847.	469.	145.	134.	124.	107.	91.	2243.
Skew	0.53	1.34	2.30	1.45	0.93	0.92	1.13	1.02	1.49	0.58	0.18	0.74	0.52

Analysis of Trend in Mean (95% SL):

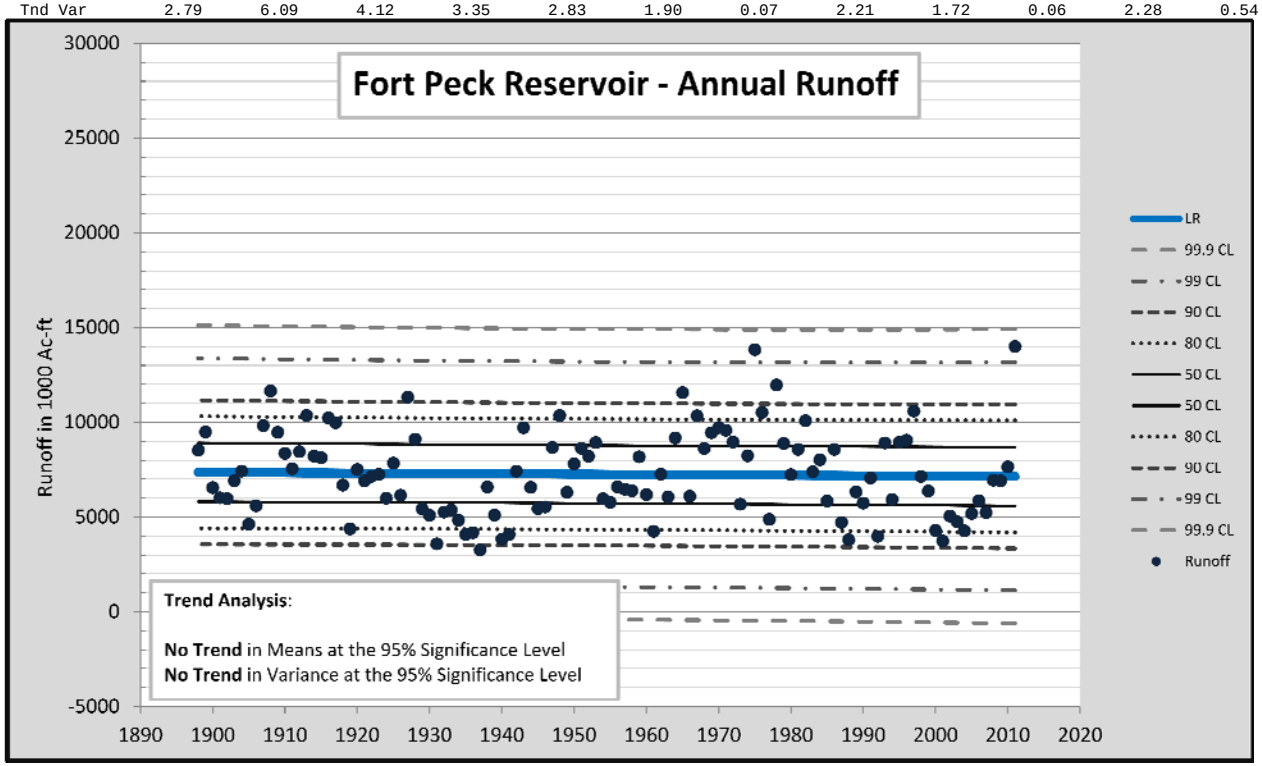
Slope	0.41	0.94	1.72	-1.44	-2.37	-3.53	0.39	0.65	0.53	0.09	0.49	0.20	-1.92
KendSum	520.	992.	885.	-1201.	-1060.	-631.	192.	642.	517.	161.	691.	170.	-288.
KendTau	0.08	0.15	0.14	-0.19	-0.16	-0.10	0.03	0.10	0.08	0.02	0.11	0.03	-0.04
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.27	2.43	2.16	-2.94	-2.59	-1.54	0.47	1.57	1.26	0.39	1.69	0.41	-0.70
Trend?	No Trend	Trend	Trend	Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	10.6789	9.4869	11.1513	0.0403	4.5059	0.0245	0.1841	0.0643	9.7333	1.6865	0.5282	4.4901	1.9958
Trend?	Trend	Trend	Trend	No Trend	Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	6675.	15783.	78695.	67875.	217271.	717291.	219743.	20981.	17869.	15471.	11413.	8237.	5030949.
Res Var	6488.	14822.	75456.	65603.	211125.	703668.	219581.	20517.	17562.	15461.	11153.	8193.	5026916.
Tnd Var	2.79	6.09	4.12	3.35	2.83	1.90	0.07	2.21	1.72	0.06	2.28	0.54	0.08



Reservoir Runoff Analysis (con’td)

Fort Peck May-July:

Analysis of Monthly Runoff

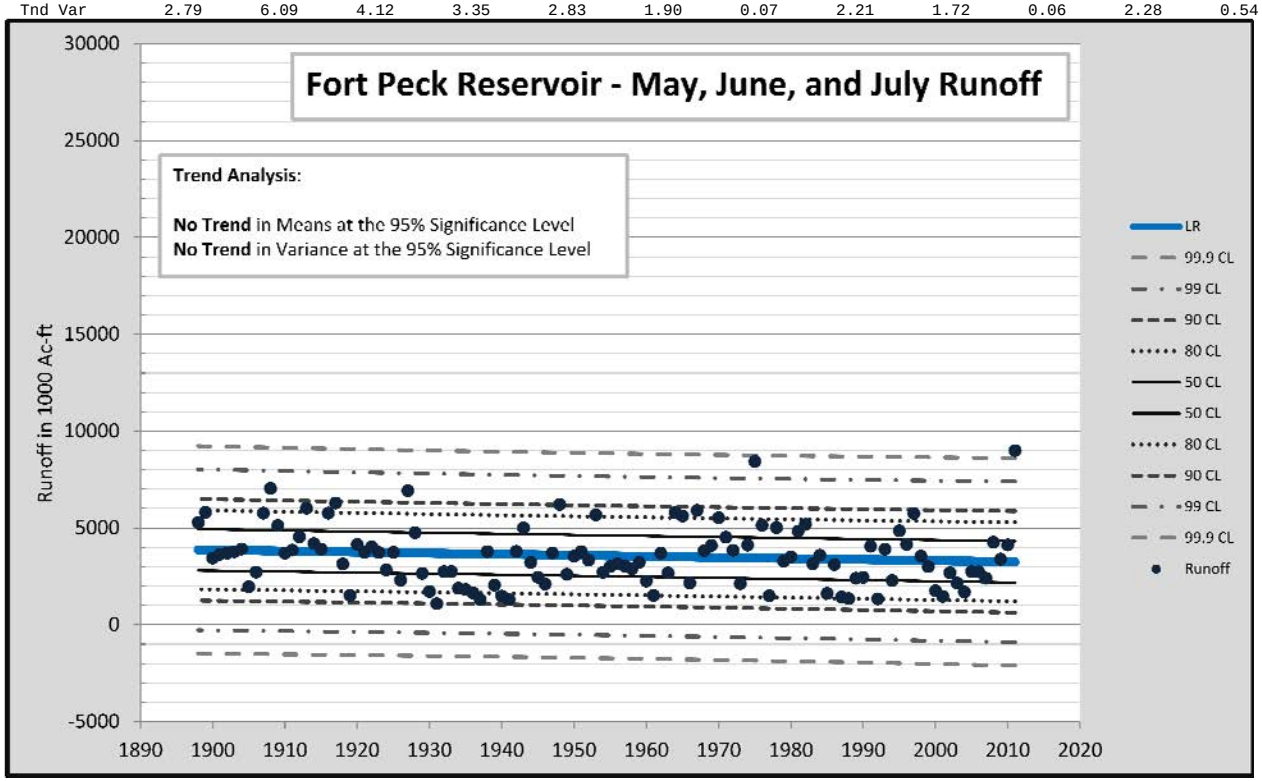
Input File: ftpk.prn

Output File: out

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MJJ
1898	313.	278.	419.	776.	1436.	2668.	1176.	216.	244.	353.	339.	313.	5280.
1899	232.	232.	413.	746.	1323.	2456.	2027.	528.	345.	413.	480.	298.	5806.
1900	309.	315.	504.	730.	1732.	1379.	335.	79.	194.	333.	294.	349.	3446.
1901	270.	226.	371.	464.	1857.	1339.	454.	67.	147.	274.	284.	262.	3650.
1902	240.	220.	264.	331.	1182.	1644.	873.	171.	179.	288.	311.	268.	3699.
1903	296.	236.	339.	676.	968.	1936.	877.	248.	214.	375.	339.	411.	3781.
1904	355.	329.	672.	768.	1325.	1765.	825.	248.	196.	286.	309.	353.	3915.
1905	300.	296.	500.	323.	405.	863.	696.	284.	167.	234.	284.	274.	1964.
1906	272.	290.	381.	668.	728.	1386.	605.	216.	248.	288.	260.	260.	2719.
1907	222.	296.	506.	819.	1133.	2412.	2220.	645.	387.	460.	367.	357.	5765.
1908	335.	298.	456.	895.	1176.	4140.	1722.	563.	468.	575.	587.	440.	7038.
1909	363.	365.	538.	676.	1119.	2938.	1071.	436.	567.	623.	462.	317.	5128.
1910	327.	301.	910.	1351.	1847.	1384.	470.	311.	365.	341.	377.	379.	3701.
1911	248.	270.	720.	589.	893.	2152.	805.	353.	383.	395.	411.	333.	3850.
1912	296.	311.	282.	704.	1396.	2249.	893.	492.	379.	545.	526.	379.	4538.
1913	256.	266.	345.	1111.	1654.	3140.	1232.	553.	305.	633.	520.	347.	6026.
1914	337.	347.	680.	867.	1597.	2003.	591.	240.	315.	494.	407.	339.	4191.
1915	315.	422.	335.	916.	1148.	1751.	1010.	591.	413.	474.	452.	303.	3909.
1916	315.	488.	799.	712.	1307.	2612.	1847.	545.	474.	409.	381.	347.	5766.
1917	375.	373.	480.	655.	1914.	3055.	1325.	383.	298.	321.	395.	411.	6294.
1918	395.	347.	492.	607.	1085.	1503.	551.	371.	270.	377.	337.	351.	3139.
1919	383.	413.	672.	559.	781.	520.	216.	93.	169.	194.	161.	220.	1517.
1920	228.	385.	553.	551.	1549.	1819.	776.	325.	280.	319.	393.	325.	4144.
1921	294.	296.	436.	704.	1303.	1857.	583.	242.	260.	282.	309.	345.	3743.
1922	282.	238.	415.	666.	1321.	2249.	454.	307.	309.	278.	317.	321.	4024.
1923	298.	270.	428.	726.	1214.	1593.	918.	452.	309.	341.	357.	347.	3725.
1924	305.	399.	391.	647.	1440.	996.	399.	260.	252.	282.	305.	319.	2835.
1925	309.	321.	484.	914.	1353.	1642.	750.	317.	359.	486.	490.	421.	3745.
1926	343.	456.	452.	851.	1279.	589.	438.	325.	337.	393.	339.	351.	2306.
1927	395.	303.	659.	492.	1771.	3904.	1250.	518.	545.	567.	508.	421.	6925.
1928	333.	502.	966.	724.	1924.	1436.	1396.	432.	377.	369.	357.	298.	4756.
1929	280.	250.	391.	466.	946.	1208.	498.	294.	290.	317.	288.	200.	2652.
1930	300.	444.	407.	863.	867.	555.	300.	218.	236.	301.	298.	303.	1722.
1931	248.	317.	557.	387.	432.	424.	230.	224.	210.	220.	179.	157.	1086.
1932	196.	157.	303.	532.	825.	1406.	516.	422.	240.	260.	218.	194.	2747.
1933	222.	212.	488.	434.	908.	1412.	430.	270.	256.	226.	339.	177.	2750.
1934	315.	450.	516.	722.	781.	811.	290.	141.	137.	204.	256.	210.	1882.
1935	198.	236.	309.	428.	593.	819.	409.	228.	228.	262.	182.	190.	1821.
1936	179.	167.	613.	430.	823.	569.	264.	230.	220.	246.	244.	196.	1656.

1937	169.	145.	341.	383.	385.	577.	343.	182.	184.	260.	163.	137.	1305.
1938	186.	204.	599.	327.	756.	1682.	1349.	298.	317.	272.	327.	272.	3787.
1939	254.	208.	891.	585.	871.	863.	311.	208.	210.	238.	244.	222.	2045.
1940	198.	246.	399.	415.	619.	619.	236.	192.	212.	246.	186.	262.	1474.
1941	226.	230.	359.	327.	335.	613.	347.	228.	305.	411.	347.	349.	1295.
1942	282.	298.	629.	825.	1131.	2061.	599.	329.	282.	331.	357.	301.	3791.
1943	325.	633.	785.	1117.	1115.	2892.	1002.	426.	317.	399.	375.	335.	5009.
1944	301.	290.	678.	456.	565.	1740.	914.	375.	309.	339.	327.	270.	3219.
1945	375.	343.	492.	353.	613.	1275.	569.	262.	292.	345.	288.	242.	2457.
1946	351.	413.	450.	514.	710.	855.	540.	258.	359.	385.	303.	399.	2105.
1947	415.	422.	1226.	960.	1547.	1500.	659.	272.	361.	524.	407.	381.	3706.
1948	367.	351.	504.	879.	1654.	3255.	1309.	541.	405.	422.	417.	256.	6218.
1949	325.	294.	849.	803.	1150.	1012.	440.	290.	208.	323.	384.	232.	2602.
1950	236.	347.	554.	804.	739.	1711.	1092.	556.	440.	483.	409.	436.	3542.
1951	427.	360.	680.	971.	1366.	1500.	921.	440.	516.	573.	512.	370.	3787.
1952	340.	484.	606.	1773.	1587.	1148.	598.	394.	355.	326.	304.	297.	3333.
1953	307.	358.	477.	366.	872.	3880.	922.	372.	371.	334.	361.	312.	5674.
1954	186.	414.	411.	510.	776.	1142.	791.	409.	288.	381.	406.	247.	2709.
1955	187.	241.	310.	662.	824.	1284.	899.	324.	265.	291.	196.	292.	3007.
1956	296.	263.	541.	628.	1075.	1591.	481.	354.	308.	336.	407.	316.	3147.
1957	208.	286.	595.	521.	1005.	1449.	579.	268.	334.	390.	456.	382.	3033.
1958	299.	284.	525.	516.	854.	1330.	711.	349.	319.	386.	420.	395.	2895.
1959	323.	322.	1324.	657.	835.	1510.	876.	303.	314.	505.	545.	663.	3221.
1960	337.	516.	877.	714.	1010.	888.	363.	264.	295.	280.	331.	313.	2261.
1961	311.	323.	358.	242.	331.	902.	283.	187.	243.	388.	443.	240.	1516.
1962	285.	446.	423.	577.	1178.	1720.	801.	381.	336.	414.	391.	315.	3699.
1963	258.	616.	503.	351.	627.	1326.	724.	319.	353.	338.	373.	275.	2677.
1964	304.	370.	364.	387.	1327.	3233.	1234.	375.	392.	418.	420.	354.	5794.
1965	518.	568.	664.	1168.	1683.	2229.	1713.	604.	585.	726.	621.	489.	5625.
1966	389.	401.	828.	638.	806.	762.	586.	254.	288.	324.	438.	381.	2154.
1967	322.	622.	729.	574.	1141.	3336.	1426.	398.	506.	469.	563.	261.	5903.
1968	448.	486.	752.	543.	880.	1928.	1016.	474.	589.	574.	557.	374.	3824.
1969	410.	432.	1035.	1264.	1392.	1161.	1548.	494.	405.	443.	497.	377.	4101.
1970	278.	451.	608.	531.	1902.	2479.	1147.	469.	451.	535.	477.	400.	5528.
1971	409.	872.	790.	763.	1550.	1865.	1108.	464.	458.	517.	474.	312.	4523.
1972	392.	476.	1169.	682.	1088.	1988.	771.	570.	426.	492.	566.	342.	3847.
1973	364.	350.	484.	492.	796.	822.	507.	292.	329.	406.	427.	410.	2125.
1974	410.	435.	489.	567.	1121.	2015.	977.	525.	462.	393.	448.	396.	4113.
1975	258.	289.	563.	923.	2647.	3257.	2528.	788.	609.	667.	666.	643.	8432.
1976	553.	603.	688.	816.	2147.	1919.	1076.	562.	566.	587.	557.	452.	5142.
1977	277.	444.	422.	455.	559.	592.	349.	265.	344.	434.	336.	402.	1500.
1978	312.	370.	1899.	1508.	1803.	1727.	1489.	542.	810.	638.	447.	423.	5019.
1979	373.	408.	1913.	1222.	1430.	1292.	564.	273.	329.	311.	415.	352.	3286.
1980	278.	328.	542.	608.	959.	1750.	802.	282.	371.	474.	464.	377.	3511.
1981	445.	392.	522.	473.	1659.	2404.	775.	323.	251.	492.	471.	370.	4838.
1982	284.	612.	841.	766.	1075.	2498.	1605.	433.	400.	566.	508.	502.	5178.
1983	441.	468.	550.	471.	858.	1215.	1079.	419.	426.	579.	560.	321.	3152.
1984	468.	543.	514.	609.	1054.	1510.	1025.	479.	422.	527.	535.	340.	3589.
1985	397.	320.	609.	703.	771.	645.	201.	288.	340.	668.	476.	431.	1617.
1986	481.	385.	1288.	654.	1157.	1395.	560.	289.	931.	588.	431.	418.	3112.
1987	271.	378.	481.	503.	516.	511.	405.	403.	345.	287.	346.	273.	1432.
1988	220.	335.	425.	387.	645.	454.	253.	115.	144.	239.	284.	302.	1352.
1989	241.	214.	840.	713.	1094.	869.	438.	315.	386.	388.	491.	344.	2401.
1990	454.	269.	531.	601.	804.	1097.	548.	294.	272.	262.	363.	246.	2449.
1991	285.	345.	393.	418.	1128.	1991.	931.	291.	238.	326.	372.	343.	4050.
1992	252.	330.	377.	363.	358.	384.	598.	240.	204.	322.	356.	200.	1340.
1993	201.	270.	721.	530.	1017.	1328.	1557.	981.	690.	550.	533.	535.	3902.
1994	361.	331.	1006.	638.	1194.	780.	313.	216.	180.	272.	339.	298.	2287.
1995	257.	330.	467.	505.	1256.	2155.	1443.	537.	412.	504.	578.	502.	4854.
1996	381.	818.	947.	995.	1210.	2174.	768.	306.	290.	377.	362.	424.	4152.
1997	512.	582.	717.	631.	1500.	3023.	1231.	586.	472.	458.	491.	394.	5754.
1998	278.	458.	458.	528.	792.	1300.	1447.	469.	335.	379.	413.	293.	3539.
1999	441.	418.	504.	416.	764.	1472.	766.	312.	292.	269.	353.	373.	3002.
2000	248.	319.	417.	417.	473.	737.	549.	207.	164.	276.	253.	237.	1759.
2001	313.	234.	395.	313.	432.	574.	460.	256.	150.	156.	243.	213.	1466.
2002	206.	230.	262.	412.	403.	1467.	812.	336.	228.	199.	258.	237.	2682.
2003	200.	290.	596.	481.	689.	1029.	435.	266.	146.	166.	204.	252.	2153.
2004	210.	247.	577.	346.	392.	759.	535.	243.	227.	238.	274.	219.	1686.
2005	209.	310.	319.	295.	637.	1357.	750.	327.	228.	228.	326.	202.	2744.
2006	413.	223.	446.	702.	861.	1340.	534.	275.	175.	289.	347.	258.	2735.
2007	256.	362.	627.	498.	826.	1114.	460.	265.	171.	218.	232.	208.	2400.
2008	200.	246.	393.	315.	867.	2236.	1155.	388.	335.	288.	332.	196.	4258.

2009	359.	339.	514.	514.	1130.	1411.	849.	397.	350.	385.	360.	300.	3390.
2010	330.	319.	582.	395.	892.	1975.	1253.	459.	425.	353.	329.	334.	4120.
2011	431.	580.	1049.	895.	2871.	4035.	2093.	538.	260.	405.	414.	428.	8999.
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MJJ
Basic Statistics:													
Mean	312.	360.	598.	643.	1091.	1636.	834.	355.	332.	383.	382.	328.	3561.
SD	82.	126.	281.	261.	466.	847.	469.	145.	134.	124.	107.	91.	1557.
Skew	0.53	1.34	2.30	1.45	0.93	0.92	1.13	1.02	1.49	0.58	0.18	0.74	0.81
Analysis of Trend in Mean (95% SL):													
Slope	0.41	0.94	1.72	-1.44	-2.37	-3.53	0.39	0.65	0.53	0.09	0.49	0.20	-5.52
KendSum	520.	992.	885.	-1201.	-1060.	-631.	192.	642.	517.	161.	691.	170.	-669.
KendTau	0.08	0.15	0.14	-0.19	-0.16	-0.10	0.03	0.10	0.08	0.02	0.11	0.03	-0.10
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.27	2.43	2.16	-2.94	-2.59	-1.54	0.47	1.57	1.26	0.39	1.69	0.41	-1.64
Trend?	No Trend	Trend	Trend	Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	10.6789	9.4869	11.1513	0.0403	4.5059	0.0245	0.1841	0.0643	9.7333	1.6865	0.5282	4.4901	1.2300
Trend?	Trend	Trend	Trend	No Trend	Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	6675.	15783.	78695.	67875.	217271.	717291.	219743.	20981.	17869.	15471.	11413.	8237.	2425597.
Res Var	6488.	14822.	75456.	65603.	211125.	703668.	219581.	20517.	17562.	15461.	11153.	8193.	2392334.
Tnd Var	2.79	6.09	4.12	3.35	2.83	1.90	0.07	2.21	1.72	0.06	2.28	0.54	1.37



Reservoir Runoff Analysis

Garrison Annual:

Analysis of Monthly Runoff

Input File: garr.prn
Output File: out

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1898	238.	339.	718.	1228.	1989.	4380.	2106.	676.	543.	458.	309.	186.	13170.
1899	272.	280.	557.	3328.	1353.	4209.	3866.	716.	395.	303.	341.	268.	15888.
1900	337.	399.	1394.	924.	1749.	3001.	851.	317.	349.	484.	329.	216.	10350.
1901	228.	282.	1107.	672.	2725.	2618.	1488.	534.	597.	468.	407.	236.	11362.
1902	262.	395.	1414.	587.	1146.	2386.	1168.	536.	526.	528.	325.	222.	9495.
1903	276.	474.	934.	851.	696.	2438.	1805.	811.	599.	500.	387.	262.	10033.
1904	319.	391.	647.	1204.	1823.	3527.	2152.	811.	591.	424.	301.	194.	12384.
1905	248.	311.	851.	484.	672.	3021.	1660.	506.	317.	329.	315.	234.	8948.
1906	294.	216.	889.	825.	1837.	4088.	1896.	904.	748.	444.	426.	284.	12851.
1907	327.	315.	1020.	613.	1424.	3737.	4094.	1500.	724.	645.	543.	272.	15214.
1908	282.	422.	889.	696.	1359.	3882.	2902.	998.	528.	662.	361.	335.	13316.
1909	347.	359.	1023.	607.	1263.	5086.	3453.	1067.	776.	474.	357.	274.	15086.
1910	345.	424.	1065.	912.	1791.	2055.	1069.	508.	405.	371.	319.	97.	9361.
1911	157.	242.	724.	555.	857.	3418.	1825.	962.	950.	595.	313.	196.	10794.
1912	238.	294.	1525.	2360.	1634.	3328.	2884.	1335.	988.	926.	666.	389.	16567.
1913	413.	335.	887.	1394.	1452.	3578.	1878.	1150.	647.	510.	460.	353.	13057.
1914	381.	361.	902.	783.	1859.	3406.	1428.	585.	498.	573.	565.	240.	11581.
1915	264.	286.	1321.	738.	1142.	2975.	2416.	1121.	962.	861.	452.	422.	12960.
1916	381.	417.	1942.	1077.	1142.	3124.	3358.	984.	456.	549.	498.	349.	14277.
1917	327.	333.	1022.	2573.	1906.	3864.	3497.	829.	678.	559.	488.	290.	16366.
1918	456.	458.	1773.	1424.	1252.	4643.	2216.	859.	593.	512.	432.	319.	14937.
1919	387.	292.	807.	988.	843.	724.	300.	212.	196.	282.	369.	321.	5721.
1920	317.	333.	1192.	948.	1712.	3465.	2479.	708.	434.	357.	363.	387.	12695.
1921	280.	415.	1039.	706.	1144.	4364.	1382.	367.	274.	184.	260.	204.	10619.
1922	270.	393.	1212.	893.	1561.	3235.	1450.	605.	407.	323.	401.	218.	10968.
1923	246.	357.	841.	1113.	1210.	2095.	3094.	766.	585.	1912.	902.	534.	13655.
1924	666.	908.	1396.	2735.	2079.	2934.	1827.	545.	468.	666.	579.	383.	15186.
1925	694.	988.	1484.	1125.	1664.	3314.	2289.	791.	520.	611.	510.	405.	14395.
1926	484.	553.	1182.	1144.	1775.	1833.	1422.	603.	682.	583.	490.	369.	11120.
1927	327.	615.	984.	1000.	1968.	4147.	2515.	1325.	948.	678.	565.	434.	15506.
1928	436.	419.	1123.	952.	2626.	2898.	2753.	833.	591.	534.	472.	357.	13994.
1929	266.	216.	1575.	1176.	1585.	3031.	1747.	405.	397.	524.	422.	300.	11644.
1930	254.	601.	1311.	1267.	1035.	1795.	976.	883.	603.	541.	415.	212.	9893.
1931	190.	290.	260.	385.	653.	1634.	397.	339.	186.	339.	224.	180.	5077.
1932	198.	173.	500.	1216.	1500.	3011.	1583.	415.	432.	450.	323.	250.	10051.
1933	284.	212.	1422.	625.	1632.	2876.	797.	383.	581.	375.	387.	131.	9705.
1934	296.	436.	645.	561.	766.	837.	246.	208.	161.	282.	254.	109.	4801.
1935	113.	256.	397.	609.	538.	2559.	1730.	403.	232.	230.	212.	278.	7557.
1936	177.	190.	819.	996.	1146.	1797.	659.	365.	220.	383.	363.	258.	7373.
1937	167.	167.	469.	649.	764.	2271.	1381.	327.	208.	409.	266.	200.	7278.
1938	258.	161.	1170.	577.	1014.	3189.	2138.	484.	393.	417.	266.	58.	10125.
1939	341.	159.	2053.	682.	1244.	2245.	837.	309.	248.	432.	365.	272.	9187.
1940	145.	206.	327.	821.	1000.	1726.	635.	224.	177.	617.	260.	349.	6487.
1941	248.	260.	391.	746.	920.	2106.	659.	724.	960.	984.	601.	442.	9041.
1942	268.	361.	970.	889.	1410.	2963.	1626.	492.	343.	440.	464.	250.	10476.
1943	296.	776.	1724.	2864.	1289.	3648.	3076.	891.	518.	575.	506.	218.	16381.

1944	290.	327.	920.	2063.	1228.	4346.	2469.	567.	395.	460.	428.	250.	13743.
1945	238.	365.	1527.	637.	780.	2362.	2194.	700.	504.	498.	333.	292.	10430.
1946	415.	315.	1089.	645.	930.	2136.	1557.	391.	492.	690.	440.	333.	9433.
1947	286.	526.	1678.	1718.	1771.	2803.	2344.	970.	476.	549.	371.	280.	13772.
1948	290.	266.	956.	1317.	1220.	3511.	1787.	583.	256.	403.	311.	-28.	10872.
1949	222.	224.	1212.	1674.	1125.	2101.	1037.	272.	303.	510.	504.	149.	9333.
1950	292.	317.	578.	2438.	1030.	2352.	2107.	801.	589.	746.	294.	372.	11916.
1951	366.	337.	627.	2022.	1342.	2206.	1770.	1132.	855.	783.	570.	136.	12146.
1952	389.	518.	490.	4865.	2193.	2463.	1382.	609.	401.	446.	457.	226.	14439.
1953	285.	361.	468.	598.	820.	3020.	1444.	604.	322.	429.	492.	275.	9118.
1954	287.	605.	613.	1252.	1140.	1248.	1558.	625.	454.	308.	392.	283.	8765.
1955	137.	272.	453.	1550.	1272.	1710.	1210.	478.	228.	418.	281.	412.	8421.
1956	467.	318.	734.	1010.	1069.	3063.	1304.	563.	438.	346.	446.	253.	10011.
1957	258.	292.	661.	747.	1244.	3423.	2147.	527.	543.	569.	535.	342.	11288.
1958	300.	246.	537.	703.	896.	1984.	1010.	401.	326.	355.	297.	247.	7302.
1959	224.	220.	1698.	742.	632.	1893.	1398.	351.	326.	532.	302.	476.	8794.
1960	194.	310.	1526.	1314.	515.	1183.	409.	185.	191.	267.	285.	150.	6529.
1961	199.	230.	462.	221.	179.	1450.	321.	178.	375.	513.	411.	162.	4701.
1962	222.	538.	559.	1100.	1258.	2938.	2396.	778.	454.	567.	429.	273.	11512.
1963	163.	572.	935.	612.	1112.	3524.	1542.	385.	485.	468.	320.	146.	10264.
1964	223.	233.	365.	585.	1012.	2852.	2624.	410.	520.	372.	318.	205.	9719.
1965	337.	287.	420.	1926.	1705.	3073.	3383.	989.	742.	710.	440.	287.	14299.
1966	143.	212.	920.	662.	785.	1212.	855.	273.	340.	360.	333.	200.	6295.
1967	171.	263.	986.	1431.	1271.	4060.	3356.	530.	459.	475.	423.	203.	13628.
1968	249.	330.	1234.	493.	569.	2969.	1898.	940.	852.	567.	569.	255.	10925.
1969	238.	255.	1260.	2118.	1568.	1911.	2349.	449.	244.	331.	410.	215.	11348.
1970	76.	336.	558.	922.	1834.	3210.	2254.	430.	410.	526.	324.	224.	11104.
1971	175.	831.	1480.	1604.	1168.	3428.	2420.	682.	724.	962.	564.	280.	14318.
1972	187.	402.	3571.	873.	1186.	3254.	1481.	920.	662.	630.	616.	259.	14041.
1973	318.	318.	882.	620.	1562.	2290.	1145.	477.	852.	651.	427.	343.	9885.
1974	297.	452.	705.	1076.	1165.	3387.	2519.	699.	506.	395.	509.	301.	12011.
1975	141.	152.	741.	1747.	2740.	2847.	3987.	983.	487.	496.	374.	306.	15001.
1976	342.	641.	1361.	993.	1553.	2947.	2017.	870.	483.	460.	345.	273.	12285.
1977	72.	289.	595.	571.	894.	1225.	391.	245.	438.	492.	124.	229.	5565.
1978	104.	134.	1549.	2415.	2750.	3428.	2986.	877.	876.	549.	203.	290.	16161.
1979	111.	236.	1314.	3213.	1442.	2034.	1220.	537.	540.	329.	357.	174.	11507.
1980	71.	166.	493.	697.	945.	1823.	993.	306.	458.	652.	468.	110.	7182.
1981	335.	250.	505.	207.	741.	2753.	1013.	272.	83.	351.	488.	185.	7183.
1982	12.	345.	1031.	1511.	902.	2489.	2958.	1041.	561.	939.	553.	368.	12710.
1983	354.	581.	981.	521.	728.	2253.	2012.	528.	232.	662.	581.	36.	9469.
1984	294.	458.	703.	551.	1276.	2295.	1754.	683.	284.	651.	502.	75.	9526.
1985	248.	165.	869.	704.	587.	1072.	514.	537.	367.	674.	308.	218.	6263.
1986	291.	216.	2237.	586.	1491.	3076.	1608.	416.	640.	1248.	459.	462.	12730.
1987	217.	383.	797.	777.	919.	1239.	580.	493.	426.	373.	336.	96.	6636.
1988	-41.	168.	588.	346.	840.	1212.	399.	-56.	62.	276.	201.	146.	4141.
1989	35.	107.	716.	1061.	1176.	1680.	1069.	299.	299.	397.	423.	26.	7288.
1990	297.	212.	760.	504.	782.	1585.	1415.	405.	231.	328.	430.	49.	6998.
1991	140.	216.	509.	402.	1257.	3478.	1841.	260.	471.	418.	478.	207.	9677.
1992	182.	288.	558.	390.	770.	1413.	1651.	468.	312.	436.	412.	70.	6950.
1993	122.	294.	867.	737.	1162.	2532.	2432.	1535.	490.	564.	407.	319.	11461.
1994	235.	225.	2023.	671.	1431.	1317.	430.	76.	135.	552.	235.	168.	7498.
1995	141.	392.	921.	519.	1341.	2968.	2747.	519.	234.	402.	279.	166.	10629.
1996	248.	898.	1513.	1526.	1277.	3545.	2142.	382.	178.	360.	246.	300.	12615.
1997	267.	646.	1890.	1974.	1609.	4652.	2917.	1271.	608.	525.	551.	491.	17401.
1998	157.	608.	709.	898.	895.	1722.	2431.	817.	404.	875.	642.	274.	10432.
1999	393.	506.	1669.	901.	1431.	3279.	2176.	672.	532.	573.	454.	238.	12824.
2000	232.	342.	680.	367.	635.	1946.	1062.	236.	143.	550.	263.	183.	6639.
2001	348.	263.	1054.	733.	537.	1290.	985.	245.	34.	352.	219.	182.	6242.
2002	184.	232.	345.	637.	530.	1838.	1175.	384.	224.	480.	238.	153.	6420.
2003	143.	320.	1359.	707.	757.	2446.	1095.	261.	109.	355.	154.	269.	7975.
2004	162.	225.	912.	616.	376.	1345.	1202.	409.	276.	523.	365.	142.	6553.
2005	197.	395.	557.	402.	1207.	2292.	1919.	366.	129.	556.	300.	93.	8413.
2006	440.	253.	494.	793.	1012.	1822.	815.	257.	113.	507.	270.	112.	6888.
2007	184.	211.	917.	635.	1439.	2340.	800.	287.	119.	416.	270.	154.	7772.
2008	191.	211.	456.	497.	837.	3164.	2892.	720.	419.	607.	314.	293.	10601.
2009	400.	353.	1063.	1352.	1209.	3100.	2393.	748.	495.	523.	398.	247.	12281.
2010	319.	285.	754.	695.	980.	3365.	2527.	616.	507.	538.	219.	308.	11113.
2011	299.	457.	1567.	2748.	4414.	6467.	5560.	1374.	515.	704.	387.	393.	24885.
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Basic Statistics:

Mean	261.	353.	1001.	1085.	1268.	2711.	1823.	610.	450.	525.	394.	249.	10730.
SD	113.	166.	497.	739.	573.	991.	948.	315.	216.	214.	122.	105.	3346.
Skew	0.64	1.59	1.58	2.17	1.91	0.49	0.77	0.74	0.45	2.97	0.69	0.08	0.62

Analysis of Trend in Mean (95% SL):

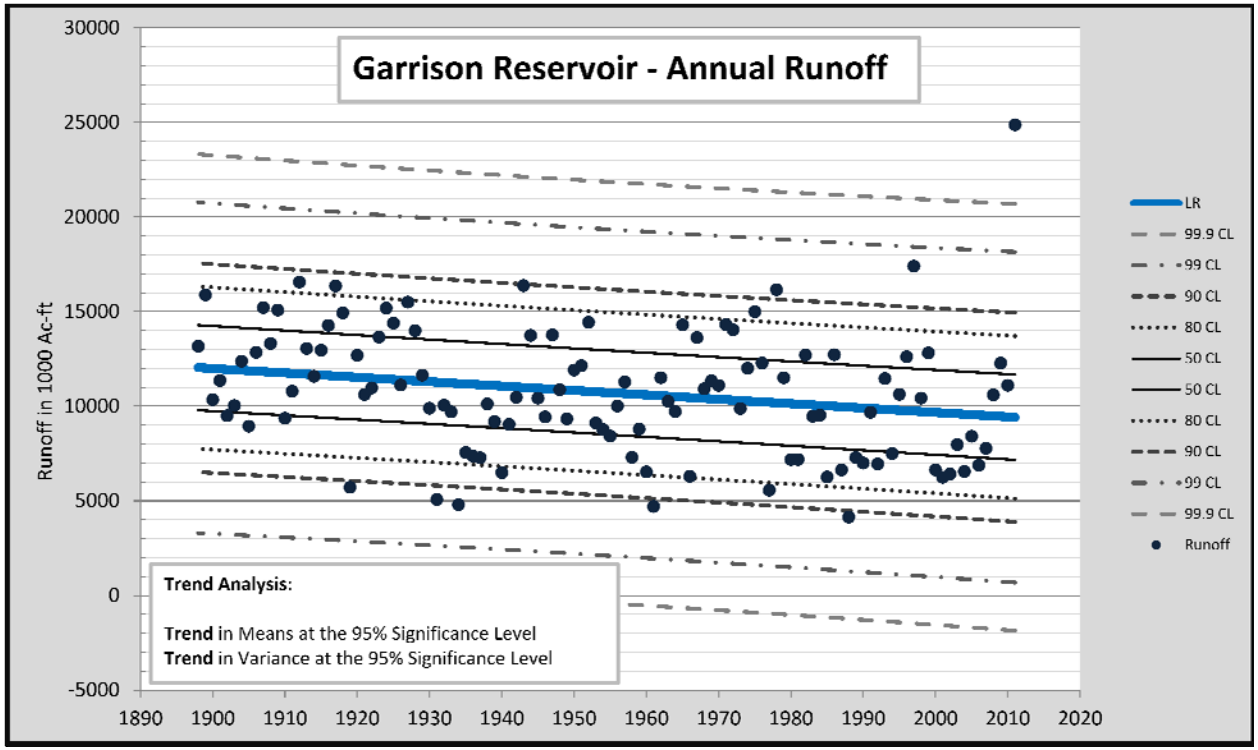
Slope	-1.13	-0.43	-0.73	-2.41	-3.08	-7.62	-1.90	-2.23	-2.35	0.05	-0.61	-0.74	-23.19
KendSum	-1369.	-657.	-446.	-755.	-1294.	-1315.	-392.	-1196.	-1515.	229.	-609.	-964.	-1251.
KendTau	-0.21	-0.10	-0.07	-0.12	-0.20	-0.20	-0.06	-0.19	-0.24	0.04	-0.09	-0.15	-0.19
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	-3.35	-1.61	-1.09	-1.85	-3.17	-3.22	-0.96	-2.93	-3.71	0.56	-1.49	-2.36	-3.06
Trend?	Trend	No Trend	No Trend	No Trend	Trend	Trend	No Trend	Trend	Trend	No Trend	No Trend	Trend	Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.1734	0.2945	3.5080	0.1956	11.8069	3.4261	1.2871	0.9615	0.1391	4.9666	0.0159	0.8701	8.0681
Trend?	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	12735.	27510.	247417.	545678.	328071.	981352.	898236.	99204.	46696.	45927.	14935.	11025.	11197772.
Res Var	11347.	27304.	246837.	539317.	317711.	917996.	894275.	93767.	40653.	45925.	14526.	10430.	10610369.
Tnd Var	10.90	0.75	0.23	1.17	3.16	6.46	0.44	5.48	12.94	0.01	2.74	5.39	5.25



Reservoir Runoff Analysis

Garrison May-July:

Analysis of Monthly Runoff

Input File: garr.prn
Output File: out

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MJJ
1898	238.	339.	718.	1228.	1989.	4380.	2106.	676.	543.	458.	309.	186.	8475.
1899	272.	280.	557.	3328.	1353.	4209.	3866.	716.	395.	303.	341.	268.	9428.
1900	337.	399.	1394.	924.	1749.	3001.	851.	317.	349.	484.	329.	216.	5601.
1901	228.	282.	1107.	672.	2725.	2618.	1488.	534.	597.	468.	407.	236.	6831.
1902	262.	395.	1414.	587.	1146.	2386.	1168.	536.	526.	528.	325.	222.	4700.
1903	276.	474.	934.	851.	696.	2438.	1805.	811.	599.	500.	387.	262.	4939.
1904	319.	391.	647.	1204.	1823.	3527.	2152.	811.	591.	424.	301.	194.	7502.
1905	248.	311.	851.	484.	672.	3021.	1660.	506.	317.	329.	315.	234.	5353.
1906	294.	216.	889.	825.	1837.	4088.	1896.	904.	748.	444.	426.	284.	7821.
1907	327.	315.	1020.	613.	1424.	3737.	4094.	1500.	724.	645.	543.	272.	9255.
1908	282.	422.	889.	696.	1359.	3882.	2902.	998.	528.	662.	361.	335.	8143.
1909	347.	359.	1023.	607.	1263.	5086.	3453.	1067.	776.	474.	357.	274.	9802.
1910	345.	424.	1065.	912.	1791.	2055.	1069.	508.	405.	371.	319.	97.	4915.
1911	157.	242.	724.	555.	857.	3418.	1825.	962.	950.	595.	313.	196.	6100.
1912	238.	294.	1525.	2360.	1634.	3328.	2884.	1335.	988.	926.	666.	389.	7846.
1913	413.	335.	887.	1394.	1452.	3578.	1878.	1150.	647.	510.	460.	353.	6908.
1914	381.	361.	902.	783.	1859.	3406.	1428.	585.	498.	573.	565.	240.	6693.
1915	264.	286.	1321.	738.	1142.	2975.	2416.	1121.	962.	861.	452.	422.	6533.
1916	381.	417.	1942.	1077.	1142.	3124.	3358.	984.	456.	549.	498.	349.	7624.
1917	327.	333.	1022.	2573.	1906.	3864.	3497.	829.	678.	559.	488.	290.	9267.
1918	456.	458.	1773.	1424.	1252.	4643.	2216.	859.	593.	512.	432.	319.	8111.
1919	387.	292.	807.	988.	843.	724.	300.	212.	196.	282.	369.	321.	1867.
1920	317.	333.	1192.	948.	1712.	3465.	2479.	708.	434.	357.	363.	387.	7656.
1921	280.	415.	1039.	706.	1144.	4364.	1382.	367.	274.	184.	260.	204.	6890.
1922	270.	393.	1212.	893.	1561.	3235.	1450.	605.	407.	323.	401.	218.	6246.
1923	246.	357.	841.	1113.	1210.	2095.	3094.	766.	585.	1912.	902.	534.	6399.
1924	666.	908.	1396.	2735.	2079.	2934.	1827.	545.	468.	666.	579.	383.	6840.
1925	694.	988.	1484.	1125.	1664.	3314.	2289.	791.	520.	611.	510.	405.	7267.
1926	484.	553.	1182.	1144.	1775.	1833.	1422.	603.	682.	583.	490.	369.	5030.
1927	327.	615.	984.	1000.	1968.	4147.	2515.	1325.	948.	678.	565.	434.	8630.
1928	436.	419.	1123.	952.	2626.	2898.	2753.	833.	591.	534.	472.	357.	8277.
1929	266.	216.	1575.	1176.	1585.	3031.	1747.	405.	397.	524.	422.	300.	6363.
1930	254.	601.	1311.	1267.	1035.	1795.	976.	883.	603.	541.	415.	212.	3806.
1931	190.	290.	260.	385.	653.	1634.	397.	339.	186.	339.	224.	180.	2684.
1932	198.	173.	500.	1216.	1500.	3011.	1583.	415.	432.	450.	323.	250.	6094.
1933	284.	212.	1422.	625.	1632.	2876.	797.	383.	581.	375.	387.	131.	5305.
1934	296.	436.	645.	561.	766.	837.	246.	208.	161.	282.	254.	109.	1849.
1935	113.	256.	397.	609.	538.	2559.	1730.	403.	232.	230.	212.	278.	4827.
1936	177.	190.	819.	996.	1146.	1797.	659.	365.	220.	383.	363.	258.	3602.
1937	167.	167.	469.	649.	764.	2271.	1381.	327.	208.	409.	266.	200.	4416.
1938	258.	161.	1170.	577.	1014.	3189.	2138.	484.	393.	417.	266.	58.	6341.
1939	341.	159.	2053.	682.	1244.	2245.	837.	309.	248.	432.	365.	272.	4326.
1940	145.	206.	327.	821.	1000.	1726.	635.	224.	177.	617.	260.	349.	3361.
1941	248.	260.	391.	746.	920.	2106.	659.	724.	960.	984.	601.	442.	3685.
1942	268.	361.	970.	889.	1410.	2963.	1626.	492.	343.	440.	464.	250.	5999.
1943	296.	776.	1724.	2864.	1289.	3648.	3076.	891.	518.	575.	506.	218.	8013.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MJJ
1944	290.	327.	920.	2063.	1228.	4346.	2469.	567.	395.	460.	428.	250.	8043.
1945	238.	365.	1527.	637.	780.	2362.	2194.	700.	504.	498.	333.	292.	5336.
1946	415.	315.	1089.	645.	930.	2136.	1557.	391.	492.	690.	440.	333.	4623.
1947	286.	526.	1678.	1718.	1771.	2803.	2344.	970.	476.	549.	371.	280.	6918.
1948	290.	266.	956.	1317.	1220.	3511.	1787.	583.	256.	403.	311.	-28.	6518.
1949	222.	224.	1212.	1674.	1125.	2101.	1037.	272.	303.	510.	504.	149.	4263.
1950	292.	317.	578.	2438.	1030.	2352.	2107.	801.	589.	746.	294.	372.	5489.
1951	366.	337.	627.	2022.	1342.	2206.	1770.	1132.	855.	783.	570.	136.	5318.
1952	389.	518.	490.	4865.	2193.	2463.	1382.	609.	401.	446.	457.	226.	6038.
1953	285.	361.	468.	598.	820.	3020.	1444.	604.	322.	429.	492.	275.	5284.
1954	287.	605.	613.	1252.	1140.	1248.	1558.	625.	454.	308.	392.	283.	3946.
1955	137.	272.	453.	1550.	1272.	1710.	1210.	478.	228.	418.	281.	412.	4192.
1956	467.	318.	734.	1010.	1069.	3063.	1304.	563.	438.	346.	446.	253.	5436.
1957	258.	292.	661.	747.	1244.	3423.	2147.	527.	543.	569.	535.	342.	6814.
1958	300.	246.	537.	703.	896.	1984.	1010.	401.	326.	355.	297.	247.	3890.
1959	224.	220.	1698.	742.	632.	1893.	1398.	351.	326.	532.	302.	476.	3923.
1960	194.	310.	1526.	1314.	515.	1183.	409.	185.	191.	267.	285.	150.	2107.
1961	199.	230.	462.	221.	179.	1450.	321.	178.	375.	513.	411.	162.	1950.
1962	222.	538.	559.	1100.	1258.	2938.	2396.	778.	454.	567.	429.	273.	6592.
1963	163.	572.	935.	612.	1112.	3524.	1542.	385.	485.	468.	320.	146.	6178.
1964	223.	233.	365.	585.	1012.	2852.	2624.	410.	520.	372.	318.	205.	6488.
1965	337.	287.	420.	1926.	1705.	3073.	3383.	989.	742.	710.	440.	287.	8161.
1966	143.	212.	920.	662.	785.	1212.	855.	273.	340.	360.	333.	200.	2852.
1967	171.	263.	986.	1431.	1271.	4060.	3356.	530.	459.	475.	423.	203.	8687.
1968	249.	330.	1234.	493.	569.	2969.	1898.	940.	852.	567.	569.	255.	5436.
1969	238.	255.	1260.	2118.	1568.	1911.	2349.	449.	244.	331.	410.	215.	5828.
1970	76.	336.	558.	922.	1834.	3210.	2254.	430.	410.	526.	324.	224.	7298.
1971	175.	831.	1480.	1604.	1168.	3428.	2420.	682.	724.	962.	564.	280.	7016.
1972	187.	402.	3571.	873.	1186.	3254.	1481.	920.	662.	630.	616.	259.	5921.
1973	318.	318.	882.	620.	1562.	2290.	1145.	477.	852.	651.	427.	343.	4997.
1974	297.	452.	705.	1076.	1165.	3387.	2519.	699.	506.	395.	509.	301.	7071.
1975	141.	152.	741.	1747.	2740.	2847.	3987.	983.	487.	496.	374.	306.	9574.
1976	342.	641.	1361.	993.	1553.	2947.	2017.	870.	483.	460.	345.	273.	6517.
1977	72.	289.	595.	571.	894.	1225.	391.	245.	438.	492.	124.	229.	2510.
1978	104.	134.	1549.	2415.	2750.	3428.	2986.	877.	876.	549.	203.	290.	9164.
1979	111.	236.	1314.	3213.	1442.	2034.	1220.	537.	540.	329.	357.	174.	4696.
1980	71.	166.	493.	697.	945.	1823.	993.	306.	458.	652.	468.	110.	3761.
1981	335.	250.	505.	207.	741.	2753.	1013.	272.	83.	351.	488.	185.	4507.
1982	12.	345.	1031.	1511.	902.	2489.	2958.	1041.	561.	939.	553.	368.	6349.
1983	354.	581.	981.	521.	728.	2253.	2012.	528.	232.	662.	581.	36.	4993.
1984	294.	458.	703.	551.	1276.	2295.	1754.	683.	284.	651.	502.	75.	5325.
1985	248.	165.	869.	704.	587.	1072.	514.	537.	367.	674.	308.	218.	2173.
1986	291.	216.	2237.	586.	1491.	3076.	1608.	416.	640.	1248.	459.	462.	6175.
1987	217.	383.	797.	777.	919.	1239.	580.	493.	426.	373.	336.	96.	2738.
1988	-41.	168.	588.	346.	840.	1212.	399.	-56.	62.	276.	201.	146.	2451.
1989	35.	107.	716.	1061.	1176.	1680.	1069.	299.	299.	397.	423.	26.	3925.
1990	297.	212.	760.	504.	782.	1585.	1415.	405.	231.	328.	430.	49.	3782.
1991	140.	216.	509.	402.	1257.	3478.	1841.	260.	471.	418.	478.	207.	6576.
1992	182.	288.	558.	390.	770.	1413.	1651.	468.	312.	436.	412.	70.	3834.
1993	122.	294.	867.	737.	1162.	2532.	2432.	1535.	490.	564.	407.	319.	6126.
1994	235.	225.	2023.	671.	1431.	1317.	430.	76.	135.	552.	235.	168.	3178.
1995	141.	392.	921.	519.	1341.	2968.	2747.	519.	234.	402.	279.	166.	7056.
1996	248.	898.	1513.	1526.	1277.	3545.	2142.	382.	178.	360.	246.	300.	6964.
1997	267.	646.	1890.	1974.	1609.	4652.	2917.	1271.	608.	525.	551.	491.	9178.
1998	157.	608.	709.	898.	895.	1722.	2431.	817.	404.	875.	642.	274.	5048.
1999	393.	506.	1669.	901.	1431.	3279.	2176.	672.	532.	573.	454.	238.	6886.
2000	232.	342.	680.	367.	635.	1946.	1062.	236.	143.	550.	263.	183.	3643.
2001	348.	263.	1054.	733.	537.	1290.	985.	245.	34.	352.	219.	182.	2812.
2002	184.	232.	345.	637.	530.	1838.	1175.	384.	224.	480.	238.	153.	3543.
2003	143.	320.	1359.	707.	757.	2446.	1095.	261.	109.	355.	154.	269.	4298.
2004	162.	225.	912.	616.	376.	1345.	1202.	409.	276.	523.	365.	142.	2923.
2005	197.	395.	557.	402.	1207.	2292.	1919.	366.	129.	556.	300.	93.	5418.
2006	440.	253.	494.	793.	1012.	1822.	815.	257.	113.	507.	270.	112.	3649.
2007	184.	211.	917.	635.	1439.	2340.	800.	287.	119.	416.	270.	154.	4579.
2008	191.	211.	456.	497.	837.	3164.	2892.	720.	419.	607.	314.	293.	6893.
2009	400.	353.	1063.	1352.	1209.	3100.	2393.	748.	495.	523.	398.	247.	6702.
2010	319.	285.	754.	695.	980.	3365.	2527.	616.	507.	538.	219.	308.	6872.
2011	299.	457.	1567.	2748.	4414.	6467.	5560.	1374.	515.	704.	387.	393.	16441.

Basic Statistics:

Mean	261.	353.	1001.	1085.	1268.	2711.	1823.	610.	450.	525.	394.	249.	5803.
SD	113.	166.	497.	739.	573.	991.	948.	315.	216.	214.	122.	105.	2179.
Skew	0.64	1.59	1.58	2.17	1.91	0.49	0.77	0.74	0.45	2.97	0.69	0.08	0.93

Analysis of Trend in Mean (95% SL):

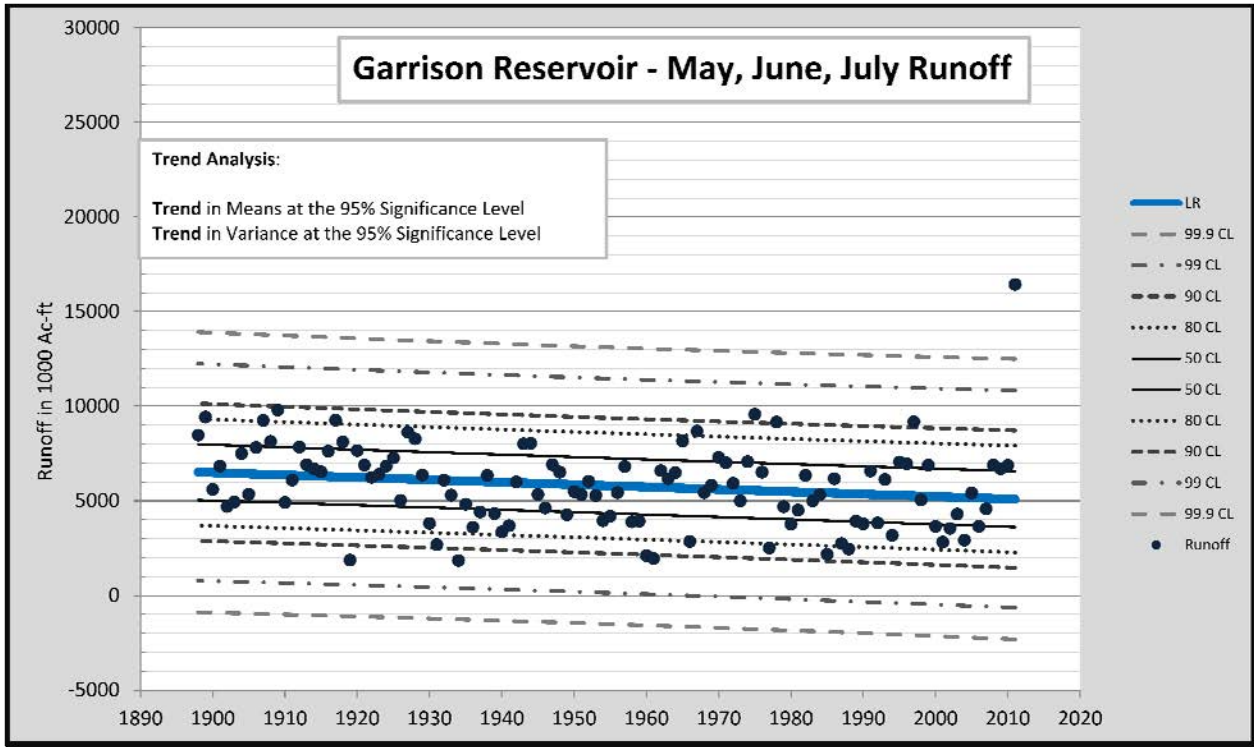
Slope	-1.13	-0.43	-0.73	-2.41	-3.08	-7.62	-1.90	-2.23	-2.35	0.05	-0.61	-0.74	-12.60
KendSum	-1369.	-657.	-446.	-755.	-1294.	-1315.	-392.	-1196.	-1515.	229.	-609.	-964.	-1188.
KendTau	-0.21	-0.10	-0.07	-0.12	-0.20	-0.20	-0.06	-0.19	-0.24	0.04	-0.09	-0.15	-0.18
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	-3.35	-1.61	-1.09	-1.85	-3.17	-3.22	-0.96	-2.93	-3.71	0.56	-1.49	-2.36	-2.91
Trend?	Trend	No Trend	No Trend	No Trend	Trend	Trend	No Trend	Trend	Trend	No Trend	No Trend	Trend	Trend

Analysis of Trend in Variance (95% SL):

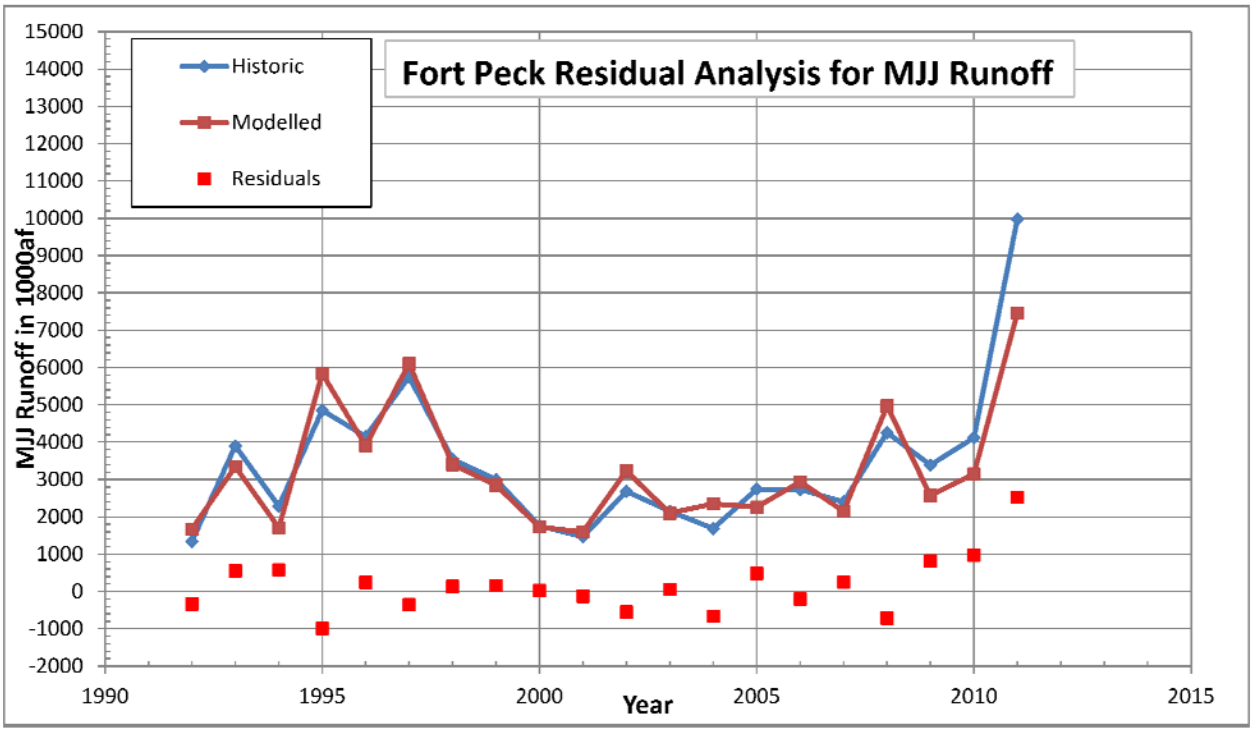
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.1734	0.2945	3.5080	0.1956	11.8069	3.4261	1.2871	0.9615	0.1391	4.9666	0.0159	0.8701	10.1910
Trend?	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	Trend

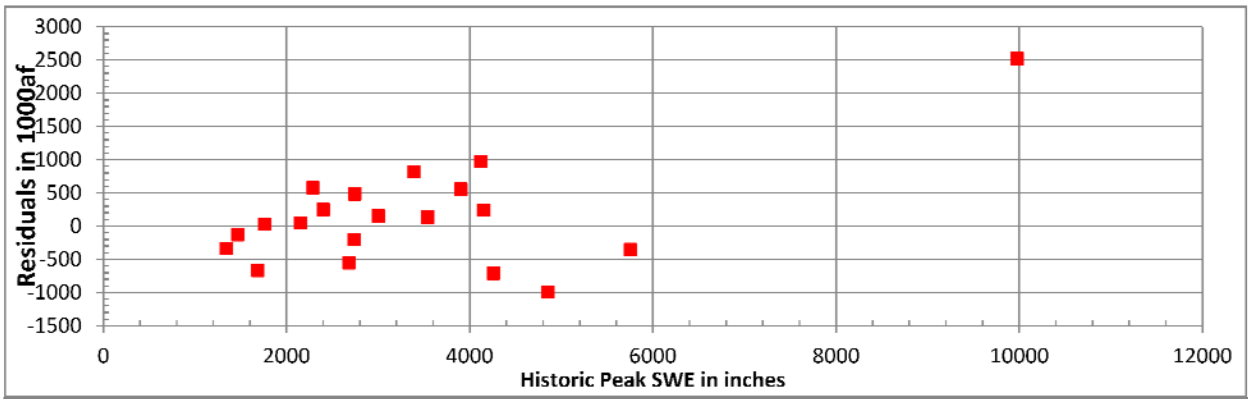
Percentage of Overall Variance that is Resulting from Trend in Mean:

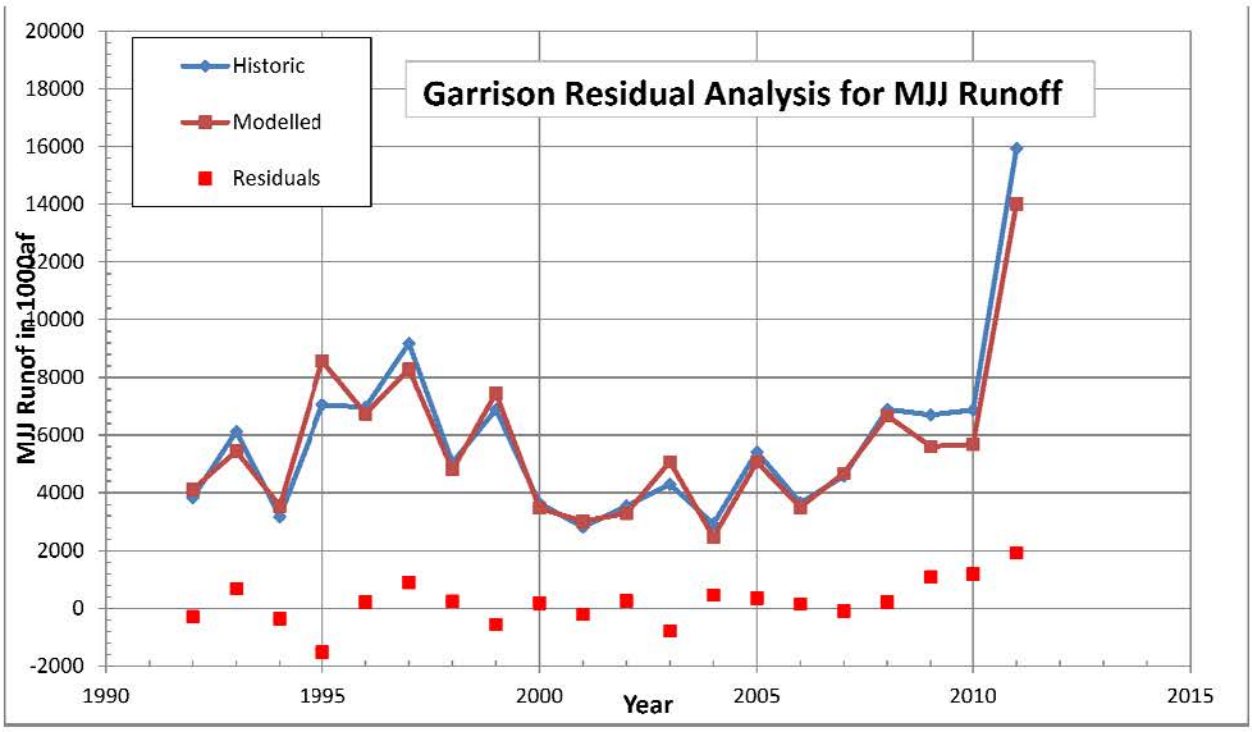
Q Var	12735.	27510.	247417.	545678.	328071.	981352.	898236.	99204.	46696.	45927.	14935.	11025.	4748618.
Res Var	11347.	27304.	246837.	539317.	317711.	917996.	894275.	93767.	40653.	45925.	14526.	10430.	4575204.
Tnd Var	10.90	0.75	0.23	1.17	3.16	6.46	0.44	5.48	12.94	0.01	2.74	5.39	3.65

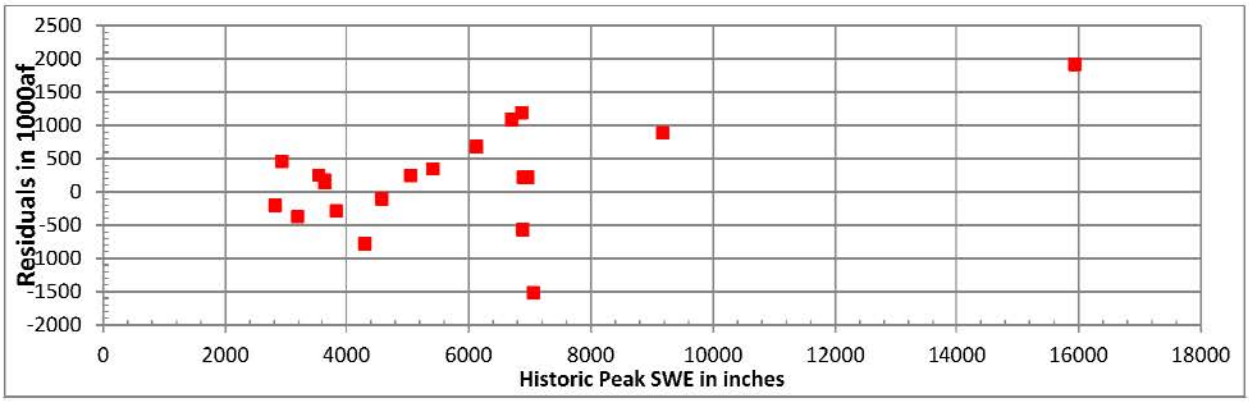


May-July Reservoir Runoff Residual Analysis






Garrison Residual Analysis for MJJ Runoff
Historic
Modelled
Residuals
MJJ Runof in 1000af
Year
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-2000
1990
1995
2000
2005
2010
2015


Residuals in 1000af
Historic Peak SWE in inches
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
0
2000
4000
6000
8000
10000
12000
14000
16000
18000

River Runoff Analysis

Streamflow at U.S. Geological Survey gages were analyzed for monthly, annual, and May-June-July (MJJ) trends for two gages on the Missouri River (above Lake Fort Peck).

- Missouri River at Toston, MT (upstream),
- Missouri River near Landusky MT (downstream), and two gages on the Yellowstone River:
    - Yellowstone River at Billings, MT (upstream),
    - Yellowstone River at Miles City, MT (downstream).

Stations selected had complete daily records from the start of water year 1960 through 2011 (water year begins October 1 and ends September 30, with the specified year as that from January through September). Significance of trends was based on the Kendall-tau non-parametric test (p=0.05). Significant trends are summarized in Table G1. There are no significant upward trends in monthly, annual, and MJJ streamflows. All significant trends are downward and occur primarily in months not typically associated with snowpack runoff. The Missouri River near Landusky (just upstream of Fort Peck Lake) has a significant downward trend in annual streamflow, a downward trend in May streamflow, and no trend in MJJ streamflow.

Table G1. Trends in monthly and annual streamflow at U.S. Geological Survey streamgages for water years 1960-2011. Red triangle pointing downward indicates acceptance of a significant downward trend (p=0.05). No symbol indicates rejection of a significant trend.

