October 16th, 2012

Upper Colorado River Basin Drought Early Warning System

Weekly Climate, Water & Drought Assessment
2010-12 La Niña event reached its biggest peak since the mid-70s in late 2010, followed by a brief excursion to ENSO-neutral conditions during mid-2011; it reached a second peak last winter, and has been followed by a weak El Niño event that may already have come and gone.

http://www.esrl.noaa.gov/psd/enso/mei
The ECMWF July 2012 forecast (left) showed a substantial range – with seven members below 0°C and five members reaching ‘Super-El Niño-size’ of +2°C or by early 2013. The mean outcome (just under +1°C) was a weak El Niño through the remainder of 2012.

The ECMWF October 2012 forecast (right) maintains weak El Niño-like conditions, mostly remaining below +0.5°C, with more ensemble members slipping back into negative territory than remaining above 0.5°C by early 2013. Looks like we will see a rare ENSO-neutral winter in the wake of double-dip La Niña.
During negative PDO and no moderate to strong ENSO event of either phase, the winter half-year (Oct-Mar) tends to be drier than average over eastern CO (left), while the West slope is slightly favored with moisture. In the positive PDO case (right), northeastern CO is most favored, while the rest of the state shows no preference for wet or dry. If we were to see a renewed El Niño while keeping negative PDO conditions, the outlook would be more favorable for all of Colorado. Meanwhile, the odds for negative PDO are extremely high, based on last winter and this summer’s values.
During positive NAO and no moderate to strong ENSO event, the winter half-year (Oct-Mar) tends to be wetter than average over eastern CO (left), while the West slope is less favored with moisture. In the negative NAO case (right), all of Colorado tends to be dry, especially over eastern plains. *If we were to see a renewed El Niño with positive NAO conditions, the outlook would be more favorable for most of Colorado.*

*At least one precursor of the NAO indicates positive conditions for this winter!*
Fall (left) remains the hardest season to predict for this region. In particular, “??” over the mountains of northern UT and CO denote an uncertain outcome. Unfortunately, a closer look at the performance of similar forecasts in the past shows a preference for dry outcomes over north-central CO, which does not bode well for the first half of our snowpack season.

Eastern CO has a tilt towards wetness where operational forecasts have been most reliable since 1999.

There is a great need to improve seasonal forecasts for Upper Basin!
In September, winter precipitation (left) is fairly predictable in much of this region, except for the eastern half of CO and SE NM.

While slightly tilting towards above-average moisture, our northern mountains show a wide spread of outcomes in similar situations in the past. IF El Niño were to rally soon, the combination of El Niño with negative PDO would improve snowpack prospects, as last seen in 1994-95.
ECWMF vs GFS from last night shows trough along West Coast, and ridging east of us – more pronounced in GFS which would be detrimental to our precipitation chances.
1. El Niño did not fully mature this summer, and will probably remain anemic into the winter.

2. No big storm in sight for the next two weeks— in contrast to typical El Niño situations, this October will probably not deliver above-average moisture – looks like we are not off to a good start.

1. My forecast for late fall (October-December) shows a tilt towards wet conditions covering most of eastern CO, with little information away from climatology further west. If El Niño had been in place, October and December would have been the months to watch to give us above-normal moisture. A first peek at late winter (January-March) shows above-normal odds for moisture in north-central and northeast CO where operational skill has been minimal at this lead-time, with a hint of expected drier-than-average conditions towards the Four Corners.

