NOAA Water Resources Monitor and Outlook

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Jeff Zimmerman - NWS Western Region Headquarters

Kevin Werner - NWS Headquarters

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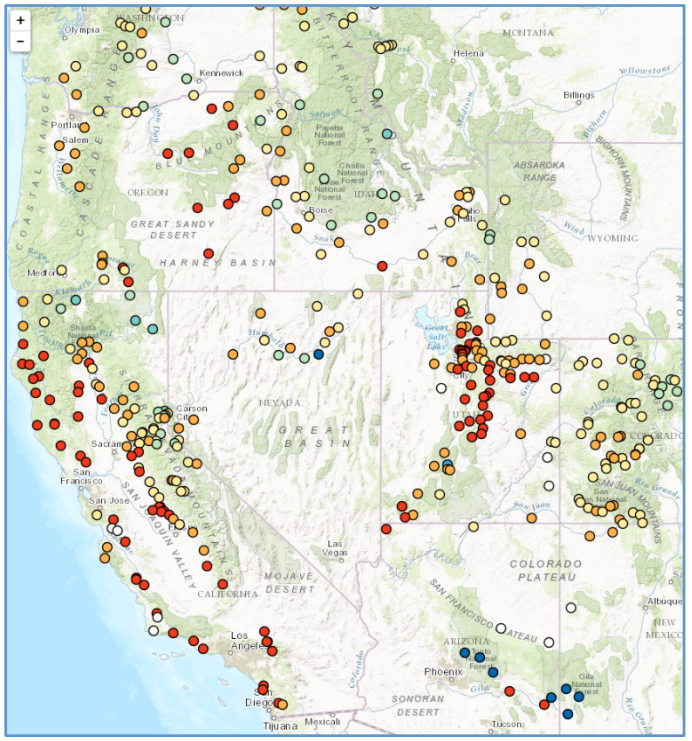


AMS 2017; 25 January, 2017

Overview

- Back ground on water supply forecasting
- Need for a consistent product across basins
- enhancements to existing products; prototypes

13 NOAA River Forecast Centers (RFCs)

- Streamflow forecasts at hundreds of locations across the country

Water Supply Forecasts in the West

- Driven by mountain snow melt
- 6 RFCs provide water supply forecasts to support water resources managers decisions
- Many large water suppliers in the West get water from more than one major basin

Water Supply Forecasts

Used for

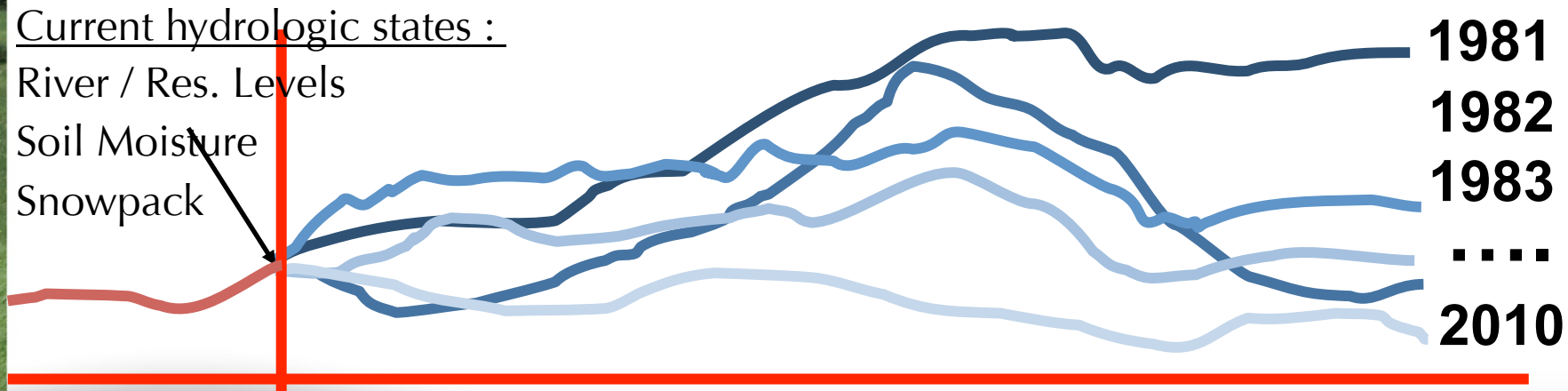
- Reservoir operations
  - Irrigation/Food Supply
  - Power generation/Price of electricity
  - Flood control
- Water supply to communities
- Endangered species
- Recreational uses/Tourism
- Drought information
- Major users: Fed, state and quasi-govt managers who in turn provide information to others

Increasing in importance of water supply'

- Population increasing in water scarce areas
- Impacts of climate change
- Growing demand due to environmental vulnerabilities
- Power generation
- Competing demands
- More and more scrutiny, requests for more and more information
- In the west, serve > 25M water users

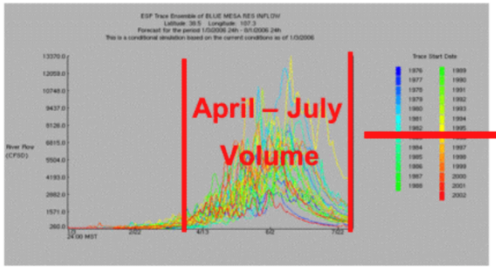
Ensemble Streamflow Prediction (ESP) Probabilistic Forecasts