Gage Number	Gage Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		MJJ	ANNUAL
06054500	Missouri River at Toston, MT		▼							▼	▼	▼	▼			
06115200	Missouri River near Landusky, MT	▼	▼	▼	▼	▼			▼		▼	▼	▼			▼
06214500	Yellowstone River at Billings, MT		▼	▼						▼		▼	▼			
06309000	Yellowstone River at Miles City, MT		▼							▼		▼				

Appendix C – Cross-Correlation

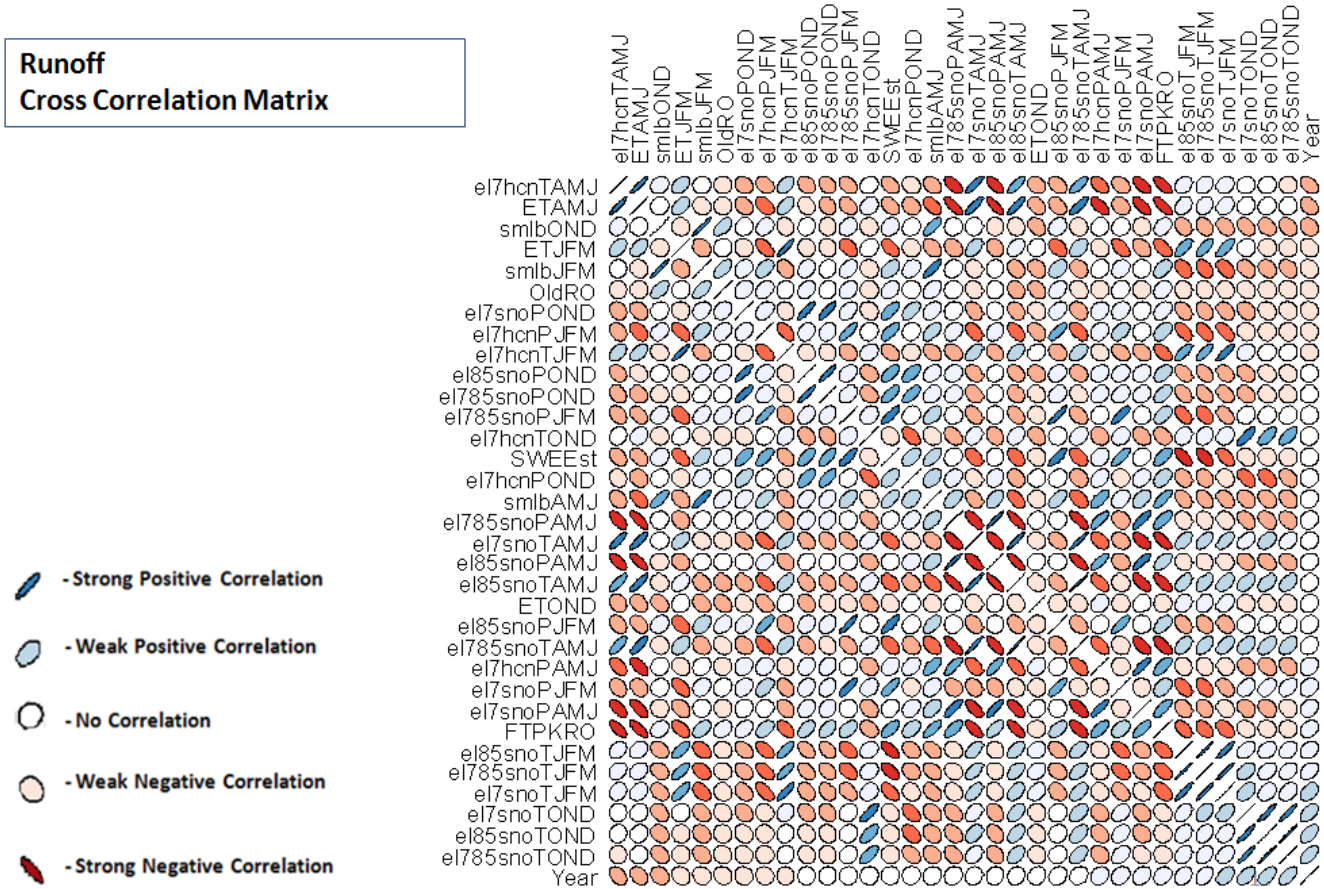
Fort Peck

	Year	FTPKRO	el7snoTOND	el7snoTJFM	el7snoTAMJ	el7hcnTOND	el7hcnTJFM	el7hcnTAMJ	el7snoPOND	el7snoPJFM	el7snoPAMJ	el7hcnPOND	el7hcnPJFM	el7hcnPAMJ	el785snoTOND	el785snoTJFM	el785snoTAMJ	el785snoPOND	el785snoPJFM	el785snoPAMJ
Year	1	0.28	0.52	0.41	0.13	0.04	-0.03	-0.4	-0.1	0.21	0.25	0.05	-0.08	0.2	0.58	0.36	0.18	0.04	0.04	0.12
FTPKRO	0.28	1	-0.19	-0.4	-0.66	-0.31	-0.48	-0.66	0.38	0.41	0.74	0.43	0.44	0.69	-0.05	-0.43	-0.64	0.46	0.46	0.68
el7snoTOND	0.52	-0.19	1	0.42	0.39	0.81	0.21	0.03	-0.26	0.33	-0.22	-0.46	-0.07	-0.23	0.94	0.41	0.45	-0.25	0.14	-0.36
el7snoTJFM	0.41	-0.4	0.42	1	0.53	0.22	0.84	0.2	-0.33	-0.38	-0.19	-0.16	-0.57	-0.1	0.34	0.96	0.51	-0.31	-0.37	-0.19
el7snoTAMJ	0.13	-0.66	0.39	0.53	1	0.3	0.52	0.84	-0.33	-0.26	-0.6	-0.2	-0.42	-0.47	0.34	0.54	0.96	-0.26	-0.38	-0.63
el7hcnTOND	0.04	-0.31	0.81	0.22	0.3	1	0.25	0.16	-0.17	0.23	-0.28	-0.53	0.09	-0.2	0.65	0.22	0.3	-0.28	0.21	-0.35
el7hcnTJFM	-0.03	-0.48	0.21	0.84	0.52	0.25	1	0.42	-0.11	-0.36	-0.32	-0.01	-0.48	-0.17	0.11	0.77	0.48	-0.09	-0.24	-0.29
el7hcnTAMJ	-0.4	-0.66	0.03	0.2	0.84	0.16	0.42	1	-0.22	-0.31	-0.63	-0.16	-0.29	-0.51	-0.01	0.23	0.77	-0.22	-0.33	-0.61
el7snoPOND	-0.1	0.38	-0.26	-0.33	-0.33	-0.17	-0.11	-0.22	1	0.25	0.12	0.55	0.35	0.2	-0.1	-0.34	-0.26	0.82	0.38	0.13
el7snoPJFM	0.21	0.41	0.33	-0.38	-0.26	0.23	-0.36	-0.31	0.25	1	-0.03	-0.04	0.48	-0.01	0.39	-0.45	-0.14	0.31	0.81	-0.21
el7snoPAMJ	0.25	0.74	-0.22	-0.19	-0.6	-0.28	-0.32	-0.63	0.12	-0.03	1	0.28	0.08	0.86	-0.17	-0.27	-0.63	0.24	0	0.84
el7hcnPOND	0.05	0.43	-0.46	-0.16	-0.2	-0.53	-0.01	-0.16	0.55	-0.04	0.28	1	0.14	0.34	-0.35	-0.24	-0.23	0.7	0.19	0.33
el7hcnPJFM	-0.08	0.44	-0.07	-0.57	-0.42	0.09	-0.48	-0.29	0.35	0.48	0.08	0.14	1	0.2	-0.02	-0.53	-0.5	0.22	0.78	0.27
el7hcnPAMJ	0.2	0.69	-0.23	-0.1	-0.47	-0.2	-0.17	-0.51	0.2	-0.01	0.86	0.34	0.2	1	-0.23	-0.16	-0.54	0.26	0.09	0.78
el785snoTOND	0.58	-0.05	0.94	0.34	0.34	0.65	0.11	-0.01	-0.1	0.39	-0.17	-0.35	-0.02	-0.23	1	0.34	0.44	-0.08	0.17	-0.3
el785snoTJFM	0.36	-0.43	0.41	0.96	0.54	0.22	0.77	0.23	-0.34	-0.45	-0.27	-0.24	-0.53	-0.16	0.34	1	0.51	-0.34	-0.43	-0.18
el785snoTAMJ	0.18	-0.64	0.45	0.51	0.96	0.3	0.48	0.77	-0.26	-0.14	-0.63	-0.23	-0.5	-0.54	0.44	0.51	1	-0.2	-0.38	-0.75
el785snoPOND	0.04	0.46	-0.25	-0.31	-0.26	-0.28	-0.09	-0.22	0.82	0.31	0.24	0.7	0.22	0.26	-0.08	-0.34	-0.2	1	0.34	0.21
el785snoPJFM	0.04	0.46	0.14	-0.37	-0.38	0.21	-0.24	-0.33	0.38	0.81	0	0.19	0.78	0.09	0.17	-0.43	-0.38	0.34	1	0.01
el785snoPAMJ	0.12	0.68	-0.36	-0.19	-0.63	-0.35	-0.29	-0.61	0.13	-0.21	0.84	0.33	0.27	0.78	-0.3	-0.18	-0.75	0.21	0.01	1
el85snoTOND	0.53	-0.11	0.94	0.33	0.4	0.67	0.12	0.08	-0.18	0.35	-0.22	-0.41	-0.03	-0.29	0.98	0.34	0.49	-0.15	0.12	-0.34
el85snoTJFM	0.29	-0.47	0.4	0.9	0.53	0.24	0.73	0.25	-0.38	-0.5	-0.27	-0.29	-0.51	-0.16	0.3	0.98	0.49	-0.39	-0.47	-0.16
el85snoTAMJ	0.14	-0.67	0.46	0.47	0.93	0.32	0.45	0.76	-0.28	-0.11	-0.66	-0.27	-0.5	-0.59	0.44	0.47	0.99	-0.22	-0.38	-0.79
el85snoPOND	0.03	0.47	-0.28	-0.31	-0.29	-0.29	-0.09	-0.24	0.86	0.27	0.26	0.63	0.22	0.23	-0.13	-0.35	-0.24	0.91	0.34	0.2
el85snoPJFM	0.18	0.51	0.07	-0.25	-0.33	0.02	-0.21	-0.34	0.31	0.79	0.01	0.17	0.73	0.14	0.15	-0.29	-0.32	0.27	0.92	0.03
el85snoPAMJ	0.13	0.58	-0.27	-0.15	-0.63	-0.23	-0.26	-0.63	0.02	-0.21	0.82	0.2	0.28	0.79	-0.28	-0.13	-0.75	0.1	0.01	0.95
smlbOND	-0.22	0.29	-0.3	-0.31	0.02	-0.07	-0.16	0.21	0.1	0.08	-0.04	0.14	0.25	0.11	-0.32	-0.3	-0.08	-0.03	0.21	0.04
smlbJFM	-0.14	0.49	-0.3	-0.42	-0.13	-0.13	-0.3	0.04	0.27	0.24	0.04	0.26	0.42	0.18	-0.25	-0.41	-0.22	0.16	0.39	0.16
smlbAMJ	0.12	0.78	-0.27	-0.38	-0.36	-0.19	-0.37	-0.31	0.34	0.31	0.45	0.4	0.54	0.65	-0.22	-0.38	-0.46	0.31	0.48	0.51
SWEEst	0.03	0.71	-0.22	-0.55	-0.62	-0.22	-0.41	-0.52	0.66	0.71	0.29	0.48	0.68	0.32	-0.08	-0.61	-0.57	0.7	0.82	0.28
ETOND	0.16	-0.02	-0.06	0.32	-0.11	-0.27	0.15	-0.22	-0.16	-0.05	0.15	0.09	-0.32	0.23	-0.09	0.24	-0.13	-0.15	-0.1	0.12
ETJFM	-0.19	-0.54	0.06	0.74	0.49	0.2	0.91	0.46	-0.06	-0.56	-0.34	-0.07	-0.55	-0.19	-0.04	0.74	0.43	-0.12	-0.42	-0.24
ETAMJ	-0.33	-0.74	0.1	0.25	0.83	0.21	0.48	0.93	-0.24	-0.25	-0.68	-0.21	-0.42	-0.64	0.04	0.26	0.83	-0.21	-0.35	-0.76

	el85snoTOND	el85snoTJFM	el85snoTAMJ	el85snoPOND	el85snoPJFM	el85snoPAMJ	smlbOND	smlbJFM	smlbAMJ	SWEEst	ETOND	ETJFM	ETAMJ
Year	0.53	0.29	0.14	0.03	0.18	0.13	-0.22	-0.14	0.12	0.03	0.16	-0.19	-0.33
FTPKRO	-0.11	-0.47	-0.67	0.47	0.51	0.58	0.29	0.49	0.78	0.71	-0.02	-0.54	-0.74
el7snoTOND	0.94	0.4	0.46	-0.28	0.07	-0.27	-0.3	-0.3	-0.27	-0.22	-0.06	0.06	0.1
el7snoTJFM	0.33	0.9	0.47	-0.31	-0.25	-0.15	-0.31	-0.42	-0.38	-0.55	0.32	0.74	0.25
el7snoTAMJ	0.4	0.53	0.93	-0.29	-0.33	-0.63	0.02	-0.13	-0.36	-0.62	-0.11	0.49	0.83
el7hcnTOND	0.67	0.24	0.32	-0.29	0.02	-0.23	-0.07	-0.13	-0.19	-0.22	-0.27	0.2	0.21
el7hcnTJFM	0.12	0.73	0.45	-0.09	-0.21	-0.26	-0.16	-0.3	-0.37	-0.41	0.15	0.91	0.48
el7hcnTAMJ	0.08	0.25	0.76	-0.24	-0.34	-0.63	0.21	0.04	-0.31	-0.52	-0.22	0.46	0.93
el7snoPOND	-0.18	-0.38	-0.28	0.86	0.31	0.02	0.1	0.27	0.34	0.66	-0.16	-0.06	-0.24
el7snoPJFM	0.35	-0.5	-0.11	0.27	0.79	-0.21	0.08	0.24	0.31	0.71	-0.05	-0.56	-0.25
el7snoPAMJ	-0.22	-0.27	-0.66	0.26	0.01	0.82	-0.04	0.04	0.45	0.29	0.15	-0.34	-0.68
el7hcnPOND	-0.41	-0.29	-0.27	0.63	0.17	0.2	0.14	0.26	0.4	0.48	0.09	-0.07	-0.21
el7hcnPJFM	-0.03	-0.51	-0.5	0.22	0.73	0.28	0.25	0.42	0.54	0.68	-0.32	-0.55	-0.42
el7hcnPAMJ	-0.29	-0.16	-0.59	0.23	0.14	0.79	0.11	0.18	0.65	0.32	0.23	-0.19	-0.64
el785snoTOND	0.98	0.3	0.44	-0.13	0.15	-0.28	-0.32	-0.25	-0.22	-0.08	-0.09	-0.04	0.04
el785snoTJFM	0.34	0.98	0.47	-0.35	-0.29	-0.13	-0.3	-0.41	-0.38	-0.61	0.24	0.74	0.26
el785snoTAMJ	0.49	0.49	0.99	-0.24	-0.32	-0.75	-0.08	-0.22	-0.46	-0.57	-0.13	0.43	0.83
el785snoPOND	-0.15	-0.39	-0.22	0.91	0.27	0.1	-0.03	0.16	0.31	0.7	-0.15	-0.12	-0.21
el785snoPJFM	0.12	-0.47	-0.38	0.34	0.92	0.01	0.21	0.39	0.48	0.82	-0.1	-0.42	-0.35
el785snoPAMJ	-0.34	-0.16	-0.79	0.2	0.03	0.95	0.04	0.16	0.51	0.28	0.12	-0.24	-0.76
el85snoTOND	1	0.31	0.5	-0.2	0.09	-0.32	-0.28	-0.24	-0.26	-0.16	-0.15	-0.03	0.13
el85snoTJFM	0.31	1	0.46	-0.39	-0.36	-0.09	-0.29	-0.41	-0.4	-0.66	0.21	0.72	0.27
el85snoTAMJ	0.5	0.46	1	-0.27	-0.34	-0.78	-0.11	-0.25	-0.51	-0.58	-0.15	0.4	0.84
el85snoPOND	-0.2	-0.39	-0.27	1	0.25	0.11	0.11	0.26	0.33	0.66	-0.22	-0.1	-0.19
el85snoPJFM	0.09	-0.36	-0.34	0.25	1	0.01	0.22	0.41	0.54	0.8	0	-0.41	-0.38
el85snoPAMJ	-0.32	-0.09	-0.78	0.11	0.01	1	-0.01	0.06	0.45	0.21	0.12	-0.21	-0.76
smlbOND	-0.28	-0.29	-0.11	0.11	0.22	-0.01	1	0.95	0.71	0.15	-0.29	-0.05	0.08
smlbJFM	-0.24	-0.41	-0.25	0.26	0.41	0.06	0.95	1	0.83	0.39	-0.26	-0.22	-0.11
smlbAMJ	-0.26	-0.4	-0.51	0.33	0.54	0.45	0.71	0.83	1	0.58	-0.07	-0.36	-0.5
SWEEst	-0.16	-0.66	-0.58	0.66	0.8	0.21	0.15	0.39	0.58	1	-0.07	-0.52	-0.54
ETOND	-0.15	0.21	-0.15	-0.22	0	0.12	-0.29	-0.26	-0.07	-0.07	1	0.11	-0.29
ETJFM	-0.03	0.72	0.4	-0.1	-0.41	-0.21	-0.05	-0.22	-0.36	-0.52	0.11	1	0.48
ETAMJ	0.13	0.27	0.84	-0.19	-0.38	-0.76	0.08	-0.11	-0.5	-0.54	-0.29	0.48	1

Fort Peck Reservoir

Runoff
Cross Correlation Matrix



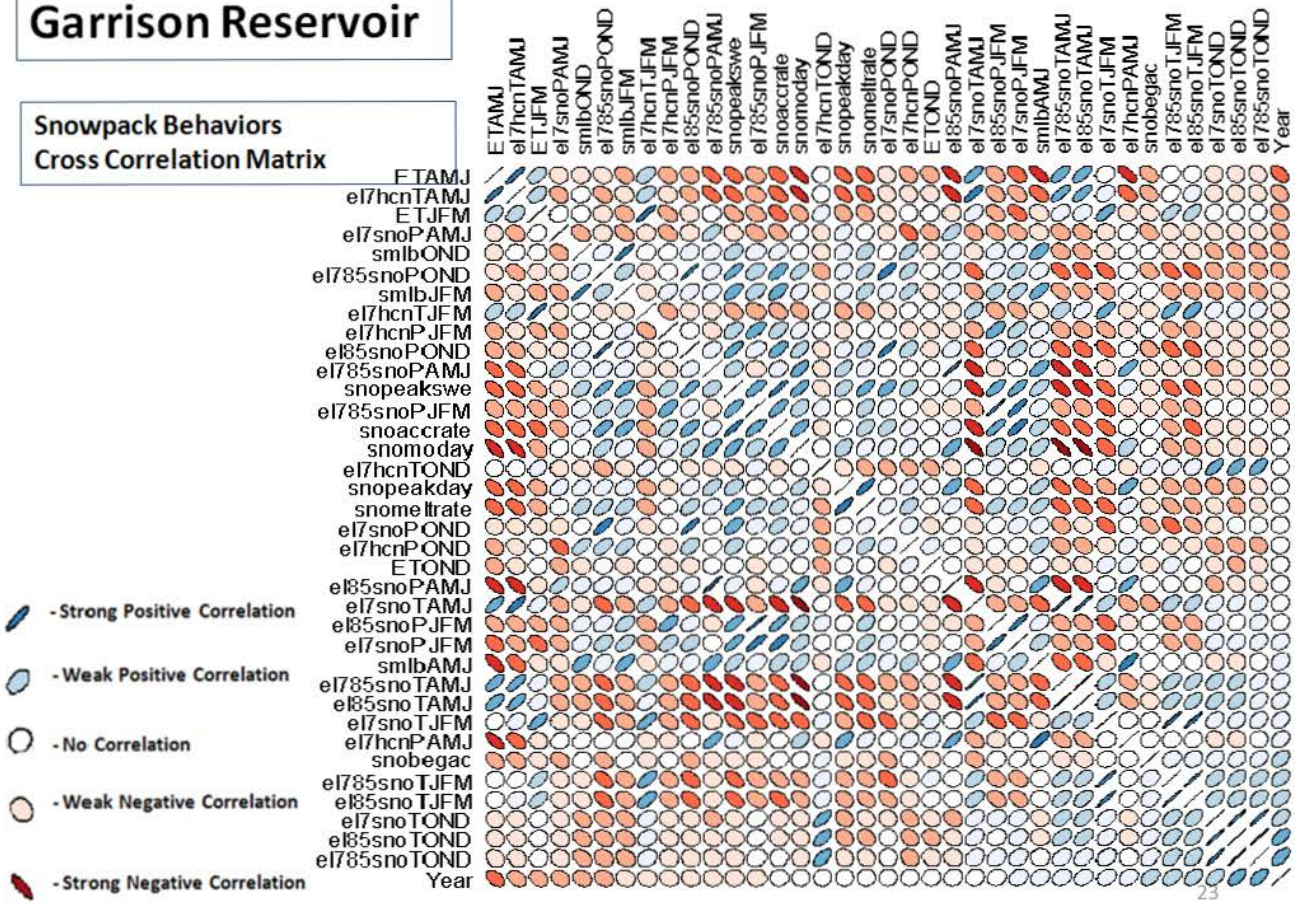
Garrison

	Year	GARRRO	snobegac	snoaccrate	snopeakswe	snopeakday	snomoday	snometrate	el7snoTOND	el7snoTJFM	el7snoTAMJ	el7hcnTOND	el7hcnTJFM	el7hcnTAMJ	el7snoPOND	el7snoPJFM	el7snoPAMJ	el7hcnPOND	el7hcnPJFM	el7hcnPAMJ
Year	1	0.3	0.42	0.01	-0.02	0.02	0.02	0.03	0.48	0.28	0.12	0.02	-0.12	-0.34	0.03	0.22	-0.23	0.03	-0.12	0.31
GARRRO	0.3	1	0.1	0.66	0.79	0.54	0.72	0.61	-0.05	-0.36	-0.61	-0.21	-0.39	-0.67	0.47	0.59	0	0.29	0.22	0.7
snobegac	0.42	0.1	1	0.15	-0.08	-0.02	0.15	-0.07	0.3	0.15	-0.21	0.36	-0.05	-0.34	-0.37	0.2	-0.29	0.09	0.02	0.11
snoaccrate	0.01	0.66	0.15	1	0.92	0.13	0.69	0.45	-0.05	-0.53	-0.61	-0.05	-0.32	-0.5	0.45	0.81	-0.31	0.3	0.48	0.04
snopeakswe	-0.02	0.79	-0.08	0.92	1	0.44	0.73	0.7	-0.15	-0.6	-0.65	-0.19	-0.35	-0.54	0.6	0.78	-0.14	0.4	0.41	0.25
snopeakday	0.02	0.54	-0.02	0.13	0.44	1	0.46	0.84	-0.22	-0.31	-0.56	-0.19	-0.21	-0.56	0.16	0.18	0.35	0.37	-0.05	0.61
snomoday	0.02	0.72	0.15	0.69	0.73	0.46	1	0.37	-0.11	-0.43	-0.84	0.04	-0.31	-0.76	0.37	0.45	0.17	0.3	0.35	0.43
snometrate	0.03	0.61	-0.07	0.45	0.7	0.84	0.37	1	-0.19	-0.43	-0.5	-0.31	-0.27	-0.49	0.38	0.5	0.06	0.46	0.05	0.37
el7snoTOND	0.48	-0.05	0.3	-0.05	-0.15	-0.22	-0.11	-0.19	1	0.34	0.34	0.7	0.26	-0.02	-0.07	0.23	-0.1	-0.26	-0.09	-0.09
el7snoTJFM	0.28	-0.36	0.15	-0.53	-0.6	-0.31	-0.43	-0.43	0.34	1	0.5	0.23	0.71	0.28	-0.46	-0.47	-0.01	-0.05	-0.37	0.1
el7snoTAMJ	0.12	-0.61	-0.21	-0.61	-0.65	-0.56	-0.84	-0.5	0.34	0.5	1	0.16	0.45	0.84	-0.19	-0.33	-0.27	-0.17	-0.23	-0.37
el7hcnTOND	0.02	-0.21	0.36	-0.05	-0.19	-0.19	0.04	-0.31	0.7	0.23	0.16	1	0.4	0.03	-0.21	0.1	-0.04	-0.26	0.18	-0.1
el7hcnTJFM	-0.12	-0.39	-0.05	-0.32	-0.35	-0.21	-0.31	-0.27	0.26	0.71	0.45	0.4	1	0.44	-0.13	-0.38	-0.02	0.1	-0.31	-0.09
el7hcnTAMJ	-0.34	-0.67	-0.34	-0.5	-0.54	-0.56	-0.76	-0.49	-0.02	0.28	0.84	0.03	0.44	1	-0.15	-0.38	-0.24	-0.16	-0.1	-0.47
el7snoPOND	0.03	0.47	-0.37	0.45	0.6	0.16	0.37	0.38	-0.07	-0.46	-0.19	-0.21	-0.13	-0.15	1	0.29	-0.02	0.27	0.04	0.06
el7snoPJFM	0.22	0.59	0.2	0.81	0.78	0.18	0.45	0.5	0.23	-0.47	-0.33	0.1	-0.38	-0.38	0.29	1	-0.31	0.15	0.49	0.05
el7snoPAMJ	-0.23	0	-0.29	-0.31	-0.14	0.35	0.17	0.06	-0.1	-0.01	-0.27	-0.04	-0.02	-0.24	-0.02	-0.31	1	-0.42	-0.31	0.15
el7hcnPOND	0.03	0.29	0.09	0.3	0.4	0.37	0.3	0.46	-0.26	-0.05	-0.17	-0.26	0.1	-0.16	0.27	0.15	-0.42	1	-0.05	0.21
el7hcnPJFM	-0.12	0.22	0.02	0.48	0.41	-0.05	0.35	0.05	-0.09	-0.37	-0.23	0.18	-0.31	-0.1	0.04	0.49	-0.31	-0.05	1	-0.01
el7hcnPAMJ	0.31	0.7	0.11	0.04	0.25	0.61	0.43	0.37	-0.09	0.1	-0.37	-0.1	-0.09	-0.47	0.06	0.05	0.15	0.21	-0.01	1
el785snoTOND	0.63	0.1	0.36	0.03	-0.07	-0.18	-0.01	-0.15	0.97	0.33	0.25	0.62	0.2	-0.14	0.02	0.28	-0.14	-0.22	-0.07	0.03
el785snoTJFM	0.43	-0.24	0.26	-0.4	-0.49	-0.28	-0.32	-0.38	0.45	0.96	0.45	0.28	0.66	0.19	-0.4	-0.3	-0.09	-0.02	-0.22	0.13
el785snoTAMJ	0.24	-0.6	-0.11	-0.59	-0.66	-0.58	-0.85	-0.51	0.43	0.49	0.98	0.18	0.4	0.76	-0.2	-0.28	-0.25	-0.27	-0.23	-0.39
el785snoPOND	-0.21	0.51	-0.28	0.66	0.79	0.32	0.56	0.56	-0.26	-0.52	-0.45	-0.23	-0.04	-0.32	0.81	0.41	-0.05	0.51	0.08	0.07
el785snoPJFM	-0.01	0.4	-0.05	0.77	0.75	0.14	0.42	0.44	0.14	-0.46	-0.33	0.2	-0.26	-0.27	0.25	0.87	-0.31	0.09	0.66	-0.05
el785snoPAMJ	-0.05	0.66	-0.07	0.24	0.4	0.55	0.69	0.31	-0.24	-0.04	-0.64	-0.1	-0.06	-0.59	0.19	0.03	0.56	0.1	-0.09	0.7
el85snoTOND	0.6	0.04	0.32	-0.03	-0.14	-0.23	-0.09	-0.21	0.97	0.33	0.34	0.63	0.21	-0.05	0	0.24	-0.12	-0.26	-0.09	-0.02
el85snoTJFM	0.43	-0.26	0.2	-0.47	-0.52	-0.27	-0.35	-0.38	0.43	0.96	0.48	0.24	0.6	0.2	-0.39	-0.34	-0.04	-0.02	-0.23	0.15
el85snoTAMJ	0.27	-0.57	-0.12	-0.58	-0.63	-0.55	-0.84	-0.46	0.46	0.47	0.97	0.18	0.37	0.73	-0.16	-0.25	-0.24	-0.27	-0.25	-0.38
el85snoPOND	-0.05	0.55	-0.21	0.66	0.77	0.27	0.56	0.52	-0.12	-0.51	-0.42	-0.19	-0.1	-0.35	0.9	0.45	0	0.43	0.04	0.07
el85snoPJFM	0.12	0.44	0.11	0.78	0.73	0.12	0.44	0.41	0.22	-0.41	-0.32	0.24	-0.27	-0.34	0.18	0.92	-0.37	0.11	0.62	-0.02
el85snoPAMJ	0.1	0.7	0.03	0.22	0.39	0.61	0.66	0.39	-0.21	0.03	-0.64	-0.16	-0.08	-0.67	0.19	0.03	0.53	0.15	-0.11	0.76
smlbOND	-0.23	0.32	0.1	0.36	0.41	0.27	0.15	0.41	-0.35	-0.11	-0.12	-0.1	0.11	0.08	0.14	0.27	-0.3	0.59	0.11	0.18
smlbJFM	-0.14	0.54	0.16	0.63	0.65	0.25	0.36	0.48	-0.3	-0.29	-0.3	-0.15	-0.14	-0.13	0.26	0.53	-0.38	0.56	0.36	0.19
smlbAMJ	0.22	0.83	0.14	0.44	0.59	0.55	0.54	0.55	-0.1	-0.05	-0.41	-0.04	-0.14	-0.45	0.22	0.42	-0.14	0.44	0.28	0.8
ETOND	0	-0.08	0.32	0.04	-0.13	-0.31	0.06	-0.37	0.72	0.11	0.1	0.87	0.25	-0.01	-0.08	0.15	0.11	-0.49	0.1	-0.14
ETJFM	-0.24	-0.41	-0.18	-0.39	-0.38	-0.25	-0.33	-0.31	0.14	0.72	0.4	0.32	0.92	0.41	-0.09	-0.46	0.09	0.03	-0.38	-0.06
ETAMJ	-0.45	-0.76	-0.38	-0.47	-0.53	-0.56	-0.76	-0.47	-0.06	0.16	0.75	0.03	0.44	0.92	-0.09	-0.39	-0.1	-0.23	-0.21	-0.66
SWEest	-0.02	0.79	-0.08	0.92	1	0.44	0.73	0.7	-0.15	-0.6	-0.65	-0.19	-0.35	-0.54	0.6	0.78	-0.14	0.4	0.41	0.25

	el785snoTOND	el785snoTJFM	el785snoTAMJ	el785snoPOND	el785snoPJFM	el785snoPAMJ	el85snoTOND	el85snoTJFM	el85snoTAMJ	el85snoPOND	el85snoPJFM	el85snoPAMJ	smlbOND	smlbJFM	smlbAMJ	ETOND	ETJFM	ETAMJ	SWEest
Year	0.63	0.43	0.24	-0.21	-0.01	-0.05	0.6	0.43	0.27	-0.05	0.12	0.1	-0.23	-0.14	0.22	0	-0.24	-0.45	-0.02
GARRRO	0.1	-0.24	-0.6	0.51	0.4	0.66	0.04	-0.26	-0.57	0.55	0.44	0.7	0.32	0.54	0.83	-0.08	-0.41	-0.76	0.79
snobegac	0.36	0.26	-0.11	-0.28	-0.05	-0.07	0.32	0.2	-0.12	-0.21	0.11	0.03	0.1	0.16	0.14	0.32	-0.18	-0.38	-0.08
snoaccrate	0.03	-0.4	-0.59	0.66	0.77	0.24	-0.03	-0.47	-0.58	0.66	0.78	0.22	0.36	0.63	0.44	0.04	-0.39	-0.47	0.92
snopeakswe	-0.07	-0.49	-0.66	0.79	0.75	0.4	-0.14	-0.52	-0.63	0.77	0.73	0.39	0.41	0.65	0.59	-0.13	-0.38	-0.53	1
snopeakday	-0.18	-0.28	-0.58	0.32	0.14	0.55	-0.23	-0.27	-0.55	0.27	0.12	0.61	0.27	0.25	0.55	-0.31	-0.25	-0.56	0.44
snomoday	-0.01	-0.32	-0.85	0.56	0.42	0.69	-0.09	-0.35	-0.84	0.56	0.44	0.66	0.15	0.36	0.54	0.06	-0.33	-0.76	0.73
snomeltrate	-0.15	-0.38	-0.51	0.56	0.44	0.31	-0.21	-0.38	-0.46	0.52	0.41	0.39	0.41	0.48	0.55	-0.37	-0.31	-0.47	0.7
el7snoTOND	0.97	0.45	0.43	-0.26	0.14	-0.24	0.97	0.43	0.46	-0.12	0.22	-0.21	-0.35	-0.3	-0.1	0.72	0.14	-0.06	-0.15
el7snoTJFM	0.33	0.96	0.49	-0.52	-0.46	-0.04	0.33	0.96	0.47	-0.51	-0.41	0.03	-0.11	-0.29	-0.05	0.11	0.72	0.16	-0.6
el7snoTAMJ	0.25	0.45	0.98	-0.45	-0.33	-0.64	0.34	0.48	0.97	-0.42	-0.32	-0.64	-0.12	-0.3	-0.41	0.1	0.4	0.75	-0.65
el7hcnTOND	0.62	0.28	0.18	-0.23	0.2	-0.1	0.63	0.24	0.18	-0.19	0.24	-0.16	-0.1	-0.15	-0.04	0.87	0.32	0.03	-0.19
el7hcnTJFM	0.2	0.66	0.4	-0.04	-0.26	-0.06	0.21	0.6	0.37	-0.1	-0.27	-0.08	0.11	-0.14	-0.14	0.25	0.92	0.44	-0.35
el7hcnTAMJ	-0.14	0.19	0.76	-0.32	-0.27	-0.59	-0.05	0.2	0.73	-0.35	-0.34	-0.67	0.08	-0.13	-0.45	-0.01	0.41	0.92	-0.54
el7snoPOND	0.02	-0.4	-0.2	0.81	0.25	0.19	0	-0.39	-0.16	0.9	0.18	0.19	0.14	0.26	0.22	-0.08	-0.09	-0.09	0.6
el7snoPJFM	0.28	-0.3	-0.28	0.41	0.87	0.03	0.24	-0.34	-0.25	0.45	0.92	0.03	0.27	0.53	0.42	0.15	-0.46	-0.39	0.78
el7snoPAMJ	-0.14	-0.09	-0.25	-0.05	-0.31	0.56	-0.12	-0.04	-0.24	0	-0.37	0.53	-0.3	-0.38	-0.14	0.11	0.09	-0.1	-0.14
el7hcnPOND	-0.22	-0.02	-0.27	0.51	0.09	0.1	-0.26	-0.02	-0.27	0.43	0.11	0.15	0.59	0.56	0.44	-0.49	0.03	-0.23	0.4
el7hcnPJFM	-0.07	-0.22	-0.23	0.08	0.66	-0.09	-0.09	-0.23	-0.25	0.04	0.62	-0.11	0.11	0.36	0.28	0.1	-0.38	-0.21	0.41
el7hcnPAMJ	0.03	0.13	-0.39	0.07	-0.05	0.7	-0.02	0.15	-0.38	0.07	-0.02	0.76	0.18	0.19	0.8	-0.14	-0.06	-0.66	0.25
el785snoTOND	1	0.47	0.37	-0.21	0.14	-0.15	0.99	0.45	0.39	-0.05	0.24	-0.1	-0.35	-0.25	0.01	0.67	0.09	-0.19	-0.07
el785snoTJFM	0.47	1	0.48	-0.5	-0.33	-0.07	0.46	0.98	0.45	-0.45	-0.26	0.02	-0.12	-0.22	0.02	0.16	0.61	0.04	-0.49
el785snoTAMJ	0.37	0.48	1	-0.51	-0.32	-0.68	0.45	0.5	1	-0.44	-0.29	-0.66	-0.23	-0.37	-0.46	0.17	0.34	0.7	-0.66
el785snoPOND	-0.21	-0.5	-0.51	1	0.41	0.31	-0.26	-0.51	-0.48	0.96	0.35	0.28	0.31	0.41	0.3	-0.18	-0.03	-0.19	0.79
el785snoPJFM	0.14	-0.33	-0.32	0.41	1	-0.03	0.1	-0.38	-0.29	0.39	0.98	-0.07	0.22	0.44	0.33	0.12	-0.31	-0.29	0.75
el785snoPAMJ	-0.15	-0.07	-0.68	0.31	-0.03	1	-0.19	-0.05	-0.67	0.3	-0.03	0.97	0.21	0.23	0.62	-0.02	0.03	-0.6	0.4
el85snoTOND	0.99	0.46	0.45	-0.26	0.1	-0.19	1	0.44	0.47	-0.09	0.19	-0.16	-0.36	-0.27	-0.05	0.69	0.09	-0.1	-0.14
el85snoTJFM	0.45	0.98	0.5	-0.51	-0.38	-0.05	0.44	1	0.49	-0.45	-0.32	0.04	-0.16	-0.26	0.02	0.13	0.59	0.04	-0.52
el85snoTAMJ	0.39	0.45	1	-0.48	-0.29	-0.67	0.47	0.49	1	-0.4	-0.27	-0.65	-0.23	-0.37	-0.44	0.17	0.32	0.68	-0.63
el85snoPOND	-0.05	-0.45	-0.44	0.96	0.39	0.3	-0.09	-0.45	-0.4	1	0.34	0.3	0.23	0.37	0.28	-0.08	-0.08	-0.24	0.77
el85snoPJFM	0.24	-0.26	-0.29	0.35	0.98	-0.03	0.19	-0.32	-0.27	0.34	1	-0.06	0.22	0.45	0.36	0.16	-0.35	-0.36	0.73
el85snoPAMJ	-0.1	0.02	-0.66	0.28	-0.07	0.97	-0.16	0.04	-0.65	0.3	-0.06	1	0.2	0.24	0.67	-0.08	0	-0.69	0.39
smlbOND	-0.35	-0.12	-0.23	0.31	0.22	0.21	-0.36	-0.16	-0.23	0.23	0.22	0.2	1	0.91	0.59	-0.22	0.05	-0.01	0.41
smlbJFM	-0.25	-0.22	-0.37	0.41	0.44	0.23	-0.27	-0.26	-0.37	0.37	0.45	0.24	0.91	1	0.68	-0.17	-0.2	-0.22	0.65
smlbAMJ	0.01	0.02	-0.46	0.3	0.33	0.62	-0.05	0.02	-0.44	0.28	0.36	0.67	0.59	0.68	1	-0.12	-0.15	-0.65	0.59
ETOND	0.67	0.16	0.17	-0.18	0.12	-0.02	0.69	0.13	0.17	-0.08	0.16	-0.08	-0.22	-0.17	-0.12	1	0.21	0.05	-0.13
ETJFM	0.09	0.61	0.34	-0.03	-0.31	0.03	0.09	0.59	0.32	-0.08	-0.35	0	0.05	-0.2	-0.15	0.21	1	0.44	-0.38
ETAMJ	-0.19	0.04	0.7	-0.19	-0.29	-0.6	-0.1	0.04	0.68	-0.24	-0.36	-0.69	-0.01	-0.22	-0.65	0.05	0.44	1	-0.53
SWEest	-0.07	-0.49	-0.66	0.79	0.75	0.4	-0.14	-0.52	-0.63	0.77	0.73	0.39	0.41	0.65	0.59	-0.13	-0.38	-0.53	1

Garrison Reservoir

Snowpack Behaviors Cross Correlation Matrix



Appendix D – "R"- Statistics Program

Fort Peck-

Input File: (ftpk2.r)

```
# Read Data:
dataset=read.table("ftpk-ex.txt",header=TRUE)
#
summary (dataset)
#
# Determine Cross-Correlations:
x=round(cor(dataset),2)
# x
write.table(x,file="outfile")
#
#library(package="ellipse")
#corr.dataset=cor(dataset)
#ord=order(corr.dataset[1,])
#xc=corr.dataset[ord, ord]
#colors=c("#A50F15","#DE2D26","#FB6A4A","#FCAE91","#FEE5D9","white",
#  "#EFF3FF","#BDD7E7","#6BAED6","#3182BD","#08519C")
#PLOTCORR(SC,COL=COLORS[5*SC +6])
#
#
#
# ***********************************************************************
# Determine Multiple Linear Regression for Peak SWE:
y2=lm(snopeakswe~el785snoPJFM+el85snoPJFM+el7snoPJFM+el785snoPOND+el85snoTJFM+el85snoPOND+el7snoTAMJ,data=dataset)
y2aic=step(y2,direction="both")
summary(y2aic)
coefficients(y2aic)
#
y2fit=fitted(y2aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snopeakswe,round(y2fit,2)),file="outfile1")
#
#
# Read in future values of drivers and predict future SWE: (using CCSM3)
#
datasetz=read.table("ftpk-fut.txt",header=TRUE)
z=predict(y2aic,newdata=datasetz,interval="prediction")
write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(cbind(datasetz$Year,z),file="f-swe-ccsm3.out")
#
# Read in future values of drivers and predict future SWE: (using CCSM4)
#
datasetz=read.table("ftpk-fut2.txt",header=TRUE)
z=predict(y2aic,newdata=datasetz,interval="prediction")
write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
write.table(cbind(datasetz$Year,z),file="f-swe-ccsm4.out")
#
# Read in values of drivers (from CCSM4 2001-2011)and predict future SWE: (using CCSM4)
#
datasetz=read.table("f-2002-11-ccsm4.txt",header=TRUE)
z=predict(y2aic,newdata=datasetz,interval="prediction")
write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
write.table(z,file="out02-11")
#
# ***********************************************************************
#
# Determine MLR for Day Begins Accumulations
#
# summary(y2)
#
y3=lm(snobegac~ETJFM+el85snoTJFM+el785snoPOND+el785snoTJFM+el7snoTJFM+el7hcnPJFM+el785snoPJFM,data=dataset)
y3aic=step(y3,direction="both")
summary(y3aic)
coefficients(y3aic)
#
y3fit=fitted(y3aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snobegac,round(y3fit,3)),file="outfile2")
#
#
# Read in future values of drivers and predict future day acc: (using CCSM3)
#
datasetz=read.table("ftpk-fut.txt",header=TRUE)
```

```
z=predict(y3aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(cbind(datasetz$Y,z),file="f-dba-ccsm3.out")
#
# Read in future values of drivers and predict future day acc: (using CCSM4)
#
datasetz=read.table("ftpk-fut2.txt",header=TRUE)
z=predict(y3aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(cbind(datasetz$Year,z),file="f-dba-ccsm4.out")
#
#
#
#*********************************************************************
#
#
# Determine Multiple Linear Regression for Peak Day:
#
y3=lm(snopeakday~ETJFM+el7snoTJFM+el7hcnTJFM+el785snoTJFM+el85snoTJFM+el7hcnPJFM+el85snoPOND,data=dataset)
# y3=lm(dataset$snopeakday~dataset$el7snoTJFM+dataset$el7hcnTJFM+dataset$el85snoTJFM)
#
y3aic=step(y3,direction="both")
summary(y3aic)
#
y3fit=fitted(y3aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snopeakday,round(y3fit,3)),file="outfile3")
#
# Read in future values of drivers and predict future peak day : (using CCSM3)
#
datasetz=read.table("ftpkoo.txt",header=TRUE)
z=predict(y3aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(cbind(datasetz$Year,z),file="f-pd-ccsm3.out")
#
#
# Read in future values of drivers and predict future peak day : (using CCSM4)
#
datasetz=read.table("ftpk-fut20.txt",header=TRUE)
z=predict(y3aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(cbind(datasetz$Year,z),file="f-pd-ccsm4.out")
#

#
# ********************************************************************
#
# Determine MLR for Accumulation Rate
#
#
#
y4=lm(snoaccrate~el785snoPOND+el85snoPJFM+el785snoPJFM+el7snoPJFM+el7snoPOND+el85snoPOND+el7snoTAMJ,data=dataset)
y4aic=step(y4,direction="both")
summary(y4aic)
#
y4fit=fitted(y4aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snoaccrate,round(y4fit,2)),file="outfile4")
#
#
#
# Read in future values of drivers and predict future peak day : (using CCSM3)
#
datasetz=read.table("ftpkoo.txt",header=TRUE)
z=predict(y4aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(z,file="outaccrate")
#
#

#*********************************************************************
#
# Determine MLR for Melt-Rate
#
#
#
y7=lm(snomeltrate~el785snoPOND+el85snoPOND+el7hcnPOND+el85snoTJFM+el785snoPJFM+el7hcnPJFM+el85snoPJFM,data=dataset)
y7aic=step(y7,direction="both")
summary(y7aic)
#
y7fit=fitted(y7aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snomeltrate,round(y7fit,2)),file="outfile7")
#
#
#
# Read in future values of drivers and predict future peak day : (using CCSM3)
```

```
#
datasetz=read.table("ftpkoo.txt",header=TRUE)
z=predict(y7aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
# write.table(z,file="outmeltrate")
write.table(cbind(datasetz$Year,z),file="f-mr-ccsm3.out")
#
#
# Read in future values of drivers and predict future peak day : (using CCSM4)
#
datasetz=read.table("ftpk-fut2.txt",header=TRUE)
z=predict(y7aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
# write.table(z,file="outmeltrate")
write.table(cbind(datasetz$Year,z),file="f-mr-ccsm4.out")
#

#*************************************************************************
#
#
#
# Determine MLR for Melt-out Day
#
#
#
y5=lm(dataset$snomoday~dataset$ETAMJ+dataset$el7snoTAMJ+dataset$el7hcnTAMJ+dataset$el785snoTAMJ+dataset$el85snoTAMJ+dataset$el7snoPAMJ+dataset$el785s
noPAMJ)
y5aic=step(y5,direction="both")
summary(y5aic)
#
y5fit=fitted(y5aic)

# "Step" gave 2 similiar parameters:  el7snoPAMJ and el785snoPAMJ
#  Forcing results to only include el7snoPAMJ
y5aic=lm(snomoday~el85snoTAMJ+ETAMJ+el7snoPAMJ,data=dataset)
summary(y5aic)
#
#
y5fit=fitted(y5aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snomoday,round(y5fit,2)),file="outfile5")
#
#
#
#
# Read in future values of drivers and predict future peak day : (using CCSM3)
#
datasetz=read.table("ftpkoo.txt",header=TRUE)
z=predict(y5aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(cbind(datasetz$Year,z),file="f-mo-ccsm3.out")
#
# Read in future values of drivers and predict future peak day : (using CCSM4)
#
datasetz=read.table("ftpk-fut20.txt",header=TRUE)
z=predict(y5aic,newdata=datasetz,interval="prediction")
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
write.table(cbind(datasetz$Year,z),file="of-mo-ccsm4.out")


#*************************************************************************
#
# Determine Multiple Linear Regression for Runoff:
dataset2=read.table("ftpk-ex2.txt",header=TRUE)
x=round(cor(dataset2),2)
x
write.table(x,file="outro")

#
y=lm(FTPKRO~el7snoPAMJ+ETAMJ+el7hcnPAMJ+el785snoPAMJ+el85snoTAMJ+el7snoTAMJ+el7hcnTAMJ+SWEEst,data=dataset2)
# y=lm(dataset2$FTPKRO~dataset2$ETAMJ+dataset2$el7snoPAMJ+dataset2$el85snoTAMJ+dataset2$SWEEst)
yaic=step(y)
#
summary(yaic)
yaicfit=fitted(yaic)
# summary (y)
# yfit=fitted(y)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset2$FTPKRO,round(yaicfit,0)),file="outfile6")
#
#
# Problem using above regression ... for forecasting ... occasionally give
#    negative inflows.  To get around this, work in log domain:
#
dataset2$SWEEst.log=log(dataset2$SWEEst)
dataset2$el7snoPAMJ.log=log(dataset2$el7snoPAMJ)
dataset2$FTPKRO.log=log(dataset2$FTPKRO)
```

```
#
y=lm(FTPKRO.log~SWEEst.log+el7snoPAMJ.log,data=dataset2)
summary(y)
yfit.log=fitted(y)
yfit=2.71^yfit.log
write.table(cbind(dataset2$FTPKRO,round(yfit,0)),file="outro-ex")
#
#
# Read in future values of drivers and predict future Runoff (CCSM3):
#
datasetz=read.table("ftpk-fut-ro.txt",header=TRUE)
# Work in log-domain to determine FTPKRO
datasetz$SWEEst.log=log(datasetz$SWEEst)
datasetz$el7snoPAMJ.log=log(datasetz$el7snoPAMJ)
#
z=predict(y,newdata=datasetz,interval="prediction")
z2=2.71^z
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
write.table(cbind(datasetz$Year,z2),file="f-ro-ccsm3.out")
#
# Read in future values of drivers and predict future Runoff (ccsm4):
#
datasetz=read.table("ro.txt",header=TRUE)
# Work in log-domain to determine FTPKRO
datasetz$SWEEst.log=log(datasetz$SWEEst)
datasetz$el7snoPAMJ.log=log(datasetz$el7snoPAMJ)
#
z=predict(y,newdata=datasetz,interval="prediction")
z2=2.71^z
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
write.table(cbind(datasetz$Year,z2),file="f-ro-ccsm4.out")
# write.table(z2,file="outRO-fut2")
#
# end
```

“R”-Statistics

Fort Peck-

Output File:

```
R version 2.14.0 (2011-10-31)
Copyright (C) 2011 The R Foundation for Statistical Computing
ISBN 3-900051-07-0
Platform: i386-pc-mingw32/i386 (32-bit)

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[Previously saved workspace restored]

> # Read Data:
> dataset=read.table("ftpk-ex.txt",header=TRUE)
> #
> summary (dataset)
      Year         snobegac       snoaccrate      snopeakswe      snopeakday
 Min.   :1992   Min.   :260.0   Min.   :0.070   Min.   :13.60   Min.   : 78.0
 1st Qu.:1997   1st Qu.:271.2   1st Qu.:0.080   1st Qu.:14.97   1st Qu.: 99.5
 Median :2002   Median :275.0   Median :0.090   Median :17.20   Median :110.0
 Mean   :2002   Mean   :276.4   Mean   :0.092   Mean   :18.19   Mean   :108.5
 3rd Qu.:2006   3rd Qu.:283.2   3rd Qu.:0.100   3rd Qu.:20.65   3rd Qu.:120.2
 Max.   :2011   Max.   :301.0   Max.   :0.140   Max.   :27.40   Max.   :128.0
    snomoday      snomeltrate       el7snoTOND       el7snoTJFM
 Min.   :171.0   Min.   :0.1400   Min.   :24.30   Min.   :17.30
 1st Qu.:180.8   1st Qu.:0.1875   1st Qu.:26.38   1st Qu.:22.60
 Median :188.5   Median :0.2000   Median :29.35   Median :24.55
 Mean   :189.2   Mean   :0.2280   Mean   :28.48   Mean   :24.18
 3rd Qu.:197.5   3rd Qu.:0.2825   3rd Qu.:29.93   3rd Qu.:26.40
 Max.   :213.0   Max.   :0.3600   Max.   :33.90   Max.   :28.30
   el7snoTAMJ      el7hcnTOND      el7hcnTJFM      el7hcnTAMJ
 Min.   :39.10   Min.   :27.60   Min.   :20.50   Min.   :47.40
 1st Qu.:40.75   1st Qu.:32.15   1st Qu.:25.77   1st Qu.:48.88
 Median :41.85   Median :33.10   Median :27.00   Median :50.10
 Mean   :42.02   Mean   :32.75   Mean   :26.75   Mean   :50.40
 3rd Qu.:43.15   3rd Qu.:33.67   3rd Qu.:28.00   3rd Qu.:51.73
 Max.   :45.80   Max.   :38.80   Max.   :34.10   Max.   :53.80
   el7snoPOND       el7snoPJFM       el7snoPAMJ       el7hcnPOND
 Min.   : 5.920   Min.   : 4.900   Min.   : 8.17   Min.   :1.050
 1st Qu.: 7.790   1st Qu.: 7.548   1st Qu.: 9.34   1st Qu.:1.820
 Median :10.045   Median : 9.080   Median :10.41   Median :2.315
 Mean   : 9.873   Mean   : 9.258   Mean   :11.12   Mean   :2.220
 3rd Qu.:10.725   3rd Qu.:11.405   3rd Qu.:12.66   3rd Qu.:2.645
 Max.   :14.950   Max.   :12.660   Max.   :16.41   Max.   :3.240
   el7hcnPJFM      el7hcnPAMJ     el785snoTOND    el785snoTJFM
 Min.   :0.970   Min.   :4.750   Min.   :21.40   Min.   :17.30
 1st Qu.:1.410   1st Qu.:5.915   1st Qu.:24.12   1st Qu.:20.38
 Median :1.665   Median :6.515   Median :26.30   Median :21.95
 Mean   :1.643   Mean   :6.617   Mean   :26.02   Mean   :21.80
 3rd Qu.:1.938   3rd Qu.:7.357   3rd Qu.:27.82   3rd Qu.:23.73
 Max.   :2.140   Max.   :8.980   Max.   :31.60   Max.   :24.90
  el785snoTAMJ    el785snoPOND     el785snoPJFM     el785snoPAMJ
 Min.   :35.60   Min.   : 5.400   Min.   : 5.270   Min.   : 8.03
 1st Qu.:37.67   1st Qu.: 7.470   1st Qu.: 7.440   1st Qu.: 9.97
 Median :39.50   Median : 9.620   Median : 9.475   Median :10.89
 Mean   :39.49   Mean   : 9.159   Mean   : 8.790   Mean   :11.50
 3rd Qu.:40.73   3rd Qu.:10.777   3rd Qu.:10.617   3rd Qu.:13.46
 Max.   :43.40   Max.   :13.500   Max.   :11.330   Max.   :15.75
  el85snoTOND     el85snoTJFM     el85snoTAMJ     el85snoPOND
 Min.   :19.70   Min.   :16.80   Min.   :33.40   Min.   : 5.060
 1st Qu.:22.90   1st Qu.:18.85   1st Qu.:35.60   1st Qu.: 7.457
 Median :24.75   Median :20.75   Median :37.70   Median : 8.985
 Mean   :24.77   Mean   :20.41   Mean   :37.48   Mean   : 9.062
 3rd Qu.:26.85   3rd Qu.:22.25   3rd Qu.:39.05   3rd Qu.:10.450
 Max.   :30.60   Max.   :23.60   Max.   :41.60   Max.   :13.010
  el85snoPJFM      el85snoPAMJ        smlbOND          smlbJFM
```

```
 Min.   : 4.500   Min.   : 8.000   Min.   : 5.370   Min.   :5.220
 1st Qu.: 6.923   1st Qu.: 9.768   1st Qu.: 7.058   1st Qu.:6.607
 Median : 8.795   Median :11.080   Median : 7.350   Median :7.015
 Mean   : 8.551   Mean   :11.584   Mean   : 7.519   Mean   :7.184
 3rd Qu.: 9.985   3rd Qu.:13.980   3rd Qu.: 7.933   3rd Qu.:7.620
 Max.   :12.930   Max.   :15.740   Max.   :10.870   Max.   :9.520
    smlbAMJ          ETOND           ETJFM           ETAMJ
 Min.   : 6.150   Min.   :2.790   Min.   :2.610   Min.   :12.21
 1st Qu.: 7.878   1st Qu.:3.235   1st Qu.:3.212   1st Qu.:13.41
 Median : 8.600   Median :3.325   Median :3.340   Median :13.63
 Mean   : 8.452   Mean   :3.342   Mean   :3.373   Mean   :13.86
 3rd Qu.: 9.130   3rd Qu.:3.487   3rd Qu.:3.643   3rd Qu.:14.61
 Max.   :11.370   Max.   :3.960   Max.   :4.510   Max.   :15.64
> #
> # Determine Cross-Correlations:
> x=round(cor(dataset),2)
> # x
> write.table(x,file="outfile")
> #
> #library(package="ellipse")
> #corr.dataset=cor(dataset)
> #ord=order(corr.dataset[1,])
> #xc=corr.dataset[ord, ord]
> #colors=c("#A50F15","#DE2D26","#FB6A4A","#FCAE91","#FEE5D9","white",
> #  "#EFF3FF","#BDD7E7","#6BAED6","#3182BD","#08519C")
> #PLOTCORR(SC,COL=COLORS[5*SC +6])
> #
> #
> #
> # ***********************************************************************
> # Determine Multiple Linear Regression for Peak SWE:
> y2=lm(snopeakswe~el785snoPJFM+el85snoPJFM+el7snoPJFM+el785snoPOND+el85snoTJFM+el85snoPOND+el7snoTAMJ,data=dataset)
> y2aic=step(y2,direction="both")
Start:  AIC=22.49
snopeakswe ~ el785snoPJFM + el85snoPJFM + el7snoPJFM + el785snoPOND +
    el85snoTJFM + el85snoPOND + el7snoTAMJ

               Df Sum of Sq    RSS    AIC
- el85snoPOND   1    0.0081 27.668 20.491
- el785snoPJFM  1    0.1755 27.836 20.612
- el7snoPJFM    1    0.4588 28.119 20.814
<none>                      27.660 22.485
- el85snoTJFM   1    3.7391 31.399 23.021
- el785snoPOND  1    8.4872 36.148 25.837
- el7snoTAMJ    1   10.6693 38.330 27.010
- el85snoPJFM   1   10.6950 38.355 27.023

Step:  AIC=20.49
snopeakswe ~ el785snoPJFM + el85snoPJFM + el7snoPJFM + el785snoPOND +
    el85snoTJFM + el7snoTAMJ

               Df Sum of Sq    RSS    AIC
- el785snoPJFM  1     0.193 27.861 18.630
- el7snoPJFM    1     0.476 28.145 18.833
<none>                      27.668 20.491
- el85snoTJFM   1     3.731 31.399 21.021
+ el85snoPOND   1     0.008 27.660 22.485
- el7snoTAMJ    1    10.689 38.358 25.024
- el85snoPJFM   1    10.911 38.579 25.140
- el785snoPOND  1    38.713 66.382 35.994

Step:  AIC=18.63
snopeakswe ~ el85snoPJFM + el7snoPJFM + el785snoPOND + el85snoTJFM +
    el7snoTAMJ

               Df Sum of Sq    RSS    AIC
- el7snoPJFM    1     0.364 28.225 16.890
<none>                      27.861 18.630
- el85snoTJFM   1     3.544 31.405 19.025
+ el785snoPJFM  1     0.193 27.668 20.491
+ el85snoPOND   1     0.025 27.836 20.612
- el7snoTAMJ    1    10.549 38.410 23.052
- el85snoPJFM   1    24.056 51.917 29.078
- el785snoPOND  1    38.728 66.589 34.056

Step:  AIC=16.89
snopeakswe ~ el85snoPJFM + el785snoPOND + el85snoTJFM + el7snoTAMJ

               Df Sum of Sq    RSS    AIC
<none>                      28.225 16.890
- el85snoTJFM   1     5.304 33.529 18.334
+ el7snoPJFM    1     0.364 27.861 18.630
+ el785snoPJFM  1     0.080 28.145 18.833
+ el85snoPOND   1     0.039 28.186 18.862
- el7snoTAMJ    1    10.191 38.416 21.055
- el785snoPOND  1    39.258 67.483 32.323
- el85snoPJFM   1    67.174 95.399 39.247
```

```
> summary(y2aic)

Call:
lm(formula = snopeakswe ~ el85snoPJFM + el785snoPOND + el85snoTJFM +
    el7snoTAMJ, data = dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-2.1436 -0.6628 -0.3401  0.7754  2.6593

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   30.8034     8.8472   3.482  0.00335 **
el85snoPJFM    0.9070     0.1518   5.975 2.55e-05 ***
el785snoPOND   0.7482     0.1638   4.568  0.00037 ***
el85snoTJFM   -0.3124     0.1860  -1.679  0.11387
el7snoTAMJ    -0.4961     0.2132  -2.327  0.03437 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.372 on 15 degrees of freedom
Multiple R-squared: 0.9047,   Adjusted R-squared: 0.8793
F-statistic:  35.6 on 4 and 15 DF,  p-value: 1.715e-07

> coefficients(y2aic)
 (Intercept)  el85snoPJFM el785snoPOND  el85snoTJFM   el7snoTAMJ
  30.8033616    0.9070046    0.7481700   -0.3123594   -0.4961372
> #
> y2fit=fitted(y2aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snopeakswe,round(y2fit,2)),file="outfile1")
> #
> #
> # Read in future values of drivers and predict future SWE: (using CCSM3)
> #
> datasetz=read.table("ftpk-fut.txt",header=TRUE)
> z=predict(y2aic,newdata=datasetz,interval="prediction")
> write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(cbind(datasetz$Year,z),file="f-swe-ccsm3.out")
> #
> # Read in future values of drivers and predict future SWE: (using CCSM4)
> #
> datasetz=read.table("ftpk-fut2.txt",header=TRUE)
> z=predict(y2aic,newdata=datasetz,interval="prediction")
> write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
> write.table(cbind(datasetz$Year,z),file="f-swe-ccsm4.out")
> #
> # Read in values of drivers (from CCSM4 2001-2011)and predict future SWE: (using CCSM4)
> #
> datasetz=read.table("f-2002-11-ccsm4.txt",header=TRUE)
> z=predict(y2aic,newdata=datasetz,interval="prediction")
> write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
> write.table(z,file="out02-11")
> #
> # ***********************************************************************
> #
> # Determine MLR for Day Begins Accumulations
> #
> # summary(y2)
> #
> y3=lm(snobegac~ETJFM+el85snoTJFM+el785snoPOND+el785snoTJFM+el7snoTJFM+el7hcnPJFM+el785snoPJFM,data=dataset)
> y3aic=step(y3,direction="both")
Start:  AIC=96.89
snobegac ~ ETJFM + el85snoTJFM + el785snoPOND + el785snoTJFM +
    el7snoTJFM + el7hcnPJFM + el785snoPJFM

               Df Sum of Sq    RSS     AIC
- el7hcnPJFM    1      0.44 1142.2  94.899
- el85snoTJFM   1      2.22 1144.0  94.931
- ETJFM         1      9.17 1150.9  95.052
- el785snoPJFM  1     20.83 1162.6  95.253
- el785snoTJFM  1     40.01 1181.8  95.581
- el7snoTJFM    1     78.36 1220.1  96.219
<none>                      1141.8  96.892
- el785snoPOND  1    402.24 1544.0 100.928

Step:  AIC=94.9
snobegac ~ ETJFM + el85snoTJFM + el785snoPOND + el785snoTJFM +
    el7snoTJFM + el785snoPJFM

               Df Sum of Sq    RSS    AIC
- el85snoTJFM   1      2.47 1144.7 92.943
- ETJFM         1      9.84 1152.0 93.071
- el785snoTJFM  1     39.72 1181.9 93.583
- el785snoPJFM  1     66.85 1209.0 94.037
- el7snoTJFM    1     83.84 1226.0 94.316
<none>                      1142.2 94.899
```

```
+ el7hcnPJFM    1      0.44 1141.8 96.892
- el785snoPOND  1    408.72 1550.9 99.017

Step:  AIC=92.94
snobegac ~ ETJFM + el785snoPOND + el785snoTJFM + el7snoTJFM +
    el785snoPJFM

               Df Sum of Sq    RSS    AIC
- ETJFM         1     10.18 1154.8 91.120
- el785snoPJFM  1     64.43 1209.1 92.038
- el7snoTJFM    1    113.73 1258.4 92.837
<none>                      1144.7 92.943
- el785snoTJFM  1    194.09 1338.8 94.075
+ el85snoTJFM   1      2.47 1142.2 94.899
+ el7hcnPJFM    1      0.69 1144.0 94.931
- el785snoPOND  1    456.42 1601.1 97.654

Step:  AIC=91.12
snobegac ~ el785snoPOND + el785snoTJFM + el7snoTJFM + el785snoPJFM

               Df Sum of Sq    RSS    AIC
- el785snoPJFM  1     83.86 1238.7 90.522
- el7snoTJFM    1    104.63 1259.5 90.854
<none>                      1154.8 91.120
- el785snoTJFM  1    215.15 1370.0 92.537
+ ETJFM         1     10.18 1144.7 92.943
+ el85snoTJFM   1      2.82 1152.0 93.071
+ el7hcnPJFM    1      1.52 1153.3 93.093
- el785snoPOND  1    546.43 1701.3 96.868

Step:  AIC=90.52
snobegac ~ el785snoPOND + el785snoTJFM + el7snoTJFM

               Df Sum of Sq    RSS    AIC
<none>                      1238.7 90.522
- el7snoTJFM    1    138.49 1377.2 90.641
+ el785snoPJFM  1     83.86 1154.8 91.120
+ el7hcnPJFM    1     64.66 1174.0 91.449
+ ETJFM         1     29.61 1209.1 92.038
+ el85snoTJFM   1      0.04 1238.7 92.521
- el785snoTJFM  1    309.86 1548.6 92.987
- el785snoPOND  1    479.62 1718.3 95.067
> summary(y3aic)

Call:
lm(formula = snobegac ~ el785snoPOND + el785snoTJFM + el7snoTJFM,
    data = dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-15.224  -5.527  -2.747   6.300  15.347

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   196.085     26.354   7.440  1.4e-06 ***
el785snoPOND    2.543      1.022   2.489   0.0242 *
el785snoTJFM    6.143      3.071   2.001   0.0627 .
el7snoTJFM     -3.179      2.377  -1.337   0.1998
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 8.799 on 16 degrees of freedom
Multiple R-squared: 0.3888,   Adjusted R-squared: 0.2742
F-statistic: 3.393 on 3 and 16 DF,  p-value: 0.04383

> coefficients(y3aic)
 (Intercept) el785snoPOND el785snoTJFM   el7snoTJFM
  196.085346     2.542527     6.143143    -3.179415
> #
> y3fit=fitted(y3aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snobegac,round(y3fit,3)),file="outfile2")
> #
> #
> # Read in future values of drivers and predict future day acc: (using CCSM3)
> #
> datasetz=read.table("ftpk-fut.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(cbind(datasetz$Y,z),file="f-dba-ccsm3.out")
> #
> # Read in future values of drivers and predict future day acc: (using CCSM4)
> #
> datasetz=read.table("ftpk-fut2.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(cbind(datasetz$Year,z),file="f-dba-ccsm4.out")
```

```
> #
> #
> #
> #************************************************************************
> #
> #
> # Determine Multiple Linear Regression for Peak Day:
> #
> y3=lm(snopeakday~ETJFM+el7snoTJFM+el7hcnTJFM+el785snoTJFM+el85snoTJFM+el7hcnPJFM+el85snoPOND,data=dataset)
> # y3=lm(dataset$snopeakday~dataset$el7snoTJFM+dataset$el7hcnTJFM+dataset$el85snoTJFM)
> #
> y3aic=step(y3,direction="both")
Start:  AIC=94.83
snopeakday ~ ETJFM + el7snoTJFM + el7hcnTJFM + el785snoTJFM +
    el85snoTJFM + el7hcnPJFM + el85snoPOND

               Df Sum of Sq    RSS     AIC
- el85snoTJFM   1      0.26 1030.2  92.835
- el785snoTJFM  1      7.66 1037.6  92.978
- el7hcnTJFM    1     12.41 1042.3  93.069
- el7snoTJFM    1     17.19 1047.1  93.161
- el7hcnPJFM    1     52.65 1082.5  93.827
<none>                      1029.9  94.830
- ETJFM         1    203.38 1233.3  96.434
- el85snoPOND   1    508.52 1538.4 100.855

Step:  AIC=92.83
snopeakday ~ ETJFM + el7snoTJFM + el7hcnTJFM + el785snoTJFM +
    el7hcnPJFM + el85snoPOND

               Df Sum of Sq    RSS    AIC
- el7hcnTJFM    1     12.69 1042.8 91.080
- el7snoTJFM    1     26.82 1057.0 91.349
- el785snoTJFM  1     42.84 1073.0 91.649
- el7hcnPJFM    1     56.22 1086.4 91.897
<none>                      1030.2 92.835
- ETJFM         1    218.34 1248.5 94.679
+ el85snoTJFM   1      0.26 1029.9 94.830
- el85snoPOND   1    583.89 1614.0 99.815

Step:  AIC=91.08
snopeakday ~ ETJFM + el7snoTJFM + el785snoTJFM + el7hcnPJFM +
    el85snoPOND

               Df Sum of Sq    RSS    AIC
- el7snoTJFM    1     14.13 1057.0 89.349
- el785snoTJFM  1     30.16 1073.0 89.650
- el7hcnPJFM    1     91.32 1134.2 90.758
<none>                      1042.8 91.080
+ el7hcnTJFM    1     12.69 1030.2 92.835
+ el85snoTJFM   1      0.55 1042.3 93.069
- ETJFM         1    501.63 1544.5 96.934
- el85snoPOND   1    613.58 1656.4 98.334

Step:  AIC=89.35
snopeakday ~ ETJFM + el785snoTJFM + el7hcnPJFM + el85snoPOND

               Df Sum of Sq    RSS    AIC
- el785snoTJFM  1     20.56 1077.5 87.734
- el7hcnPJFM    1    109.53 1166.5 89.321
<none>                      1057.0 89.349
+ el7snoTJFM    1     14.13 1042.8 91.080
+ el85snoTJFM   1      9.25 1047.7 91.173
+ el7hcnTJFM    1      0.01 1057.0 91.349
- ETJFM         1    523.42 1580.4 95.394
- el85snoPOND   1    604.37 1661.3 96.393

Step:  AIC=87.73
snopeakday ~ ETJFM + el7hcnPJFM + el85snoPOND

               Df Sum of Sq    RSS    AIC
- el7hcnPJFM    1     99.96 1177.5 87.508
<none>                      1077.5 87.734
+ el85snoTJFM   1     27.65 1049.9 89.214
+ el785snoTJFM  1     20.56 1057.0 89.349
+ el7snoTJFM    1      4.54 1073.0 89.650
+ el7hcnTJFM    1      1.99 1075.5 89.697
- el85snoPOND   1    619.89 1697.4 94.823
- ETJFM         1    776.34 1853.9 96.586

Step:  AIC=87.51
snopeakday ~ ETJFM + el85snoPOND

               Df Sum of Sq    RSS     AIC
<none>                      1177.5  87.508
+ el7hcnPJFM    1     99.96 1077.5  87.734
+ el85snoTJFM   1     19.04 1158.5  89.182
```

```
+ el785snoTJFM  1     10.99 1166.5  89.321
+ el7hcnTJFM    1      6.45 1171.0  89.398
+ el7snoTJFM    1      0.02 1177.5  89.508
- el85snoPOND   1    752.30 1929.8  95.389
- ETJFM         1   1629.03 2806.5 102.879
> summary(y3aic)

Call:
lm(formula = snopeakday ~ ETJFM + el85snoPOND, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-17.8747  -3.5157  -0.7623   4.4480  13.2408

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 151.8691    17.5702   8.644 1.25e-07 ***
ETJFM       -20.9600     4.3220  -4.850  0.00015 ***
el85snoPOND   3.0091     0.9131   3.296  0.00427 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 8.323 on 17 degrees of freedom
Multiple R-squared: 0.6909,   Adjusted R-squared: 0.6545
F-statistic:    19 on 2 and 17 DF,  p-value: 4.638e-05

> #
> y3fit=fitted(y3aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snopeakday,round(y3fit,3)),file="outfile3")
> #
> # Read in future values of drivers and predict future peak day : (using CCSM3)
> #
> datasetz=read.table("ftpkoo.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(cbind(datasetz$Year,z),file="f-pd-ccsm3.out")
> #
> #
> # Read in future values of drivers and predict future peak day : (using CCSM4)
> #
> datasetz=read.table("ftpk-fut20.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(cbind(datasetz$Year,z),file="f-pd-ccsm4.out")
> #
>
> #
> # ***********************************************************************
> #
> # Determine MLR for Accumulation Rate
> #
> #
> #
> y4=lm(snoaccrate~el785snoPOND+el85snoPJFM+el785snoPJFM+el7snoPJFM+el7snoPOND+el85snoPOND+el7snoTAMJ,data=dataset)
> y4aic=step(y4,direction="both")
Start:  AIC=-169.38
snoaccrate ~ el785snoPOND + el85snoPJFM + el785snoPJFM + el7snoPJFM +
    el7snoPOND + el85snoPOND + el7snoTAMJ

               Df  Sum of Sq       RSS     AIC
- el7snoPOND    1 0.00000839 0.0018943 -171.29
- el7snoPJFM    1 0.00006641 0.0019523 -170.69
- el785snoPJFM  1 0.00009252 0.0019784 -170.42
<none>                       0.0018859 -169.38
- el85snoPJFM   1 0.00029465 0.0021805 -168.48
- el85snoPOND   1 0.00030342 0.0021893 -168.40
- el7snoTAMJ    1 0.00039147 0.0022774 -167.61
- el785snoPOND  1 0.00125757 0.0031434 -161.16

Step:  AIC=-171.29
snoaccrate ~ el785snoPOND + el85snoPJFM + el785snoPJFM + el7snoPJFM +
    el85snoPOND + el7snoTAMJ

               Df  Sum of Sq       RSS     AIC
- el7snoPJFM    1 0.00008051 0.0019748 -172.46
- el785snoPJFM  1 0.00009744 0.0019917 -172.29
<none>                       0.0018943 -171.29
- el85snoPJFM   1 0.00028797 0.0021822 -170.46
- el7snoTAMJ    1 0.00038371 0.0022780 -169.60
+ el7snoPOND    1 0.00000839 0.0018859 -169.38
- el85snoPOND   1 0.00043993 0.0023342 -169.12
- el785snoPOND  1 0.00127236 0.0031666 -163.02

Step:  AIC=-172.46
snoaccrate ~ el785snoPOND + el85snoPJFM + el785snoPJFM + el85snoPOND +
    el7snoTAMJ
```

```
               Df  Sum of Sq       RSS     AIC
- el785snoPJFM  1 0.00005342 0.0020282 -173.93
<none>                        0.0019748 -172.46
+ el7snoPJFM    1 0.00008051 0.0018943 -171.29
- el85snoPJFM   1 0.00035211 0.0023269 -171.18
- el7snoTAMJ    1 0.00036129 0.0023361 -171.10
+ el7snoPOND    1 0.00002248 0.0019523 -170.69
- el85snoPOND   1 0.00047934 0.0024541 -170.11
- el785snoPOND  1 0.00137300 0.0033478 -163.90

Step:  AIC=-173.93
snoaccrate ~ el785snoPOND + el85snoPJFM + el85snoPOND + el7snoTAMJ

               Df  Sum of Sq       RSS     AIC
<none>                        0.0020282 -173.93
- el7snoTAMJ    1 0.00033104 0.0023592 -172.90
+ el785snoPJFM  1 0.00005342 0.0019748 -172.46
+ el7snoPJFM    1 0.00003648 0.0019917 -172.29
+ el7snoPOND    1 0.00002284 0.0020054 -172.15
- el85snoPOND   1 0.00053941 0.0025676 -171.21
- el85snoPJFM   1 0.00089673 0.0029249 -168.60
- el785snoPOND  1 0.00139048 0.0034187 -165.49
> summary(y4aic)

Call:
lm(formula = snoaccrate ~ el785snoPOND + el85snoPJFM + el85snoPOND +
    el7snoTAMJ, data = dataset)

Residuals:
      Min        1Q    Median        3Q       Max
-0.018504 -0.005497 -0.001478  0.007436  0.018493

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   0.137997   0.075943   1.817  0.08923 .
el785snoPOND  0.009803   0.003057   3.207  0.00588 **
el85snoPJFM   0.003258   0.001265   2.575  0.02111 *
el85snoPOND  -0.006152   0.003080  -1.997  0.06426 .
el7snoTAMJ   -0.002568   0.001641  -1.565  0.13850
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01163 on 15 degrees of freedom
Multiple R-squared: 0.7069,   Adjusted R-squared: 0.6288
F-statistic: 9.045 on 4 and 15 DF,  p-value: 0.0006339

> #
> y4fit=fitted(y4aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snoaccrate,round(y4fit,2)),file="outfile4")
> #
> #
> #
> # Read in future values of drivers and predict future peak day : (using CCSM3)
> #
> datasetz=read.table("ftpkoo.txt",header=TRUE)
> z=predict(y4aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(z,file="outaccrate")
> #
> #
>
> #*****************************************************************************
> #
> # Determine MLR for Melt-Rate
> #
> #
> #
> y7=lm(snomeltrate~el785snoPOND+el85snoPOND+el7hcnPOND+el85snoTJFM+el785snoPJFM+el7hcnPJFM+el85snoPJFM,data=dataset)
> y7aic=step(y7,direction="both")
Start:  AIC=-122.56
snomeltrate ~ el785snoPOND + el85snoPOND + el7hcnPOND + el85snoTJFM +
    el785snoPJFM + el7hcnPJFM + el85snoPJFM

               Df Sum of Sq      RSS     AIC
- el85snoPOND   1 0.0002713 0.019875 -124.28
- el785snoPOND  1 0.0002723 0.019876 -124.28
- el785snoPJFM  1 0.0003331 0.019936 -124.22
- el85snoPJFM   1 0.0014060 0.021009 -123.17
- el7hcnPJFM    1 0.0014421 0.021046 -123.14
<none>                      0.019603 -122.56
- el85snoTJFM   1 0.0029706 0.022574 -121.73
- el7hcnPOND    1 0.0033643 0.022968 -121.39

Step:  AIC=-124.28
snomeltrate ~ el785snoPOND + el7hcnPOND + el85snoTJFM + el785snoPJFM +
```

```
    el7hcnPJFM + el85snoPJFM

               Df Sum of Sq      RSS     AIC
- el785snoPJFM  1 0.0002603 0.020135 -126.02
- el85snoPJFM   1 0.0012668 0.021141 -125.05
- el7hcnPJFM    1 0.0014117 0.021286 -124.91
<none>                      0.019875 -124.28
- el785snoPOND  1 0.0027177 0.022592 -123.72
- el85snoTJFM   1 0.0030990 0.022974 -123.38
- el7hcnPOND    1 0.0033576 0.023232 -123.16
+ el85snoPOND   1 0.0002713 0.019603 -122.56

Step:  AIC=-126.02
snomeltrate ~ el785snoPOND + el7hcnPOND + el85snoTJFM + el7hcnPJFM +
    el85snoPJFM

               Df Sum of Sq      RSS     AIC
- el7hcnPJFM    1 0.0011696 0.021305 -126.89
- el85snoPJFM   1 0.0016274 0.021762 -126.47
<none>                      0.020135 -126.02
- el785snoPOND  1 0.0024781 0.022613 -125.70
- el85snoTJFM   1 0.0028644 0.022999 -125.36
- el7hcnPOND    1 0.0036486 0.023784 -124.69
+ el785snoPJFM  1 0.0002603 0.019875 -124.28
+ el85snoPOND   1 0.0001984 0.019936 -124.22

Step:  AIC=-126.89
snomeltrate ~ el785snoPOND + el7hcnPOND + el85snoTJFM + el85snoPJFM

               Df Sum of Sq      RSS     AIC
<none>                      0.021305 -126.89
- el785snoPOND  1 0.0022591 0.023564 -126.88
+ el7hcnPJFM    1 0.0011696 0.020135 -126.02
- el7hcnPOND    1 0.0036118 0.024916 -125.76
+ el85snoPOND   1 0.0002186 0.021086 -125.10
+ el785snoPJFM  1 0.0000182 0.021286 -124.91
- el85snoTJFM   1 0.0053228 0.026627 -124.43
- el85snoPJFM   1 0.0076478 0.028952 -122.76
> summary(y7aic)

Call:
lm(formula = snomeltrate ~ el785snoPOND + el7hcnPOND + el85snoTJFM +
    el85snoPJFM, data = dataset)

Residuals:
      Min        1Q    Median        3Q       Max
-0.056043 -0.016044 -0.005774  0.010294  0.090083

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   0.188407   0.126312   1.492   0.1565
el785snoPOND  0.007601   0.006027   1.261   0.2265
el7hcnPOND    0.031538   0.019777   1.595   0.1316
el85snoTJFM  -0.008903   0.004599  -1.936   0.0720 .
el85snoPJFM   0.009555   0.004118   2.320   0.0348 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03769 on 15 degrees of freedom
Multiple R-squared: 0.7266,   Adjusted R-squared: 0.6537
F-statistic: 9.965 on 4 and 15 DF,  p-value: 0.0003852

> #
> y7fit=fitted(y7aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snomeltrate,round(y7fit,2)),file="outfile7")
> #
> #
> #
> # Read in future values of drivers and predict future peak day : (using CCSM3)
> #
> datasetz=read.table("ftpkoo.txt",header=TRUE)
> z=predict(y7aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> # write.table(z,file="outmeltrate")
> write.table(cbind(datasetz$Year,z),file="f-mr-ccsm3.out")
> #
> #
> # Read in future values of drivers and predict future peak day : (using CCSM4)
> #
> datasetz=read.table("ftpk-fut2.txt",header=TRUE)
> z=predict(y7aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> # write.table(z,file="outmeltrate")
> write.table(cbind(datasetz$Year,z),file="f-mr-ccsm4.out")
> #
>
```

```
> #*************************************************************************
> #
> #
> #
> # Determine MLR for Melt-out Day
> #
> #
> #
>
y5=lm(dataset$snomoday~dataset$ETAMJ+dataset$el7snoTAMJ+dataset$el7hcnTAMJ+dataset$el785snoTAMJ+dataset$el85snoTAMJ+dataset$el7snoPAMJ+dataset$el785s
noPAMJ)
> y5aic=step(y5,direction="both")
Start:  AIC=79.55
dataset$snomoday ~ dataset$ETAMJ + dataset$el7snoTAMJ + dataset$el7hcnTAMJ +
    dataset$el785snoTAMJ + dataset$el85snoTAMJ + dataset$el7snoPAMJ +
    dataset$el785snoPAMJ

                       Df Sum of Sq    RSS    AIC
- dataset$el785snoTAMJ  1     0.020 479.81 77.553
- dataset$el7snoTAMJ    1     1.451 481.24 77.613
- dataset$el85snoTAMJ   1     2.019 481.81 77.636
- dataset$el7hcnTAMJ    1     3.588 483.38 77.701
<none>                              479.79 79.552
- dataset$ETAMJ         1    69.078 548.87 80.242
- dataset$el7snoPAMJ    1    76.627 556.41 80.516
- dataset$el785snoPAMJ  1    77.590 557.38 80.550

Step:  AIC=77.55
dataset$snomoday ~ dataset$ETAMJ + dataset$el7snoTAMJ + dataset$el7hcnTAMJ +
    dataset$el85snoTAMJ + dataset$el7snoPAMJ + dataset$el785snoPAMJ

                       Df Sum of Sq    RSS    AIC
- dataset$el7snoTAMJ    1     1.781 481.59 75.627
- dataset$el7hcnTAMJ    1     3.621 483.43 75.703
- dataset$el85snoTAMJ   1    13.490 493.30 76.108
<none>                              479.81 77.553
- dataset$ETAMJ         1    73.132 552.94 78.390
- dataset$el7snoPAMJ    1    76.747 556.56 78.521
- dataset$el785snoPAMJ  1    78.861 558.67 78.597
+ dataset$el785snoTAMJ  1     0.020 479.79 79.552

Step:  AIC=75.63
dataset$snomoday ~ dataset$ETAMJ + dataset$el7hcnTAMJ + dataset$el85snoTAMJ +
    dataset$el7snoPAMJ + dataset$el785snoPAMJ

                       Df Sum of Sq    RSS    AIC
- dataset$el7hcnTAMJ    1     2.179 483.77 73.717
<none>                              481.59 75.627
- dataset$ETAMJ         1    71.415 553.01 76.393
- dataset$el7snoPAMJ    1    95.982 577.57 77.262
+ dataset$el7snoTAMJ    1     1.781 479.81 77.553
+ dataset$el785snoTAMJ  1     0.350 481.24 77.613
- dataset$el785snoPAMJ  1   130.532 612.12 78.424
- dataset$el85snoTAMJ   1   131.613 613.20 78.459

Step:  AIC=73.72
dataset$snomoday ~ dataset$ETAMJ + dataset$el85snoTAMJ + dataset$el7snoPAMJ +
    dataset$el785snoPAMJ

                       Df Sum of Sq    RSS    AIC
<none>                              483.77 73.717
- dataset$el7snoPAMJ    1   102.173 585.94 75.550
+ dataset$el7hcnTAMJ    1     2.179 481.59 75.627
+ dataset$el7snoTAMJ    1     0.339 483.43 75.703
+ dataset$el785snoTAMJ  1     0.023 483.75 75.717
- dataset$el85snoTAMJ   1   129.591 613.36 76.464
- dataset$el785snoPAMJ  1   168.957 652.73 77.708
- dataset$ETAMJ         1   252.562 736.33 80.119
> summary(y5aic)

Call:
lm(formula = dataset$snomoday ~ dataset$ETAMJ + dataset$el85snoTAMJ +
    dataset$el7snoPAMJ + dataset$el785snoPAMJ)

Residuals:
   Min     1Q Median     3Q    Max
-9.299 -3.560  1.070  4.904  6.388

Coefficients:
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)           403.576     46.607   8.659  3.2e-07 ***
dataset$ETAMJ          -8.227      2.940  -2.798   0.0135 *
dataset$el85snoTAMJ    -2.344      1.170  -2.005   0.0634 .
dataset$el7snoPAMJ      1.930      1.085   1.780   0.0954 .
dataset$el785snoPAMJ   -2.949      1.288  -2.289   0.0370 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 5.679 on 15 degrees of freedom
Multiple R-squared: 0.7992,   Adjusted R-squared: 0.7457
F-statistic: 14.93 on 4 and 15 DF,  p-value: 4.118e-05

> #
> y5fit=fitted(y5aic)
>
> # "Step" gave 2 similiar parameters:  el7snoPAMJ and el785snoPAMJ
> #  Forcing results to only include el7snoPAMJ
> y5aic=lm(snomoday~el85snoTAMJ+ETAMJ+el7snoPAMJ,data=dataset)
> summary(y5aic)

Call:
lm(formula = snomoday ~ el85snoTAMJ + ETAMJ + el7snoPAMJ, data = dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-11.762  -3.524   1.288   4.050   9.518

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 339.8304    42.0300   8.085 4.83e-07 ***
el85snoTAMJ  -1.1960     1.1882  -1.007   0.3291
ETAMJ        -7.8466     3.3013  -2.377   0.0303 *
el7snoPAMJ    0.2675     0.9056   0.295   0.7715
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.387 on 16 degrees of freedom
Multiple R-squared: 0.7291,   Adjusted R-squared: 0.6783
F-statistic: 14.36 on 3 and 16 DF,  p-value: 8.428e-05

> #
> #
> y5fit=fitted(y5aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snomoday,round(y5fit,2)),file="outfile5")
> #
> #
> #
> #
> # Read in future values of drivers and predict future peak day : (using CCSM3)
> #
> datasetz=read.table("ftpkoo.txt",header=TRUE)
> z=predict(y5aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(cbind(datasetz$Year,z),file="f-mo-ccsm3.out")
> #
> # Read in future values of drivers and predict future peak day : (using CCSM4)
> #
> datasetz=read.table("ftpk-fut20.txt",header=TRUE)
> z=predict(y5aic,newdata=datasetz,interval="prediction")
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="outjunk")
> write.table(cbind(datasetz$Year,z),file="of-mo-ccsm4.out")
>
>
> #************************************************************************
> #
> # Determine Multiple Linear Regression for Runoff:
> dataset2=read.table("ftpk-ex2.txt",header=TRUE)
> x=round(cor(dataset2),2)
> x
              Year FTPKRO el7snoTOND el7snoTJFM el7snoTAMJ el7hcnTOND
Year          1.00   0.28       0.52       0.41       0.13       0.04
FTPKRO        0.28   1.00      -0.19      -0.40      -0.66      -0.31
el7snoTOND    0.52  -0.19       1.00       0.42       0.39       0.81
el7snoTJFM    0.41  -0.40       0.42       1.00       0.53       0.22
el7snoTAMJ    0.13  -0.66       0.39       0.53       1.00       0.30
el7hcnTOND    0.04  -0.31       0.81       0.22       0.30       1.00
el7hcnTJFM   -0.03  -0.48       0.21       0.84       0.52       0.25
el7hcnTAMJ   -0.40  -0.66       0.03       0.20       0.84       0.16
el7snoPOND   -0.10   0.38      -0.26      -0.33      -0.33      -0.17
el7snoPJFM    0.21   0.41       0.33      -0.38      -0.26       0.23
el7snoPAMJ    0.25   0.74      -0.22      -0.19      -0.60      -0.28
el7hcnPOND    0.05   0.43      -0.46      -0.16      -0.20      -0.53
el7hcnPJFM   -0.08   0.44      -0.07      -0.57      -0.42       0.09
el7hcnPAMJ    0.20   0.69      -0.23      -0.10      -0.47      -0.20
el785snoTOND  0.58  -0.05       0.94       0.34       0.34       0.65
el785snoTJFM  0.36  -0.43       0.41       0.96       0.54       0.22
el785snoTAMJ  0.18  -0.64       0.45       0.51       0.96       0.30
el785snoPOND  0.04   0.46      -0.25      -0.31      -0.26      -0.28
el785snoPJFM  0.04   0.46       0.14      -0.37      -0.38       0.21
el785snoPAMJ  0.12   0.68      -0.36      -0.19      -0.63      -0.35
el85snoTOND   0.53  -0.11       0.94       0.33       0.40       0.67
el85snoTJFM   0.29  -0.47       0.40       0.90       0.53       0.24
el85snoTAMJ   0.14  -0.67       0.46       0.47       0.93       0.32
```

