Water Resources Monitoring and Outlook

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Outline

- Water Supply Forecasting in NOAA's NWS RFCs
  - Products and Services
  - Forecasting methods
- Case for the WRMO
- WRMO prototype
- Future enhancements to the WRMO

13 River Forecast Centers

- Streamflow forecasts at hundreds of locations across the country
- Used for flood warning program, recreational uses, etc.

Water Supply Forecasts in the West

- Driven by mountain snow melt
- 6 RFCs provide water supply forecasts to support water resources managers decisions

Water Supply Forecasts

- NOAA's NWS RFCs have been producing water supply forecasts for decades
- Probabilistic volumetric forecasts of streamflow at a given location over a defined period (usually the runoff season, i.e. Apr-July)

	Forecast Period	90% Exceedance Volume	70% Exceedance Volume	50% Exceedance Volume	Percent Average	30% Exceedance Volume	10% Exceedance Volume
Lake Powell, Glen Cyn Dam, At	April-July	3800	4650	***5700***	**80**	6500	8000

Example: Lake Powell Inflow forecast for April-July 2016 on March 1

Water Supply Forecasts

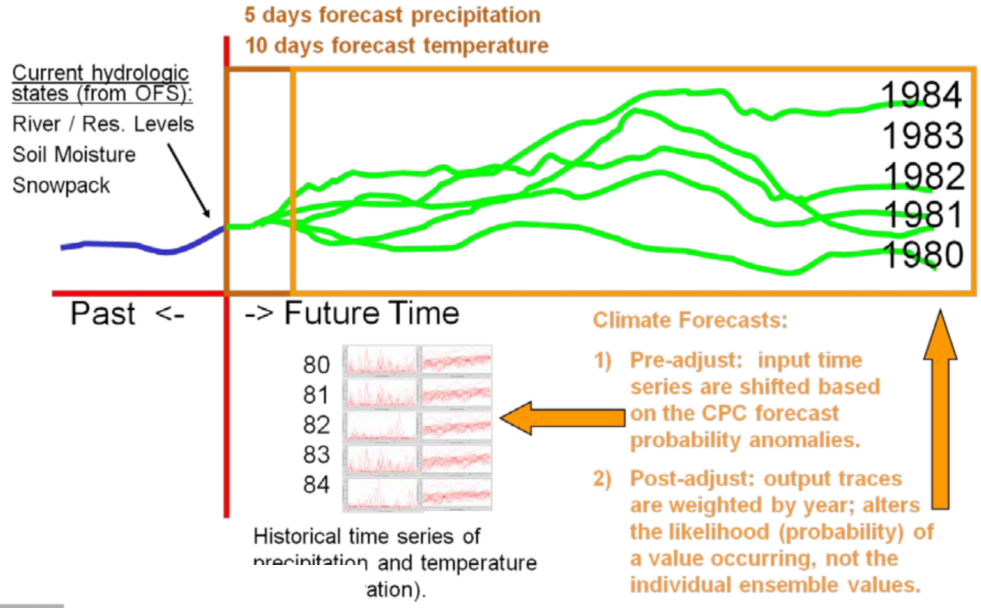
Used for

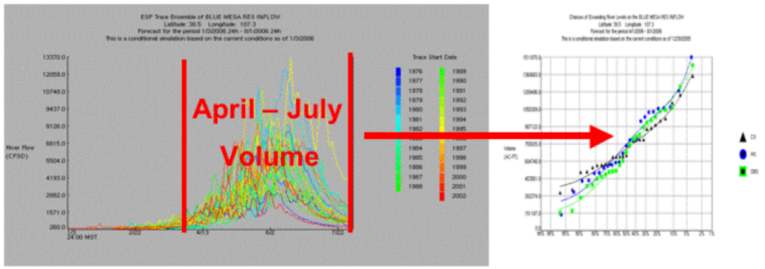
- Reservoir operations
  - Irrigation
    - Food Supply
  - Power generation
    - Price of electricity
- Water supply to communities
- Endangered species
- Recreational uses
  - Tourism
- Drought information

