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INTERMOUNTAIN WEST CLIMATE SUMMARY

A product of the Western Water Assessment

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Brad Udall Ð WWA Director

Jeff Lukas, Christina Alvord, Kristen Averyt Ð Editors/Writers

Lucia Harrop Ð Graphic Designer

Klaus Wolter, Gary Bates Ð Asst. Editors

PRINTER-FRIENDLY VERSION

January 2010 Summary

Temperature & Precipitation — *The operative word for December was "cold", with large departures from average temperatures and many new records for daily minimum temperatures across the region. Storms in December mainly tracked across the southern part of the region, leaving above-average precipitation in southern Utah, and southwestern and eastern Colorado, and below-average precipitation elsewhere.*

Hydrological Conditions — *Overall drier-than-average conditions for most of the region since October 1 have led to an expansion of drought area, below-average January 1 regional snowpacks, and below-average January 1 forecasts for spring-summer runoff for nearly all basins.*

ENSO — *The ongoing El Ni–o strengthened and is currently a moderate to strong event. It is expected to peak in the next 1-2 months and then persist through at least spring 2010, while continuing to exert some influence on climate in the Intermountain West.*

Climate Forecasts — *Seasonal climate outlooks indicate an enhanced risk of above-average temperatures over much of the Intermountain West during February 2010 and through the spring. An enhanced risk of above-average precipitation is also indicated for February across much of the region, but in subsequent forecast periods there is no clear precipitation signal for the region.*

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Announcements & News

WUCA White Paper on Climate Modeling for Water Management

WWAÕs Joe Barsugli, with Chris Anderson (Iowa State University), and Joel Smith and Jason Vogel (Stratus Consulting, Boulder, CO), have prepared a white paper for the Water Utility Climate Alliance (WUCA), entitled ÒOptions for Improving Climate Modeling to Assist Water Utility Planning for Climate ChangeÓ, which is now available. The report (1) explains how climate models work; (2) describes how models have been used in the water sector to assess potential impacts on our systems; and (3) makes recommendations regarding how to improve modeling and downscaling techniques so these tools can be more useful for the water sector. WUCA is a consortium of ten of the nationÕs largest water providers, including Denver Water, and provides leadership and collaboration on climate change issues affecting water agencies.

(**download PDF** of WUCA White Paper)

Copenhagen Climate Summit produces non-binding, non-specific accord

Negotiations at last monthÕs United Nations Climate Change Summit 2009 (COP15) in Copenhagen, Denmark, resulted in a non-binding agreement, known as the Copenhagen Accord. The accord was drawn up by representatives from the U.S, China, India, Brazil and South Africa, and accepted by delegates of most of the other countries participating in the summit. The accord affirms the Òultimate objectiveÓ of stabilizing concentrations of greenhouse gases in the atmosphere and avoiding dangerous anthropogenic interference with the climate system (represented by a threshold of 2iC warming), but does not specify cuts in greenhouse gas emissions. Instead, it asks each of 40 developed countries, by the end of January 2010, to submit to the UN an emissions reductions target for 2020, and for other countries to detail their Òplans and actionsÓ to reduce the growth in their emissions. While the accord itself provides no clear direction regarding global emissions reductions, it is believed that the targets due at the end of this month, and further agreements that may be reached at the COP16 summit in Mexico in late 2010, may yet provide this direction.

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Feature Article

Understanding the Climate Vulnerabilities, Needs, and Resources of Tribal Communities: A Summary of Two Recent Workshops

Christina Alvord, Western Water Assessment

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Focus Article

Colorado Climate Trends Website: A New Tool from the Colorado Climate Center

Kristen Averyt, Western Water Assessment

(download pdf)

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Recent Climate Conditions

In December, temperatures were colder than average across nearly all of the Intermountain West, with widepread departures of 6Ð12 ¼F below average (Figure RC-2). The average temperatures for December ranged from below 10¼F in the western half of **Wyoming** and at high elevations in the Rocky Mountains, up to 30¼F and above in the southeast corner of **Colorado** and the southernmost part of **Utah** (Figure RC-1). The unusually cold average temperatures were driven by multiple outbreaks of Arctic air during the month, which were also reflected in the records table (Table RC-1).

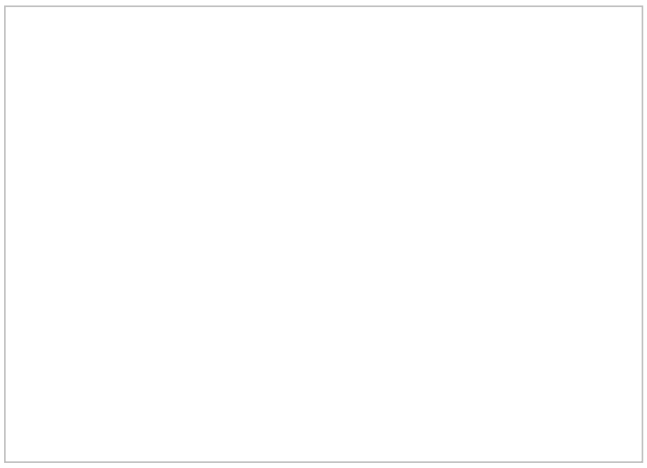

Figure RC-1. Average temperature for the month of December 2009 in iF. (Source: High Plains Regional Climate Center)

Figure RC-2. Departure from average temperature for the month of December 2009 in iF. (Source: High Plains Regional Climate Center)

Location	Record	New	Old	Year
December 3				
Alpine, UT	Low Min Temperature	10	10	2004
Alta, UT	Low Min Temperature	1	1	1996
Laketown, UT	Low Min Temperature	-2	1	2006
Bountiful-val Verda, UT	Low Min Temperature	13	15	2006
Alpine, UT	Low Max Temperature	28	29	2004
Alta, UT	Low Max Temperature	13	15	1968
Coalville, UT	Low Max Temperature	28	28	1945
Laketown, UT	Low Max Temperature	22	25	1945
Cheyenne, WY	Low Max Temperature	10	16	1873
Laramie, WY	Low Max Temperature	4	18	1978
Laramie, WY	Low Min Temperature	-19	-19	1978
Rawlins, WY	Low Max Temperature	11	18	1978
Rawlins, WY	Low Min Temperature	-12	-11	1978
December 4				
Alpine, UT	Low Min Temperature	7	12	2004
Escalante, UT	Low Min Temperature	1	6	1955
Hanksville, UT	Low Min Temperature	-6	3	1934
Price, UT	Low Min Temperature	2	5	2004
Provo BYU, UT	Low Min Temperature	11	13	1992
Spanish Fork, UT	Low Min Temperature	6	6	1991
Utah Test Range, UT	Low Min Temperature	3	3	1996
Zion National Park, UT	Low Min Temperature	12	14	1996
Price, UT	Low Max Temperature	26	26	2005
Grand Junction, CO	Low Min Temperature	1	2	2004
December 5				
Grand Junction, CO	Low Min Temperature	2	7	2006
Sidney NE Airport, WY	Low Min Temperature	-5	-4	2008
December 6				
Cheyenne, WY	Daily Max Snowfall	3.4	3	1927

