January 1, 2016 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:

Water Supply Forecast Summary:

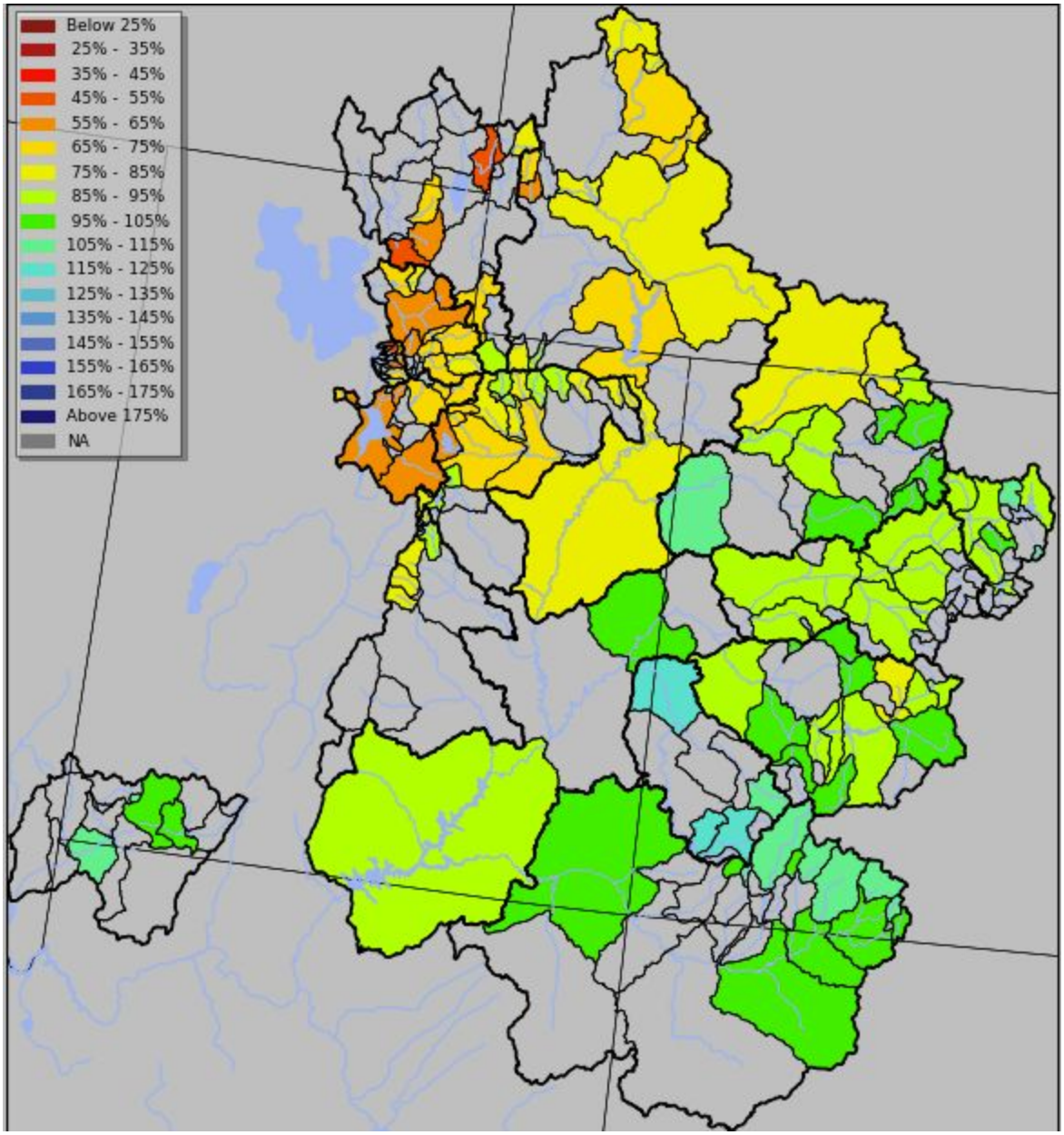
Above average April-July runoff volumes are anticipated at this time in the San Juan River Basin, Dolores River Basin, Sevier River Basin, and Virgin River Basin. Along the Colorado River mainstem, with the exception of a couple headwater basins that are slightly above average, near to slightly below average runoff is expected. Below average volumes are expected in the upper Green River Basin of Wyoming. Forecast volumes are more variable in the Yampa River Basin with near average runoff volumes expected in the headwaters and below average volumes farther downstream, and in the Little Snake River Basin. Similar volumes are anticipated in the Gunnison River Basin with near average April-July volumes in some headwater locations and below average volumes downstream.

The lowest April-July runoff volumes with respect to average are anticipated in the Duchesne and Great Basin of northern Utah. Although several locations report favorable snowpack conditions, the snowpack in these areas is more variable compared to the upper Colorado River Basin. Very low soil moisture conditions compared to average entering the winter is also impacting forecasts in these areas.

