NOAA's Colorado Basin River Forecast Center

The CBRFC: Who we are and What we do.

Brent Bernard, *Hydrologist*

CWOA Meeting

October 1, 2015

Durango, Colorado

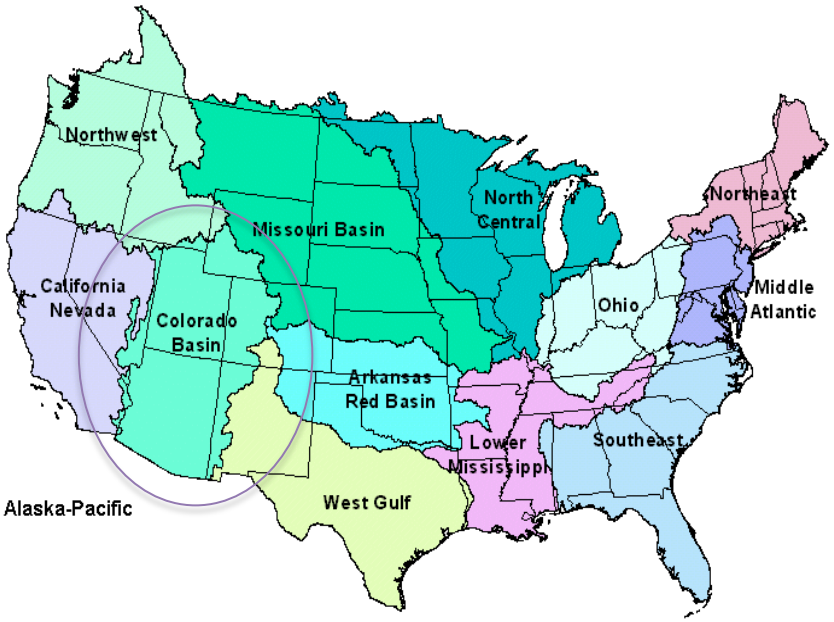
Who we are…

Mission: To understand and predict changes in the Earth's environment … to meet our Nation's economic, social, and environmental needs

Mission: The NWS provides weather, hydrologic, and climate forecasts and warnings … for the protection of life and property and the enhancement of the national economy

The Colorado Basin River Forecast Center generates streamflow forecasts and related datasets for the Colorado and eastern Great Basins

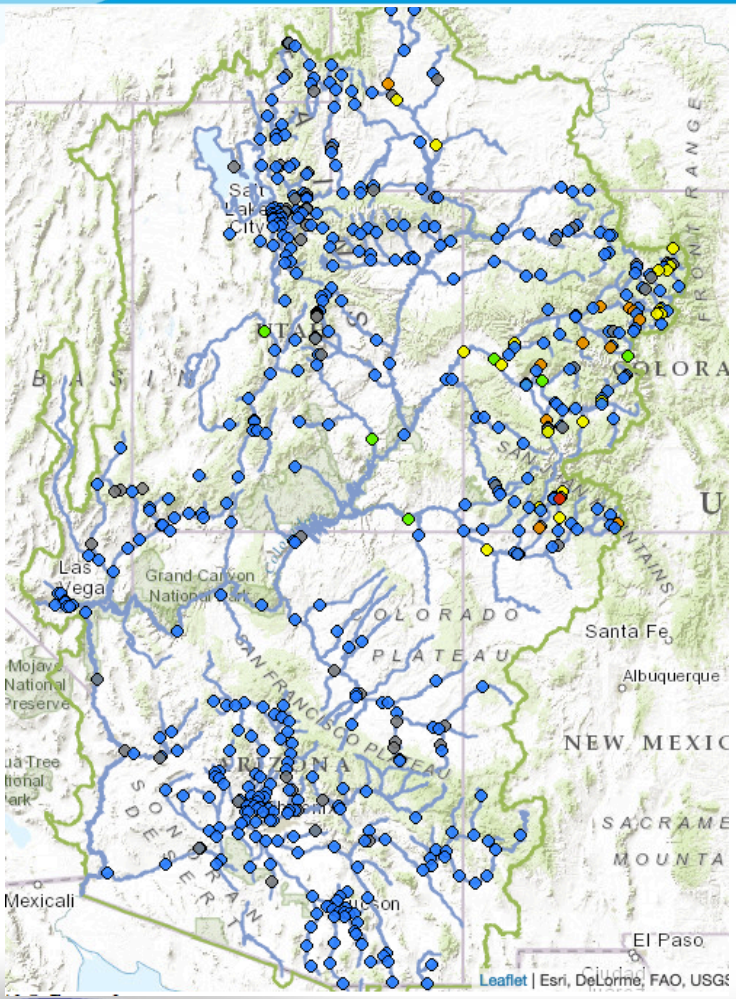
Colorado Basin River Forecast Center



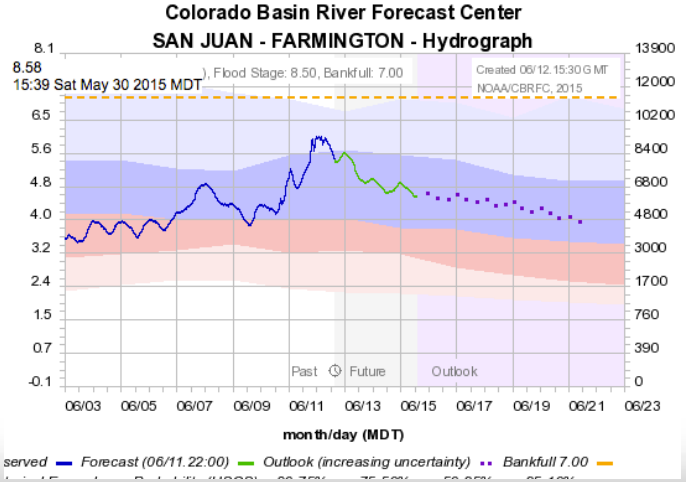
National Weather Service River Forecast Centers

- One of 13 RFCs in the nation
- Located in Salt Lake City
- Provide streamflow forecasts for the Colorado River and Eastern Great Basin

Deterministic and Flood Forecasts

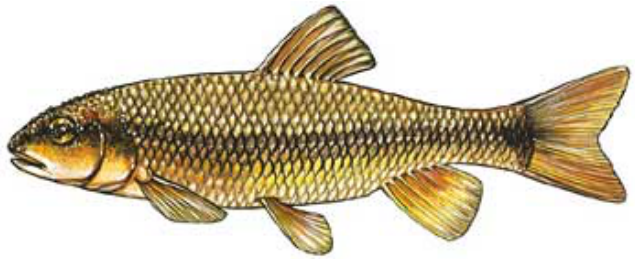


- Nominally provided at ~400 points every 6 hours (or 1 hour) out to 10 days.
- Flexible web interface to forecasts and data
- The operation requires large amounts of data (e.g. snow, precip, temps, streamflow)

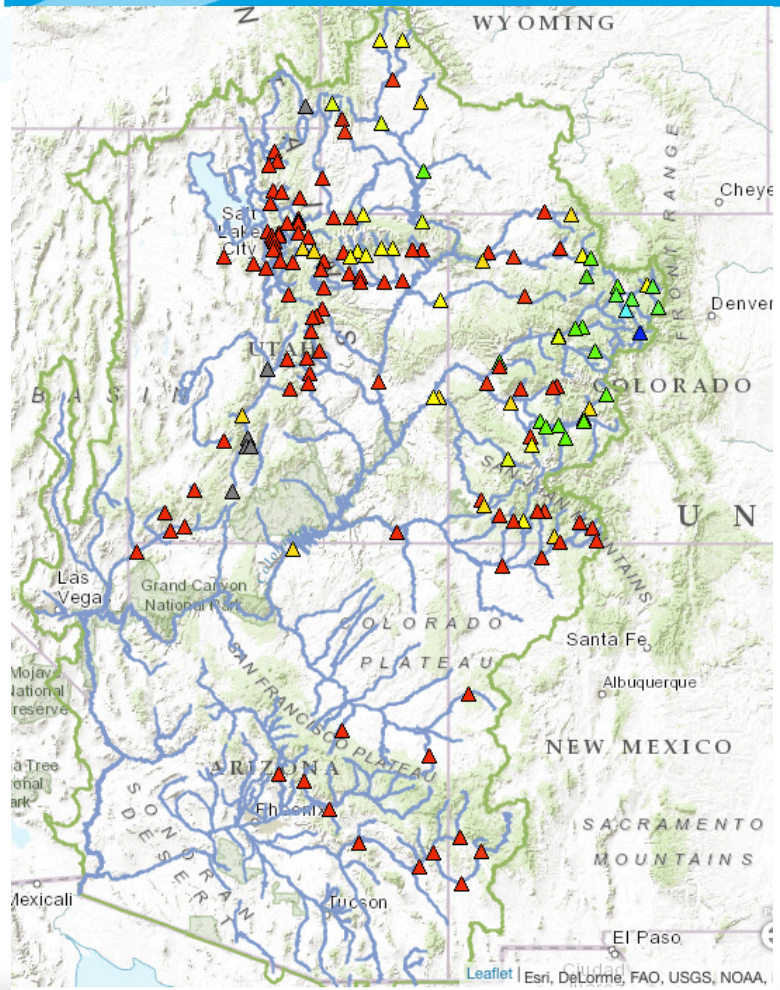


Flood Forecasts / Routine Forecasts

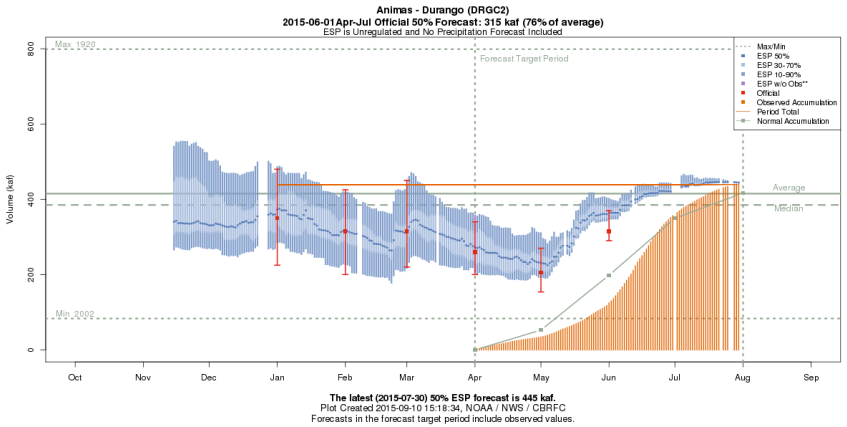
- Support the NWS Flood Warning Program
- Recreational uses
- Reservoir management
- Environmental requirements



Water Supply Forecasts



- Provided at ~160 points
- Official forecast once a month Jan-June
- Model guidance updated daily
- Volumetric probabilistic forecast (expected volume of water past a point over the runoff season April-July)



Water Supply Forecast Uses

- Major input to USBR reservoir models (24-Months Study)
- Water managers throughout the basin

