



Office of the Washington State Climatologist

October 6, 2014

September Event Summary

The mean September temperatures across WA state were warmer than normal with western WA experiencing greater warm anomalies than eastern WA. The mean September temperature ranked among the top ten warmest for many western WA weather stations (see Table 1). For Everett, it was the warmest September since records began in 1915. Total September precipitation was variable across the state, but generally near-normal to above normal in western WA and below normal east of the Cascade Mountains.

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Station	Mean Sept. Temperature (°F)	Ranking	Record (°F)/Year	Previous Record
Everett	62.6	1	-	62.4; 1957
Quillayute	60.3	2	61.3; 2013	-
SeaTac	64.8	2	65.7; 1967	-
Bellingham	61.1	3	61.7; 1995	-
Olympia	61.1	7	63.2; 1974	-
Hoquiam	62.2	8	63.3; 1995	-

Table 1: The mean September 2014 temperature, ranking (from warmest to coldest), the prior record and year if applicable, and the current record holder for selected western WA stations.

The wetter than normal monthly totals for western WA are largely a result of a fall-like week during the last full week of the month (Sept 22-25). During this time, a frontal system moved through on the 23rd into the 24th, bringing about an inch of rain throughout the southern and central Puget Sound.

The 24-hour precipitation measurements from CoCoRaHS on the morning of the 23rd are shown in Figure 1. Part of Mason and Kitsap counties got about 2 inches of precipitation. This rainy period set maximum daily rainfall records at Hoquiam (1.3"), SeaTac (0.72"), and the Seattle Weather Forecasting Office (0.65") on the 23rd and in Yakima (0.30") on the 24th. Note that parts of eastern WA received a quarter to half an inch of precipitation on the 24th from the same system. The other shot of heavy rain occurred on the evening of September 2nd

where convective-type precipitation dropped heavy precipitation in a short time. The central and northern Puget Sound received the heaviest amounts, with peak values up to about 1.50". Daily maximum rainfall records were set at the Seattle WFO (0.58") and Omak (0.37").

Aside from the events described above, morning clouds and afternoon sun were common west of the Cascade Mountains and sunny skies were the norm east of the Cascades. It is worth mentioning the warm high temperatures on September 6 that set several daily maximum temperature records in western WA; SeaTac (90°F), Quillayute (89°F), Olympia (89°F), Hoquiam (87°F), and the Seattle WFO (87°F) all set daily high temperature records. It is unusual for high temperatures to reach 90°F in September in Seattle, though a 90 degree day was also recorded at SeaTac in September in 2013 and 2012. Prior to recent years, the last 90 degree day in September at SeaTac was in 1990. Another interesting September event was the low temperatures recorded on the 11th and 12th around eastern WA. Low temperatures got down into the upper 20s and lower 30s and Omak set a record daily low temperature on September 11 with 33°F.

