NOAA's Colorado Basin River Forecast Center

An Overview of the CBRFC Products and Services

2017 Stakeholder Open House

Overview

Forecasts & services provided by the CBRFC fall into a couple of broad categories:

Public Safety – Supporting NWS flood warning responsibilities

Water Resources – Supports water management, planning, reservoir operations

Products & services have evolved

We offered & you (as stakeholders) responded

Your feedback drives the evolution of products and services

Consistent requirements expressed by stakeholders

Accuracy, lead-time (becoming more important), forecast volume distribution (the when?)

Successful communication: Forecasts, skill, and ***what is driving the forecasts*** (increasingly important)

Perhaps the biggest challenge we deal with

Emphasis: Stakeholder Engagement – Evolving Products/Services – Addressing Challenges

CBRFC Hydrologic Products and Services

Short Range … … … … … … Long Range

Public Safety

Flash Flood Guidance

Hourly / Daily Forecasts Reaching Critical Thresholds

Hourly/Daily Forecasts During Reservoir Filling

Long Range Spring Snow Melt Peak Flows

Weekly, Monthly Reservoir Inflow Forecasts

Water Resources

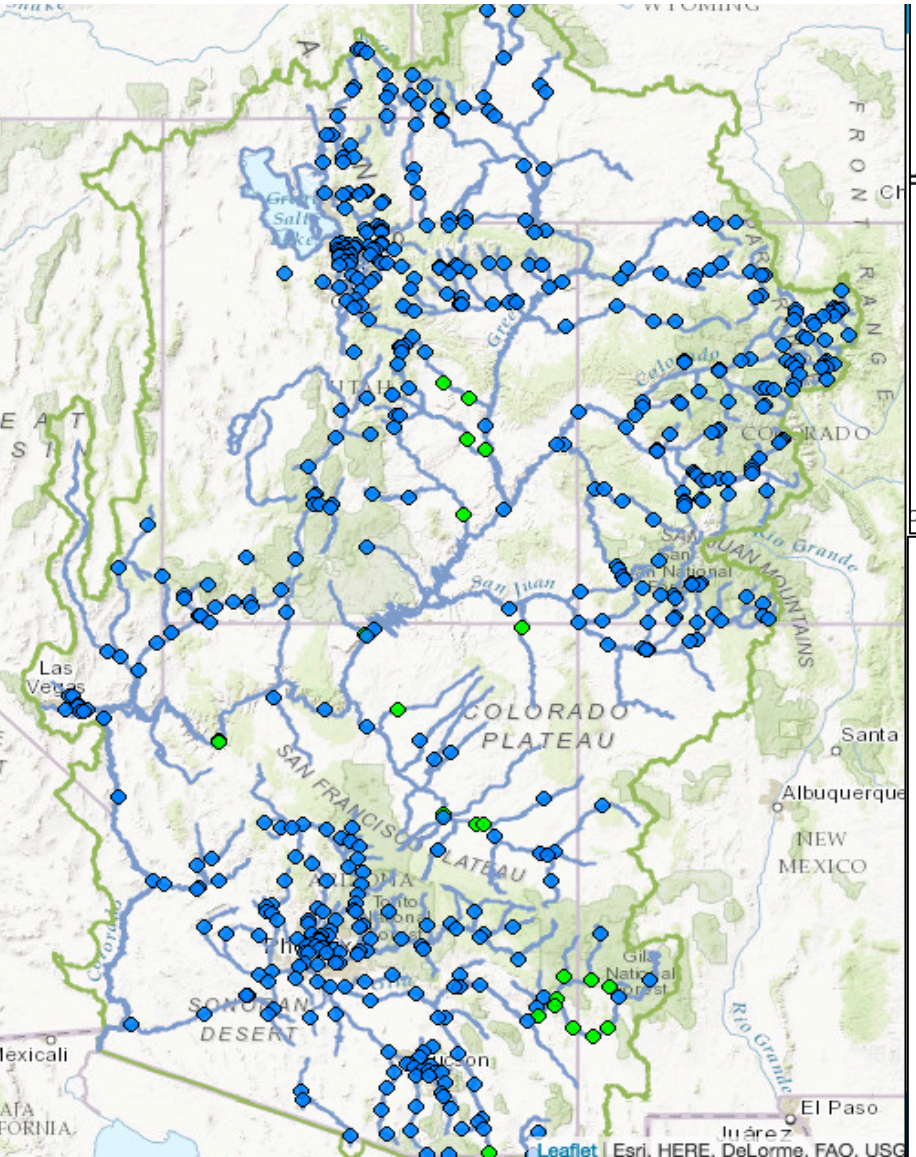
Monthly, Seasonal Water Supply Volume

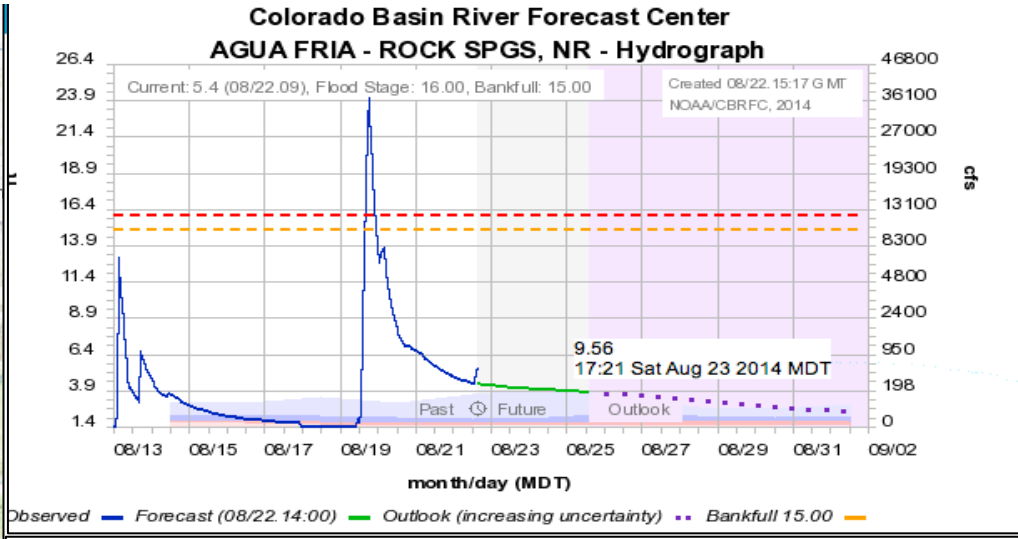
CBRFC Products and Services

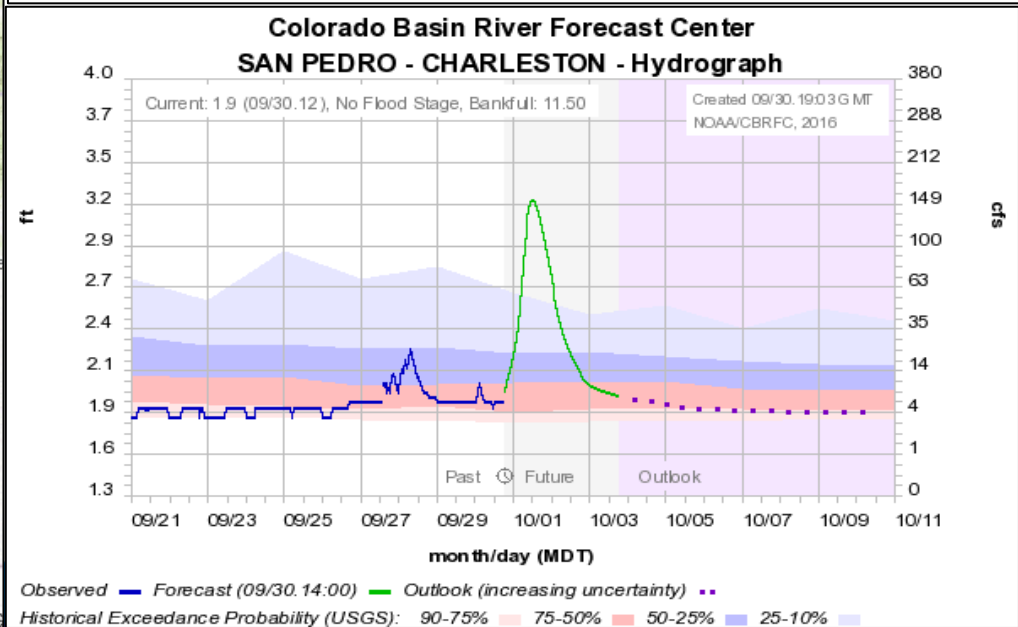
- Core Products and Services
  - Hourly streamflow stage/flow forecasts out to 10 days
  - Monthly and seasonal streamflow volume and peak flow forecasts
  - Seasonal water supply and peak flow briefings (webinars)
  - Providing historical and annual forecast verification information
  - Providing hydrologic basin conditions information
  - Attending your stakeholder meetings/Participating in coordination calls

Short Range Products: Hourly/Daily forecast streamflow hydrographs (utilizes short range weather forecasts)

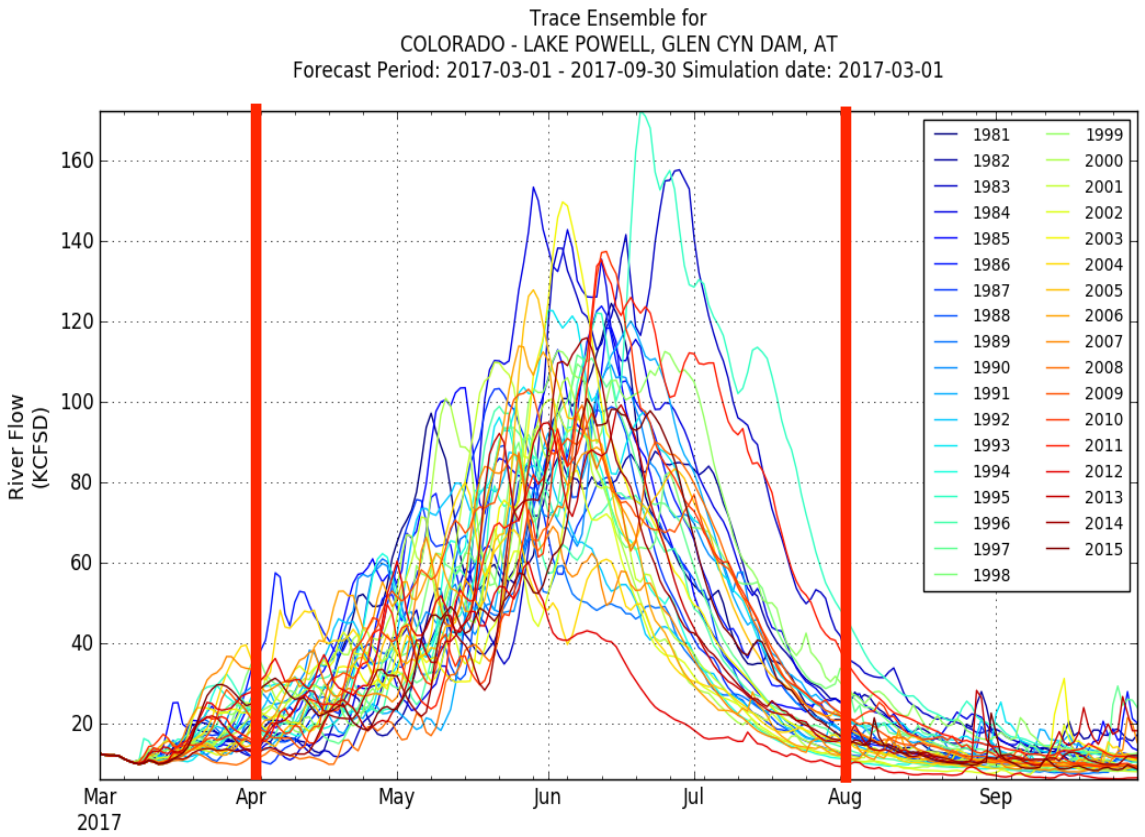
Rises due to snowmelt, observed or forecast rainfall, reservoir releases, routing upstream flows & flash floods that enter main channels, etc.







Long Range Products: Ensemble of future streamflow possibilities (relies primarily on climatology of the model calibration period)

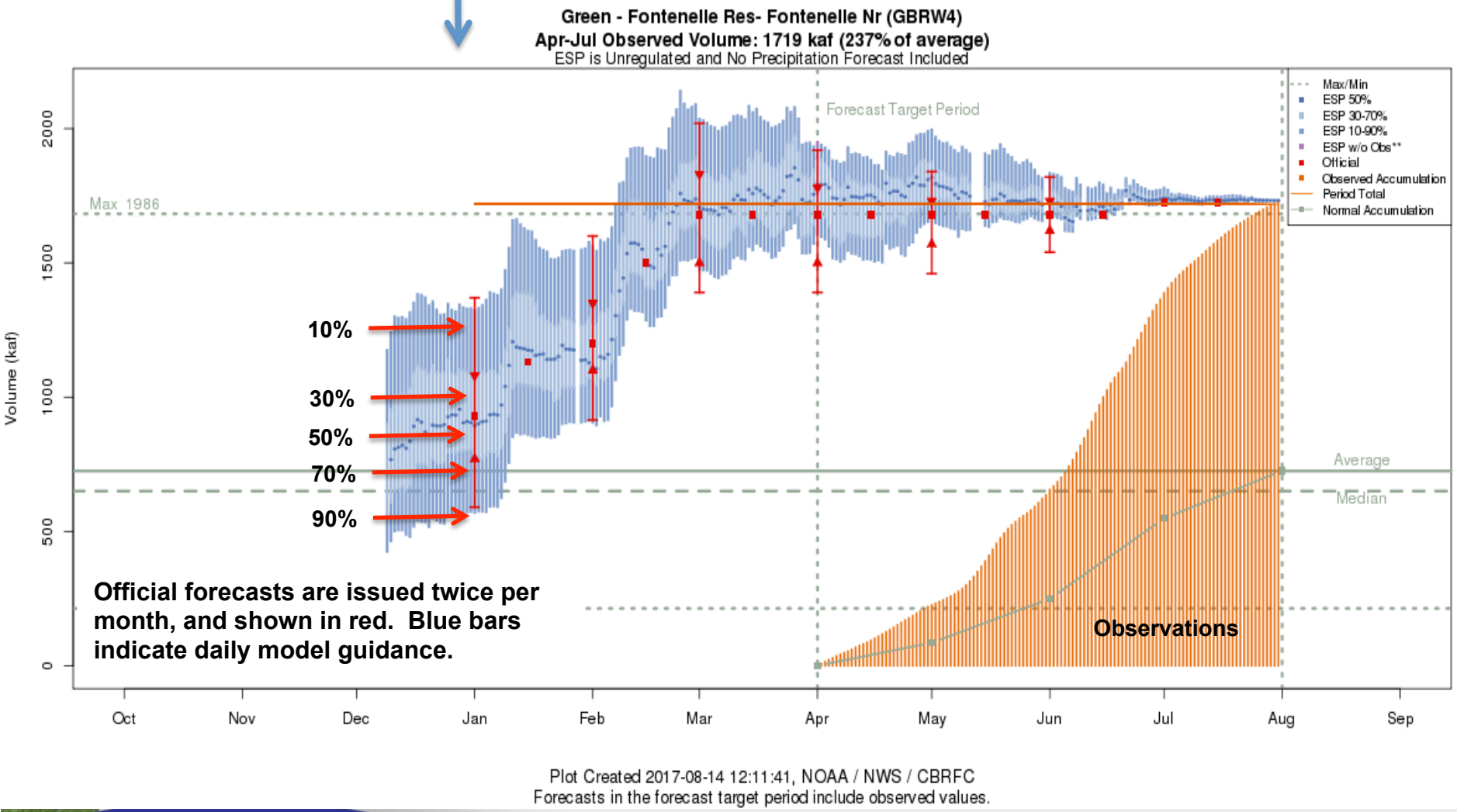


Exceedance Probabilities

90%	9548.25
80%	10484.47
70%	10936.41
60%	11182.51
50%	11437.82
40%	11814.53
30%	12008.62
20%	12359.32
10%	14011.41