December 7				
Bountiful-Val Verde, UT	Low Max Temperature	23	30	1998
Coalville, UT	Low Max Temperature	12	15	1978
Duchesne, UT	Low Max Temperature	11	19	1931
Provo BYU, UT	Low Max Temperature	25	27	2005
Utah Test Range, UT	Low Max Temperature	22	23	2005
December 9				
Alpine, UT	Low Min Temperature	-1	4	2005
Bountiful-val Verda, UT	Low Min Temperature	6	6	2005
Bryce Canyon Airport, UT	Low Min Temperature	-31	-22	1951
Price, UT	Low Min Temperature	-7	3	2005
Laramie, WY	Low Max Temperature	3	5	1978
Casper, WY	Low Min Temperature	-29	-20	1977
December 10				
Bountiful-val Verda, UT	Low Min Temperature	4	11	2005
Hanksville, UT	Low Min Temperature	-11	-10	1978
Hite Ranger Station, UT	Low Min Temperature	12	15	1978
Randolph, UT	Low Min Temperature	-17	-12	2001
December 11				
Grand Junction, CO	Low Min Temperature	-12	-4	1978
Bountiful-val Verda, UT	Low Min Temperature	6	10	1985
Ferron, UT	Low Min Temperature	-7	-3	1971
Hanksville, IT	Low Min Temperature	-12	-9	1978
Logan Radio KVNU, UT	Low Min Temperature	-11	-6	1997
Alpine, UT	Low Max Temperature	26	26	1997
Bullfrog, UT	Low Max Temperature	27	30	1978
Grantsville, UT	Low Max Temperature	21	29	2005
Hanksville, UT	Low Max Temperature	22	24	1961
December 15				
Bryce Canyon Airport, UT	Low Min Temperature	-11	-11	1972
December 26				
Casper, WY	Low Min Temperature	-15	-14	1944
Grantsville, UT	Low Max Temperature	21	24	2001
Ferron, UT	Low Max Temperature	19	19	1990
December 27				
Rawlins, WY	Low Min Temperature	-8	-7	2007
Wendover, UT	Low Max Temperature	12	13	1990
Bryce Canyon Airport, UT	Low Min Temperature	-17	-14	1966
December 28				
Laramie, WY	Low Min Temperature	-20	-18	1954
Salt Lake City, UT	Low Max Temperature	23	24	1939
Utah Test Range, UT	Low Max Temperature	15	26	1990
Wendover, UT	Low Max Temperature	12	20	1985
December 29				
Wendover, UT	Low Max Temperature	16	18	1988

Table RC-1. Record temperature and precipitation events in the Intermountain West during December 2009. (Source: NOAA National Weather Service)

In southern **Utah,** far western **Colorado,** and the **Colorado** Front Range, storms accompanied the intrusion of cold air masses, resulting in December precipitation totals exceeding 150% of average (Figure RC-4). Elsewhere in the region, precipitation was near average or less than average, with northern **Utah** and much of **Wyoming** experiencing less than 60% of average precipitation (Figure RC-4). This north-south gradient in precipitation was reflected in the seasonal snowpack accumulation across the region (Figure SP-1).

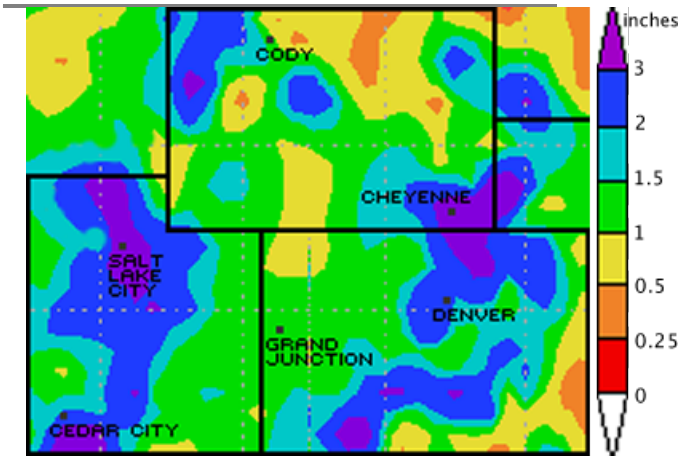

Figure RC-3. Precipitation for the month of December 2009 (inches). (Source: NOAA ESRL Physical Science Division)

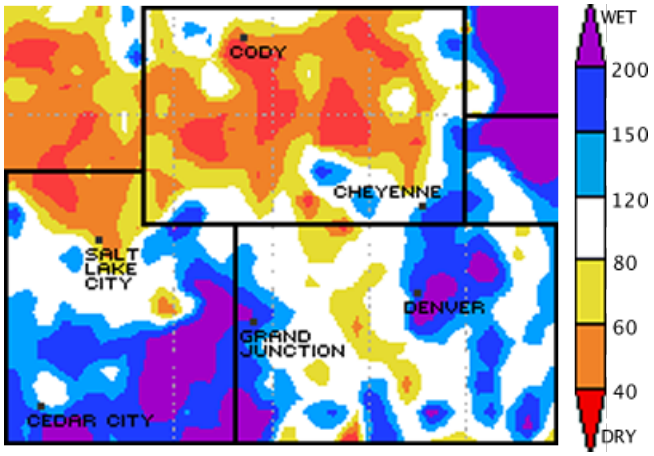

Figure RC-4. Precipitation for the month of December 2009 as percent of average precipitation for December. (Source: NOAA ESRL Physical Science Division)

As of the end of December, the 3-month SPI indicated moderately wet conditions in the climate divisions within eastern **Colorado** and southeast **Wyoming** (Figure RC-5). The 36-month SPI (Figure RC-6) still indicates dry conditions in the western areas of both **Utah** and **Wyoming**. The January 19, 2010 U.S. Drought Monitor (Figure RC-7) reflects these persistent dry conditions.

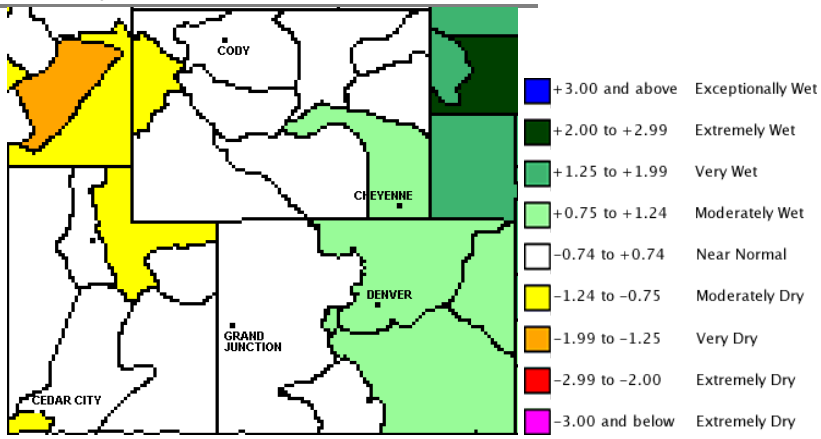

Figure RC-5. 3-month Intermountain West regional Standardized Precipitation Index as of the end of December 2009 (data from 10/01/09Ð 12/31/09). (Source: Western Regional Climate Center)