Increasing in importance

- Increasing population 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

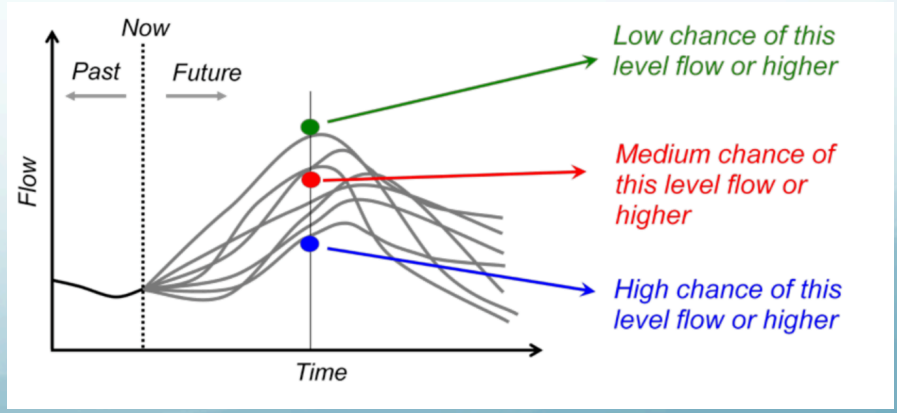
ESP method





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

# Statistics based on all years.			
# 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



COLORADO BASIN RIVER FORECAST CENTER

NATIONAL WEATHER SERVICE / NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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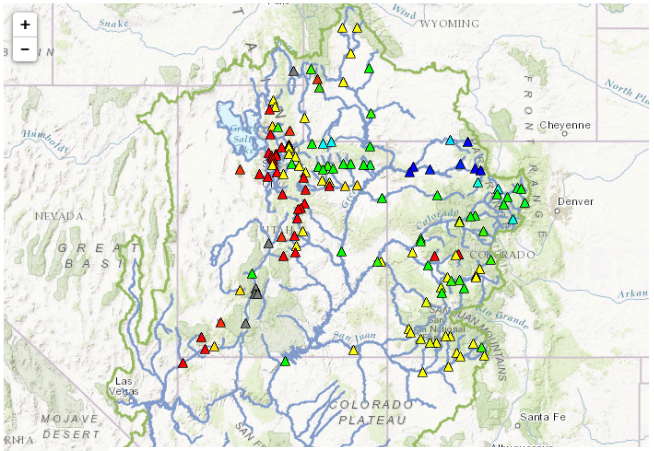
News Most recent presentations of Water Supply Briefings can be found here: Read More...

Conditions Map

Help



- River Conditions
- Snow Conditions
- Water Supply Forecasts

Official Forecast Date: 2016-6-1
ESP Model Run Date: 2016-07-31

Show | Hide Other Types

- Official Percent Average
- Official Percent Median
- ESP Model Percent Average
- ESP Model Percent Median

- < 70%
- 70-90%
- 90-110%
- 110-130%
- >130%
- Regulated
- No Forecast

Offices
- CBRFC
- WGRFC
- ABRFC

San Juan - Bluff- Nr (BFFU1)
2016-06-01Apr-Jul Official 50% Forecast: 780 kaf (71% of average)
ESP is Unregulated and No Precipitation Forecast Included

CALIFORNIA NEVADA RIVER FORECAST CENTER

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Local forecast by "City, St" or ZIP Code — Go — Location Help

NOAA / NWS News and Local CNRFC Information

New "About CNRFC" Section Added - Learn more about the CNRFC and our various products on our new "About CNRFC" pages under the "About Us" menu above, or click the direct link here.

October 2016 Datum Change - On Oct 3, 2016 the CA Department of Water Resources will change the reporting of river stage data collected on 5 locations in the lower Sacramento River area from the current datum (NGVD29) to the NAVD88 datum. This will affect critical stages at these locations. For more information on these changes, please check out this webpage hosted by CDEC (California Data Exchange Center).

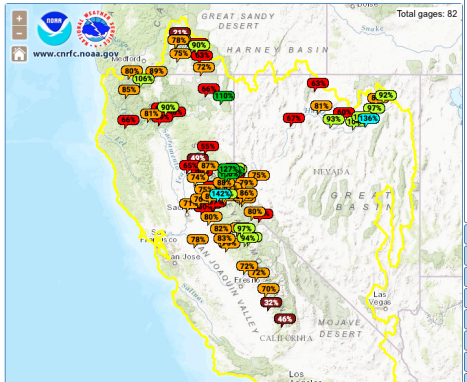
NORMAL — All River Guidance (Flood Forecast) Points Are Currently and Forecast to Remain Below Critical Stages — NORMAL

Recently-Issued CNRFC Text Products: Text Product Description | ID | Date/Time Issued to Web