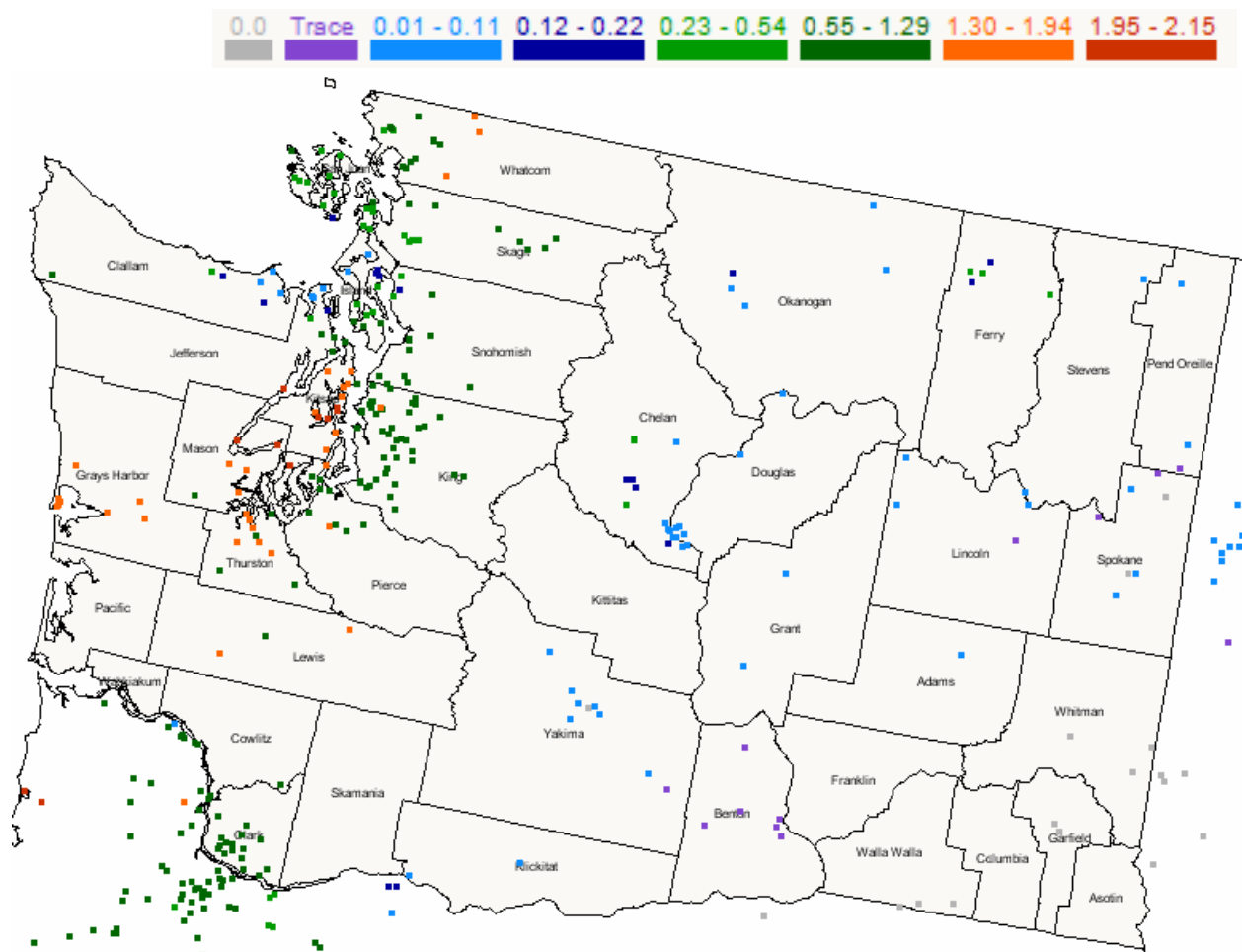


Figure 1: 24-hour precipitation measurements ending the morning of 24 September 2014 from CoCoRaHS volunteer observers.

Drought Update

In the last month, there have been some minor changes to the depiction of conditions in WA state from the US Drought Monitor. The precipitation on the Olympic Peninsula over the last month has helped the deficit and streamflows are coming back up, particularly in the eastern Olympic Peninsula. The “abnormally dry” depiction (D0) on the Olympic Peninsula has lessened, and is expected to continue to improve with the onset of fall precipitation. Some other minor changes to the DM have been made to ensure that the depiction represents the short and long-term conditions. The 30 September edition of the US Drought Monitor is shown in Figure 2.

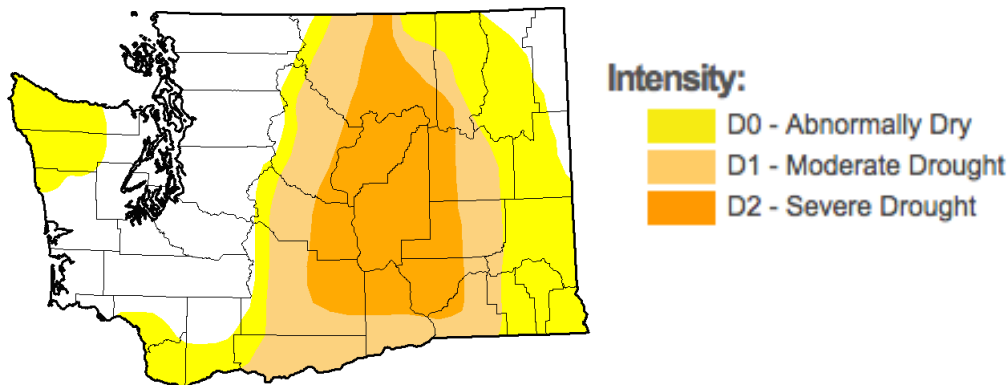


Figure 2: The 30 September 2014 edition of the US Drought Monitor (<http://droughtmonitor.unl.edu/>).

