May 2017
Colorado River Basin Water Supply Briefing

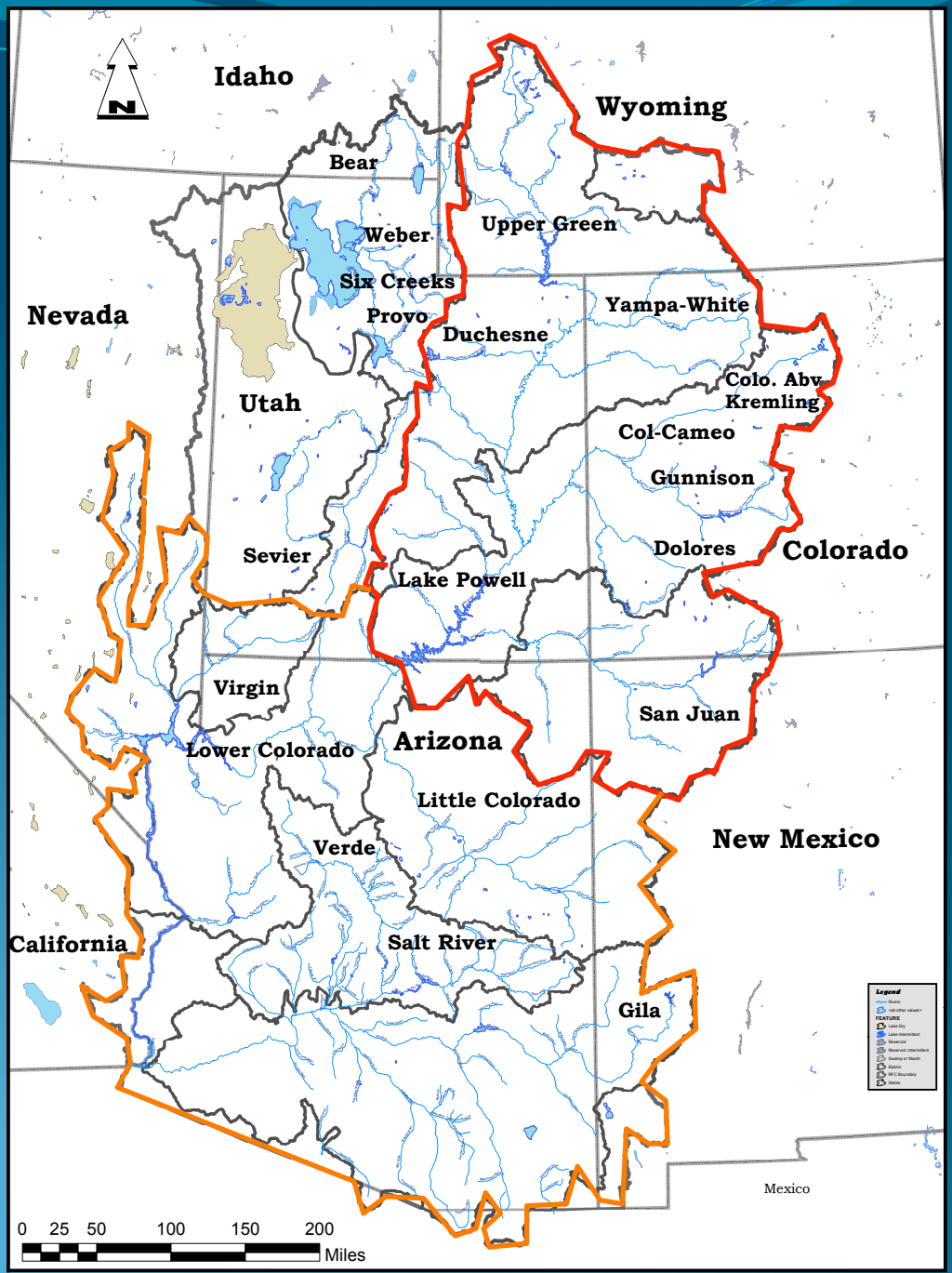
May 5, 2017

Brenda Alcorn – Sr. Hydrologist

Colorado Basin River Forecast Center
National Weather Service
NOAA

Please mute your phone until ready to ask questions

CBRFC Forecast Areas



Today's Presentation

April weather impacts:
- Below normal precipitation across much of the area – some exceptions
- Near normal mean monthly temperatures – periods above and below

Snowpack conditions:
- Significant snow remains in several higher elevation areas

May 2017 water supply forecasts overview
- Significant April volumes in most areas
- April-July forecast trends over the last month

May forecast error – an improvement over April
- Primary sources of error from this point onward

Upcoming weather – Potential impacts to water supply forecasts

Peak Flow Summary

Contacts & Questions

*** Please mute your phone until ready to ask questions ***

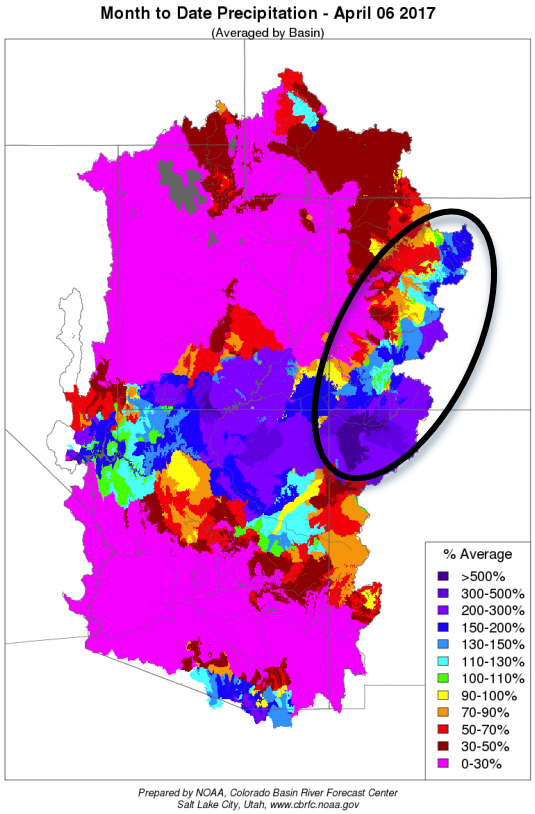
April Weather

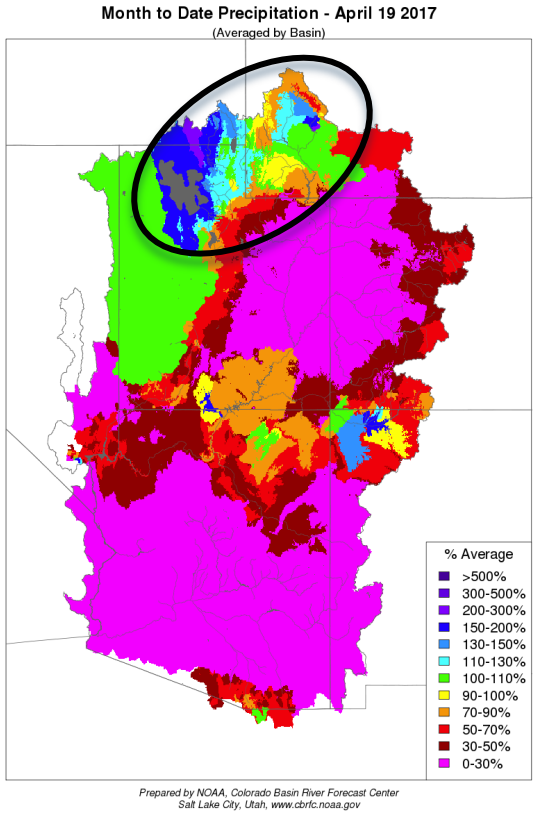
Precipitation distribution over the month of April

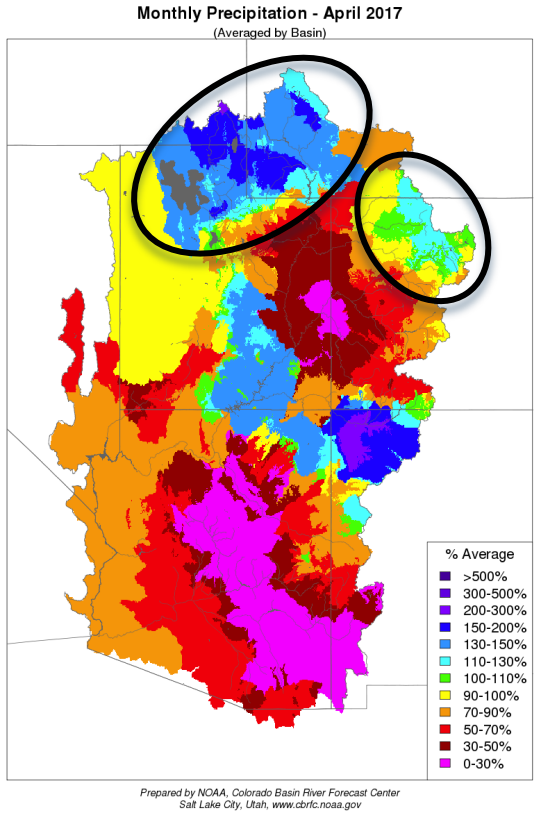
Storms tracked through the middle of the CBRFC area early in the month mostly benefitting the San Juan Basin, but also hitting parts of the Gunnison, Dolores, and Colorado headwaters.

A couple of systems brushed by the very northern part of the area during the second two weeks of the month.

Widespread precipitation the final week of April with significant amounts in the headwaters of the Green River, Yampa River and Colorado mainstem.

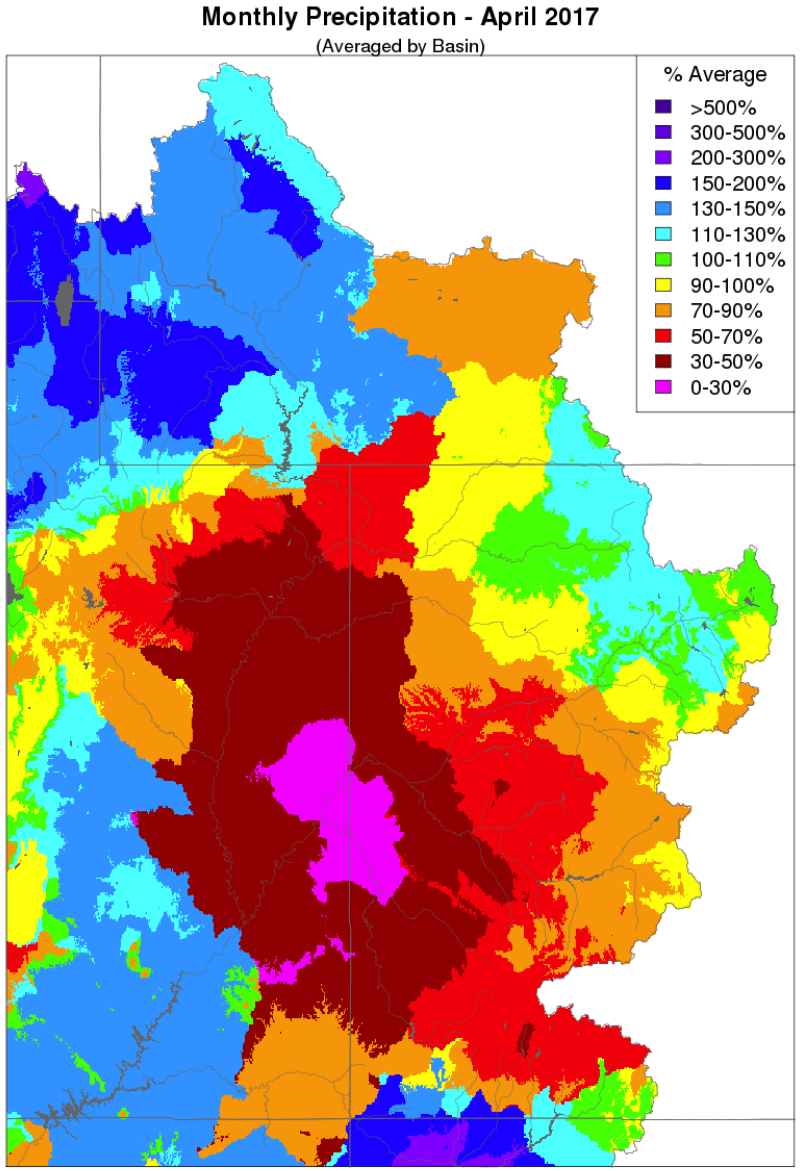






April Weather

Monthly Precipitation distribution by major river basins

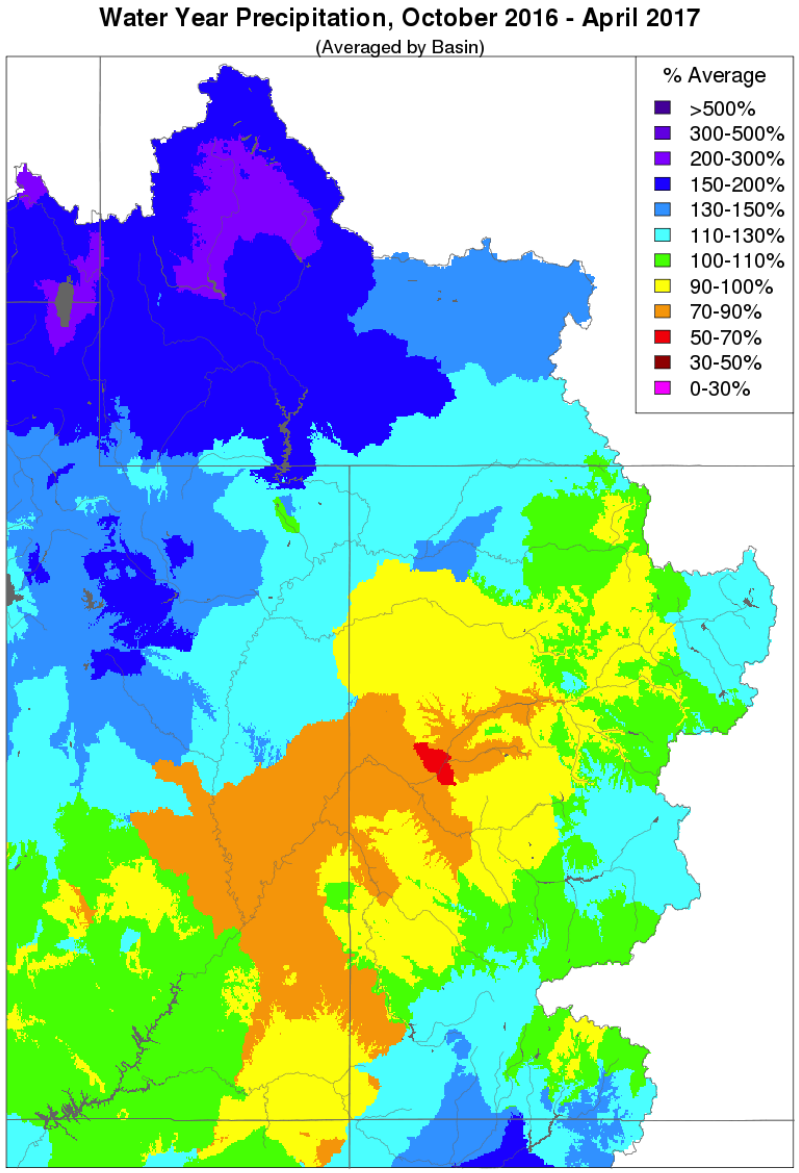


Upper Colorado River Basin
Apr 2017 Precipitation (% average)

Upper Green:	120%
Duchesne:	75%
Yampa/White:	110%
Colorado Mainstem:	90%
Gunnison:	70%
Dolores:	55%
San Juan:	70%

April Weather

Seasonal Precipitation distribution by major river basins

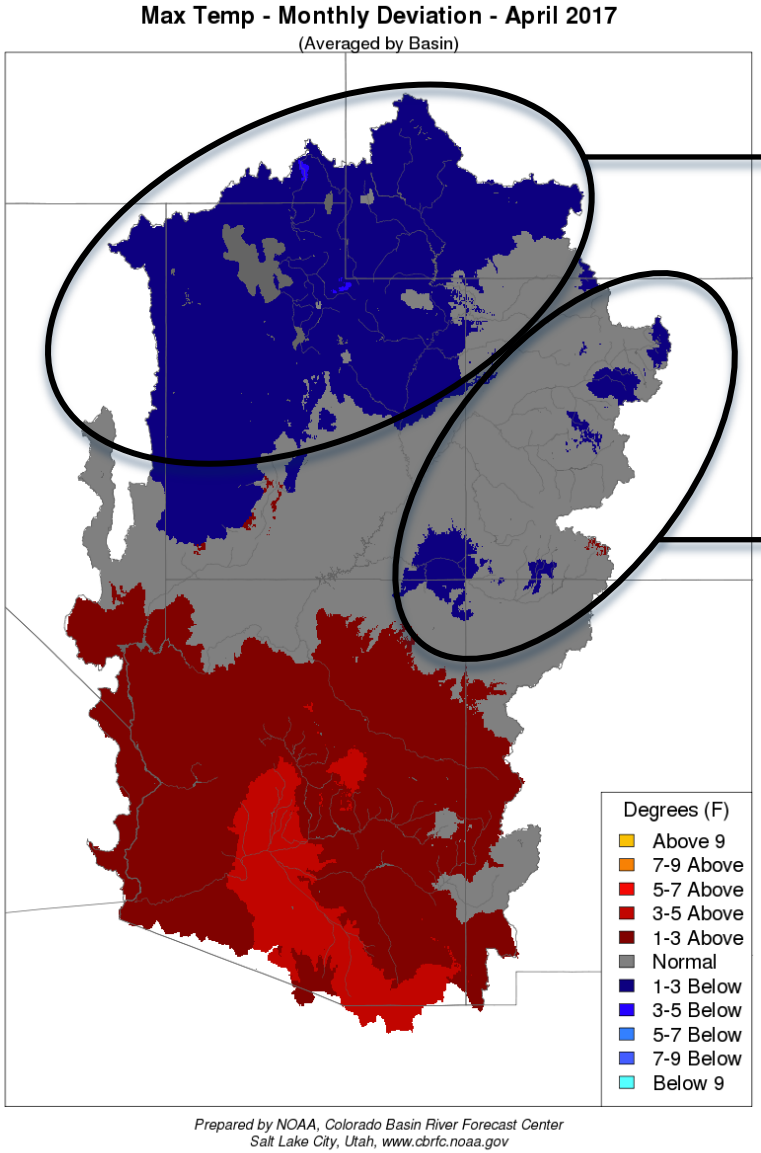


Upper Colorado River Basin
Oct-Apr 2017 Precipitation (% average)

Upper Green:	165%
Duchesne:	140%
Yampa/White:	105%
Colorado Mainstem:	105%
Gunnison:	110%
Dolores:	110%
San Juan:	110%

April Weather

Monthly Temperatures



Below normal mean monthly temperatures in the northwest part of the basin:

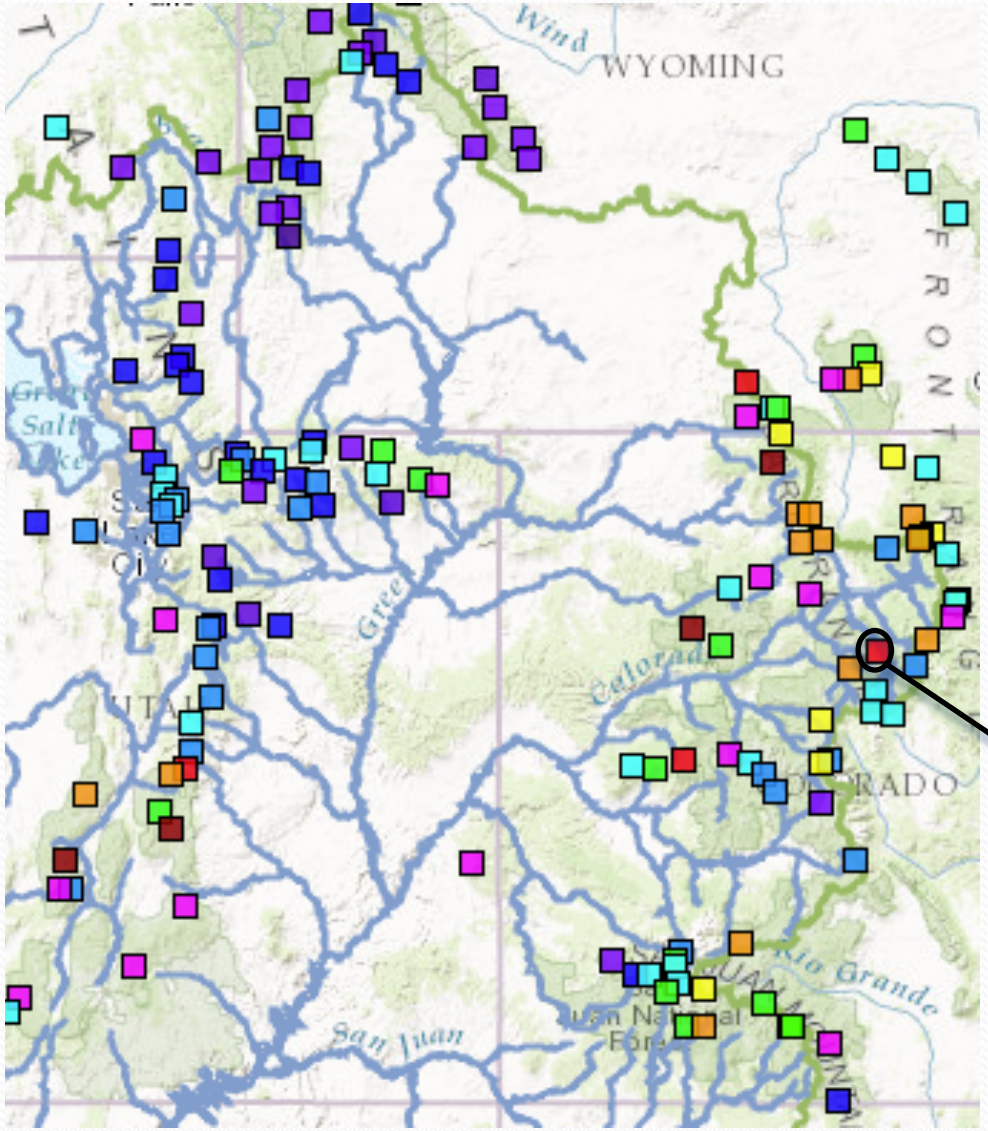
- more frequent storms and unsettled weather

Near normal mean monthly temperatures in western Colorado:

- periods of above and below average temperatures
- cool beginning and end of month and warmer in between

April Weather – Impacts on Snowpack

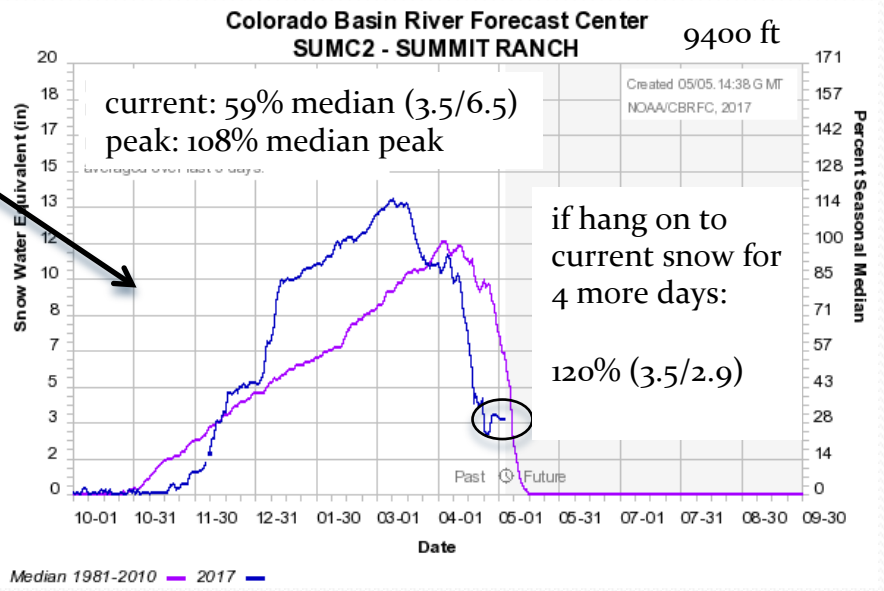
May 4th SNOTEL Snow Conditions
Percent Median



Percent Median snow conditions are not as informative during the melt period as they are during accumulation.