Long Range Products: Seasonal Forecast Volumes

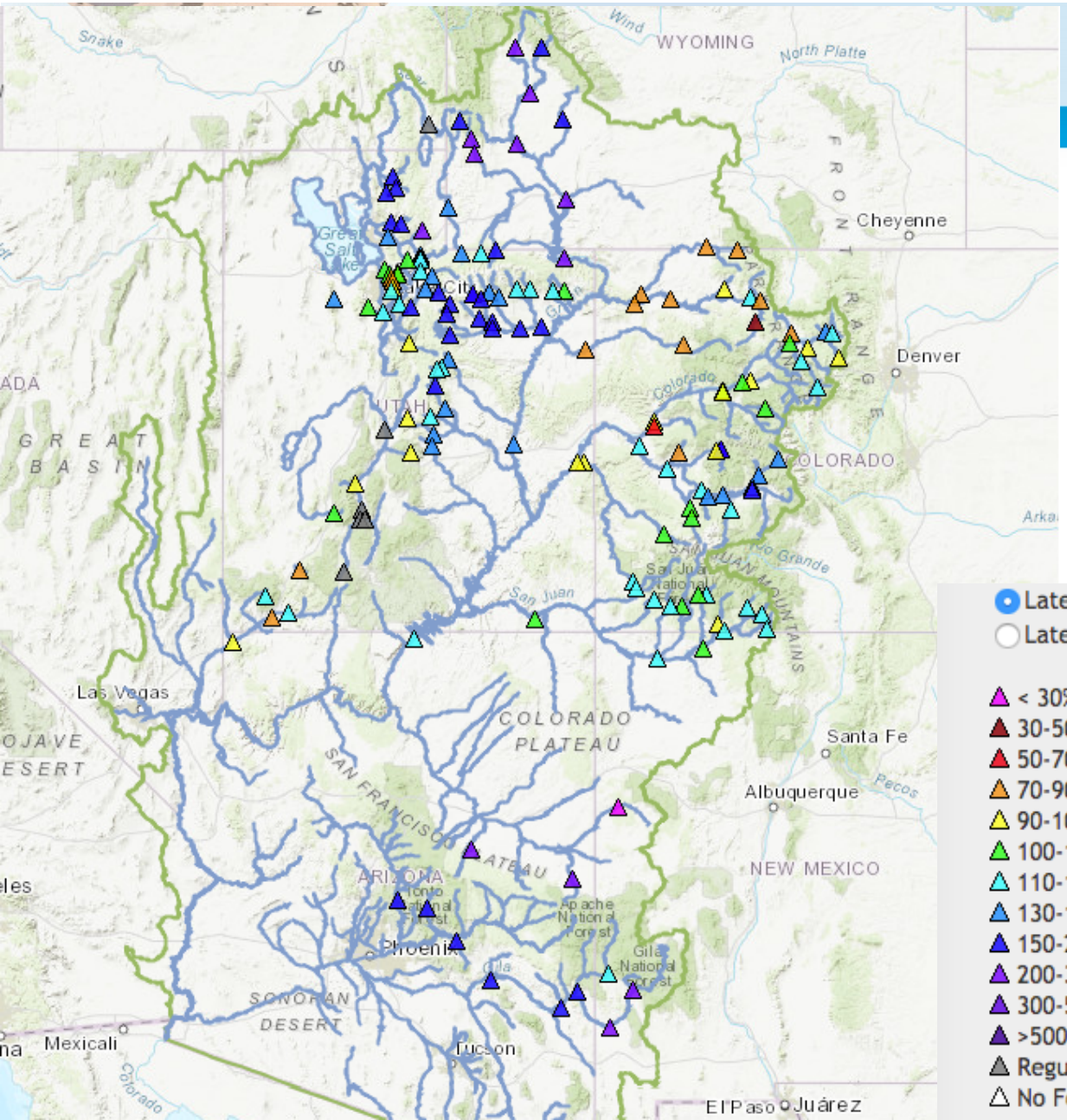
Probability distribution of April-July volume Evolution of the forecast over a season



Official forecasts are issued twice per month, and shown in red. Blue bars indicate daily model guidance.

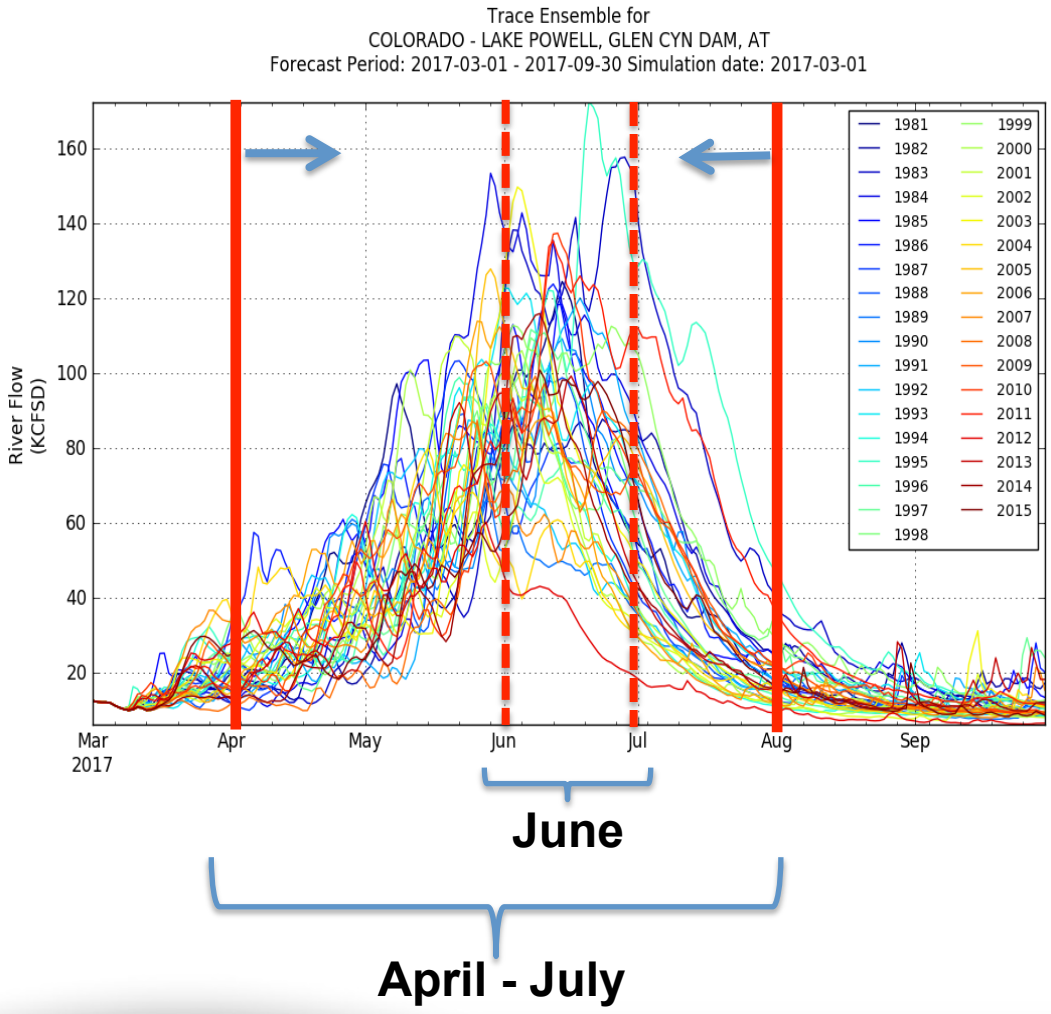
Plot Created 2017-08-14 12:11:41, NOAA / NWS / CBRFC
Forecasts in the forecast target period include observed values.

