

# Update on West-Wide Hydrologic Forecasting at the University of Washington

*Alan Hamlet*

Andy Wood

Dennis P. Lettenmaier

*Department of Civil and Environmental Engineering*

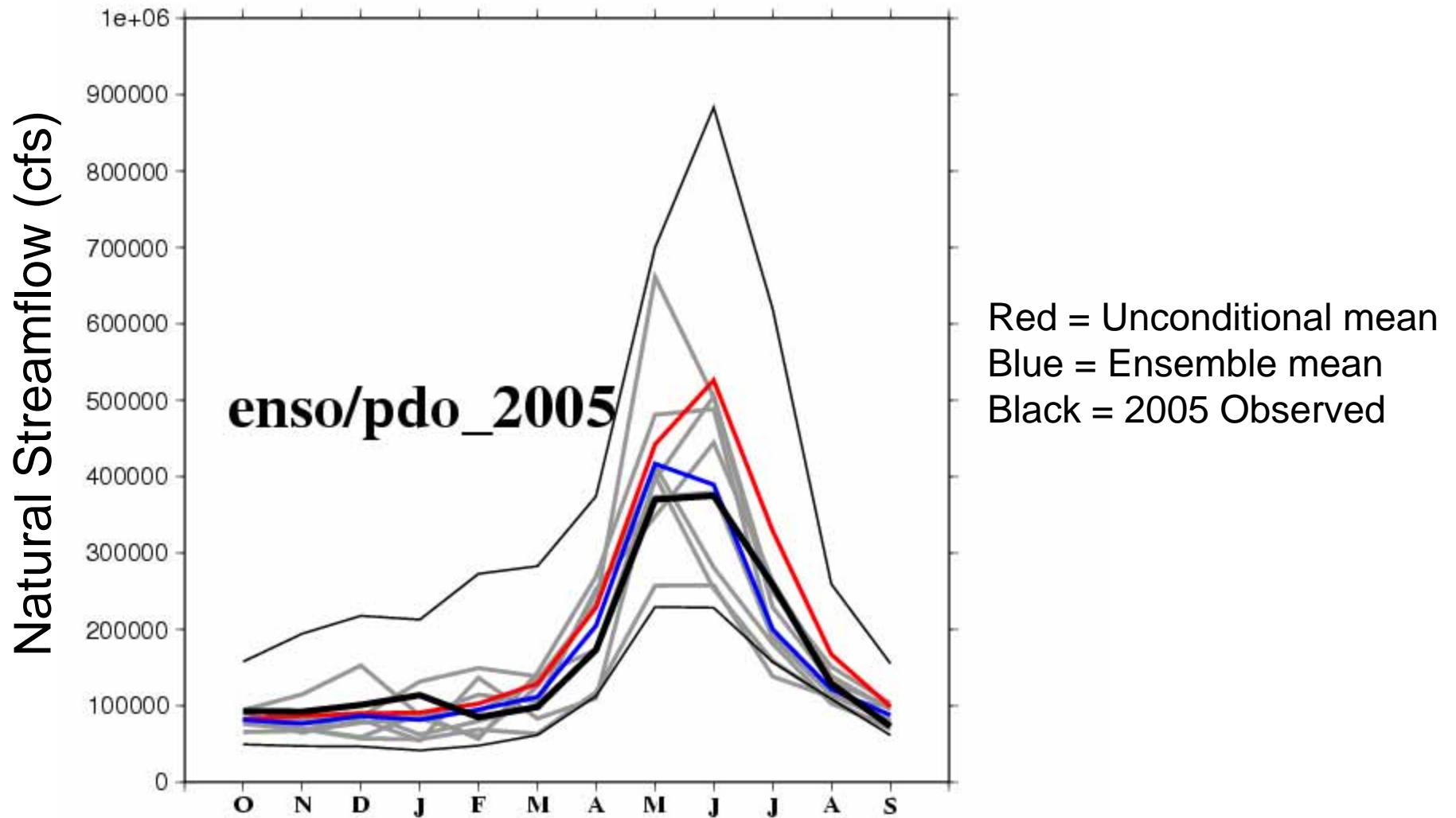


for

**2006 NOAA Climate Prediction Applications Science Workshop**

*March 21-25, 2006, Tucson*

# Bias Corrected Long Range Streamflow Forecast for the Columbia River at The Dalles Nino3.4 index between 0.2 and 1.2 and warm PDO (interannual)

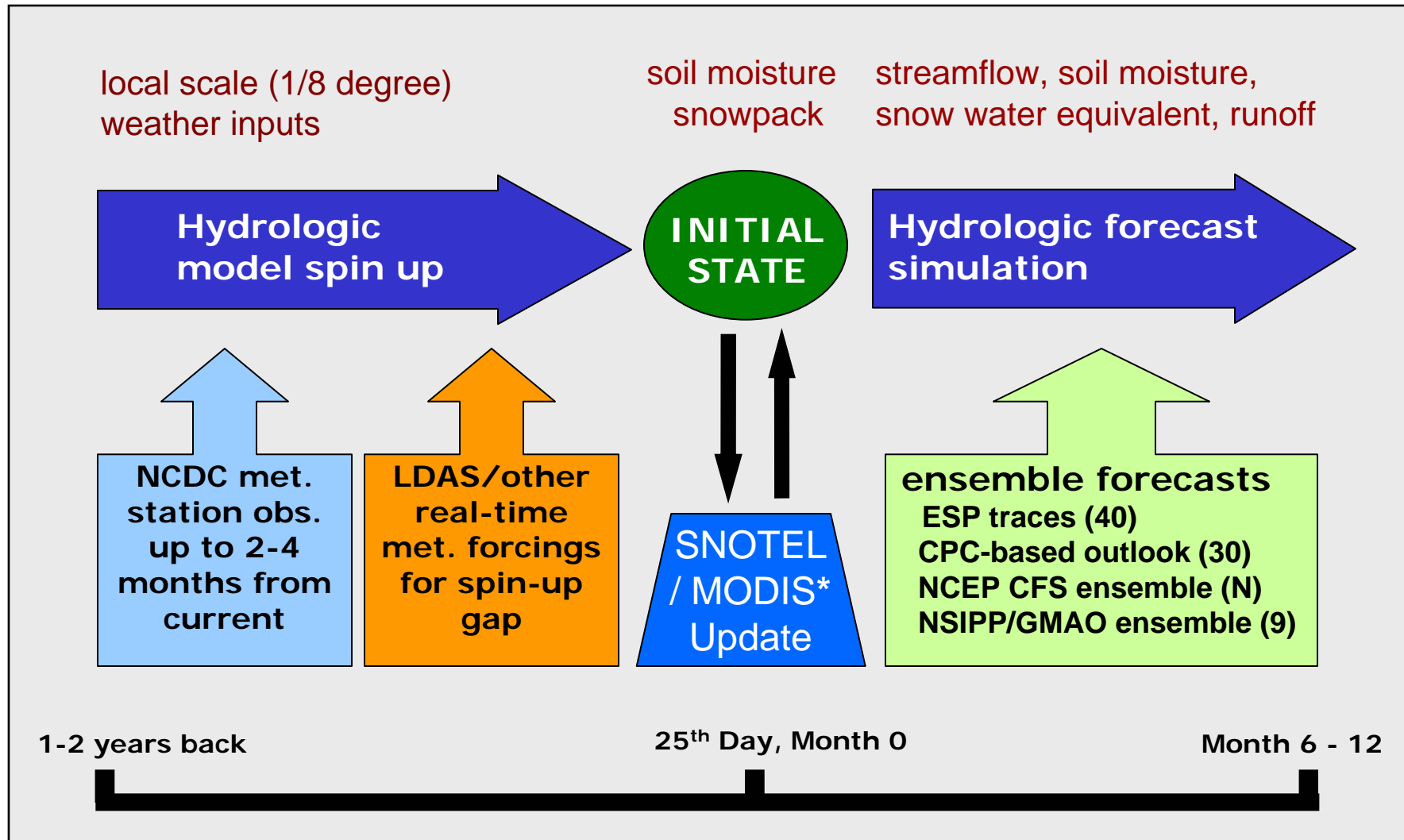


# Presentation Outline

---

1. **Introduction: UW Experimental Hydrologic Forecasting System**
2. Water Year 2006: Current Conditions and Outlook
3. Current research activities:
  - Multi-model forecast approach
  - Daily nowcast update (from SW Monitor)
  - Interaction with NRCS Water & Climate Center
  - Basin-average water balance analyses
  - Pilot basin operational efforts

