Forecasting Atmospheric Rivers for Water Managers
FRM Training Seminars, St. Louis, MO, February 26th, 2020

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NOAA – NWS – California Nevada River Forecast Center

General weather pattern across the Eastern Pacific Ocean and West Coast for each storm period during January and February 2017.
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Quality Control (QC) & Process Observed Meteorological Data

Freezing Level

Temperature

Precipitation
Quality Control (QC) & Process Hydrological Data

- Hourly Stage & Flow
- Reservoir Inflow/Outflow & Storage
- Projected Reservoir Releases
Forecasting involves integrating numerous Numerical Weather Prediction (NWP) fields, observations, forecaster knowledge of physics and forecaster experience.

- NWP improves as computers get more powerful and forecast skill follows.
- Forecasters add about ten years worth of model development in terms of skill in predicting precipitation.
You guys are always wrong.
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Observations & forecasts

Hourly Stage & Streamflow

Reservoir Inflow Outflow and Storage

Anticipated Reservoir Outflow

QC’d Datasets
Russian River at Guerneville
Russian River - Guerneville (GUEC1)
River Stage / Flow Plot
Maximum Value: 37.8 Feet / 61,473 cfs (January 12, 2017 at 01 UTC)
Monitor Stage: 29.0 Feet
Flood Stage: 32.0 Feet
Deterministic Hydrologic Forecasts

- Daily RFC Forecasting
  - Data Ingest
  - Data QC
  - Model Updating

- Forecast Meteorology

- Mean Areal Time Series

- Precipitation Temperature

- Hydrologic Models

- Current States
  - Soil
  - Snow water
  - Reservoir Levels
  - Streamflow

Mean Areal Time Series
Precipitation Temperature
Hydrologic Models
Current States
Forecast Meteorology

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Probabilistic Hydrologic Forecasts

- Historical Time Series
  - MAPs/MATs
  - 59 Years of Record

- Forecast Meteorology
  - 15 days

- Mean Areal Time Series
  - Precipitation
  - Temperature

- Daily RFC Forecasting
  - Data Ingest
  - Data QC
  - Model Updating

- Hydrologic Models
  - Current States
    - Soil
    - Snow water
    - Reservoir Levels
    - Streamflow

- 15 days Meteorology
  - Mean Areal Time Series

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He
Ensemble River Forecasts
Timeline
Observed Weather

Short Term Weather Models
Days 1-15

Climatology
Days 16-365

Streamflow Forecasts

Streamflow
Model States

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Role of Forecasts in Decision Support

Forecasts
/single-value or probabilistic/ → DS Model → processed outcomes

NOAA/NWS

Decision Support Model

Decision Maker

if outcomes are unacceptable
specify new decision

DS Model

estimate risk of outcomes based on specified decision
Role of Forecasts in Decision Support for Typical Reservoir Operations

- **NOAA/NWS**
- **Decision Support Model**
- **Decision Maker**

- **Reservoir Inflow Forecasts**
- **Reservoir Spreadsheet Model**
- **Forecast pool elevation/elevations**
- **Threshold exceedance probabilities based on a specified release strategy**
- **If outcomes are unacceptable specify new release strategy**

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Role of Forecasts in Decision Support for Typical Reservoir Operations

- Reservoir Inflow Forecasts
- Reservoir Spreadsheet Model
- Decision Support Model
- NOAA/NWS
- Decision Maker
- Downstream River Forecasts
- Reservoir elevation/elevations
- Threshold exceedance probabilities based on a specified release strategy
- If outcomes are acceptable, send new release strategy to NWS