April 2017 Water Supply Briefing

National Weather Service, Northwest River Forecast Center

Telephone Conference: 1-888-677-0012
Pass Code: 91999

Presentation available after brief at:
www.nwrfc.noaa.gov/presentations/presentations.cgi

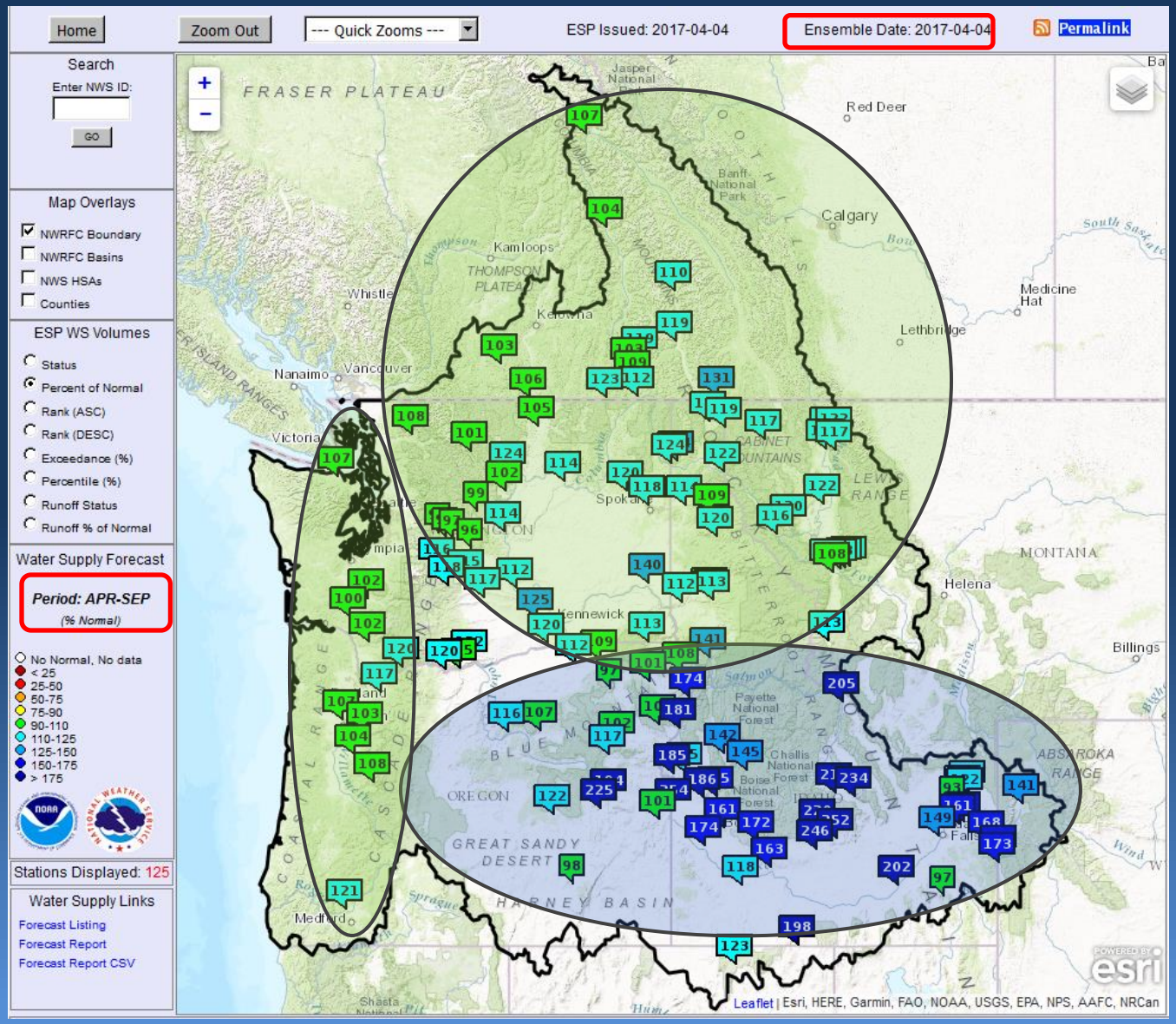
Kevin Berghoff, NWRFC
W-ptr.Webmaster@noaa.gov
(503) 326-7291

Presentation Outline

- Basic summary of latest forecasts
- NWRFC volume forecasting overview, background
  - Modeling system
  - Forecast methodology
- Forecast inputs
  - Observed conditions
  - Future conditions
- Forecast outputs
  - Latest volume forecasts
- Tour of various products
  - Monthly volumes
  - Climate index relationships
  - Data downloads
- Questions

Water Supply Summary

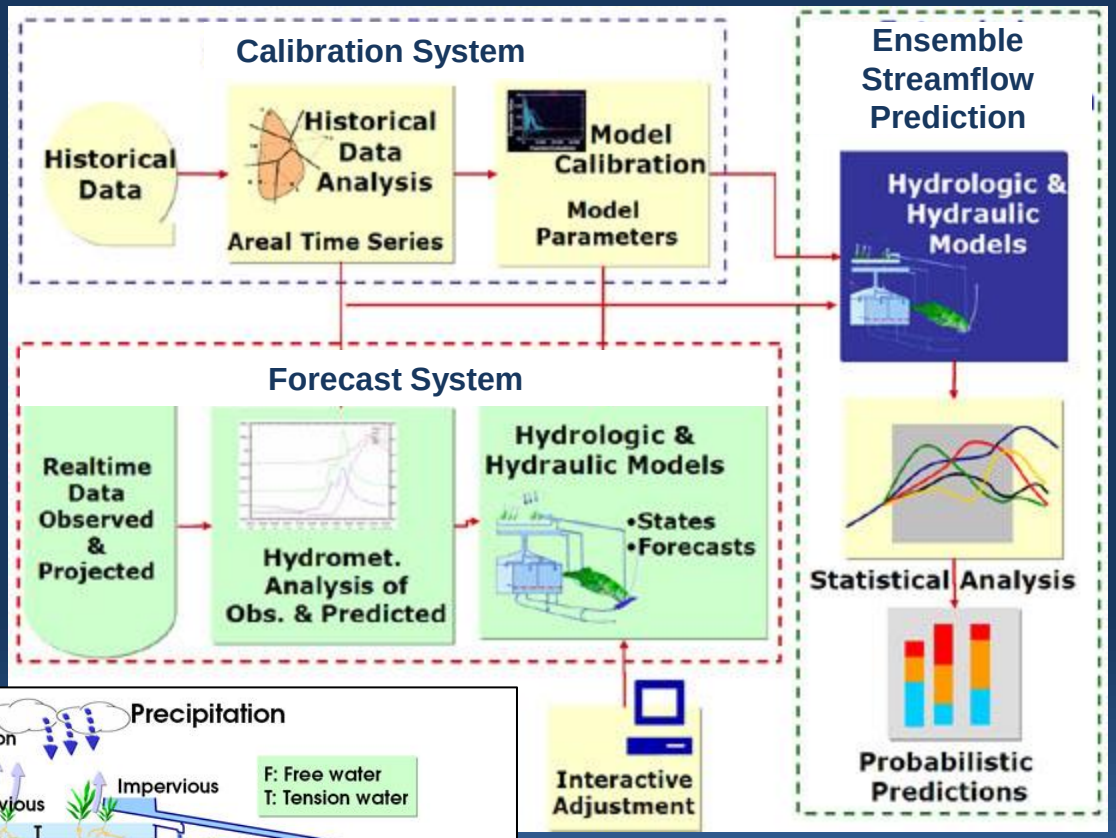
www.nwrfc.noaa.gov/ws/

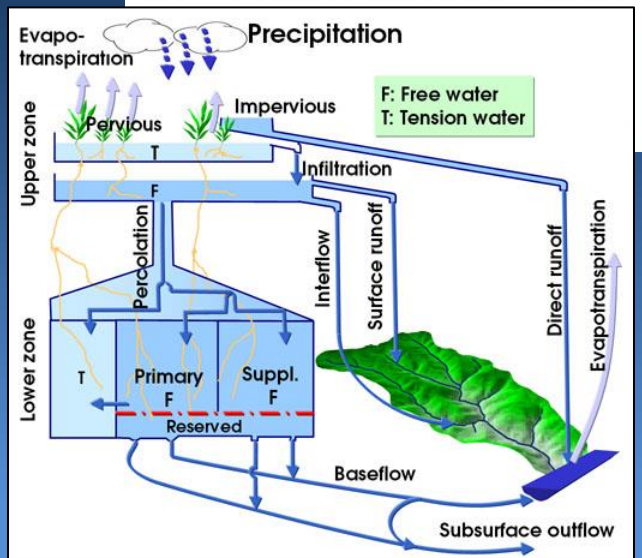


- West of Cascades:
  - Near to slightly above normal
- East of Cascades:
  - Above normal throughout the Upper Columbia
  - Above to well above normal through the Snake basin
- Primary drivers:
  - Snowpack distribution
  - Weather yet to come

Modeling System

- Community Hydrologic Prediction System (CHPS) software platform
- National Weather Service River Forecast System (NWSRFS) modeling components
- Models are physically- and empirically-based, but simplified
  - Conceptual, or lumped parameter
  - Primary inputs are precipitation and temperature
  - Primary outputs are streamflows





Forecast Methodology

- Forecasts are updated daily, but observed data is assimilated and models are run continuously

- Forecasts are compared to 30 year observed (adjusted) runoff normals (currently 1981-2010)

- Water supply forecasts:
  - Volumes are adjusted for major upstream storage, as described in the adjustment section of the NWRFC water supply webpage

- Natural volume forecasts:
  - Volumes are adjusted for all known man-made upstream activity, including storage, consumptive use, and diversions

Volume Forecast Inputs

- Observed Conditions:
  - Precipitation
  - Temperature
  - Snowpack
  - Soil moisture

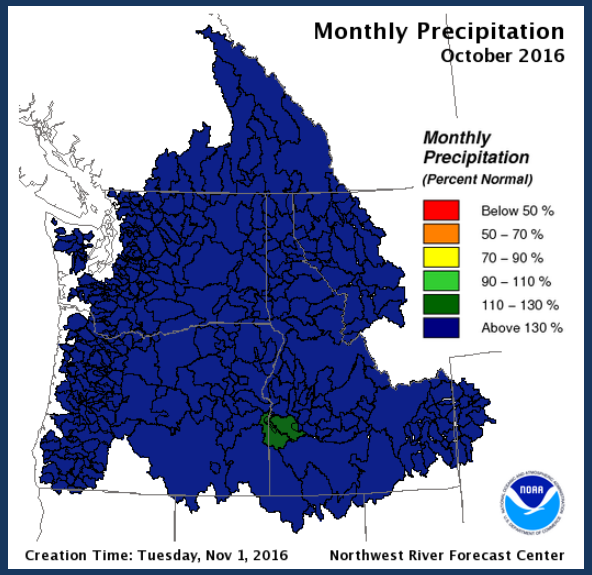
Model “states”

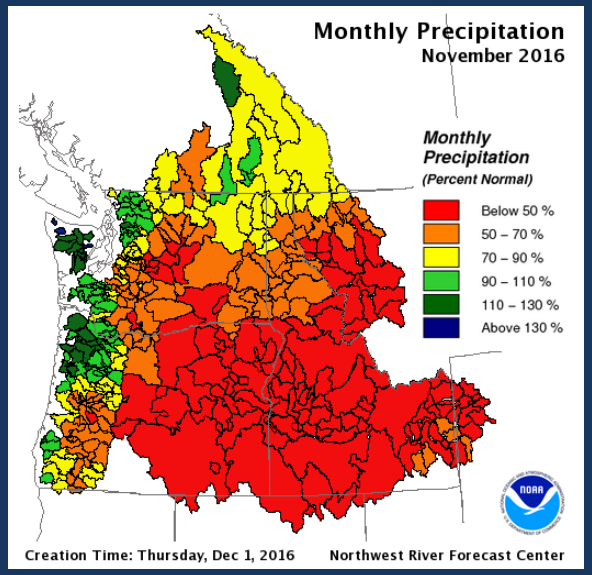
- Future Conditions (Anticipated and Statistical):
  - 0, 5, or 10 days of QPF/QTF
  - Ensemble of precipitation and temperature climatology appended thereafter

