

2011: A Really Big Year

Kevin Werner

NOAA/NWS Colorado Basin River Forecast Center



**Utah Water Users Workshop
November 29, 2011
Provo, UT**



Outline

- River Forecast Center overview
- 2011 runoff review
- Forecast verification
- Upcoming events



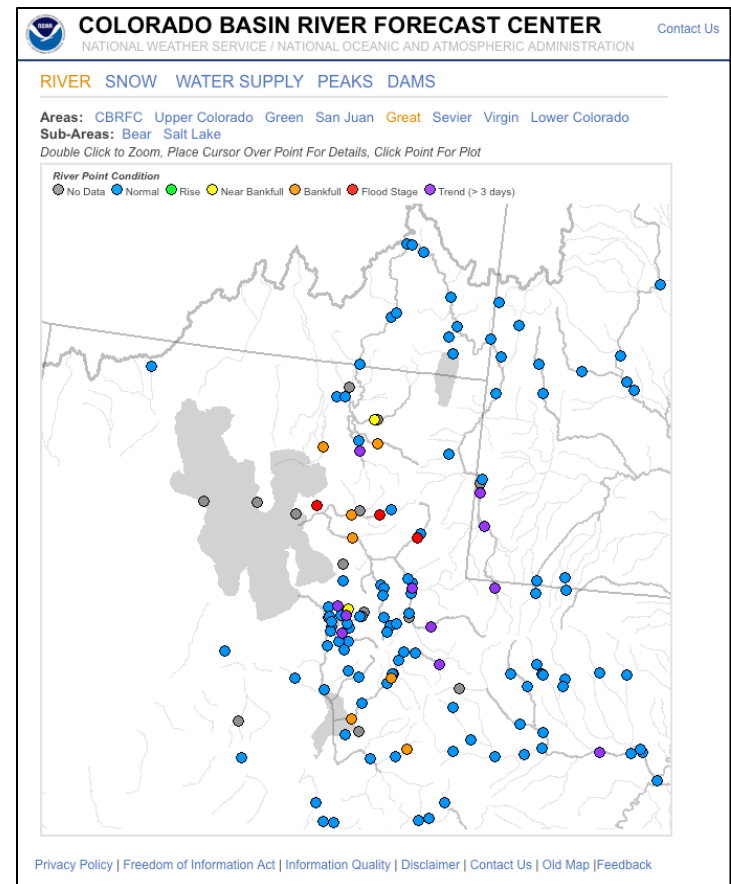
Colorado Basin River Forecast Center



The Colorado Basin River Forecast Center (CBRFC) generates streamflow forecasts across the Colorado and Utah. The latest forecasts, data, and more are available online:

- **Daily streamflow forecasts**
- **Long lead peak flow forecasts**
- **Water supply forecasts**
- **Webinar briefings**
- **Email updates**
- **And More....**

www.cbrfc.noaa.gov



Late 2010

October 18, 2010, 2:05 PM

Lake Mead Hits Record Low Level

By FELICITY BARRINGER



Jim Wilson/The New York Times

Bleached rock indicating a former high-water mark on outcroppings surrounding Lake Mead.



Sometime between 11 and noon on Sunday, the water level in Lake Mead, the massive reservoir whose water fills the taps of millions of people across the Southwest, fell [lower](#) than it ever has since it was filled 75 years ago.

The New York Times

LAS VEGAS REVIEW-JOURNAL

Drought-stricken Lake Mead falls to a level not seen since 1937



K.M. CANNON/LAS VEGAS REVIEW-JOURNAL

An aerial photo taken Saturday shows the marina operations in Lake Mead's Hemenway Harbor, just down the hill from Boulder City. All of the docks shown used to be located elsewhere but had to be moved to their present locations because of the reservoir's falling water level. » [Buy this photo](#)

BY HENRY BREAN
LAS VEGAS REVIEW-JOURNAL

Posted: Oct. 19, 2010 | 12:00 a.m.
Updated: Oct. 19, 2010 | 7:17 a.m.

Oddly, the drought's latest milestone arrived on a rainy day.

Snow is a blessing, unless there's too much

Water • Statewide,
Utah has abundant
water in snowpack.

BY MARK HAVNES THE SALT LAKE TRIBUNE
PUBLISHED JANUARY 22, 2011 5:00 PM

This is an archived article that was published on sltrib.com in 2011, and information in the article may be outdated. It is provided only for personal research purposes and may not be reprinted.

Article Tools



Photos



Cedar City • Year-round residents of Duck Creek Village, 30 miles east of here, love the snow that brings eager snowmobilers to the high mountain community in southern Utah. But this year, record amounts of snow have been more a curse than a blessing.

Shortly before Christmas, 7 feet of wet heavy snow fell over several days. Trees as tall as 50 feet snapped, bringing down power lines. As temperatures plunged, more than 2 million gallons of water leaked into homes after pipes burst.



The Salt Lake Tribune

Tools

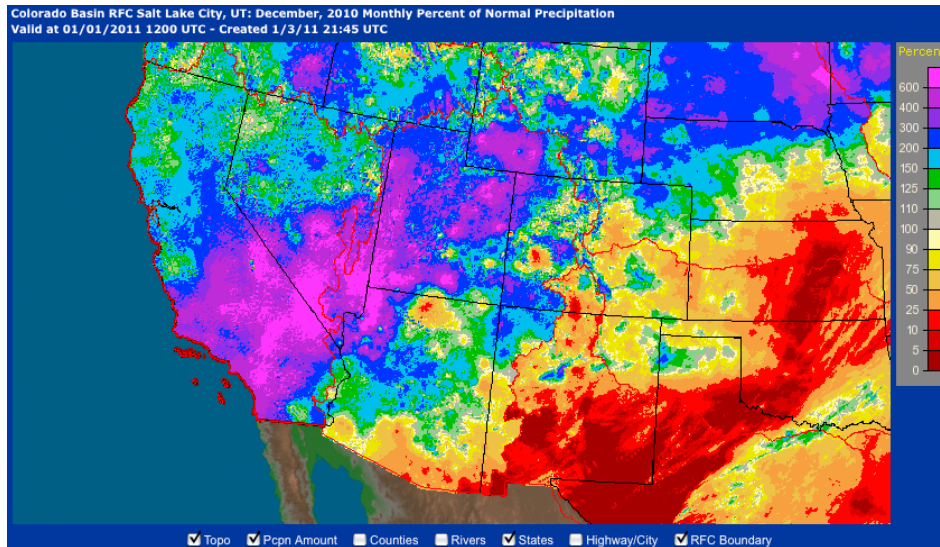
183 28

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Early 2011

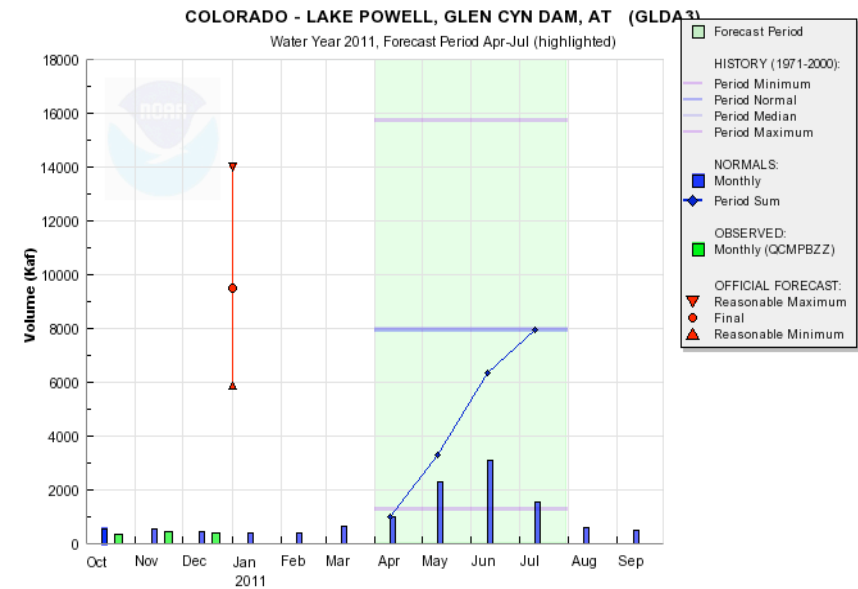
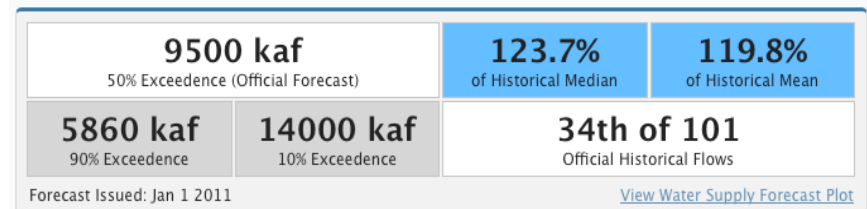


Pre Holiday Storm:

- Lake Mead up ~2 feet from local runoff
- Large snow accumulation
- Forecasts reflected that....

Seasonal Water Supply Forecast

Forecast Period: Apr-Jul



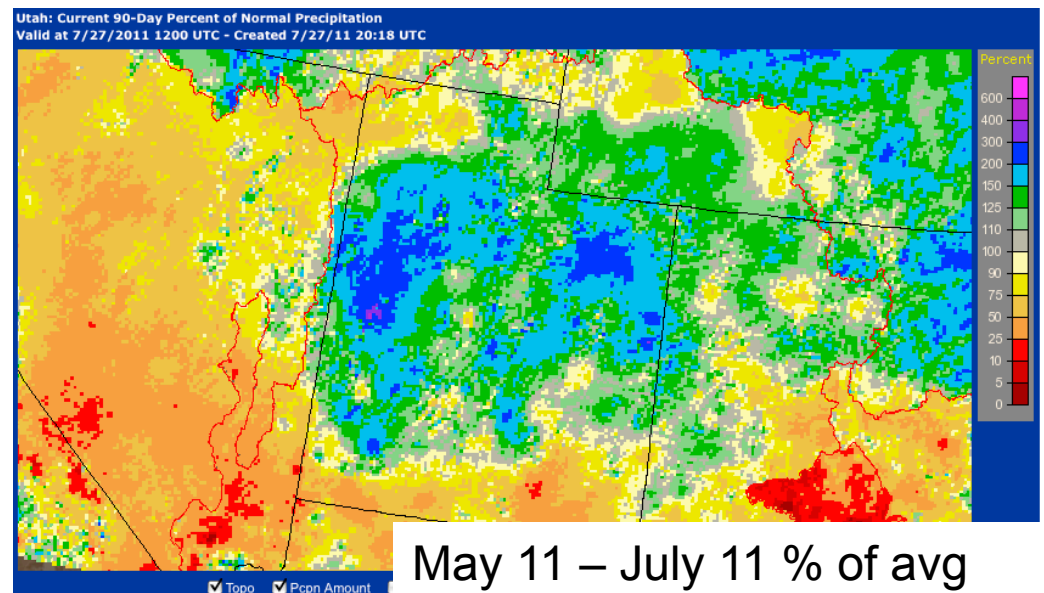
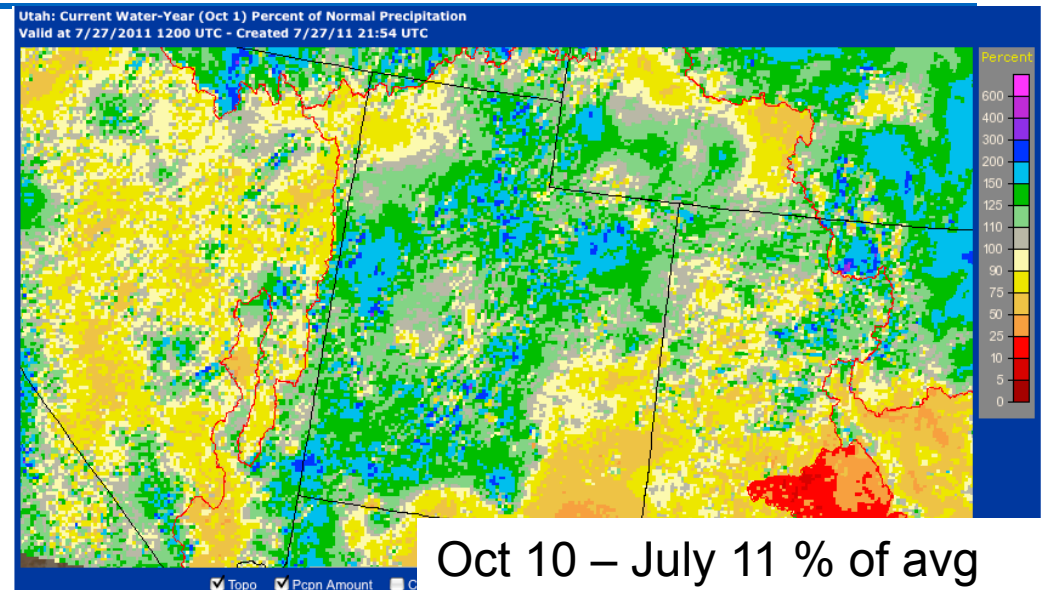
CBRFC/NWS/NOAA 01/07/11 15:21:06 UTC

Irrational Exuberance?



