Office of the Washington State Climatologist

August 9, 2010

July Summary

A shift from the cool and wet pattern that existed for most of the spring occurred in July. Average July temperatures were closer to normal, and total July precipitation was much below normal for most of the state.

In this Issue

The continuation of cool and wet June conditions abruptly ended on July 7. Temperatures climbed into the 90's around the state for the next several days, causing several heat advisories to be issued by the National Weather Service and some daily temperature records to be broken. For example, SeaTac Airport, Seattle WFO, Hoquiam, and Quillayute reached 90°F, 84°F, 94°F, and 92°F, respectively, breaking previous daily records of 88°F, 82°F, 81°F, and 80°F, respectively, on July 7. More daily records were broken on July 8, such as SeaTac reaching 95°F and Bellingham reaching 88°F.

Temperatures were moderated on the west side by July 10 by onshore flow that brought clouds to the area. The east side cooled down the next day, and temperatures dropped to below normal for several days for the whole state. Temperatures warmed to above normal on the 14th & 15th, and temperatures generally stayed warm on the east side for the remainder of the month. This warmth and dryness resulting in increased fire danger levels for some eastern WA counties. According the the department of natural resources, fire danger is high in Asotin, Clark, Columbia, Douglas, Garfield, Kittitas, Klickitat, Lincoln, Okanogan, Skamania, Spokane, Stevens, Walla Walla, and Yakima Counties. The last few days of the July, however, did see measurable precipitation on the

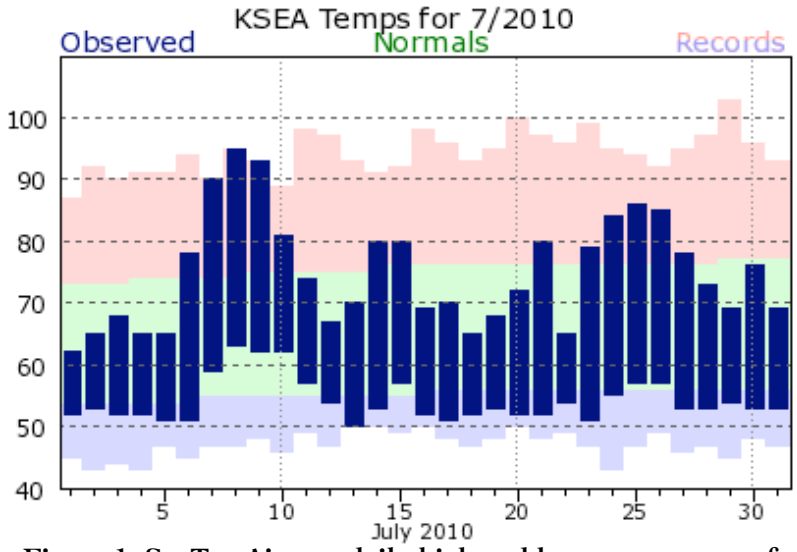


Figure 1: SeaTac Airport daily high and low temperatures for July from the National Weather Service.

east side of the Cascades, most notably on July 28 & 30.

The west side of the Cascades (example station; Figure 1) experienced a persistent pattern of overnight and morning clouds giving way to afternoon sun due to onshore flow from the 16th through the 23rd. An upper level ridge built on the 24th, keeping the west side warmer than normal through the 26th. The onshore flow returned though, bringing in more overnight and morning clouds and keeping the daytime high temperatures near to below normal for the remainder of the month.

Thunderstorms in WA State

A message from your State Climatologist

Thunderstorms occur in the state of Washington relatively infrequently (Figure 2). There are about 20,000 lightning flashes per year on average (1996-2008), according to the National Lightning Detection Network. This sounds like a lot, but in terms of the frequency of flashes per unit area, Washington State actually ranks dead last compared to the rest of the continental United States. Given that it rains often, especially west of the Cascades, it may be puzzling why our rains are so rarely accompanied by lightning. This issue is pursued in the present note.