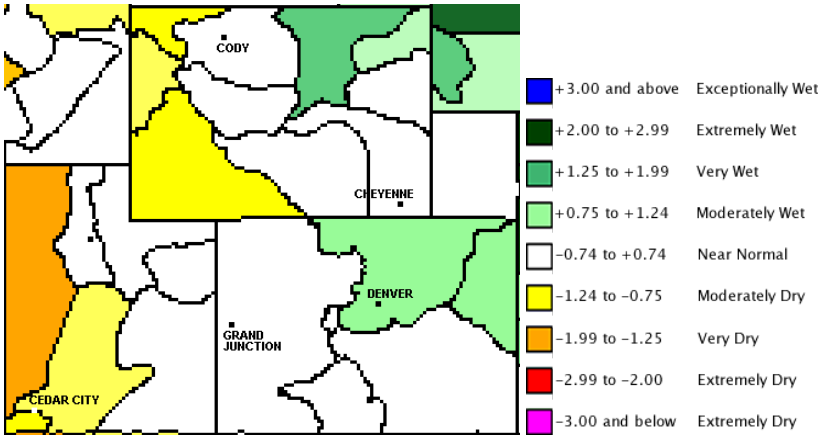

Figure RC-6. 36-month Intermountain West regional Standardized Precipitation Index as of the end of December 2009 (data from 1/01/07Ð12/31/09). (Source: Western Regional Climate Center)

The US Drought Monitor for January 19, 2010 shows an increase in abnormally dry and drought conditions in the Intermountain West since early December. A small area of severe drought (D2) conditions persists in extreme southern **Utah** and southwest **Colorado**. Moderate drought (D1) conditions continue to extend from this area into southern **Utah** and southwestern **Colorado**, and D1 conditions have recently developed in far western **Wyoming** and extreme northeast **Utah** along the Idaho border. Abnormally dry conditions now cover most of the rest of **Utah**, western **Colorado**, and parts of western and northern **Wyoming**. Although recent snowfall in southern **Colorado** and **Utah** has helped boost snowpack percentages in these basins (Figure SP-2), this precipitation was insufficient to improve drought conditions since the December 1 Drought Monitor.

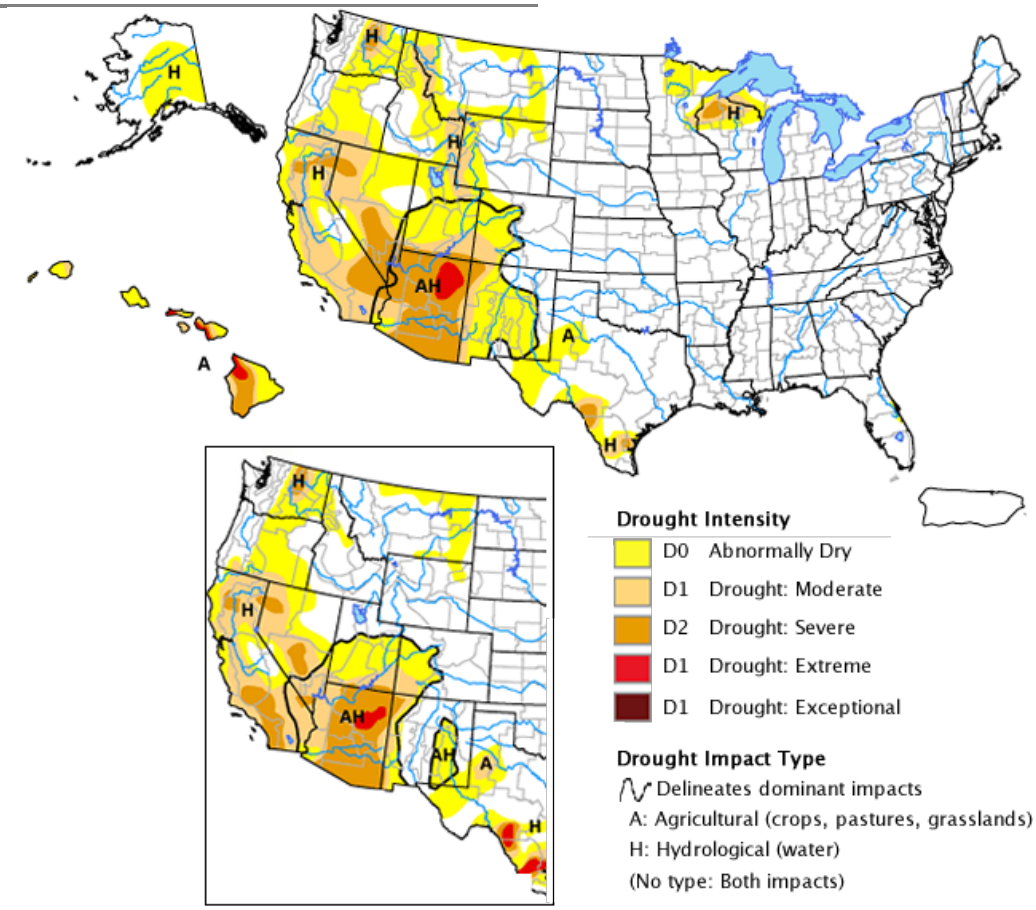

Figure RC-7. U.S. Drought Monitor from January 19, 2010 (full size) and December 1, 2009 (inset, lower left) for comparison. (Source: National Drought Mitigation Center)

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Intermountain West Snowpack

The 2010 water year has unfolded in contrast with the start of water years 2008 and 2009, which began with a dry fall, then yielded above-average precipitation in December. This year, wet conditions across the region in October were followed by widepread dry conditions in November, and a dry December throughout northern **Utah**, **Wyoming**, and central **Colorado**. As a result, January 1 SWE across the Intermountain West was below average in most basins (Figure SP-1).

In **Colorado**, January 1 snowpacks were below average in all basins except for the Dolores, northern Rio Grande, North Platte, and portions of the Arkansas basin. Statewide, water-year precipitation and snowpack fell below average in early November, with statewide snowpack at 86% of average as of January 1. Basinwide percentages ranged from a low of 74% of average in the Yampa and White Basins to 97% of average in the combined Rio Grande, San Juan, Animas, Dolores, and San Miguel basins (Figure SP-1). Two major storms in December in southwestern **Colorado** helped boost snowpack percentages to near-average levels in these basins.

In general, **Utah** snowpacks show a north-south gradient, with the northern basins reporting below average snowpacks (<90% of average) and the southwestern basins reporting near- or above-average snowpacks (Figure SP-1). Above-average December precipitation in southern **Utah** (144Ð200% of average) helped increase snowpack percentages in these areas. Although precipitation was below average in northern Utah basins, the very low temperatures helped conserve snowpacks at lower elevations through December.