CoCoRaHS

Thank you, Community, Collaborative, Rain, Hail, and Snow (CoCoRaHS) volunteers for your continued dedication to the program. The 2014 water year (October 1, 2013-September 30, 2014) has officially ended, and your CoCoRaHS water year reports should be available within the next 3 weeks or so: <http://www.cocorahs.org/WaterYearSummary/>. As we head into the 2015 water year, please keep up your good reporting habits and remember to spread the word about the program! We are always looking for new volunteers and the beginning of new water year is a great time to start. The CoCoRaHS gauge at the OWSC office at the University of Washington received 2.62” of precipitation for September: in between the totals for SeaTac (2.23”) and the Seattle Weather Forecast Office (3.01”).

Winter Preview: What Can We Expect?

A message from the State Climatologist

As many of our readers are likely well aware, there is a high likelihood (between 60 and 65% chance) of a weak El Niño developing during the fall and winter. Sea-surface temperature anomalies are above normal throughout the equatorial Pacific Ocean at the time of this writing (more information in the Climate Outlook below), but the predicted El Niño has been slow to start. So what does this mean for the fall and winter weather in WA State?

During El Niño winters, there tends to be less total precipitation and snow by April 1 and warmer than normal mean temperatures over the winter as a whole. Figure 3 shows the total October-March precipitation for Washington State compared to the Southern Oscillation Index (SOI) in the preceding months. Negative (positive) SOI indices indicate El Niño (La Niña) conditions; when El Niño conditions are developing or developed, the winter has less total precipitation in the mean statewide. However, it is important to note the variation from one El Niño year to another. While the El Niño winter precipitation mean is about 2" less than the average for all 81 years, there are certainly plenty of El Niño winters that have more precipitation statewide than some La Niña winters. The SOI was only -0.35 for June-September 2014; the tropical Pacific is still considered to be in a neutral rather than El Niño state. But according to the ENSO forecast models as a group, the SOI should trend negatively through November.

Washington Statewide October-March Precipitation (versus Southern Oscillation Index for prior June-November)