2. Bottomline: El Niño may already have come and gone, so we may end up with a rare ENSO-neutral winter after a double-dip La Niña. While El Niño would boost our chances for moisture overall in next six months, negative PDO conditions will favor the mountains over the eastern plains during the winter. A positive NAO would increase our chances for moisture east of the divide. Both of these conditions are more likely than not for now – stay tuned!
- Assessment of current water conditions
- Precipitation Forecast
- Recommendations for Drought Monitor
Precipitation/Snowpack Update
Water Year Average Precipitation for Selected Stations

- Grand Junction
- Vail
- Vail Pass
- Georgetown
- Denver
- Burlington

Precipitation (inches)

Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep
---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----
Colorado, Utah and Wyoming Water Year 2012
Precipitation as Percentage of Normal (Oct 2011 - Sept 2012)

awy_sep12_pn

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Snotel Water Year Precipitation Percentile Ranking for 30 September 2012 (Stations with 15+ years of data only)
6 Month SPI
4/15/2012 - 10/14/2012

Generated 10/15/2012 at HPRCC using provisional data.
Colorado River near Colorado-Utah State Line
14th Percentile
60% of Normal

Green River at Green River, Utah
8th Percentile
44% of Normal

San Juan River near Bluff, Utah
19th Percentile
43% of Normal
7-day average streamflow compared to historical streamflow
Temperature Departure from Normal
10/8/2012 – 10/14/2012
VIC Soil Moisture
14 October 2012
eMODIS VegDRI Vegetation
16 September 2012
CoAgMet Reference Evapotranspiration Stations
Holyoke Kimberly-Penman Reference ET (1992 - 2012)

NOTE: Paoli used for period of missing data.
Lucerne Kimberly-Penman Reference ET (1992 - 2012)

- Average
- 2006
- 2009
- 2012

Date:
4/1 5/1 6/1 7/1 8/1 9/1
Reservoir Update
Colorado Statewide Reservoir Levels on October 1st for Years 1997-2012

Percent of Average

--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---
Colorado Reservoir Storage Map

Percent of Average

- Blue: >= 150
- Light Blue: 130 - 149
- Light Lime: 110 - 129
- Light Green: 90 - 109
- Light Yellow: 70 - 89
- Orange: 50 - 69
- Red: < 50

Yampa and White
- 91% of Avg
- 76% of Capacity
- LY 113% of Avg

Upper Colorado
- 71% of Avg
- 58% of Capacity
- LY 110% of Avg

South Platte
- 73% of Avg
- 41% of Capacity
- LY 121% of Avg

Statewide:
- 67% of Avg
- 38% of Capacity
- LY 105% of Avg

San Miguel, Dolores, Animas and San Juan
- 66% of Avg
- 42% of Capacity
- LY 101% of Avg

Gunnison
- 61% of Avg
- 47% of Capacity
- LY 105% of Avg

Arkansas
- 68% of Avg
- 19% of Capacity
- LY 88% of Avg

Rio Grande
- 47% of Avg
- 12% of Capacity
- LY 47% of Avg

Lake Powell: 70% of Avg
- 57% of Capacity

End of September 2012

Provisional Data Subject to Revision
Precipitation Forecast
Recommendations

[Map showing drought intensity with legend: Abnormally Dry (D0), Drought - Moderate (D1), Drought - Severe (D2), Drought - Extreme (D3), Drought - Exceptional (D4)]

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INFO

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NIDIS - UPPER COLORADO BASIN PILOT PROJECT

For more information
NIDIS Weekly Climate, Water and Drought Assessment Summary

Upper Colorado River Basin

October 16, 2012
Precipitation

Last week, beneficial precipitation fell in the Upper Colorado River Basin (UCRB), with most areas receiving between 0.25 and 1.00 inch. (Fig. 1). The northern part of the basin in WY received less than 0.25 inches. Eastern and Central Utah received between 1 and 2.5 inches of precipitation for the week. East of the basin, eastern CO was dry receiving less than 0.10 inches with areas closer to the mountains up to 0.25 inches. Southeast Colorado in Baca and Prowers Counties fared well, receiving up to 1.00 inches.

