An Unprecedented Warm Beginning to the Winter of 2015-2016?

By Dr. Anthony Lupo

Throughout the Fall season this year we've heard about the onset of a monster El Nino, one on par with the huge El Nino of 1997-1998. As fall has evolved the El Nino has certainly been a strong one. Typically, El Nino results in warmer temperatures for the eastern 2/3 of the country, and colder temperatures for the western USA. This December's weather has certainly El Nino-like.

But, it should be noted that not all El Ninos produce the same weather patterns over the USA. El Nino influences the path of the jet stream, and this impact depends on the location and the shape of the anomalous warm water mass in the Eastern Tropical Pacific. The El Nino of 1997-1998 was not as noteworthy for warm conditions in the eastern US.

As fall rolled into winter, December has been off-the-charts warm for much of the country. And this follows a very warm fall (September - November). Unprecedented we're told, as surfers rode the waves Christmas day off New York and New Jersey. And there was unusual severe weather as well, as tornadoes and flooding rains occurred from Texas to Florida, and also up north as far as Michigan. This severe weather resulted in fatalities through the Christmas Holiday.

Of course, climate change has been fingered as playing as much a role as El Nino in the occurrence of this unprecedented weather. This means at least partly related to human carbon dioxide emissions, or that we may have brought this on ourselves. All the talk has been about how this is the "new normal". Is this warm weather a prelude to our future? Many have asked the question across the nation.

Thus it is instructive to put Fall 2015 into a historical perspective. One could look at the "cumulative warmth" of each fall dating back to 1889, the date for which records are first available in our region. This quantity is simply the sum of each month's temperature anomaly for a season. The monthly temperature anomaly was calculated using the 1889 - 2014 average for each month. This quantity is similar in concept to heating or cooling degree days. For Columbia, MO, Fall 1931was the warmest at +19.7 F. Fall 1963 was second at +15.5 F, while Fall 2015 was third at +15.1 F. Thus, for this region, Fall 2015 was the third warmest, unusual for sure, but not unprecedented. Then, looking at the statewide mean temperatures for the September to November period showed Fall 2015 was only the ninth warmest on record, while the same period for 1931 was only 4th warmest. This disparity between these two statistics means that the fall of 1931 and 2015 was consistently very warm but not uniformly so across our region.

Nationwide, the situation was much the same, warmer than normal temperatures were the rule. Examining Figure 1 shows that the surface temperature pattern for November 1931 (Fig 1 left) strongly resembled November 2015 (Fig 1 center) in form and magnitude. Note that the eastern part of the USA was very warm, while the western part was very cold compared to normal as shown by the size and color of the circles (Fig. 1 right).

How about globally? Using the 500 hPa height field to compare global weather patterns (Figure 2), shows the 500 hPa height fields are similar for the Fall 1931 versus Fall 2015. The contours on this map can be thought off as the cumulative energy in the atmosphere up to that level. It should be noted that the height data for 1931 was constructed using surface records, as 500 hPa height measurements were not available at that time.

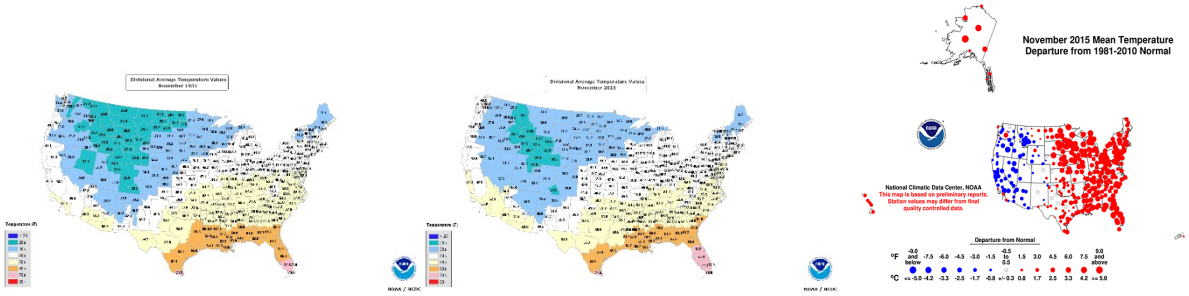

Figure 1. November surface temperature (F) for the USA (left), (center) by climate division for 1931 and 2015, respectively, and (right) the 2015 anomaly, where blue is cold and red is warm with the size of the circle corresponding to a magnitude.

Looking further at the regional temperatures for the start of winter in this area, the fall of 1931 was followed up by the warmest winter in the 126 year period of record for the state of Missouri by far (almost 2 F more that the second warmest winter). It is highly likely that our grandparents and great grandparents were also wondering where winter had gone.