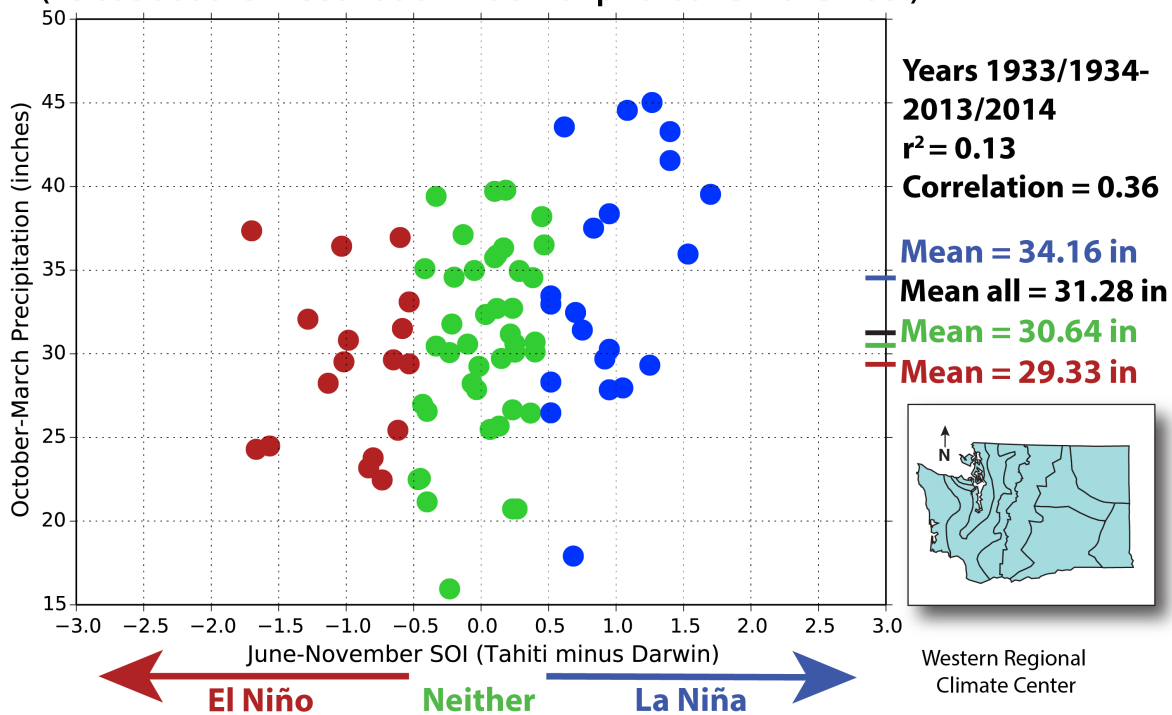


Figure 3: Statewide average Oct-Mar precipitation from 1933 through 2014 vs. a measure of ENSO in the preceding and beginning of the event (Jun-Nov). (from WRCC)

The most recent El Niño was a moderate event in 2009-10. That event provides a good example of how the variability in weather still exists even when the winter mean is predicted as warmer and drier than normal. In early December 2009, an arctic air outbreak occurred causing temperatures in the single digits around the state. Just like lowland snow, those cold air outbreaks are less likely in an El Niño winter but that is not a guarantee that they won't happen. New research performed by our undergraduate summer intern, Alexandra Caruthers, on ENSO's influences on WA state windstorms tells a similar story. While strong wind events can certainly occur during an El Niño (such as the Hanukkah Eve Storm in December 2006),

there is a lower likelihood of strong windstorms during an El Niño winter (Table 2) for many stations around the state. Figure 4 shows the accumulated energy (AE) of all of the wind events that occurred in each ENSO index for Spokane, and the lines show the mean and uncertainty of the AE for La Niña (blue), neutral (black), and El Niño (red).

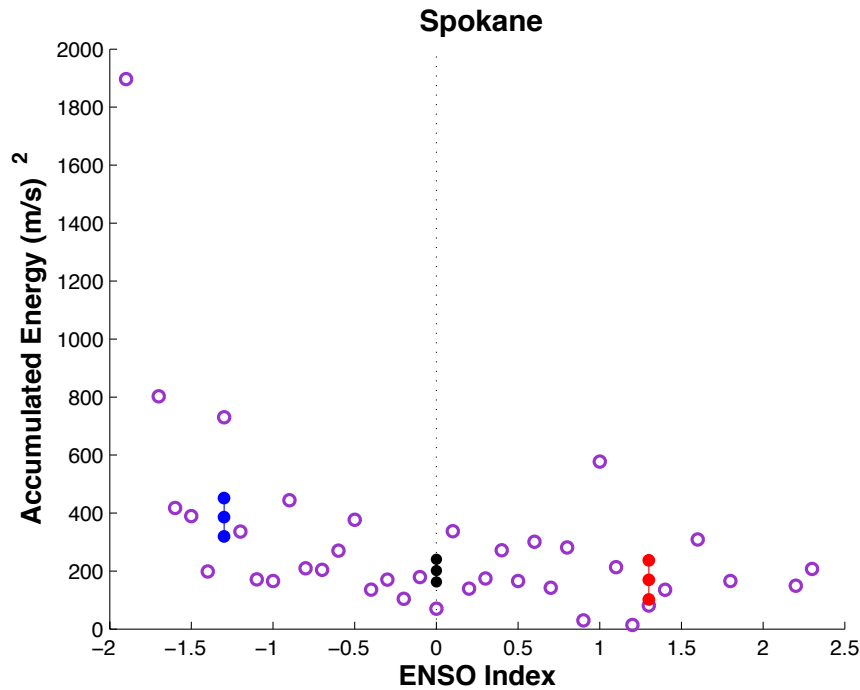


Figure 4: Average accumulated wind energy (AE) for each ENSO index for Spokane AP. The bars represent the mean and uncertainty for the La Niña (blue), neutral (black), and El Niño (red) phases.