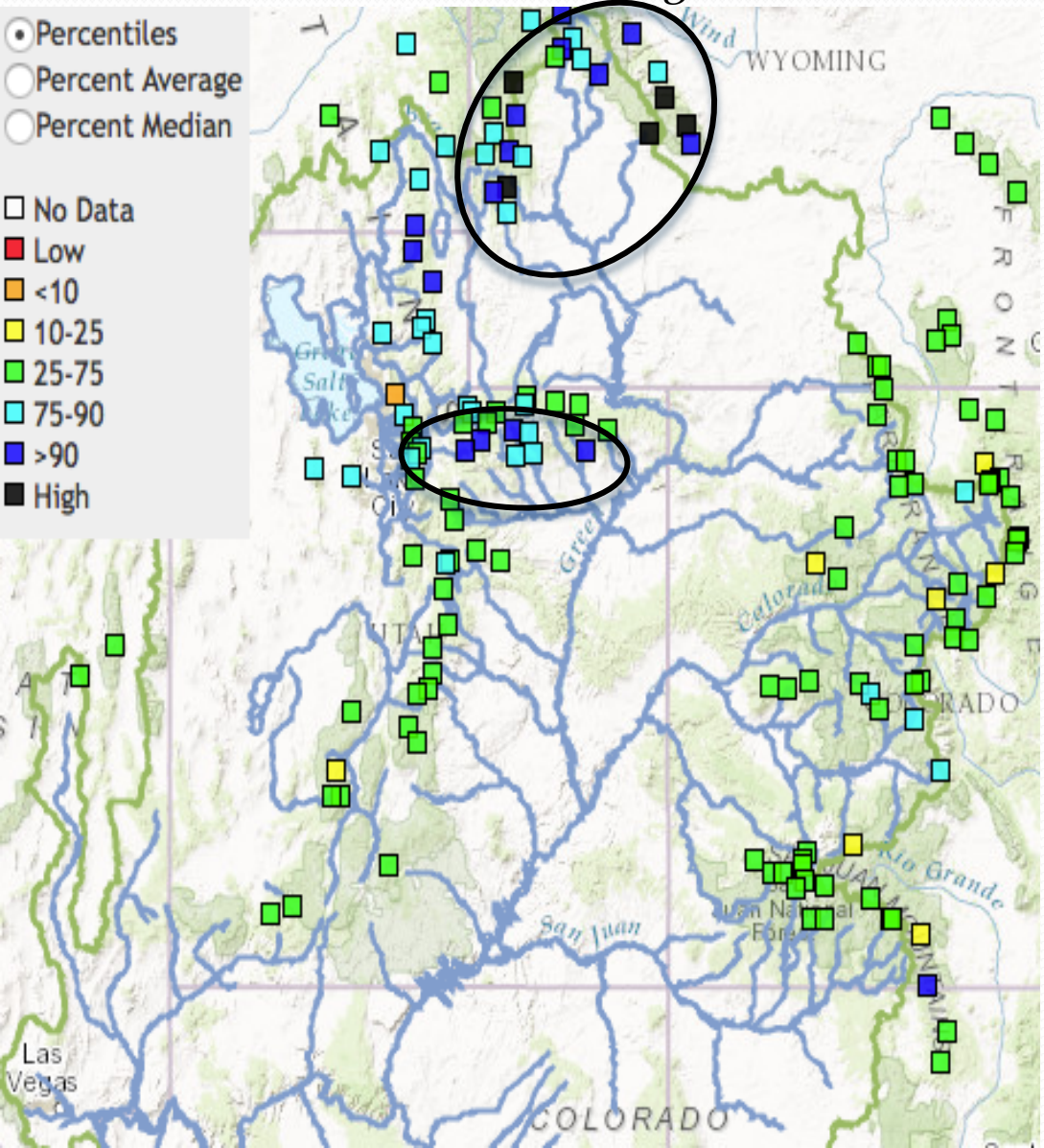
Can vary significantly day to day and site to site.

Very sensitive to melt rate and magnitude of median value.



Current Snow Conditions

May 4th SNOTEL Snow Conditions
Historical Ranking



Black boxes indicate sites that are the highest on record for this date.

Green River headwaters

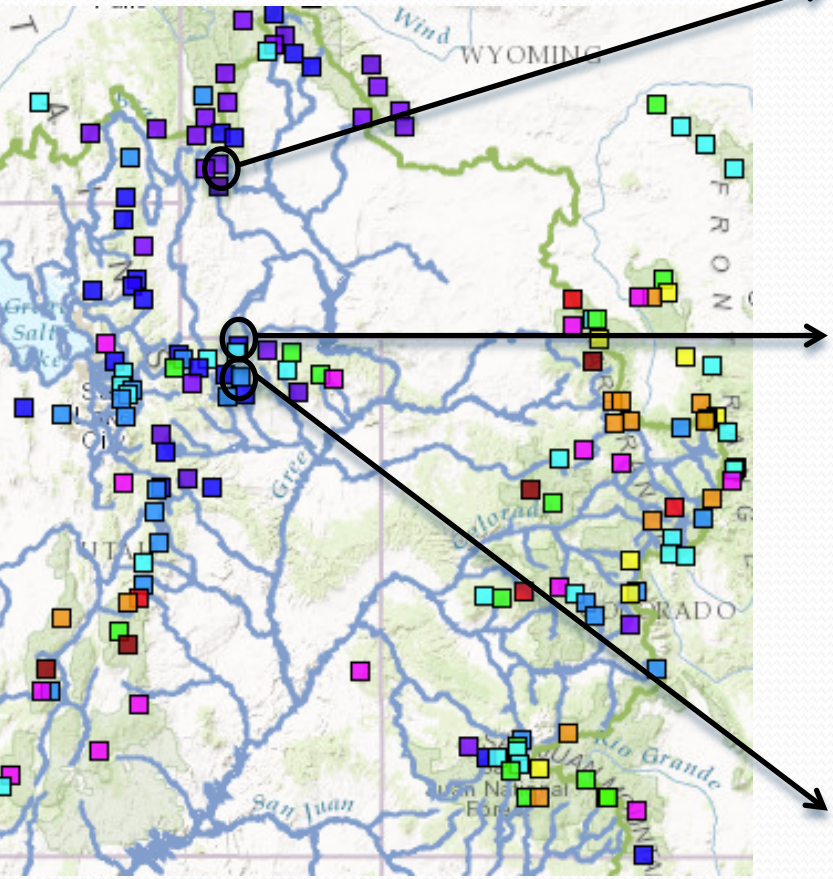
Most sites indicated by dark blue are the 2nd or 3rd highest on record for this date.

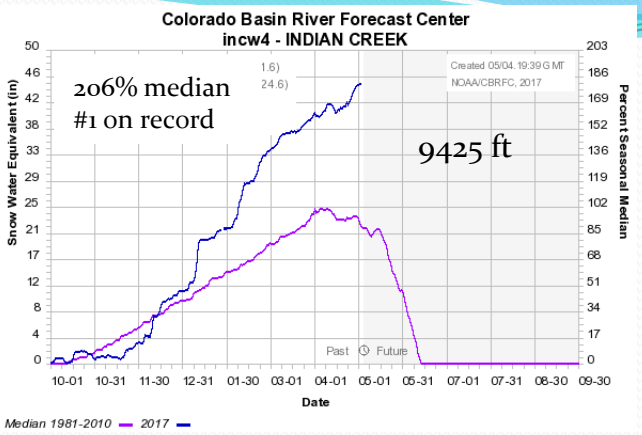
Green River headwaters

Duchesne River Basin

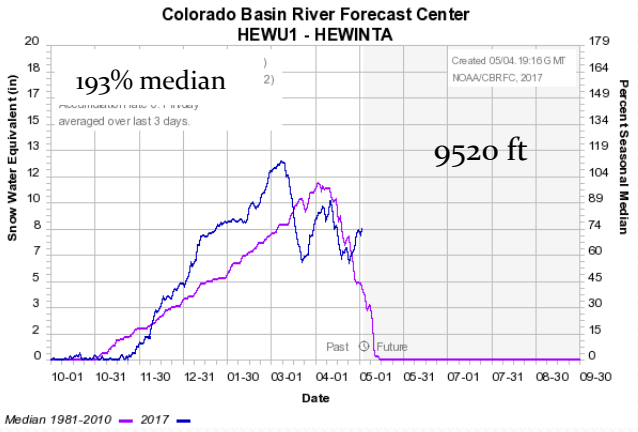
Periods of record are generally 34-39 years.

April Weather – Impacts on Snowpack



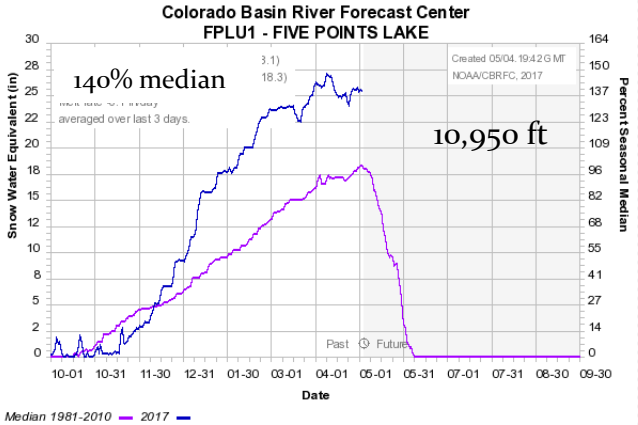


Another wet month plus below normal temperatures → no significant melt yet



Significant melt during warm March with some recovery at end of month.

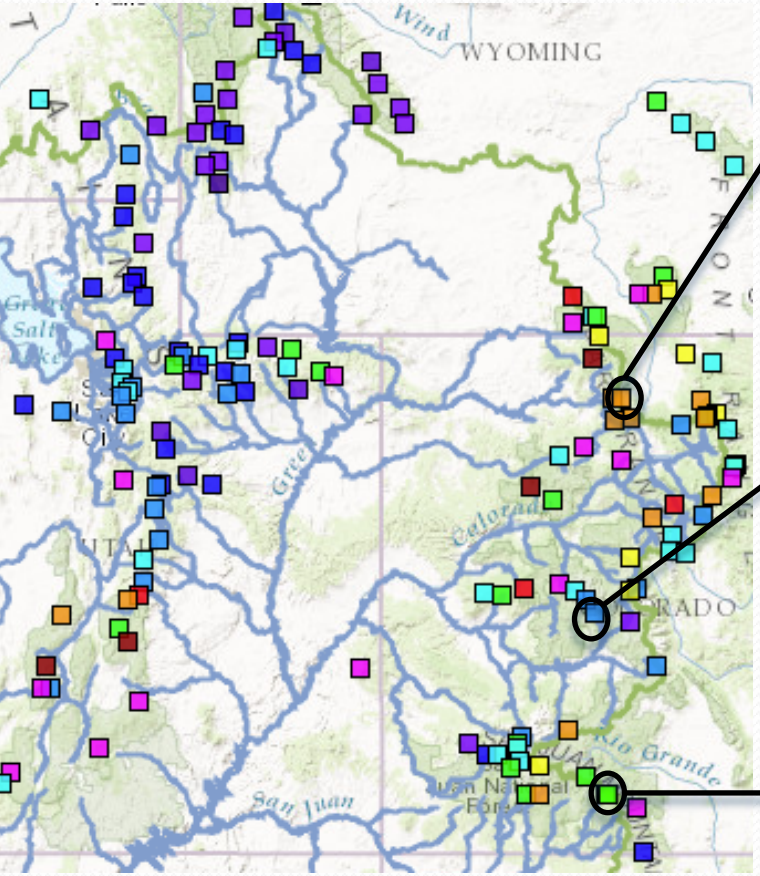
Some 'normal' melt during middle of April with another bump in snow at end of month.

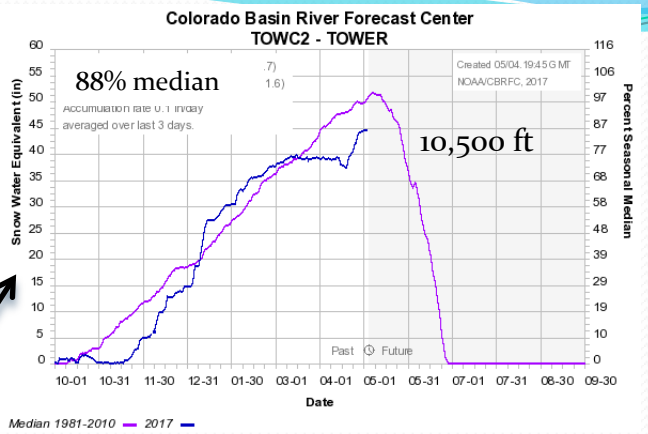


Higher elevation site with little melt to date (normal).

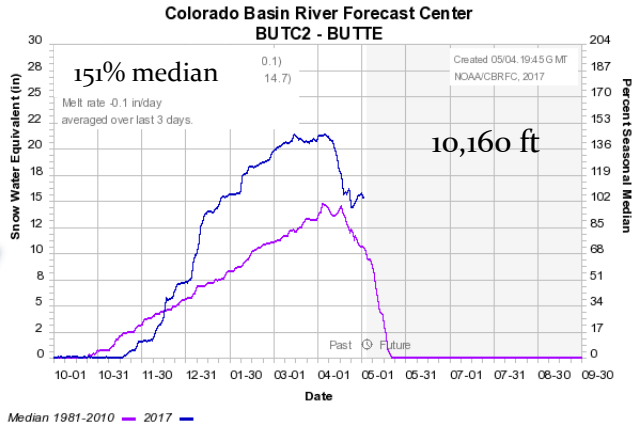
Did not see much additional snow during April.

April Weather – Impacts on Snowpack



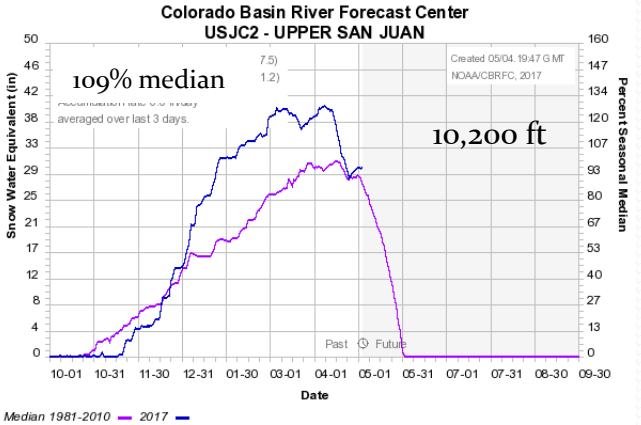


After essentially zero additional snow since mid-March, benefitted from end of April storms.



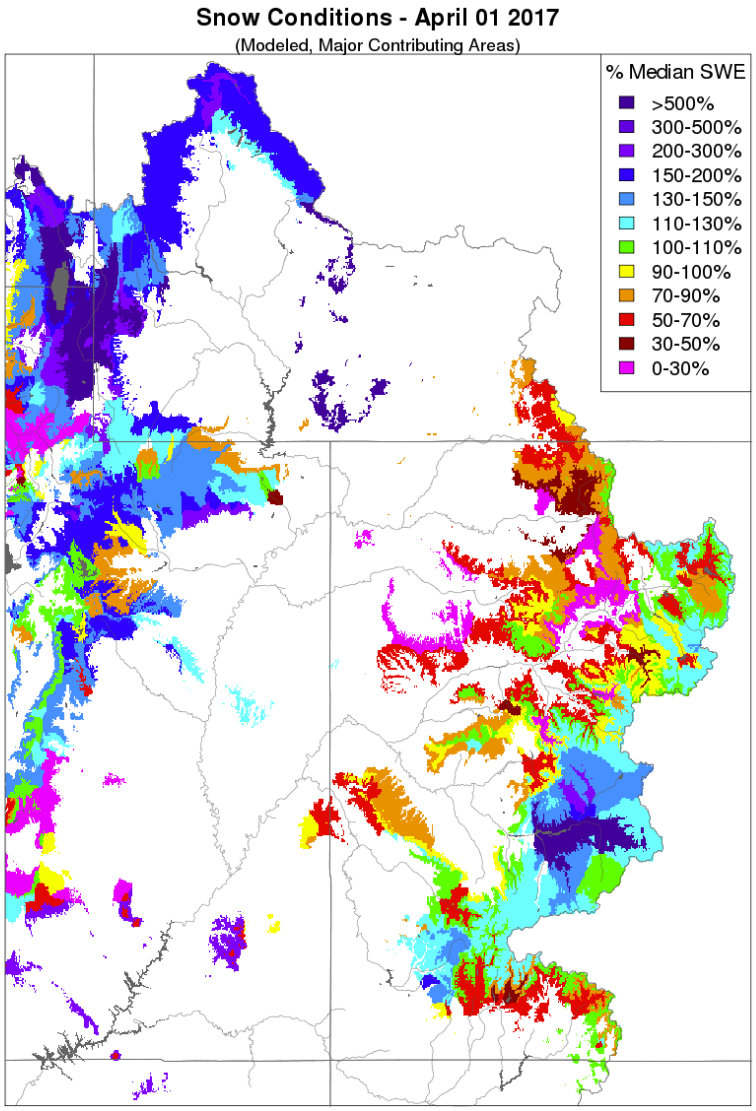
Little snow/precipitation during March and significant melt during April.

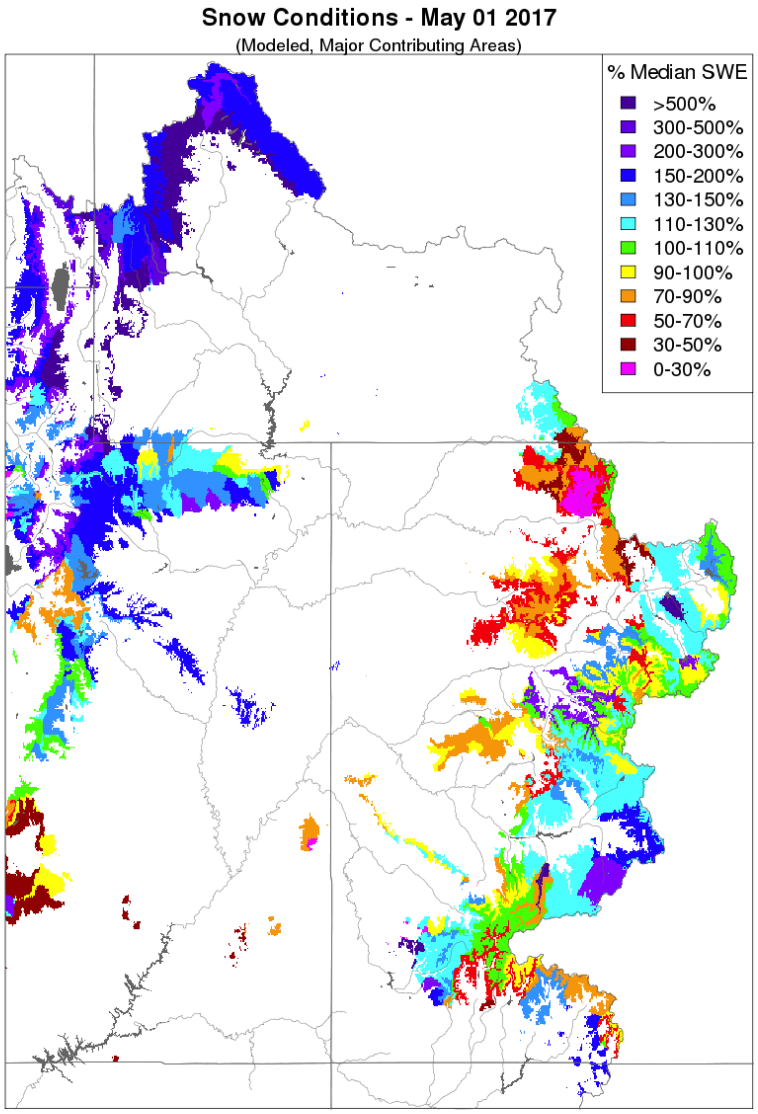
Benefitted from end of April storms by slowing down the melt and gaining back a small amount of snow.



