

# WeatherWorks



Your Weather Experts

## **2015 Summer Forecast**



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WeatherWorks was founded in 1986 in an effort to bring quality meteorological expertise to both the public and private sectors. WeatherWorks' mission has remained the same ever since: to minimize risk, increase profits, and help maintain safe operations.

If this seasonal forecast or any other forecast products would be beneficial to your organization, please e-mail us at [kenelliott@weatherworksinc.com](mailto:kenelliott@weatherworksinc.com). We would be more than happy to discuss how WeatherWorks can work for you.

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## A Review of Summer 2014

On the national level, 2014 went down as a fairly typical summer. The average temperature was 71.7°F, just 0.3°F above the 20th century average. While the trend of late has been for warm summers, 2014 was the coolest summer since 2009. The hottest temperatures were on the West Coast, as California, Oregon, and Washington all had one of their top-five warmest summers on record. While much of the Central U.S. experienced below normal temperatures, no state had a top-ten coolest summer.

Overall, the eastern half of the country was largely spared from temperature extremes in 2014. In the Midwest, it ended up on the cool side of normal, but temperature anomalies were still fairly modest (less than 2.0°F). On the other hand, New England finished above normal, though readings only topped average by about 1.0°F. As for the rest of the Northeast and Mid-Atlantic, temperatures generally ended up within a half degree of the norm.

Excessive heat was also less of an issue for much of nation in 2014. The total number of stations with at least one day at or above 100°F in 2014 was lower than the three prior years. The same can be said for the number of stations with at least ten days topping 100°F, and the total population exposed to such excessive heat.

In terms of precipitation, 2014 ranked as the ninth wettest summer on record, with an average of 9.39 inches. The most precipitation was in the Midwest and Northern Plains, where North Dakota, South Dakota, Nebraska, Iowa and Illinois all had top-ten wettest

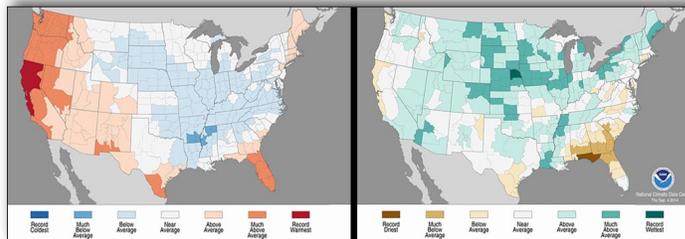


Fig. 1: Summer 2014 (June, July, August) Temperature (left) and Precipitation (right) Departures from Average (NOAA)

summers. Meanwhile, much of the East Coast (with the exception of Northern New England) ended up with around normal precipitation.

The Midwest had a stormy start to meteorological summer in 2014, as June ended up being the wettest month of the year. Several systems moved across the area during the month, bringing thunderstorms and torrential downpours. Both Chicago and Indianapolis finished with over 7 inches of rain, recording 7.81 and 7.04 inches, respectively. In fact, Chicago more than doubled their June average of 3.69 inches! While precipitation departures were not as high in Ohio, the Buckeye State still saw plenty of rain (widespread 5 to 6 inches) in June of 2014.

Meanwhile, on the West Coast, drought conditions worsened. This was especially true in California, where relief was nowhere to be found. In total, the percentage of the state facing exceptional drought conditions (the highest category) increased from 25% to 58%.