Home Page Version: Interactive Map | Legacy — Download PNG | Show Data Table | Enlarge Map | PERMALINK | Map Search — Go

Geographic Overlays: CNRFC Boundary | States | Counties | Lakes | Rivers | Drainage Basins | National Parks | Burn Areas 2015 2014 2013

Point Data Filters: Elevation Filter: -500 to 15000 ft — Apply — Enable all — Disable all



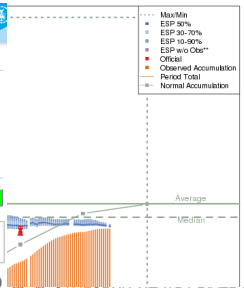
- Rivers/Reservoirs
- Water Resources

Data updated (unless otherwise noted): Thu Sep 15 2016 09:19 AM PDT
- Observed Water Year Flow To Date (WY2016)
- Previous Water Year Flow (WY2015)
- Forecast ESP Water Supply Seasonal Volume
- Forecast ESP Water Year Volume
- NWS Water Supply Seasonal Volume Forecast (Updated Thu Jun 30 11:00 AM PDT)
- Observed Date of Peak Flow / Inflow (Apr 1-Jul 31)
- Forecast Date of Peak Flow / Inflow (Apr 1-Jul 31)

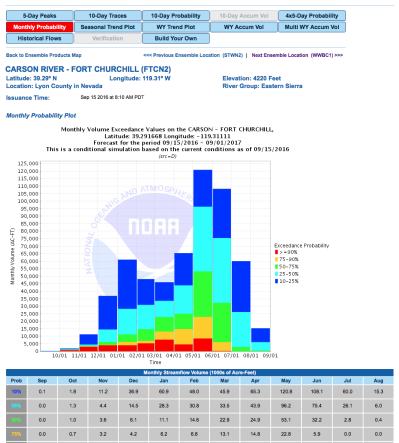
Monthly Archive — Month/Year: Sep 2016
- Monthly Accumulated Flow (Data to Apr 2011)

Reservoir Storage (Data to 1925 for all reservoirs/1951 for "major") — % Normal | % Capacity — Major | All | Major | All

- Snow Data
- Observed Precipitation (QPE)
- Forecast Precipitation (QPF)
- Observed Temperatures
- Forecast Temperatures
- Freezing Levels
- Flash Flood Guidance
- Water Temperatures



CALIFORNIA NEVADA RIVER FORECAST CENTER



Northwest River Forecast Center

Water Supply Forecasts

header image office name

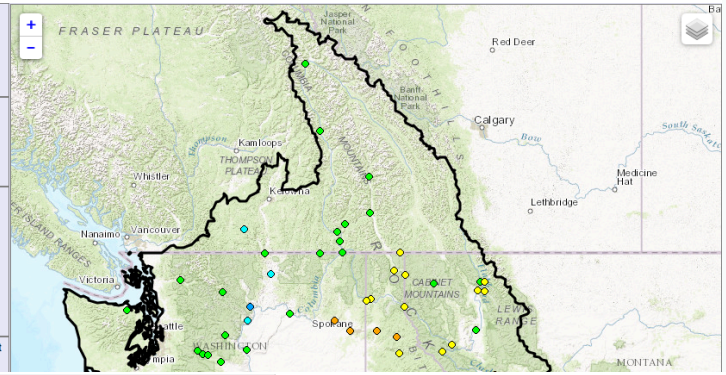
River and Hydrology | Water Supply | Observations | Weather Forecasts | Climate | NWRFC

Search — Enter NWS ID: — GO

Map Overlays
- NWRFC Boundary
- NWRFC Basins
- NWS HSAs
- Counties

ESP WS Volumes
- Status
- Percent of Normal
- Rank (ASC)
- Rank (DESC)
- Exceedance (%)
- Percentile (%)
- Runoff Status
- Runoff % of Normal

Water Supply Forecast



Period: APR-SEP (% Normal)

No Normal, No da
- < 25
- 25-50
- 50-75
- 75-90
- 90-110
- 110-125
- 125-150
- 150-175
- > 175