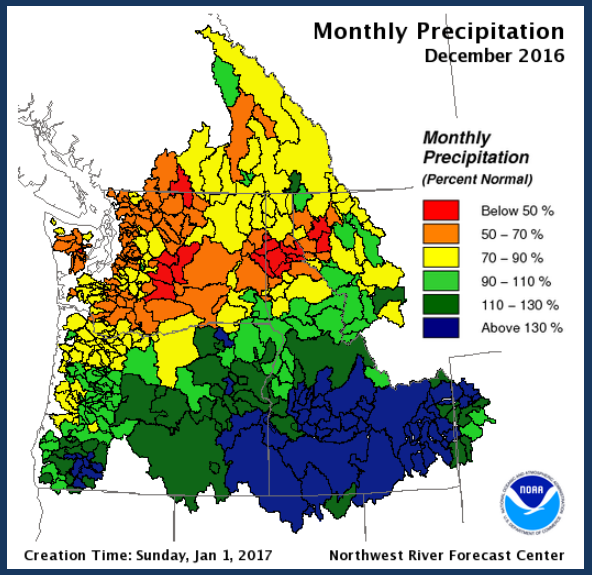
Model “forcings”

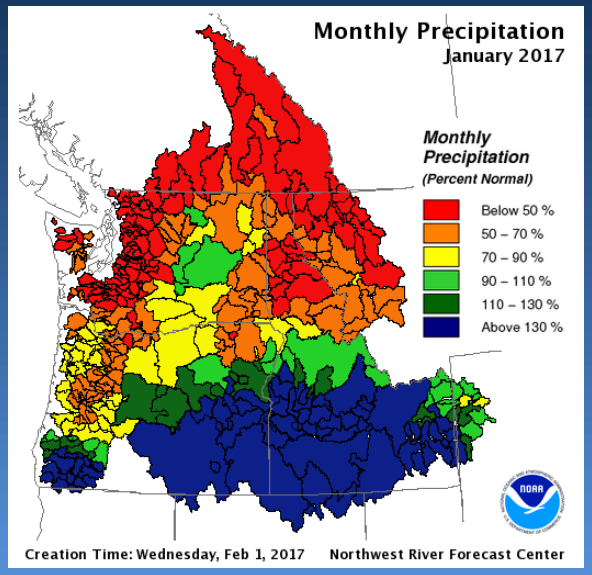
Observed Precipitation

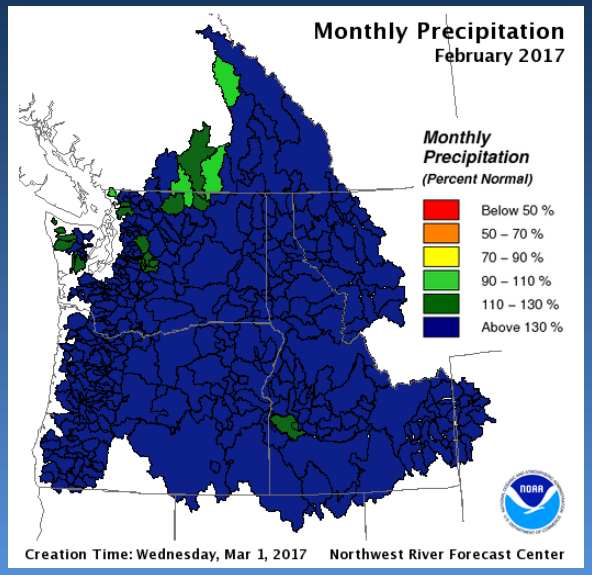
www.nwrfc.noaa.gov/water_supply/wy_summary

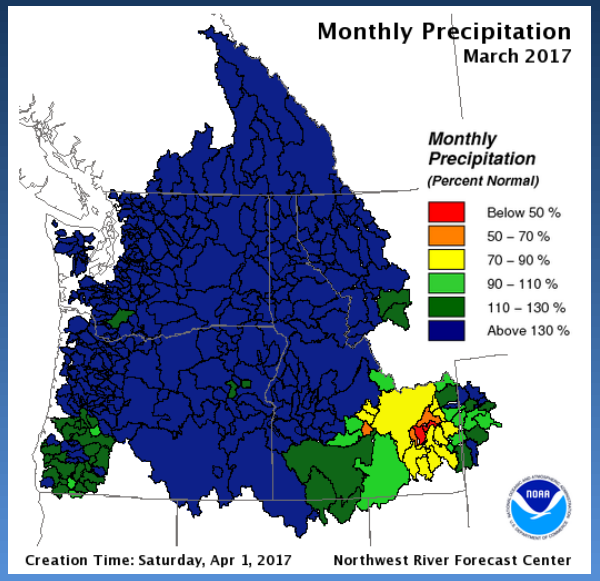






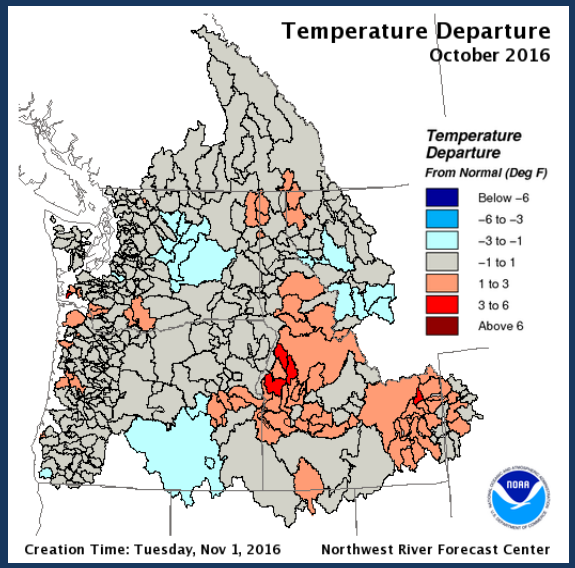


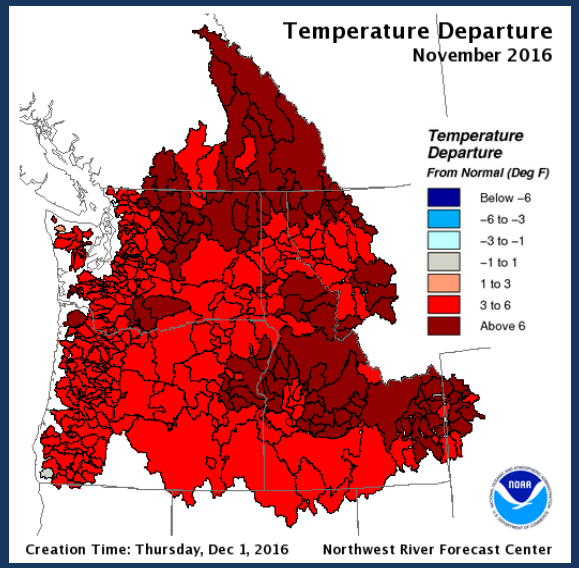


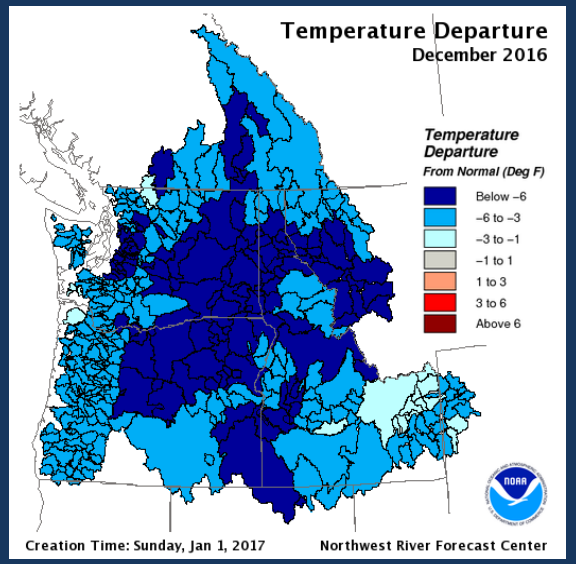


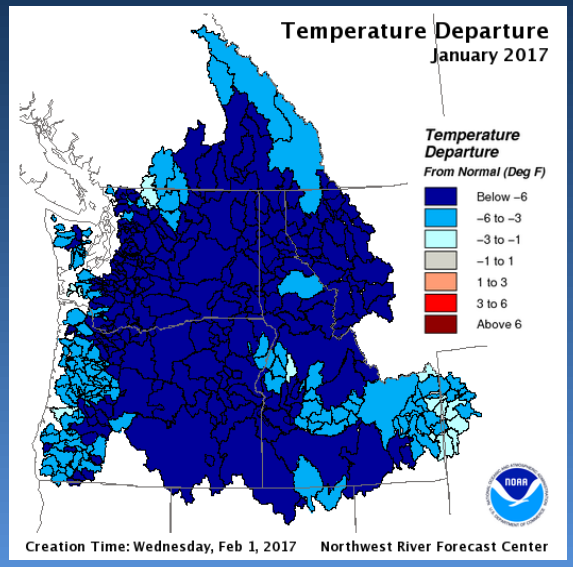
Observed Temperatures

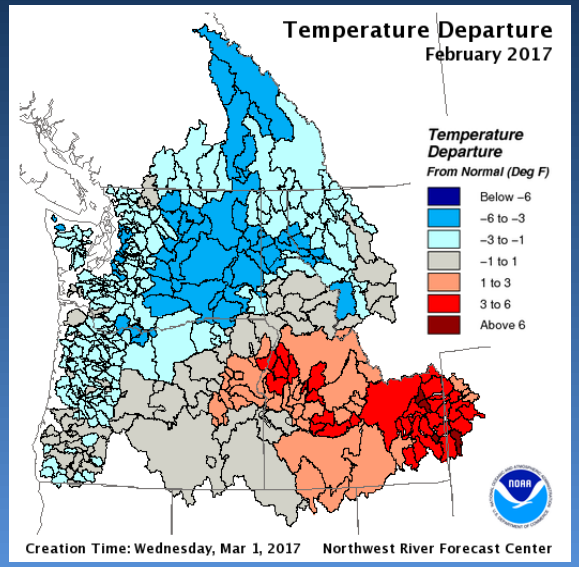
www.nwrfc.noaa.gov/water_supply/wy_summary