Modeling system

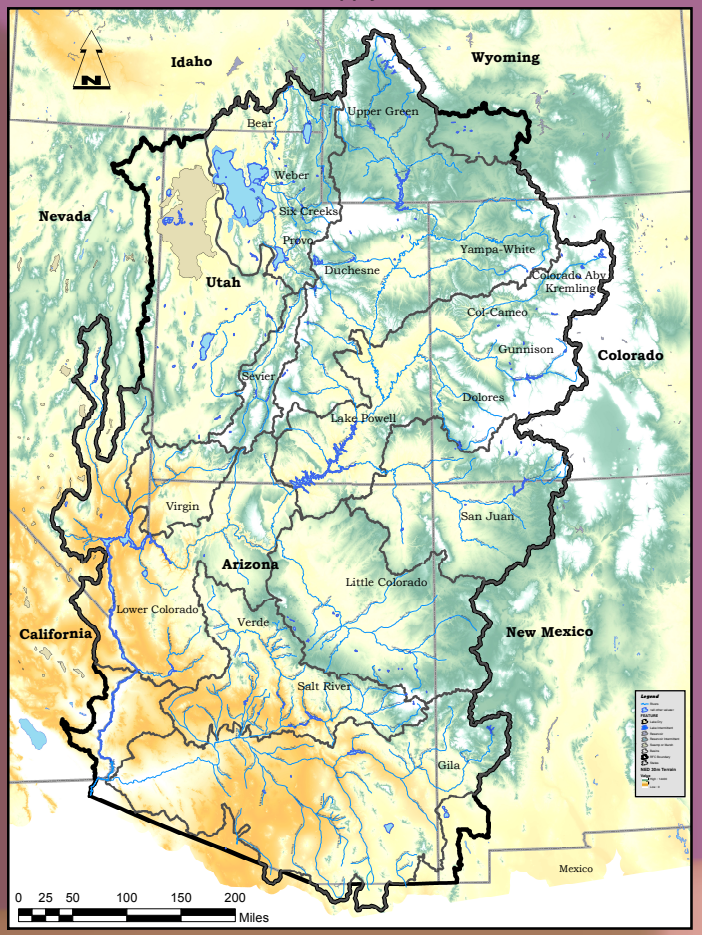
Calibration Model:
30-years of record (1981-2010)
Really important for having a model that is accurate and based on historical information.

Operations Model:
Really important for disseminating timely information and data to our stakeholders, protecting life and property, and maintenance of our model states.

ESP Model:
Important for decision support services we provide, especially with how it relates to water supply. Forecasts made with this information have big operational and policy implications.

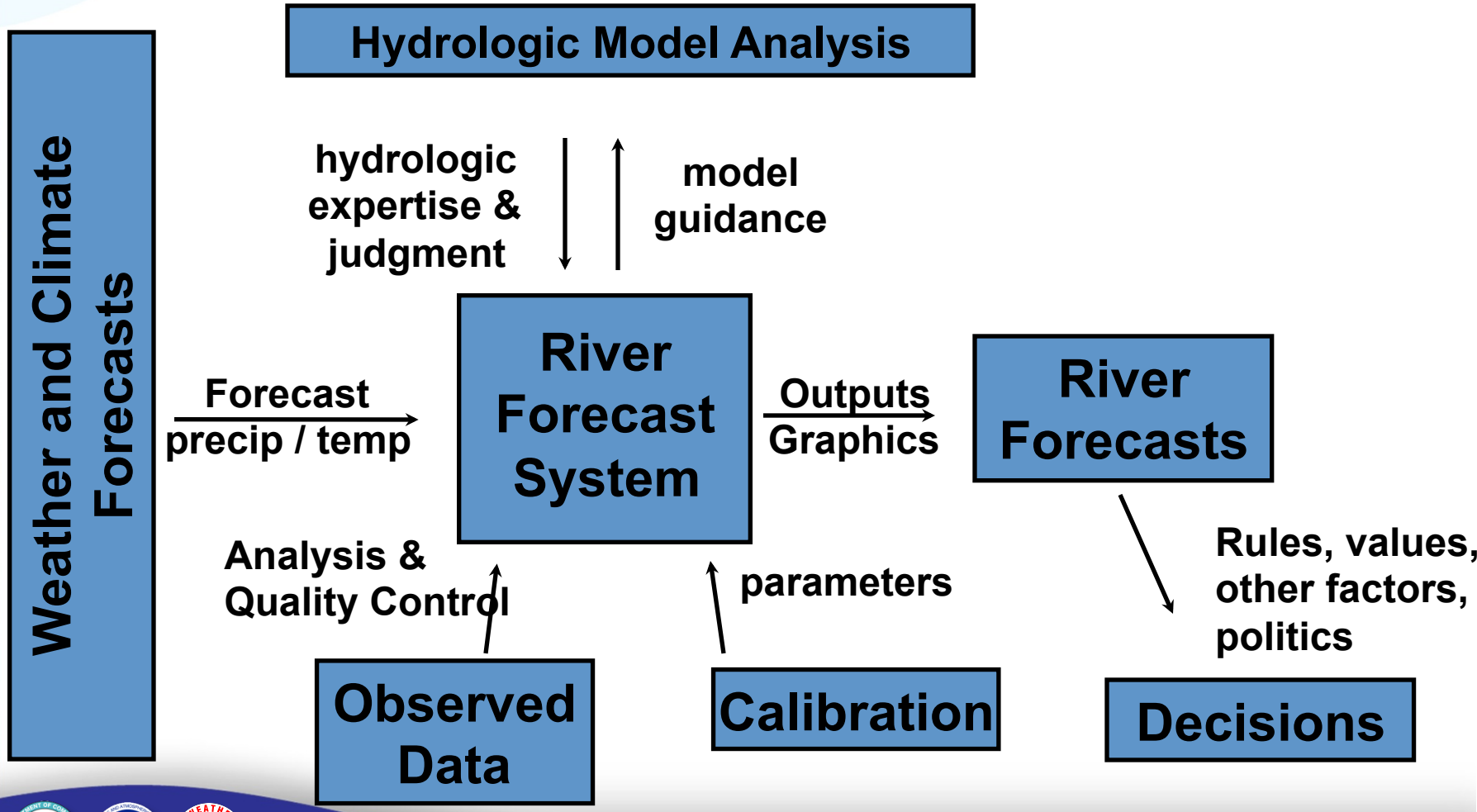
CBRFC Forecasting Process

CBRFC Water Supply Forecast Basins



NOAA,NWS,CBRFC www.cbrfc.noaa.gov B.Bernard 2014

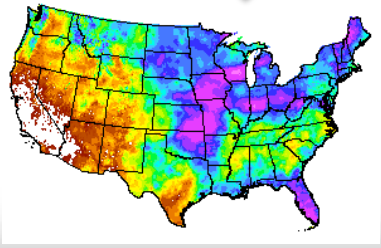
Numerical Modeling Process
Lump Sum Model

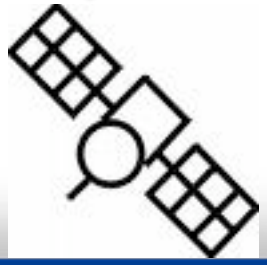


Observed Data: Sat, Gage, Radar

- High quality precipitation **analyses** and forecasts are key to RFC operations
- RFC staff quality control precipitation from gauge reports and radar and satellite estimates.
- Precipitation estimates for specific locations, spatially gridded, and basin averages are produced hourly to monthly.

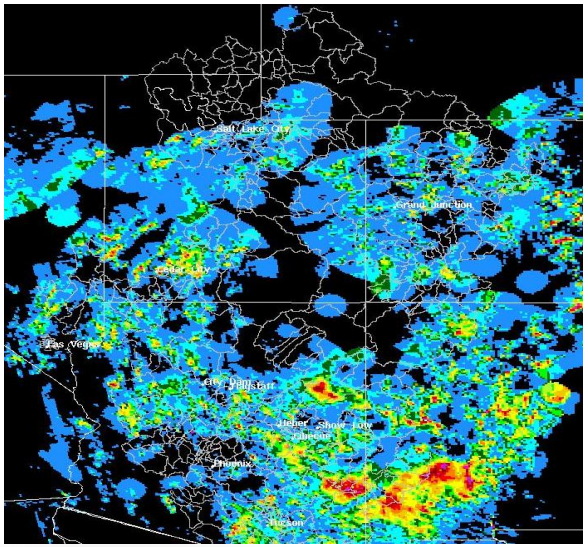
Multi-sensor Precipitation Estimator: Tool for hourly precipitation analysis

