

# **The Pacific Northwest Drought Monitor**

**Dennis P. Lettenmaier, Mu Xiao, and Julie Vano**  
**Department of Civil and Environmental Engineering**  
**University of Washington**

**Inland Northwest Drought Forum**  
**Idaho Water Center**  
**Boise, ID**

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**Department of Civil  
and Environmental  
Engineering**



# UW Drought Monitoring System for Washington State

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## Current Conditions

[Plots](#)

## Current SPI/SRI

## Related

[UW Surface Water  
Monitor](#)

The plots below show current percentiles for soil moisture and SWE relative to a recent climatological period. These will update daily with a lag of ~1 day.

*NOTE: This site is under development, hence not all links shown are active nor all the plots are reliable yet*

### Current Plots

[SM](#)[SWE](#)[Runoff](#)

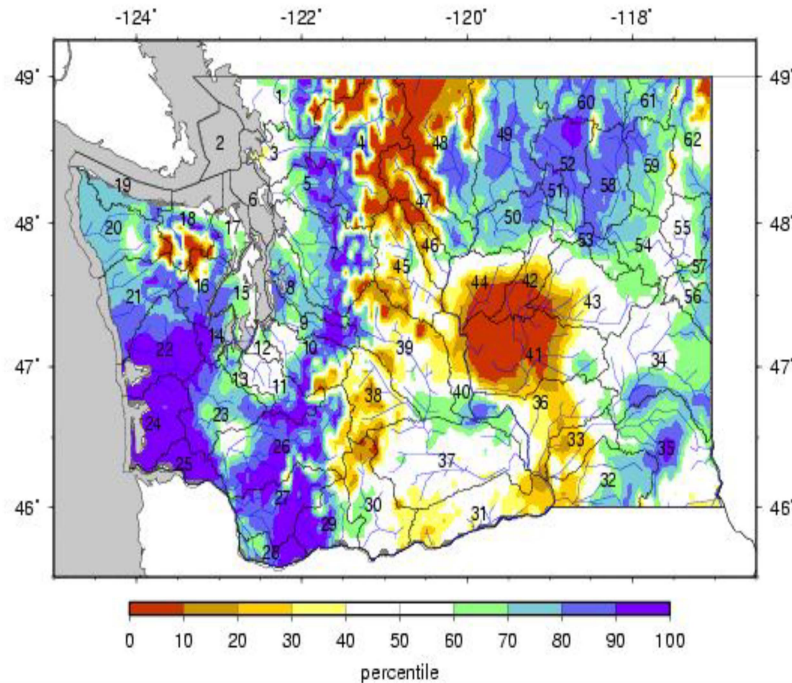
### Change Plots

[1 day](#)[1 week](#)[2 weeks](#)[1 month](#)[SM](#)[SM](#)[SM](#)[SM](#)[SWE](#)[SWE](#)[SWE](#)[SWE](#)[1mo 2mo](#)[3mo 6mo](#)[9mo 12mo](#)[18mo 24mo](#)[36mo 48mo](#)[60mo WY](#)

## Basin Averages Plots

Please follow the links below. The plots show climate and moisture conditions (averaged within each WRIA) as they evolve on a daily basis, relative to historical conditions.