For Water Year 2012 most of the UCRB was drier than average (Fig. 2). Some parts in central Utah and southwest Wyoming saw above average precipitation for the water year. The San Juan mountains in CO received near average precipitation. Northwest CO was the driest part of the basin, with most areas receiving between 30% and 70% of average water year precipitation. East of the basin, most of eastern CO saw between 70% and 90% of average water year precipitation, with parts of the Front Range, Saguache County, and the Sangre de Cristos receiving near average precipitation for the water year.
Streamflow

As of October 15th, about 33% of the USGS streamgages in the UCRB recorded normal (25th – 75th percentile) 7-day average streamflows (Fig. 3). About 38% percent of the gages in the basin are recording much below normal or low (i.e. lowest on record) streamflows, and 3% of the gages are recording above normal flows. As flows return to a normal baseflow, the rivers are expected to run lower, and small changes could mean larger changes in percentiles rankings. Accumulated volumes for this time of year is a better indicator of how runoff has been affected by dry conditions.

Flows on all three key gages across the basin decreased slightly from last week (Fig. 4). The Colorado River near the CO-UT state line and the Green River at Green River, UT are both recording flows in the below normal range, at the 14th and 8th percentiles, respectively. Flows on the San Juan River near Bluff, UT increased slightly from last week from the 13th percentile to the 19th percentile.
Water Supply and Demand

The UCRB saw near normal temperatures last week with an isolated area in the Upper Green River Basin seeing 2 to 4 degrees above normal. East of the basin, the rest of CO experienced temperatures 2 to 6 degrees cooler than normal. Satellite vegetation conditions show very dry vegetation through much of the northern part of the UCRB and throughout eastern CO (Fig. 5). Improved vegetation conditions show up in the central and southern mountains of CO and also in southern UT, however still very dry. For the growing season, reference evapotranspiration (ET) rates were higher than average across the western slope. Stations in southeast and northeast CO reported near record or record high reference ET accumulations for the growing season.

For the month of September, all the major reservoirs in the UCRB saw a volume decrease, which is normal during this time of year. Navajo and Granby reservoirs decreased more than what is normal for this time of year, while Green Mountain decreased less than average. The Colorado statewide reservoir storage on October 1st was 67% of normal. Only 2002 was lower on October 1st in the past 15 years at 48% of average.

Precipitation Forecast

The upcoming week will see the UCRB sandwiched between a ridge of high pressure over the eastern Pacific and a deep area of low pressure developing over the northern plains. A strong jet streak moving down the west side of the plains low will be positioned directly over the basin on Wednesday and lead to gusty winds over the northern areas. Expect to see rain showers breaking out by Wednesday morning with some accumulating snow possible above 10,000 ft. through the day. Limited moisture associated with this system should keep any appreciable accumulation to the high terrain of WY and northern CO/UT, with generally less than 0.10 inches of liquid equivalent possible throughout the duration of the event. On Thursday the entire pattern begins to shift eastward, allowing the tall pacific ridge to move over the UCRB and bring a return to seasonal temperatures and dry conditions through the weekend. The potential for high mountain snow showers will return moving into early next week as moisture and a weak disturbance are expected to approach the northern sections of the basin on Monday.
Fig. 5: eMODIS VegDRI showing satellite vegetation conditions as of October 16th.

Fig. 6: Quantitative precipitation forecast (QPF) by the Hydrologic Prediction Center out to 12UTC Sunday, October 21st.
**Drought and Water Discussion**

**UCRB:** Slight improvements for the UCRB are recommended (Fig. 7). A trimming of the D3 in Garfield and eastern Mesa Counties to D2. It is also recommended the D3 in eastern Gunnison County and Chaffee County be improved to D2. The D3 in western Gunnison County should remain there due to some of the lowest streamflows on record.

**Eastern CO:** Only a slight trimming of the D2 in SW Larimer County into SE Jackson and NE Grand Counties is recommended. The rest of Eastern CO is remaining status quo because of the long term dryness.

![Drought categories and their associated percentiles](image)

Fig. 7: October 16\textsuperscript{nd} draft of U.S. Drought Monitor for the UCRB with recommendations.