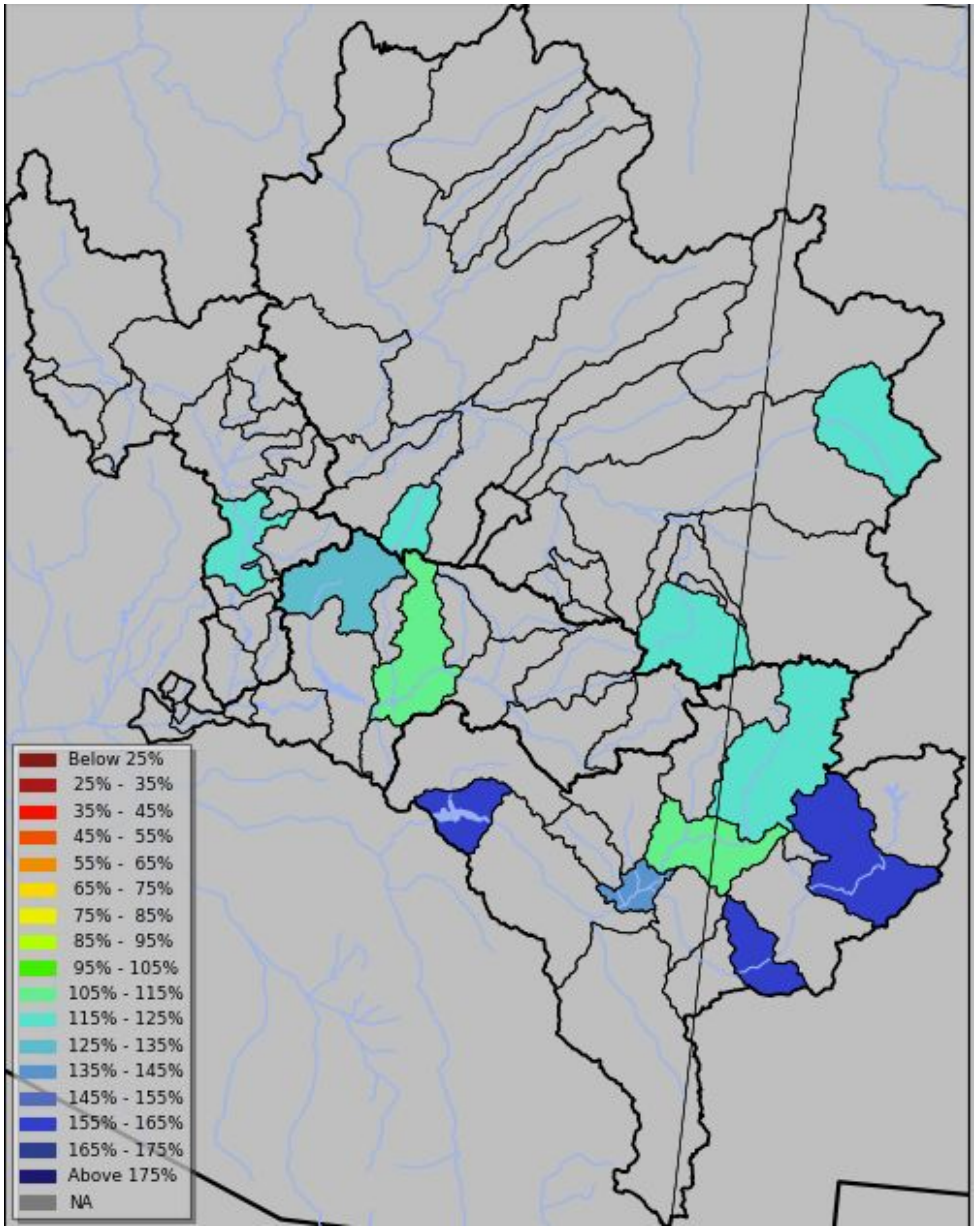
In the Lower Colorado River Basin above median January-May volumes are forecast for the Little Colorado River Basin, Salt River Basin, Verde River Basin, and Gila River Basin. El Niño historically correlates with higher streamflow volumes in the Lower Colorado River Basin. The strong El Niño event underway is impacting the forecasts in these areas along with favorable snow conditions and above average rainfall observed the past couple of months.

April-July inflow forecasts for some of the major reservoirs in the upper Colorado River Basin include Lake Powell 6.4 MAF (89% of average), Fontenelle Reservoir 550 KAF (76% of average), Flaming Gorge 700 KAF (71% of average), Blue Mesa Reservoir 610 KAF (90% of average), McPhee Reservoir 660 KAF (117% of average), and Navajo Reservoir 770 KAF (105% of average).

The summary above used forecasts at the 50% exceedance probability level. The full forecast range includes several possibilities given there is considerable time remaining in the snow accumulation season.



Upper Colorado Basin: 2016 April-July forecast volumes as a percent of 1981-2010 average
(50% exceedance probability forecast)



Lower Colorado Basin (AZ/NM): 2016 January-May forecast volumes as a percent of 1981-2010 median (50% exceedance probability forecast)

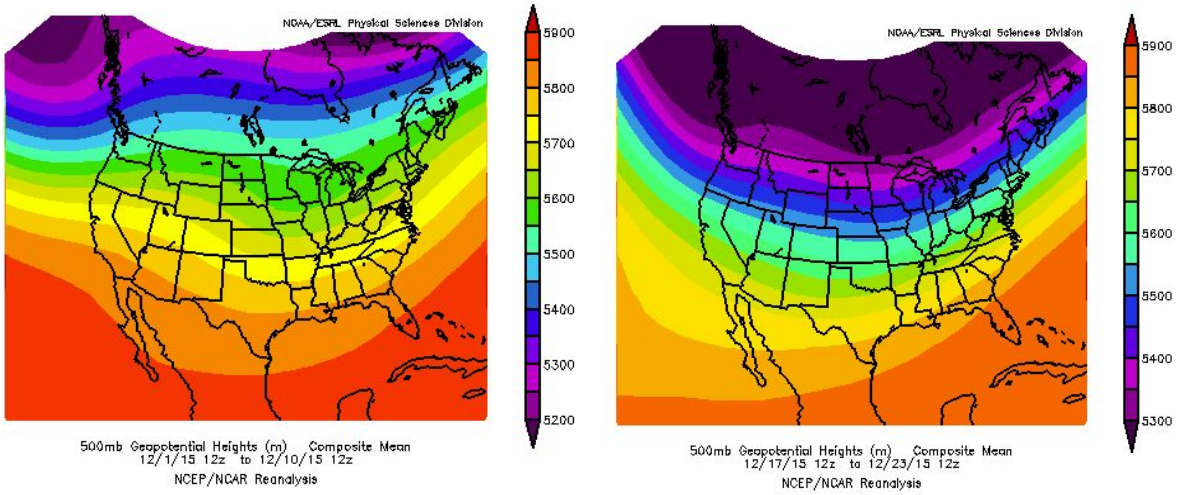
[Click here for specific site water supply forecasts]