el85snoPOND	0.03	0.47	-0.28	-0.31	-0.29	-0.29
el85snoPJFM	0.18	0.51	0.07	-0.25	-0.33	0.02
el85snoPAMJ	0.13	0.58	-0.27	-0.15	-0.63	-0.23
smlbOND	-0.22	0.29	-0.30	-0.31	0.02	-0.07
smlbJFM	-0.14	0.49	-0.30	-0.42	-0.13	-0.13
smlbAMJ	0.12	0.78	-0.27	-0.38	-0.36	-0.19
SWEEst	0.03	0.71	-0.22	-0.55	-0.62	-0.22
ETOND	0.16	-0.02	-0.06	0.32	-0.11	-0.27
ETJFM	-0.19	-0.54	0.06	0.74	0.49	0.20
ETAMJ	-0.33	-0.74	0.10	0.25	0.83	0.21

	el7hcnTJFM	el7hcnTAMJ	el7snoPOND	el7snoPJFM	el7snoPAMJ	el7hcnPOND
Year	-0.03	-0.40	-0.10	0.21	0.25	0.05
FTPKRO	-0.48	-0.66	0.38	0.41	0.74	0.43
el7snoTOND	0.21	0.03	-0.26	0.33	-0.22	-0.46
el7snoTJFM	0.84	0.20	-0.33	-0.38	-0.19	-0.16
el7snoTAMJ	0.52	0.84	-0.33	-0.26	-0.60	-0.20
el7hcnTOND	0.25	0.16	-0.17	0.23	-0.28	-0.53
el7hcnTJFM	1.00	0.42	-0.11	-0.36	-0.32	-0.01
el7hcnTAMJ	0.42	1.00	-0.22	-0.31	-0.63	-0.16
el7snoPOND	-0.11	-0.22	1.00	0.25	0.12	0.55
el7snoPJFM	-0.36	-0.31	0.25	1.00	-0.03	-0.04
el7snoPAMJ	-0.32	-0.63	0.12	-0.03	1.00	0.28
el7hcnPOND	-0.01	-0.16	0.55	-0.04	0.28	1.00
el7hcnPJFM	-0.48	-0.29	0.35	0.48	0.08	0.14
el7hcnPAMJ	-0.17	-0.51	0.20	-0.01	0.86	0.34
el785snoTOND	0.11	-0.01	-0.10	0.39	-0.17	-0.35
el785snoTJFM	0.77	0.23	-0.34	-0.45	-0.27	-0.24
el785snoTAMJ	0.48	0.77	-0.26	-0.14	-0.63	-0.23
el785snoPOND	-0.09	-0.22	0.82	0.31	0.24	0.70
el785snoPJFM	-0.24	-0.33	0.38	0.81	0.00	0.19
el785snoPAMJ	-0.29	-0.61	0.13	-0.21	0.84	0.33
el85snoTOND	0.12	0.08	-0.18	0.35	-0.22	-0.41
el85snoTJFM	0.73	0.25	-0.38	-0.50	-0.27	-0.29
el85snoTAMJ	0.45	0.76	-0.28	-0.11	-0.66	-0.27
el85snoPOND	-0.09	-0.24	0.86	0.27	0.26	0.63
el85snoPJFM	-0.21	-0.34	0.31	0.79	0.01	0.17
el85snoPAMJ	-0.26	-0.63	0.02	-0.21	0.82	0.20
smlbOND	-0.16	0.21	0.10	0.08	-0.04	0.14
smlbJFM	-0.30	0.04	0.27	0.24	0.04	0.26
smlbAMJ	-0.37	-0.31	0.34	0.31	0.45	0.40
SWEEst	-0.41	-0.52	0.66	0.71	0.29	0.48
ETOND	0.15	-0.22	-0.16	-0.05	0.15	0.09
ETJFM	0.91	0.46	-0.06	-0.56	-0.34	-0.07
ETAMJ	0.48	0.93	-0.24	-0.25	-0.68	-0.21

	el7hcnPJFM	el7hcnPAMJ	el785snoTOND	el785snoTJFM	el785snoTAMJ
Year	-0.08	0.20	0.58	0.36	0.18
FTPKRO	0.44	0.69	-0.05	-0.43	-0.64
el7snoTOND	-0.07	-0.23	0.94	0.41	0.45
el7snoTJFM	-0.57	-0.10	0.34	0.96	0.51
el7snoTAMJ	-0.42	-0.47	0.34	0.54	0.96
el7hcnTOND	0.09	-0.20	0.65	0.22	0.30
el7hcnTJFM	-0.48	-0.17	0.11	0.77	0.48
el7hcnTAMJ	-0.29	-0.51	-0.01	0.23	0.77
el7snoPOND	0.35	0.20	-0.10	-0.34	-0.26
el7snoPJFM	0.48	-0.01	0.39	-0.45	-0.14
el7snoPAMJ	0.08	0.86	-0.17	-0.27	-0.63
el7hcnPOND	0.14	0.34	-0.35	-0.24	-0.23
el7hcnPJFM	1.00	0.20	-0.02	-0.53	-0.50
el7hcnPAMJ	0.20	1.00	-0.23	-0.16	-0.54
el785snoTOND	-0.02	-0.23	1.00	0.34	0.44
el785snoTJFM	-0.53	-0.16	0.34	1.00	0.51
el785snoTAMJ	-0.50	-0.54	0.44	0.51	1.00
el785snoPOND	0.22	0.26	-0.08	-0.34	-0.20
el785snoPJFM	0.78	0.09	0.17	-0.43	-0.38
el785snoPAMJ	0.27	0.78	-0.30	-0.18	-0.75
el85snoTOND	-0.03	-0.29	0.98	0.34	0.49
el85snoTJFM	-0.51	-0.16	0.30	0.98	0.49
el85snoTAMJ	-0.50	-0.59	0.44	0.47	0.99
el85snoPOND	0.22	0.23	-0.13	-0.35	-0.24
el85snoPJFM	0.73	0.14	0.15	-0.29	-0.32
el85snoPAMJ	0.28	0.79	-0.28	-0.13	-0.75
smlbOND	0.25	0.11	-0.32	-0.30	-0.08
smlbJFM	0.42	0.18	-0.25	-0.41	-0.22
smlbAMJ	0.54	0.65	-0.22	-0.38	-0.46
SWEEst	0.68	0.32	-0.08	-0.61	-0.57
ETOND	-0.32	0.23	-0.09	0.24	-0.13
ETJFM	-0.55	-0.19	-0.04	0.74	0.43
ETAMJ	-0.42	-0.64	0.04	0.26	0.83

	el785snoPOND	el785snoPJFM	el785snoPAMJ	el85snoTOND	el85snoTJFM
Year	0.04	0.04	0.12	0.53	0.29
FTPKRO	0.46	0.46	0.68	-0.11	-0.47
el7snoTOND	-0.25	0.14	-0.36	0.94	0.40
el7snoTJFM	-0.31	-0.37	-0.19	0.33	0.90
el7snoTAMJ	-0.26	-0.38	-0.63	0.40	0.53
el7hcnTOND	-0.28	0.21	-0.35	0.67	0.24
el7hcnTJFM	-0.09	-0.24	-0.29	0.12	0.73
el7hcnTAMJ	-0.22	-0.33	-0.61	0.08	0.25

el7snoPOND	0.82	0.38	0.13	-0.18	-0.38
el7snoPJFM	0.31	0.81	-0.21	0.35	-0.50
el7snoPAMJ	0.24	0.00	0.84	-0.22	-0.27
el7hcnPOND	0.70	0.19	0.33	-0.41	-0.29
el7hcnPJFM	0.22	0.78	0.27	-0.03	-0.51
el7hcnPAMJ	0.26	0.09	0.78	-0.29	-0.16
el785snoTOND	-0.08	0.17	-0.30	0.98	0.30
el785snoTJFM	-0.34	-0.43	-0.18	0.34	0.98
el785snoTAMJ	-0.20	-0.38	-0.75	0.49	0.49
el785snoPOND	1.00	0.34	0.21	-0.15	-0.39
el785snoPJFM	0.34	1.00	0.01	0.12	-0.47
el785snoPAMJ	0.21	0.01	1.00	-0.34	-0.16
el85snoTOND	-0.15	0.12	-0.34	1.00	0.31
el85snoTJFM	-0.39	-0.47	-0.16	0.31	1.00
el85snoTAMJ	-0.22	-0.38	-0.79	0.50	0.46
el85snoPOND	0.91	0.34	0.20	-0.20	-0.39
el85snoPJFM	0.27	0.92	0.03	0.09	-0.36
el85snoPAMJ	0.10	0.01	0.95	-0.32	-0.09
smlbOND	-0.03	0.21	0.04	-0.28	-0.29
smlbJFM	0.16	0.39	0.16	-0.24	-0.41
smlbAMJ	0.31	0.48	0.51	-0.26	-0.40
SWEEst	0.70	0.82	0.28	-0.16	-0.66
ETOND	-0.15	-0.10	0.12	-0.15	0.21
ETJFM	-0.12	-0.42	-0.24	-0.03	0.72
ETAMJ	-0.21	-0.35	-0.76	0.13	0.27

	el85snoTAMJ	el85snoPOND	el85snoPJFM	el85snoPAMJ	smlbOND	smlbJFM
Year	0.14	0.03	0.18	0.13	-0.22	-0.14
FTPKRO	-0.67	0.47	0.51	0.58	0.29	0.49
el7snoTOND	0.46	-0.28	0.07	-0.27	-0.30	-0.30
el7snoTJFM	0.47	-0.31	-0.25	-0.15	-0.31	-0.42
el7snoTAMJ	0.93	-0.29	-0.33	-0.63	0.02	-0.13
el7hcnTOND	0.32	-0.29	0.02	-0.23	-0.07	-0.13
el7hcnTJFM	0.45	-0.09	-0.21	-0.26	-0.16	-0.30
el7hcnTAMJ	0.76	-0.24	-0.34	-0.63	0.21	0.04
el7snoPOND	-0.28	0.86	0.31	0.02	0.10	0.27
el7snoPJFM	-0.11	0.27	0.79	-0.21	0.08	0.24
el7snoPAMJ	-0.66	0.26	0.01	0.82	-0.04	0.04
el7hcnPOND	-0.27	0.63	0.17	0.20	0.14	0.26
el7hcnPJFM	-0.50	0.22	0.73	0.28	0.25	0.42
el7hcnPAMJ	-0.59	0.23	0.14	0.79	0.11	0.18
el785snoTOND	0.44	-0.13	0.15	-0.28	-0.32	-0.25
el785snoTJFM	0.47	-0.35	-0.29	-0.13	-0.30	-0.41
el785snoTAMJ	0.99	-0.24	-0.32	-0.75	-0.08	-0.22
el785snoPOND	-0.22	0.91	0.27	0.10	-0.03	0.16
el785snoPJFM	-0.38	0.34	0.92	0.01	0.21	0.39
el785snoPAMJ	-0.79	0.20	0.03	0.95	0.04	0.16
el85snoTOND	0.50	-0.20	0.09	-0.32	-0.28	-0.24
el85snoTJFM	0.46	-0.39	-0.36	-0.09	-0.29	-0.41
el85snoTAMJ	1.00	-0.27	-0.34	-0.78	-0.11	-0.25
el85snoPOND	-0.27	1.00	0.25	0.11	0.11	0.26
el85snoPJFM	-0.34	0.25	1.00	0.01	0.22	0.41
el85snoPAMJ	-0.78	0.11	0.01	1.00	-0.01	0.06
smlbOND	-0.11	0.11	0.22	-0.01	1.00	0.95
smlbJFM	-0.25	0.26	0.41	0.06	0.95	1.00
smlbAMJ	-0.51	0.33	0.54	0.45	0.71	0.83
SWEEst	-0.58	0.66	0.80	0.21	0.15	0.39
ETOND	-0.15	-0.22	0.00	0.12	-0.29	-0.26
ETJFM	0.40	-0.10	-0.41	-0.21	-0.05	-0.22
ETAMJ	0.84	-0.19	-0.38	-0.76	0.08	-0.11

	smlbAMJ	SWEEst	ETOND	ETJFM	ETAMJ
Year	0.12	0.03	0.16	-0.19	-0.33
FTPKRO	0.78	0.71	-0.02	-0.54	-0.74
el7snoTOND	-0.27	-0.22	-0.06	0.06	0.10
el7snoTJFM	-0.38	-0.55	0.32	0.74	0.25
el7snoTAMJ	-0.36	-0.62	-0.11	0.49	0.83
el7hcnTOND	-0.19	-0.22	-0.27	0.20	0.21
el7hcnTJFM	-0.37	-0.41	0.15	0.91	0.48
el7hcnTAMJ	-0.31	-0.52	-0.22	0.46	0.93
el7snoPOND	0.34	0.66	-0.16	-0.06	-0.24
el7snoPJFM	0.31	0.71	-0.05	-0.56	-0.25
el7snoPAMJ	0.45	0.29	0.15	-0.34	-0.68
el7hcnPOND	0.40	0.48	0.09	-0.07	-0.21
el7hcnPJFM	0.54	0.68	-0.32	-0.55	-0.42
el7hcnPAMJ	0.65	0.32	0.23	-0.19	-0.64
el785snoTOND	-0.22	-0.08	-0.09	-0.04	0.04
el785snoTJFM	-0.38	-0.61	0.24	0.74	0.26
el785snoTAMJ	-0.46	-0.57	-0.13	0.43	0.83
el785snoPOND	0.31	0.70	-0.15	-0.12	-0.21
el785snoPJFM	0.48	0.82	-0.10	-0.42	-0.35
el785snoPAMJ	0.51	0.28	0.12	-0.24	-0.76
el85snoTOND	-0.26	-0.16	-0.15	-0.03	0.13
el85snoTJFM	-0.40	-0.66	0.21	0.72	0.27
el85snoTAMJ	-0.51	-0.58	-0.15	0.40	0.84
el85snoPOND	0.33	0.66	-0.22	-0.10	-0.19
el85snoPJFM	0.54	0.80	0.00	-0.41	-0.38
el85snoPAMJ	0.45	0.21	0.12	-0.21	-0.76
smlbOND	0.71	0.15	-0.29	-0.05	0.08

```
smlbJFM         0.83   0.39 -0.26 -0.22 -0.11
smlbAMJ         1.00   0.58 -0.07 -0.36 -0.50
SWEEst          0.58   1.00 -0.07 -0.52 -0.54
ETOND          -0.07  -0.07  1.00  0.11 -0.29
ETJFM          -0.36  -0.52  0.11  1.00  0.48
ETAMJ          -0.50  -0.54 -0.29  0.48  1.00
> write.table(x,file="outro")
>
> #
> y=lm(FTPKRO~el7snoPAMJ+ETAMJ+el7hcnPAMJ+el785snoPAMJ+el85snoTAMJ+el7snoTAMJ+el7hcnTAMJ+SWEEst,data=dataset2)
> # y=lm(dataset2$FTPKRO~dataset2$ETAMJ+dataset2$el7snoPAMJ+dataset2$el85snoTAMJ+dataset2$SWEEst)
> yaic=step(y)
Start:  AIC=281.61
FTPKRO ~ el7snoPAMJ + ETAMJ + el7hcnPAMJ + el785snoPAMJ + el85snoTAMJ +
    el7snoTAMJ + el7hcnTAMJ + SWEEst

               Df Sum of Sq      RSS    AIC
- el7snoTAMJ    1     33517 10632567 279.67
- el7hcnPAMJ    1    130534 10729585 279.86
- el785snoPAMJ  1    235030 10834080 280.05
- el7hcnTAMJ    1    363087 10962138 280.29
- el85snoTAMJ   1    433082 11032132 280.41
- ETAMJ         1    774138 11373188 281.02
<none>                      10599050 281.61
- el7snoPAMJ    1   2062335 12661386 283.17
- SWEEst        1  12624077 23223127 295.30

Step:  AIC=279.67
FTPKRO ~ el7snoPAMJ + ETAMJ + el7hcnPAMJ + el785snoPAMJ + el85snoTAMJ +
    el7hcnTAMJ + SWEEst

               Df Sum of Sq      RSS    AIC
- el7hcnPAMJ    1    201301 10833868 278.05
- el785snoPAMJ  1    208054 10840621 278.06
- el7hcnTAMJ    1    329974 10962541 278.29
- ETAMJ         1    776915 11409482 279.08
<none>                      10632567 279.67
- el85snoTAMJ   1   1128934 11761501 279.69
- el7snoPAMJ    1   2877135 13509702 282.46
- SWEEst        1  12863583 23496150 293.53

Step:  AIC=278.05
FTPKRO ~ el7snoPAMJ + ETAMJ + el785snoPAMJ + el85snoTAMJ + el7hcnTAMJ +
    SWEEst

               Df Sum of Sq      RSS    AIC
- el7hcnTAMJ    1    179768 11013636 276.38
- el785snoPAMJ  1    225976 11059844 276.46
- ETAMJ         1    584395 11418263 277.10
- el85snoTAMJ   1   1034364 11868232 277.87
<none>                      10833868 278.05
- el7snoPAMJ    1   3625160 14459029 281.82
- SWEEst        1  12666024 23499892 291.54

Step:  AIC=276.38
FTPKRO ~ el7snoPAMJ + ETAMJ + el785snoPAMJ + el85snoTAMJ + SWEEst

               Df Sum of Sq      RSS    AIC
- ETAMJ         1    625290 11638926 275.48
- el785snoPAMJ  1    815388 11829024 275.81
<none>                      11013636 276.38
- el85snoTAMJ   1   1345581 12359218 276.68
- el7snoPAMJ    1   3667427 14681063 280.13
- SWEEst        1  13647694 24661331 290.50

Step:  AIC=275.48
FTPKRO ~ el7snoPAMJ + el785snoPAMJ + el85snoTAMJ + SWEEst

               Df Sum of Sq      RSS    AIC
- el85snoTAMJ   1    820244 12459170 274.85
- el785snoPAMJ  1   1131066 12769993 275.34
<none>                      11638926 275.48
- el7snoPAMJ    1   4180442 15819368 279.62
- SWEEst        1  15853877 27492804 290.67

Step:  AIC=274.84
FTPKRO ~ el7snoPAMJ + el785snoPAMJ + SWEEst

               Df Sum of Sq      RSS    AIC
- el785snoPAMJ  1    387919 12847089 273.46
<none>                      12459170 274.85
- el7snoPAMJ    1   4699601 17158771 279.25
- SWEEst        1  18734302 31193473 291.20

Step:  AIC=273.46
FTPKRO ~ el7snoPAMJ + SWEEst
```

```
             Df Sum of Sq      RSS    AIC
<none>                    12847089 273.46
- SWEEst      1  19196678 32043768 289.74
- el7snoPAMJ  1  22509712 35356801 291.70
> #
> summary(yaic)

Call:
lm(formula = FTPKRO ~ el7snoPAMJ + SWEEst, data = dataset2)

Residuals:
     Min       1Q   Median       3Q      Max
-1187.55  -408.69    -9.07   269.30  2479.08

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -7300.35    1226.83  -5.951 1.58e-05 ***
el7snoPAMJ    505.13      92.55   5.458 4.26e-05 ***
SWEEst        280.04      55.56   5.040 0.000101 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 869.3 on 17 degrees of freedom
Multiple R-squared: 0.8214,   Adjusted R-squared: 0.8004
F-statistic:  39.1 on 2 and 17 DF,  p-value: 4.369e-07

> yaicfit=fitted(yaic)
> # summary (y)
> # yfit=fitted(y)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset2$FTPKRO,round(yaicfit,0)),file="outfile6")
> #
> #
> # Problem using above regression ... for forecasting ... occasionally give
> #    negative inflows.  To get around this, work in log domain:
> #
> dataset2$SWEEst.log=log(dataset2$SWEEst)
> dataset2$el7snoPAMJ.log=log(dataset2$el7snoPAMJ)
> dataset2$FTPKRO.log=log(dataset2$FTPKRO)
> #
> y=lm(FTPKRO.log~SWEEst.log+el7snoPAMJ.log,data=dataset2)
> summary(y)

Call:
lm(formula = FTPKRO.log ~ SWEEst.log + el7snoPAMJ.log, data = dataset2)

Residuals:
    Min      1Q  Median      3Q     Max
-0.3565 -0.1249  0.0082  0.1393  0.2700

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)      0.4996     0.7478   0.668    0.513
SWEEst.log       1.5529     0.2249   6.904 2.55e-06 ***
el7snoPAMJ.log   1.2720     0.2345   5.424 4.56e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1968 on 17 degrees of freedom
Multiple R-squared: 0.8563,   Adjusted R-squared: 0.8394
F-statistic: 50.64 on 2 and 17 DF,  p-value: 6.901e-08

> yfit.log=fitted(y)
> yfit=2.71^yfit.log
> write.table(cbind(dataset2$FTPKRO,round(yfit,0)),file="outro-ex")
> #
> #
> # Read in future values of drivers and predict future Runoff (CCSM3):
> #
> datasetz=read.table("ftpk-fut-ro.txt",header=TRUE)
> # Work in log-domain to determine FTPKRO
> datasetz$SWEEst.log=log(datasetz$SWEEst)
> datasetz$el7snoPAMJ.log=log(datasetz$el7snoPAMJ)
> #
> z=predict(y,newdata=datasetz,interval="prediction")
> z2=2.71^z
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
> write.table(cbind(datasetz$Year,z2),file="f-ro-ccsm3.out")
> #
> # Read in future values of drivers and predict future Runoff (ccsm4):
> #
> datasetz=read.table("ro.txt",header=TRUE)
> # Work in log-domain to determine FTPKRO
> datasetz$SWEEst.log=log(datasetz$SWEEst)
> datasetz$el7snoPAMJ.log=log(datasetz$el7snoPAMJ)
> #
> z=predict(y,newdata=datasetz,interval="prediction")
```

```
> z2=2.71^z
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
> write.table(cbind(datasetz$Year,z2),file="f-ro-ccsm4.out")
> # write.table(z2,file="outRO-fut2")
> #
> # end
>
>
>
>
>
>
> proc.time()
   user  system elapsed
   1.07    0.70    8.59
```

Fort Peck R-Batch file:

```
"l:\public\reservoirregulation\monthly inflow forecast\stochastic\r\r-2.14.0\bin\R" CMD BATCH "ftpk2.r" "OUT"
```

“R”-Statistics

Garrison-

Input File: (garr2.r)

```
# Read Data:
dataset=read.table("garr-ex.txt",header=TRUE)
#
summary (dataset)
#
# Determine Cross-Correlations:
x=round(cor(dataset),2)
x
write.table(x,file="outfile")
#
# ***********************************************************************
# Determine Multiple Linear Regression for Peak SWE:
y2=lm(snopeakswe~el785snoPOND+el85snoPOND+el785snoPJFM+el85snoPJFM+el785snoTAMJ+el85snoTAMJ,data=dataset)
y2aic=step(y2,direction="both")
summary(y2aic)
#
y2fit=fitted(y2aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$el7snoPJFM,dataset$el785snoTAMJ,dataset$el785snoPOND,y2fit),file="outg")
write.table(cbind(dataset$Year,dataset$snopeakswe,round(y2fit,2)),file="outfile1")
#
# Read in future values of drivers and predict future SWE:  (using CCSM3)
#
datasetx=read.table("garrbill.txt",header=TRUE)
z=predict(y2aic,newdata=datasetx,interval="prediction")
write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="G-SWE-CCSM3.OUT")
#
# Read in future values of drivers and predict future SWE:  (using CCSM4)
#
datasetz=read.table("garrfut3.txt",header=TRUE)
z=predict(y2aic,newdata=datasetz,interval="prediction")
write.table(cbind(datasetz$el7snoPJFM,datasetz$el785snoTAMJ,datasetz$el785snoPOND,z),file="outj2")
write.table(cbind(datasetz$Year,datasetz$el785snoPOND,datasetz$el7snoPJFM,datasetz$el785snoTAMJ,z),file="outk2")
write.table(cbind(datasetz$Year,z),file="G-SWE-CCSM4.OUT")
#
# Read in values of drivers (from CCSM4 2001-2011)and predict future SWE: (using CCSM4)
#
datasetz=read.table("g-2002-11-ccsm4.txt",header=TRUE)
z=predict(y2aic,newdata=datasetz,interval="prediction")
write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
write.table(z,file="outg02-11")
#
# ***********************************************************************
#
# Determine MLR for Day Begins Accumulations (DBA)
#
# summary(y2)
#
y3=lm(snobegac~ETAMJ+el785snoTOND+el7hcnTOND+el7hcnTAMJ+el85snoTOND+el785snoPOND+el785snoTJFM,data=dataset)
y3aic=step(y3,direction="both")
summary(y3aic)
#
y3fit=fitted(y3aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snobegac,round(y3fit,3)),file="outfile2")
#
#
#
# Read in future values of drivers and predict DBA:  (using CCSM3)
#
datasetx=read.table("garrbill.txt",header=TRUE)
z=predict(y3aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-dba-ccsm3.out")
#
#
# Read in future values of drivers and predict DBA:  (using CCSM4)
#
datasetx=read.table("garrfut3.txt",header=TRUE)
z=predict(y3aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
```

```
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-dba-ccsm4.out")
#
#
#
#
#**********************************************************************
#
#
# Determine Multiple Linear Regression for Peak Day:
#
y3=lm(snopeakday~el85snoPAMJ+el7hcnPAMJ+smlbAMJ+el785snoTAMJ+ETAMJ+el7snoTAMJ+el7hcnTAMJ,data=dataset)
# y3=lm(dataset$snopeakday~dataset$el7snoTJFM+dataset$el7hcnTJFM+dataset$el85snoTJFM)
#
y3aic=step(y3,direction="both")
summary(y3aic)
#
y3fit=fitted(y3aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snopeakday,round(y3fit,3)),file="outfile3")
#
#
#
# Read in future values of drivers and predict Peak Day:  (using CCSM3)
#
datasetx=read.table("garrbill.txt",header=TRUE)
z=predict(y3aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-pd-ccsm3.out")
#
#
#
# Read in future values of drivers and predict Peak Day:  (using CCSM4)
#
datasetx=read.table("garr-fut20.txt",header=TRUE)
z=predict(y3aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-pd-ccsm4.out")
#

#
# ********************************************************************
#
# Determine MLR for Accumulation Rate
#
#
#
y4=lm(snoaccrate~el85snoPJFM+el785snoPJFM+el85snoPOND+el785snoPOND+el785snoTAMJ+el85snoTAMJ+el7hcnTAMJ,data=dataset)
y4aic=step(y4,direction="both")
summary(y4aic)
#
# regression results in 2 similar paramaters: el85snoPJFM and el785snoPFM
#    same for:                                el85snosnoTAMJ and el785snoTAMJ
#    so just use:  el85snoPJFM and el785snoTAMJ
#
y4aic=lm(snoaccrate~el85snoPJFM+el785snoTAMJ+el85snoPOND,data=dataset)
summary(y4aic)
#
y4fit=fitted(y4aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snoaccrate,round(y4fit,2)),file="outfile4")
#
#
# Read in future values of drivers and predict Accum Rate:  (using CCSM3)
#
datasetx=read.table("garrbill.txt",header=TRUE)
z=predict(y4aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(z,file="outaccrate")
#
#
#
# ********************************************************************
#
# Determine MLR for Melt-Rate Rate
#
#
#
y7=lm(snomeltrate~el785snoPOND+el85snoPOND+el785snoTAMJ+el7snoTAMJ+el7snoPJFM+el7hcnTAMJ,data=dataset)
y7aic=step(y7,direction="both")
summary(y7aic)
#
y7fit=fitted(y7aic)
# Write Actual vs Simulated - (One-year per row)
```

```
write.table(cbind(dataset$snomeltrate,round(y7fit,2)),file="outfile7")
#
#
# Read in future values of drivers and predict Melt Rate:  (using CCSM3)
#
datasetx=read.table("garrbill.txt",header=TRUE)
z=predict(y7aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-mr-ccsm3.out")
#
#
# Read in future values of drivers and predict Melt Rate:  (using CCSM4)
#
datasetx=read.table("garr-fut20.txt",header=TRUE)
z=predict(y7aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-mr-ccsm4.out")
#
#
#**************************************************************************
#
#
# Determine MLR for Melt-out Day
#
#
#
y5=lm(dataset$snomoday~dataset$el785snoTAMJ+dataset$el7snoTAMJ+dataset$el85snoTAMJ+dataset$el7hcnTAMJ+dataset$ETAMJ+dataset$el85snoPAMJ+dataset$el785
snoPAMJ)
y5aic=step(y5,direction="both")
summary(y5aic)
#
#
# "Step" gave 2 similiar parameters:  el7snoPAMJ and el785snoPAMJ
#  Forcing results to only include el7snoPAMJ
y5aic=lm(snomoday~el85snoTAMJ+ETAMJ+el7snoPAMJ,data=dataset)
summary(y5aic)
#
#
y5fit=fitted(y5aic)
# Write Actual vs Simulated - (One-year per row)
write.table(cbind(dataset$snomoday,round(y5fit,2)),file="outfile5")
#
#
#
# Read in future values of drivers and predict Melt-Out Day:  (using CCSM3)
#
datasetx=read.table("garrbill.txt",header=TRUE)
z=predict(y5aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-mo-ccsm3.out")

#
#
#
# Read in future values of drivers and predict Melt-Out Day:  (using CCSM4)
#
datasetx=read.table("garr-fut20.txt",header=TRUE)
z=predict(y5aic,newdata=datasetx,interval="prediction")
# write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
# write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
write.table(cbind(datasetx$Year,z),file="g-mo-ccsm4.out")

#
#
#
#**************************************************************************
#
# Determine Multiple Linear Regression for Runoff:
dataset=read.table("garr-ex2.txt",header=TRUE)
x=round(cor(dataset),2)
write.table(x,file="out-ro")
#
#y=lm(dataset2$FTPKRO~dataset2$smlbAMJ+dataset2$el7snoPAMJ+dataset2$el7hcnPAMJ+dataset2$el785snoPAMJ+dataset2$el85snoTAMJ+dataset2$OldRO)
y=lm(GARRRO~ETAMJ+SWEest+el85snoPAMJ+el7hcnPAMJ+el7hcnTAMJ+el785snoPAMJ+el7snoTAMJ,data=dataset)
yaic=step(y)
#
summary(yaic)
#
#
#
#
# Problem using above regression ... for forecasting ... occasionally give
#    negative inflows.  To get around this, work in log domain:
#
```

```
dataset$SWEest.log=log(dataset$SWEest)
dataset$el7hcnPAMJ.log=log(dataset$el7hcnPAMJ)
dataset$GARRRO.log=log(dataset$GARRRO)
#
y=lm(GARRRO.log~SWEest.log+el7hcnPAMJ.log,data=dataset)
summary(y)
yfit.log=fitted(y)
yfit=2.71^yfit.log
write.table(cbind(dataset$GARRRO,round(yfit,0)),file="outro-ex")
#
#
# Read in future values of drivers and predict future Runoff (CCSM3):
#
datasetz=read.table("garr-fut-ro.txt",header=TRUE)
# Work in log-domain to determine FTPKRO
datasetz$SWEest.log=log(datasetz$SWEest)
datasetz$el7hcnPAMJ.log=log(datasetz$el7hcnPAMJ)
#
z=predict(y,newdata=datasetz,interval="prediction")
z2=2.71^z
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
write.table(cbind(datasetz$Year,z2),file="G-RO-CCSM3.OUT")
#
#
# Read in future values of drivers and predict future Runoff (ccsm4):
#
datasetz=read.table("garr-fut-ro5.txt",header=TRUE)
# Work in log-domain to determine FTPKRO
datasetz$SWEest.log=log(datasetz$SWEest)
datasetz$el7hcnPAMJ.log=log(datasetz$el7snoPAMJ)
#
z=predict(y,newdata=datasetz,interval="prediction")
z2=2.71^z
# write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
write.table(cbind(datasetz$Year,z2),file="G-RO-CCSM4.OUT")
#
# end
```

Garrison R-Batch file:

```
"l:\public\reservoirregulation\monthly inflow forecast\stochastic\r\r-2.14.0\bin\R" CMD
BATCH "garr2.r" "OUT"
```

“R”-Statistics

Garrison-

Output File:

```
R version 2.14.0 (2011-10-31)
Copyright (C) 2011 The R Foundation for Statistical Computing
ISBN 3-900051-07-0
Platform: i386-pc-mingw32/i386 (32-bit)

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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Previously saved workspace restored]

> # Read Data:
> dataset=read.table("garr-ex.txt",header=TRUE)
> #
> summary (dataset)
      Year          GARRRO         snobegac       snoaccrate      snopeakswe
 Min.   :1992   Min.   : 2812   Min.   :256.0   Min.   :0.060   Min.   :11.90
 1st Qu.:1997   1st Qu.: 3648   1st Qu.:262.8   1st Qu.:0.070   1st Qu.:14.35
 Median :2002   Median : 5233   Median :273.5   Median :0.080   Median :15.60
 Mean   :2002   Mean   : 5777   Mean   :271.0   Mean   :0.082   Mean   :17.14
 3rd Qu.:2006   3rd Qu.: 6888   3rd Qu.:279.0   3rd Qu.:0.090   3rd Qu.:19.60
 Max.   :2011   Max.   :15938   Max.   :284.0   Max.   :0.110   Max.   :25.40
   snopeakday       snomoday      snomeltrate       el7snoTOND
 Min.   : 77.0   Min.   :160.0   Min.   :0.1200   Min.   :26.52
 1st Qu.:108.5   1st Qu.:175.0   1st Qu.:0.2175   1st Qu.:27.64
 Median :119.5   Median :181.5   Median :0.2550   Median :30.06
 Mean   :116.8   Mean   :182.7   Mean   :0.2650   Mean   :29.65
 3rd Qu.:130.2   3rd Qu.:192.2   3rd Qu.:0.3225   3rd Qu.:31.19
 Max.   :136.0   Max.   :202.0   Max.   :0.3700   Max.   :35.37
   el7snoTJFM      el7snoTAMJ      el7hcnTOND      el7hcnTJFM
 Min.   :19.86   Min.   :40.38   Min.   :26.81   Min.   :19.43
 1st Qu.:24.01   1st Qu.:42.05   1st Qu.:31.87   1st Qu.:23.84
 Median :25.93   Median :43.20   Median :32.75   Median :24.61
 Mean   :25.56   Mean   :43.45   Mean   :32.50   Mean   :25.46
 3rd Qu.:28.02   3rd Qu.:44.95   3rd Qu.:33.88   3rd Qu.:27.41
 Max.   :28.91   Max.   :47.63   Max.   :38.96   Max.   :33.44
   el7hcnTAMJ      el7snoPOND       el7snoPJFM      el7snoPAMJ
 Min.   :50.19   Min.   : 3.500   Min.   :2.700   Min.   : 4.800
 1st Qu.:51.79   1st Qu.: 5.475   1st Qu.:4.425   1st Qu.: 7.175
 Median :52.90   Median : 6.400   Median :5.600   Median : 7.950
 Mean   :53.11   Mean   : 6.610   Mean   :5.975   Mean   : 7.950
 3rd Qu.:54.33   3rd Qu.: 7.525   3rd Qu.:7.625   3rd Qu.: 8.625
 Max.   :56.53   Max.   :11.700   Max.   :9.900   Max.   :11.500
   el7hcnPOND      el7hcnPJFM      el7hcnPAMJ     el785snoTOND
 Min.   :0.940   Min.   :0.890   Min.   :3.990   Min.   :22.80
 1st Qu.:1.702   1st Qu.:1.140   1st Qu.:4.777   1st Qu.:24.34
 Median :2.010   Median :1.305   Median :5.340   Median :26.97
 Mean   :2.011   Mean   :1.417   Mean   :5.867   Mean   :26.48
 3rd Qu.:2.165   3rd Qu.:1.765   3rd Qu.:6.588   3rd Qu.:28.30
 Max.   :3.480   Max.   :2.200   Max.   :9.610   Max.   :31.61
  el785snoTJFM    el785snoTAMJ    el785snoPOND     el785snoPJFM
 Min.   :17.04   Min.   :36.63   Min.   : 4.520   Min.   :3.550
 1st Qu.:20.12   1st Qu.:38.96   1st Qu.: 5.300   1st Qu.:4.515
 Median :22.32   Median :40.99   Median : 6.375   Median :6.310
 Mean   :21.95   Mean   :40.61   Mean   : 6.628   Mean   :5.957
 3rd Qu.:23.98   3rd Qu.:41.94   3rd Qu.: 7.420   3rd Qu.:7.055
 Max.   :24.49   Max.   :44.68   Max.   :10.870   Max.   :8.640
  el785snoPAMJ     el85snoTOND     el85snoTJFM     el85snoTAMJ
 Min.   : 5.570   Min.   :20.15   Min.   :15.03   Min.   :33.04
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 1st Qu.: 7.317   1st Qu.:21.76   1st Qu.:17.19   1st Qu.:35.51
 Median : 9.200   Median :23.86   Median :19.60   Median :37.94
 Mean   : 9.159   Mean   :23.82   Mean   :19.23   Mean   :37.42
 3rd Qu.:10.803   3rd Qu.:25.86   3rd Qu.:21.26   3rd Qu.:38.77
 Max.   :13.150   Max.   :29.47   Max.   :21.78   Max.   :41.77
  el85snoPOND      el85snoPJFM      el85snoPAMJ        smlbOND
 Min.   : 5.670   Min.   : 4.450   Min.   : 6.040   Min.   :5.700
 1st Qu.: 7.060   1st Qu.: 6.247   1st Qu.: 8.627   1st Qu.:6.800
 Median : 8.480   Median : 8.890   Median :10.525   Median :7.350
 Mean   : 8.596   Mean   : 8.431   Mean   :10.636   Mean   :7.335
 3rd Qu.: 9.825   3rd Qu.: 9.940   3rd Qu.:12.043   3rd Qu.:8.000
 Max.   :14.110   Max.   :12.360   Max.   :15.760   Max.   :9.000
    smlbJFM          smlbAMJ           ETOND           ETJFM
 Min.   :5.400   Min.   : 6.300   Min.   :2.770   Min.   :2.440
 1st Qu.:6.275   1st Qu.: 7.675   1st Qu.:3.303   1st Qu.:3.047
 Median :6.850   Median : 8.000   Median :3.405   Median :3.245
 Mean   :6.960   Mean   : 8.130   Mean   :3.448   Mean   :3.279
 3rd Qu.:7.625   3rd Qu.: 8.525   3rd Qu.:3.678   3rd Qu.:3.583
 Max.   :8.400   Max.   :11.400   Max.   :4.220   Max.   :4.580
     ETAMJ           SWEest
 Min.   :12.55   Min.   :11.90
 1st Qu.:14.00   1st Qu.:14.35
 Median :14.50   Median :15.60
 Mean   :14.55   Mean   :17.14
 3rd Qu.:15.06   3rd Qu.:19.60
 Max.   :16.02   Max.   :25.40
> #
> # Determine Cross-Correlations:
> x=round(cor(dataset),2)
> x
              Year GARRRO snobegac snoaccrate snopeakswe snopeakday snomoday
Year          1.00   0.30     0.42       0.01      -0.02       0.02     0.02
GARRRO        0.30   1.00     0.10       0.66       0.79       0.54     0.72
snobegac      0.42   0.10     1.00       0.15      -0.08      -0.02     0.15
snoaccrate    0.01   0.66     0.15       1.00       0.92       0.13     0.69
snopeakswe   -0.02   0.79    -0.08       0.92       1.00       0.44     0.73
snopeakday    0.02   0.54    -0.02       0.13       0.44       1.00     0.46
snomoday      0.02   0.72     0.15       0.69       0.73       0.46     1.00
snometltrate  0.03   0.61    -0.07       0.45       0.70       0.84     0.37
el7snoTOND    0.48  -0.05     0.30      -0.05      -0.15      -0.22    -0.11
el7snoTJFM    0.28  -0.36     0.15      -0.53      -0.60      -0.31    -0.43
el7snoTAMJ    0.12  -0.61    -0.21      -0.61      -0.65      -0.56    -0.84
el7hcnTOND    0.02  -0.21     0.36      -0.05      -0.19      -0.19     0.04
el7hcnTJFM   -0.12  -0.39    -0.05      -0.32      -0.35      -0.21    -0.31
el7hcnTAMJ   -0.34  -0.67    -0.34      -0.50      -0.54      -0.56    -0.76
el7snoPOND    0.03   0.47    -0.37       0.45       0.60       0.16     0.37
el7snoPJFM    0.22   0.59     0.20       0.81       0.78       0.18     0.45
el7snoPAMJ   -0.23   0.00    -0.29      -0.31      -0.14       0.35     0.17
el7hcnPOND    0.03   0.29     0.09       0.30       0.40       0.37     0.30
el7hcnPJFM   -0.12   0.22     0.02       0.48       0.41      -0.05     0.35
el7hcnPAMJ    0.31   0.70     0.11       0.04       0.25       0.61     0.43
el785snoTOND  0.63   0.10     0.36       0.03      -0.07      -0.18    -0.01
el785snoTJFM  0.43  -0.24     0.26      -0.40      -0.49      -0.28    -0.32
el785snoTAMJ  0.24  -0.60    -0.11      -0.59      -0.66      -0.58    -0.85
el785snoPOND -0.21   0.51    -0.28       0.66       0.79       0.32     0.56
el785snoPJFM -0.01   0.40    -0.05       0.77       0.75       0.14     0.42
el785snoPAMJ -0.05   0.66    -0.07       0.24       0.40       0.55     0.69
el85snoTOND   0.60   0.04     0.32      -0.03      -0.14      -0.23    -0.09
el85snoTJFM   0.43  -0.26     0.20      -0.47      -0.52      -0.27    -0.35
el85snoTAMJ   0.27  -0.57    -0.12      -0.58      -0.63      -0.55    -0.84
el85snoPOND  -0.05   0.55    -0.21       0.66       0.77       0.27     0.56
el85snoPJFM   0.12   0.44     0.11       0.78       0.73       0.12     0.44
el85snoPAMJ   0.10   0.70     0.03       0.22       0.39       0.61     0.66
smlbOND      -0.23   0.32     0.10       0.36       0.41       0.27     0.15
smlbJFM      -0.14   0.54     0.16       0.63       0.65       0.25     0.36
smlbAMJ       0.22   0.83     0.14       0.44       0.59       0.55     0.54
ETOND         0.00  -0.08     0.32       0.04      -0.13      -0.31     0.06
ETJFM        -0.24  -0.41    -0.18      -0.39      -0.38      -0.25    -0.33
ETAMJ        -0.45  -0.76    -0.38      -0.47      -0.53      -0.56    -0.76
SWEest       -0.02   0.79    -0.08       0.92       1.00       0.44     0.73
              snometltrate el7snoTOND el7snoTJFM el7snoTAMJ el7hcnTOND el7hcnTJFM
Year                  0.03       0.48       0.28       0.12       0.02      -0.12
GARRRO                0.61      -0.05      -0.36      -0.61      -0.21      -0.39
snobegac             -0.07       0.30       0.15      -0.21       0.36      -0.05
snoaccrate            0.45      -0.05      -0.53      -0.61      -0.05      -0.32
snopeakswe            0.70      -0.15      -0.60      -0.65      -0.19      -0.35
snopeakday            0.84      -0.22      -0.31      -0.56      -0.19      -0.21
snomoday              0.37      -0.11      -0.43      -0.84       0.04      -0.31
snometltrate          1.00      -0.19      -0.43      -0.50      -0.31      -0.27
el7snoTOND           -0.19       1.00       0.34       0.34       0.70       0.26
el7snoTJFM           -0.43       0.34       1.00       0.50       0.23       0.71
el7snoTAMJ           -0.50       0.34       0.50       1.00       0.16       0.45
el7hcnTOND           -0.31       0.70       0.23       0.16       1.00       0.40
el7hcnTJFM           -0.27       0.26       0.71       0.45       0.40       1.00
el7hcnTAMJ           -0.49      -0.02       0.28       0.84       0.03       0.44
el7snoPOND            0.38      -0.07      -0.46      -0.19      -0.21      -0.13
el7snoPJFM            0.50       0.23      -0.47      -0.33       0.10      -0.38
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el7snoPAMJ	0.06	-0.10	-0.01	-0.27	-0.04	-0.02
el7hcnPOND	0.46	-0.26	-0.05	-0.17	-0.26	0.10
el7hcnPJFM	0.05	-0.09	-0.37	-0.23	0.18	-0.31
el7hcnPAMJ	0.37	-0.09	0.10	-0.37	-0.10	-0.09
el785snoTOND	-0.15	0.97	0.33	0.25	0.62	0.20
el785snoTJFM	-0.38	0.45	0.96	0.45	0.28	0.66
el785snoTAMJ	-0.51	0.43	0.49	0.98	0.18	0.40
el785snoPOND	0.56	-0.26	-0.52	-0.45	-0.23	-0.04
el785snoPJFM	0.44	0.14	-0.46	-0.33	0.20	-0.26
el785snoPAMJ	0.31	-0.24	-0.04	-0.64	-0.10	-0.06
el85snoTOND	-0.21	0.97	0.33	0.34	0.63	0.21
el85snoTJFM	-0.38	0.43	0.96	0.48	0.24	0.60
el85snoTAMJ	-0.46	0.46	0.47	0.97	0.18	0.37
el85snoPOND	0.52	-0.12	-0.51	-0.42	-0.19	-0.10
el85snoPJFM	0.41	0.22	-0.41	-0.32	0.24	-0.27
el85snoPAMJ	0.39	-0.21	0.03	-0.64	-0.16	-0.08
smlbOND	0.41	-0.35	-0.11	-0.12	-0.10	0.11
smlbJFM	0.48	-0.30	-0.29	-0.30	-0.15	-0.14
smlbAMJ	0.55	-0.10	-0.05	-0.41	-0.04	-0.14
ETOND	-0.37	0.72	0.11	0.10	0.87	0.25
ETJFM	-0.31	0.14	0.72	0.40	0.32	0.92
ETAMJ	-0.47	-0.06	0.16	0.75	0.03	0.44
SWEest	0.70	-0.15	-0.60	-0.65	-0.19	-0.35

	el7hcnTAMJ	el7snoPOND	el7snoPJFM	el7snoPAMJ	el7hcnPOND	el7hcnPJFM
Year	-0.34	0.03	0.22	-0.23	0.03	-0.12
GARRRO	-0.67	0.47	0.59	0.00	0.29	0.22
snobegac	-0.34	-0.37	0.20	-0.29	0.09	0.02
snoaccrate	-0.50	0.45	0.81	-0.31	0.30	0.48
snopeakswe	-0.54	0.60	0.78	-0.14	0.40	0.41
snopeakday	-0.56	0.16	0.18	0.35	0.37	-0.05
snomoday	-0.76	0.37	0.45	0.17	0.30	0.35
snomeltrate	-0.49	0.38	0.50	0.06	0.46	0.05
el7snoTOND	-0.02	-0.07	0.23	-0.10	-0.26	-0.09
el7snoTJFM	0.28	-0.46	-0.47	-0.01	-0.05	-0.37
el7snoTAMJ	0.84	-0.19	-0.33	-0.27	-0.17	-0.23
el7hcnTOND	0.03	-0.21	0.10	-0.04	-0.26	0.18
el7hcnTJFM	0.44	-0.13	-0.38	-0.02	0.10	-0.31
el7hcnTAMJ	1.00	-0.15	-0.38	-0.24	-0.16	-0.10
el7snoPOND	-0.15	1.00	0.29	-0.02	0.27	0.04
el7snoPJFM	-0.38	0.29	1.00	-0.31	0.15	0.49
el7snoPAMJ	-0.24	-0.02	-0.31	1.00	-0.42	-0.31
el7hcnPOND	-0.16	0.27	0.15	-0.42	1.00	-0.05
el7hcnPJFM	-0.10	0.04	0.49	-0.31	-0.05	1.00
el7hcnPAMJ	-0.47	0.06	0.05	0.15	0.21	-0.01
el785snoTOND	-0.14	0.02	0.28	-0.14	-0.22	-0.07
el785snoTJFM	0.19	-0.40	-0.30	-0.09	-0.02	-0.22
el785snoTAMJ	0.76	-0.20	-0.28	-0.25	-0.27	-0.23
el785snoPOND	-0.32	0.81	0.41	-0.05	0.51	0.08
el785snoPJFM	-0.27	0.25	0.87	-0.31	0.09	0.66
el785snoPAMJ	-0.59	0.19	0.03	0.56	0.10	-0.09
el85snoTOND	-0.05	0.00	0.24	-0.12	-0.26	-0.09
el85snoTJFM	0.20	-0.39	-0.34	-0.04	-0.02	-0.23
el85snoTAMJ	0.73	-0.16	-0.25	-0.24	-0.27	-0.25
el85snoPOND	-0.35	0.90	0.45	0.00	0.43	0.04
el85snoPJFM	-0.34	0.18	0.92	-0.37	0.11	0.62
el85snoPAMJ	-0.67	0.19	0.03	0.53	0.15	-0.11
smlbOND	0.08	0.14	0.27	-0.30	0.59	0.11
smlbJFM	-0.13	0.26	0.53	-0.38	0.56	0.36
smlbAMJ	-0.45	0.22	0.42	-0.14	0.44	0.28
ETOND	-0.01	-0.08	0.15	0.11	-0.49	0.10
ETJFM	0.41	-0.09	-0.46	0.09	0.03	-0.38
ETAMJ	0.92	-0.09	-0.39	-0.10	-0.23	-0.21
SWEest	-0.54	0.60	0.78	-0.14	0.40	0.41

	el7hcnPAMJ	el785snoTOND	el785snoTJFM	el785snoTAMJ	el785snoPOND
Year	0.31	0.63	0.43	0.24	-0.21
GARRRO	0.70	0.10	-0.24	-0.60	0.51
snobegac	0.11	0.36	0.26	-0.11	-0.28
snoaccrate	0.04	0.03	-0.40	-0.59	0.66
snopeakswe	0.25	-0.07	-0.49	-0.66	0.79
snopeakday	0.61	-0.18	-0.28	-0.58	0.32
snomoday	0.43	-0.01	-0.32	-0.85	0.56
snomeltrate	0.37	-0.15	-0.38	-0.51	0.56
el7snoTOND	-0.09	0.97	0.45	0.43	-0.26
el7snoTJFM	0.10	0.33	0.96	0.49	-0.52
el7snoTAMJ	-0.37	0.25	0.45	0.98	-0.45
el7hcnTOND	-0.10	0.62	0.28	0.18	-0.23
el7hcnTJFM	-0.09	0.20	0.66	0.40	-0.04
el7hcnTAMJ	-0.47	-0.14	0.19	0.76	-0.32
el7snoPOND	0.06	0.02	-0.40	-0.20	0.81
el7snoPJFM	0.05	0.28	-0.30	-0.28	0.41
el7snoPAMJ	0.15	-0.14	-0.09	-0.25	-0.05
el7hcnPOND	0.21	-0.22	-0.02	-0.27	0.51
el7hcnPJFM	-0.01	-0.07	-0.22	-0.23	0.08
el7hcnPAMJ	1.00	0.03	0.13	-0.39	0.07
el785snoTOND	0.03	1.00	0.47	0.37	-0.21
el785snoTJFM	0.13	0.47	1.00	0.48	-0.50
el785snoTAMJ	-0.39	0.37	0.48	1.00	-0.51

el785snoPOND	0.07	-0.21	-0.50	-0.51	1.00
el785snoPJFM	-0.05	0.14	-0.33	-0.32	0.41
el785snoPAMJ	0.70	-0.15	-0.07	-0.68	0.31
el85snoTOND	-0.02	0.99	0.46	0.45	-0.26
el85snoTJFM	0.15	0.45	0.98	0.50	-0.51
el85snoTAMJ	-0.38	0.39	0.45	1.00	-0.48
el85snoPOND	0.07	-0.05	-0.45	-0.44	0.96
el85snoPJFM	-0.02	0.24	-0.26	-0.29	0.35
el85snoPAMJ	0.76	-0.10	0.02	-0.66	0.28
smlbOND	0.18	-0.35	-0.12	-0.23	0.31
smlbJFM	0.19	-0.25	-0.22	-0.37	0.41
smlbAMJ	0.80	0.01	0.02	-0.46	0.30
ETOND	-0.14	0.67	0.16	0.17	-0.18
ETJFM	-0.06	0.09	0.61	0.34	-0.03
ETAMJ	-0.66	-0.19	0.04	0.70	-0.19
SWEest	0.25	-0.07	-0.49	-0.66	0.79

	el785snoPJFM	el785snoPAMJ	el85snoTOND	el85snoTJFM	el85snoTAMJ
Year	-0.01	-0.05	0.60	0.43	0.27
GARRRO	0.40	0.66	0.04	-0.26	-0.57
snobegac	-0.05	-0.07	0.32	0.20	-0.12
snoaccrate	0.77	0.24	-0.03	-0.47	-0.58
snopeakswe	0.75	0.40	-0.14	-0.52	-0.63
snopeakday	0.14	0.55	-0.23	-0.27	-0.55
snomoday	0.42	0.69	-0.09	-0.35	-0.84
snometrate	0.44	0.31	-0.21	-0.38	-0.46
el7snoTOND	0.14	-0.24	0.97	0.43	0.46
el7snoTJFM	-0.46	-0.04	0.33	0.96	0.47
el7snoTAMJ	-0.33	-0.64	0.34	0.48	0.97
el7hcnTOND	0.20	-0.10	0.63	0.24	0.18
el7hcnTJFM	-0.26	-0.06	0.21	0.60	0.37
el7hcnTAMJ	-0.27	-0.59	-0.05	0.20	0.73
el7snoPOND	0.25	0.19	0.00	-0.39	-0.16
el7snoPJFM	0.87	0.03	0.24	-0.34	-0.25
el7snoPAMJ	-0.31	0.56	-0.12	-0.04	-0.24
el7hcnPOND	0.09	0.10	-0.26	-0.02	-0.27
el7hcnPJFM	0.66	-0.09	-0.09	-0.23	-0.25
el7hcnPAMJ	-0.05	0.70	-0.02	0.15	-0.38
el785snoTOND	0.14	-0.15	0.99	0.45	0.39
el785snoTJFM	-0.33	-0.07	0.46	0.98	0.45
el785snoTAMJ	-0.32	-0.68	0.45	0.50	1.00
el785snoPOND	0.41	0.31	-0.26	-0.51	-0.48
el785snoPJFM	1.00	-0.03	0.10	-0.38	-0.29
el785snoPAMJ	-0.03	1.00	-0.19	-0.05	-0.67
el85snoTOND	0.10	-0.19	1.00	0.44	0.47
el85snoTJFM	-0.38	-0.05	0.44	1.00	0.49
el85snoTAMJ	-0.29	-0.67	0.47	0.49	1.00
el85snoPOND	0.39	0.30	-0.09	-0.45	-0.40
el85snoPJFM	0.98	-0.03	0.19	-0.32	-0.27
el85snoPAMJ	-0.07	0.97	-0.16	0.04	-0.65
smlbOND	0.22	0.21	-0.36	-0.16	-0.23
smlbJFM	0.44	0.23	-0.27	-0.26	-0.37
smlbAMJ	0.33	0.62	-0.05	0.02	-0.44
ETOND	0.12	-0.02	0.69	0.13	0.17
ETJFM	-0.31	0.03	0.09	0.59	0.32
ETAMJ	-0.29	-0.60	-0.10	0.04	0.68
SWEest	0.75	0.40	-0.14	-0.52	-0.63

	el85snoPOND	el85snoPJFM	el85snoPAMJ	smlbOND	smlbJFM	smlbAMJ	ETOND
Year	-0.05	0.12	0.10	-0.23	-0.14	0.22	0.00
GARRRO	0.55	0.44	0.70	0.32	0.54	0.83	-0.08
snobegac	-0.21	0.11	0.03	0.10	0.16	0.14	0.32
snoaccrate	0.66	0.78	0.22	0.36	0.63	0.44	0.04
snopeakswe	0.77	0.73	0.39	0.41	0.65	0.59	-0.13
snopeakday	0.27	0.12	0.61	0.27	0.25	0.55	-0.31
snomoday	0.56	0.44	0.66	0.15	0.36	0.54	0.06
snometrate	0.52	0.41	0.39	0.41	0.48	0.55	-0.37
el7snoTOND	-0.12	0.22	-0.21	-0.35	-0.30	-0.10	0.72
el7snoTJFM	-0.51	-0.41	0.03	-0.11	-0.29	-0.05	0.11
el7snoTAMJ	-0.42	-0.32	-0.64	-0.12	-0.30	-0.41	0.10
el7hcnTOND	-0.19	0.24	-0.16	-0.10	-0.15	-0.04	0.87
el7hcnTJFM	-0.10	-0.27	-0.08	0.11	-0.14	-0.14	0.25
el7hcnTAMJ	-0.35	-0.34	-0.67	0.08	-0.13	-0.45	-0.01
el7snoPOND	0.90	0.18	0.19	0.14	0.26	0.22	-0.08
el7snoPJFM	0.45	0.92	0.03	0.27	0.53	0.42	0.15
el7snoPAMJ	0.00	-0.37	0.53	-0.30	-0.38	-0.14	0.11
el7hcnPOND	0.43	0.11	0.15	0.59	0.56	0.44	-0.49
el7hcnPJFM	0.04	0.62	-0.11	0.11	0.36	0.28	0.10
el7hcnPAMJ	0.07	-0.02	0.76	0.18	0.19	0.80	-0.14
el785snoTOND	-0.05	0.24	-0.10	-0.35	-0.25	0.01	0.67
el785snoTJFM	-0.45	-0.26	0.02	-0.12	-0.22	0.02	0.16
el785snoTAMJ	-0.44	-0.29	-0.66	-0.23	-0.37	-0.46	0.17
el785snoPOND	0.96	0.35	0.28	0.31	0.41	0.30	-0.18
el785snoPJFM	0.39	0.98	-0.07	0.22	0.44	0.33	0.12
el785snoPAMJ	0.30	-0.03	0.97	0.21	0.23	0.62	-0.02
el85snoTOND	-0.09	0.19	-0.16	-0.36	-0.27	-0.05	0.69
el85snoTJFM	-0.45	-0.32	0.04	-0.16	-0.26	0.02	0.13
el85snoTAMJ	-0.40	-0.27	-0.65	-0.23	-0.37	-0.44	0.17
el85snoPOND	1.00	0.34	0.30	0.23	0.37	0.28	-0.08

```
el85snoPJFM         0.34        1.00       -0.06    0.22    0.45    0.36  0.16
el85snoPAMJ         0.30       -0.06        1.00    0.20    0.24    0.67 -0.08
smlbOND             0.23        0.22        0.20    1.00    0.91    0.59 -0.22
smlbJFM             0.37        0.45        0.24    0.91    1.00    0.68 -0.17
smlbAMJ             0.28        0.36        0.67    0.59    0.68    1.00 -0.12
ETOND              -0.08        0.16       -0.08   -0.22   -0.17   -0.12  1.00
ETJFM              -0.08       -0.35        0.00    0.05   -0.20   -0.15  0.21
ETAMJ              -0.24       -0.36       -0.69   -0.01   -0.22   -0.65  0.05
SWEest              0.77        0.73        0.39    0.41    0.65    0.59 -0.13
             ETJFM ETAMJ SWEest
Year         -0.24 -0.45  -0.02
GARRRO       -0.41 -0.76   0.79
snobegac     -0.18 -0.38  -0.08
snoaccrate   -0.39 -0.47   0.92
snopeakswe   -0.38 -0.53   1.00
snopeakday   -0.25 -0.56   0.44
snomoday     -0.33 -0.76   0.73
snomeltrate  -0.31 -0.47   0.70
el7snoTOND    0.14 -0.06  -0.15
el7snoTJFM    0.72  0.16  -0.60
el7snoTAMJ    0.40  0.75  -0.65
el7hcnTOND    0.32  0.03  -0.19
el7hcnTJFM    0.92  0.44  -0.35
el7hcnTAMJ    0.41  0.92  -0.54
el7snoPOND   -0.09 -0.09   0.60
el7snoPJFM   -0.46 -0.39   0.78
el7snoPAMJ    0.09 -0.10  -0.14
el7hcnPOND    0.03 -0.23   0.40
el7hcnPJFM   -0.38 -0.21   0.41
el7hcnPAMJ   -0.06 -0.66   0.25
el785snoTOND  0.09 -0.19  -0.07
el785snoTJFM  0.61  0.04  -0.49
el785snoTAMJ  0.34  0.70  -0.66
el785snoPOND -0.03 -0.19   0.79
el785snoPJFM -0.31 -0.29   0.75
el785snoPAMJ  0.03 -0.60   0.40
el85snoTOND   0.09 -0.10  -0.14
el85snoTJFM   0.59  0.04  -0.52
el85snoTAMJ   0.32  0.68  -0.63
el85snoPOND  -0.08 -0.24   0.77
el85snoPJFM  -0.35 -0.36   0.73
el85snoPAMJ   0.00 -0.69   0.39
smlbOND       0.05 -0.01   0.41
smlbJFM      -0.20 -0.22   0.65
smlbAMJ      -0.15 -0.65   0.59
ETOND         0.21  0.05  -0.13
ETJFM         1.00  0.44  -0.38
ETAMJ         0.44  1.00  -0.53
SWEest       -0.38 -0.53   1.00
> write.table(x,file="outfile")
> #
> # ********************************************************************
> # Determine Multiple Linear Regression for Peak SWE:
> y2=lm(snopeakswe~el785snoPOND+el85snoPOND+el785snoPJFM+el85snoPJFM+el785snoTAMJ+el85snoTAMJ,data=dataset)
> y2aic=step(y2,direction="both")
Start:  AIC=17.36
snopeakswe ~ el785snoPOND + el85snoPOND + el785snoPJFM + el85snoPJFM +
    el785snoTAMJ + el85snoTAMJ

               Df Sum of Sq    RSS    AIC
- el785snoTAMJ  1    0.0084 23.662 15.363
- el785snoPJFM  1    0.0771 23.731 15.421
- el85snoTAMJ   1    0.1015 23.756 15.442
- el785snoPOND  1    0.5521 24.206 15.817
- el85snoPOND   1    2.3587 26.013 17.257
<none>                      23.654 17.356
- el85snoPJFM   1    3.9381 27.592 18.436

Step:  AIC=15.36
snopeakswe ~ el785snoPOND + el85snoPOND + el785snoPJFM + el85snoPJFM +
    el85snoTAMJ

               Df Sum of Sq    RSS    AIC
- el785snoPJFM  1    0.0761 23.738 13.427
- el785snoPOND  1    0.5477 24.210 13.821
<none>                      23.662 15.363
- el85snoPOND   1    2.7625 26.425 15.572
- el85snoPJFM   1    3.9505 27.613 16.451
+ el785snoTAMJ  1    0.0084 23.654 17.356
- el85snoTAMJ   1   18.4446 42.107 24.890

Step:  AIC=13.43
snopeakswe ~ el785snoPOND + el85snoPOND + el85snoPJFM + el85snoTAMJ

               Df Sum of Sq    RSS    AIC
- el785snoPOND  1     0.481 24.220 11.829
<none>                      23.738 13.427
```

```
- el85snoPOND   1     2.983 26.721 13.795
+ el785snoPJFM  1     0.076 23.662 15.363
+ el785snoTAMJ  1     0.007 23.731 15.421
- el85snoTAMJ   1    18.549 42.287 22.975
- el85snoPJFM   1    60.394 84.133 36.733

Step:  AIC=11.83
snopeakswe ~ el85snoPOND + el85snoPJFM + el85snoTAMJ

               Df Sum of Sq    RSS    AIC
<none>                      24.220 11.829
+ el785snoPOND  1     0.481 23.738 13.427
+ el785snoPJFM  1     0.009 24.210 13.821
+ el785snoTAMJ  1     0.004 24.216 13.826
- el85snoTAMJ   1    23.416 47.636 23.357
- el85snoPOND   1    55.638 79.858 33.690
- el85snoPJFM   1    61.136 85.355 35.022
> summary(y2aic)

Call:
lm(formula = snopeakswe ~ el85snoPOND + el85snoPJFM + el85snoTAMJ,
    data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-2.12917 -0.59412  0.02645  0.36473  2.61538

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  22.4727     5.9195   3.796  0.00158 **
el85snoPOND   0.8940     0.1475   6.063 1.65e-05 ***
el85snoPJFM   0.8592     0.1352   6.355 9.55e-06 ***
el85snoTAMJ  -0.5414     0.1377  -3.933  0.00119 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.23 on 16 degrees of freedom
Multiple R-squared: 0.9202,   Adjusted R-squared: 0.9052
F-statistic: 61.48 on 3 and 16 DF,  p-value: 5.305e-09

> #
> y2fit=fitted(y2aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$el7snoPJFM,dataset$el785snoTAMJ,dataset$el785snoPOND,y2fit),file="outg")
> write.table(cbind(dataset$Year,dataset$snopeakswe,round(y2fit,2)),file="outfile1")
> #
> # Read in future values of drivers and predict future SWE:  (using CCSM3)
> #
> datasetx=read.table("garrbill.txt",header=TRUE)
> z=predict(y2aic,newdata=datasetx,interval="prediction")
> write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="G-SWE-CCSM3.OUT")
> #
> # Read in future values of drivers and predict future SWE:  (using CCSM4)
> #
> datasetz=read.table("garrfut3.txt",header=TRUE)
> z=predict(y2aic,newdata=datasetz,interval="prediction")
> write.table(cbind(datasetz$el7snoPJFM,datasetz$el785snoTAMJ,datasetz$el785snoPOND,z),file="outj2")
> write.table(cbind(datasetz$Year,datasetz$el785snoPOND,datasetz$el7snoPJFM,datasetz$el785snoTAMJ,z),file="outk2")
> write.table(cbind(datasetz$Year,z),file="G-SWE-CCSM4.OUT")
> #
> # Read in values of drivers (from CCSM4 2001-2011)and predict future SWE: (using CCSM4)
> #
> datasetz=read.table("g-2002-11-ccsm4.txt",header=TRUE)
> z=predict(y2aic,newdata=datasetz,interval="prediction")
> write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
> write.table(z,file="outg02-11")
> #
> # ***********************************************************************
> #
> # Determine MLR for Day Begins Accumulations (DBA)
> #
> # summary(y2)
> #
> y3=lm(snobegac~ETAMJ+el785snoTOND+el7hcnTOND+el7hcnTAMJ+el85snoTOND+el785snoPOND+el785snoTJFM,data=dataset)
> y3aic=step(y3,direction="both")
Start:  AIC=91.24
snobegac ~ ETAMJ + el785snoTOND + el7hcnTOND + el7hcnTAMJ + el85snoTOND +
    el785snoPOND + el785snoTJFM

               Df Sum of Sq    RSS    AIC
- el785snoTJFM  1     0.132 860.94 89.246
- ETAMJ         1     0.290 861.09 89.249
- el7hcnTAMJ    1    12.276 873.08 89.526
- el785snoTOND  1    41.924 902.73 90.194
- el85snoTOND   1    42.184 902.99 90.200
```

```
- el7hcnTOND    1    57.788 918.59 90.542
<none>                     860.80 91.243
- el785snoPOND  1   128.185 988.99 92.019

Step:  AIC=89.25
snobegac ~ ETAMJ + el785snoTOND + el7hcnTOND + el7hcnTAMJ + el85snoTOND +
    el785snoPOND

               Df Sum of Sq     RSS    AIC
- ETAMJ         1     0.254  861.19 87.252
- el7hcnTAMJ    1    14.164  875.10 87.572
- el85snoTOND   1    48.763  909.70 88.348
- el785snoTOND  1    50.651  911.59 88.389
- el7hcnTOND    1    58.700  919.64 88.565
<none>                       860.94 89.246
- el785snoPOND  1   160.022 1020.96 90.655
+ el785snoTJFM  1     0.132  860.80 91.243

Step:  AIC=87.25
snobegac ~ el785snoTOND + el7hcnTOND + el7hcnTAMJ + el85snoTOND +
    el785snoPOND

               Df Sum of Sq     RSS    AIC
- el85snoTOND   1    57.493  918.68 86.544
- el7hcnTOND    1    59.240  920.43 86.582
- el785snoTOND  1    60.890  922.08 86.618
- el7hcnTAMJ    1    84.588  945.78 87.126
<none>                       861.19 87.252
- el785snoPOND  1   185.285 1046.48 89.149
+ ETAMJ         1     0.254  860.94 89.246
+ el785snoTJFM  1     0.095  861.09 89.249

Step:  AIC=86.54
snobegac ~ el785snoTOND + el7hcnTOND + el7hcnTAMJ + el785snoPOND

               Df Sum of Sq     RSS    AIC
- el785snoTOND  1     4.227  922.91 84.636
- el7hcnTOND    1    55.498  974.18 85.717
<none>                       918.68 86.544
+ el85snoTOND   1    57.493  861.19 87.252
- el785snoPOND  1   150.989 1069.67 87.587
+ el785snoTJFM  1    10.471  908.21 88.315
+ ETAMJ         1     8.983  909.70 88.348
- el7hcnTAMJ    1   251.991 1170.67 89.392

Step:  AIC=84.64
snobegac ~ el7hcnTOND + el7hcnTAMJ + el785snoPOND

               Df Sum of Sq     RSS    AIC
<none>                       922.91 84.636
- el7hcnTOND    1   119.736 1042.65 85.076
- el785snoPOND  1   163.738 1086.65 85.902
+ el785snoTJFM  1    14.479  908.43 86.320
+ ETAMJ         1    11.124  911.79 86.393
+ el785snoTOND  1     4.227  918.68 86.544
+ el85snoTOND   1     0.830  922.08 86.618
- el7hcnTAMJ    1   285.343 1208.25 88.024
> summary(y3aic)

Call:
lm(formula = snobegac ~ el7hcnTOND + el7hcnTAMJ + el785snoPOND,
    data = dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-11.412  -4.321  -0.544   5.430  12.042

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  382.2695    65.4239   5.843  2.5e-05 ***
el7hcnTOND     0.9178     0.6370   1.441   0.1689
el7hcnTAMJ    -2.4153     1.0859  -2.224   0.0409 *
el785snoPOND  -1.9362     1.1492  -1.685   0.1114
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 7.595 on 16 degrees of freedom
Multiple R-squared: 0.3679,   Adjusted R-squared: 0.2493
F-statistic: 3.104 on 3 and 16 DF,  p-value: 0.0562

> #
> y3fit=fitted(y3aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snobegac,round(y3fit,3)),file="outfile2")
> #
> #
> #
```

```
> # Read in future values of drivers and predict DBA:  (using CCSM3)
> #
> datasetx=read.table("garrbill.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-dba-ccsm3.out")
> #
> #
> # Read in future values of drivers and predict DBA:  (using CCSM4)
> #
> datasetx=read.table("garrfut3.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-dba-ccsm4.out")
> #
> #
> #
> #
> #*************************************************************************
> #
> #
> # Determine Multiple Linear Regression for Peak Day:
> #
> y3=lm(snopeakday~el85snoPAMJ+el7hcnPAMJ+smlbAMJ+el785snoTAMJ+ETAMJ+el7snoTAMJ+el7hcnTAMJ,data=dataset)
> # y3=lm(dataset$snopeakday~dataset$el7snoTJFM+dataset$el7hcnTJFM+dataset$el85snoTJFM)
> #
> y3aic=step(y3,direction="both")
Start:  AIC=108.16
snopeakday ~ el85snoPAMJ + el7hcnPAMJ + smlbAMJ + el785snoTAMJ +
    ETAMJ + el7snoTAMJ + el7hcnTAMJ

               Df Sum of Sq    RSS    AIC
- el7snoTAMJ    1     10.09 2015.5 106.26
- smlbAMJ       1     35.58 2041.0 106.51
- el785snoTAMJ  1     41.47 2046.9 106.57
- el85snoPAMJ   1     64.62 2070.1 106.79
<none>                      2005.4 108.16
- ETAMJ         1    249.76 2255.2 108.50
- el7hcnTAMJ    1    298.02 2303.5 108.93
- el7hcnPAMJ    1    416.97 2422.4 109.94

Step:  AIC=106.26
snopeakday ~ el85snoPAMJ + el7hcnPAMJ + smlbAMJ + el785snoTAMJ +
    ETAMJ + el7hcnTAMJ

               Df Sum of Sq    RSS    AIC
- smlbAMJ       1     55.87 2071.4 104.81
- el85snoPAMJ   1     61.57 2077.1 104.86
- el785snoTAMJ  1    161.77 2177.3 105.80
<none>                      2015.5 106.26
- ETAMJ         1    269.68 2285.2 106.77
- el7hcnTAMJ    1    293.89 2309.4 106.98
- el7hcnPAMJ    1    424.90 2440.4 108.08
+ el7snoTAMJ    1     10.09 2005.4 108.16

Step:  AIC=104.8
snopeakday ~ el85snoPAMJ + el7hcnPAMJ + el785snoTAMJ + ETAMJ +
    el7hcnTAMJ

               Df Sum of Sq    RSS    AIC
- el85snoPAMJ   1     45.79 2117.2 103.24
- ETAMJ         1    214.75 2286.2 104.78
- el785snoTAMJ  1    215.17 2286.6 104.78
<none>                      2071.4 104.81
- el7hcnTAMJ    1    238.86 2310.3 104.99
+ smlbAMJ       1     55.87 2015.5 106.26
+ el7snoTAMJ    1     30.39 2041.0 106.51
- el7hcnPAMJ    1    581.41 2652.8 107.75

Step:  AIC=103.24
snopeakday ~ el7hcnPAMJ + el785snoTAMJ + ETAMJ + el7hcnTAMJ

               Df Sum of Sq    RSS    AIC
- ETAMJ         1    171.01 2288.2 102.80
- el785snoTAMJ  1    171.69 2288.9 102.80
- el7hcnTAMJ    1    193.19 2310.4 102.99
<none>                      2117.2 103.24
+ el85snoPAMJ   1     45.79 2071.4 104.81
+ smlbAMJ       1     40.09 2077.1 104.86
+ el7snoTAMJ    1     22.05 2095.1 105.03
- el7hcnPAMJ    1    768.06 2885.2 107.43

Step:  AIC=102.8
snopeakday ~ el7hcnPAMJ + el785snoTAMJ + el7hcnTAMJ
```

```
               Df Sum of Sq    RSS    AIC
- el7hcnTAMJ    1     25.72 2313.9 101.02
- el785snoTAMJ  1    206.67 2494.9 102.53
<none>                      2288.2 102.80
+ ETAMJ         1    171.01 2117.2 103.24
+ el7snoTAMJ    1     27.98 2260.2 104.55
+ el85snoPAMJ   1      2.05 2286.2 104.78
+ smlbAMJ       1      0.96 2287.2 104.79
- el7hcnPAMJ    1    660.27 2948.5 105.87