COLUMBIA - JOHN DAY DAM (JDAO3)
Forecasts for Water Year 2016

Official Forecast

10 days QPF: **Ensemble: 2016-09-15** *Issued:* 2016-09-15

Forecast Period	Forecasts Are in KAF: 90 %	50 %	% Average	10 %	30 Year Average (1981-2010)
APR-SEP	81740	81811	90	81954	90714
APR-JUL	72179	72179	92	72179	78433
JAN-SEP	104959	105030	95	105173	110866
JAN-JUL	95398	95398	97	95398	98586
OCT-SEP	119411	119482	95	119625	126095

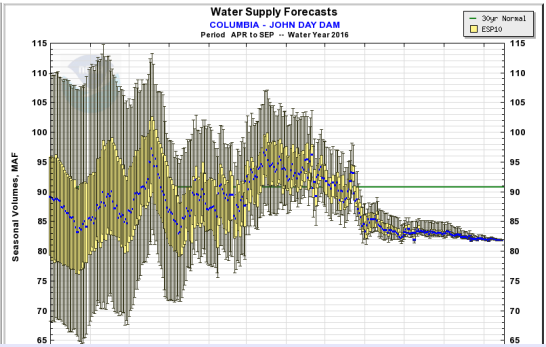
5 days QPF: **Ensemble: 2016-09-15** *Issued:* 2016-09-15

APR-SEP	81672	81780	90	82046	90714
APR-JUL	72179	72179	92	72179	78433
JAN-SEP	104891	104999	95	105265	110866
JAN-JUL	95398	95398	97	95398	98586
OCT-SEP	119343	119451	95	119717	126095

0 days QPF: **Ensemble: 2016-09-15** *Issued:* 2016-09-15

APR-SEP	81545	81732	90	82121	90714
APR-JUL	72179	72179	92	72179	78433
JAN-SEP	104764	104951	95	105339	110866
JAN-JUL	95398	95398	97	95398	98586
OCT-SEP	119233	119420	95	119808	126095

Stations Displayed
Water Supply L
Forecast Listing
Forecast Report
Forecast Report CS