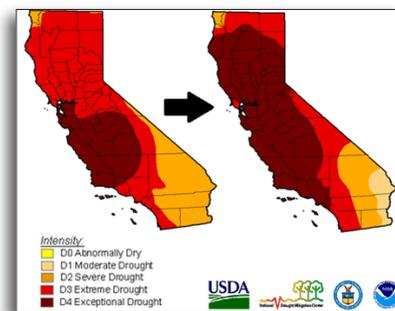
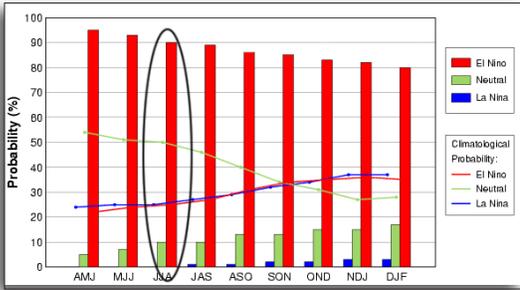


Fig. 2: Expansion of California Drought June 2014 (Left) vs. September 2014 (Right)

## El Niño and the PDO: Implications for the Summer



**Fig. 3: ENSO Probabilistic Forecast Through Winter 15-16, Summer Circled (CPC/IRI)**

After a “false start” in 2014, El Niño finally came to fruition at the end of the past winter. With El Niño (see brief explanation to the right) projected to continue for the remainder of this year, it is expected to have an impact on this upcoming summer. It will also be the first summer with El Niño conditions present since the Summer of 2009.

Another important oscillation that has recently been in a state of flux is the Pacific Decadal Oscillation (PDO). Unlike El Niño, SST anomalies associated with the PDO occur in the North-

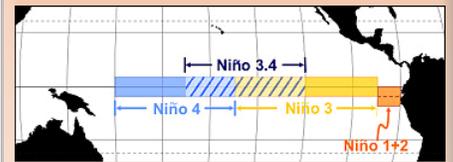
ern Pacific Ocean. The PDO is also different as it takes place on a time scale of decades. The PDO has two phases, a “warm” and “cool” phase. The warm phase is characterized by cooler SSTs in the western Pacific, and warmer than normal ocean waters off the West Coast of North America. The opposite holds true for the cool phase.

While the cool phase had been dominant since the late 1990s, the positive state of the PDO has been favored over the last year and a half. In fact, since last December, the PDO has been strongly positive, with index values generally greater than 2 (these are the highest values since 1997).

Overall, El Niño and the warm phase of the PDO correlate with cooler than normal air temperatures across the Eastern U.S. On the other hand, warmer than usual temperatures can be expected along the West Coast in this setup.

### El Niño Explained

In its simplest form, El Niño is the anomalous warming of ocean waters in the Equatorial Pacific Ocean off of the South American coast. While a Pacific Ocean phenomenon, El Niño has global weather and climate implications, which are relevant during all times of year.



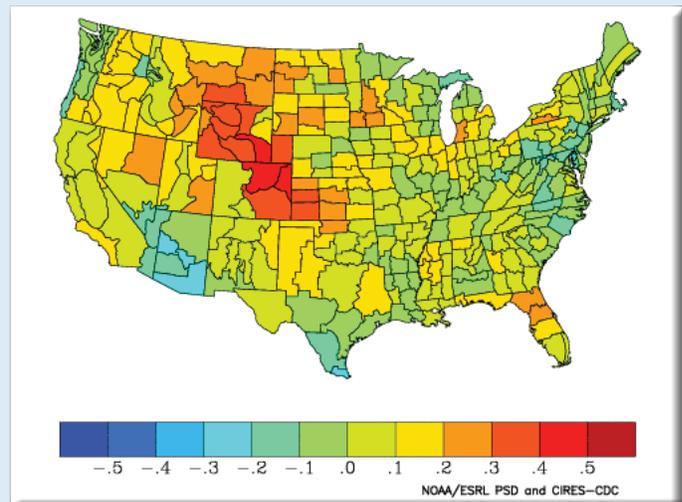
**Common Regions monitored for El Niño (Central Niño 3.4 area most important)**

In general, the correlations between El Niño and summer weather patterns are strongest and most reliable in Australia and in southeastern Asia. However, there are still meaningful relationships to be made in the United States. Typically El Niño summers are a bit cooler than normal for the Midwest and Ohio River Valley.

