NOAA's Colorado Basin River Forecast Center

Developing Climate-Informed Ensemble Streamflow Forecasts over the Colorado River Basin

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- Michelle Stokes – Hydrologist In Charge

Overview

- Points to Take Away
- Background
- Data and Methodology
- Provisional Results
- Next Steps

Points to Take Away

- The CBRFC is attempting to utilize climate information to inform long-term streamflow projections
  - Utilize projections of precipitation and temperature change from BCSD CMIP3 and CMIP5 data to inform historical inputs driving ESP products
  - Provisional results indicate earlier and decreased seasonal (April – July) runoff

Points to Take Away

- Further efforts will attempt to incorporate:
  - Changes to evapotranspiration
  - Use of a stochastic weather generator
  - Couple with a reservoir operations model
- Will eventually separate runs by SRES and RCP scenarios

Background

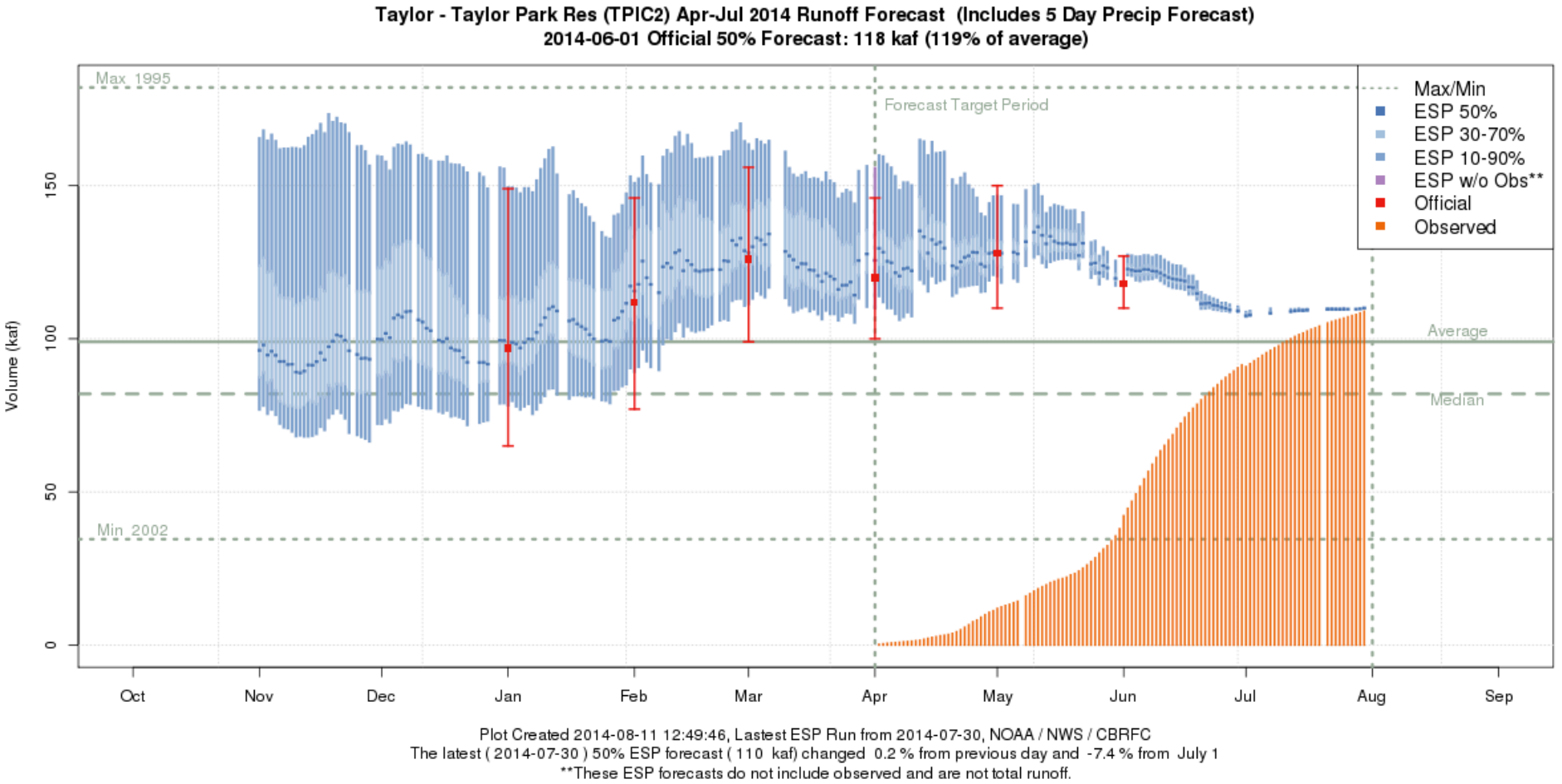
- Stakeholders throughout the Colorado River Basin are developing long-term policy guidelines
  - Some decisions are based on CBRFC forecasts
  - Agencies needs to take climate change information into account
- CBRFC would like to provide decision support

Background

- CBRFC ensemble forecasts rely on current and initial conditions and future climate (precipitation and temperature) as defined over a historical period spanning 1981 – 2010
  - Can also include 5-day QPF and 10-day QTF
  - Limited by sequencing and magnitude of climate events in the historical period

Photos by John Dohrenwend

Ensemble Streamflow Prediction



Plot Created 2014-08-11 12:49:46, Lastest ESP Run from 2014-07-30, NOAA / NWS / CBRFC
The latest (2014-07-30) 50% ESP forecast (110 kaf) changed 0.2 % from previous day and -7.4 % from July 1
**These ESP forecasts do not include observed and are not total runoff.