Station	La Niña	Neutral	El Niño
Quillayute	1.3	0.8	1.3
Hoquiam	0.8	0.6	0.5
Bellingham	1.9	0.5	0.5
Whidbey Island	1.5	0.7	0.6
SeaTac	1.0	0.6	0.5
Olympia	0.7	0.5	0.6
Omak	0.5	0.6	0.3
Wenatchee	0.9	0.9	0.4
Moses Lake	1.4	0.8	0.4
Yakima	0.7	0.9	0.4
Spokane	1.6	0.8	0.6
Walla Walla	1.0	0.8	0.7

Table 2: The likelihood (average number per month) of a strong wind event occurring in a given ENSO phase.

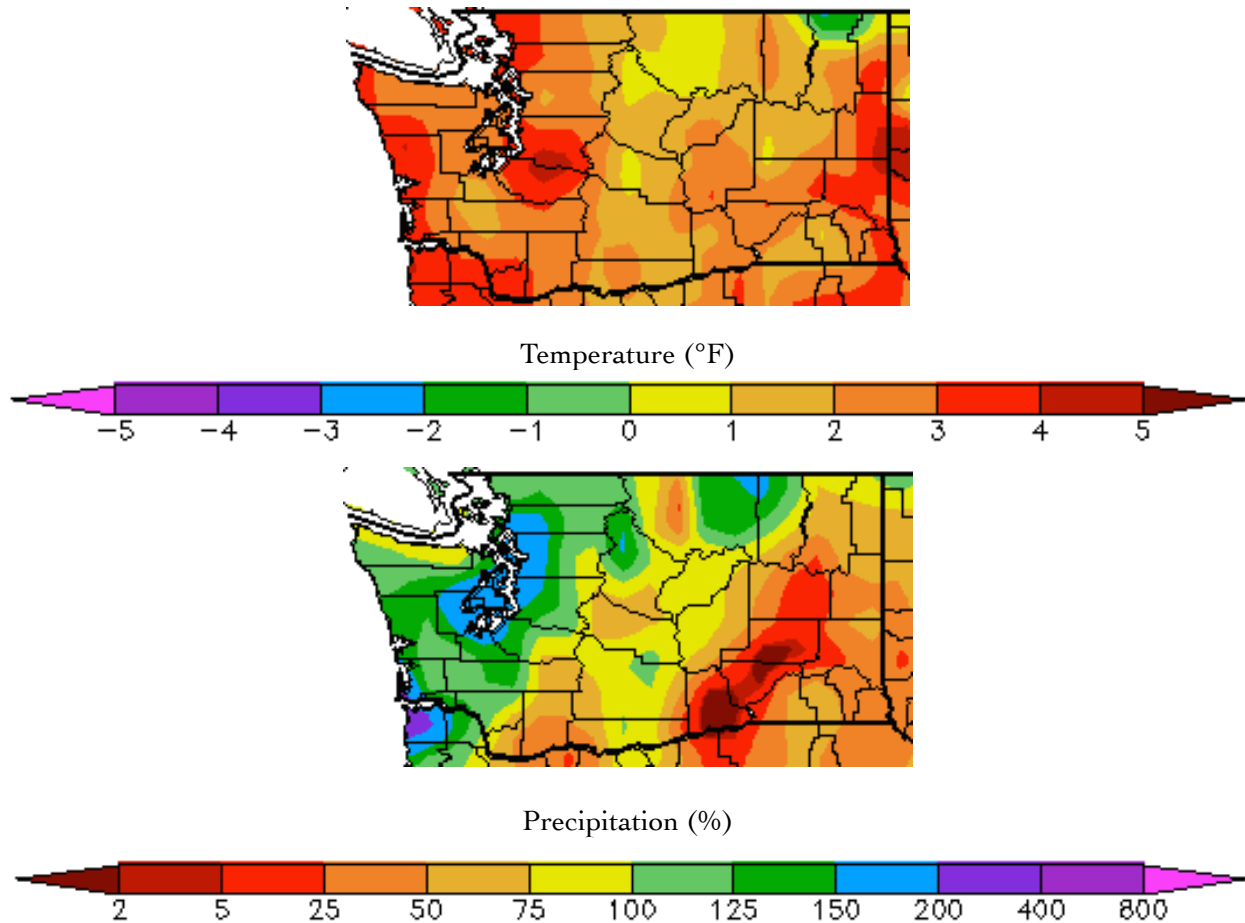
To summarize, the upcoming winter is expected to be warmer and drier as a whole, but there should be plenty of variability on daily to weekly time scales as always. Previous research confirms that lowland snow and windstorms are less likely. Aside from the ENSO forecast, an area of warmer than normal sea-surface temperatures that has persisted in the northern Pacific since last winter – known affectionately as “the blob” - is another sign that a warmer winter than usual is liable to be on the way. The relatively warm temperatures off our coast tend to be reflected in low-level thermal fields over land due to the prevailing winds from the southwest off the ocean.