Wyoming snowpacks were below average in western and central basins as of January 1, and near or above average across eastern basins (Figure SP-1). Below-average precipitation in central and western basins, as low as 39% of average in the Upper Green River basin, resulted in minimal gains in snowpack amounts in these areas. East of the Divide, snowpacks range from 85%-109% of average, with the Belle Fouche, Cheyenne, and North Platte river basins reporting the highest SWE amounts in the state.

[Much of the text in this section comes from the NRCS State Basin Outlook Reports: http://www.wcc.nrcs.usda.gov/cgibin/bor.pl.]

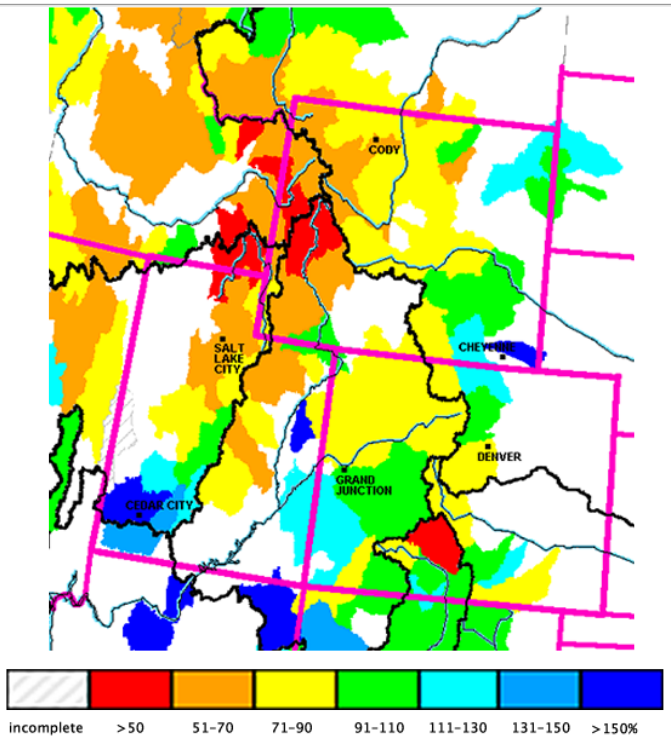

Figure SP-1. Snow water equivalent (SWE) as a percent of average for available SNOTEL and snow course sites, averaged across each basin, in the Intermountain West as of January 1, 2010. (Source: Natural Resources

Conservation Service)

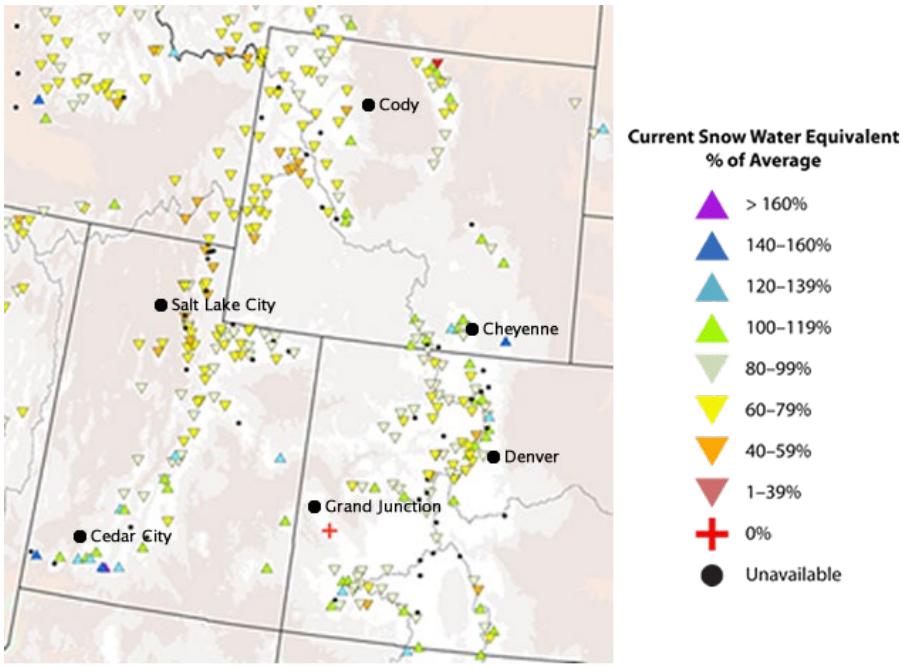

Figure SP-2. Current snow water equivalent (SWE) as a percent of average for individual SNOTEL sites as of January 4, 2010. (Source: Natural Resources Conservation Service)

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Spring and Summer Streamflow Forecasts for the 2010 Runoff Season

January is the first month in the water year in which the NRCS issues streamflow forecasts for the approaching spring and summer runoff. Although streamflow forecasts can change considerably from January to April, the January forecast does provide a preliminary indication of the likely runoff anomaly.

Reflecting the generally below-average January 1 snowpacks, streamflow is forecasted to be below average in most basins across the Intermountain West,with the lowest forecasted flows in northern **Utah** and western and northern **Wyoming** (Figure STRM-1).

In **Colorado**, slightly below-average runoff is forecasted statewide.The forecasts for western slope basins are generally below average, with near-average streamflow forecasted in most basins east of the Continental Divide. The lowest forecasted flows are for the Yampa, White, North Platte, Upper Colorado, Gunnison, Dolores and Animas Rivers, ranging from 70% to 90% of average. For the Arkansas, San Juan, San Miguel, Colorado, the main stem of the Rio Grande, and most of the South Platte, forecasted flows generally range from 90% to 100% of average.

Wyoming streamflow is forecasted to be lowest in northern basins, with the outlook improving to the south. Flow is forecasted to be 51% of average in the Big Horn, Power and Tongue River basins; from 60-72% of average for the Snake, Upper Yellowstone and Madison, Wind, Shoshone, Clarks Fork, Upper Green, and Little Bear River basins; and 102% of average for the Belle Fourche and Cheyenne River basins.

With the exception of the Sevier and Beaver River basins, **Utah** streamflow forecasts are below average for all basins, with most basins forecasted to be from 60%-90% of average. The lowest flows are forecasted for the northern part of the state, with near-average flows forecasted in southwestern Utah in portions of the Virgin, Beaver, and Sevier basins. The January 1 forecast for Lake Powell is for 78% of average spring-summer inflow.

[Much of the text in this section comes from the NRCS State Basin Outlook Reports: http://www.wcc.nrcs.usda.gov/cgibin/bor.pl.]