## ENSO/PDO Impact On Summer Precipitation

With El Niño conditions predicted to continue for the rest of 2015, we can expect it to have an influence on precipitation for the upcoming summer. The image to the right shows precipitation correlations associated with El Niño conditions. While a bit counterintuitive, the yellows, oranges, and reds reflect above average precipitation, while the greens and blues correspond to below normal rainfall.

During El Niño summers, higher than average rainfall can be expected in the Rockies and the Great Plains. The same can be said for Northern and Central Florida. The correlation between El Niño and precipitation is weaker for the Midwest, but still points towards above normal rainfall. In addition to El Niño, a positive PDO regime (not shown) also favors slightly wetter than average conditions for portions of the Midwest and Ohio River Valley.



**Fig. 4: Summer Correlation with Precipitation and ENSO (Negative Values Represent Dry Weather, Positive Wet)**

## Other Global Indices & Atmospheric Oscillations

Below is a summary of the oscillations anticipated to have an impact during the Summer of 2015. In addition to the previously discussed El Niño and PDO, the QBO, and PNA are also included.

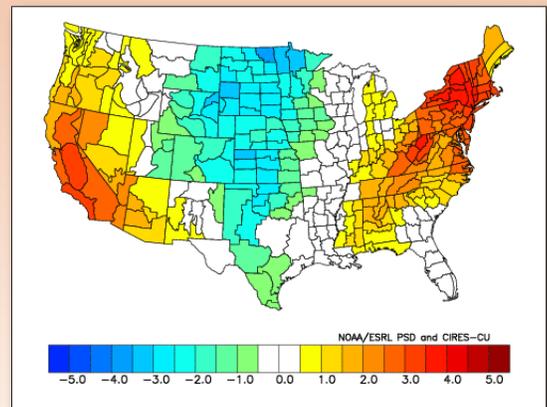
The QBO, which is expected to remain in its negative phase for the summer, will also favor cooler than normal temperatures across the Eastern U.S. Likewise, the forecast positive phase of the PNA (albeit weak) is also supportive of below average temperatures.

Primary Oscillations with Impacts on Eastern U.S. Summertime Weather Patterns				
	El Niño Southern Oscillation (ENSO)	Quasi-Biennial Oscillation (QBO)	Pacific Decadal Oscillation (PDO)	Pacific-North American Connection (PNA)
<b>Primary Geographic Area</b>	Equatorial Pacific Ocean	Stratosphere: 10 to 50 millibars	Pacific Ocean – North of 20°N	Pacific Ocean / Intermountain West
<b>Eastern U.S. Impacts (Positive Phase)</b>	<i>El Niño:</i> Cooler than average temperatures	Above average temperatures	Associated with El Niño type conditions	Below normal temperatures / stormier than normal
<b>Eastern U.S. Impacts (Negative Phase)</b>	<i>Neutral / La Niña:</i> Warmer than normal temps & drier than average	Cooler than average temperatures	Associated with La Niña type conditions	Above normal temperatures / relatively tranquil
<b>Expected Phase: Summer 2015</b>	Positive: <i>El Niño</i>	Negative	Positive	Weakly Positive

## June 1957: A “Battleground” Across the Midwest

In most of our long range forecasts, Analog or “Scenario” years is a tool that we use frequently. It is a great way to look into the past and try to match up previously observed and forecast weather patterns with actual outcomes. Oftentimes, the analog year that is chosen is obvious, and other times, it’s not. This forecast falls into that latter category - as no summer we found seems to have everything we’re looking for this year.

- Despite the fact that the oscillations in the table above generally favor below average temperatures for summers in the Midwest, things could get off to a seasonable or even warm start
- A majority of the analog years for the upcoming summer point to near average or even above normal temperature anomalies in June
- This is especially true for June of 1957 (see temperature anomalies to the right)
- El Niño conditions were present leading into June 1957, and the PDO was in its positive state
- The temperature pattern clearly shows warmth on the West Coast, Northeast, Mid-Atlantic and Ohio Valley, while Illinois and Indiana are caught in the middle



*Fig. 5: June 1957 Temperature Anomalies*

# WeatherWorks 2015 Summer Forecast

## Drawing Similarities to 2014:

### Another Summer of Variable Weather Expected

As stated on the prior page, multiple “analog” years were taken into consideration for this summer forecast. In addition to 1957, 2014 was a year that had similarities to what we expect for this summer. In fact, last year the QBO and PDO were in their negative and positive phases respectively, which as previously mentioned, is also expected to continue this year.