Precipitation at beginning and end of month was not enough to offset significant melt in between.

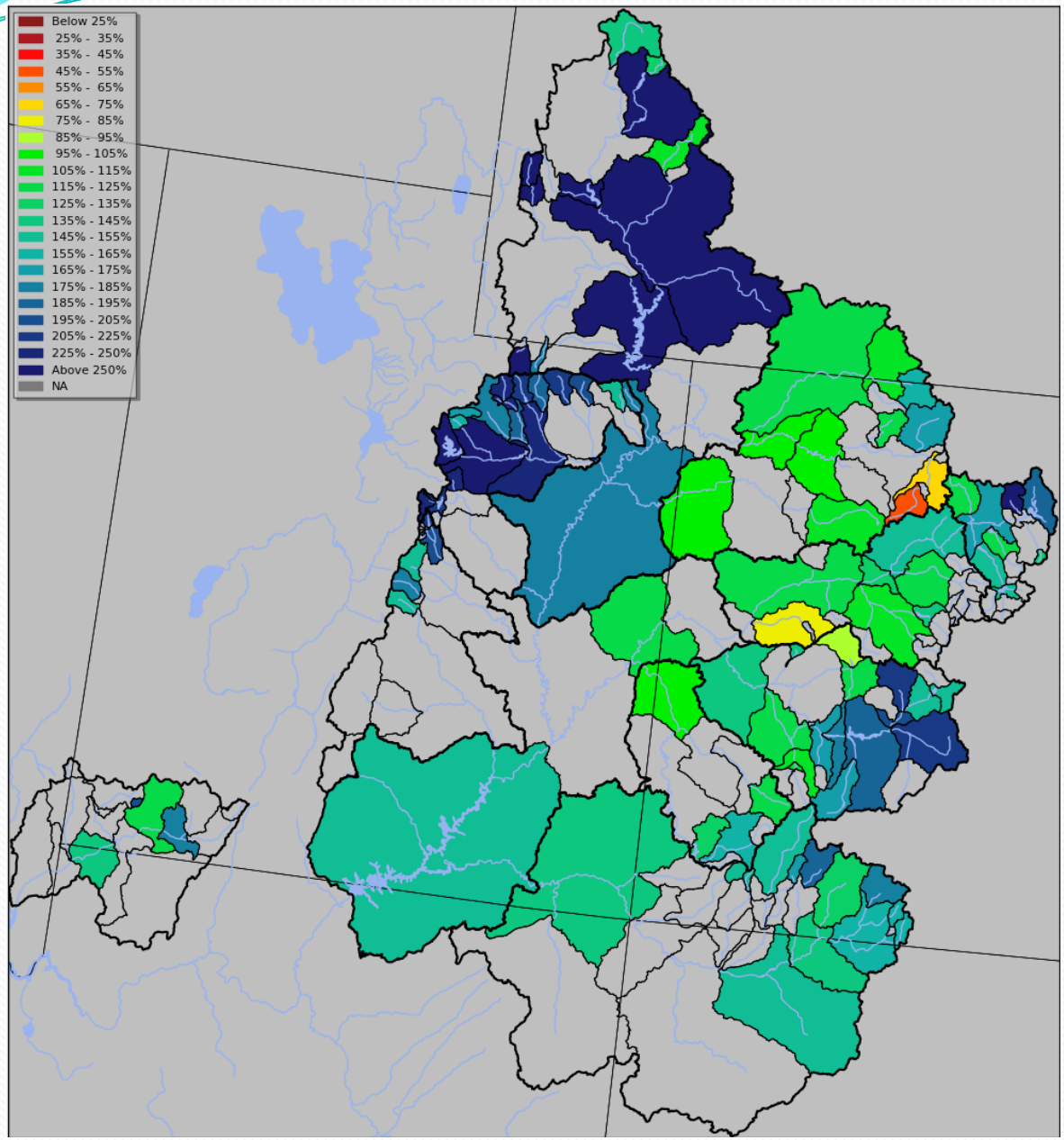
April Weather – Impacts on Snowpack





April Weather – Streamflow Impacts

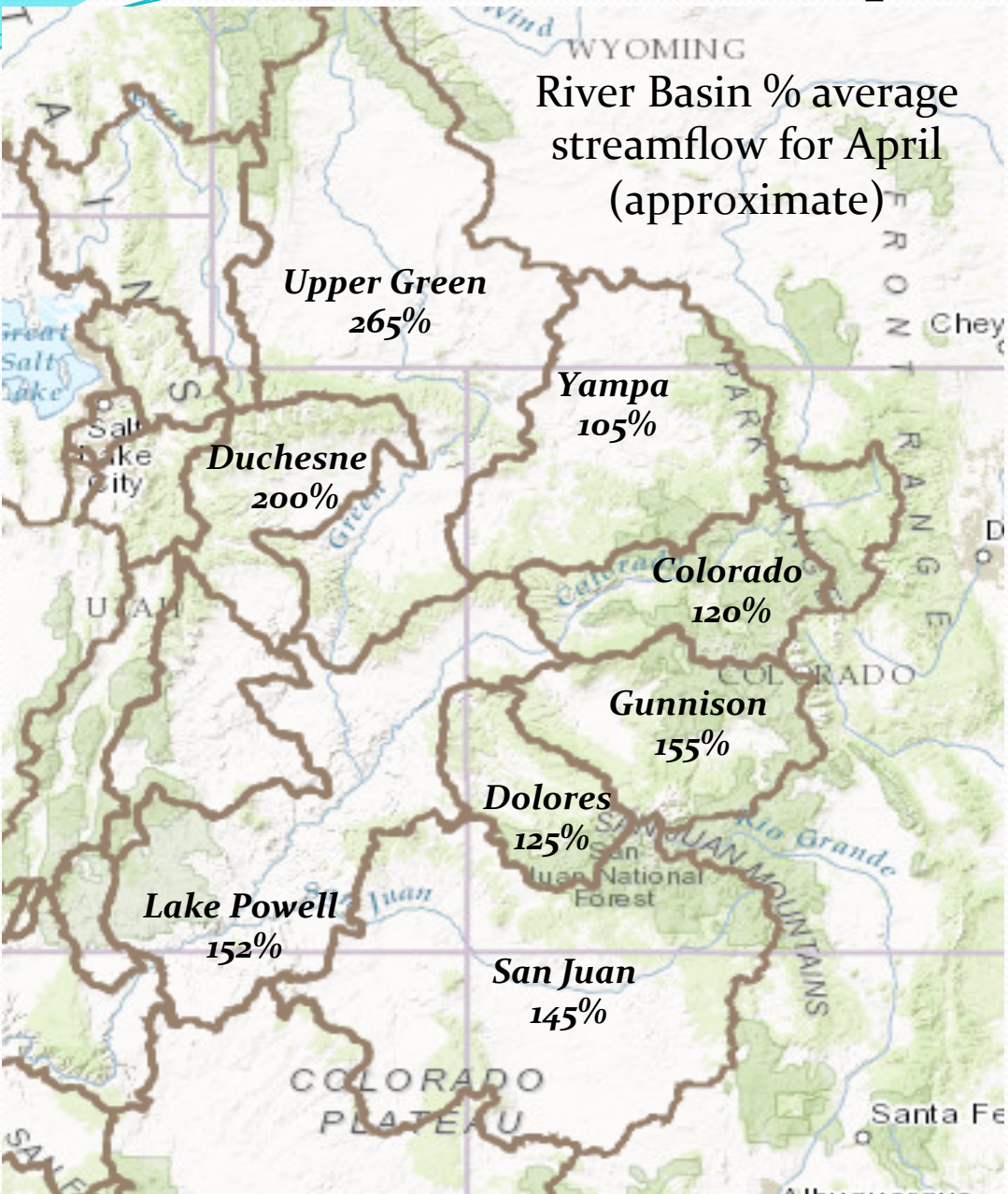
April streamflow volumes (unregulated) as a % of average



April started with above average streamflows as many sites had record March unregulated volumes due to the warm weather and large low to mid-elevation snowpack.

With so much water already in the system, many sites again observed above average and some near record unregulated volumes in April.

April Weather – Streamflow Impacts
Record April Runoff



Notable April Volumes

Site (Rank/POR) – Apr Vol KAF / % Avg – old record (year)			
Fontenelle (1/52)*	225 / 264%	180	(1986)
Flaming Gorge (1/55)*	350 / 262%	299	(1969)
Granby (2/90)	26 / 191%	30	(1962)
Willow Creek (2/98)	15 / 357%	16	(1962)
Blue Mesa (1/49)*	145/ 188%	137	(1985)
McPhee(7/37)	95 / 134%	162	(1985)
Vallecito (1/76)*	45 / 192%	42	(2005)
Navajo (8/47)	234 / 138%	392	(1985)
Lemon Res(5/54)	10 / 173%	13	(2005)
Lake Powell(5/54)	1607 / 152%	2708	(1985)

At least 9 sites in Upper Green River and Duchesne basins with records

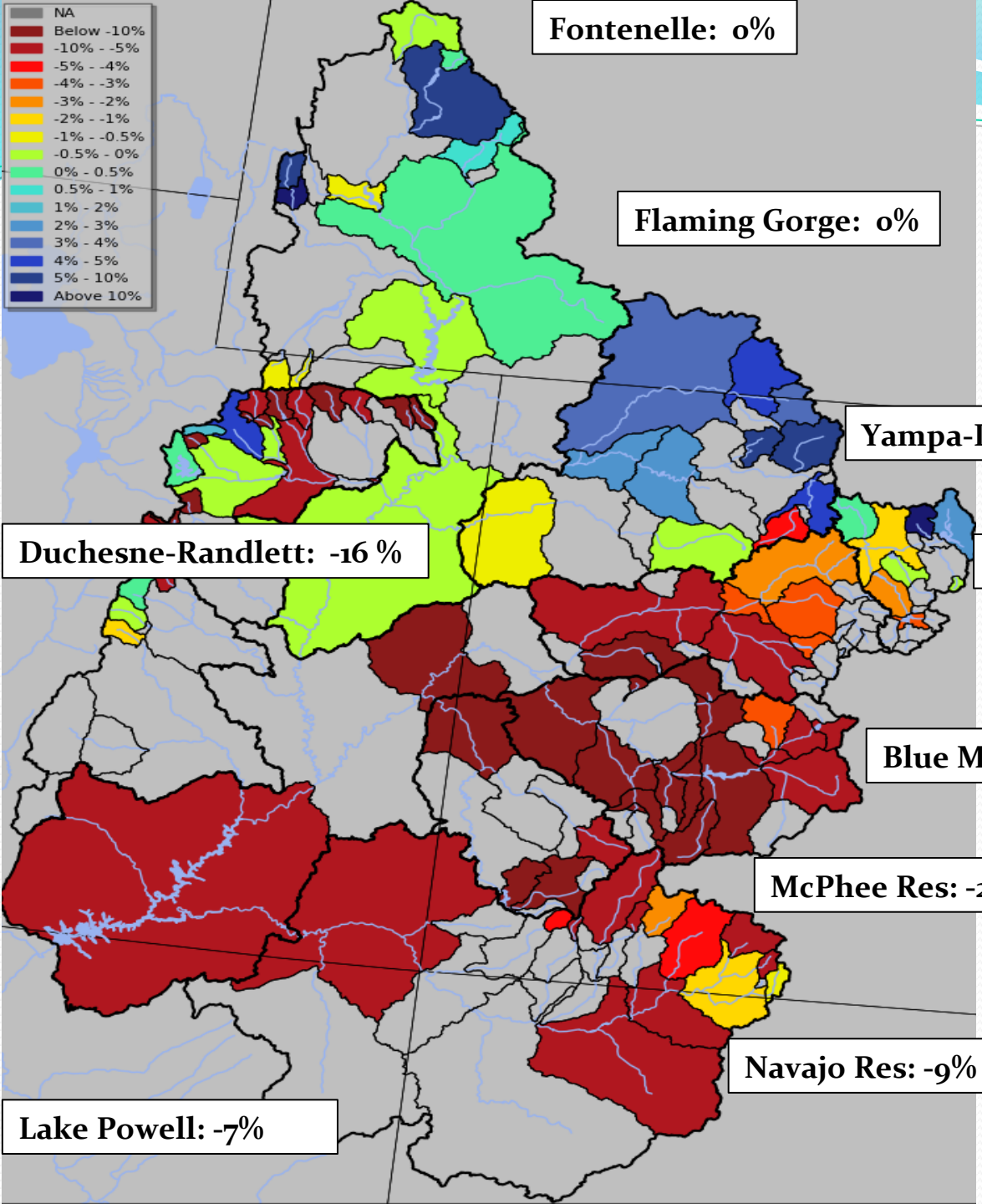
Many more sites in top 5 of record across the area

Data is provisional – not all basin stream flow sites included

Upper Colorado April-July Streamflow Volume Forecasts

(% of 1981-2010 average)

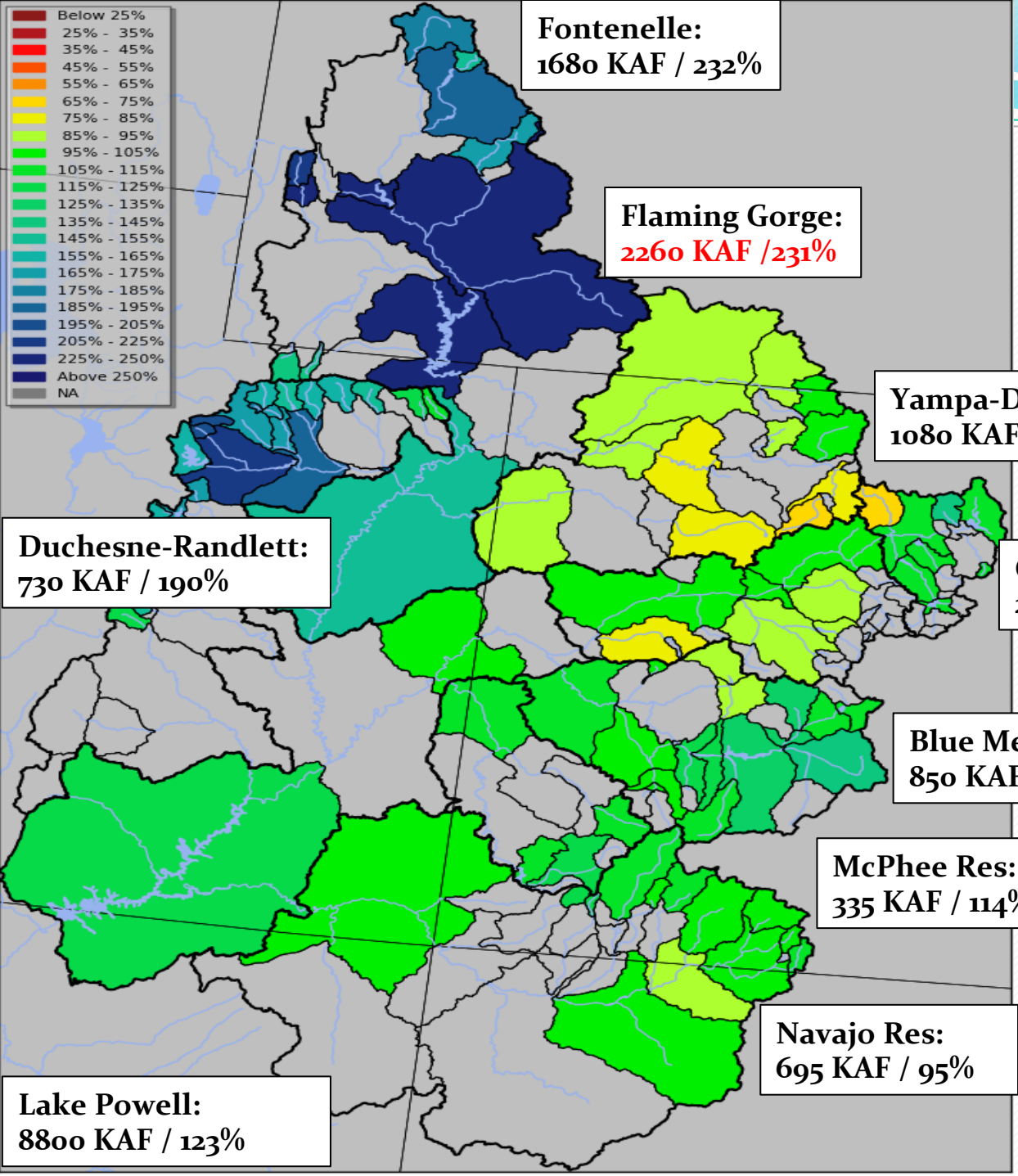
% of Average Change from April 1st Forecasts



Upper Colorado April-July Streamflow Volume Forecasts

(% of 1981-2010 average)

Forecasts as of May 1 2017



Fontenelle:
1680 KAF / 232%

Flaming Gorge:
2260 KAF /231%

Yampa-Deerlodge:
1080 KAF / 87%

Duchesne-Randlett:
730 KAF / 190%

Colorado-Cameo:
2250 KAF / 95%

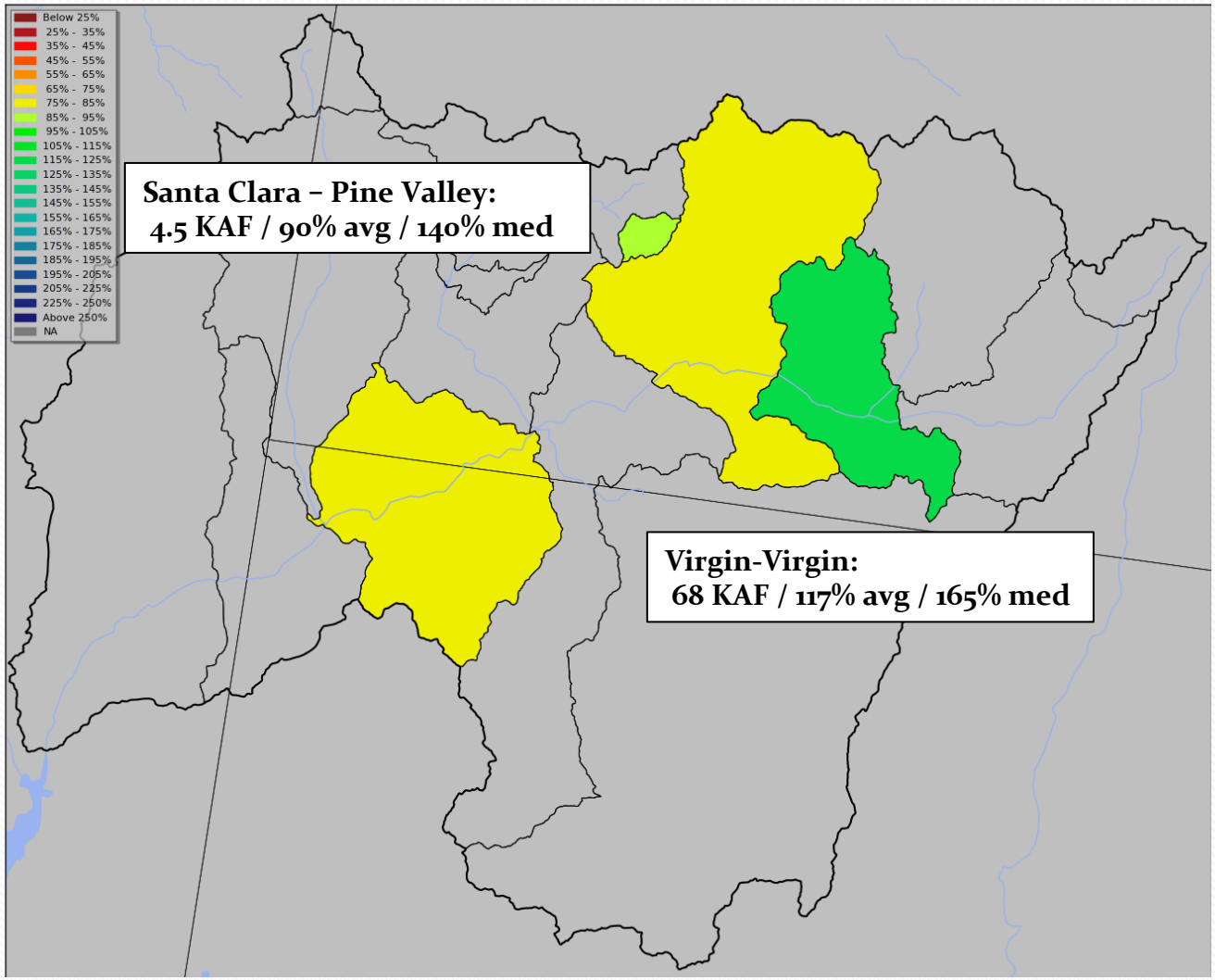
Blue Mesa:
850 KAF / 126%

McPhee Res:
335 KAF / 114%

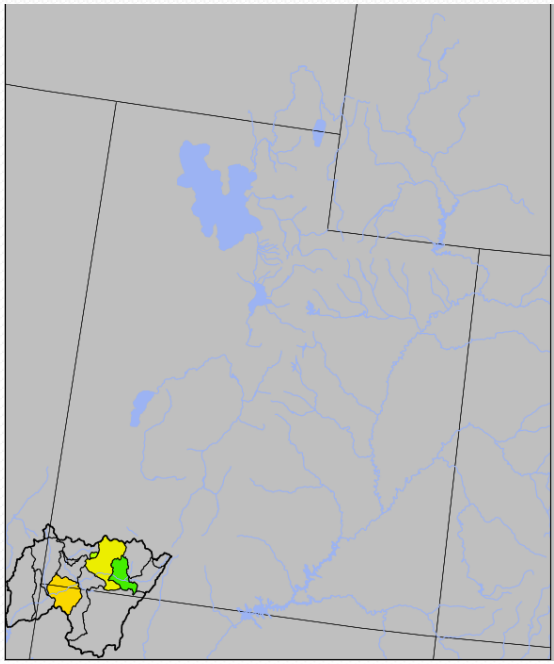
Navajo Res:
695 KAF / 95%

Lake Powell:
8800 KAF / 123%

Lower Colorado (Virgin River)
April-July Streamflow Volume Forecasts
(% of 1981-2010 average / median)