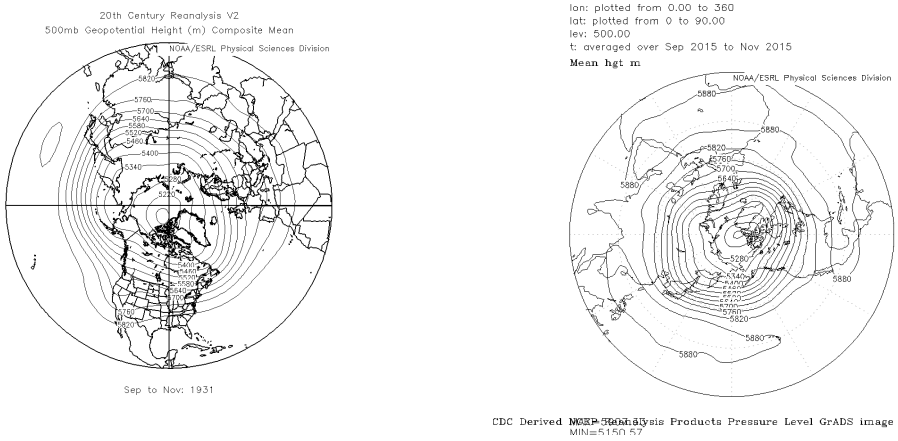

Figure 2. The mean 500 hPa height (m) for September to November (left) 1931 and (right) 2015, the contour interval is every 60 m.

Using the cumulative anomaly statistic, the winter of 1931-1932 produced a value of +26.4 F for Columbia, MO. The jet stream for December 1931 compared to December 2015 (to Dec 28th) (Figure 3) shows that similar conditions existed over the USA for both years, with a trough over the western US and ridging over the east. Normal conditions would show the opposite. Thus, it might be reasonable to expect that the winter of 2015-2016 could be one of the warmer winters on record if the pattern for winter is established. But, then again, Mother Nature may not cooperate!

Interestingly, the winter of 1931-1932 was not characterized by El Nino conditions in the Pacific Region, and conditions were what we would call ENSO neutral, neither El Nino nor La Nina. Again, the impact of sea surface temperature anomalies on the jet stream are influenced by their location and their shape.

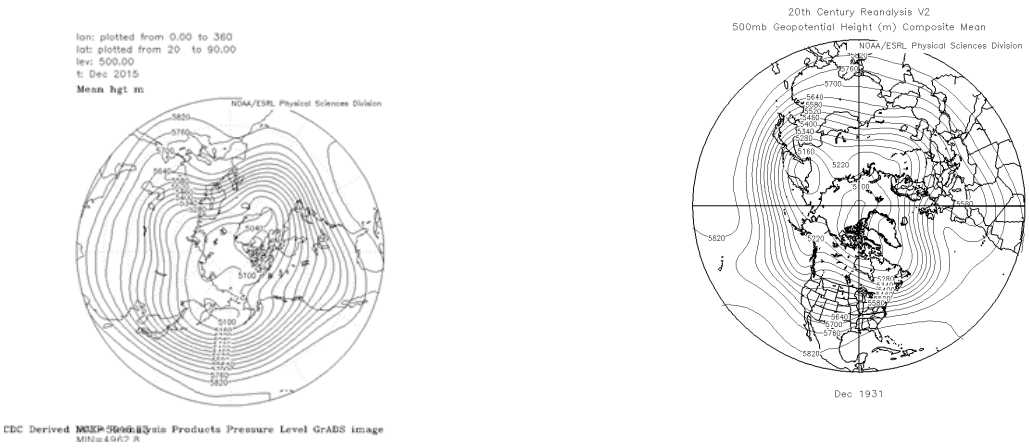

Figure 3. As in Fig. 2, except for the month of December.

But, November and December of 2015 have been quite wet as well for much of the midwest and south. Warm and wet conditions also characterized two other similar November and December periods. This was the years 1982 and 1895. The former was a strong El Nino year, while the latter was characterized by warm waters in the El Nino region (though not warm enough to be classified as El Nino). In Columbia, November – December period for 2015, 1982, and 1895 ranked as the 2nd, 6th, and 3rd wettest overall.

Is it fair to say El Nino is contributing to this unusual pattern? Yes, it is likely. Is what we are experiencing unprecedented in our short period of climate records? The answer to that is no, it's happened before. Also, since a very warm fall and winter pattern is rare, it is also fair to say that 2015 is not indicative of some "new normal". In fact, to have six or more months (two seasons) in a row average so far above or below normal (more than two standard deviations) is very rare, occurring only three times (1931, 1976, 2012) in the 126 year period. The winter of 2015-2016 has two more months to go before it can be determined to join that crowd.