Water Supply Discussion

Weather Synopsis:

Autumn precipitation was generally below average over the northern third of the CBRFC forecast area that includes the Great Basin of northern Utah, Duchesne River Basin, upper Green River Basin in Wyoming, and Yampa River Basin in Colorado. The weather pattern was more conducive to precipitation occurring over the southern two-thirds of the CBRFC forecast area, particularly in October and November. Splitting storm systems were the more frequent type of storm observed with most of the energy in these systems tracking across these southern areas.

December observed a bit of a role reversal with precipitation favoring the northern half of the CBRFC forecast area. Dry conditions to start the month gave way to a very moist pattern that started around the third week of the month and lasted for several days. Mountains received impressive snow amounts particularly in southwest Colorado and parts of central Utah. Farther south drier conditions were observed over the Lower Colorado River Basin in Arizona.



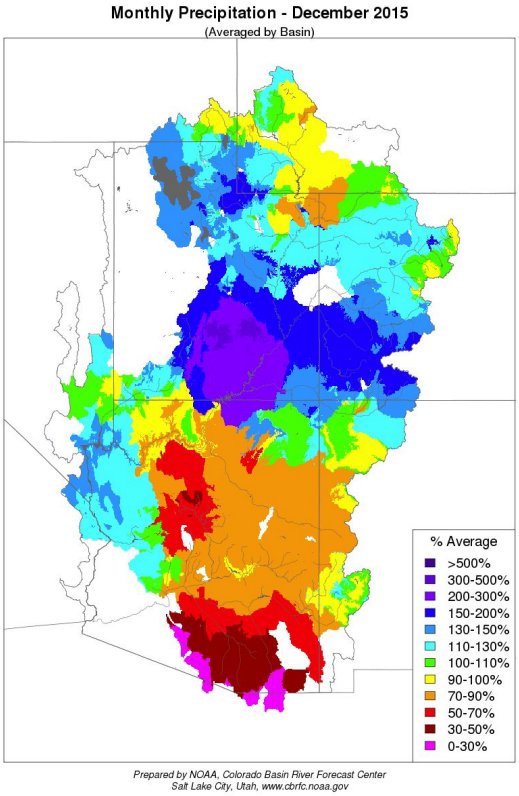
Mean upper air pattern at the 500 mb (Approx 18,000 feet) level.
Left: Mean upper air pattern during early December 2016 indicates high pressure and warm, dry conditions.
Right: By the 3rd week of December the pattern switched to a more zonal flow bringing significant moisture.

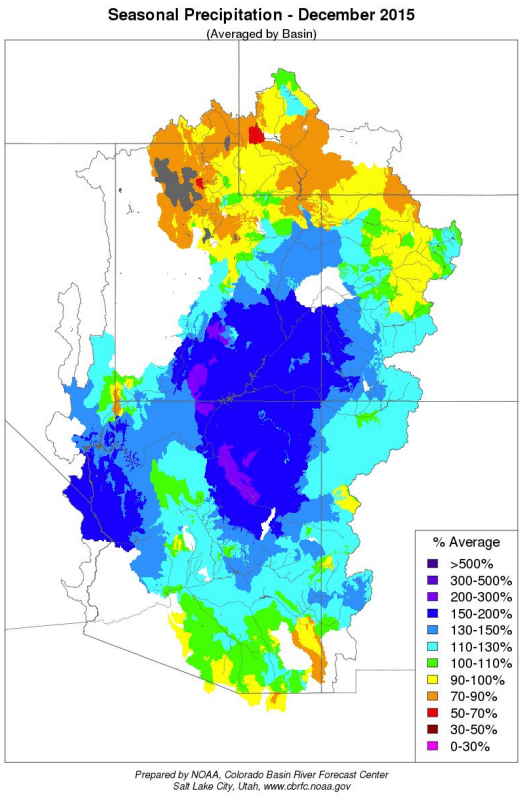
Precipitation and Temperatures:

Lake Powell was roughly the dividing line between areas receiving near to above average precipitation and below average precipitation in December 2015. River basins north of Lake Powell that include the Upper Colorado River Basin and Great Basin generally had near or above average precipitation. Exceptions to this were some of the lower elevation drainages in the eastern Duchesne River Basin. Highest precipitation amounts, compared to average, occurred in the Gunnison River Basin, Dolores River Basin, and higher elevations of the San Juan River Basin. Higher precipitation amounts were also observed over many of the Colorado and Green River tributaries in southeast Utah, the Sevier River Basin, and headwaters of the Bear and Weber River Basins.

Below average precipitation was widely observed in the Lower Colorado River Basin below Lake Powell. Exceptions included headwaters of the Gila River Basin where amounts were closer to average.

The seasonal precipitation (October-December) map shows the impact of the dry October and November in parts of the Great Basin. Much below average seasonal precipitation was observed from the Bear River Basin into the Weber River Basin and also in lower elevations in the eastern Duchesne River Basin. Most other areas were closer to average with above average amounts extending from the Lower Green River Basin below Flaming Gorge into the Gunnison, Dolores, San Juan, and Lower Colorado River Basins.