Spring 2011

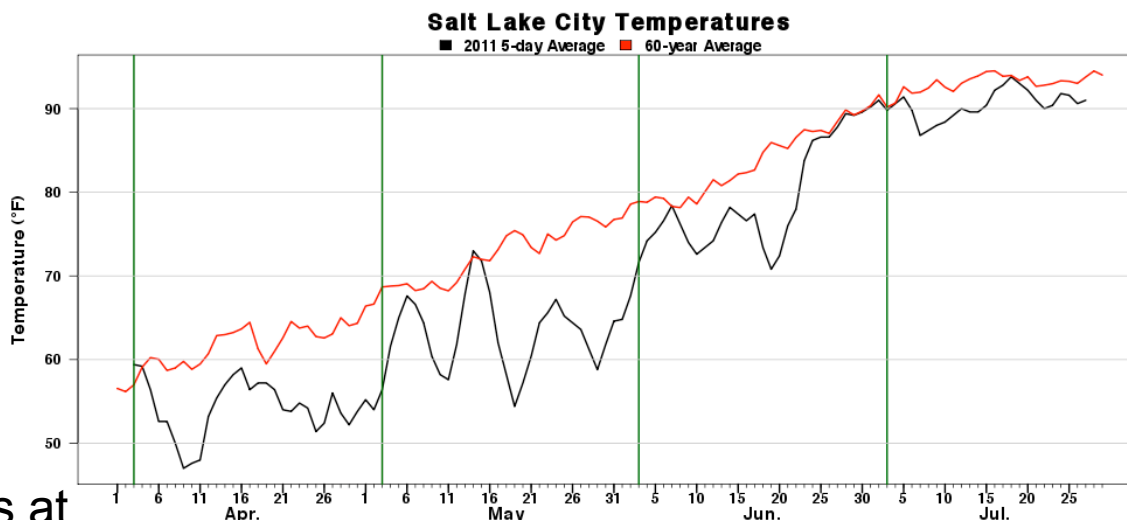
- ❖ Winter and Spring 2011 were much wetter than normal for most of Utah – especially the months of March/April/May
- ❖ Spring was very cold across Utah
- ❖ Snowpack accumulated to record or near record amounts at most SNOTEL sites
- ❖ Snow melt was delayed – and largely tempered by cool May/June weather
- ❖ Flood did occur in low elevation basins (May/June) and high elevation basins (late June/July)





Spring 2011

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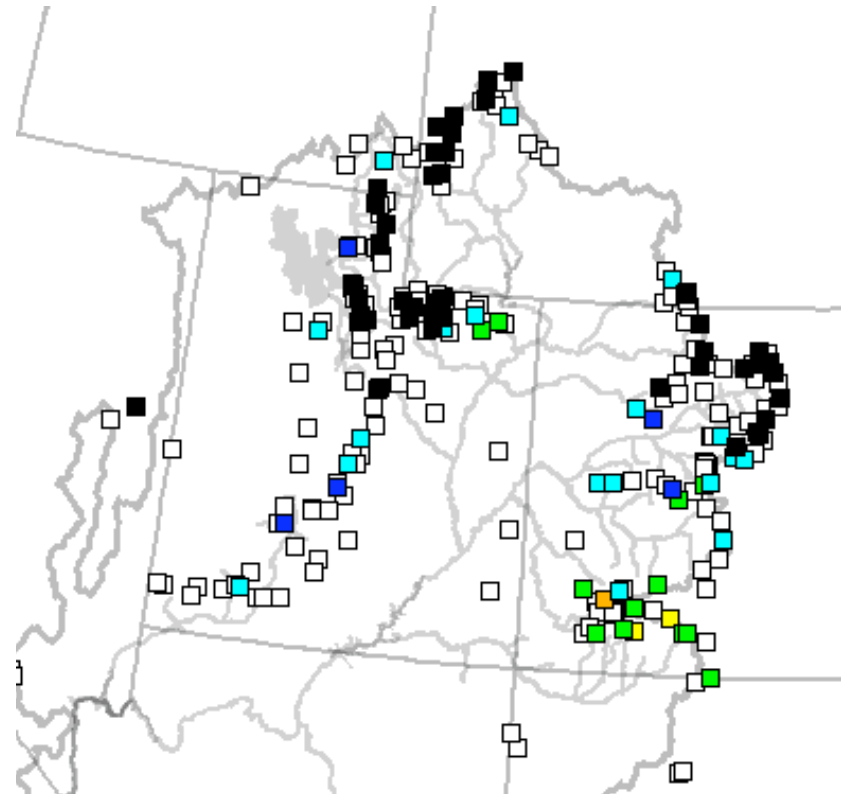
Number of Days Below 60-yr Average (April 1 – July 29)

Year	Number of Days Below Normal	Standard Deviation of Below Normal Days
2011	92	-2.55
1998	84	-1.98
1995	82	-1.84
1983	79	-1.62
1953	77	-1.48
1999	76	-1.41
1991	75	-1.34
1975	75	-1.134
1993	73	-1.19
1982	73	-1.19
2010	71	-1.05
1965	71	-1.05

Average number of days below 60-year average: 56.32 days
 Standard deviation of days below 60-year average: 13.97 days

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April 2011



[Leah Hogsten | The Salt Lake Tribune] Norm Manning releases water that flooded into his yard along 4700 West in Plain City Wednesday April 20, 2011 when the culvert next to the Weber River flooded. Manning has managed to build his own levy around his 22-acre property and kept the waters at bay. The overflowing Weber River breached an earthen levee in seven locations from Plain City to the Marriott-Slaterville area. Although the water has begun to recede, expected rainfall Wednesday night threatens to bring back floodwaters seeping toward numerous structures.

Real flooding danger comes from delayed snowpack melt

Weather » Coming storms aren't expected to significantly swell rivers and streams.

BY CHRISTOPHER SMART
The Salt Lake Tribune

Tweet 5 +1 0 Like 6

First published Apr 20 2011 06:58PM
Updated May 5, 2011 02:34AM

It's wet, and it's going to get wetter.

That forecast isn't good news for people living or farming along northern Utah waterways. But it shouldn't lead to more flooding this week. The delay in snowpack melt, however, is raising the flood potential in May and, perhaps, June.



» E-mail this story



[Chris Detrick | The Salt Lake Tribune] Students Yiwon Zhang and Dong Dong Fu walk across the George S Eccles 2002 Legacy Bridge at the University of Utah Thursday April 7, 2011.

Snow season won't go away as flood potential swings upward

Spring weather » Continued snowfall means flooding likely.

BY CHRISTOPHER SMART
The Salt Lake Tribune

Tweet 3 +1 0 Like 6

First published Apr 27 2011 09:22PM
Updated May 17, 2011 02:03AM

Don't put away the wet weather gear yet — it's still snow season, according to Friday's forecast.

Already this week, Alta has received 18 inches of new snow and now reports an And Snowbird is — a record for that



» E-mail this story
» Printer-friendly version





May/June/July 2011



(Jeremy Harmon | The Salt Lake Tribune) A fence post pokes up through the water as floodwaters rise along the Sevier River Saturday.

Hope fades for Utah orderly spring runoff; farmland underwater

Mountains' snowpack remains massive; more rain forecast for Monday, then high temps.

BY BRIAN MAFFLY AND ERIN ALBERTY
THE SALT LAKE TRIBUNE
First published May 29 2011 01:04PM
Updated Jun 13, 2011 01:25AM

Tweet 16 +1 0 Like 45

Ogden Canyon • For the past few days, the usually docile Ogden River has been tearing past the dining decks at Keith and Belinda Boulders' restaurant, The holding back



(Al Hartmann | The Salt Lake Tribune) A car climbs to the top of Little Cottonwood Canyon near Alta Ski Resort on May 10, during a clearing snowstorm. Snowpack was 400 percent of normal, but concerns of flooding have largely died down.

Cool spring saved northern Utah from record snows

Preparation » Floods of 1983, 2010 readied people for high water.

Article Tools

» E-mail this story
» Printer-friendly version

Photos

BY CHRISTOPHER SMART
The Salt Lake Tribune

Tweet 6 +1 0 Like 3

First published Jul 04 2011 01:01AM
Updated Jul 7, 2011 08:28AM

Remember early March, when water managers sounded the alarm that flooding seemed all but certain? The water in mountain snow threatened to replay the events of 1983, when torrents of runoff caused entire hillsides to collapse and led to widespread flooding, including a river down State Street in Salt Lake City.

Then, on top of that enormous snowpack came the wettest 90-day period in Utah history — 11.73 inches of water was reported at the Salt Lake City International Airport and even more fell at higher elevations. Local government and water



