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INTERMOUNTAIN WEST CLIMATE SUMMARY

A product of the Western Water Assessment

Issued July 22, 2010, Vol. 6, Issue 5

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PRINTER-FRIENDLY VERSION

July 2010 Summary

Temperature — *June saw cooler-than-average temperatures in Wyoming and northern Utah, and warmer-than-average conditions to the south, particularly in southeastern Colorado.*

Precipitation — *Most of Wyoming and portions of Utah and northern Colorado experienced above-average precipitation in June, while dry conditions were prevalent in southern Colorado.*

Hydrological Conditions — *Very warm temperatures in late May and early June led to above-average peak daily flows in the first half of June in most basins. Major flooding occurred in central and southeast Wyoming.*

ENSO — *La Ni–a conditions are currently developing across the equatorial Pacific, and the onset of a La Ni–a event is likely by the end of August.*

Climate Forecasts — *For August and subsequent seasons, the CPC seasonal outlooks call for an enhanced probability of warmer-than-average temperatures for the western parts of the Intermountain region, and an enhanced probability of below-average precipitation for Utah and above-average precipitation in northeast Colorado.*

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Announcements & News

WWA-CBRFC Streamflow Forecast Workshop
August 2, 2010, Salt Lake City, UT

WWA, with Climate Assessment for the Southwest (CLIMAS) and the NOAA NWS Colorado Basin River Forecast Center (CBRFC) in Salt Lake City, is presenting a one-day workshop on Monday, August 2, for potential users of the online Water Resources Outlook tool, developed by CBRFC to provide user-friendly access to streamflow forecast data for individual forecast points across the western US. The workshop sessions are designed to both educate participants about the tool and the forecasts, and solicit feedback to improve the tool.

For more information and to register, please visit the workshop webpage here. The new Water Supply Outlook tool can be accessed here.

Changes in WWA and IWCS staff

Christina Alvord, who has served as WWA research associate and IWCS writer/editor for three years, is returning to school and will leave WWA in early August. We wish Christina the best with her future plans.

Eric Gordon, who was a student research assistant with WWA during this past year, has joined WWA as our full-time Program Manager. He will also assist with the production of the IWCS.

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Feature Article

The National Integrated Drought Information System (NIDIS) in the Upper Colorado River Basin: A Progress Report

By Jim Verdin, Lisa Darby, and Roger Pulwarty (NIDIS Program Office)

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Focus Article

The NOAA NWS Water Resources Outlook Tool

By Kristen Averyt (WWA) and Kevin Werner (NOAA NWS Colorado Basin River Forecast Center)

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Recent Climate Conditions

Average temperatures for June ranged from below 60iF in high-elevation mountain regions of **Colorado** and **Wyoming** and up to 80iF in parts of southeastern **Utah** and **Colorado** (Figure RC-1). Across southern **Colorado** and southeastern **Utah**, temperatures were 2Ð6iF higher than normal. Most of **Wyoming**, however**,** saw below-average temperatures , as persistent precipitation events led to cooler weather (Figure RC-2).

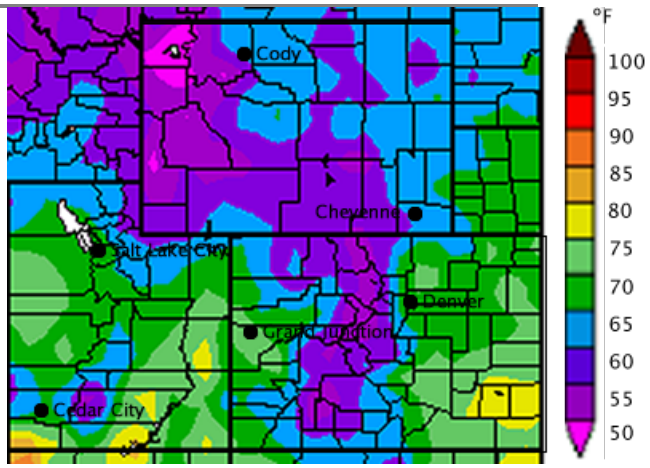

Figure RC-1. Average temperature for the month of June 2010 in iF. (Source: High Plains Regional Climate Center)

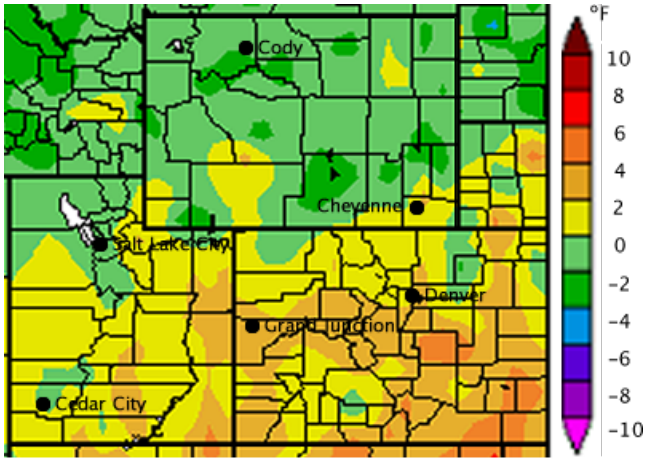

Figure RC-2. Departure from average temperature for the month of June 2010 in iF. (Source: High Plains Regional Climate Center)

June precipitation generally favored **Wyoming** and parts of northeastern **Colorado**, while southern **Colorado** and **Utah** received little moisture (Figure RC-3). Much of southern **Colorado** was abnormally dry, with some areas receiving less than 40% of average precipitation for the month. In contrast, parts of southern and northwestern **Wyoming**, received more than 200% of average June precipitation, including unusually heavy snows (for June) in the mountains (Figure RC-4).