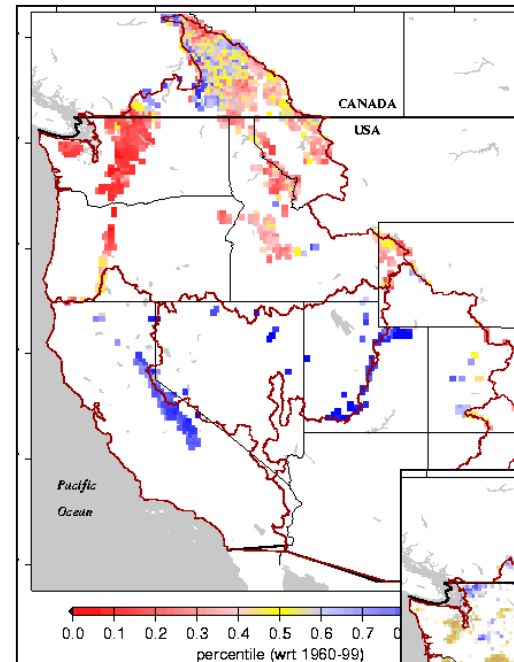
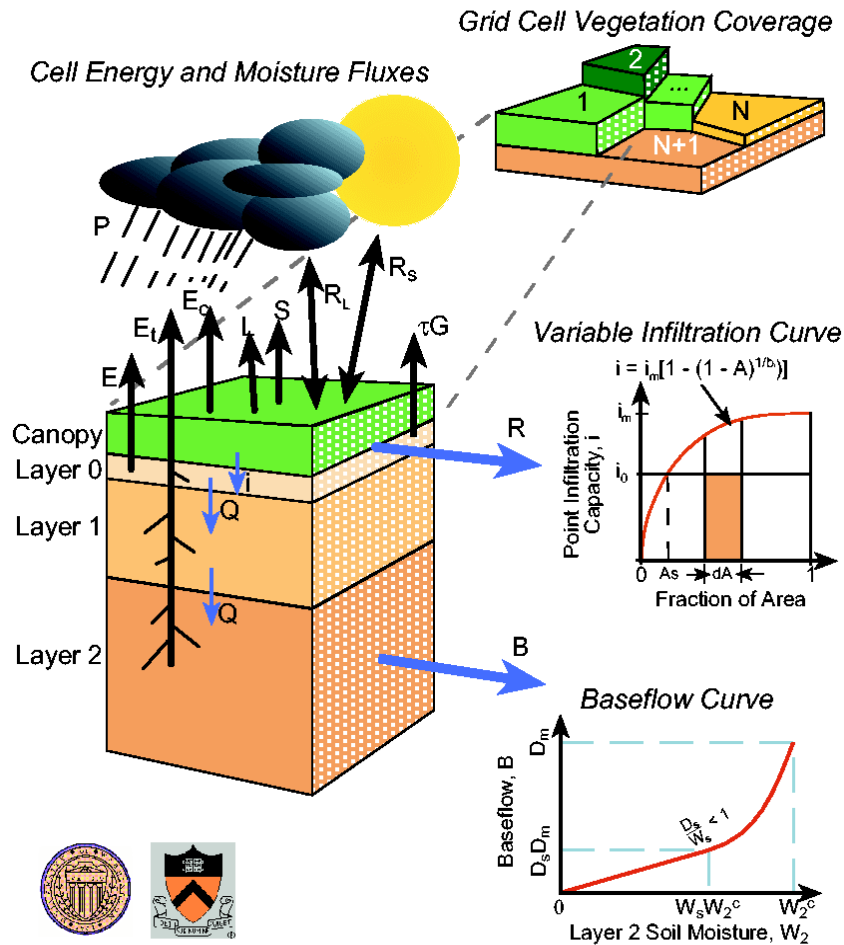
# Experimental W. US Hydrologic Forecast System



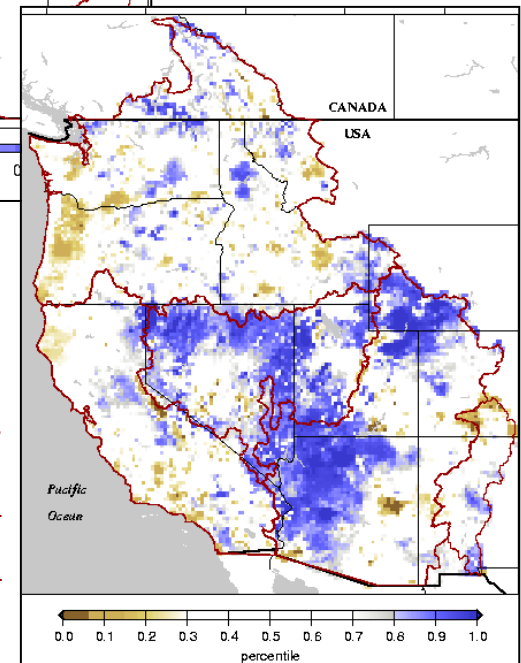
\* experimental, not yet in real-time product