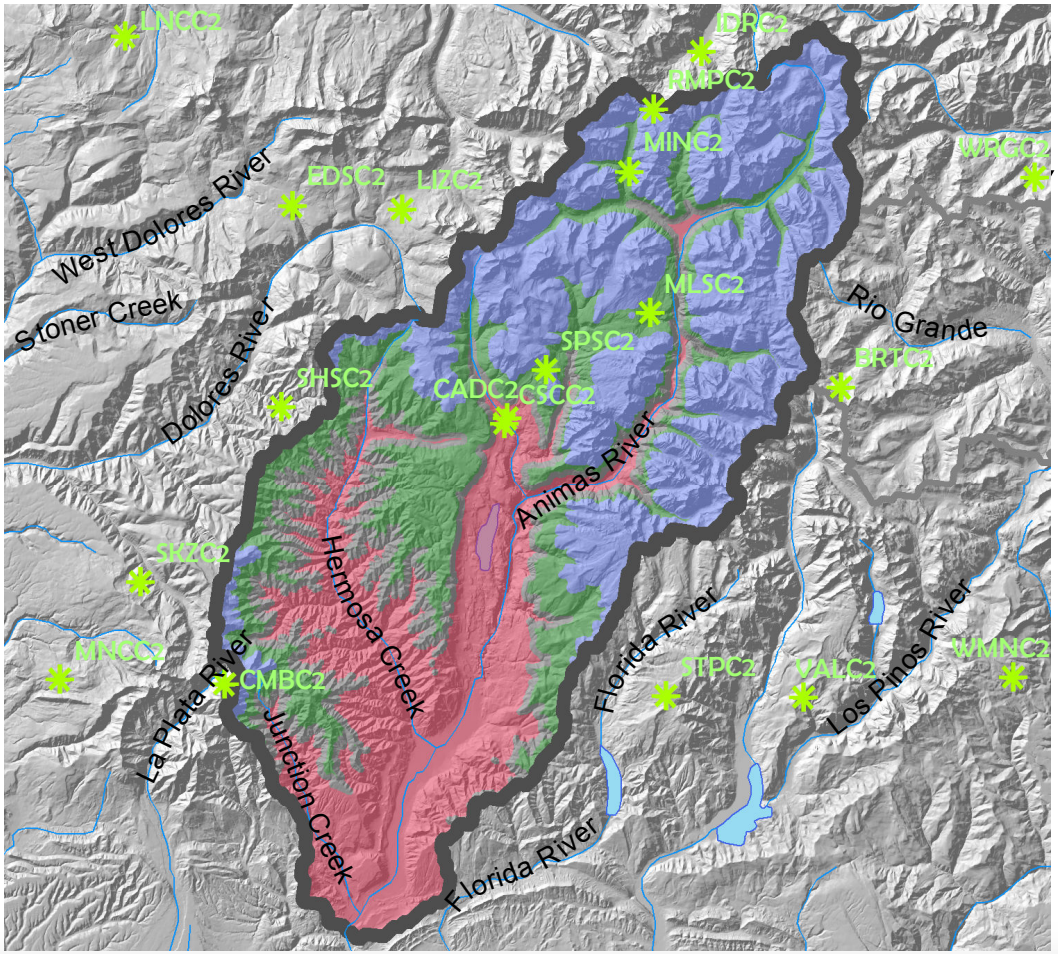




Observed Data Model Inputs

- Precipitation
- Temperature
- Streamflow

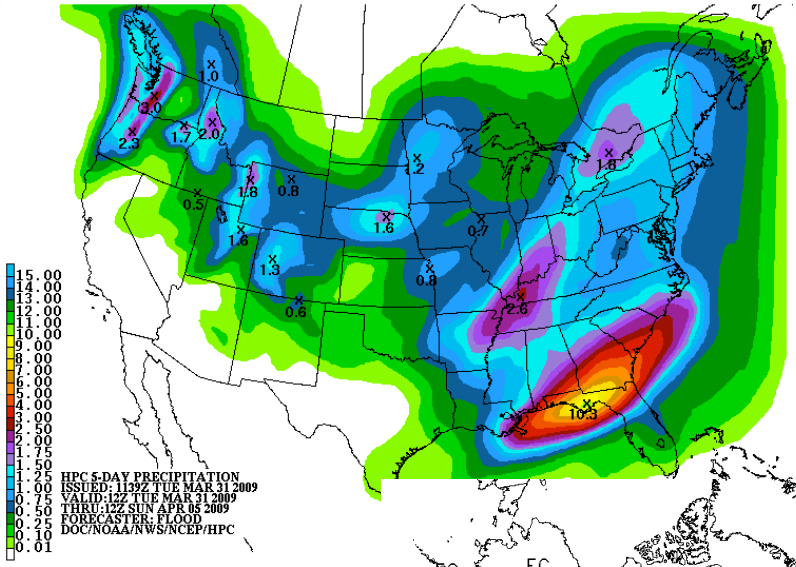


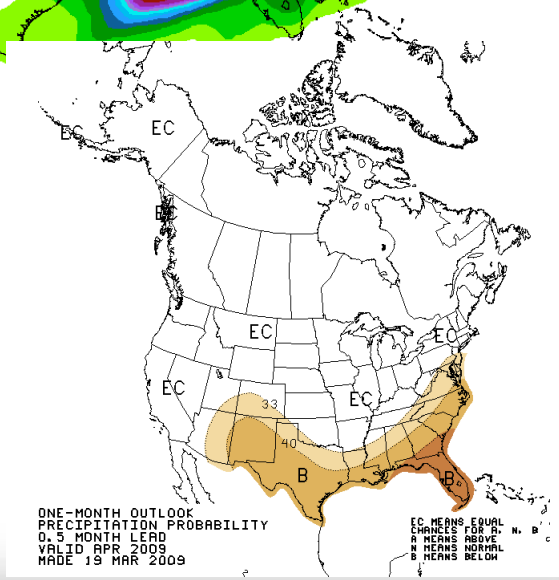


Weather and Climate Forecasts

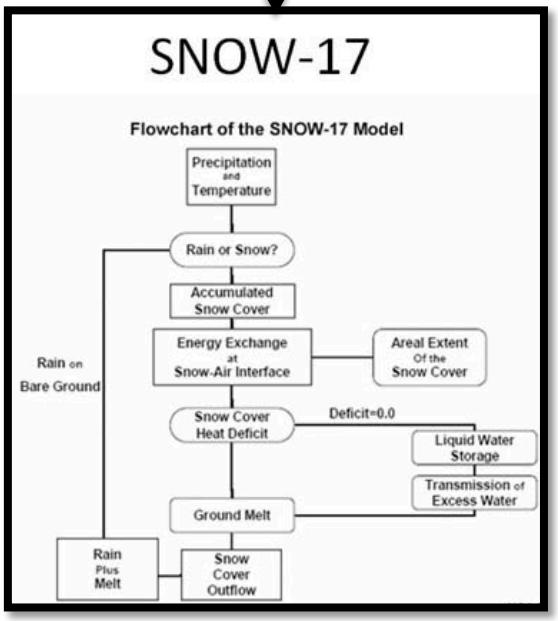
RFC forecast system incorporates both weather and climate forecasts:

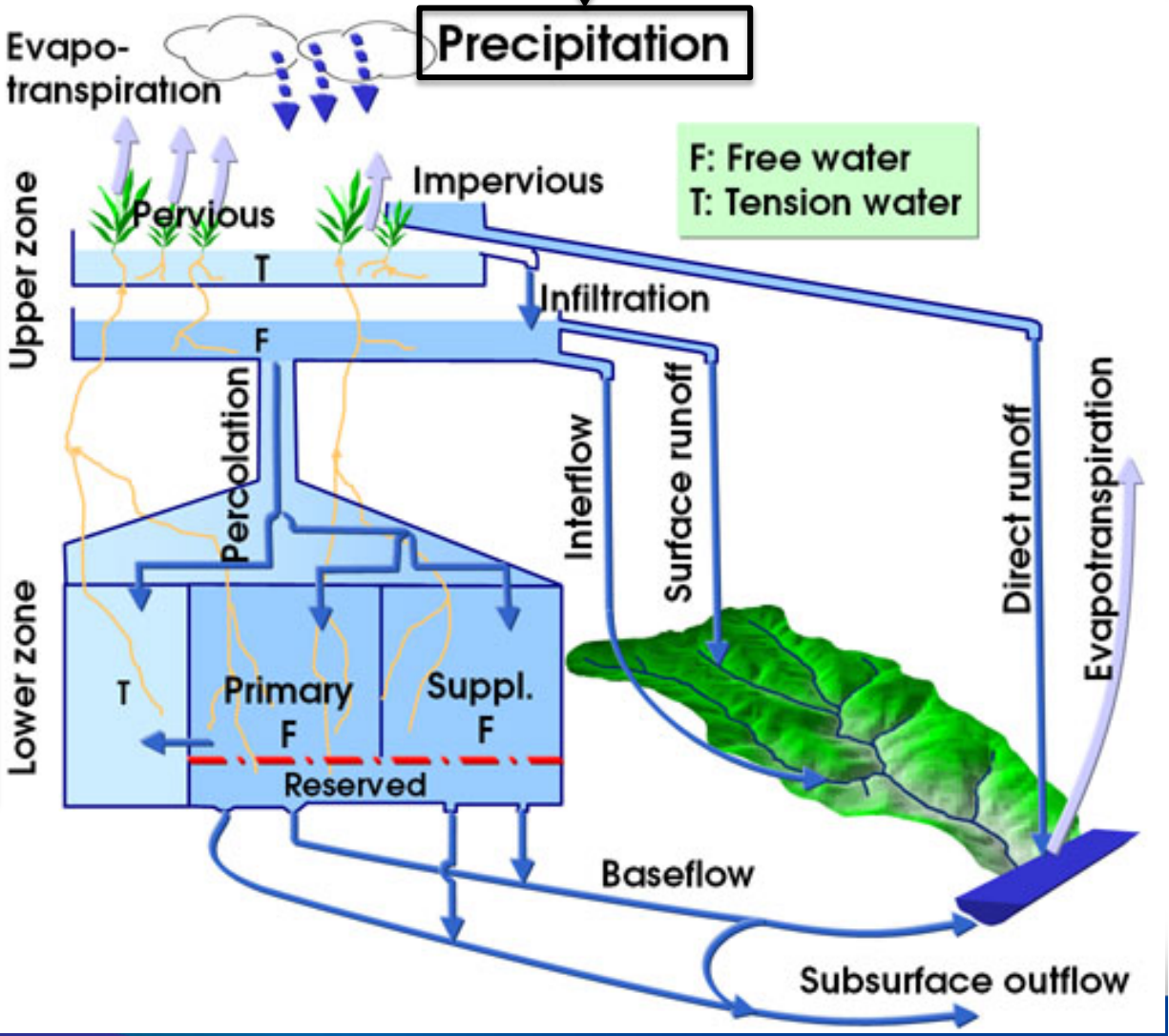
- **Weather forecasts integrated into daily operations with forecaster control over point and basin average values**
  - **5 days precipitation forecast**
  - **10 days temperature forecast**
- **Climate forecasts are integrated into seasonal water supply forecasts through probability shifts to ensemble traces in ESP**