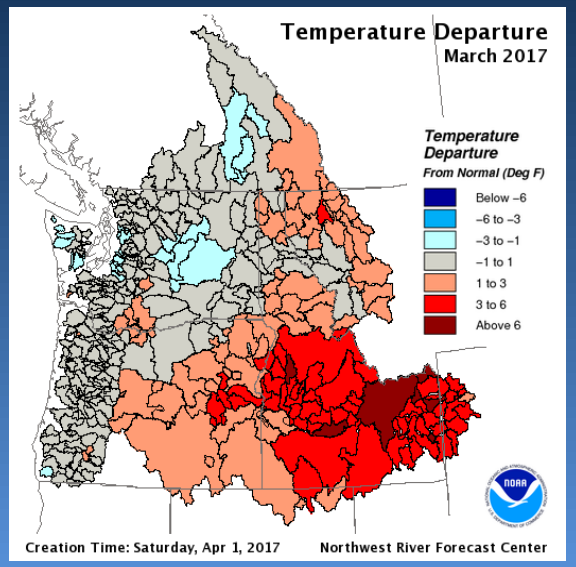






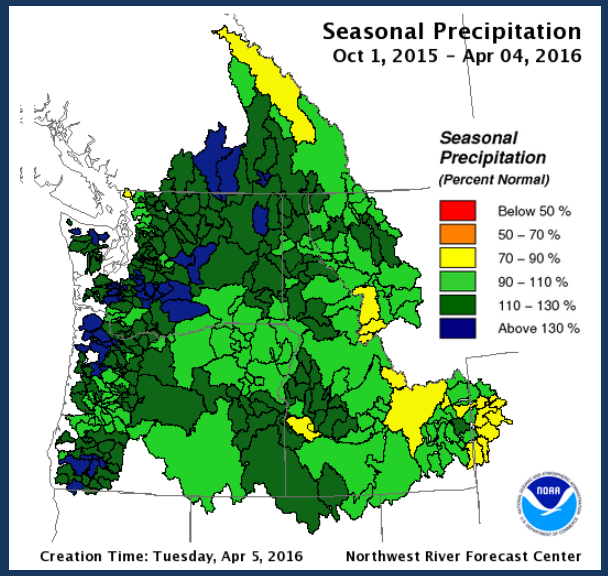


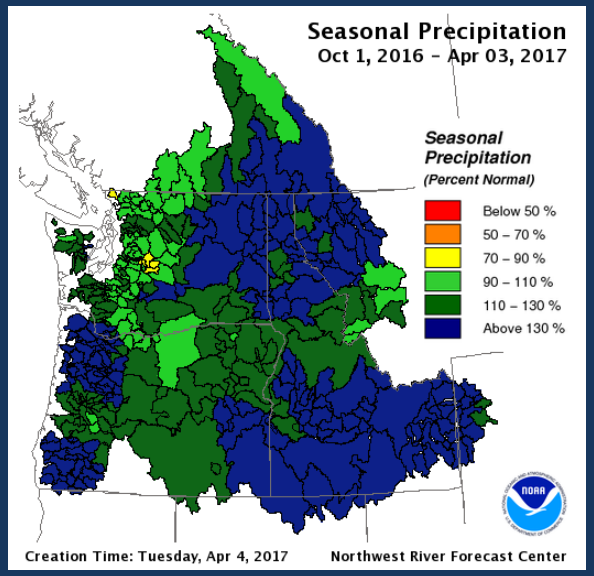




Observed Precipitation Summary

www.nwrfc.noaa.gov/water_supply/wy_summary

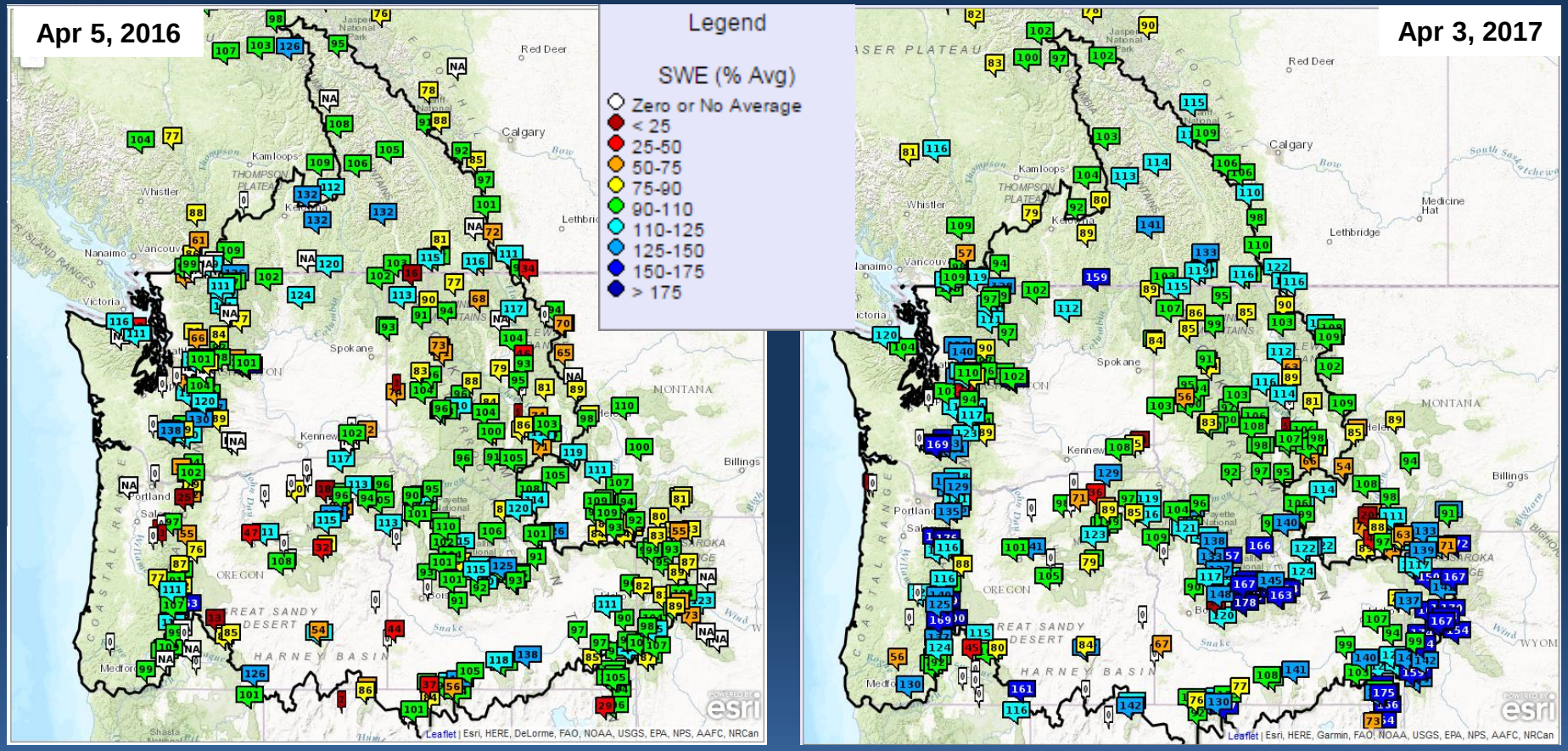




DIVISION NAME	WY 2016 % NORM	WY 2017 % NORM
Columbia River above Arrow Lakes	98	110
Kootenai River	108	135
Pend Oreille River	105	132
Spokane River	111	133
Columbia River above Grand Coulee	106	127
Snake River	103	139
Columbia River above The Dalles	107	127
Western Washington	118	110
Western Oregon	118	139

Observed Snowpack Conditions

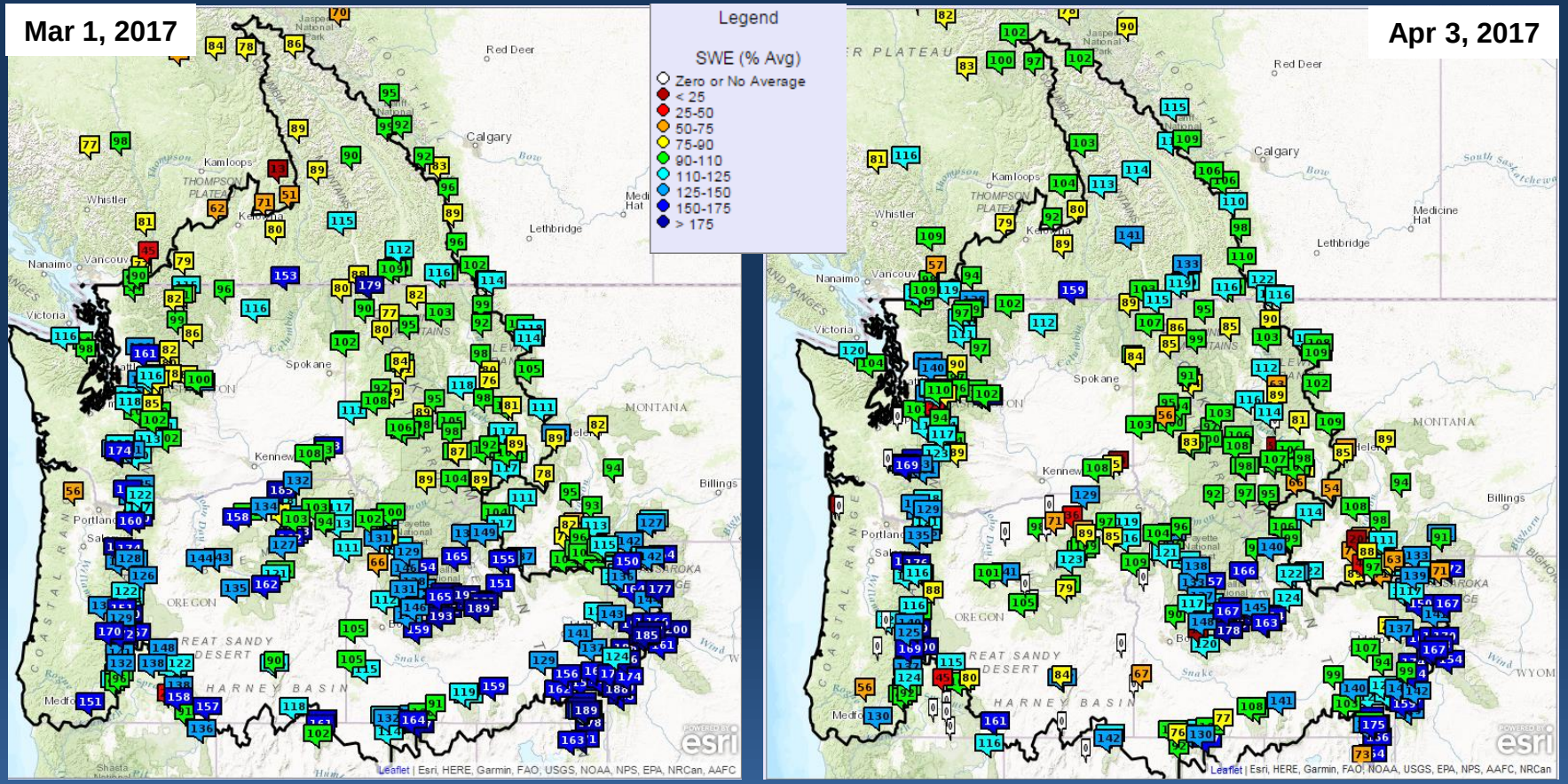
www.nwrfc.noaa.gov/snow



- April 2016 Snowpack
  - Below normal in upper Snake, Western MT
- April 2017 Snowpack
  - Well above normal upper, middle Snake. Normal to above normal in Upper Columbia
- Observed snow water equivalent (SWE) values provided by:
  - Natural Resources Conservation Service (NRCS) SNOTEL network, and Environment Canada (EC) Automated Snow Pillow network