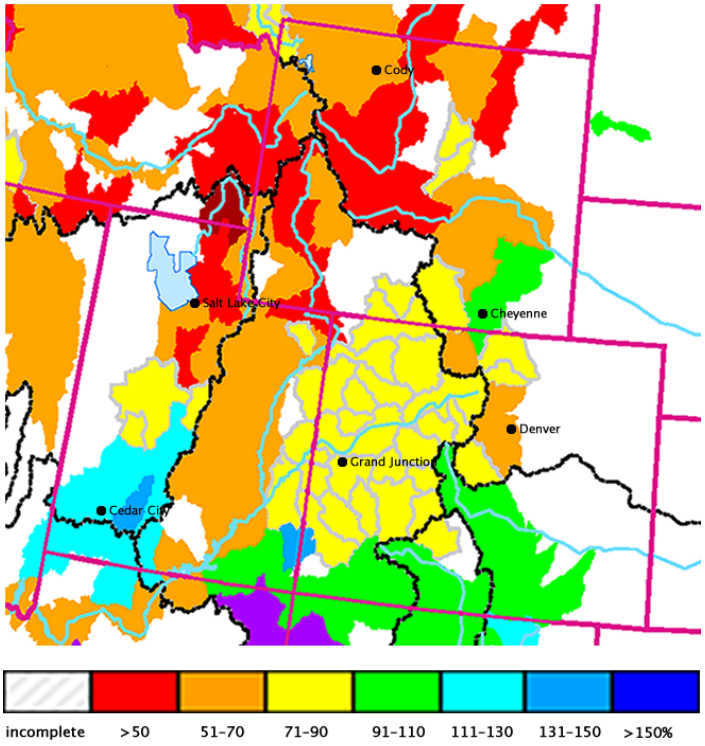

Figure STRM-1. NRCS outlook for natural streamflows for spring and summer in the Intermountain West region as a percent of average streamflows (data through January 1, 2010). (Source: Natural Resource Conservation Service)

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ENSO Status and Forecast

The El Ni–o event which began in July strengthened in November and December, and currently has monthly sea surface temperature (SST) anomalies indicative of a moderate to strong El Ni–o: 1.0¼C to 2.5¼C above average across the central and east-central equatorial Pacific (Figure EN-1). According to the early January ENSO Diagnostic Discussion from NOAA CPC, this El Ni–o event will likely peak in strength in the next 1-2 months, and then persist through at least spring 2010 while declining in intensity.

Expected El Ni–o impacts through March 2010 for the contiguous United States include above-average precipitation for the southern tier of the country, including portions of the Intermountain West region, with below-average precipitation in the Pacific Northwest and in the Ohio and Tennessee Valleys (see Figures PPT-1 and PPT-2 below).

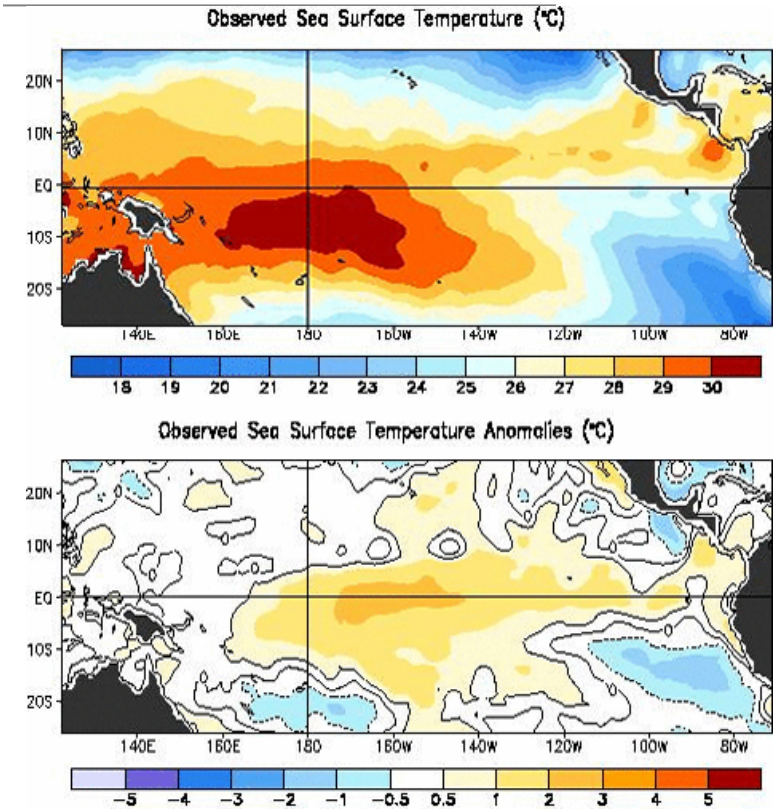

Figure EN-1. Observed SST (upper) and the observed SST anomalies (lower) in the Pacific Ocean. The Ni–o 3.4 region encompasses the area between 120iWÐ170iW and 5iNÐ5iS. The graphics represent the 7-day average centered on January 13, 2010. (Source: NOAA Climate Prediction Center)

According the International Research Institute for Climate and Society (IRI), which partners with NOAA on these outlooks, the probabilities for continuing El Ni–o conditions stay at or above 90% through the February-April season, decreasing to 55-60% by the April-June season and to the climatological probability of 25% by the July-September season. Across a broad set of dynamical and statistical forecast models, nearly all indicate maintenance of at least moderate El Ni–o conditions during the ongoing JanuaryÐMarch season (Figure EN-2).

The NOAA ENSO Diagnostic Discussion will be updated on the first Thursday of February 2010.

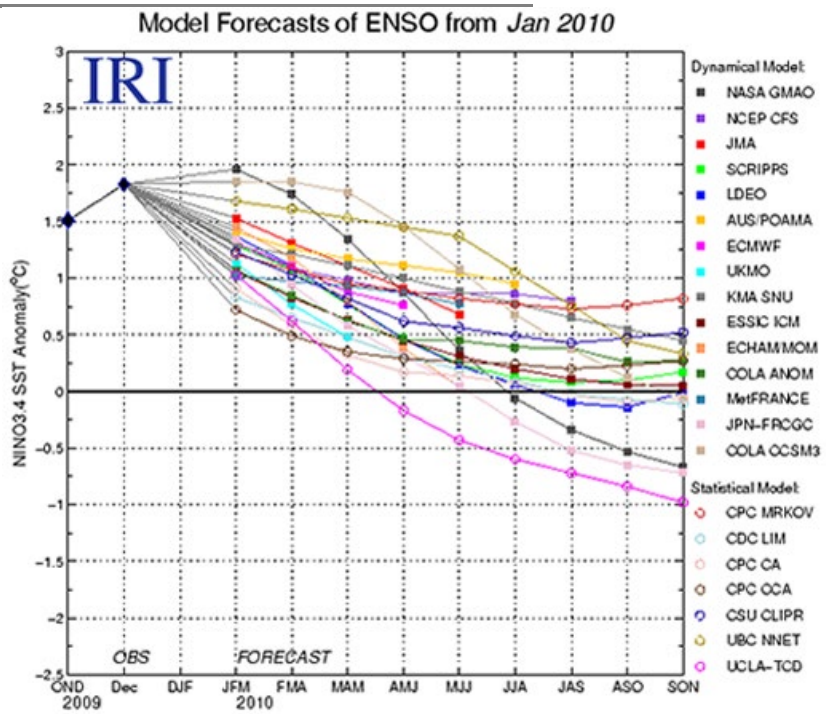

Figure EN-2. Forecasts made by dynamical and statistical models for sea surface temperatures (SST) in the Ni–o 3.4 region for nine overlapping 3-month periods from JanuaryÐMarch 2010 to SeptemberÐNovember 2010 (released January 20, 2010). (Source: International Research Institute (IRI) for Climate and Society)

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Temperature Outlook
February–June 2010 (Released January 21, 2010)

The latest temperature outlooks from the NOAA Climate Prediction Center indicate an enhanced risk of above-average temperatures for February 2010 over the much of the western U.S., including Wyoming, Utah, and western Colorado, with the highest increase in risk forecast for northern Utah and western Wyoming (Figure TEMP-1). In subsequent seasons through spring 2010, the region with enhanced risk of above-average temperatures shifts to the west and south but continues to cover all or part of Wyoming, Utah, and Colorado (Figures TEMP-2 to TEMP-4).