One difference, and quite an important one, in the overall pattern between this year and last is the state of ENSO. While El Niño failed to emerge in 2014,

it has definitely come on strong over the last few months.

So while they are certainly not carbon copies of one another, we can to some extent use 2014 as a guide for this forecast. True to the WeatherWorks Summer Forecast of 2014, it was a highly variable summer, with a warm start in June for the Midwest and Northeast, but a cool end for much of the Central and Eastern U.S (see Figure 6 below).

To the right is the official WeatherWorks Summer 2015 forecast. Take

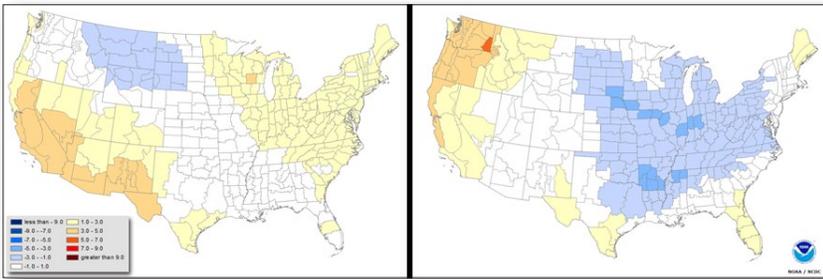
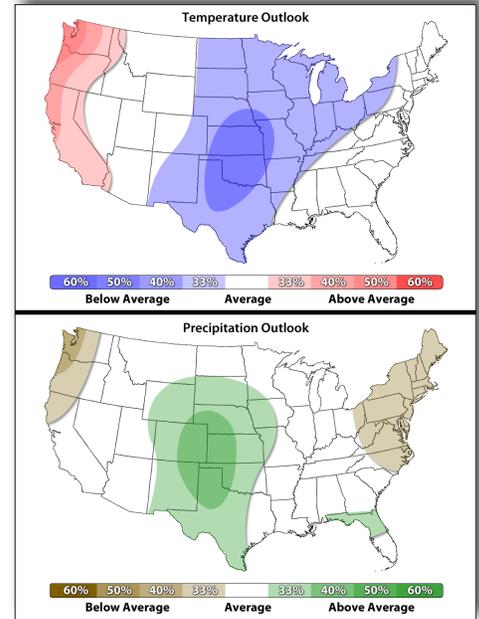


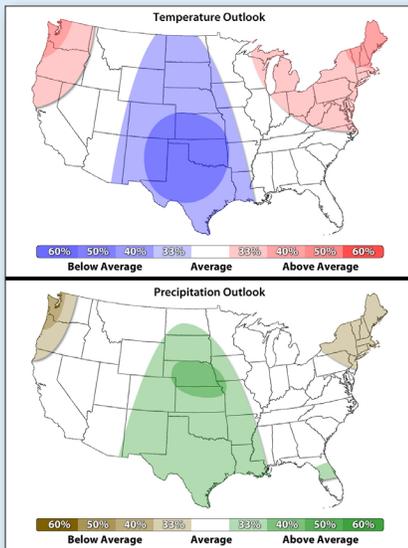
Fig. 6: 2014 Temperature Anomalies June (Left) vs. July/August (Right)



note that the maps shown are for meteorological summer (June - August) as a whole. As for any three month period (and to some extent in the monthly forecasts that follow), some degree of variation is expected during the forecast time frames.