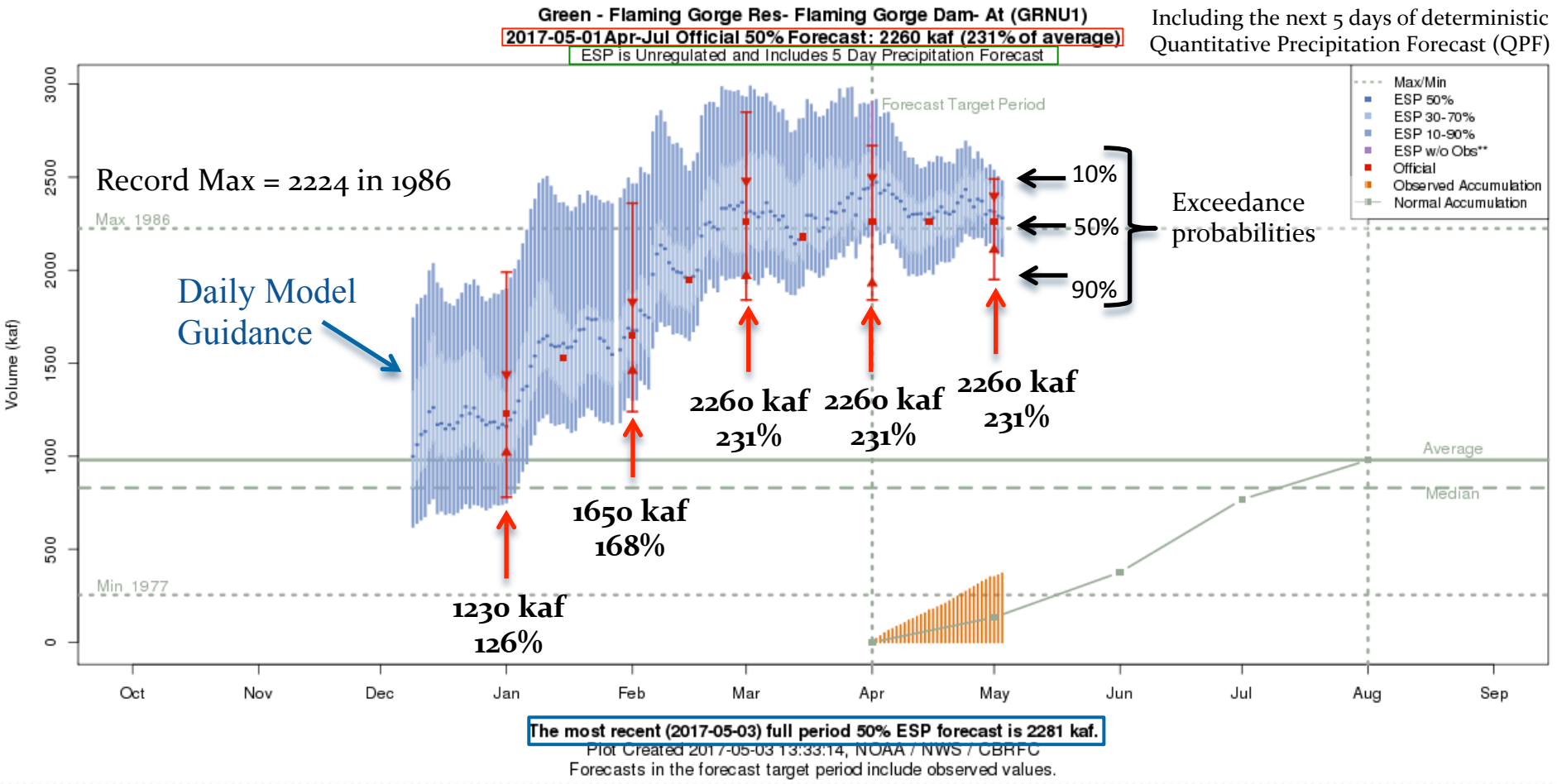
Forecasts as of May 1 2017



Little change to small increases since April 1 forecast

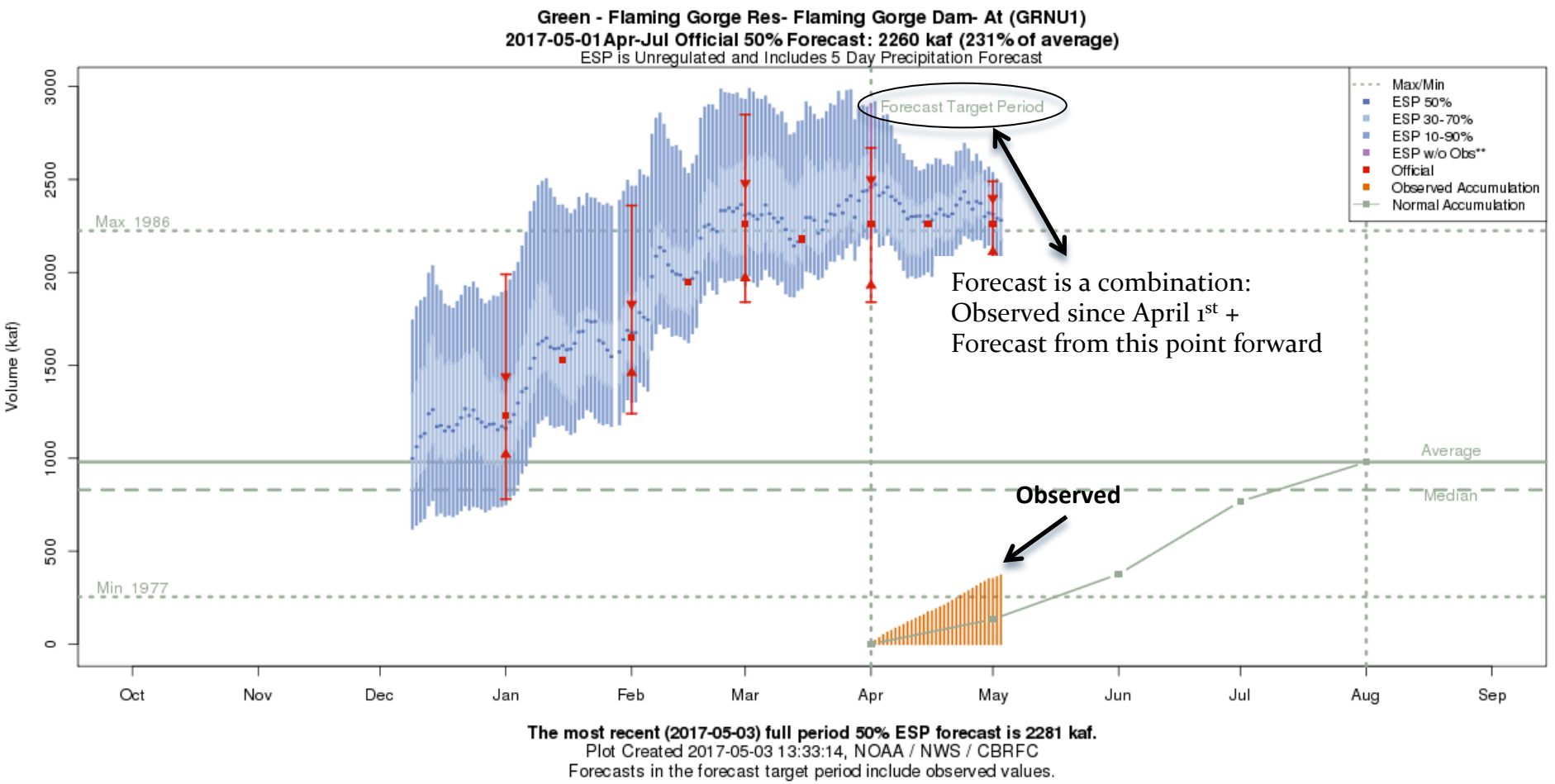
Forecast Evolution Plot: Flaming Gorge Inflow

Daily Ensemble Streamflow Prediction (ESP) Model Run & Official Forecasts

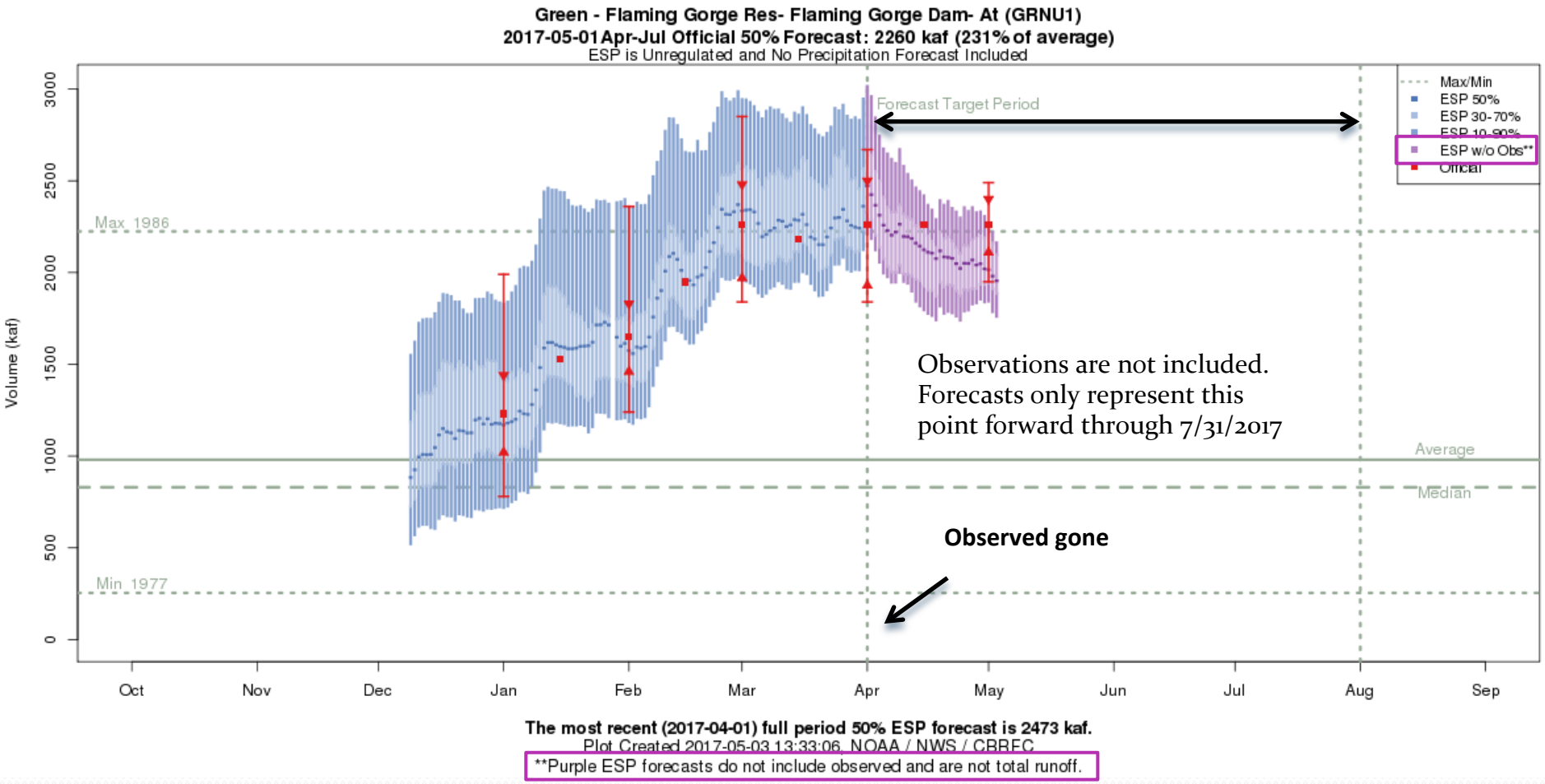


Plots are available at: https://www.cbrfc.noaa.gov
Select WATER SUPPLY from the top menu
Click on desired location for pop-up, click again for full screen

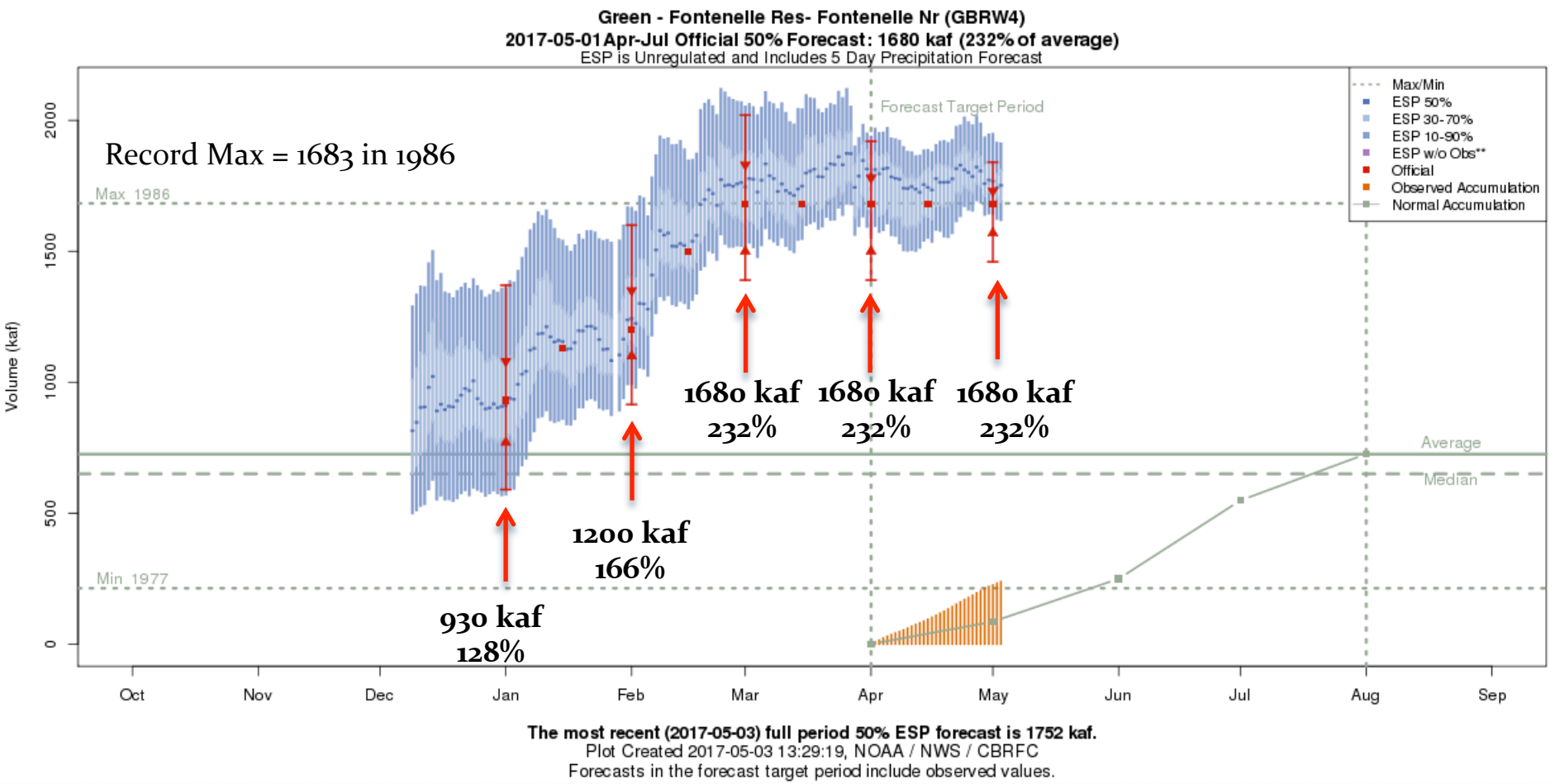
Forecast Evolution Plot: Flaming Gorge Inflow



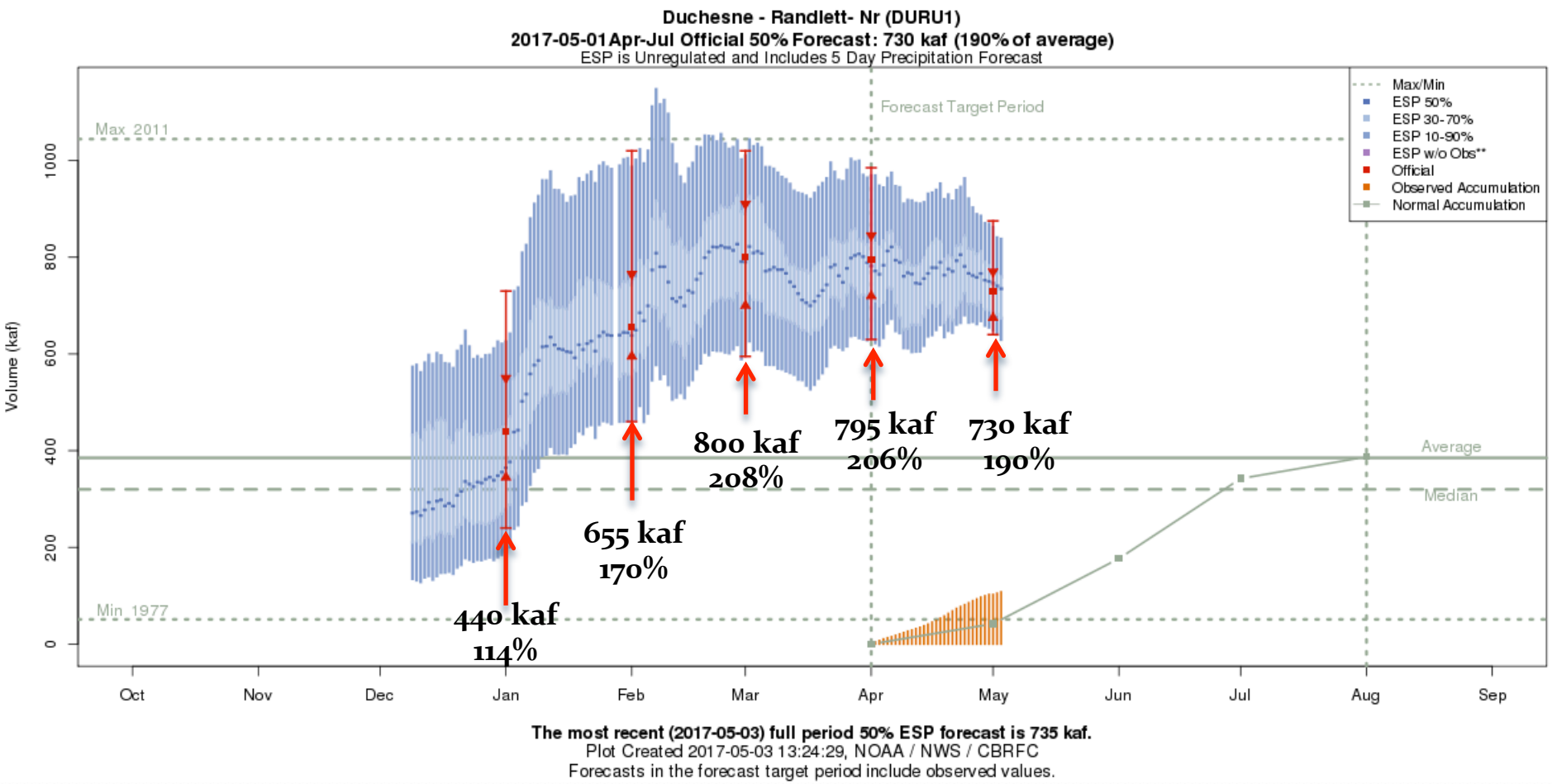
Forecast Evolution Plot: Flaming Gorge Inflow