Step:  AIC=101.02
snopeakday ~ el7hcnPAMJ + el785snoTAMJ

               Df Sum of Sq    RSS    AIC
<none>                      2313.9 101.02
+ el7hcnTAMJ    1     25.72 2288.2 102.80
+ ETAMJ         1      3.54 2310.4 102.99
+ smlbAMJ       1      0.46 2313.5 103.02
+ el85snoPAMJ   1      0.12 2313.8 103.02
+ el7snoTAMJ    1      0.01 2313.9 103.02
- el785snoTAMJ  1    652.30 2966.2 103.99
- el7hcnPAMJ    1    795.26 3109.2 104.93
> summary(y3aic)

Call:
lm(formula = snopeakday ~ el7hcnPAMJ + el785snoTAMJ, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-28.2731  -6.2928  -0.1969   4.7293  22.4793

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   211.881     62.279   3.402  0.00339 **
el7hcnPAMJ      4.899      2.027   2.417  0.02717 *
el785snoTAMJ   -3.049      1.393  -2.189  0.04283 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 11.67 on 17 degrees of freedom
Multiple R-squared: 0.508,    Adjusted R-squared: 0.4501
F-statistic: 8.777 on 2 and 17 DF,  p-value: 0.002408

> #
> y3fit=fitted(y3aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snopeakday,round(y3fit,3)),file="outfile3")
> #
> #
> #
> # Read in future values of drivers and predict Peak Day:  (using CCSM3)
> #
> datasetx=read.table("garrbill.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-pd-ccsm3.out")
> #
> #
> #
> # Read in future values of drivers and predict Peak Day:  (using CCSM4)
> #
> datasetx=read.table("garr-fut20.txt",header=TRUE)
> z=predict(y3aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-pd-ccsm4.out")
> #
>
> #
> # ************************************************************************
> #
> # Determine MLR for Accumulation Rate
> #
> #
> #
> y4=lm(snoaccrate~el85snoPJFM+el785snoPJFM+el85snoPOND+el785snoPOND+el785snoTAMJ+el85snoTAMJ+el7hcnTAMJ,data=dataset)
> y4aic=step(y4,direction="both")
Start:  AIC=-196.71
snoaccrate ~ el85snoPJFM + el785snoPJFM + el85snoPOND + el785snoPOND +
    el785snoTAMJ + el85snoTAMJ + el7hcnTAMJ

               Df  Sum of Sq        RSS     AIC
- el7hcnTAMJ    1 1.3396e-05 0.00049424 -198.16
- el785snoPOND  1 1.4292e-05 0.00049514 -198.13
<none>                       0.00048084 -196.71
- el785snoTAMJ  1 6.3344e-05 0.00054419 -196.24
```

```
- el785snoPJFM  1 7.8393e-05 0.00055924 -195.69
- el85snoTAMJ   1 1.0886e-04 0.00058971 -194.63
- el85snoPOND   1 1.4021e-04 0.00062106 -193.60
- el85snoPJFM   1 2.5219e-04 0.00073303 -190.28

Step:  AIC=-198.16
snoaccrate ~ el85snoPJFM + el785snoPJFM + el85snoPOND + el785snoPOND +
    el785snoTAMJ + el85snoTAMJ

               Df  Sum of Sq        RSS     AIC
- el785snoPOND  1 7.5210e-06 0.00050176 -199.86
<none>                       0.00049424 -198.16
- el785snoPJFM  1 6.8844e-05 0.00056308 -197.56
+ el7hcnTAMJ    1 1.3396e-05 0.00048084 -196.71
- el85snoPOND   1 1.2694e-04 0.00062117 -195.59
- el785snoTAMJ  1 1.4391e-04 0.00063815 -195.05
- el85snoTAMJ   1 1.8485e-04 0.00067909 -193.81
- el85snoPJFM   1 2.9505e-04 0.00078929 -190.80

Step:  AIC=-199.86
snoaccrate ~ el85snoPJFM + el785snoPJFM + el85snoPOND + el785snoTAMJ +
    el85snoTAMJ

               Df  Sum of Sq        RSS     AIC
<none>                       0.00050176 -199.86
- el785snoPJFM  1 0.00008552 0.00058728 -198.72
+ el785snoPOND  1 0.00000752 0.00049424 -198.16
+ el7hcnTAMJ    1 0.00000662 0.00049514 -198.13
- el785snoTAMJ  1 0.00013646 0.00063822 -197.05
- el85snoTAMJ   1 0.00017759 0.00067935 -195.80
- el85snoPJFM   1 0.00033158 0.00083334 -191.72
- el85snoPOND   1 0.00066160 0.00116336 -185.04
> summary(y4aic)

Call:
lm(formula = snoaccrate ~ el85snoPJFM + el785snoPJFM + el85snoPOND +
    el785snoTAMJ + el85snoTAMJ, data = dataset)

Residuals:
       Min         1Q     Median         3Q        Max
-0.0105944 -0.0041846  0.0008258  0.0044414  0.0080350

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)  -0.0157216  0.0665963  -0.236 0.816794
el85snoPJFM   0.0088471  0.0029087   3.042 0.008794 **
el785snoPJFM -0.0066066  0.0042769  -1.545 0.144714
el85snoPOND   0.0034988  0.0008143   4.296 0.000739 ***
el785snoTAMJ  0.0156943  0.0080431   1.951 0.071327 .
el85snoTAMJ  -0.0161671  0.0072629  -2.226 0.042952 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.005987 on 14 degrees of freedom
Multiple R-squared: 0.898,    Adjusted R-squared: 0.8616
F-statistic: 24.66 on 5 and 14 DF,  p-value: 1.776e-06

> #
> # regression results in 2 similar paramaters: el85snoPJFM and el785snoPFM
> #    same for:                                el85snosnoTAMJ and el785snoTAMJ
> #    so just use:  el85snoPJFM and el785snoTAMJ
> #
> y4aic=lm(snoaccrate~el85snoPJFM+el785snoTAMJ+el85snoPOND,data=dataset)
> summary(y4aic)

Call:
lm(formula = snoaccrate ~ el85snoPJFM + el785snoTAMJ + el85snoPOND,
    data = dataset)

Residuals:
       Min         1Q     Median         3Q        Max
-0.0112216 -0.0060775  0.0008055  0.0042245  0.0099884

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   0.1090773  0.0391635   2.785  0.01324 *
el85snoPJFM   0.0042165  0.0007577   5.565 4.27e-05 ***
el785snoTAMJ -0.0020777  0.0008520  -2.439  0.02678 *
el85snoPOND   0.0025315  0.0008364   3.027  0.00802 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.006875 on 16 degrees of freedom
Multiple R-squared: 0.8463,   Adjusted R-squared: 0.8175
F-statistic: 29.36 on 3 and 16 DF,  p-value: 9.667e-07

> #
```

```
> y4fit=fitted(y4aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snoaccrate,round(y4fit,2)),file="outfile4")
> #
> #
> # Read in future values of drivers and predict Accum Rate:  (using CCSM3)
> #
> datasetx=read.table("garrbill.txt",header=TRUE)
> z=predict(y4aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(z,file="outaccrate")
> #
> #
> #
> # ***********************************************************************
> #
> # Determine MLR for Melt-Rate Rate
> #
> #
> #
> y7=lm(snomeltrate~el785snoPOND+el85snoPOND+el785snoTAMJ+el7snoTAMJ+el7snoPJFM+el7hcnTAMJ,data=dataset)
> y7aic=step(y7,direction="both")
Start:  AIC=-109.45
snomeltrate ~ el785snoPOND + el85snoPOND + el785snoTAMJ + el7snoTAMJ +
    el7snoPJFM + el7hcnTAMJ

               Df Sum of Sq      RSS     AIC
- el785snoTAMJ  1 0.0002439 0.041961 -111.33
- el7snoTAMJ    1 0.0002624 0.041980 -111.33
- el85snoPOND   1 0.0009010 0.042618 -111.02
- el785snoPOND  1 0.0022474 0.043965 -110.40
- el7hcnTAMJ    1 0.0023666 0.044084 -110.35
<none>                     0.041717 -109.45
- el7snoPJFM    1 0.0047897 0.046507 -109.28

Step:  AIC=-111.33
snomeltrate ~ el785snoPOND + el85snoPOND + el7snoTAMJ + el7snoPJFM +
    el7hcnTAMJ

               Df Sum of Sq      RSS     AIC
- el7snoTAMJ    1 0.0000186 0.041980 -113.33
- el85snoPOND   1 0.0018944 0.043856 -112.45
- el7hcnTAMJ    1 0.0021228 0.044084 -112.35
<none>                     0.041961 -111.33
- el7snoPJFM    1 0.0045473 0.046509 -111.28
- el785snoPOND  1 0.0047387 0.046700 -111.19
+ el785snoTAMJ  1 0.0002439 0.041717 -109.45

Step:  AIC=-113.33
snomeltrate ~ el785snoPOND + el85snoPOND + el7snoPJFM + el7hcnTAMJ

               Df Sum of Sq      RSS     AIC
- el85snoPOND   1 0.0019487 0.043929 -114.42
<none>                     0.041980 -113.33
- el7snoPJFM    1 0.0045890 0.046569 -113.25
- el785snoPOND  1 0.0053015 0.047281 -112.95
- el7hcnTAMJ    1 0.0057966 0.047776 -112.74
+ el7snoTAMJ    1 0.0000186 0.041961 -111.33
+ el785snoTAMJ  1 0.0000001 0.041980 -111.33

Step:  AIC=-114.42
snomeltrate ~ el785snoPOND + el7snoPJFM + el7hcnTAMJ

               Df Sum of Sq      RSS     AIC
- el7snoPJFM    1 0.0036735 0.047602 -114.81
<none>                     0.043929 -114.42
- el7hcnTAMJ    1 0.0052591 0.049188 -114.16
+ el85snoPOND   1 0.0019487 0.041980 -113.33
- el785snoPOND  1 0.0092291 0.053158 -112.61
+ el785snoTAMJ  1 0.0003462 0.043582 -112.58
+ el7snoTAMJ    1 0.0000729 0.043856 -112.45

Step:  AIC=-114.81
snomeltrate ~ el785snoPOND + el7hcnTAMJ

               Df Sum of Sq      RSS     AIC
<none>                     0.047602 -114.81
+ el7snoPJFM    1 0.0036735 0.043929 -114.42
- el7hcnTAMJ    1 0.0088194 0.056421 -113.41
+ el85snoPOND   1 0.0010333 0.046569 -113.25
+ el785snoTAMJ  1 0.0000489 0.047553 -112.83
+ el7snoTAMJ    1 0.0000050 0.047597 -112.81
- el785snoPOND  1 0.0150807 0.062683 -111.31
> summary(y7aic)

Call:
```

```
lm(formula = snomeltrate ~ el785snoPOND + el7hcnTAMJ, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.14366 -0.02889  0.01063  0.04275  0.05020 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)  
(Intercept)   0.857463   0.420993   2.037   0.0576 .
el785snoPOND  0.018091   0.007795   2.321   0.0330 *
el7hcnTAMJ   -0.013414   0.007558  -1.775   0.0939 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.05292 on 17 degrees of freedom
Multiple R-squared: 0.423,    Adjusted R-squared: 0.3551 
F-statistic: 6.232 on 2 and 17 DF,  p-value: 0.009332

> #
> y7fit=fitted(y7aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snomeltrate,round(y7fit,2)),file="outfile7")
> #
> #
> # Read in future values of drivers and predict Melt Rate:  (using CCSM3)
> #
> datasetx=read.table("garrbill.txt",header=TRUE)
> z=predict(y7aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-mr-ccsm3.out")
> #
> #
> # Read in future values of drivers and predict Melt Rate:  (using CCSM4)
> #
> datasetx=read.table("garr-fut20.txt",header=TRUE)
> z=predict(y7aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-mr-ccsm4.out")
> #
> #
> #*************************************************************************
> #
> #
> # Determine MLR for Melt-out Day
> #
> #
> #
>
y5=lm(dataset$snomoday~dataset$el785snoTAMJ+dataset$el7snoTAMJ+dataset$el85snoTAMJ+dataset$el7hcnTAMJ+dataset$ETAMJ+dataset$el85snoPAMJ+dataset$el785
snoPAMJ)
> y5aic=step(y5,direction="both")
Start:  AIC=76.45
dataset$snomoday ~ dataset$el785snoTAMJ + dataset$el7snoTAMJ + 
    dataset$el85snoTAMJ + dataset$el7hcnTAMJ + dataset$ETAMJ + 
    dataset$el85snoPAMJ + dataset$el785snoPAMJ

                       Df Sum of Sq    RSS    AIC
- dataset$el785snoTAMJ  1     0.044 410.87 74.451
- dataset$el7snoTAMJ    1     0.145 410.97 74.456
- dataset$el85snoTAMJ   1     1.873 412.70 74.540
- dataset$el7hcnTAMJ    1     2.009 412.84 74.546
<none>                              410.83 76.449
- dataset$ETAMJ         1    84.377 495.21 78.185
- dataset$el85snoPAMJ   1   151.382 562.21 80.723
- dataset$el785snoPAMJ  1   170.390 581.22 81.388

Step:  AIC=74.45
dataset$snomoday ~ dataset$el7snoTAMJ + dataset$el85snoTAMJ + 
    dataset$el7hcnTAMJ + dataset$ETAMJ + dataset$el85snoPAMJ + 
    dataset$el785snoPAMJ

                       Df Sum of Sq    RSS    AIC
- dataset$el7snoTAMJ    1     0.127 411.00 72.457
- dataset$el7hcnTAMJ    1     2.261 413.13 72.561
- dataset$el85snoTAMJ   1     9.807 420.68 72.923
<none>                              410.87 74.451
- dataset$ETAMJ         1    84.569 495.44 76.194
+ dataset$el785snoTAMJ  1     0.044 410.83 76.449
- dataset$el85snoPAMJ   1   155.149 566.02 78.858
- dataset$el785snoPAMJ  1   178.436 589.31 79.664

Step:  AIC=72.46
dataset$snomoday ~ dataset$el85snoTAMJ + dataset$el7hcnTAMJ + 
    dataset$ETAMJ + dataset$el85snoPAMJ + dataset$el785snoPAMJ
```

```
                       Df Sum of Sq    RSS    AIC
- dataset$el7hcnTAMJ    1     3.053 414.05 70.605
<none>                               411.00 72.457
+ dataset$el7snoTAMJ    1     0.127 410.87 74.451
+ dataset$el785snoTAMJ  1     0.025 410.97 74.456
- dataset$ETAMJ         1    93.974 504.97 74.575
- dataset$el85snoTAMJ   1    96.642 507.64 74.681
- dataset$el85snoPAMJ   1   157.319 568.32 76.939
- dataset$el785snoPAMJ  1   185.731 596.73 77.915

Step:  AIC=70.61
dataset$snomoday ~ dataset$el85snoTAMJ + dataset$ETAMJ + dataset$el85snoPAMJ +
    dataset$el785snoPAMJ

                       Df Sum of Sq    RSS    AIC
<none>                               414.05 70.605
+ dataset$el7hcnTAMJ    1     3.053 411.00 72.457
+ dataset$el7snoTAMJ    1     0.918 413.13 72.561
+ dataset$el785snoTAMJ  1     0.742 413.31 72.569
- dataset$el85snoTAMJ   1   129.588 543.64 74.051
- dataset$el85snoPAMJ   1   154.314 568.37 74.941
- dataset$el785snoPAMJ  1   182.682 596.73 75.915
- dataset$ETAMJ         1   272.741 686.79 78.726
> summary(y5aic)

Call:
lm(formula = dataset$snomoday ~ dataset$el85snoTAMJ + dataset$ETAMJ +
    dataset$el85snoPAMJ + dataset$el785snoPAMJ)

Residuals:
     Min       1Q   Median       3Q      Max
-10.7913  -2.3174   0.1669   3.1156   9.0908

Coefficients:
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)          370.1965    38.4346   9.632 8.17e-08 ***
dataset$el85snoTAMJ   -1.9015     0.8776  -2.167   0.0468 *
dataset$ETAMJ         -8.1947     2.6070  -3.143   0.0067 **
dataset$el85snoPAMJ   -6.2349     2.6370  -2.364   0.0320 *
dataset$el785snoPAMJ   7.5537     2.9363   2.573   0.0212 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.254 on 15 degrees of freedom
Multiple R-squared: 0.8405,   Adjusted R-squared: 0.798
F-statistic: 19.76 on 4 and 15 DF,  p-value: 7.655e-06

> #
> #
> # "Step" gave 2 similiar parameters:  el7snoPAMJ and el785snoPAMJ
> #  Forcing results to only include el7snoPAMJ
> y5aic=lm(snomoday~el85snoTAMJ+ETAMJ+el7snoPAMJ,data=dataset)
> summary(y5aic)

Call:
lm(formula = snomoday ~ el85snoTAMJ + ETAMJ + el7snoPAMJ, data = dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-12.834  -2.539   1.588   3.215  10.469

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 368.22670   28.52597  12.908  7.1e-10 ***
el85snoTAMJ  -3.13485    0.86718  -3.615  0.00232 **
ETAMJ        -4.63812    2.19926  -2.109  0.05106 .
el7snoPAMJ   -0.09375    0.98013  -0.096  0.92498
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 6.132 on 16 degrees of freedom
Multiple R-squared: 0.7682,   Adjusted R-squared: 0.7248
F-statistic: 17.68 on 3 and 16 DF,  p-value: 2.476e-05

> #
> #
> y5fit=fitted(y5aic)
> # Write Actual vs Simulated - (One-year per row)
> write.table(cbind(dataset$snomoday,round(y5fit,2)),file="outfile5")
> #
> #
> #
> # Read in future values of drivers and predict Melt-Out Day:  (using CCSM3)
> #
> datasetx=read.table("garrbill.txt",header=TRUE)
> z=predict(y5aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
```

```
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-mo-ccsm3.out")
>
> #
> #
> #
> # Read in future values of drivers and predict Melt-Out Day:  (using CCSM4)
> #
> datasetx=read.table("garr-fut20.txt",header=TRUE)
> z=predict(y5aic,newdata=datasetx,interval="prediction")
> # write.table(cbind(datasetx$Year,datasetx$el785snoPOND,datasetx$el7snoPJFM,datasetx$el785snoTAMJ,z),file="outk1")
> # write(datasetx$el785snoPOND,datasetx$elsfile="outbill",ncolumns=1)
> write.table(cbind(datasetx$Year,z),file="g-mo-ccsm4.out")
>
> #
> #
> #
> #*************************************************************************
> #
> # Determine Multiple Linear Regression for Runoff:
> dataset=read.table("garr-ex2.txt",header=TRUE)
> x=round(cor(dataset),2)
> write.table(x,file="out-ro")
> #
> #y=lm(dataset2$FTPKRO~dataset2$smlbAMJ+dataset2$el7snoPAMJ+dataset2$el7hcnPAMJ+dataset2$el785snoPAMJ+dataset2$el85snoTAMJ+dataset2$OldRO)
> y=lm(GARRRO~ETAMJ+SWEest+el85snoPAMJ+el7hcnPAMJ+el7hcnTAMJ+el785snoPAMJ+el7snoTAMJ,data=dataset)
> yaic=step(y)
Start:  AIC=284.57
GARRRO ~ ETAMJ + SWEest + el85snoPAMJ + el7hcnPAMJ + el7hcnTAMJ +
    el785snoPAMJ + el7snoTAMJ

               Df Sum of Sq      RSS    AIC
- el785snoPAMJ  1      8777 13592008 282.58
- el7hcnTAMJ    1    100741 13683973 282.72
- el85snoPAMJ   1    201044 13784275 282.87
- ETAMJ         1    286697 13869929 282.99
<none>                      13583231 284.57
- el7snoTAMJ    1   2096894 15680125 285.44
- el7hcnPAMJ    1   3979054 17562285 287.71
- SWEest        1  41990506 55573737 310.75

Step:  AIC=282.59
GARRRO ~ ETAMJ + SWEest + el85snoPAMJ + el7hcnPAMJ + el7hcnTAMJ +
    el7snoTAMJ

              Df Sum of Sq      RSS    AIC
- el7hcnTAMJ   1    110077 13702086 280.75
- ETAMJ        1    329599 13921608 281.06
- el85snoPAMJ  1    971165 14563173 281.96
<none>                     13592008 282.58
- el7snoTAMJ   1   2511344 16103353 283.98
- el7hcnPAMJ   1   3970351 17562359 285.71
- SWEest       1  42953399 56545407 309.10

Step:  AIC=280.75
GARRRO ~ ETAMJ + SWEest + el85snoPAMJ + el7hcnPAMJ + el7snoTAMJ

              Df Sum of Sq      RSS    AIC
- el85snoPAMJ  1   1430972 15133058 280.73
<none>                     13702086 280.75
- el7snoTAMJ   1   2446278 16148364 282.03
- ETAMJ        1   2841074 16543160 282.51
- el7hcnPAMJ   1   4730312 18432398 284.68
- SWEest       1  42983385 56685471 307.15

Step:  AIC=280.73
GARRRO ~ ETAMJ + SWEest + el7hcnPAMJ + el7snoTAMJ

             Df Sum of Sq      RSS    AIC
- el7snoTAMJ  1   1247759 16380817 280.32
<none>                    15133058 280.73
- ETAMJ       1   2502295 17635353 281.79
- el7hcnPAMJ  1  16233676 31366733 293.31
- SWEest      1  41953894 57086952 305.29

Step:  AIC=280.32
GARRRO ~ ETAMJ + SWEest + el7hcnPAMJ

             Df Sum of Sq      RSS    AIC
- ETAMJ       1   1281576 17662393 279.82
<none>                    16380817 280.32
- el7hcnPAMJ  1  19321847 35702664 293.90
- SWEest      1  44020067 60400884 304.42

Step:  AIC=279.82
GARRRO ~ SWEest + el7hcnPAMJ
```

```
             Df Sum of Sq      RSS    AIC
<none>                    17662393 279.82
- el7hcnPAMJ  1  44547636 62210029 303.01
- SWEest      1  68611990 86274383 309.55
> #
> summary(yaic)

Call:
lm(formula = GARRRO ~ SWEest + el7hcnPAMJ, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-1963.36  -544.71    57.92   439.63  2471.92

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -9104.80    1258.19  -7.236 1.39e-06 ***
SWEest        491.45      60.48   8.126 2.95e-07 ***
el7hcnPAMJ   1100.88     168.12   6.548 4.97e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1019 on 17 degrees of freedom
Multiple R-squared: 0.8951,   Adjusted R-squared: 0.8827
F-statistic: 72.51 on 2 and 17 DF,  p-value: 4.759e-09

> #
> #
> #
> #
> # Problem using above regression ... for forecasting ... occasionally give
> #    negative inflows.  To get around this, work in log domain:
> #
> dataset$SWEest.log=log(dataset$SWEest)
> dataset$el7hcnPAMJ.log=log(dataset$el7hcnPAMJ)
> dataset$GARRRO.log=log(dataset$GARRRO)
> #
> y=lm(GARRRO.log~SWEest.log+el7hcnPAMJ.log,data=dataset)
> summary(y)

Call:
lm(formula = GARRRO.log ~ SWEest.log + el7hcnPAMJ.log, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-0.22216 -0.09413  0.01962  0.07899  0.16372

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)      3.0327     0.3641   8.329 2.10e-07 ***
SWEest.log       1.3765     0.1246  11.051 3.51e-09 ***
el7hcnPAMJ.log   0.9490     0.1205   7.878 4.50e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1181 on 17 degrees of freedom
Multiple R-squared: 0.9338,   Adjusted R-squared: 0.926
F-statistic: 119.9 on 2 and 17 DF,  p-value: 9.514e-11

> yfit.log=fitted(y)
> yfit=2.71^yfit.log
> write.table(cbind(dataset$GARRRO,round(yfit,0)),file="outro-ex")
> #
> #
> # Read in future values of drivers and predict future Runoff (CCSM3):
> #
> datasetz=read.table("garr-fut-ro.txt",header=TRUE)
> # Work in log-domain to determine FTPKRO
> datasetz$SWEest.log=log(datasetz$SWEest)
> datasetz$el7hcnPAMJ.log=log(datasetz$el7hcnPAMJ)
> #
> z=predict(y,newdata=datasetz,interval="prediction")
> z2=2.71^z
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
> write.table(cbind(datasetz$Year,z2),file="G-RO-CCSM3.OUT")
> #
> #
> # Read in future values of drivers and predict future Runoff (ccsm4):
> #
> datasetz=read.table("garr-fut-ro5.txt",header=TRUE)
> # Work in log-domain to determine FTPKRO
> datasetz$SWEest.log=log(datasetz$SWEest)
> datasetz$el7hcnPAMJ.log=log(datasetz$el7snoPAMJ)
> #
> z=predict(y,newdata=datasetz,interval="prediction")
> z2=2.71^z
> # write.table(cbind(datasetz$el85snoPJFM,datasetz$el785snoPOND,datasetz$el85snoTJFM,datasetz$el7snoTAMJ,z),file="output")
```

```
> write.table(cbind(datasetz$Year,z2),file="G-RO-CCSM4.OUT")
> #
> # end
>
>
>
>
>
> # end
>
>
>
>
>
>
> proc.time()
   user  system elapsed
   1.24    0.65    4.55
```

R output for linear regression model for:

Missouri River near Landusky, Montana

```
Call:
lm(formula = logQ ~ dat$SWEest + dat$el85snoTAMJ + dat$ETAMJ +
    dat$el7snoPAMJ + dat$el785snoTAMJ)

Residuals:
     Min       1Q   Median       3Q      Max
-0.31507 -0.11350 -0.02222  0.16201  0.37618

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)      14.0375299  1.8230119   7.700 2.13e-06 ***
dat$SWEest        0.0024007  0.0006304   3.808  0.00192 **
dat$el85snoTAMJ  -0.6752516  0.4113790  -1.641  0.12297
dat$ETAMJ        -0.0034105  0.0047040  -0.725  0.48037
dat$el7snoPAMJ    0.0015648  0.0013255   1.181  0.25747
dat$el785snoTAMJ  0.5821793  0.4159629   1.400  0.18340
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2296 on 14 degrees of freedom
Multiple R-squared: 0.8602,   Adjusted R-squared: 0.8103
F-statistic: 17.23 on 5 and 14 DF,  p-value: 1.526e-05
```

R output for linear regression model for:

Yellowstone River at Miles City, Montana

```
Call:
lm(formula = logQ ~ dat$SWEest + dat$ETAMJ + dat$el85snoPOND +
    dat$el85snoPAMJ + dat$el85snoTAMJ)

Residuals:
     Min       1Q   Median       3Q      Max
-0.21735 -0.07777  0.01102  0.06109  0.19507

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)      13.6609956  0.8964536  15.239 4.13e-10 ***
dat$SWEest        0.0028437  0.0005472   5.197 0.000135 ***
dat$ETAMJ        -0.0011629  0.0020195  -0.576 0.573865
dat$el85snoPOND   0.0004045  0.0008384   0.482 0.636909
dat$el85snoPAMJ   0.0027829  0.0006443   4.319 0.000707 ***
dat$el85snoTAMJ   0.0270158  0.0348216   0.776 0.450754
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Residual standard error: 0.1174 on 14 degrees of freedom
Multiple R-squared: 0.9412,   Adjusted R-squared: 0.9202
F-statistic: 44.82 on 5 and 14 DF,  p-value: 3.996e-08
```

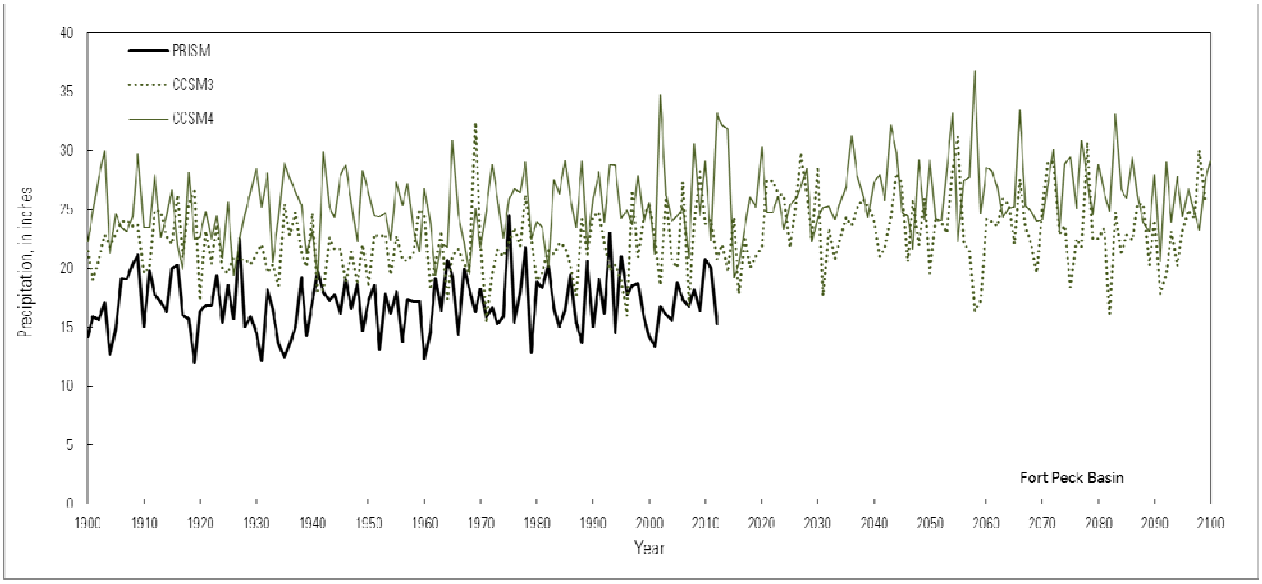
Appendix E – CCSM Climate Projections for the Fort Peck and Garrison Basins

Projections of CCSM output of annual total precipitation and average air-temperature were averaged for the Fort Peck and Garrison Basins for 1900-2100. Significant upward trends are indicated for annual precipitation and air-temperature, with significance based on the Kendall-tau non-parametric test (p=0.05) (Figures H1, H2). A linear-regression applied to CCSM3 and CCSM4 output indicates increases precipitation on the order of 1 to 2 inches per 100 years and increased average temperature of 3°F per 100 years for both the Fort Peck and Garrison Basins.

Comparison of Parameter-elevation Regressions on Independent Slopes Model (PRISM; Daly et al., 1994; Daly et al., 2002) output with CCSM output for 1900-2012, indicates a wet bias in both basins, on the order of 4 to 8 inches (Table H1). The PRISM interpolates monthly weather station data to a 2.5 arc-minute grid spacing (approximately 4-kilometer grid spacing at the latitude of the Missouri River) for the conterminous United States. Variables interpolated include monthly precipitation, and monthly maximum and minimum surface air-temperature. The CCSM3 output has a cold bias for both basins, and CCSM4 has a cold bias for the Fort Peck Basin and a warm bias for the Garrison Basin. The CCSM bias for these basins should be considered with the caveat that grid resolution and elevation dataset used by CCSM does not accurately capture the topographic features of the Fort Peck and Garrison Basins. For example, the topography of CCSM3 generally resolves the Cordillera of the western United States, but does not resolve the Rocky Mountains from the Sierra Nevada or ranges between (Figure H3).

Table H1. Comparison of PRISM and CCSM output of annual precipitation (PREC) and average temperature (TAVE) for 1900-1912. [Δ = change]

	PREC (inches)	PREC Bias (Δ inches)	TAVE (°F)	TAVE Bias (Δ°F)
Fort Peck Basin				
PRISM	17.02		41.3	
CCSM3	21.83	4.81	38.7	-2.6
CCSM4	25.04	8.02	40.0	-1.3
Garrison Basin				
PRISM	14.84		41.9	
CCSM3	18.89	4.05	41.3	-0.6
CCSM4	21.48	6.64	42.8	0.9



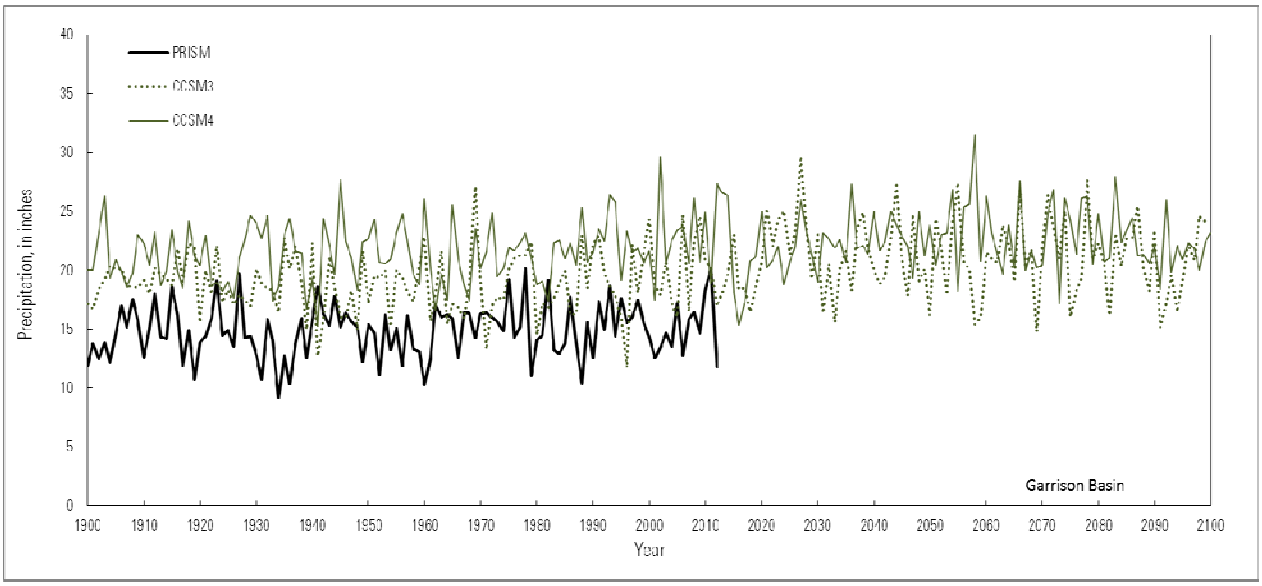
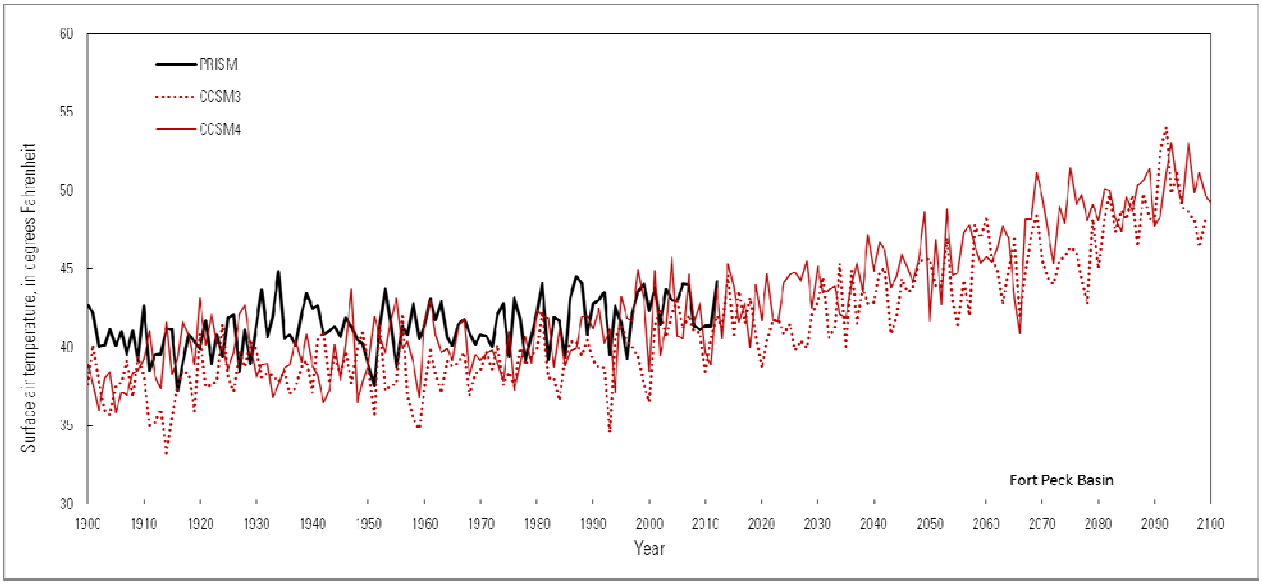


Figure H1. Historic (PRISM), contemporary (2011) and projected (CCSM3, CCSM4) trends in annual precipitation for Fort Peck and Garrison Basins.



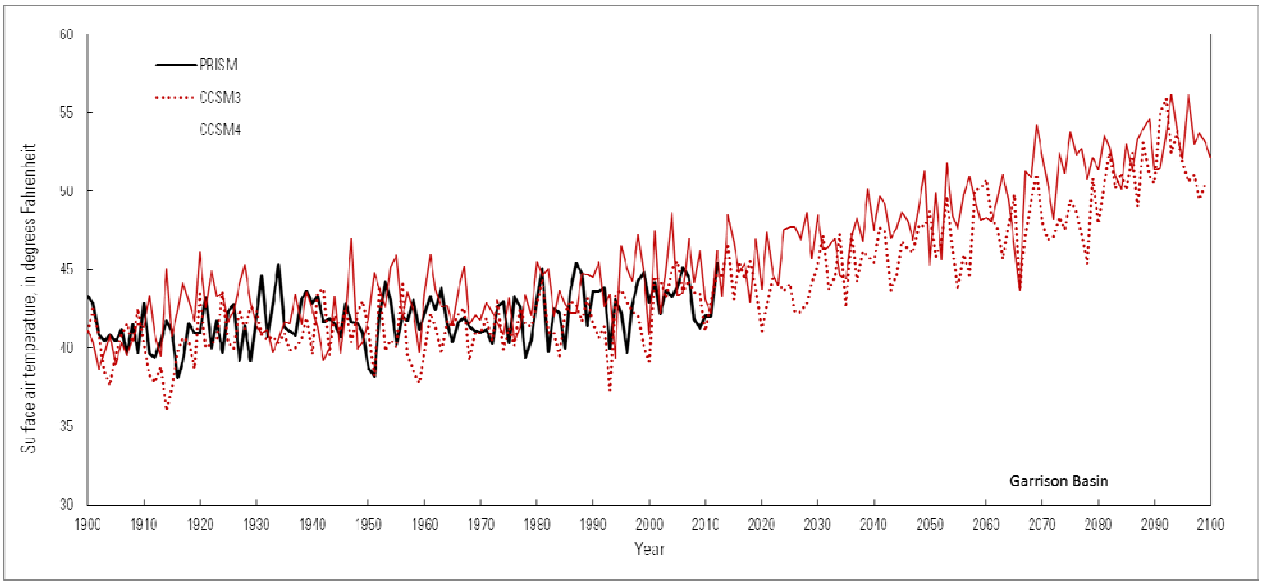


Figure H2. Historic (PRISM), contemporary (2011), and projected (CCSM3, CCSM4) trends in annual average surface air-temperature for Fort Peck and Garrison Basins.

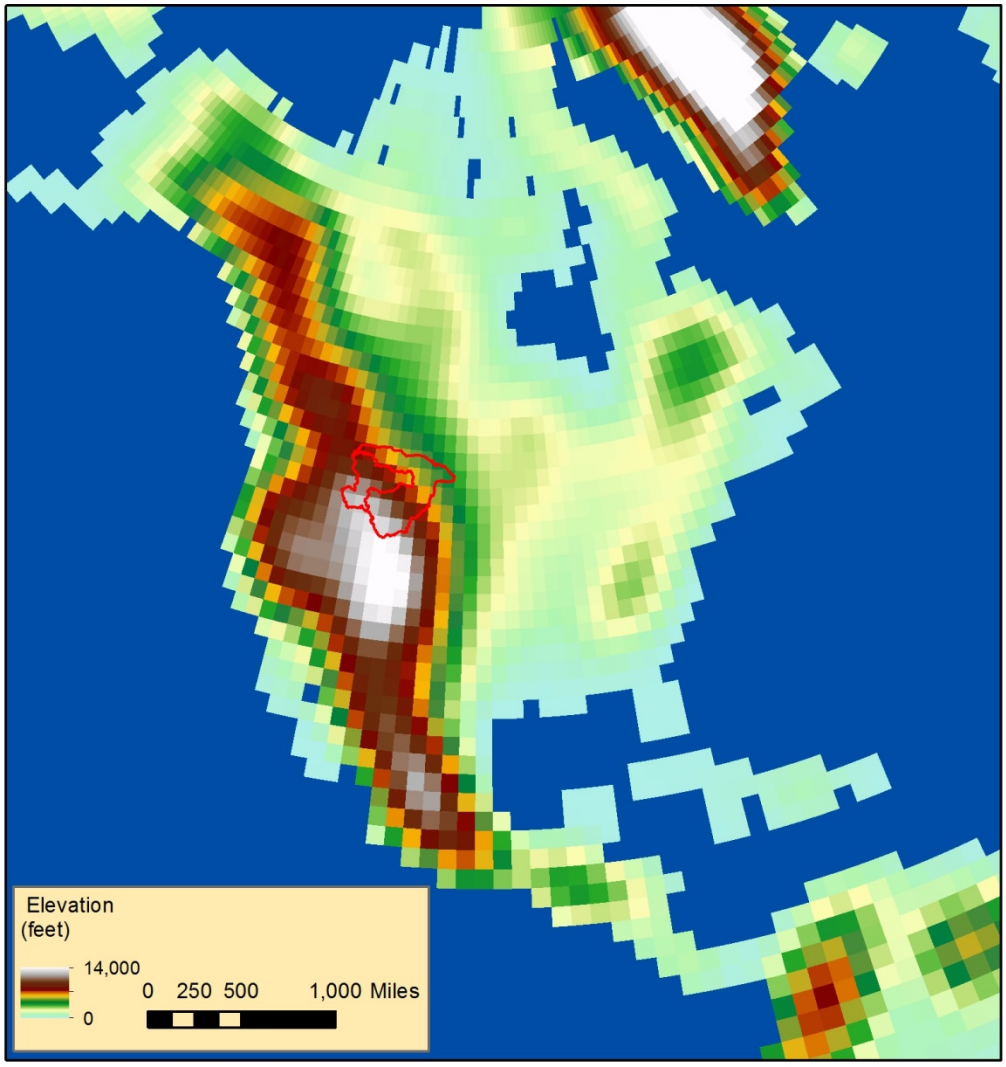


Figure H3. CCSM3 representation of terrain for North America. Blue points are ocean points. Fort Peck and Garrison Basins are outlined in red.

Appendix F - Projected Driver Trend Analysis

CCSM3

SNOTEL Temperature – Fort Peck

```
Analysis of Monthly Time-Series Data


Output File: c:\climate\ccsm3\FTPK_SNO_TempAvg_All.txt
DSS File: c:\climate\ClimateChangeData.dss