# Experimental W. US Hydrologic Forecast System

## Variable Infiltration Capacity (VIC) Macroscale Hydrologic Model

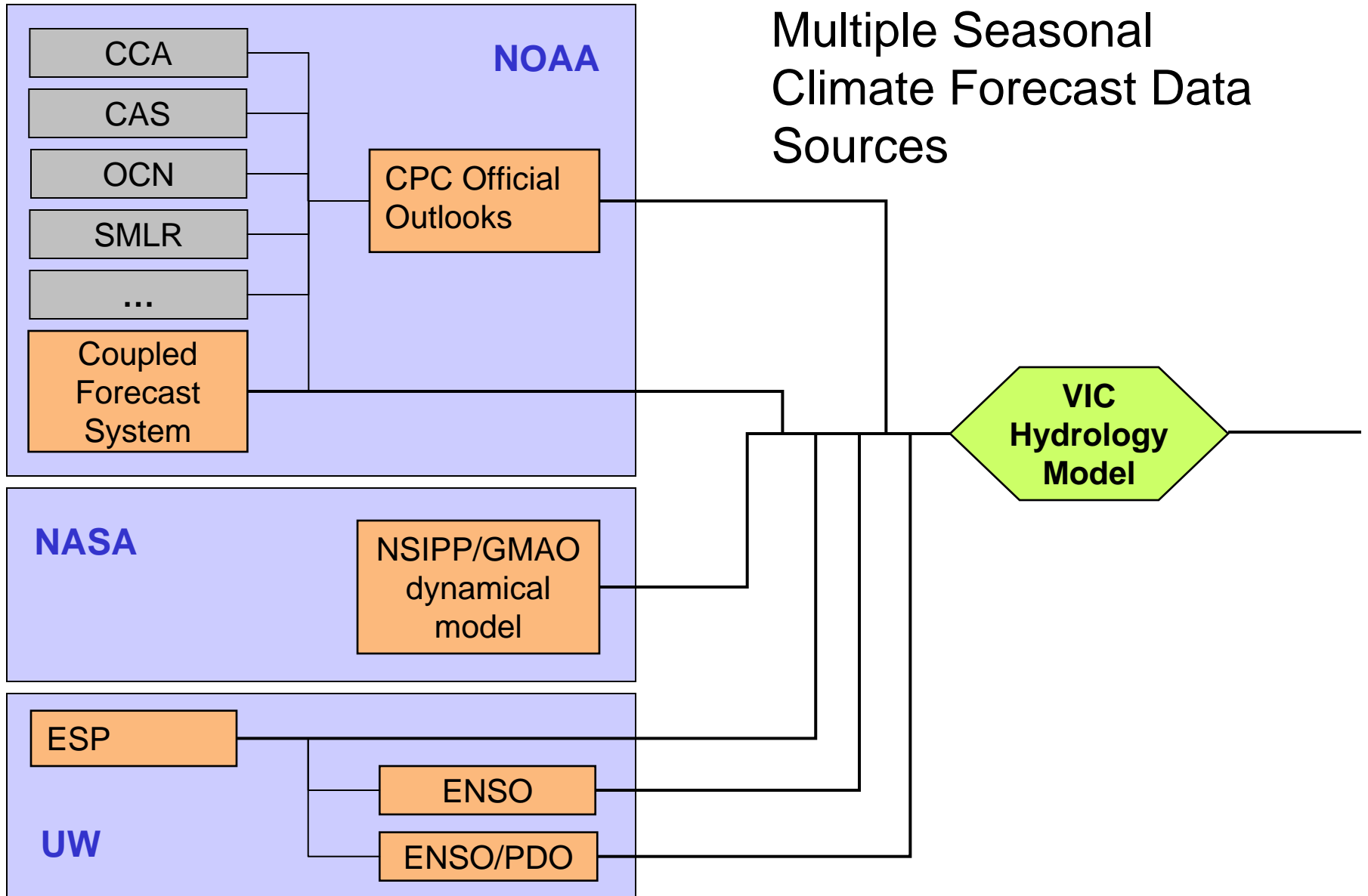


*Snowpack  
Initial  
Condition*



*Soil Moisture  
Initial  
Condition*

# Experimental W. US Hydrologic Forecast System

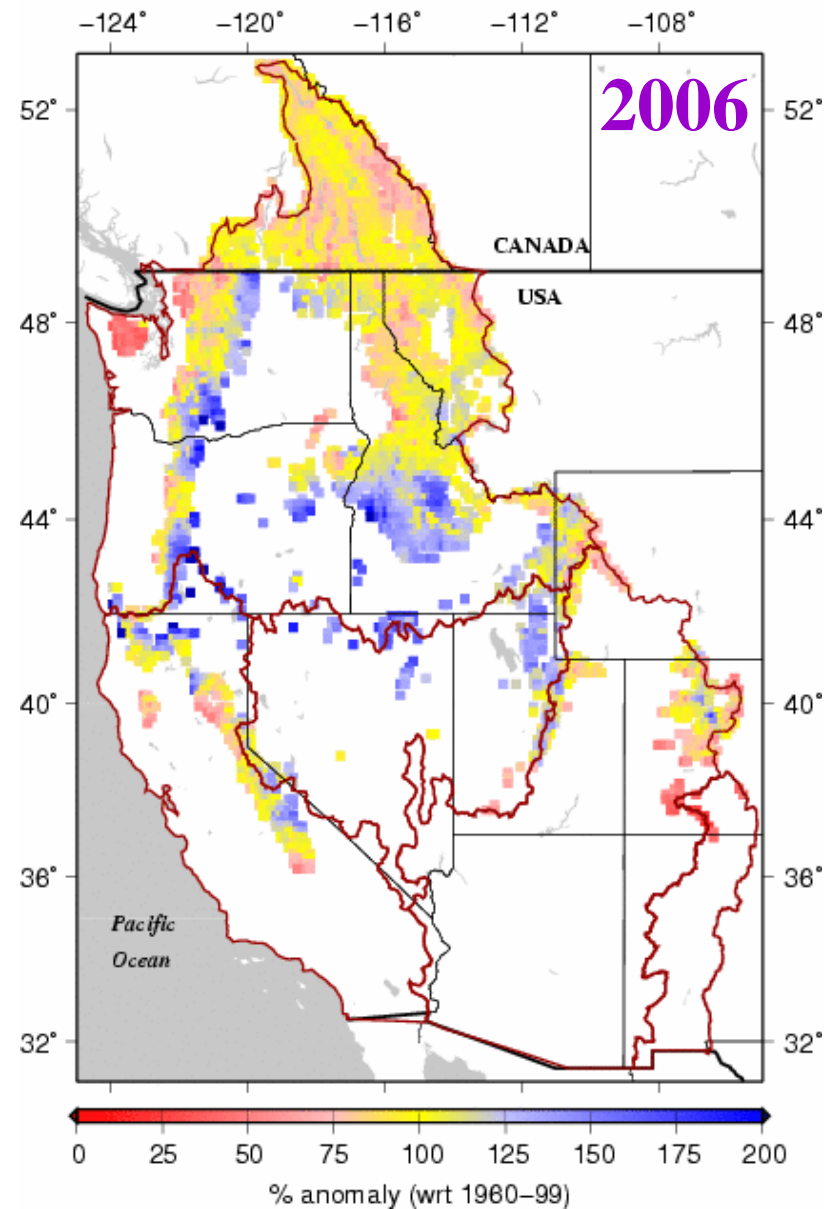
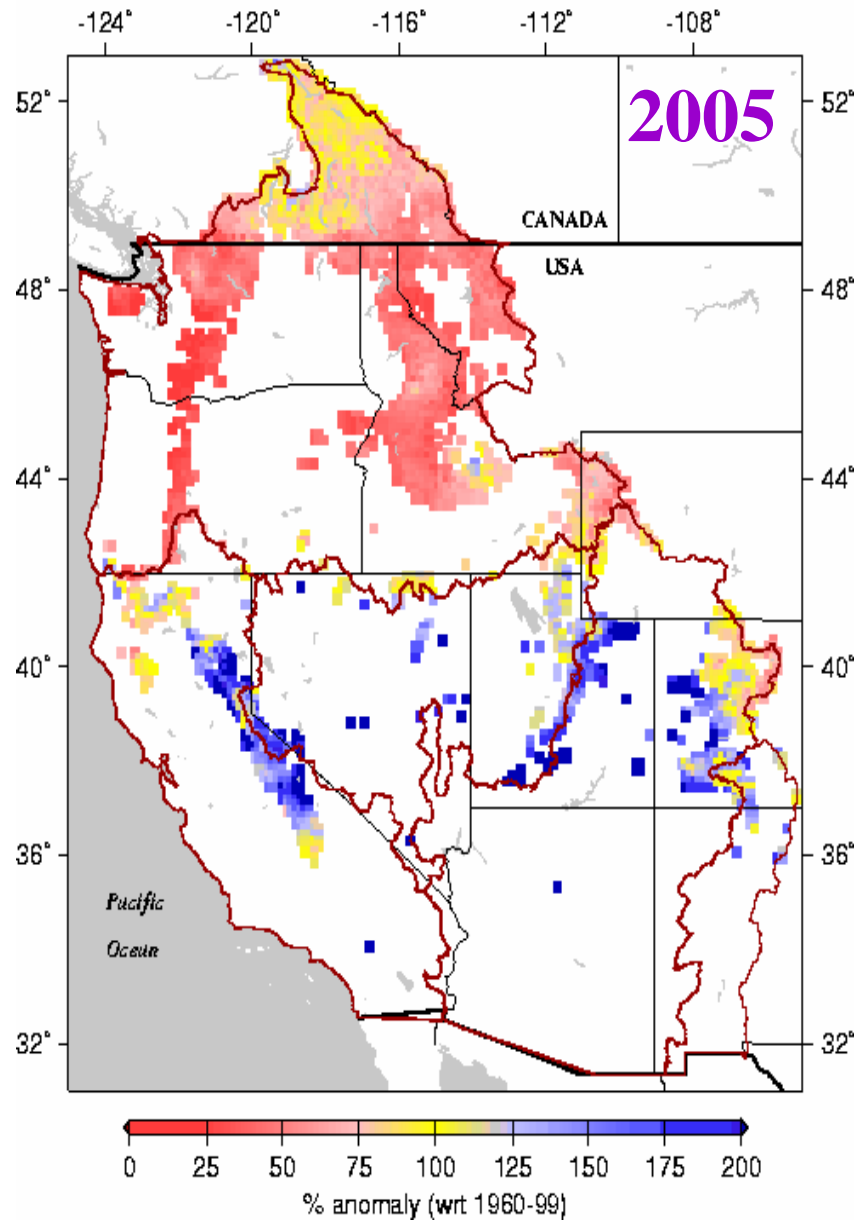