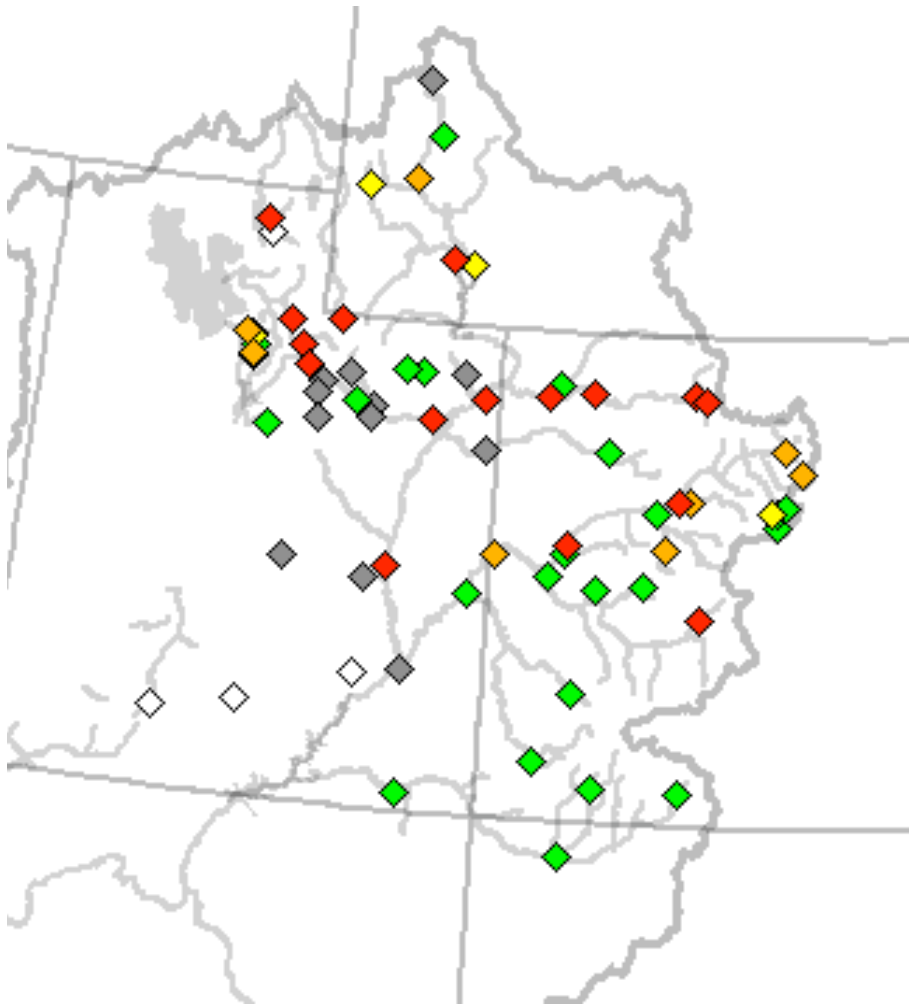
Basin Water every morning



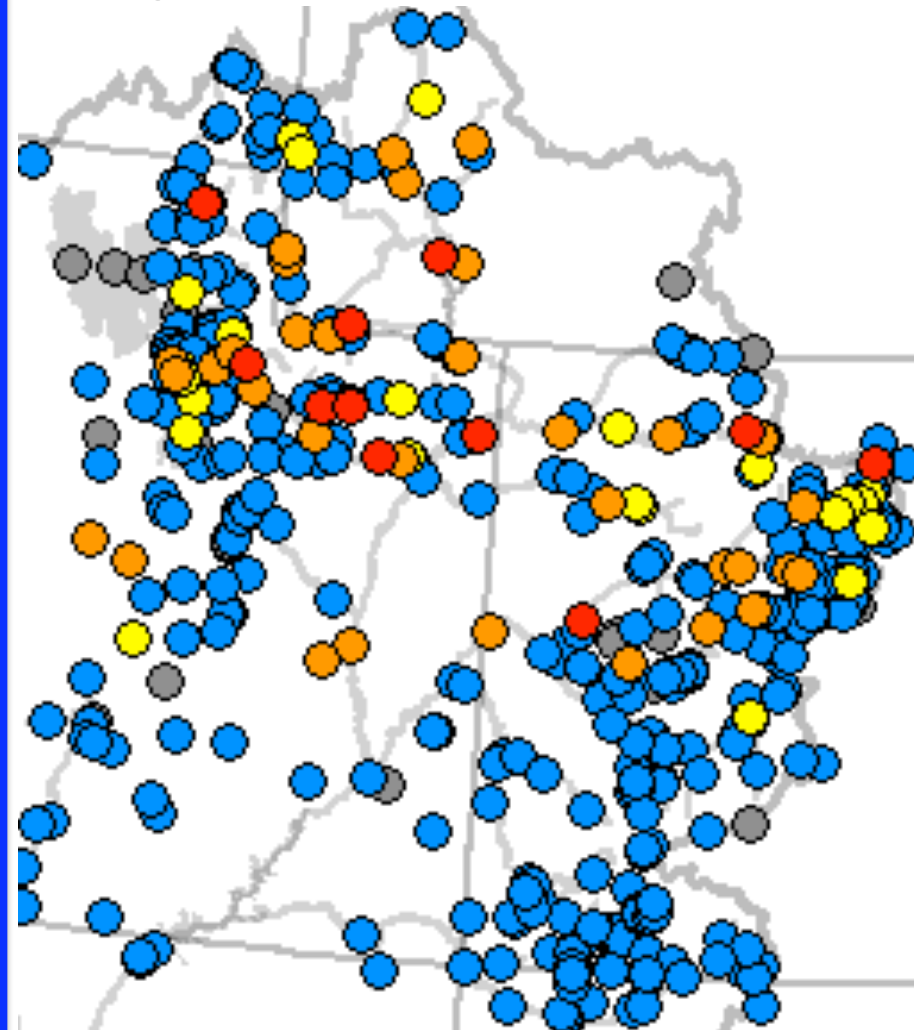
Peak Flow Forecasts



Long Lead Peak Flow Forecasts



Daily Forecasts



Forecast Verification

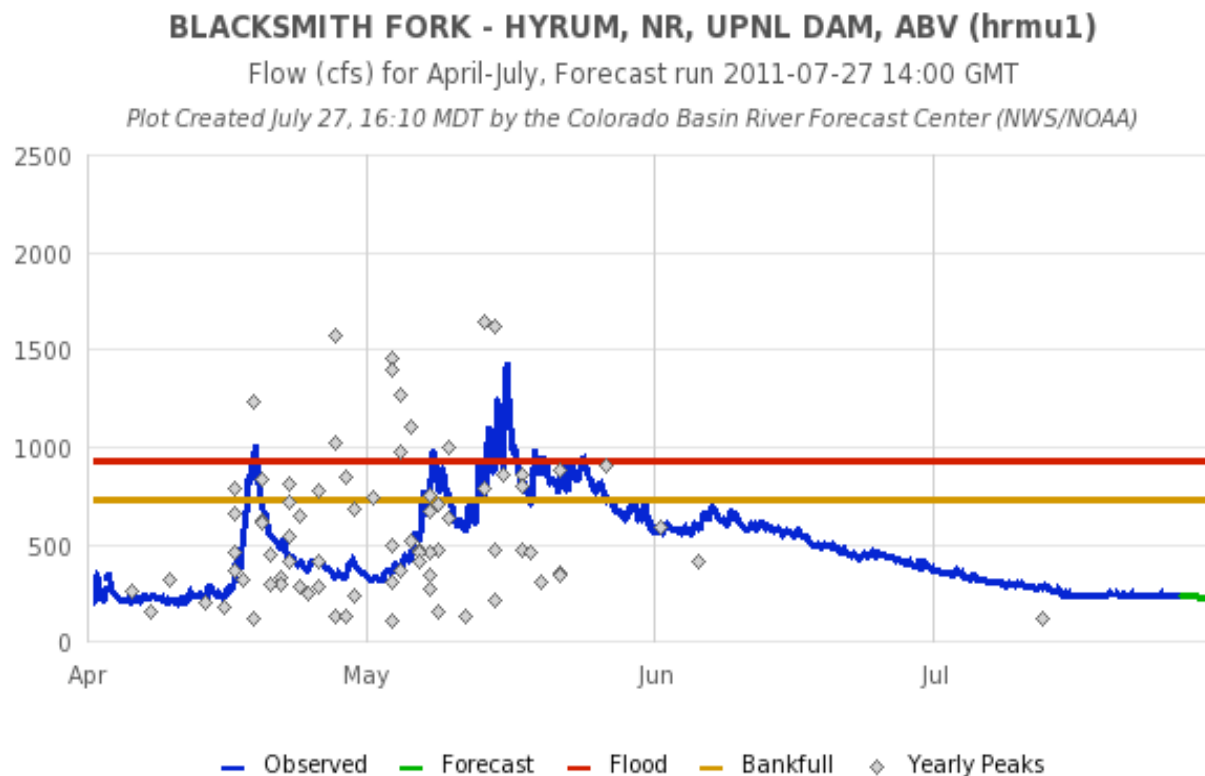
- ✔ Verification: Comparison of forecasts with observed streamflow in order to:
 - ✔ Assess the **skill** of the forecast system
 - ✔ Identify **conditions** when we are less skillful
 - ✔ **Track** changes in skill over time
- ✔ Verification has applications for:
 - ✔ Forecasters
 - ✔ Administration
 - ✔ Forecast users
- ✔ Verification can be a complex subject
- ✔ Results shown here are based on preliminary streamflow data which may change as USGS makes additional measurements and finalizes data





Low Elevation Basins

- Basins with elevations ranging from ~5-10kft
- Including:
 - Blacksmith Fork
 - Little Bear
 - Lower Weber
 - Chalk Creek
 - Red Butte
 - Emigration
 - Spanish Fork
- Rivers generally peaked in May
- Some with rain enhanced peaks

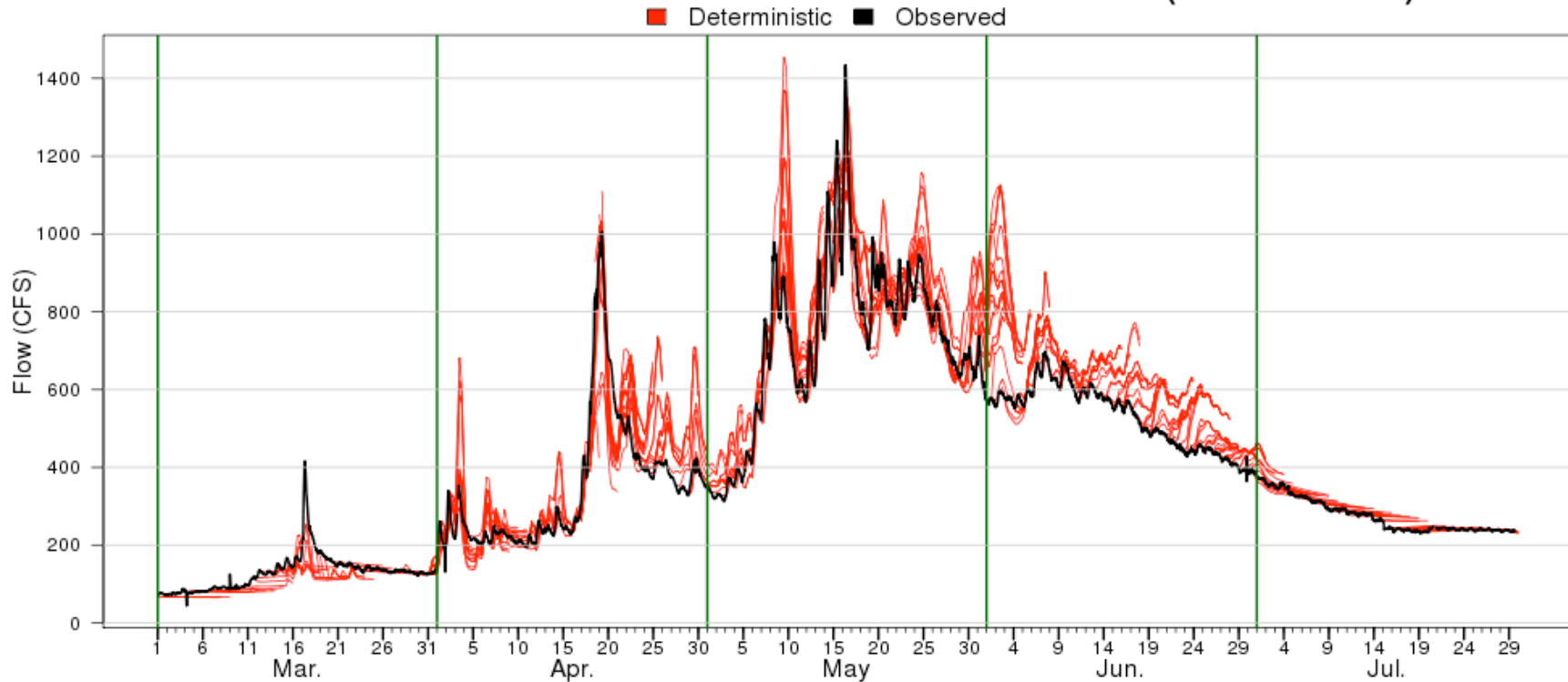




Blacksmith Fork Daily Forecasts



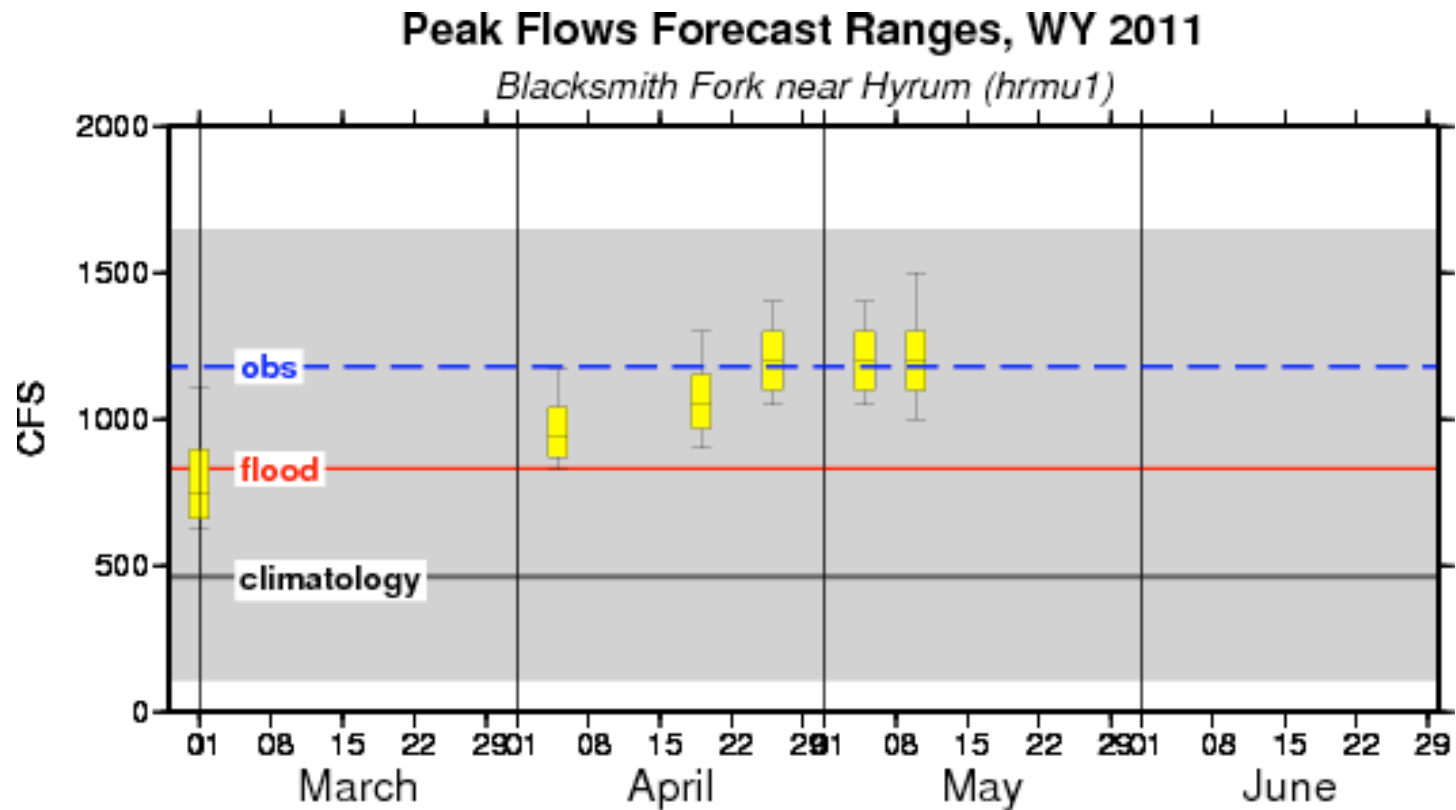
Deterministic Forecasts vs. Observed Streamflow for HRMU1 (Mar. 1 - Present)