Long Range Products: Water Supply Seasonal Forecast Volumes



Water supply forecast evolution plots exist for all of these sites

Long Range Products: From the standard ensemble output additional information is available and expanded forecast products provided.



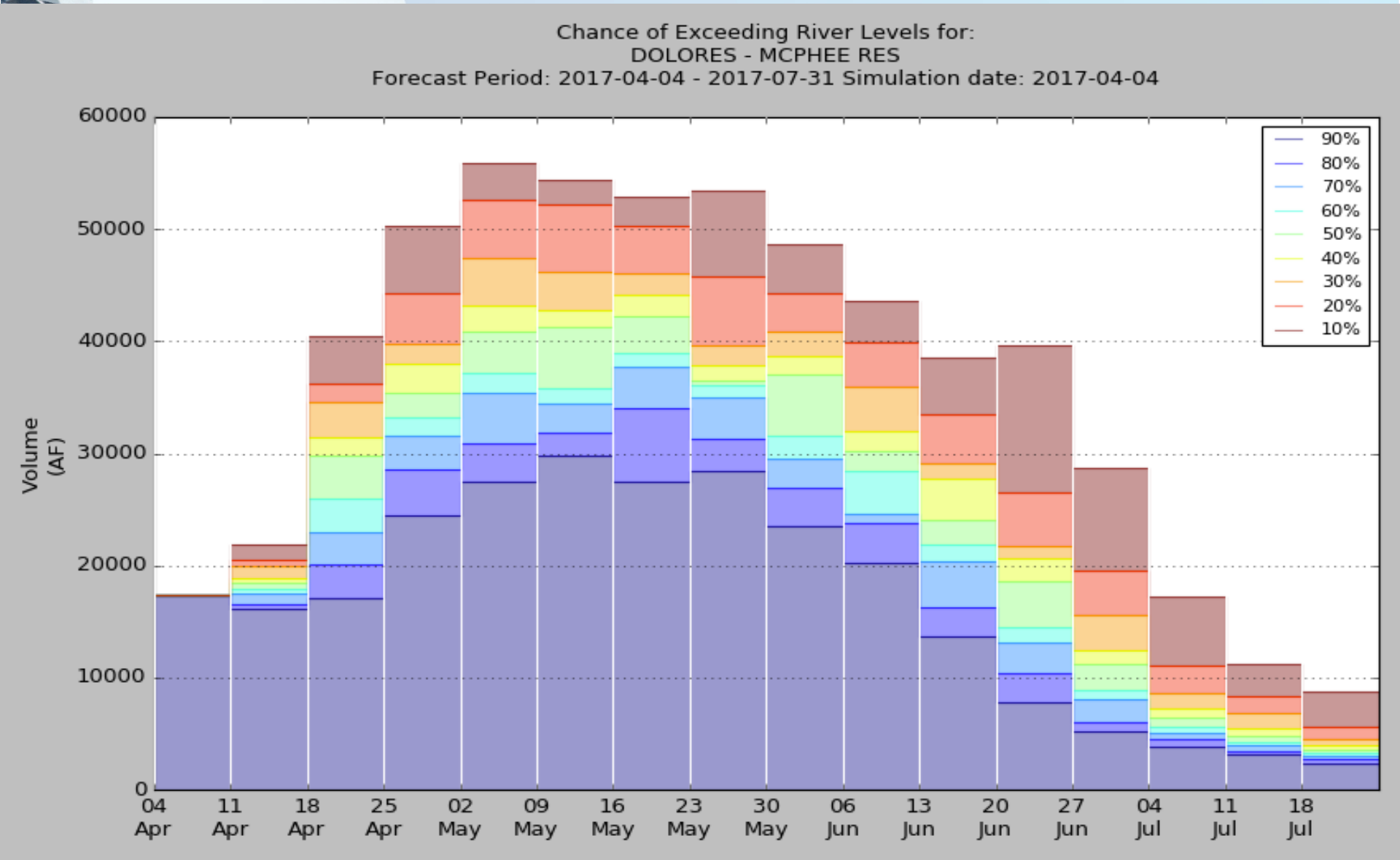
Various time periods and streamflow parameters can be analyzed.

Forecast products have evolved to include this type of information.

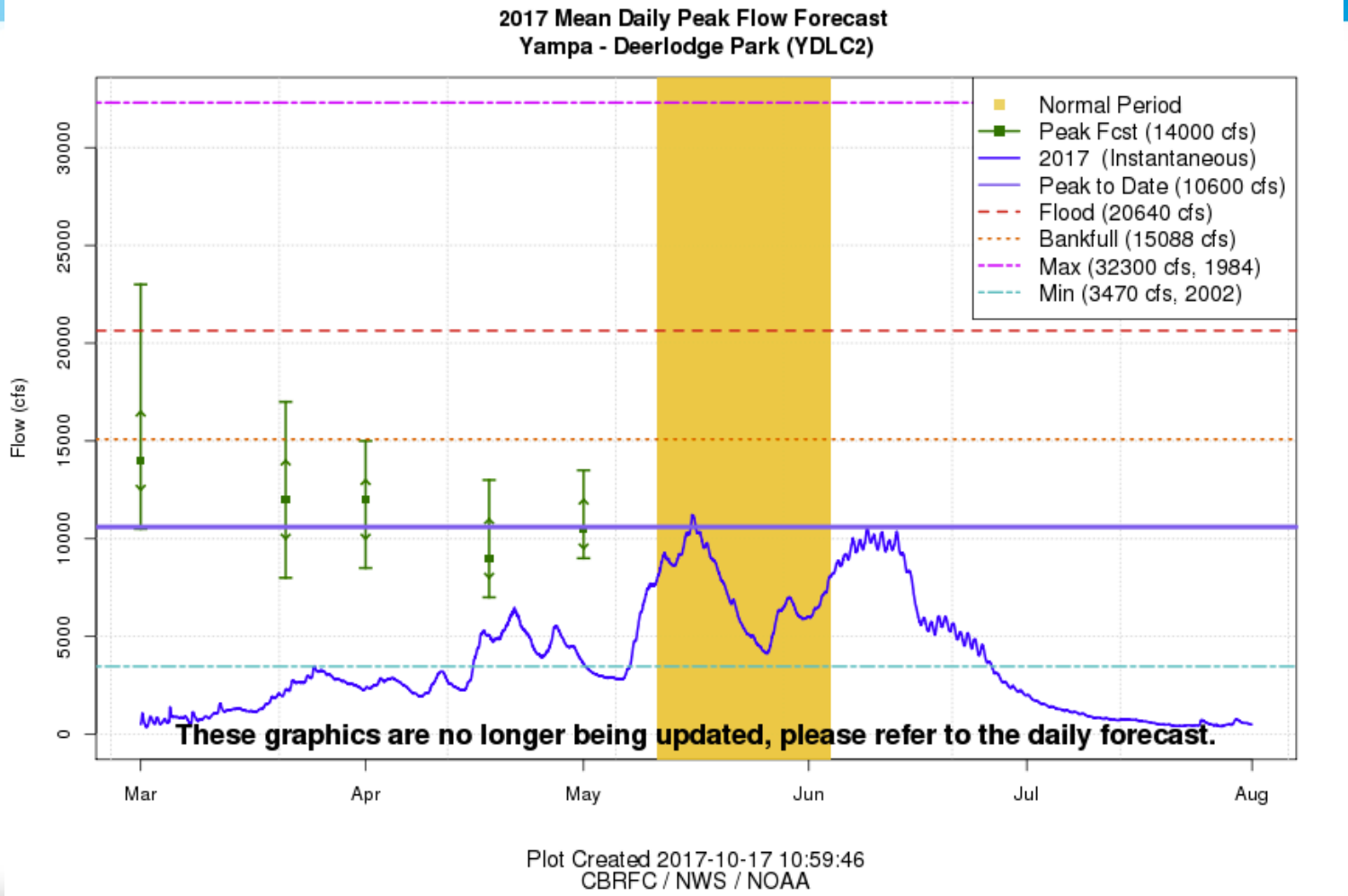
These products and information are a result of stakeholder requests.