Temperature impacts of El Ni–o over the U.S. are typically weak during the summer and early fall, and strengthen during the late fall and winter. ENSO composites heavily influence the outlooks for temperature for November and subsequent seasons through the winter.

Note: These climate outlooks are intended for use prior to the start of their valid period (in this case, prior to the beginning of February). Within any given valid period observations and NWS short- and medium-range forecasts should be consulted. The February temperature forecast will be updated on January 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 February 18th.

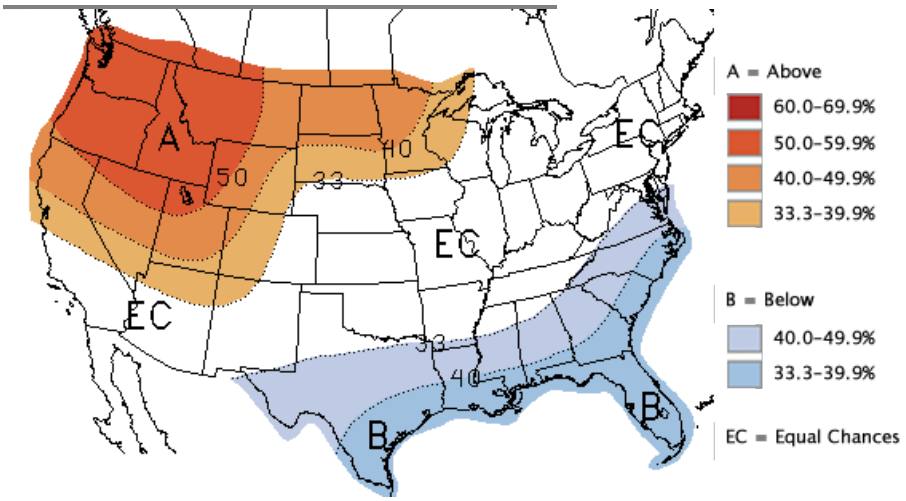

Figure TEMP-1. Long-lead national temperature forecast for February 2010. (Source: NOAA Climate Prediction Center)

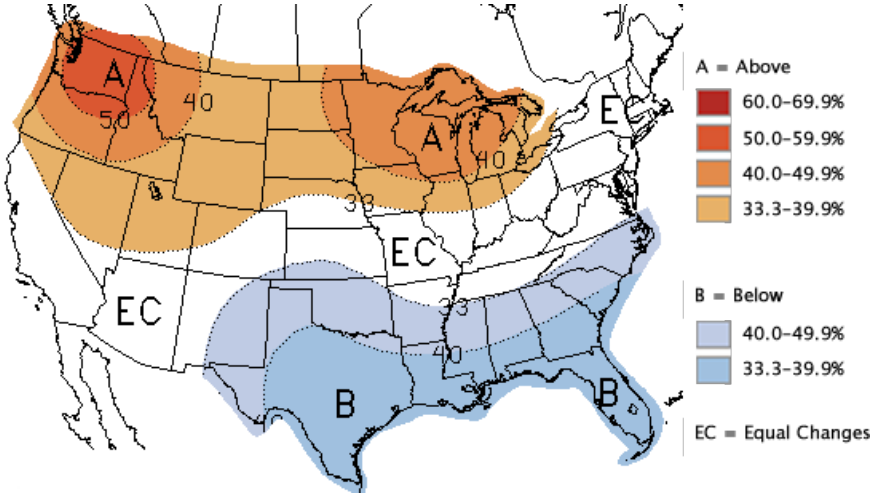

Figure TEMP-2. Long-lead national temperature forecast for FebruaryÐApril 2010. (Source: NOAA Climate Prediction Center)

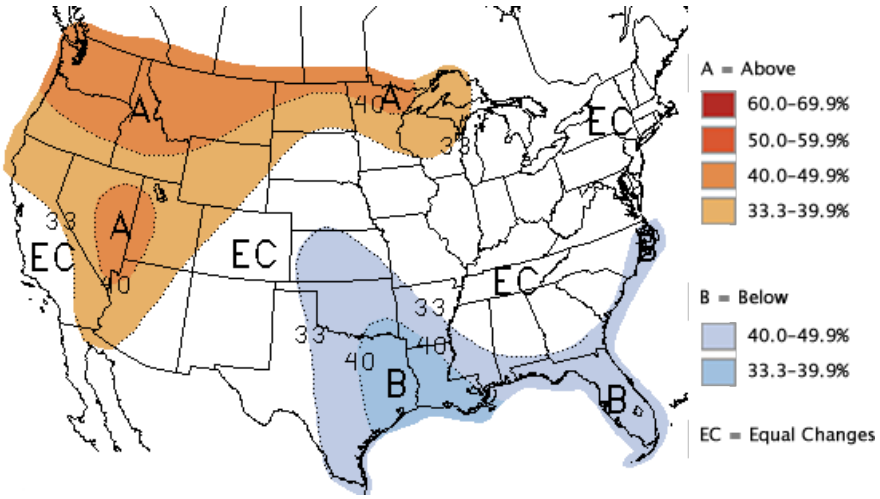

Figure TEMP-3. Long-lead national temperature forecast for MarchÐMay 2010. (Source: NOAA Climate Prediction Center)

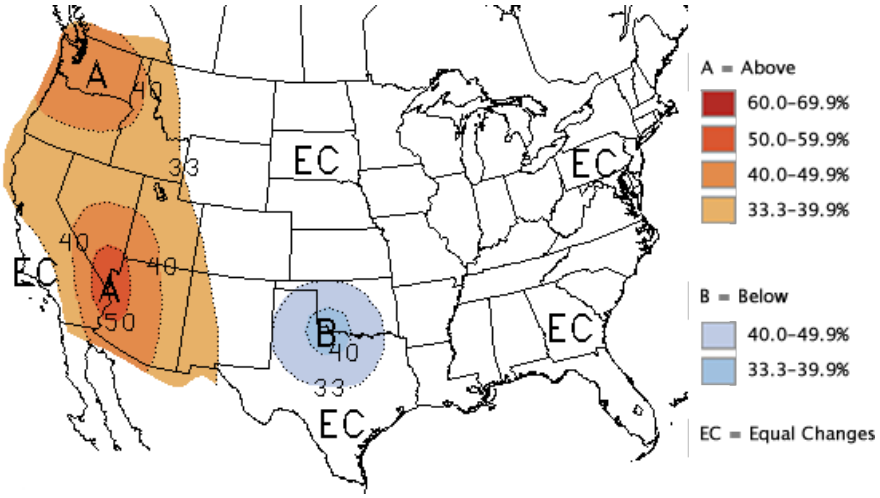

Figure TEMP-4. Long-lead national temperature forecast for AprilÐJune 2010. (Source: NOAA Climate Prediction Center)

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(provides explanations of graphics and additional information sources)

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Precipitation Outlook

February–June 2010 (Released on January 21, 2010)

The CPC precipitation outlook for February 2010 shows an enhanced risk of above-average precipitation for most of the southern tier of the continental U.S., including Colorado, southern and central Utah, and southeast Wyoming (Figure PPT-1). In subsequent seasons through Spring 2010, however, the forecast for the Intermountain West region is for equal chances for below, near, or above median precipitation, similar to climatology (Figures PPT-2 to PPT-4).