Monthly and water year precipitation graphics
(Averaged by CBRFC hydrologic modeled basins)

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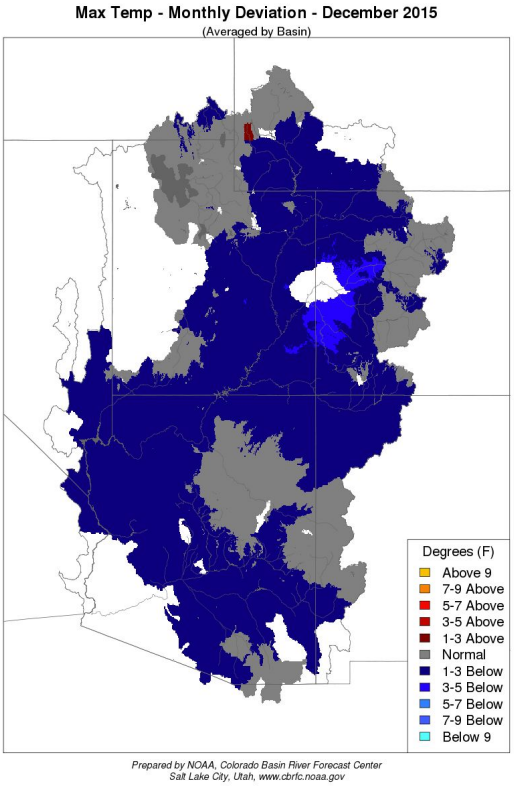
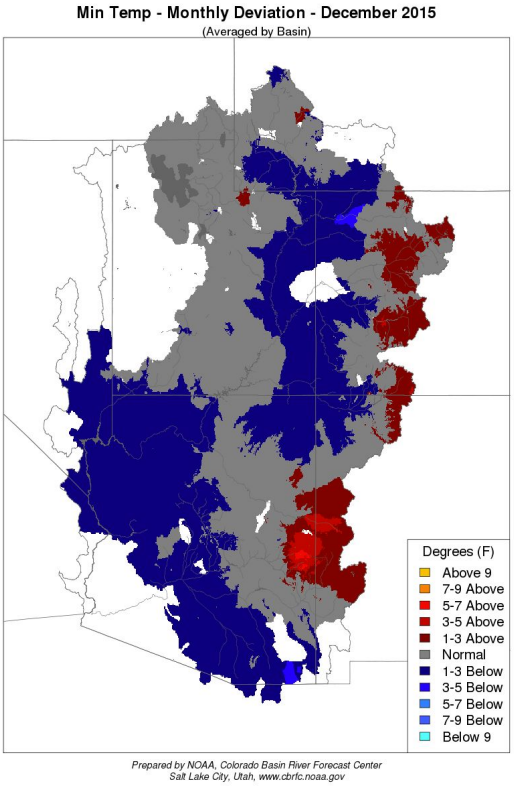
The mean monthly maximum temperatures were slightly below average for the month of December while minimum temperatures varied from slightly below to slightly above average. Early in the month, mean daily temperatures were as much as 20 degrees above average under a ridge of high pressure, however much colder temperatures occurred during the second half of the month.





Monthly maximum and minimum temperature departure from average.
(Averaged by CBRFC hydrologic modeled basins)

Snowpack:

Entering December snowpack conditions were quite mediocre with the exception of a few sites in the Colorado River headwaters and some higher elevations in the San Juan River Basin. Snowpack conditions have improved over all areas compared to early December, particularly in southwest Colorado and areas of central Utah that drain into the Sevier and Colorado rivers. A few of the SNOTEL sites in these areas rank in their top 3-7 of historical record that typically covers the last 30-36 years.