Observed Snowpack Conditions

www.nwrfc.noaa.gov/snow



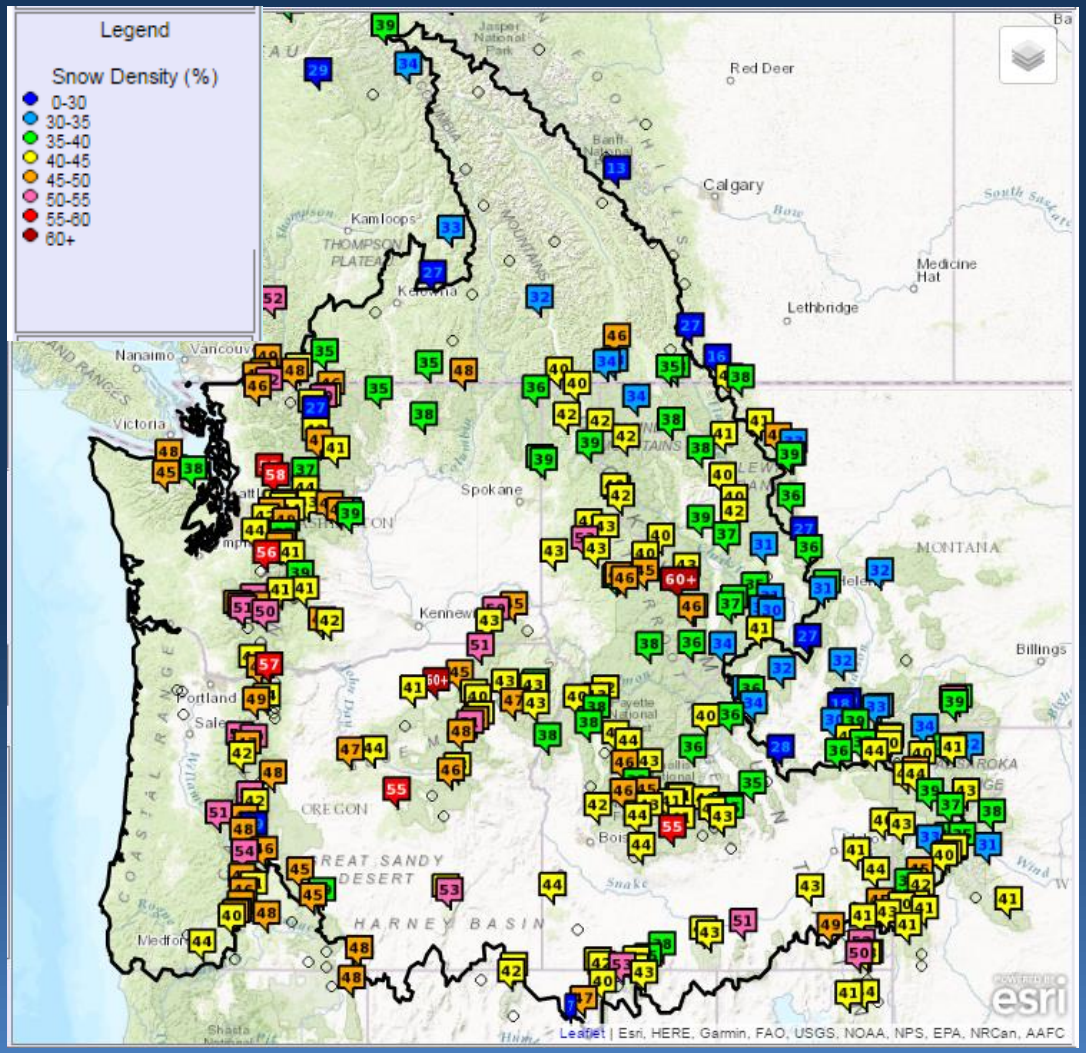
- Still well above normal in upper and middle Snake
- Above normal in Upper Columbia

Observed Snowpack Density/Ripeness

https://www.nwrfc.noaa.gov/snow/index.html?version=20160408v2

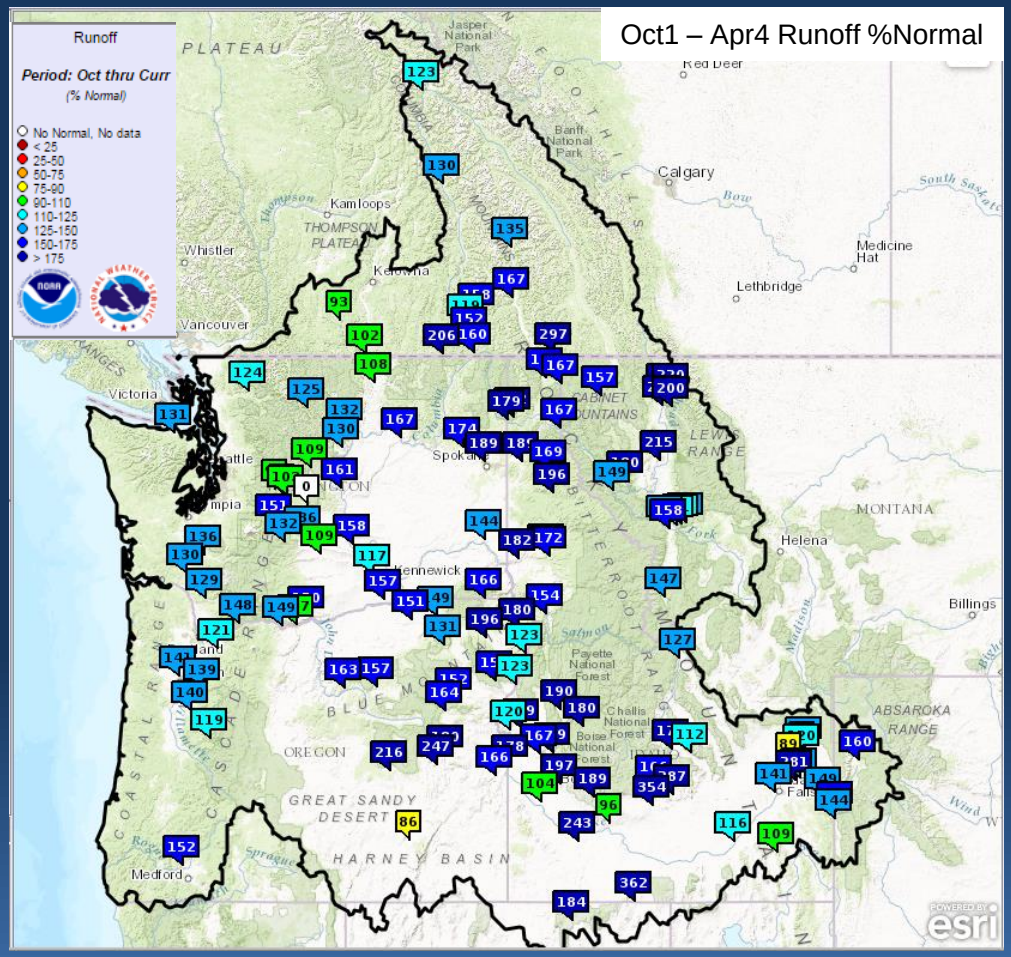
UPDATE

The Snow Density page has now been added to the RFC webpage (4/6/2017). Go to the listed url and select “Snow Density” in the Map Type box. Hovering over any point will bring up a plot of SWE, Snow Depth, Snow Density and Accum Precip.



Snowpack density is used as an indicator of snow “ripeness”

Observed Runoff Conditions



LOCATION	Oct1-Apr4 % NORM	Jan1 – Apr4 % NORM	March % NORM
Columbia River – Arrow Lakes	120	99	119
Kootenai River – Queens Bay	168	144	203
Columbia River – Birchbank	153	134	167
Pend Oreille River– Albeni Falls	180	181	277
Spokane River – Long Lake	189	205	284
Columbia River - Grand Coulee	168	161	226
Snake River – Lower Granite	141	173	254
Columbia River – The Dalles	149	158	225

- Well above normal runoff for all areas
- Near or above record March runoff at some locations

Volume Forecast Inputs

- Observed Conditions:
  - Precipitation
  - Temperature
  - Snowpack
  - Soil moisture

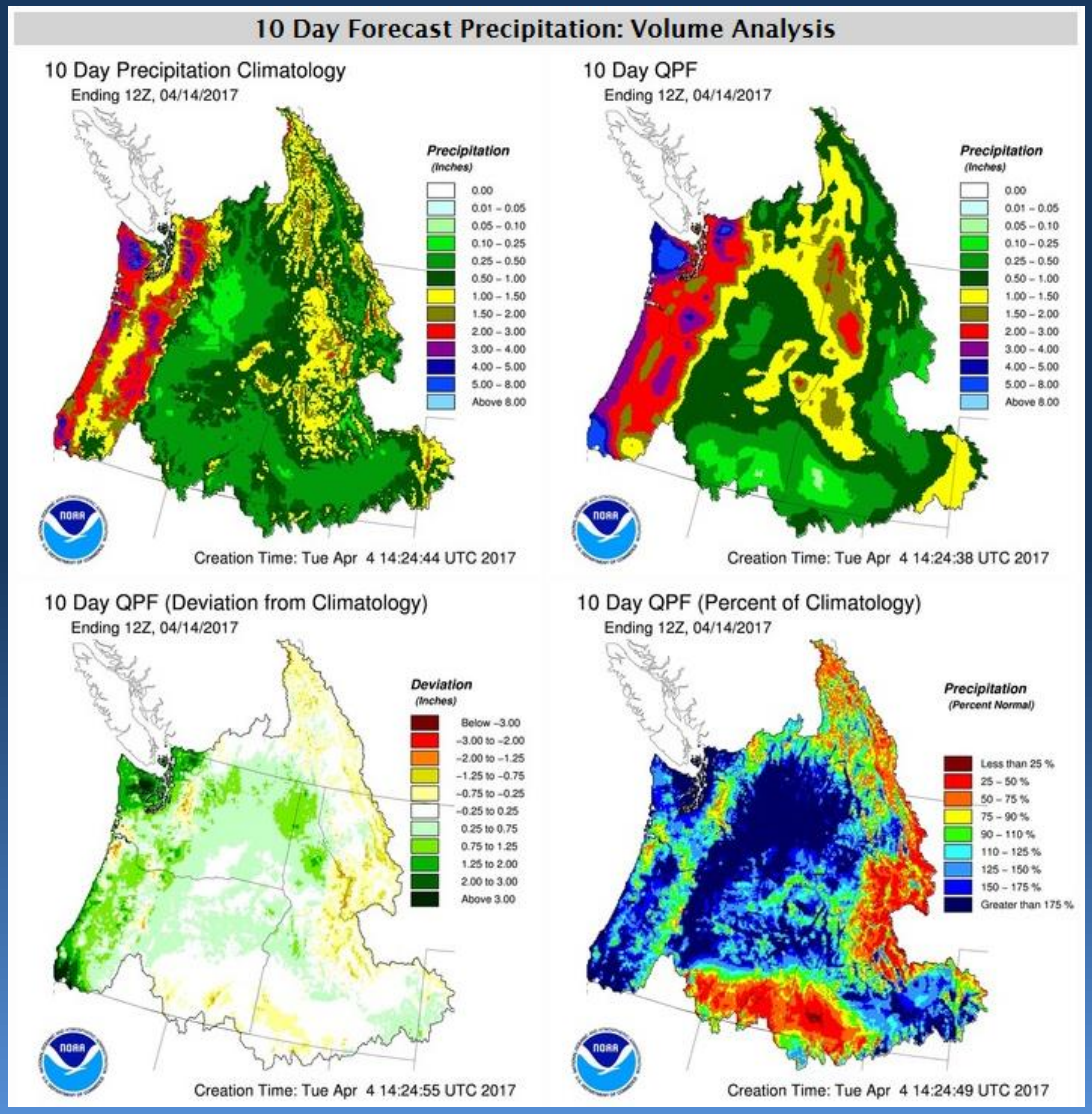
Model “states”

- Future Conditions (Anticipated and Statistical):
  - 0, 5, or 10 days of QPF/QTF
  - Ensemble of precipitation and temperature climatology appended thereafter

Model “forcings”

Deterministic Forcings (QPF and QTF)

www.nwrfc.noaa.gov/water_supply/wy_summary

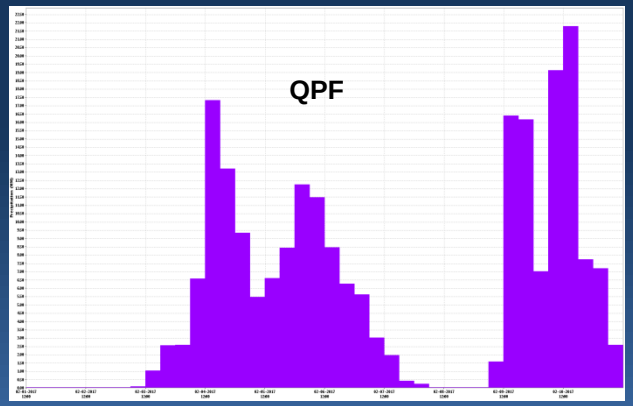


- Generally wet conditions forecasted over next 10 days
  - West of the Cascades, Northern Idaho, Upper Snake
  - Below normal along crest of the Rockies in MT and ID
- 10 day precip forecast can significantly affect ESP volume forecast