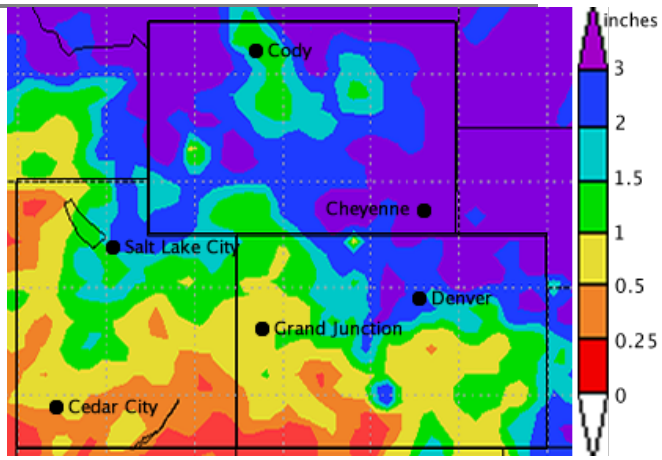

Figure RC-3. Precipitation for the month of June 2010 (inches). (Source: NOAA ESRL Physical Science Division)

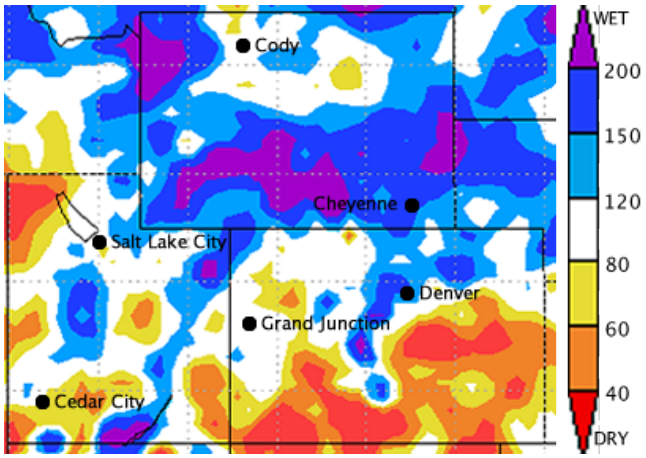

Figure RC-4. Precipitation for the month of June 2010 as percent of average precipitation for June. (Source: NOAA ESRL Physical Science Division)

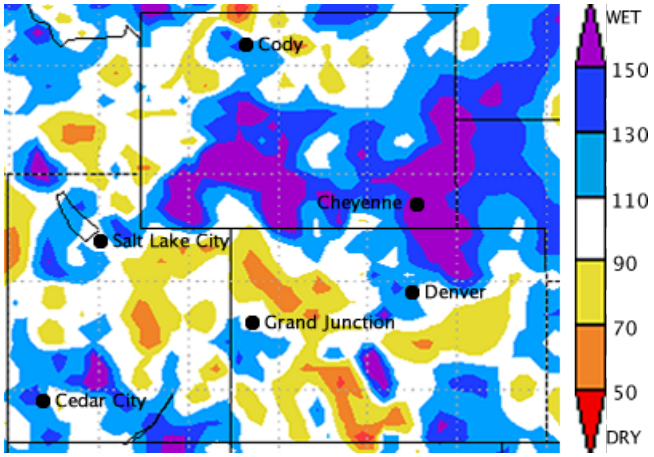

Figure RC-4b. Precipitation for water-year-to-date (October 2009ÐJune 2010) as percent of average precipitation for that period. (Source: NOAA ESRL Physical Science Division)

The 3-month SPI as of July 1 (Figure RC-5) shows some changes from recent months. Most of eastern and central **Wyoming** is now very wet or moderately wet, while low precipitation in southeastern **Utah** and southeastern **Colorado** has left those regions moderately dry. The 36-month SPI (Figure RC-6) shows near-average long-term conditions in most of the climate divisions in the three-state region, with dry conditions in western **Utah** and far northwestern **Wyoming**. Southeastern **Wyoming** and northeastern **Colorado** are moderately wet to very wet.

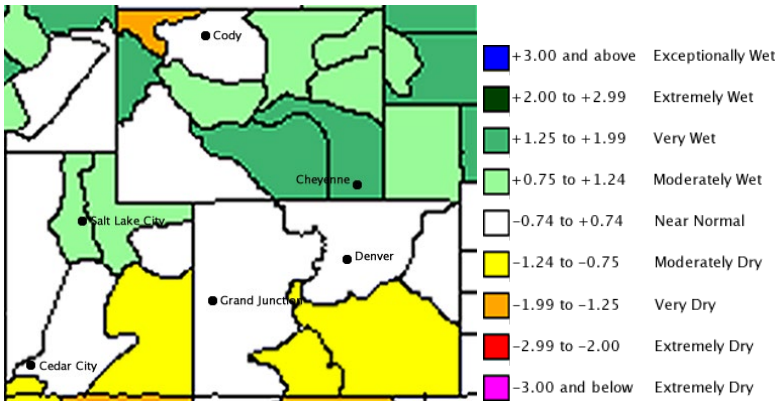

Figure RC-5. 3-month Intermountain West regional Standardized Precipitation Index as of the end of June 2010 (data from 4/01/10Ð 6/30/10). (Source: Western Regional Climate Center)

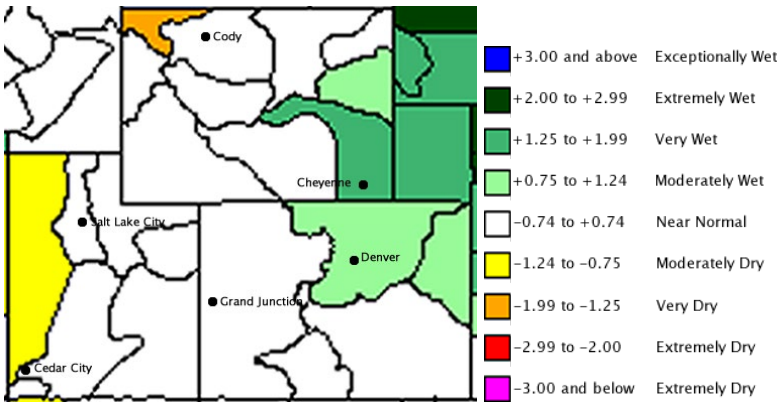

Figure RC-6. 36-month Intermountain West regional Standardized Precipitation Index as of the end of June 2010 (data from 07/01/07Ð6/30/10). (Source: Western Regional Climate Center)

The U.S. Drought Monitor for July 13 indicates that drought conditions have improved in western **Wyoming** compared with the previous month. Some of that area remains under moderate drought (D1) conditions, while abnormally dry conditions are persisting in northwestern **Colorado** (Figure RC-7). Abnormally dry conditions have

expanded in the upper Rio Grande basin in southern **Colorado** but have decreased in extent in northeastern **Utah**.