/FTPK-SNOTEL/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1M
First Year: 2012
Last Year:  2099
```

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	-15.20	-3.50	-2.50	-0.60	4.50	13.10	18.80	16.80	5.20	3.50	-3.00	-9.50	2.30
2013	-9.30	-4.80	-6.10	-2.60	10.20	13.80	19.60	17.70	8.10	0.70	-5.90	-7.80	2.80
2014	-7.90	-2.90	-4.90	0.80	8.90	12.00	18.40	16.40	6.00	-0.80	-7.30	-8.40	2.52
2015	-5.00	-8.40	-9.20	3.00	11.20	12.60	16.70	18.40	12.50	3.40	-4.40	-1.10	4.14
2016	-6.80	-11.70	-6.10	-2.70	7.60	11.70	15.50	19.10	11.40	1.60	-2.00	-10.30	2.27
2017	-5.20	-12.40	-4.10	4.70	7.30	18.50	19.80	19.60	10.20	2.90	-3.60	-8.90	4.07
2018	-8.20	-5.20	-5.80	-0.70	3.80	10.70	17.60	16.80	9.50	0.90	-3.10	-4.00	2.69
2019	-10.50	-8.50	-2.70	-0.30	7.30	16.70	17.90	14.90	12.80	4.80	-1.70	-7.80	3.58
2020	-5.10	-7.40	-2.10	0.90	6.60	14.00	18.60	18.40	8.20	-1.30	-12.00	-11.60	2.27
2021	-13.50	-7.10	-4.40	-4.90	3.80	13.40	18.50	18.70	6.80	-1.20	-6.60	-11.30	1.02
2022	-11.30	-4.20	-4.00	-3.10	5.00	13.50	13.80	19.50	11.10	-1.40	-2.50	-10.70	2.14
2023	-7.90	-2.60	-6.00	1.80	6.00	15.40	16.50	14.60	10.40	3.70	-4.90	-12.10	2.91
2024	-7.50	-4.70	-3.50	0.10	7.70	10.80	15.90	16.00	10.90	0.90	-5.70	-4.00	3.08
2025	-6.20	-5.10	-7.40	-1.00	7.40	13.20	11.90	16.90	6.20	-0.90	-4.40	-6.60	2.00
2026	-16.10	-14.90	-2.60	0.10	7.50	17.90	20.00	17.30	8.90	0.70	-1.70	-4.30	2.73
2027	-10.70	-12.10	-2.60	-3.30	7.10	17.50	16.20	16.70	11.90	-1.30	-5.40	-13.20	1.73
2028	-10.30	-6.50	-5.60	0.00	3.50	13.00	17.80	19.00	11.90	-0.20	-3.00	-8.90	2.56
2029	-12.30	-4.70	-3.60	-2.50	4.40	13.20	18.30	12.20	7.80	2.20	-4.20	-8.30	1.88
2030	-8.60	-6.30	-4.90	-2.10	3.90	13.50	20.10	18.40	11.90	1.40	-2.30	-6.10	3.24
2031	-4.60	-9.90	-3.10	-1.10	3.70	14.60	18.90	18.50	10.50	3.00	-2.50	-4.80	3.60
2032	-5.40	-6.90	-6.50	0.70	5.00	17.10	21.90	18.80	10.40	0.90	-2.50	-5.20	4.03
2033	-12.50	-9.50	-4.20	-3.00	6.00	16.70	18.80	18.40	12.40	-0.20	-6.60	-8.90	2.28
2034	-12.20	-12.10	-6.30	2.70	6.80	13.30	18.30	17.10	12.70	5.20	-4.30	-5.80	2.95
2035	-2.80	-3.10	-1.70	4.70	3.40	14.10	23.30	20.50	13.10	0.20	-4.20	-9.70	4.82
2036	-8.90	-14.40	-8.00	-4.10	7.90	15.70	17.90	15.40	10.30	3.20	-7.30	-5.30	1.87
2037	-4.50	-6.30	-1.60	1.30	6.00	18.20	18.70	15.70	15.70	2.70	-3.50	-5.90	4.71
2038	-6.70	-3.40	-4.40	-0.20	9.40	15.10	17.80	15.30	8.50	0.60	-0.90	-15.40	2.97
2039	-6.70	-11.20	-3.60	-0.30	6.10	15.50	18.60	18.80	12.90	4.50	0.60	-2.90	4.36
2040	-6.10	-3.00	-0.20	0.80	5.80	14.20	19.20	16.90	11.30	-3.20	-5.30	-10.80	3.30
2041	-10.90	-10.20	-2.40	1.00	10.40	15.90	19.20	18.10	13.00	3.10	-4.60	-9.40	3.60

2042	-5.50	-4.20	-4.60	0.90	6.30	10.90	20.30	19.10	12.40	1.00	2.20	-3.90	4.57
2043	-4.10	-6.40	-7.60	1.70	9.40	17.90	19.10	20.00	13.50	6.80	-4.90	-10.30	4.59
2044	-7.60	-5.70	-6.80	1.40	8.90	12.40	18.10	17.20	7.80	-1.50	-4.40	-10.20	2.47
2045	-7.20	-8.20	-7.00	-0.90	3.80	14.50	19.00	18.00	9.50	0.70	-1.00	-5.40	2.98
2046	-3.70	-10.20	-6.90	0.80	8.20	16.40	19.80	16.80	11.10	2.70	-2.90	-2.50	4.13
2047	-5.20	-3.20	0.20	1.00	9.70	15.20	16.00	15.70	8.80	1.10	-1.70	-11.80	3.82
2048	-8.60	-5.70	-3.80	3.10	11.80	14.50	19.80	16.20	11.70	3.40	-1.20	-13.40	3.98
2049	-5.80	-5.50	-3.60	2.90	7.70	17.60	19.20	20.80	11.10	2.70	-3.00	-5.20	4.91
2050	-4.90	-2.30	-3.50	3.40	9.00	18.20	23.80	17.60	12.90	6.40	-2.10	-14.80	5.31
2051	-6.70	-3.20	-1.00	4.10	8.80	10.70	19.50	21.40	8.30	5.40	-0.50	-8.00	4.90
2052	-7.10	-3.20	-2.20	2.60	9.90	10.70	17.80	20.30	14.10	0.30	-5.20	-4.90	4.42
2053	-8.50	-3.80	0.30	3.70	13.20	15.80	21.30	18.40	7.40	0.60	-4.80	-12.50	4.26
2054	-4.00	-1.20	-2.20	-0.80	9.30	10.50	18.20	21.10	16.80	6.50	0.00	-5.70	5.71
2055	-3.10	-1.70	-1.90	1.50	6.80	13.90	17.80	18.70	7.60	1.00	-5.50	-9.80	3.77
2056	-3.70	-7.60	-1.70	1.60	5.00	13.00	18.30	15.30	7.50	4.60	-2.90	-9.90	3.29
2057	-3.30	-7.70	-0.90	2.80	8.10	16.20	19.60	16.80	10.40	4.50	-0.20	-10.50	4.65
2058	-16.90	-12.60	-6.40	-3.00	6.30	18.50	22.10	20.90	13.70	3.80	0.10	-9.30	3.10
2059	-12.20	-5.30	-1.50	1.80	10.30	18.40	24.80	21.10	16.50	8.30	-0.10	-7.00	6.26
2060	-7.80	-1.30	-6.40	-0.60	8.70	16.30	23.10	21.70	13.80	7.50	-1.20	-8.20	5.47
2061	-7.80	-5.70	-4.60	1.20	10.10	18.10	23.60	20.70	13.60	9.60	1.50	-3.30	6.42
2062	-6.50	-4.20	-5.00	1.90	8.20	15.90	21.70	20.20	12.40	4.00	-4.60	-2.20	5.15
2063	-4.70	-12.40	-1.70	0.30	9.40	19.70	24.00	22.80	9.40	3.10	-1.00	-11.10	4.82
2064	-8.90	-1.90	0.50	0.90	8.20	8.70	14.60	16.30	6.30	2.30	-1.50	-4.90	3.38
2065	-7.90	-4.90	-6.60	4.10	9.80	14.50	20.60	21.40	15.40	-0.20	-6.30	-5.10	4.57
2066	-14.30	-6.50	-0.70	4.90	10.50	16.80	23.90	21.80	8.30	7.80	-0.80	-2.70	5.75
2067	-10.70	-9.50	-5.10	3.60	9.60	12.50	18.20	17.80	9.20	1.70	-2.90	-2.70	3.47
2068	-12.90	-9.90	-5.00	3.10	9.60	17.50	21.10	21.40	13.00	4.10	-4.50	-2.50	4.58
2069	-5.20	-3.10	0.60	1.90	12.20	20.20	24.00	20.50	11.20	3.10	-2.40	-10.40	6.05
2070	-2.90	-1.40	0.40	3.00	7.10	17.70	24.80	23.40	11.60	4.30	-2.20	-4.60	6.77
2071	-1.20	-4.10	-0.10	-0.20	9.60	13.90	18.90	12.70	14.40	4.20	-2.20	-4.10	5.15
2072	-3.40	-1.40	0.40	1.00	7.70	9.50	18.60	19.50	11.80	2.20	-4.30	-10.30	4.28
2073	-10.50	-5.50	-3.10	1.60	6.00	16.10	22.40	21.70	11.70	5.00	-2.40	-8.50	4.54
2074	-5.10	-4.00	-3.60	0.30	6.50	19.60	20.60	20.60	11.20	1.30	-2.30	-6.80	4.86
2075	-6.60	-6.20	-4.40	0.40	11.60	16.60	25.50	22.20	16.30	2.40	-5.70	-9.20	5.24
2076	-14.20	-5.00	-2.40	1.90	13.90	20.50	24.60	21.70	12.60	4.10	-2.70	-13.20	5.15
2077	-10.10	-5.10	-3.10	1.40	8.00	18.50	21.70	22.60	14.20	2.80	-0.30	-5.60	5.42
2078	-8.90	-5.40	-0.20	-1.40	6.40	14.80	22.10	18.50	11.60	3.70	-3.50	-6.10	4.30
2079	-15.00	-9.80	-7.90	1.90	5.50	14.90	21.50	21.20	10.90	8.70	-0.70	-3.10	4.01
2080	-4.70	-1.20	-1.30	1.80	8.40	17.80	22.70	24.20	13.30	5.40	-2.50	-6.20	6.47
2081	-10.90	-7.50	-5.60	-0.60	10.20	20.40	25.60	22.50	14.40	2.50	-2.10	-11.50	4.78
2082	-5.20	-2.30	-0.80	-0.90	13.80	18.10	19.80	20.60	15.30	5.70	0.40	-5.70	6.57
2083	-7.30	-3.60	1.30	7.60	10.20	16.90	22.30	21.90	11.90	6.90	-1.60	-0.40	7.17
2084	-4.30	-1.30	-0.50	0.30	8.00	14.70	19.50	21.30	12.20	9.20	0.40	-8.40	5.92
2085	-4.10	-6.10	-0.30	4.20	10.50	18.10	24.10	21.40	16.50	7.00	-2.60	-4.80	6.99
2086	-9.70	-8.30	-1.30	5.70	13.50	14.60	24.40	20.20	17.30	5.70	-2.50	-1.50	6.51
2087	-9.20	-0.60	2.90	4.90	9.40	22.00	24.70	21.90	14.70	6.70	2.30	-9.50	7.52
2088	-11.90	-9.00	0.40	4.00	10.60	18.40	22.40	22.40	14.50	1.90	1.90	-3.30	6.03
2089	-2.60	1.70	0.40	6.20	9.60	16.80	23.70	21.50	13.50	6.80	-1.60	-5.10	7.58
2090	-7.20	-13.80	-2.90	5.20	11.30	23.00	24.80	22.60	15.30	5.90	-0.10	-5.60	6.54
2091	-1.60	0.70	-1.60	3.60	12.20	14.60	17.40	19.40	14.40	5.20	-3.80	-7.40	6.09
2092	-5.30	-0.80	4.20	3.90	11.20	18.60	23.80	23.60	17.10	8.00	2.40	-1.00	8.81
2093	-0.70	-2.20	3.20	4.10	16.50	25.40	26.50	25.00	14.70	10.70	1.20	-7.30	9.76
2094	-2.30	-2.70	2.30	2.70	8.50	18.50	23.30	24.10	16.10	6.10	-1.00	-7.20	7.37
2095	-0.90	-1.90	2.20	4.50	11.80	21.80	25.80	24.10	13.40	5.00	2.00	-9.20	8.22
2096	-8.60	-5.70	-1.00	4.40	13.00	17.90	23.50	22.70	16.30	3.50	2.70	-3.20	7.13

2097	-3.10	-5.60	-3.80	2.00	12.90	16.10	22.80	22.60	14.10	6.80	0.50	-3.60	6.81
2098	-3.80	-5.50	1.80	2.60	9.60	20.70	24.40	22.70	12.80	2.60	-2.40	-5.50	6.67
2099	-6.10	-0.90	0.40	3.30	7.10	15.80	22.50	20.90	14.00	3.30	-4.40	-6.60	5.78

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-7.40	-5.73	-2.83	1.36	8.45	15.83	20.44	19.44	11.87	3.35	-2.54	-7.18	4.59
SD	3.69	3.65	2.89	2.48	2.75	3.13	3.04	2.72	2.85	2.89	2.57	3.41	1.78
Skew	-0.51	-0.55	0.10	-0.16	0.24	0.23	-0.10	-0.28	-0.24	0.22	-0.36	-0.19	0.41
Analysis of Trend in Mean (95% SL):													
Slope	0.04	0.05	0.06	0.05	0.06	0.06	0.08	0.07	0.06	0.06	0.05	0.04	0.06
KendSum	726.	870.	1510.	1463.	1497.	1379.	1862.	1968.	1556.	1503.	1312.	649.	2441.
KendTau	0.19	0.23	0.39	0.38	0.39	0.36	0.49	0.51	0.41	0.39	0.34	0.17	0.64
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.61	3.13	5.44	5.27	5.39	4.97	6.71	7.09	5.60	5.41	4.72	2.34	8.79
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.5367	0.0021	1.4063	1.3034	0.0365	3.0331	0.1351	0.0385	0.8925	0.1332	0.4055	0.3781	1.7751
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	13.60	13.32	8.34	6.14	7.54	9.80	9.23	7.42	8.14	8.35	6.61	11.60	3.16
Res Var	12.67	11.85	5.61	4.33	5.14	7.33	4.94	3.93	5.48	5.65	4.94	10.79	0.99
Tnd Var	6.86	11.01	32.66	29.50	31.74	25.13	46.45	47.00	32.75	32.38	25.33	6.99	68.80

SNOTEL Temperature – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\ccsm3\GARR_SNO_TempAvg_All.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-SNOTEL/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1M
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	-16.30	-5.10	-3.70	-1.00	5.40	11.50	17.20	15.80	4.30	3.30	-4.50	-11.70	1.27

2013	-10.80	-6.30	-7.30	-3.80	10.00	13.00	20.50	18.20	8.00	-0.30	-6.60	-8.70	2.16
2014	-8.90	-4.10	-6.00	-0.10	9.50	12.30	18.60	17.60	6.80	-1.70	-9.40	-10.10	2.04
2015	-7.00	-9.80	-10.10	2.90	9.60	11.90	15.10	18.80	12.30	2.80	-6.10	-2.70	3.14
2016	-8.70	-13.00	-6.50	-3.50	6.70	10.50	14.30	20.40	10.70	0.00	-3.90	-12.70	1.19
2017	-7.40	-13.60	-5.50	2.50	6.50	17.20	19.50	20.00	9.40	1.70	-5.30	-10.20	2.90
2018	-9.30	-7.30	-7.40	-1.90	4.30	10.40	18.70	17.20	9.30	0.40	-4.70	-5.90	1.98
2019	-12.10	-9.60	-3.80	-1.40	6.50	15.20	17.90	15.30	13.20	3.80	-3.30	-9.50	2.68
2020	-6.80	-9.50	-3.30	0.30	6.80	14.00	18.00	18.80	8.00	-1.10	-13.20	-13.00	1.58
2021	-14.50	-8.90	-6.10	-6.10	4.60	13.00	17.30	18.70	6.50	-2.70	-8.30	-12.90	0.05
2022	-13.10	-6.10	-5.70	-4.00	5.10	11.70	11.30	17.80	11.90	-2.10	-4.30	-12.40	0.84
2023	-9.90	-4.00	-7.10	1.50	5.90	15.40	15.20	14.40	9.70	2.80	-6.40	-13.30	2.02
2024	-8.70	-6.30	-4.80	-0.60	7.20	10.10	14.30	14.80	11.10	0.10	-7.40	-5.70	2.01
2025	-8.50	-7.10	-8.80	-2.00	6.50	11.70	10.60	16.50	7.40	-1.50	-6.80	-8.80	0.77
2026	-17.60	-16.90	-4.30	-0.60	7.60	15.10	18.60	16.70	9.60	0.20	-3.30	-6.20	1.58
2027	-12.70	-13.30	-4.10	-4.30	6.70	14.50	14.60	15.10	11.70	-2.10	-7.30	-14.90	0.33
2028	-10.70	-8.40	-7.50	-0.70	2.10	10.70	15.70	18.50	11.50	-1.90	-4.80	-9.70	1.23
2029	-12.40	-6.30	-4.60	-3.10	3.50	12.00	17.80	11.90	7.40	0.70	-5.20	-9.90	0.98
2030	-8.90	-7.60	-6.90	-3.20	3.40	12.90	19.80	18.30	11.00	-0.20	-3.80	-7.60	2.27
2031	-6.80	-10.90	-4.90	-2.00	3.20	14.10	19.10	18.30	10.10	2.40	-4.10	-6.70	2.65
2032	-7.00	-8.40	-7.70	-0.50	4.10	16.30	21.00	19.10	9.50	0.00	-4.20	-6.80	2.95
2033	-13.90	-9.80	-4.70	-4.20	5.10	15.80	20.00	18.20	11.90	-1.10	-7.20	-10.00	1.68
2034	-11.80	-12.10	-7.00	2.90	6.10	13.40	19.20	18.40	12.10	4.20	-5.70	-7.00	2.72
2035	-4.70	-5.00	-3.20	2.80	3.10	13.20	22.20	18.90	11.60	-1.10	-6.20	-12.00	3.30
2036	-10.30	-15.10	-9.10	-5.20	7.30	14.70	16.80	14.90	10.30	2.20	-9.10	-6.20	0.93
2037	-5.40	-7.50	-2.80	1.20	5.60	17.30	18.80	15.30	15.10	2.30	-5.50	-8.30	3.84
2038	-8.70	-5.20	-6.30	-0.20	9.50	15.40	17.00	14.80	8.20	-0.50	-2.60	-15.60	2.15
2039	-7.80	-12.10	-5.10	-1.30	4.70	15.10	17.90	18.90	12.20	3.10	-1.30	-4.60	3.31
2040	-8.20	-4.80	-2.00	-0.90	5.60	12.70	18.40	17.80	12.30	-3.60	-6.90	-11.50	2.41
2041	-11.70	-10.90	-3.80	-0.10	10.90	16.00	19.10	18.80	13.40	3.00	-6.30	-11.10	3.11
2042	-6.70	-6.00	-6.20	-0.10	7.00	10.60	19.80	17.70	12.50	0.20	0.70	-5.90	3.63
2043	-6.50	-7.40	-9.50	0.60	9.30	15.70	17.60	20.30	12.70	7.10	-6.00	-11.40	3.54
2044	-9.70	-7.70	-8.50	0.50	8.40	13.00	18.90	16.00	6.80	-3.00	-5.00	-11.30	1.53
2045	-7.90	-9.70	-7.80	-2.00	4.00	13.80	16.20	18.00	9.60	-0.30	-2.80	-7.40	1.98
2046	-5.50	-11.80	-8.10	0.40	7.10	14.60	18.20	15.50	11.20	2.20	-5.00	-4.30	2.88
2047	-6.60	-4.50	-1.20	0.60	9.00	15.40	14.50	15.70	9.80	-0.40	-2.90	-13.20	3.02
2048	-10.80	-7.80	-4.50	2.60	12.10	12.40	19.40	14.60	11.30	1.60	-3.20	-14.80	2.74
2049	-6.20	-7.00	-5.50	1.50	6.40	15.70	18.70	20.70	11.10	1.70	-4.40	-6.60	3.84
2050	-5.60	-3.50	-5.60	2.30	7.70	17.60	24.10	16.60	13.10	5.20	-4.00	-14.80	4.43
2051	-8.00	-5.30	-2.70	2.90	8.60	10.40	20.10	21.60	7.70	5.90	-1.80	-8.80	4.22
2052	-7.70	-4.30	-2.90	1.60	9.90	9.00	16.00	20.60	13.70	-0.60	-6.70	-6.00	3.55
2053	-10.10	-4.60	-1.50	2.40	11.60	16.00	21.20	19.20	8.40	-0.10	-6.40	-13.10	3.58
2054	-5.90	-2.70	-3.90	-1.40	10.00	11.90	17.10	20.90	15.30	4.60	-1.30	-7.00	4.80
2055	-5.10	-3.80	-3.20	0.20	6.90	13.10	17.40	20.00	7.90	-0.40	-6.70	-10.40	2.99
2056	-5.20	-8.40	-3.60	-0.20	4.10	11.90	15.80	15.70	8.80	3.60	-4.50	-9.40	2.38
2057	-4.80	-8.80	-3.20	2.30	8.30	14.80	18.70	17.10	10.30	3.50	-2.10	-12.50	3.63
2058	-18.10	-12.20	-7.80	-3.60	6.20	15.60	21.10	21.40	13.60	3.20	-1.20	-10.80	2.28
2059	-14.10	-6.90	-2.50	1.40	9.60	16.90	25.20	21.60	16.50	8.30	-2.20	-8.50	5.44
2060	-9.00	-3.00	-7.70	-1.10	9.30	15.80	23.50	22.80	14.70	6.90	-2.30	-10.00	4.99
2061	-9.00	-7.60	-6.10	0.70	7.80	16.00	22.70	20.70	13.50	9.20	0.90	-5.10	5.31
2062	-7.90	-4.60	-6.40	0.40	7.80	15.30	21.80	20.50	13.30	2.80	-6.20	-4.30	4.38
2063	-6.50	-12.50	-3.60	-1.10	10.40	19.10	23.70	22.50	9.00	2.80	-2.40	-12.50	4.08
2064	-9.40	-3.70	-0.60	0.80	7.30	7.50	14.20	15.90	6.60	1.20	-3.30	-6.80	2.47
2065	-9.00	-6.90	-8.10	3.20	8.90	13.90	20.20	21.20	16.30	-0.60	-7.40	-6.50	3.77
2066	-16.30	-7.40	-0.90	4.70	9.80	16.70	23.50	21.90	8.30	7.40	-2.10	-4.40	5.10
2067	-12.70	-11.00	-6.20	1.90	9.00	12.80	16.30	17.50	9.50	0.20	-4.70	-5.00	2.30

2068	-14.30	-11.40	-6.80	1.60	9.60	17.20	20.00	22.00	12.90	3.20	-6.30	-4.50	3.60
2069	-7.40	-5.10	-1.10	0.80	12.30	19.00	22.90	20.90	11.10	2.30	-3.10	-12.20	5.03
2070	-4.60	-3.50	-0.80	3.30	6.50	18.10	25.60	24.20	12.40	4.10	-4.10	-6.70	6.21
2071	-3.20	-5.90	-1.80	-1.90	8.50	13.90	16.80	13.20	14.50	4.10	-4.00	-6.00	4.02
2072	-5.50	-3.60	-1.40	0.20	8.00	9.40	16.20	18.90	12.40	1.50	-6.40	-12.70	3.08
2073	-11.90	-6.10	-4.40	1.50	6.30	14.90	21.60	21.90	13.10	4.90	-3.70	-8.10	4.17
2074	-7.30	-6.40	-5.10	-0.20	5.60	17.90	20.50	20.40	13.10	-0.70	-3.90	-8.30	3.80
2075	-8.20	-7.00	-5.20	-0.40	10.10	14.90	22.90	20.80	16.20	1.90	-7.30	-10.70	4.00
2076	-16.10	-7.20	-3.90	0.70	13.80	19.10	23.70	23.00	14.60	3.70	-4.40	-14.80	4.35
2077	-10.30	-6.80	-4.40	0.80	7.70	17.70	22.40	22.90	13.80	2.40	-1.90	-6.00	4.86
2078	-9.80	-7.40	-1.00	-2.50	5.80	14.20	20.80	19.60	12.20	2.80	-5.10	-7.90	3.47
2079	-16.20	-9.20	-9.40	0.70	4.70	15.20	19.00	19.90	11.00	7.60	-2.10	-5.10	3.01
2080	-6.50	-2.90	-2.60	1.10	8.50	15.80	21.90	23.60	13.10	4.90	-4.10	-7.60	5.43
2081	-10.70	-7.20	-6.10	-0.30	9.80	19.20	24.60	22.40	14.90	1.00	-3.70	-12.60	4.28
2082	-7.40	-3.80	-2.80	-1.70	13.10	16.60	19.70	21.10	16.10	5.20	-1.40	-7.40	5.61
2083	-8.00	-4.90	-0.70	6.70	10.50	16.00	22.00	22.30	12.20	6.30	-2.70	-2.10	6.47
2084	-5.80	-3.80	-1.80	-0.40	7.40	13.00	18.80	21.20	12.60	9.40	-1.50	-10.20	4.91
2085	-5.80	-7.00	-2.30	3.10	8.60	17.10	24.80	21.80	16.60	5.80	-3.00	-6.30	6.12
2086	-11.30	-10.40	-2.50	5.10	12.60	14.00	23.90	19.00	16.90	6.00	-4.00	-3.20	5.51
2087	-10.50	-2.80	1.40	4.60	10.00	21.00	23.40	22.50	14.80	4.80	0.80	-9.70	6.69
2088	-10.80	-9.70	-0.70	3.70	11.00	18.20	20.20	22.10	14.80	1.00	-0.10	-5.50	5.35
2089	-4.40	0.10	-0.60	5.40	9.30	18.10	23.60	22.20	14.90	7.50	-2.90	-6.40	7.23
2090	-9.20	-15.10	-4.20	3.90	11.00	22.60	23.60	22.90	16.00	4.70	-1.50	-6.80	5.66
2091	-3.50	-0.90	-3.30	2.60	10.30	12.70	15.40	17.50	14.30	5.90	-5.20	-9.30	4.71
2092	-7.20	-2.90	2.40	4.00	11.30	19.10	23.10	23.40	16.50	7.70	1.60	-2.60	8.03
2093	-2.70	-4.50	1.60	3.20	16.70	25.00	25.20	24.60	14.40	8.90	-1.20	-8.50	8.56
2094	-3.90	-4.80	0.40	1.90	9.40	16.40	23.80	25.00	16.10	5.20	-1.90	-9.00	6.55
2095	-2.00	-4.00	0.70	3.40	11.50	21.80	25.90	24.60	13.50	4.80	0.60	-9.80	7.58
2096	-9.10	-7.70	-1.30	3.00	13.20	19.00	22.10	22.90	16.50	3.60	0.40	-5.50	6.43
2097	-5.30	-8.30	-4.20	1.10	11.40	13.50	21.20	22.50	14.80	6.00	-0.90	-5.50	5.53
2098	-5.30	-6.50	0.40	2.20	9.90	19.20	25.00	23.80	14.40	2.60	-4.30	-6.50	6.24
2099	-6.60	-2.60	-0.70	2.60	7.60	16.40	21.40	21.50	13.90	3.20	-4.80	-8.00	5.32
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-8.81	-7.20	-4.21	0.51	8.09	14.99	19.69	19.42	11.96	2.59	-4.08	-8.66	3.69
SD	3.50	3.37	2.83	2.52	2.76	3.11	3.35	2.94	2.89	3.07	2.57	3.21	1.84
Skew	-0.64	-0.57	0.08	-0.22	0.24	0.38	-0.23	-0.25	-0.31	0.22	-0.30	-0.20	0.37
Analysis of Trend in Mean (95% SL):													
Slope	0.04	0.04	0.06	0.05	0.06	0.07	0.08	0.08	0.07	0.07	0.05	0.04	0.06
KendSum	813.	886.	1536.	1455.	1509.	1488.	1620.	1901.	1782.	1532.	1374.	733.	2455.
KendTau	0.21	0.23	0.40	0.38	0.39	0.39	0.42	0.50	0.47	0.40	0.36	0.19	0.64
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.93	3.19	5.53	5.24	5.43	5.36	5.84	6.85	6.42	5.52	4.95	2.64	8.84
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.4165	0.0475	0.7995	1.5477	0.0038	6.2804	0.0000	0.1669	1.3437	0.0195	0.5615	0.6304	1.3980

Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	12.25	11.33	8.03	6.36	7.61	9.67	11.24	8.66	8.35	9.41	6.59	10.31	3.37
Res Var	11.27	10.03	5.32	4.41	5.19	6.89	7.14	4.84	4.87	6.22	4.76	9.45	1.04
Tnd Var	7.94	11.50	33.78	30.75	31.80	28.71	36.51	44.16	41.65	33.82	27.65	8.36	69.01

HCN Temperature – Fort Peck

Analysis of Monthly Time-Series Data

Output File: c:\climate\ccsm3\FTPK_HCN_TempAvg.txt
DSS File: c:\climate\ClimateChangeData.dss

/FTPK-HCN/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1MON/
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	-12.72	0.27	2.45	3.29	8.22	17.36	22.64	20.52	8.66	7.20	0.55	-5.83	6.05
2013	-5.90	-0.81	-1.85	2.24	14.81	17.83	23.63	21.86	11.96	4.68	-2.39	-5.14	6.74
2014	-5.24	0.29	-0.83	4.81	13.30	15.88	22.42	20.46	9.82	3.40	-3.15	-4.31	6.40
2015	-0.67	-5.01	-5.49	7.51	15.53	16.95	20.62	22.82	16.58	7.43	-0.29	2.58	8.21
2016	-3.05	-8.61	-2.67	2.13	12.45	15.81	19.24	23.53	15.77	5.00	1.79	-7.56	6.15
2017	-1.07	-10.09	-1.34	8.07	11.74	22.74	23.59	23.99	13.86	6.76	0.28	-5.33	7.77
2018	-3.38	-0.74	-1.97	3.08	7.94	14.47	21.35	20.46	13.11	4.00	0.44	0.22	6.58
2019	-6.61	-4.69	1.05	4.08	11.56	20.80	21.41	18.36	16.49	8.75	1.92	-3.84	7.44
2020	-0.71	-2.89	1.57	5.12	10.57	17.55	22.09	22.22	11.78	2.32	-7.95	-8.21	6.12
2021	-10.33	-3.10	-0.31	-0.21	7.95	17.18	22.44	22.47	10.68	2.36	-2.54	-6.99	4.97
2022	-7.46	-0.13	0.33	1.06	8.78	17.75	17.80	23.17	14.70	2.03	1.22	-7.38	5.99
2023	-3.79	1.48	-2.14	6.26	10.27	19.01	20.05	17.28	14.36	7.63	-0.78	-9.20	6.70
2024	-4.02	-0.74	0.78	4.21	11.49	14.24	19.08	19.49	14.40	4.70	-2.15	-0.39	6.76
2025	-2.06	-0.51	-3.37	3.30	11.98	17.51	15.77	21.03	10.15	2.92	-0.63	-2.26	6.15
2026	-12.35	-11.68	1.65	4.80	11.31	21.92	23.81	20.74	13.03	4.70	1.98	-0.97	6.58
2027	-5.91	-8.46	1.34	1.15	11.39	21.03	19.89	20.40	15.47	2.42	-1.70	-9.63	5.62
2028	-7.80	-2.52	-2.15	3.96	7.57	17.66	20.76	22.57	15.35	3.55	0.59	-6.33	6.10
2029	-9.76	-0.29	0.73	1.63	8.63	17.07	21.86	15.80	11.21	6.00	-0.12	-4.30	5.70
2030	-6.77	-3.16	-0.75	2.86	8.00	16.81	23.85	22.17	15.80	4.92	1.51	-2.24	6.92
2031	-0.80	-7.80	0.57	3.15	7.62	18.35	22.89	22.62	14.08	7.18	1.41	-0.63	7.39
2032	-1.79	-2.58	-2.23	5.52	9.43	21.15	26.15	22.65	14.44	4.73	1.48	-1.39	8.13
2033	-8.94	-6.54	-0.59	1.49	10.30	20.21	22.60	22.31	16.09	3.51	-2.49	-4.98	6.08
2034	-10.54	-10.25	-2.86	7.25	10.83	17.17	21.93	20.70	16.21	9.42	-0.14	-2.37	6.45
2035	0.88	0.23	2.04	9.19	7.33	17.90	27.07	24.33	17.27	4.20	-0.28	-5.43	8.73
2036	-4.98	-12.05	-4.35	0.48	12.91	19.88	21.77	19.47	13.89	7.24	-3.63	-2.85	5.65
2037	-1.41	-3.16	2.59	5.42	9.56	22.01	22.53	19.07	19.46	6.17	0.57	-1.36	8.45
2038	-3.29	0.00	-0.52	3.77	13.56	18.96	21.45	18.57	12.32	4.42	3.17	-12.93	6.62

2039	-4.24	-8.37	0.81	3.34	10.73	18.86	21.89	22.52	16.56	8.08	4.30	0.80	7.94
2040	-1.50	1.15	3.76	4.67	9.72	18.24	23.12	20.91	15.06	0.55	-1.41	-7.09	7.26
2041	-7.48	-8.75	1.83	5.61	14.76	20.06	23.04	21.69	16.47	6.67	-0.22	-5.59	7.34
2042	-1.62	0.04	-0.87	5.21	10.56	14.39	23.89	22.87	16.01	4.68	6.06	-0.03	8.43
2043	-0.09	-2.57	-3.26	5.98	13.60	22.32	23.13	24.31	16.99	10.58	-1.46	-7.43	8.51
2044	-3.49	-2.50	-2.79	5.74	13.00	16.07	21.77	20.53	11.86	2.58	-0.81	-6.79	6.26
2045	-5.02	-4.12	-3.49	3.74	8.28	18.50	22.20	21.83	13.57	4.67	3.17	-1.29	6.84
2046	0.37	-6.51	-3.14	5.55	12.58	20.64	23.92	20.57	14.77	6.60	0.50	1.65	8.13
2047	-1.41	0.53	4.39	4.88	13.93	18.98	20.34	19.06	12.90	5.28	2.30	-9.15	7.67
2048	-4.61	-1.48	-0.20	7.83	15.57	18.23	23.58	19.98	15.69	7.46	2.67	-10.69	7.84
2049	-2.75	-1.50	0.17	7.10	11.48	21.92	23.00	24.65	15.41	6.76	0.60	-1.39	8.79
2050	-3.11	0.64	0.16	7.54	13.35	22.48	27.40	20.68	16.93	10.00	2.11	-11.63	8.88
2051	-2.20	0.84	2.88	8.09	13.23	14.82	23.11	25.20	12.39	9.31	3.54	-5.34	8.82
2052	-4.91	1.12	2.32	6.62	13.47	14.35	20.92	23.91	17.54	4.23	-1.53	-2.23	7.98
2053	-5.00	-1.58	4.51	8.19	17.54	19.54	25.94	22.18	11.14	3.67	-1.08	-9.71	7.95
2054	0.23	2.17	2.01	3.06	13.14	14.49	21.51	25.06	20.67	10.23	3.82	-1.50	9.57
2055	0.42	2.38	1.45	5.50	10.89	17.20	21.61	22.66	11.41	4.59	-1.46	-7.45	7.43
2056	0.02	-6.39	2.30	5.40	8.95	16.71	21.73	18.47	11.01	8.73	0.64	-8.32	6.60
2057	0.11	-6.02	3.34	7.15	11.64	20.33	23.66	20.14	13.47	7.89	3.78	-7.14	8.20
2058	-13.81	-11.04	-2.87	1.72	10.29	23.12	26.29	25.05	17.52	7.68	3.79	-5.61	6.84
2059	-8.06	-1.55	2.56	5.69	14.23	21.94	28.97	25.10	20.23	12.11	3.63	-3.65	10.10
2060	-3.79	2.75	-2.31	3.90	12.70	20.44	27.05	25.97	17.45	11.58	2.88	-4.50	9.51
2061	-4.40	-1.65	-0.98	5.77	14.61	22.02	27.31	24.89	17.22	13.52	5.18	0.68	10.35
2062	-3.66	-1.57	-0.64	5.65	12.46	20.09	25.61	23.90	16.15	8.27	-1.33	1.63	8.88
2063	-0.86	-10.66	1.85	4.32	13.54	23.61	27.86	26.88	13.10	6.99	2.43	-7.21	8.49
2064	-6.01	1.59	4.28	5.24	11.91	12.61	18.63	20.32	10.13	6.44	2.38	-0.46	7.25
2065	-5.18	-0.61	-2.46	8.47	14.05	18.41	24.54	25.27	19.40	3.42	-2.90	-0.99	8.45
2066	-9.99	-3.36	3.13	9.08	15.00	20.23	27.81	26.06	11.37	11.53	2.48	1.28	9.55
2067	-7.99	-6.79	-2.01	7.67	13.55	16.34	21.86	21.84	12.36	5.05	0.80	0.77	6.95
2068	-9.39	-6.88	-0.72	7.42	13.48	21.50	25.11	25.22	17.06	7.94	-0.93	1.26	8.42
2069	-1.32	0.59	4.34	5.89	16.43	24.20	27.70	24.33	14.93	6.54	0.55	-6.41	9.81
2070	0.31	2.69	3.51	6.84	11.48	21.69	29.03	27.45	15.17	7.49	0.85	-1.57	10.41
2071	2.73	-0.05	3.39	2.97	13.65	17.95	22.41	16.12	17.90	7.79	1.99	-0.56	8.86
2072	0.30	2.57	4.59	4.92	12.02	12.77	22.39	23.18	15.70	5.84	0.02	-6.20	8.18
2073	-7.23	-2.58	0.63	5.42	10.02	19.70	26.21	26.09	15.66	8.92	0.98	-7.38	8.04
2074	-1.04	0.07	0.06	4.36	10.92	23.63	24.52	24.13	14.92	5.37	1.64	-2.93	8.80
2075	-2.78	-2.68	-1.10	4.42	15.77	20.62	29.42	25.90	19.83	6.20	-2.18	-5.72	8.98
2076	-9.37	-1.07	1.60	6.19	18.24	23.85	28.59	25.73	16.13	8.14	1.04	-8.71	9.20
2077	-8.18	-2.25	0.62	5.72	11.65	22.79	25.78	26.38	18.27	6.59	3.64	-2.00	9.08
2078	-5.76	-1.88	3.57	2.78	10.72	18.76	26.06	21.85	15.65	7.62	0.70	-2.65	8.12
2079	-11.11	-8.50	-4.67	5.91	9.42	18.65	24.48	24.31	14.39	12.42	2.79	0.85	7.41
2080	-0.92	2.68	2.62	5.85	12.44	21.32	26.75	28.44	17.00	8.89	1.13	-2.58	10.30
2081	-8.69	-4.75	-1.46	4.09	14.55	25.14	29.44	26.61	17.58	6.29	1.70	-8.27	8.52
2082	-1.38	1.07	2.84	3.27	17.93	21.97	23.55	24.27	19.19	8.72	3.96	-1.77	10.30
2083	-2.90	0.45	5.37	11.16	14.58	20.79	26.71	25.91	15.88	10.61	1.80	3.06	11.12
2084	-0.81	3.18	2.95	4.43	12.22	19.05	23.13	25.10	15.63	12.95	4.08	-4.14	9.81
2085	-0.45	-2.64	2.95	8.50	14.86	21.20	27.74	24.96	20.55	11.03	0.55	-1.50	10.65
2086	-6.43	-3.92	2.51	9.71	17.84	18.26	28.34	23.70	21.27	8.96	0.56	2.67	10.29
2087	-5.94	3.39	7.15	8.98	13.70	25.64	28.19	25.67	17.94	10.71	5.98	-6.86	11.21
2088	-10.18	-5.67	4.18	8.01	14.61	21.72	25.65	26.08	17.98	5.10	5.71	0.04	9.44
2089	-0.66	5.45	4.44	9.95	13.81	20.88	27.52	25.30	17.30	10.26	2.24	-1.83	11.22
2090	-3.15	-10.51	1.13	9.12	15.31	26.62	28.86	26.77	19.22	9.06	4.02	-2.38	10.34
2091	2.53	4.66	2.68	7.82	16.36	18.64	21.72	22.98	18.54	8.94	0.18	-3.37	10.14
2092	-1.49	2.81	8.12	8.22	14.79	22.21	27.48	27.27	21.29	11.69	6.43	3.01	12.65
2093	3.03	1.65	7.19	8.35	20.40	29.51	30.16	29.07	18.09	14.29	5.03	-4.17	13.55

2094	0.71	1.41	6.19	6.48	12.48	22.35	27.08	28.40	19.53	9.96	2.66	-3.02	11.19
2095	1.91	1.75	6.09	8.45	15.65	25.83	29.53	28.18	16.95	8.84	5.93	-6.22	11.91
2096	-6.29	-1.44	2.72	8.90	17.03	21.71	26.57	26.14	19.47	7.09	6.37	1.12	10.78
2097	0.73	-2.29	-0.93	6.14	17.07	20.80	26.33	26.29	17.32	10.82	4.20	0.39	10.57
2098	-0.97	-2.80	5.96	6.63	13.56	24.15	28.33	26.78	16.58	5.90	1.86	-2.58	10.28
2099	-3.63	2.94	4.50	7.47	10.78	19.25	25.61	24.59	17.73	6.88	-1.44	-2.81	9.32
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-3.96	-2.27	1.04	5.55	12.59	19.72	24.21	23.24	15.60	7.10	1.22	-3.64	8.37
SD	3.86	4.12	2.95	2.38	2.77	3.17	3.08	2.88	2.86	2.90	2.58	3.66	1.77
Skew	-0.48	-0.64	0.09	-0.12	0.20	0.19	-0.07	-0.31	-0.23	0.21	-0.28	-0.22	0.44
Analysis of Trend in Mean (95% SL):													
Slope	0.03	0.05	0.06	0.05	0.06	0.06	0.08	0.07	0.06	0.06	0.05	0.04	0.06
KendSum	570.	799.	1415.	1401.	1429.	1330.	1776.	1840.	1513.	1459.	1259.	560.	2355.
KendTau	0.15	0.21	0.37	0.37	0.37	0.35	0.46	0.48	0.40	0.38	0.33	0.15	0.62
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.05	2.88	5.10	5.05	5.15	4.79	6.40	6.63	5.45	5.25	4.53	2.01	8.48
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.1604	0.0463	1.4115	0.8609	0.0020	2.5648	0.0856	0.1337	0.6916	0.1425	0.0343	0.4383	2.0331
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	14.91	17.02	8.71	5.68	7.69	10.05	9.52	8.31	8.17	8.44	6.64	13.40	3.13
Res Var	14.18	15.54	6.16	4.11	5.46	7.71	5.24	4.78	5.65	5.91	5.12	12.57	1.07
Tnd Var	4.91	8.67	29.28	27.59	29.00	23.25	44.95	42.48	30.87	29.92	22.82	6.24	65.75

HCN Temperature – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\ccsm3\GARR_HCN_TempAvg.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-HCN/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1MON/
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

2012	-12.62	-0.11	3.07	4.66	11.24	17.92	22.47	20.51	9.61	8.45	0.51	-6.85	6.57
2013	-6.38	-0.69	-1.03	3.37	16.58	18.70	25.55	23.54	13.39	5.54	-1.83	-5.99	7.56
2014	-5.85	0.29	-0.05	5.77	16.01	17.73	23.73	23.39	12.21	4.17	-3.18	-4.30	7.49
2015	-1.08	-5.13	-4.58	8.51	15.70	17.85	20.76	23.77	17.78	8.46	-0.13	1.74	8.64
2016	-3.48	-8.98	-1.75	3.65	13.58	16.70	19.87	25.79	16.73	5.01	1.48	-8.86	6.65
2017	-1.77	-9.95	-1.87	7.67	12.83	22.58	24.44	25.88	14.50	7.53	0.09	-5.32	8.05
2018	-3.25	-0.86	-2.05	3.48	10.39	15.97	23.56	21.83	14.26	4.88	0.15	0.04	7.37
2019	-6.55	-4.73	1.05	5.55	12.62	20.87	22.62	19.92	18.39	9.31	1.80	-4.30	8.05
2020	-0.86	-3.32	1.66	6.57	12.76	19.03	23.05	23.55	13.09	4.10	-7.48	-8.06	7.01
2021	-10.85	-3.28	-0.22	1.09	10.32	18.34	22.38	23.00	12.04	2.63	-2.26	-7.17	5.50
2022	-7.40	-0.63	0.59	2.37	10.73	18.09	17.50	22.72	17.03	3.05	0.64	-8.29	6.37
2023	-4.16	1.00	-1.57	8.19	12.02	20.38	21.15	18.53	15.63	8.45	-0.43	-9.45	7.48
2024	-4.22	-0.71	1.45	5.53	13.07	15.23	18.79	19.69	15.99	5.60	-2.58	-0.77	7.26
2025	-2.61	-0.50	-3.28	4.15	13.36	17.80	16.59	22.37	12.76	4.12	-1.17	-2.80	6.73
2026	-12.39	-12.63	1.63	6.37	13.22	21.28	24.25	21.43	15.61	6.03	2.06	-1.39	7.12
2027	-6.16	-8.00	1.31	2.35	13.06	20.78	20.45	20.45	16.63	3.57	-2.02	-9.45	6.08
2028	-7.70	-2.66	-2.49	5.05	8.33	17.10	20.22	23.32	16.31	3.66	0.27	-6.10	6.28
2029	-9.32	-0.19	1.88	3.25	9.91	17.50	22.63	17.21	12.34	6.13	0.49	-4.19	6.47
2030	-6.65	-3.21	-0.95	4.06	9.49	17.64	24.12	23.09	16.49	4.99	1.57	-2.84	7.32
2031	-2.08	-8.55	0.16	4.55	9.03	19.58	24.42	23.82	15.02	8.51	1.61	-0.87	7.93
2032	-2.26	-2.44	-1.44	6.80	11.08	22.12	26.39	24.06	15.30	5.49	1.60	-1.37	8.78
2033	-8.78	-6.04	0.34	2.54	11.32	21.37	25.07	23.34	16.93	4.14	-1.62	-4.71	6.99
2034	-9.83	-9.65	-1.87	9.20	11.48	18.73	24.61	23.42	16.89	10.45	0.23	-2.38	7.61
2035	0.05	-0.33	2.03	9.79	8.98	18.70	27.71	24.19	17.40	5.04	-0.66	-6.28	8.89
2036	-4.74	-11.87	-3.58	1.70	14.51	20.67	22.43	20.85	15.30	8.23	-4.01	-3.37	6.34
2037	-1.48	-3.38	2.84	7.39	10.82	22.45	23.84	19.99	20.01	7.55	0.33	-2.06	9.02
2038	-4.31	-0.72	-0.65	5.54	15.18	20.75	22.35	19.37	13.73	5.16	3.32	-12.04	7.31
2039	-4.86	-8.58	1.04	4.37	11.59	20.10	23.26	23.87	17.22	8.46	4.01	0.40	8.41
2040	-1.62	1.08	3.60	5.26	11.51	18.54	23.91	22.97	17.30	2.13	-1.25	-6.49	8.08
2041	-7.70	-10.15	1.83	6.42	16.88	21.63	24.61	23.13	17.85	8.20	0.04	-5.72	8.09
2042	-1.76	-0.30	-0.73	6.41	13.01	15.65	25.21	23.21	17.27	5.76	6.14	-0.40	9.12
2043	-0.91	-2.05	-3.07	6.86	15.46	22.16	23.00	25.79	17.57	12.42	-1.36	-7.90	9.00
2044	-4.18	-3.29	-2.80	6.91	14.19	18.13	23.33	21.09	12.72	3.03	0.16	-6.51	6.90
2045	-5.15	-4.14	-2.54	4.62	10.62	19.31	21.70	23.05	15.52	5.33	3.20	-1.98	7.46
2046	-0.20	-6.41	-2.48	7.06	13.83	21.04	24.08	20.83	16.57	7.95	-0.66	1.60	8.60
2047	-1.55	-0.03	5.01	6.66	15.20	20.67	21.10	20.04	15.62	5.55	2.79	-9.51	8.46
2048	-5.56	-1.62	0.53	9.03	16.80	18.12	25.03	20.13	17.02	7.52	2.39	-10.74	8.22
2049	-2.30	-1.40	0.09	7.86	11.54	21.63	24.07	25.59	17.29	7.64	0.94	-1.74	9.27
2050	-4.62	-0.19	-0.14	8.59	14.26	23.92	29.07	21.12	18.47	10.15	2.35	-10.61	9.36
2051	-2.15	0.57	3.01	8.64	15.03	16.32	25.33	26.65	13.63	11.36	3.68	-5.22	9.74
2052	-5.37	1.42	3.54	7.56	14.86	13.96	20.67	24.77	18.21	5.21	-1.47	-3.20	8.35
2053	-5.48	-1.96	4.78	9.15	17.93	20.88	27.11	24.50	13.59	4.24	-1.14	-8.83	8.73
2054	-0.19	1.68	2.38	4.24	15.71	17.63	22.38	26.15	20.88	9.73	3.86	-1.38	10.26
2055	-0.54	2.23	1.78	6.43	12.87	18.05	23.66	25.44	13.45	5.05	-0.82	-7.22	8.36
2056	-0.47	-6.57	1.95	5.82	10.02	17.44	21.32	20.38	13.69	9.55	0.38	-7.74	7.15
2057	-0.73	-7.06	2.78	8.82	13.05	20.24	24.04	21.57	14.35	8.41	3.45	-7.74	8.43
2058	-13.73	-10.20	-2.47	3.28	11.81	22.16	26.38	26.56	18.97	8.97	4.09	-5.58	7.52
2059	-8.59	-1.96	2.93	6.94	14.94	21.35	30.78	26.90	21.33	13.55	3.01	-4.17	10.58
2060	-3.76	2.49	-1.64	5.46	15.00	21.19	28.28	28.39	19.66	12.67	3.45	-4.68	10.54
2061	-4.12	-1.74	-0.81	7.47	14.58	22.32	27.75	25.74	18.36	14.43	5.78	0.41	10.85
2062	-3.97	-1.54	0.03	6.30	14.29	21.23	26.52	25.02	18.34	8.98	-1.28	0.91	9.57
2063	-1.28	-10.08	1.24	5.01	16.37	23.99	28.82	27.68	14.65	8.58	2.53	-7.09	9.20
2064	-6.02	1.28	4.79	7.36	12.55	13.20	20.17	21.62	12.35	7.21	2.37	-0.82	8.01
2065	-5.22	-0.58	-2.02	9.52	15.23	19.83	25.16	26.34	21.78	4.51	-2.57	-0.94	9.25
2066	-10.20	-3.39	4.62	10.95	16.26	21.62	28.65	27.42	12.74	12.65	2.36	1.04	10.39

2067	-8.47	-6.97	-1.87	7.26	14.53	18.05	22.05	22.73	13.74	4.94	0.52	-0.26	7.19
2068	-9.27	-6.88	-0.69	7.51	14.81	22.45	25.84	26.54	18.58	8.85	-1.27	0.88	8.95
2069	-1.95	-0.14	4.23	6.72	17.98	24.61	27.74	26.14	16.24	7.00	0.61	-6.49	10.22
2070	-0.34	2.36	3.36	8.88	13.21	23.41	31.27	29.74	17.32	8.24	0.28	-3.50	11.19
2071	1.89	-0.30	3.34	3.07	14.37	20.03	22.00	18.19	19.18	9.19	2.23	-0.94	9.35
2072	-0.69	2.13	5.11	6.03	14.08	14.52	21.76	23.80	17.61	6.55	-0.04	-6.72	8.68
2073	-7.18	-2.50	1.01	7.04	12.33	20.09	26.82	27.56	18.35	10.56	1.12	-6.96	9.02
2074	-1.69	-0.73	0.48	5.95	12.40	23.53	25.77	25.12	18.38	5.50	1.75	-2.85	9.47
2075	-2.97	-2.62	-0.48	5.92	16.05	20.51	28.03	25.45	20.79	7.49	-2.26	-5.98	9.16
2076	-9.25	-1.61	1.58	6.71	19.91	24.44	29.36	27.75	19.49	9.61	0.96	-8.29	10.06
2077	-7.96	-2.28	0.80	6.89	12.81	23.89	26.91	27.64	19.43	7.83	3.45	-1.09	9.86
2078	-5.66	-2.34	4.30	4.05	12.22	20.11	26.46	23.84	17.81	8.57	1.05	-3.09	8.94
2079	-10.93	-7.81	-5.03	6.23	11.10	20.94	24.55	24.66	15.96	12.83	2.59	0.74	7.99
2080	-1.28	2.29	3.28	7.30	14.10	21.50	27.62	28.79	18.09	9.99	1.27	-2.16	10.90
2081	-7.84	-3.89	0.10	6.45	16.01	25.42	29.63	27.33	19.36	6.70	1.75	-8.21	9.40
2082	-2.33	0.79	2.27	4.32	18.44	22.65	25.16	26.12	21.09	9.49	3.59	-1.64	10.83
2083	-2.05	0.47	5.23	11.75	16.22	21.53	27.20	27.36	17.86	11.64	2.13	2.77	11.84
2084	-1.03	2.93	3.21	5.78	13.85	19.45	24.00	26.08	17.52	14.61	3.60	-4.06	10.49
2085	-1.22	-2.09	2.48	9.18	15.49	21.91	29.68	26.05	21.87	11.74	1.18	-1.80	11.21
2086	-6.86	-4.14	3.19	10.96	18.55	19.12	28.01	23.60	22.00	10.36	0.12	2.44	10.61
2087	-6.29	2.70	7.84	10.62	16.10	25.59	28.58	27.72	19.14	10.39	6.21	-6.21	11.87
2088	-9.25	-5.59	4.37	9.81	16.81	22.22	25.71	27.04	19.90	5.61	5.25	-0.71	10.10
2089	-1.84	5.31	5.36	10.84	15.15	24.01	29.15	27.25	19.60	12.06	2.52	-1.84	12.30
2090	-3.24	-10.38	1.63	9.83	17.01	27.82	29.03	28.03	21.49	9.01	4.42	-2.48	11.01
2091	2.02	4.63	3.15	9.10	16.42	18.83	22.00	22.47	20.18	11.16	0.77	-3.56	10.60
2092	-2.32	1.66	7.88	10.22	16.30	24.04	27.97	28.43	22.21	12.82	7.53	2.89	13.30
2093	2.58	0.68	7.47	9.53	22.39	30.05	30.07	29.56	19.36	13.91	4.36	-4.41	13.80
2094	-0.28	0.74	6.04	7.21	15.27	22.33	28.86	30.62	20.86	10.89	3.06	-3.02	11.88
2095	1.06	0.87	6.39	9.28	17.09	27.35	31.05	29.99	18.37	10.32	6.20	-5.75	12.69
2096	-6.23	-1.83	3.38	9.93	18.70	23.87	26.86	28.34	20.67	8.61	5.73	0.45	11.54
2097	-0.11	-3.44	-0.50	7.34	17.47	20.24	26.13	27.33	19.16	11.88	4.50	0.15	10.85
2098	-1.77	-3.04	6.19	8.28	15.72	24.19	30.07	28.94	19.46	7.34	1.83	-3.09	11.18
2099	-3.67	2.53	5.36	9.16	12.75	21.27	25.72	26.41	19.09	8.28	-0.84	-2.60	10.29
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-4.27	-2.48	1.34	6.72	14.08	20.55	24.97	24.45	17.14	7.99	1.27	-3.83	8.99
SD	3.60	4.00	2.92	2.36	2.65	3.02	3.19	3.02	2.78	2.99	2.56	3.49	1.78
Skew	-0.50	-0.66	0.13	-0.14	0.20	0.25	-0.14	-0.19	-0.31	0.20	-0.17	-0.15	0.40
Analysis of Trend in Mean (95% SL):													
Slope	0.03	0.05	0.06	0.05	0.06	0.06	0.08	0.08	0.07	0.06	0.05	0.04	0.06
KendSum	576.	720.	1459.	1374.	1421.	1433.	1647.	1790.	1790.	1474.	1292.	693.	2376.
KendTau	0.15	0.19	0.38	0.36	0.37	0.37	0.43	0.47	0.47	0.39	0.34	0.18	0.62
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.07	2.59	5.25	4.95	5.12	5.16	5.93	6.45	6.45	5.31	4.65	2.49	8.56
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410

BP RSS	0.0276	0.2625	1.6289	0.5428	0.1063	4.5037	0.0053	0.1425	0.9882	0.0313	0.0080	0.6620	1.8796
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	12.94	15.96	8.50	5.56	7.05	9.11	10.20	9.09	7.70	8.92	6.56	12.18	3.16
Res Var	12.26	14.63	5.95	3.97	4.98	6.63	6.27	5.32	4.65	6.20	4.97	11.18	1.05
Tnd Var	5.27	8.38	29.95	28.67	29.28	27.29	38.58	41.51	39.66	30.46	24.24	8.21	66.83

SNOTEL Precipitation – Fort Peck

Analysis of Monthly Time-Series Data

Output File: c:\climate\ccsm3\FTPK_SNO_Precip_All.txt
DSS File: c:\climate\ClimateChangeData.dss

/FTPK-SNOTEL/ALL/precip/01JAN2001 - 01JAN2099/1MON
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	144.50	57.70	71.90	70.10	55.20	38.60	4.60	1.80	37.20	93.80	99.60	156.10	831.10
2013	155.20	136.30	107.40	106.90	54.70	37.20	11.80	34.90	43.90	74.30	64.70	54.00	881.30
2014	65.00	114.30	103.90	27.40	46.60	57.80	61.40	16.40	24.20	80.30	122.90	81.90	802.10
2015	153.40	115.20	89.10	93.30	68.10	92.50	48.70	0.60	31.20	88.60	92.50	71.20	944.40
2016	98.30	63.80	94.90	47.20	51.40	45.60	24.20	0.60	16.20	76.50	54.60	102.90	676.20
2017	37.90	96.30	82.60	82.30	124.50	42.00	7.00	15.30	46.40	86.70	113.00	82.30	816.30
2018	104.20	55.50	71.10	91.40	83.60	22.90	37.20	36.50	23.60	80.90	87.00	93.90	787.80
2019	113.60	65.90	121.20	87.90	55.10	56.80	53.40	0.40	20.90	70.40	67.30	66.00	778.90
2020	91.80	67.10	113.50	75.10	64.50	37.90	13.70	11.90	63.80	75.90	60.00	123.80	799.00
2021	57.80	92.60	99.90	73.90	100.40	109.60	78.40	39.00	32.50	104.60	100.40	97.20	986.30
2022	97.00	64.80	72.10	115.90	65.30	33.00	94.80	79.80	65.50	79.30	110.70	106.50	984.70
2023	79.40	68.00	103.90	107.50	107.70	76.00	42.00	37.40	39.10	92.40	92.50	117.70	963.60
2024	93.00	69.70	74.90	110.50	84.20	108.90	113.60	37.40	40.80	69.20	111.50	74.40	988.10
2025	54.40	83.80	82.40	79.30	76.00	80.20	63.10	6.10	58.10	88.40	56.40	91.20	819.40
2026	64.90	99.50	104.60	85.70	28.50	120.40	102.00	21.80	8.90	129.60	69.70	83.80	919.40
2027	138.10	45.60	75.10	128.50	80.70	110.60	82.80	29.70	20.90	72.40	81.60	130.80	996.80
2028	81.50	43.00	108.30	104.80	94.50	61.90	11.00	64.50	30.90	85.30	126.10	105.50	917.30
2029	126.80	62.90	97.40	46.60	74.30	83.30	4.00	27.30	20.40	88.20	121.10	75.50	827.80
2030	83.90	80.50	90.00	145.20	91.60	80.10	26.90	25.50	22.10	97.40	198.00	104.90	1046.10
2031	81.10	68.30	74.80	62.60	90.00	15.70	8.20	18.70	60.70	86.60	103.10	60.40	730.20
2032	73.00	82.70	119.20	87.70	71.20	93.90	15.20	6.20	6.50	81.70	122.50	116.90	876.70
2033	96.20	97.90	84.70	70.10	61.70	47.70	38.20	8.80	31.40	44.20	115.20	110.80	806.90
2034	51.40	75.50	94.60	93.90	101.90	57.20	30.80	37.30	40.00	68.10	109.20	57.30	817.20
2035	89.50	99.50	89.70	80.20	45.10	67.40	57.70	22.60	21.70	73.40	93.70	146.90	887.40
2036	160.50	94.40	77.40	90.40	119.40	52.60	16.90	33.80	3.80	78.60	94.20	32.20	854.20
2037	71.80	121.70	75.50	103.40	41.00	86.00	72.90	55.10	45.90	57.80	60.50	96.10	887.70

2038	119.20	88.80	68.40	95.40	96.00	72.50	57.90	5.70	17.90	71.80	88.60	112.10	894.30
2039	62.00	89.50	78.20	118.20	93.80	68.90	28.30	9.50	29.50	120.20	80.40	95.40	873.90
2040	100.60	115.00	81.20	67.00	82.90	55.20	50.00	3.60	22.70	70.50	112.70	96.10	857.50
2041	57.20	21.60	94.50	82.50	58.50	119.70	52.60	24.30	23.30	70.10	87.30	65.80	757.40
2042	89.10	106.10	70.50	115.00	42.20	97.80	39.60	5.20	11.40	38.10	101.90	117.90	834.80
2043	67.60	106.80	80.60	86.50	73.30	31.20	38.60	61.10	38.90	101.20	121.80	79.00	886.60
2044	166.40	55.00	80.60	96.10	82.80	66.90	105.40	15.30	62.70	86.30	94.20	101.30	1013.00
2045	98.30	91.70	106.90	85.10	63.50	62.10	57.40	64.30	41.40	132.00	108.10	139.60	1050.40
2046	82.00	72.10	82.70	102.50	75.60	55.20	76.00	38.30	37.80	55.10	57.40	107.40	842.10
2047	64.90	64.80	119.50	48.10	36.20	148.80	62.90	62.10	45.80	65.50	106.20	61.80	886.60
2048	122.60	70.70	42.70	110.90	52.30	56.70	43.00	7.00	42.80	78.30	140.50	94.60	862.10
2049	166.80	128.40	67.20	93.70	88.50	97.90	8.10	49.10	10.50	36.90	110.90	94.00	952.00
2050	70.10	63.40	45.80	71.40	88.30	99.60	35.10	0.60	48.30	47.20	50.50	116.10	736.40
2051	150.40	41.50	70.40	79.90	41.80	76.80	81.80	2.10	21.90	74.10	89.90	123.80	854.40
2052	114.20	118.40	73.00	58.20	40.70	59.80	34.80	42.50	52.40	68.30	122.50	93.00	877.80
2053	91.90	126.40	105.10	120.30	56.90	59.60	51.50	4.20	16.50	61.20	61.50	75.10	830.20
2054	73.50	54.40	85.80	99.50	65.50	138.80	92.30	2.70	61.20	97.30	107.30	123.80	1002.10
2055	128.70	104.90	79.70	79.40	77.20	121.60	69.70	46.20	42.60	107.10	140.50	178.90	1176.50
2056	117.10	90.40	32.00	79.20	74.40	50.20	28.40	36.40	25.20	50.20	95.20	117.60	796.30
2057	100.70	120.10	87.00	81.30	46.50	64.60	22.30	4.90	4.40	68.40	121.40	136.90	858.50
2058	52.70	85.40	136.60	48.20	24.60	46.50	6.40	0.30	9.40	50.50	56.70	102.80	620.10
2059	136.00	65.30	86.70	49.60	41.40	20.10	9.80	1.10	22.70	46.00	142.10	88.50	709.30
2060	125.00	90.20	99.20	69.40	131.00	70.30	15.80	7.80	6.50	24.70	56.80	134.90	831.60
2061	121.80	105.60	112.10	76.10	55.30	82.90	24.00	13.00	30.10	76.10	103.30	111.00	911.30
2062	91.40	103.80	73.30	97.40	45.80	41.30	11.70	14.90	53.60	103.20	126.10	92.60	855.10
2063	141.60	64.30	105.60	88.90	54.10	125.20	99.90	14.30	57.20	76.60	72.80	62.40	962.90
2064	108.30	51.20	107.10	71.00	73.70	130.50	23.50	5.30	22.20	133.20	121.50	121.00	968.50
2065	50.90	119.50	116.20	83.30	90.10	53.70	13.90	12.60	39.50	86.90	114.20	57.40	838.20
2066	58.50	120.60	93.80	85.50	70.00	98.20	75.70	35.40	69.60	61.90	71.20	73.50	913.90
2067	71.10	105.80	87.40	50.20	106.20	17.50	35.10	1.90	83.10	92.00	88.10	145.00	883.40
2068	98.30	44.40	75.20	101.00	59.20	22.40	25.80	4.50	42.10	106.00	113.10	91.80	783.80
2069	112.80	41.60	105.80	103.90	63.20	15.90	6.90	0.90	28.50	71.20	107.60	103.80	762.10
2070	112.80	71.50	97.80	119.00	120.80	51.50	50.30	34.50	4.60	80.90	68.90	76.10	888.70
2071	112.60	95.80	59.50	103.80	91.50	84.80	83.80	25.00	32.90	108.60	127.80	89.60	1015.70
2072	101.60	140.50	117.30	125.50	110.30	54.40	31.20	2.40	13.30	48.20	188.10	161.50	1094.30
2073	62.20	66.20	98.80	98.30	58.90	76.50	38.40	22.10	33.30	74.90	130.90	68.10	828.60
2074	94.90	71.20	117.80	90.80	76.50	60.90	13.30	22.20	10.10	70.70	112.90	100.00	841.30
2075	57.90	49.20	83.00	81.20	34.00	57.10	18.70	9.30	61.70	55.50	121.60	61.50	690.70
2076	160.70	47.40	127.80	54.80	60.50	66.40	38.20	2.10	30.60	71.50	80.00	98.80	838.80
2077	146.00	63.40	126.70	109.20	58.40	48.80	15.60	11.50	27.00	81.60	94.30	91.00	873.50
2078	82.80	122.20	99.50	76.50	153.80	61.80	93.90	18.00	37.50	37.10	122.50	103.60	1009.20
2079	103.00	48.30	76.40	91.00	49.60	83.10	21.60	3.90	21.10	99.10	86.10	96.80	780.00
2080	118.60	152.10	88.50	62.30	65.10	38.00	18.60	0.80	44.90	52.20	103.60	119.30	864.00
2081	82.20	107.20	59.40	85.90	30.40	136.30	60.60	25.60	6.70	96.60	46.60	118.50	856.00
2082	38.00	79.40	41.70	62.10	69.10	39.40	17.80	0.80	61.90	49.00	75.20	73.20	607.60
2083	75.90	34.00	147.20	122.40	101.30	102.70	58.30	22.80	36.70	61.80	122.40	47.40	932.90
2084	64.50	86.80	84.10	79.50	74.40	56.90	9.10	9.80	17.60	52.70	119.70	114.90	770.00
2085	83.40	66.50	104.50	51.20	72.40	74.20	2.50	32.80	10.50	121.10	142.20	66.50	827.80
2086	141.80	40.80	78.70	92.20	85.30	7.20	42.10	7.00	37.00	53.20	132.70	117.50	835.50
2087	111.90	96.70	122.30	80.20	60.40	42.60	96.70	7.20	22.80	83.20	141.10	99.10	964.20
2088	163.60	118.80	129.70	52.80	69.40	49.80	13.80	8.00	19.00	69.60	115.20	123.90	933.60
2089	71.40	82.90	115.30	76.60	49.10	36.20	17.80	9.80	27.40	38.90	132.40	150.80	808.60
2090	74.10	81.40	84.20	81.40	40.40	127.60	110.90	37.20	22.10	45.50	108.00	80.80	893.60
2091	72.90	46.20	29.10	80.30	41.20	43.30	46.10	1.40	21.80	47.50	84.80	155.80	670.40
2092	99.80	63.60	86.90	89.60	43.40	4.30	12.60	1.40	67.90	39.30	125.70	106.10	740.60

2093	143.40	71.50	91.10	103.40	74.90	67.80	4.60	2.20	20.00	81.20	105.80	65.20	831.10
2094	159.40	24.50	40.60	77.10	68.40	21.20	7.40	7.90	8.80	53.70	122.40	126.10	717.50
2095	141.50	56.50	116.50	65.90	34.10	18.90	65.50	39.20	17.90	60.90	77.40	93.10	787.40
2096	118.50	70.80	108.90	102.90	31.50	97.90	45.70	16.60	24.60	78.20	165.70	66.50	927.80
2097	105.60	102.00	64.80	108.30	54.20	36.80	11.40	7.90	17.60	123.40	148.80	118.20	899.00
2098	103.40	46.30	101.30	122.30	116.70	66.90	43.80	24.30	43.90	103.10	180.80	110.20	1063.00
2099	50.80	103.00	63.40	55.40	44.90	82.70	85.20	49.60	46.30	53.90	155.10	81.60	871.90

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	99.22	81.33	89.70	85.96	69.65	66.37	41.82	19.66	32.11	75.52	104.99	99.28	865.61
SD	33.36	28.31	23.22	22.16	25.77	32.59	30.10	18.51	17.87	23.41	30.81	28.10	102.61
Skew	0.32	0.20	-0.23	-0.04	0.70	0.46	0.67	1.07	0.56	0.36	0.41	0.29	0.16
Analysis of Trend in Mean (95% SL):													
Slope	0.09	-0.10	0.02	-0.03	-0.13	-0.14	-0.10	-0.15	-0.06	-0.18	0.39	0.09	-0.30
KendSum	189.	-210.	154.	-87.	-451.	-293.	-248.	-418.	-252.	-643.	909.	209.	-144.
KendTau	0.05	-0.05	0.04	-0.02	-0.12	-0.08	-0.06	-0.11	-0.07	-0.17	0.24	0.05	-0.04
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	0.68	-0.75	0.55	-0.31	-1.62	-1.05	-0.89	-1.50	-0.90	-2.31	3.27	0.75	-0.52
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.0108	0.8576	7.8820	1.1012	0.7469	0.3206	0.0010	4.3478	0.1527	3.3242	0.3322	0.0142	0.7435
Trend?	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	1113.19	801.44	539.23	491.23	664.35	1062.21	905.77	342.68	319.23	548.00	949.30	789.44	10528.04
Res Var	1107.59	794.58	539.00	490.81	653.30	1049.75	899.38	327.32	317.23	525.70	850.65	784.60	10468.45
Tnd Var	0.50	0.86	0.04	0.08	1.66	1.17	0.71	4.48	0.63	4.07	10.39	0.61	0.57

SNOTEL Precipitation – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\ccsm3\GARR_SNO_Precip_All.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-SNOTEL/ALL/precip/01JAN2001 - 01JAN2099/1MON
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	93.00	38.70	57.00	106.10	37.40	56.10	4.60	0.30	31.00	65.30	69.10	113.30	671.90
2013	98.00	81.10	81.60	95.10	56.00	38.30	43.10	21.50	27.60	64.10	50.30	57.90	714.60
2014	40.50	83.50	92.10	21.90	52.10	78.30	122.50	22.90	14.90	51.80	76.60	56.50	713.60
2015	100.20	86.20	70.50	66.30	73.70	149.30	77.50	5.50	34.10	84.40	59.90	65.70	873.30
2016	59.50	70.20	66.30	42.70	60.10	72.80	33.40	3.90	31.20	116.50	35.50	62.70	654.80
2017	33.50	71.70	81.00	87.10	95.70	38.30	9.20	9.60	36.90	53.20	86.90	52.80	655.90
2018	86.20	33.10	71.90	59.00	63.20	59.90	43.60	39.60	31.40	59.90	62.50	72.50	682.80
2019	80.80	49.30	84.80	69.70	49.60	42.80	92.90	2.20	22.60	67.00	49.00	55.70	666.40
2020	75.80	54.90	95.90	57.50	50.40	50.10	64.20	40.80	64.10	56.40	42.30	76.00	728.40
2021	45.70	63.30	85.90	63.30	71.20	137.80	134.30	63.50	32.10	85.30	71.80	73.10	927.30
2022	66.10	37.30	60.10	72.20	63.30	50.30	120.10	76.60	42.90	60.10	73.70	84.30	807.00
2023	56.00	56.70	82.40	61.90	108.00	88.60	100.20	53.00	22.30	75.90	63.50	84.20	852.70
2024	57.50	75.40	79.00	92.10	119.10	123.10	181.00	54.80	24.70	49.80	88.90	51.00	996.40
2025	47.50	74.10	57.40	68.60	101.50	154.90	92.50	11.10	27.50	61.30	53.60	82.00	832.00
2026	54.20	84.80	70.50	81.90	37.20	176.90	121.60	56.10	1.30	97.90	76.40	59.40	918.20
2027	87.90	42.40	76.30	114.00	94.00	151.50	110.90	45.30	19.10	57.30	76.50	90.90	966.10
2028	71.80	29.70	65.70	77.10	100.80	97.80	57.10	73.90	33.90	62.30	75.70	62.70	808.50
2029	79.60	50.70	82.50	36.80	59.30	84.70	15.10	34.60	26.70	65.50	87.80	51.30	674.60
2030	68.30	75.10	71.30	105.70	114.90	87.10	31.30	33.10	14.30	72.90	127.60	65.00	866.60
2031	57.70	55.60	69.70	65.10	82.40	53.30	24.40	15.40	60.30	54.10	84.30	41.50	663.80
2032	62.00	85.70	79.90	84.40	79.30	122.80	0.60	14.40	3.50	59.30	108.10	53.10	753.10
2033	81.00	56.50	64.50	41.30	65.00	50.30	21.30	1.80	26.30	40.70	74.90	66.50	590.10
2034	39.30	59.80	83.70	93.20	74.10	65.00	75.40	71.80	41.80	53.50	75.30	52.60	785.50
2035	57.20	85.40	60.00	53.30	64.10	89.40	107.20	46.10	15.00	43.90	81.10	92.60	795.30
2036	113.70	74.90	47.50	53.00	114.90	72.60	18.50	37.80	3.70	46.10	88.90	25.10	696.70
2037	70.50	85.20	76.20	70.60	52.00	88.20	91.20	82.70	34.70	57.10	26.70	67.10	802.20
2038	93.40	81.00	69.90	91.80	134.50	96.80	75.90	16.50	26.50	116.50	61.70	67.80	932.30
2039	46.10	65.10	53.50	117.50	64.70	105.80	55.60	3.40	17.70	107.20	54.20	74.50	765.30
2040	68.20	101.70	74.30	71.60	56.70	54.70	51.10	8.10	13.50	55.60	71.90	76.00	703.40
2041	45.10	23.00	74.50	73.60	36.10	96.00	76.10	71.50	19.10	68.10	47.90	53.60	684.60
2042	54.20	72.20	62.20	97.60	36.20	132.70	61.10	6.70	15.60	20.30	68.80	96.00	723.60
2043	53.30	87.90	79.90	60.00	73.40	17.50	45.50	84.30	52.40	95.10	85.30	66.90	801.50
2044	113.80	46.20	67.90	90.40	80.30	90.90	173.30	22.80	38.10	88.90	66.20	76.80	955.60
2045	71.70	75.20	78.20	61.40	64.70	110.30	78.60	90.00	26.80	90.80	78.90	80.80	907.40
2046	63.40	51.50	57.80	86.50	83.00	61.10	113.10	42.00	20.00	35.00	34.10	92.40	739.90
2047	53.90	47.90	88.20	60.30	21.50	206.70	72.10	78.40	31.60	86.90	60.20	63.30	871.00
2048	76.50	49.30	56.30	109.60	62.40	73.40	52.70	17.40	38.30	54.40	91.30	65.50	747.10

2049	103.10	96.00	71.00	83.20	107.40	82.80	17.90	57.00	6.30	27.70	68.90	64.50	785.80
2050	50.90	48.50	40.20	58.20	85.30	116.70	13.10	0.50	51.10	22.00	41.50	81.20	609.20
2051	93.10	29.10	64.50	84.80	32.50	128.10	118.20	11.00	33.50	57.10	66.80	90.30	809.00
2052	88.20	95.00	52.20	64.70	76.70	87.20	53.30	28.60	24.90	46.80	100.50	64.30	782.40
2053	59.10	73.90	87.90	89.80	49.80	34.80	98.60	5.70	21.00	56.30	36.90	56.90	670.70
2054	57.00	53.30	72.40	76.50	44.50	139.20	115.80	0.20	64.90	92.40	80.30	91.40	887.90
2055	78.70	85.60	55.80	92.00	76.30	146.70	135.80	51.50	19.10	80.50	105.10	149.80	1076.90
2056	78.80	91.00	34.30	40.70	53.10	100.30	52.70	30.00	19.50	51.50	68.90	102.50	723.30
2057	87.40	89.70	73.10	94.80	49.00	106.70	53.60	1.10	4.70	52.50	62.90	96.30	771.80
2058	41.40	75.90	84.40	51.20	44.40	92.00	5.50	2.80	3.90	35.10	47.00	72.10	555.70
2059	93.30	52.80	80.10	50.90	60.70	38.70	3.90	1.90	8.20	32.70	94.30	64.20	581.70
2060	84.90	73.20	83.40	45.20	162.80	98.40	26.00	18.70	19.10	10.90	25.40	85.80	733.80
2061	92.50	78.70	90.40	76.90	48.20	91.30	33.50	20.70	15.60	78.70	75.40	74.80	776.70
2062	72.90	80.00	73.30	99.80	31.50	59.20	29.10	18.50	58.30	63.10	93.30	72.10	751.10
2063	106.90	49.50	65.40	75.00	35.30	188.50	99.20	29.80	47.50	62.10	47.10	52.10	858.40
2064	79.80	43.00	78.00	64.60	81.70	140.30	57.40	14.10	8.30	119.30	74.00	87.60	848.10
2065	48.90	87.90	69.30	57.50	94.60	56.40	33.00	2.70	32.60	48.70	82.50	48.00	662.10
2066	54.50	78.30	79.30	85.90	78.20	113.20	156.20	44.80	41.40	65.90	51.40	55.80	904.90
2067	68.80	83.20	64.70	47.70	73.70	23.80	80.50	2.30	71.50	65.50	58.20	101.00	740.90
2068	69.70	35.50	53.30	83.90	77.90	78.90	70.90	14.00	28.90	75.80	94.00	70.40	753.20
2069	65.30	36.90	100.70	59.80	55.00	20.90	6.90	0.00	9.30	50.60	86.30	81.40	573.10
2070	99.50	53.60	80.60	124.30	115.00	61.10	123.90	19.50	2.70	46.00	56.00	50.10	832.30
2071	81.70	67.70	51.70	76.10	56.70	101.90	153.60	15.30	20.80	79.40	112.00	75.50	892.40
2072	72.80	94.00	105.80	87.40	93.00	79.50	52.20	13.60	5.30	31.60	133.30	102.50	871.00
2073	59.50	55.90	79.50	86.10	80.30	108.50	49.10	51.70	15.70	78.20	87.10	53.20	804.80
2074	65.90	66.50	88.90	79.40	136.60	105.40	78.70	67.60	10.00	49.00	83.40	60.00	891.40
2075	55.90	38.60	72.60	70.10	28.40	93.60	27.90	1.40	32.30	38.50	82.80	57.50	599.60
2076	110.80	40.90	86.10	40.00	35.90	45.20	35.80	0.20	51.00	39.20	52.70	60.10	597.90
2077	85.80	44.50	88.90	120.30	46.40	90.00	64.90	7.10	13.20	80.10	61.40	70.90	773.50
2078	71.20	108.20	92.40	70.00	122.60	74.30	164.60	61.00	31.60	35.00	79.40	72.70	983.00
2079	88.20	28.30	60.50	89.70	41.40	137.10	50.80	22.30	13.90	69.70	63.80	64.70	730.40
2080	122.10	105.50	60.00	37.70	59.20	54.90	44.70	20.50	41.70	70.90	66.40	109.40	793.00
2081	71.30	78.40	61.50	86.70	25.60	134.00	68.50	23.60	0.20	52.70	53.10	79.60	735.20
2082	35.00	64.70	27.60	51.40	64.50	88.40	40.50	0.10	43.70	32.70	50.90	57.90	557.40
2083	69.40	33.30	104.70	92.00	120.20	144.90	99.00	35.00	24.70	33.10	86.70	45.10	888.10
2084	60.50	55.30	88.10	56.80	147.80	62.30	12.30	11.20	11.00	43.20	105.90	79.50	733.90
2085	73.50	59.30	63.00	57.60	86.10	90.90	41.40	66.20	7.10	78.10	105.10	38.30	766.60
2086	108.30	39.30	64.90	54.80	49.10	43.70	74.50	3.10	25.30	86.10	81.90	123.10	754.10
2087	112.70	88.10	105.30	66.60	68.30	75.90	164.40	10.00	19.60	73.90	102.00	77.90	964.70
2088	100.10	78.70	88.50	56.30	56.30	49.90	49.90	23.40	15.70	26.00	71.00	84.90	700.70
2089	56.60	74.70	91.90	83.40	39.10	57.90	61.30	4.80	16.60	39.80	88.90	123.40	738.40
2090	56.80	54.90	68.40	59.90	54.70	177.50	154.70	91.90	14.80	25.70	72.50	65.80	897.60
2091	53.00	39.90	38.40	46.40	30.70	63.80	45.80	3.30	18.40	32.50	52.10	91.40	515.70
2092	69.20	62.30	53.60	94.30	47.70	14.80	49.90	10.50	83.30	41.60	95.90	78.70	701.80
2093	96.70	63.00	71.10	84.90	54.60	137.50	4.40	1.70	20.80	63.50	85.00	56.60	739.80
2094	88.30	27.30	36.30	81.10	58.70	48.30	26.50	5.30	2.70	42.10	81.90	107.10	605.60
2095	120.90	49.40	74.40	75.50	21.30	27.90	111.10	30.10	8.80	38.00	60.90	71.10	689.40
2096	82.90	65.20	83.40	101.20	37.70	170.90	79.40	18.00	17.80	44.20	82.50	52.10	835.30
2097	72.70	78.40	39.40	99.50	42.10	107.80	13.70	5.00	7.10	86.70	97.10	97.80	747.30
2098	98.20	31.50	67.80	96.80	74.50	69.60	89.30	26.70	30.80	63.10	116.10	75.70	840.10
2099	44.90	64.30	48.50	54.10	59.40	124.50	140.40	64.90	64.10	28.60	87.30	56.80	837.80
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Basic Statistics:

Mean	73.67	63.76	71.52	74.13	68.47	89.91	69.13	27.62	25.95	59.37	73.90	73.08	770.51
SD	21.13	20.57	16.32	21.13	29.75	41.67	45.33	25.86	17.40	22.76	21.50	20.53	112.67
Skew	0.31	-0.03	-0.33	0.09	0.91	0.51	0.59	0.89	0.98	0.47	0.14	0.89	0.12

Analysis of Trend in Mean (95% SL):

Slope	0.17	-0.07	-0.06	0.03	-0.16	0.00	0.00	-0.18	-0.07	-0.24	0.21	0.12	-0.25
KendSum	485.	-217.	-166.	50.	-489.	42.	-54.	-433.	-496.	-762.	649.	385.	-41.
KendTau	0.13	-0.06	-0.04	0.01	-0.13	0.01	-0.01	-0.11	-0.13	-0.20	0.17	0.10	-0.01
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.74	-0.78	-0.59	0.18	-1.76	0.15	-0.19	-1.56	-1.78	-2.74	2.34	1.38	-0.14
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	Trend	No Trend	No Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.2284	0.1709	9.4429	0.3865	0.8335	0.1861	0.0083	0.4053	4.1377	0.0002	0.0007	1.3592	0.0848
Trend?	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	446.34	423.17	266.42	446.45	885.01	1736.00	2054.45	668.56	302.77	517.92	462.17	421.47	12694.79
Res Var	427.51	420.20	264.28	445.75	867.68	1736.00	2054.45	648.37	299.69	478.76	434.38	411.59	12655.22
Tnd Var	4.22	0.70	0.80	0.16	1.96	0.00	0.00	3.02	1.02	7.56	6.01	2.34	0.31

HCN Precipitation – Fort Peck

Analysis of Monthly Time-Series Data

Output File: c:\climate\ccsm3\FTPK_HCN_Precip.txt
DSS File: c:\climate\ClimateChangeData.dss

/FTPK-HCN/ALL/precip/01JAN2001 - 01JAN2099/1MON/CC
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	65.40	19.40	20.90	19.60	24.70	17.50	0.30	0.10	16.20	27.40	34.50	70.50	316.50
2013	60.10	59.70	38.80	53.10	21.90	17.70	7.10	22.80	10.10	22.20	15.70	18.40	347.60
2014	15.70	37.10	38.40	6.10	11.40	34.80	30.40	10.90	12.20	27.40	43.70	27.70	295.80
2015	60.40	43.50	27.00	22.40	31.20	59.50	17.90	2.70	11.40	40.90	42.70	14.80	374.40
2016	32.00	22.20	33.20	11.80	12.60	28.20	16.00	0.00	2.50	36.20	14.40	38.40	247.50
2017	10.10	34.40	26.40	27.30	79.60	23.00	5.90	4.80	21.90	39.90	42.80	18.80	334.90
2018	33.50	11.70	25.10	38.40	37.70	5.50	23.60	20.80	11.40	21.30	33.50	27.80	290.30
2019	49.70	16.80	45.30	27.30	23.90	33.20	45.60	0.20	7.90	25.00	21.50	14.90	311.30

2020	26.20	18.80	41.80	24.90	33.60	18.20	9.30	15.70	29.00	20.50	11.50	47.90	297.40
2021	18.80	30.40	40.80	22.20	50.70	51.70	47.20	31.90	13.50	46.30	38.10	31.30	422.90
2022	31.90	24.70	22.40	56.20	24.60	22.40	58.80	51.50	27.80	33.20	41.30	34.30	429.10
2023	27.60	17.90	33.90	47.60	63.60	55.60	19.70	13.90	12.80	38.60	30.90	40.70	402.80
2024	25.20	21.80	23.40	38.60	35.20	59.00	77.30	14.70	10.50	24.80	38.50	20.50	389.50
2025	8.10	22.20	17.60	23.90	35.20	45.20	46.10	1.40	25.00	36.50	10.90	31.80	303.90
2026	21.00	26.80	42.90	27.80	3.80	75.60	63.70	12.50	0.90	57.20	19.50	23.60	375.30
2027	63.90	8.60	32.60	66.30	32.10	53.80	80.20	23.80	11.60	28.50	21.40	50.20	473.00
2028	23.90	12.90	39.30	40.30	52.50	57.30	13.20	28.60	9.60	38.30	50.80	39.20	405.90
2029	49.40	19.50	37.90	13.20	28.90	58.20	6.60	12.50	8.70	33.60	39.90	26.80	335.20
2030	32.10	28.80	24.60	55.10	50.70	56.40	14.50	15.50	4.60	46.50	89.90	35.70	454.40
2031	24.10	17.00	20.30	14.30	43.90	5.10	7.80	14.70	24.50	28.40	37.10	19.30	256.50
2032	23.40	28.60	40.10	33.60	36.40	61.50	4.20	1.90	0.40	36.50	51.50	32.50	350.60
2033	39.50	42.80	23.40	24.70	30.20	28.50	30.70	2.10	10.90	10.30	36.60	39.60	319.30
2034	11.40	19.20	29.60	39.80	51.40	33.00	26.30	21.40	15.70	23.60	41.70	16.20	329.30
2035	27.80	30.40	29.90	29.10	27.90	43.90	46.30	9.90	5.40	25.50	33.50	59.10	368.70
2036	71.40	35.00	26.80	31.50	75.90	27.40	8.60	15.10	0.20	38.40	30.00	4.60	364.90
2037	26.70	47.80	26.70	41.40	13.40	56.50	46.40	26.30	22.70	28.50	11.50	39.00	386.90
2038	52.50	24.20	26.20	44.10	37.40	63.50	45.10	4.30	8.60	43.80	36.20	47.00	432.90
2039	9.80	24.70	32.10	57.60	60.50	39.90	16.90	5.90	14.70	67.60	27.50	29.40	386.60
2040	39.20	48.30	32.10	15.10	45.50	23.20	33.70	2.60	10.90	41.10	37.80	32.90	362.40
2041	17.80	1.30	47.10	29.60	13.90	88.30	29.60	12.70	3.20	25.30	31.00	15.20	315.00
2042	27.80	45.50	16.20	46.60	14.20	47.30	22.50	1.50	3.20	7.30	46.10	53.90	332.10
2043	16.90	45.10	24.80	35.30	29.50	13.70	34.50	30.80	19.40	40.90	45.40	15.30	351.60
2044	64.80	16.00	32.00	25.70	24.50	43.50	83.20	11.20	25.10	39.20	28.50	36.70	430.40
2045	38.00	32.00	32.40	31.40	31.40	27.00	31.70	43.20	9.10	55.50	37.40	50.70	419.80
2046	26.70	23.70	23.70	47.70	38.00	30.30	27.40	19.40	12.50	10.10	11.60	36.30	307.40
2047	20.20	15.20	45.70	15.30	24.70	97.00	42.80	39.10	18.40	21.80	45.90	19.80	405.90
2048	48.90	19.20	13.00	56.80	18.60	16.70	22.30	5.40	12.10	25.00	55.30	40.50	333.80
2049	79.90	54.00	24.10	36.10	37.90	60.00	15.40	30.30	0.80	7.50	35.70	39.50	421.20
2050	24.60	16.00	15.80	29.10	30.60	57.70	23.90	0.20	19.70	13.30	9.80	47.00	287.70
2051	51.30	6.40	24.30	38.60	17.40	52.20	68.40	5.80	7.20	19.50	33.90	43.30	368.30
2052	37.20	49.30	18.80	14.80	15.60	36.50	21.60	30.30	16.70	24.30	57.60	26.50	349.20
2053	33.60	48.80	36.60	55.50	25.60	25.50	45.40	2.20	6.30	34.70	13.50	25.20	352.90
2054	25.60	19.30	27.30	47.70	33.70	111.60	55.40	0.80	29.40	37.40	32.20	43.40	463.80
2055	41.10	40.50	23.60	36.20	41.80	78.50	48.10	28.80	14.70	36.10	62.70	75.70	527.80
2056	38.80	36.60	7.40	26.40	31.40	30.20	21.30	23.60	7.10	20.10	26.60	42.90	312.40
2057	34.30	44.60	24.50	33.70	15.00	29.20	13.40	2.10	0.00	30.80	47.20	56.20	331.00
2058	11.60	28.30	45.60	21.50	9.40	30.90	3.40	0.50	3.70	18.40	15.20	34.80	223.30
2059	59.40	16.10	32.60	5.60	15.50	12.10	5.40	1.10	5.20	16.80	60.20	28.70	258.70
2060	53.20	31.70	34.50	21.10	93.50	50.40	15.90	9.50	1.50	3.40	19.40	47.40	381.50
2061	50.10	41.50	36.80	25.40	18.60	52.00	18.40	9.50	11.60	31.20	42.10	34.60	371.80
2062	34.00	48.00	24.90	39.50	14.60	40.60	9.90	4.20	19.90	38.60	46.90	25.30	346.40
2063	61.00	13.80	43.50	25.70	29.70	74.90	65.40	1.10	16.40	28.60	33.40	14.20	407.70
2064	44.20	13.10	31.60	31.20	30.60	88.20	14.70	1.80	6.30	58.10	46.00	41.80	407.60
2065	13.60	45.10	44.20	28.80	40.60	30.30	11.70	4.60	19.50	34.20	46.40	17.00	336.00
2066	16.10	52.40	34.60	45.30	47.60	55.60	43.80	18.20	31.70	23.30	28.20	25.70	422.50
2067	28.80	39.40	26.90	13.70	66.30	4.70	22.50	2.50	40.20	34.40	39.50	61.10	380.00
2068	33.20	9.30	21.20	44.60	27.70	18.10	27.10	4.00	15.40	52.20	42.70	32.10	327.60
2069	42.40	14.30	42.10	37.90	21.40	13.20	3.80	0.20	13.20	38.80	38.50	36.80	302.60
2070	33.40	18.20	44.00	69.00	74.80	19.70	37.00	17.90	0.30	29.20	28.00	23.10	394.60
2071	32.80	32.30	16.80	56.20	49.90	45.20	49.50	11.80	11.50	67.40	48.20	35.70	457.30
2072	39.20	65.70	46.30	50.90	62.50	37.80	15.70	0.40	2.70	10.80	88.10	74.80	494.90
2073	11.70	13.50	32.50	35.20	24.90	50.40	31.40	20.50	5.60	44.10	46.30	17.70	333.80
2074	34.60	25.40	64.00	33.60	34.20	40.60	7.70	19.80	5.70	23.60	50.90	32.30	372.40

2075	18.80	10.80	32.60	25.00	10.20	48.40	6.80	8.10	34.40	17.50	38.50	16.60	267.70
2076	67.20	10.70	50.60	20.40	20.80	36.60	34.50	0.40	12.10	23.60	35.00	44.60	356.50
2077	64.80	16.00	40.60	42.00	17.50	22.90	10.40	9.50	10.60	35.60	30.60	26.60	327.10
2078	35.80	43.90	40.10	24.60	104.20	35.40	75.40	22.60	21.10	13.90	53.30	40.40	510.70
2079	32.50	19.30	22.10	42.80	30.40	48.20	20.20	3.10	9.60	49.40	26.80	39.50	343.90
2080	53.80	62.70	24.50	13.90	26.50	15.70	23.10	3.10	26.30	14.90	38.30	51.90	354.70
2081	21.80	42.90	18.10	38.30	9.50	88.40	35.40	18.60	0.70	47.80	11.80	41.60	374.90
2082	14.70	24.00	12.60	18.90	22.70	30.30	9.70	0.80	38.20	14.20	25.10	19.60	230.80
2083	22.10	4.50	64.80	44.80	41.10	67.70	39.10	21.20	14.10	18.40	46.50	18.50	402.80
2084	15.40	31.40	36.10	27.50	42.90	36.80	12.40	5.10	7.40	14.80	44.10	35.10	309.00
2085	31.10	19.90	42.50	9.90	37.50	35.60	7.60	29.20	1.20	61.90	55.20	17.20	348.80
2086	60.60	7.50	25.60	37.30	51.90	6.10	25.30	5.10	19.80	23.80	52.10	47.40	362.50
2087	34.50	29.50	60.10	22.30	26.60	37.50	59.50	4.90	14.10	39.10	49.70	30.70	408.50
2088	78.50	46.80	55.80	19.30	29.10	27.10	14.80	14.00	9.10	33.00	41.20	44.90	413.60
2089	20.40	27.80	42.50	28.90	23.70	20.70	14.80	10.10	6.70	15.30	42.30	56.70	309.90