- Start with current conditions (from the daily model run)
- Apply precipitation and temperature from each historical year (1981-2010)
- A forecast is generated for each of the years (1981-2010*) *as if, going forward,* that year will happen
- This creates 30 possible future streamflow patterns. Each year is given a 1/30 chance of occurring



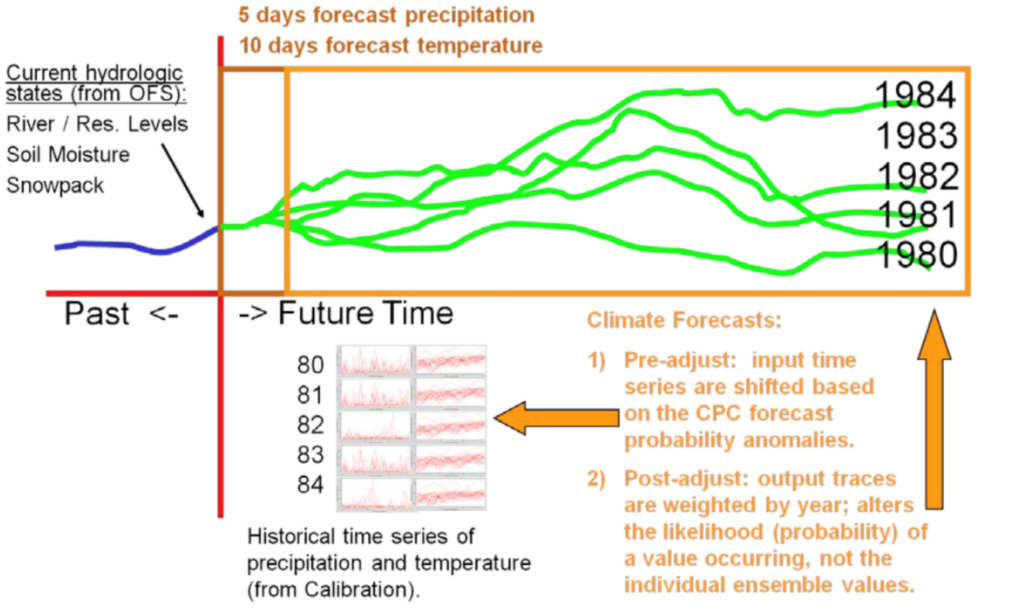
*Being updated this to 1981-2015

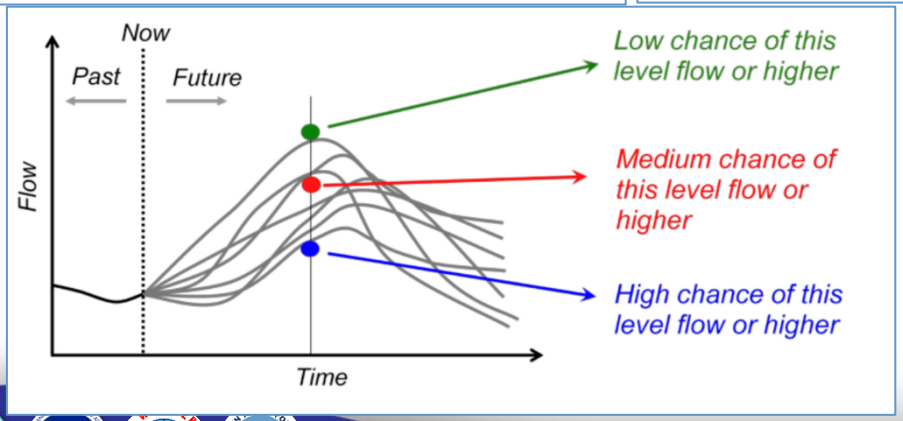
Ensemble Streamflow Prediction method (cont)



1. Select a forecast window
2. Select a forecast variable
3. Model derives a distribution function
4. 50% exceedance value = most probable forecast
5. Correct for model bias

# Exceedance Probabilities	Conditional Simulation	Historical Simulation	Historical Observed
0.900	438320.500	328520.656	262730.375
0.750	559369.562	499977.531	435810.375
0.500	711742.375	751782.938	691946.625
0.250	877104.812	973699.188	935549.938
0.100	1080490.375	1170393.125	1157333.250