# Presentation Outline

---

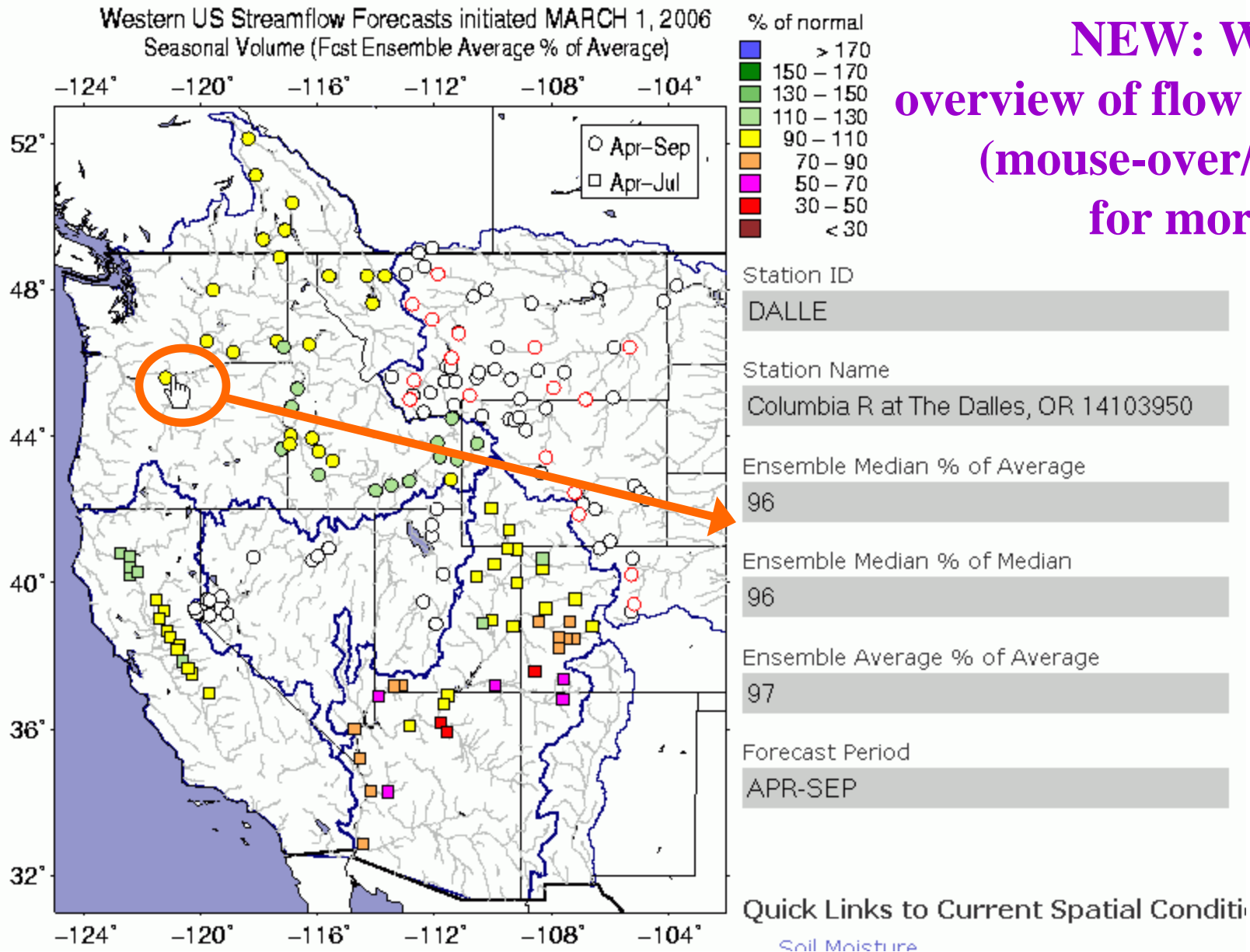
1. Introduction: UW Experimental Hydrologic Forecasting System
- 2. Water Year 2006: Current Conditions and Outlook**
3. Current research activities:
  - Multi-model forecast approach
  - Daily nowcast update (from SW Monitor)
  - Interaction with NRCS Water & Climate Center
  - Basin-average water balance analyses
  - Pilot basin operational efforts

# SWE: MAR-1 compared with 1 year ago





# Streamflow: MAR-1 Forecast for 2006



**NEW: West-wide overview of flow forecasts (mouse-over/clickable for more details)**

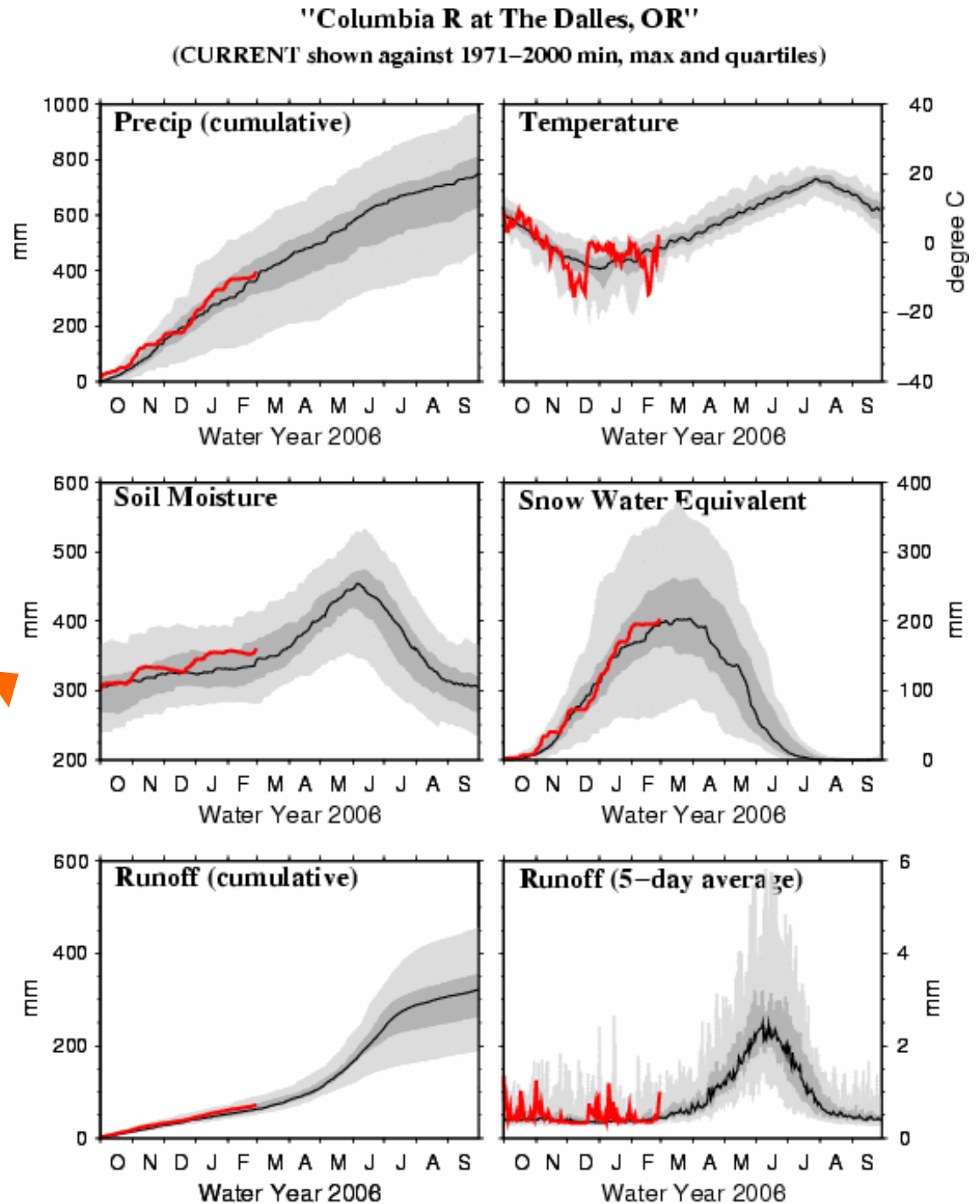
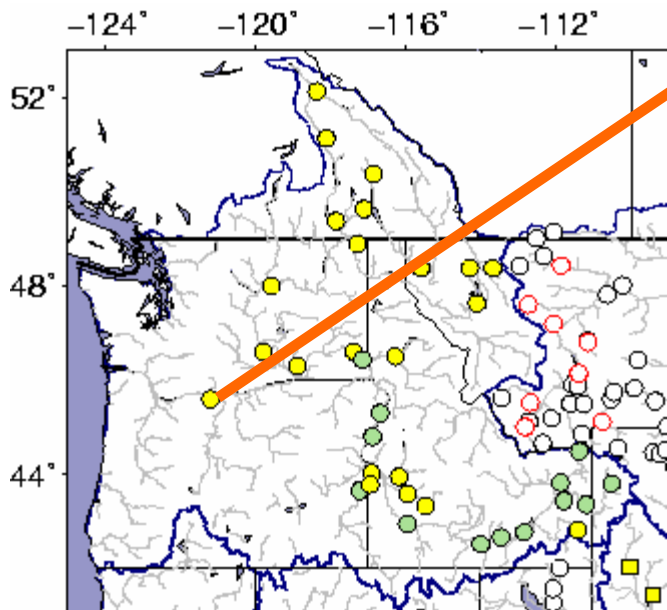
# Presentation Outline