## Soil Moisture Percentiles for 20120513



## WRIA basin averages (daily update)

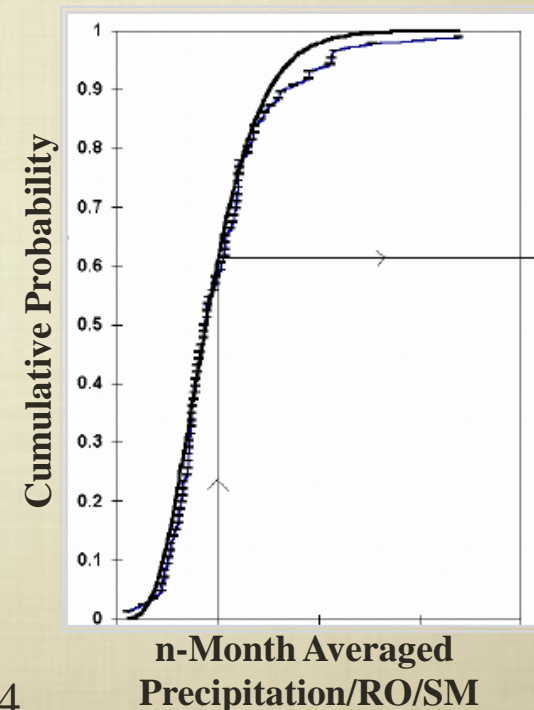
# Data

- **LSM:** Variable Infiltration Capacity (VIC) Model<sup>10</sup>
- **Forcings:** Precipitation, Tmax, Tmin, Wind Speed<sup>11</sup>
- **Spatial Resolution:** 1/16<sup>th</sup> deg. (~6 km)
- **Temporal Resolution:** Daily
- **Simulation Period:** 1916-2006
- **Hydrologic variables used for estimating drought indicators:** Monthly precipitation, Soil moisture and Runoff (Surface +Base flow)

<sup>10</sup>Liang et al., 1994; <sup>11</sup>Elsner et al., 2010

# Drought Indicators

	<b>Standardized Precipitation Index (SPI)<sup>12</sup></b>	<b>Standardized Runoff Index (SRI)<sup>13</sup></b>	<b>Soil Moisture Percentile (SMP)<sup>14</sup></b>
Data Used	Precipitation	Runoff (Surface+Base flow)	Soil Moisture
Average Period(s)	3,6,12,24,and 36 months	3,6,12,24, and 36 months	1 month
Distribution	Gamma	Gamma	Weibull
Climatology	1955-2005	1955-2005	1955-2005



<sup>12</sup>McKee et al., 1993; <sup>13</sup>Shukla and Wood, 2008; <sup>14</sup>Sheffield et al., 2004






# Approach

## (Analysis of Indicators and Droughts)

Table 1: Drought severity classifications based on percentiles.

Standardized Precipitation Index (SPI) (percentiles)	Standardized Runoff Index (SRI) (percentiles)	Soil Moisture Percentile (SMP)	Drought Severity Class
0.50 to 1.0	0.50 to 1.0	0.50 to 1.0	<b>1</b>
0.35 to 0.50	0.35 to 0.50	0.35 to 0.50	<b>2</b>
0.20 to 0.35	0.20 to 0.35	0.20 to 0.35	<b>3</b>
0.10 to 0.20	0.10 to 0.20	0.10 to 0.20	<b>4</b>
0.05 to 0.10	0.05 to 0.10	0.05 to 0.10	<b>5</b>
0 to 0.05	0 to 0.05	0 to 0.05	<b>6</b>

### Intensity:

-  D0 Abnormally Dry
-  D1 Drought - Moderate
-  D2 Drought - Severe
-  D3 Drought - Extreme
-  D4 Drought - Exceptional



# Approach

**Statewide Drought:** Drought in 31 or more WRIAs (i.e. 62/2).

Drought declaration and recovery approach following Steinemann and Cavalcanti (2006)

Month 1	$\geq 31$
Month 2	$\geq 31$
Month 3	$\geq 31$

## Drought Onset

31 WRIAs or more of the state is under class-3 drought (\*Moderate Drought) or above, for 3 consecutive months

Month 1	$< 31$
Month 2	$< 31$
Month 3	$< 31$
Month 4	$< 31$

## Drought Recovery

31 WRIAs or less of the state is under class-3 drought (\*Moderate Drought) or above, for 4 consecutive months

# Approach

**Yakima Drought:** Drought severity Class 3 or more severe.

Drought Severity Class	Intensity
Class 2	Abnormally Dry
Class 3	Moderate Drought
Class 4	Severe Drought
Class 5	Extreme Drought
Class 6	Exceptional Drought

Month 1	$\geq$ Class 3
Month 2	$\geq$ Class 3
Month 3	$\geq$ Class 3

## Drought Onset

Yakima is under Class 3 drought (\*Moderate drought) or above, for 3 consecutive months

Month 1	$<$ Class 3
Month 2	$<$ Class 3
Month 3	$<$ Class 3
Month 4	$<$ Class 3

## Drought Recovery

Yakima is under Class 1 or 2 drought for 4 consecutive months

# Results

**Drought: 1976-1977**



# Statewide Drought

## Results

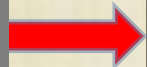
Table 2: Number of WRIAs under class 3 or more severe drought according to DMS indicators during the 1976-77 drought.