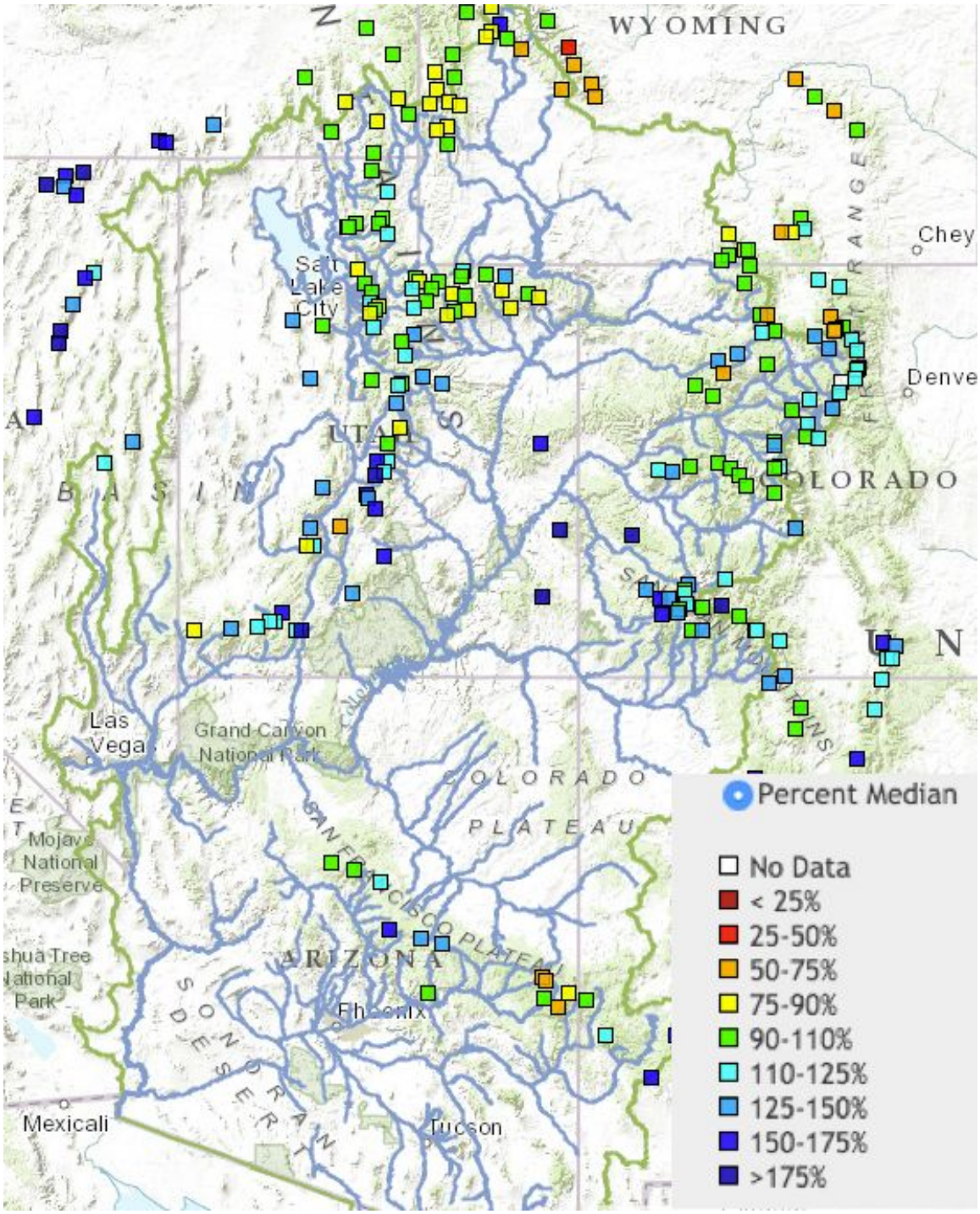
Southern Utah river basins including Colorado River tributaries, Virgin, and Sevier River Basins have snowpack conditions that are much above their historical median for early January. These conditions also exist in some of the San Juan River Basin. Some SNOTEL sites in these areas exceed 150 percent of median for early January.

Elsewhere snow conditions are a bit more variable with a mix of above and below median conditions. There are a greater number of sites with below median snow in the Duchesne River Basin, upper Green River Basin in Wyoming, and the Bear River Basin.

Snowpack conditions in the Lower Colorado River Basin, specifically in the Gila and Verde River Basins, have also improved to near or above median for early January with below median conditions in the headwaters of the Salt River Basin.

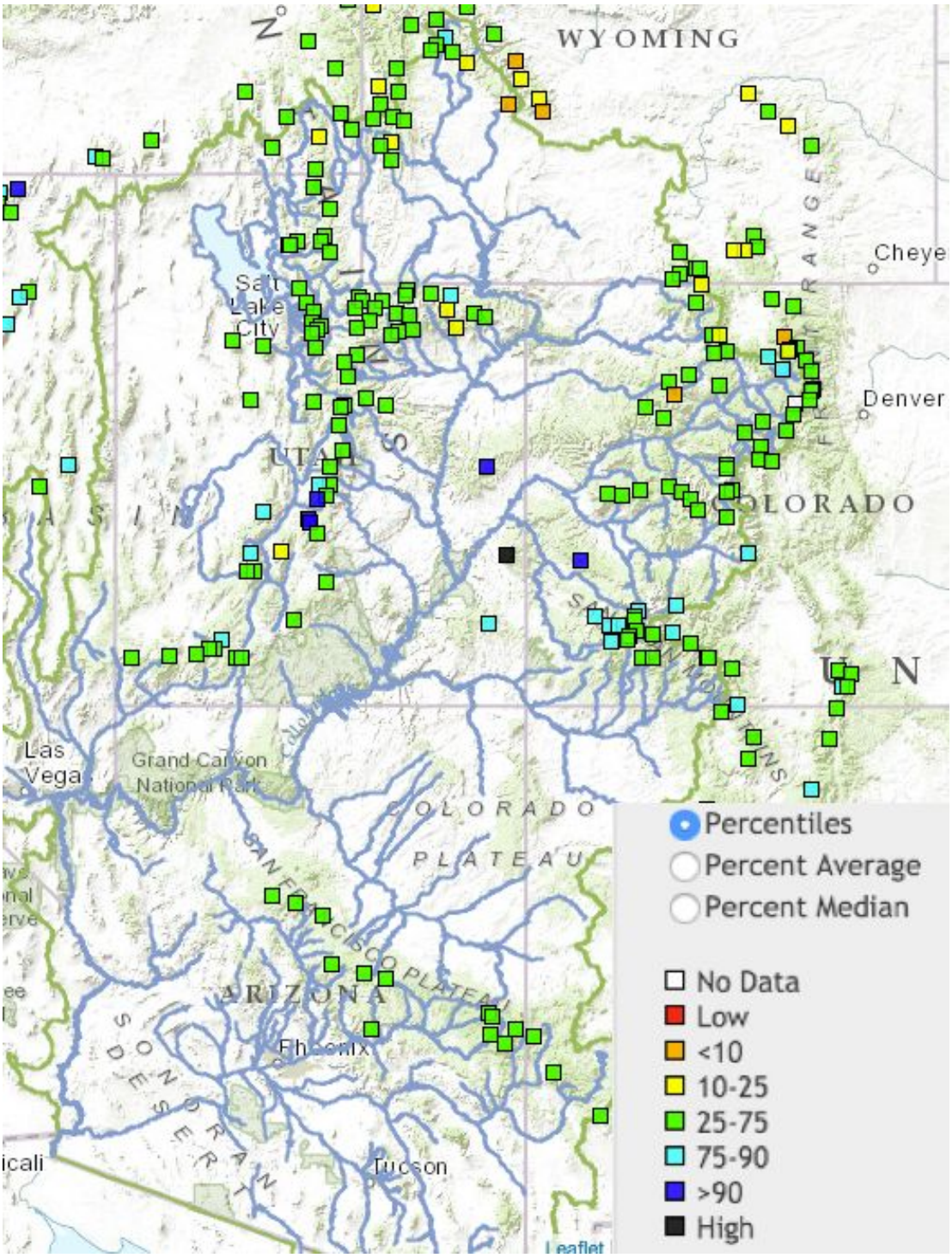
Highest elevation snow, above 10-11 thousand feet, is not well represented by SNOTEL sites. Due to dry conditions in the fall, and also warm conditions through October, high elevation snow accumulation had a late start.
This can be seen in the image representation of snow from the CBRFC hydrologic model below.