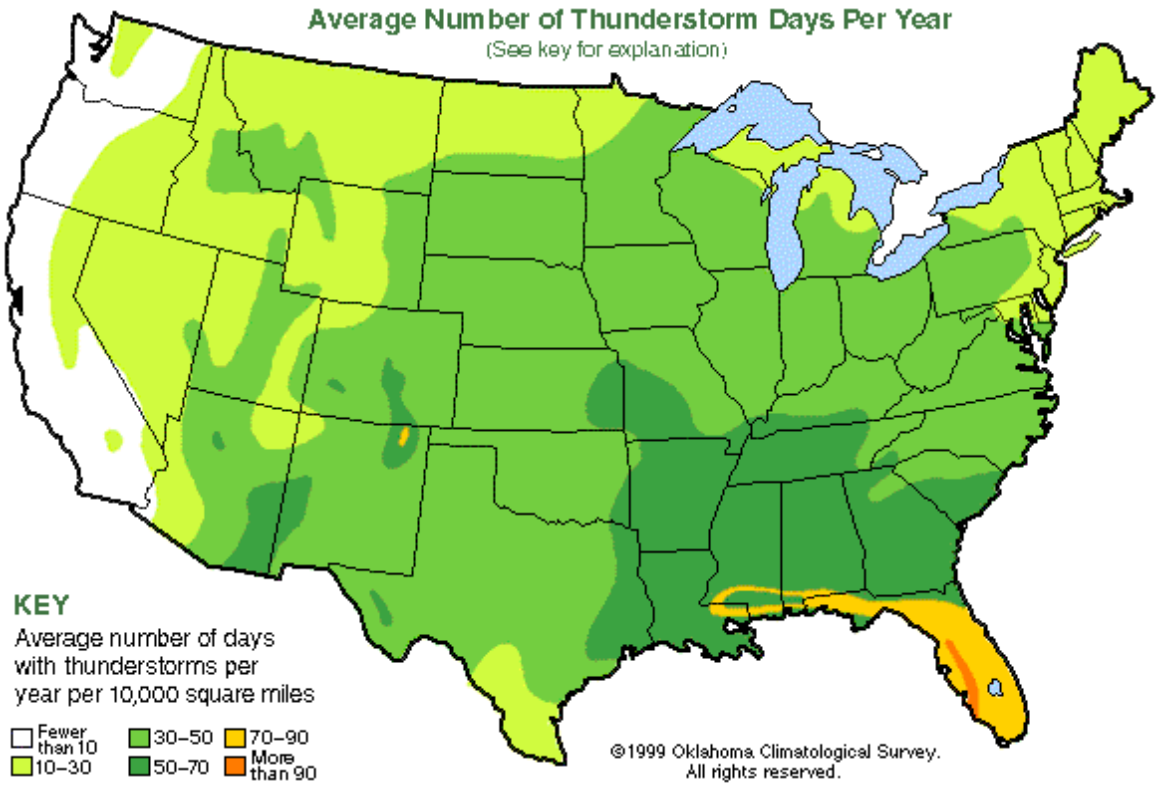


Figure 2: Average number of days with thunderstorms per year from the Oklahoma Climatological Survey.

It should be recognized that while lightning is uncommon in Washington State, particularly in the densely populated Puget Sound lowlands, severe thunderstorms do occur occasionally. Notably, an intense squall line moved through Vancouver, WA on 5 April 1972 that was accompanied by lightning and a F3 tornado. Washington actually had the dubious distinction of leading the nation in fatalities (6) due to tornadoes that year. More recently, a series of strong thunderstorms hit eastern Washington during the first two weeks of July 2006 resulting in damaging hail and flash floods in a number of locations.

The process through which clouds become electrified, i.e., build up the large static charge that is released by lightning, is not fully understood. It appears that a common mechanism involves the interactions between graupel (large ice particles that have collected supercooled liquid water) and smaller ice particles. A decent rule of thumb is that active cumulus clouds must extend up at least as high as the -20°C level. This temperature is found at roughly the 5-6 km level, and the active convection here does not often reach this high. Which begs the question, why not?