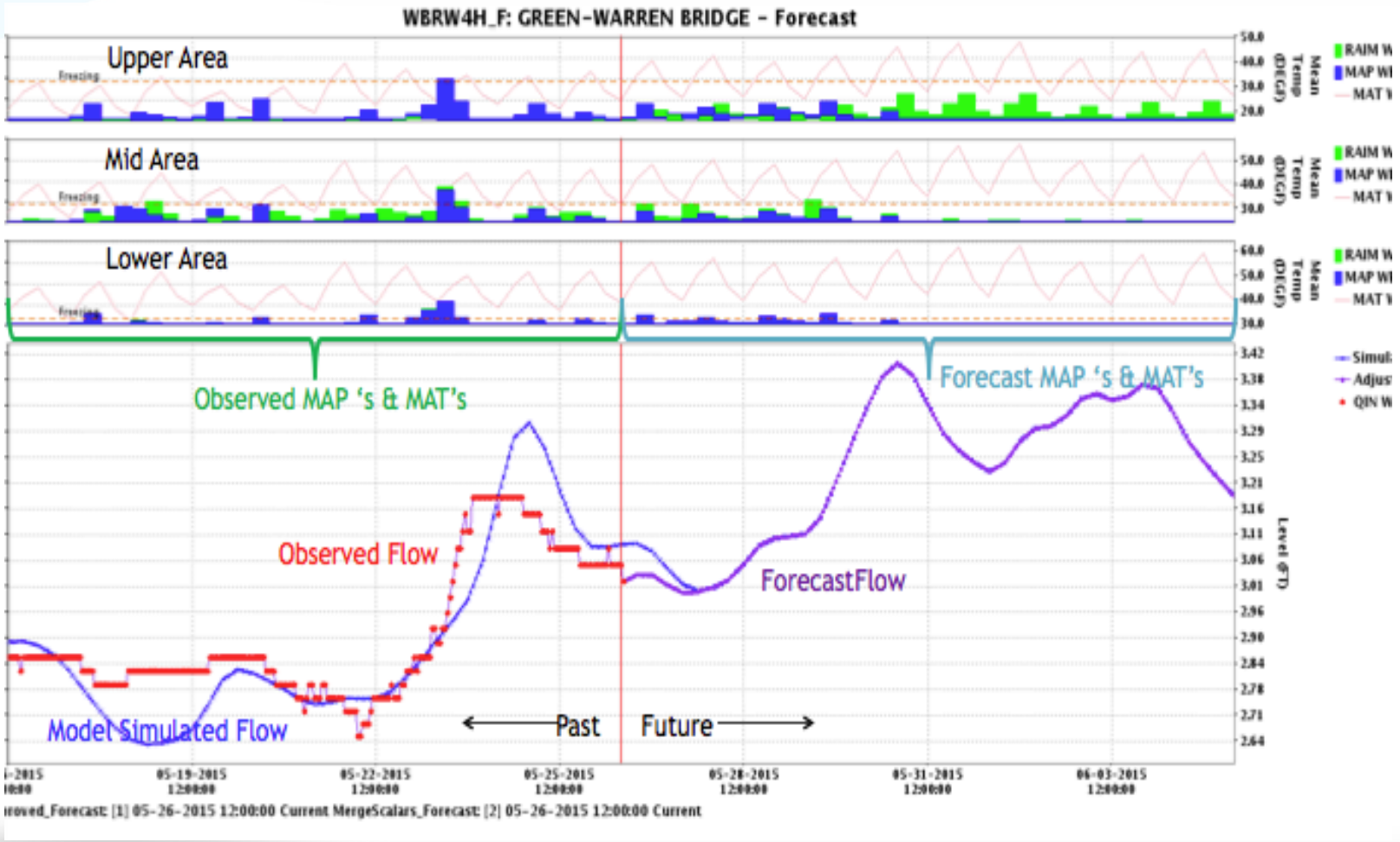


Model Components

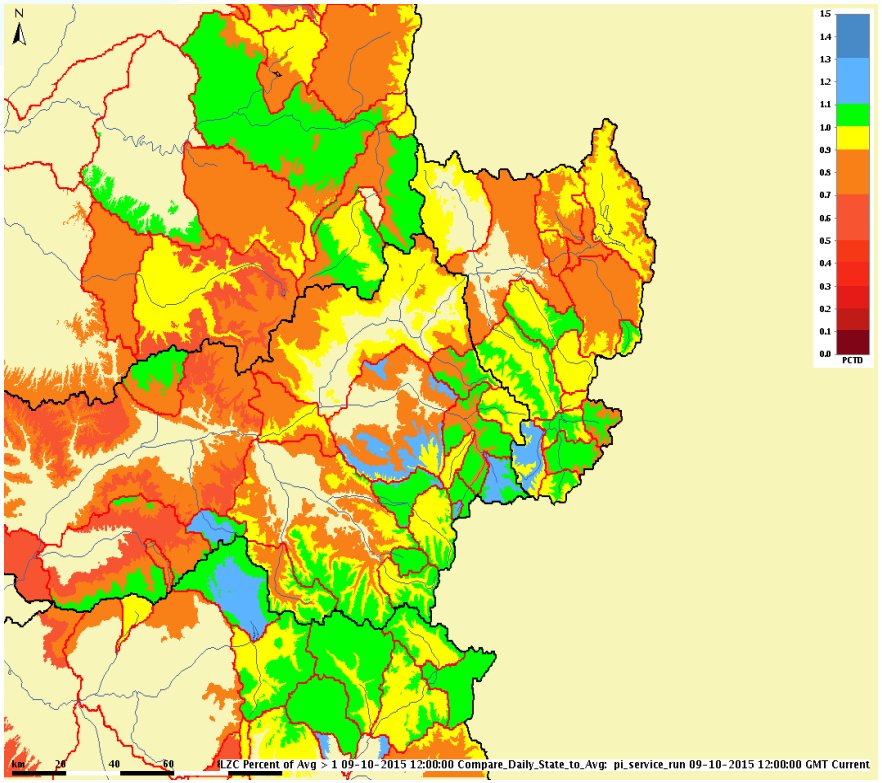




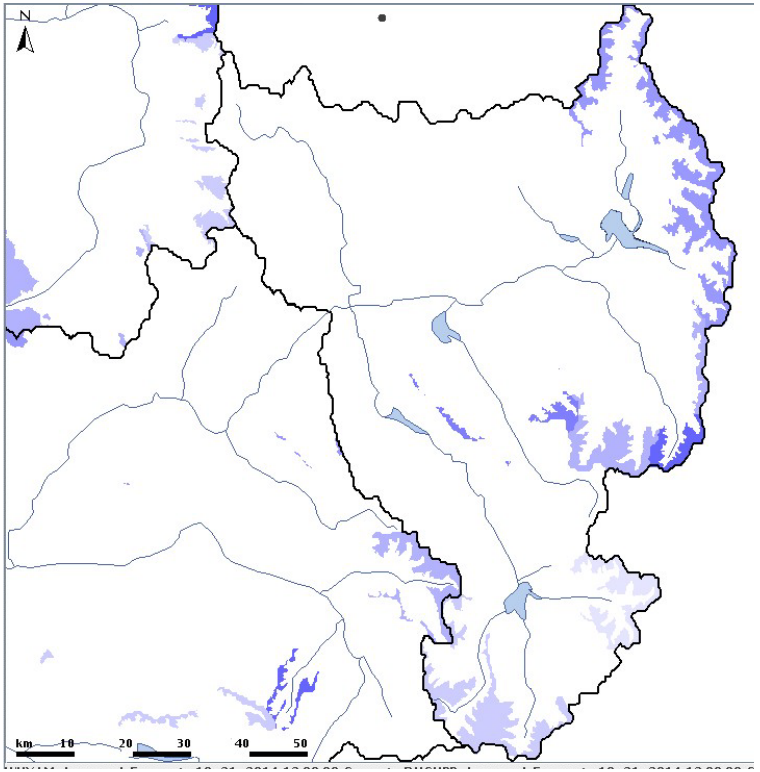
CHPS-Interface to the model



CHPS - Spatial Displays

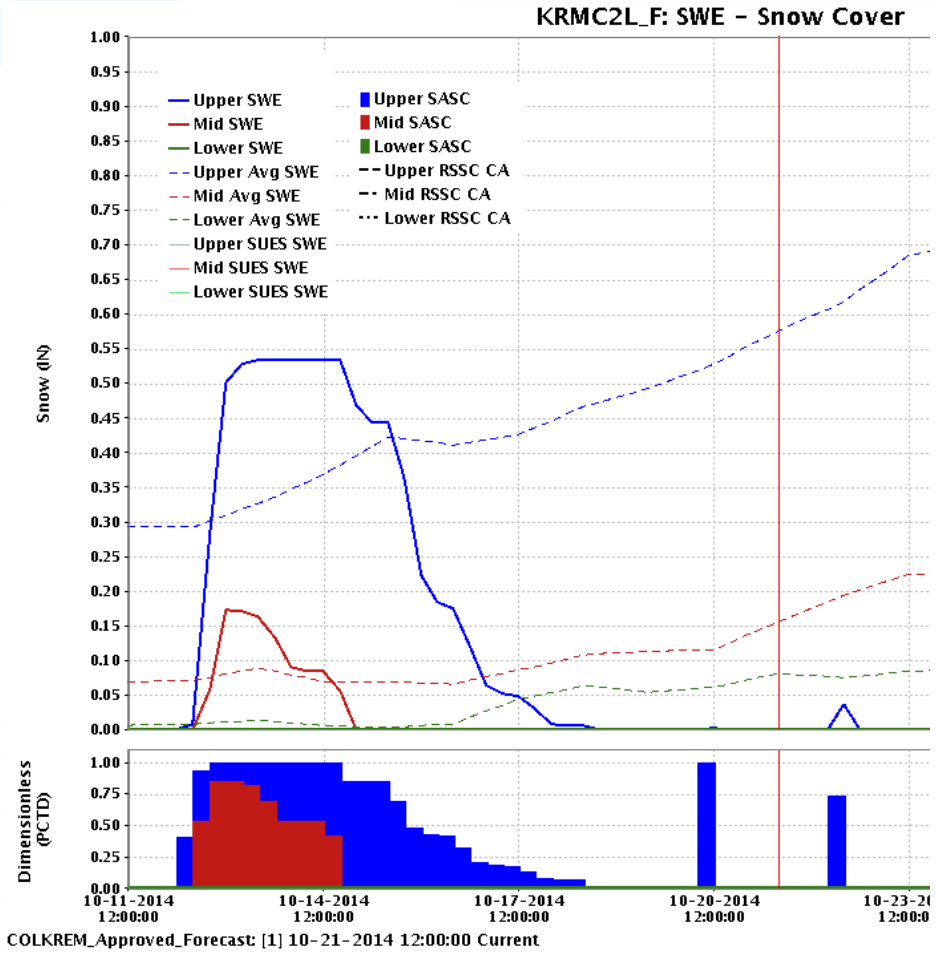


Basin modeled soil moisture states as a percent of average.



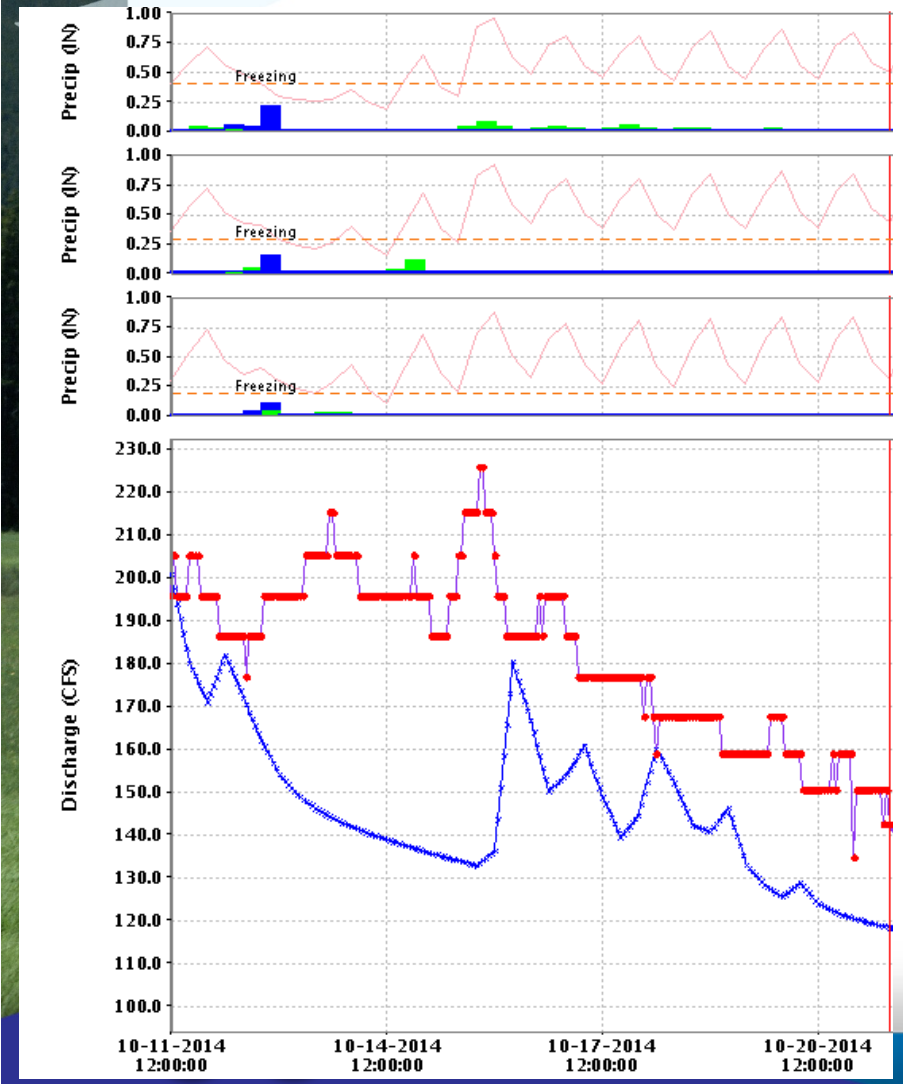
Snow water equivalent accumulation and melt.