## June 2015 Forecast

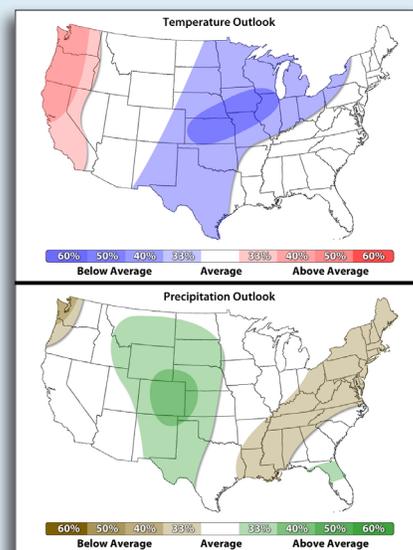
- The Midwest is expected to be the battleground between the cool / wet in the central part of the country and dry / warm to the east
- On the otherhand, the summer is anticipated to get off to a warm start across the Ohio River Valley, Northeast and Mid-Atlantic
- In addition to the Eastern U.S., the Northwest is favored to see above average temperatures for June
- As previously mentioned, cooler than normal conditions are predicted for much of the Central U.S., especially Northern Texas and Oklahoma
- Precipitation is likely to follow a similar pattern to temperatures, as the Northeast and Pacific Northwest are trending on the dry side
- The middle of country is likely to be active, with the highest confidence for wet conditions across the Central Plains



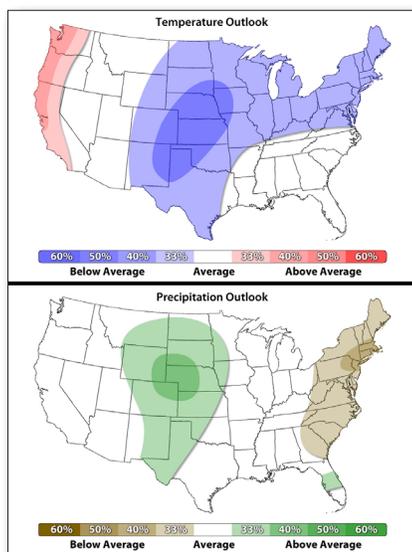
# WeatherWorks 2015 Summer Forecast

## July 2015 Forecast

- The below average readings across the central part of the country are favored to shift a bit eastward during the July. This will likely result in cooler than usual conditions for the Midwest and Great Lakes Region
- The East Coast is predicted to see normal temperatures. Thus no prolonged periods of excessive heat are expected for the Northeast and Mid-Atlantic
- In contrast to the Eastern U.S., above average temperatures are projected to extend across the West Coast. As a result, a large number of 90+ degree days can be expected, especially for inland locations
- In congruence with the typical El Niño year, plenty of rainfall is anticipated for the Great Plains, Rockies and parts of Florida
- With a lack of organized systems, much of the Ohio River Valley and East Coast should see below normal precipitation amounts. These areas will likely have rely to on typical summertime thunderstorms for rainfall
- The dry trend in the Pacific Northwest is forecast to linger through July



## August 2015 Forecast



- Cooler than normal conditions are not only projected to continue across the Central U.S. and Midwest for August, but expand into the Northeast and Mid-Atlantic as well. Thus, several shots of cooler air will likely have it feeling like early fall for much of the country, especially towards the end of the month
- Similar to July, positive temperature anomalies are predicted to be mostly confined to the West Coast
- Typical late-summer showers and thunderstorms will likely result in near normal rainfall totals for the Midwest and much of the Mississippi River Valley
- Wetter than normal conditions are anticipated to continue across the Plains, Rockies and central Florida
- Unlike the first two months of summer, the Pacific Northwest is expected to return to more normal precipitation patterns
- Unfortunately for folks along the East Coast, below normal rainfall is predicted through the end of summer. Also with suppressed tropical activity expected this year, the Northeast and Mid-Atlantic will likely lose one of their avenues for summer rainfall