Month	SMP	SPI-3	SRI-3	SPI-6	SRI-6	SPI-12	SRI-12	SPI-24	SRI-24	SPI-36	SRI-36
Jan-76	0	1	0	0	0	0	0	0	0	0	0
Feb-76	0	0	0	0	0	0	0	0	0	0	0
Mar-76	1	0	1	0	0	0	0	0	0	0	0
Apr-76	0	0	3	0	0	0	0	0	0	0	0
May-76	4	25	4	0	0	0	0	0	0	0	0
Jun-76	0	37	4	3	0	0	0	0	0	0	0
Jul-76	0	3	3	2	0	0	0	0	0	0	0
Aug-76	0	0	0	0	3	0	0	0	0	0	0
Sep-76	0	0	0	3	0	0	0	0	0	0	0
Oct-76	11	8	7	13	3	3	0	0	0	0	0
Nov-76	52	61	55	58	30	10	0	0	0	0	0
Dec-76	61	61	61	59	41	59	17	0	0	1	0
Jan-77	61	61	61	61	53	61	38	30	1	13	0
Feb-77	61	61	61	61	61	61	41	50	3	20	0
Mar-77	57	61	61	61	61	61	49	50	10	24	3
Apr-77	61	61	61	61	61	61	54	53	18	44	12
May-77	55	19	60	61	61	61	58	45	22	38	15
Jun-77	53	50	61	61	61	61	61	52	26	39	19
Jul-77	56	4	55	56	61	61	61	49	31	54	23
Aug-77	53	0	52	8	59	61	61	49	34	33	22
Sep-77	22	0	34	2	57	61	61	30	34	19	23
Oct-77	22	0	28	1	50	61	61	58	44	16	20
Nov-77	23	0	21	1	39	61	61	60	53	13	21
Dec-77	2	0	1	0	18	9	56	61	56	5	17
Jan-78	8	0	1	0	6	2	50	61	60	14	18
Feb-78	8	5	2	1	1	0	44	61	61	20	15
Mar-78	21	55	23	9	1	2	42	61	59	32	17
Apr-78	8	37	29	2	2	0	29	61	60	18	15
May-78	0	5	31	5	4	2	19	61	61	12	19
Jun-78	6	0	22	41	28	1	11	61	61	17	20

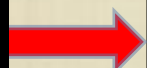
Drought Onset

Drought Recovery

Official Drought Onset



Official Drought Recovery





# Results

## Yakima Drought

Table 3: Drought severity classes according to DMS indicators in the Yakima River Basin during the 1976-77 drought.

Month	SMP	SPI-3	SRI-3	SPI-6	SRI-6	SPI-12	SRI-12	SPI-24	SRI-24	SPI-36	SRI-36
Jan-76	1	1	1	1	1	1	1	1	1	1	1
Feb-76	1	1	1	1	1	1	1	1	1	1	1
Mar-76	1	1	1	1	1	1	1	1	1	1	1
Apr-76	1	1	2	1	1	1	1	1	1	1	1
May-76	1	3	2	1	1	1	1	1	1	1	1
Jun-76	1	3	1	1	1	1	1	1	1	1	1
Jul-76	1	1	1	1	1	1	1	1	1	1	1
Aug-76	1	1	1	1	1	1	1	1	1	1	1
Sep-76	1	1	1	1	1	1	1	1	1	1	1
Oct-76	1	2	1	2	1	1	1	1	1	1	1
Nov-76	4	6	4	4	1	1	1	1	1	1	1
Dec-76	5	6	6	6	3	4	2	1	1	1	1
Jan-77	6	6	6	6	6	6	3	3	1	2	1
Feb-77	6	6	6	6	6	6	4	3	1	2	1
Mar-77	6	6	6	6	6	6	5	3	1	2	1
Apr-77	6	4	6	6	6	6	5	3	1	3	1
May-77	6	1	6	6	6	6	6	3	2	3	1
Jun-77	6	3	6	6	6	6	6	3	2	3	2
Jul-77	6	1	6	3	6	6	6	3	3	3	2
Aug-77	4	1	4	1	5	6	6	3	3	3	2
Sep-77	1	1	2	1	5	6	6	2	3	2	2
Oct-77	1	1	1	1	4	6	6	3	3	2	2
Nov-77	1	1	1	1	2	4	6	3	3	1	2
Dec-77	1	1	1	1	1	2	3	3	3	1	1
Jan-78	1	1	1	1	1	1	3	4	3	2	1
Feb-78	1	1	1	1	1	1	2	5	4	2	2
Mar-78	2	4	3	2	1	1	2	5	4	3	2
Apr-78	2	3	3	1	1	1	2	5	4	2	2
May-78	1	2	3	2	1	1	1	4	4	2	2
Jun-78	1	1	3	4	3	1	1	4	4	2	2