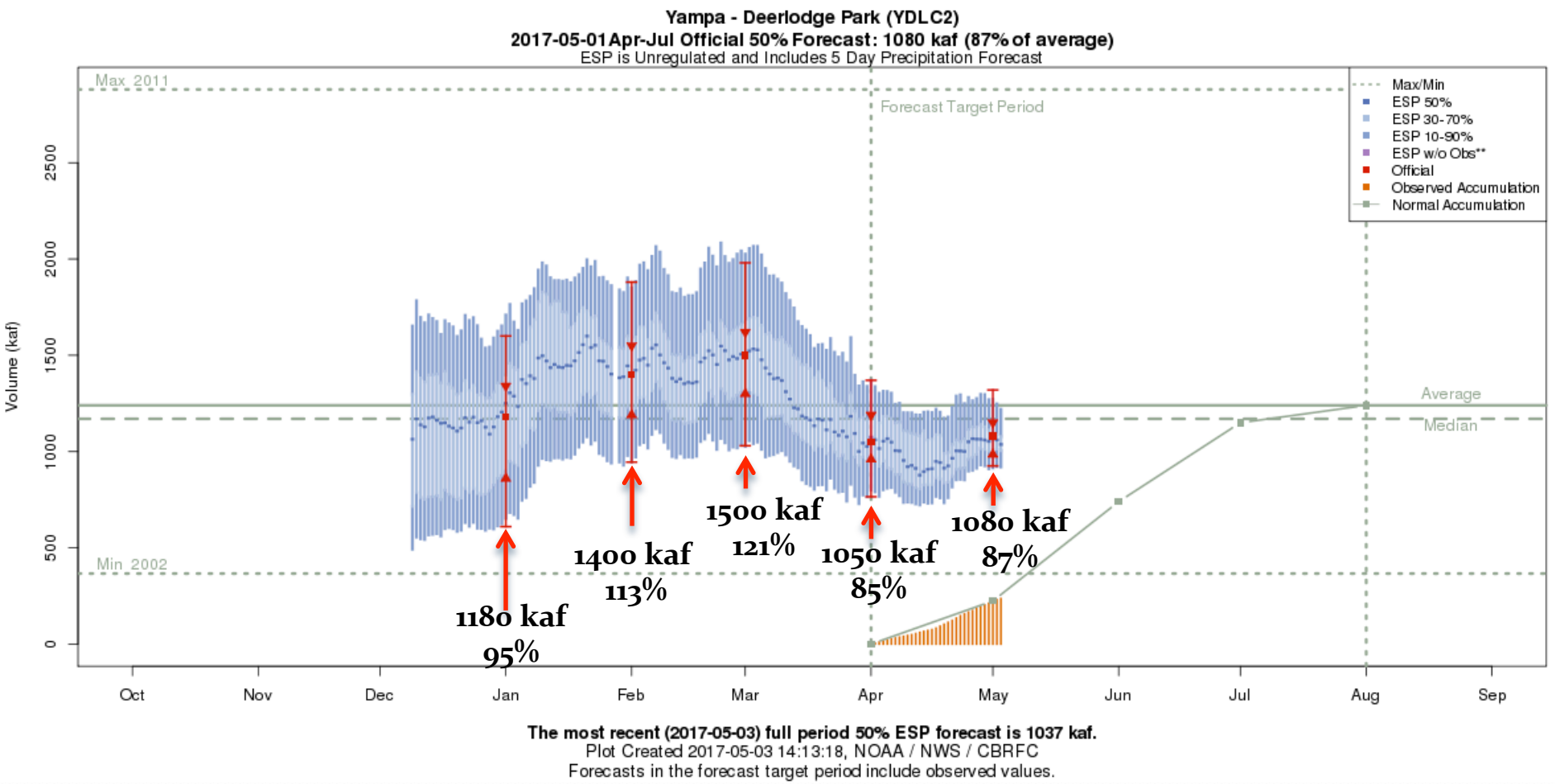
Forecast Evolution Plot: Fontenelle Inflow



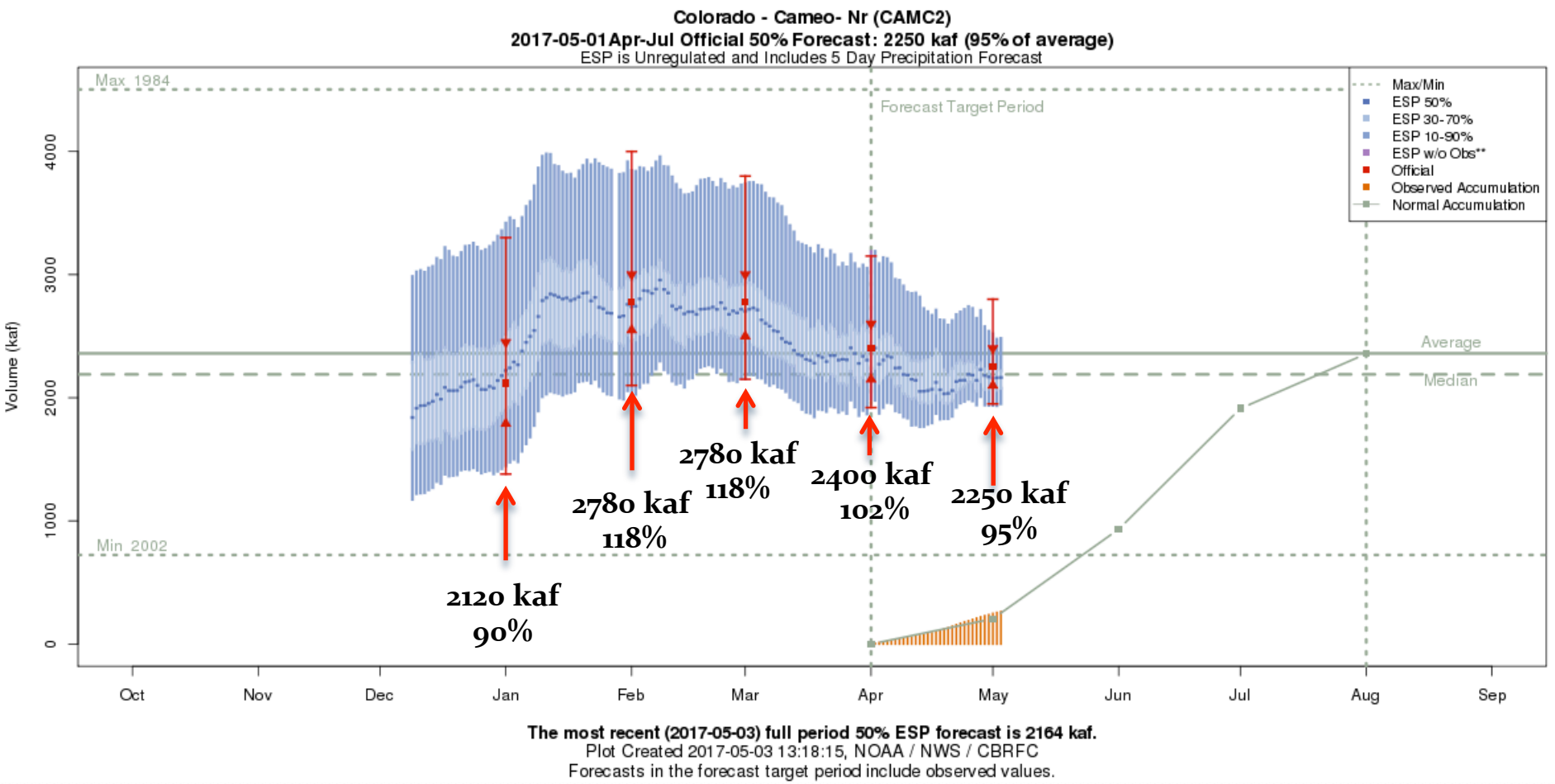
Forecast Evolution Plot: Duchesne-Randlett



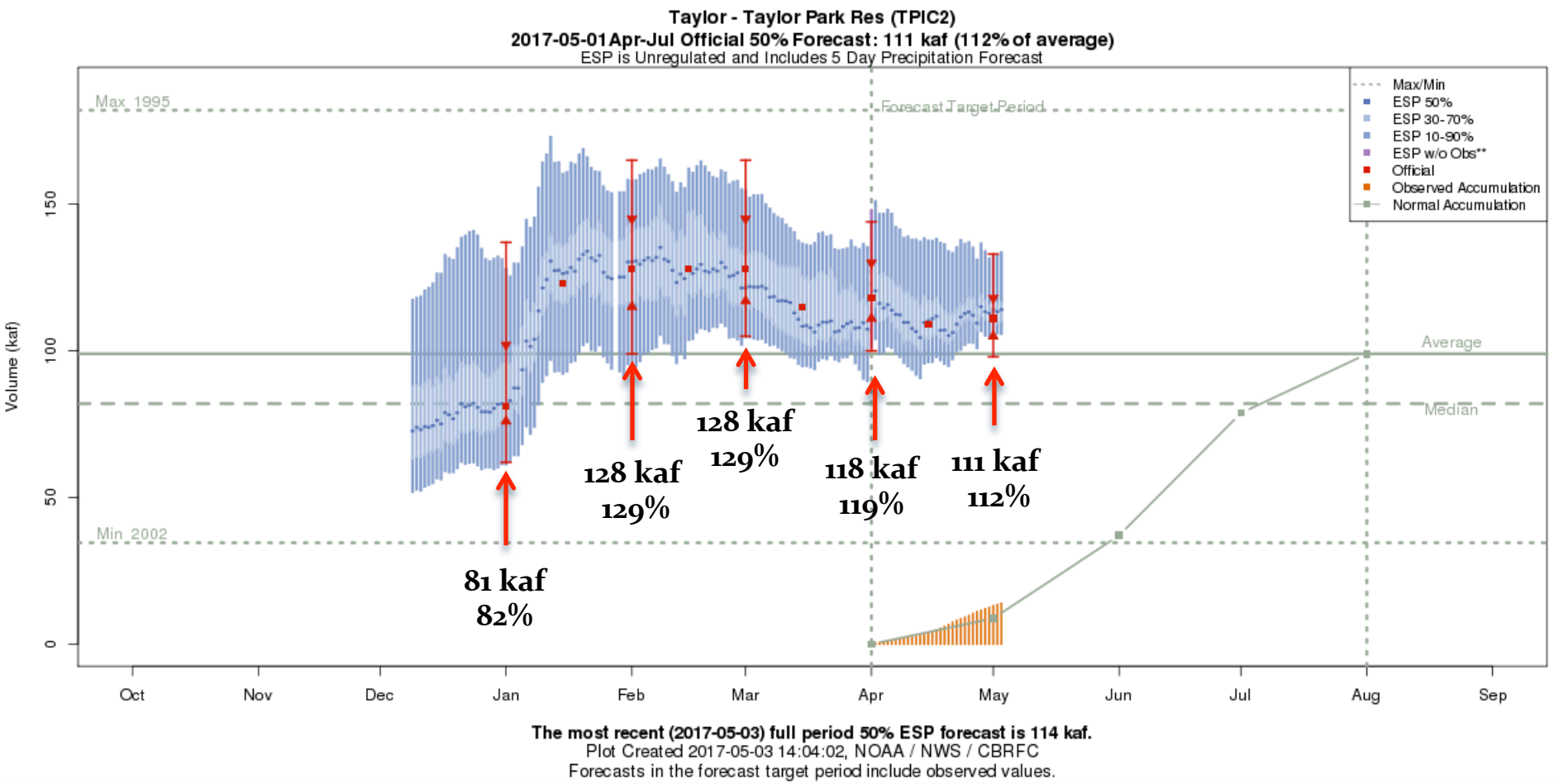
Forecast Evolution Plot: Yampa – Deerlodge Park



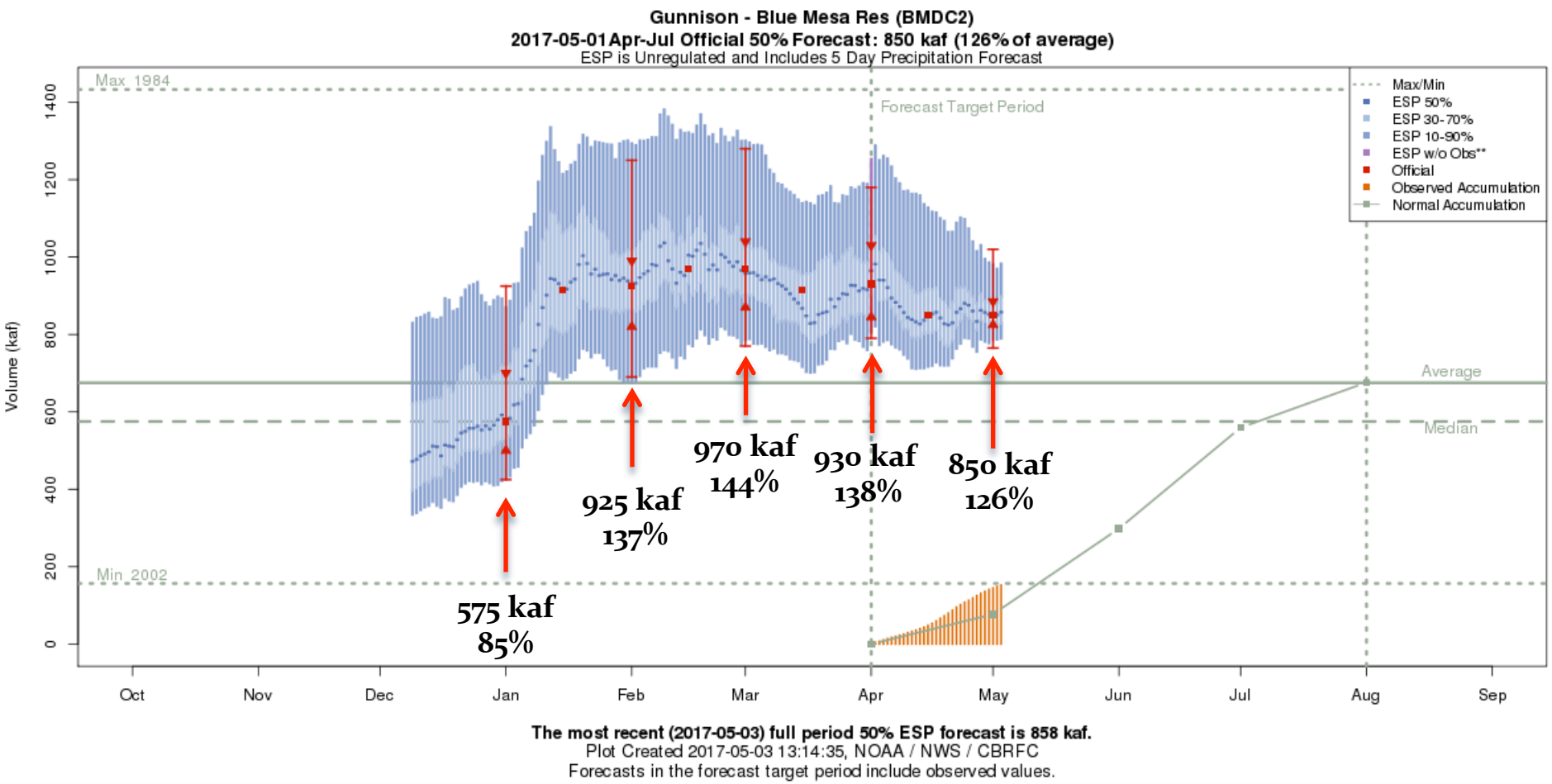
Forecast Evolution Plot: Colorado near Cameo



Forecast Evolution Plot: Taylor – Taylor Park Inflow

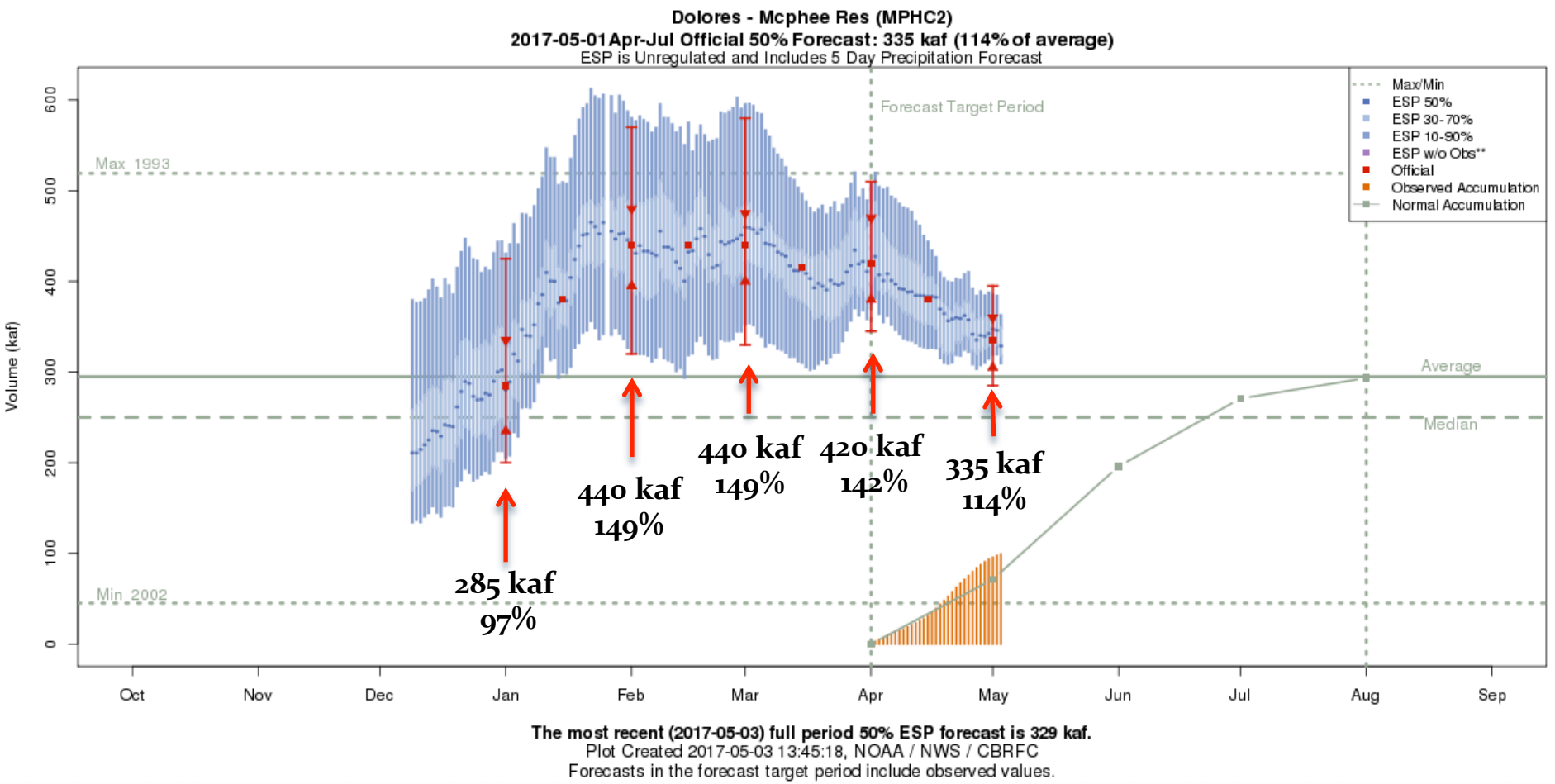


Forecast Evolution Plot: Gunnison – Blue Mesa Inflow

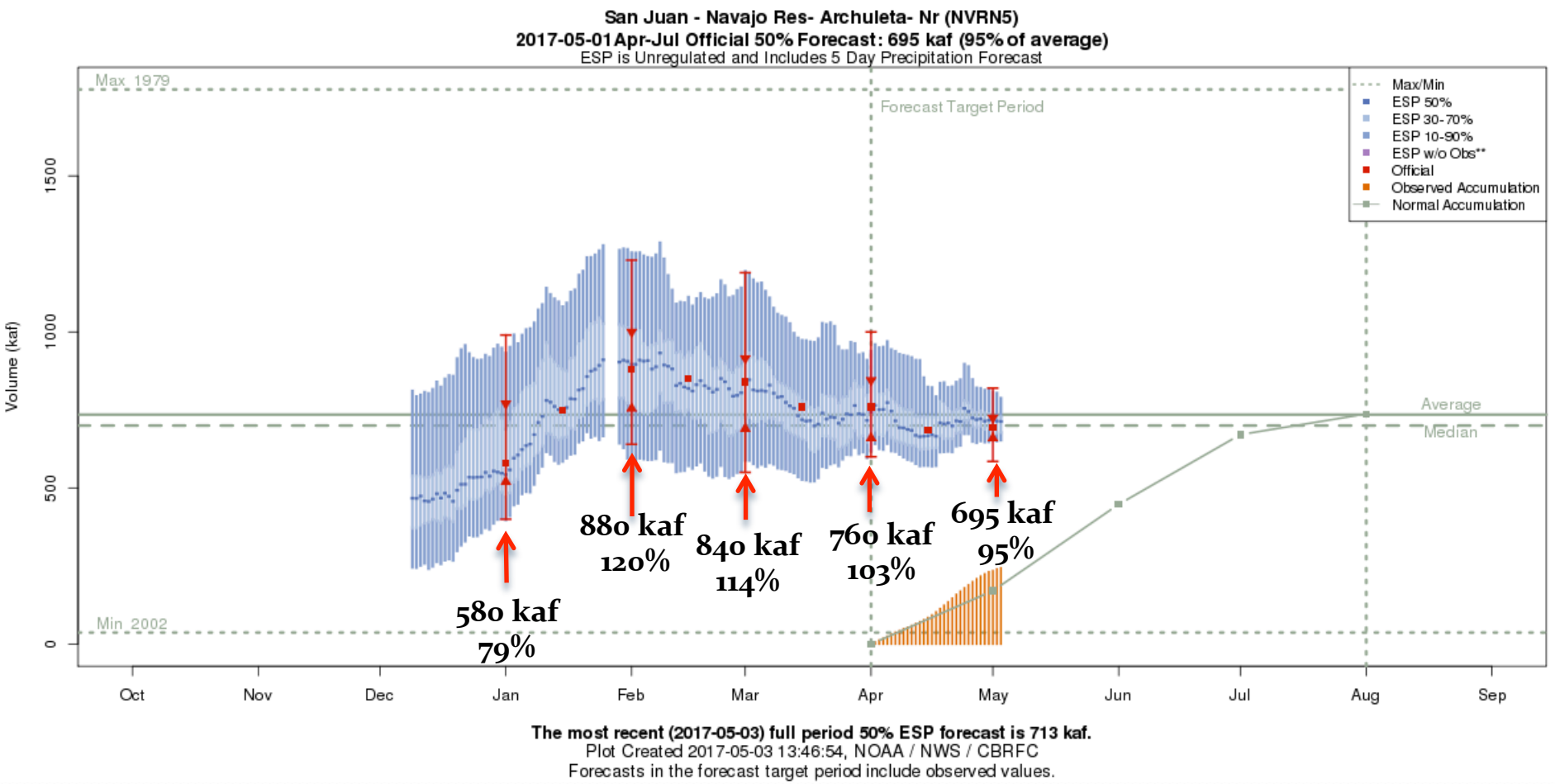


The most recent (2017-05-03) full period 50% ESP forecast is 858 kaf.
Plot Created 2017-05-03 13:14:35, NOAA / NWS / CBRFC
Forecasts in the forecast target period include observed values.