The factors discussed above are reproduced, at least in principle, by NCEP’s Coupled Forecast System (CFS) global atmosphere-ocean model used for seasonal weather forecasts. The CFS predictions include above normal temperatures and below normal precipitation for a majority of the fall and winter months in WA. Forecasts are available at <http://www.cpc.ncep.noaa.gov/products/CFSv2/CFSv2seasonal.shtml>.

Climate Summary

Mean September temperatures were warmer than normal across all of WA State, marking the third month in a row of above normal temperatures statewide. The map below from the High Plains Regional Climate Center shows the greatest anomalies between 3 and 4°F on the coast, northern and central Puget Sound, and far eastern WA. Temperature anomalies were between 1 and 3°F for the rest of the state.

Total September precipitation varied across the state, with western WA generally receiving above normal precipitation and eastern WA below. The wettest areas received between 150 and 200% of normal precipitation such as locations in the central and southern Sound like Olympia (180%) and Seattle (198%; Table 3). The driest places in September were in the lower Columbia Basin and southeast WA where only between 5 and 50% of normal precipitation fell. Pasco was a dry spot, only receiving 13% of normal precipitation (Table 3).



September temperature (°F) departure from normal (top) and September precipitation % of normal (bottom).

(High Plains Regional Climate Center (<http://www.hprcc.unl.edu>); relative to the 1981-2010 normal).

	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	Percent of Normal
Western Washington						
Olympia	61.1	58.9	2.2	3.07	1.71	180
Seattle WFO	64.7	61.6	3.1	3.01	1.52	198
SeaTac AP	64.8	61.3	3.5	2.23	1.50	149
Quillayute	60.3	56.6	3.7	4.55	3.82	119
Hoquiam	62.3	58.7	3.6	3.44	2.28	151
Bellingham AP	61.1	57.2	3.9	1.87	1.78	105
Vancouver AP	66.2	63.6	2.6	1.15	1.56	74
Eastern Washington						
Spokane AP	63.1	60.2	2.9	0.26	0.67	39
Wenatchee	67.3	64.4	2.9	0.16	0.34	47
Omak	63.5	62.6	0.9	0.77	0.58	133
Pullman AP	61.0	58.2	2.8	0.44	0.78	56
Ephrata	66.7	63.8	2.9	0.29	0.36	81
Pasco AP	65.4	63.4	2.0	0.05	0.40	13
Hanford	69.2	66.4	2.8	0.16	0.31	52

Table 3: September climate summaries for locations around Washington with a climate normal baseline of 1981-2010. Note that the Vancouver Pearson Airport and Seattle WFO 1981-2010 normals involved using surrounding stations in NCDC's new normal release, as records for these station began in 1998 and 1986, respectively.

Climate Outlook

The equatorial Pacific Ocean is still in the ENSO-neutral category, according to the Climate Prediction Center (CPC): <http://www.cpc.ncep.noaa.gov>. Averaged over the last month, the sea-surface temperatures (SSTs) are above normal throughout the entire equatorial Pacific Ocean. As noted above, there is model consensus that a weak El Niño will develop, and the CPC assigns a probability of 60-65% that it will develop by winter. The “El Niño Watch” that was initially released by the CPC in early March is still in effect.

The Climate Prediction Center seasonal outlook for October is indicating increased chances of above normal temperatures for the entire state, with the three-class probability exceeding 50%. For precipitation, the outlook is calling for higher chances of below normal precipitation for the state. The probability of below normal precipitation is highest in southwest WA and decreases from southwest to northeast across the state.

The October-November-December (OND) outlook is similar to the October outlook. Warmer than normal temperatures and below normal precipitation is expected statewide, though the probabilities are less in this outlook than in the October only outlook, as is often the case for 3-month outlooks.



October outlook for temperature (left) and precipitation (right) from the CPC.



October-November-December outlook for temperature (left) and precipitation (right) from the CPC.