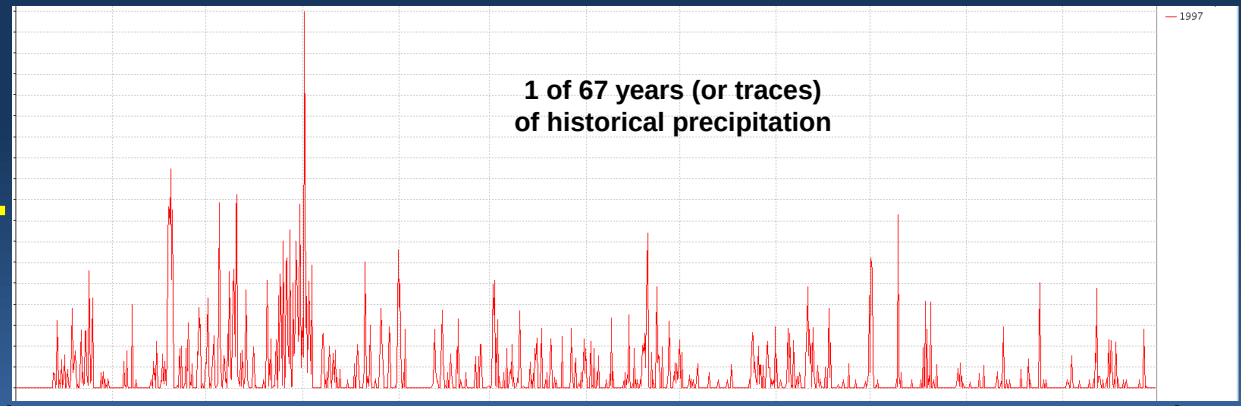
Ensemble Forcings (Climatology)

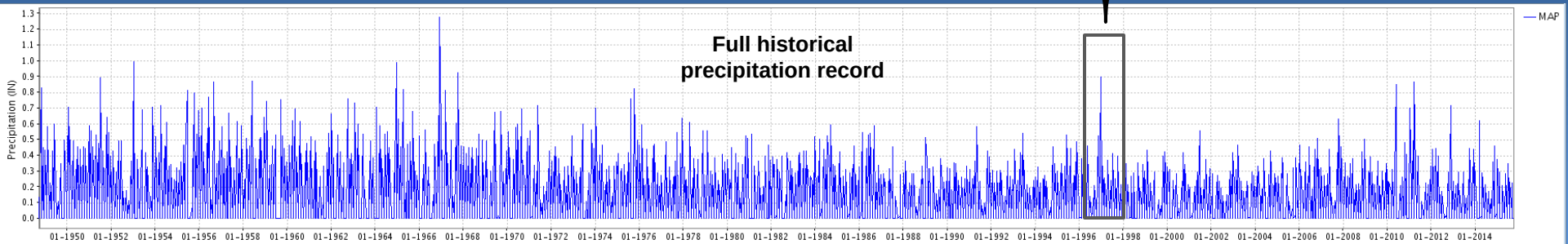
- Probabilistic guidance (climatological possibilities) used beyond deterministic (QPF/QTF) period (0, 5, or 10 days)

- Unique sets (years) of historical observations
  - Precipitation and temperature data for every year of historical record (1949 – 2016)
  - QPF/QTF + one year of historical data = one forcing trace