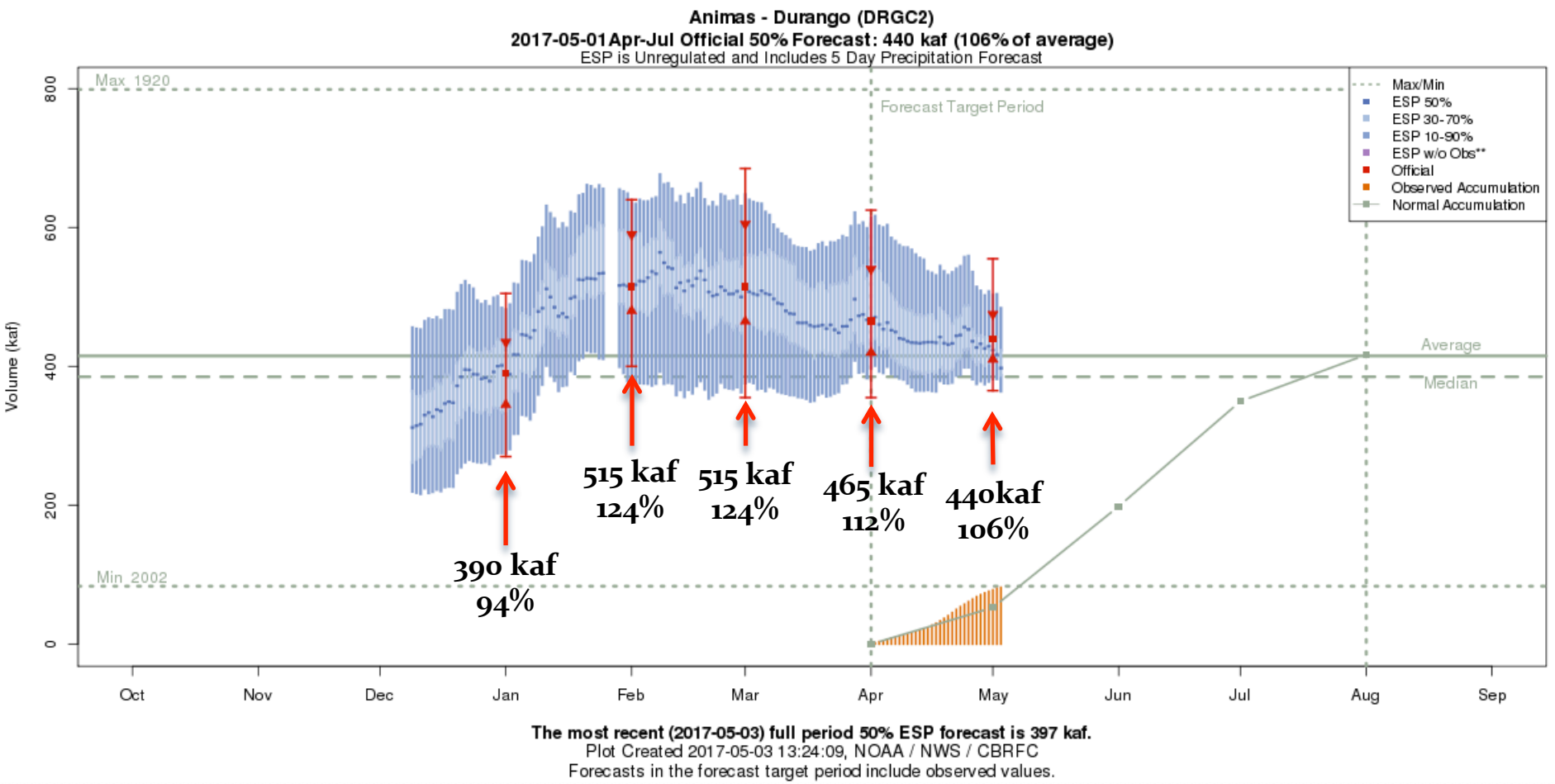
Forecast Evolution Plot: Dolores – McPhee Reservoir Inflow



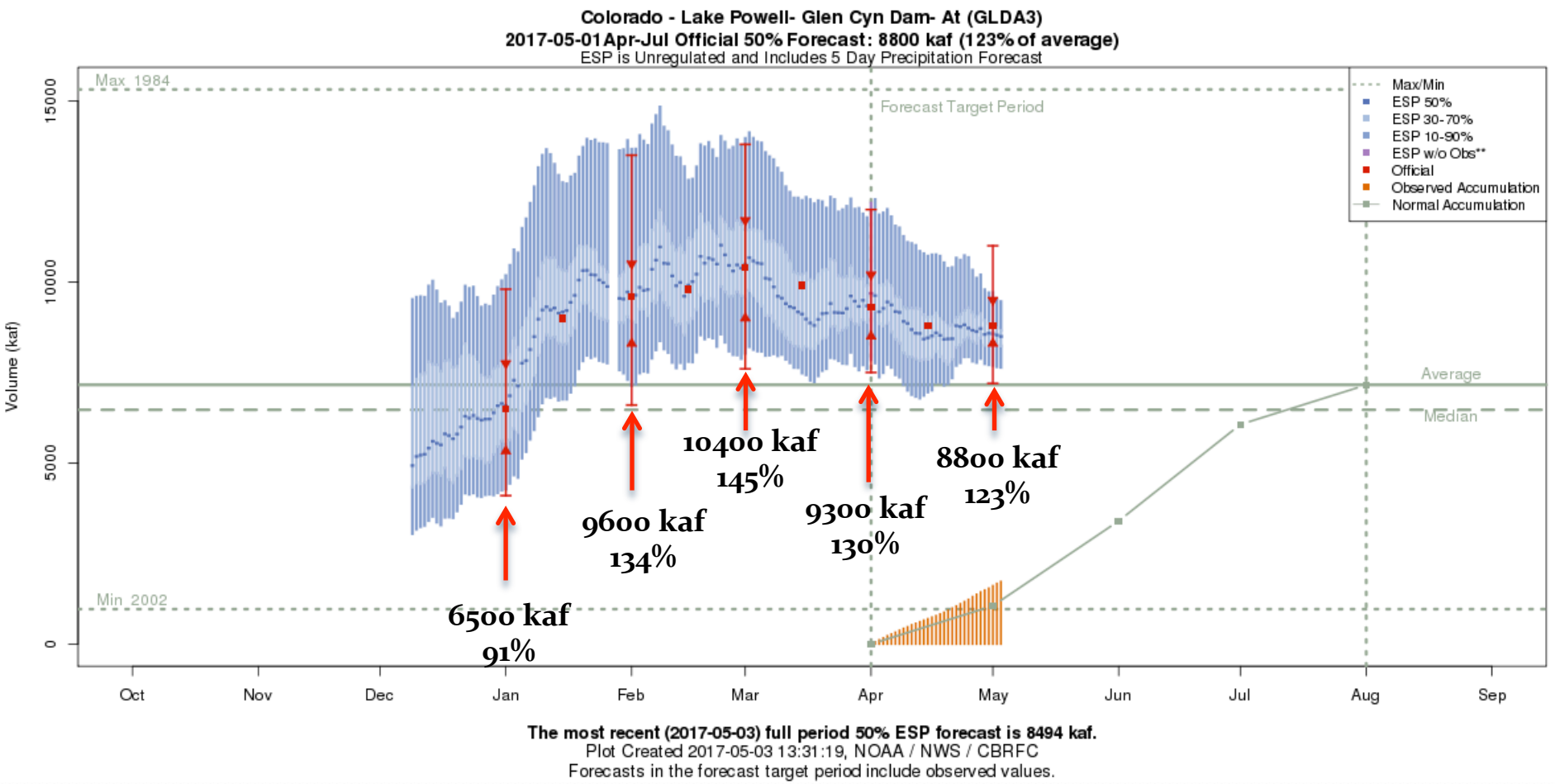
Forecast Evolution Plot: San Juan – Navajo Reservoir Inflow



Forecast Evolution Plot: Animas - Durango



Forecast Evolution Plot: Lake Powell Inflow



Forecast Validation: How good are forecasts in May ?

Historical Model Error 1981-2010

Improvement in forecast error between Apr & May

Forecasts are better than just going with average

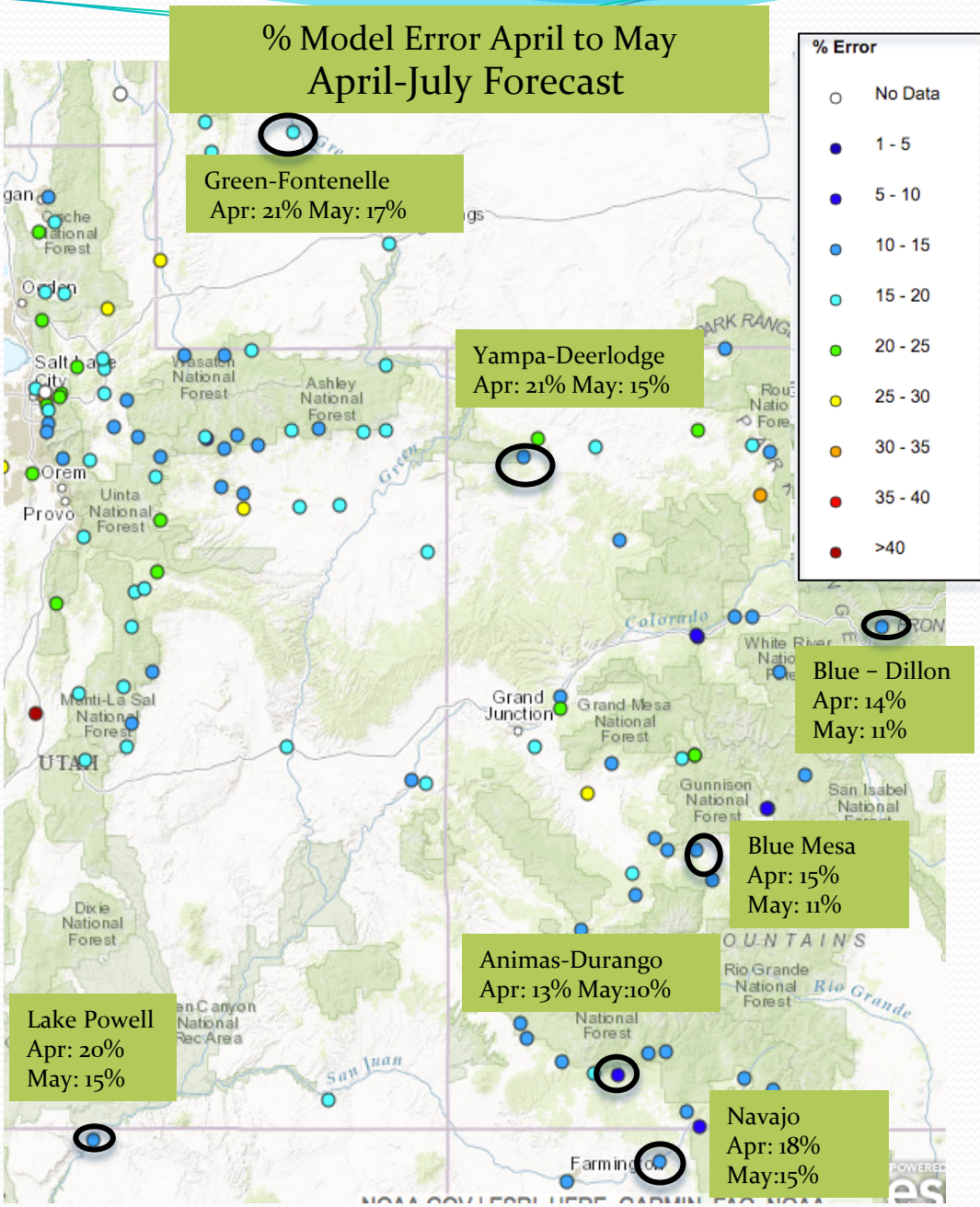
Primary sources of error from this point forward:
- Extreme weather (wet or dry)
- Correct model representation of snowpack
- Consistency of meteorological model guidance

Where We Do Better:
- Headwaters
- Primarily snow melt basins
- Known diversions / demands

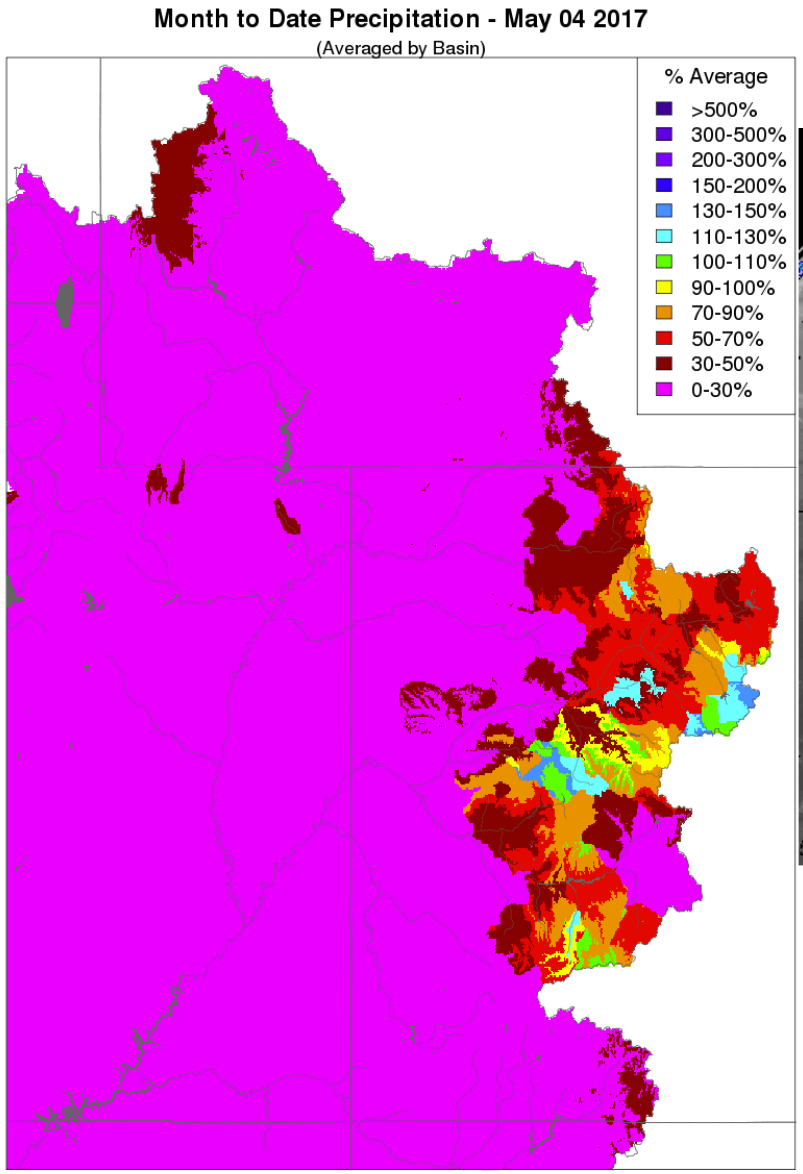
Where We Do Worse:
- Lower elevations (rain or early melt)
- Downstream of diversions / irrigation
- Little is known about diversions / demands

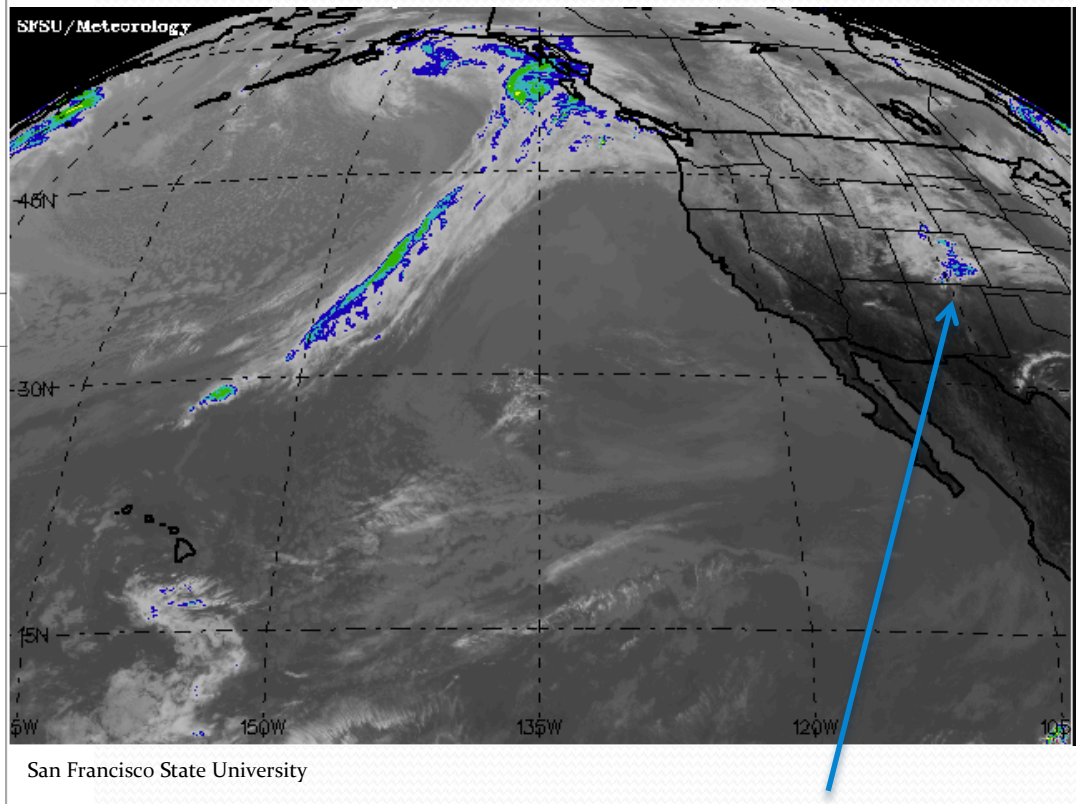
Map is available at:
https://www.cbrfc.noaa.gov/arc/verif/verif.php

From Water Supply drop down menu
→ select Historical Verification Map



May 2017 Weather: Precipitation so far….