---

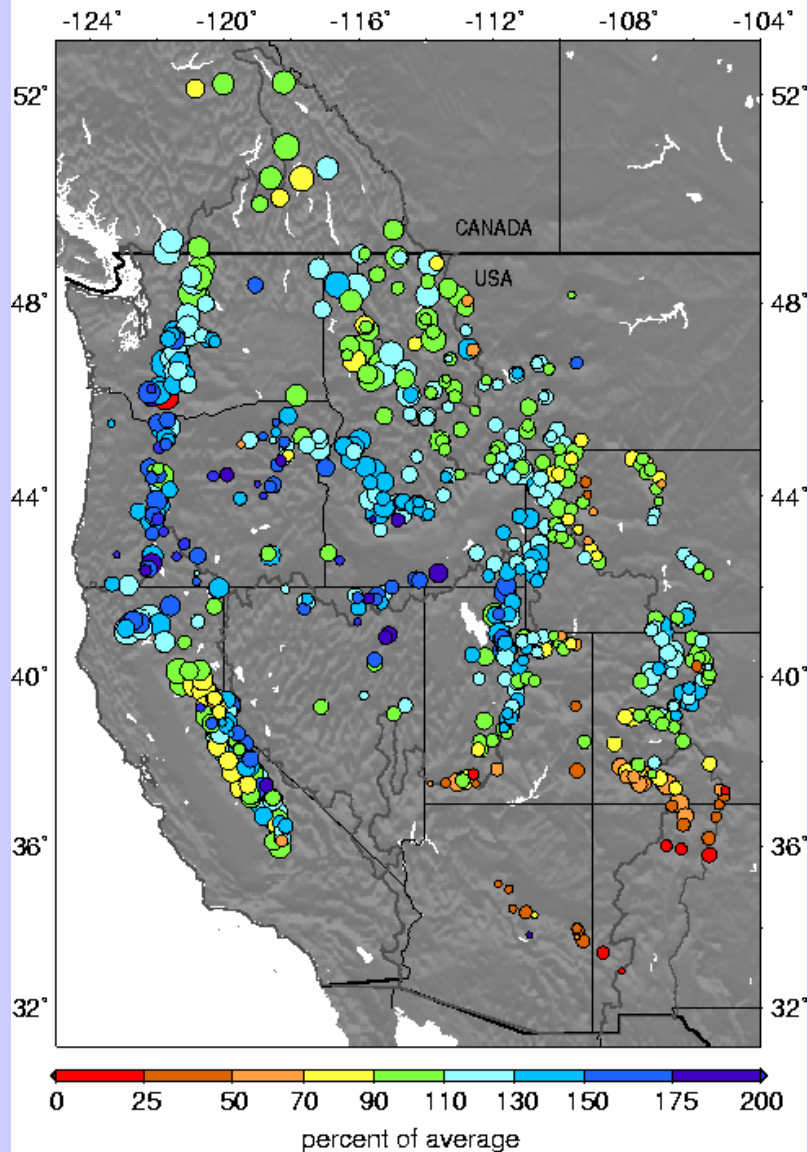
1. Introduction: UW Experimental Hydrologic Forecasting System
2. Water Year 2006 : Current Conditions and Outlook
- 3. Current research activities:**
  - Daily SWE observation west-wide roundup
  - Multi-model forecast approach
  - Daily nowcast update (from SW Monitor)
  - Interaction with NRCS Water & Climate Center
  - Basin-average water balance analyses
  - Pilot basin operational efforts

# Current Activities: added Basin-average water balance analyses

Now clicking the stream  
flow forecast map also  
accesses current basin-  
averaged conditions



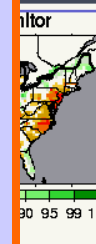
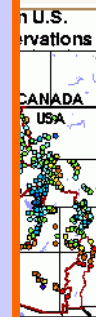
Snotel/ASP Anomalies (wrt 1990-2004 average), 20060318  
(circle areas proportional to normal SWE avg on current date)



## Daily Updating West-at-a-glance SWE from NRCS, EC, CADWR

Analyses:

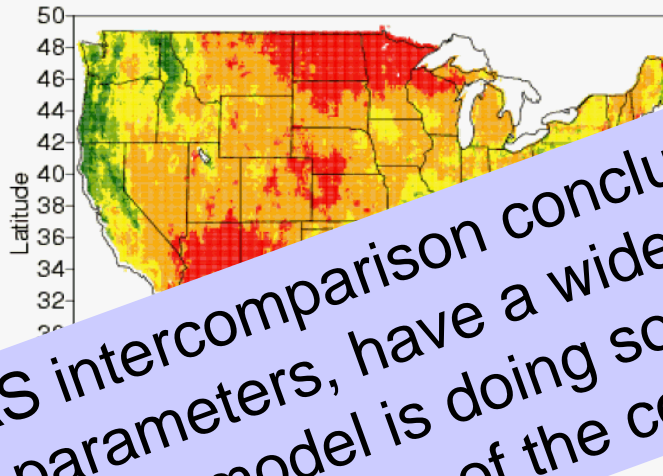
- Current Anomalies
- Percentiles:
  - Current
  - 1-week change
  - 2-week change



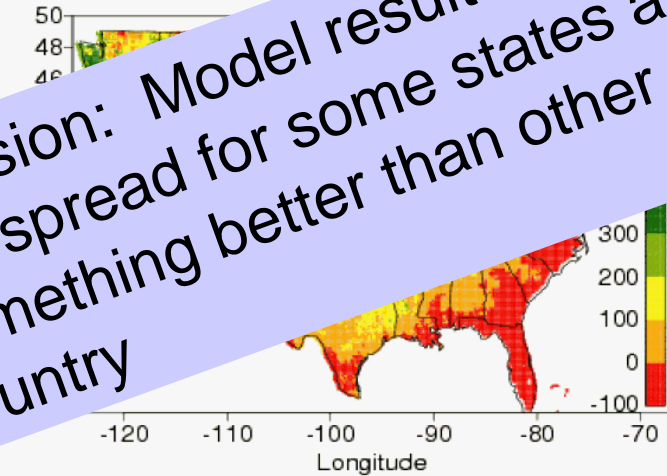
# Current Activities: Multi-model forecasts

Seasonal Change of Total Column Soil Moisture [mm]  
30 Apr. minus 30 Sep., 99, at 237

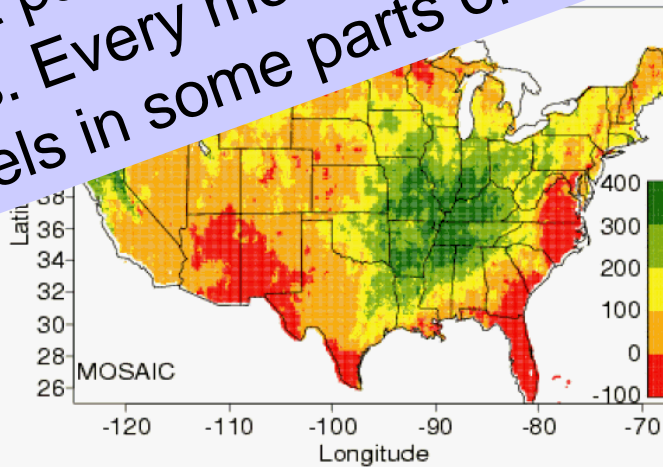
NOAH



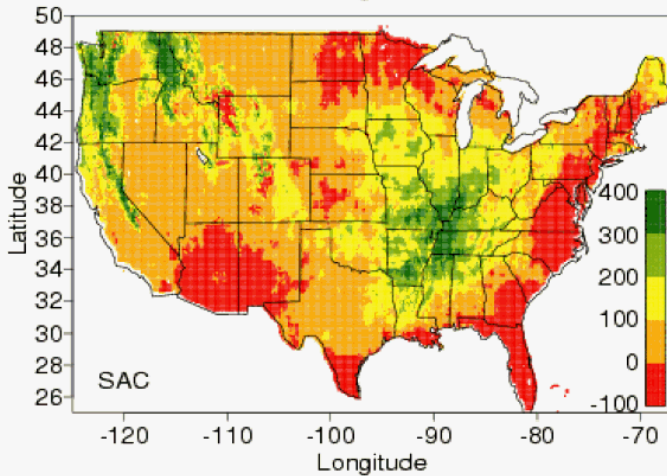
VIC



MOSAIC



SAC



An LDAS intercomparison conclusion: Model results, using default parameters, have a wide spread for some states and fluxes. Every model is doing something better than other models in some parts of the country