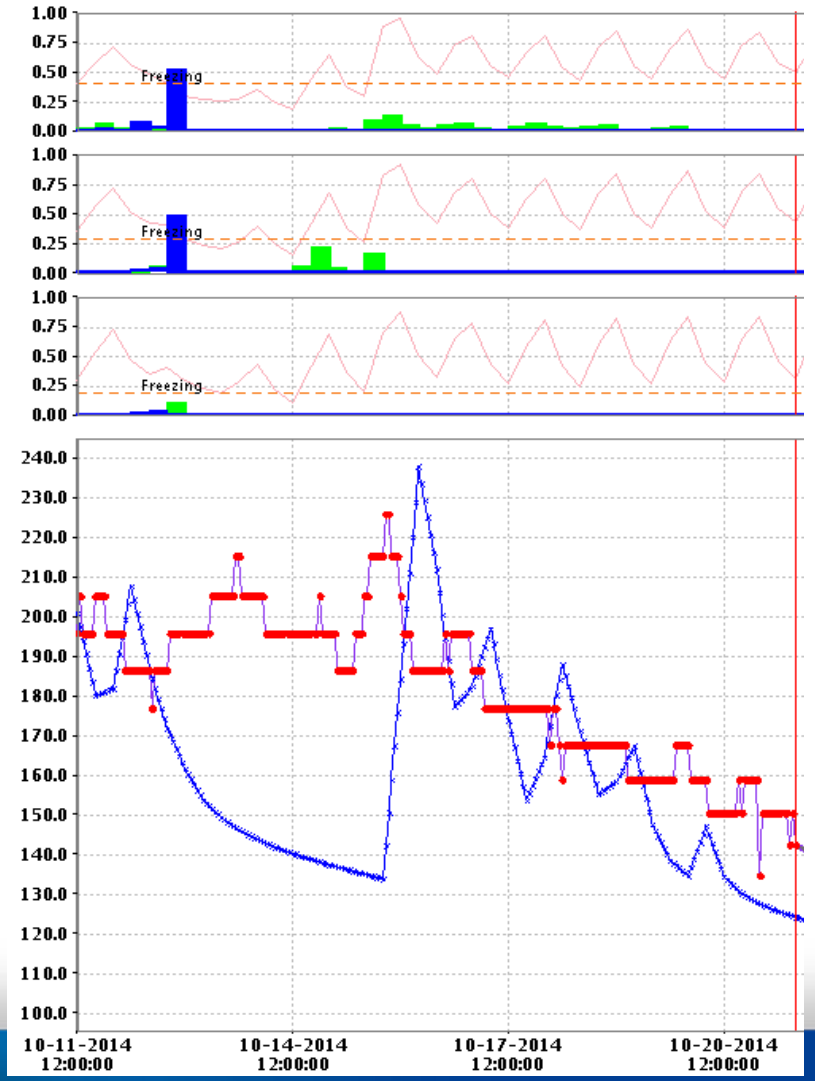
Interacting with the model



Forecasters have the ability to modify the model's behavior through the use of "mods". Mods can adjust many model parameters: precipitation amounts, temperatures, rate of melt, etc…

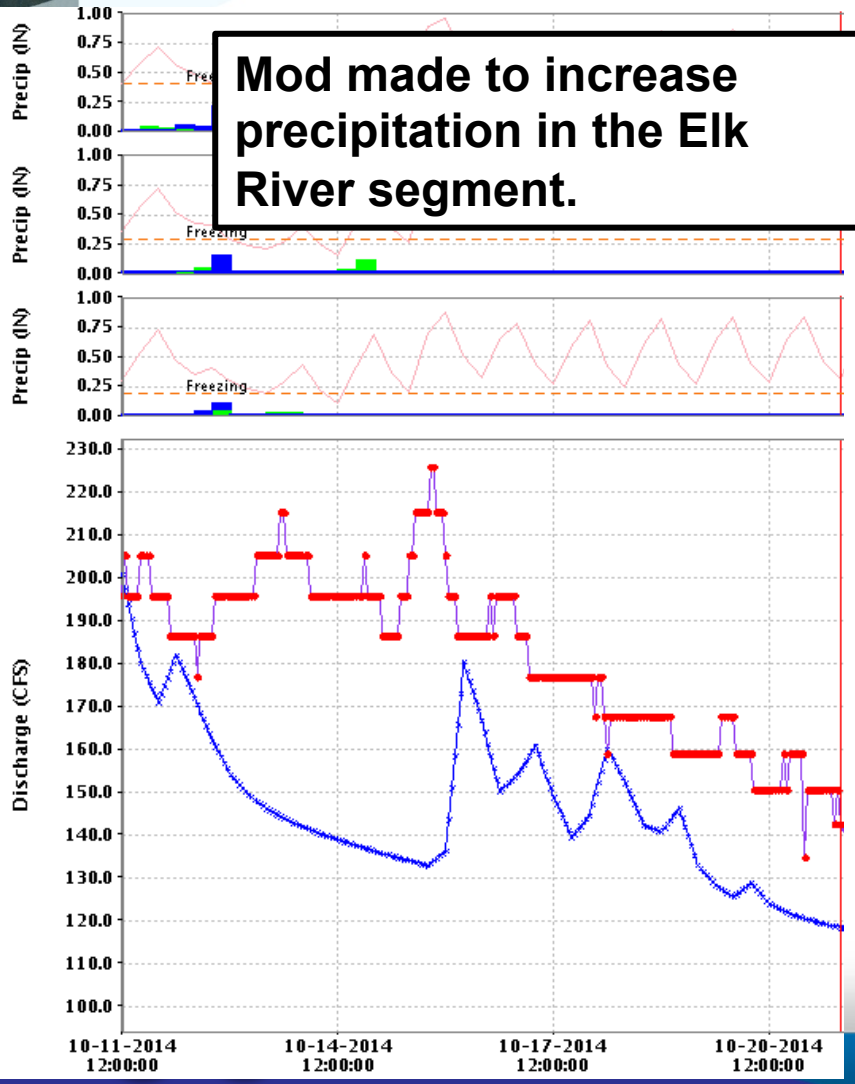
Developing Mods

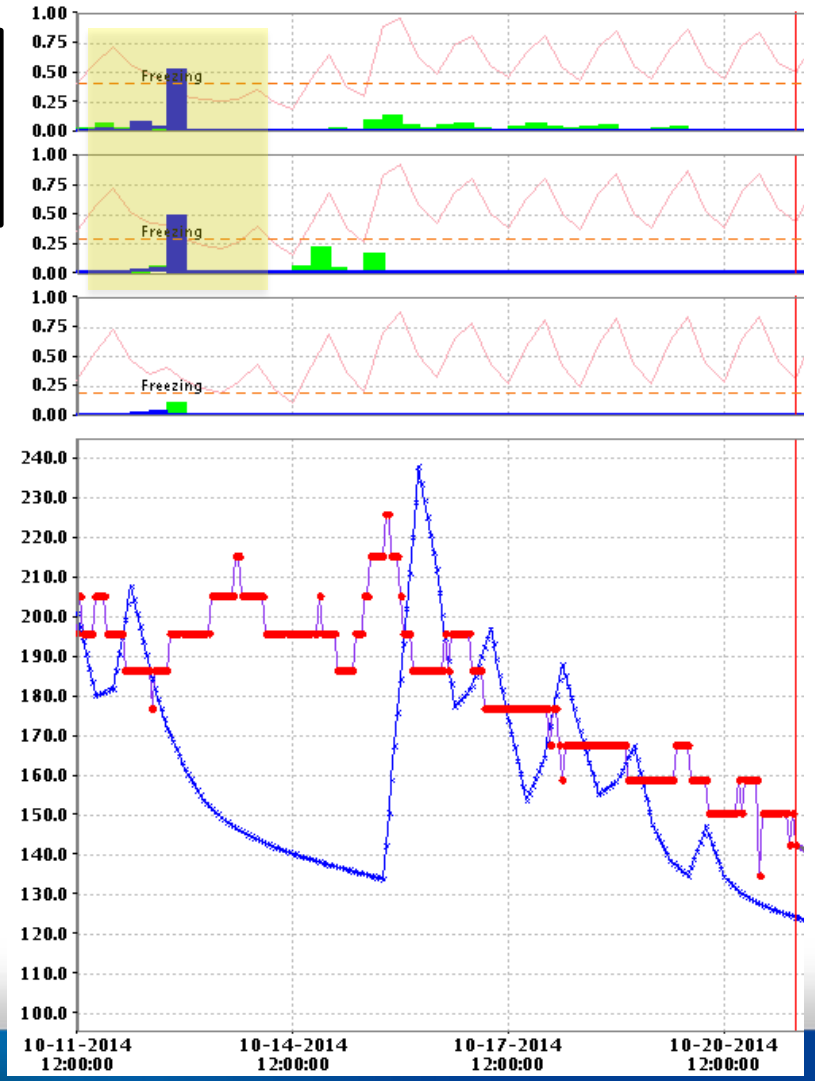




Developing Mods

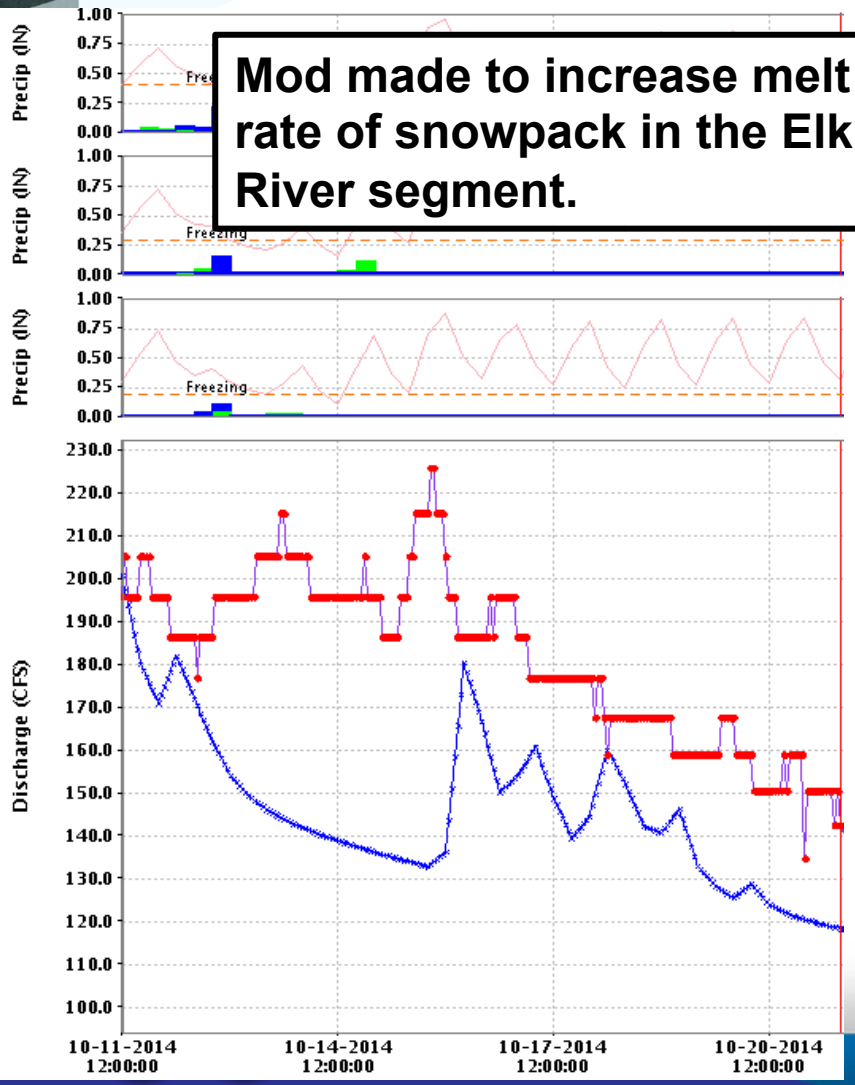
Mod made to increase precipitation in the Elk River segment.