Long Range Products: From the standard ensemble output additional information is available and expanded forecast products provided.

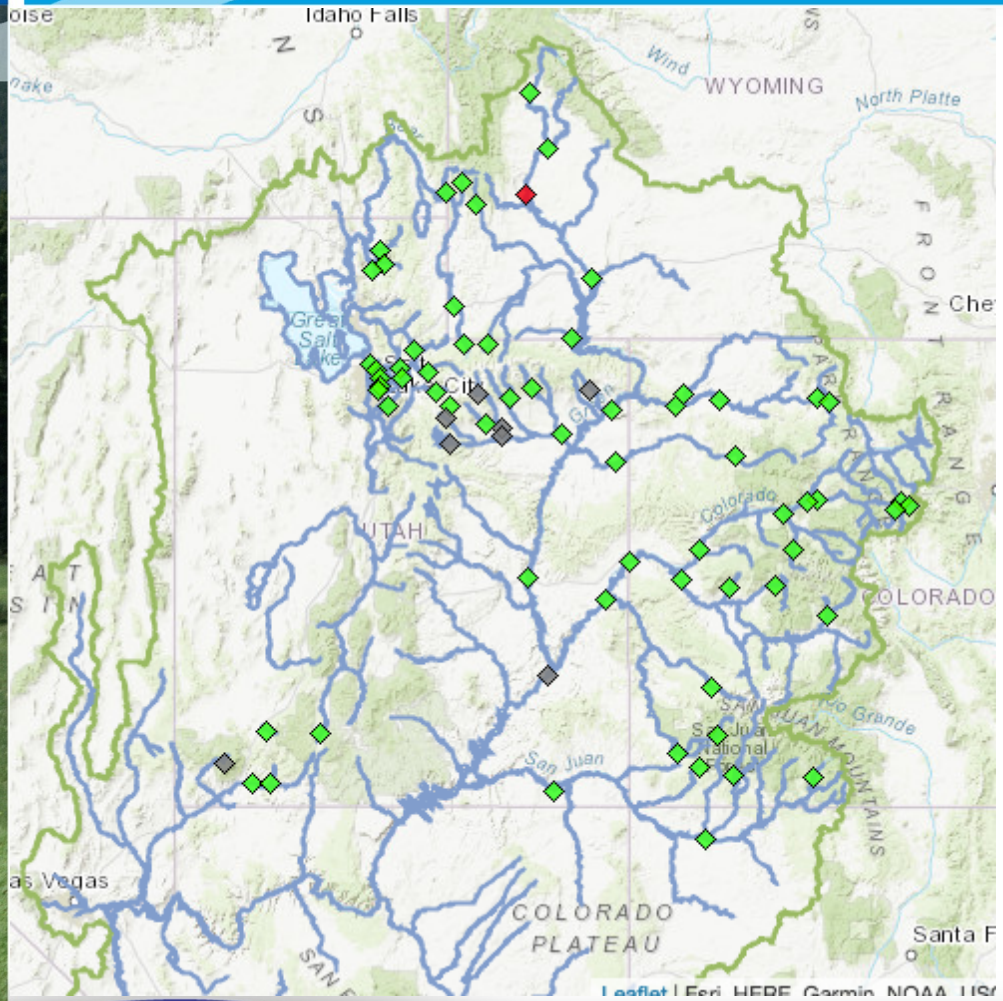
Seasonal forecast volume distributed weekly



Long Range Products: Seasonal (snowmelt) peak flow probability distribution forecast plot.



Long Range Products: Seasonal (snowmelt) peak flow forecasts



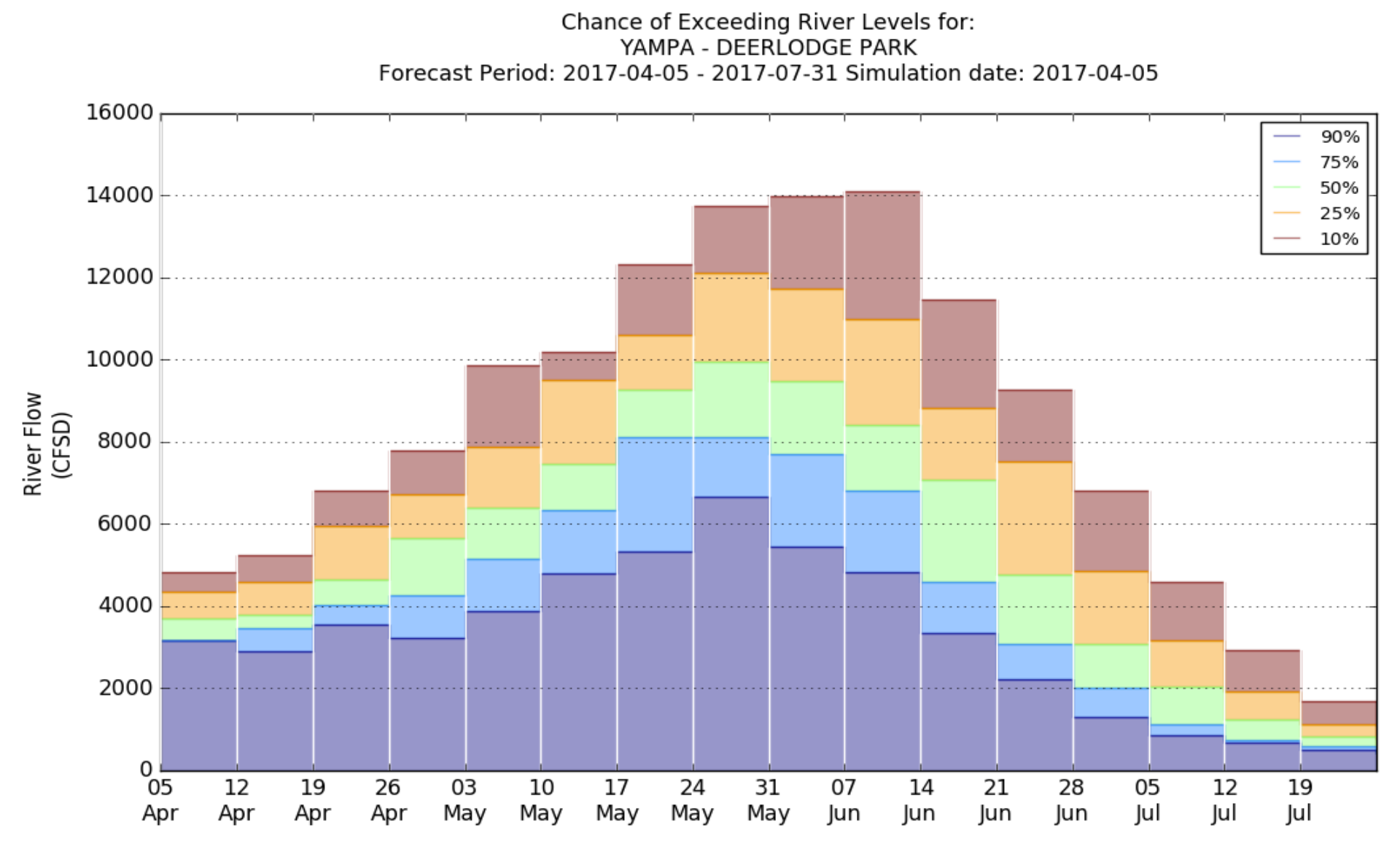
Seasonal peak flow forecasts are issued for these sites