First five days of all streamflow forecasts issued shown

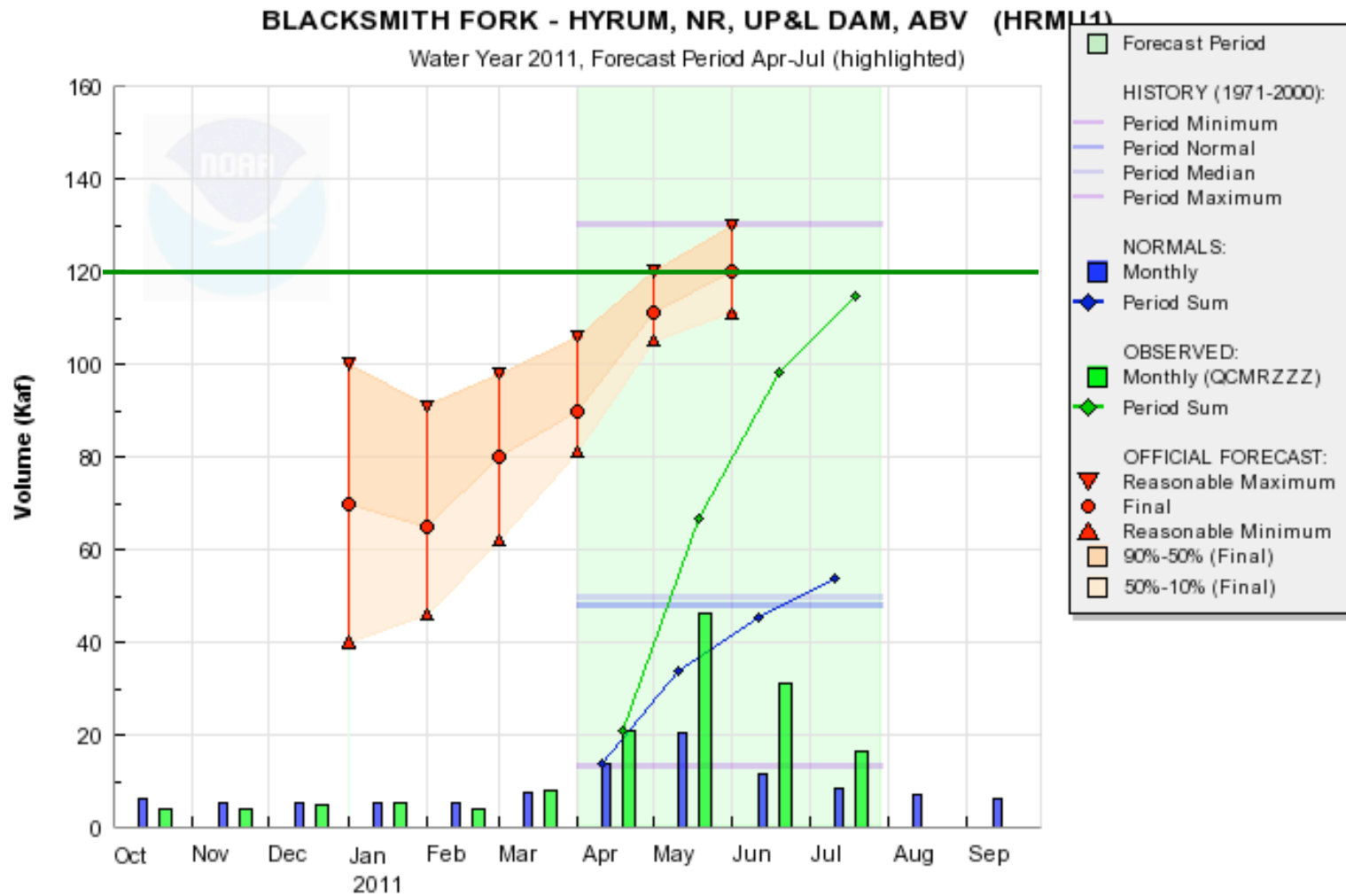


Blacksmith Fork Long Lead Peak Forecasts





Blacksmith Fork Water Supply Volume Forecasts





Middle Elevation Basins

- Basins with elevations ranging from ~6-12kft

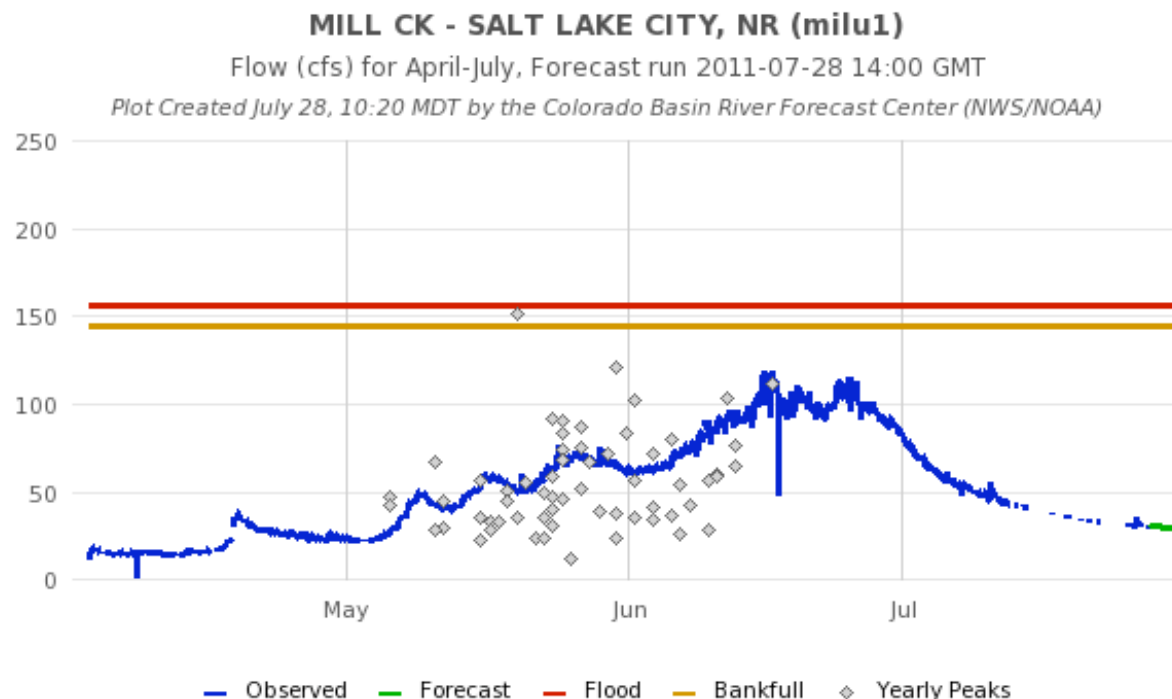
- Including:

- Big Cottonwood
- Logan
- Mill Creek
- American Fork
- Ashley Creek
- Big Brush Creek
- Sevier

- Rivers peaked in June

- Peaks were largely mitigated by cool weather

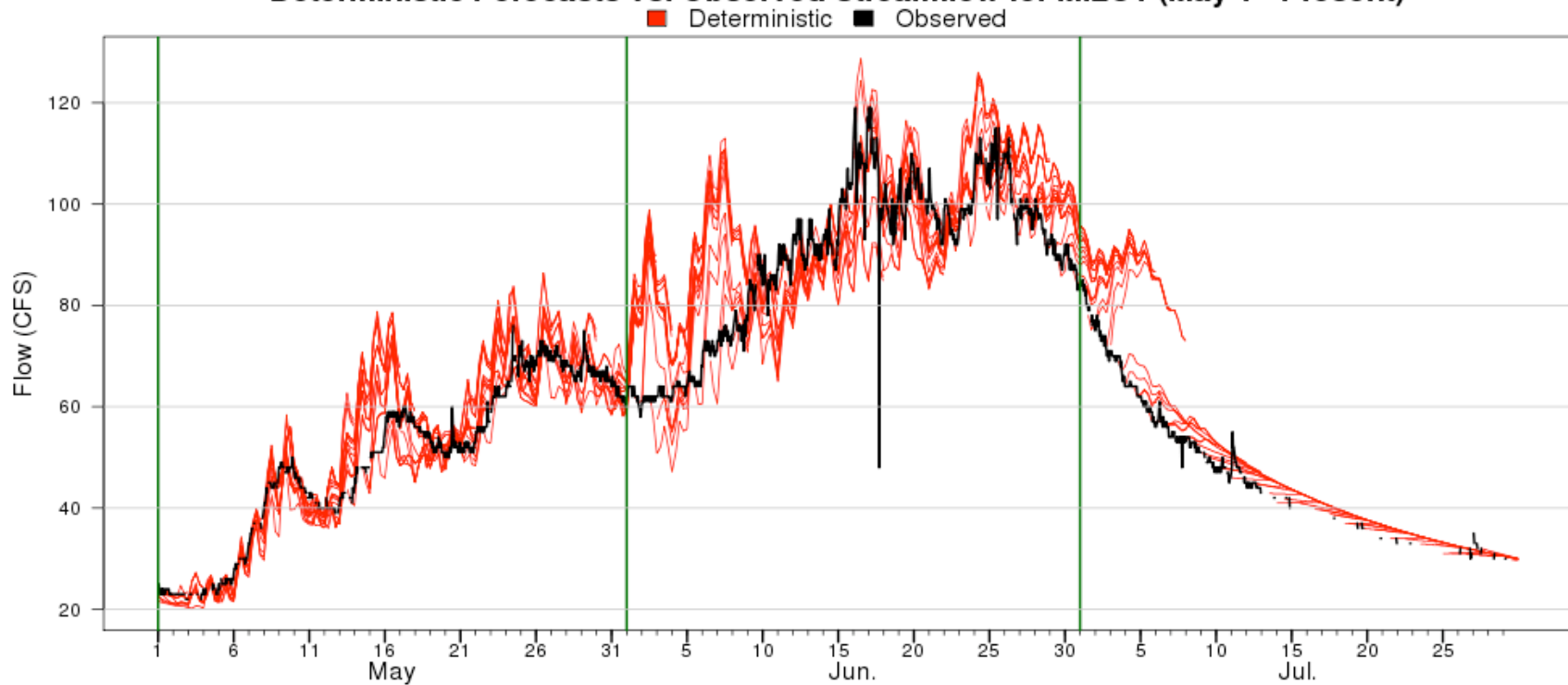
- Rivers ran high several weeks





Mill Creek: Daily forecasts

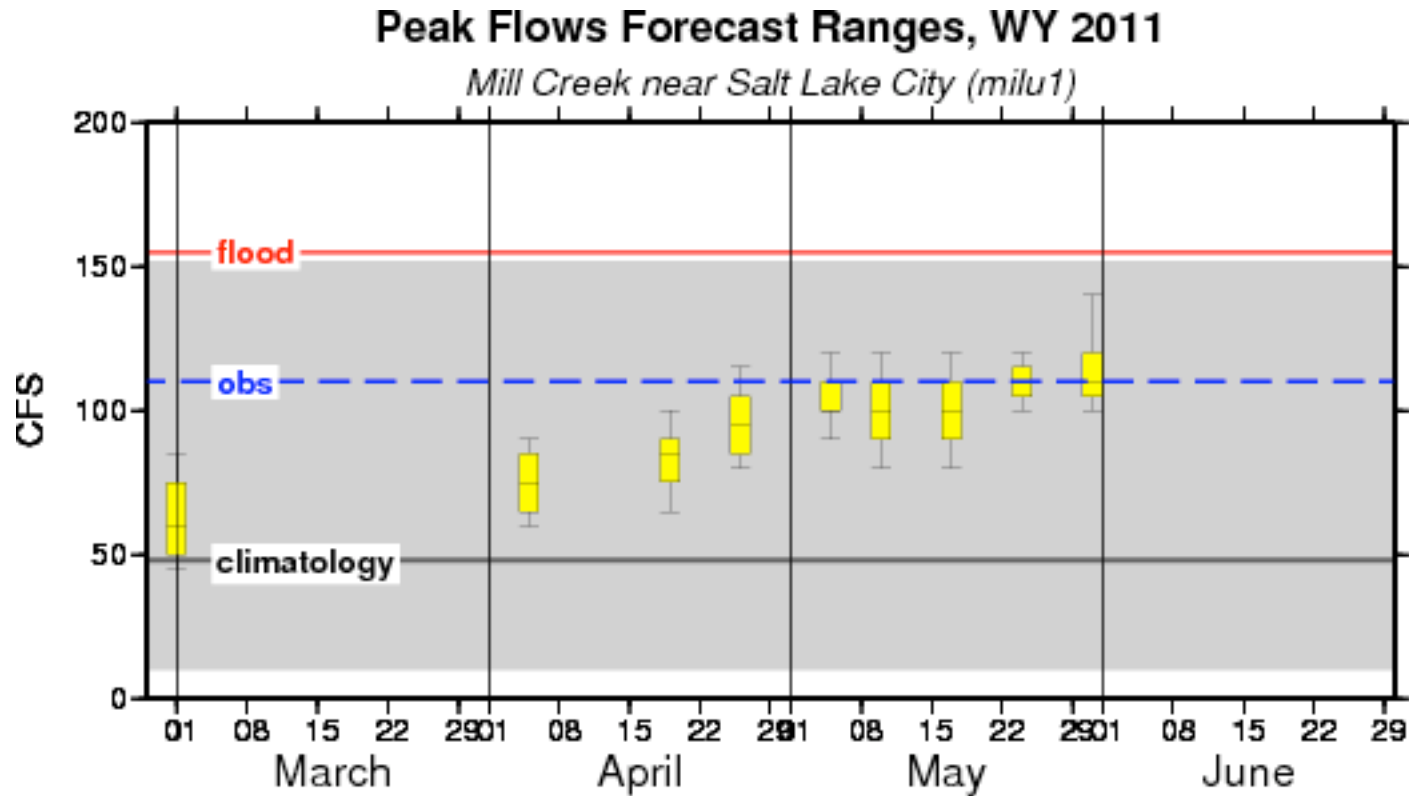
Deterministic Forecasts vs. Observed Streamflow for MILU1 (May 1 - Present)



First five days of all streamflow forecasts issued shown



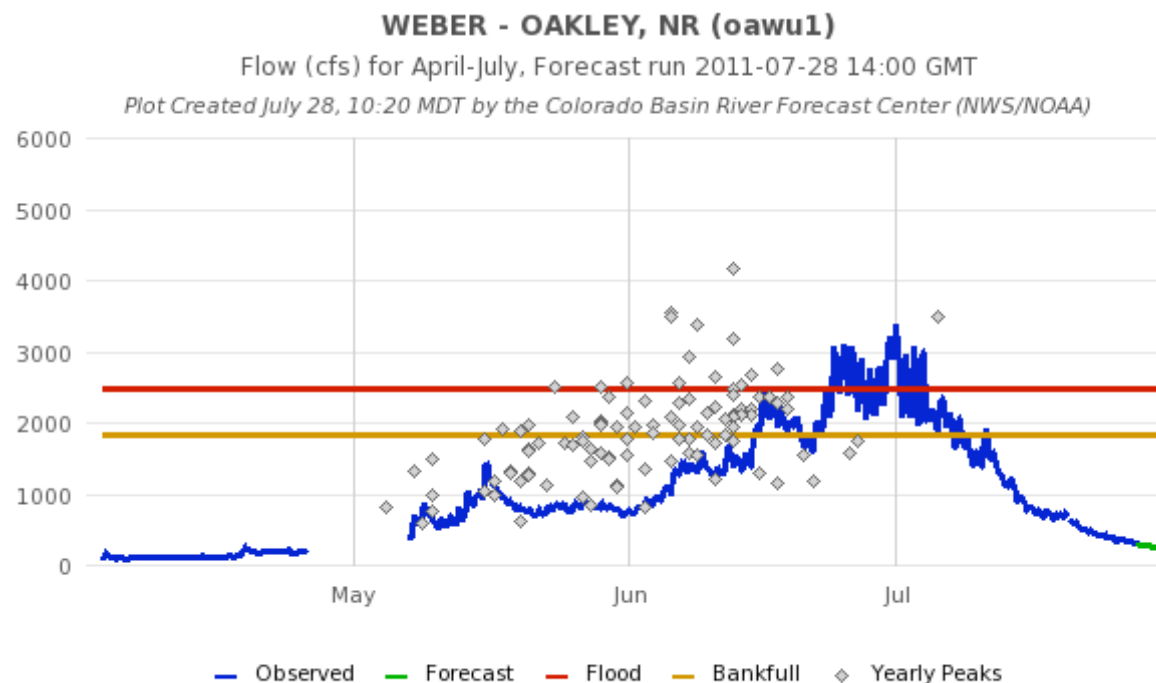
Mill Creek Long Lead Peak Forecasts





High Elevation Basins

- Basins with elevations ranging from ~7-13kft
- Including:
 - Little Cottonwood
 - Upper Weber
 - Upper Bear
 - Most Uinta drainages
- River peaked in last week of June or early July
- Peaks were enhanced with hot temperatures