# Current Activities: Multi-model forecasts

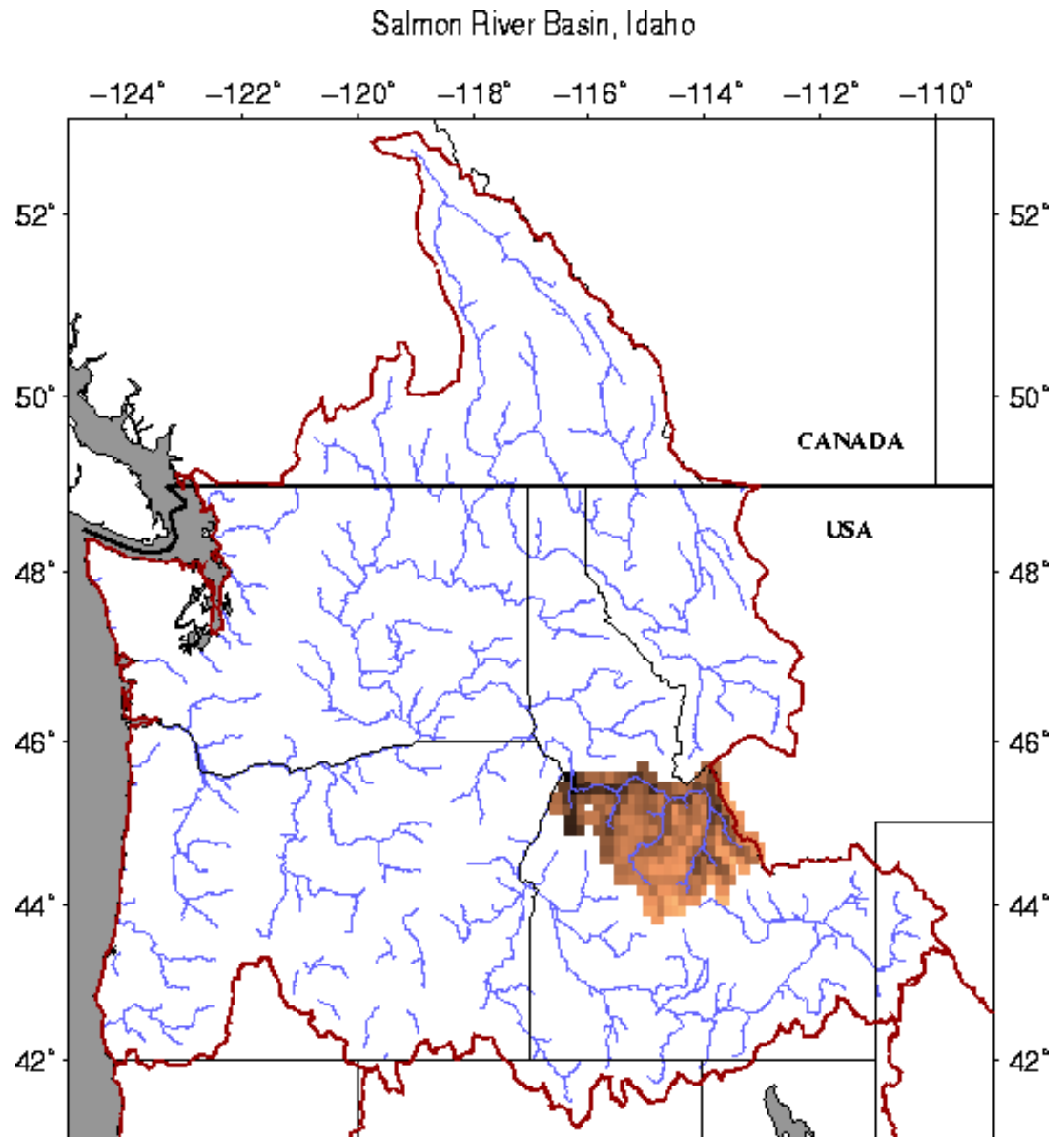
## Test Case

- **Salmon River basin**  
(upstream of Whitebird, ID)

- retrospective (deterministic  
evaluation):