 Drought Onset

 Drought Recovery

Official  
Drought  
Onset



Official  
Drought  
Recovery



Drought Severity Class	Intensity
Class 2	Abnormally Dry
Class 3	Moderate Drought
Class 4	Severe Drought
Class 5	Extreme Drought
Class 6	Exceptional Drought



## Current Conditions

[VIC Plots](#)

[Drought Indices](#)

Current percentiles for soil moisture, SWE and other variables with respect to the climatological period (1949-2010). These update daily by 11-12 pm PST, and have a lag of 1-2 days. Click the mouse over links below to see different maps. Note: SM & SWE maps are for daily values, whereas RO maps are for cumulative values. SW Monitor description: For details about the genesis and implementation of the Surface Water Monitor see: Wood, A.W. 2008, [The University of Washington Surface Water Monitor: An experimental platform for national hydrologic assessment and prediction](#), in Proceedings of the AMS 22nd Conference on Hydrology, New Orleans, LA, January 20-24, 2008.

	Soil Moisture	SWE	Total Moisture Storage (SM+SWE)	Cumulative Runoff
Current Plots	<a href="#">[sm]</a>	<a href="#">swe</a>	<a href="#">stot</a>	<a href="#">1mo</a> <a href="#">2mo</a> <a href="#">3mo</a> <a href="#">6mo</a> <a href="#">9mo</a> <a href="#">12mo</a> <a href="#">18mo</a> <a href="#">24mo</a> <a href="#">36mo</a> <a href="#">48mo</a> <a href="#">60mo</a>

## HUC basin average

[\[Click to see region index\]](#)

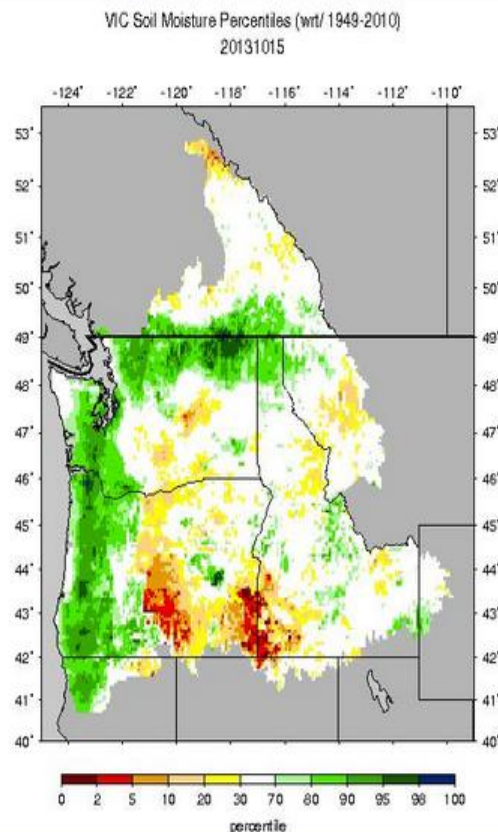
1-80:

81-120:

121-180:

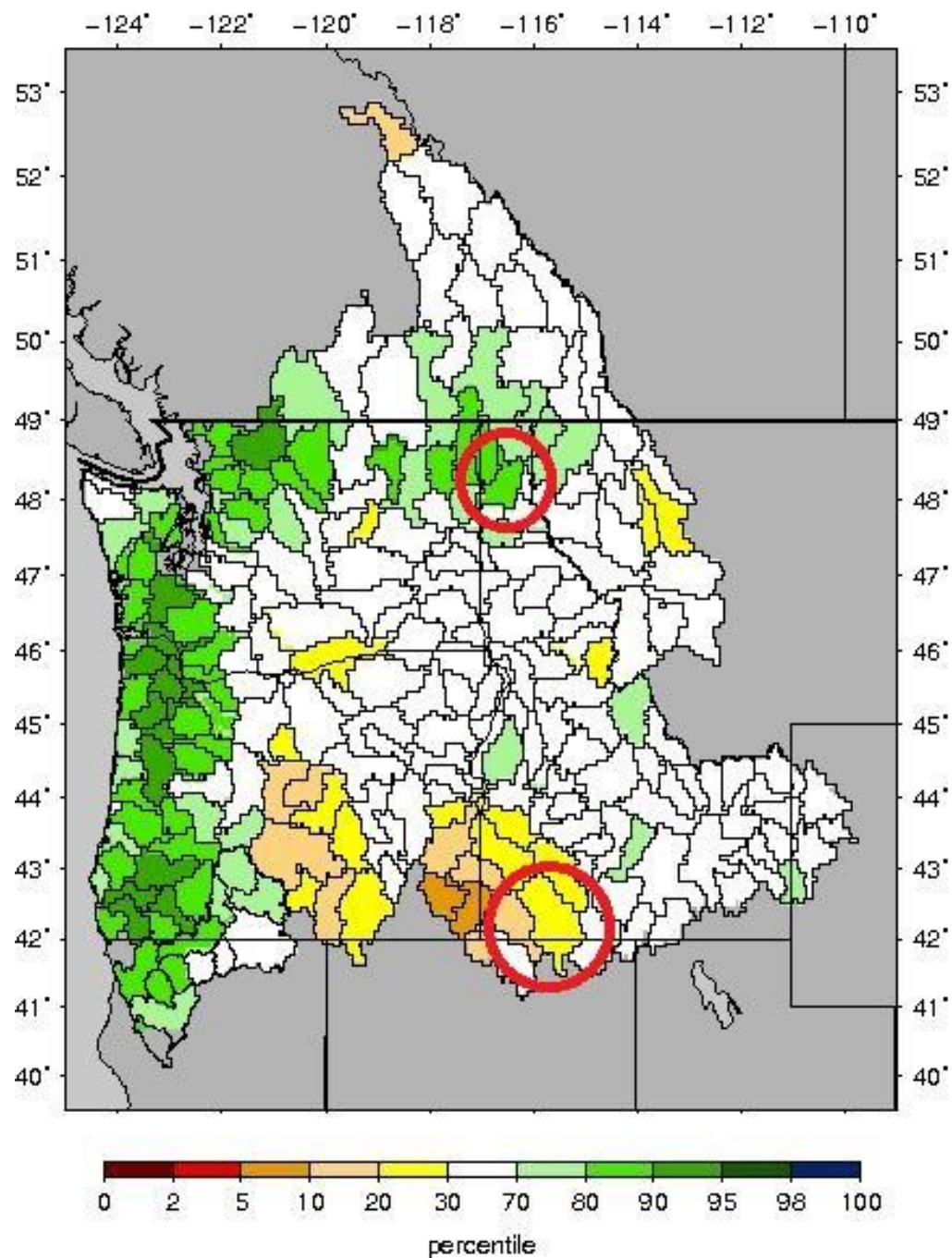
181-238:

The University of Washington's PNW Drought Monitor ([http://www.hydro.washington.edu/forecast/pnw\\_monitor](http://www.hydro.washington.edu/forecast/pnw_monitor)). Shown are soil moisture percentiles as of 10/15)