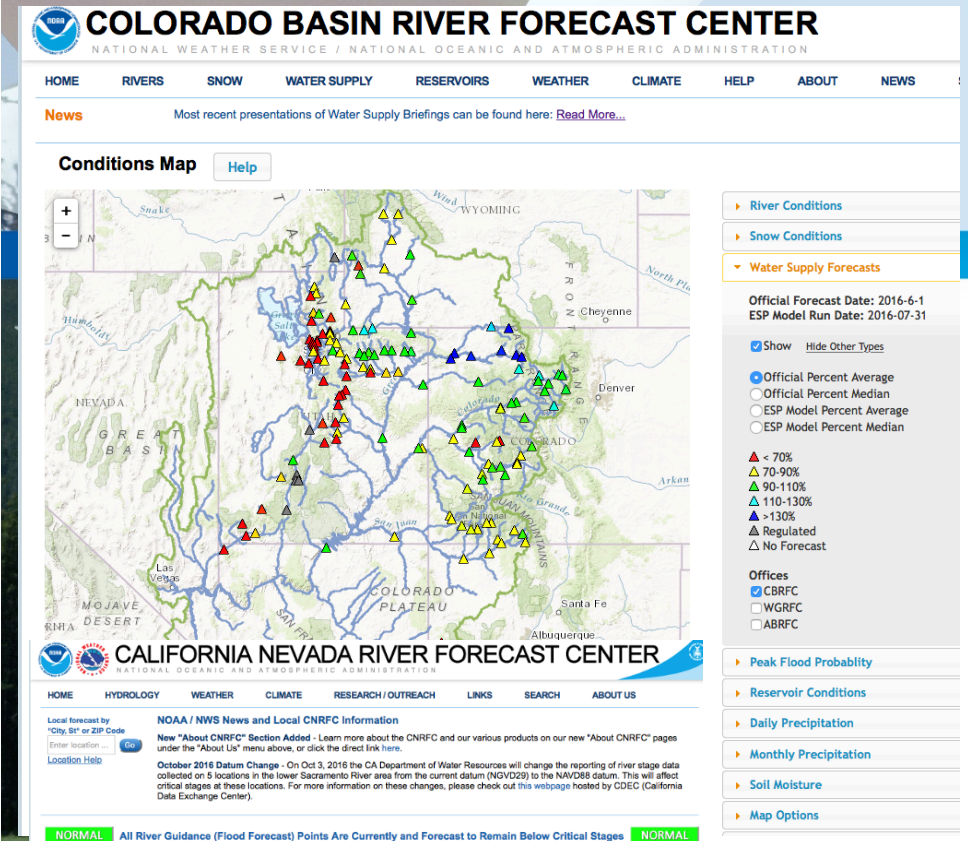
Need for a consistent product and enhancements

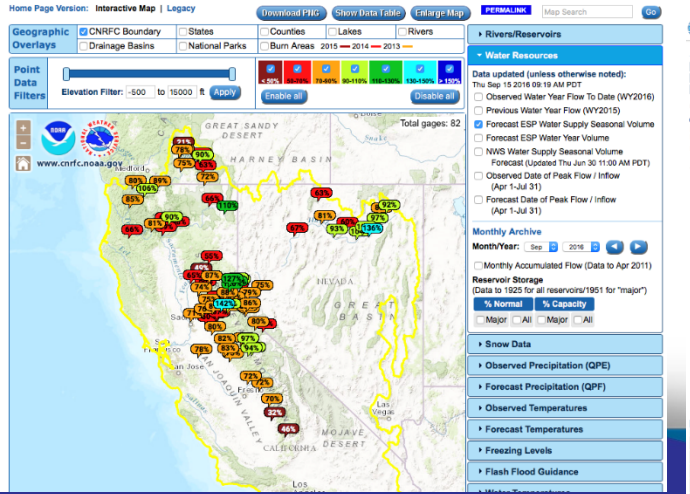
- Challenges: Each RFC has a separate webpage for its forecast area
  - Challenge for states with multiple basins, e.g CO, UT, WY
- Feedback from user studies and stakeholder meetings that's not yet incorporated in products, better:
  - Documentation & user guide
  - Verification information
  - Potential to incorporate climate outlooks: NOAA CPC week 3-4, monthly, seasonal outlooks
  - Seasonal water outlook envisioned based on CPC outlooks and other analysis

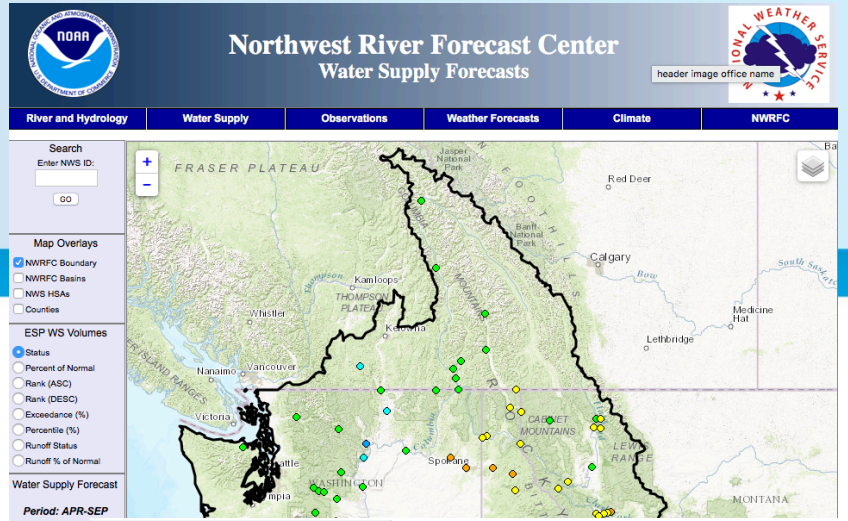
Need for a way to see contextual information and supporting data, now often on other sites:

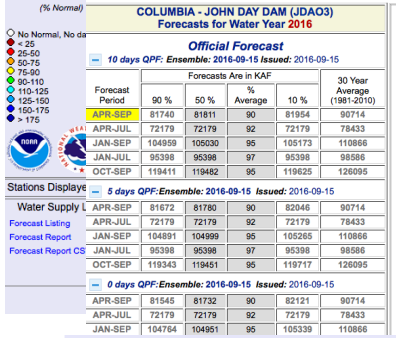
- Snow information (observed)
- Soil moisture information
- Temperature and precipitation
- Reservoir conditions

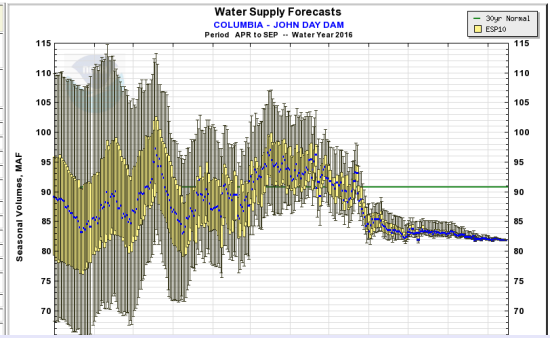
- **mid-2007**

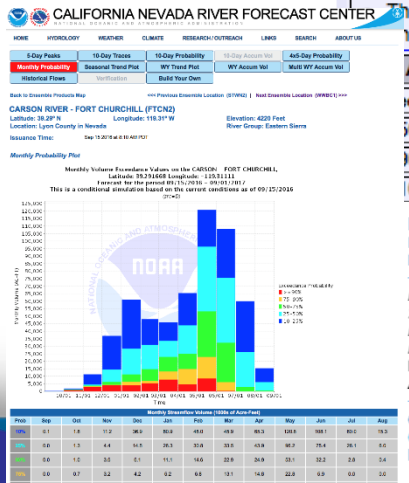












JDAO3 ● COLUMBIA - JOHN DAY DAM

Based on 45 years of historical record (1971-2015):
The median (50%) forecast is ranked 31st wettest and 16th driest
The percentile is placed in the 34th percentile of the record (exceedance probability is 66%)

APR-SEP	Ensemble Traces: 2016-09-15		Issued: 2016-09-15		(Units in KAF)	
edance	10 Day QPF (Official)		5 Day QPF		Climatology	
0%	81811	90%	81780	90%	81732	90%
0%	81740	90%	81672	90%	81545	90%
0%	81954	90%	82046	90%	82121	91%

noff
7386.4 KAF 95%

FORT CHURCHILL, NR (FTCN2)
Latitude: 39.29°N Longitude: 119.31°W
Elevation: 4180 Ft

ESP Water Supply Seasonal Forecast Issuance: Sep 15 2016
Forecast Period: Apr - Jul 2016
Most Probable Volume: 127.6 kaf
Percent of Mean: 75%
Average seasonal flow: 171.0 kaf

CNRFC ESP Water Supply Seasonal Forecast (Text)
CNRFC ESP Water Supply Monthly Forecast (Image)
Link to Water Supply Trend Plots