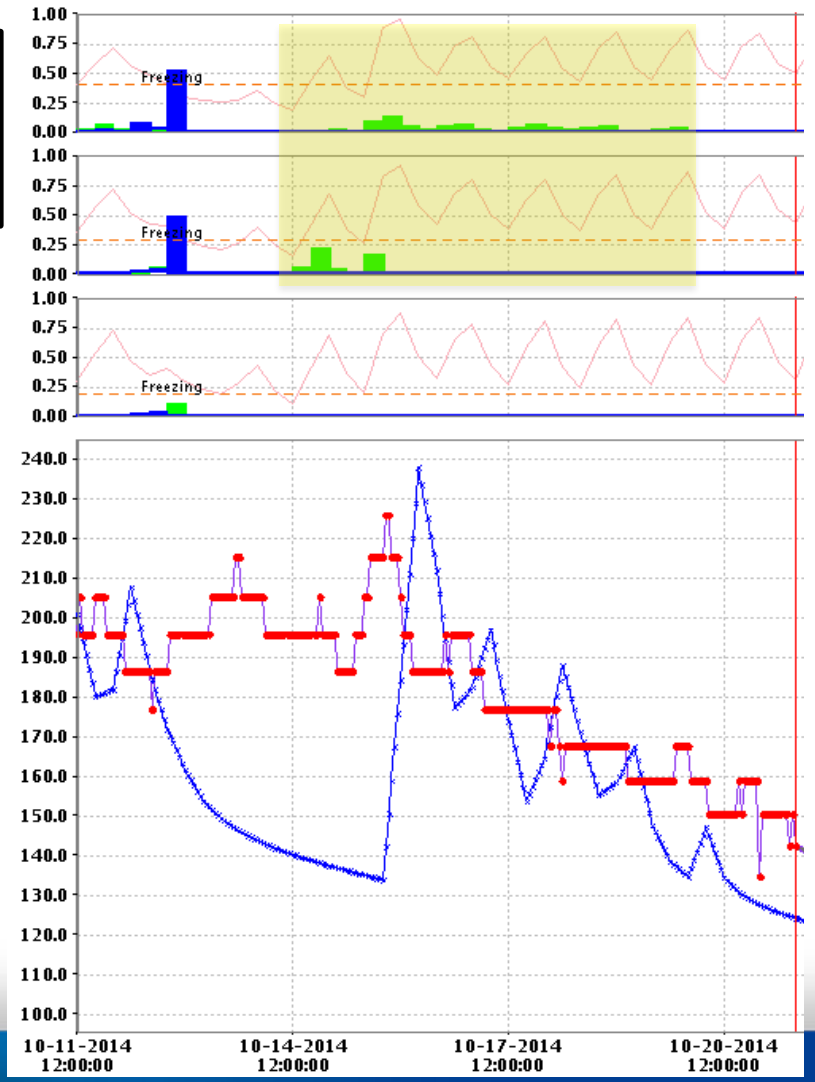




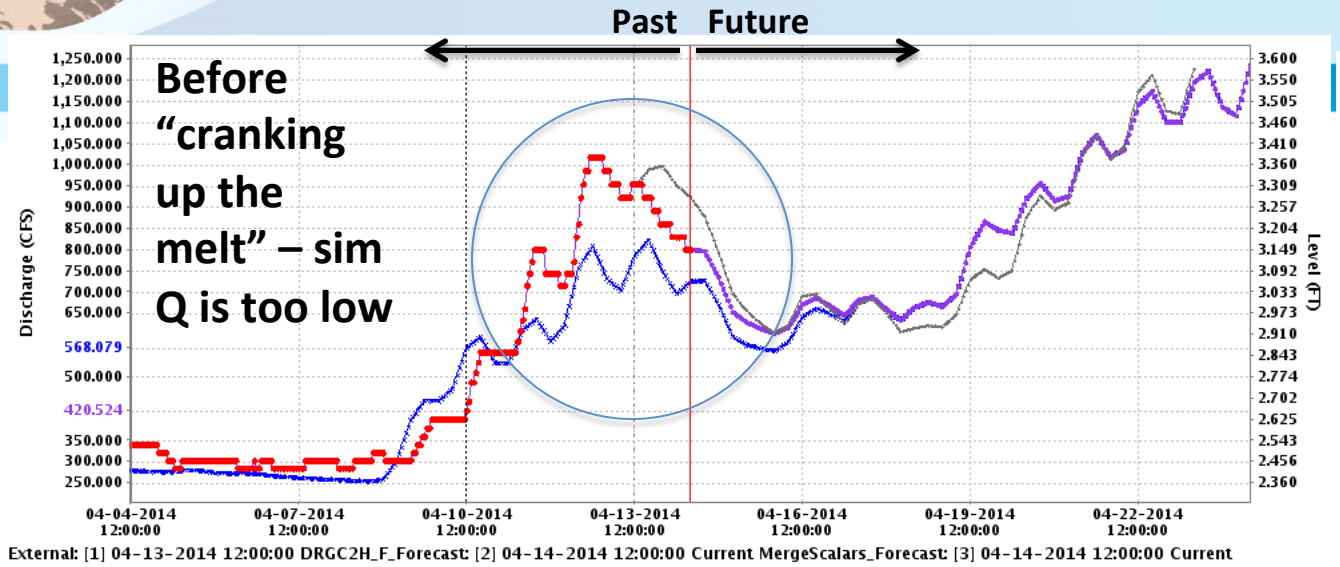
Developing Mods

Mod made to increase melt rate of snowpack in the Elk River segment.

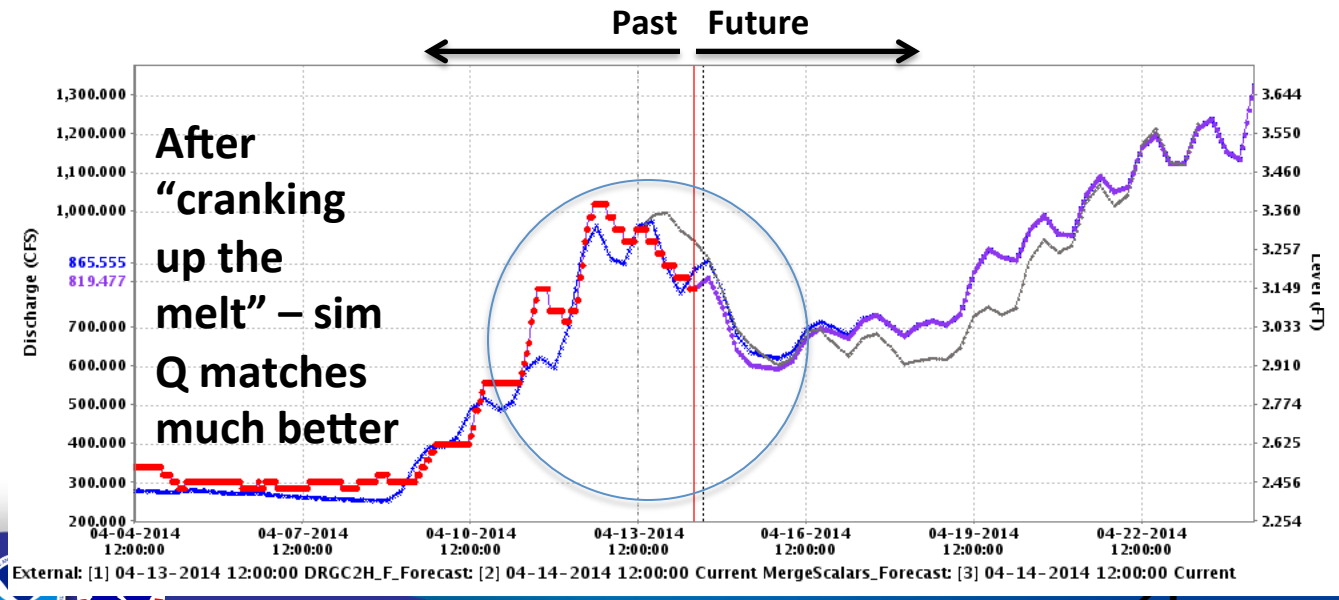




Manual Adjustments by Forecasters



Recent Obs Q
Model Sim Q
Official Fcst Q

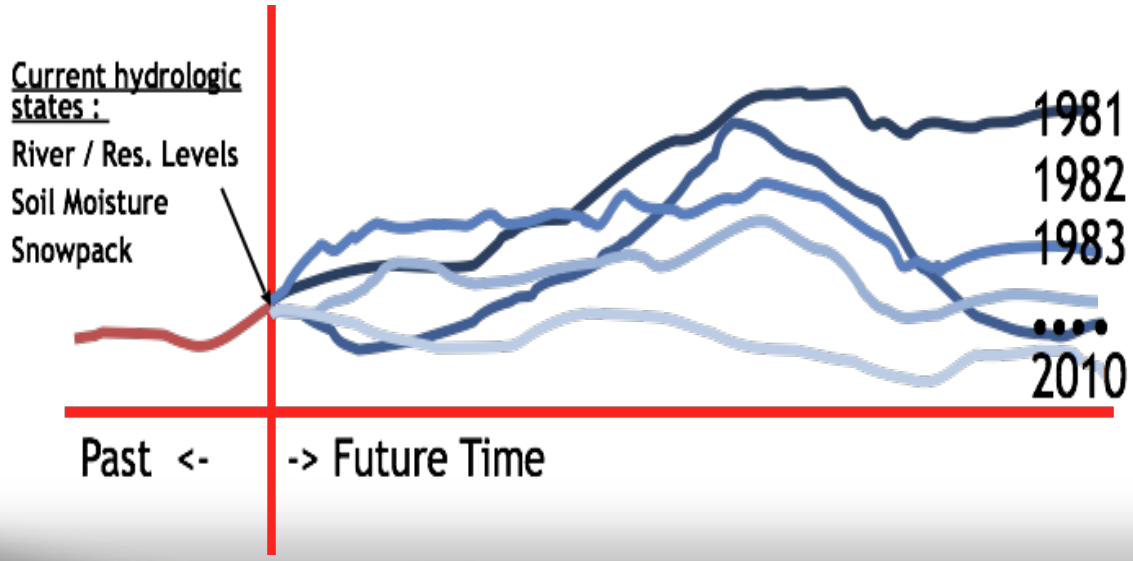


Recent Obs Q
Model Sim Q
Official Fcst Q

Credit: plots courtesy B. Bernard (CBRFC)

Ensemble Streamflow Prediction -ESP

- Start with current conditions
- Apply precipitation and temperature from each historical year (1981-2010) *going forward*
- 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



Our Partners

- We are highly dependent on real-time gage networks to inform our models and forecasts.
  - NRCS SNOTEL network
  - USGS streamflow network
  - BOR Reservoir network

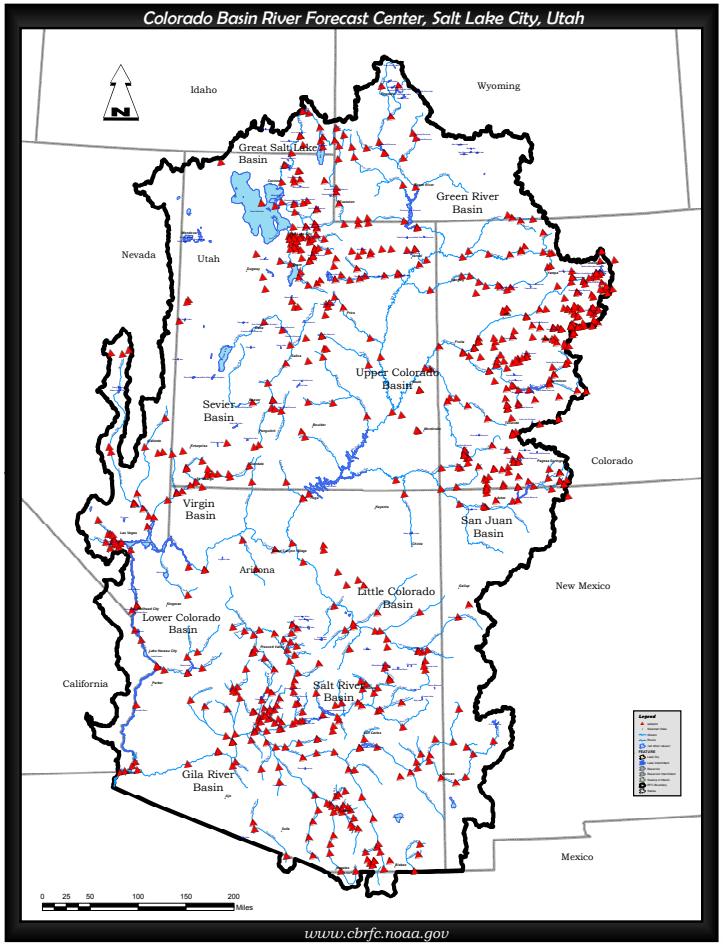
NRCS
Natural Resources Conservation Service