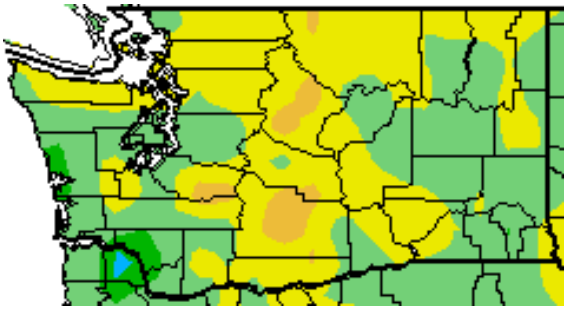
Deep cumulus convection is relatively uncommon in Washington State (and the Pacific Northwest in general) because of the lack of low-level air with high moisture content. The relative humidity is often high, but that is virtually always when it is also cool. We simply do not experience the combination of warm and muggy conditions that can plague other portions of the United States, particularly east of the Rocky Mountains in the summertime. The dewpoint temperature of the low-level air is comparable to the temperature of the last large body of water with which it has interacted, and there are no bodies of warm water upstream of the Pacific Northwest. A relatively low dewpoint temperature means there is less water vapor to condense and thereby represent a source of heat to generate the deep, vigorous convection typically required for a thunderstorm. In contrast, most of the thunderstorms that occur west of the Cascades are more characterized by cool air aloft, and many of their counterparts east of the Cascades are associated with the transport of moisture at mid-levels (~3 km) from the Great Basin region during summer. The more common thunderstorms that occur in the Cascades are generally associated with elevated heating and upslope-directed winds.

The numerical weather prediction (NWP) models in current use are reasonably effective for anticipating the prospects of thunderstorms out at least a few days, but will never be able to pinpoint their specific locations and timing more than a few hours into the future. There has not been much research on how the local frequency and distribution of lightning relates to the atmospheric circulation on seasonal time scales, but such information might prove useful from forest fire management and other perspectives. In closing, it is worth pointing out that while lightning is relatively rare in Washington, it obviously does occur, and it is prudent to be mindful of this threat while outdoors in certain conditions. If you see lightning or hear thunder, you should take action to minimize the threat, especially if in exposed locations like the mountains or on lakes. When thunder roars, go indoors!

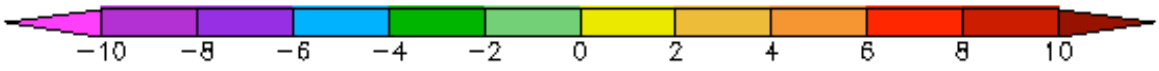
Climate Summary

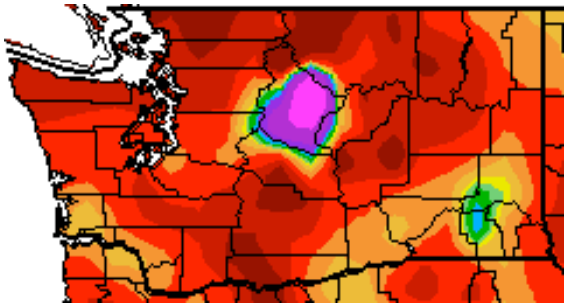
The average July temperatures were mostly within 2°F of normal, according to the High Plains Regional Climate Center plot shown below. The locations shown in Table 1 were closer to normal, and were mainly within 1.5°F of normal. The exceptions were Vancouver and Yakima, which were 1.9°F and 2.8°F above normal, respectively. In general, central WA had above normal temperatures for July.

Precipitation, unlike what was experienced in June, was below normal for virtually the entire state. Most of the state received less than 50% of normal July precipitation. The bull's eye of wetter than normal July precipitation on the map below resulted from greater than normal precipitation at Leavenworth and west of Wenatchee that mostly came from two thunderstorms events near the end of the month. Vancouver was again another exception (Table 1), receiving 163% of normal precipitation for July. Two locations in the Blue Mountains (southeast WA) also received above normal precipitation for the month, likely a result from thunderstorms.

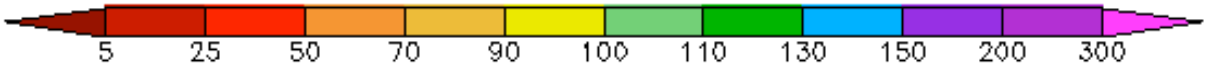


Temperature (°F)





Precipitation (%)



(July temperature (°F) departure from normal (top) and July precipitation % of normal (bottom). Source: High Plains Regional Climate Center (http://www.hprcc.unl.edu).