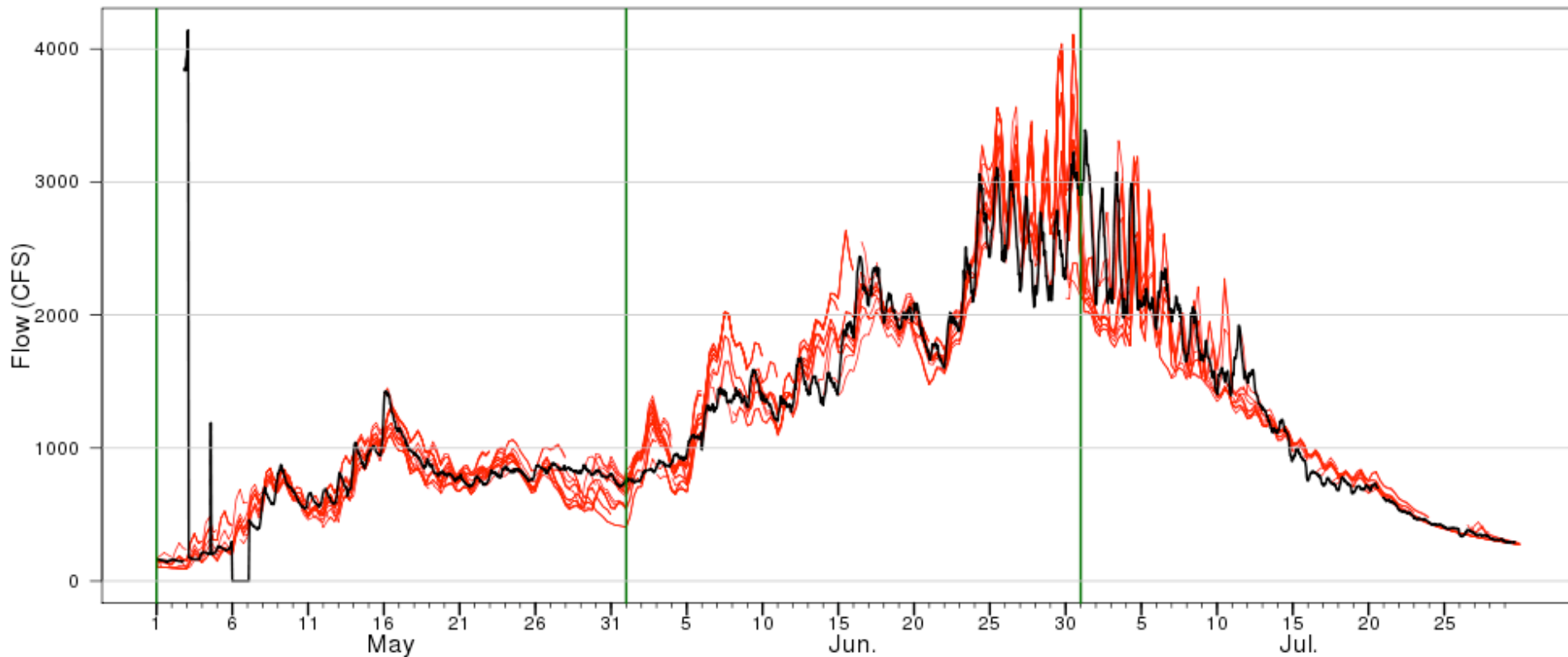


Weber at Oakley Daily forecasts



Deterministic Forecasts vs. Observed Streamflow for OAWU1 (May 1 - Present)

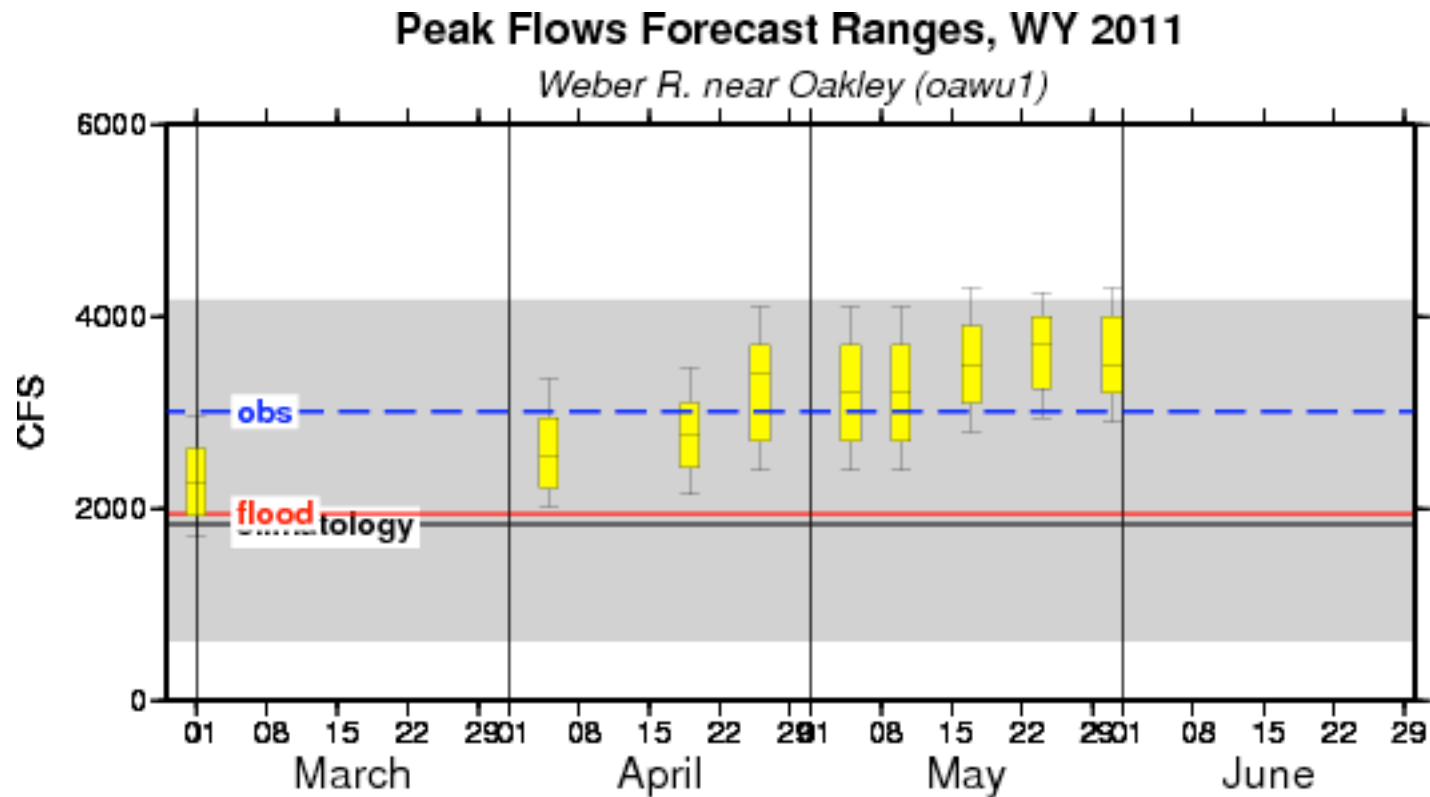
■ Deterministic ■ Observed



First five days of all streamflow forecasts issued shown

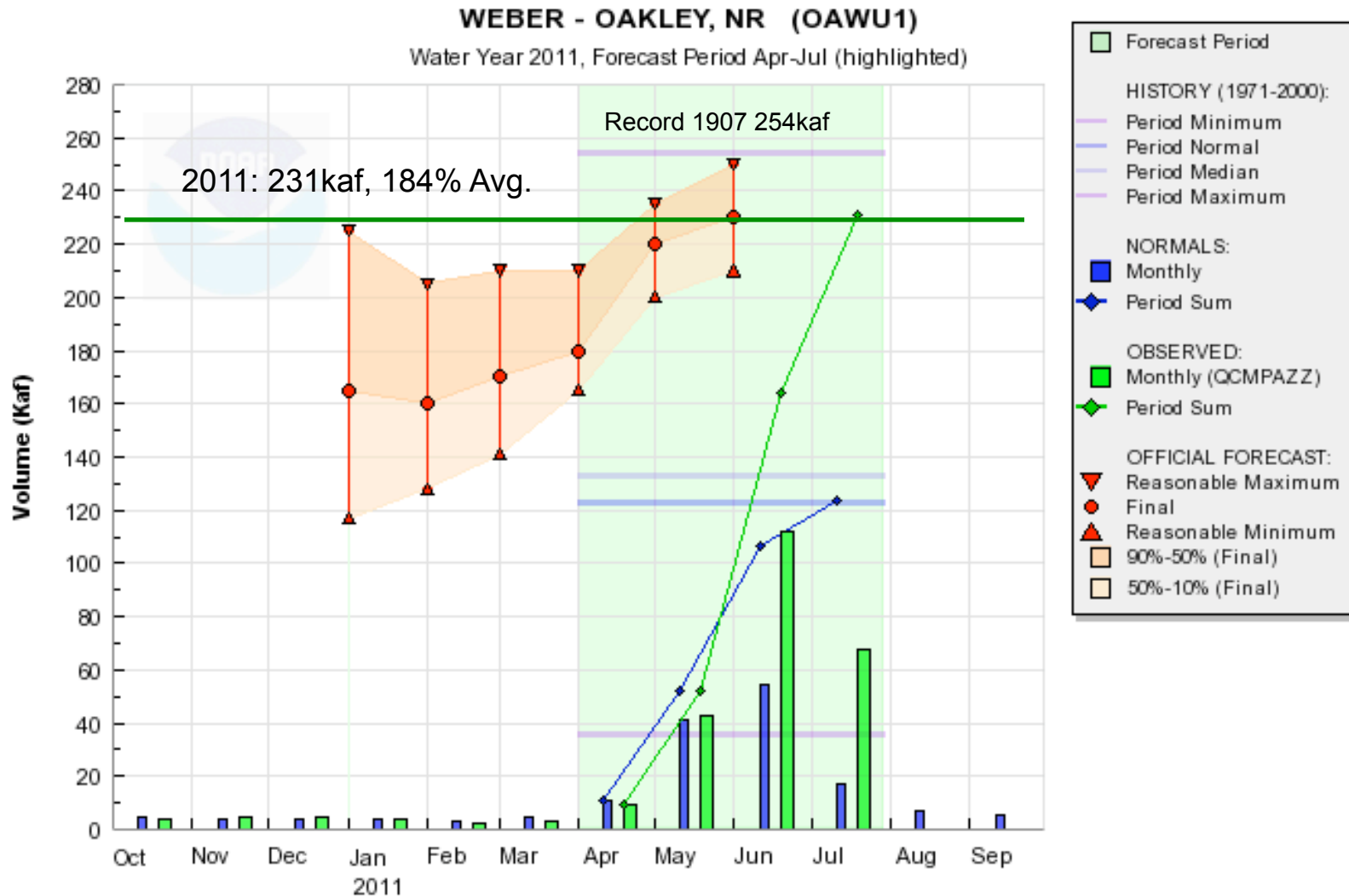


Weber at Oakley Long Lead Peak Forecasts





Weber at Oakley Water Supply Volume Forecasts



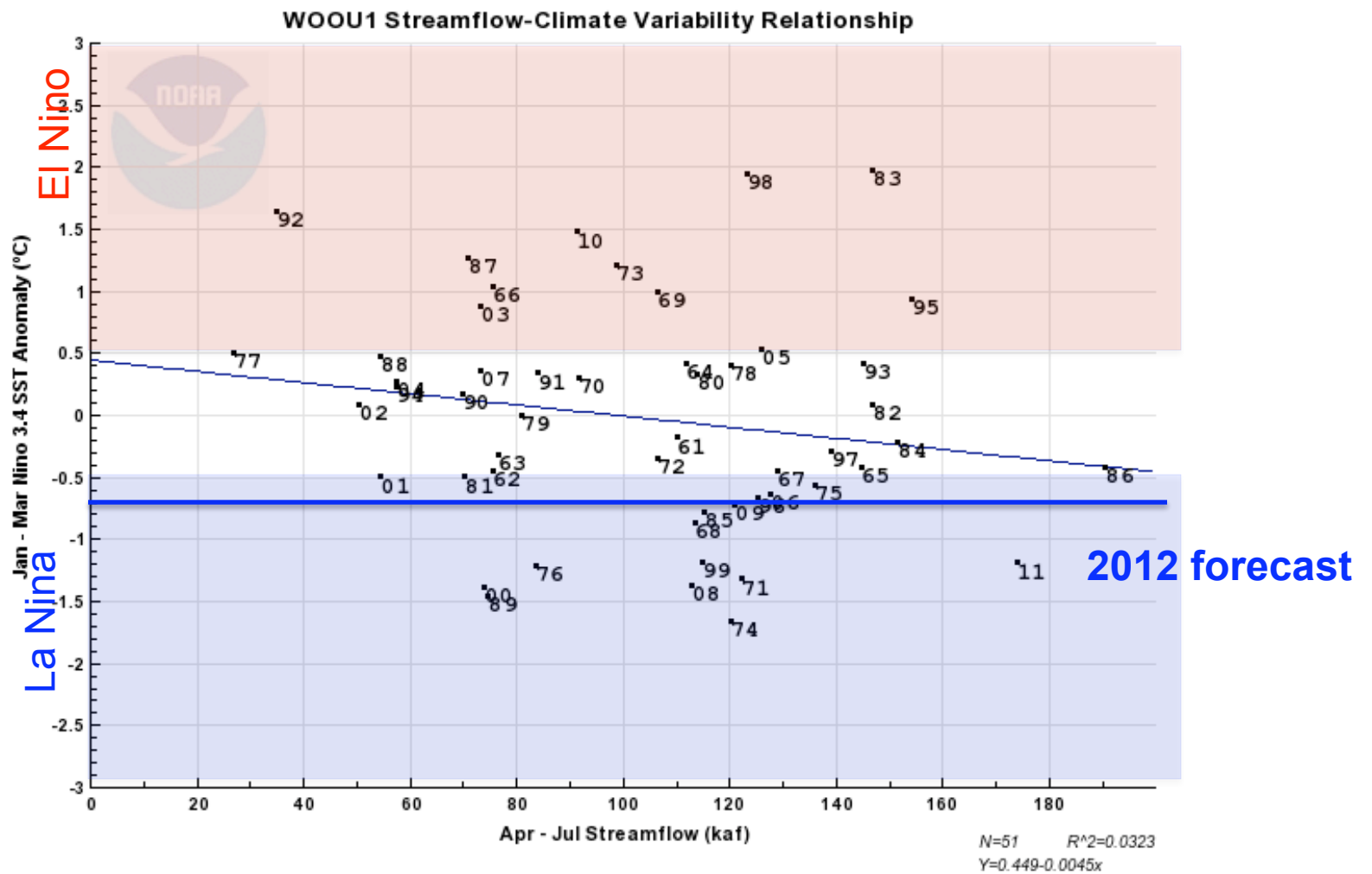


Summary

- ☑ 2011: cool and wet spring made for unique hydrology. Both long lead and daily forecasts performed relatively well.
 - ☑ Record April-July volumes:
 - ☑ Bear (UT/WY stateline), Weber (Echo, East Canyon, Ogden), Provo, North slope Uintas, Duchense
- ☑ More forecast verification: Additional streamflow and volume plots online
- ☑ Forecast Issues
 - ☑ Early season (April and before) peak and volume forecasts generally too low as April and May moisture not well forecast
 - ☑ Struggled with reservoir release plans (especially Weber and Duchesne systems)
 - ☑ Temperature forecasts in late May / early June were much too high causing streamflow forecasts to be too high



2012



Source: wateroutlook.nwrfc.noaa.gov



Upcoming

- ✔ Official **water supply forecasts** begin January 1
 - ✔ Official forecasts issued monthly January through June
 - ✔ **Weekly updates** via weekly ESP
- ✔ Forecast **webinars** monthly starting January 6
- ✔ Long lead **peak flow forecasts** begin March 1
- ✔ Individual **meetings** with water managers

- ✔ New **1981-2010** normal and calibration period goes into affect 1/1/12
 - ✔ Lower averages in most basins
 - ✔ Better data set with SNOTEL network spanning most of new period

- ✔ New CBRFC **webpage** now online

- ✔ More Information available online: **www.cbrfc.noaa.gov**



Feedback, Questions, Concerns always welcome....