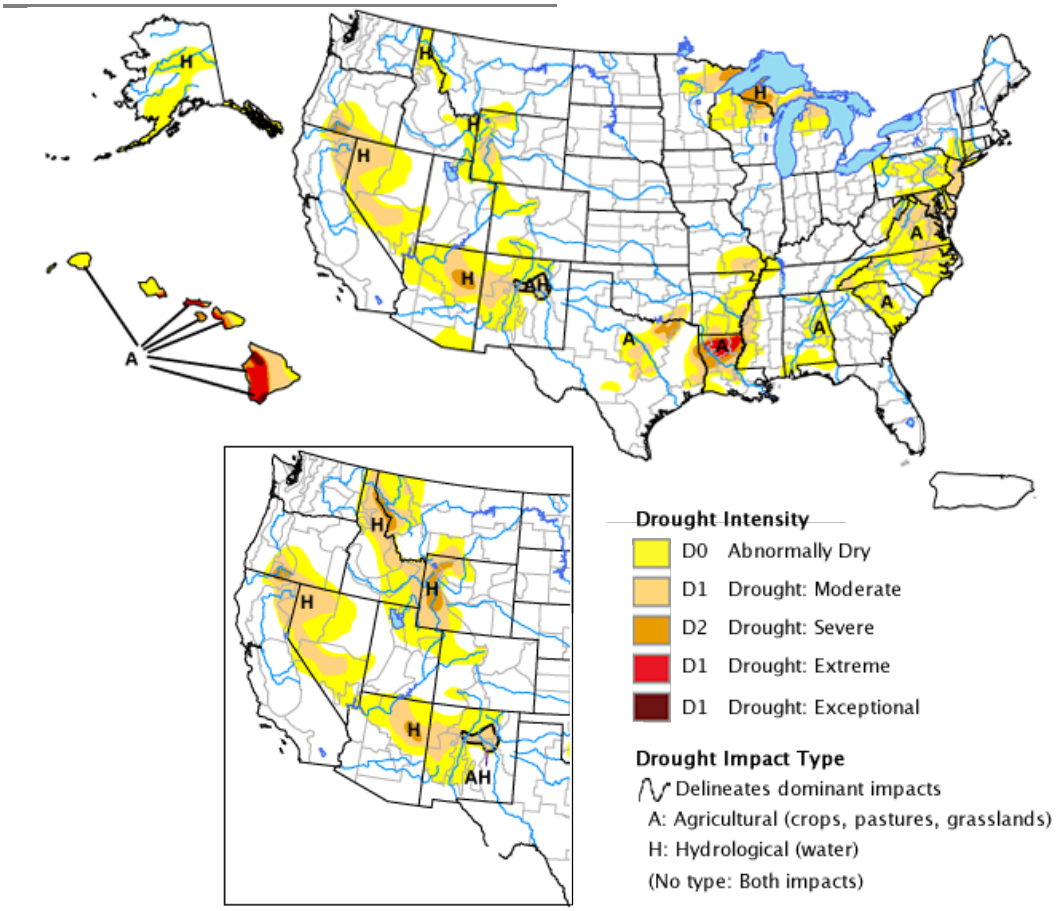

Figure RC-7. Drought Monitor from July 13, 2010 (full size) and June 15, 2010 (inset, lower left) for comparison. (Source: National Drought Mitigation Center)

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Intermountain West Snowpack - The Spring Meltout in Retrospective

In **Colorado**, statewide snowpack sank to 53% of average on June 1, with snowpack amounts varying widely between northern and southern basins. Cool and wet conditions in May slowed the onset of meltout in the northern and central mountains. In early June, very warm temperatures triggering abrupt melt of the remaining snowpack and the highest daily streamflows in central Colorado since 1995. Dust that was widely deposited in several dust-on-snow events in the spring further accelerated the melt, especially in southwest Colorado.

In **Utah**, the snowpack trajectory was similar to Colorado, with May precipitation highest in northern basins (>110% of average) and lowest in southern basins (<50% of average). May was an exceptionally cool month across Utah with temperatures 2Ð6i F below average. Above-average temperatures in June triggered rapid melting of snowpacks .

June 1 snowpack across **Wyoming** was 124% of average due to cool temperatures and well-above average precipitation (107Ð178% of average) across the state during May. Snowfall events during May and June helped to alleviate the the below-average streamflow forecasts in many parts of the state, while exacerbating the flooding risk in basins which already had near-average to above-average snowpacks.

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Spring and Summer Streamflow - Forecasted and Observed

Throughout this past winter into early spring 2010, regional snowpacks showed a strong north-to-south gradient, with higher snowpacks in the south and lower snowpacks in the north. The streamflow forecasts issued April 1 varied accordingly across the region. Storms which boosted snowpacks in April, May, and June, coupled with warm temperatures in late May and early June, yielded higher than expected runoff peaks and June runoff volumes, especially in northern and central **Colorado**, and in **Wyoming**. As of July 20, daily streamflows are reported as "normal" (25thÐ75th percentiles) in most basins across the region.

In **Colorado**, the June 1 streamflow forecasts for AprilÐJuly were below average in all basins, with the lowest projected flows in central and southern basins. With the onset of very warm and dry conditions in late May, daily streamflows soon exceeded the projected peak flows at forecast points in the Arkansas and Colorado River basins. The Colorado River at the Colorado-Utah state line peaked on June 9 at 30,000 cubic feet per second (cfs), well above the typical peak. Streamflows then dropped off sharply, and as of July 20, daily streamflows across Colorado are mostly in the "normal" category, with an increasing number of gages in central and southwest basins dropping to "below normal" (below the 25th percentile).