- Mean Daily
- Instantaneous

- No Forecast
- No FLood Stage
- <10%
- >10-25%
- >25-50%
- >50%

Long Range Products: From the standard ensemble output additional information is available and expanded forecast products provided.

Seasonal forecast peak distributed weekly



Expanded Forecast Products:

Yampa - Deerlodge
Daily Average Forecast Flow (ending 12z on given date)
Units: CFSD

Created: May 13 2017

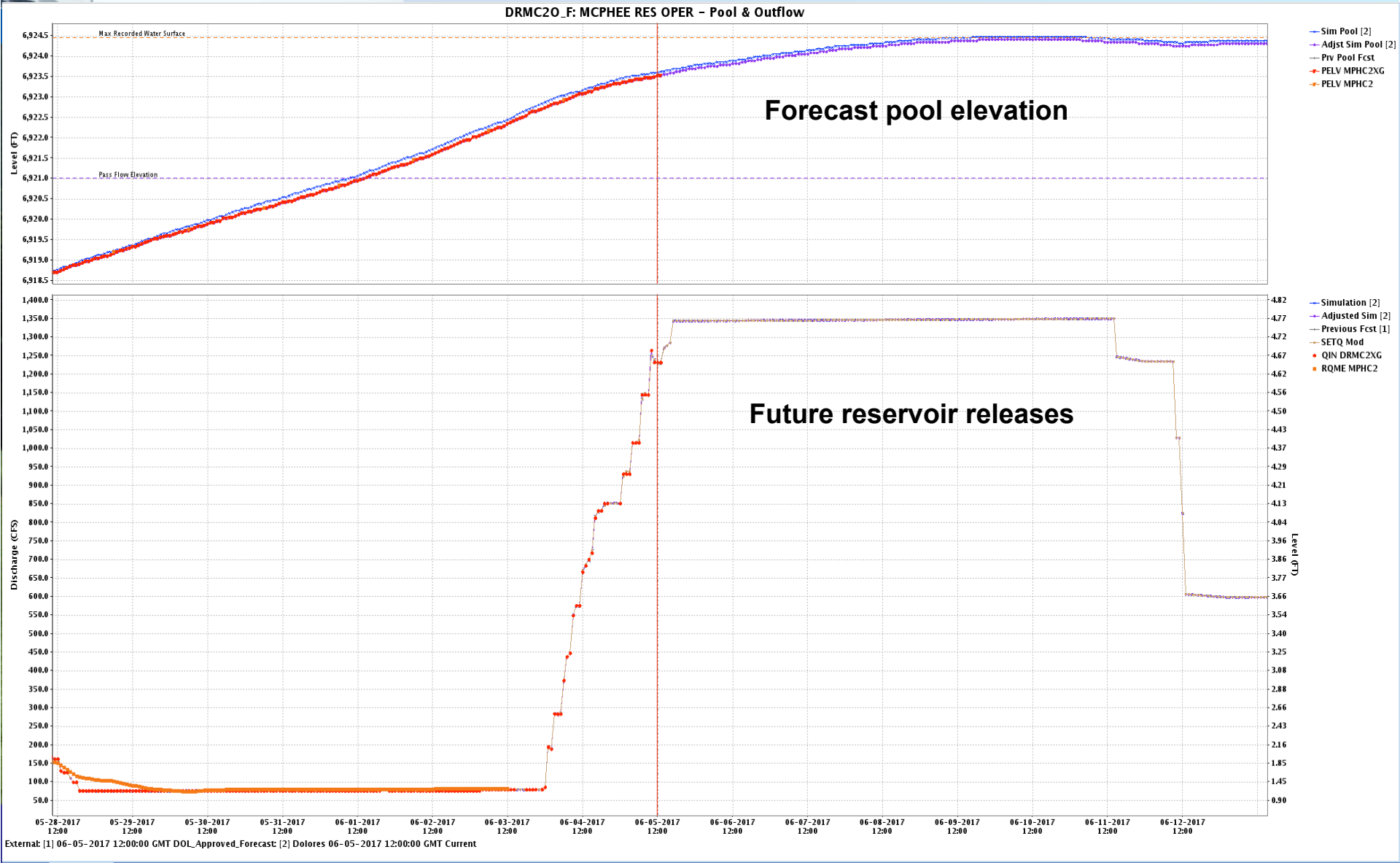
DAILY TOTAL: deterministic forecast flow (official forecast on CBRFC website)
ESP TOTAL: 50% exceedance forecast flow based on climatology

DATE	TOTAL	
2017-05-14	8762	Daily Model Output (20170513)
2017-05-15	9749	
2017-05-16	10008	
2017-05-17	9262	
2017-05-18	8460	
2017-05-19	7143	
2017-05-20	6626	
2017-05-21	5674	
2017-05-22	4682	
2017-05-23	4145	
2017-05-24	4407	ESP Model Output (20170512)
2017-05-25	5544	
2017-05-26	6384	
2017-05-27	6762	
2017-05-28	6757	
2017-05-29	6825	
2017-05-30	6799	
2017-05-31	6666	
2017-06-01	6418	

Combination of mean daily flow from daily deterministic model (driven by short term weather guidance) and long range mean daily flow (driven by climatology)

Products like this were developed at stakeholder requests.

Expanded Forecast Services: Direct output graphics from the daily deterministic hydrologic model has been increasingly utilized in weekly briefings / coordination calls during spring runoff.



The current “Special Forecast Products” web page.

This was developed in response to stakeholder needs / requests.