USGS
science for a changing world

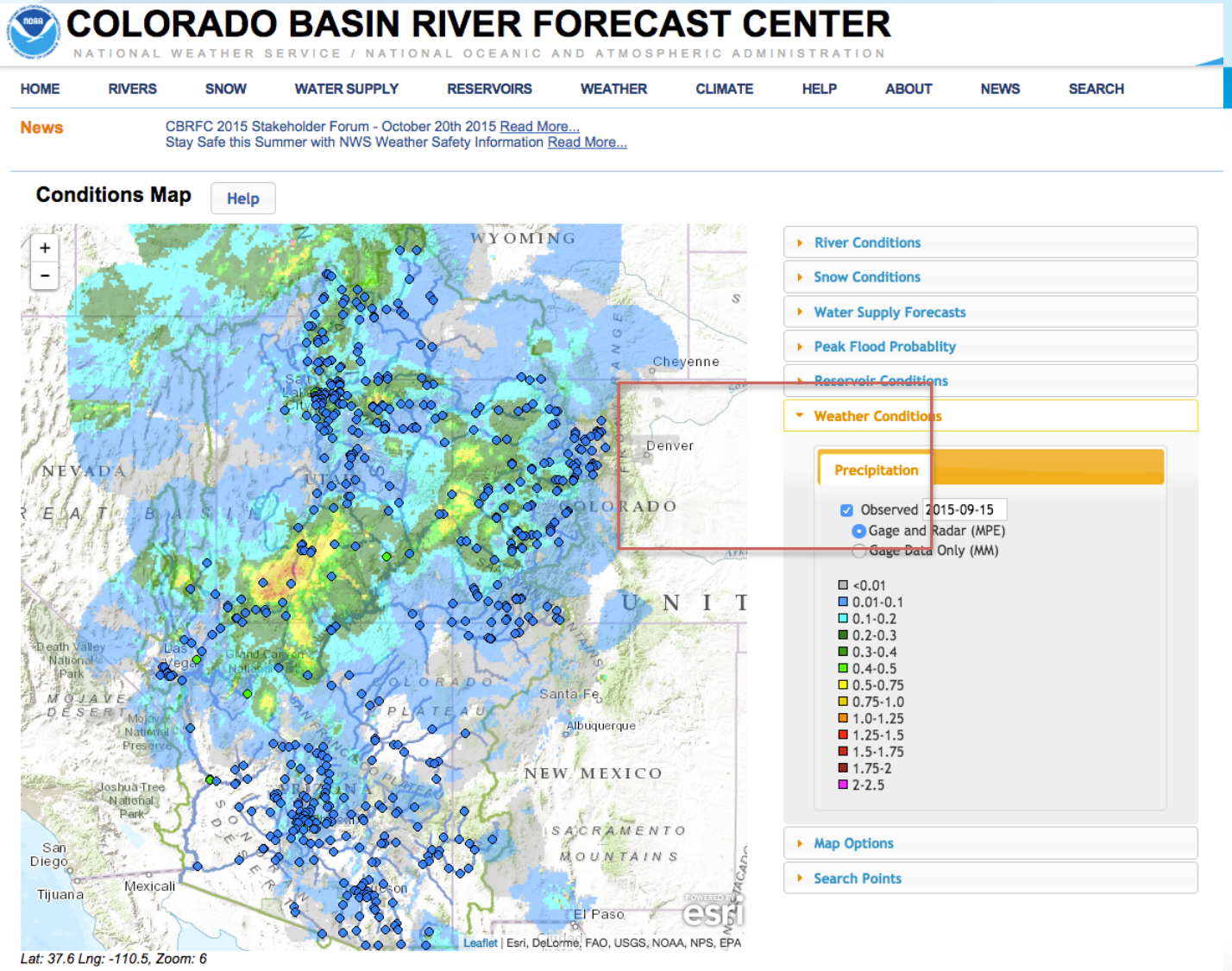
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

“Quick Tour” products and Services

- www.cbrfc.noaa.gov
- Webinars
- Static Map Products
- Join the Mailing list via (webmaster)
- Call us anytime!



Quick tour of cbrfc.noaa.gov



COLORADO BASIN RIVER FORECAST CENTER

NATIONAL WEATHER SERVICE / NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

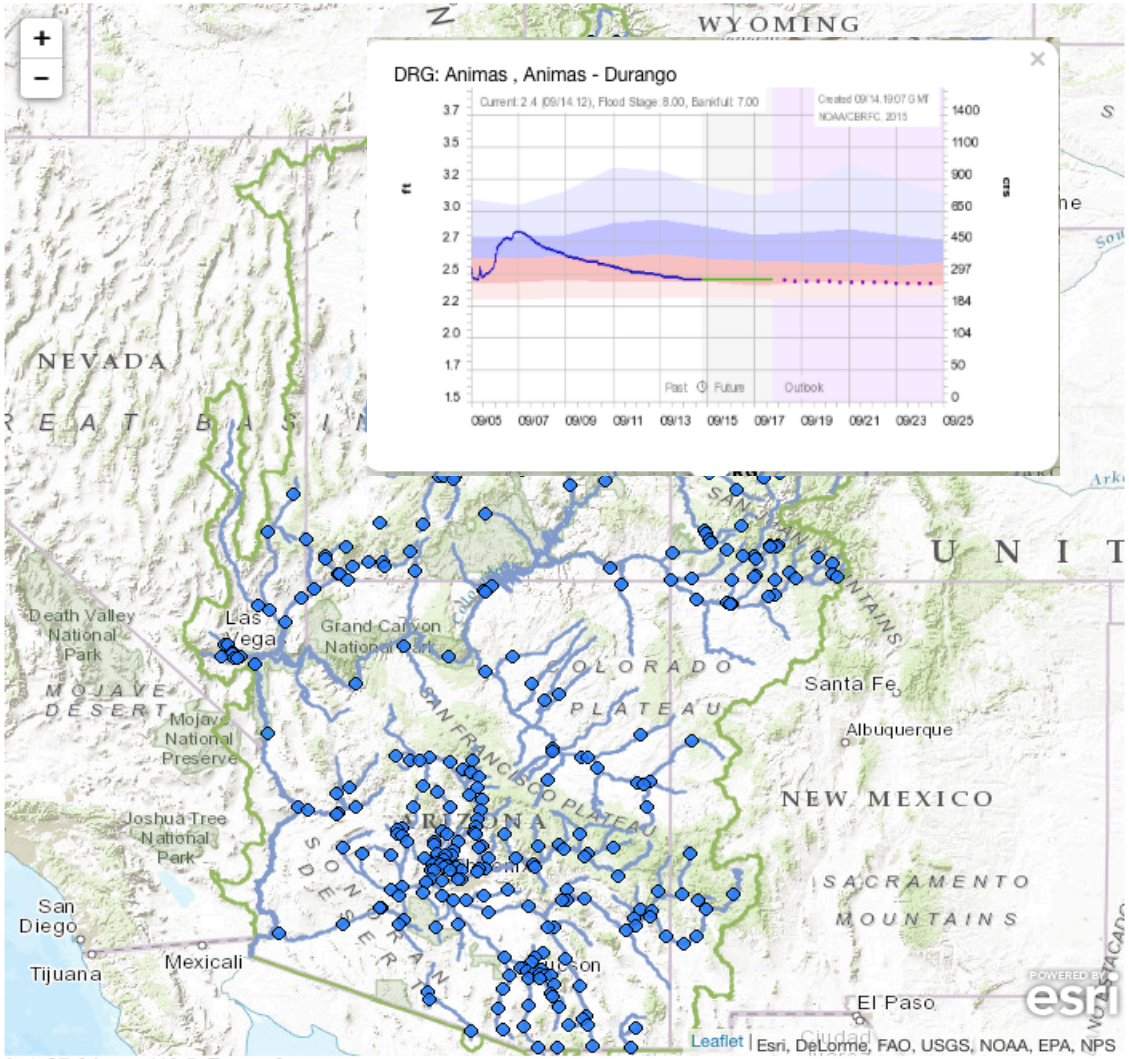
HOME | RIVERS | SNOW | WATER SUPPLY | RESERVOIRS | WEATHER | CLIMATE | HELP | ABOUT | NEWS | SEARCH

News

CBRFC 2015 Stakeholder Forum - October 20th 2015 Read More...
Stay Safe this Summer with NWS Weather Safety Information Read More...

Conditions Map

Help



Lat: 37.6 Lng: -110.5, Zoom: 6

River Conditions

Data Updated: 09/14/19Z Help

Show Hide Other Types
- Data
- Forecast
- Reservoir Inflow
- Reservoir Outflow
- Official Flood
- Active

- Not Available
- Normal
- Significant Rise
- Near Bankfull
- Above Bankfull
- Above Flood Stage
- Outlook (> 3 days)

Popup Alerts

Snow Conditions

Water Supply Forecasts

Peak Flood Probablity

Reservoir Conditions

Weather Conditions

Map Options

Search Points

COLORADO BASIN RIVER FORECAST CENTER

NATIONAL WEATHER SERVICE / NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