In **Wyoming**, the June 1 forecasts for the JuneÐSeptember streamflow were generally below-average statewide, with the most probable yield statewide at 80% of average. As in Colorado, heavy late-season snows led to higher-than-expected June flows, which caused major flooding in mid-June in the Wind, Big Horn, and Laramie River basins. As of July 20, daily streamflows are mostly "normal" across the state, with the Cheyenne and Belle Fourche basins reporting above-average flows.

In **Utah**, the June 1 forecasts for AprilÐJuly runoff volumes in basins across the state followed a strong north-to-south gradient, with northern basins ranging from 65Ð85% of average, and mainly above-average in southern basins. Wet conditions (>110% of average precipitation) during June in northern and central Utah helped maintain or improve June runoff volumes in those basins. As of July 20, daily streamflows across the state are mainly in the "normal" category, according to the USGS.

The June 1 forecast for AprilÐJuly inflow into Lake Powell was for 65% of average inflow; however, the June inflow volume ended up at 90% of average (2.78 maf). As a result, the final April-July inflow forecast released July 1 was increased to 72% of average (5.69 maf).

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Reservoir Supply

The greater-than-forecasted runoff volumes through June in most basins, combined with the generally above-average storage heading into the runoff season, has resulted in above-average reservoir levels in most reservoirs across the region at the beginning of July (Figure RES-1).

	Reservoir	Current storage (af)	Capacity (af)	% Full	Average on 6/30	% of Average
COLORADO	Dillon Reservoir	250,897	257,304	97%	249,000	101%
	Turquoise Lake	117,864	129,399	91%	116,562	101%
	Lake Granby	536,213	539,758	99%	432,950	124%
	Blue Mesa	735,117	829,500	88%	695,200	106%
	Pueblo	237,600	235,000	101%	160,500	148%
UTAH	Strawberry	1,018,400	1,106,500	92%	710,000	143%
	Utah Lake	852,000	870,900	98%	872,200	98%
	Bear Lake	572,700	1,302,000	44%	972,100	59%
	Lake Powell	15,861,837	24,322,000	65%	19,801,000	80%
WYOMING	Fontenelle	328,954	344,800	95%	271,100	121%
	Flaming Gorge	3,248,669	3,749,000	87%	3,235,000	100%
	Seminoe	985,397	1,017,273	97%	827,800	119%
	Boysen	732,808	741,594	99%	714,600	103%
	Buffalo Bill	604,545	644,128	94%	550,000	110%

Figure RES-1. All reservoir content data is from June 30, 2010. Percent of average ranges are color-coded as follows: green: >90%; light green: 60Ð89%; yellow: 40Ð59%; orange: 20Ð39%; red: 0Ð19%.

In **Colorado**, reservoir storage improved significantly in May and June across most of the state, resulting in above-average reservoir conditions statewide by the end of June, with the exception of the Rio Grande basin (90% of average). Statewide end-of-June storage is at its highest level since 2000.

In **Wyoming**, total storage at the end of June was also above average in most basins, with all reservoirs listed in Figure RES-1 reporting average or above-average storage. By July 1, Fontenelle Reservoir had almost filled (95% of capacity).

Utah reservoir conditions range widely, from a high of 143% of average for Strawberry Reservoir to a low of 59% of average for Bear Lake (Figure RES-1). Storage in Lake Powell is slightly lower (15.86 maf) than on the same date last year (16.06 maf).

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ENSO Status and Forecast

La Ni–a conditions are currently developing across the equatorial Pacific, and the onset of a La Ni–a event is likely during July-August 2010. Negative sea surface temperature anomalies continue to strengthen (Figure EN-1), with a swath of the eastern equatorial Pacific 1Ð2iC below average. Accordingly, NOAA's Climate Prediction Center (CPC) has issued a La Ni–a Watch, indicating that conditions are favorable for the development of La Ni–a in the next three months.

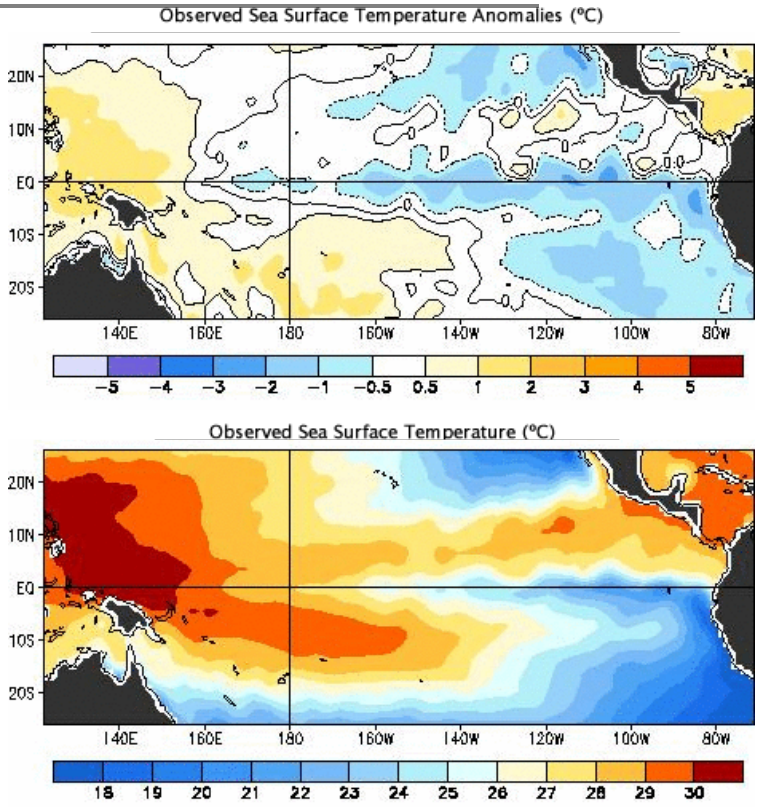

Figure EN-1. Observed SST (upper) and the observed SST anomalies (lower) in the Pacific Ocean. The Ni–o 3.4 region encompasses the area between 120iWÐ170iW and 5iNÐ5iS. The graphics represent the 7-day average centered on July 7, 2010. (Source: NOAA Climate Prediction Center)

Model forecasts of SST anomalies (Figure EN-2) reflect a strong consensus for the development and strengthening, of (-0.5iC or greater in the Ni–o-3.4 region). The dynamical models tend to project stronger La Ni–a conditions than the statistical models. The large majority of models project that the La Ni–a event will persist through the coming winter, and then shift towards neutral conditions in spring 2011.