	Mean Temperature (°F)			Precipitation (inches)		
	Average	Normal	Departure from Normal	Total	Normal	% of Normal
Western WA						
Olympia	62.5	62.8	-0.3	0.16	0.82	20
Seattle	64.4	65.2	-0.8	0.13	0.97	13
Sea-Tac	64.5	65.3	-0.8	0.31	0.79	39
Quillayute	57.8	58.6	-0.8	0.37	2.34	16
Vancouver	67.3	65.4	1.9	1.30	0.80	163
Eastern WA						
Spokane	68.9	68.6	0.3	0.36	0.76	47
Omak	71.6	71.0	0.6	0.22	0.80	28
Ephrata	74.6	74.7	-0.1	0.05	0.44	11
Pullman	64.6	65.9	-1.3	0.32	0.79	41
Pasco	73.6	74.9	-1.3	0.19	0.25	76
Yakima	71.8	69.0	2.8	0.08	0.22	36

Table 1 - July Climate Summaries from around Washington from NWS (climate normal baseline is 1971-2000 except for Seattle WFO that has a baseline of 1986-2000).

Website Updates

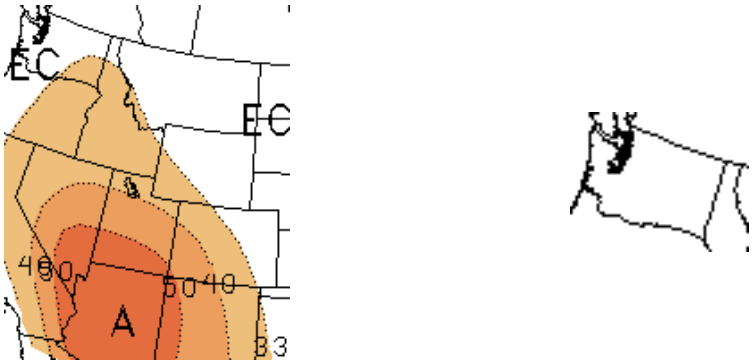
Our climate inventory maps (http://www.climate.washington.edu/maps/), a convenient utility that plots the locations of stations and the parameters available overlaid on Google Maps, were updated this month with 10 relatively new SNOTEL sites. The sites were installed in 2008 and 2009 and were mainly located in Whatcom County, though there was 1 site each in Jefferson, King, Klickitat, Pierce, and Skamania Counties.

Climate Outlook

La Niña conditions are developing across the equatorial Pacific as the negative sea surface temperatures (SSTs) are continuing to strengthen, according to the Climate Prediction Center (CPC; http://www.cpc.noaa.gov/products/precip/CWlink/MJO/enso.shtml). Models are in agreement that the La Niña conditions will continue to develop and persist through the boreal winter though the strength of the impending La Niña varies between the models (http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html).

The late summer/early fall CPC outlook (August-September-October; ASO) has at least a 33% chance of above normal temperatures for the southeastern corner of WA and equal chances of below, equal to, or above normal temperatures for the remainder of the state. For precipitation, the ASO outlook has a 33% chance each for above average, normal, or below average conditions.

The CPC outlook for fall reflects the expected La Niña development. The fall outlook (September-October-November; SON) calls for equal chances of below, equal to, or above normal temperature for the whole state. Precipitation, on the other hand, is expected to be above normal for SON, with at least a 33% chance in eastern WA and 40% chance in western WA.



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

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

Community Collaborative Rain, Hail, and Snow Network

It may be our dry season, but your CoCoRaHS reports are still important to submit. Please remember to record your zeros. Thanks to the observers that have consistently reported this summer. It's not too late to start if you've already signed up! If you have any questions about getting started, please contact the state coordinator (wash.cocorahs@gmail.com) or your regional or local coordinator (http://www.cocorahs.org/Content.aspx?page=coord_wa). If you'd like to volunteer to take daily precipitation measurements, visit www.cocorahs.org.