How can we help?

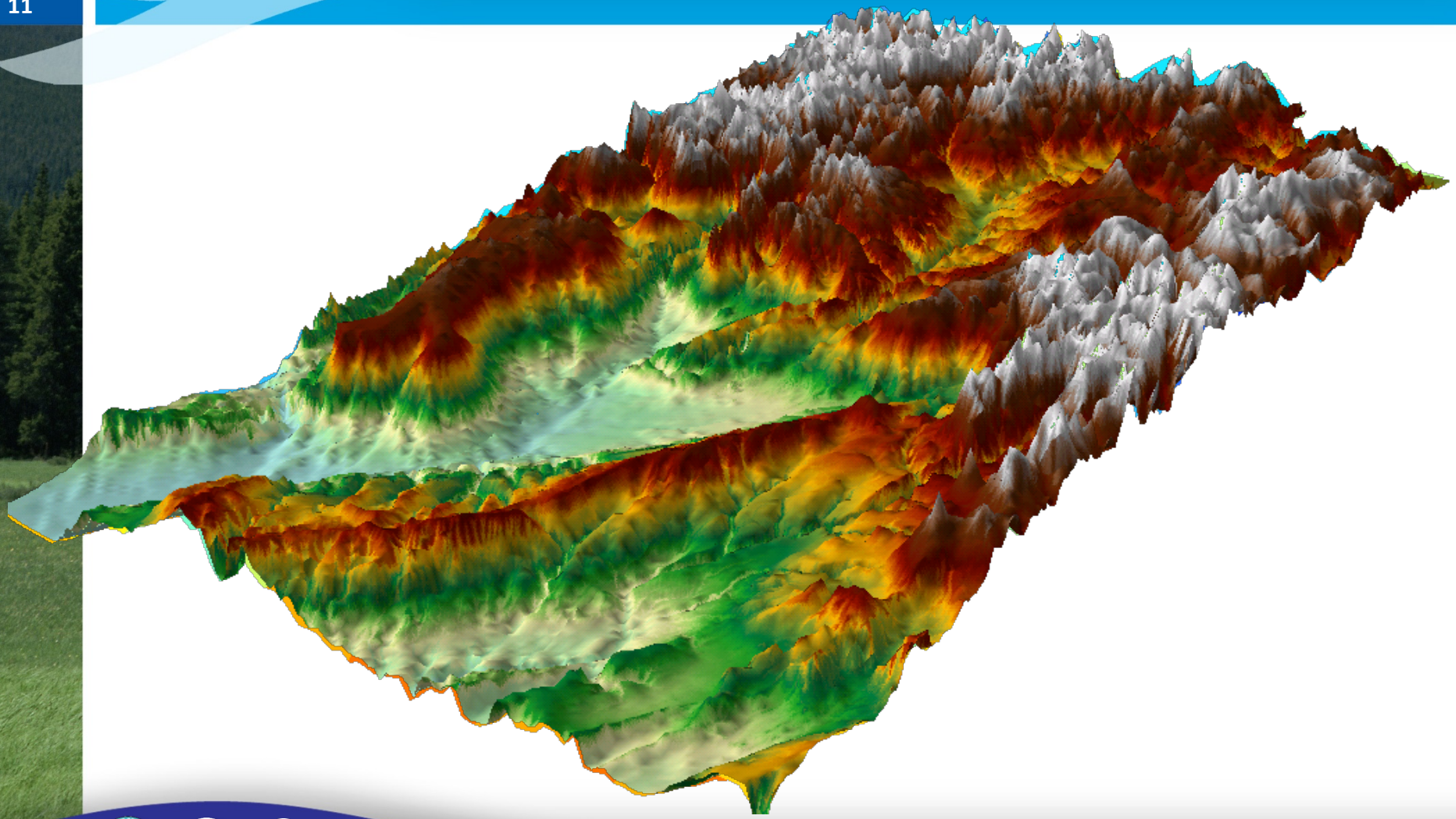
- Providing decision support for policy makers means making projections at a policy scale
  - Information from the latest climate projections
  - Innovate ways to develop climate patterns outside of the historical record
    - Working with the University of Colorado
    - Incorporation of other climatic indicators
- Partner with stakeholders to understand needs

Data and Methodology

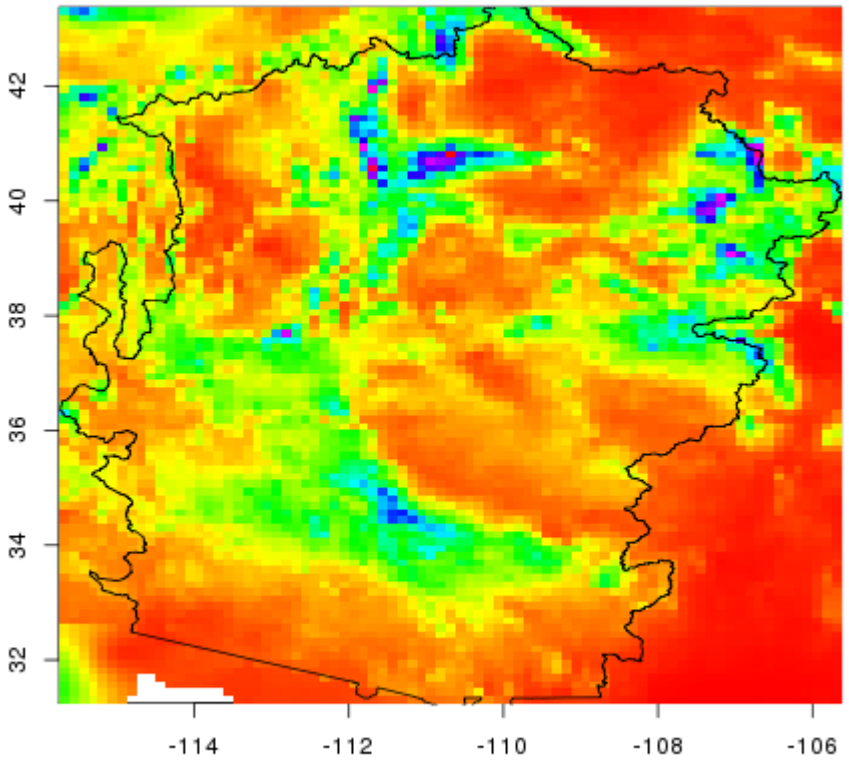
- To “inform” our current historical input of climate data we utilized projected changes from BCSD CMIP3 and CMIP5 data
  - BCSD CMIP data is made available by Reclamation, LLNL, and others at:

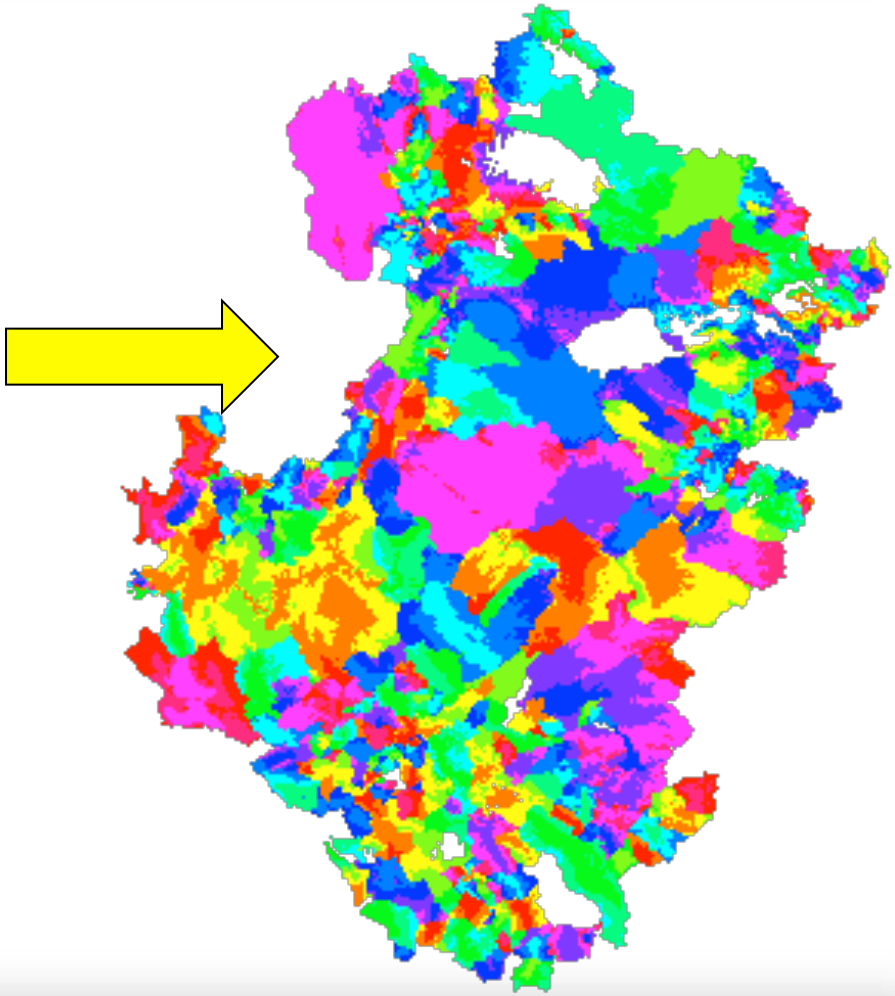
    http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html
  - Gridded projections of climate need to be averaged over spatial zones defined in the CBRFC’s lumped hydrologic model
- Currently averaged over all model runs