2090	22.10	23.90	28.10	33.50	14.60	73.20	67.00	25.70	5.30	11.90	36.80	20.80	362.90
2091	22.50	16.60	5.60	26.60	13.40	27.20	31.40	0.80	12.80	13.30	29.30	67.70	267.20
2092	33.00	19.60	26.10	35.90	17.20	3.60	16.50	1.20	44.20	12.50	52.90	35.90	298.60
2093	71.50	20.40	31.90	42.70	32.60	47.10	0.90	0.60	7.70	42.40	32.70	18.20	348.70
2094	78.50	1.60	12.20	26.70	43.40	15.50	10.70	4.30	3.10	17.30	49.70	47.80	310.80
2095	69.70	14.30	42.90	22.80	17.80	11.60	57.30	32.30	5.20	19.40	19.50	27.90	340.70
2096	42.90	28.50	44.90	40.70	8.30	54.30	38.20	14.70	8.50	24.80	64.50	23.90	394.20
2097	50.80	40.30	23.20	44.10	19.50	25.20	3.70	3.10	6.60	65.80	62.80	48.30	393.40
2098	36.50	13.30	32.30	63.10	84.20	43.20	34.40	11.00	22.40	41.40	91.50	33.60	506.90
2099	13.50	33.50	18.40	15.90	12.40	37.90	85.90	38.60	21.80	18.40	79.20	31.70	407.20
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	36.60	27.57	31.74	33.10	33.41	40.47	29.26	12.40	12.95	30.46	39.03	34.90	361.90
SD	18.43	14.60	11.82	13.98	19.81	22.39	21.37	11.75	9.63	14.45	16.89	14.64	62.02
Skew	0.61	0.51	0.43	0.36	1.34	0.72	0.88	1.03	1.05	0.58	0.76	0.60	0.32
Analysis of Trend in Mean (95% SL):													
Slope	0.09	-0.03	0.04	0.01	-0.04	-0.07	0.00	-0.04	0.02	-0.05	0.22	0.06	0.19
KendSum	305.	-182.	159.	54.	-302.	-253.	-32.	-186.	-68.	-380.	824.	300.	187.
KendTau	0.08	-0.05	0.04	0.01	-0.08	-0.07	-0.01	-0.05	-0.02	-0.10	0.22	0.08	0.05
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.10	-0.65	0.57	0.19	-1.08	-0.91	-0.11	-0.67	-0.24	-1.37	2.97	1.08	0.67
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.4131	0.4240	9.3261	0.4898	1.4897	0.0270	0.0287	0.5548	3.8307	3.4209	0.9885	0.0159	0.5152
Trend?	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	339.66	213.05	139.81	195.53	392.56	501.34	456.64	138.05	92.79	208.93	285.14	214.43	3846.08
Res Var	334.80	212.36	138.55	195.49	391.60	498.36	456.64	136.86	92.59	207.00	254.73	212.36	3822.62
Tnd Var	1.43	0.33	0.90	0.02	0.24	0.59	0.00	0.87	0.21	0.92	10.67	0.96	0.61

HCN Precipitation – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\ccsm3\GARR_HCN_Precip.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-HCN/ALL/precip/01JAN2001 - 01JAN2099/1MON/CC
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	43.20	13.20	17.70	47.40	14.10	39.70	5.40	1.90	14.70	21.00	27.00	49.70	295.00
2013	34.70	33.30	30.00	52.90	23.10	23.00	37.80	9.30	10.80	21.10	15.50	27.30	318.80
2014	14.60	29.80	33.50	7.30	22.60	49.10	58.40	30.20	14.40	23.80	29.70	20.60	334.00
2015	37.10	36.80	25.00	23.90	31.70	89.70	29.20	15.30	25.20	43.20	26.50	20.00	403.60
2016	21.40	24.40	25.30	12.40	24.10	53.50	27.90	1.40	10.90	79.80	9.30	23.70	314.10
2017	11.50	28.20	27.70	34.80	71.30	20.30	8.90	4.20	24.20	27.60	33.70	12.60	305.00
2018	30.70	12.20	29.00	21.40	22.20	23.00	30.10	20.50	14.90	15.70	29.50	27.20	276.40
2019	34.70	15.20	29.30	30.10	22.20	33.40	68.80	6.00	15.40	30.70	18.90	17.80	322.50
2020	23.60	18.50	48.50	20.60	34.60	29.50	44.00	40.00	31.70	15.10	9.20	30.20	345.50
2021	13.80	20.50	38.90	21.10	30.70	71.80	88.00	49.40	17.90	38.40	35.60	26.80	452.90
2022	21.10	15.20	21.70	29.70	33.70	41.50	60.90	53.80	14.80	29.40	27.50	24.60	373.90
2023	19.90	16.40	28.40	29.20	53.90	79.50	70.00	26.40	7.90	34.20	21.30	29.90	417.00
2024	19.90	34.20	22.50	35.40	48.20	74.10	124.20	23.00	12.30	20.50	33.00	14.30	461.60
2025	13.40	24.40	12.90	25.60	58.30	90.40	61.20	5.60	14.50	26.00	13.00	30.50	375.80
2026	18.90	25.00	30.60	30.70	10.00	81.10	84.40	32.50	1.30	44.80	26.50	16.30	402.10
2027	41.20	11.50	34.90	76.80	44.40	102.50	102.70	35.70	14.60	25.50	27.10	35.30	552.20
2028	26.60	10.20	23.90	28.40	48.50	92.60	38.00	34.20	11.00	29.50	34.70	23.10	400.70
2029	30.20	16.70	35.00	10.80	27.10	71.30	27.60	20.40	12.60	24.40	29.60	18.50	324.20
2030	26.50	28.70	20.00	47.20	75.00	70.20	17.20	20.60	4.40	36.80	50.50	18.60	415.70
2031	15.60	16.30	16.50	21.70	35.10	25.30	25.40	14.50	28.40	28.20	35.50	14.30	276.80
2032	20.40	41.00	26.50	34.50	46.00	84.20	2.00	5.80	0.70	31.70	54.50	11.10	358.40
2033	32.20	24.70	23.10	13.60	29.00	32.80	16.20	2.20	7.90	16.70	21.50	25.00	244.90
2034	10.10	14.50	27.10	33.90	50.30	38.20	41.10	40.00	24.00	22.10	28.60	19.50	349.40
2035	18.00	30.70	24.20	25.90	46.90	49.30	75.60	22.00	6.20	17.60	32.10	34.50	383.00
2036	46.10	25.70	20.40	16.80	69.00	41.40	16.20	19.00	0.70	16.80	35.80	5.60	313.50
2037	32.30	37.20	28.50	46.70	25.30	55.30	61.60	46.80	16.50	34.00	6.90	28.10	419.20
2038	36.50	26.00	31.50	44.00	54.00	84.70	46.30	10.60	11.70	64.20	26.50	26.00	462.00
2039	10.40	21.20	22.50	66.10	48.80	66.40	35.20	5.20	12.80	58.40	26.00	22.10	395.10
2040	29.00	38.10	33.50	23.50	37.00	28.10	35.70	12.00	9.90	37.60	32.70	24.90	342.00
2041	16.20	5.90	39.20	30.30	15.50	79.50	33.70	41.20	5.20	23.20	17.80	13.50	321.20
2042	17.80	30.70	16.10	48.10	13.20	62.20	59.10	5.00	9.10	6.30	39.60	42.00	349.20
2043	14.40	35.20	32.40	28.20	39.20	11.60	54.20	40.50	32.00	55.40	37.00	21.70	401.80
2044	40.10	16.80	30.30	42.00	35.70	62.50	125.10	17.00	17.00	54.70	23.00	30.60	494.80
2045	24.20	27.00	28.20	28.50	24.30	44.80	39.70	43.60	5.90	35.30	31.00	32.30	364.80
2046	22.00	17.10	20.60	42.10	40.00	29.50	49.60	28.50	7.10	8.20	9.00	28.20	301.90
2047	20.60	12.80	43.20	37.30	30.30	116.50	42.60	56.30	12.50	38.10	26.80	20.90	457.90
2048	33.20	15.50	19.20	66.70	29.50	27.30	27.30	12.50	17.90	17.50	38.00	27.70	332.30

2049	47.70	42.50	22.60	31.60	48.10	45.10	22.90	41.00	1.80	8.10	24.60	25.50	361.50
2050	14.20	13.00	17.60	23.00	30.80	76.40	16.60	0.70	27.10	8.30	13.00	33.50	274.20
2051	31.40	4.10	24.90	50.80	19.10	105.20	86.00	14.80	17.50	18.20	29.30	31.30	432.60
2052	29.90	36.50	16.20	28.10	30.40	61.10	46.80	25.30	12.50	24.30	53.60	17.50	382.20
2053	17.40	27.20	33.00	44.50	27.20	27.00	66.30	6.30	5.20	28.20	7.00	21.50	310.80
2054	17.20	29.80	21.50	43.00	21.30	121.30	52.00	1.00	37.50	42.40	25.40	30.20	442.60
2055	28.80	23.40	22.20	37.80	46.90	96.40	83.20	28.40	10.00	30.50	47.70	56.40	511.70
2056	23.20	32.10	8.90	14.90	34.10	67.10	45.30	20.70	15.40	38.20	19.50	34.90	354.30
2057	31.70	36.10	23.40	52.50	21.30	56.30	42.80	6.00	2.10	21.80	22.80	37.20	354.00
2058	11.30	26.00	29.90	28.30	23.10	69.90	2.30	0.80	3.60	19.10	16.20	25.80	256.30
2059	40.80	16.50	30.80	15.30	34.70	28.70	11.90	7.00	1.70	14.60	40.80	25.20	268.00
2060	33.00	30.00	29.40	17.30	121.60	57.70	30.00	23.00	6.40	2.80	12.90	29.00	393.10
2061	39.30	31.70	36.00	23.70	17.80	58.50	37.80	21.30	8.50	41.50	32.60	23.80	372.50
2062	30.50	40.60	30.50	52.00	11.60	56.40	21.70	5.20	23.50	24.30	35.70	22.50	354.50
2063	39.10	12.90	31.70	29.00	28.30	136.80	73.10	10.00	20.00	29.40	21.70	17.30	449.30
2064	32.40	12.50	23.60	27.90	30.50	95.60	41.30	7.10	2.40	58.80	29.90	27.90	389.90
2065	14.90	33.90	29.20	26.90	46.30	33.80	23.00	7.50	28.00	21.50	27.80	17.70	310.50
2066	15.80	30.80	32.30	37.30	63.70	74.80	84.00	29.80	30.20	29.30	27.20	20.10	475.30
2067	27.80	30.70	25.20	13.30	52.40	18.10	36.90	9.50	31.60	26.90	34.50	49.50	356.40
2068	22.00	10.00	15.10	45.90	44.00	53.20	59.10	12.10	15.00	40.50	35.40	25.30	377.60
2069	24.10	16.80	42.20	28.00	19.30	18.40	2.60	0.20	6.20	33.20	31.70	27.00	249.70
2070	28.70	11.80	37.20	79.80	67.10	28.20	73.80	13.70	1.90	18.50	31.70	13.70	406.10
2071	28.90	21.70	13.60	44.10	41.40	67.80	91.10	13.40	12.00	64.30	46.00	37.10	481.40
2072	31.30	41.40	51.20	40.00	60.50	52.30	27.50	8.00	3.60	8.00	56.70	40.40	420.90
2073	15.00	14.60	24.50	36.50	42.30	71.30	41.10	38.40	4.60	36.70	32.70	16.20	373.90
2074	25.10	25.70	41.20	30.90	69.30	77.10	50.00	49.50	5.20	16.80	42.20	23.00	456.00
2075	21.80	10.00	27.30	32.80	9.80	60.30	14.40	13.60	20.70	11.80	32.70	18.90	274.10
2076	42.70	9.60	36.60	17.30	11.90	20.70	63.00	2.30	30.00	18.60	25.50	28.10	306.30
2077	37.10	15.40	31.30	49.10	16.50	38.40	37.00	14.70	4.80	39.10	19.50	23.70	326.60
2078	31.90	39.70	42.30	32.40	88.00	41.30	100.40	44.20	27.00	19.60	31.10	25.30	523.20
2079	34.00	14.70	23.60	49.60	37.10	72.70	38.80	21.30	11.40	32.10	21.10	21.80	378.20
2080	57.50	46.90	17.50	8.80	23.80	36.00	43.00	19.10	32.70	26.50	28.10	60.20	400.10
2081	25.50	32.70	23.40	51.70	7.80	71.50	45.00	18.00	0.00	29.00	21.60	28.70	354.90
2082	12.50	23.60	9.90	17.90	35.10	60.80	39.80	3.00	20.60	8.70	15.90	22.10	269.90
2083	22.50	7.50	49.80	40.70	50.10	90.00	53.50	36.90	11.40	12.00	30.20	20.50	425.10
2084	19.50	19.50	39.70	30.10	84.80	47.40	9.90	12.70	9.30	14.30	37.20	30.10	354.50
2085	33.00	25.00	26.20	19.20	40.20	61.20	51.20	50.50	1.20	38.00	41.40	13.50	400.60
2086	50.30	19.00	16.30	28.60	44.70	32.00	44.40	6.80	17.10	79.80	28.30	57.90	425.20
2087	40.60	31.90	66.50	26.00	38.80	70.80	76.50	10.20	13.20	35.00	40.20	23.90	473.60
2088	39.80	32.50	43.30	24.10	29.10	27.90	33.30	25.80	16.50	19.50	27.30	35.30	354.40
2089	13.20	26.50	35.30	34.40	19.00	29.90	39.40	18.40	6.10	18.10	27.30	48.40	316.00
2090	22.50	17.50	28.40	24.60	24.30	96.20	87.90	66.30	7.80	10.60	24.00	24.10	434.20
2091	15.10	18.00	10.30	16.70	13.20	41.30	41.80	2.30	15.60	13.60	20.40	42.50	250.80
2092	16.90	26.10	13.30	40.60	16.50	12.50	39.50	9.30	45.20	10.30	43.60	29.50	303.30
2093	43.50	18.70	25.10	44.50	35.80	75.40	5.10	1.80	7.30	38.10	28.90	19.40	343.60
2094	41.50	3.90	14.70	35.50	34.30	27.90	18.10	5.30	4.50	19.30	37.90	44.30	287.20
2095	59.50	14.30	25.80	34.20	20.30	28.50	72.30	20.70	4.20	17.30	14.80	24.20	336.10
2096	28.40	26.30	31.50	43.70	10.80	107.20	57.30	14.30	11.80	17.80	30.80	19.70	399.60
2097	30.60	31.20	11.00	50.20	18.70	68.50	11.00	5.20	7.30	46.40	45.70	42.80	368.60
2098	37.30	11.30	22.70	51.20	79.40	38.80	62.50	15.70	19.40	24.80	57.60	22.90	443.60
2099	12.30	20.40	11.20	13.30	28.60	54.60	126.50	51.80	35.40	10.20	44.70	25.10	434.10
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Basic Statistics:

Mean	27.42	23.24	27.44	33.58	36.78	57.30	47.18	19.82	13.78	28.07	29.49	27.02	371.12
SD	11.10	9.95	10.19	14.51	20.27	27.27	28.12	15.90	9.84	15.58	11.08	10.44	67.77
Skew	0.54	0.18	0.79	0.72	1.34	0.50	0.75	0.88	0.89	1.18	0.28	1.11	0.27

Analysis of Trend in Mean (95% SL):

Slope	0.09	-0.02	0.00	0.04	-0.01	-0.03	0.03	-0.04	0.01	-0.09	0.10	0.09	0.15
KendSum	438.	-113.	-78.	265.	-212.	-100.	124.	-172.	-153.	-446.	544.	436.	202.
KendTau	0.11	-0.03	-0.02	0.07	-0.06	-0.03	0.03	-0.04	-0.04	-0.12	0.14	0.11	0.05
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.57	-0.40	-0.28	0.95	-0.76	-0.36	0.44	-0.62	-0.55	-1.60	1.96	1.57	0.72
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	2.0683	0.1741	11.1822	0.4661	2.3621	0.0049	0.0273	0.2249	4.0910	0.0118	0.0269	2.2011	0.0082
Trend?	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	123.32	99.07	103.87	210.66	410.88	743.85	790.84	252.73	96.88	242.84	122.73	108.97	4592.75
Res Var	118.29	98.77	103.86	209.75	410.74	743.05	790.32	251.76	96.86	237.52	116.18	103.65	4578.85
Tnd Var	4.08	0.30	0.01	0.43	0.04	0.11	0.07	0.38	0.02	2.19	5.33	4.89	0.30

Computed Evapotranspiration – Fort Peck

Analysis of Monthly Time-Series Data

Output File: C:\Climate\ET\outFTPK_ET_CCSM3.txt
DSS File: C:\Climate\Month-Met.DSS

//Fort Peck/Evapotranspiration/01JAN2000 - 01JAN20
First Year: 2001
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.46	0.52	1.58	2.97	4.34	6.44	7.46	6.55	3.33	1.52	0.64	0.14	35.95
2002	0.47	0.84	1.73	2.38	5.06	7.73	8.44	6.94	3.91	1.62	0.63	0.48	40.23
2003	0.65	0.88	1.80	2.87	5.95	6.34	7.28	6.89	3.99	2.02	0.79	0.45	39.91
2004	0.69	0.96	1.34	2.59	4.39	6.32	7.49	6.54	4.24	1.90	0.59	0.47	37.52
2005	0.47	0.80	1.31	2.93	5.52	7.28	8.49	7.28	3.69	2.27	0.80	0.55	41.39
2006	0.59	1.07	1.90	3.52	4.75	7.61	8.63	7.04	3.34	1.70	0.60	0.60	41.35
2007	0.45	0.93	1.83	3.03	4.75	6.73	6.75	5.99	4.08	1.48	0.68	0.57	37.27
2008	0.55	0.62	1.83	2.89	4.48	7.76	7.96	7.32	4.06	2.12	0.86	0.46	40.91

2009	0.59	0.85	1.65	3.27	4.96	5.01	8.44	6.07	4.26	1.61	0.75	0.50	37.96
2010	0.58	1.01	1.67	3.10	4.66	6.20	7.46	6.24	3.49	2.13	0.75	0.31	37.60
2011	0.61	0.73	1.50	2.27	4.83	5.58	8.31	6.15	4.58	1.85	0.53	0.33	37.27
2012	0.22	1.01	1.99	2.92	4.73	6.70	8.28	6.91	3.20	1.89	0.81	0.42	39.08
2013	0.51	0.99	1.57	2.60	6.04	7.11	8.90	7.38	3.73	1.54	0.70	0.47	41.54
2014	0.55	0.99	1.61	2.89	6.03	6.70	8.37	6.95	3.51	1.54	0.62	0.47	40.23
2015	0.68	0.74	1.35	3.78	6.31	6.75	7.83	7.51	4.51	1.96	0.70	0.62	42.74
2016	0.59	0.60	1.46	2.45	5.44	6.31	7.56	7.65	4.35	1.54	0.80	0.41	39.16
2017	0.64	0.54	1.69	4.03	5.33	8.14	8.63	7.66	4.13	1.87	0.75	0.45	43.86
2018	0.61	0.90	1.58	2.68	4.39	6.22	8.19	7.08	3.99	1.53	0.75	0.55	38.47
2019	0.46	0.82	1.85	2.85	5.21	7.82	8.02	6.41	4.54	1.98	0.83	0.49	41.28
2020	0.67	0.85	1.74	2.99	5.29	6.91	8.20	7.36	3.72	1.54	0.46	0.37	40.10
2021	0.33	0.83	1.64	2.32	4.50	6.89	8.38	7.47	3.26	1.41	0.66	0.40	38.09
2022	0.48	0.93	1.65	2.43	4.51	6.67	6.83	7.40	4.25	1.46	0.71	0.41	37.73
2023	0.55	1.10	1.61	3.34	5.13	7.58	7.45	5.88	4.09	1.85	0.72	0.33	39.63
2024	0.58	0.93	1.64	2.68	5.10	5.99	7.43	6.48	4.07	1.61	0.65	0.55	37.71
2025	0.59	0.95	1.42	2.53	5.39	6.30	6.17	7.08	3.51	1.66	0.67	0.51	36.78
2026	0.22	0.38	1.73	3.04	5.25	7.86	8.54	6.84	3.87	1.68	0.83	0.58	40.82
2027	0.49	0.57	1.66	2.32	5.70	7.44	7.38	6.96	4.38	1.38	0.64	0.32	39.24
2028	0.47	0.93	1.59	2.70	4.17	6.47	7.47	7.48	4.27	1.59	0.73	0.40	38.27
2029	0.37	0.97	1.69	2.41	4.55	6.78	8.12	5.58	3.72	1.85	0.72	0.48	37.24
2030	0.50	0.87	1.50	2.88	4.52	6.60	8.73	7.22	4.38	1.56	0.79	0.53	40.08
2031	0.65	0.64	1.69	2.34	4.28	6.98	8.37	7.23	4.11	1.85	0.79	0.56	39.49
2032	0.61	0.90	1.58	3.12	4.96	7.96	9.13	7.34	4.00	1.54	0.78	0.54	42.46
2033	0.41	0.72	1.56	2.37	5.11	7.46	8.58	7.39	4.47	1.58	0.67	0.50	40.82
2034	0.36	0.57	1.51	3.43	5.20	6.81	8.23	7.00	4.46	2.25	0.71	0.55	41.08
2035	0.67	0.94	1.84	3.69	4.15	7.04	9.40	7.63	4.51	1.64	0.74	0.45	42.70
2036	0.55	0.37	1.38	2.23	5.64	7.39	7.92	6.61	4.04	1.94	0.63	0.52	39.22
2037	0.64	0.81	1.95	3.08	4.48	7.88	8.18	6.71	4.96	1.76	0.75	0.55	41.75
2038	0.58	0.97	1.71	2.65	5.89	7.24	7.83	6.27	3.92	1.81	0.86	0.22	39.95
2039	0.55	0.57	1.79	2.68	5.10	7.01	8.21	7.45	4.61	2.13	0.94	0.59	41.63
2040	0.60	0.99	2.11	2.74	4.81	6.96	8.47	7.08	4.19	1.31	0.70	0.42	40.38
2041	0.45	0.58	1.91	3.10	5.98	7.41	8.31	7.23	4.49	1.81	0.69	0.43	42.39
2042	0.62	0.99	1.75	3.05	4.96	5.73	8.37	7.27	4.47	1.64	1.04	0.58	40.47
2043	0.64	0.92	1.42	2.99	6.07	7.85	8.27	7.77	4.55	2.26	0.73	0.39	43.86
2044	0.58	0.88	1.35	3.18	5.53	6.69	8.01	6.58	3.71	1.41	0.72	0.39	39.03
2045	0.52	0.78	1.50	2.54	4.27	7.20	7.93	7.19	3.85	1.68	0.80	0.53	38.79
2046	0.66	0.64	1.34	3.04	5.52	7.60	8.48	6.64	4.18	1.71	0.73	0.59	41.13
2047	0.63	1.00	2.03	3.15	5.89	7.28	7.37	6.45	3.97	1.71	0.88	0.33	40.69
2048	0.57	0.91	1.64	3.81	6.64	6.63	8.33	6.57	4.29	1.89	0.84	0.29	42.41
2049	0.63	0.91	1.94	3.44	5.21	7.74	8.30	7.76	4.16	1.82	0.71	0.57	43.19
2050	0.59	0.96	1.84	3.49	5.43	7.84	9.50	6.59	4.62	2.25	0.83	0.27	44.21
2051	0.65	1.04	2.26	3.63	5.41	5.89	8.48	7.85	3.68	2.23	0.88	0.46	42.46
2052	0.57	1.03	2.06	3.38	5.88	5.85	7.68	7.85	4.58	1.51	0.66	0.55	41.60
2053	0.52	0.90	2.14	3.68	6.78	7.36	8.96	7.20	3.47	1.48	0.68	0.31	43.48
2054	0.65	1.00	1.85	2.54	5.62	6.20	7.94	7.88	5.03	2.23	0.85	0.57	42.36
2055	0.68	1.08	1.84	3.02	5.20	6.50	7.89	7.39	3.41	1.56	0.69	0.39	39.65
2056	0.67	0.75	1.92	3.11	4.65	6.11	7.92	6.30	3.54	1.98	0.73	0.36	38.04
2057	0.64	0.72	2.26	3.40	5.14	7.61	8.50	6.66	3.96	2.16	0.81	0.38	42.24
2058	0.17	0.46	1.45	2.51	5.06	7.99	8.97	7.82	4.57	1.95	0.84	0.45	42.24
2059	0.43	0.87	1.84	3.42	6.14	8.00	9.84	7.97	5.07	2.49	0.88	0.50	47.45
2060	0.60	1.09	1.48	2.98	5.76	7.81	9.40	8.15	4.64	2.51	0.87	0.45	45.74
2061	0.55	0.90	1.54	3.09	5.74	7.72	9.46	7.74	4.65	2.63	1.07	0.61	45.70
2062	0.59	0.90	1.58	3.18	5.38	7.46	8.90	7.63	4.38	2.00	0.69	0.59	43.28
2063	0.65	0.52	1.86	2.66	6.06	8.46	9.48	8.07	3.81	1.77	0.79	0.37	44.50

2064	0.50	1.03	2.00	2.96	5.53	4.91	6.95	6.88	3.31	1.85	0.94	0.56	37.42
2065	0.56	0.97	1.42	3.59	5.68	6.56	8.68	7.81	4.96	1.40	0.64	0.56	42.83
2066	0.36	0.81	2.06	3.66	5.89	7.64	9.57	8.10	3.42	2.37	0.82	0.61	45.31
2067	0.44	0.67	1.50	3.32	5.58	6.40	7.87	7.03	3.49	1.67	0.75	0.58	39.30
2068	0.37	0.70	1.58	3.56	5.45	8.10	8.75	7.99	4.21	1.86	0.74	0.57	43.88
2069	0.64	0.94	2.04	2.99	6.68	8.58	9.42	7.60	4.08	1.76	0.77	0.40	45.90
2070	0.70	1.12	2.07	3.12	5.06	8.18	9.85	8.50	4.30	2.02	0.75	0.51	46.18
2071	0.71	0.94	2.01	2.62	5.55	6.96	8.13	5.82	4.79	1.96	0.83	0.56	40.88
2072	0.63	1.00	2.26	2.96	5.48	5.30	8.08	7.25	4.17	1.66	0.70	0.40	39.89
2073	0.46	0.88	1.70	2.75	4.58	7.43	9.21	7.88	4.49	2.21	0.74	0.42	42.75
2074	0.63	0.92	1.64	2.82	5.11	8.16	8.72	7.58	4.12	1.80	0.75	0.51	42.76
2075	0.59	0.89	1.63	2.88	6.13	7.68	10.00	7.82	5.03	1.88	0.71	0.45	45.69
2076	0.36	0.97	1.79	3.25	7.00	8.27	9.71	8.05	4.24	2.10	0.73	0.34	46.81
2077	0.45	0.89	1.57	3.40	5.20	8.01	8.84	8.12	4.57	1.78	0.95	0.54	44.32
2078	0.52	0.97	1.99	2.60	5.15	7.31	9.10	7.20	4.40	1.95	0.80	0.50	42.49
2079	0.30	0.59	1.34	3.19	4.64	6.98	8.45	7.70	4.09	2.53	0.83	0.60	41.24
2080	0.64	1.21	2.05	3.22	5.78	7.59	9.18	8.42	4.61	2.11	0.79	0.51	46.11
2081	0.40	0.78	1.61	2.88	5.96	8.57	9.67	8.11	4.48	1.85	0.76	0.35	45.42
2082	0.62	0.97	2.18	2.55	6.89	7.54	8.41	7.64	4.87	2.06	0.89	0.54	45.16
2083	0.64	0.97	2.47	4.15	5.78	7.65	9.11	8.04	4.16	2.22	0.84	0.65	46.68
2084	0.67	1.19	1.90	2.55	5.19	7.07	8.11	7.76	4.26	2.45	0.90	0.48	42.53
2085	0.61	0.85	2.09	3.60	5.82	7.80	9.33	7.76	5.02	2.23	0.77	0.54	46.42
2086	0.47	0.79	1.95	3.88	6.60	6.74	9.66	7.40	5.18	2.10	0.80	0.64	46.21
2087	0.50	1.14	2.47	3.67	5.95	8.76	9.71	8.00	4.65	2.29	0.93	0.39	48.46
2088	0.35	0.75	1.90	3.40	6.14	7.79	8.73	7.94	4.76	1.83	0.88	0.57	45.04
2089	0.73	1.21	2.08	4.00	5.81	7.70	9.38	7.92	4.55	2.18	0.83	0.53	46.92
2090	0.60	0.45	1.68	3.81	6.27	9.04	9.62	8.19	4.69	2.19	0.90	0.51	47.95
2091	0.73	1.13	1.88	3.46	6.26	6.55	7.47	7.15	4.70	2.23	0.74	0.48	42.78
2092	0.61	1.23	3.01	3.65	5.98	7.96	9.36	8.22	5.07	2.34	1.00	0.66	49.09
2093	0.73	1.00	2.59	3.52	7.25	9.75	9.99	8.50	4.34	2.65	0.84	0.46	51.62
2094	0.69	0.99	2.27	2.86	5.30	8.00	9.25	8.46	4.85	2.13	0.77	0.51	46.08
2095	0.72	1.14	2.66	3.55	6.14	8.86	9.80	8.35	4.49	2.16	0.98	0.41	49.26
2096	0.47	0.94	1.95	3.80	6.63	8.00	9.03	7.89	4.73	2.00	0.93	0.56	46.93
2097	0.68	0.87	1.60	3.03	6.71	7.09	9.03	7.84	4.67	2.21	0.83	0.57	45.13
2098	0.69	0.80	2.47	2.99	5.81	8.58	9.62	8.09	4.43	1.74	0.74	0.49	46.45
2099	0.56	1.15	2.12	3.17	4.78	7.18	8.80	7.53	4.43	1.78	0.71	0.50	42.71
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.55	0.87	1.80	3.07	5.44	7.24	8.51	7.33	4.24	1.90	0.77	0.48	42.21
SD	0.12	0.19	0.32	0.45	0.70	0.87	0.80	0.66	0.47	0.31	0.10	0.10	3.30
Skew	-0.98	-0.62	1.02	0.21	0.25	-0.16	-0.22	-0.47	-0.28	0.32	0.19	-0.70	0.38
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.09
KendSum	664.	851.	1566.	1255.	1704.	1509.	1936.	2208.	1701.	1516.	1545.	622.	2677.
KendTau	0.14	0.18	0.32	0.26	0.35	0.31	0.40	0.46	0.35	0.31	0.32	0.13	0.55
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.00	2.57	4.73	3.79	5.15	4.56	5.85	6.67	5.14	4.58	4.67	1.88	8.09
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	No Trend	Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.2390	0.0706	14.2851	0.0545	0.2223	1.3839	0.0135	0.5170	0.1303	0.0001	0.1623	2.4429	2.1941
Trend?	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	0.01	0.04	0.10	0.21	0.49	0.76	0.64	0.44	0.22	0.10	0.01	0.01	10.88
Res Var	0.01	0.03	0.08	0.18	0.36	0.62	0.42	0.28	0.17	0.07	0.01	0.01	4.79
Tnd Var	2.63	7.16	26.10	14.73	25.71	19.05	34.65	37.57	23.89	21.70	21.03	5.13	55.97

Computed Evapotranspiration – Garrison

Analysis of Monthly Time-Series Data

Output File: C:\Climate\ET\outGARR_ET_CCSM3.txt
DSS File: C:\Climate\Month-Met.DSS

//Garrison/Evapotranspiration/01JAN2000 - 01JAN209
First Year: 2001
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.44	0.51	1.69	3.21	4.33	6.20	7.36	6.57	3.88	1.52	0.69	0.17	36.57
2002	0.48	0.83	2.02	2.77	5.72	8.04	8.77	7.24	4.04	1.79	0.64	0.48	42.82
2003	0.65	0.81	1.81	3.26	6.03	6.49	7.44	6.87	4.10	2.12	0.84	0.47	40.89
2004	0.69	0.92	1.45	2.95	4.95	6.39	7.71	6.66	4.39	2.07	0.58	0.46	39.22
2005	0.46	0.84	1.39	3.37	5.83	7.16	8.76	7.40	3.92	2.41	0.85	0.55	42.94
2006	0.58	1.06	2.17	4.02	5.23	7.92	8.60	7.03	3.49	1.71	0.61	0.61	43.03
2007	0.45	0.94	1.98	3.22	5.14	6.55	6.86	6.21	4.16	1.73	0.72	0.58	38.54
2008	0.56	0.57	1.82	3.34	4.92	7.65	8.00	7.51	4.12	2.14	0.86	0.45	41.94
2009	0.57	0.78	1.65	3.70	5.46	5.04	8.50	6.30	4.31	1.73	0.81	0.48	39.33
2010	0.54	1.08	1.85	3.32	4.99	6.19	7.15	6.55	3.68	2.28	0.77	0.29	38.69
2011	0.59	0.69	1.59	2.60	5.13	6.02	8.19	6.28	4.60	1.99	0.57	0.35	38.60
2012	0.22	1.05	2.19	3.25	5.45	6.95	7.85	6.84	3.40	2.08	0.84	0.41	40.53
2013	0.50	1.02	1.71	2.85	6.49	7.24	9.16	7.59	3.95	1.81	0.72	0.42	43.46
2014	0.51	1.04	1.73	3.22	6.66	7.03	8.43	7.50	3.99	1.66	0.61	0.45	42.83
2015	0.68	0.75	1.39	4.05	6.41	6.83	7.55	7.51	4.68	2.12	0.74	0.62	43.33
2016	0.59	0.56	1.66	2.91	5.80	6.32	7.50	7.80	4.33	1.59	0.80	0.36	40.22
2017	0.64	0.52	1.65	4.06	5.60	7.82	8.70	7.85	4.15	1.99	0.74	0.46	44.18
2018	0.59	0.93	1.59	2.82	5.17	6.57	8.53	7.15	4.10	1.66	0.77	0.57	40.45
2019	0.46	0.80	1.90	3.26	5.56	7.68	8.08	6.56	4.68	2.14	0.88	0.49	42.49
2020	0.66	0.84	1.88	3.41	5.83	7.12	8.05	7.51	3.82	1.70	0.47	0.37	41.66
2021	0.30	0.80	1.76	2.68	5.03	7.07	8.11	7.23	3.49	1.47	0.71	0.41	39.06
2022	0.48	0.92	1.72	2.70	5.02	6.72	6.52	7.03	4.48	1.53	0.72	0.38	38.22
2023	0.57	1.12	1.71	3.87	5.52	7.66	7.50	5.95	4.32	2.06	0.77	0.32	41.37

2024	0.56	0.93	1.83	3.11	5.56	6.17	7.02	6.40	4.27	1.77	0.66	0.56	38.84
2025	0.59	0.96	1.44	2.79	5.72	6.50	6.18	7.26	3.91	1.81	0.66	0.51	38.33
2026	0.22	0.30	1.90	3.49	5.65	7.46	8.38	6.92	4.33	1.94	0.89	0.59	42.07
2027	0.48	0.61	1.78	2.61	6.06	7.29	7.20	6.73	4.55	1.55	0.64	0.32	39.82
2028	0.46	0.95	1.50	2.99	4.37	6.19	6.92	7.29	4.38	1.61	0.76	0.41	37.83
2029	0.37	1.02	1.95	2.84	4.90	6.60	8.08	5.84	3.77	1.92	0.78	0.51	38.58
2030	0.48	0.85	1.51	3.23	4.91	6.67	8.57	7.28	4.45	1.63	0.83	0.51	40.92
2031	0.63	0.56	1.69	2.81	4.70	7.12	8.60	7.40	4.22	2.05	0.83	0.58	41.19
2032	0.62	0.89	1.70	3.56	5.43	8.07	9.03	7.50	4.23	1.70	0.84	0.55	44.12
2033	0.42	0.71	1.68	2.61	5.28	7.55	9.02	7.40	4.62	1.71	0.73	0.52	42.25
2034	0.35	0.53	1.55	4.04	5.53	7.13	8.69	7.31	4.46	2.41	0.75	0.57	43.32
2035	0.66	0.94	1.95	3.98	4.65	7.15	9.18	7.35	4.52	1.81	0.73	0.43	43.35
2036	0.57	0.37	1.47	2.57	5.99	7.48	7.81	6.75	4.25	2.11	0.63	0.51	40.51
2037	0.65	0.79	2.08	3.71	4.78	7.92	8.35	6.79	5.07	1.96	0.79	0.52	43.41
2038	0.55	0.96	1.73	3.06	6.24	7.48	7.79	6.23	4.08	1.86	0.92	0.24	41.14
2039	0.52	0.57	1.83	2.87	5.23	7.17	8.20	7.59	4.64	2.12	0.96	0.59	42.29
2040	0.61	1.05	2.19	2.97	5.29	6.87	8.51	7.38	4.53	1.49	0.74	0.46	42.09
2041	0.45	0.44	2.05	3.38	6.46	7.65	8.53	7.34	4.58	1.98	0.74	0.42	44.02
2042	0.63	0.97	1.80	3.37	5.67	5.89	8.60	7.14	4.67	1.81	1.11	0.59	42.25
2043	0.64	1.01	1.53	3.35	6.46	7.73	8.07	7.96	4.54	2.52	0.77	0.38	44.96
2044	0.57	0.85	1.33	3.56	5.92	6.98	8.18	6.55	3.89	1.42	0.76	0.40	40.41
2045	0.51	0.78	1.59	2.91	4.97	7.22	7.34	7.25	4.23	1.78	0.86	0.53	39.97
2046	0.67	0.64	1.45	3.37	5.81	7.56	8.36	6.58	4.43	1.95	0.72	0.61	42.15
2047	0.62	0.98	2.27	3.57	6.19	7.53	7.51	6.50	4.35	1.84	0.96	0.31	42.63
2048	0.53	0.91	1.79	4.15	6.76	6.43	8.47	6.43	4.55	1.88	0.89	0.27	43.06
2049	0.66	0.94	1.93	3.65	5.25	7.72	8.43	7.77	4.42	2.01	0.76	0.57	44.11
2050	0.53	0.91	1.83	3.86	5.67	8.15	9.47	6.44	4.76	2.33	0.89	0.31	45.15
2051	0.64	1.07	2.31	3.80	5.96	6.31	8.72	7.95	3.85	2.49	0.97	0.46	44.53
2052	0.54	1.07	2.32	3.68	6.08	5.52	7.29	7.72	4.64	1.70	0.69	0.52	41.77
2053	0.51	0.88	2.33	3.95	6.85	7.48	9.08	7.56	3.89	1.60	0.69	0.33	45.15
2054	0.66	1.05	2.00	2.85	6.26	6.98	7.78	8.00	5.02	2.23	0.92	0.55	44.30
2055	0.66	1.15	1.90	3.29	5.77	6.57	8.32	7.83	3.83	1.63	0.76	0.40	42.11
2056	0.68	0.68	1.90	3.25	5.01	6.22	7.50	6.52	3.93	2.15	0.74	0.36	38.94
2057	0.63	0.62	2.23	3.87	5.53	7.43	8.36	6.79	4.05	2.18	0.85	0.36	42.90
2058	0.17	0.44	1.51	2.84	5.48	7.64	8.78	8.09	4.68	2.08	0.90	0.47	43.08
2059	0.41	0.87	2.01	3.66	6.28	7.69	10.09	8.14	5.15	2.70	0.86	0.50	48.36
2060	0.60	1.15	1.54	3.37	6.30	7.86	9.45	8.43	4.96	2.65	0.95	0.45	47.71
2061	0.57	0.92	1.62	3.55	5.72	7.63	9.42	7.67	4.65	2.74	1.13	0.62	46.24
2062	0.59	0.91	1.75	3.39	5.90	7.56	8.92	7.58	4.65	2.10	0.71	0.60	44.66
2063	0.66	0.49	1.83	2.87	6.70	8.28	9.57	8.13	4.03	2.08	0.83	0.37	45.84
2064	0.49	1.04	2.26	3.51	5.62	4.90	7.20	7.11	3.78	1.99	0.98	0.57	39.45
2065	0.55	1.00	1.50	3.90	6.22	6.93	8.59	7.89	5.17	1.55	0.68	0.58	44.56
2066	0.35	0.80	2.41	4.14	6.21	7.87	9.57	8.21	3.53	2.54	0.85	0.62	47.10
2067	0.41	0.65	1.53	3.27	5.72	6.68	7.52	7.06	3.63	1.65	0.74	0.58	39.44
2068	0.38	0.71	1.68	3.67	5.76	8.31	8.77	8.09	4.44	2.08	0.74	0.58	45.21
2069	0.62	0.90	2.17	3.28	6.75	8.54	9.20	7.84	4.30	1.86	0.79	0.40	46.65
2070	0.70	1.13	2.13	3.72	5.58	8.42	10.20	8.79	4.62	2.07	0.74	0.48	48.58
2071	0.72	0.95	2.05	2.65	5.75	7.34	7.68	6.22	4.88	2.21	0.91	0.56	41.92
2072	0.64	1.07	2.45	3.24	5.88	5.67	7.64	7.27	4.49	1.80	0.72	0.40	41.27
2073	0.46	0.86	1.77	3.24	5.16	7.43	9.04	8.18	4.76	2.39	0.79	0.41	44.49
2074	0.62	0.93	1.79	3.26	5.41	7.92	8.77	7.60	4.56	1.84	0.78	0.51	43.99
2075	0.57	0.88	1.72	3.33	6.16	7.45	9.39	7.54	5.14	2.02	0.70	0.45	45.35
2076	0.37	0.96	1.80	3.51	7.48	8.25	9.76	8.19	4.70	2.35	0.77	0.35	48.49
2077	0.43	0.85	1.67	3.66	5.48	8.23	8.89	8.25	4.65	1.94	0.97	0.58	45.60
2078	0.52	0.97	2.23	3.04	5.63	7.50	9.01	7.48	4.67	2.13	0.86	0.49	44.53

2079	0.31	0.60	1.25	3.32	5.09	7.47	8.14	7.52	4.28	2.59	0.85	0.63	42.05
2080	0.67	1.22	2.28	3.63	6.11	7.50	9.20	8.34	4.74	2.21	0.84	0.51	47.25
2081	0.43	0.82	1.86	3.45	6.40	8.50	9.52	8.09	4.63	1.86	0.80	0.35	46.71
2082	0.61	0.98	2.12	2.82	7.03	7.68	8.59	7.81	5.08	2.16	0.90	0.57	46.35
2083	0.65	1.03	2.50	4.41	6.20	7.59	9.14	8.24	4.47	2.41	0.88	0.68	48.20
2084	0.67	1.22	2.00	3.00	5.73	7.07	8.10	7.69	4.52	2.67	0.92	0.47	44.06
2085	0.61	0.92	2.07	3.85	6.04	7.82	9.62	7.85	5.12	2.40	0.83	0.56	47.69
2086	0.45	0.79	2.11	4.21	6.80	6.93	9.18	7.11	5.26	2.26	0.80	0.69	46.59
2087	0.50	1.13	2.73	4.10	6.55	8.74	9.51	8.21	4.75	2.25	1.00	0.41	49.88
2088	0.36	0.74	2.03	3.91	6.49	7.66	8.51	7.99	5.00	1.87	0.91	0.56	46.03
2089	0.69	1.22	2.35	4.22	6.14	8.40	9.61	8.08	4.80	2.42	0.86	0.55	49.34
2090	0.60	0.44	1.80	4.14	6.70	9.30	9.57	8.26	5.03	2.21	0.98	0.53	49.56
2091	0.74	1.23	2.03	3.80	6.31	6.46	7.42	6.78	4.94	2.53	0.81	0.48	43.53
2092	0.59	1.13	2.98	4.15	6.29	8.27	9.19	8.27	5.20	2.51	1.12	0.71	50.41
2093	0.76	0.98	2.76	3.85	7.73	9.77	9.72	8.46	4.44	2.61	0.87	0.47	52.42
2094	0.66	0.99	2.29	3.19	6.07	7.70	9.53	8.73	4.94	2.26	0.84	0.52	47.72
2095	0.72	1.11	2.73	3.83	6.47	8.99	9.95	8.56	4.61	2.35	1.05	0.43	50.80
2096	0.47	0.92	2.10	4.08	7.03	8.35	8.80	8.11	4.82	2.19	0.97	0.57	48.41
2097	0.68	0.80	1.63	3.53	6.85	6.83	8.81	7.99	4.84	2.46	0.92	0.59	45.93
2098	0.67	0.78	2.60	3.50	6.23	8.25	9.82	8.42	4.69	1.94	0.79	0.48	48.17
2099	0.56	1.17	2.36	3.72	5.34	7.52	8.57	7.77	4.61	2.02	0.75	0.52	44.91
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.55	0.87	1.91	3.41	5.82	7.31	8.47	7.42	4.43	2.03	0.81	0.48	43.51
SD	0.12	0.21	0.34	0.46	0.66	0.85	0.85	0.68	0.43	0.32	0.12	0.10	3.36
Skew	-0.86	-0.60	0.70	0.04	0.22	-0.16	-0.26	-0.25	-0.29	0.22	0.24	-0.39	0.31
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.09
KendSum	688.	832.	1509.	1279.	1702.	1586.	1805.	2112.	1987.	1551.	1546.	760.	2604.
KendTau	0.14	0.17	0.31	0.26	0.35	0.33	0.37	0.44	0.41	0.32	0.32	0.16	0.54
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.08	2.51	4.56	3.86	5.14	4.79	5.45	6.38	6.00	4.69	4.67	2.29	7.87
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.1551	0.0128	8.4678	0.3001	0.0038	1.7167	0.0472	0.0412	0.0003	0.0184	0.0474	1.0979	1.1580
Trend?	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	0.01	0.04	0.12	0.21	0.44	0.72	0.72	0.46	0.19	0.10	0.01	0.01	11.28
Res Var	0.01	0.04	0.09	0.18	0.32	0.57	0.52	0.30	0.13	0.08	0.01	0.01	5.15
Tnd Var	3.22	6.67	23.59	15.35	26.53	20.68	27.57	35.96	31.44	21.85	21.59	7.16	54.30

CCSM4

SNOTEL Temperature – Fort Peck

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\FTPK_SNO_TempAvg_All.txt
DSS File: c:\climate\ClimateChangeData.dss

/FTPK-SNOTEL/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1M
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	-3.60	-2.60	-4.30	0.00	7.00	13.70	16.50	19.60	10.80	2.80	-1.90	-14.60	3.62
2013	-8.90	-6.30	-6.10	-1.70	6.30	14.60	16.90	16.20	7.40	1.10	-6.80	-7.10	2.13
2014	-3.20	-1.00	0.10	-1.60	7.10	12.30	17.80	18.20	11.10	1.50	-6.90	-5.40	4.17
2015	-7.90	-5.40	-5.90	-0.30	7.10	11.80	18.20	17.80	12.40	2.30	-1.50	-9.20	3.28
2016	-12.90	-10.00	-2.30	-0.40	5.30	14.80	19.10	16.30	9.40	0.40	-6.10	-6.00	2.30
2017	-9.10	-6.60	-2.90	-1.00	7.60	11.20	18.90	18.60	12.50	1.30	-5.10	-10.90	2.88
2018	-12.00	-18.80	-7.70	-1.00	7.00	14.00	20.70	18.70	10.30	2.30	-5.10	-12.20	1.35
2019	-9.60	-5.50	-3.10	1.50	7.00	13.60	19.80	17.80	13.60	5.60	-5.10	-13.50	3.51
2020	-15.00	-9.00	-6.20	2.60	7.60	13.90	19.40	18.20	13.00	2.60	-6.50	-8.10	2.71
2021	-2.50	-5.80	-1.40	2.90	6.10	14.10	20.70	18.30	11.20	3.00	-7.10	-7.70	4.32
2022	-11.10	-8.40	-8.60	-1.50	6.10	13.10	19.50	18.00	13.70	1.90	-5.50	-9.20	2.33
2023	-10.70	-16.80	-4.90	0.20	7.70	14.40	19.20	19.30	12.60	1.00	-4.20	-8.00	2.48
2024	-6.40	-7.10	-3.60	0.40	7.90	13.40	19.50	18.00	13.10	4.20	-4.20	-11.90	3.61
2025	-9.90	-4.30	-2.70	0.40	6.70	12.90	20.80	18.10	10.10	4.70	-7.60	-3.20	3.83
2026	-6.70	-6.70	-2.30	2.50	7.90	11.90	19.60	18.40	9.90	0.90	-2.20	-8.60	3.72
2027	-5.60	-4.70	1.10	1.40	8.70	14.10	18.00	18.30	10.70	0.80	-8.60	-11.40	3.57
2028	-6.20	-5.30	-4.40	-0.80	8.20	14.80	18.60	19.00	13.30	4.40	-1.80	-8.60	4.27
2029	-12.40	-9.60	-5.30	1.60	2.60	14.30	20.40	19.00	12.40	0.40	-4.60	-4.40	2.87
2030	-8.80	-7.30	-4.20	1.50	10.30	12.40	18.40	15.80	12.90	5.00	-1.80	-4.00	4.18
2031	-5.70	-8.60	-6.10	-0.30	7.20	12.50	19.20	18.90	10.10	3.10	-3.50	-9.20	3.13
2032	-5.40	-3.50	-3.30	1.00	7.60	14.90	20.60	19.10	10.10	0.60	-7.90	-10.90	3.58
2033	-6.90	-4.80	-8.20	-1.80	7.80	11.70	20.00	16.40	14.70	4.90	-2.30	-11.10	3.37
2034	-13.60	-7.20	-5.50	-3.00	5.80	13.10	19.10	18.80	11.30	6.00	-2.00	-10.90	2.66
2035	-7.00	-6.10	-5.90	-0.90	4.40	13.40	18.50	18.90	9.20	0.60	-5.50	-7.30	2.69
2036	-10.60	-4.20	-1.90	1.90	4.70	15.60	20.60	20.80	11.00	2.20	-6.90	-10.10	3.59
2037	-4.40	-5.10	-1.10	1.30	6.20	14.80	21.30	16.90	10.60	4.90	-4.30	-6.30	4.57
2038	-6.20	-6.90	-4.50	0.70	7.20	12.30	20.90	20.00	11.90	4.80	-10.20	-6.80	3.60
2039	-7.00	-8.10	-2.90	1.10	6.70	14.20	20.40	20.40	12.40	7.50	-0.70	-3.70	5.02
2040	-5.70	-2.60	0.00	-1.10	7.50	13.80	18.70	19.70	9.70	5.00	-3.30	-12.60	4.09
2041	-2.80	-3.30	-1.00	1.60	7.10	13.00	19.30	19.00	11.20	2.70	-2.90	-4.70	4.93
2042	-4.10	-5.00	-3.10	1.70	3.90	12.50	19.50	18.30	13.80	6.70	0.30	-9.20	4.61
2043	-10.70	-6.00	-1.80	1.40	6.20	13.20	19.60	19.30	9.10	3.40	-4.20	-5.20	3.69
2044	-9.50	-8.60	-5.00	-0.20	8.20	13.90	20.50	17.30	10.90	5.00	0.00	-6.30	3.85
2045	-6.70	-3.30	-3.40	1.50	6.60	13.00	19.40	20.00	14.10	3.20	-4.70	-4.50	4.60

2046	-10.00	-6.00	-4.50	-0.10	6.10	14.10	18.20	20.80	13.80	4.80	-2.20	-5.40	4.13
2047	-9.90	-9.80	-7.70	0.70	8.30	13.60	19.50	17.50	10.60	7.10	-2.80	-5.20	3.49
2048	-9.40	-4.00	-5.40	1.20	8.40	14.40	19.70	19.80	12.00	3.30	-4.20	-4.30	4.29
2049	-4.30	-3.70	1.50	1.40	9.40	15.10	21.40	19.80	14.20	6.10	0.20	-9.00	6.01
2050	-11.90	-8.50	-7.60	-0.70	6.30	14.10	18.70	17.00	14.10	2.20	-0.10	-13.00	2.55
2051	-6.50	-6.40	-3.70	3.90	10.10	15.50	21.00	19.50	11.40	5.50	-2.80	-7.50	5.00
2052	-9.60	-10.30	-5.10	0.00	6.80	11.90	20.50	18.60	14.70	6.60	-4.60	-14.80	2.89
2053	-4.30	-0.50	-0.70	4.30	7.00	14.10	23.20	20.60	13.30	6.30	-4.60	-4.50	6.18
2054	-4.20	-5.20	-1.90	0.90	6.60	15.30	20.40	19.20	13.10	0.40	-5.00	-11.60	4.00
2055	-10.50	-14.80	-4.20	0.40	9.30	16.60	20.80	19.50	13.90	6.20	-4.30	-4.00	4.07
2056	-8.20	0.50	0.60	4.90	8.70	12.40	19.80	20.00	14.00	6.50	-6.50	-7.80	5.41
2057	-3.80	-3.70	-0.70	0.50	7.90	13.20	19.40	18.30	13.90	5.50	-0.60	-3.80	5.51
2058	-8.20	-1.90	0.40	0.30	7.10	12.40	20.80	20.00	14.40	4.00	-1.30	-6.60	5.12
2059	-4.70	-12.10	-5.50	2.00	7.70	14.80	21.60	21.20	11.30	7.20	-3.40	-5.20	4.58
2060	-11.10	-1.50	-6.40	3.50	8.10	15.00	20.40	21.70	11.30	2.90	-1.20	-5.30	4.78
2061	-9.80	-7.10	-8.70	-0.20	11.30	14.00	19.50	21.30	16.00	6.20	2.40	-9.00	4.66
2062	-9.60	-4.40	-1.10	3.20	7.70	15.90	20.60	20.40	13.40	4.60	-3.20	-10.20	4.78
2063	-8.30	-9.00	0.00	2.50	9.50	17.20	21.60	20.50	13.60	7.00	0.20	-6.30	5.71
2064	-8.40	-4.80	-2.20	3.90	10.40	14.60	21.40	20.70	13.80	7.70	-0.60	-11.80	5.39
2065	-14.40	-9.40	-3.90	1.90	10.20	15.50	22.10	21.70	14.70	5.00	-10.80	-11.20	3.45
2066	-18.10	-12.20	-11.20	1.60	7.50	15.90	20.20	20.90	11.30	5.40	-2.80	-6.40	2.67
2067	-4.90	-4.90	-3.60	-0.80	8.90	17.90	23.10	20.40	14.20	5.30	0.50	-4.00	6.01
2068	-5.50	-1.80	-7.60	3.00	9.60	15.70	22.40	21.40	14.20	5.60	-2.00	-3.50	5.96
2069	-3.80	-6.10	1.80	2.30	10.50	19.90	23.60	22.90	16.80	5.20	-0.20	-1.60	7.61
2070	-4.60	0.40	-3.60	2.50	9.30	16.10	23.00	20.90	13.40	6.00	-0.10	-3.40	6.66
2071	-3.80	-2.10	-5.00	0.90	11.80	14.50	22.90	19.90	12.60	4.30	-0.40	-8.10	5.63
2072	-9.80	-10.80	-5.30	2.10	8.80	15.20	20.90	21.90	14.10	3.50	-0.90	-7.40	4.36
2073	-7.50	-1.40	-1.70	0.20	8.60	16.90	23.20	21.70	15.20	2.60	-2.30	-2.80	6.06
2074	-7.40	0.10	-0.10	0.80	6.00	14.20	21.70	19.60	14.40	4.60	-2.50	-3.50	5.66
2075	-4.50	-0.90	3.20	4.30	13.70	18.70	21.40	21.50	13.80	5.90	-0.60	-3.50	7.75
2076	-3.70	-4.00	0.40	2.00	9.20	14.60	22.70	19.70	12.10	7.00	-1.10	-5.50	6.12
2077	-6.60	-1.10	-0.30	0.70	9.50	15.20	21.30	22.30	17.80	4.10	1.10	-2.60	6.78
2078	-3.60	-4.10	-4.30	1.70	9.20	14.80	21.70	21.80	15.80	7.50	2.10	-9.00	6.13
2079	-2.90	-5.50	-2.10	0.70	7.40	18.10	23.10	22.20	16.10	7.20	-2.30	-7.60	6.20
2080	-15.00	-3.10	1.10	1.10	7.30	15.30	22.50	19.70	15.80	5.70	2.60	-3.10	5.83
2081	-5.20	-5.20	-0.10	1.50	8.20	17.90	24.20	23.60	15.30	4.60	0.90	-4.00	6.81
2082	-3.70	0.20	-1.50	4.70	11.90	18.10	22.80	20.20	13.90	6.90	-0.40	-8.00	7.09
2083	-4.80	-4.00	-1.90	5.20	8.80	13.80	22.10	22.70	13.10	4.70	-5.30	-1.80	6.05
2084	-9.70	-2.50	-1.20	4.40	8.50	17.40	23.20	21.10	16.00	4.00	-1.80	-11.30	5.68
2085	-9.30	-2.40	-3.00	2.80	9.70	16.10	24.20	22.80	15.40	5.20	1.10	-1.90	6.72
2086	-5.40	-0.20	-0.20	3.70	9.80	16.60	23.20	22.10	19.30	6.10	-5.30	-9.70	6.67
2087	-0.90	-0.40	-1.20	4.40	10.80	15.30	22.70	22.70	12.70	5.30	-4.60	-2.80	7.00
2088	-5.50	-4.90	-1.50	5.50	10.30	17.10	23.80	22.30	17.00	8.10	1.10	-8.00	7.11
2089	-5.10	-4.30	-0.80	4.50	9.70	16.20	24.60	24.10	14.00	7.00	1.80	-4.40	7.28
2090	-6.90	-4.90	-1.70	1.90	10.70	16.60	22.20	23.10	18.30	6.00	0.30	-16.30	5.78
2091	-15.80	-7.50	-0.10	-0.90	13.00	19.60	23.10	24.00	16.90	6.20	-1.20	-4.30	6.08
2092	-3.80	2.30	-1.50	1.00	10.20	17.60	24.20	22.50	15.40	6.90	2.40	-5.00	7.68
2093	0.20	-2.00	0.00	6.50	9.30	18.40	23.80	23.70	14.90	7.60	4.20	-3.90	8.56
2094	-8.70	2.50	3.00	4.30	10.30	18.00	24.30	23.50	13.60	6.20	0.30	-10.90	7.20
2095	-10.00	-12.90	0.00	3.30	11.90	20.20	23.50	21.30	15.70	5.90	2.10	-1.20	6.65
2096	-1.00	0.50	0.60	6.80	9.50	18.30	24.80	21.50	19.20	7.60	-0.10	-4.30	8.62
2097	-10.40	-3.30	-0.90	2.80	11.10	18.40	25.30	24.30	16.00	6.70	0.20	-11.10	6.59
2098	-10.30	-4.00	1.20	4.30	13.10	17.40	26.30	23.80	15.90	9.60	-0.10	-6.30	7.57
2099	-4.20	-0.60	0.20	1.70	10.30	20.60	24.30	23.80	16.30	4.60	-0.60	-12.70	6.97

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-7.48	-5.21	-2.77	1.56	8.32	15.04	21.10	20.17	13.35	4.67	-2.50	-7.26	4.92
SD	3.59	3.97	2.90	1.99	2.04	2.13	2.06	2.05	2.36	2.14	3.04	3.48	1.66
Skew	-0.47	-0.81	-0.40	0.37	0.15	0.59	0.22	0.11	0.12	-0.38	-0.37	-0.40	0.15
Analysis of Trend in Mean (95% SL):													
Slope	0.03	0.06	0.05	0.05	0.05	0.06	0.07	0.07	0.07	0.05	0.07	0.04	0.06
KendSum	541.	1118.	1234.	1552.	1905.	2107.	2562.	2538.	2028.	1650.	1692.	820.	2519.
KendTau	0.14	0.29	0.32	0.41	0.50	0.55	0.67	0.66	0.53	0.43	0.44	0.21	0.66
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.95	4.03	4.44	5.59	6.86	7.59	9.23	9.14	7.31	5.94	6.09	2.95	9.08
Trend?	No Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	1.5656	0.1438	0.3936	2.5375	0.0016	1.5478	0.6737	0.0825	0.0092	1.4728	0.0050	2.8308	0.0499
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	12.89	15.72	8.39	3.97	4.17	4.55	4.23	4.19	5.56	4.58	9.27	12.12	2.76
Res Var	12.48	13.25	6.75	2.58	2.32	2.01	1.10	1.25	2.69	2.68	5.89	11.23	0.76
Tnd Var	3.21	15.75	19.55	34.99	44.43	55.89	74.07	70.25	51.74	41.40	36.46	7.39	72.42

SNOTEL Temperature – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\GARR_SNO_TempAvg_All.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-SNOTEL/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1M
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	-5.40	-4.70	-4.90	-2.00	5.80	12.50	14.80	18.80	10.80	1.40	-3.30	-15.30	2.38
2013	-9.20	-8.00	-7.70	-2.40	4.10	13.30	16.70	16.20	7.80	0.60	-7.30	-8.60	1.29
2014	-4.90	-2.40	-1.40	-3.60	6.20	11.50	16.30	17.00	10.20	0.50	-7.30	-6.60	2.96
2015	-8.90	-6.70	-7.50	-1.40	6.50	10.90	16.90	16.70	11.70	1.20	-3.10	-9.40	2.24
2016	-13.40	-11.80	-3.40	-1.80	5.30	13.70	19.50	17.30	9.80	-0.30	-7.50	-7.10	1.69

2017	-10.90	-8.20	-4.10	-2.80	7.60	10.50	18.00	17.30	11.30	-0.30	-6.50	-12.40	1.63
2018	-13.70	-20.50	-7.90	-2.10	6.10	12.30	19.20	18.80	10.30	1.10	-6.70	-13.50	0.28
2019	-10.40	-6.80	-4.20	-0.70	5.60	12.50	18.00	17.90	12.70	5.20	-5.40	-14.70	2.47
2020	-15.70	-9.60	-8.10	1.70	6.00	11.70	17.60	16.70	11.70	1.50	-8.00	-10.20	1.28
2021	-3.60	-7.90	-3.10	2.00	5.90	13.50	19.40	17.90	10.80	1.80	-8.50	-8.60	3.30
2022	-12.90	-10.40	-9.40	-2.70	5.30	11.70	17.60	17.50	13.30	1.40	-5.90	-10.80	1.23
2023	-12.10	-17.80	-6.50	-1.90	6.40	13.60	17.50	17.90	12.20	0.60	-5.20	-9.40	1.28
2024	-7.50	-8.70	-4.60	0.00	6.50	13.90	18.80	18.80	13.30	4.10	-5.50	-12.60	3.04
2025	-11.50	-6.10	-4.70	-1.30	5.90	12.70	19.40	18.00	10.30	3.70	-8.90	-5.00	2.71
2026	-8.70	-8.70	-4.00	0.60	6.70	10.30	18.30	17.50	9.90	0.00	-3.80	-11.10	2.25
2027	-7.30	-6.20	-1.30	-0.20	7.30	12.30	16.40	16.90	10.30	0.20	-8.90	-12.60	2.24
2028	-7.90	-6.50	-5.40	-1.80	7.40	13.80	19.00	17.90	12.70	3.30	-3.10	-10.20	3.27
2029	-13.20	-9.60	-5.30	1.20	2.10	12.50	18.90	18.80	12.30	-1.00	-6.90	-6.30	1.96
2030	-10.70	-9.50	-5.60	0.00	8.90	12.40	18.20	16.20	12.10	4.60	-3.20	-6.00	3.12
2031	-6.90	-10.40	-8.00	-2.00	6.40	11.50	17.70	18.30	10.70	1.90	-6.10	-11.60	1.79
2032	-6.80	-4.70	-4.70	-1.00	6.40	14.10	19.90	18.70	9.60	0.20	-8.90	-12.00	2.57
2033	-8.70	-6.20	-9.40	-3.60	6.40	10.70	18.90	16.70	14.30	4.00	-3.50	-12.10	2.29
2034	-14.40	-8.70	-6.80	-3.70	5.00	12.20	16.90	17.70	10.30	5.00	-3.40	-13.00	1.43
2035	-8.00	-7.20	-6.70	-2.70	3.60	12.10	17.40	18.00	9.00	-0.10	-7.40	-9.50	1.54
2036	-12.60	-6.10	-4.10	0.90	3.60	14.40	19.20	19.80	10.90	1.20	-8.00	-11.30	2.32
2037	-6.40	-6.80	-2.70	0.50	5.40	13.80	19.70	16.80	10.90	4.00	-5.50	-7.70	3.50
2038	-8.20	-7.70	-4.90	-0.80	6.70	11.10	20.40	19.70	11.80	3.40	-11.20	-8.10	2.68
2039	-8.60	-10.50	-5.00	-0.20	5.30	12.90	19.30	19.70	13.00	6.30	-2.50	-5.70	3.67
2040	-7.20	-4.50	-1.50	-1.90	5.90	12.80	17.30	18.40	10.30	4.20	-4.10	-15.10	2.88
2041	-4.60	-4.70	-3.20	-0.10	5.80	11.70	17.10	18.70	11.50	2.60	-4.10	-6.30	3.70
2042	-6.00	-6.70	-4.60	1.20	3.50	10.50	17.80	17.40	12.90	5.60	-1.20	-10.50	3.32
2043	-11.20	-7.50	-3.50	0.10	5.30	12.80	19.40	19.50	10.10	2.20	-5.20	-7.00	2.92
2044	-11.50	-10.60	-6.50	-1.40	6.50	13.00	18.80	16.40	10.20	4.30	-1.70	-8.00	2.46
2045	-8.50	-5.10	-5.70	0.30	5.60	11.70	17.80	18.60	14.40	2.40	-6.80	-5.70	3.25
2046	-10.90	-7.30	-5.60	-0.70	6.30	13.50	17.20	19.30	12.60	3.30	-4.00	-6.90	3.07
2047	-12.10	-10.80	-9.40	-0.30	6.80	11.80	19.00	16.60	10.80	5.80	-3.90	-6.80	2.29
2048	-10.90	-5.50	-7.90	0.10	7.70	13.20	20.10	20.20	12.30	3.00	-5.00	-5.60	3.48
2049	-6.50	-5.30	-0.90	0.20	8.50	13.80	19.50	20.10	13.50	5.60	-1.80	-10.80	4.66
2050	-12.40	-9.80	-8.40	-2.00	6.20	12.70	17.80	17.20	13.50	2.20	-0.90	-13.80	1.86
2051	-8.10	-7.80	-6.20	2.00	8.70	14.70	20.10	18.70	12.00	4.70	-3.90	-8.60	3.86
2052	-11.20	-11.30	-6.60	-2.10	5.80	11.60	19.10	19.10	14.90	5.70	-6.10	-15.70	1.93
2053	-5.10	-2.10	-2.60	2.60	5.70	12.70	22.20	21.00	13.10	5.30	-5.00	-6.20	5.13
2054	-5.30	-7.00	-3.10	0.20	6.10	15.40	20.20	19.20	12.90	-0.60	-5.80	-12.40	3.32
2055	-10.50	-14.50	-6.00	-0.60	8.20	15.10	19.20	19.10	13.30	4.80	-5.00	-6.10	3.08
2056	-9.40	-1.70	-0.90	3.20	7.70	11.30	18.10	18.30	12.20	5.00	-8.30	-8.90	3.88
2057	-5.80	-5.70	-2.10	-0.80	6.90	13.20	18.50	18.20	13.80	5.30	-2.30	-5.60	4.47
2058	-10.20	-3.60	-0.80	-1.00	6.60	11.70	19.00	19.10	13.70	3.20	-2.80	-8.70	3.85
2059	-7.10	-13.30	-6.50	1.30	6.40	14.10	20.10	19.40	11.70	6.50	-3.90	-5.70	3.58
2060	-11.10	-3.50	-8.10	3.00	6.70	14.30	19.30	21.30	11.50	1.40	-2.50	-7.30	3.75
2061	-11.90	-7.80	-9.90	-1.10	9.20	12.60	18.50	19.90	15.40	5.20	1.10	-10.70	3.38
2062	-11.00	-6.50	-3.40	1.90	6.20	14.60	19.30	20.00	13.10	3.90	-3.80	-11.80	3.54
2063	-10.60	-9.40	-1.40	1.60	8.70	15.80	20.40	20.50	14.70	6.10	-1.00	-7.30	4.84
2064	-9.50	-6.80	-4.40	2.80	9.50	13.50	19.80	20.10	13.20	7.20	-1.80	-13.20	4.20
2065	-14.20	-9.50	-4.40	0.90	9.30	14.40	20.60	21.00	14.80	3.70	-11.40	-11.90	2.78
2066	-19.80	-13.60	-10.70	0.60	7.30	14.00	19.70	19.80	11.90	5.00	-3.40	-7.30	1.96
2067	-5.40	-5.80	-5.70	-1.70	8.10	16.90	22.60	20.10	14.30	4.00	-0.90	-5.80	5.06
2068	-7.30	-3.90	-10.40	2.20	8.70	14.80	21.80	22.10	14.00	4.90	-3.40	-4.70	4.90
2069	-5.40	-8.30	0.00	1.40	10.20	17.90	22.20	22.90	17.10	5.80	-1.40	-3.50	6.57
2070	-6.50	-1.60	-5.20	1.50	8.80	15.10	21.80	21.30	13.40	4.70	-1.30	-5.30	5.56
2071	-6.40	-3.80	-5.50	-0.30	10.70	14.00	21.90	20.20	12.40	3.60	-1.40	-10.50	4.57

2072	-11.70	-12.90	-6.30	0.30	7.50	13.90	19.40	21.50	13.40	3.30	-2.00	-9.00	3.12
2073	-8.90	-3.30	-3.50	-0.90	7.10	15.70	21.60	20.80	15.00	2.50	-4.00	-4.60	4.79
2074	-9.30	-1.00	-1.60	-0.30	5.80	14.20	20.60	19.10	14.00	3.60	-3.90	-5.20	4.67
2075	-5.50	-3.10	1.70	2.60	12.80	17.20	21.00	20.20	13.00	4.60	-2.00	-5.10	6.45
2076	-6.00	-6.40	-1.30	1.00	8.10	13.00	21.10	19.50	13.00	6.50	-2.30	-6.30	4.99
2077	-6.80	-2.40	-1.20	-0.30	8.60	14.00	20.60	22.00	16.90	3.50	0.20	-3.90	5.93
2078	-5.80	-4.20	-5.60	0.90	7.50	13.80	20.60	21.10	15.50	7.00	0.30	-10.60	5.04
2079	-4.60	-8.10	-4.60	0.50	5.80	16.90	21.90	21.70	15.20	5.90	-3.70	-9.70	4.77
2080	-16.80	-4.50	0.30	0.10	5.70	14.00	21.40	19.20	15.30	6.00	1.40	-5.30	4.73
2081	-7.10	-7.20	-1.80	0.80	7.40	17.80	23.10	22.50	15.20	3.40	0.10	-5.70	5.71
2082	-6.00	-2.10	-3.70	4.50	11.40	16.70	22.30	19.30	13.80	6.80	-1.70	-10.40	5.91
2083	-5.70	-5.70	-3.70	4.90	7.40	12.80	20.20	20.60	13.20	4.10	-6.70	-3.50	4.83
2084	-10.20	-4.60	-2.80	3.50	7.40	16.00	22.20	21.00	15.60	2.70	-3.60	-13.20	4.50
2085	-11.00	-3.60	-3.80	2.30	8.50	15.60	24.40	23.10	15.20	4.30	-0.30	-3.60	5.93
2086	-6.90	-2.10	-1.10	2.50	9.80	15.70	21.40	22.20	18.70	5.70	-6.60	-10.60	5.72
2087	-2.60	-2.80	-3.10	3.30	9.40	13.80	22.50	21.70	12.50	4.10	-6.40	-4.40	5.67
2088	-7.70	-6.90	-4.00	4.70	9.20	16.00	22.30	22.10	16.80	7.80	-0.20	-8.70	5.95
2089	-7.20	-6.50	-2.50	3.30	8.30	14.90	22.80	23.10	14.90	6.90	0.90	-6.30	6.05
2090	-7.10	-6.70	-2.80	0.60	9.90	15.60	21.10	23.70	17.70	6.30	-0.50	-17.10	5.06
2091	-15.70	-8.70	-2.40	-1.90	12.20	18.90	23.60	24.20	16.30	5.90	-3.00	-6.10	5.28
2092	-5.70	0.60	-2.30	-0.50	9.30	16.20	22.60	20.50	15.50	6.00	1.10	-6.90	6.37
2093	-1.80	-3.80	-1.70	5.20	7.80	16.20	22.40	22.90	15.80	6.90	3.50	-5.00	7.37
2094	-9.60	0.50	1.70	3.50	10.70	17.10	23.50	23.90	14.70	6.00	-1.10	-12.70	6.52
2095	-11.20	-13.90	-1.80	1.90	10.40	18.60	21.70	21.10	16.80	5.70	1.10	-3.00	5.62
2096	-2.70	-1.00	-1.50	6.00	9.30	17.30	23.90	21.30	18.80	6.90	-1.10	-5.60	7.63
2097	-11.80	-5.60	-3.20	1.90	9.40	17.00	23.20	24.00	16.10	5.30	-0.30	-12.20	5.32
2098	-11.70	-6.10	-0.90	3.10	11.80	15.90	24.60	23.20	16.30	8.80	-1.40	-8.40	6.27
2099	-5.90	-2.20	-1.40	0.40	9.70	19.20	24.20	24.50	17.30	4.60	-1.30	-13.20	6.33
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-8.92	-6.80	-4.29	0.40	7.34	13.95	19.96	19.70	13.20	3.90	-3.73	-8.77	3.83
SD	3.37	3.77	2.74	2.11	2.01	2.07	2.13	2.10	2.31	2.22	3.02	3.34	1.65
Skew	-0.48	-0.82	-0.26	0.36	0.33	0.50	0.18	0.38	0.23	-0.35	-0.24	-0.35	0.18
Analysis of Trend in Mean (95% SL):													
Slope	0.02	0.06	0.05	0.05	0.05	0.06	0.07	0.07	0.07	0.06	0.07	0.04	0.06
KendSum	538.	1068.	1148.	1672.	1880.	2076.	2504.	2514.	2280.	1784.	1750.	817.	2565.
KendTau	0.14	0.28	0.30	0.44	0.49	0.54	0.65	0.66	0.60	0.47	0.46	0.21	0.67
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.94	3.85	4.13	6.02	6.77	7.48	9.02	9.06	8.21	6.43	6.30	2.94	9.24
Trend?	No Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	1.2680	0.2445	0.1363	2.6073	0.4972	1.0739	0.9587	1.7830	0.0007	1.2006	0.3870	2.5683	0.0001
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	11.35	14.21	7.50	4.47	4.05	4.27	4.53	4.41	5.31	4.94	9.12	11.12	2.73
Res Var	10.99	12.02	6.12	2.70	2.20	1.90	1.28	1.29	1.97	2.68	5.65	10.31	0.69
Tnd Var	3.20	15.43	18.36	39.60	45.71	55.59	71.74	70.75	62.99	45.86	38.02	7.35	74.76

HCN Temperature – Fort Peck

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\FTPK_HCN_TempAvg.txt
DSS File: c:\climate\ClimateChangeData.dss

/FTPK-HCN/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1MON/
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	-1.41	0.94	-0.87	3.44	11.54	17.77	20.87	24.10	15.16	6.36	1.63	-12.35	7.27
2013	-8.29	-4.92	-2.22	2.88	10.91	19.15	21.10	20.59	11.24	3.96	-4.55	-3.96	5.49
2014	0.32	2.96	4.07	2.29	11.03	16.28	21.95	22.71	15.08	5.46	-3.58	-1.29	8.11
2015	-5.91	-1.41	-2.03	3.90	11.45	16.59	22.89	22.59	16.81	6.39	2.27	-6.62	7.24
2016	-11.67	-6.24	1.22	3.30	9.56	19.78	23.86	21.28	13.56	3.48	-2.52	-3.34	6.02
2017	-7.21	-4.35	0.72	3.01	11.96	15.80	23.51	23.05	17.07	5.02	-1.10	-7.12	6.70
2018	-9.01	-15.74	-5.10	3.22	11.72	18.38	25.81	23.33	14.29	4.90	-2.61	-8.08	5.09
2019	-7.16	-2.23	0.30	5.43	10.75	18.12	24.67	22.59	18.35	9.28	-1.44	-10.39	7.36
2020	-12.93	-9.02	-3.30	6.61	11.55	18.43	24.03	22.99	17.62	6.18	-4.01	-4.53	6.14
2021	0.08	-3.55	1.44	6.71	10.13	18.84	25.81	23.15	15.26	6.95	-3.64	-7.07	7.84
2022	-8.17	-5.50	-6.38	2.34	10.78	17.06	24.25	22.61	18.20	5.75	-2.29	-5.54	6.09
2023	-8.63	-14.18	-2.49	4.68	12.09	18.66	23.51	24.33	17.46	5.03	-0.22	-6.88	6.11
2024	-4.46	-3.27	-0.86	4.66	11.91	17.90	24.20	22.57	17.56	8.17	-0.69	-8.61	7.42
2025	-7.99	-0.22	0.66	4.81	10.67	17.29	25.66	22.62	14.47	8.63	-4.15	0.42	7.74
2026	-3.60	-2.15	2.00	6.51	12.03	16.43	24.55	23.07	13.95	4.57	1.35	-5.27	7.79
2027	-2.22	-1.48	4.88	5.49	12.98	18.66	22.86	23.06	14.87	4.22	-5.21	-8.66	7.45
2028	-2.84	-1.68	-0.79	2.96	12.35	19.09	23.21	23.58	17.47	8.20	1.91	-4.98	8.21
2029	-9.72	-7.55	-2.75	5.80	6.63	18.85	25.17	23.59	16.71	4.37	-0.72	-1.31	6.59
2030	-5.12	-4.65	-1.29	5.96	15.09	16.33	22.65	19.55	17.44	8.98	1.66	-0.60	8.00
2031	-3.15	-4.51	-2.17	4.07	11.30	16.46	23.62	23.69	14.28	6.55	0.28	-5.59	7.07
2032	-3.43	-0.83	0.76	5.11	11.66	19.37	25.21	23.91	14.45	3.63	-4.35	-8.92	7.21
2033	-3.55	-2.34	-5.17	2.63	11.96	15.92	24.85	20.95	19.02	8.86	1.42	-6.91	7.30
2034	-12.21	-4.60	-3.33	0.75	10.58	17.38	23.46	23.57	15.91	9.87	1.33	-6.75	6.33
2035	-5.07	-5.89	-2.82	2.81	8.73	17.77	23.09	23.58	13.61	4.29	-2.05	-3.46	6.22
2036	-7.67	-0.99	2.31	6.00	8.44	19.36	25.18	25.33	15.20	6.00	-3.71	-6.79	7.39
2037	-1.69	-1.78	2.24	5.32	10.08	18.88	25.88	21.51	15.04	8.89	-1.53	-4.58	8.19
2038	-2.51	-5.07	-1.71	4.39	11.80	16.52	25.55	24.40	16.00	8.74	-7.50	-4.84	7.15
2039	-2.95	-4.86	1.19	6.07	10.92	18.41	24.96	24.80	16.92	11.32	2.62	0.29	9.14
2040	-2.79	0.73	3.16	2.90	12.07	18.27	23.39	24.52	14.07	8.52	-0.82	-9.59	7.87
2041	0.10	-0.95	3.20	5.50	11.29	17.73	24.25	23.80	15.46	6.68	0.78	-1.19	8.89
2042	0.20	-0.93	1.00	5.66	8.13	17.18	23.90	22.73	18.24	10.18	3.45	-6.72	8.59

2043	-9.76	-2.85	2.29	4.96	10.05	16.55	24.22	24.01	13.26	7.15	-0.80	-1.26	7.32
2044	-5.84	-5.99	-2.17	4.08	12.47	18.02	24.81	21.17	15.20	8.57	3.69	-2.08	7.66
2045	-2.94	-0.36	0.05	5.49	10.75	17.26	23.75	24.49	18.29	7.29	-1.29	-0.86	8.49
2046	-7.28	-2.17	-1.12	4.29	10.65	18.70	22.71	25.49	18.35	7.99	1.25	-2.98	7.99
2047	-5.87	-7.18	-4.06	4.48	12.77	18.63	23.86	22.08	14.81	11.09	0.79	-2.40	7.42
2048	-6.44	-0.33	-1.21	5.69	12.40	19.35	24.56	24.57	16.44	7.38	-1.58	-1.69	8.26
2049	-0.31	-1.70	5.34	5.42	13.67	19.67	26.08	24.45	18.38	10.04	4.09	-6.06	9.92
2050	-10.02	-5.60	-4.88	3.50	10.00	18.53	22.64	21.05	18.49	5.74	3.83	-10.06	6.10
2051	-3.33	-3.21	-0.19	7.55	14.20	19.94	25.91	24.30	15.82	9.63	1.02	-4.41	8.94
2052	-6.07	-8.35	-1.69	4.05	10.54	16.28	24.94	23.06	19.38	10.64	-0.58	-12.28	6.66
2053	-1.96	2.66	2.61	8.29	11.42	18.90	28.43	25.59	17.09	10.05	-1.65	-0.65	10.06
2054	-0.78	-1.52	1.25	5.03	10.85	18.84	25.07	23.70	16.92	3.89	-1.88	-8.42	7.75
2055	-9.71	-13.48	-0.15	4.45	13.49	21.56	25.72	24.19	18.23	9.75	-0.41	-0.31	7.78
2056	-6.89	4.52	4.46	8.98	12.62	16.61	24.84	24.60	18.71	10.62	-3.15	-5.15	9.23
2057	-0.35	-0.25	3.33	4.59	12.12	17.54	23.82	22.58	18.01	9.42	2.86	-0.03	9.47
2058	-5.53	1.10	3.78	4.40	10.82	16.13	24.37	24.27	18.57	7.89	1.97	-2.39	8.78
2059	-1.30	-9.07	-3.29	6.17	11.65	18.99	26.69	25.52	15.49	10.81	-1.80	-1.81	8.17
2060	-8.82	1.64	-3.38	7.06	12.37	19.09	24.60	26.49	15.51	6.43	2.22	-2.56	8.39
2061	-6.82	-4.50	-6.07	2.35	15.67	18.71	23.54	25.61	20.17	9.70	6.00	-5.81	8.21
2062	-5.72	-0.62	2.66	6.68	11.56	20.17	25.08	25.13	17.42	8.09	0.23	-6.96	8.64
2063	-5.68	-7.91	3.59	6.92	13.97	21.92	26.57	25.24	17.98	11.09	3.85	-3.78	9.48
2064	-6.64	-1.86	0.86	7.88	14.43	18.67	26.18	25.55	17.94	11.39	3.11	-8.89	9.05
2065	-13.43	-7.75	-0.10	6.29	14.42	20.05	26.69	26.48	19.39	8.83	-8.34	-8.94	6.97
2066	-16.63	-9.79	-10.28	5.47	11.70	20.18	24.45	25.46	15.62	8.17	-0.92	-4.72	5.73
2067	-2.98	-2.14	0.35	3.30	13.30	22.53	27.63	25.09	18.30	8.91	3.22	-0.67	9.74
2068	-2.73	1.58	-4.19	6.71	13.68	19.90	26.86	26.21	18.02	9.26	1.63	-0.73	9.68
2069	-1.57	-3.51	5.24	6.09	14.17	23.68	28.54	27.74	21.25	9.02	3.39	2.27	11.36
2070	-1.19	3.90	-0.98	6.79	13.34	20.59	27.81	25.55	17.62	9.53	2.87	-0.29	10.46
2071	-0.54	0.61	-3.14	5.12	16.15	19.09	27.72	24.76	16.48	8.09	3.11	-4.93	9.38
2072	-6.79	-7.77	-2.32	6.38	12.99	20.09	25.30	26.29	18.50	6.83	2.52	-4.41	8.13
2073	-5.06	1.72	2.21	4.15	12.92	21.55	28.01	26.75	20.09	6.50	1.27	1.42	10.13
2074	-4.22	3.67	3.61	4.70	10.08	18.60	26.29	24.71	18.88	7.98	1.02	-0.39	9.58
2075	-2.24	1.30	6.95	8.12	17.99	23.60	26.15	26.25	17.93	9.61	3.32	-0.81	11.51
2076	-0.24	-0.57	4.40	6.24	13.76	19.56	27.77	24.49	16.20	11.11	2.77	-3.15	10.19
2077	-4.84	1.53	3.63	4.81	13.92	19.59	26.20	26.88	22.45	7.77	4.83	0.18	10.58
2078	-0.30	-2.95	-1.04	4.96	13.31	18.98	26.58	26.75	19.43	11.15	5.84	-6.23	9.71
2079	0.45	-1.36	1.27	4.26	11.48	22.33	28.18	26.86	20.49	11.08	1.85	-4.06	10.24
2080	-11.62	0.50	3.82	5.16	11.40	19.90	26.77	23.71	20.02	9.50	5.79	0.81	9.65
2081	-1.28	-1.54	3.31	5.76	12.11	22.04	28.99	28.30	19.26	8.37	4.29	-0.64	10.75
2082	-0.56	3.29	1.92	8.16	15.93	22.99	27.23	24.60	17.64	10.57	2.04	-4.81	10.75
2083	-2.19	-1.14	1.36	9.25	12.98	18.03	26.21	27.09	16.57	8.46	-1.04	1.83	9.78
2084	-7.75	0.59	1.33	8.34	12.92	21.44	27.84	25.31	20.40	7.69	1.58	-8.35	9.28
2085	-5.42	0.10	-0.81	6.64	13.56	20.36	29.25	27.70	19.81	8.72	4.82	1.22	10.50
2086	-3.62	2.46	2.96	7.21	13.64	21.20	28.04	26.64	24.06	9.02	-2.39	-8.87	10.03
2087	2.00	3.01	2.17	8.37	14.68	19.53	27.12	27.22	17.02	9.24	-0.60	0.94	10.89
2088	-2.53	-0.86	2.09	9.62	14.47	21.53	28.89	26.92	21.66	11.91	4.82	-5.86	11.06
2089	-1.35	-0.31	2.95	8.36	13.89	21.02	29.77	29.04	18.31	11.03	5.55	-0.70	11.46
2090	-4.87	-1.29	2.02	5.53	14.53	21.00	26.85	27.81	22.77	9.49	3.79	-13.86	9.48
2091	-14.13	-4.61	3.46	2.50	17.22	24.27	27.93	28.57	21.30	10.03	1.75	-0.61	9.81
2092	-0.06	6.05	1.46	4.35	14.31	21.62	29.16	27.00	19.57	10.63	5.73	-3.00	11.40
2093	3.32	1.07	2.78	10.77	13.69	23.17	28.97	28.61	19.21	11.29	7.17	-1.03	12.42
2094	-6.11	5.87	6.36	8.08	14.42	22.18	29.06	28.17	17.99	9.90	2.52	-7.87	10.88
2095	-8.68	-11.52	2.44	7.59	16.00	24.73	28.43	26.19	20.21	9.77	5.42	2.69	10.27
2096	1.70	3.35	3.98	10.92	14.03	22.37	29.39	26.03	23.76	11.37	3.39	-1.20	12.42
2097	-6.93	0.72	3.10	7.30	15.22	23.21	30.55	29.52	20.18	10.54	3.50	-9.45	10.62

2098	-8.04	-1.01	4.40	7.86	17.28	21.64	31.46	28.57	20.36	13.67	2.85	-2.90	11.35
2099	-0.98	3.16	3.12	5.73	14.88	25.32	29.23	28.54	20.68	8.12	1.59	-12.19	10.60

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-4.77	-2.24	0.54	5.55	12.51	19.44	25.77	24.81	17.64	8.38	0.85	-4.22	8.69
SD	4.01	4.33	3.19	2.00	2.06	2.20	2.23	2.14	2.45	2.24	3.16	3.80	1.72
Skew	-0.53	-0.78	-0.63	0.32	0.12	0.55	0.24	0.06	0.16	-0.40	-0.48	-0.35	0.07
Analysis of Trend in Mean (95% SL):													
Slope	0.03	0.06	0.05	0.04	0.05	0.06	0.07	0.07	0.07	0.05	0.07	0.03	0.06
KendSum	592.	1112.	1104.	1449.	1818.	2064.	2418.	2486.	1914.	1584.	1568.	703.	2452.
KendTau	0.15	0.29	0.29	0.38	0.47	0.54	0.63	0.65	0.50	0.41	0.41	0.18	0.64
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.13	4.00	3.98	5.22	6.55	7.44	8.71	8.96	6.89	5.71	5.65	2.53	8.83
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	1.1342	0.1246	0.3851	3.6622	0.0493	1.2154	0.5385	0.0571	0.0029	1.7120	0.0341	4.8704	0.0350
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	16.05	18.75	10.20	4.00	4.25	4.86	4.96	4.57	5.98	5.00	9.98	14.41	2.95
Res Var	15.49	16.03	8.69	2.77	2.49	2.23	1.55	1.52	3.12	3.05	6.72	13.69	0.93
Tnd Var	3.47	14.54	14.80	30.84	41.42	54.05	68.79	66.65	47.76	39.04	32.66	4.99	68.28

HCN Temperature – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\GARR_HCN_TempAvg.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-HCN/ALL/TEMP-AVG/01JAN2001 - 01JAN2099/1MON/
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	-2.83	-0.23	-0.11	3.66	12.72	18.46	21.70	25.04	16.89	6.61	1.70	-12.84	7.56
2013	-9.05	-6.47	-1.94	4.37	11.05	20.19	22.66	22.21	13.16	4.87	-4.04	-4.17	6.07

2014	-0.12	3.05	4.52	2.78	11.91	17.47	22.64	23.15	15.77	6.35	-2.74	-1.12	8.64
2015	-6.72	-1.23	-1.90	5.02	12.86	18.00	24.00	23.62	17.70	7.16	2.06	-6.27	7.86
2016	-12.16	-6.49	1.48	3.74	11.66	21.13	26.09	24.04	15.40	3.82	-2.53	-3.63	6.88
2017	-8.95	-5.93	0.85	3.58	14.20	17.28	24.34	23.65	17.75	4.96	-0.69	-6.97	7.01
2018	-9.70	-16.10	-4.20	4.03	13.19	18.72	27.02	25.24	15.84	4.71	-3.23	-8.10	5.62
2019	-7.44	-2.30	0.54	5.31	11.37	18.79	25.43	24.52	19.48	10.19	-0.41	-10.47	7.92
2020	-13.62	-10.16	-3.56	7.78	12.19	18.75	24.58	23.36	18.54	6.79	-4.53	-5.64	6.21
2021	-0.43	-4.86	1.04	7.89	11.87	20.54	26.94	24.70	16.61	7.42	-3.37	-8.22	8.34
2022	-8.89	-6.57	-5.66	2.46	12.50	18.13	24.87	23.98	19.54	7.04	-1.82	-6.25	6.61
2023	-10.35	-14.21	-2.88	4.78	12.90	19.70	24.15	25.29	18.78	6.47	0.19	-8.50	6.36
2024	-5.23	-3.40	-0.98	6.26	12.33	20.31	25.08	24.83	19.41	9.58	-0.65	-7.99	8.30
2025	-9.40	-0.29	0.26	5.50	11.90	19.09	26.49	23.83	16.39	9.24	-4.09	0.03	8.25
2026	-4.79	-2.42	2.42	6.72	12.81	17.33	26.12	24.38	15.68	5.09	0.91	-6.78	8.12
2027	-3.02	-2.01	4.32	5.84	13.59	19.25	23.77	23.84	16.28	5.19	-4.32	-9.18	7.80
2028	-3.72	-1.73	-0.34	3.88	13.16	20.16	25.12	24.37	18.38	8.80	2.02	-4.99	8.76
2029	-9.55	-6.87	-1.76	7.40	8.19	19.09	25.67	25.13	18.29	4.65	-1.45	-2.22	7.21
2030	-5.76	-5.37	-1.39	6.69	16.01	18.40	24.22	21.47	18.78	10.30	1.66	-1.63	8.61
2031	-3.76	-4.94	-2.16	4.64	12.52	17.22	24.36	25.00	16.70	6.51	-0.67	-6.62	7.40
2032	-4.47	-0.72	1.20	5.11	12.29	20.79	26.45	25.31	15.88	4.83	-3.79	-9.85	7.75
2033	-4.33	-2.81	-4.76	2.92	12.56	16.67	25.91	22.88	20.53	9.64	1.57	-6.42	7.86
2034	-12.89	-4.76	-4.26	2.08	12.19	18.27	23.44	24.59	16.84	10.41	1.20	-7.19	6.66
2035	-5.57	-7.55	-2.11	3.22	10.03	18.74	24.08	24.62	15.48	5.45	-2.39	-4.06	6.66
2036	-8.35	-1.30	2.10	6.94	9.53	20.10	26.20	26.66	16.92	6.89	-3.64	-7.09	7.91
2037	-2.91	-2.01	2.18	6.45	11.07	20.00	26.72	23.39	17.18	9.71	-1.70	-5.50	8.72
2038	-2.84	-5.06	-0.73	4.61	13.36	17.85	27.26	25.99	17.69	9.24	-7.12	-5.63	7.89
2039	-3.37	-6.43	0.82	7.45	11.57	19.76	25.96	25.76	19.00	11.45	1.93	-0.21	9.47
2040	-3.45	0.14	2.81	3.99	12.41	19.08	24.07	25.26	16.31	8.95	-0.41	-10.43	8.23
2041	-1.29	-1.80	3.29	5.97	12.30	18.77	24.61	25.81	17.34	8.17	1.15	-1.50	9.40
2042	-0.10	-0.94	1.31	7.06	9.81	17.55	24.11	23.62	19.46	10.45	3.10	-7.35	9.01
2043	-10.43	-3.31	2.68	5.53	10.95	17.85	25.85	26.32	15.56	7.31	-0.71	-1.74	7.99
2044	-6.68	-6.87	-1.94	4.83	13.16	19.65	26.05	22.32	16.38	9.45	3.50	-2.18	8.14
2045	-3.78	-1.47	-0.50	6.12	11.83	17.98	24.41	25.35	20.03	8.38	-1.98	-0.70	8.81
2046	-7.27	-1.86	-0.77	5.66	12.97	20.26	23.82	25.96	18.80	8.01	0.59	-3.80	8.53
2047	-6.73	-6.90	-3.89	5.15	13.16	19.00	25.01	23.23	16.63	11.47	1.01	-3.11	7.84
2048	-7.28	-0.32	-1.91	6.99	13.69	20.19	26.54	26.83	18.46	8.67	-1.39	-2.13	9.03
2049	-0.98	-2.77	4.99	6.03	14.89	20.57	26.90	26.28	19.17	11.19	3.67	-6.69	10.27
2050	-10.46	-5.64	-4.19	4.58	11.67	19.61	23.68	22.93	19.61	7.49	4.68	-9.79	7.01
2051	-4.24	-3.20	-0.99	7.42	14.65	21.18	27.19	25.41	18.01	10.60	1.82	-4.13	9.48
2052	-6.44	-9.11	-1.58	3.93	11.34	17.69	25.38	24.77	21.44	11.43	-0.04	-12.47	7.20
2053	-2.38	2.42	2.28	8.12	12.36	20.03	29.76	27.58	18.35	10.48	-0.84	-0.79	10.61
2054	-0.71	-1.73	1.77	6.35	12.43	20.56	26.88	25.50	18.67	4.73	-1.70	-8.22	8.71
2055	-10.11	-13.11	-0.46	5.43	14.47	22.66	26.67	26.04	19.44	9.88	0.27	-1.07	8.34
2056	-7.78	4.06	4.84	9.16	13.63	17.53	25.98	24.99	19.00	10.70	-3.36	-5.76	9.42
2057	-1.38	-1.36	3.84	5.41	13.10	19.41	24.78	24.24	19.42	10.90	2.61	-0.41	10.05
2058	-6.36	0.60	3.90	5.17	12.26	17.22	24.76	25.28	19.70	8.67	1.90	-3.04	9.17
2059	-2.38	-8.59	-3.08	7.24	12.42	20.23	27.54	25.51	17.55	11.26	-2.08	-1.28	8.69
2060	-8.71	0.69	-3.43	7.96	12.77	19.86	25.29	27.91	17.31	6.51	2.26	-3.43	8.75
2061	-7.67	-4.22	-6.14	2.85	15.72	19.50	24.75	26.15	21.24	10.19	6.15	-6.12	8.53
2062	-5.68	-0.70	2.28	7.45	12.27	21.18	26.21	26.72	18.64	9.13	1.14	-7.69	9.25
2063	-6.89	-8.52	3.86	8.19	15.64	23.06	27.60	27.09	20.52	11.93	4.10	-3.86	10.23
2064	-7.67	-2.84	0.45	8.48	15.25	19.47	26.79	26.67	18.83	12.38	3.56	-9.24	9.34
2065	-13.45	-7.45	0.98	7.45	15.73	21.29	27.36	27.78	21.07	8.84	-7.56	-8.79	7.77
2066	-18.01	-10.38	-9.21	5.93	13.62	20.63	25.81	26.49	17.99	8.98	-0.84	-4.86	6.35
2067	-3.14	-2.27	0.39	4.54	14.61	23.52	29.15	27.07	20.09	9.18	2.81	-1.36	10.38
2068	-4.21	0.80	-4.96	7.67	14.81	20.93	28.30	28.99	18.95	9.96	1.76	-0.81	10.18

2069	-2.43	-4.54	5.15	6.98	15.39	23.75	29.62	29.73	23.40	11.30	3.60	2.08	12.00
2070	-1.97	3.27	-1.25	7.81	14.39	21.40	28.59	27.86	19.17	9.61	2.60	-0.92	10.88
2071	-1.68	-0.15	-3.10	6.03	16.78	20.63	28.66	26.78	17.79	9.14	3.50	-5.78	9.88
2072	-7.27	-8.58	-1.91	6.75	13.77	21.04	25.96	27.43	19.60	7.75	2.60	-4.79	8.53
2073	-5.92	0.97	2.40	5.39	13.95	22.80	28.65	28.11	22.39	8.38	1.12	1.39	10.80
2074	-5.06	3.84	3.88	5.32	11.70	20.32	27.12	26.20	20.11	8.54	1.18	-1.25	10.16
2075	-2.47	-0.66	6.74	8.60	19.10	24.35	27.90	27.46	18.59	9.75	3.47	-1.68	11.76
2076	-1.24	-1.84	4.45	7.26	14.91	20.19	28.28	26.05	18.84	12.28	3.13	-3.17	10.76
2077	-4.83	0.86	4.38	5.60	14.89	20.51	27.75	28.39	23.40	8.55	5.32	-0.31	11.21