Kevin Werner

CBRFC Service Coordination Hydrologist

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Email: kevin.werner@noaa.gov





Backup Slides

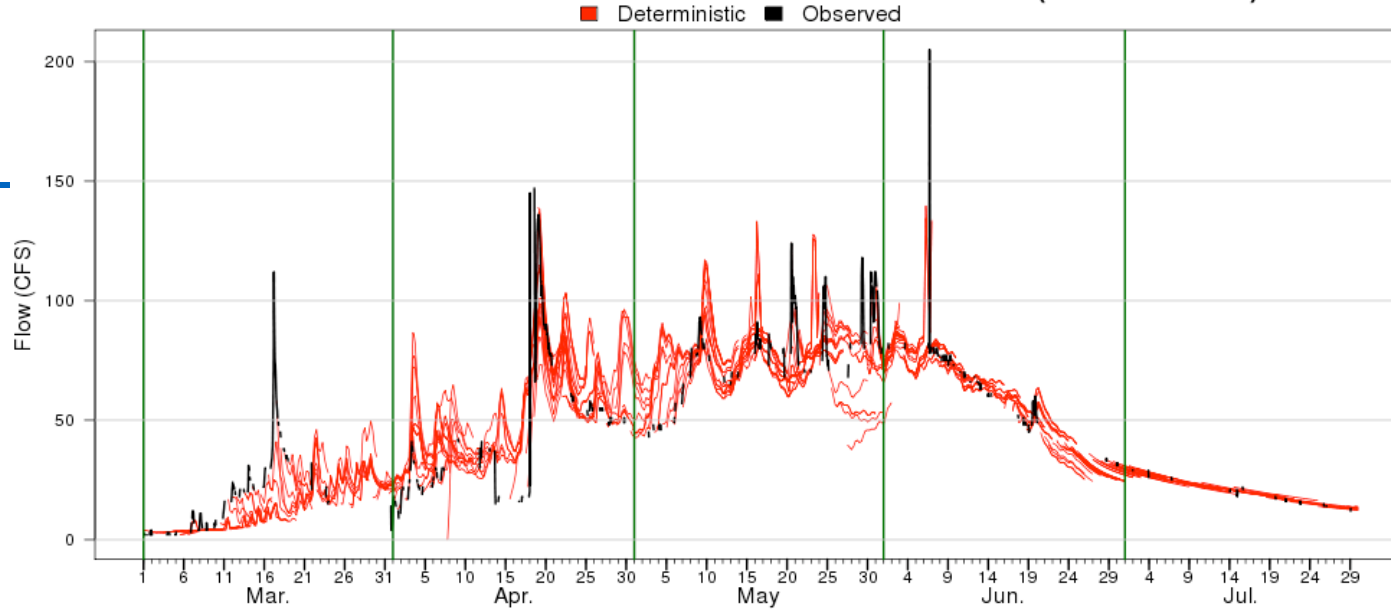
Forecast verification for:

- Emigration near SLC
- Little Cottonwood near SLC
- Provo near Woodland
- Logan near Logan
- Bear near UT/WY border

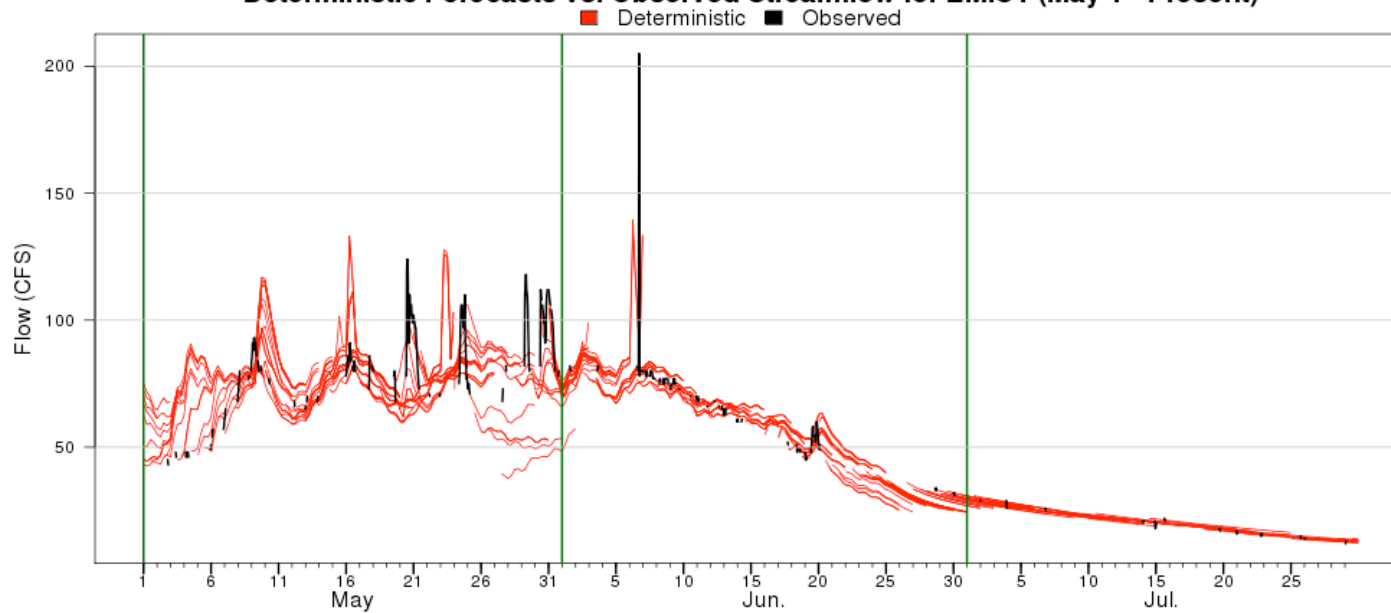


Emigration Ck near SLC

Deterministic Forecasts vs. Observed Streamflow for EMIU1 (Mar. 1 - Present)

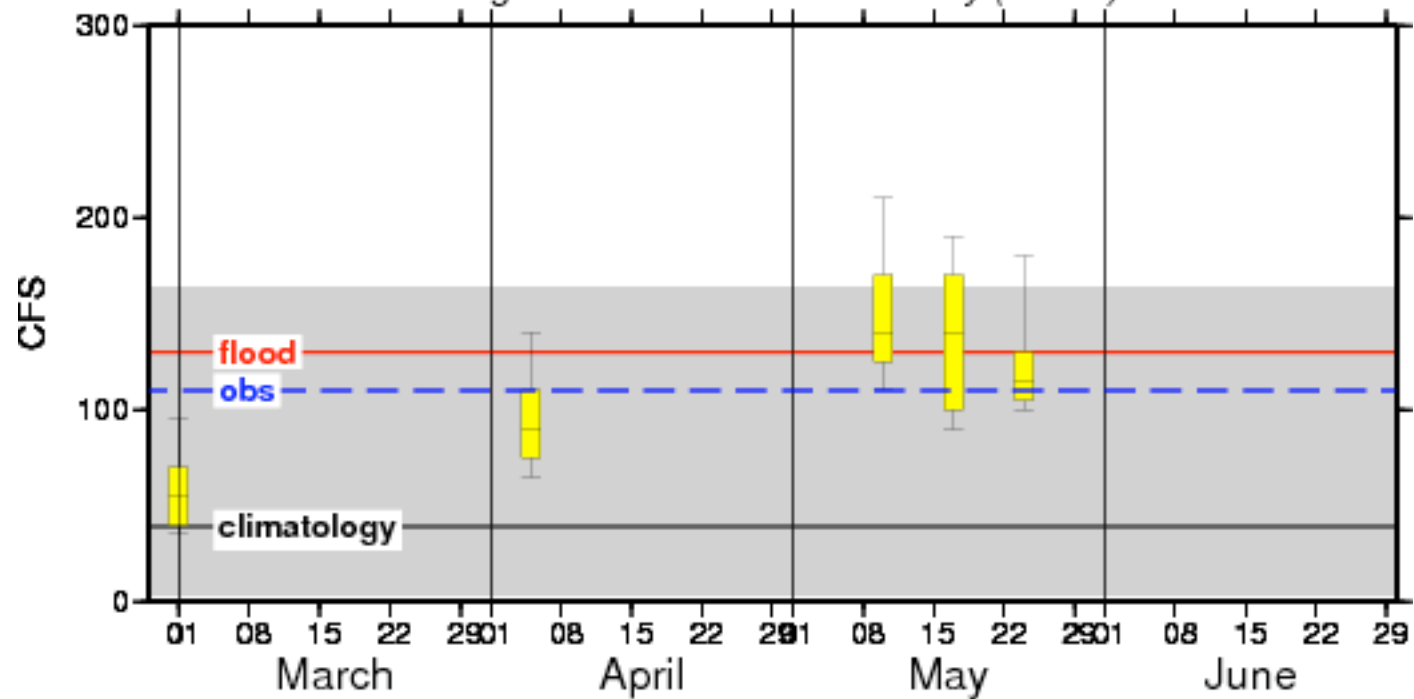


Deterministic Forecasts vs. Observed Streamflow for EMIU1 (May 1 - Present)



Peak Flows Forecast Ranges, WY 2011

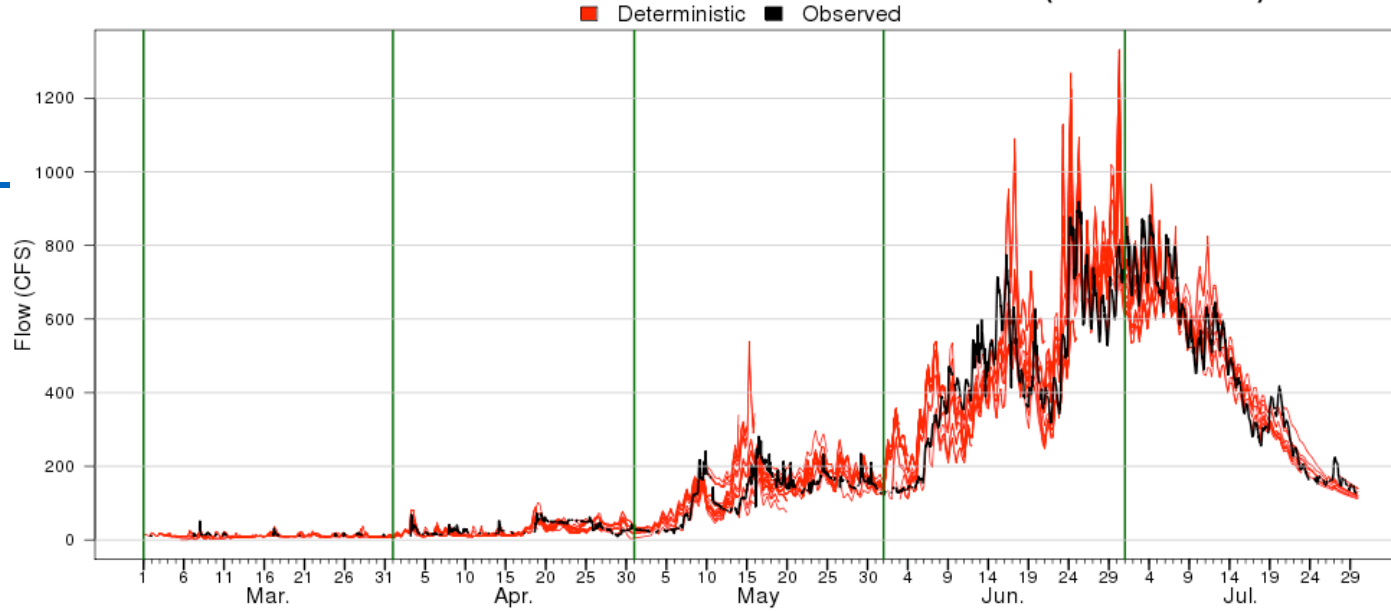
Emigration Ck near Salt Lake City (emiu1)