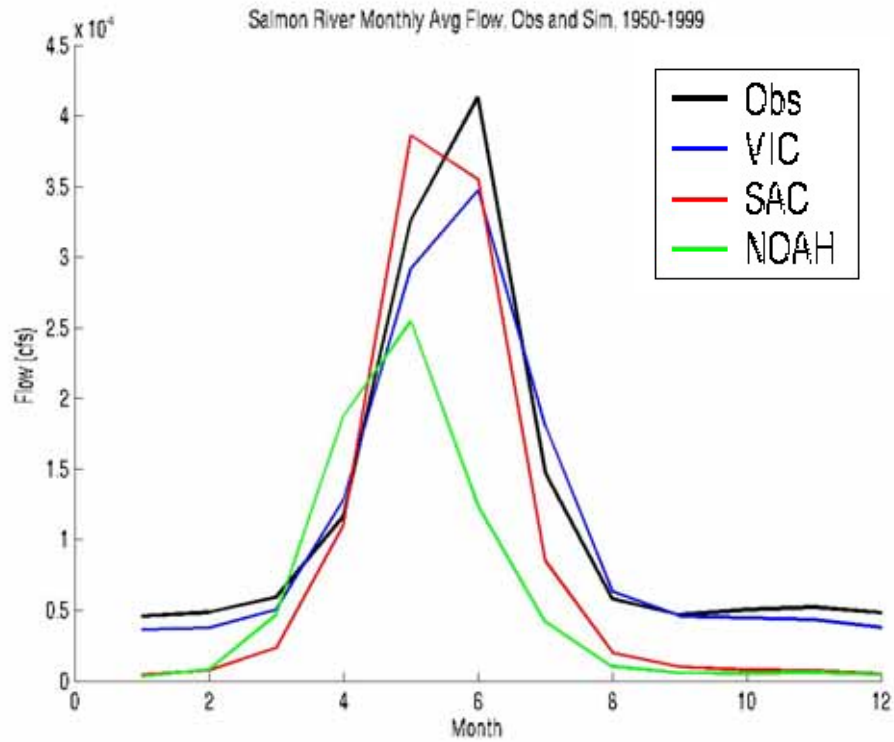
**25 year training**

**20 year validation**

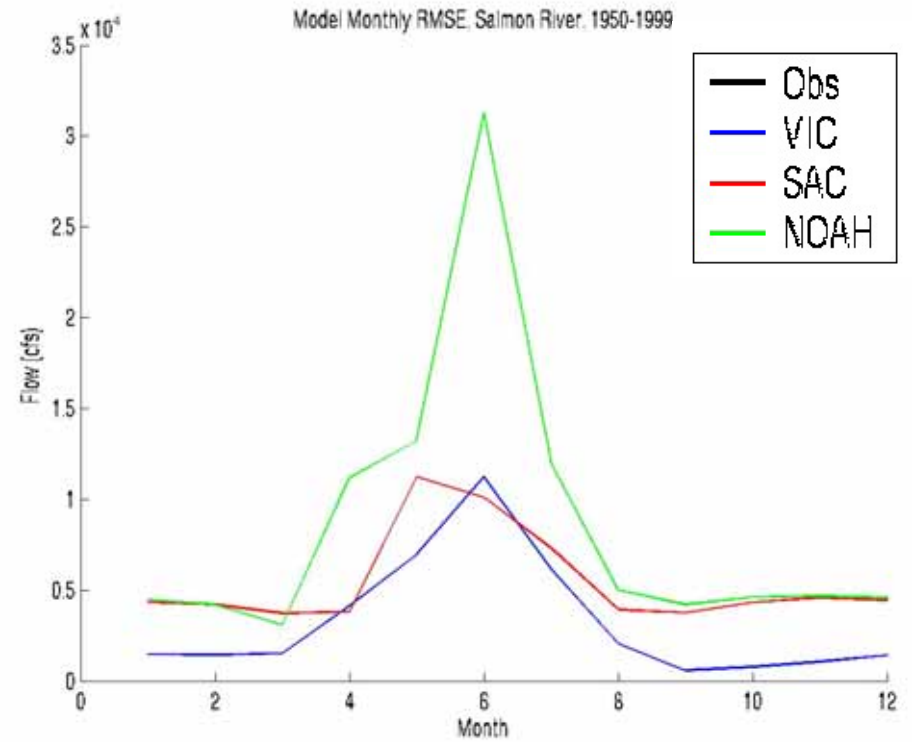


# Individual Model Results

## Monthly Avg Flow

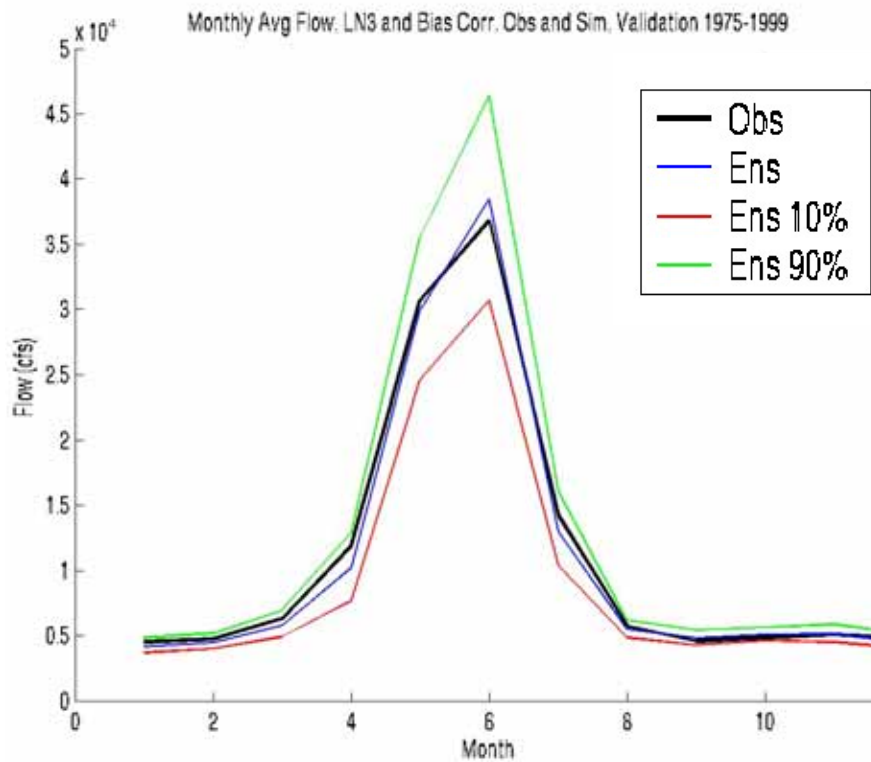


## Monthly RMSE

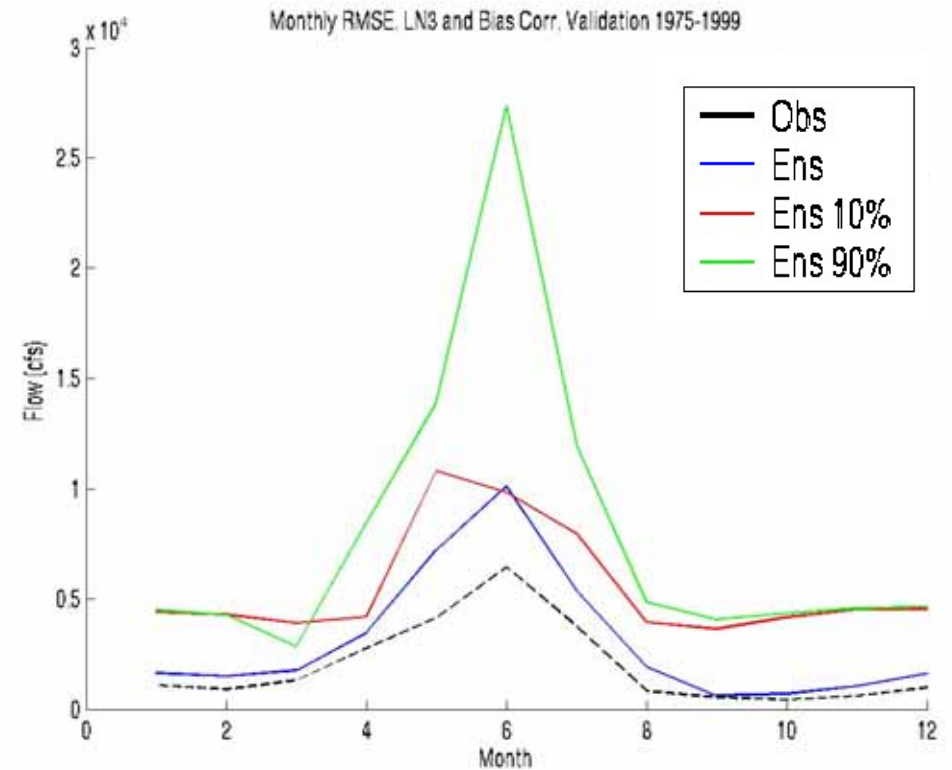


# Multi-model ensemble results: flow and error

## Monthly Avg Flow



## Monthly RMSE





# UW Real-time Daily Nowcast SM, SWE (RO)

UW Experimental Surface Water Monitor - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

http://www.hydro.washington.edu/forecast/monitor/

## Experimental Surface Water Monitor for the Continental U.S.

Home Info Links Contacts

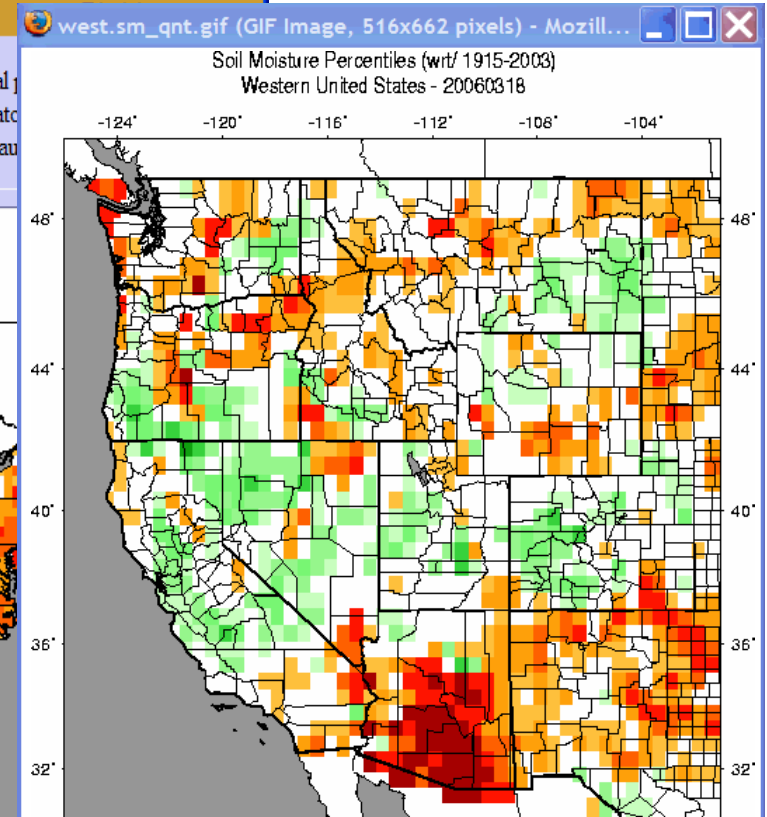
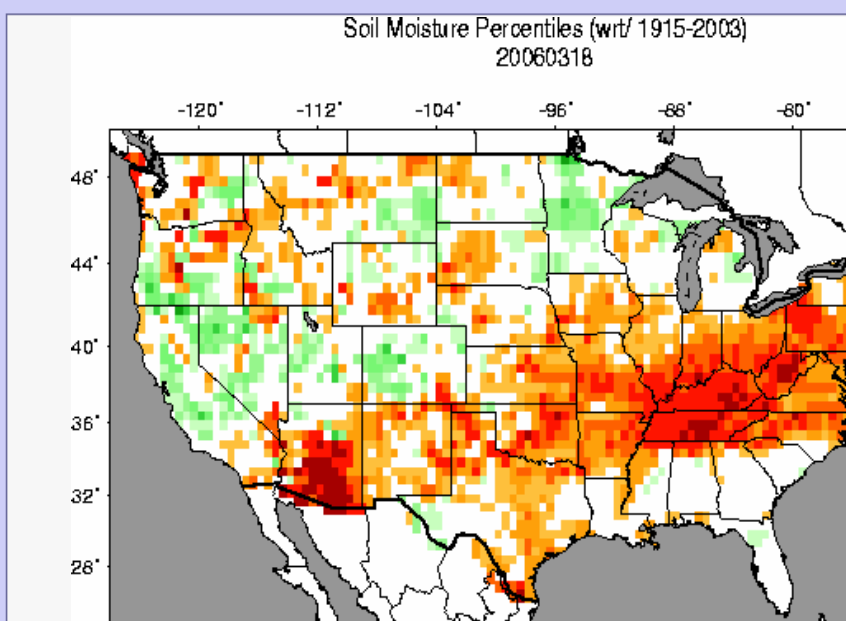
Current Conditions  
SM Plots  
(DM version)  
SWE Plots  
Data