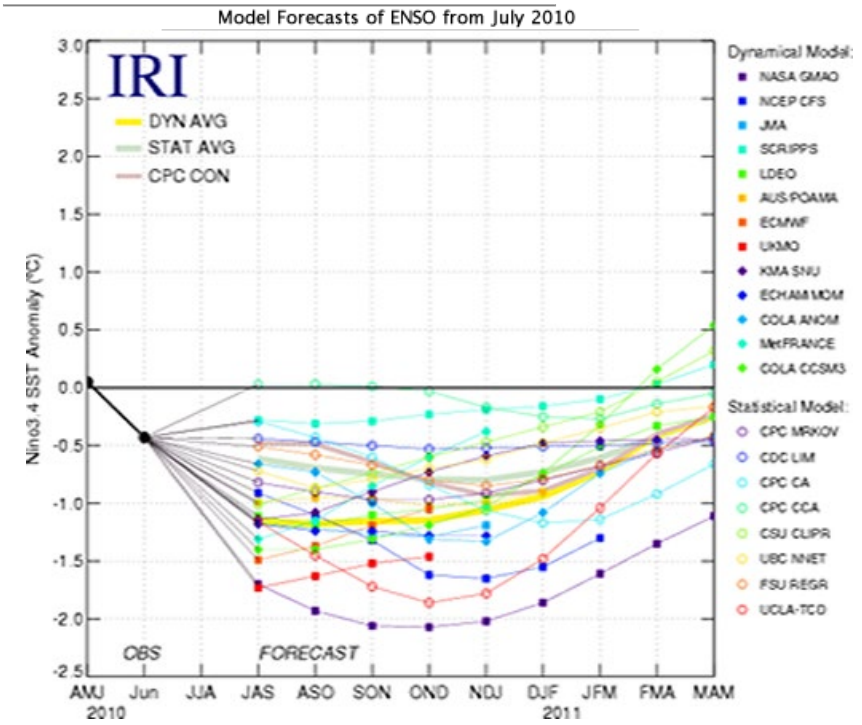

Figure EN-2. Forecasts made by dynamical and statistical models for sea surface temperatures (SST) in the Ni–o 3.4 region for nine overlapping 3-month periods from JulyÐSeptember 2010 to MarchÐMay 2011 (released July 16, 2010). (Source: International Research Institute (IRI) for Climate and Society)

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Temperature Outlook
August–December 2010 (Released July 15, 2010)

The latest temperature outlooks from the NOAA Climate Prediction Center indicate an enhanced probability of above-average temperatures across much of the West in the coming months. For August 2010, the likelihood of warmer temperatures is focused on **Utah** and **Wyoming** (Figure TEMP-1), and in the AugustÐOctober season, on **Utah** and southwest **Colorado** (TEMP-2). For OctoberÐDecember and NovemberÐJanuary (Figures TEMP-3 and TEMP-4), the area of increased odds of above-average temperatures moves to the south, with southern **Utah** and southern **Colorado** showing the greatest chance of warming within the Intermountain region.

The increased odds of warm temperatures in the western US indicated in these forecasts reflects both the continuation of the long-term trend towards warmer temperatures in the region and the typical pattern in fall seen under La Ni–a conditions.

The August 2010 temperature forecast will be updated on July 31st on the CPC web page. This Òzero-leadÓ monthly update will incorporate information from the short-range numerical weather prediction models and the latest monthly predictions from the Climate Forecast System models. The Seasonal Outlooks are updated on the third Thursday of the month, and the next one will be issued on August 19th.

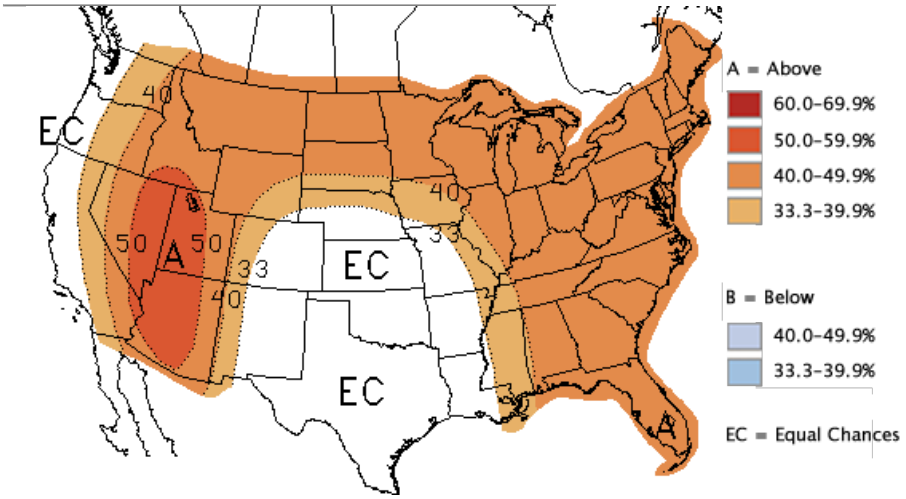

Figure TEMP-1. Long-lead national temperature forecast for August 2010. (Source: NOAA Climate Prediction Center)