Need for Downscaling



Gridded to Lumped Inputs

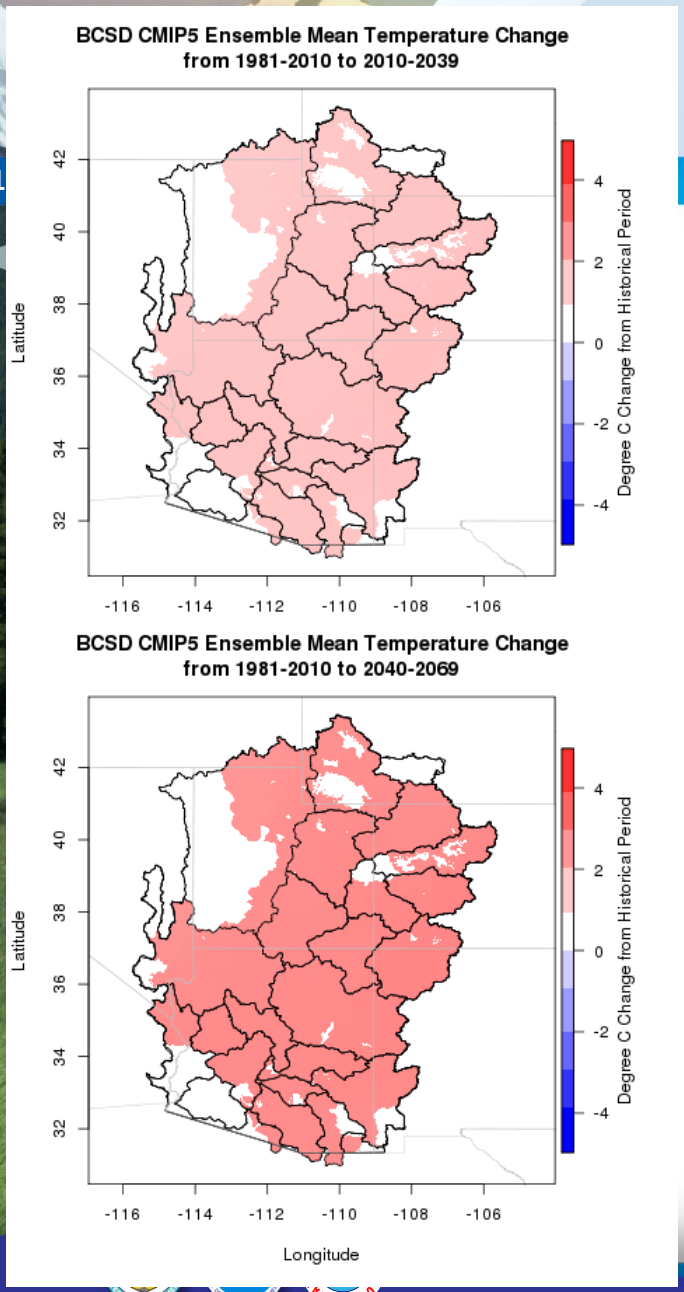


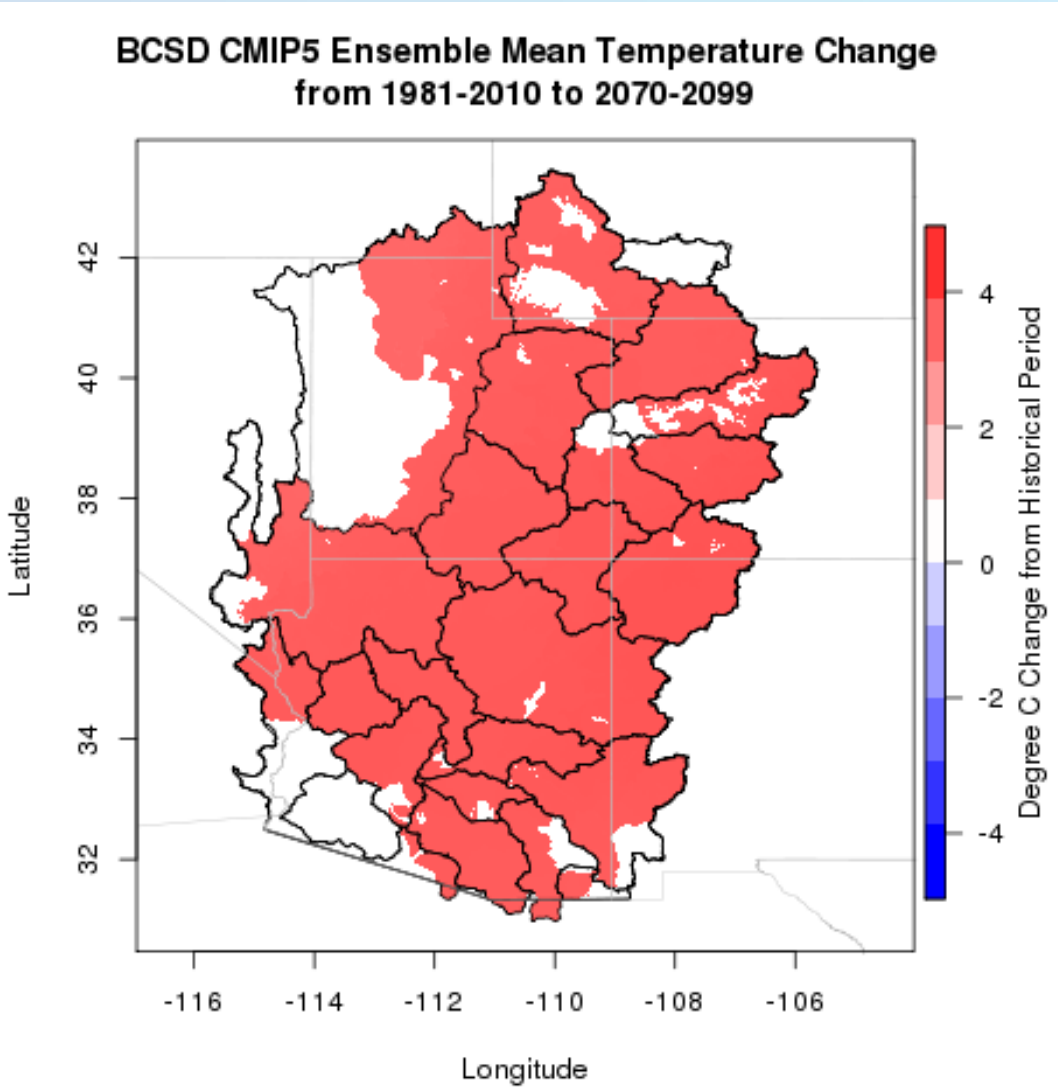


Data and Methodology

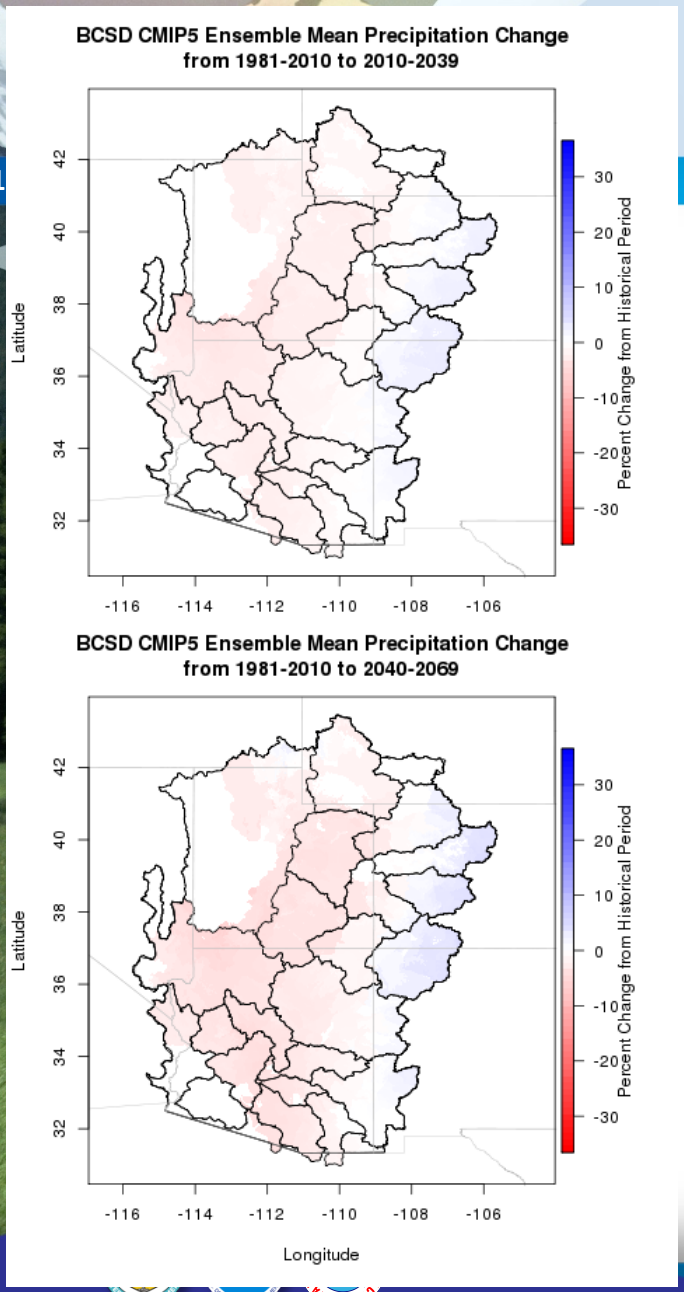
- Average, relative modeled change from 1981-2010 to three future periods is derived
  - 2010-2039, 2040-2069, 2070-2099
  - Gridded values are averaged over each zone
  - Percent change in precipitation is considered
  - Degrees Celsius change in temperature is considered
- Historical information perturbed to develop "climate informed" input