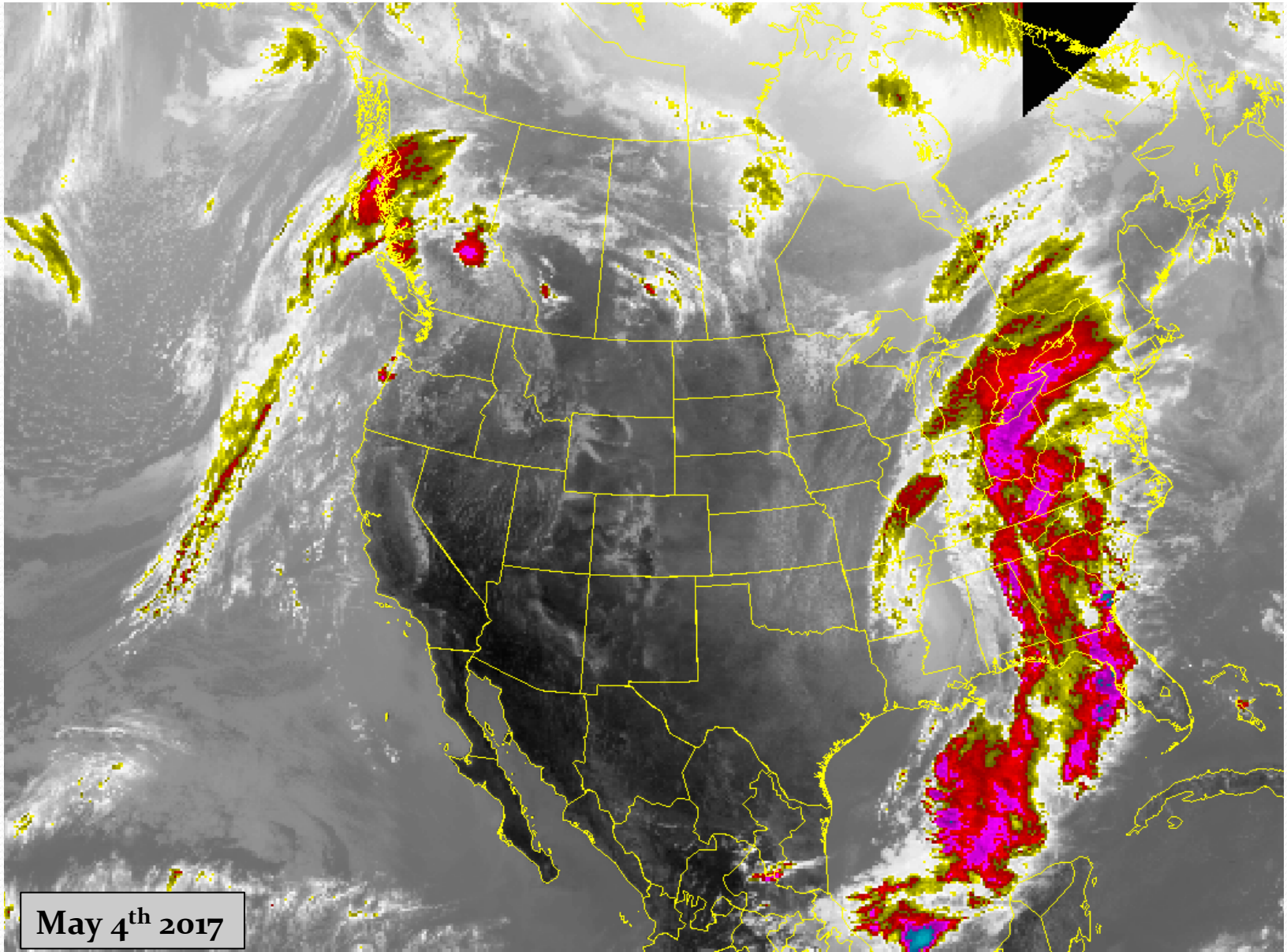


San Francisco State University

Storm system exiting Colorado on May 2nd

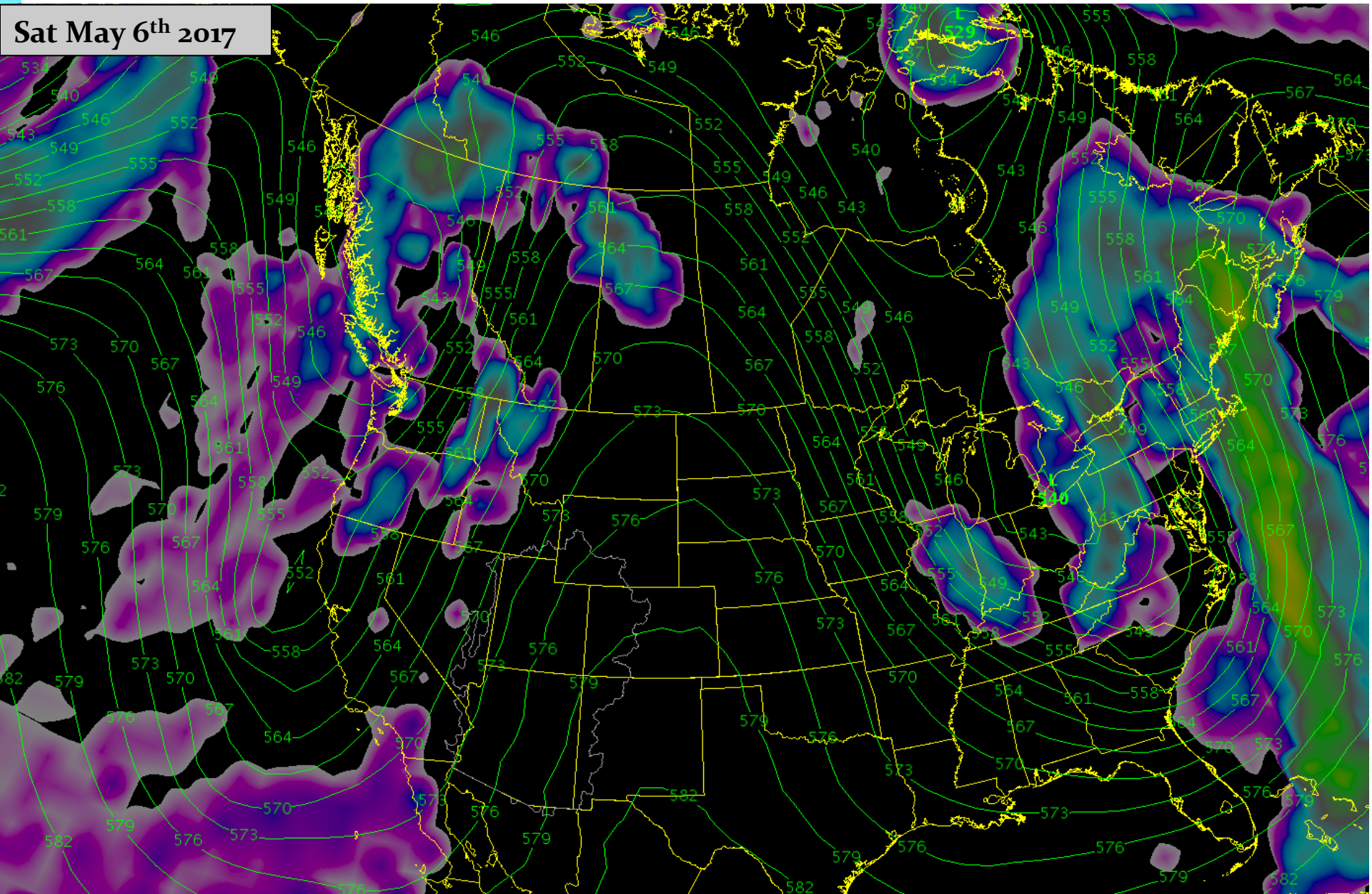
Upcoming Weather and Impacts to Water Supply Forecasts

Satellite Image – Here comes the heat! Ridge of high pressure currently over the area. But a big forecast challenge lies ahead.



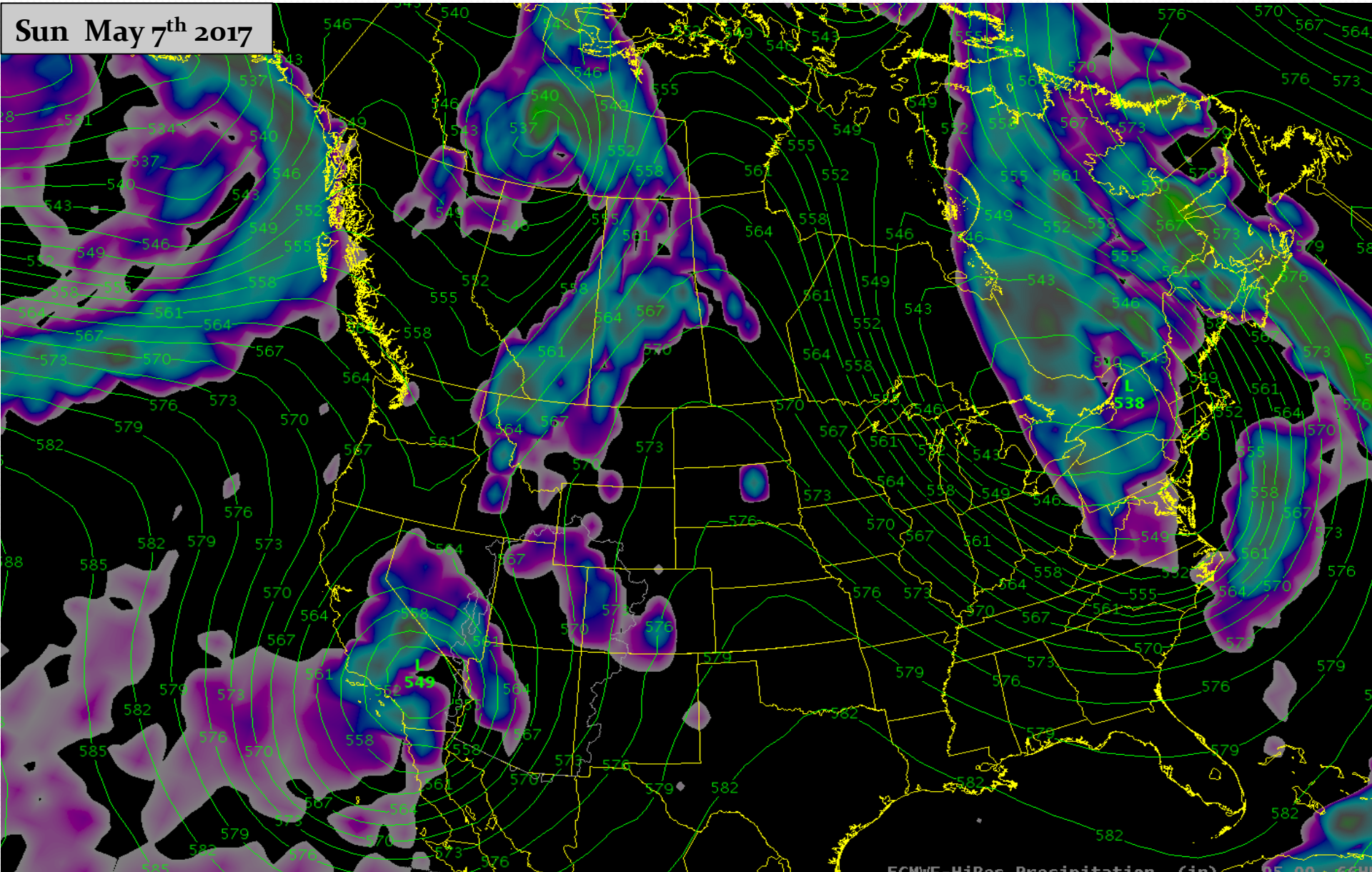
Upcoming Weather and Impacts to Water Supply Forecasts

Closed/ Cutoff low pressure system developing off west coast. Ridge axis over eastern Colorado. Increasing southwest winds. Max temperatures 10-15 degrees above average Fri-Sat. Rivers on the rise!



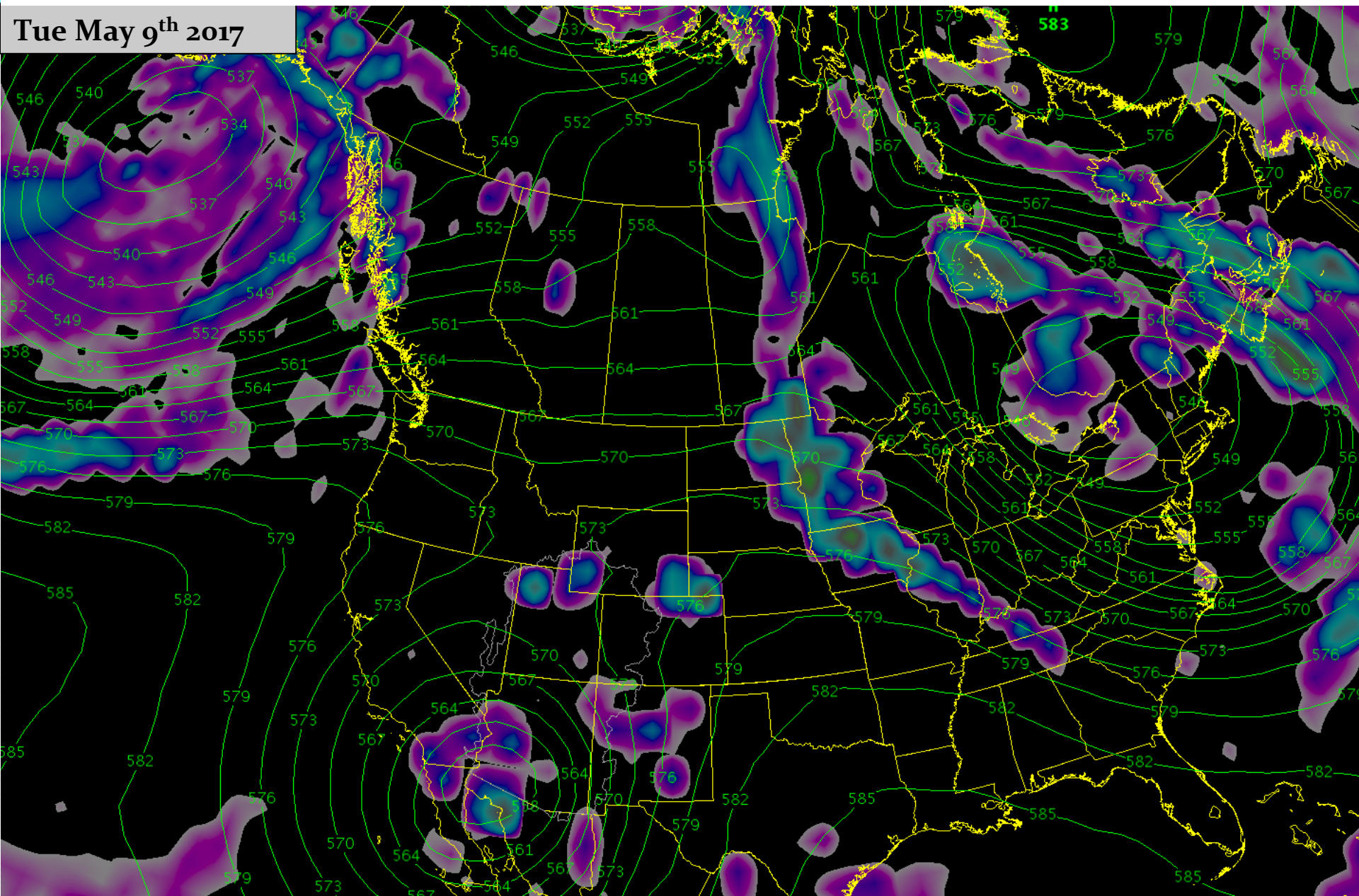
Upcoming Weather and Impacts to Water Supply Forecasts

Cutoff low along the southern California Coast. Mild southwest flow over the area. Temperatures above average but increasing cloud cover if moisture is drawn northward. Snowmelt continues in earnest.



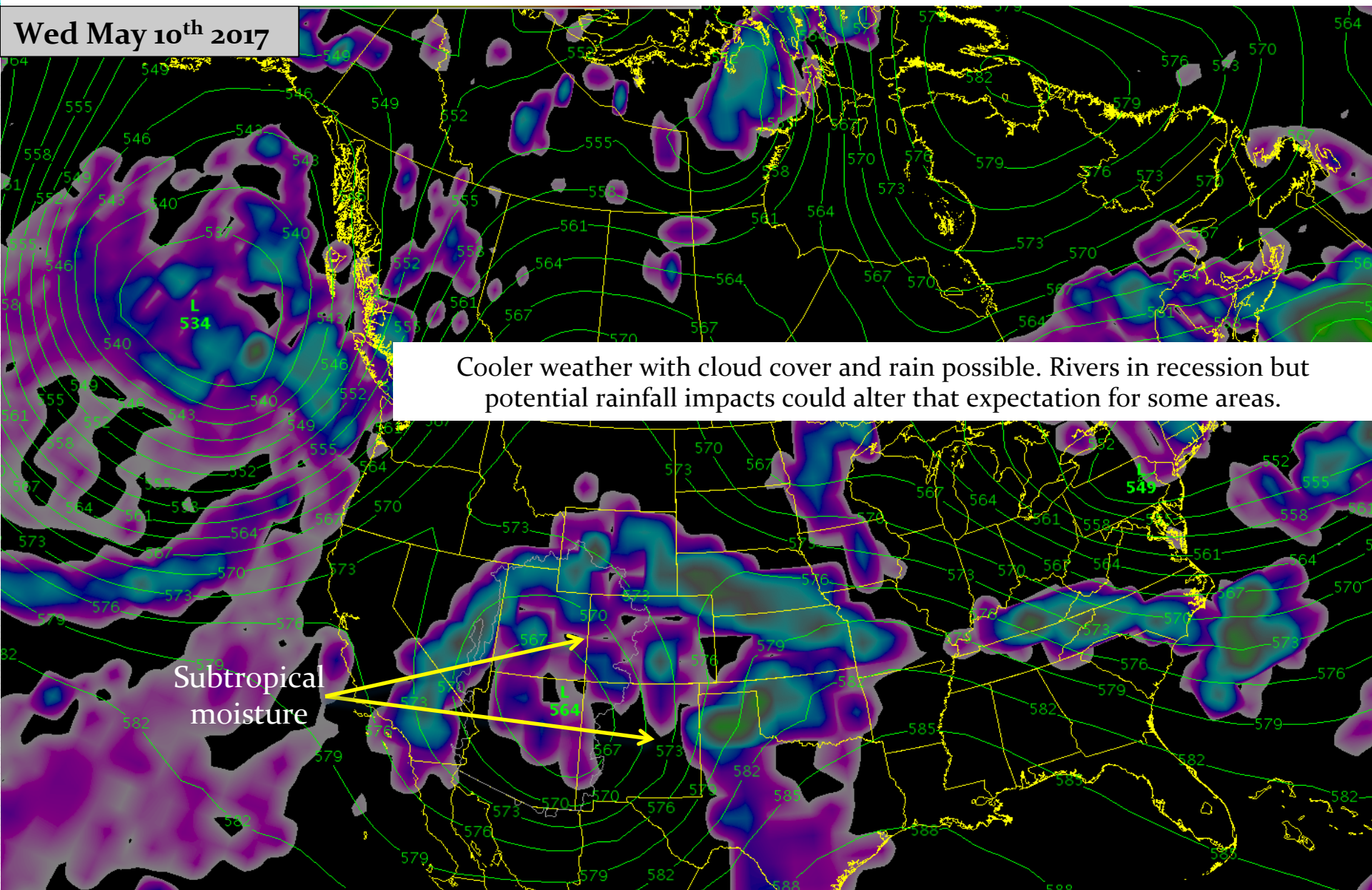
Upcoming Weather and Impacts to Water Supply Forecasts

Cutoff low is still to the southwest but models suggest it begins moving. Huge forecast challenge as the track of the low pressure will have significant implications for parts of the Upper Colorado River Basin.



Upcoming Weather and Impacts to Water Supply Forecasts

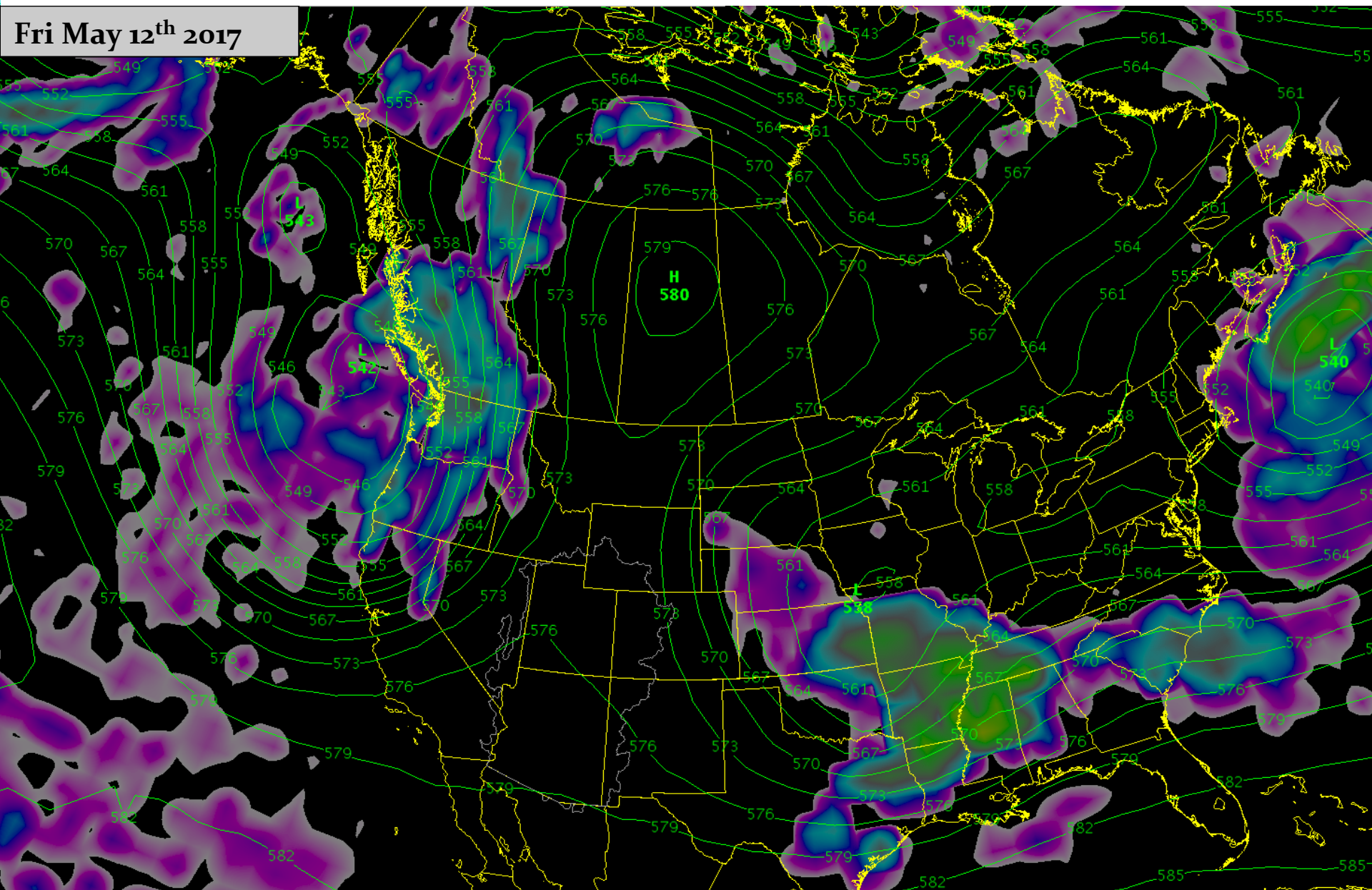
In this forecast scenario the low pressure lifts north. Sub-tropical moisture is tapped and drawn northward. Mild air mass, high freezing levels, and potential for significant rainfall exists.