The image below shows conditions of snotel sites across the CBRFC area as of January 5, 2016.
For more details and daily updates, please refer here.



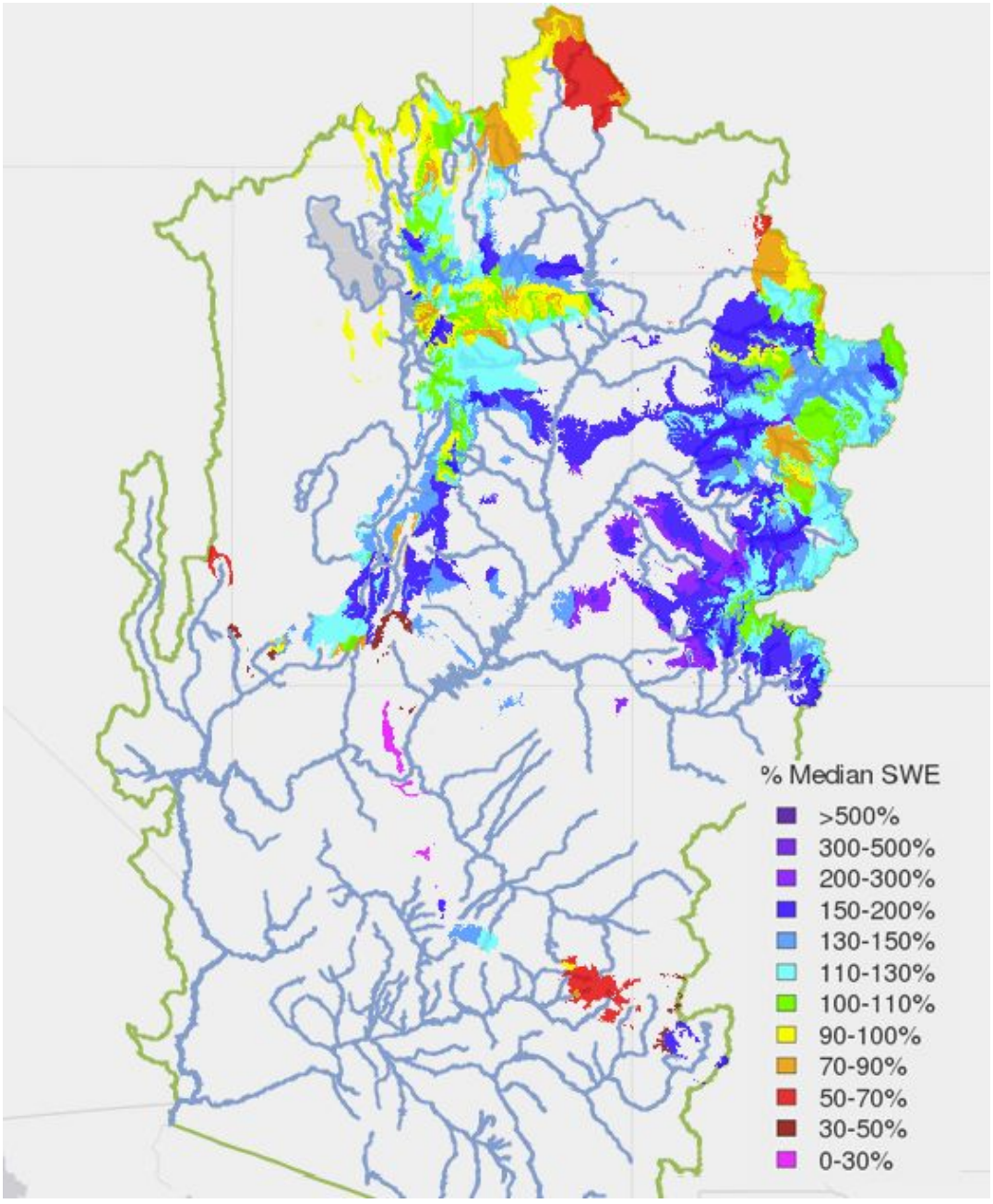
Percent Median Snow Conditions as of January 5th 2016

The snow percentile image displayed below indicates where the current snow measurement ranks in the historical record for each site. Some sites in Central Utah and southwest Colorado are in their top 10 of record (typically 30-36 years). The Lasal Mountain site in southeast Utah is the highest it has been in early January in 35 years of record.



Snow Percentile Image: Historical SNOTEL ranking as of January 5th 2016

The image below is the representation of snow in the CBRFC hydrologic model. Only those areas that provide the greatest contribution to the April-July runoff volumes are displayed. Snow at the higher elevations of several river basins are indicating lower values as a percent of median compared to lower elevations.