2078	-1.44	-2.55	-1.13	5.92	13.45	20.41	27.64	28.11	20.58	12.11	5.47	-7.11	10.12
2079	-0.24	-2.15	0.56	5.92	11.96	23.21	29.37	28.43	21.29	11.47	2.13	-4.56	10.62
2080	-12.19	0.53	4.14	6.14	12.02	20.95	27.72	25.02	21.42	11.73	6.00	0.12	10.30
2081	-1.56	-1.90	3.41	7.14	13.65	24.15	30.62	29.29	20.51	8.80	4.96	-1.15	11.49
2082	-1.52	2.47	1.53	9.71	17.49	24.08	28.77	25.79	18.93	11.90	1.57	-6.29	11.20
2083	-2.45	-1.88	0.79	10.52	13.59	19.20	26.57	27.45	18.06	9.74	-0.45	1.30	10.20
2084	-7.75	-0.24	0.42	9.13	14.14	22.48	29.05	27.22	21.98	8.33	1.16	-8.96	9.75
2085	-5.48	-0.38	-0.37	7.76	14.28	21.96	31.47	29.85	21.29	9.26	4.75	0.71	11.26
2086	-4.57	1.37	3.36	7.85	15.30	22.09	28.87	28.40	25.70	9.50	-2.39	-9.99	10.46
2087	1.26	2.32	1.95	9.12	15.41	20.65	28.87	28.11	18.39	9.94	-0.63	0.62	11.33
2088	-3.69	-0.98	1.12	10.78	15.43	22.22	30.07	28.67	23.51	13.20	4.97	-5.54	11.65
2089	-2.23	-1.17	2.92	9.06	14.56	21.78	30.14	30.05	20.76	12.52	6.16	-1.01	11.96
2090	-4.63	-1.66	2.62	6.14	15.52	22.04	28.13	30.28	23.89	11.23	4.33	-13.46	10.37
2091	-14.13	-5.00	2.87	3.23	18.51	25.13	30.34	30.49	22.30	11.49	0.98	-0.86	10.45
2092	-0.88	5.83	2.16	4.75	15.25	22.41	29.72	27.28	21.21	11.19	5.65	-4.65	11.66
2093	2.66	0.67	2.60	11.68	14.49	23.41	30.12	29.95	21.79	12.29	7.65	-1.20	13.01
2094	-6.09	4.97	6.36	9.27	16.73	23.70	30.60	30.23	20.68	11.12	1.92	-8.62	11.74
2095	-9.79	-11.57	1.97	8.35	16.65	25.73	28.88	27.99	22.94	11.07	5.55	2.60	10.86
2096	0.83	2.95	3.44	12.23	16.17	23.69	30.51	27.58	24.91	12.50	3.82	-1.47	13.10
2097	-7.08	-0.17	2.87	8.69	15.61	24.42	31.00	31.17	22.04	10.83	4.06	-9.95	11.12
2098	-8.63	-1.91	3.57	8.33	17.93	22.43	32.51	29.87	22.52	14.60	2.59	-3.69	11.68
2099	-1.50	3.26	2.71	6.05	16.44	25.92	31.19	30.80	23.31	9.51	1.58	-12.28	11.42
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	-5.45	-2.73	0.57	6.36	13.58	20.50	26.83	26.24	19.21	9.19	0.95	-4.66	9.21
SD	3.96	4.28	3.09	2.08	2.01	2.16	2.33	2.22	2.41	2.32	3.13	3.78	1.73
Skew	-0.56	-0.72	-0.52	0.33	0.28	0.49	0.24	0.26	0.32	-0.38	-0.34	-0.26	0.08
Analysis of Trend in Mean (95% SL):													
Slope	0.03	0.06	0.04	0.05	0.05	0.06	0.07	0.07	0.07	0.06	0.07	0.03	0.06
KendSum	641.	1075.	990.	1534.	1793.	2060.	2352.	2481.	2077.	1706.	1587.	661.	2450.
KendTau	0.17	0.28	0.26	0.40	0.47	0.54	0.61	0.65	0.54	0.45	0.41	0.17	0.64
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	2.31	3.87	3.56	5.53	6.46	7.42	8.47	8.94	7.48	6.14	5.72	2.38	8.83
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.8063	0.3284	0.2332	3.8386	0.0290	0.6160	0.7165	0.6792	0.1683	1.5619	0.0551	4.7340	0.0002
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	15.70	18.30	9.55	4.34	4.04	4.65	5.42	4.92	5.81	5.38	9.81	14.31	2.99
Res Var	15.00	15.62	8.34	2.92	2.33	2.12	1.80	1.58	2.60	3.04	6.53	13.61	0.90
Tnd Var	4.48	14.62	12.76	32.67	42.30	54.37	66.71	67.95	55.31	43.40	33.45	4.90	69.93

SNOTEL Precipitation – Fort Peck

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\FTPK_SNO_Precip_All.txt
DSS File: c:\climate\ClimateChangeData.dss

/FTPK-SNOTEL/ALL/precip/01JAN2001 - 01JAN2099/1MON
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	110.50	68.00	147.80	77.50	156.50	97.90	124.60	13.10	31.00	76.10	115.30	63.90	1082.20
2013	120.70	67.50	87.80	84.20	86.60	114.70	92.60	30.90	36.50	102.20	130.00	89.50	1043.20
2014	109.60	84.60	74.40	90.70	128.10	173.70	81.40	32.70	30.80	86.40	85.70	57.60	1035.70
2015	101.20	55.90	76.90	43.80	46.10	88.60	74.80	18.80	16.50	42.90	53.00	73.70	692.20
2016	103.80	43.10	84.60	72.80	57.70	80.30	19.60	23.80	44.00	79.00	67.60	72.70	749.00
2017	108.80	80.10	54.70	73.70	65.10	129.10	43.80	50.10	28.20	35.10	82.90	90.50	842.10
2018	113.00	45.70	101.90	72.10	109.40	104.00	64.20	17.60	40.10	64.70	82.80	73.60	889.10
2019	51.20	98.40	101.90	66.40	108.00	63.80	75.60	16.20	25.10	114.60	77.60	74.90	873.70
2020	66.50	108.20	79.80	100.00	100.50	99.10	86.20	55.00	45.10	103.70	81.90	99.40	1025.40
2021	104.10	61.50	97.90	95.50	109.10	38.30	59.80	45.60	43.30	33.00	77.60	99.20	864.90
2022	53.90	85.80	82.10	71.90	95.80	97.90	36.00	32.90	21.60	67.60	97.80	62.70	806.00
2023	93.30	46.70	65.20	77.50	87.40	102.60	87.00	33.20	23.20	102.40	67.50	105.70	891.70
2024	120.20	77.40	86.90	85.90	46.00	41.40	57.10	15.80	22.50	59.00	83.20	76.40	771.80
2025	66.70	74.90	53.90	77.20	115.50	126.70	35.90	23.90	47.40	60.60	72.30	79.20	834.20
2026	78.70	30.60	59.70	73.40	109.30	81.10	91.20	62.50	46.10	74.20	74.00	69.50	850.30
2027	90.80	58.70	66.40	77.20	92.60	126.60	109.40	51.60	43.90	55.90	56.80	78.30	908.20
2028	102.80	61.90	104.70	99.30	57.20	86.10	22.20	29.50	38.30	76.40	143.80	73.90	896.10
2029	61.60	87.60	76.60	101.90	91.00	83.60	26.20	33.30	24.90	54.80	44.60	25.50	711.60
2030	53.90	59.90	54.50	74.30	81.10	119.90	44.90	63.00	56.90	46.70	31.60	123.60	810.30
2031	112.90	40.20	40.90	59.50	136.60	139.20	77.40	23.50	35.10	18.60	46.80	62.60	793.30
2032	93.80	70.30	68.60	96.10	71.10	73.10	32.90	30.70	41.50	79.50	77.00	98.50	833.10
2033	45.10	80.20	94.90	79.40	100.10	86.50	34.80	17.30	35.80	51.60	109.90	65.80	801.40
2034	125.90	64.90	103.80	85.70	88.10	119.70	33.80	39.00	27.90	62.40	70.20	53.00	874.40
2035	108.80	90.80	68.00	75.60	105.10	113.80	63.20	33.40	50.50	76.20	77.00	61.80	924.20
2036	49.60	35.80	79.50	110.60	136.50	126.40	60.60	53.70	41.10	85.70	99.20	88.30	967.00
2037	108.00	62.30	72.90	88.60	115.70	93.10	84.50	48.20	20.00	51.40	65.50	80.90	891.10
2038	73.80	125.70	83.80	39.40	97.00	109.80	35.00	29.30	11.80	76.60	55.10	96.40	833.70
2039	56.60	38.40	64.00	96.50	151.30	107.60	44.80	31.60	23.20	25.50	57.60	67.10	764.20

2040	99.60	73.00	100.10	95.90	84.70	113.60	84.40	32.50	30.10	75.80	68.90	54.20	912.80
2041	117.40	82.60	49.50	104.00	107.90	93.10	110.90	37.50	22.20	68.70	85.60	99.50	978.90
2042	70.20	50.80	52.90	85.70	90.20	71.20	125.50	43.00	67.70	37.50	81.70	89.60	866.00
2043	114.60	76.10	116.00	108.80	129.80	108.90	27.80	42.70	42.40	63.40	81.90	108.50	1020.90
2044	61.00	69.50	71.90	95.60	71.90	159.00	111.90	64.80	48.60	79.50	64.60	60.90	959.20
2045	53.20	77.60	59.80	76.00	69.40	77.80	92.90	36.50	13.80	75.40	53.20	114.10	799.70
2046	83.80	37.20	91.50	79.10	83.90	61.80	69.40	53.50	47.70	62.10	65.80	89.90	825.70
2047	54.00	74.10	53.80	59.10	97.90	83.70	73.30	13.50	23.70	37.40	92.90	111.40	774.80
2048	86.10	45.30	65.90	115.50	75.00	103.90	40.10	27.80	25.60	139.10	80.10	102.70	907.10
2049	34.30	102.90	70.10	94.70	99.30	131.20	106.40	7.60	17.30	55.90	34.60	70.80	825.10
2050	91.30	89.90	91.60	76.00	82.60	116.70	79.50	34.30	12.90	102.50	107.60	79.70	964.60
2051	58.80	86.80	73.50	39.80	116.80	69.90	29.80	29.50	21.50	51.10	89.10	150.60	817.20
2052	66.70	86.80	74.50	44.30	99.80	79.00	56.00	4.80	36.10	47.30	124.10	67.70	787.10
2053	114.20	69.70	80.00	109.50	165.20	85.40	49.80	11.50	51.20	36.90	93.00	90.70	957.10
2054	139.20	45.40	118.20	90.10	119.80	122.60	24.10	57.50	55.20	80.20	78.10	71.80	1002.20
2055	94.90	82.30	90.10	82.90	126.20	51.10	48.60	41.00	38.60	42.20	57.00	69.50	824.40
2056	77.50	29.50	74.20	96.60	100.20	170.90	123.80	29.80	74.90	34.90	69.20	74.00	955.50
2057	106.70	73.50	74.20	85.80	94.10	66.30	56.20	62.80	44.50	64.80	66.50	66.00	861.40
2058	78.00	97.60	131.50	99.10	120.10	170.10	71.20	44.90	57.40	68.90	68.20	58.80	1065.80
2059	62.30	56.30	90.80	62.80	71.20	83.50	52.80	23.10	32.60	14.40	136.60	164.00	850.40
2060	82.80	99.10	72.70	74.50	114.70	79.60	80.20	49.80	40.60	54.00	100.40	84.30	932.70
2061	42.80	79.90	71.30	82.70	48.60	153.30	103.30	40.20	29.10	59.20	78.60	114.30	903.30
2062	43.90	57.30	59.20	108.70	92.80	80.70	75.80	43.00	17.80	128.70	100.10	55.70	863.70
2063	59.90	82.90	112.40	69.90	76.80	75.30	37.20	59.60	28.50	25.50	75.10	132.10	835.20
2064	84.90	47.70	54.70	98.80	49.30	119.80	38.60	34.20	33.60	66.40	75.10	93.60	796.70
2065	102.90	104.00	82.20	78.20	81.30	87.20	37.50	31.10	27.30	19.60	74.90	134.90	861.10
2066	50.60	63.80	79.00	73.90	151.90	157.50	98.60	32.00	17.30	91.20	111.70	114.20	1041.70
2067	99.10	54.40	63.80	41.70	73.40	48.00	46.00	89.00	17.20	98.20	82.60	121.00	834.40
2068	84.90	92.80	63.50	55.60	84.00	78.00	20.50	20.20	28.10	67.80	130.30	115.40	841.10
2069	101.40	42.30	85.90	81.00	96.50	61.20	49.90	5.90	27.50	92.70	76.40	84.30	805.00
2070	89.80	49.00	70.70	77.00	75.90	89.50	36.10	48.70	38.10	52.60	111.70	83.40	822.50
2071	92.90	123.40	115.30	80.50	63.80	96.20	40.50	11.50	70.30	52.80	65.70	54.40	867.30
2072	68.50	69.20	99.50	115.10	106.40	84.50	89.90	27.40	32.80	55.70	97.10	110.50	956.60
2073	77.50	75.00	84.10	99.40	97.30	43.70	28.00	59.90	33.80	106.00	55.60	91.90	852.20
2074	68.10	112.90	121.20	107.60	90.40	138.60	31.10	50.70	7.60	51.60	72.40	59.50	911.70
2075	99.90	120.50	88.00	95.60	73.60	109.80	63.70	70.60	31.60	61.30	26.40	118.40	959.40
2076	81.00	63.90	96.60	73.80	72.90	137.90	27.50	32.10	40.50	41.30	113.30	133.30	914.10
2077	108.10	139.80	106.90	94.20	76.90	88.10	65.60	26.90	54.10	84.10	98.20	134.30	1077.20
2078	15.50	149.60	90.80	92.90	97.80	123.20	50.80	50.90	25.90	76.60	63.80	55.20	893.00
2079	97.80	61.60	67.90	115.40	84.90	107.00	53.00	29.50	43.60	48.70	97.80	66.20	873.40
2080	46.00	72.00	133.10	112.10	102.20	68.30	38.50	41.20	57.90	125.00	66.50	65.40	928.20
2081	57.50	66.60	73.90	93.40	90.10	99.80	50.00	16.20	14.20	88.70	100.60	90.50	841.50
2082	58.10	26.60	30.70	64.60	102.90	94.90	56.80	41.80	44.00	40.60	89.50	74.40	724.90
2083	141.90	98.30	90.80	90.90	70.40	174.50	65.90	38.00	50.70	61.90	112.90	83.20	1079.40
2084	90.10	43.20	57.90	114.50	89.50	118.10	47.90	53.40	40.10	65.10	52.20	65.60	837.60
2085	52.00	110.70	112.50	97.00	48.80	85.10	10.80	9.20	45.40	98.40	110.20	99.40	879.50
2086	81.60	96.70	96.80	83.20	59.10	89.00	104.30	12.60	46.90	83.90	94.90	97.40	946.40
2087	112.00	99.80	103.10	78.50	95.70	104.20	36.90	24.60	42.20	43.50	47.90	102.50	890.90
2088	81.20	60.00	59.30	88.80	84.00	136.10	53.80	6.80	15.10	58.40	53.20	106.40	803.10
2089	81.30	48.60	73.20	66.70	111.50	95.30	44.60	39.10	17.70	68.10	91.40	78.50	816.00
2090	107.30	48.90	99.90	81.90	60.40	125.90	45.90	26.60	27.90	103.70	91.40	76.30	896.10
2091	62.90	68.50	81.70	76.30	46.60	59.40	31.20	5.10	26.40	82.50	64.10	69.80	674.50
2092	80.90	69.20	101.30	92.40	96.70	102.80	79.70	26.40	28.80	39.30	121.60	137.40	976.50
2093	77.10	81.30	63.30	61.20	122.20	62.60	39.80	25.40	42.40	30.20	52.20	114.50	772.20
2094	113.00	42.40	75.10	137.60	70.90	133.30	50.60	19.40	48.10	65.10	77.20	29.50	862.20

2095	127.60	46.80	82.20	117.00	85.20	79.70	42.10	15.10	21.60	49.10	80.80	104.40	851.60
2096	129.10	75.50	65.10	82.00	99.90	118.10	13.80	31.40	5.70	80.80	77.50	131.90	910.80
2097	59.90	46.70	63.20	78.70	100.60	34.00	45.20	13.60	62.40	97.80	105.50	110.30	817.90
2098	57.60	57.90	86.50	120.40	61.20	88.80	43.20	24.40	35.40	32.70	72.20	77.50	757.80
2099	92.50	103.10	102.10	113.10	44.00	67.10	37.00	7.80	23.80	54.20	124.50	104.20	873.40
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	84.22	72.32	81.84	85.40	92.06	99.32	58.47	33.48	34.75	65.95	81.55	87.89	877.26
SD	26.14	25.30	21.35	19.26	26.01	31.41	27.61	17.08	14.41	25.66	24.07	26.17	88.60
Skew	-0.07	0.62	0.50	-0.15	0.40	0.36	0.66	0.51	0.40	0.43	0.31	0.43	0.38
Analysis of Trend in Mean (95% SL):													
Slope	-0.09	0.09	0.05	0.19	-0.23	-0.06	-0.31	-0.09	0.00	-0.03	0.08	0.25	-0.16
KendSum	-287.	167.	223.	589.	-569.	-160.	-654.	-414.	1.	-127.	214.	648.	-29.
KendTau	-0.07	0.04	0.06	0.15	-0.15	-0.04	-0.17	-0.11	0.00	-0.03	0.06	0.17	-0.01
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	-1.03	0.60	0.80	2.12	-2.05	-0.57	-2.35	-1.49	0.00	-0.45	0.77	2.33	-0.10
Trend?	No Trend	No Trend	No Trend	Trend	Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.2594	3.1752	0.2693	1.5150	2.2850	0.1068	3.5843	0.2750	1.5944	0.0176	0.0042	2.6566	1.2602
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	683.20	640.15	455.74	370.80	676.41	986.71	762.39	291.59	207.59	658.28	579.41	684.78	7849.51
Res Var	677.51	634.38	453.92	347.80	641.79	984.02	699.44	285.81	207.59	657.70	574.72	645.37	7833.50
Tnd Var	0.83	0.90	0.40	6.20	5.12	0.27	8.26	1.98	0.00	0.09	0.81	5.76	0.20

SNOTEL Precipitation – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\GARR_SNO_Precip_All.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-SNOTEL/ALL/precip/01JAN2001 - 01JAN2099/1MON
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	80.70	48.80	89.10	74.10	113.90	92.80	167.40	56.10	40.20	52.00	67.30	46.50	928.90
2013	74.70	55.60	58.30	45.60	95.50	127.40	59.00	48.40	41.10	94.50	78.30	50.50	828.90
2014	59.00	45.80	59.40	83.00	92.70	173.40	154.70	51.90	54.90	63.30	42.90	24.70	905.70
2015	66.30	45.70	49.10	30.60	48.60	133.70	100.50	42.60	41.50	48.50	29.80	42.90	679.80
2016	47.80	41.00	45.40	56.60	45.80	88.50	21.60	19.80	42.10	61.50	33.60	39.70	543.40
2017	64.30	59.10	37.10	75.90	46.90	134.50	49.40	62.30	34.60	32.10	49.60	51.30	697.10
2018	72.30	27.50	66.10	79.00	95.10	135.10	72.80	18.30	44.10	68.50	53.20	47.20	779.20
2019	38.50	63.00	66.30	49.30	144.00	102.40	95.30	19.70	36.90	62.80	38.90	38.10	755.20
2020	51.50	72.40	71.70	71.20	127.20	152.00	97.30	95.60	58.70	66.10	53.20	61.90	978.80
2021	51.10	51.50	72.60	73.00	102.30	59.30	92.60	66.20	45.10	57.90	52.70	76.10	800.40
2022	36.10	59.00	66.00	60.50	79.10	115.30	61.70	44.60	42.40	56.60	67.90	34.70	723.90
2023	63.20	35.00	35.90	95.80	90.10	104.50	99.90	71.80	29.40	54.20	32.50	62.30	774.60
2024	63.00	56.70	57.30	61.70	57.00	51.40	96.60	12.40	22.90	35.80	44.70	44.70	604.20
2025	50.60	40.50	36.70	47.60	98.10	111.10	97.40	36.90	30.70	69.10	34.50	51.20	704.40
2026	52.50	22.90	38.40	61.40	107.60	107.20	91.20	81.90	34.20	58.70	47.10	47.40	750.50
2027	57.00	53.80	53.10	97.30	111.50	137.30	153.20	68.90	51.90	33.00	39.40	47.80	904.20
2028	68.50	37.70	65.30	89.50	61.90	66.80	27.20	60.90	46.40	32.90	70.40	44.50	672.00
2029	47.90	50.30	40.70	78.20	116.70	135.50	62.40	43.50	25.30	69.90	48.10	14.50	733.00
2030	32.00	51.20	54.60	55.40	108.40	76.00	47.60	35.40	54.10	41.60	12.90	79.60	648.80
2031	65.10	36.10	28.20	58.70	144.30	206.00	113.80	35.40	22.50	18.70	45.30	46.80	820.90
2032	46.30	45.90	39.90	114.60	87.30	80.10	40.70	58.50	28.20	69.70	50.70	67.90	729.80
2033	23.70	45.00	74.20	56.90	99.50	101.10	62.20	24.90	41.50	76.50	58.70	39.40	703.60
2034	96.10	53.20	77.20	69.70	77.70	166.10	52.60	70.90	55.80	44.10	35.60	37.70	836.70
2035	68.30	67.80	44.50	69.10	89.90	119.30	58.70	39.30	23.40	31.10	61.70	38.80	711.90
2036	37.00	19.40	83.90	69.40	171.30	130.20	81.30	74.10	32.70	59.70	78.30	58.90	896.20
2037	74.60	44.50	46.90	52.20	92.10	117.00	83.90	50.30	19.30	46.90	49.30	53.80	730.80
2038	42.10	84.30	60.90	29.90	101.20	136.40	49.30	45.00	6.90	99.00	38.30	66.20	759.50
2039	36.30	27.10	43.10	84.40	127.50	80.80	75.90	56.90	28.60	28.50	43.50	37.80	670.40
2040	51.90	53.80	72.10	78.70	96.20	117.50	163.30	102.30	29.80	47.30	46.40	40.80	900.10
2041	65.10	55.70	37.60	92.20	123.10	108.80	138.90	22.10	21.20	33.10	58.90	55.30	812.00
2042	34.20	28.30	45.10	58.30	110.60	109.00	136.00	87.00	51.50	36.60	49.00	55.90	801.50
2043	74.70	46.20	94.90	78.90	124.30	125.10	55.50	17.30	34.10	58.70	45.00	52.60	807.30
2044	56.10	52.70	59.90	69.00	69.20	180.50	117.90	84.30	69.30	52.70	31.00	38.90	881.50
2045	28.50	64.80	73.00	49.70	72.60	134.90	117.50	59.60	12.60	47.90	45.80	84.30	791.20
2046	67.80	34.20	89.70	53.50	63.30	95.70	102.20	68.20	61.40	38.40	39.50	54.30	768.20
2047	31.90	48.50	56.80	52.50	107.70	78.50	72.70	21.20	9.70	38.70	60.70	58.50	637.40
2048	56.30	38.00	56.10	81.20	57.70	114.70	46.90	36.80	14.20	118.10	56.80	58.30	735.10

2049	17.90	57.70	64.50	85.60	73.90	172.60	136.30	29.00	17.40	51.60	17.90	38.30	762.70
2050	75.40	60.10	66.90	53.90	106.10	69.00	122.30	41.70	24.40	59.10	63.20	44.80	786.90
2051	37.50	51.30	69.90	41.70	108.70	84.10	60.70	57.30	18.00	35.50	39.20	103.20	707.10
2052	35.50	59.00	60.50	47.10	87.30	119.30	116.70	8.40	30.80	50.10	84.10	50.20	749.00
2053	62.00	52.40	80.40	100.50	156.10	67.70	62.50	32.70	73.90	27.00	64.00	48.30	827.50
2054	83.70	29.50	115.90	78.20	109.20	101.20	51.80	24.10	56.80	72.90	50.60	49.00	822.90
2055	55.50	60.90	69.90	55.30	143.20	74.90	68.20	53.10	45.20	36.20	47.10	36.60	746.10
2056	49.00	13.50	57.00	87.20	112.20	215.80	147.00	51.00	99.30	51.70	54.70	58.10	996.50
2057	59.80	62.80	43.60	72.50	87.90	66.20	144.10	80.30	29.90	46.90	38.10	39.10	771.20
2058	45.20	57.30	108.60	89.30	86.10	185.30	132.80	51.30	51.30	73.00	43.00	34.90	958.10
2059	34.80	47.30	68.90	42.80	73.30	113.70	77.60	29.50	29.20	8.90	83.10	105.30	714.40
2060	72.30	71.90	67.30	43.10	97.30	92.90	107.60	68.30	42.40	62.40	71.30	65.50	862.30
2061	38.00	47.40	54.50	53.50	73.80	131.10	107.50	45.70	38.60	43.70	51.30	59.10	744.20
2062	28.00	43.10	67.30	81.40	108.30	99.40	67.60	53.60	23.70	64.20	52.60	47.40	736.60
2063	44.50	67.60	59.10	48.80	80.60	111.60	51.30	82.70	12.80	15.00	45.60	95.30	714.90
2064	67.90	50.60	34.50	86.90	62.10	153.30	75.60	68.10	46.70	36.50	49.80	69.10	801.10
2065	62.90	73.70	58.00	79.90	104.80	60.20	71.90	45.60	26.10	37.90	65.80	75.50	762.30
2066	48.50	38.40	62.40	63.50	127.40	158.70	99.40	60.50	11.40	40.60	84.90	92.10	887.80
2067	51.70	37.90	58.60	34.10	64.70	82.60	32.60	71.30	16.70	61.10	52.10	70.70	634.10
2068	53.30	64.10	94.50	27.70	112.30	94.10	29.20	13.80	35.70	85.10	72.00	52.30	734.10
2069	76.60	23.40	71.50	57.30	112.70	104.20	66.90	6.70	21.30	46.10	51.60	40.30	678.60
2070	63.50	29.00	48.90	70.90	87.90	125.40	54.10	45.00	26.10	50.20	63.90	50.50	715.40
2071	51.80	85.90	91.70	71.50	97.90	98.00	58.40	40.00	71.20	40.20	67.50	43.40	817.50
2072	52.40	51.10	63.10	126.00	123.60	123.60	99.80	31.30	44.40	28.10	82.00	79.30	904.70
2073	51.80	35.10	50.60	65.30	84.50	63.80	57.90	86.60	21.60	62.80	37.90	46.60	664.50
2074	40.30	72.90	107.40	83.60	94.70	146.40	71.90	96.60	13.60	37.00	48.60	41.10	854.10
2075	66.60	85.50	50.20	98.70	57.70	131.90	64.40	86.00	41.90	36.90	21.70	86.50	828.00
2076	60.70	42.20	54.50	62.10	67.30	188.30	74.30	38.80	12.10	39.20	65.00	99.80	804.30
2077	86.60	82.00	78.70	83.30	86.50	103.30	88.90	62.20	56.50	57.30	60.50	94.80	940.60
2078	19.70	76.40	95.70	74.10	153.50	112.30	88.40	62.40	16.60	72.40	40.40	54.70	866.60
2079	60.90	62.10	51.00	70.10	141.50	113.70	50.10	30.60	42.40	36.10	55.00	49.00	762.50
2080	38.50	46.50	95.60	108.60	129.90	98.80	71.60	54.10	48.10	41.90	49.10	34.40	817.10
2081	37.30	43.90	93.40	67.00	83.60	61.40	66.70	21.20	14.00	66.70	53.60	61.30	670.10
2082	44.10	24.80	21.70	28.40	101.30	128.40	53.60	60.20	39.90	20.30	63.10	69.60	655.40
2083	86.70	65.40	59.10	58.80	120.90	158.10	101.60	75.70	25.50	34.60	79.70	56.10	922.20
2084	51.30	37.90	40.50	92.60	66.90	130.20	59.70	74.20	43.10	50.50	47.70	43.10	737.70
2085	41.10	72.60	97.00	63.50	105.10	125.80	22.50	22.30	47.60	88.10	68.90	70.20	824.70
2086	53.80	74.60	73.30	62.70	49.70	110.40	130.30	10.70	34.30	58.00	80.80	85.30	823.90
2087	78.00	75.90	105.10	58.00	82.30	85.10	33.70	51.80	33.80	32.60	42.60	70.80	749.70
2088	61.20	58.00	44.50	82.50	83.60	129.70	82.90	16.90	19.50	73.90	31.20	65.90	749.80
2089	57.40	39.70	70.60	38.80	136.90	95.90	79.50	37.50	8.30	31.60	39.70	47.60	683.50
2090	84.00	36.70	56.80	73.90	39.50	154.10	58.20	30.20	35.00	54.40	61.90	41.80	726.50
2091	42.20	40.50	104.20	69.90	80.90	51.70	31.30	5.10	39.40	43.70	60.70	41.30	610.90
2092	53.60	38.90	82.80	99.60	90.20	166.50	91.00	26.00	32.40	63.00	80.80	82.80	907.60
2093	36.10	50.50	52.00	58.90	133.80	88.20	94.10	50.00	20.10	11.00	29.40	72.00	696.10
2094	82.20	39.30	45.40	100.30	78.70	167.50	40.10	28.00	26.50	37.80	56.90	24.90	727.60
2095	105.10	57.70	80.20	111.10	81.90	105.80	99.20	32.50	19.90	21.90	50.80	49.90	816.00
2096	69.20	47.10	60.10	78.10	92.70	140.90	33.70	32.20	5.70	79.70	43.10	86.80	769.30
2097	51.90	59.90	42.90	69.90	101.10	68.30	58.30	28.30	52.50	110.90	65.10	76.10	785.20
2098	42.00	45.80	62.00	67.10	83.90	83.30	46.50	34.00	39.60	28.50	75.10	68.40	676.20
2099	60.70	76.80	69.60	116.40	66.50	100.70	29.30	14.20	23.50	28.90	100.10	70.50	757.20
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Basic Statistics:

Mean	55.27	51.00	63.97	69.85	96.03	115.01	79.99	47.17	34.61	50.55	53.37	56.72	773.53
SD	17.34	15.93	20.01	20.73	27.24	35.54	34.88	23.32	16.89	20.78	16.38	18.80	89.76
Skew	0.28	0.13	0.51	0.26	0.29	0.50	0.58	0.27	0.81	0.73	0.26	0.64	0.25

Analysis of Trend in Mean (95% SL):

Slope	0.03	0.10	0.17	0.13	-0.05	-0.04	-0.38	-0.17	-0.12	-0.11	0.17	0.24	-0.02
KendSum	58.	336.	505.	367.	-185.	-89.	-686.	-473.	-557.	-439.	683.	840.	-20.
KendTau	0.02	0.09	0.13	0.10	-0.05	-0.02	-0.18	-0.12	-0.15	-0.11	0.18	0.22	-0.01
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	0.21	1.21	1.82	1.32	-0.66	-0.32	-2.47	-1.70	-2.00	-1.58	2.46	3.02	-0.07
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	Trend	No Trend	Trend	Trend	No Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.6689	1.4513	2.2314	1.1921	0.3445	0.0017	4.4405	0.0494	0.2729	2.3152	1.0483	2.3200	1.6703
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	300.68	253.88	400.23	429.91	742.25	1263.18	1216.55	544.02	285.41	431.70	268.19	353.26	8056.90
Res Var	299.92	247.79	381.66	418.15	740.82	1262.13	1122.99	525.81	275.21	424.09	249.95	315.66	8056.50
Tnd Var	0.25	2.40	4.64	2.73	0.19	0.08	7.69	3.35	3.57	1.76	6.80	10.64	0.00

HCN Precipitation – Fort Peck

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\FTPK_HCN_Precip.txt
DSS File: c:\climate\ClimateChangeData.dss

/FTPK-HCN/ALL/precip/01JAN2001 - 01JAN2099/1MON/CC
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	43.20	13.70	53.20	35.20	108.60	49.30	90.60	4.50	11.50	26.90	37.40	19.90	494.00
2013	44.00	22.20	22.60	34.70	27.20	67.70	63.20	17.40	23.50	58.20	53.40	23.50	457.60
2014	28.10	25.90	17.50	52.30	84.10	116.70	45.70	14.00	10.30	30.10	28.50	6.40	459.60
2015	32.90	11.90	22.30	7.60	16.70	39.30	39.80	4.50	4.70	13.10	20.20	21.40	234.40
2016	32.80	11.90	29.60	20.40	19.50	33.20	8.80	3.50	12.70	27.40	18.10	17.10	235.00
2017	40.80	28.30	13.70	19.90	24.50	77.50	25.20	21.70	5.20	7.80	15.80	33.10	313.50
2018	34.80	6.30	39.20	33.90	56.00	50.10	25.40	5.20	19.60	22.60	25.10	25.60	343.80
2019	20.20	34.70	38.40	28.40	52.20	29.10	28.90	5.10	4.80	40.10	25.50	21.20	328.60

2020	18.30	35.50	41.20	44.60	42.00	50.90	43.40	20.50	11.90	39.80	29.00	29.60	406.70
2021	31.50	20.20	34.30	32.10	63.70	11.70	27.60	17.30	18.60	10.10	17.40	32.20	316.70
2022	10.50	33.20	33.60	30.60	52.80	51.30	20.40	12.60	4.50	22.10	30.50	19.20	321.30
2023	26.80	8.70	18.60	25.50	37.80	74.20	45.10	10.10	12.00	30.60	10.60	31.00	331.00
2024	50.90	22.20	46.20	42.90	14.90	22.60	29.80	3.70	5.70	14.30	28.50	13.50	295.20
2025	26.40	15.20	15.20	26.20	79.80	71.70	15.40	6.40	23.70	25.70	14.50	18.70	338.90
2026	27.80	6.10	24.80	33.10	53.40	32.30	40.00	32.10	29.10	19.50	21.60	17.70	337.50
2027	29.90	15.20	32.60	30.10	41.60	57.90	55.00	22.90	11.10	18.80	20.60	20.70	356.40
2028	30.30	32.70	41.10	60.30	21.50	53.70	18.70	8.50	9.40	28.70	62.20	20.80	387.90
2029	16.40	28.30	21.80	35.00	50.70	51.30	12.60	14.60	7.90	20.90	12.60	6.60	278.70
2030	16.70	18.60	13.50	29.10	30.50	83.90	28.00	30.80	16.90	8.80	15.70	37.10	329.60
2031	40.90	8.30	7.20	32.00	69.40	83.50	45.80	11.40	11.00	9.10	9.60	13.60	341.80
2032	30.80	18.30	18.90	55.10	28.90	34.20	16.10	11.30	12.20	37.90	22.80	35.90	322.40
2033	12.80	28.20	31.00	24.20	63.10	49.60	12.70	4.40	12.90	11.70	35.50	17.40	303.50
2034	50.40	20.30	37.30	35.60	51.00	72.70	11.20	16.30	4.60	15.70	18.00	12.60	345.70
2035	40.60	36.50	18.90	24.30	48.40	53.20	33.10	11.60	17.50	30.30	26.90	11.60	352.90
2036	15.20	5.80	19.70	51.70	84.60	89.90	33.90	22.20	13.10	31.50	42.50	24.70	434.80
2037	44.10	19.80	21.50	37.60	79.40	59.90	39.10	24.30	4.10	17.50	23.50	34.30	405.10
2038	27.50	60.20	25.30	11.90	51.50	57.90	16.90	23.10	5.90	43.80	14.60	29.50	368.10
2039	11.00	7.80	10.50	33.00	93.50	47.30	28.30	18.10	12.90	6.60	18.50	11.50	299.00
2040	47.20	21.00	33.80	43.70	32.80	67.70	41.10	11.60	15.00	24.10	35.70	12.60	386.30
2041	44.50	29.60	20.40	46.90	43.70	53.20	54.60	17.70	2.80	18.80	24.40	21.30	377.90
2042	18.60	9.70	8.90	49.50	48.50	40.70	73.40	18.30	18.90	10.50	25.20	29.90	352.10
2043	34.40	22.10	58.90	55.80	79.70	70.80	10.40	22.70	23.90	24.30	24.90	31.20	459.10
2044	15.40	25.30	31.10	35.30	27.20	108.80	59.80	39.20	27.10	32.30	16.60	10.20	428.30
2045	11.90	23.80	15.50	21.30	31.50	43.50	56.90	19.20	5.60	43.30	9.40	33.40	315.30
2046	31.10	5.40	28.00	30.40	34.90	24.40	35.30	26.20	17.70	28.20	27.00	27.70	316.30
2047	11.60	19.80	16.60	17.60	39.10	36.80	46.60	2.40	4.80	5.60	31.90	28.70	261.50
2048	26.70	10.10	20.30	82.60	36.50	50.40	26.60	10.10	7.40	89.20	28.20	34.70	422.80
2049	6.10	43.30	20.20	32.00	52.40	60.60	60.40	3.90	10.10	14.60	3.70	21.50	328.80
2050	27.40	31.50	31.40	28.90	33.80	67.50	56.20	10.00	5.00	44.70	28.80	19.40	384.60
2051	18.50	37.60	25.80	8.60	66.80	42.80	9.70	16.50	9.30	13.90	18.80	54.50	322.80
2052	12.10	29.70	19.60	16.00	64.60	41.80	34.10	1.50	9.80	10.50	42.70	19.80	302.20
2053	39.60	21.40	34.50	50.00	116.40	29.50	17.90	3.00	20.60	10.40	25.40	26.20	394.90
2054	48.30	14.40	48.80	33.80	71.70	97.60	10.30	54.20	31.10	42.80	32.80	19.00	504.80
2055	40.70	26.80	26.50	29.70	53.40	15.40	20.90	16.20	8.60	14.60	7.50	17.70	278.00
2056	20.80	4.00	20.10	31.20	44.30	103.30	58.90	9.70	29.10	6.90	24.60	22.80	375.70
2057	41.60	34.60	20.90	31.30	58.70	38.10	33.80	35.50	17.40	19.10	22.40	17.80	371.20
2058	29.30	45.70	61.70	47.90	81.50	125.20	42.70	23.70	18.20	26.20	23.60	13.40	539.10
2059	15.60	19.40	28.50	21.30	34.80	52.10	18.40	6.50	10.70	1.20	60.10	66.50	335.10
2060	30.00	36.30	20.90	26.10	55.50	41.80	59.30	25.20	17.60	23.20	33.30	25.70	394.90
2061	14.00	21.70	23.20	32.60	15.80	87.10	78.00	21.70	8.90	18.60	32.30	39.70	393.60
2062	11.20	33.80	19.00	53.10	35.50	51.20	47.50	17.60	3.10	69.10	28.40	16.70	386.20
2063	15.20	32.20	37.70	19.80	49.20	35.20	10.60	29.70	15.10	3.80	22.60	50.70	321.80
2064	30.10	19.10	22.20	46.80	24.30	79.30	14.50	14.50	15.80	21.60	22.70	37.50	348.40
2065	36.10	38.70	34.90	22.30	35.60	59.40	18.60	6.60	6.20	3.80	20.70	52.20	335.10
2066	12.10	15.90	24.70	23.80	108.70	95.50	68.70	12.80	5.90	45.80	47.50	36.30	497.70
2067	34.30	14.70	20.40	7.10	22.60	20.60	25.50	50.90	8.40	45.60	34.10	43.50	327.70
2068	23.40	45.80	25.10	13.40	41.10	43.40	8.30	6.30	11.70	28.90	45.60	37.50	330.50
2069	34.30	11.80	37.30	33.00	49.30	36.80	21.80	0.30	12.30	32.70	28.60	25.60	323.80
2070	28.20	10.60	27.20	27.60	27.20	54.00	15.90	24.80	12.90	18.10	44.00	23.60	314.10
2071	31.70	48.70	55.80	29.10	18.50	54.40	20.90	2.50	44.70	19.60	26.20	14.40	366.50
2072	26.30	30.20	26.90	66.10	62.70	37.20	55.10	15.00	11.40	20.60	33.40	37.50	422.40
2073	25.80	23.30	24.20	35.10	39.80	14.30	10.20	26.80	8.30	41.00	11.10	19.90	279.80
2074	22.60	30.90	70.80	42.30	42.60	92.60	18.70	20.50	2.30	13.70	30.80	15.20	403.00

2075	51.10	46.40	44.00	51.90	35.60	45.30	38.80	36.30	6.70	22.60	4.10	45.30	428.10
2076	22.30	16.10	23.20	22.00	26.60	67.00	9.80	14.40	13.90	15.40	31.20	58.00	319.90
2077	36.60	59.80	32.80	33.80	33.90	48.50	25.30	15.90	22.20	30.50	32.50	54.70	426.50
2078	0.70	66.50	32.80	52.70	39.30	81.80	24.40	23.10	9.70	28.00	14.30	13.40	386.70
2079	27.50	13.80	21.60	55.00	30.50	56.50	21.50	13.00	9.40	11.90	30.50	19.80	311.00
2080	11.60	34.20	54.70	52.50	55.80	33.20	30.70	24.50	20.10	52.80	19.20	14.20	403.50
2081	13.10	21.30	22.90	26.40	57.60	66.10	21.40	5.80	3.90	58.20	42.10	24.90	363.70
2082	26.60	2.50	9.10	36.60	64.10	43.60	36.60	32.20	16.90	16.50	34.30	27.60	346.60
2083	52.60	35.90	23.40	58.00	40.80	124.80	32.10	19.20	19.50	15.80	38.50	25.60	486.20
2084	27.30	15.60	15.20	71.70	40.20	82.50	22.40	25.50	27.20	34.80	20.10	15.50	398.00
2085	17.80	46.10	40.60	44.80	24.50	45.10	2.10	0.90	14.40	41.10	39.50	31.60	348.50
2086	30.10	46.30	32.60	41.40	23.40	60.10	49.10	7.30	13.60	44.20	38.90	39.20	426.20
2087	41.10	37.20	39.30	25.70	62.20	53.90	21.80	11.40	20.40	10.40	8.90	31.00	363.30
2088	32.30	21.30	20.80	51.80	35.40	86.80	19.70	0.70	3.80	20.80	15.10	32.20	340.70
2089	22.60	11.60	25.10	19.40	55.90	64.80	17.40	15.10	4.50	22.90	24.60	16.20	300.10
2090	43.70	15.40	31.60	35.50	34.50	85.80	16.60	12.20	6.30	43.90	26.80	25.60	377.90
2091	20.00	24.40	28.70	30.20	16.90	28.40	21.80	0.40	6.70	45.80	18.20	18.30	259.80
2092	23.70	20.30	32.60	40.00	55.70	52.00	47.90	8.90	12.50	13.00	46.50	53.30	406.40
2093	20.50	35.90	33.70	20.40	84.30	20.50	14.50	12.60	18.70	5.20	24.80	41.40	332.50
2094	40.40	16.00	38.50	94.60	34.70	88.30	20.80	9.40	15.80	25.30	22.50	5.90	412.20
2095	46.90	12.50	24.80	60.70	40.40	44.20	16.50	5.70	4.50	12.00	31.70	31.10	331.00
2096	43.80	25.70	16.10	25.20	46.20	73.10	4.10	14.20	0.50	44.50	23.80	46.90	364.10
2097	11.70	13.10	11.70	40.20	51.00	9.80	18.40	4.20	35.20	51.10	36.90	44.40	327.70
2098	19.40	10.60	38.50	63.60	21.70	50.60	20.20	9.40	13.10	12.90	23.90	34.80	318.70
2099	29.50	41.80	40.10	56.50	19.60	38.20	17.90	2.20	10.80	23.00	66.30	49.80	395.70
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	28.01	24.72	28.70	36.70	47.26	56.78	30.84	15.29	13.01	25.68	27.15	27.40	361.56
SD	12.04	13.54	12.33	16.14	22.04	25.10	18.45	10.84	8.05	15.93	12.18	12.93	60.10
Skew	0.11	0.75	0.97	0.86	0.97	0.61	0.93	1.11	1.21	1.16	0.81	0.77	0.56
Analysis of Trend in Mean (95% SL):													
Slope	-0.03	0.09	0.04	0.15	-0.14	0.01	-0.21	-0.02	0.01	0.05	0.07	0.17	0.19
KendSum	-213.	401.	353.	506.	-366.	23.	-702.	-174.	52.	176.	487.	778.	281.
KendTau	-0.06	0.10	0.09	0.13	-0.10	0.01	-0.18	-0.05	0.01	0.05	0.13	0.20	0.07
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	-0.76	1.44	1.27	1.82	-1.32	0.08	-2.53	-0.62	0.18	0.63	1.75	2.80	1.01
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.0705	2.9808	0.0028	3.9045	3.2728	0.2313	3.6861	0.2441	2.0399	0.2784	0.1655	4.9976	2.2344
Trend?	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	144.90	183.28	152.00	260.49	485.89	629.86	340.49	117.53	64.86	253.90	148.40	167.06	3611.82
Res Var	144.28	177.56	150.83	245.22	473.05	629.84	311.98	117.30	64.77	252.53	144.75	148.78	3587.04
Tnd Var	0.43	3.12	0.77	5.86	2.64	0.00	8.37	0.20	0.13	0.54	2.45	10.94	0.69

HCN Precipitation – Garrison

Analysis of Monthly Time-Series Data

Output File: c:\climate\CCSM4\GARR_HCN_Precip.txt
DSS File: c:\climate\ClimateChangeData.dss

/GARR-HCN/ALL/precip/01JAN2001 - 01JAN2099/1MON/CC
First Year: 2012
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	18.70	8.80	20.10	29.30	74.30	50.00	97.00	16.00	16.00	17.00	25.20	18.30	390.70
2013	17.20	16.50	11.20	20.00	31.70	57.90	67.70	20.70	30.40	68.90	21.10	10.20	373.50
2014	9.80	10.80	18.90	44.60	60.40	100.60	72.70	19.70	15.80	16.10	12.90	1.40	383.70
2015	18.40	11.10	11.40	6.20	16.00	45.20	47.40	10.10	9.90	17.40	11.90	13.40	218.40
2016	9.80	15.60	14.30	13.30	14.90	25.40	14.10	8.40	11.40	15.00	5.70	6.70	154.60
2017	15.90	14.30	6.90	20.00	11.80	63.40	31.80	21.00	4.50	8.20	3.70	14.20	215.70
2018	15.50	4.10	17.40	39.30	43.30	61.80	19.10	7.30	15.30	24.20	15.30	10.80	273.40
2019	13.80	14.40	19.80	17.80	69.90	51.40	25.20	5.70	5.30	20.40	9.40	10.40	263.50
2020	9.30	19.10	25.90	26.40	51.00	65.40	32.70	35.30	20.30	16.70	20.30	14.90	337.30
2021	17.60	11.20	18.30	20.10	54.10	19.90	30.30	20.80	15.50	18.30	10.30	17.30	253.70
2022	4.00	16.20	17.80	29.80	37.30	44.90	32.40	15.90	12.40	16.70	18.20	18.30	263.90
2023	13.70	8.60	9.70	33.40	30.10	84.40	40.50	18.50	14.50	15.00	2.30	13.80	284.50
2024	20.60	15.20	30.70	30.40	18.70	27.00	55.10	6.30	4.80	9.10	11.30	4.90	234.10
2025	12.00	6.10	5.40	20.00	58.60	73.40	27.90	15.90	13.30	32.50	7.10	10.20	282.40
2026	16.80	4.20	16.80	41.40	39.10	39.70	22.00	36.00	23.80	22.60	16.00	10.90	289.30
2027	12.60	9.60	30.60	60.30	53.70	57.40	57.70	23.60	13.60	10.60	21.70	9.80	361.20
2028	17.00	26.30	21.80	58.10	28.10	47.10	27.90	17.00	11.60	12.50	20.00	8.30	295.70
2029	10.70	10.60	11.20	23.70	60.00	60.00	27.80	22.10	8.30	33.40	18.00	2.30	288.10
2030	5.10	12.50	12.00	23.40	36.10	51.70	27.40	26.30	10.70	9.30	10.60	18.00	243.10
2031	17.70	5.20	4.10	33.30	69.10	98.10	55.60	11.10	4.60	16.70	8.70	12.20	336.40
2032	14.10	12.00	12.00	83.40	26.60	41.10	20.20	23.90	4.60	29.60	13.40	15.30	296.20
2033	6.70	18.90	27.80	24.50	63.90	61.10	19.00	13.00	12.00	20.80	11.30	11.00	290.00
2034	18.60	15.50	26.90	24.40	39.20	94.00	20.30	26.60	15.40	7.30	6.10	6.40	300.70
2035	19.60	16.90	9.50	22.10	47.40	40.80	24.90	11.70	9.70	9.50	17.60	5.60	235.30
2036	9.30	1.30	30.60	33.60	119.20	72.90	35.00	19.90	8.40	23.10	35.10	11.30	399.70
2037	19.00	10.20	13.80	19.60	68.10	57.60	26.20	25.30	5.70	12.60	16.10	17.90	292.10
2038	9.80	23.30	15.10	20.60	53.10	51.10	16.50	21.90	7.00	54.20	10.70	17.70	301.00
2039	8.10	5.70	6.70	32.80	66.80	31.20	40.30	31.60	12.70	12.90	11.80	10.50	271.10
2040	27.60	16.40	18.30	48.50	31.10	51.10	60.40	31.90	12.90	16.60	17.70	7.90	340.40
2041	20.60	17.00	14.20	41.90	44.50	50.10	52.60	8.60	8.90	8.60	14.50	10.80	292.30
2042	6.40	3.30	7.60	32.20	65.10	41.70	70.80	32.10	11.10	6.50	9.00	14.70	300.50
2043	14.50	11.10	48.10	31.40	63.00	75.60	21.70	8.90	35.90	20.00	11.30	10.70	352.20
2044	10.00	14.30	14.00	18.30	25.70	90.90	41.70	33.40	47.70	18.10	4.00	5.50	323.60
2045	5.40	25.60	21.60	13.90	42.60	59.40	57.00	20.50	2.90	30.30	17.00	16.90	313.10
2046	14.00	7.70	27.60	22.90	32.30	38.80	56.30	31.30	32.60	10.10	14.00	8.60	296.20
2047	4.00	9.60	18.50	17.60	39.10	46.40	56.70	5.20	2.50	5.90	14.70	7.80	228.00
2048	9.10	11.50	19.50	51.50	37.20	64.20	37.70	11.60	5.40	66.50	21.00	13.20	348.40

2049	3.90	20.00	18.60	33.80	33.70	71.60	49.60	15.10	10.40	13.10	5.50	12.30	287.60
2050	17.60	14.00	13.70	31.80	39.60	39.10	77.70	18.10	10.50	28.10	9.80	9.30	309.30
2051	8.90	26.10	34.30	12.30	43.10	52.60	20.20	27.60	7.40	9.80	4.90	29.00	276.20
2052	8.80	16.50	14.20	25.30	57.30	70.50	47.70	7.30	6.00	16.70	19.90	13.90	304.10
2053	15.60	9.90	38.10	43.50	100.30	17.70	19.40	11.30	38.30	9.20	14.00	9.70	327.00
2054	18.40	5.90	41.90	46.00	57.70	76.70	25.20	18.00	25.00	53.80	27.00	10.60	406.20
2055	15.40	10.60	23.50	18.30	51.90	19.70	24.10	17.50	10.40	6.70	10.70	5.30	214.10
2056	10.70	2.30	10.70	23.90	49.20	104.30	52.40	20.00	32.50	21.90	18.50	17.60	364.00
2057	23.00	35.00	14.90	19.70	51.70	43.70	62.20	38.40	12.30	13.10	13.40	14.40	341.80
2058	20.70	31.10	48.10	60.80	70.90	118.70	49.50	24.20	11.70	30.90	16.40	10.50	493.50
2059	6.70	9.50	17.60	19.70	37.20	78.10	25.10	6.10	11.50	1.10	32.50	27.10	272.20
2060	25.40	24.30	11.20	20.00	54.70	61.80	73.60	29.00	16.30	28.30	17.90	13.10	375.60
2061	13.30	13.20	11.90	31.90	18.20	77.60	67.10	22.20	11.90	14.00	18.70	20.20	320.20
2062	10.00	20.10	18.90	25.50	36.50	65.10	36.90	23.80	6.10	21.00	9.20	11.10	284.20
2063	8.80	19.40	16.60	16.70	43.70	52.30	16.30	32.10	11.70	3.00	9.40	23.40	253.40
2064	16.40	13.50	11.80	34.50	36.40	99.60	25.30	42.90	19.40	10.50	9.50	20.50	340.30
2065	14.20	18.60	20.30	26.00	32.90	43.20	30.60	7.20	11.50	16.70	13.60	16.20	251.00
2066	8.10	6.00	23.30	29.30	100.90	66.60	71.10	21.10	9.10	20.40	25.50	21.40	402.80
2067	19.30	12.40	14.90	9.30	22.30	33.40	21.00	30.50	11.10	28.50	15.10	20.90	238.70
2068	13.10	28.00	36.60	7.90	55.40	48.10	12.70	4.10	19.30	34.30	13.90	10.80	284.20
2069	20.90	5.90	31.70	24.60	56.10	51.40	23.30	0.50	6.00	13.70	20.30	9.80	264.20
2070	15.40	3.70	19.30	28.40	32.50	60.90	20.80	13.10	13.00	17.90	26.70	6.90	258.60
2071	12.90	26.90	46.40	25.90	35.40	55.50	34.60	13.80	42.20	13.60	24.90	11.20	343.30
2072	11.50	24.90	9.10	81.30	83.30	48.60	52.10	13.40	17.30	17.40	23.10	16.10	398.10
2073	14.60	9.20	10.80	18.30	26.30	20.00	16.90	24.70	3.60	28.90	9.70	6.50	189.50
2074	11.50	12.00	60.80	32.50	54.70	96.00	38.30	36.60	3.70	10.10	20.40	7.00	383.60
2075	29.00	14.80	31.30	42.00	23.30	42.20	42.10	30.10	11.10	20.30	3.80	21.90	311.90
2076	20.00	6.70	13.20	19.50	28.60	85.40	25.20	20.40	8.10	15.40	12.10	29.70	284.30
2077	18.80	21.70	16.80	38.00	45.30	64.60	32.00	30.90	18.00	28.10	11.00	28.20	353.40
2078	3.60	25.10	42.40	46.40	77.00	66.00	35.20	18.70	10.30	24.20	6.40	20.40	375.70
2079	10.10	15.10	12.90	34.30	54.20	62.70	16.60	11.80	12.00	6.40	11.10	14.30	261.50
2080	11.90	25.50	35.60	56.70	65.50	46.20	39.40	28.60	14.80	14.20	12.30	5.30	356.00
2081	7.50	8.90	28.90	19.00	46.70	51.50	18.30	9.60	3.90	31.70	25.40	14.10	265.50
2082	17.30	2.30	4.80	23.60	49.70	44.60	31.90	28.50	20.10	9.30	22.60	24.20	278.90
2083	19.80	30.70	16.10	39.70	72.50	103.20	42.40	24.40	11.10	10.00	19.50	16.00	405.40
2084	15.00	11.70	11.00	45.10	39.40	73.60	23.60	27.60	27.10	24.00	14.60	8.00	320.70
2085	14.50	23.90	24.80	32.60	56.90	62.20	7.90	3.60	11.80	39.90	23.50	20.20	321.80
2086	11.30	24.00	20.80	34.40	25.50	86.30	41.70	11.30	8.20	31.70	20.00	27.10	342.30
2087	20.60	19.10	40.00	14.90	53.20	36.10	31.80	20.10	22.30	5.30	5.00	11.00	279.40
2088	25.40	22.60	14.70	44.80	30.20	83.30	21.20	2.70	2.70	43.20	8.10	14.30	313.20
2089	10.50	10.30	24.70	11.60	75.50	60.10	31.00	16.40	7.40	11.10	10.60	8.80	278.00
2090	24.60	9.40	18.70	32.70	28.60	92.30	21.70	16.70	7.70	17.00	9.90	9.40	288.70
2091	12.00	11.60	34.90	29.60	26.40	27.70	18.90	1.80	10.70	26.70	19.30	10.40	230.00
2092	21.60	7.90	29.30	54.80	62.80	70.20	45.60	9.10	13.00	20.40	24.90	18.90	378.50
2093	12.00	11.70	27.90	17.00	92.10	21.90	28.60	14.70	7.30	3.20	14.80	23.50	274.70
2094	21.60	12.10	24.30	50.30	56.90	69.70	15.00	17.80	11.30	17.80	11.00	6.00	313.80
2095	26.40	11.70	19.40	48.50	37.70	50.10	32.90	12.90	3.00	7.70	18.40	10.80	279.50
2096	19.00	11.20	12.90	25.90	45.90	72.20	12.30	13.30	2.80	37.80	12.80	26.40	292.50
2097	8.70	18.30	7.90	28.30	48.90	23.40	23.70	6.20	23.40	73.00	12.30	20.30	294.40
2098	11.50	6.30	24.70	34.60	25.00	50.90	11.60	10.20	15.60	9.90	32.40	30.40	263.10
2099	14.10	26.30	22.60	52.30	34.30	43.70	15.00	4.90	9.00	19.40	44.60	21.90	308.10
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual

Basic Statistics:

Mean	14.37	14.42	20.86	31.29	47.81	58.59	35.56	18.48	13.28	20.27	15.36	14.03	304.31
SD	5.80	7.50	11.11	14.84	20.25	21.97	18.23	9.66	8.96	13.95	7.57	6.61	55.84
Skew	0.28	0.55	1.13	1.12	0.88	0.38	0.97	0.27	1.71	1.82	1.00	0.62	0.38

Analysis of Trend in Mean (95% SL):

Slope	0.04	0.05	0.10	0.07	0.04	0.04	-0.22	-0.05	-0.02	0.02	0.06	0.09	0.21
KendSum	353.	332.	557.	409.	59.	141.	-769.	-351.	-261.	114.	429.	751.	271.
KendTau	0.09	0.09	0.15	0.11	0.02	0.04	-0.20	-0.09	-0.07	0.03	0.11	0.20	0.07
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	1.27	1.19	2.00	1.47	0.21	0.50	-2.77	-1.26	-0.94	0.41	1.54	2.70	0.97
Trend?	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.5652	2.0618	2.2144	0.0475	0.3229	0.1711	7.3326	0.0888	0.1466	0.2198	3.4748	5.4621	1.0519
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	33.59	56.24	123.33	220.12	410.19	482.70	332.25	93.37	80.33	194.61	57.31	43.75	3117.91
Res Var	32.70	54.72	117.33	216.76	409.18	481.82	300.10	91.59	79.98	194.26	54.80	38.31	3089.77
Tnd Var	2.66	2.70	4.87	1.52	0.24	0.18	9.68	1.91	0.44	0.18	4.39	12.43	0.90

Computed Evapotranspiration – Fort Peck

Analysis of Monthly Time-Series Data

Output File: C:\Climate\ET\outFTPK_ET_CCSM4.txt
DSS File: C:\Climate\Month-Met.DSS

//Fort Peck/Evapotranspiration/01JAN2000 - 01JAN20
First Year: 2001
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.21	0.85	2.07	3.71	5.53	7.59	8.59	6.81	4.48	2.04	0.71	0.59	43.18
2002	0.43	0.85	1.17	2.88	4.10	5.53	7.78	6.64	3.90	1.88	0.59	0.41	36.16
2003	0.45	0.64	1.47	2.48	5.05	6.39	7.95	7.23	3.58	2.09	0.77	0.40	38.50
2004	0.67	1.13	2.00	2.92	4.85	5.97	7.30	6.92	4.32	2.26	1.05	0.42	39.81
2005	0.33	0.74	1.85	2.45	5.37	6.60	8.83	7.15	4.05	1.40	0.68	0.34	39.79
2006	0.35	0.62	0.81	2.82	4.99	6.61	7.75	7.32	4.29	1.91	0.74	0.49	38.70
2007	0.44	0.92	1.73	3.08	5.77	7.09	8.43	7.39	4.44	2.21	0.71	0.47	42.68
2008	0.41	0.75	1.79	2.78	4.69	5.75	6.94	6.42	4.16	1.85	0.94	0.48	36.96

2009	0.60	0.86	1.79	3.14	5.25	7.12	7.99	6.70	3.97	1.56	0.79	0.37	40.14
2010	0.36	0.45	1.57	2.49	4.15	5.51	7.98	7.09	3.46	1.81	0.75	0.46	36.08
2011	0.39	0.62	1.29	1.87	4.96	6.07	7.94	7.20	4.45	1.63	0.72	0.28	37.42
2012	0.66	1.03	1.54	2.99	5.03	6.57	7.03	7.42	4.23	1.84	0.79	0.23	39.36
2013	0.45	0.82	1.52	2.54	4.81	6.93	7.46	6.74	3.73	1.56	0.61	0.49	37.66
2014	0.68	1.13	2.15	2.71	4.86	5.78	7.59	7.10	4.19	1.69	0.63	0.55	39.06
2015	0.51	0.90	1.61	2.99	5.52	6.40	8.04	7.29	4.69	1.99	0.96	0.41	41.31
2016	0.30	0.78	1.96	2.73	5.08	7.18	8.63	6.96	3.92	1.78	0.74	0.50	40.56
2017	0.48	0.81	1.88	2.69	5.51	5.96	8.28	7.09	4.50	1.90	0.68	0.37	40.15
2018	0.37	0.17	1.23	2.60	5.07	6.65	8.64	7.39	4.06	1.79	0.66	0.39	39.02
2019	0.52	0.95	1.71	3.21	4.98	6.86	8.31	7.39	4.73	1.85	0.75	0.29	41.55
2020	0.25	0.59	1.46	3.23	5.01	6.68	8.03	6.97	4.27	1.79	0.64	0.47	39.39
2021	0.73	0.85	1.86	3.30	4.74	7.17	8.81	7.17	4.17	2.07	0.64	0.39	41.90
2022	0.43	0.79	1.28	2.61	4.91	6.46	8.45	7.16	4.75	1.79	0.66	0.45	39.74
2023	0.42	0.26	1.59	2.92	5.29	6.84	7.94	7.45	4.60	1.58	0.75	0.42	40.06
2024	0.57	0.83	1.65	2.90	5.40	7.14	8.46	7.29	4.77	2.08	0.73	0.35	42.17
2025	0.47	0.94	1.95	2.95	4.76	6.46	8.73	7.21	4.07	2.16	0.60	0.57	40.87
2026	0.58	0.98	1.95	3.29	5.12	6.25	8.22	6.91	4.03	1.64	0.80	0.46	40.23
2027	0.63	0.95	2.33	3.09	5.38	6.51	7.58	6.99	4.13	1.85	0.60	0.38	40.42
2028	0.59	0.97	1.66	2.47	5.48	7.12	8.34	7.42	4.61	2.06	0.79	0.46	41.97
2029	0.37	0.63	1.57	3.07	3.86	7.04	8.72	7.34	4.56	1.70	0.79	0.62	40.27
2030	0.59	0.81	1.73	3.26	6.02	6.37	8.10	6.32	4.32	2.16	0.92	0.53	41.13
2031	0.59	0.83	1.61	2.94	4.74	6.03	8.01	7.37	4.01	2.07	0.81	0.43	39.44
2032	0.59	0.97	1.75	2.92	5.21	7.11	8.88	7.58	4.11	1.66	0.60	0.35	41.73
2033	0.61	0.87	1.22	2.56	5.11	6.13	8.58	6.83	4.73	2.07	0.84	0.41	39.96
2034	0.26	0.81	1.41	2.37	4.92	6.41	8.29	7.35	4.29	2.16	0.84	0.40	39.51
2035	0.54	0.78	1.54	2.80	4.34	6.52	8.17	7.23	3.85	1.65	0.66	0.48	38.56
2036	0.49	1.01	1.86	3.01	4.00	6.83	8.48	7.54	4.18	1.81	0.62	0.40	40.23
2037	0.64	0.91	1.99	3.01	4.62	6.94	8.56	6.85	4.22	2.24	0.77	0.51	41.26
2038	0.66	0.76	1.74	3.11	5.09	6.33	9.08	7.75	4.49	2.14	0.53	0.47	42.15
2039	0.59	0.83	1.85	3.03	4.84	6.63	8.61	7.54	4.58	2.53	0.90	0.58	42.51
2040	0.64	1.06	2.11	2.62	5.23	6.64	7.84	7.45	4.07	2.02	0.82	0.33	40.83
2041	0.70	0.95	2.17	3.02	4.89	6.66	7.97	7.23	4.34	1.92	0.78	0.53	41.16
2042	0.74	0.98	1.87	3.24	4.24	6.53	7.93	7.07	4.44	2.37	0.96	0.41	40.78
2043	0.38	0.91	1.89	2.98	4.55	6.24	8.49	7.46	3.89	1.95	0.77	0.54	40.05
2044	0.53	0.75	1.64	2.82	5.35	6.41	8.05	6.57	4.15	2.02	0.98	0.52	39.79
2045	0.61	1.01	1.85	3.15	5.03	6.71	8.12	7.57	4.95	1.99	0.73	0.58	42.30
2046	0.50	0.93	1.65	2.86	4.95	7.01	7.90	7.43	4.69	2.10	0.86	0.52	41.40
2047	0.52	0.66	1.46	3.04	5.25	6.80	8.11	7.01	4.17	2.44	0.85	0.52	40.83
2048	0.52	1.09	1.66	3.24	5.33	6.96	8.54	7.57	4.50	1.90	0.75	0.54	42.60
2049	0.75	0.84	2.41	2.98	5.64	6.70	8.53	7.65	4.85	2.24	0.99	0.44	44.02
2050	0.35	0.74	1.30	2.79	4.57	6.69	7.80	6.69	4.87	1.77	0.88	0.32	38.77
2051	0.62	0.86	1.72	3.78	5.80	7.28	8.80	7.66	4.55	2.23	0.79	0.48	44.57
2052	0.49	0.64	1.62	2.97	4.85	6.32	8.34	7.54	4.90	2.39	0.77	0.26	41.09
2053	0.65	1.15	2.09	3.49	4.69	6.76	9.22	7.93	4.38	2.33	0.75	0.57	44.01
2054	0.64	1.03	1.88	2.86	4.80	6.74	8.75	7.27	4.33	1.67	0.75	0.39	41.11
2055	0.39	0.34	1.53	2.83	5.20	7.57	8.66	7.49	4.74	2.37	0.79	0.56	42.47
2056	0.48	1.38	2.28	3.62	5.10	5.78	7.78	7.33	4.32	2.34	0.73	0.45	41.59
2057	0.67	0.99	2.02	2.84	5.02	6.78	8.28	6.99	4.66	2.18	0.98	0.61	42.02
2058	0.56	1.00	2.04	2.82	4.74	5.81	8.14	7.44	4.58	1.97	0.86	0.53	40.49
2059	0.64	0.57	1.44	3.28	5.08	6.88	8.76	7.80	4.30	2.59	0.79	0.57	42.70
2060	0.43	1.10	1.51	3.36	5.20	6.80	8.28	7.60	4.34	1.98	0.83	0.55	41.98
2061	0.51	0.77	1.26	2.72	6.05	6.48	7.78	7.53	4.89	2.25	1.16	0.46	41.86
2062	0.54	0.99	2.02	3.33	5.13	7.08	8.54	7.58	4.73	1.96	0.81	0.43	43.14
2063	0.52	0.64	1.92	3.31	5.68	7.54	8.78	7.59	4.74	2.52	1.02	0.55	44.81

2064	0.51	0.98	1.98	3.39	5.92	6.66	8.76	7.73	4.77	2.39	0.93	0.38	44.40
2065	0.23	0.63	1.70	3.10	5.68	7.16	8.92	7.92	4.88	2.37	0.51	0.34	43.44
2066	0.12	0.52	0.83	3.05	4.85	6.58	8.17	7.63	4.40	2.15	0.81	0.46	39.57
2067	0.60	0.93	1.85	2.86	5.40	7.86	9.32	7.45	4.82	2.13	0.95	0.58	44.75
2068	0.62	1.12	1.43	3.30	5.56	7.12	9.26	7.97	4.76	2.26	0.82	0.60	44.82
2069	0.67	0.92	2.33	3.22	5.53	8.14	9.48	8.45	5.27	2.11	0.95	0.66	47.73
2070	0.67	1.25	1.82	3.27	5.48	7.29	9.20	7.78	4.59	2.25	0.94	0.60	45.14
2071	0.70	1.00	1.39	2.97	6.19	6.74	9.15	7.73	4.25	2.11	0.98	0.50	43.71
2072	0.46	0.65	1.45	2.97	5.28	7.03	8.32	7.85	4.66	2.02	0.95	0.49	42.13
2073	0.55	1.13	2.01	2.83	5.13	7.67	9.40	7.87	4.97	1.82	0.86	0.63	44.87
2074	0.59	1.10	2.03	2.83	4.60	6.50	8.85	7.34	4.94	2.10	0.86	0.61	42.35
2075	0.66	1.05	2.50	3.65	6.56	7.81	8.81	7.60	4.60	2.17	1.06	0.58	47.05
2076	0.67	1.05	2.08	3.30	5.75	6.71	9.33	7.74	4.40	2.41	0.89	0.55	44.88
2077	0.59	1.01	1.98	2.85	5.57	6.96	8.70	8.15	5.28	2.00	0.99	0.63	44.71
2078	0.75	0.86	1.68	2.99	5.26	6.74	8.84	7.87	4.86	2.22	1.05	0.44	43.56
2079	0.69	0.95	1.90	2.86	5.09	7.50	9.09	8.05	4.83	2.41	0.84	0.51	44.72
2080	0.32	1.03	2.07	2.91	5.02	6.98	9.01	7.30	4.83	2.09	1.09	0.63	43.28
2081	0.65	0.96	2.10	3.01	5.13	7.70	9.54	8.49	5.11	2.07	0.95	0.57	46.28
2082	0.71	1.29	2.27	3.81	6.07	7.82	9.18	7.47	4.58	2.39	0.87	0.51	46.97
2083	0.62	0.89	1.77	3.80	5.45	6.16	8.49	7.92	4.29	2.07	0.77	0.61	42.84
2084	0.47	1.17	2.05	3.64	5.44	7.30	9.19	7.55	4.96	2.09	0.91	0.39	45.16
2085	0.55	1.01	1.77	3.22	5.72	7.27	9.87	8.49	4.89	2.05	0.94	0.62	46.40
2086	0.63	1.15	2.04	3.53	5.60	7.29	9.00	8.01	5.43	2.11	0.72	0.36	45.87
2087	0.75	1.20	1.95	3.56	5.76	6.78	9.13	8.18	4.53	2.26	0.84	0.62	45.56
2088	0.64	1.03	2.06	3.84	5.82	7.33	9.29	8.12	5.33	2.52	1.06	0.46	47.50
2089	0.65	1.03	2.10	3.62	5.34	7.24	9.65	8.44	4.87	2.37	0.98	0.59	46.88
2090	0.57	1.01	1.86	3.27	6.02	7.17	8.76	8.35	5.40	2.22	0.94	0.20	45.77
2091	0.20	0.80	2.12	2.68	6.46	8.34	9.38	8.68	5.21	2.24	0.91	0.58	47.60
2092	0.73	1.45	1.96	2.82	5.46	7.34	9.35	7.93	4.96	2.44	1.03	0.53	46.00
2093	0.77	1.15	2.22	4.16	5.54	7.85	9.51	8.41	4.84	2.51	1.24	0.61	48.81
2094	0.52	1.48	2.54	3.50	5.83	7.47	9.31	8.41	4.58	2.27	0.90	0.45	47.26
2095	0.45	0.50	2.13	3.43	5.93	8.32	9.30	8.07	5.04	2.37	1.09	0.66	47.29
2096	0.73	1.20	2.28	4.00	5.51	7.46	9.77	7.86	5.70	2.42	0.98	0.56	48.47
2097	0.48	1.06	2.05	3.58	5.74	8.00	9.87	8.61	4.77	2.20	0.99	0.35	47.70
2098	0.45	0.94	2.22	3.45	6.32	7.41	9.81	8.28	4.92	2.73	0.95	0.53	48.01
2099	0.64	1.10	1.95	3.12	6.06	8.47	9.73	8.50	5.25	2.18	0.86	0.25	48.11
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.54	0.90	1.81	3.07	5.24	6.88	8.58	7.52	4.55	2.08	0.83	0.48	42.48
SD	0.14	0.23	0.33	0.38	0.52	0.61	0.64	0.51	0.42	0.27	0.14	0.10	3.02
Skew	-0.67	-0.46	-0.46	0.24	-0.04	0.23	-0.06	0.20	0.06	-0.18	0.14	-0.43	0.25
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.09
KendSum	1151.	1579.	1500.	1652.	1771.	2061.	2631.	2999.	2451.	1999.	2120.	1256.	3241.
KendTau	0.24	0.33	0.31	0.34	0.37	0.42	0.54	0.62	0.51	0.41	0.44	0.26	0.67
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	3.48	4.77	4.53	4.99	5.35	6.23	7.95	9.06	7.41	6.04	6.41	3.79	9.79
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend

Analysis of Trend in Variance (95% SL):

ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.3707	0.1119	0.9221	0.0779	0.9798	0.0393	3.1147	0.1370	0.0770	1.9420	0.1499	5.4203	1.8309
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend

Percentage of Overall Variance that is Resulting from Trend in Mean:

Q Var	0.02	0.05	0.11	0.15	0.27	0.37	0.41	0.26	0.18	0.07	0.02	0.01	9.13
Res Var	0.02	0.04	0.09	0.11	0.20	0.24	0.18	0.10	0.09	0.04	0.01	0.01	2.54
Tnd Var	8.97	17.85	18.12	27.51	27.14	35.56	55.24	61.85	48.82	36.14	34.24	10.45	72.22

Computed Evapotranspiration – Garrison

Analysis of Monthly Time-Series Data

Output File: C:\Climate\ET\outGARR_ET_CCSM4.txt
DSS File: C:\Climate\Month-Met.DSS

//Garrison/Evapotranspiration/01JAN2000 - 01JAN209
First Year: 2001
Last Year: 2099

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2001	0.12	0.76	2.16	3.94	5.72	7.81	8.70	6.67	4.60	2.23	0.79	0.62	44.12
2002	0.42	0.86	1.10	3.24	4.51	5.59	7.73	6.41	3.89	2.01	0.61	0.41	36.78
2003	0.47	0.69	1.67	2.93	5.33	6.57	8.00	7.13	4.00	2.20	0.81	0.44	40.24
2004	0.68	1.21	2.05	3.09	5.01	6.23	7.32	6.88	4.37	2.40	1.14	0.46	40.84
2005	0.31	0.71	1.93	2.78	5.49	6.58	8.60	7.00	4.07	1.49	0.71	0.32	39.99
2006	0.31	0.63	0.79	3.28	5.40	6.76	7.52	7.12	4.33	1.98	0.83	0.50	39.45
2007	0.42	0.88	1.97	3.32	5.75	7.17	8.26	7.45	4.29	2.31	0.76	0.47	43.05
2008	0.33	0.70	1.78	3.07	4.88	6.01	6.97	6.39	4.17	1.94	1.04	0.52	37.80
2009	0.57	0.87	1.85	3.40	5.62	7.46	8.07	6.84	4.40	1.81	0.90	0.37	42.16
2010	0.35	0.42	1.80	2.93	4.74	5.75	8.10	6.98	3.53	1.97	0.74	0.51	37.82
2011	0.40	0.64	1.36	2.14	5.23	6.27	7.98	7.20	4.54	1.87	0.80	0.28	38.71
2012	0.66	1.08	1.79	3.04	5.30	6.62	7.11	7.37	4.32	1.93	0.88	0.21	40.31
2013	0.41	0.72	1.64	2.98	4.89	7.07	7.61	6.81	3.92	1.69	0.67	0.53	38.94
2014	0.73	1.23	2.32	2.88	5.01	6.07	7.42	6.87	4.19	1.88	0.72	0.63	39.95
2015	0.52	1.01	1.74	3.27	5.82	6.72	8.23	7.24	4.59	2.08	1.01	0.46	42.69
2016	0.28	0.79	2.10	2.86	5.44	7.38	8.85	7.23	4.08	1.82	0.77	0.54	42.14
2017	0.43	0.73	2.02	2.94	5.95	6.36	8.16	7.03	4.57	1.92	0.80	0.42	41.33
2018	0.38	0.13	1.36	2.87	5.38	6.60	8.75	7.53	4.21	1.80	0.69	0.41	40.11
2019	0.50	0.98	1.86	3.21	5.04	6.84	8.39	7.54	4.81	2.10	0.85	0.30	42.42
2020	0.19	0.47	1.44	3.56	5.16	6.62	8.05	6.79	4.45	1.92	0.64	0.46	39.75
2021	0.76	0.80	1.92	3.62	5.12	7.43	8.83	7.20	4.32	2.12	0.70	0.37	43.19
2022	0.41	0.74	1.32	2.80	5.30	6.60	8.39	7.19	4.71	1.98	0.76	0.45	40.65
2023	0.36	0.25	1.58	3.07	5.57	6.87	7.87	7.45	4.73	1.89	0.86	0.37	40.87

2024	0.55	0.86	1.71	3.38	5.41	7.52	8.30	7.44	4.86	2.26	0.83	0.40	43.52
2025	0.39	1.03	1.97	3.23	5.10	6.80	8.65	7.14	4.28	2.28	0.65	0.62	42.14
2026	0.58	0.97	2.13	3.41	5.34	6.39	8.57	6.99	4.14	1.75	0.85	0.43	41.55
2027	0.64	0.97	2.36	3.23	5.46	6.58	7.68	6.90	4.24	1.94	0.67	0.36	41.03
2028	0.62	0.98	1.80	2.73	5.53	7.23	8.43	7.30	4.63	2.22	0.89	0.49	42.85
2029	0.38	0.69	1.79	3.53	4.29	6.85	8.51	7.30	4.67	1.73	0.79	0.60	41.13
2030	0.57	0.78	1.73	3.50	6.13	6.78	8.21	6.54	4.51	2.35	0.96	0.57	42.63
2031	0.62	0.81	1.66	3.09	5.09	6.03	7.90	7.42	4.28	2.05	0.83	0.43	40.21
2032	0.58	1.08	1.95	3.07	5.37	7.29	8.75	7.40	4.27	1.77	0.65	0.32	42.50
2033	0.60	0.86	1.31	2.80	5.23	6.15	8.54	6.98	4.90	2.26	0.94	0.45	41.02
2034	0.22	0.81	1.39	2.67	5.24	6.30	8.00	7.25	4.30	2.30	0.90	0.41	39.79
2035	0.54	0.65	1.64	2.88	4.75	6.68	8.16	7.32	4.18	1.84	0.70	0.50	39.84
2036	0.47	1.03	2.03	3.38	4.30	6.83	8.41	7.59	4.33	1.98	0.66	0.41	41.42
2037	0.64	0.94	2.09	3.37	4.84	6.99	8.59	7.03	4.53	2.32	0.78	0.47	42.59
2038	0.68	0.78	1.88	3.15	5.46	6.46	9.11	7.65	4.57	2.22	0.55	0.46	42.97
2039	0.61	0.73	1.85	3.45	5.05	6.97	8.54	7.39	4.71	2.49	0.94	0.64	43.37
2040	0.65	1.14	2.16	2.91	5.38	6.80	7.86	7.32	4.30	2.11	0.86	0.30	41.79
2041	0.73	0.96	2.24	3.24	5.20	6.79	7.94	7.53	4.51	2.14	0.88	0.59	42.75
2042	0.77	1.06	2.03	3.58	4.66	6.49	7.74	6.87	4.59	2.40	1.01	0.40	41.60
2043	0.34	0.95	2.06	3.15	4.80	6.47	8.57	7.82	4.14	1.99	0.84	0.59	41.72
2044	0.51	0.71	1.68	3.08	5.50	6.65	8.20	6.56	4.24	2.21	1.01	0.56	40.91
2045	0.61	0.99	1.81	3.41	5.20	6.67	8.05	7.43	5.00	2.16	0.75	0.64	42.72
2046	0.50	0.95	1.84	3.20	5.56	7.29	7.84	7.34	4.68	2.15	0.88	0.53	42.76
2047	0.53	0.69	1.53	3.20	5.46	6.80	8.23	7.03	4.45	2.48	0.92	0.55	41.87
2048	0.51	1.14	1.70	3.55	5.66	7.09	8.73	7.83	4.68	2.06	0.78	0.56	44.29
2049	0.75	0.85	2.43	3.21	5.92	6.85	8.34	7.65	4.83	2.39	1.06	0.44	44.72
2050	0.32	0.76	1.41	3.12	5.00	6.97	7.55	6.80	4.84	2.02	1.03	0.36	40.18
2051	0.62	0.91	1.68	3.84	5.92	7.45	8.96	7.49	4.62	2.33	0.90	0.52	45.24
2052	0.51	0.59	1.74	2.99	5.01	6.49	8.20	7.58	5.03	2.43	0.78	0.22	41.57
2053	0.70	1.21	2.10	3.58	4.99	7.14	9.52	7.98	4.28	2.32	0.79	0.63	45.24
2054	0.71	1.02	2.04	3.24	5.18	7.02	8.96	7.37	4.40	1.66	0.79	0.39	42.78
2055	0.36	0.31	1.69	3.16	5.59	7.85	8.80	7.55	4.70	2.33	0.85	0.59	43.78
2056	0.45	1.44	2.42	3.83	5.40	6.06	8.14	7.33	4.22	2.32	0.67	0.45	42.73
2057	0.70	0.97	2.23	3.16	5.31	7.12	8.15	7.05	4.73	2.29	0.99	0.63	43.33
2058	0.53	1.06	2.16	3.03	5.15	5.99	7.95	7.34	4.58	2.00	0.90	0.53	41.22
2059	0.67	0.60	1.59	3.60	5.32	7.08	8.81	7.54	4.44	2.55	0.75	0.61	43.56
2060	0.42	1.15	1.45	3.65	5.37	6.86	8.13	7.75	4.42	1.93	0.88	0.53	42.54
2061	0.47	0.83	1.26	2.88	6.16	6.70	7.94	7.49	4.91	2.26	1.21	0.45	42.56
2062	0.57	1.04	2.08	3.63	5.37	7.25	8.68	7.74	4.72	2.08	0.90	0.39	44.45
2063	0.50	0.58	2.19	3.72	6.07	7.69	8.83	7.67	4.89	2.55	1.07	0.54	46.30
2064	0.46	0.96	1.93	3.67	6.03	6.73	8.68	7.59	4.64	2.49	1.00	0.34	44.52
2065	0.22	0.68	1.94	3.46	6.02	7.42	8.91	7.94	4.92	2.25	0.48	0.35	44.59
2066	0.08	0.48	0.87	3.36	5.35	6.79	8.34	7.58	4.50	2.19	0.80	0.47	40.81
2067	0.64	0.95	1.86	3.21	5.83	8.04	9.46	7.59	4.84	2.12	0.97	0.62	46.13
2068	0.62	1.16	1.29	3.65	5.74	7.25	9.37	8.27	4.53	2.23	0.87	0.67	45.65
2069	0.67	0.84	2.46	3.46	5.82	7.97	9.46	8.50	5.32	2.37	0.98	0.73	48.58
2070	0.68	1.31	1.77	3.62	5.75	7.30	9.28	7.97	4.58	2.23	0.96	0.61	46.06
2071	0.70	0.98	1.40	3.31	6.40	6.97	9.19	7.77	4.19	2.20	1.00	0.45	44.56
2072	0.44	0.61	1.57	3.26	5.58	7.17	8.35	7.87	4.65	2.04	1.00	0.48	43.02
2073	0.54	1.17	2.12	3.11	5.53	8.00	9.48	7.87	5.12	2.01	0.89	0.70	46.54
2074	0.57	1.26	2.17	3.09	5.02	6.81	8.75	7.41	4.91	2.11	0.89	0.61	43.60
2075	0.65	1.01	2.67	3.71	6.84	8.07	9.01	7.61	4.50	2.21	1.08	0.57	47.93
2076	0.67	1.04	2.28	3.58	6.10	6.82	9.37	7.78	4.64	2.47	0.96	0.56	46.27
2077	0.59	1.08	2.23	3.13	5.89	7.04	8.94	8.08	5.15	2.00	1.09	0.64	45.86
2078	0.71	0.90	1.71	3.26	5.32	7.05	9.08	8.01	4.81	2.30	1.08	0.40	44.63

2079	0.75	0.98	1.89	3.29	5.27	7.70	9.31	8.15	4.83	2.43	0.92	0.51	46.03
2080	0.28	1.14	2.27	3.20	5.16	7.22	9.08	7.21	4.94	2.40	1.16	0.66	44.72
2081	0.68	1.01	2.24	3.45	5.58	8.10	9.80	8.37	4.95	2.07	1.05	0.59	47.89
2082	0.71	1.28	2.22	4.17	6.36	7.97	9.33	7.32	4.53	2.47	0.86	0.44	47.66
2083	0.68	0.92	1.88	4.19	5.51	6.47	8.42	7.78	4.32	2.23	0.82	0.67	43.89
2084	0.47	1.14	1.97	3.88	5.80	7.47	9.44	7.70	5.01	2.09	0.90	0.36	46.23
2085	0.56	1.09	1.82	3.60	5.83	7.46	10.19	8.43	4.84	2.05	1.01	0.66	47.54
2086	0.60	1.12	2.19	3.75	6.08	7.40	9.03	8.11	5.56	2.06	0.67	0.29	46.86
2087	0.79	1.25	1.99	3.86	5.99	7.07	9.43	8.04	4.49	2.31	0.83	0.67	46.72
2088	0.62	1.05	2.04	4.16	6.11	7.50	9.51	8.26	5.35	2.55	1.08	0.47	48.70
2089	0.68	1.03	2.20	3.93	5.48	7.39	9.55	8.33	4.98	2.51	1.12	0.62	47.82
2090	0.60	1.02	2.11	3.41	6.25	7.28	8.93	8.52	5.31	2.32	1.02	0.17	46.94
2091	0.18	0.82	2.16	2.81	6.74	8.40	9.68	8.72	5.03	2.32	0.89	0.62	48.37
2092	0.75	1.52	2.07	2.93	5.71	7.33	9.32	7.60	4.92	2.37	1.08	0.48	46.08
2093	0.85	1.16	2.21	4.43	5.69	7.83	9.55	8.29	5.03	2.58	1.29	0.61	49.52
2094	0.54	1.44	2.59	3.87	6.37	7.85	9.58	8.45	4.78	2.37	0.90	0.37	49.11
2095	0.39	0.42	2.16	3.66	6.13	8.46	9.11	8.05	5.23	2.43	1.14	0.73	47.91
2096	0.79	1.29	2.32	4.35	6.08	7.68	9.81	7.84	5.70	2.35	1.03	0.58	49.82
2097	0.48	1.07	2.16	3.90	5.81	8.21	9.67	8.57	4.75	2.17	1.05	0.29	48.13
2098	0.42	0.94	2.21	3.73	6.53	7.40	10.05	8.23	5.02	2.72	0.95	0.50	48.70
2099	0.68	1.24	2.01	3.28	6.52	8.61	10.09	8.56	5.31	2.23	0.89	0.20	49.62
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Basic Statistics:													
Mean	0.53	0.91	1.89	3.34	5.51	7.04	8.63	7.52	4.61	2.17	0.88	0.49	43.53
SD	0.16	0.26	0.35	0.39	0.50	0.61	0.70	0.52	0.38	0.24	0.15	0.13	3.02
Skew	-0.56	-0.43	-0.63	0.30	0.20	0.24	0.06	0.20	0.21	-0.29	0.02	-0.30	0.24
Analysis of Trend in Mean (95% SL):													
Slope	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.09
KendSum	1156.	1494.	1290.	1750.	1859.	2140.	2636.	2962.	2341.	1694.	1745.	799.	3194.
KendTau	0.24	0.31	0.27	0.36	0.38	0.44	0.54	0.61	0.48	0.35	0.36	0.16	0.66
INormValI	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96	1.96
kendZ	3.49	4.51	3.90	5.29	5.62	6.47	7.97	8.95	7.07	5.12	5.27	2.41	9.65
Trend?	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend	Trend
Analysis of Trend in Variance (95% SL):													
ChiVal	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410	3.8410
BP RSS	0.2668	0.0113	1.0692	1.1005	0.0216	0.3181	1.3461	0.6948	0.5069	1.7190	0.0161	7.4774	1.6440
Trend?	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	Trend	No Trend
Percentage of Overall Variance that is Resulting from Trend in Mean:													
Q Var	0.03	0.07	0.12	0.16	0.25	0.37	0.48	0.27	0.14	0.06	0.02	0.02	9.11
Res Var	0.02	0.05	0.11	0.11	0.17	0.24	0.21	0.10	0.08	0.04	0.02	0.01	2.54
Tnd Var	9.97	17.53	14.05	27.66	31.88	36.82	56.69	62.30	45.98	27.41	23.29	4.19	72.13

Appendix G – Projected Trend Analysis

Runoff Analysis

Fort Peck – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variances of May-July Data:
 (Using Output from R)


Infile=  f-ro-ccsm3.out
Outfile= f-ro-ccsm3-out


    2012   2194.0100
    2013   3557.6179
    2014    942.4330
    2015   3359.8860
    2016   1321.1320
    2017   1896.7927
    2018   2291.8911
    2019   2405.2888
    2020   1806.6150
    2021   4428.4634
    2022   2879.7012
    2023   3791.7744
    2024   3592.8989
    2025   2277.2913
    2026   2920.3674
    2027   4098.0215
    2028   3471.9019
    2029   3615.5110
    2030   4564.5093
    2031   2230.9578
    2032   3125.1248
    2033   2680.1672
    2034   2971.6592
    2035   1559.1227
    2036   5356.0981
    2037   1921.0837
    2038   2460.2593
    2039   3343.2444
    2040   2287.3557
    2041   2276.4124
    2042   2411.2688
    2043   1618.1097
    2044   3493.2170
    2045   2636.0164
    2046   2690.2097
    2047   1725.7812
    2048   1405.6606
    2049   3663.5022
    2050   1182.2561
    2051   1573.8357
    2052   1708.5359
    2053   2555.0269
    2054   2376.5342
    2055   3669.9807
    2056   3246.0623
    2057   1706.6873
    2058   1662.1373
    2059    850.3916
    2060   3213.0715
    2061   1939.4290
    2062   2001.0322
    2063   3532.9561
    2064   2686.7158
    2065   3077.4751
```

```
    2066   2573.6699
    2067   1512.8307
    2068   1774.9968
    2069   1300.2556
    2070   2791.1858
    2071   2583.3215
    2072   4742.8110
    2073   3083.9429
    2074   2188.5803
    2075   1152.8756
    2076   1895.4410
    2077   2326.2051
    2078   3932.1909
    2079   2579.0312
    2080   1596.4679
    2081   2652.1177
    2082    615.6729
    2083   1894.9462
    2084   1496.2430
    2085   1272.5792
    2086   1870.7744
    2087   1839.8491
    2088   2423.6167
    2089    957.2651
    2090   1925.2050
    2091    494.0183
    2092    664.3944
    2093   1127.3682
    2094    815.8939
    2095    691.5275
    2096   1492.1970
    2097   1792.5933
    2098   3323.8069
    2099   1488.9735


Basic Statistics:
Mean=      2353.7087
Variance= **********
Skew=         0.4836



Linear Regression:
slope=      -16.0582
intercept=35361.4297



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.2837
Kendall Z test statistic=   -3.9104
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       3.91 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        1.7756
test statistic (rss/2)=      0.8878
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.89)
```