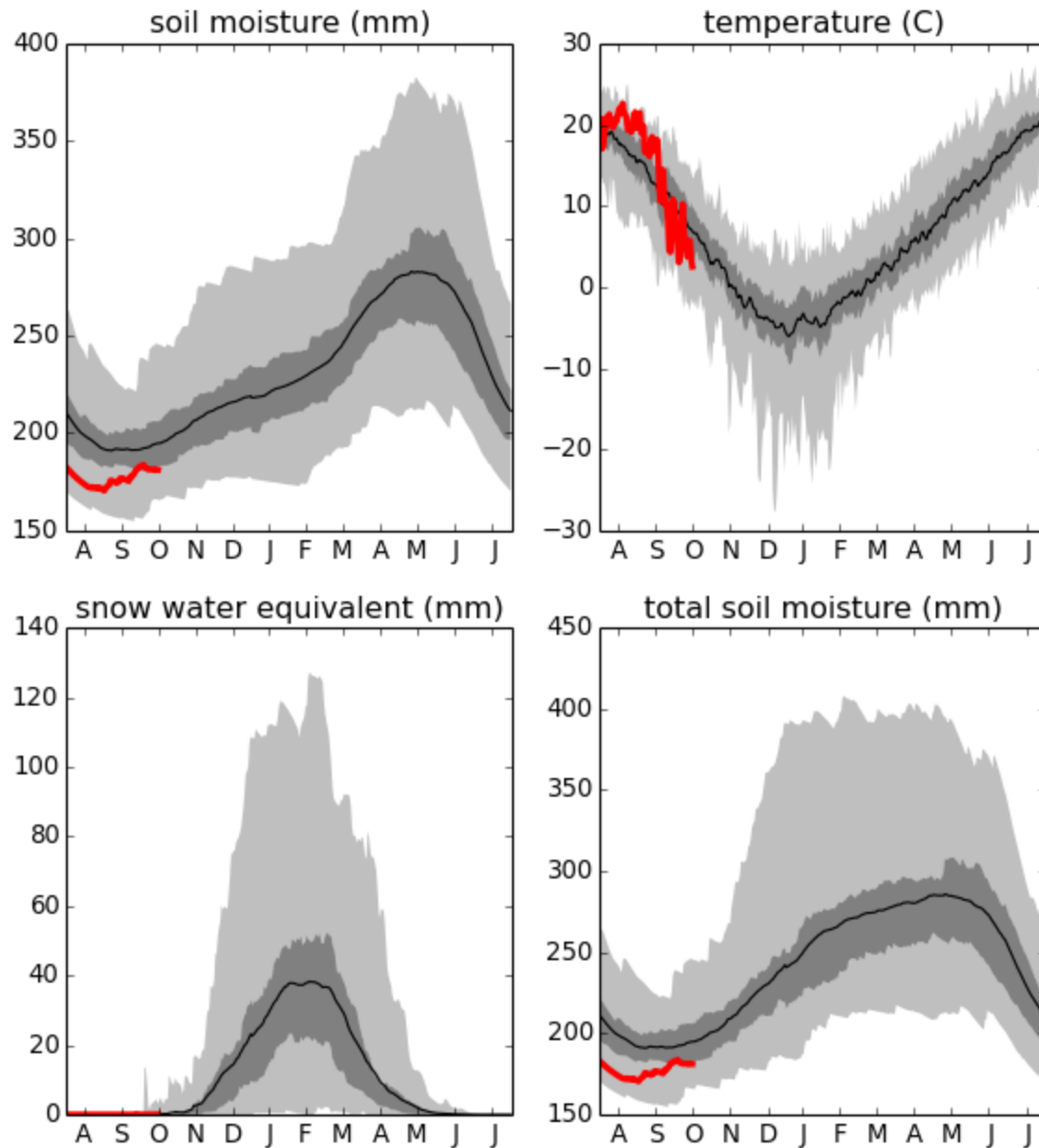


# VIC Soil Moisture Percentiles (wrt/ 1949-2010)

20131013