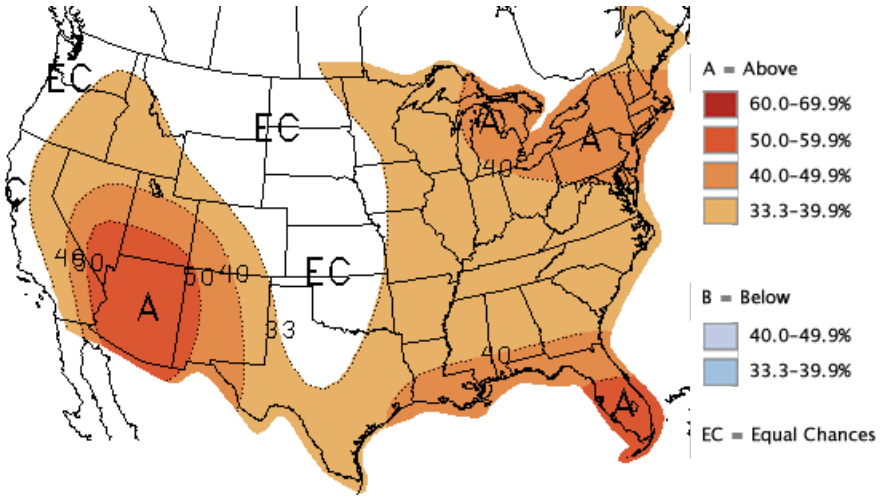

Figure TEMP-2. Long-lead national temperature forecast for AugustÐOctober 2010. (Source: NOAA Climate Prediction Center)

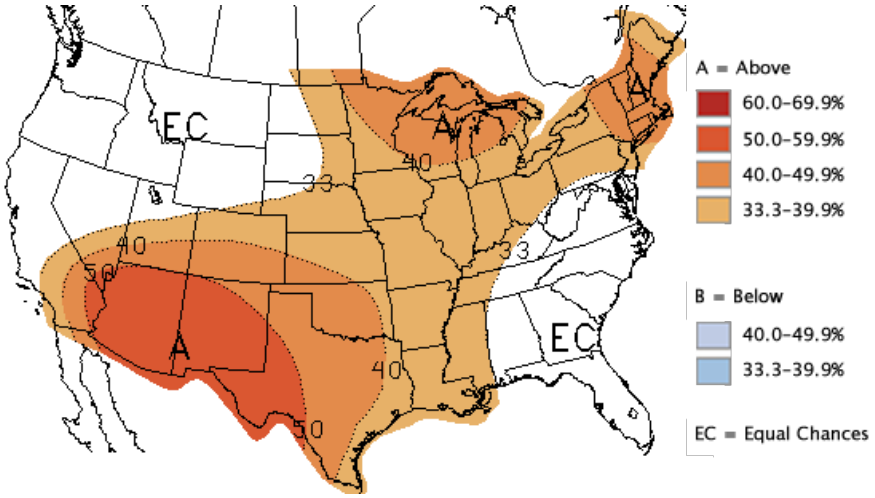

Figure TEMP-3. Long-lead national temperature forecast for SeptemberÐNovember 2010. (Source: NOAA Climate Prediction Center)

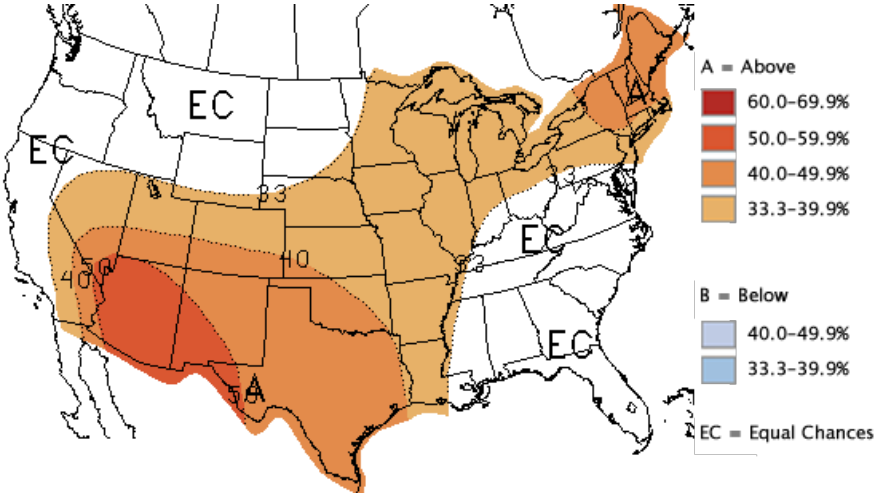

Figure TEMP-4. Long-lead national temperature forecast for OctoberÐDecember 2010. (Source: NOAA Climate Prediction Center)

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Precipitation Outlook
August–December 2010 (Released on July 15, 2010)

The CPC precipitation outlooks for August 2010 and the AugustÐOctober and SeptemberÐNovember seasons (Figures PPT-1 through PPT-3) show an increased probability of below-average precipitation focused on the Great Basin, including **Utah** and adjacent portions of western **Wyoming** and western **Colorado** and across the High Plains. In the AugustÐOctober and SeptemberÐNovember seasons, a region of increased probability of above-average precipitation is shown in the northern Great Plains, extending into far eastern **Wyoming** and northeastern **Colorado**.

For the OctoberÐDecember season, the area of higher odds of dry conditions shifts to the south, and equal chances for below-, near-, or above-average precipitation are forecasted across nearly all of the Intermountain West (PPT-4). These seasonal precipitation forecasts are based on the Climate Forecast System models, ENSO composites (e.g., the developing La Ni–a event), and precipitation trends.

The August 2010 precipitation forecast will be updated on July 31st on the CPC web page. This Òzero-leadÓ monthly update will incorporate information from the short range numerical weather prediction models and the latest monthly predictions from the Climate Forecast System models. The Seasonal Outlooks are updated on the third Thursday of the month, and the next one will be issued on August 19th.