Special Forecast Products

Volumes
Upper Basin Reservoirs (3 month + Apr-Jul): current | archive
Upper Basin Reservoirs (Water Year): current | archive
San Juan (Animas-La Plata): current | archive
Lake Mead Local: current | archive
Utah Reservoirs: current | archive

CUWCD
CUWCD peaks: current | archive
West Fork Duchesne inflow csv: current | archive
West Fork Duchesne inflow plot: current | archive

Yampa - Deerlodge Peak
Text Product (no QPF): current | archive
Traces Graph (no QPF): current | archive
Traces Text Table (no QPF): current | archive
Weekly Exceedance Histogram (no QPF): current | archive
Exceedance Probability Graph: current | archive
Daily model/ESP merge csv: current | archive

Green River - LaBarge Peak
Daily model/ESP merge csv: current | archive

North Fork - Gunnison Peak
Text Product (no QPF): current | archive
Weekly Exceedance Histogram (no QPF): current | archive
Daily model/ESP merge csv: current | archive

Animas - Durango Peak
Text Product (no QPF): current | archive
Weekly Exceedance Histogram (no QPF): current | archive

McPhee Inflow
Daily model/ESP merge csv: current | archive
Daily Exceedance: current | archive

CBRFC Products and Services

Core Products & Services

Evolving Products and Services

Weekly / Monthly probabilistic reservoir inflow products

Weekly exceedance peak flow forecast products

Mean daily deterministic inflow forecast product (format for easy upload)

Pushing to stakeholders a bi-monthly water supply narrative Jan-Jun

Increased participation in river basin calls (communicating the forecast)

Upper Colorado Situational Awareness web page

Precipitation, temperature, snow, averaged by model river basins

Model snow and soil states as represented by the model

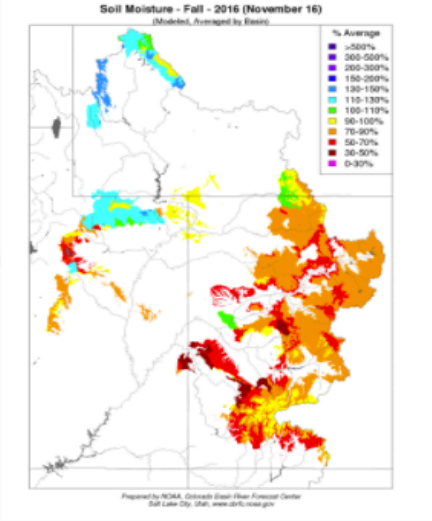
Short term probabilistic river flow forecasts (future)

** Weekly Basin Specific hydrologic & weather briefing information*

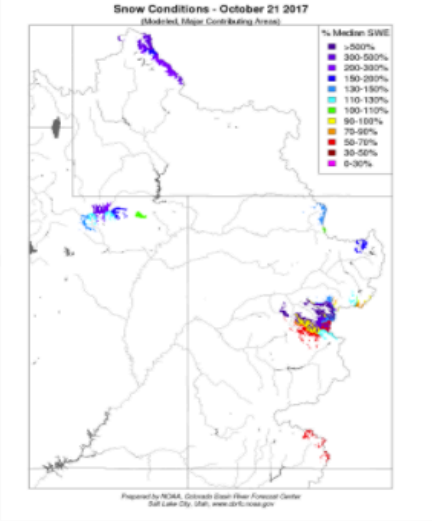
** Possibly on the horizon – Attempt to improve communication regarding forecast changes*

Upper Colorado Situational Awareness

Soil Moisture



Snow Conditions



Lake Powell Unregulated Inflow (kaf) Water Year 2018 Forecasts as of 2017-10-01

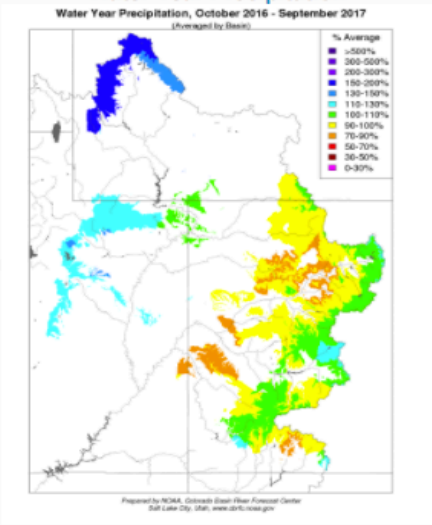
Period	Obs to Date	Full Fcst	%Avg
Apr-Jul	0	6250	87%
Water Year	0	9720	90%

Lake Powell %Average Precipitation Water Year 2017

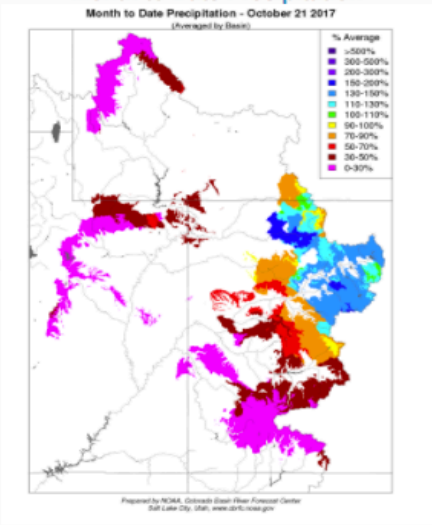
Area	Oct	Nov	Dec	Jan	Feb	Mar	
UC-Powell	60	75	180	237	119	69	

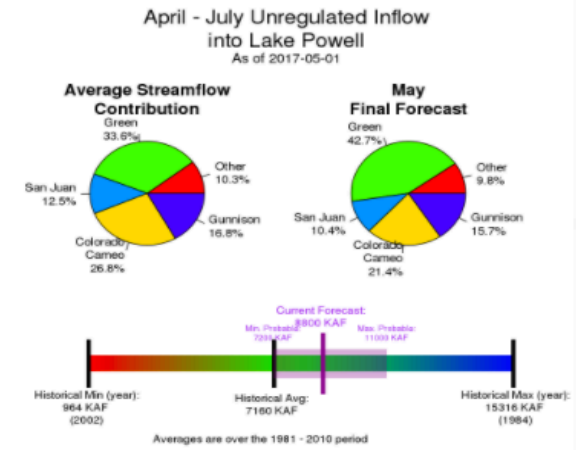
Area	Apr	May	Jun	Jul	Aug	Sep	Water Year	
UC-Powell	88	94	22	126	74	104	107	

Water Year Precipitation



Month to Date Precipitation





More Information

Lake Powell Forecast Evolution Plot
Apr-July Text Forecast Product
Water Year Text Forecast Product
Lake Powell Snotel Group Plot
Lake Powell Snotel Group Data
USBR 24 Month Study