Runoff Analysis

Fort Peck – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variances of May-July Data:
  (Using Output from R)



 Infile=  f-ro-ccsm4.out
 Outfile= f-ro-ccsm4-out


     2012   4992.0493
     2013   4630.4321
     2014   6701.7749
     2015   1782.4286
     2016   1857.3062
     2017   3005.0879
     2018   4152.3979
     2019   2341.7529
     2020   3427.4282
     2021   2758.6208
     2022   3140.3562
     2023   2848.6887
     2024   2299.8638
     2025   3128.1487
     2026   1983.0397
     2027   2090.0850
     2028   2563.9963
     2029   3607.6841
     2030   1714.3043
     2031   3540.3608
     2032   1711.1913
     2033   3348.0471
     2034   4990.1201
     2035   3536.4792
     2036   3796.5642
     2037   3807.7993
     2038   3005.7751
     2039   3476.6296
     2040   2381.2808
     2041   2673.9822
     2042   2326.5820
     2043   5166.5459
     2044   3911.3159
     2045   1799.0884
     2046   2615.1479
     2047   2093.1047
     2048   2844.5583
     2049   2790.5740
     2050   3248.0471
     2051   1733.5243
     2052   3108.8523
     2053   3388.9978
     2054   4921.8096
     2055   2714.9929
     2056   2016.7864
     2057   2480.9580
     2058   5451.7803
     2059   2010.6324
     2060   3650.0251
     2061   2523.0845
     2062   2006.2745
     2063   2515.3647
     2064   1689.7726
     2065   3110.6025
     2066   5160.2822
     2067   1366.2325
     2068   2208.8616
     2069   1753.4790
```

```
    2070   1653.8691
    2071   2592.0664
    2072   2624.0623
    2073   2009.7897
    2074   4662.9287
    2075   1183.8243
    2076   2032.2906
    2077   3633.8235
    2078   4111.4941
    2079   2652.6804
    2080   2707.7317
    2081   2481.1614
    2082    836.1456
    2083   4080.1445
    2084   2293.9797
    2085   1928.1254
    2086   2132.3682
    2087   3321.5325
    2088   1652.6138
    2089   1701.4011
    2090   2666.7219
    2091   1537.6550
    2092   2398.7017
    2093   1131.6149
    2094   1663.5444
    2095   1924.6862
    2096   1857.4368
    2097   1356.1061
    2098   2218.9277
    2099   1375.3129


Basic Statistics:
Mean=      2776.4055
Variance= **********
Skew=         0.9990




Linear Regression:
slope=      -17.0008
intercept=37721.5898




Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.2868
Kendall Z test statistic=   -3.9537
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       3.95 > 1.96 )




Breausch-Pagan test for Trend in Variances:

rss =                       6.7387
test statistic (rss/2)=     3.3694
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       3.37)
```

Runoff Analysis

Garrison – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variances of May-July Data:
  (Using Output from R)



 Infile=  g-ro-ccsm3.out
 Outfile= g-ro-ccsm3-out


     2012   3194.7922
     2013   3872.1863
     2014   1960.2185
     2015   3926.5469
     2016   3055.6687
     2017   2754.4380
     2018   2222.5391
     2019   2428.1494
     2020   2240.9949
     2021   3903.0071
     2022   3498.5315
     2023   4168.4805
     2024   5242.4517
     2025   4758.6655
     2026   3186.2993
     2027   7436.0806
     2028   5641.5400
     2029   3851.0603
     2030   6626.4219
     2031   3036.6716
     2032   4598.9746
     2033   2522.4404
     2034   2677.3350
     2035   3242.1899
     2036   4495.7817
     2037   2870.3127
     2038   3959.6106
     2039   5144.4546
     2040   3363.2849
     2041   2060.9094
     2042   3097.8091
     2043   1822.7637
     2044   4598.8037
     2045   3606.7507
     2046   3096.2400
     2047   3312.7214
     2048   2513.8591
     2049   3975.7617
     2050   1596.6786
     2051   3256.3972
     2052   3766.8867
     2053   2162.0200
     2054   3662.3193
     2055   6255.6401
     2056   5344.9907
     2057   3816.5850
     2058   3653.7900
     2059   1465.4836
     2060   5037.1807
     2061   2197.6460
     2062   3525.1089
     2063   4648.6987
     2064   4102.6714
     2065   3276.1250
     2066   2859.8179
     2067   1924.4971
     2068   2656.6992
     2069   1394.9293
```

```
    2070   4309.9883
    2071   3341.7363
    2072   6599.2319
    2073   4599.5771
    2074   4826.4380
    2075   1998.5923
    2076    910.7770
    2077   1985.4521
    2078   5989.9775
    2079   3582.0769
    2080   2181.7556
    2081   3264.7830
    2082   1453.8359
    2083   2084.1707
    2084   3819.5918
    2085   2662.9106
    2086   2142.2095
    2087   4439.4023
    2088   2237.2188
    2089   1435.8629
    2090   2290.4216
    2091    977.2180
    2092    841.7713
    2093   1748.5945
    2094   1635.6002
    2095   1676.5839
    2096   2312.9490
    2097   2612.1372
    2098   4103.7974
    2099   2215.6323


Basic Statistics:
Mean=      3282.3772
Variance= **********
Skew=         0.6466



Linear Regression of Data:
slope=      -16.6514
intercept=37509.2383



Linear Regression of Residuals:
slope=        0.0001
intercept=    0.7698



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.2074
Kendall Z test statistic=   -2.8580
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       2.86 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       0.0774
test statistic (rss/2)=     0.0387
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.04)
```

Runoff Analysis

Garrison – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variances of May-July Data:
  (Using Output from R)


 Infile=  g-ro-ccsm4.out
 Outfile= g-ro-ccsm4-out


     2002   8663.7490
     2003   5397.8018
     2004   4176.6792
     2005   4020.3193
     2006   3327.6787
     2007   2650.6528
     2008   6389.5991
     2009   1802.5527
     2010   4768.5312
     2011   4426.1230
     2012   6296.9380
     2013   5732.0698
     2014  10293.4307
     2015   3358.6814
     2016   2377.0674
     2017   4447.5845
     2018   4749.6392
     2019   4780.9893
     2020   5852.8921
     2021   3877.8391
     2022   5091.4277
     2023   4170.5830
     2024   2250.1619
     2025   3557.9609
     2026   3438.9053
     2027   4758.8789
     2028   3022.6880
     2029   4922.9854
     2030   2917.2446
     2031   6199.4468
     2032   2758.4358
     2033   5322.1030
     2034   8082.7939
     2035   4632.8027
     2036   4923.5942
     2037   5345.6187
     2038   4734.7500
     2039   5015.0220
     2040   4293.4121
     2041   4736.4883
     2042   3901.2866
     2043   7463.1274
     2044   5692.1836
     2045   3792.8948
     2046   4173.0522
     2047   2959.8069
     2048   3706.3381
     2049   5878.0957
     2050   3879.4885
     2051   3320.6091
     2052   4503.5435
     2053   6875.5703
     2054   5373.7676
     2055   4465.5693
     2056   3502.4617
     2057   3622.4084
     2058   6914.7065
     2059   2789.3264
     2060   4425.6768
     2061   4603.2007
```

```
    2062   3620.5566
    2063   2962.8870
    2064   3549.2827
    2065   3277.4036
    2066   5727.0513
    2067   2663.0913
    2068   3651.3425
    2069   3291.4539
    2070   2650.2864
    2071   3984.4177
    2072   5015.8174
    2073   2525.5723
    2074   6582.7515
    2075   2431.1526
    2076   4314.0410
    2077   6177.3413
    2078   6023.0063
    2079   4967.2817
    2080   5221.2197
    2081   2541.6792
    2082   1341.7683
    2083   5196.4751
    2084   3323.7861
    2085   3758.2456
    2086   4333.8716
    2087   4359.2471
    2088   3443.0950
    2089   3786.5906
    2090   2730.1245
    2091   1980.0189
    2092   3519.9612
    2093   3766.7681
    2094   2581.5715
    2095   3773.8625
    2096   2185.1287
    2097   2687.6211
    2098   3547.8938
    2099   3937.6216


Basic Statistics:
Mean=      4294.2915
Variance= **********
Skew=         1.0436


Linear Regression of Data:
slope=      -15.8421
intercept=36778.5898


Linear Regression of Residuals:
slope=        0.0009
intercept=   -2.8979


Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.2022
Kendall Z test statistic=   -2.9465
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       2.95 > 1.96 )


Breausch-Pagan test for Trend in Variances:

rss =                      16.2166
test statistic (rss/2)=     8.1083
Trend in Variance ?           Trend

Trend in Variance at 95% Significance Level
(       8.11 > 3.841 )
```

Day Snowpack Accumulation Begins Analysis

Fort Peck – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  f-dba-ccsm3.out
 Outfile= f-dba-ccsm3-out


     2012    271.1581
     2013    278.7245
     2014    274.7351
     2015    266.8039
     2016    262.8835
     2017    269.2185
     2018    267.3785
     2019    266.1118
     2020    268.6685
     2021    259.8579
     2022    270.4133
     2023    277.4050
     2024    279.6119
     2025    266.3227
     2026    240.2429
     2027    260.0788
     2028    270.4993
     2029    274.6996
     2030    278.0637
     2031    289.0143
     2032    267.5392
     2033    269.4884
     2034    263.6395
     2035    289.2825
     2036    258.5629
     2037    278.2130
     2038    272.7116
     2039    272.2945
     2040    287.3859
     2041    266.6999
     2042    275.5839
     2043    269.2545
     2044    270.8214
     2045    272.5207
     2046    279.4290
     2047    283.5370
     2048    267.8436
     2049    285.5393
     2050    288.0336
     2051    278.3628
     2052    286.2941
     2053    288.8572
     2054    282.2349
     2055    301.5234
     2056    304.8769
     2057    284.8187
     2058    255.7571
     2059    263.2049
     2060    277.4800
     2061    268.4414
     2062    285.6890
     2063    282.0200
     2064    285.8375
     2065    282.9739
     2066    269.2391
     2067    261.3849
     2068    261.3795
     2069    295.1853
     2070    301.6929
```

```
    2071    288.8424
    2072    301.8332
    2073    290.0210
    2074    283.1286
    2075    276.9913
    2076    258.9665
    2077    278.8329
    2078    281.5812
    2079    252.8787
    2080    293.2437
    2081    272.5574
    2082    290.2158
    2083    278.0384
    2084    290.3692
    2085    291.8253
    2086    277.3929
    2087    297.9811
    2088    283.7517
    2089    311.6630
    2090    270.4756
    2091    295.2234
    2092    301.6899
    2093    305.8263
    2094    298.7500
    2095    309.0018
    2096    277.3742
    2097    288.5190
    2098    308.1355
    2099    310.9562


Basic Statistics:
Mean=       279.4727
Variance=   207.7941
Skew=         0.2087



Linear Regression of Data:
slope=        0.3132
intercept= -364.2411



Linear Regression of Residuals:
slope=        0.0408
intercept=  -10.3890



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                 0.3913
Kendall Z test statistic=    5.3953
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       5.40 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       9.2482
test statistic (rss/2)=     4.6241
Trend in Variance ?           Trend

Trend in Variance at 95% Significance Level
(       4.62 > 3.841 )
```

Day Snowpack Accumulation Begins Analysis

Fort Peck – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
 (Using Output from R)


Infile=  f-dba-ccsm4.out
Outfile= f-dba-ccsm4.trend


    2012    282.2823
    2013    274.1379
    2014    299.0107
    2015    265.3413
    2016    252.5999
    2017    269.6120
    2018    234.2676
    2019    270.0689
    2020    263.2363
    2021    292.9645
    2022    253.3590
    2023    247.3314
    2024    278.8308
    2025    267.4270
    2026    261.7631
    2027    281.2209
    2028    266.9295
    2029    268.3969
    2030    254.6476
    2031    260.7833
    2032    272.3392
    2033    267.7917
    2034    265.0353
    2035    275.4867
    2036    265.4646
    2037    285.4228
    2038    275.9927
    2039    263.2203
    2040    279.2961
    2041    282.2731
    2042    271.8090
    2043    270.7392
    2044    259.1861
    2045    270.1039
    2046    266.5723
    2047    250.5610
    2048    263.6117
    2049    296.5018
    2050    254.1217
    2051    275.5287
    2052    265.2912
    2053    295.8990
    2054    280.2668
    2055    262.6119
    2056    284.0359
    2057    276.0324
    2058    281.3239
    2059    262.8547
    2060    283.2070
    2061    261.3767
    2062    265.7161
    2063    281.9630
    2064    277.2393
    2065    263.6305
    2066    242.6463
    2067    289.8046
    2068    278.4290
    2069    299.6280
```

```
    2070    288.2494
    2071    289.1569
    2072    251.4824
    2073    284.5624
    2074    288.9477
    2075    296.2458
    2076    280.4297
    2077    300.3692
    2078    297.1124
    2079    275.6253
    2080    268.8257
    2081    279.5151
    2082    295.1735
    2083    281.4695
    2084    284.9273
    2085    275.6491
    2086    305.4384
    2087    301.1952
    2088    270.7372
    2089    273.3530
    2090    279.2151
    2091    269.8952
    2092    295.1448
    2093    307.5253
    2094    294.5181
    2095    270.1412
    2096    302.3694
    2097    274.6694
    2098    289.1389
    2099    289.8206


Basic Statistics:
Mean=       275.7741
Variance=   226.4062
Skew=        -0.0863



Linear Regression of Data:
slope=        0.2723
intercept= -283.8396



Linear Regression of Residuals:
slope=       -0.0115
intercept=    4.1597



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                 0.3140
Kendall Z test statistic=    4.3285
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       4.33 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       0.5525
test statistic (rss/2)=     0.2762
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.28)
```

Day Snowpack Accumulation Begins Analysis

Garrison – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  g-dba-ccsm3.out
 Outfile= g-dba-ccsm3-out


     2012    266.2635
     2013    262.6077
     2014    264.1496
     2015    259.2403
     2016    276.2979
     2017    256.0959
     2018    279.5663
     2019    267.6928
     2020    271.3723
     2021    273.1102
     2022    269.9142
     2023    258.3085
     2024    269.3740
     2025    271.9445
     2026    262.0452
     2027    270.0446
     2028    270.8911
     2029    275.2997
     2030    276.8933
     2031    269.9907
     2032    269.6174
     2033    271.7369
     2034    264.1344
     2035    272.2830
     2036    265.1721
     2037    265.1515
     2038    267.2394
     2039    262.7707
     2040    274.2609
     2041    252.1171
     2042    273.6035
     2043    263.2826
     2044    262.5500
     2045    266.5851
     2046    260.1248
     2047    266.9777
     2048    255.7345
     2049    260.2849
     2050    259.6354
     2051    267.6558
     2052    272.6312
     2053    251.0106
     2054    266.8774
     2055    269.0206
     2056    261.7796
     2057    259.2782
     2058    268.1389
     2059    265.5677
     2060    268.0604
     2061    268.2290
     2062    269.6779
     2063    257.9202
     2064    277.4155
     2065    255.6183
     2066    251.8402
     2067    273.6657
     2068    256.8723
     2069    250.9863
     2070    254.1487
```

```
    2071    272.3835
    2072    271.4057
    2073    258.6630
    2074    261.6414
    2075    262.3504
    2076    248.1311
    2077    261.9980
    2078    272.8922
    2079    269.5430
    2080    267.8224
    2081    253.1980
    2082    256.1630
    2083    259.5219
    2084    275.6133
    2085    259.5874
    2086    255.1440
    2087    245.3220
    2088    251.7910
    2089    255.4299
    2090    245.0486
    2091    265.4366
    2092    253.6763
    2093    242.7400
    2094    263.0583
    2095    246.8965
    2096    252.9873
    2097    265.3036
    2098    254.1588
    2099    257.8102


Basic Statistics:
Mean=       263.3690
Variance=    70.0174
Skew=        -0.3523



Linear Regression of Data:
slope=       -0.1608
intercept=  593.8678



Linear Regression of Residuals:
slope=       -0.0525
intercept=   14.8181



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.3239
Kendall Z test statistic=   -4.4655
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       4.47 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        4.0409
test statistic (rss/2)=     2.0205
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       2.02)
```

Day Snowpack Accumulation Begins Analysis

Garrison – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)


 Infile=  g-dba-ccsm4.out
 Outfile= g-dba-ccsm4.trend


     2012    271.4346
     2013    269.3054
     2014    271.0508
     2015    275.4164
     2016    275.2871
     2017    273.8268
     2018    272.1747
     2019    267.8310
     2020    268.9663
     2021    261.9847
     2022    271.6984
     2023    269.3016
     2024    267.4434
     2025    274.1082
     2026    273.7125
     2027    267.7903
     2028    268.3315
     2029    277.2969
     2030    266.6485
     2031    281.5746
     2032    271.6321
     2033    270.3260
     2034    278.1628
     2035    283.2151
     2036    272.3680
     2037    264.6730
     2038    273.5576
     2039    262.1692
     2040    283.0512
     2041    271.0876
     2042    279.2400
     2043    278.7767
     2044    272.0115
     2045    280.0930
     2046    269.1340
     2047    273.9661
     2048    270.0168
     2049    261.2187
     2050    280.0277
     2051    261.4355
     2052    279.5399
     2053    262.7184
     2054    273.2124
     2055    258.4161
     2056    273.4427
     2057    269.2669
     2058    283.4457
     2059    270.9791
     2060    266.0440
     2061    268.7834
     2062    270.5531
     2063    256.8231
     2064    268.1570
     2065    263.2154
     2066    260.2028
     2067    259.5252
     2068    264.8047
     2069    259.2223
```

```
    2070    271.1202
    2071    266.7503
    2072    267.8676
    2073    263.3598
    2074    276.6119
    2075    255.5442
    2076    269.4041
    2077    267.9472
    2078    269.5009
    2079    269.6147
    2080    273.3715
    2081    270.5569
    2082    254.8550
    2083    265.4331
    2084    262.2661
    2085    261.4540
    2086    261.6788
    2087    252.2160
    2088    260.0869
    2089    264.4212
    2090    272.9395
    2091    257.4140
    2092    269.4958
    2093    253.8869
    2094    265.2986
    2095    255.6415
    2096    261.1960
    2097    257.9764
    2098    249.3667
    2099    260.0099


Basic Statistics:
Mean=       268.1475
Variance=    55.8274
Skew=        -0.1412



Linear Regression of Data:
slope=       -0.1568
intercept=  590.5314



Linear Regression of Residuals:
slope=       -0.0227
intercept=    7.0770



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.3636
Kendall Z test statistic=   -5.0133
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       5.01 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       0.7174
test statistic (rss/2)=     0.3587
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.36)
```

Day of Peak Snowpack Accumulation Analysis

Fort Peck – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)


 Infile=  f-pd-ccsm3.out
 Outfile= f-pd-ccsm3-out


     2012    119.2233
     2013    128.8670
     2014    108.5338
     2015    126.3082
     2016    125.7842
     2017    119.3977
     2018    119.2098
     2019    116.5660
     2020    106.9503
     2021    122.3694
     2022    122.2760
     2023    118.5655
     2024    120.6002
     2025    119.2565
     2026    129.4522
     2027    128.3191
     2028    123.1113
     2029    124.8908
     2030    124.9043
     2031    136.8919
     2032    114.6360
     2033    133.3111
     2034    131.8709
     2035    106.3381
     2036    139.8305
     2037    103.3539
     2038    106.9202
     2039    123.7048
     2040    107.9288
     2041    121.3909
     2042    107.1713
     2043    118.2957
     2044    127.5461
     2045    125.7998
     2046    141.2199
     2047    100.2514
     2048    113.3151
     2049    115.6093
     2050    109.0702
     2051     93.6615
     2052    108.1954
     2053    109.6896
     2054     99.9339
     2055    115.2004
     2056    134.6123
     2057    106.2354
     2058    145.3745
     2059    109.8868
     2060    117.6835
     2061    112.3086
     2062    121.3442
     2063    126.3352
     2064    102.1337
     2065    134.6320
     2066    114.8612
     2067    120.3336
     2068    132.5246
     2069    112.3439
```

```
    2070    102.9835
    2071    100.1912
    2072    108.6406
    2073    136.2963
    2074    117.9865
    2075    118.9110
    2076    113.8868
    2077    118.8602
    2078    109.4707
    2079    134.7680
    2080    102.0216
    2081    125.4978
    2082    103.2418
    2083     88.4993
    2084     99.4493
    2085    111.7348
    2086    122.9536
    2087    101.7726
    2088    127.3552
    2089    101.7331
    2090    133.1949
    2091     99.7783
    2092     81.9591
    2093     93.4290
    2094     98.7469
    2095     92.5170
    2096    107.6829
    2097    121.1419
    2098    114.2748
    2099    118.2334


Basic Statistics:
Mean=       116.0630
Variance=   163.9062
Skew=        -0.1158



Linear Regression of Data:
slope=       -0.1722
intercept=  470.0634



Linear Regression of Residuals:
slope=       -0.0699
intercept=    9.1186



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.2304
Kendall Z test statistic=   -3.1752
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       3.18 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       8.2406
test statistic (rss/2)=     4.1203
Trend in Variance ?           Trend

Trend in Variance at 95% Significance Level
(       4.12 > 3.841 )
```

Day of Peak Snowpack Accumulation Analysis

Fort Peck – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  f-pd-ccsm4.out
 Outfile= f-pd-ccsm4-out


     2012    114.3797
     2013    128.4467
     2014    113.2518
     2015    117.6980
     2016    110.2074
     2017    116.9914
     2018    145.7336
     2019    112.2681
     2020    138.7472
     2021    119.0957
     2022    129.2893
     2023    135.2536
     2024    128.4436
     2025    110.3008
     2026    109.7747
     2027     99.5853
     2028    109.0826
     2029    134.2917
     2030    103.3259
     2031    118.3912
     2032    100.2151
     2033    129.2499
     2034    130.2201
     2035    117.9522
     2036    108.8564
     2037    114.3517
     2038    111.2731
     2039    116.4902
     2040     92.2929
     2041     97.6200
     2042    111.6787
     2043    115.3073
     2044    125.0299
     2045    106.0393
     2046    120.6231
     2047    123.8273
     2048    119.4692
     2049    112.6842
     2050    124.3731
     2051    125.5403
     2052    133.7988
     2053    102.6525
     2054    106.4989
     2055    133.6577
     2056     86.9408
     2057     99.5915
     2058    102.5020
     2059    125.3930
     2060    135.9352
     2061    134.1080
     2062    111.4038
     2063    124.5349
     2064    113.1107
     2065    131.1010
     2066    153.1048
     2067    125.0475
     2068    122.3777
     2069    112.0741
     2070    108.8056
```

```
    2071    122.1287
    2072    121.8932
    2073    110.1244
    2074    109.1646
    2075     88.0013
    2076     98.5207
    2077    118.1172
    2078    128.3481
    2079    105.5350
    2080    109.0432
    2081    108.4113
    2082     99.4120
    2083    108.3366
    2084    109.2517
    2085    106.2655
    2086    115.5843
    2087    106.7760
    2088    104.2608
    2089    105.1386
    2090    111.3623
    2091    122.2521
    2092     95.3964
    2093    107.3124
    2094     81.4455
    2095    108.8274
    2096     94.4407
    2097    115.1091
    2098    121.6109
    2099    101.2776


Basic Statistics:
Mean=       114.7004
Variance=   172.3906
Skew=         0.1935



Linear Regression of Data:
slope=       -0.1580
intercept=  439.4555



Linear Regression of Residuals:
slope=        0.0062
intercept=    0.2892



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.2262
Kendall Z test statistic=   -3.1175
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       3.12 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        0.0544
test statistic (rss/2)=      0.0272
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.03)
```

Day of Peak Snowpack Accumulation Analysis

Garrison – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  g-pd-ccsm3.out
 Outfile= g-pd-ccsm3-out


     2012    101.1998
     2013     94.4056
     2014     86.2671
     2015     94.4807
     2016    102.7026
     2017     87.8066
     2018    100.3296
     2019     89.9798
     2020     89.1741
     2021    113.1817
     2022    108.3369
     2023    101.1656
     2024    110.6004
     2025    115.0043
     2026     94.2417
     2027    123.0332
     2028    121.0855
     2029    109.4746
     2030    124.2752
     2031     98.7449
     2032    106.1306
     2033     95.3371
     2034     93.4250
     2035     99.1686
     2036    103.8069
     2037     91.6120
     2038    101.6823
     2039    112.1078
     2040     96.3603
     2041     86.3422
     2042    103.0720
     2043     79.2551
     2044     98.0739
     2045    100.8188
     2046     91.6233
     2047    101.0616
     2048     85.3895
     2049     91.7319
     2050     85.1879
     2051    104.7857
     2052     96.8495
     2053     75.7594
     2054    109.5871
     2055    109.3150
     2056    104.3951
     2057     90.0168
     2058    100.2411
     2059     75.8525
     2060    105.5963
     2061     84.5408
     2062     91.4108
     2063     97.1797
     2064    112.3045
     2065     84.3392
     2066     88.4696
     2067     84.7589
     2068     86.7228
     2069     65.4273
     2070     93.8103
```

```
    2071    103.3653
    2072    108.7550
    2073     98.1553
    2074    103.0925
    2075     85.9943
    2076     59.5970
    2077     82.8367
    2078    110.4696
    2079    103.6264
    2080     77.8562
    2081     83.2008
    2082     82.0035
    2083     86.4007
    2084    105.9946
    2085     81.4970
    2086     73.9845
    2087     73.1073
    2088     67.1473
    2089     67.5882
    2090     70.6517
    2091     78.0412
    2092     62.5037
    2093     59.2950
    2094     79.8317
    2095     60.2223
    2096     78.4582
    2097     88.9986
    2098     87.2448
    2099     81.1111


Basic Statistics:
Mean=        92.6144
Variance=   215.0783
Skew=        -0.2582



Linear Regression of Data:
slope=       -0.3266
intercept=  763.8873



Linear Regression of Residuals:
slope=       -0.0132
intercept=    2.2245



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.3793
Kendall Z test statistic=   -5.2295
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       5.23 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        1.0586
test statistic (rss/2)=      0.5293
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.53)
```

Day of Peak Snowpack Accumulation Analysis

Garrison – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  g-pd-ccsm4.out
 Outfile= g-pd-ccsm4-out


     2012    109.8165
     2013    103.7311
     2014    124.3838
     2015     94.0742
     2016     89.5995
     2017    100.9876
     2018    108.0529
     2019    105.8046
     2020    102.2223
     2021     89.7673
     2022    105.4405
     2023    105.9459
     2024     88.4720
     2025    107.9493
     2026    101.2156
     2027    108.0631
     2028    101.0193
     2029    109.7351
     2030     93.0987
     2031    119.7455
     2032    104.4487
     2033    114.2155
     2034    115.7342
     2035    108.7560
     2036    119.7666
     2037    102.7122
     2038    103.3170
     2039    102.6635
     2040    105.7122
     2041    105.2657
     2042    109.4140
     2043    110.2081
     2044    103.1425
     2045    101.2974
     2046     93.7306
     2047     97.0186
     2048    101.4381
     2049     96.6584
     2050    100.8783
     2051     85.1449
     2052    111.8527
     2053    103.4086
     2054    106.4242
     2055     85.6299
     2056    104.3120
     2057     98.4066
     2058    127.5675
     2059     96.7402
     2060     92.7660
     2061     96.5880
     2062     93.6971
     2063     84.5514
     2064     96.5869
     2065     85.2376
     2066    108.0843
     2067     81.1336
     2068     85.8308
     2069     82.7870
     2070     88.1443
```

```
    2071     88.6888
    2072    111.8294
    2073     83.1697
    2074    110.9264
    2075     71.6326
    2076     96.8001
    2077     98.9339
    2078    106.6635
    2079     97.7415
    2080    107.1703
    2081     86.6037
    2082     74.5558
    2083    106.7827
    2084     92.0523
    2085     92.6567
    2086     88.2743
    2087     82.2759
    2088     86.6136
    2089     90.9093
    2090     92.4389
    2091     73.7836
    2092    101.4426
    2093     82.8959
    2094     88.0558
    2095     80.5711
    2096     78.6873
    2097     78.5414
    2098     75.5741
    2099     82.7489


Basic Statistics:
Mean=        97.6070
Variance=   142.5944
Skew=        -0.0289



Linear Regression of Data:
slope=       -0.2669
intercept=  646.2603



Linear Regression of Residuals:
slope=       -0.0057
intercept=    1.5597



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.4002
Kendall Z test statistic=   -5.5179
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       5.52 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        0.1330
test statistic (rss/2)=      0.0665
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.07)
```

Peak Snowpack Accumulation Analysis

Fort Peck – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  f-swe-ccsm3.out
 Outfile= f-swe-ccsm3.trend


     2012     22.4649
     2013     26.8727
     2014     16.9584
     2015     21.6599
     2016     20.2533
     2017     14.0049
     2018     21.0173
     2019     19.8771
     2020     17.4026
     2021     22.0739
     2022     20.7347
     2023     19.0570
     2024     19.5621
     2025     17.6399
     2026     19.6164
     2027     20.9658
     2028     19.9407
     2029     23.7991
     2030     20.7113
     2031     22.7086
     2032     18.6304
     2033     23.1237
     2034     18.6721
     2035     16.0995
     2036     25.5939
     2037     14.9923
     2038     16.4500
     2039     18.6327
     2040     19.5574
     2041     14.6310
     2042     18.0739
     2043     16.0183
     2044     21.4764
     2045     22.2364
     2046     20.3108
     2047     14.1828
     2048     14.7353
     2049     20.9623
     2050     10.6935
     2051     15.5370
     2052     19.5825
     2053     16.9899
     2054     14.1305
     2055     20.6060
     2056     22.8443
     2057     17.5698
     2058     23.1103
     2059     15.9523
     2060     19.7946
     2061     17.0231
     2062     17.7030
     2063     20.3203
     2064     16.5967
     2065     21.0458
     2066     16.7133
     2067     16.6901
     2068     17.7593
```

```
    2069     14.6724
    2070     15.7195
    2071     15.0542
    2072     22.7052
    2073     21.5937
    2074     17.6262
    2075     14.0199
    2076     17.7042
    2077     18.0976
    2078     20.3563
    2079     19.0126
    2080     18.9890
    2081     16.6808
    2082      9.9487
    2083     11.9288
    2084     13.8261
    2085     14.2769
    2086     17.5365
    2087     16.8535
    2088     23.0071
    2089     13.4350
    2090     15.6140
    2091      7.9608
    2092     12.5184
    2093      9.9918
    2094     11.5682
    2095     13.7420
    2096     14.2173
    2097     15.9126
    2098     16.5785
    2099     17.5109


Basic Statistics:
Mean=        17.8525
Variance=    13.2016
Skew=        -0.1862




Linear Regression of Data:
slope=       -0.0717
intercept=  165.2385




Linear Regression of Residuals:
slope=       -0.0510
intercept=    1.9112




Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.3396
Kendall Z test statistic=   -4.6817
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       4.68 > 1.96 )




Breausch-Pagan test for Trend in Variances:

rss =                       0.7606
test statistic (rss/2)=     0.3803
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.38)
```

Peak Snowpack Accumulation Analysis

Fort Peck – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)


 Infile=  f-swe-ccsm4.out
 Outfile= f-swe-ccsm4.trend


     2012     20.6640
     2013     22.5488
     2014     21.3334
     2015     18.6712
     2016     17.0745
     2017     19.5997
     2018     21.8072
     2019     17.7334
     2020     19.4676
     2021     18.7730
     2022     19.0054
     2023     18.6249
     2024     21.2546
     2025     15.7325
     2026     15.1081
     2027     13.8609
     2028     17.6379
     2029     21.1872
     2030     12.3077
     2031     17.5317
     2032     14.0137
     2033     19.4540
     2034     23.1061
     2035     18.8525
     2036     14.8967
     2037     18.1579
     2038     19.1532
     2039     15.8062
     2040     14.9222
     2041     16.0689
     2042     17.0897
     2043     20.7173
     2044     18.0182
     2045     15.5793
     2046     19.5339
     2047     16.7771
     2048     16.3256
     2049     16.2490
     2050     19.4062
     2051     16.1612
     2052     21.1168
     2053     16.0417
     2054     19.7675
     2055     18.4705
     2056     11.0695
     2057     16.2132
     2058     18.7100
     2059     16.2769
     2060     20.1926
     2061     16.6112
     2062     13.3324
     2063     18.2261
     2064     12.5380
     2065     20.4706
     2066     18.5310
     2067     17.1400
     2068     17.1309
     2069     13.7323
     2070     13.9449
```

```
    2071     18.6990
    2072     15.8745
    2073     16.6607
    2074     20.1701
    2075     10.2993
    2076     15.0520
    2077     21.8592
    2078     19.1896
    2079     14.9554
    2080     17.3018
    2081     14.5539
    2082      7.8356
    2083     18.3630
    2084     13.1052
    2085     15.7746
    2086     16.8286
    2087     18.2595
    2088     11.6066
    2089     13.2366
    2090     16.2049
    2091     15.7453
    2092     14.1537
    2093     11.4712
    2094      9.9844
    2095     13.4852
    2096     12.0428
    2097     13.7362
    2098     14.6411
    2099     13.2949


Basic Statistics:
Mean=        16.7513
Variance=     9.6109
Skew=        -0.3362



Linear Regression of Data:
slope=       -0.0622
intercept=  144.6799



Linear Regression of Residuals:
slope=       -0.0679
intercept=    2.1376



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.3516
Kendall Z test statistic=   -4.8475
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       4.85 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        1.0144
test statistic (rss/2)=      0.5072
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.51)
```

Peak Snowpack Accumulation Analysis

Garrison – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)


 Infile=  g-swe-ccsm3.out
 Outfile= g-swe-ccsm3.trend


     2012     15.2511
     2013     17.7925
     2014     12.6639
     2015     13.8030
     2016     16.0062
     2017     11.7287
     2018     15.6188
     2019     14.0048
     2020     13.3188
     2021     15.3547
     2022     15.8842
     2023     13.3433
     2024     16.1004
     2025     14.0084
     2026     13.3773
     2027     16.3210
     2028     16.1681
     2029     16.5680
     2030     16.6603
     2031     16.9728
     2032     14.2118
     2033     15.7095
     2034     11.7501
     2035     13.5284
     2036     16.6917
     2037     12.0363
     2038     11.8617
     2039     14.4238
     2040     17.3342
     2041      9.5603
     2042     12.9937
     2043     12.0104
     2044     15.8725
     2045     17.0768
     2046     13.9324
     2047     10.3563
     2048     11.1591
     2049     15.4752
     2050      7.7232
     2051     10.5932
     2052     15.3112
     2053     11.6566
     2054     11.0787
     2055     16.6491
     2056     20.1735
     2057     14.5937
     2058     14.8233
     2059     10.2678
     2060     13.4354
     2061     11.6928
     2062     14.5673
     2063     12.7863
     2064     13.6953
     2065     14.9429
     2066      9.6079
     2067     11.9947
     2068     10.4975
     2069     11.2119
```

```
    2070     12.9939
    2071     11.8206
    2072     19.4527
    2073     15.1446
    2074     13.9853
    2075     10.7060
    2076      9.9591
    2077     10.5827
    2078     17.4343
    2079     12.1046
    2080     15.0932
    2081     12.9543
    2082      7.9196
    2083      7.4812
    2084     12.5334
    2085     11.8226
    2086     11.0735
    2087     15.8273
    2088     13.7023
    2089      9.7301
    2090      9.3306
    2091      8.1980
    2092      7.4641
    2093      7.2985
    2094      9.5799
    2095     10.9165
    2096      8.7148
    2097     10.6578
    2098     12.8216
    2099     12.0596


Basic Statistics:
Mean=        13.1091
Variance=     8.1004
Skew=        -0.0194



Linear Regression of Data:
slope=       -0.0545
intercept=  125.2228



Linear Regression of Residuals:
slope=       -0.1435
intercept=    2.8818



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.3380
Kendall Z test statistic=   -4.6601
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       4.66 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       3.4808
test statistic (rss/2)=     1.7404
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       1.74)
```

Peak Snowpack Accumulation Analysis

Garrison – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
 (Using Output from R)


Infile=  g-swe-ccsm4.out
Outfile= g-swe-ccsm4.trend


    2012     13.3599
    2013     13.8390
    2014     15.3183
    2015     11.2312
    2016      9.5405
    2017     11.5030
    2018     11.3838
    2019     12.1945
    2020     11.6896
    2021     11.6270
    2022     13.8126
    2023     10.7338
    2024     11.0066
    2025      9.4421
    2026      9.9184
    2027     10.8634
    2028      9.9937
    2029     10.9829
    2030      8.7084
    2031     10.2813
    2032      8.3887
    2033     13.5882
    2034     15.8929
    2035     12.3666
    2036      9.5270
    2037     12.5201
    2038     12.3105
    2039     11.3179
    2040     10.6718
    2041     10.7663
    2042     10.2890
    2043     12.7035
    2044     11.7408
    2045     10.5440
    2046     12.8990
    2047      9.5131
    2048     10.2301
    2049     11.9575
    2050     11.4995
    2051      9.1780
    2052     13.0532
    2053     12.6542
    2054     12.0030
    2055     11.4259
    2056      7.4167
    2057     11.5408
    2058     12.2292
    2059      9.6972
    2060     12.6108
    2061     11.4624
    2062      9.0270
    2063      9.3097
    2064      8.4975
    2065     10.4759
    2066     10.8231
    2067     11.4124
    2068     11.5148
    2069      9.8359
```

```
    2070      7.4861
    2071     12.0314
    2072     10.2932
    2073     10.4795
    2074     12.6097
    2075      6.9878
    2076      9.4537
    2077     14.7462
    2078     13.1081
    2079     10.7142
    2080     10.9403
    2081      8.0684
    2082      5.0967
    2083     10.7189
    2084      7.9330
    2085      9.7964
    2086     12.1057
    2087     14.5131
    2088      7.3574
    2089      9.5097
    2090      7.9073
    2091      8.7316
    2092      9.2059
    2093      9.4734
    2094      5.5022
    2095      8.9097
    2096      5.9048
    2097      9.8834
    2098     10.3518
    2099      9.8133


Basic Statistics:
Mean=        10.6813
Variance=     4.2642
Skew=        -0.1741



Linear Regression of Data:
slope=       -0.0342
intercept=   81.0546



Linear Regression of Residuals:
slope=       -0.2590
intercept=    3.7660



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.2806
Kendall Z test statistic=   -3.8672
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       3.87 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       4.4631
test statistic (rss/2)=     2.2316
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       2.23)
```

Snowpack Melt Rate Analysis

Fort Peck – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)


 Infile=  f-mr-ccsm3.out
 Outfile= f-mr-ccsm3-out


     2012      0.3792
     2013      0.4539
     2014      0.2319
     2015      0.3832
     2016      0.3407
     2017      0.2906
     2018      0.3305
     2019      0.3307
     2020      0.2486
     2021      0.3244
     2022      0.3496
     2023      0.3343
     2024      0.3240
     2025      0.2923
     2026      0.3683
     2027      0.3708
     2028      0.3296
     2029      0.3956
     2030      0.3206
     2031      0.4265
     2032      0.3097
     2033      0.4050
     2034      0.3367
     2035      0.2349
     2036      0.4511
     2037      0.2364
     2038      0.2613
     2039      0.3559
     2040      0.3316
     2041      0.3221
     2042      0.2554
     2043      0.3280
     2044      0.3589
     2045      0.3577
     2046      0.4158
     2047      0.2016
     2048      0.2895
     2049      0.3786
     2050      0.2116
     2051      0.2354
     2052      0.3088
     2053      0.3214
     2054      0.1933
     2055      0.3165
     2056      0.4224
     2057      0.2833
     2058      0.4610
     2059      0.2823
     2060      0.3388
     2061      0.2922
     2062      0.3184
     2063      0.3675
     2064      0.2263
     2065      0.4254
     2066      0.3367
     2067      0.2965
     2068      0.4090
     2069      0.3137
     2070      0.2729
```

```
    2071      0.2190
    2072      0.3693
    2073      0.4427
    2074      0.3167
    2075      0.2966
    2076      0.3379
    2077      0.3284
    2078      0.3063
    2079      0.3747
    2080      0.3236
    2081      0.3459
    2082      0.2240
    2083      0.2139
    2084      0.2124
    2085      0.2690
    2086      0.3927
    2087      0.3338
    2088      0.4188
    2089      0.2535
    2090      0.3772
    2091      0.1491
    2092      0.2452
    2093      0.2421
    2094      0.2071
    2095      0.2729
    2096      0.2585
    2097      0.3147
    2098      0.3812
    2099      0.3573


Basic Statistics:
Mean=         0.3190
Variance=     0.0046
Skew=        -0.0743



Linear Regression of Data:
slope=       -0.0005
intercept=    1.4237



Linear Regression of Residuals:
slope=      -10.4188
intercept=    4.3237



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.1311
Kendall Z test statistic=   -1.8057
Trend in Mean ?            No Trend

No Trend in Means at 95% Significance Level
(1.96 <       1.81)



Breausch-Pagan test for Trend in Variances:

rss =                        1.7804
test statistic (rss/2)=      0.8902
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.89)
```

Snowpack Melt Rate Analysis

Fort Peck – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  f-mr-ccsm4.out
 Outfile= f-mr-ccsm4-out


     2012      0.2789
     2013      0.3444
     2014      0.3404
     2015      0.2783
     2016      0.2692
     2017      0.2750
     2018      0.3662
     2019      0.2820
     2020      0.3470
     2021      0.2895
     2022      0.2939
     2023      0.3369
     2024      0.3092
     2025      0.2331
     2026      0.2440
     2027      0.2026
     2028      0.2621
     2029      0.3780
     2030      0.1980
     2031      0.2716
     2032      0.1800
     2033      0.3258
     2034      0.3244
     2035      0.2347
     2036      0.2439
     2037      0.2927
     2038      0.2818
     2039      0.2899
     2040      0.1668
     2041      0.2293
     2042      0.2435
     2043      0.2941
     2044      0.3131
     2045      0.2270
     2046      0.3181
     2047      0.3177
     2048      0.2748
     2049      0.3374
     2050      0.2715
     2051      0.3075
     2052      0.3448
     2053      0.2298
     2054      0.2646
     2055      0.3536
     2056      0.1430
     2057      0.2143
     2058      0.2324
     2059      0.2711
     2060      0.3817
     2061      0.3127
     2062      0.2704
     2063      0.3486
     2064      0.2354
     2065      0.3646
     2066      0.3672
     2067      0.3351
     2068      0.3383
     2069      0.2717
     2070      0.2387
```

```
    2071      0.2901
    2072      0.2841
    2073      0.2784
    2074      0.2632
    2075      0.1735
    2076      0.2336
    2077      0.3346
    2078      0.3324
    2079      0.2177
    2080      0.2656
    2081      0.2584
    2082      0.2314
    2083      0.2838
    2084      0.2453
    2085      0.2582
    2086      0.2900
    2087      0.3170
    2088      0.2065
    2089      0.2383
    2090      0.2606
    2091      0.3240
    2092      0.2214
    2093      0.2420
    2094      0.1741
    2095      0.2488
    2096      0.1939
    2097      0.3174
    2098      0.3360
    2099      0.2191


Basic Statistics:
Mean=         0.2765
Variance=     0.0028
Skew=        -0.1406



Linear Regression of Data:
slope=       -0.0004
intercept=    1.0453



Linear Regression of Residuals:
slope=       -0.8112
intercept=    1.2243



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.1364
Kendall Z test statistic=   -1.8777
Trend in Mean ?            No Trend

No Trend in Means at 95% Significance Level
(1.96 <       1.88)



Breausch-Pagan test for Trend in Variances:

rss =                        0.0052
test statistic (rss/2)=      0.0026
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.00)
```

Snowpack Melt Rate Analysis

Garrison – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  g-mr-ccsm3.out
 Outfile= g-mr-ccsm3-out


     2012      0.2954
     2013      0.2750
     2014      0.2194
     2015      0.2062
     2016      0.2881
     2017      0.2191
     2018      0.3081
     2019      0.2348
     2020      0.2243
     2021      0.2972
     2022      0.3223
     2023      0.2368
     2024      0.2972
     2025      0.2605
     2026      0.2232
     2027      0.2826
     2028      0.3224
     2029      0.3068
     2030      0.3051
     2031      0.3324
     2032      0.2176
     2033      0.2832
     2034      0.2240
     2035      0.2415
     2036      0.2700
     2037      0.2012
     2038      0.1894
     2039      0.3019
     2040      0.2929
     2041      0.1960
     2042      0.2531
     2043      0.1908
     2044      0.2699
     2045      0.2995
     2046      0.2485
     2047      0.1857
     2048      0.2069
     2049      0.2309
     2050      0.1504
     2051      0.1973
     2052      0.2711
     2053      0.1733
     2054      0.2200
     2055      0.2953
     2056      0.3713
     2057      0.2305
     2058      0.2624
     2059      0.1776
     2060      0.2116
     2061      0.1481
     2062      0.2357
     2063      0.2083
     2064      0.2648
     2065      0.2486
     2066      0.1501
     2067      0.2176
     2068      0.2109
     2069      0.1859
     2070      0.2013
```

```
    2071      0.2234
    2072      0.3220
    2073      0.2818
    2074      0.2285
    2075      0.2058
    2076      0.1294
    2077      0.1736
    2078      0.2704
    2079      0.2397
    2080      0.2083
    2081      0.2010
    2082      0.1810
    2083      0.1179
    2084      0.2200
    2085      0.1958
    2086      0.1751
    2087      0.1972
    2088      0.1986
    2089      0.1385
    2090      0.1476
    2091      0.1717
    2092      0.1347
    2093      0.0649
    2094      0.1977
    2095      0.1434
    2096      0.1108
    2097      0.1782
    2098      0.2226
    2099      0.2424


Basic Statistics:
Mean=         0.2263
Variance=     0.0033
Skew=        -0.0498



Linear Regression of Data:
slope=       -0.0013
intercept=    2.8309



Linear Regression of Residuals:
slope=       -2.8430
intercept=    1.6434



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.4018
Kendall Z test statistic=   -5.5395
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       5.54 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       0.7369
test statistic (rss/2)=     0.3685
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.37)
```

Snowpack Melt Rate Analysis

Garrison – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  g-mr-ccsm4.out
 Outfile= g-mr-ccsm4-out


     2012      0.2324
     2013      0.2429
     2014      0.3081
     2015      0.2182
     2016      0.2076
     2017      0.2261
     2018      0.2183
     2019      0.2491
     2020      0.2010
     2021      0.2165
     2022      0.2762
     2023      0.2249
     2024      0.2056
     2025      0.2083
     2026      0.2262
     2027      0.2111
     2028      0.1998
     2029      0.2429
     2030      0.1772
     2031      0.2333
     2032      0.1860
     2033      0.2866
     2034      0.2765
     2035      0.2383
     2036      0.2143
     2037      0.2500
     2038      0.2355
     2039      0.2463
     2040      0.2089
     2041      0.2111
     2042      0.2387
     2043      0.2380
     2044      0.2224
     2045      0.2138
     2046      0.2284
     2047      0.2113
     2048      0.1958
     2049      0.2422
     2050      0.2042
     2051      0.1860
     2052      0.2708
     2053      0.2181
     2054      0.1958
     2055      0.1936
     2056      0.1729
     2057      0.2237
     2058      0.2232
     2059      0.1990
     2060      0.2288
     2061      0.2480
     2062      0.1951
     2063      0.1544
     2064      0.1774
     2065      0.1665
     2066      0.2153
     2067      0.2234
     2068      0.1974
     2069      0.1893
     2070      0.1638
```

```
    2071      0.1791
    2072      0.1887
    2073      0.2095
    2074      0.2175
    2075      0.0857
    2076      0.1803
    2077      0.2262
    2078      0.2437
    2079      0.1984
    2080      0.1988
    2081      0.1446
    2082      0.1280
    2083      0.1735
    2084      0.1672
    2085      0.1620
    2086      0.2076
    2087      0.2060
    2088      0.1265
    2089      0.1681
    2090      0.1502
    2091      0.1472
    2092      0.1803
    2093      0.1740
    2094      0.0973
    2095      0.0930
    2096      0.0842
    2097      0.1675
    2098      0.1974
    2099      0.1489


Basic Statistics:
Mean=         0.2019
Variance=     0.0018
Skew=        -0.5714



Linear Regression of Data:
slope=       -0.0011
intercept=    2.4160



Linear Regression of Residuals:
slope=       -8.1702
intercept=    2.6497



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.4684
Kendall Z test statistic=   -6.4585
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       6.46 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        4.3978
test statistic (rss/2)=      2.1989
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       2.20)
```

Snowpack Melt Out Day Analysis

Fort Peck – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
 (Using Output from R)



Infile=  f-mo-ccsm3.out
Outfile= f-mo-ccsm3-out


    2012    181.0158
    2013    168.3050
    2014    167.2202
    2015    156.3056
    2016    183.2106
    2017    147.7555
    2018    191.9392
    2019    165.3774
    2020    171.0166
    2021    191.4605
    2022    188.6577
    2023    164.6700
    2024    185.6737
    2025    181.7479
    2026    162.1053
    2027    170.7974
    2028    191.2899
    2029    187.9036
    2030    187.1247
    2031    186.6615
    2032    165.4397
    2033    174.8197
    2034    170.0272
    2035    173.2867
    2036    174.7794
    2037    166.9535
    2038    165.2226
    2039    175.8842
    2040    177.4001
    2041    158.9328
    2042    185.9105
    2043    153.2442
    2044    169.7450
    2045    184.2198
    2046    162.8411
    2047    159.7664
    2048    151.1740
    2049    158.4538
    2050    153.8031
    2051    172.5203
    2052    170.2175
    2053    143.6871
    2054    180.5513
    2055    175.3295
    2056    183.4517
    2057    159.5443
    2058    168.8584
    2059    144.6940
    2060    159.6163
    2061    156.5750
    2062    161.9985
    2063    150.8465
    2064    189.3285
    2065    162.3510
    2066    148.9419
    2067    167.1091
    2068    150.3719
    2069    138.1734
```

```
    2070    159.2262
    2071    171.3623
    2072    186.1437
    2073    173.1863
    2074    161.7400
    2075    154.6449
    2076    134.7561
    2077    156.5012
    2078    174.7839
    2079    174.6228
    2080    154.9897
    2081    150.2806
    2082    150.4389
    2083    144.3755
    2084    174.1677
    2085    147.3640
    2086    146.8730
    2087    135.9322
    2088    145.2826
    2089    144.6933
    2090    127.7914
    2091    157.2657
    2092    142.4396
    2093    112.5824
    2094    157.4184
    2095    132.1659
    2096    136.2315
    2097    152.9882
    2098    146.8043
    2099    167.8362


Basic Statistics:
Mean=       163.3091
Variance=   273.2207
Skew=        -0.3238



Linear Regression of Data:
slope=       -0.3904
intercept=  965.7382



Linear Regression of Residuals:
slope=       -0.0130
intercept=    3.1253



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.4316
Kendall Z test statistic=   -5.9504
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       5.95 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       1.4656
test statistic (rss/2)=     0.7328
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.73)
```

Snowpack Melt Out Day Analysis

Fort Peck – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  f-mo-ccsm4.out
 Outfile= f-mo-ccsm4-out


     2012    178.9301
     2013    182.9509
     2014    191.0013
     2015    176.7341
     2016    175.0716
     2017    183.6421
     2018    182.1391
     2019    172.7610
     2020    173.3272
     2021    170.6986
     2022    185.3721
     2023    173.4829
     2024    170.1440
     2025    183.4102
     2026    176.7020
     2027    172.8091
     2028    173.2831
     2029    184.1903
     2030    167.9982
     2031    187.2581
     2032    170.7738
     2033    187.6859
     2034    189.7457
     2035    188.3129
     2036    184.2432
     2037    177.0924
     2038    178.9001
     2039    180.0334
     2040    179.6841
     2041    177.6238
     2042    184.1328
     2043    184.2566
     2044    178.7953
     2045    174.6164
     2046    176.7633
     2047    172.7551
     2048    169.8232
     2049    169.1691
     2050    183.2706
     2051    152.8903
     2052    183.1574
     2053    173.6855
     2054    178.6678
     2055    166.2246
     2056    175.9883
     2057    176.6293
     2058    189.1592
     2059    169.6779
     2060    167.7353
     2061    169.7615
     2062    165.5927
     2063    156.5398
     2064    160.9603
     2065    162.6714
     2066    177.4399
     2067    161.0723
     2068    160.4324
     2069    149.6868
     2070    160.6158
```

```
    2071    163.0192
    2072    169.8999
    2073    165.3521
    2074    183.5422
    2075    140.0979
    2076    165.2645
    2077    168.1346
    2078    171.3807
    2079    167.2706
    2080    173.1657
    2081    162.8306
    2082    142.7774
    2083    166.9380
    2084    157.7418
    2085    158.7312
    2086    155.7678
    2087    159.0885
    2088    150.7975
    2089    158.5086
    2090    157.2546
    2091    145.6219
    2092    163.2680
    2093    144.7930
    2094    152.4601
    2095    143.0379
    2096    149.3102
    2097    147.8564
    2098    147.3548
    2099    144.9036


Basic Statistics:
Mean=       169.3675
Variance=   162.5241
Skew=        -0.4650



Linear Regression of Data:
slope=       -0.3780
intercept=  946.3980



Linear Regression of Residuals:
slope=       -0.0091
intercept=    2.5483



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.5606
Kendall Z test statistic=   -7.7308
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       7.73 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       0.6782
test statistic (rss/2)=     0.3391
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.34)
```

Snowpack Melt Out Day Analysis

Garrison – CCSM3 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  g-mo-ccsm3.out
 Outfile= g-mo-ccsm3-out


     2012    166.9234
     2013    156.1771
     2014    150.2283
     2015    143.3135
     2016    174.3059
     2017    139.0280
     2018    177.9276
     2019    155.1363
     2020    153.6541
     2021    179.1085
     2022    178.1632
     2023    147.2227
     2024    168.8722
     2025    169.1536
     2026    150.7882
     2027    163.4043
     2028    183.8176
     2029    179.2793
     2030    175.6348
     2031    172.5244
     2032    152.8041
     2033    166.6209
     2034    149.5246
     2035    160.4667
     2036    163.5540
     2037    147.8229
     2038    144.2113
     2039    162.9394
     2040    166.4210
     2041    137.5473
     2042    167.1564
     2043    140.3140
     2044    151.7216
     2045    169.6509
     2046    150.3011
     2047    141.6130
     2048    137.9108
     2049    147.6938
     2050    135.6038
     2051    153.5090
     2052    159.6913
     2053    128.0339
     2054    155.5809
     2055    158.0795
     2056    172.2834
     2057    143.1539
     2058    161.7453
     2059    134.6930
     2060    142.0532
     2061    145.3259
     2062    147.3061
     2063    132.8125
     2064    174.6722
     2065    141.2296
     2066    125.4424
     2067    151.8236
     2068    133.8612
     2069    122.7429
     2070    134.3897
```

```
    2071    157.7981
    2072    167.7617
    2073    152.8775
    2074    148.0470
    2075    144.2992
    2076    117.5113
    2077    139.9595
    2078    160.9520
    2079    156.4149
    2080    141.7495
    2081    130.0512
    2082    135.5775
    2083    121.5081
    2084    158.3637
    2085    133.0824
    2086    126.2516
    2087    112.2196
    2088    123.4228
    2089    120.4606
    2090    105.3109
    2091    144.7980
    2092    117.3398
    2093     85.5329
    2094    138.1912
    2095    110.9872
    2096    112.5335
    2097    140.6791
    2098    126.5593
    2099    142.0740


Basic Statistics:
Mean=       147.3782
Variance=   369.1499
Skew=        -0.4392



Linear Regression of Data:
slope=       -0.4922
intercept= 1159.1091



Linear Regression of Residuals:
slope=       -0.0153
intercept=    3.2475



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.4629
Kendall Z test statistic=   -6.3828
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       6.38 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                        3.1993
test statistic (rss/2)=     1.5997
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       1.60)
```

Snowpack Melt Out Day Analysis

Garrison – CCSM4 Projected data – 2012-2099:

```
Program ATrend: Tests for Trends in Means and Variance s of Annual Data:
  (Using Output from R)



 Infile=  g-mo-ccsm4.out
 Outfile= g-mo-ccsm4-out


     2012    169.6989
     2013    172.1155
     2014    177.7482
     2015    166.3832
     2016    164.8658
     2017    169.7372
     2018    169.9547
     2019    166.7241
     2020    161.8659
     2021    154.3028
     2022    174.5744
     2023    163.8028
     2024    155.7997
     2025    166.8042
     2026    166.5297
     2027    161.9877
     2028    161.2476
     2029    171.3350
     2030    153.1044
     2031    173.0851
     2032    159.7104
     2033    178.8156
     2034    178.1820
     2035    178.5336
     2036    166.2169
     2037    162.0729
     2038    167.7760
     2039    164.1987
     2040    167.9124
     2041    165.9275
     2042    172.7573
     2043    167.8620
     2044    164.9205
     2045    165.2421
     2046    158.6690
     2047    163.2349
     2048    154.5400
     2049    152.6569
     2050    167.7648
     2051    141.8224
     2052    173.7004
     2053    156.9559
     2054    156.8254
     2055    149.9847
     2056    156.3257
     2057    160.4816
     2058    170.6189
     2059    154.2062
     2060    150.9306
     2061    158.0262
     2062    151.5049
     2063    139.1096
     2064    144.3375
     2065    144.9786
     2066    156.3250
     2067    146.2169
     2068    143.6917
     2069    133.5707
```

```
    2070    143.9657
    2071    146.3087
    2072    154.3471
    2073    151.6731
    2074    162.5450
    2075    121.7475
    2076    150.8579
    2077    152.8243
    2078    155.0103
    2079    149.8095
    2080    159.5241
    2081    140.7001
    2082    122.4400
    2083    146.4173
    2084    139.0872
    2085    141.0822
    2086    136.8058
    2087    141.2281
    2088    130.4104
    2089    141.7691
    2090    141.8133
    2091    131.1732
    2092    148.1528
    2093    131.1060
    2094    125.6469
    2095    126.4953
    2096    123.9911
    2097    133.1154
    2098    129.4709
    2099    128.6627


Basic Statistics:
Mean=       154.2779
Variance=   217.5302
Skew=        -0.4361



Linear Regression of Data:
slope=       -0.4718
intercept= 1124.0641



Linear Regression of Residuals:
slope=       -0.0084
intercept=    2.2914



Kendall-Tau Test for Trend in Mean:

Kendall-tau=                -0.6181
Kendall Z test statistic=   -8.5237
Trend in Mean ?               Trend

Trend in Means at 95% Significance Level
(       8.52 > 1.96 )



Breausch-Pagan test for Trend in Variances:

rss =                       0.8855
test statistic (rss/2)=     0.4428
Trend in Variance ?        No Trend

No Trend in Variance at 95% Significance Level
(3.841 >       0.44)
```

Appendix H – Analysis Programs

Software	Purpose	Input Type	Input Data	Batch File
R (Version 2.14.2)	-Muliple Linear Regression -Parameter Cross-Correlation -Projection of Future Snowpack Behavior and Runoff based on MLR	Text Files	Ftpk2.r Garr2.r	Go2.bat Gog2.bat
Mtrend.exe **-MTrendosR.exe** **-MTrendosT.exe**	-VB-Gui for following 2 programs -Monthly Trend Analysis – Annual Sums -Monthly Trend Analysis – Annual Averages	NA HEC-DSS Files HEC-DSS Files	NA NRCS-PT.dss	NA TREND-TEMP-SM.BAT
Month.exe	-Monthly Trend for Runoff – Annual	Text Files	Ftpk.prn and Garr.prn	NA
Monthmjj.exe	-Monthly Trend for Runoff - MJJ	Text Files	Ftpk.prn and Garr.prn	NA
SNOTEL.exe	-For Daily SNOTEL Record Determines: - Peak SWE, Day Begins Accumulating, Day of Peak Accumulation, Day of Melt-out, etc.	HEC-DSS Files	NRCS-SWE.dss	Execall.bat
Fut-Trend.exe	-Monthly Trend Analysis using R Output for Projected Temps, Precips, and Runoff	R Output Files	Various	NA
ConvertSWE.exe	-Converts NRCS SNOTEL data to HEC-DSS	NRCS csv files	Various	NA