

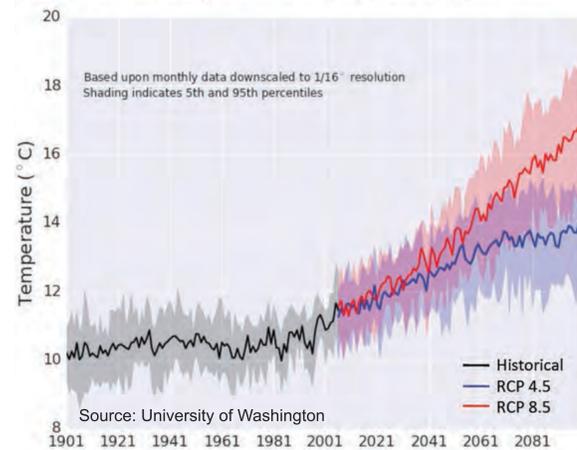


Climate Change Effects

Temperature and Precipitation Trends for Columbia River Basin

Temperature Change

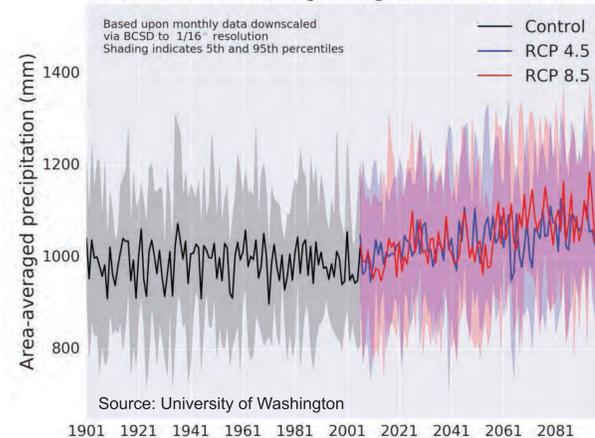
Average annual daily maximum temperature (across 10 models)



- ▶ Temperature increase depends on future emissions
- ▶ Warmer temperatures means less snow

Precipitation Change

Annual precipitation across Columbia River Basin and Pacific coastal drainages (avg. across 10 models)

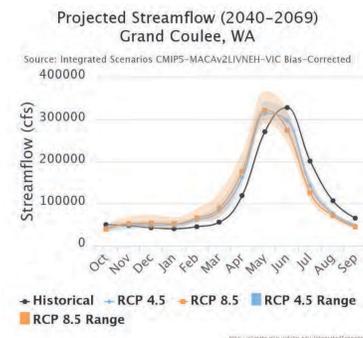


- ▶ Precipitation trend is not as clear
- ▶ More precipitation in the winter, less in the summer

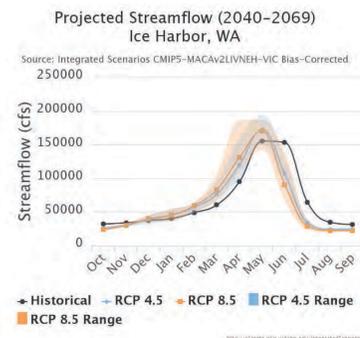
Federal agencies asked the University of Washington to use the Global Climate Modeling information to give projections of temperature and precipitation for the Columbia River Basin

Streamflow Projections – Without Dam Regulation

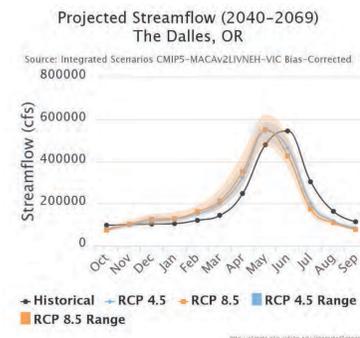
Upper Columbia Grand Coulee



Snake River Ice Harbor



Lower Columbia The Dalles



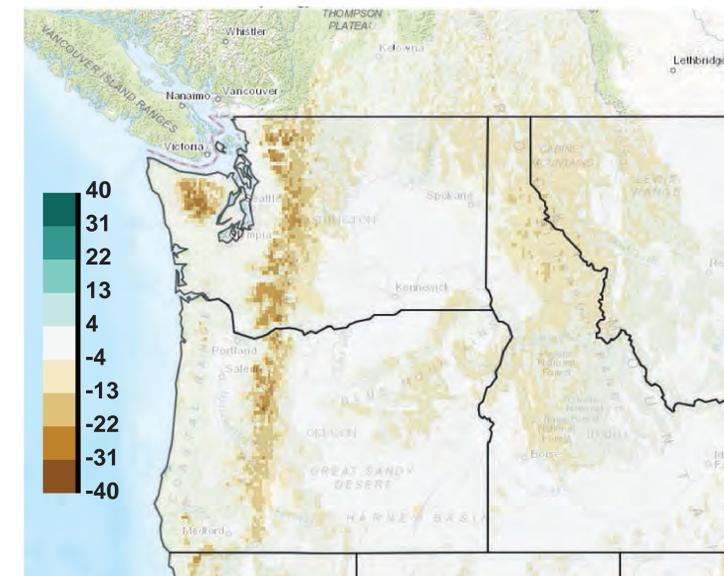
Expected Flow Changes through Mid-Century (not including dam regulation):

- ▶ Higher winter flows, mostly in southern half of the basin
- ▶ No significant change in Canadian winter flows
- ▶ Higher spring flows, but more uncertainty on individual flow peaks
- ▶ Earlier spring runoff peak
- ▶ Lower summer flows
- ▶ Large year-to-year swings in annual volumes will likely continue

Changes in Snowpack: Nature's Reservoirs

Projected change in April 1st snow water equivalent
RCP 8.5 2040-2069 vs 1971-2000

Data Source: Hydrology: VIC, Multi-Model Mean



- ▶ The Columbia River Basin has historically been a snowmelt river system
- ▶ Measuring basin snow provides information for forecasting runoff
- ▶ Warmer winter temperature means less snow in the mountains
- ▶ Rain events in spring and winter are expected to increase
- ▶ Ecosystem and hydrology will change in response

Our Future with Climate Change

- ▶ Snow will continue in the mountains, but there will be less
- ▶ Snowpack, which is a key “natural reservoir” will tend to:
 - shrink, more in US, less in Canada
 - be more variable from year-to-year
 - harder to predict water volumes
- ▶ More winter precipitation will fall as rain
- ▶ The Columbia River Basin will continue to be dry in the summer and become even drier
- ▶ Temperatures will be warmer year round, with more warming east of the Cascades than near the coast
- ▶ More runoff in the winter
- ▶ Less runoff in the summer
- ▶ Meeting all reservoir operations will be more difficult
- ▶ Federal agencies are studying future adaptation options