Cooler weather with cloud cover and rain possible. Rivers in recession but potential rainfall impacts could alter that expectation for some areas.

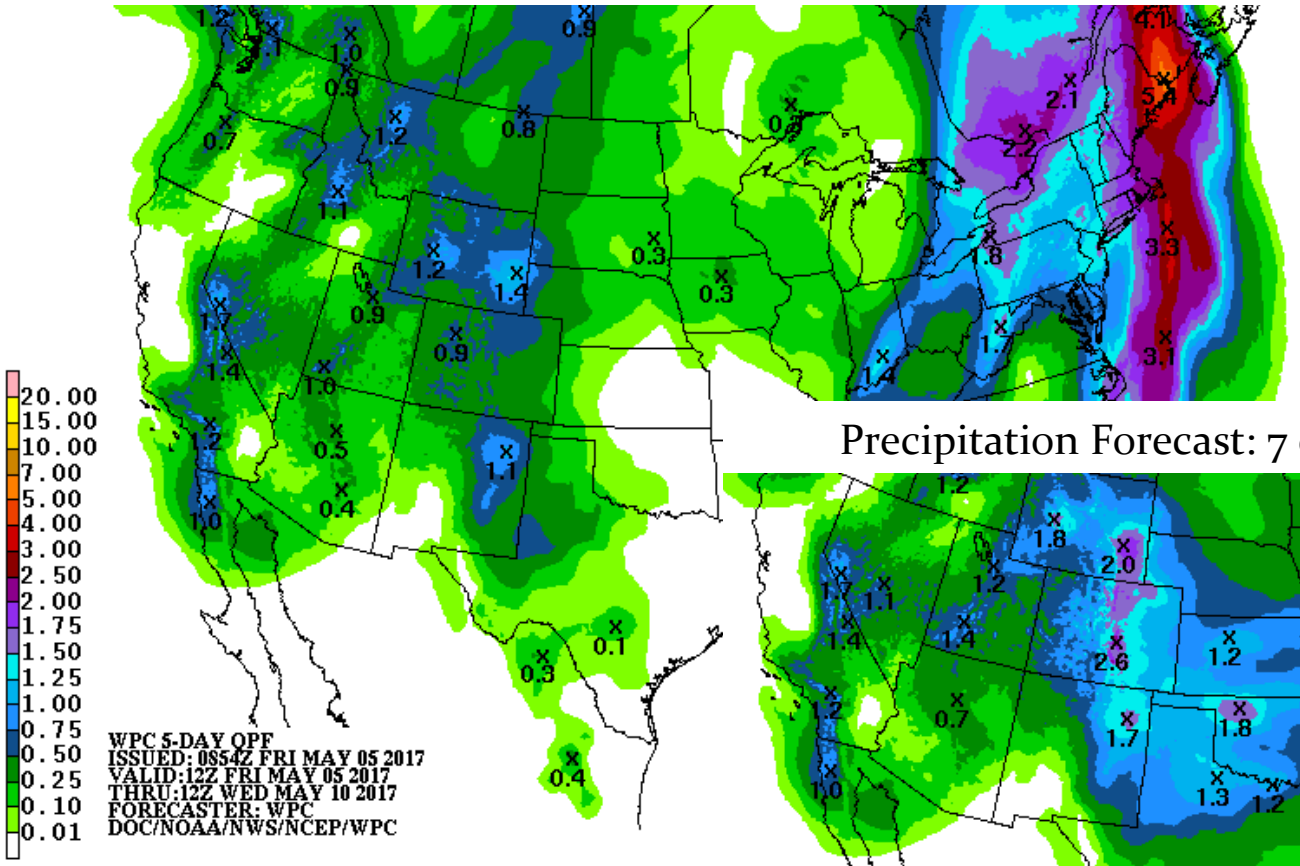
Upcoming Weather and Impacts to Water Supply Forecasts

Despite the track of the low, models move it on and out with a progressive ridge of high pressure and warming over the area. Rivers anticipated to resume seasonal rise due to increased snowmelt (low confidence).

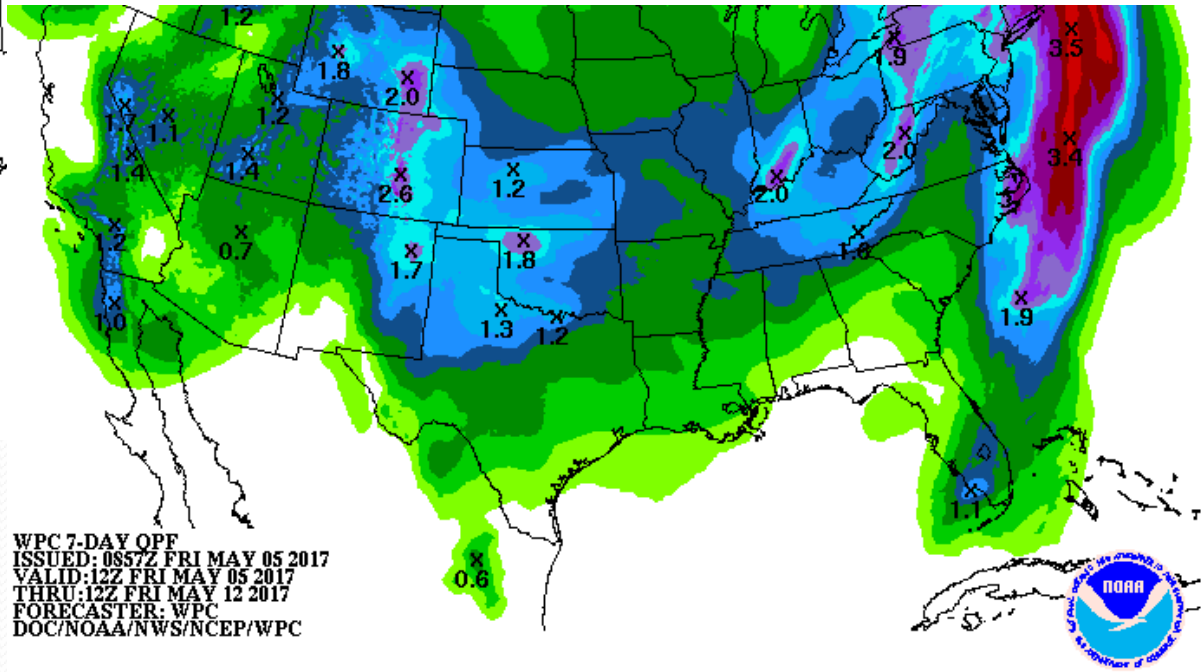


Upcoming Weather and Impacts to Water Supply Forecasts

Precipitation Forecast: 5 day total (May 5th-May 10th)



Precipitation Forecast: 7 day total (May 5th-May 12th)



Upcoming Weather and Impacts to Water Supply Forecasts

"The Cutoff Low – Weatherman's Woe"

Implications of the closed / cutoff low

Meteorological models do not handle the position or track of these well.
Meteorological models struggle with the amount of moisture they contain.
The longer it stays off the coast the more moisture it picks up.

Latest forecast model:

Expected to be over the area Tuesday into Thursday
Anticipate some strong storms and possible heavy rain in areas

The "Mights" associated with this type of low pressure:

If the low stays put longer than advertised: Mild temperatures & extended snowmelt
If the low drops farther south: less or very little precipitation, continued snowmelt
If the low slows down as it moves over the area: Much more precipitation is possible

There are lots of implications for timing of peak flow forecasts that impact spring reservoir release operations

Key Points

Much above average runoff volumes were observed in April with some record values.

Precipitation was below normal for the second month in a row over much of the area, with the exception of the Green River Basin of Wyoming and the Yampa River Basin.

April-July forecast volumes were reduced in those areas that received below normal precipitation. Most forecast volumes are still near to above average.

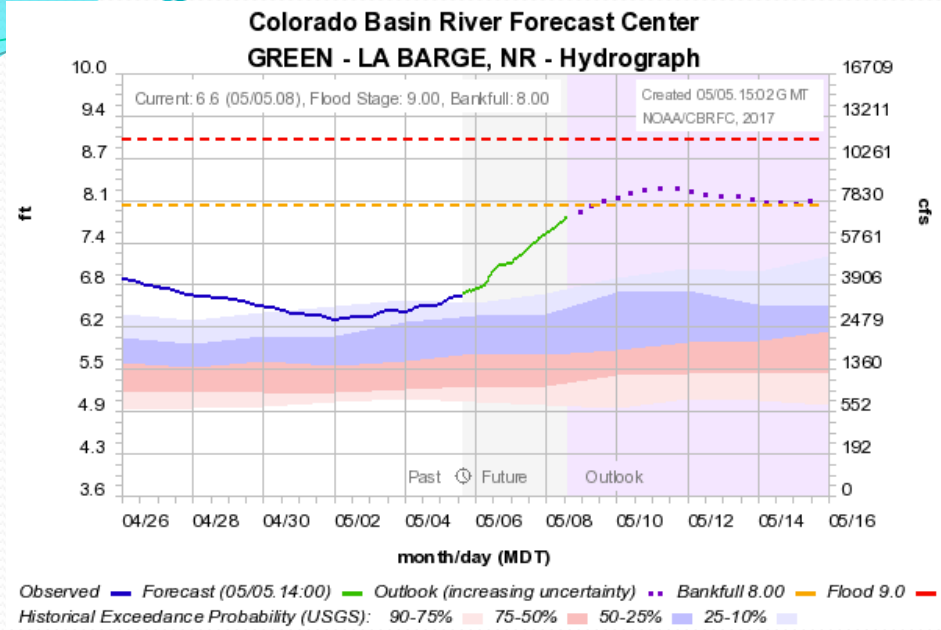
Significant snowpack remains in the Green River Basin of Wyoming, Duchesne River Basin and Gunnison Basin headwaters. High runoff volumes are anticipated in these areas, especially in the Green River Basin and Duchesne.

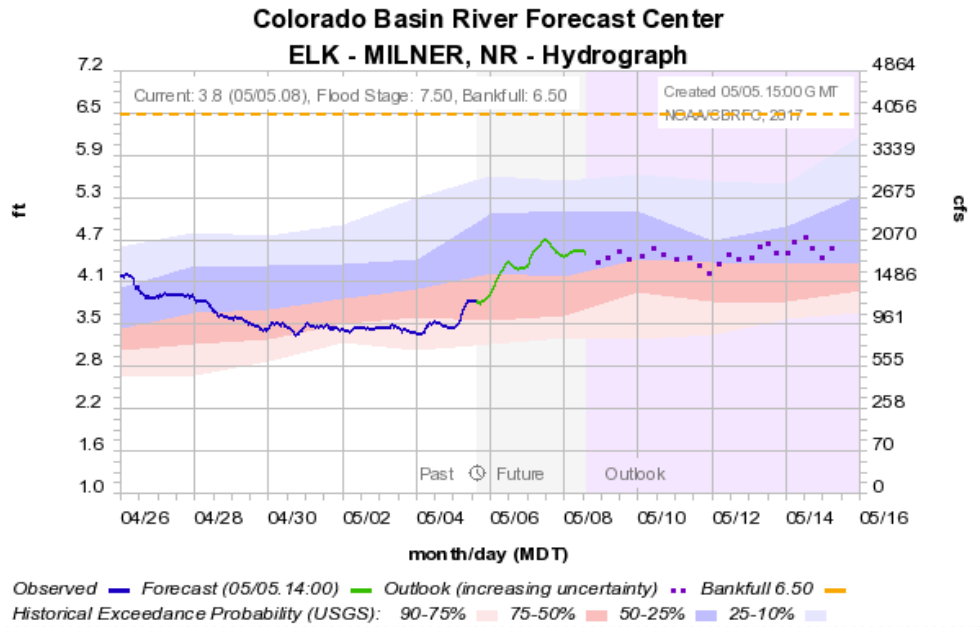
At this time May looks typical with a series of storms and dry/warm periods in-between. Rain events may become a concern as streams rise due to snowmelt throughout the month.

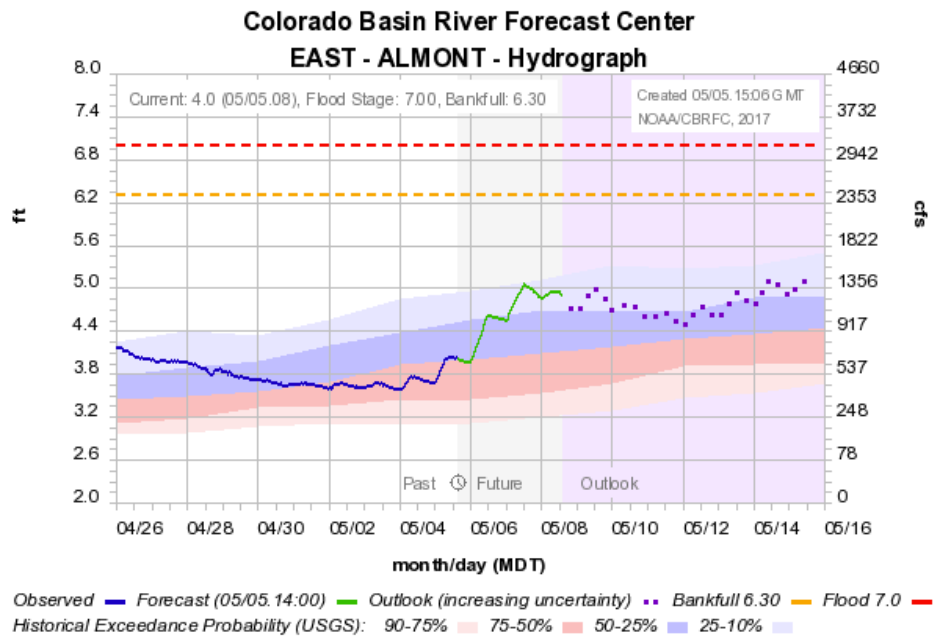
We continue to see active reservoir operation activity in anticipation of the high inflow forecasts. As we receive plans these will be incorporated into our model and reflected in our daily forecasts.

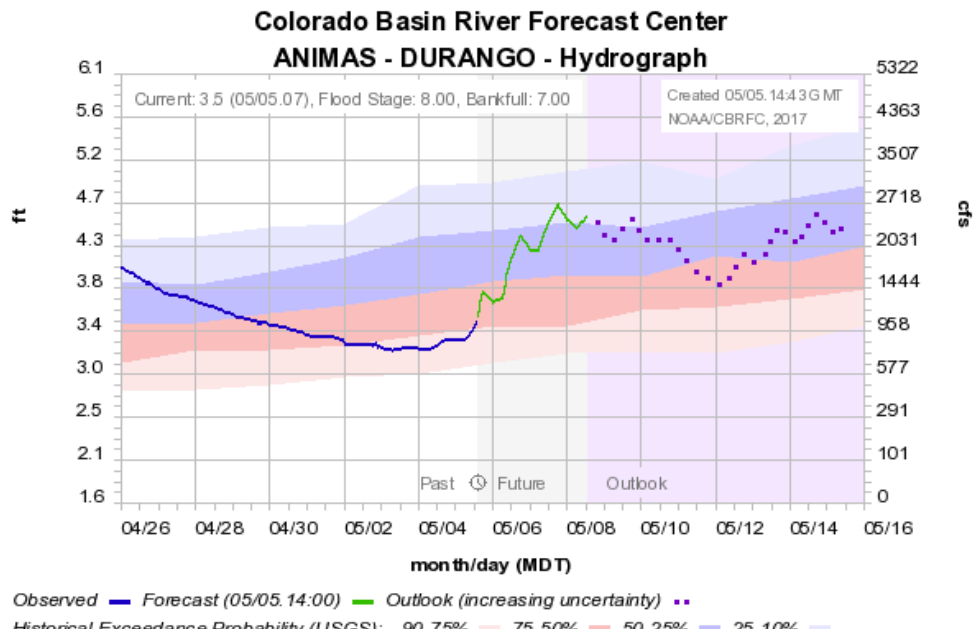
Daily deterministic forecasts available on the CBRFC web page (www.cbrfc.noaa.gov)

Expecting increasing streamflows due to warm temperatures

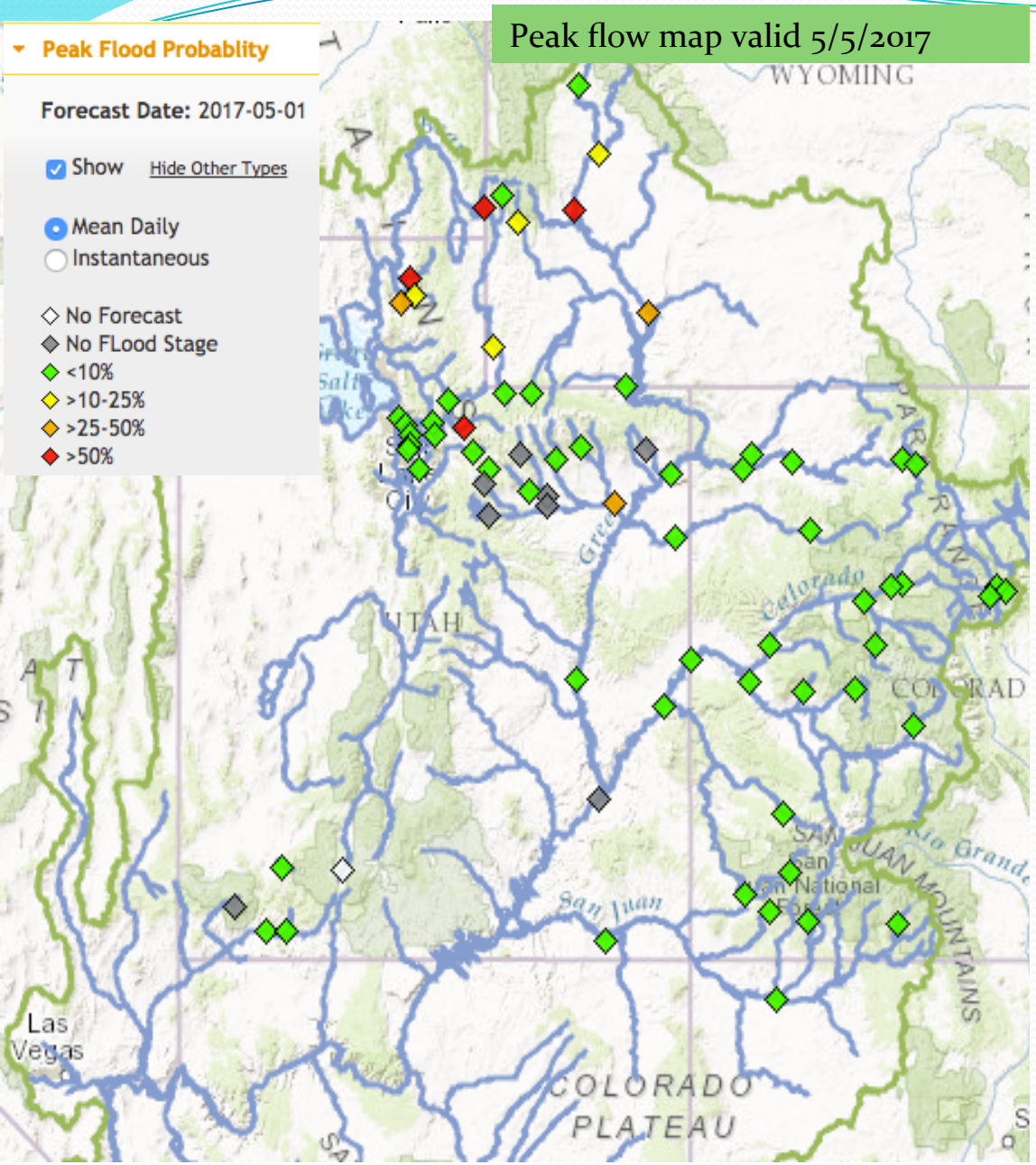








Spring Runoff Peak Flows



Peak flow forecasts were updated this morning.

Spring runoff peak flow forecasts have changed little from mid-April forecasts in most areas.

Upper Green (WY) and Duchesne River Basin forecasts remain high with flooding probable on some rivers.

Reservoir release plans and operations impact downstream forecasts

2017 water supply briefing schedule

- 2017 monthly water supply briefings for the Colorado River Basin
  - Great Basin water supply briefing
    - ***Today 1:30 pm***
  - No further webinars scheduled at this time

- Peak flow briefing: *As Needed (nothing currently scheduled)*

- All registration information has been posted to the CBRFC web page.

CBRFC Water Supply Contacts

Please contact us with any questions

Michelle Stokes – Hydrologist In Charge
michelle.stokes@noaa.gov

Paul Miller– Service Coordination Hydrologist
Paul.miller@noaa.gov

Basin Focal Points (Forecasters)

Brenda Alcorn – Colorado River, Lake Powell Focal Point
brenda.alcorn@noaa.gov

Greg Smith – San Juan, Gunnison, Dolores Focal Point
greg.smith@noaa.gov

Ashley Nielson – Green River Basin Focal Point
ashley.nielson@noaa.gov

Tracy Cox – Lower Colorado Basin, Virgin, Sevier Focal Point
tracy.cox@noaa.gov

Brent Bernard – Great Basin Focal Point
brent.bernard@noaa.gov