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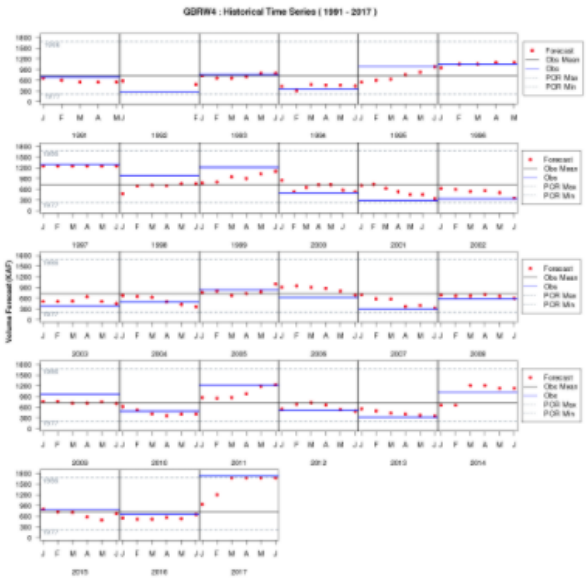
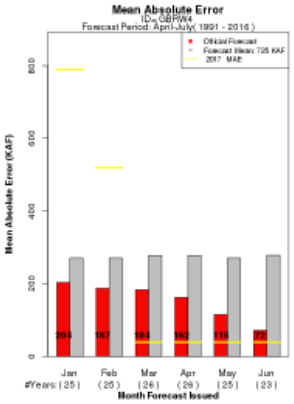
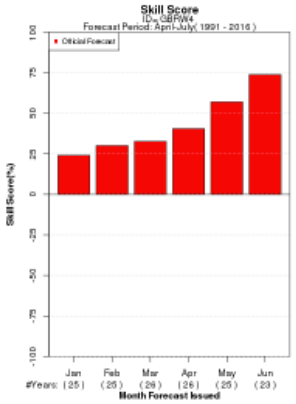
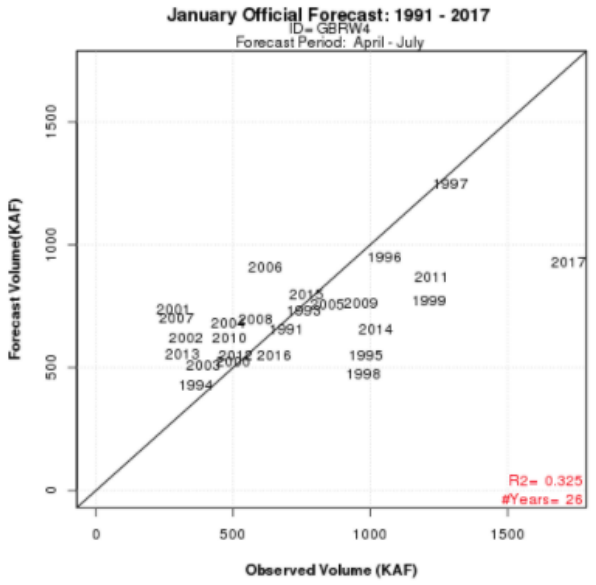
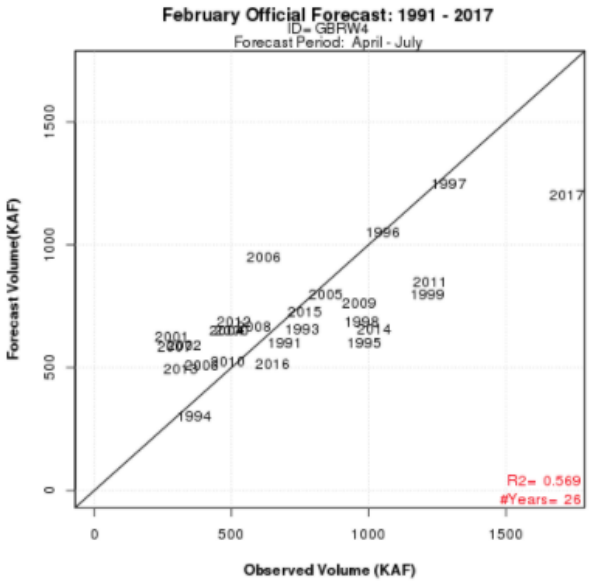
Historical and Annual verification information

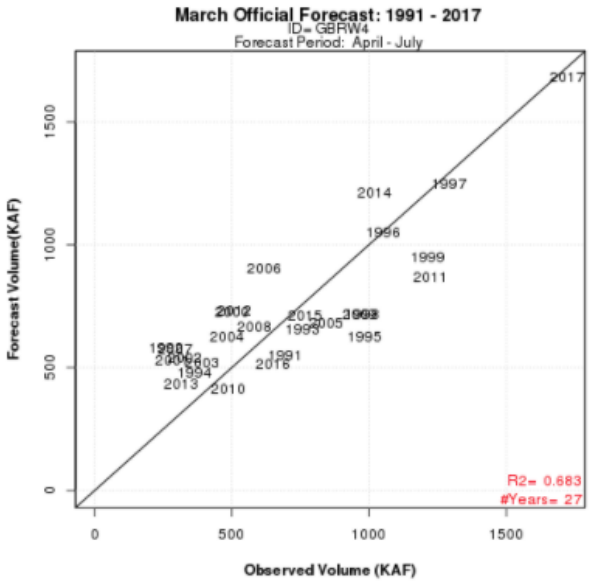






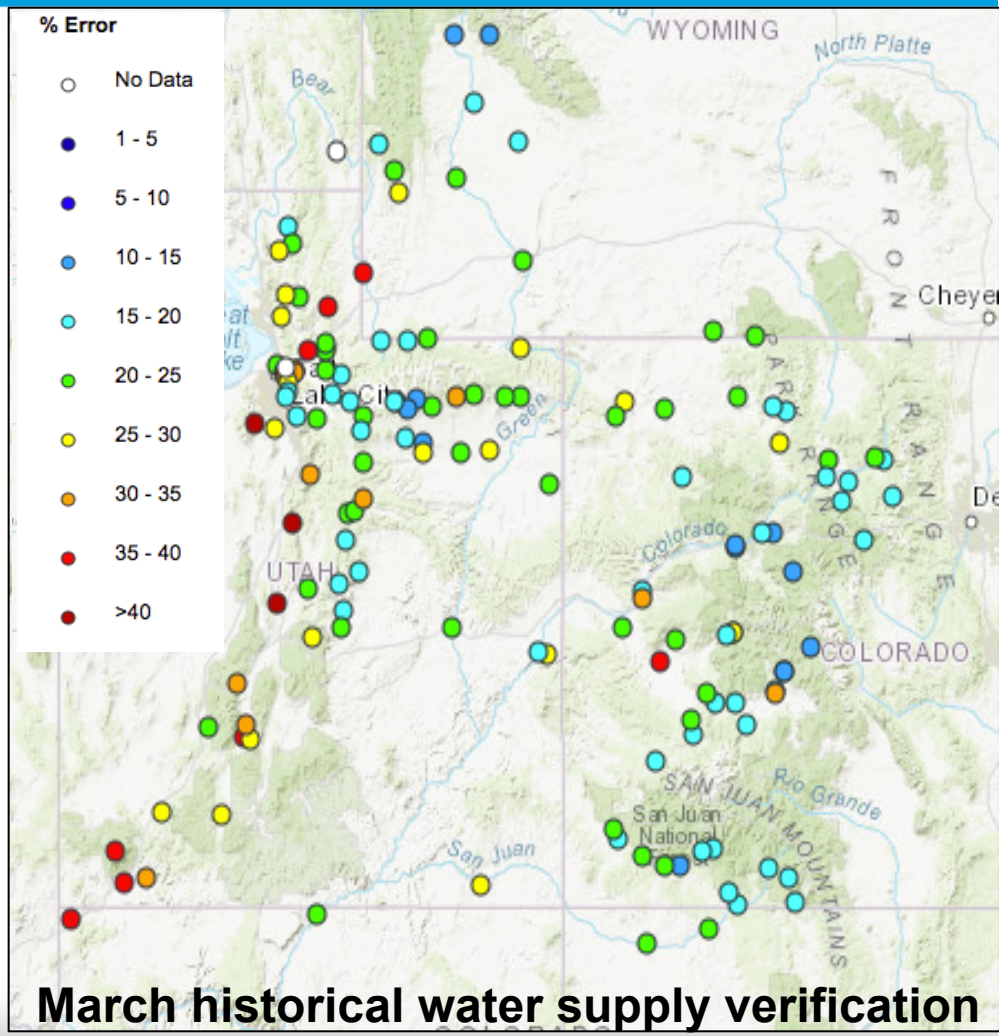






Verification Products: Map images indicating where seasonal volume model forecast performance is “better” or “worse” at various forecast issue dates.

- Historical and past year’s model mean absolute percent error are available at various lead times
  - Cooler colors = less error
- Errors typically lower at
  - Headwater locations
  - Snowmelt is primary source of runoff
  - Few or well documented diversions



March historical water supply verification

Conclusion

Forecasts provided by the CBRFC fall into a couple of broad categories:

Public Safety – Supporting NWS flood warning responsibilities

Water Resources – Supports water management, planning, reservoir operations

Products & services have evolved

We offered & you (as stakeholders) responded

Your feedback drives the evolution of products and services

Consistent requirements expressed by stakeholders

Accuracy, lead-time (becoming more important), forecast volume distribution (the when?)

Successful communication of forecasts and ***what is driving the forecasts*** (increasingly important)

Perhaps the biggest challenge we deal with

Stakeholder interaction helps us provide the proper information to you

Willing to visit your office / attend your meetings to determine what that should be