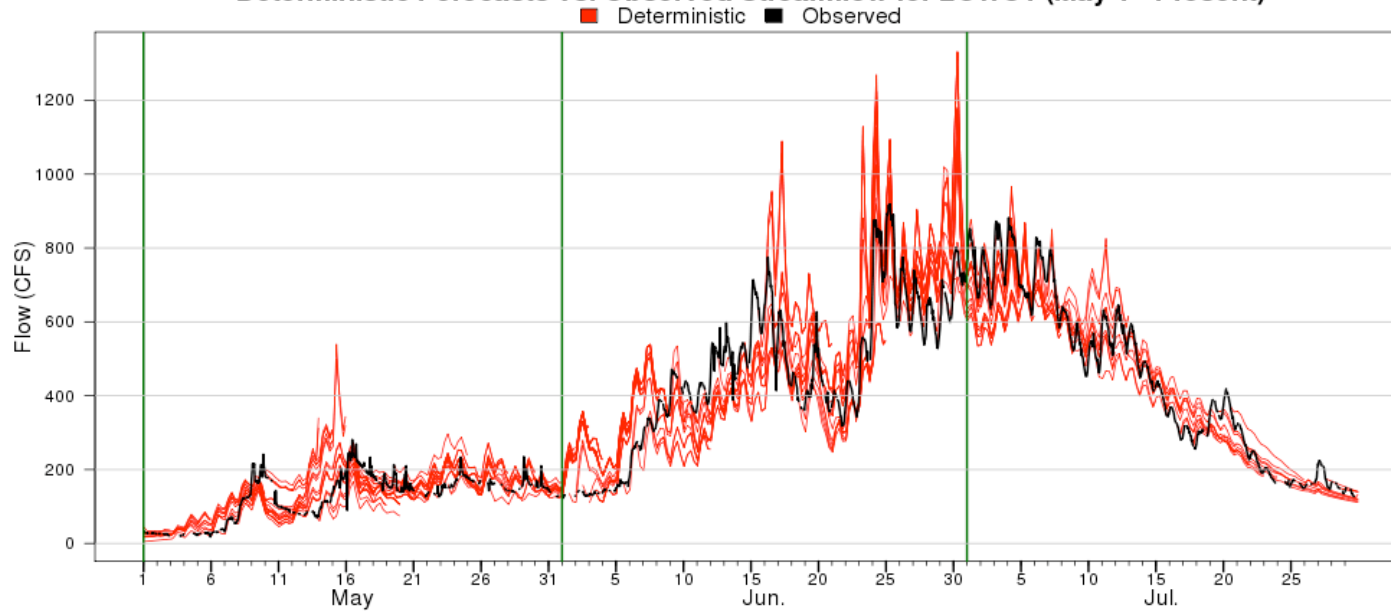


Little Cottonwood near SLC

Deterministic Forecasts vs. Observed Streamflow for LCWU1 (Mar. 1 - Present)

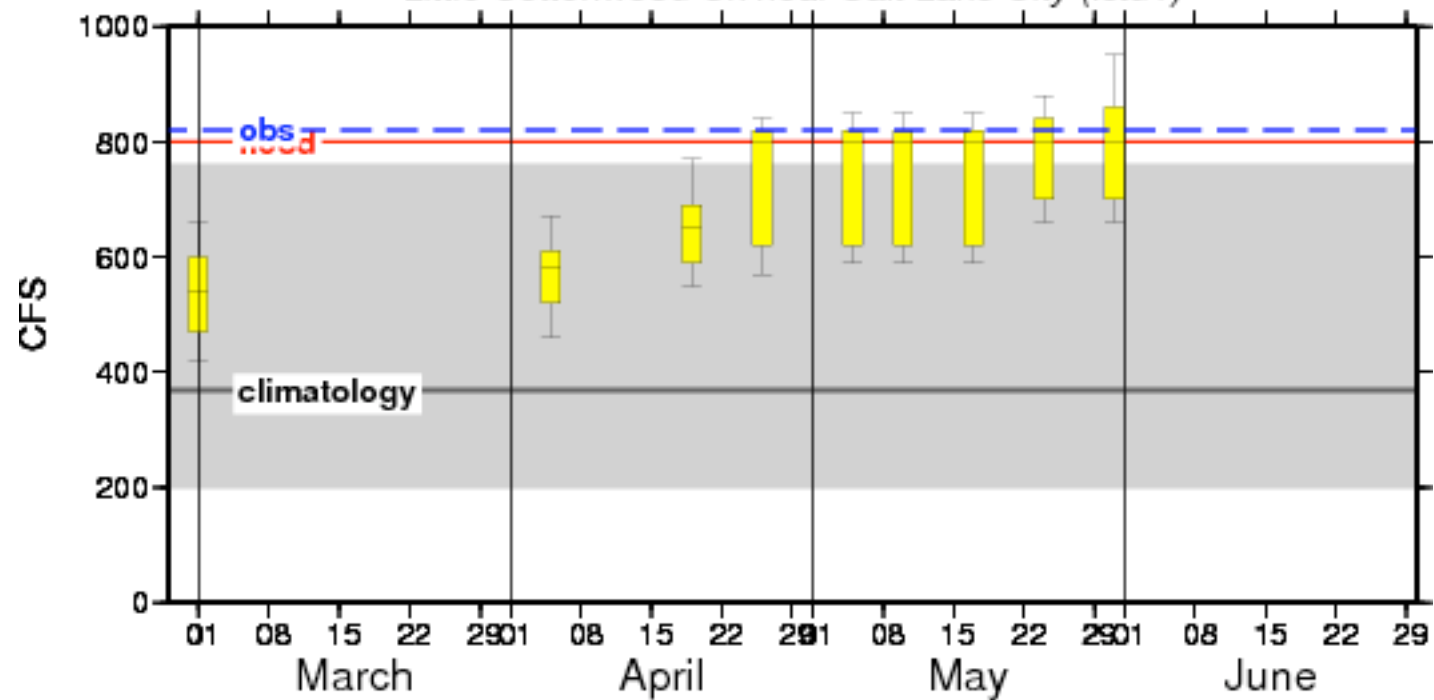


Deterministic Forecasts vs. Observed Streamflow for LCWU1 (May 1 - Present)



Peak Flows Forecast Ranges, WY 2011

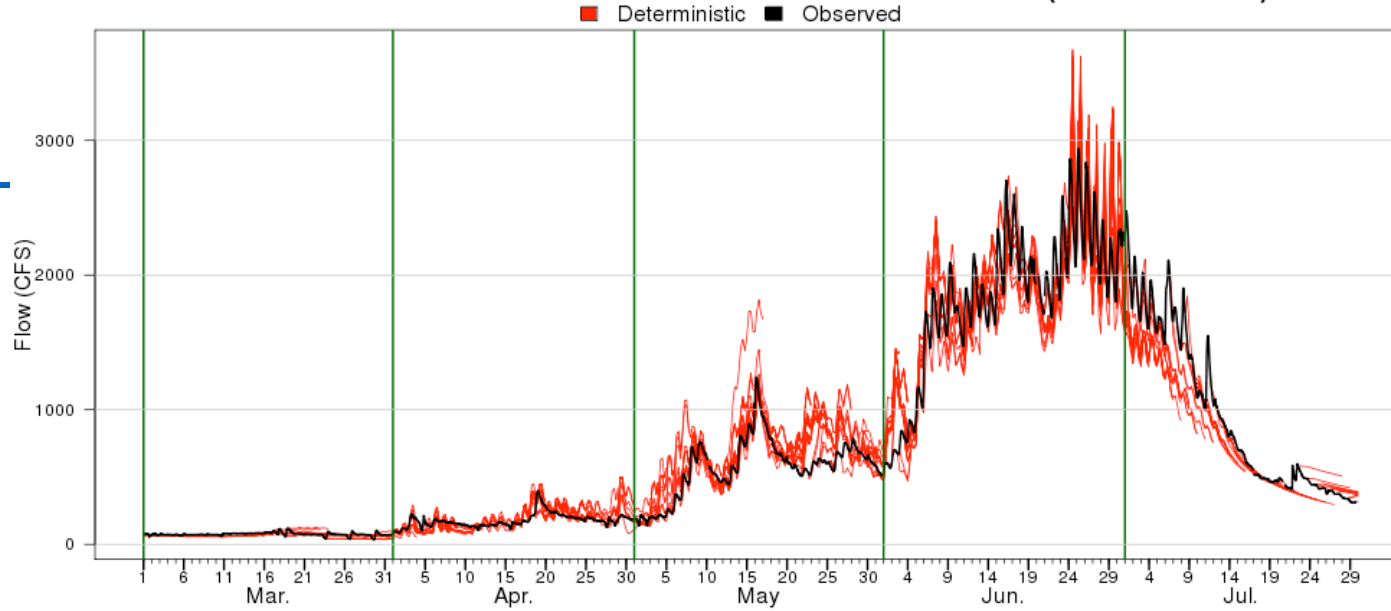
Little Cottonwood Ck near Salt Lake City (lctu1)



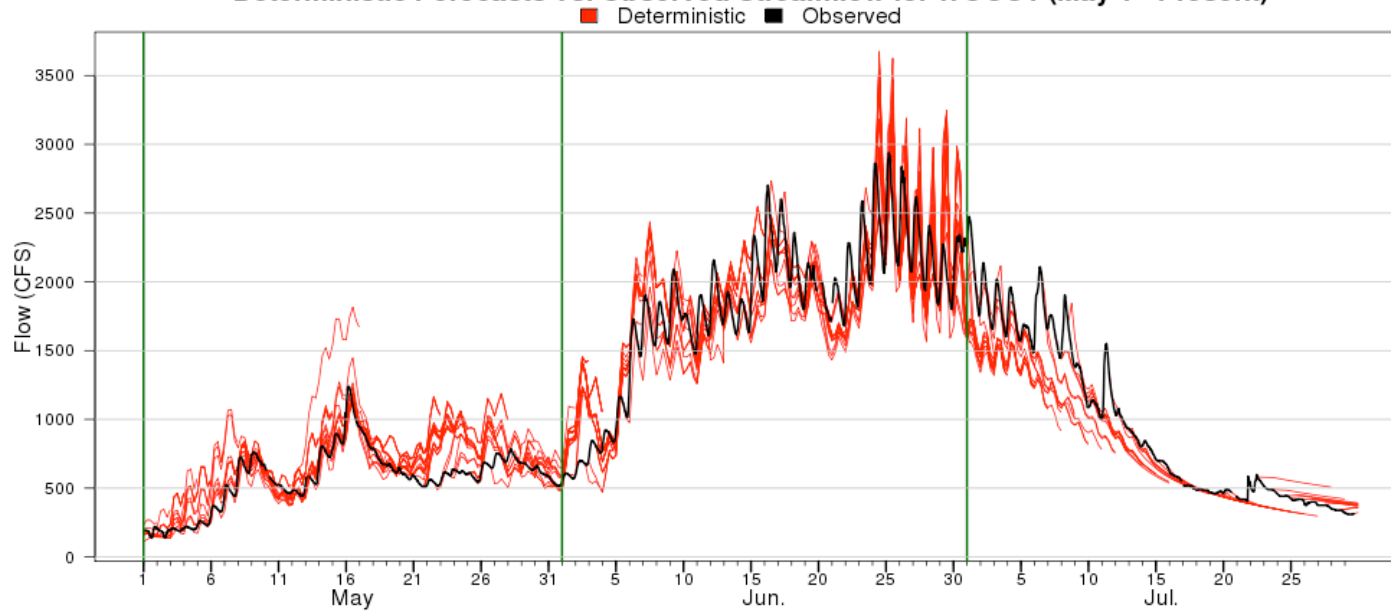


Provo R near Woodland

Deterministic Forecasts vs. Observed Streamflow for WOOU1 (Mar. 1 - Present)

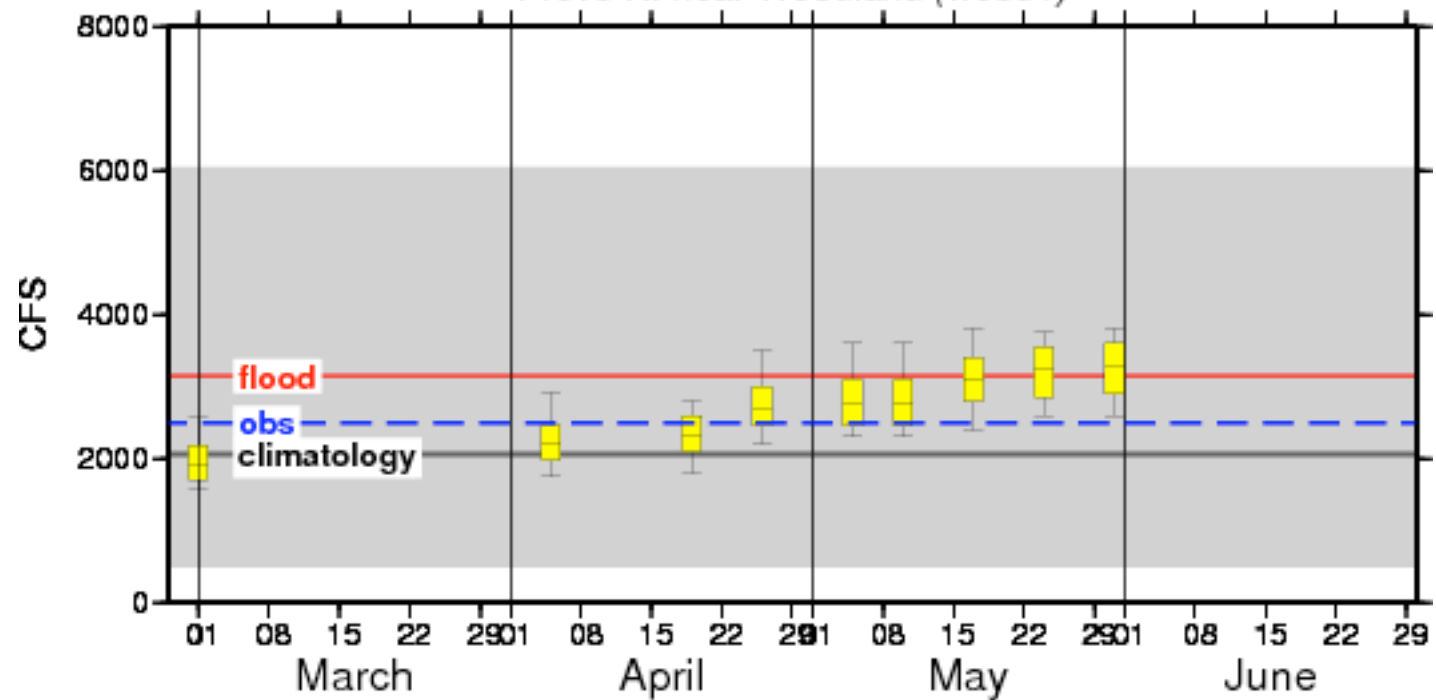


Deterministic Forecasts vs. Observed Streamflow for WOOU1 (May 1 - Present)