+





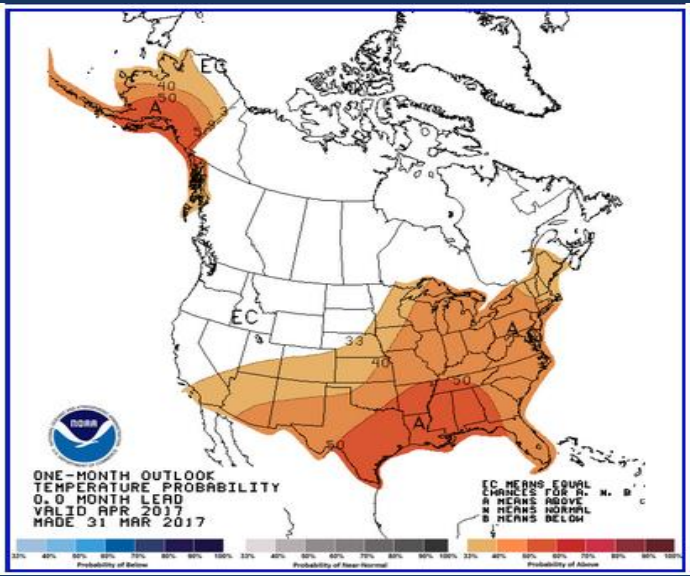
Climate Outlook

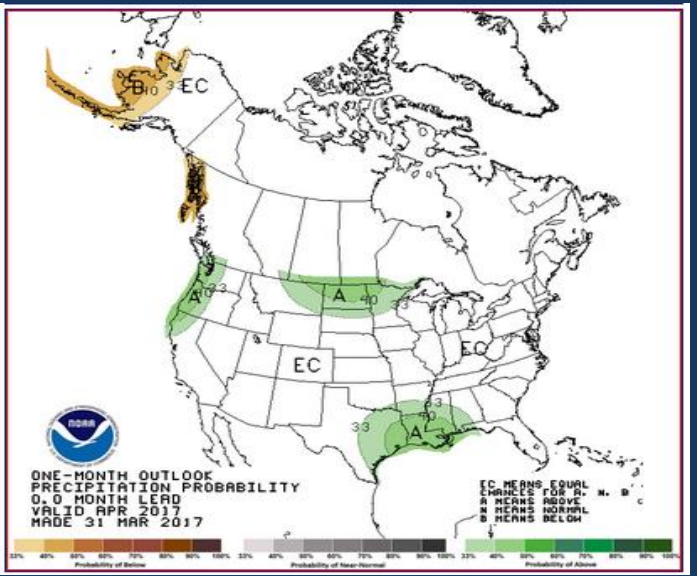
www.cpc.ncep.noaa.gov

Temperature

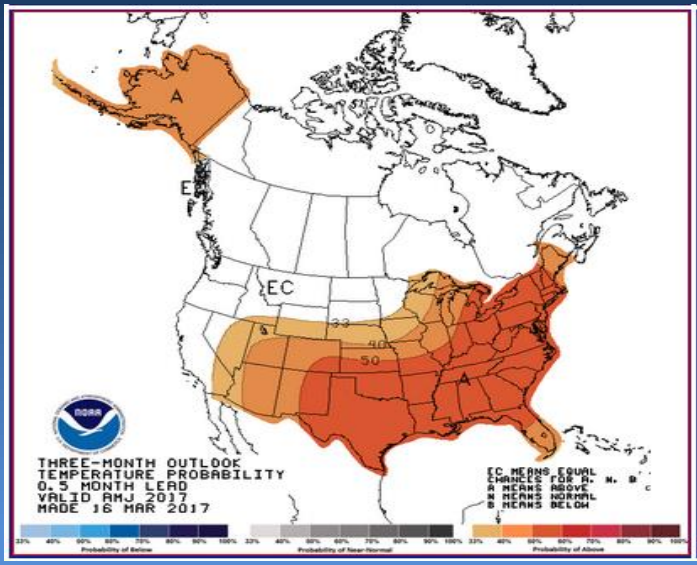
Precipitation

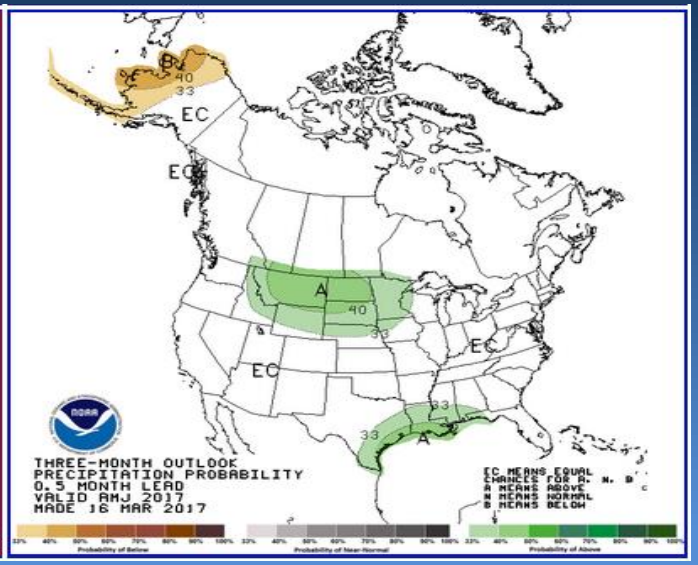
Current Month Outlook





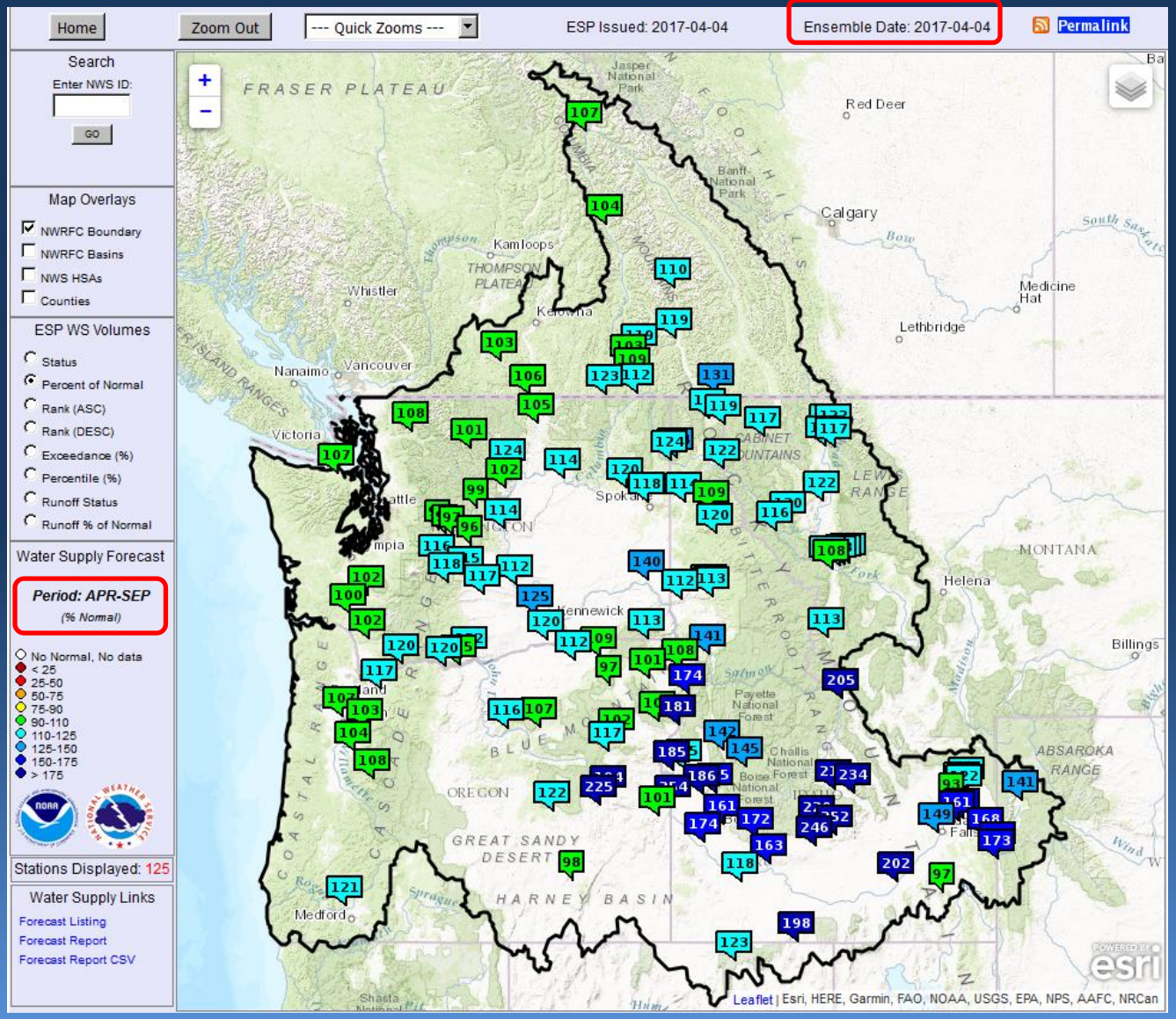
Three Month Outlook





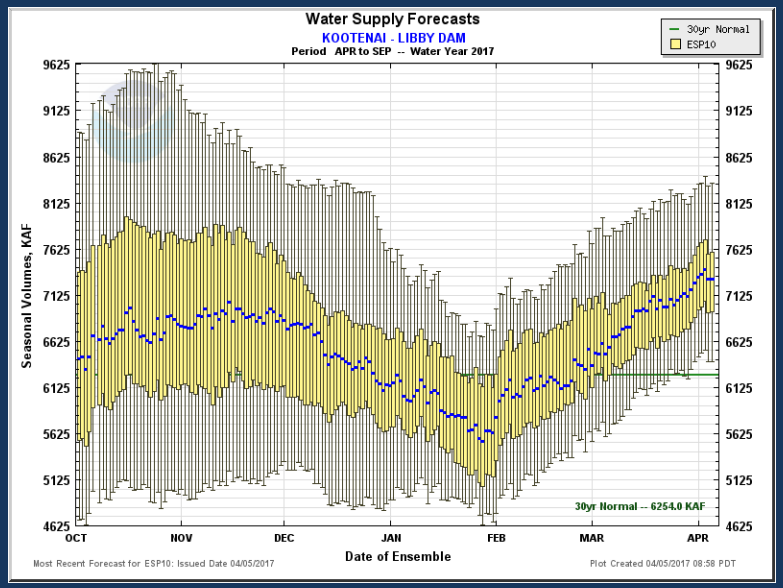
ESP Water Supply Forecasts

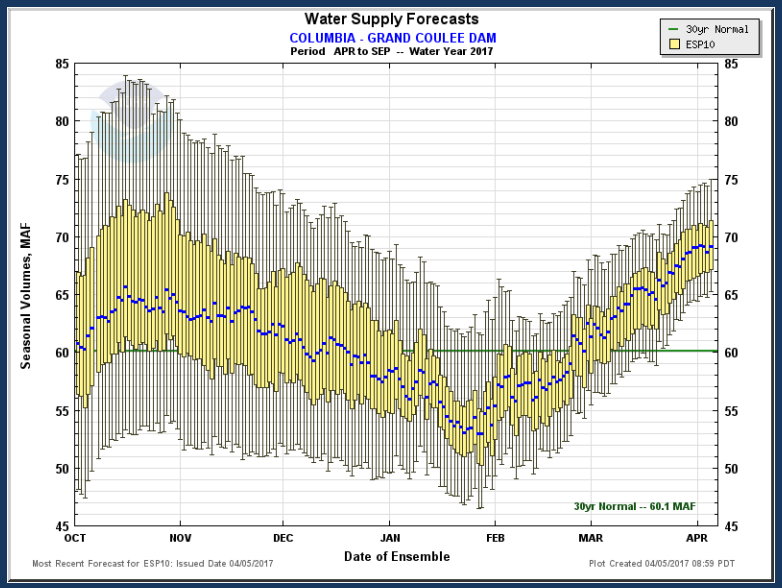
www.nwrfc.noaa.gov/ws/

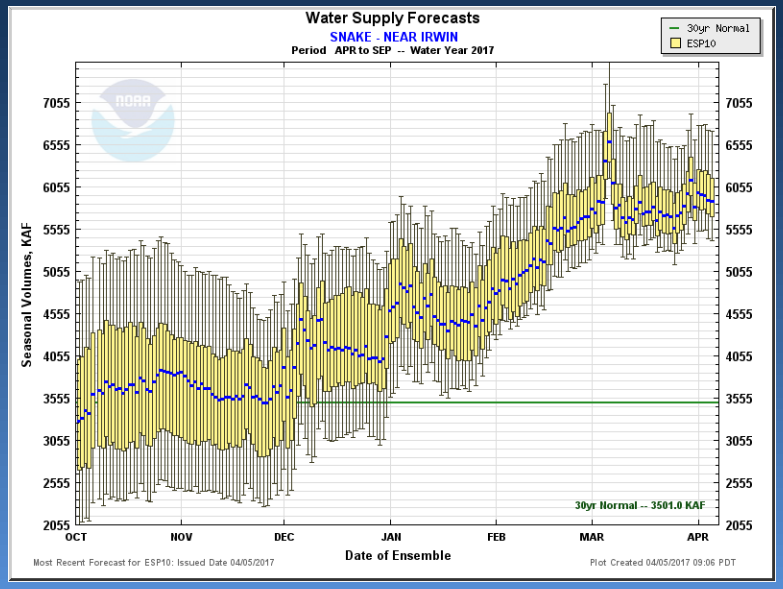


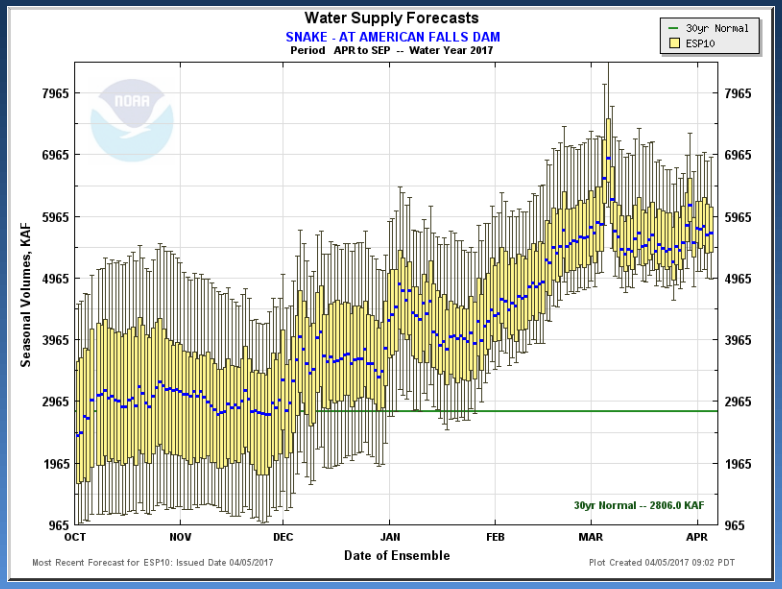
LOCATION	APR – SEP % NORM
Columbia River – Mica Dam	107
Kootenai River – Libby Dam	117
SF Flathead River – Hungry Horse Dam	117
Spokane River – Lake Coeur D Alene	114
Columbia River – Grand Coulee Dam	114
Snake River – Jackson Lake	141
Snake River – Palisades Dam	168
Snake River – American Falls Dam	202
Snake River – Lower Granite Dam	140
Columbia River – The Dalles Dam	120

Water Supply Forecasts



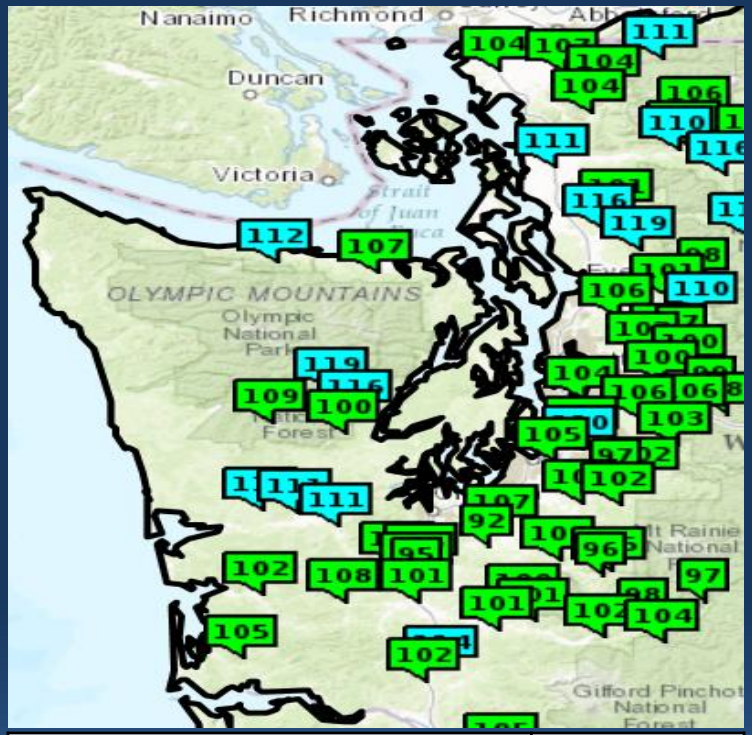




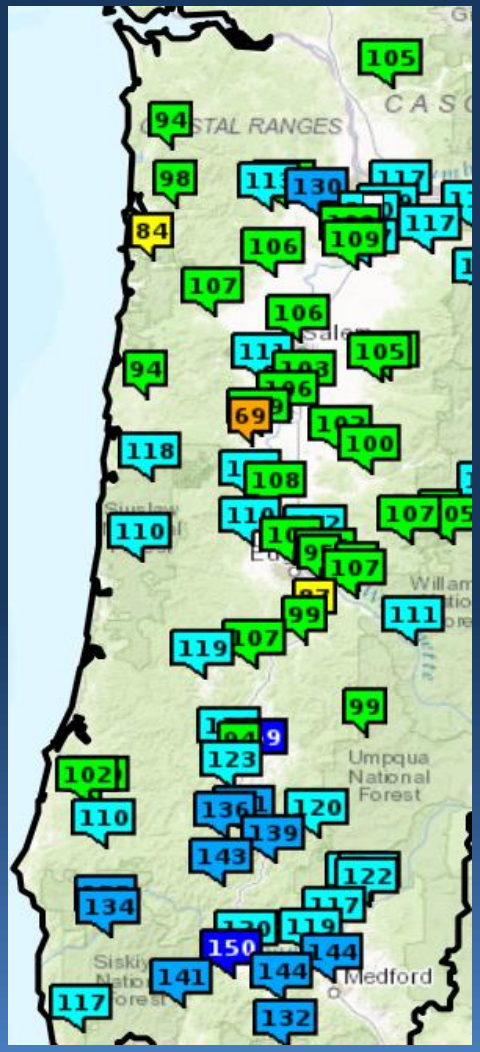


ESP Natural Volume Forecasts

www.nwrfc.noaa.gov/ws/



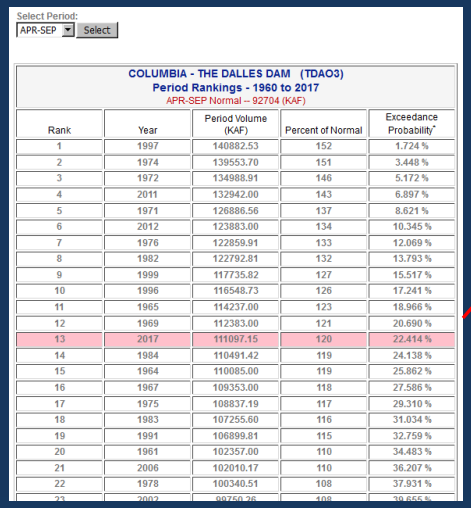
LOCATION	APR – SEP % NORM
Skagit River – Concrete	110
Stillaguamish River - Arlington	116
Snohomish River - Monroe	106
Cedar River – Renton	104
Cowlitz River – Castle Rock	102
Chehalis River – Porter	111
Dungeness River – Sequim	107