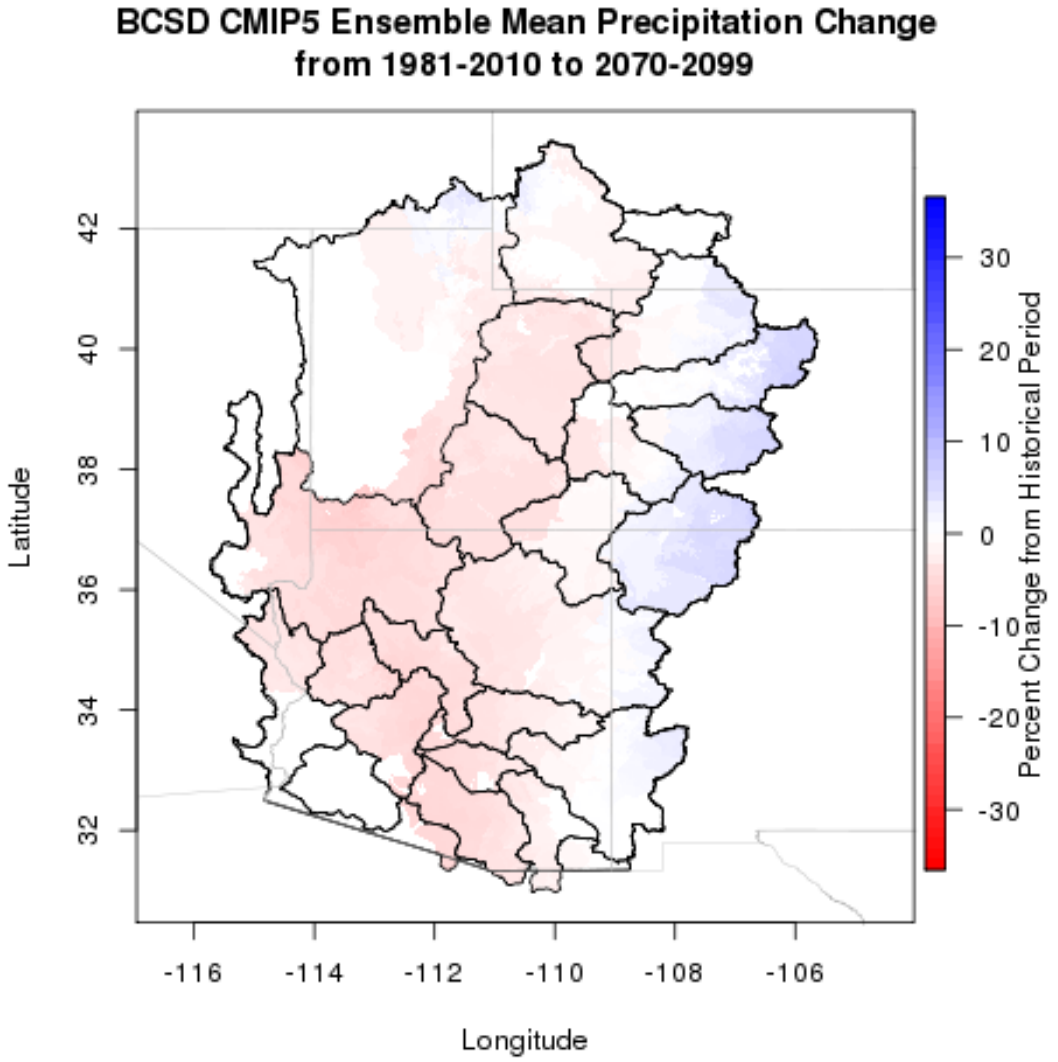
Results - Temperature



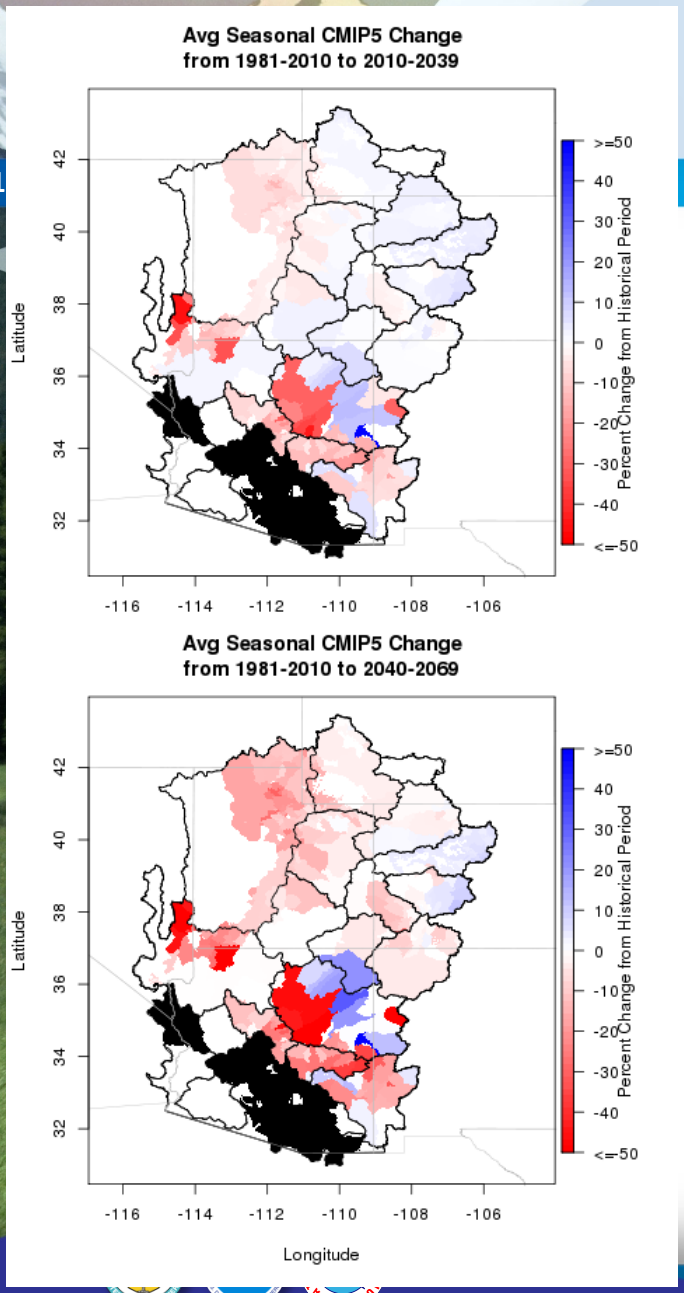


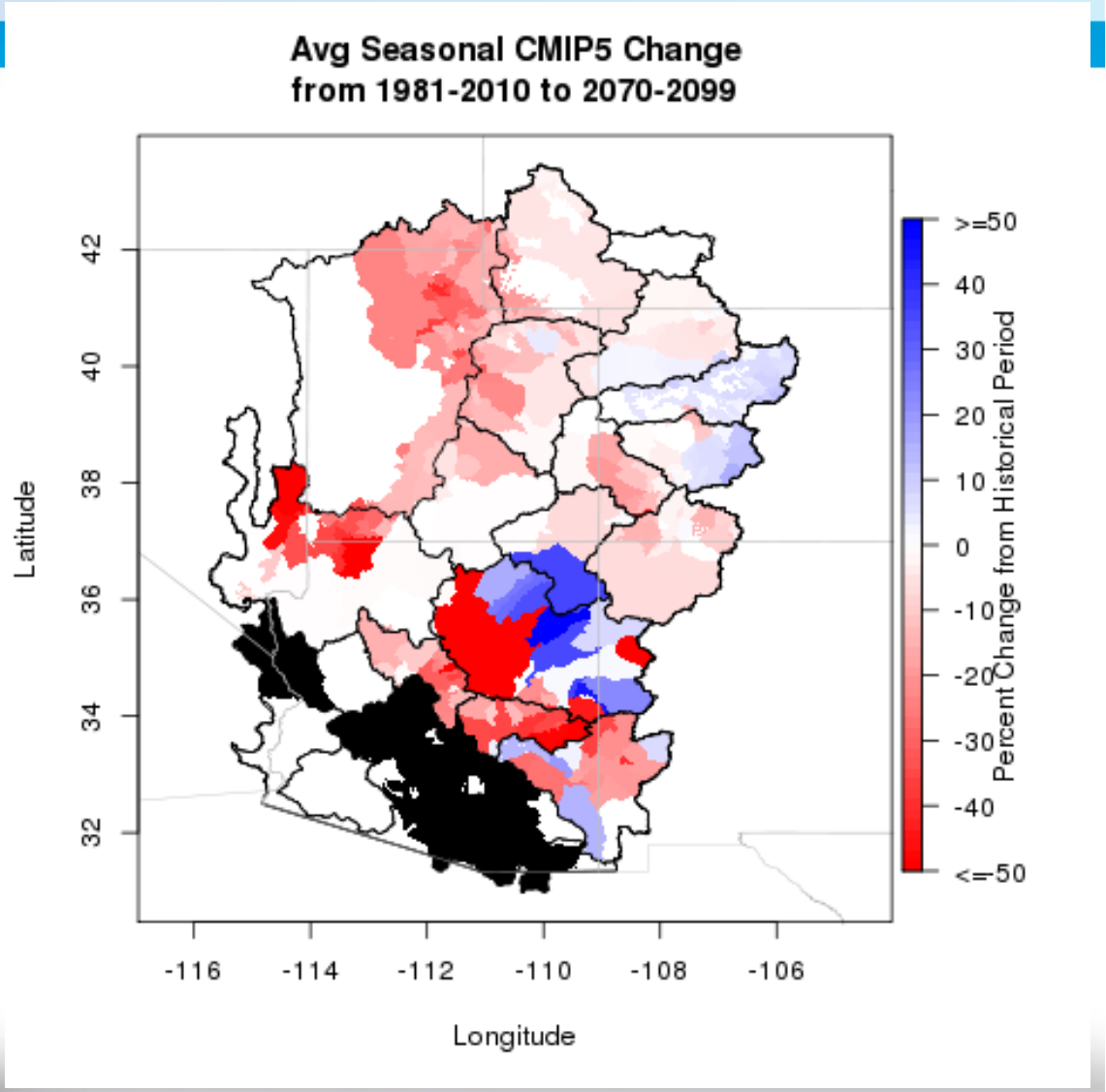
Results - Precipitation



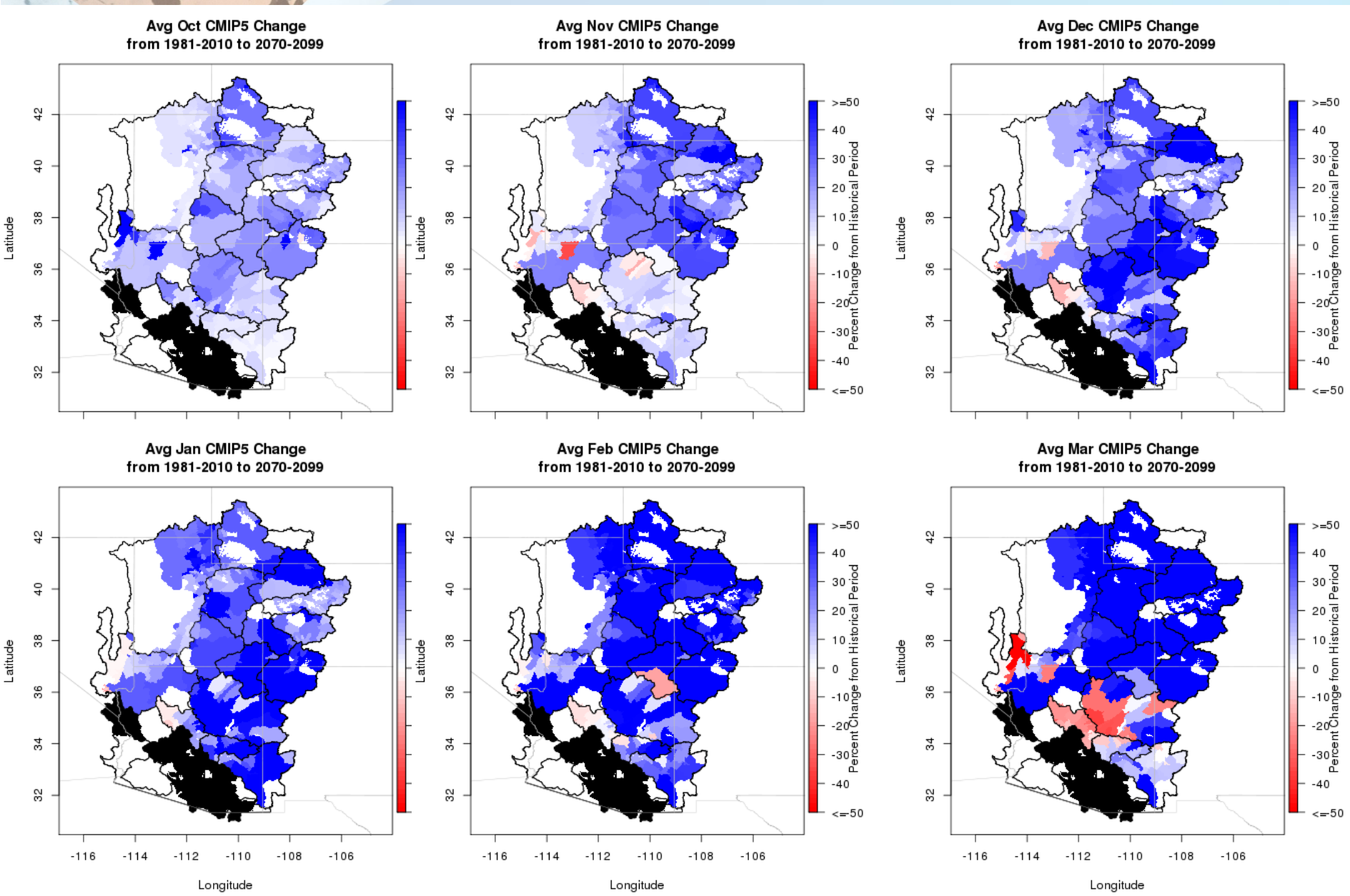


Results - Streamflow





Streamflow Impacts



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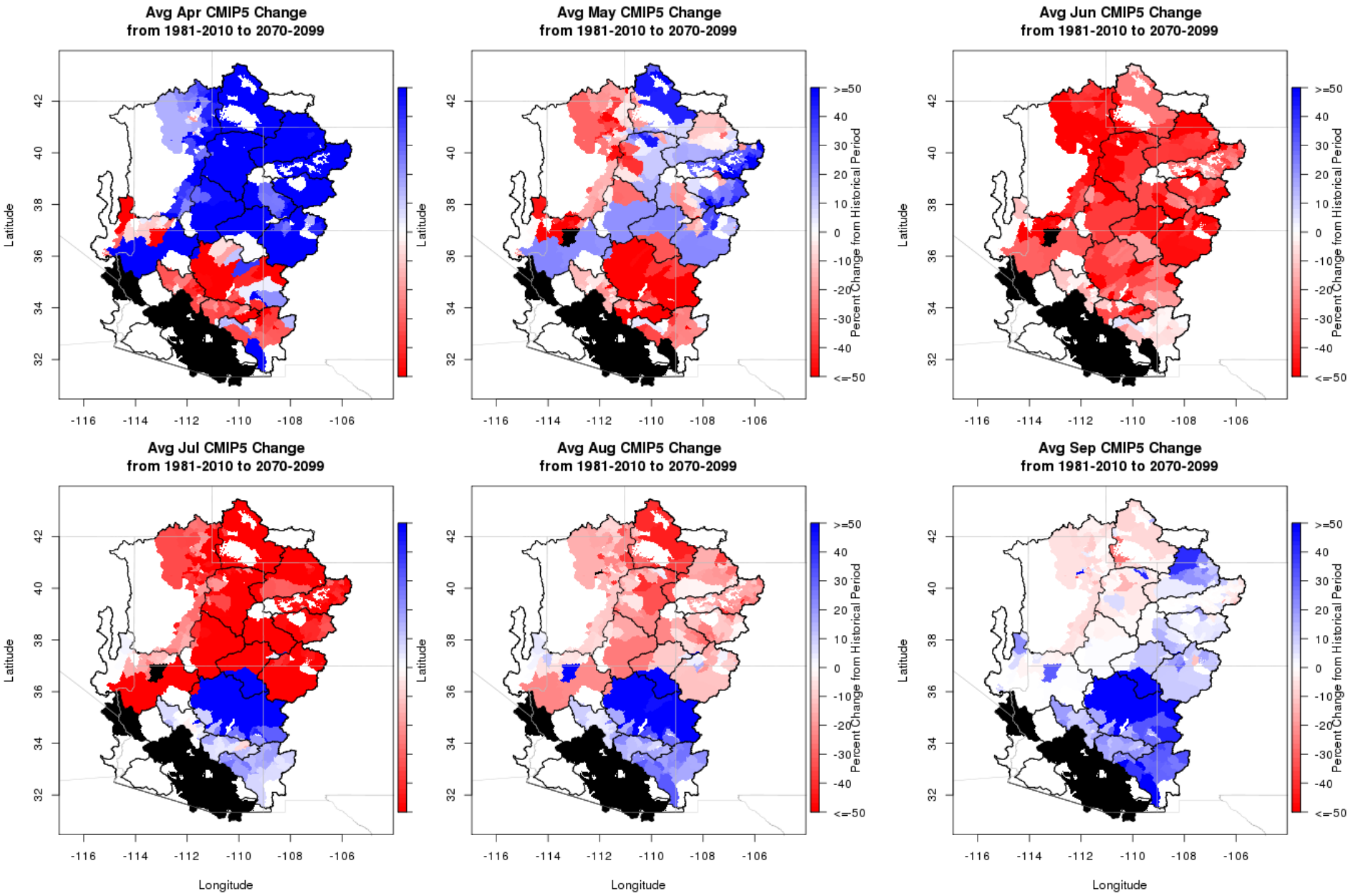

Limitations

- Process is still dependent on historical sequences of precipitation and temperature
- Process does not incorporate a dynamic ET component (yet!). ET is derived using a monthly coefficient that is static through time
- Possible wet bias introduced during the BCSD process?

Next Steps

- Working with colleagues at the University of Colorado to utilize a stochastic weather generator
  - Capable of producing weather sequences not observed in the historical record
  - Can be weighted to incorporate other climate information (e.g., teleconnections, CPC info)
  - Latest results show increased reliability and accuracy using IRI forecast information

Next Steps Continued

- Build on past work done in our office to incorporate dynamic evapotranspiration
- Partner with stakeholders to make this work for them
  - Impacts to reservoir operations?
  - Inform long-term policy development
- Compare with recently released VIC streamflow projections

Questions?

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Extra Slides

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Streamflow Impacts