Peak Flows Forecast Ranges, WY 2011

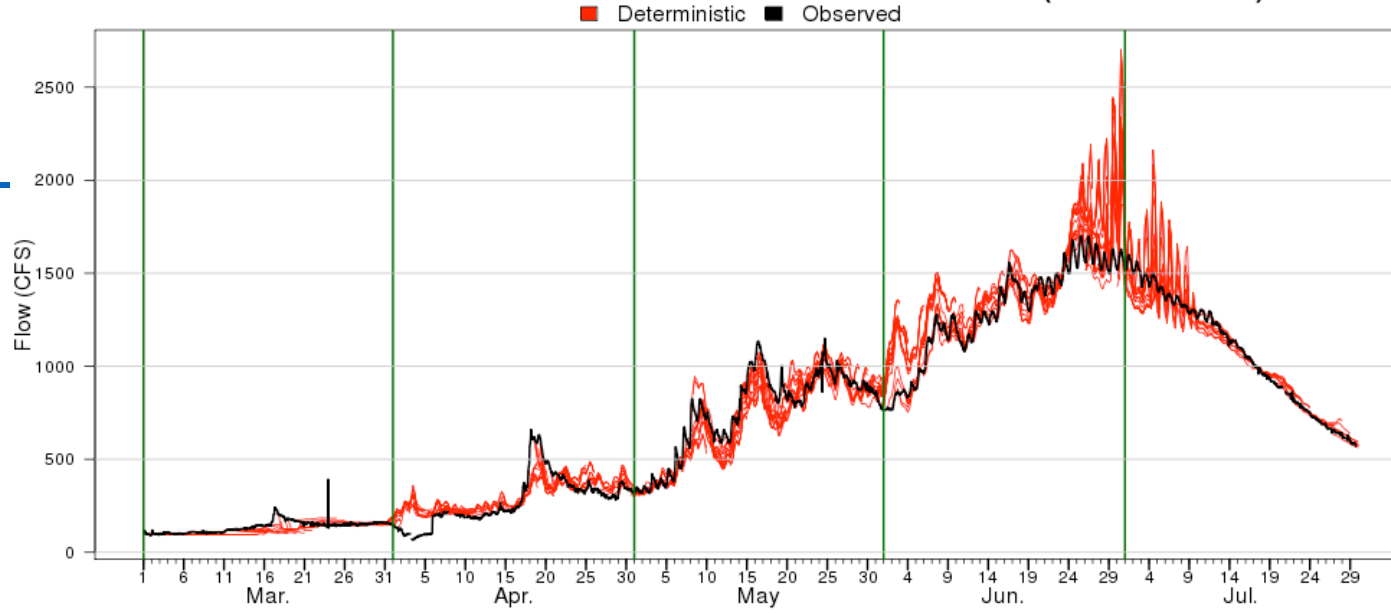
Provo R. near Woodland (woou1)



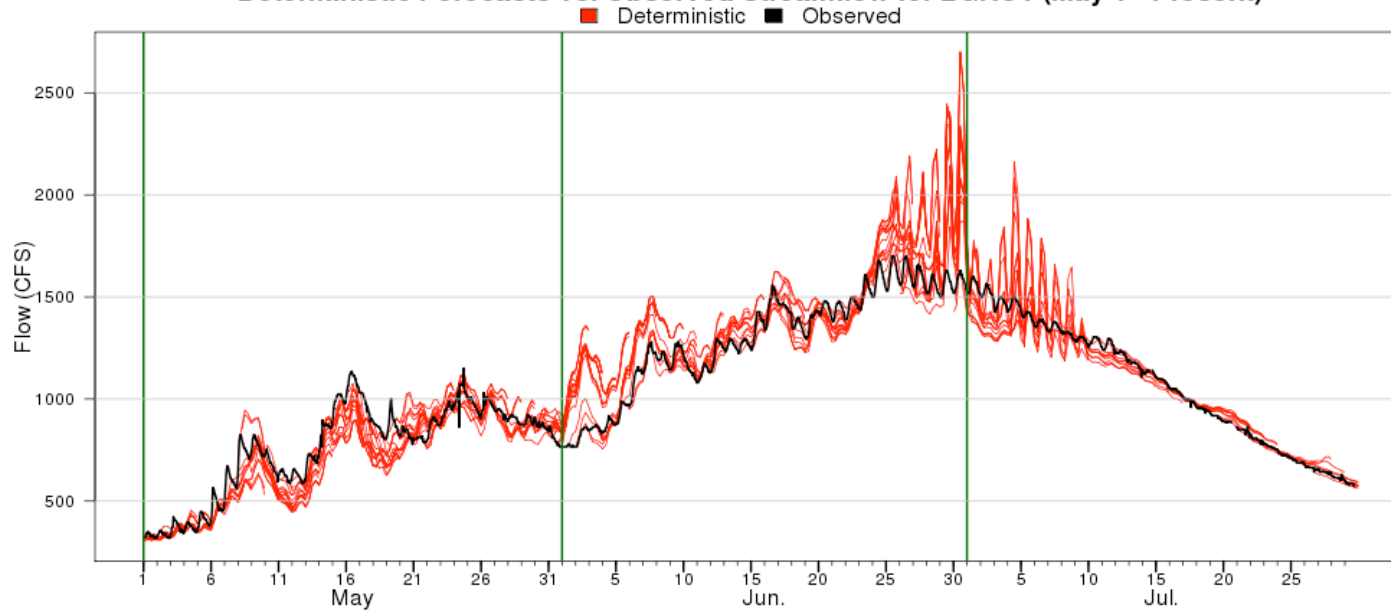


Logan R near Logan

Deterministic Forecasts vs. Observed Streamflow for LGNU1 (Mar. 1 - Present)



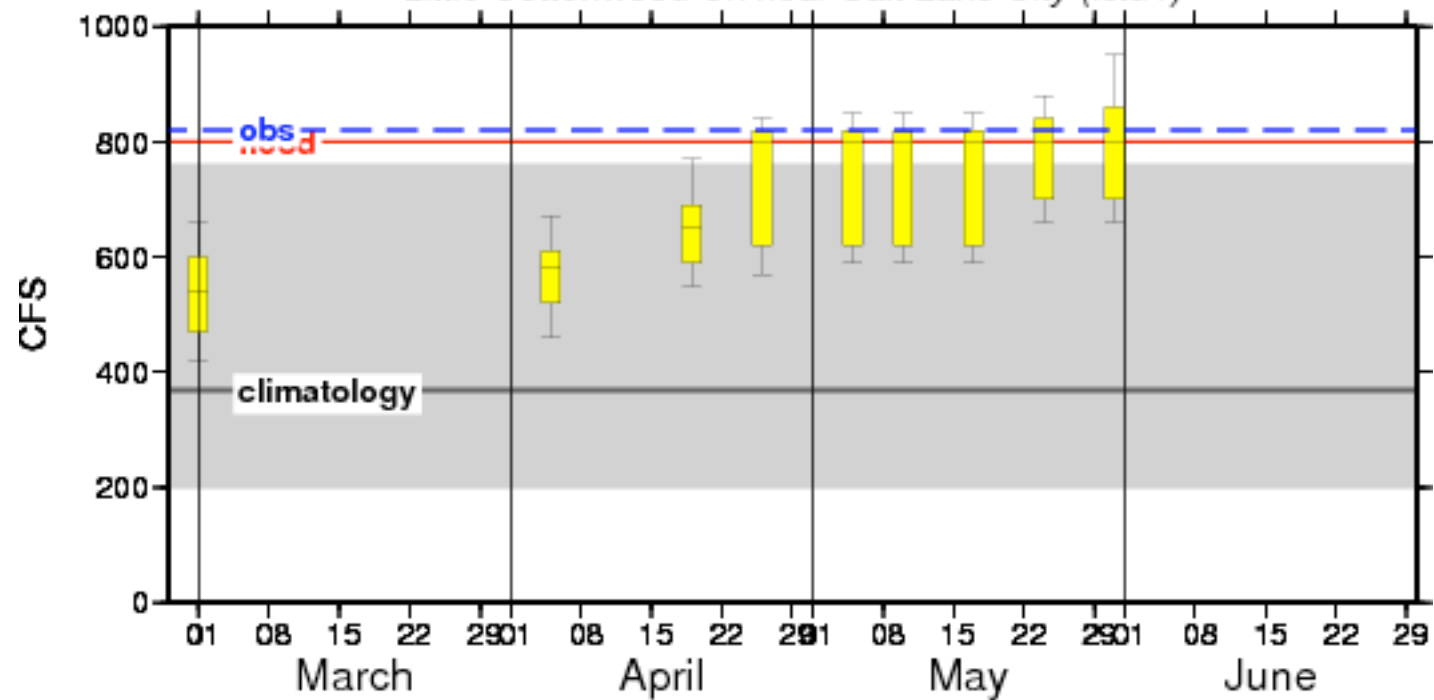
Deterministic Forecasts vs. Observed Streamflow for LGNU1 (May 1 - Present)





Peak Flows Forecast Ranges, WY 2011

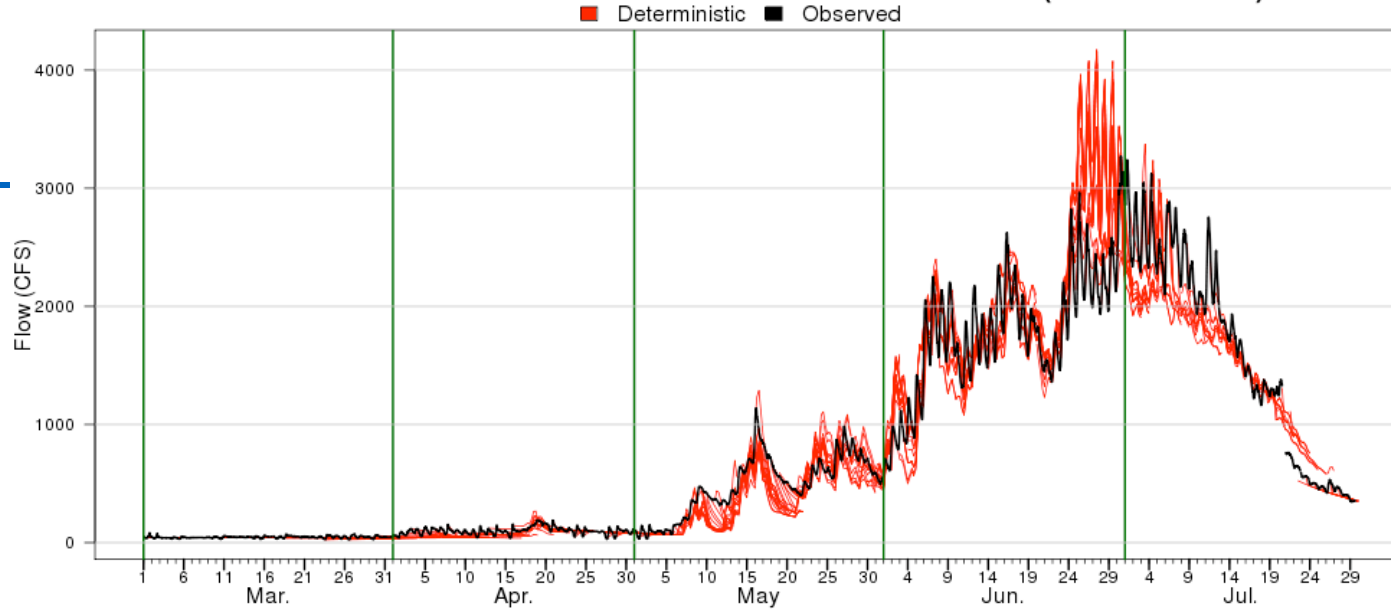
Little Cottonwood Ck near Salt Lake City (lctu1)



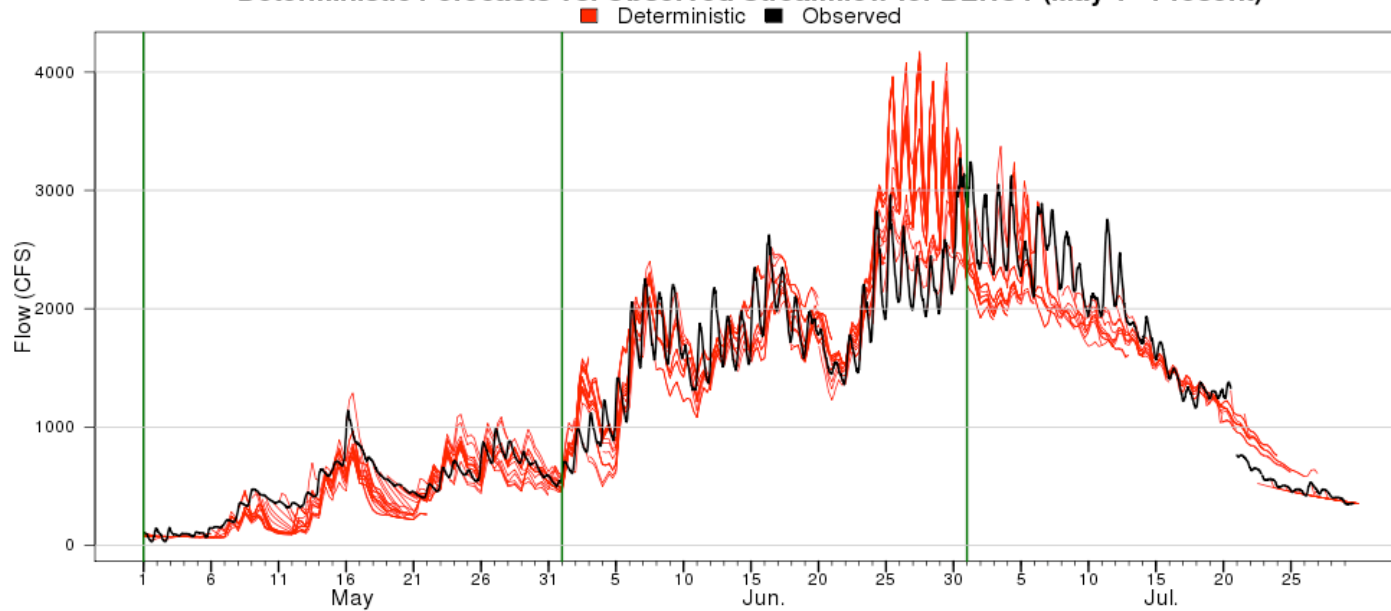


Bear at UT/WY state line

Deterministic Forecasts vs. Observed Streamflow for BERU1 (Mar. 1 - Present)



Deterministic Forecasts vs. Observed Streamflow for BERU1 (May 1 - Present)



Peak Flows Forecast Ranges, WY 2011

Bear R. near UT/WY stateline (beru1)