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%

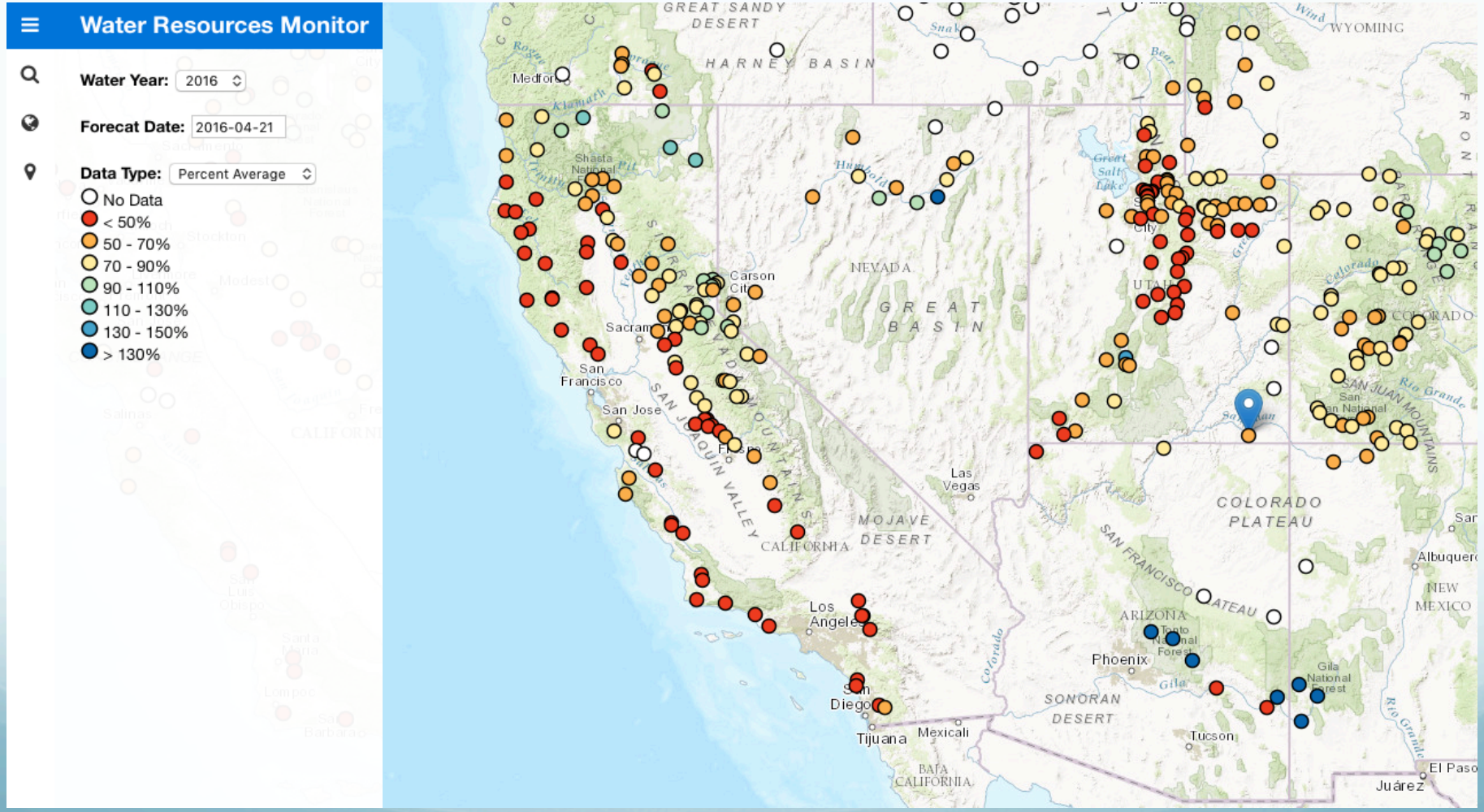
noff	
7386.4 KAF	95%

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

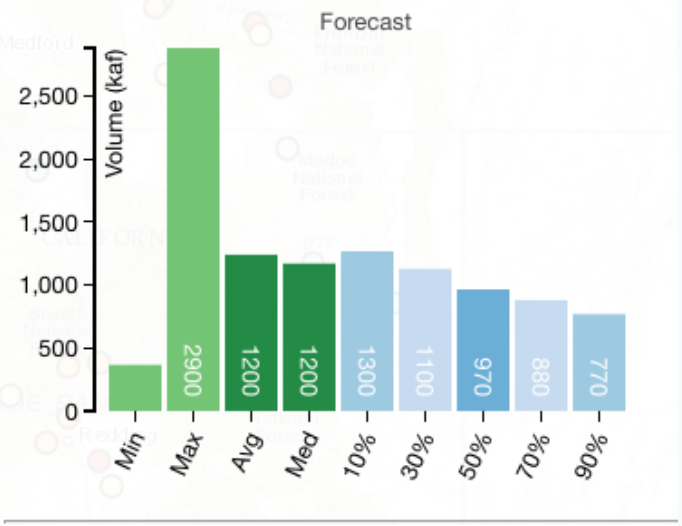
CNRFC ESP Water Supply Seasonal Forecast (Text)
CNRFC ESP Water Supply Monthly Forecast (Image)
Link to Water Supply Trend Plots