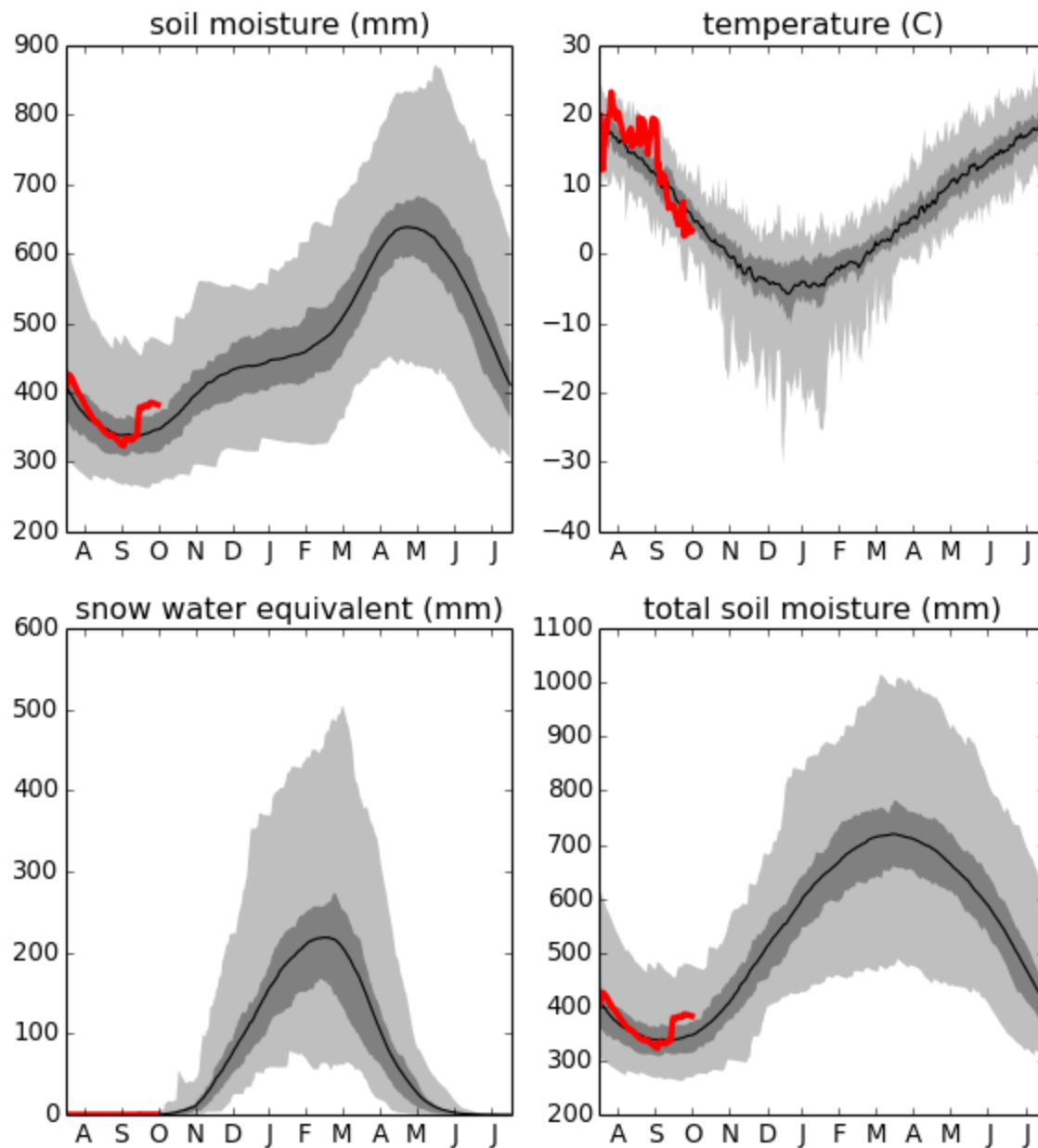


2013(from Aug) Bruneau  
(Current shown against 1949-2010 min, max and quantiles)