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- Feedback from user studies and stakeholder meetings that's not yet incorporated in products; they request better:
  - Documentation & user guide
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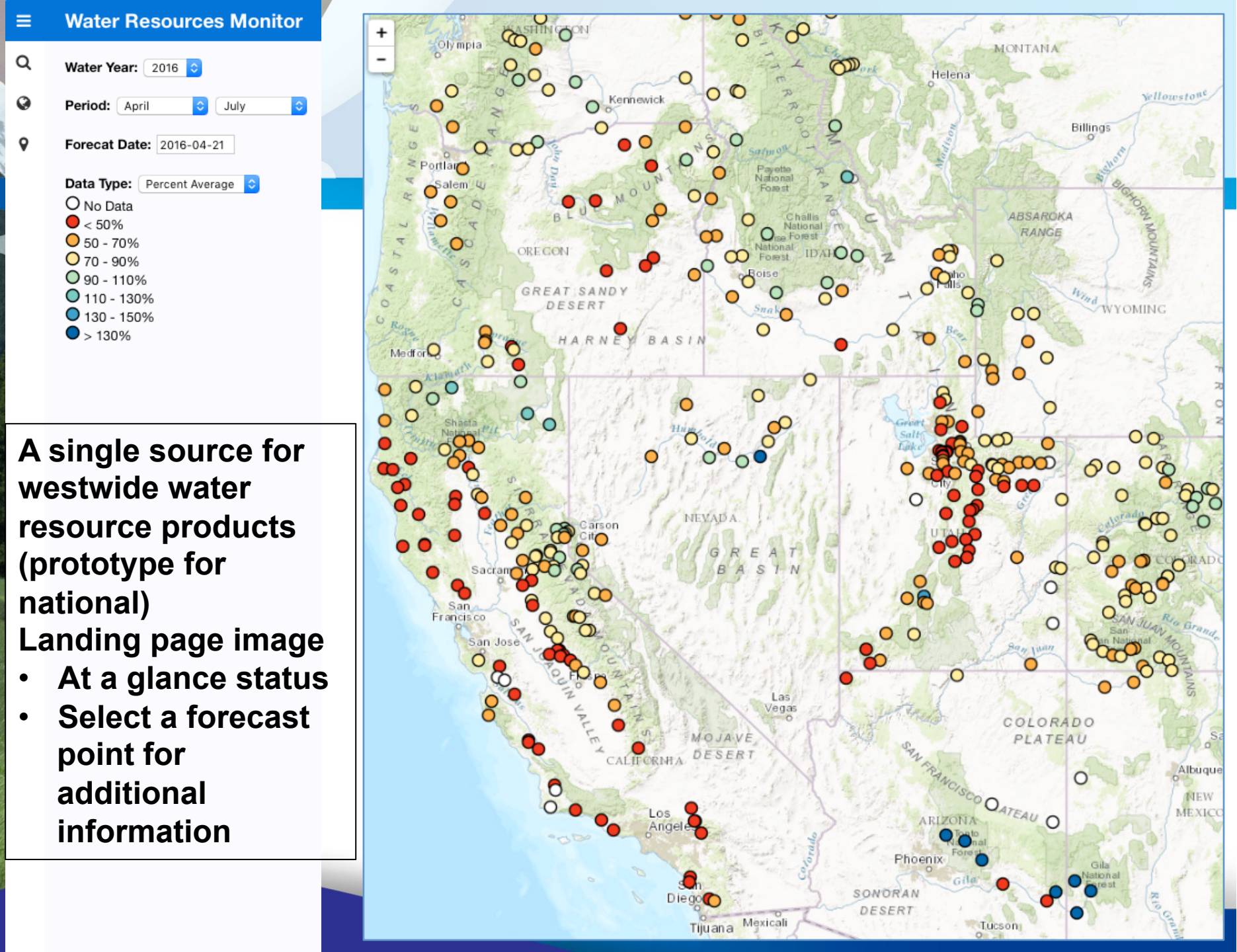
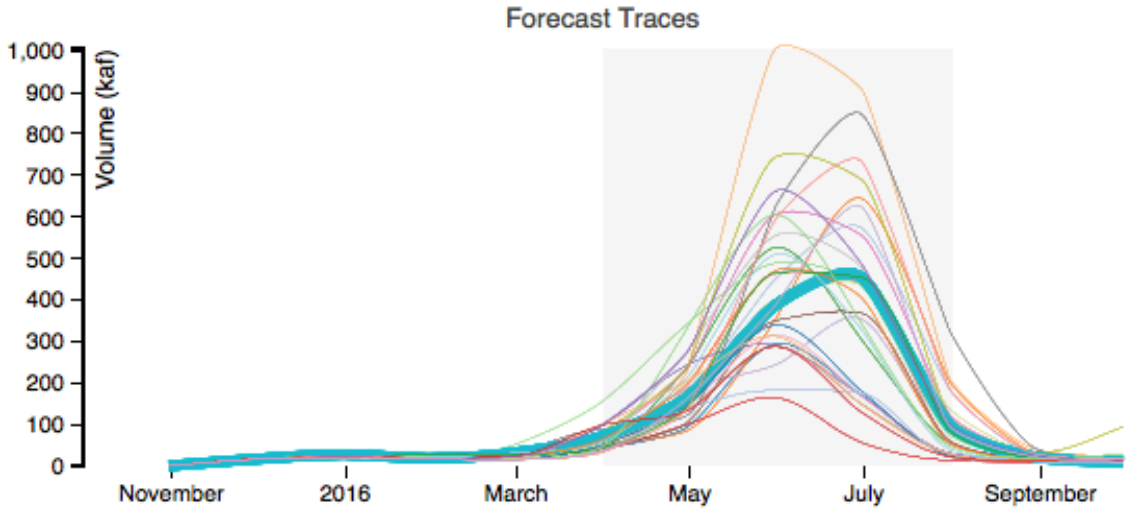


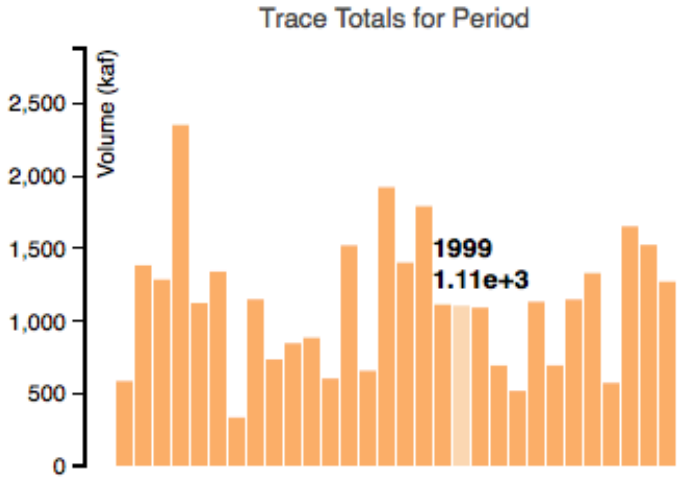
A single source for westwide water resource products (prototype for national)