Modeled Snow: Snow representation from the CBRFC hydrologic model Jan 5th 2016

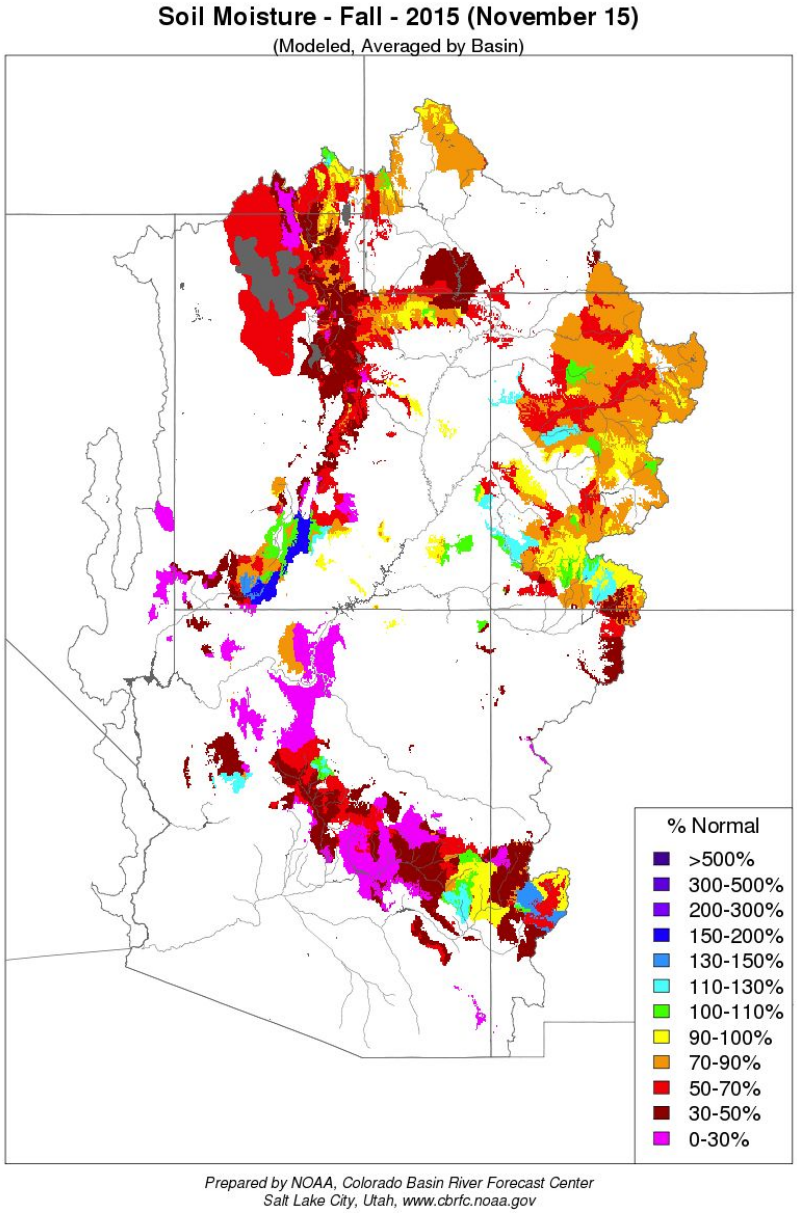
Soil Moisture:

Soil moisture conditions in the higher elevation headwater areas are important entering the winter, prior to snowfall, as it influences the efficiency of the snowmelt runoff the following spring. Modeled soil moisture conditions as of November 15th were generally below or much below average. Soil moisture was exceptionally low in much of

the Great Basin of central and northern Utah. Soil moisture conditions were more favorable in parts of the San Juan and Dolores River Basin as well as parts of the Sevier and Virgin River Basins in southwest Utah. There were also a few isolated basins near or above average in the Bear, Duchesne, Gunnison, and White River Basins but generally conditions were not as favorable.

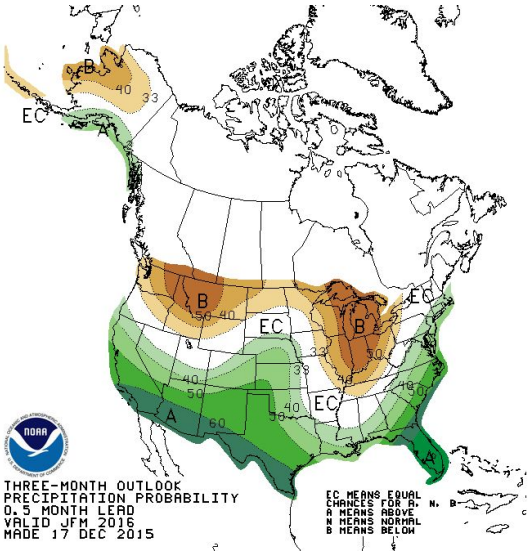
Soil moisture conditions tend to fluctuate more in the Lower Colorado River Basin in the winter due to the frequency of rain events and possibility of melting snow. Soil conditions in the fall are less informative than they are in the northern basins that remain under snowpack throughout the winter season.