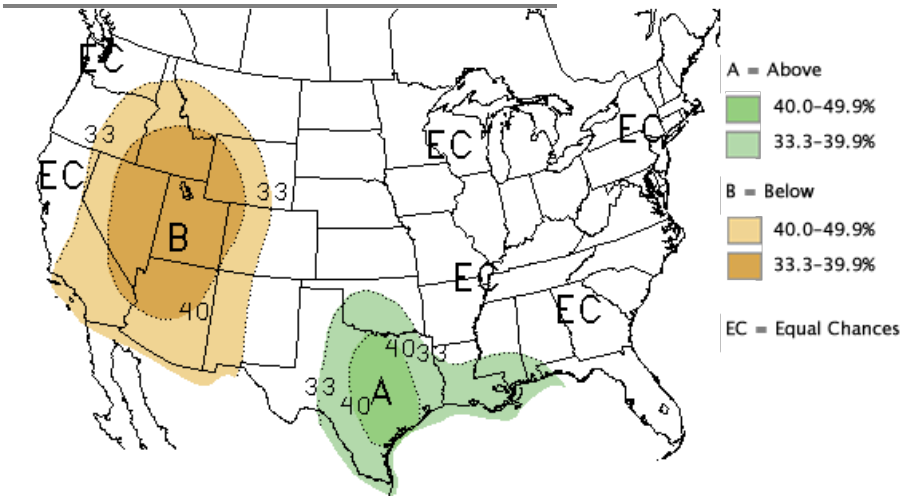

Figure PPT-1. Long-lead national precipitation forecast for August 2010. (Source: NOAA Climate Prediction Center)

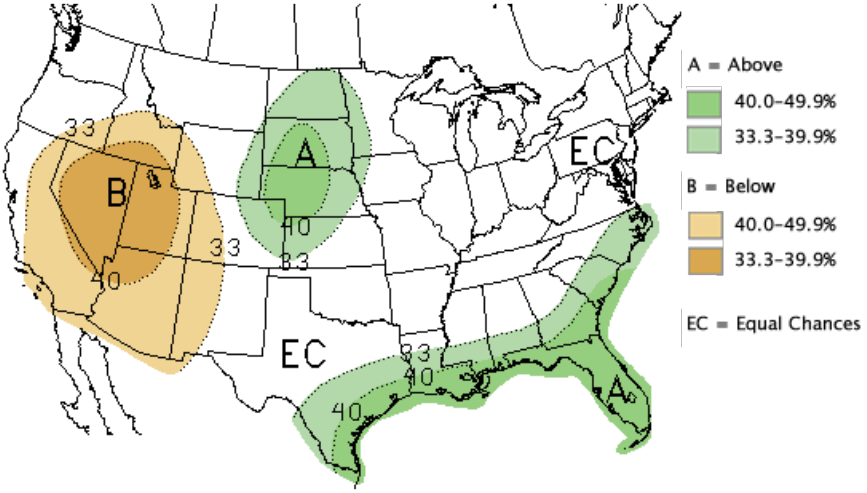

Figure PPT-2. Long-lead national precipitation forecast for AugustÐOctober 2010. (Source: NOAA Climate Prediction Center)

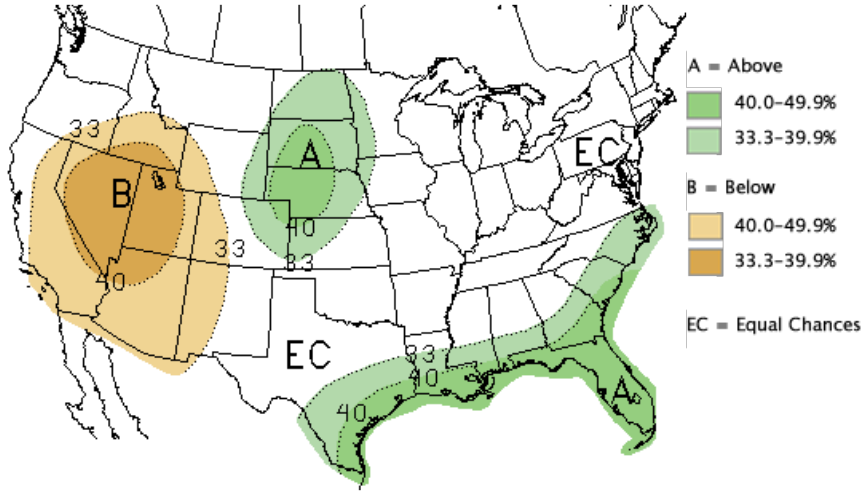

Figure PPT-3. Long-lead national precipitation forecast for SeptemberÐNovember 2010. (Source: NOAA Climate Prediction Center)

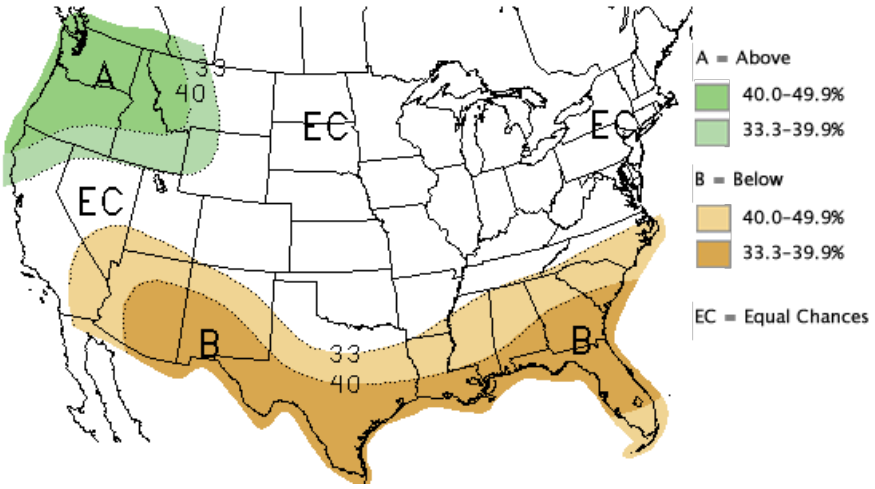

Figure PPT-4. Long-lead national precipitation forecast for OctoberÐDecember 2010. (Source: NOAA Climate Prediction Center)

The experimental SWcast forecast guidance released on June 28 for the late summer season (JulyÐSeptember 2010) shows increased odds for a suppressed monsoon in northwestern **Utah** and along the **Colorado** Front Range, while southeastern **Colorado** has above-average odds for a wet late summer (Figure PPT-5). The associated forecast discussion notes that the end of the El Ni–o event and developing La Ni–a conditions point to a greater threat of dry conditions in Colorado and Utah over the next three months.