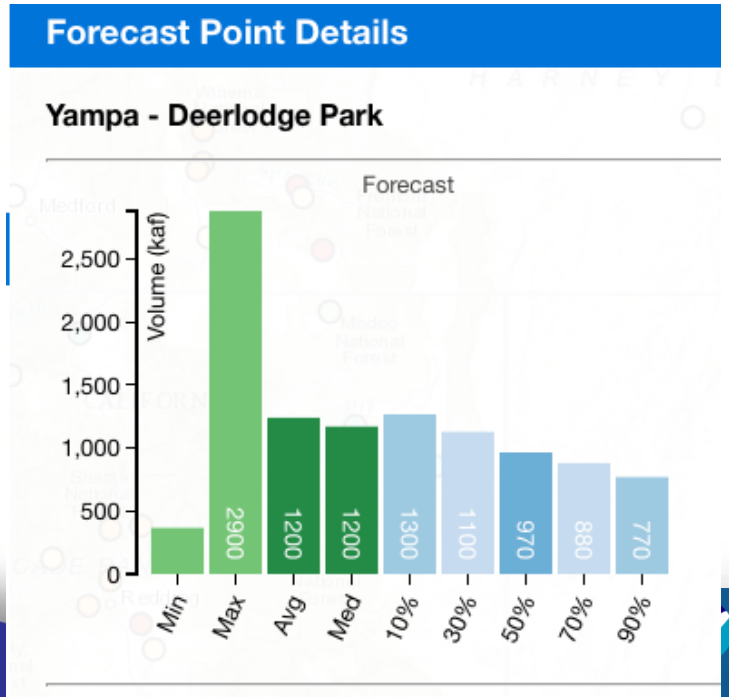
Landing page image

- **At a glance status**
- **Select a forecast point for additional information**