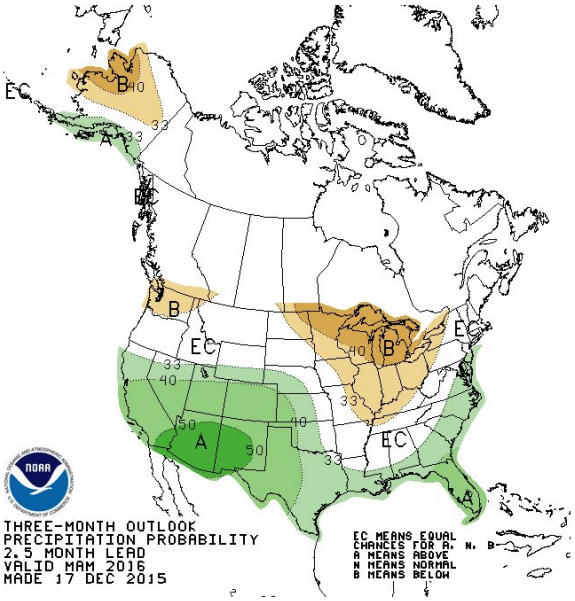
In the map below, areas in the blue are above the historical model soil moisture average while those in the yellow, orange, and red are below average. Only the higher elevation areas that have greatest impact to runoff volumes are displayed. The areas in white are not included.

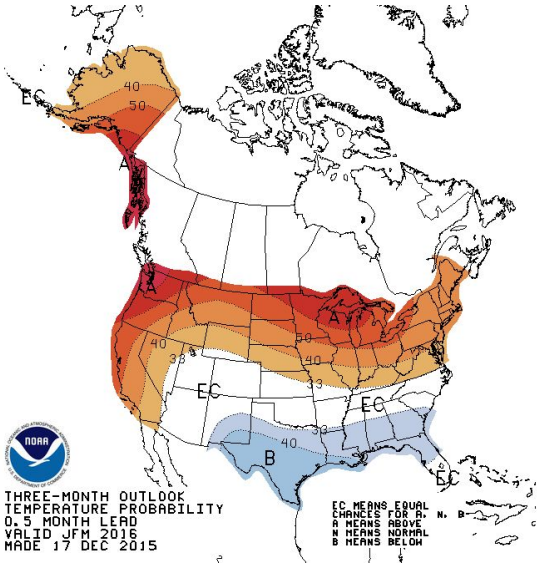


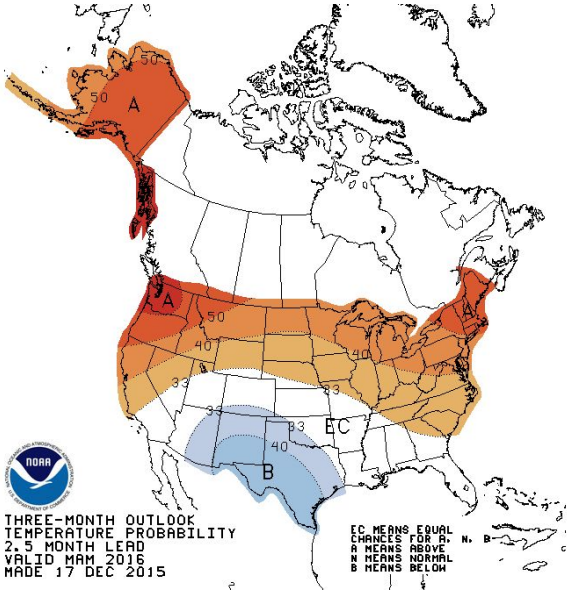
Climate Outlook:
A strong El Niño Southern Oscillation (ENSO) condition currently exists across most of the equatorial Pacific Ocean. Positive sea surface temperature anomalies greater than 2 degrees celsius extend from 170 degrees West eastward to the coast of South America. El Niño is expected to remain strong through the Northern Hemisphere winter of 2015-2016, with a transition to ENSO-neutral conditions anticipated during late spring or early summer 2016. The current El Niño is anticipated to be among the 3 strongest on record dating back to 1950.

The Climate Prediction Center indicates enhanced chances of above normal precipitation over the southern half of the CBRFC forecast area during the January through March period. This potential for above average precipitation expands to cover most of the CBRFC forecast area during the March through May period. The potential for above average temperatures exist throughout this time period over the western and northern sections of the United States including the Green River Basin of Wyoming.









Conclusion:

Snowpack is favorable in many areas of the CBRFC as of early January. However due to dry and warm conditions in the fall highest elevation snowpack in several areas had a late start and is lower compared to the historical median than snowpack in lower elevations. The impact is slightly lower streamflow forecast volumes where this has occurred.

Very low modeled soil moisture conditions were widespread entering the winter season with the impact being lower forecasts in those areas affected. The current strong El Niño underway also correlates with higher winter precipitation across the southern tier of the United States and historically has a positive impact on streamflow volumes in the Lower Colorado River Basin.

Areas where snowpack and soil moisture have combined to produce highest forecasts with respect to average include the San Juan River Basin, Dolores River Basin, Sevier River Basin, and Virgin River Basin. In these areas above average April-July runoff volumes are expected at this time.

Above median forecasts are anticipated throughout the Lower Colorado River Basin due to a combination of the strong El Niño event, favorable snowpack, and recent months with above average precipitation.

A somewhat variable snowpack, with locations reporting both above and below average snow exist in the Great Basin and Duchesne River Basin of northern Utah. In these areas, particularly the Great Basin, model soil moisture conditions were significantly below average entering the winter. The impact is for lower forecast volumes then what might typically be expected given the current snow conditions with an average soil moisture scenario.

Elsewhere forecasts generally range in the 80 to 110 percent of average category with headwater locations in the Yampa, White, Colorado, and Gunnison River Basins closer to average and lesser volumes with respect to average anticipated farther downstream.

End Of Month Reservoir Content Tables

Green River Basin
Upper Colorado River Basin

San Juan River Basin
Great Salt Lake Basin
Sevier Basin

Basin Conditions and Summary Graphics

Green River Basin
Upper Colorado River Basin
San Juan River Basin
Great Salt Lake Basin
Sevier River Basin
Virgin River Basin