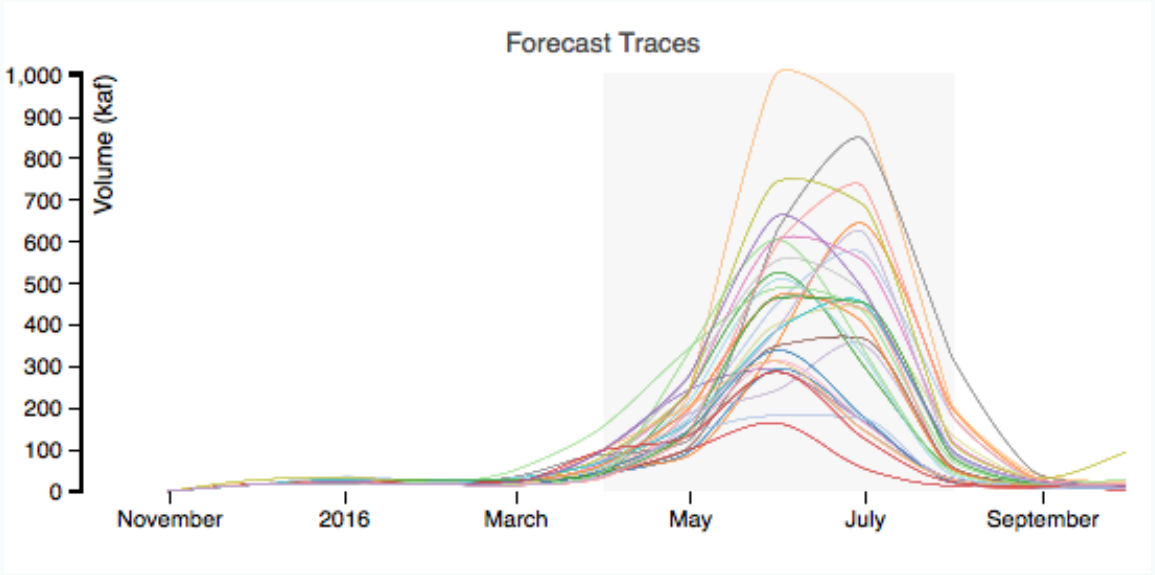
WRMO


Water Resources Monitor
Water Year: 2016
Forecat Date: 2016-04-21
Data Type: Percent Average
No Data
< 50%
50 - 70%
70 - 90%
90 - 110%
110 - 130%
130 - 150%
> 130%
GREAT SANDY DESERT
HARNEY BASIN
WYOMING
Medford
Shasta National
Carson City
NEVADA
GREAT BASIN
Sacramento
San Francisco
San Jose
SAN JOAQUIN VALLEY
SIERRA NEVADA MOUNTAINS
CALIFORNIA
MOJAVE DESERT
Las Vegas
COLORADO PLATEAU
SAN FRANCISCO PLATEAU
ARIZONA
Phoenix
Tonto National Forest
Gila National Forest
SONORAN DESERT
Los Angeles
San Diego
Tijuana
Mexicali
BAJA CALIFORNIA
Tucson
Albuquerque
NEW MEXICO
El Paso
Juárez
SAN JUAN MOUNTAINS
Great Salt Lake
Salt Lake City
UTAH
COLORADO
Colorado
Rio Grande
Gila
Snake
Bear
Wind
Klamath
Humboldt
Truckee
Carson
Stockton
Modesto
Salinas
Fresno
Santa Barbara
Lompoc