Prototypes: forecast traces

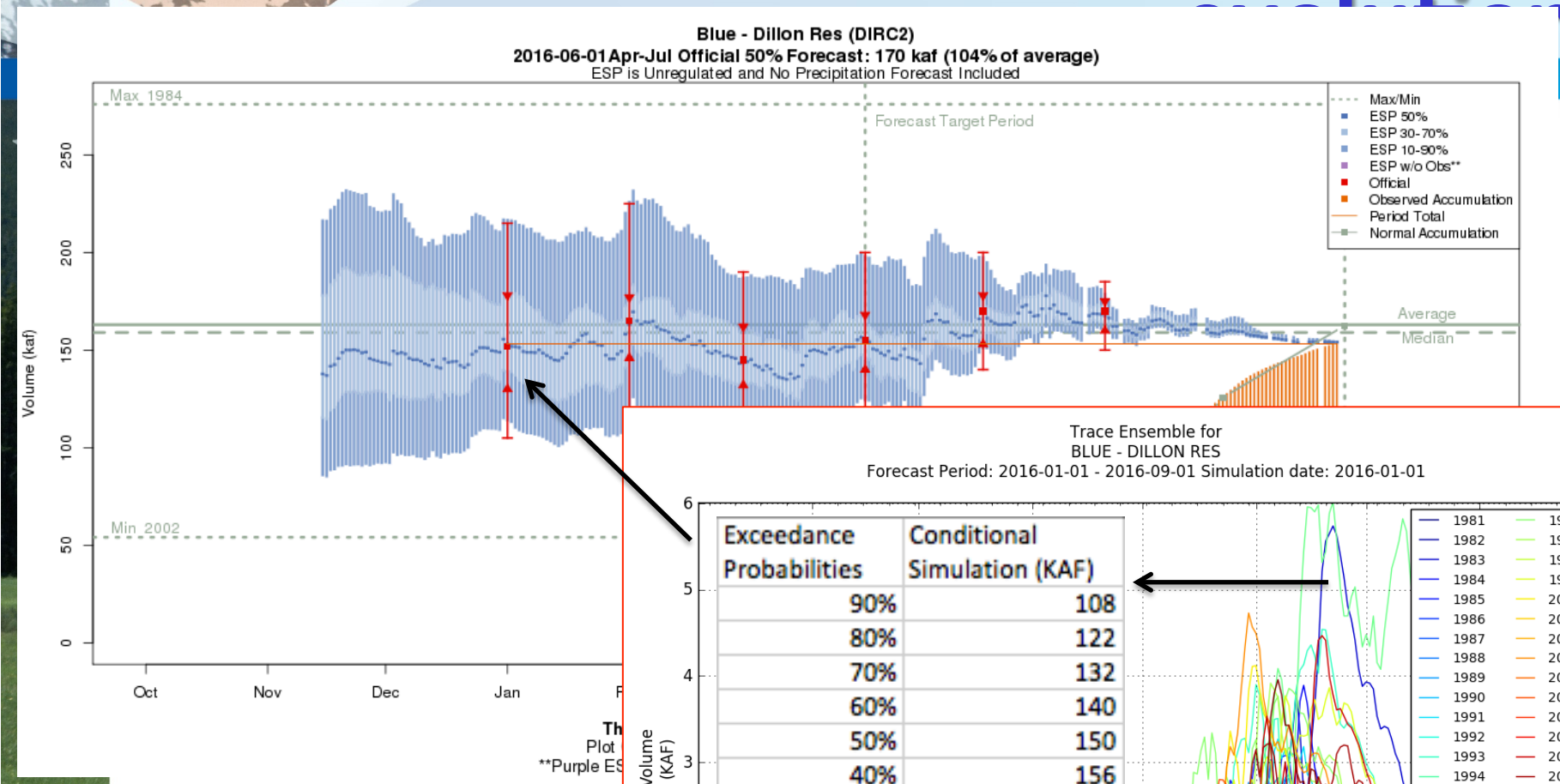


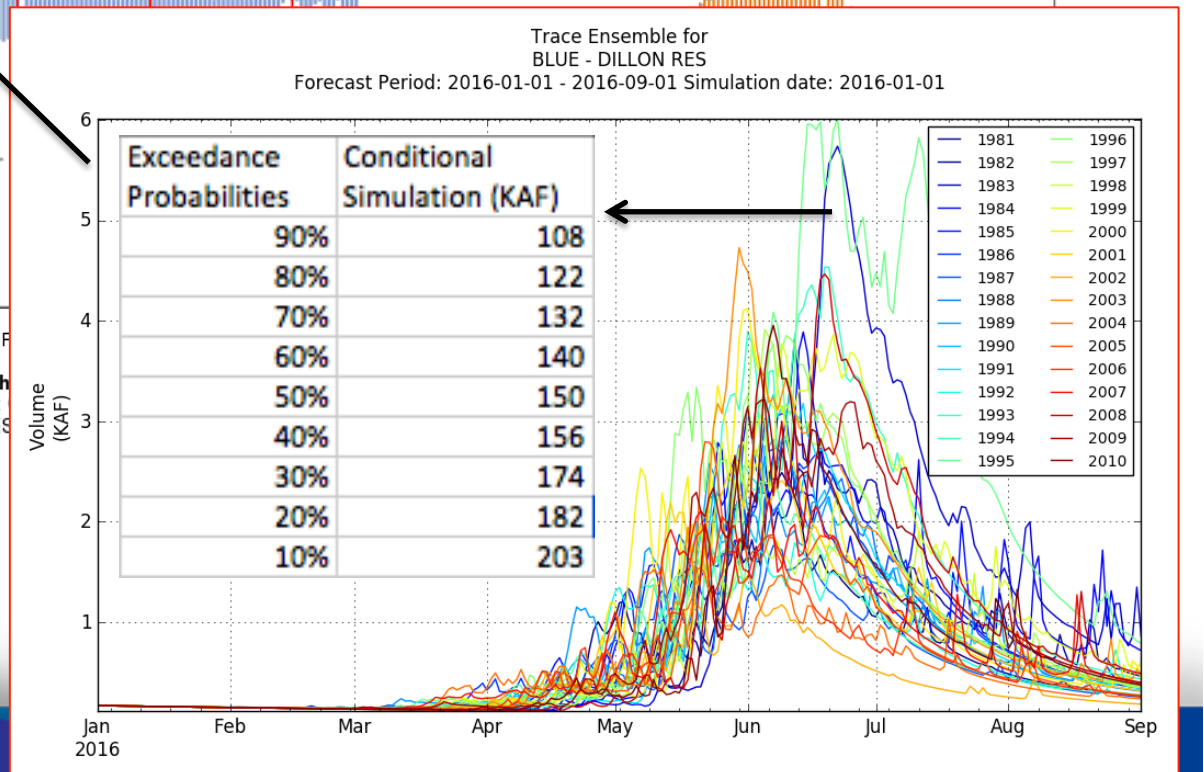




Science, Service & Stewardship

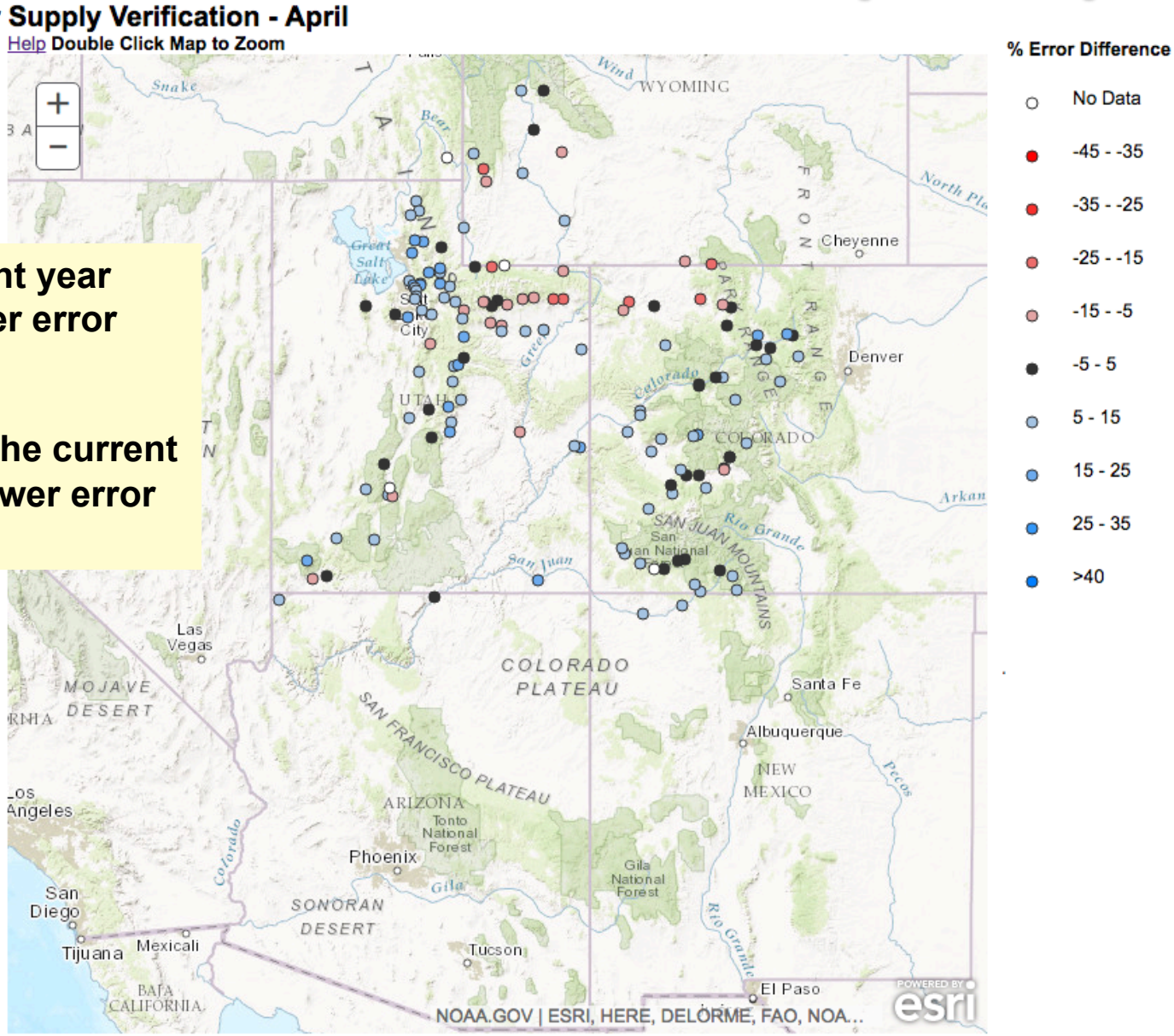
Communicating Forecast





Exceedance Probabilities	Conditional Simulation (KAF)
90%	108
80%	122
70%	132
60%	140
50%	150
40%	156
30%	174
20%	182
10%	203

Forecast Verification (2016)



Red indicates current year forecast had a higher error than the ESP model

Blue indicates that the current year forecast had lower error than the ESP model

Benefits & upcoming features

Benefits:

- One location for all forecasts westwide, eventually nationally
- Updated daily; Options for user-customization
- Based on user needs & feedback, including User defined periods,
- Documentation & user guide
- Verification information

Upcoming Features:

Supporting data, currently not easily viewed from RFC pages:

  - Snow information (observed)
  - Soil moisture information
  - Temperature and precipitation
  - Reservoir conditions

- Climate outlooks: NOAA CPC week 3-4, monthly, seasonal outlooks
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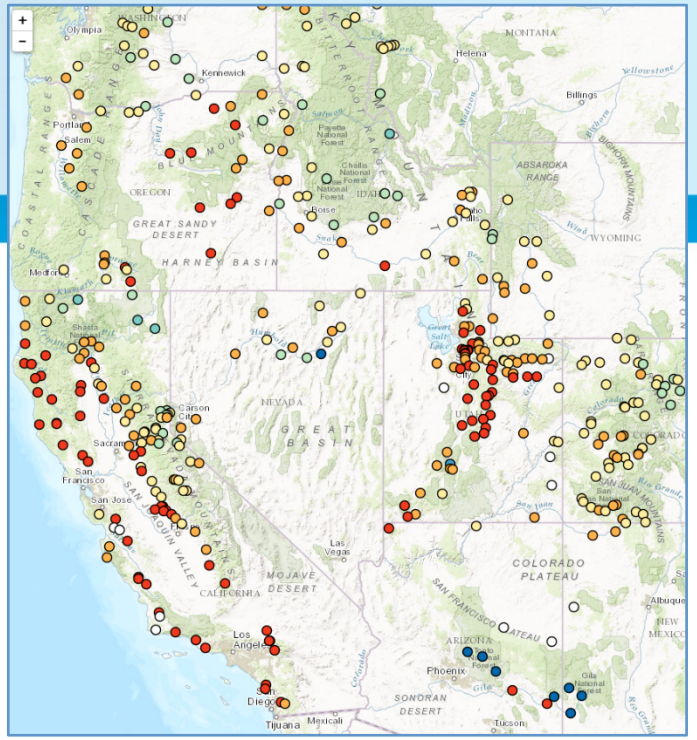
Comments on observations

- River Forecast Centers depend on obs and data with partner agencies, not just data from NOAA: USGS streamflow gages; obs and forecasts for smaller streams by Dept. Ag/NRCS; NRCS soil moisture; NASA remote sensing
- Snow obs & data are critical (NRCS snotel, NOAA/NASA SNODAS, etc)
  - In the west, snow is a reservoir
- Additional SNOTEL sites in areas that are poor in data have the potential to improve the water supply forecasts.
- "We always need more snow information"

Thank you



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- For more info: CBRFC.noaa.gov/WRMO, beta available in mid-2017

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The Take Away

- Overall, CBRFC forecasts performed well throughout much of the basin this season
  - Dry and warm February and March conditions, coupled with dry soil moisture conditions, impeded runoff
  - An unusually wet May negatively impacted forecast performance in the Green River Basin
- Great Basin forecasts were impacted by early runoff in March, but some areas in the north did benefit from May precipitation
- Lower Colorado River Basin did not realize forecasted wet El Niño conditions