Areas of above- or below-median precipitation are largely due to expected El Ni–o impacts on climate, including the typical El Ni–o-influenced tilt of the odds towards above-median winter precipitation for some areas of the southern tier, especially southern California and southern Arizoan, and towards dry conditions for the Pacific Northwest. The influence of El Ni–o on precipitation is expected to decrease as the El Ni–o conditions diminish through the spring.

Note: these climate outlooks are intended for use prior to the start of their valid period (in this case, prior to the beginning of February). Within any given valid period observations and NWS short- and medium-range forecasts should be consulted. The February 2010 precipitation forecast will be updated on January 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 February 18th.

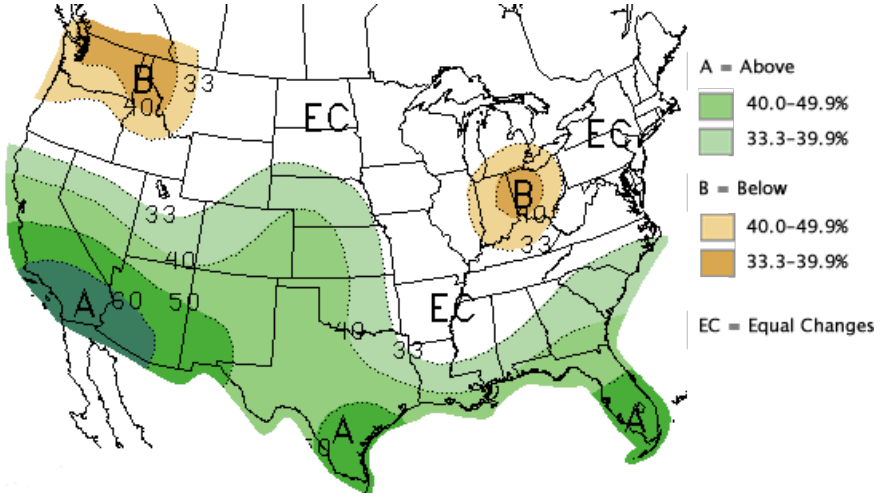

Figure PPT-1. Long-lead national precipitation forecast for February 2010. (Source: NOAA Climate Prediction Center)

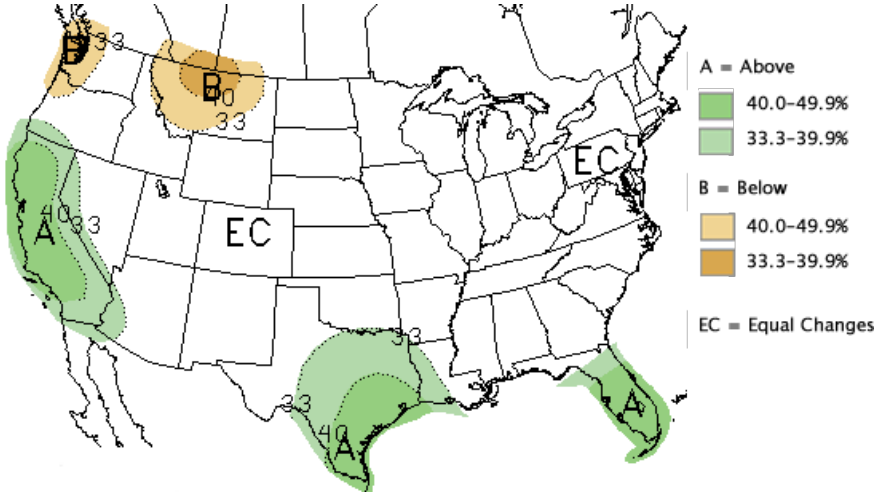

Figure PPT-2. Long-lead national precipitation forecast for FebruaryÐApril 2010. (Source: NOAA Climate Prediction Center)

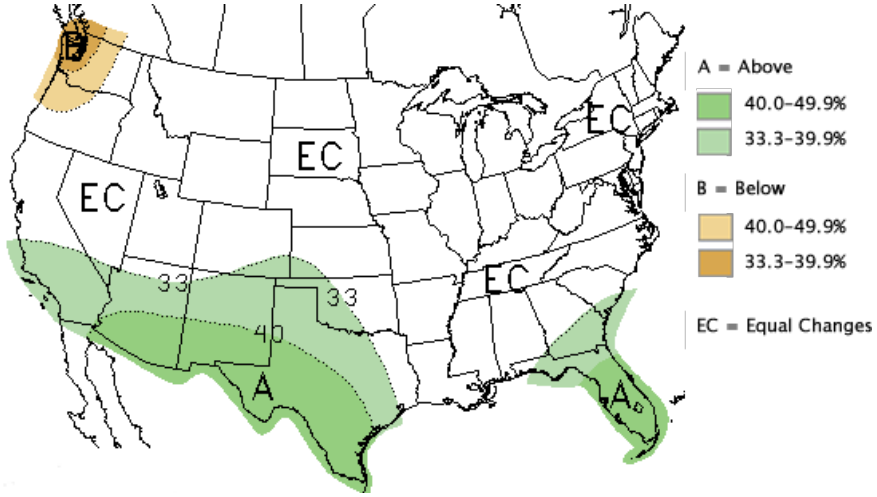

Figure PPT-3. Long-lead national precipitation forecast for MarchÐMay 2010. (Source: NOAA Climate Prediction Center)

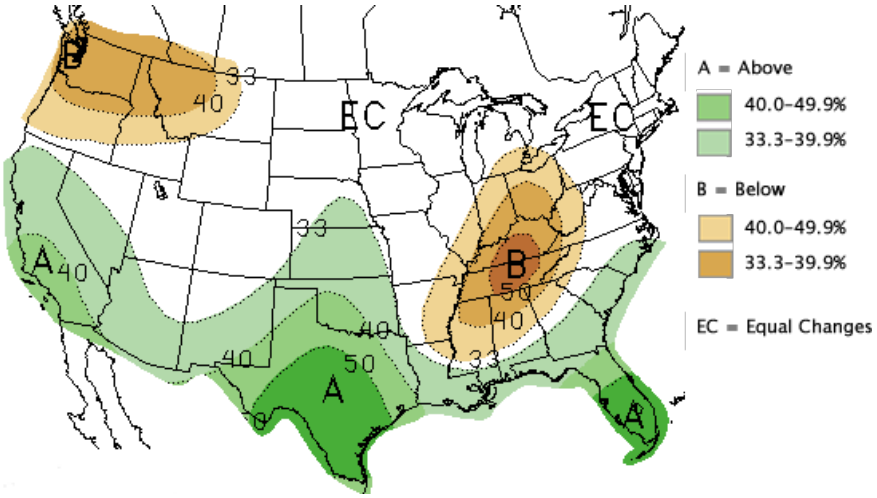

Figure PPT-4. Long-lead national precipitation forecast for AprilÐJune 2010. (Source: NOAA Climate Prediction Center)