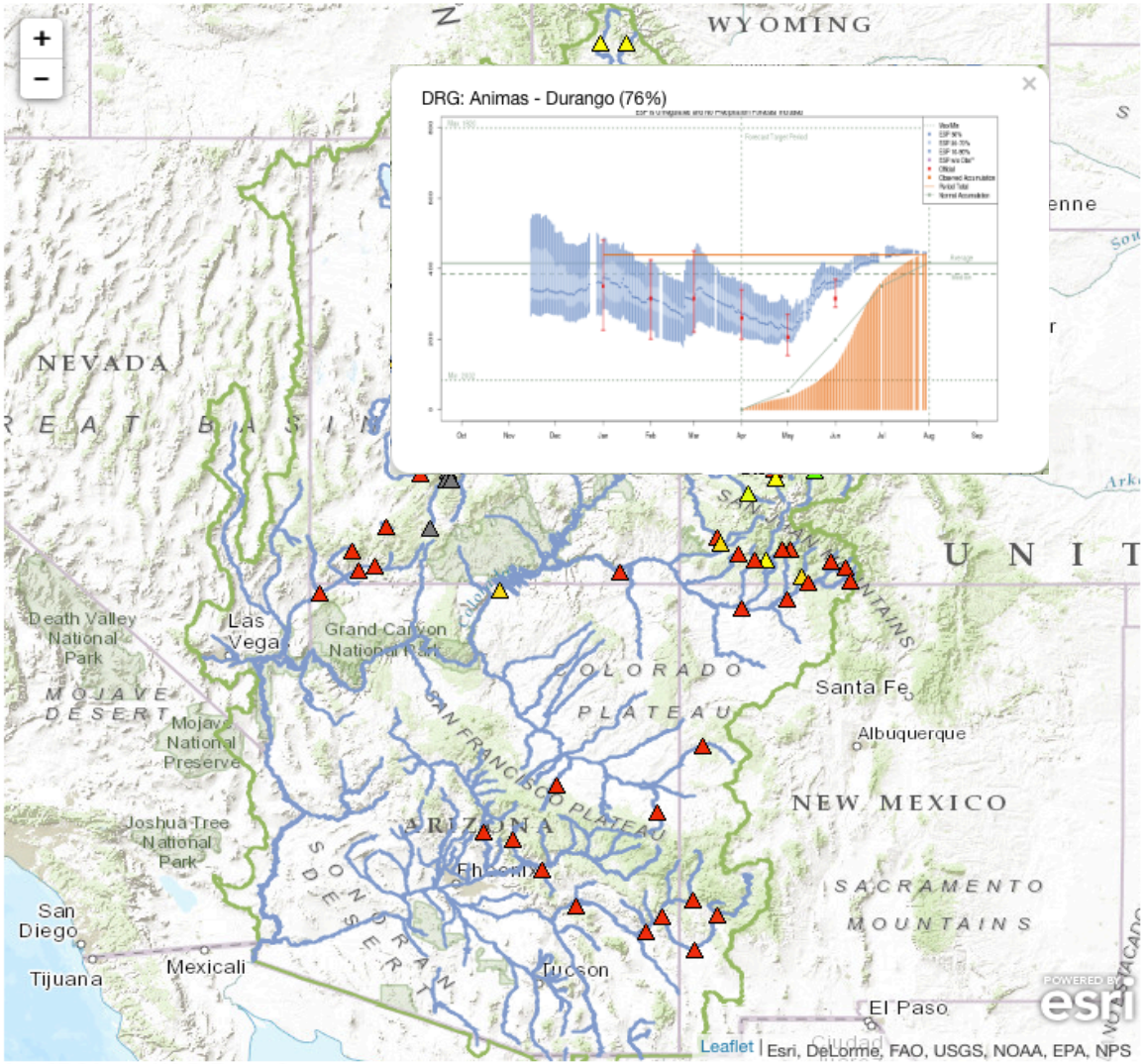
HOME | RIVERS | SNOW | WATER SUPPLY | RESERVOIRS | WEATHER | CLIMATE | HELP | ABOUT | NEWS | SEARCH

News

CBRFC 2015 Stakeholder Forum - October 20th 2015 Read More...
Stay Safe this Summer with NWS Weather Safety Information Read More...

Conditions Map

Help



Lat: 37.6 Lng: -110.5, Zoom: 6

- River Conditions
- Snow Conditions
- Water Supply Forecasts

Official Forecast Date: 2015-6-1 Help
ESP Run Date: 2015-07-30

Show Hide Other Types

- (•) Official Percent Average
- ( ) Official Percent Median
- ( ) ESP Percent Average
- ( ) ESP Percent Median

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

Offices

- [x] CBRFC
- [ ] WGRFC
- [ ] ABRFC

- Peak Flood Probablity
- Reservoir Conditions
- Weather Conditions
- Map Options
- Search Points

Quick tour of cbrfc.noaa.gov

June 1, 2015 Water Supply Forecast Discussion

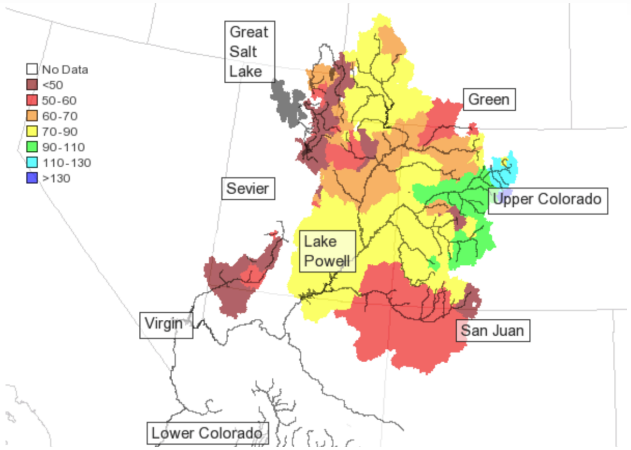
The Colorado Basin River Forecast Center (CBRFC) geographic forecast area includes the Upper Colorado River Basin, Lower Colorado River Basin, and Eastern Great Basin.

Seasonal Water Supply Forecasts:

Quick Summary:

May was a complete reversal of the 2014-2015 winter season as significant precipitation and below average temperatures occurred throughout the month. Monthly precipitation amounts were impressive with several locations throughout the CBRFC forecast area receiving between 200 and 400 percent of their May average and some locations nearing record amounts. Cooler temperatures also delayed melting of the higher elevation snowpack resulting in higher June runoff volumes than previously anticipated.

Snowpack was at or near record low levels at many locations entering May with much below average April-July runoff volumes expected particularly in the Great Basin, Duchesne River Basin and areas south including the Virgin River Basin and San Juan Basin. The impact of the May precipitation to water supply forecasts varied but was most significant in these areas where a lack of runoff contribution was expected due to the lack of snow. In some river basins where heavier precipitation was observed during the month of May, April-July runoff volume forecasts issued the first of May have already been exceeded.



Options (on/off): Plot
Area: CBRFC Green Colorado San Juan Great Sevier Virgin Low Col WGRFC ABRFC

Columns (on/off): Area Sub Area NWS ID DS River Location Forecast Date Avg Cond Med Cond Forecast Period Min 90 MP 50 Max 10 Avg Med Pct Avg Pct Med

Click column heading to sort by that data. Click ID to view point info. Click Area, Sub Area, or Forecast Period to show only those points.

	Area	Sub Area	NWS ID	River	Location	Forecast Date	Avg Cond	Med Cond	Forecast Period	Min 90	MP 50	Max 10	Avg	Med	Pct Avg	Pct Med
1	Green	Upper	WBRW4	Green	Daniel	2015-6-1	△	▲	Apr 01-Jul 31	190	**220**	255	245	220	*90*	*100*
2	Green	Upper	WBRW4	Green	Daniel	2015-6-1	△	▲	Jun 01-Jul 31	115	**145**	180	168	150	*86*	*97*
3	Green	Upper	FRAW4	Pine Ck	Fremont Lk	2015-6-1	△	△	Apr 01-Jul 31	66	**81**	98	98	94	*83*	*86*
4	Green	Upper	FRAW4	Pine Ck	Fremont Lk	2015-6-1	△	△	Jun 01-Jul 31	46	**61**	78	76	73	*80*	*84*
5	Green	Upper	BPNW4	New Fork	Big Piney	2015-6-1	△	△	Apr 01-Jul 31	220	**260**	305	355	315	*73*	*83*
6	Green	Upper	BPNW4	New Fork	Big Piney	2015-6-1	▲	△	Jun 01-Jul 31	133	**175**	220	255	230	*69*	*76*
7	Green	Upper	GBRW4	Green	Fontenelle Res	2015-6-1	▲	▲	Apr 01-Jul 31	590	**675**	810	725	650	*93*	*104*
8	Green	Upper	GBRW4	Green	Fontenelle Res	2015-6-1	△	▲	Jun 01-Jul 31	280	**365**	500	475	380	*77*	*96*
9	Green	Upper	BSRW4	Big Sandy	Farson	2015-6-1	△	△	Apr 01-Jul 31	36	**42**	50	52	47	*81*	*89*
10	Green	Upper	BSRW4	Big Sandy	Farson	2015-6-1	▲	△	Jun 01-Jul 31	17	**23**	31	34	32	*68*	*72*
11	Green	Upper	GRRW4	Green	Green River	2015-6-1	▲	▲	Apr 01-Jul 31	595	**680**	815	730	630	*93*	*108*
12	Green	Upper	GRRW4	Green	Green River	2015-6-1	△	▲	Jun 01-Jul 31	290	**375**	510	480	365	*78*	*103*
13	Green	Upper	SLRW4	Ef Smiths Fork	Stateline Res	2015-6-1	△	▲	Apr 01-Jul 31	20	**22**	25	26	23	*85*	*96*
14	Green	Upper	SLRW4	Ef Smiths Fork	Stateline Res	2015-6-1	△	△	Jun 01-Jul 31	11.6	**13.3**	16.5	17.8	15.9	*75*	*84*
15	Green	Upper	BNRU1	Blacks Fork	Robertson	2015-6-1	△	△	Apr 01-Jul 31	59	**68**	81	89	93	*76*	*73*
16	Green	Upper	BNRU1	Blacks Fork	Robertson	2015-6-1	▲	▲	Jun 01-Jul 31	30	**39**	52	59	63	*66*	*62*
17	Green	Upper	HMFW4	Hams Fork	Frontier	2015-6-1	▲	△	Apr 01-Jul 31	50	**53**	60	54	47	*98*	*113*
18	Green	Upper	HMFW4	Hams Fork	Frontier	2015-6-1	▲	△	Jun 01-Jul 31	13.1	**16**	23	26	20	*62*	*80*

COLORADO BASIN RIVER FORECAST CENTER

NATIONAL WEATHER SERVICE / NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

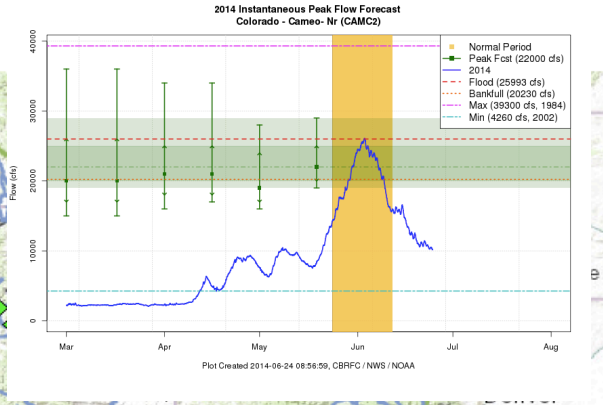
HOME | RIVERS | SNOW | WATER SUPPLY | RESERVOIRS | WEATHER | CLIMATE | HELP | ABOUT | NEWS | SEARCH

News

CBRFC 2015 Stakeholder Forum - October 20th 2015 Read More...
Stay Safe this Summer with NWS Weather Safety Information Read More...

Peak Flow Forecasts

Conditions Map Help



Lat: 37.6 Lng: -110.5, Zoom: 6

- River Conditions
- Snow Conditions
- Water Supply Forecasts
- Peak Flood Probablity

Forecast Date: 2015-07-01 Help

☑ Show Hide Other Types

◉ Mean Daily
○ Instantaneous

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

- Reservoir Conditions
- Weather Conditions
- Map Options
- Search Points

Used as a “heads-up” for potential flooding in the spring, and by reservoir operators to manage releases to meet various environmental resource managers requirements.

Contact us!
801 534-3570

- Brent Bernard – Hydrologist
- brent.bernard@noaa.gov
- Michelle Stokes – Hydrologist In Charge
- michelle.stokes@noaa.gov
- Brenda Alcorn – Colorado Headwaters Basin Focal Point
- brenda.alcorn@noaa.gov
- Greg Smith – San Juan Basin Focal Point
- greg.smith@noaa.gov
- Ashley Nielson – Green River Basin Focal Point
- ashley.nielson@noaa.gov

Questions?