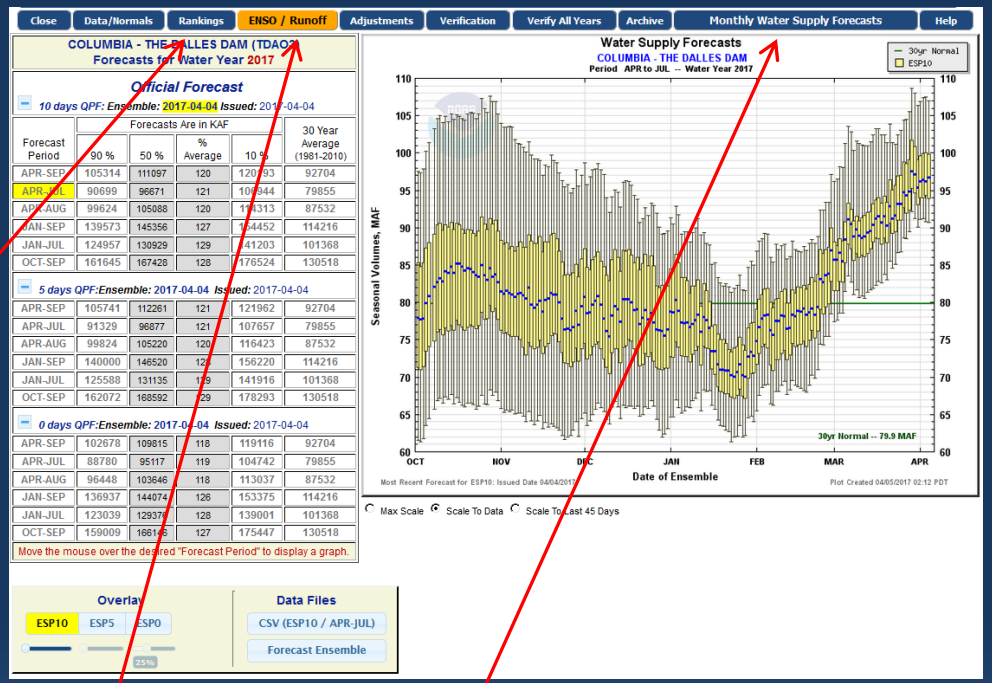


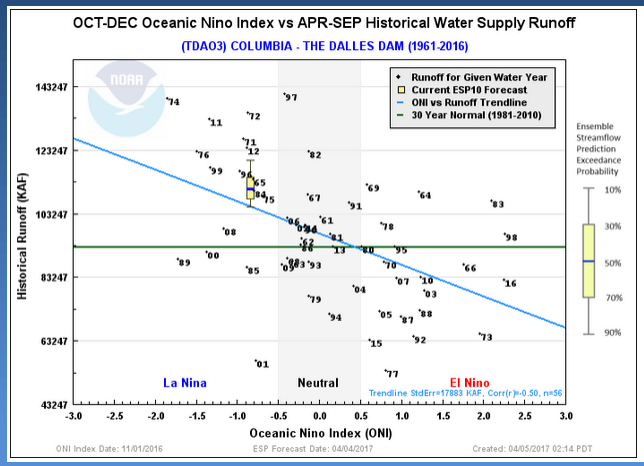
LOCATION	APR – SEP % NORM
Lewis River – Merwin	105
Clackamas River – Estacada	117
Tualatin River – Farmington	130
Nehalem River – Foss	94
Mckenzie River – Vida	107
Coast Fk Willamette River – Goshen	95
Willamette River – Salem	106
Siuslaw River – Mapleton	110
Umpqua River – Elkton	119
SF Coquille River – Myrtle Point	102
Rogue River – Grants Pass	120
Illinois River – Agness	134