The latest experimental PSD SWcast precipitation forecast guidance for JanuaryÐMarch 2010 has returned to a slightly dry outlook for Arizona and **Utah**, and most of **Colorado** also has above-average chances for a dry late winter (Figure PPT-5). The forecast for eastern New Mexico into southeast **Colorado** remains tilted towards wet, consistent with El Ni–o expectations. Historically, the persistence of El Ni–o through the winter increases the odds for a wet January through March season in Arizona and New Mexico, while **Utah** and **Colorado** often end up closer to average due to a wet March being balanced out by a dry JanuaryÐFebruary. The experimental forecast for this season is tilted drier for **Utah** and **Colorado** than the historical climatology would indicate, reflecting non-ENSO influences as well as the late onset (NovemberÐDecember 2009) of moderate-to-strong El Ni–o conditions.

The first outlook to April-June 2010 will be available from the SWcast webpage (see Notes) by January 29th.

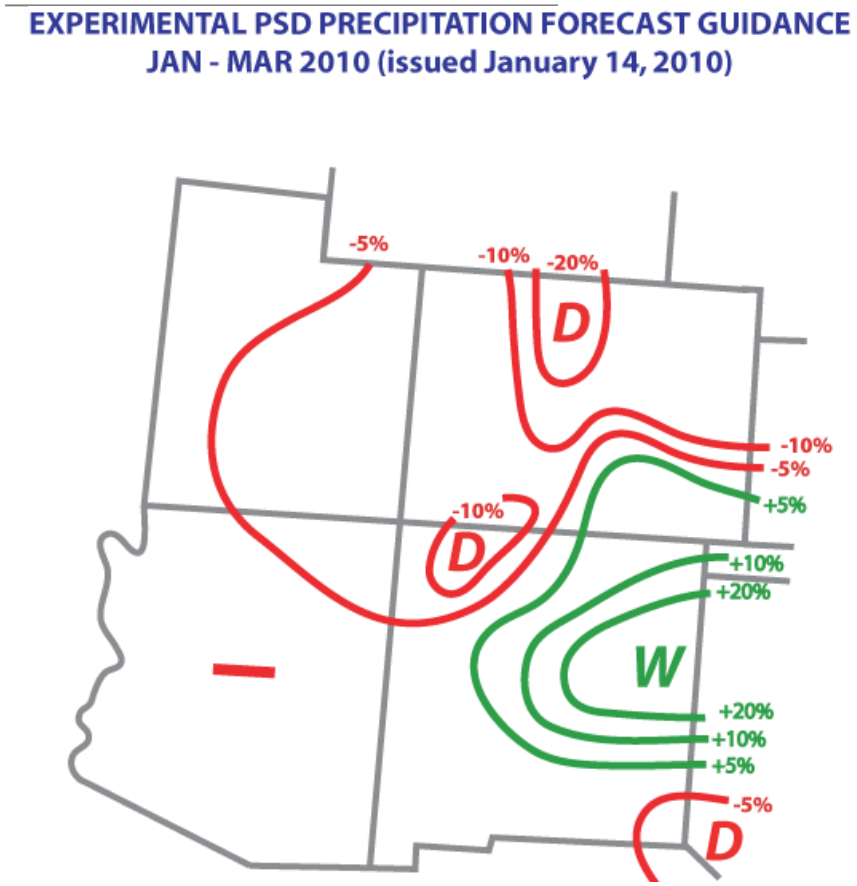

Figure PPT-5. Experimental precipitation forecast guidance. Forecasted shifts in tercile probabilities for JanuaryÐ March 2010. (Source: NOAA ESRL Physical Science Division)

Notes & Weblinks
(provides explanations of graphics and additional information sources)

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Seasonal Drought Outlook
through April 2010 (Released January 21, 2010)

The January 19 U.S. Drought Monitor indicated that southernmost **Utah** was in severe (D2) drought, and southeastern Utah extending into southwestern **Colorado** was in moderate (D1) drought, as were portions of western **Wyoming** and northeast **Utah** (Figure RC-7, above).

The U.S. Seasonal Drought Outlook projects where drought conditions (D1-D4) are likely to improve, and where new drought areas might develop, over the next three months. The January 21 Drought Outlook indicates that all areas in the Intermountain West reporting drought conditions are expected to improve, except for northern **Wyoming**. Improvement in observed drought conditions is expected by the end of April 2010 in southern **Utah** extending into the Four Corners area, and some improvement is expected in western **Wyoming** and northern **Utah**. The development of new areas of drought in the Intermountain West is not expected for the forecasted period (Figure DO-1).

Readers interested in the next 5 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 February 4th.

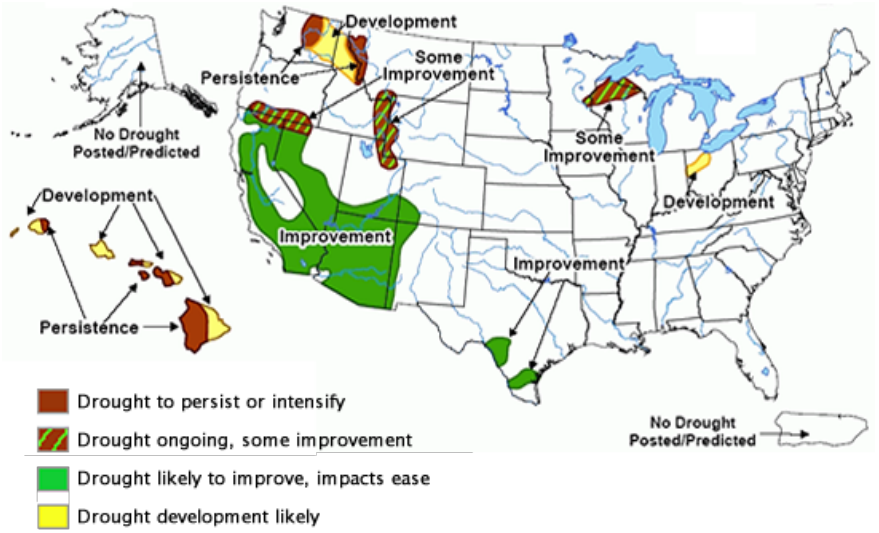

Figure DO-1. Seasonal Drought Outlook for January 21ÐApril 2010. (Source: NOAA Climate Prediction Center)

Notes & Weblinks

(provides explanations of graphics and additional information sources)

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Cooperative Institute for Research in Environmental Sciences ■ University of Colorado Boulder ■ 216 UCB ■ Boulder, CO 80309-0216 ■ Phone: 303-735-8173