(Editors' Note: For now, this marks the last SWcast issued by Klaus Wolter of NOAA PSD. He is reevaluating the operational skill of his forecasts, identifying what, if any, improvements could be made to the forecasts, and trying to locate additional sources of funding for his efforts. Klaus has been publicly releasing the SWcasts for over eight years, and they have been part of the IWCS since our first issue in 2005. Our thanks to Klaus for his good work. If you have feedback regarding the future of the SWcasts, please contact Klaus at klaus.wolter@noaa.gov.)

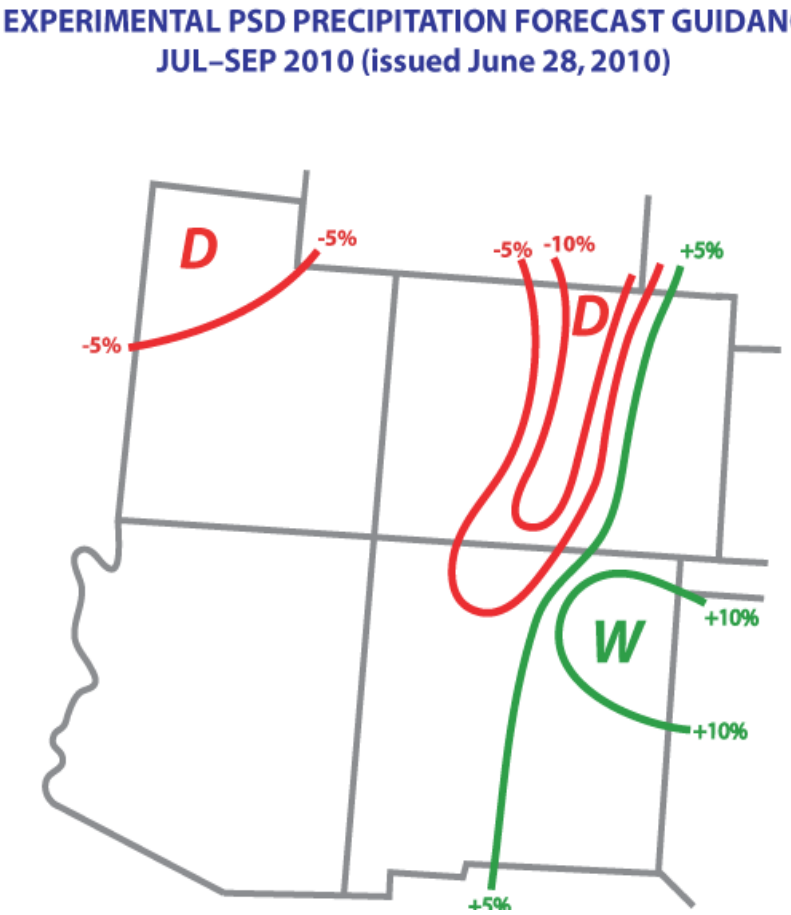

Figure PPT-5. Experimental precipitation forecast guidance. Forecasted shifts in tercile probabilities for JulyÐ September 2010. (Source: NOAA ESRL Physical Science Division)

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Seasonal Drought Outlook
through October 2010 (Released July 15, 2010)

The U.S. Seasonal Drought Outlook (DO) projects how drought areas categorized in the U.S. Drought Monitor might change and where new drought areas might develop. The two areas in western Wyoming currently categorized as moderate drought (D1) are projected to persist through the next three months (Figure DO-1). No new areas of drought (D1ÐD4) are projected to develop in the Intermountain region.

Readers interested in the next 1Ð5 days and 6Ð10 days can consult the ÒLooking AheadÓ section of each weekÕs Drought Monitor for near-term drought outlook conditions. The next Seasonal Drought Outlook will be issued August 5th.

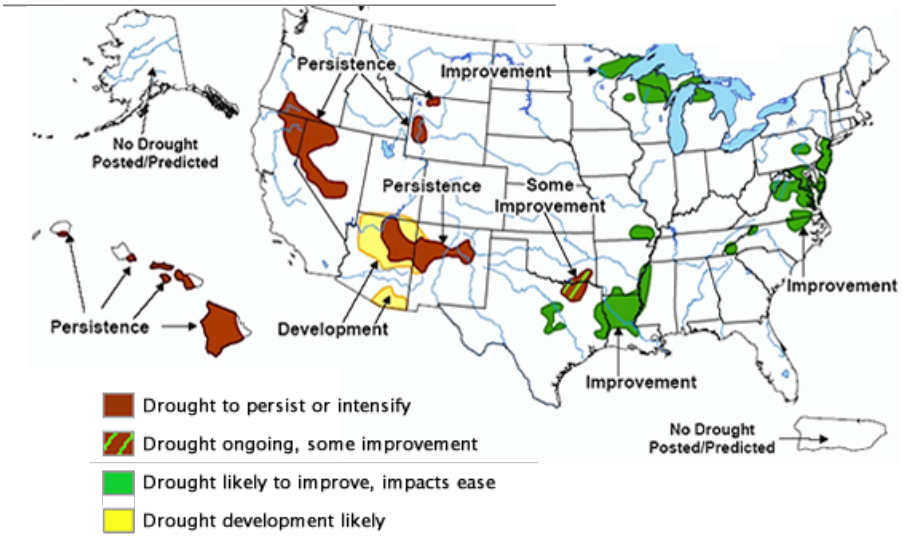

Figure DO-1. Seasonal Drought Outlook for July 15, 2010ÐOctober 2010. (Source: NOAA Climate Prediction Center)

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The Intermountain West Climate Summary is published periodically by Western Water Assessment (WWA), a joint project of the University of Colorado Cooperative Institute for Research in Environmental Sciences (CIRES) and the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL), researching water, climate, and societal interaction.

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