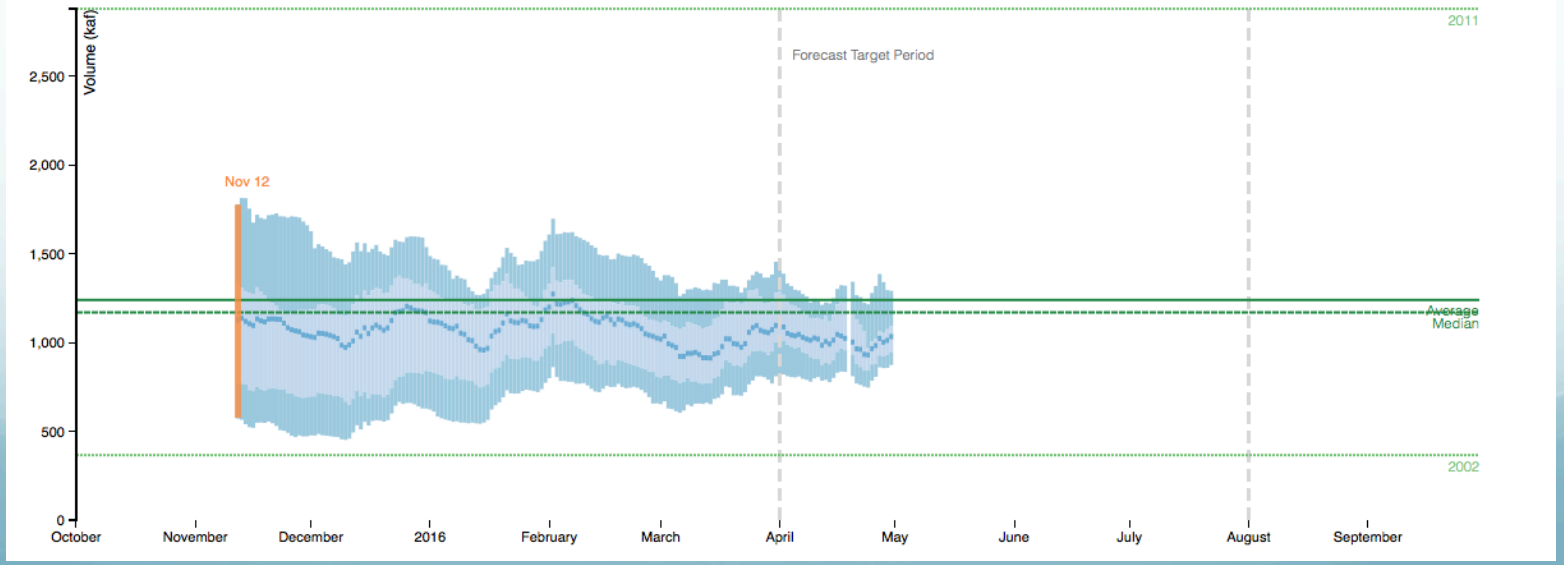
Forecast Point Details

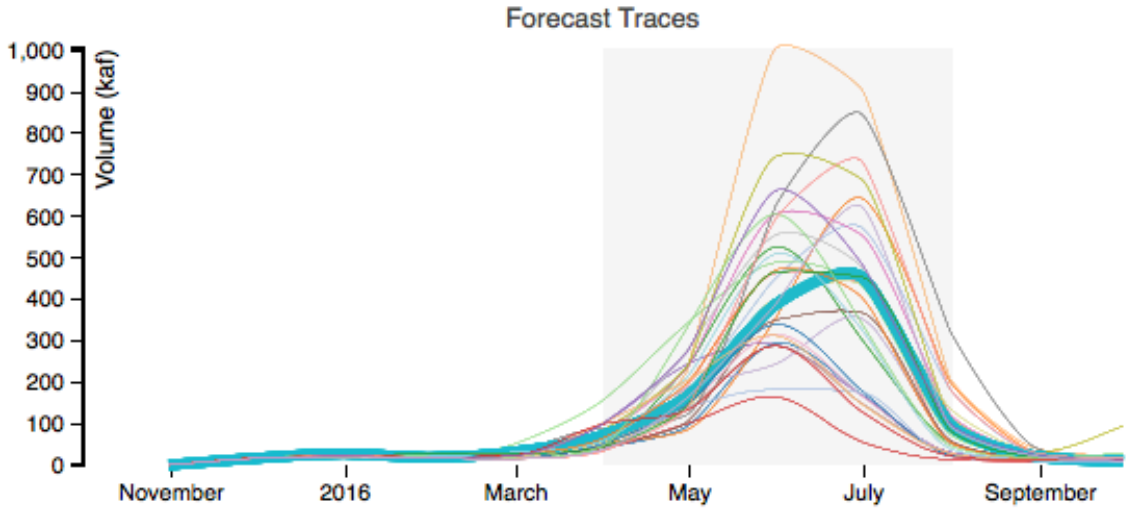
Yampa - Deerlodge Park

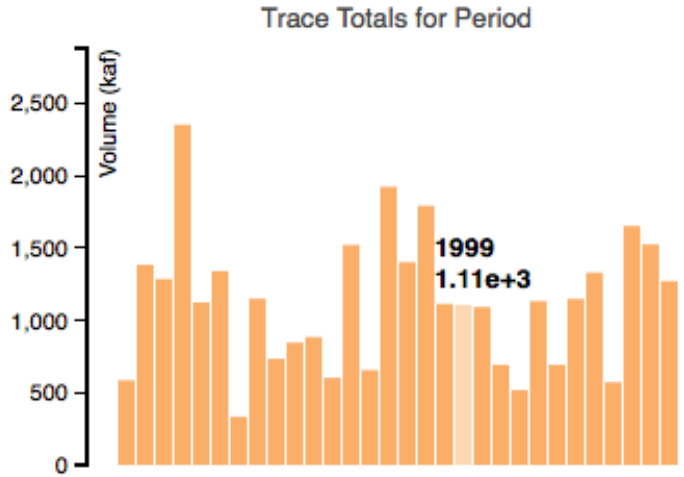




Location	Water Year	Forecast Period	Selected Forecast	Most Probable	Average	Percent Average
Yampa - Deerlodge Park (YDLC2)	2016	Apr - Jul	Nov 12	1128 kaf	1240 kaf	91%




Forecast Traces
Volume (kaf)
1,000
900
800
700
600
500
400
300
200
100
0
November
2016
March
May
July
September


Trace Totals for Period
Volume (kaf)
2,500
2,000
1,500
1,000
500
0
1999
1.11e+3

Benefits of WRMO

- One location for all forecasts
- More flexibility
- User defined periods
- Updated daily
- Stakeholder driven

Future features

- Ancillary data:
  - Snow information (observed)
  - Soil moisture information
  - Temperature and precipitation
  - Reservoir conditions
  - Documentation
- Climate outlook information based on CPC outlooks
- Verification information