Change since:  
1 week ago  
2 weeks ago  
1 month ago

Archive  
(1915-present)  
SM & SWE Plots

Powered by **LACIS**  
NOAA Regional Climate Centers

The plots below show the current percentiles for soil moisture with respect to the climatological update daily by 2 pm PST, and have a lag of 1-2 days. This version of the map is colored to match the [Climate Prediction Center soil moisture tool](#). Click the map (west, central, east) to launch



We are currently migrating the daily update methods to the west-wide forecast system (1/8 degree)

# Current Activities: Interaction with NRCS NWCC

---

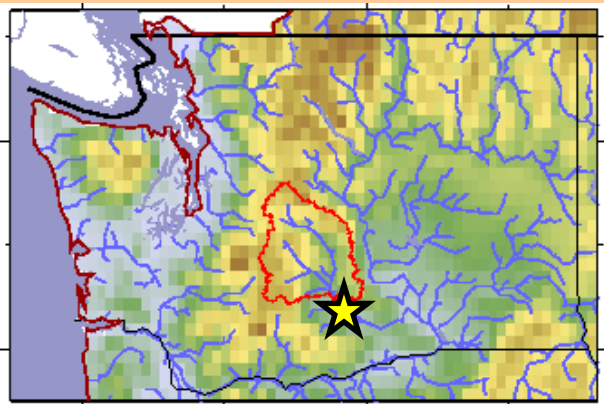
Since last year, we have exchanged nowcast/forecast results with the NRCS National Water and Climate Center (head: Phil Pasteris)

- Under a Memorandum of Understanding between NRCS & UW:
  - ❑ UW provides forecast results and data as NRCS requests
  - ❑ NRCS provides access to stream flow and climate data (primarily via NOAA ACIS)
  - ❑ NRCS has created a place for links to “experimental water supply forecasts” from its official website. **Currently the UW is the only one, and they would like more!**
  - ❑ We generally attempt to schedule a “pre-forecast” conference call just prior to NRCS coordination of forecasts with NWS RFCs, in which we summarize our forecast outlooks and compare notes.
  - ❑ In addition, there is a fair amount of informal exchange.

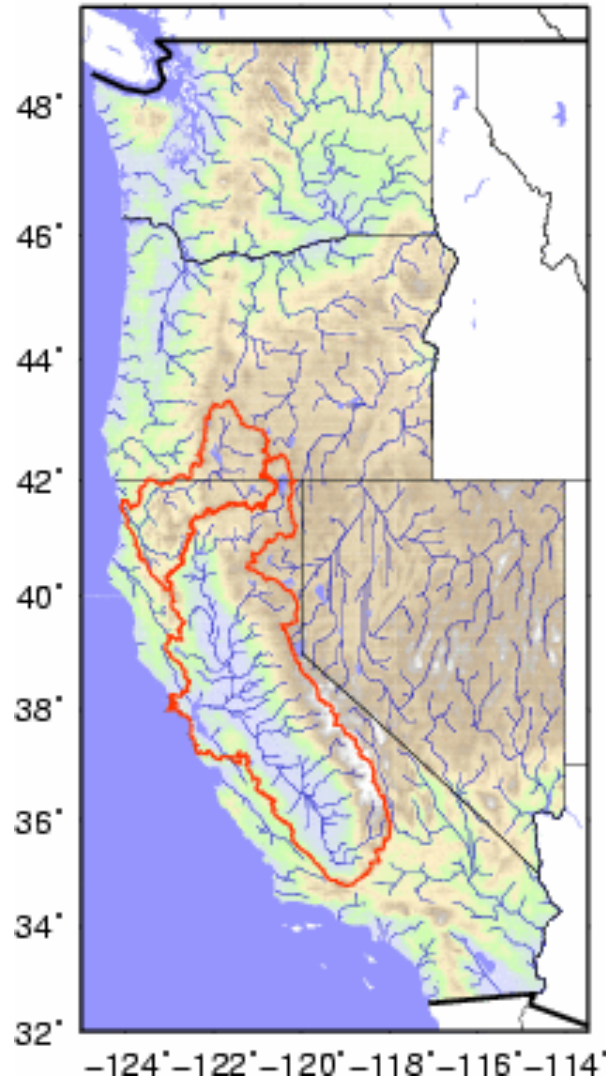
# Current Activities: Pilot basin operational efforts

For both projects,  
model resolution  
in target basins is  
increasing to 1/16  
degree lat-lon  
resolution

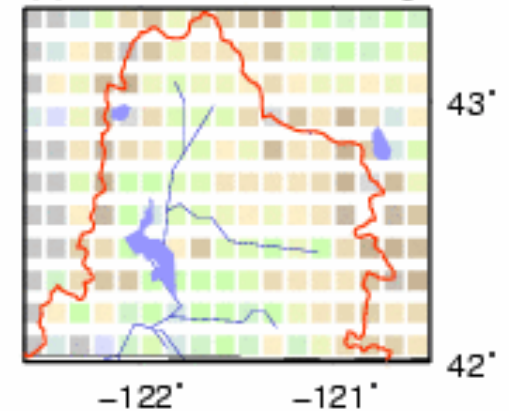
The Yakima R. Basin,  
within WA State domain  
for SARP project



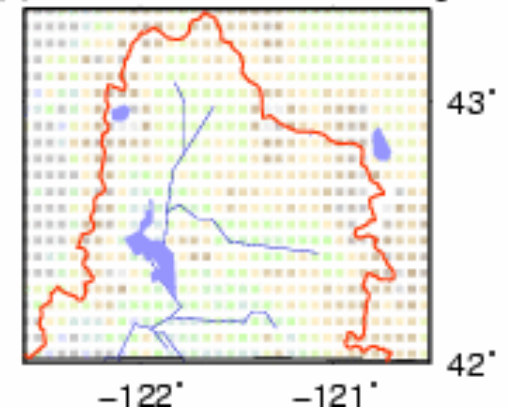
Western 4-State 16th Degree Modeling Region



Upper Klamath, 1/8 Degree



Upper Klamath R., 1/16 Degree



# Questions?

---

## Websites:

[www.hydro.washington.edu / forecast / westwide /](http://www.hydro.washington.edu/forecast/westwide/)

[www.hydro.washington.edu / forecast / monitor /](http://www.hydro.washington.edu/forecast/monitor/)

## Email:

Andy Wood: [aww@u.washington.edu](mailto:aww@u.washington.edu)