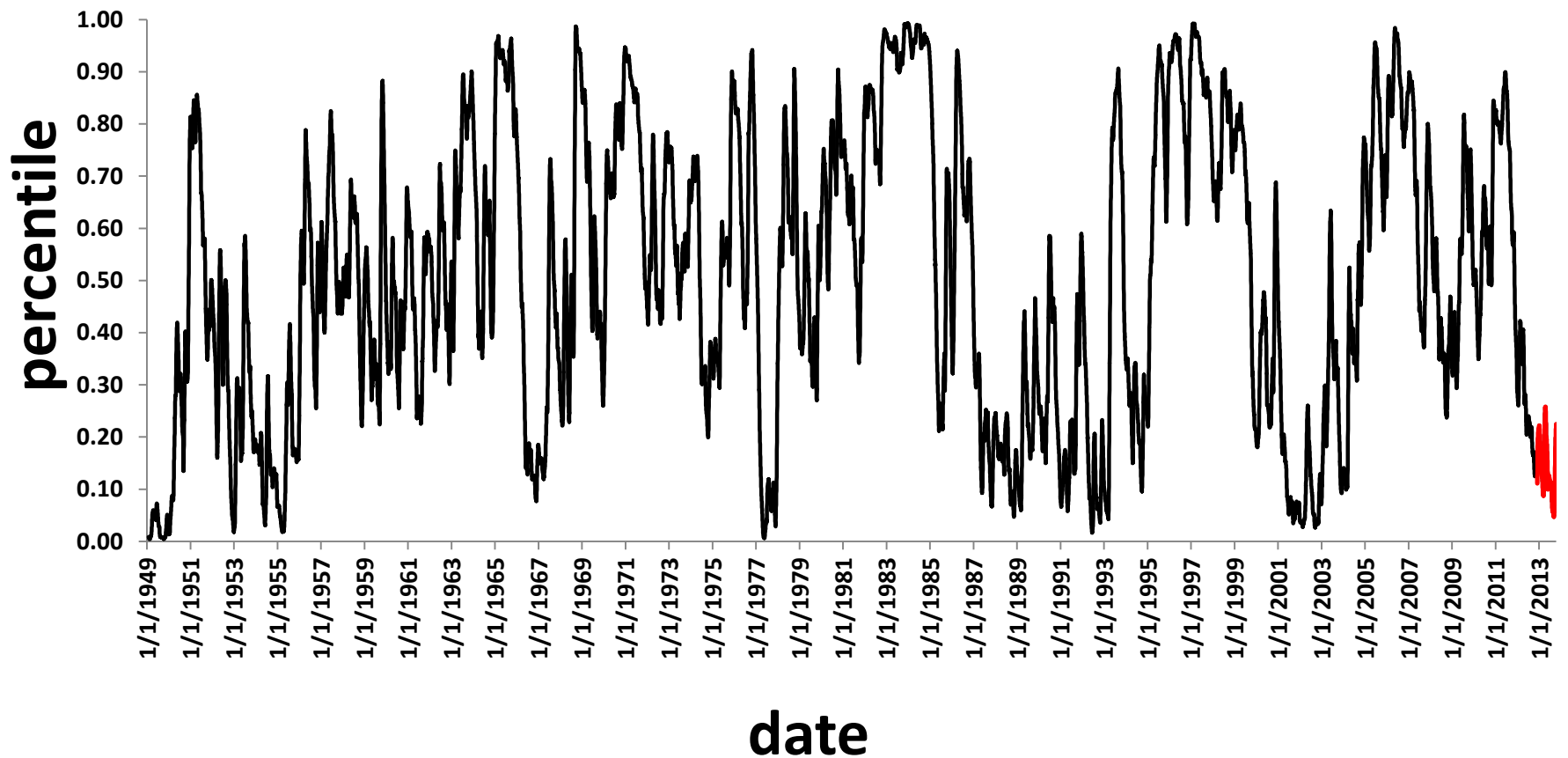


2013(from Aug) Pend Oreille Lake  
(Current shown against 1949-2010 min, max and quantiles)





# Bruneau basin- average time series



# Summary

- PNW drought monitor is up and running, updates to previous day's conditions by 2 PM Pacific
- SMP, SPR, SRI conversions to drought categories (future) per UW and CPC U.S. drought systems (at much coarser spatial resolutions)
- Spatial information, and at ~scale of Washington WRIAs
- Comments and suggestions welcome