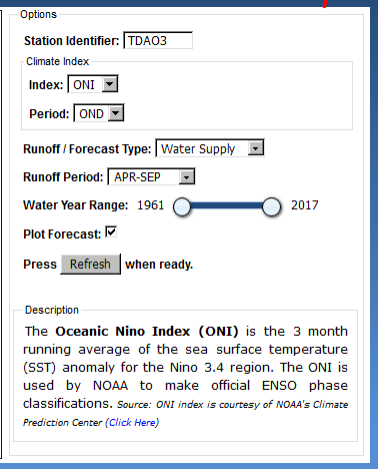
Various Volume Products

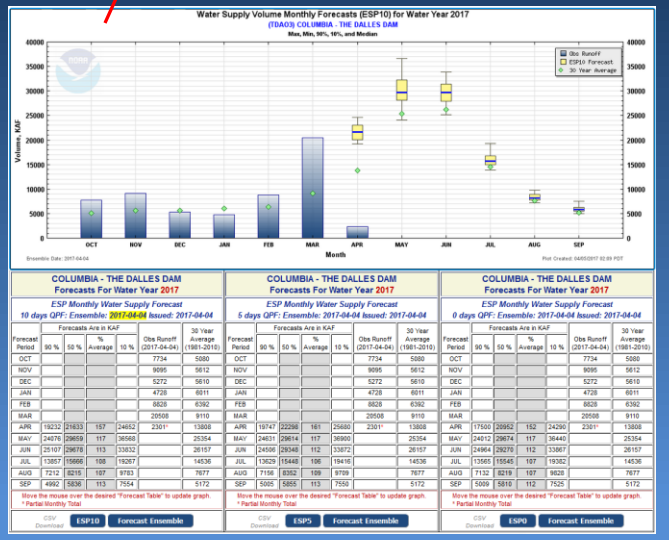
www.nwrfc.noaa.gov/ws/



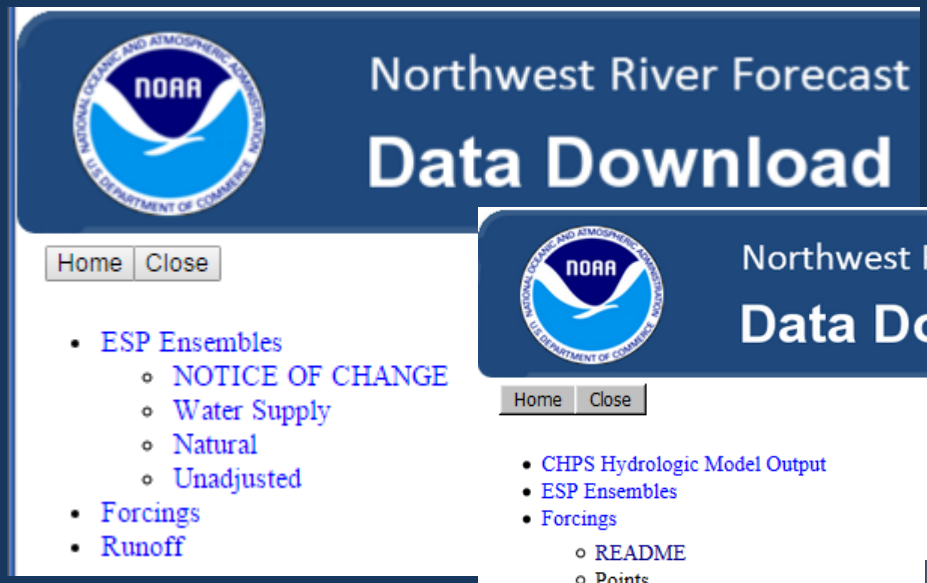


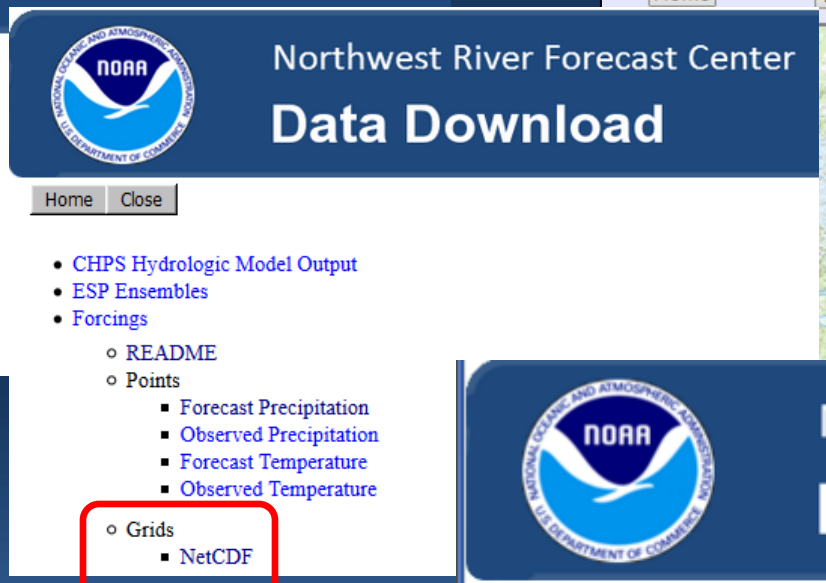


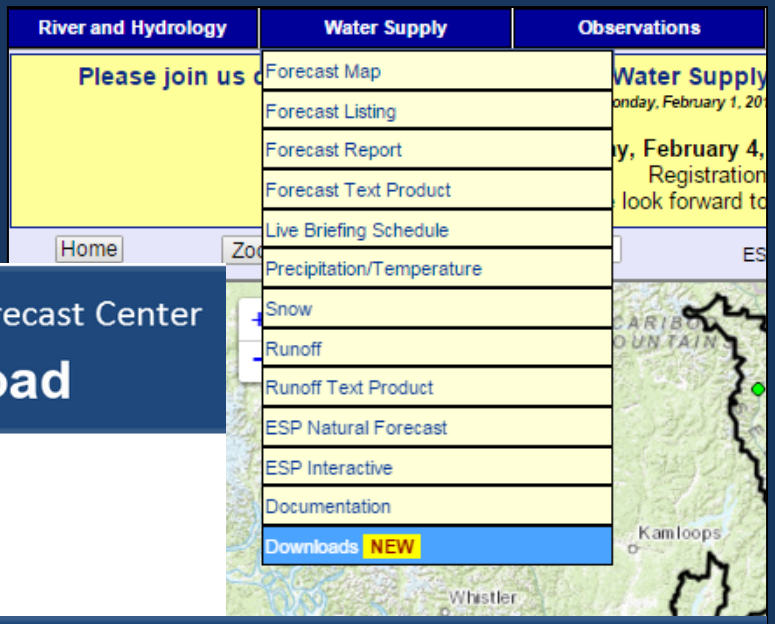


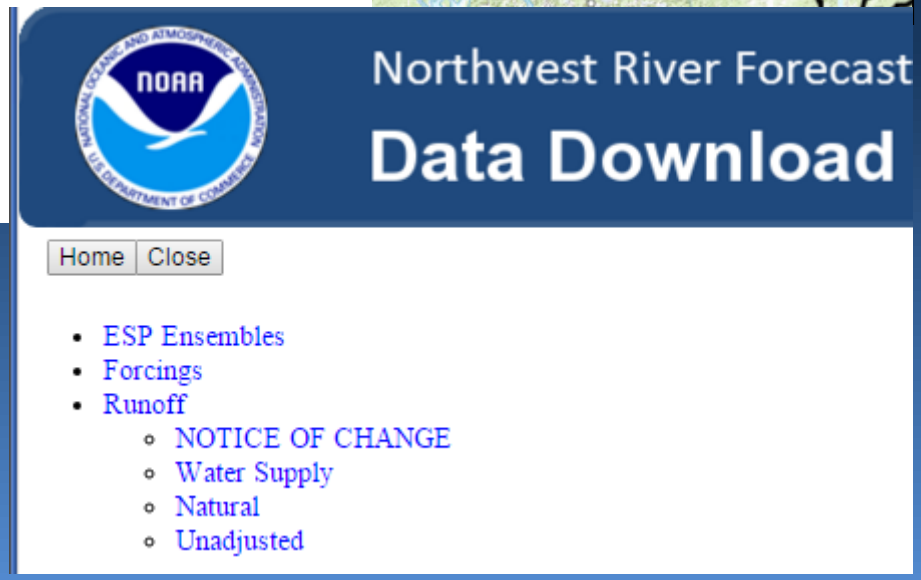


Data Downloads



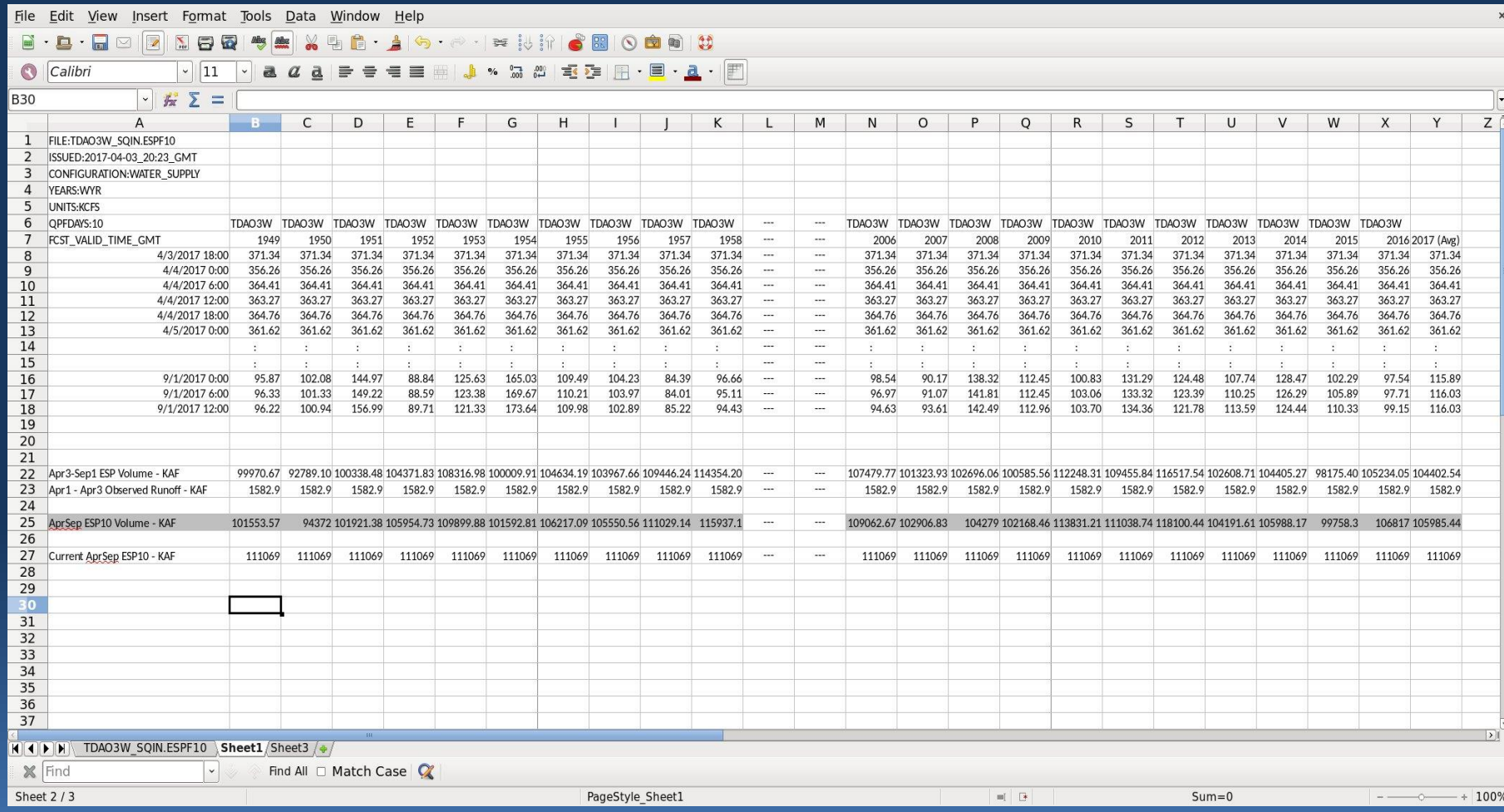






- New Product – now have gridded temperature and precip forcings available in a netcdf format

Data Downloads

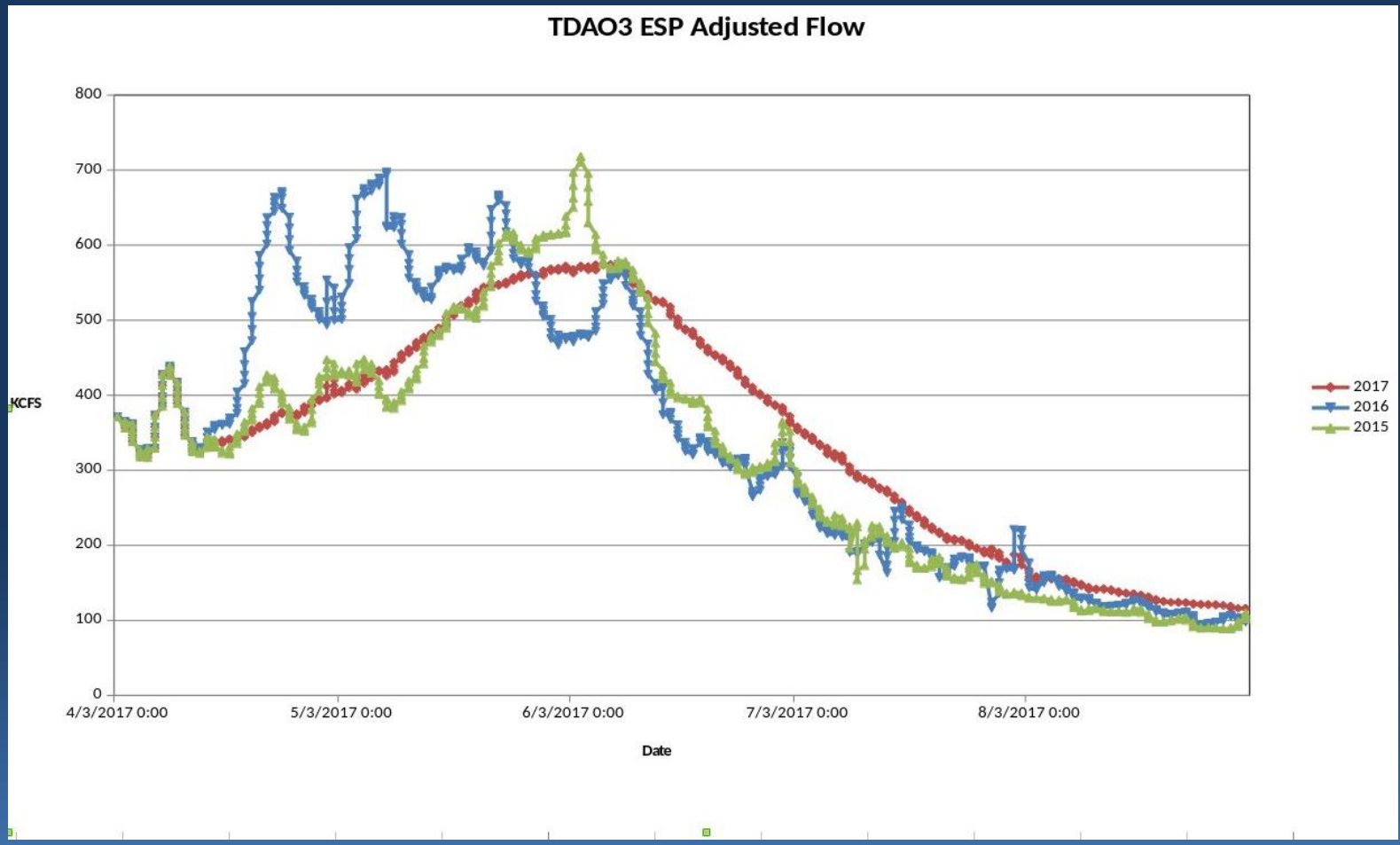


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	FILE:TDAO3W_SQIN.ESPF10																									
2	ISSUED:2017-04-03_20:23_GMT																									
3	CONFIGURATION:WATER_SUPPLY																									
4	YEARS:WYR																									
5	UNITS:KCFS																									
6	QPFDAYS:10	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	---	---	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	TDAO3W	
7	FCST_VALID_TIME_GMT	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	---	---	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 (Avg)	
8	4/3/2017 18:00	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	---	---	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	371.34	
9	4/4/2017 0:00	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	---	---	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	356.26	
10	4/4/2017 6:00	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	---	---	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	364.41	
11	4/4/2017 12:00	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	---	---	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	363.27	
12	4/4/2017 18:00	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	---	---	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	364.76	
13	4/5/2017 0:00	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	---	---	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	361.62	
14		:	:	:	:	:	:	:	:	:	:	---	---	:	:	:	:	:	:	:	:	:	:	:	:	
15		:	:	:	:	:	:	:	:	:	:	---	---	:	:	:	:	:	:	:	:	:	:	:	:	
16	9/1/2017 0:00	95.87	102.08	144.97	88.84	125.63	165.03	109.49	104.23	84.39	96.66	---	---	98.54	90.17	138.32	112.45	100.83	131.29	124.48	107.74	128.47	102.29	97.54	115.89	
17	9/1/2017 6:00	96.33	101.33	149.22	88.59	123.38	169.67	110.21	103.97	84.01	95.11	---	---	96.97	91.07	141.81	112.45	103.06	133.32	123.39	110.25	126.29	105.89	97.71	116.03	
18	9/1/2017 12:00	96.22	100.94	156.99	89.71	121.33	173.64	109.98	102.89	85.22	94.43	---	---	94.63	93.61	142.49	112.96	103.70	134.36	121.78	113.59	124.44	110.33	99.15	116.03	
19																										
20																										
21																										
22	Apr3-Sep1 ESP Volume - KAF	99970.67	92789.10	100338.48	104371.83	108316.98	100009.91	104634.19	103967.66	109446.24	114354.20	---	---	107479.77	101323.93	102696.06	100585.56	112248.31	109455.84	116517.54	102608.71	104405.27	98175.40	105234.05	104402.54	
23	Apr1 - Apr3 Observed Runoff - KAF	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	---	---	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	1582.9	
24																										
25	AprSep ESP10 Volume - KAF	101553.57	94372	101921.38	105954.73	109899.88	101592.81	106217.09	105550.56	111029.14	115937.1	---	---	109062.67	102906.83	104279	102168.46	113831.21	111038.74	118100.44	104191.61	105988.17	99758.3	106817	105985.44	
26																										
27	Current AprSep ESP10 - KAF	111069	111069	111069	111069	111069	111069	111069	111069	111069	111069	---	---	111069	111069	111069	111069	111069	111069	111069	111069	111069	111069	111069	111069	
28																										
29																										
30																										
31																										
32																										
33																										
34																										
35																										
36																										
37																										

ESP ensemble traces easily imported to spreadsheet

- Calculate Apr-Sep adjusted runoff volume for each ESP trace for historic record (1949-2016)

Data Downloads



Plot the current ESP trace (2017) against other analog years of interest

April 2017 Water Supply Briefing

National Weather Service, Northwest River Forecast Center

Questions?

Presentation available after brief at:
www.nwrfc.noaa.gov/presentations/presentations.cgi

Kevin Berghoff, Bruce Anderson, Taylor Dixon, NWRFC
W-ptr.Webmaster@noaa.gov
(503) 326-7291