The "New Normal" – or Was It?

THE SAMUEL ROBERTS NOBLE FOUNDATION

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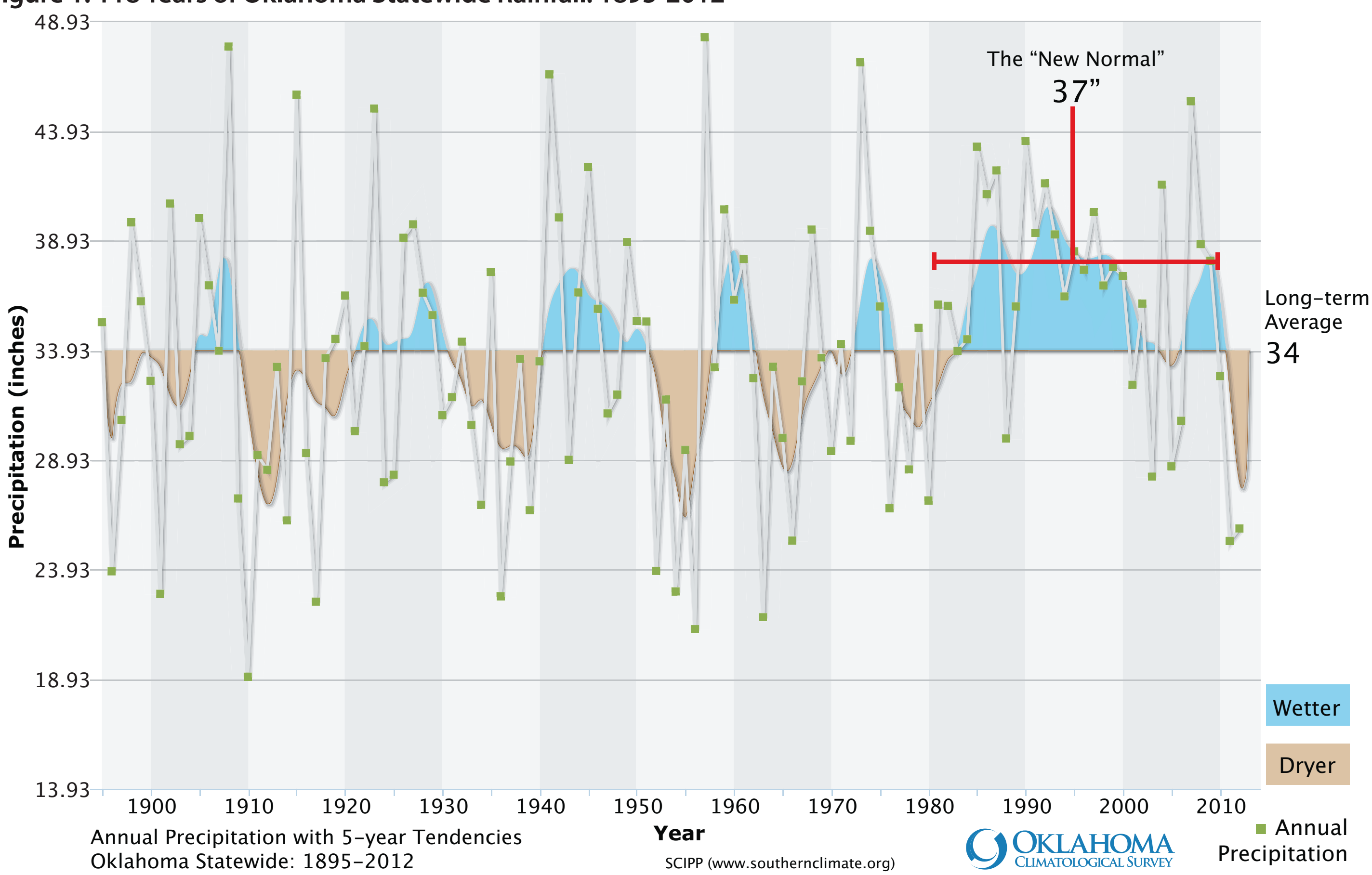
The recent drought has caused many to reflect upon the past and wonder what is in store for the future. Just a couple of years ago, few agricultural producers took the time to ponder drought, much less how devastating its effects would be. The droughts of the 1930s and 50s are history, and only a few of today's agricultural producers remember the hardships they caused. We talk about normal rainfall and expect every year to be "normal." But, all of the sudden, normal doesn't seem to exist anymore. That's because we redefined normal to mean average to above average rainfall and expect it to occur each and every year. However, this "new normal" pattern of rainfall is simply a perception of our recent past, a 30-year stretch of above average rainfall and increased productivity.

The "new normal" can be defined as the period of time from 1981 to 2010, a span of 30 years, when Oklahoma rainfall was significantly more abundant than it had been in the previous 87 years. Figure 1 depicts Oklahoma yearly rainfall from 1895 to 2012. It also reveals trends in rainfall patterns by depicting a five-year rolling average.

Until 1980, alternating wet and dry periods trended in seven- to 10-year cycles in Oklahoma with somewhat regular frequency. However, from 1981 to 2010, the trend remained wet – so much so that the average annual rainfall for this period was an impressive 3 inches above the 118-year average of 34 inches. This phenomenon became evident in the mid-1990s as consecutive years of above average rainfall were observed, causing growing concerns of drought in the future. The implication of the chart is that drought is a normal part of the weather cycle and should be expected some 25 percent of the time. What the state was experiencing during the 30-year wet period was not "normal," and the probability of drier conditions was to be expected.

Figure 1. 118 Years of Oklahoma Statewide Rainfall: 1895-2012



From a livestock grazing perspective, drought can be defined as "slow plant growth when you expect fast growth" or "no growth when you expect slow growth." Or if drought for Oklahoma can be defined as receiving less than 29 inches of rainfall (more than 5 inches below average), then drought has occurred some 20 percent of the time since 1895 (Figure 2). Using this definition, it would not be unexpected to see the frequency of drought increase over the coming 20 to 30 years. Moreover, severe drought in Oklahoma – less than 24 inches of annual rainfall or more than 10 inches below average – has occurred 7.6 percent of the time since 1895. This hasn't happened since 1963, but 2011 and 2012 came close with just over 25 inches. It is also worth noting that there were only two occurrences when we received the state's average annual rainfall of 34 inches. Therefore, "normal" is anything but average.

What made the drought so severe in 2011-2012 is that it actually began in the fall of 2010 with a dry winter, and conditions remained dry through the spring and summer. The Southern Great Plains started off on the right foot in 2012, but the rains quit when they were needed most – in May and June. Instead we experienced record high temperatures in the spring of 2012 causing a "flash" drought and conditions continued to deteriorate for the remainder of the year.

Figure 2. Probability of Oklahoma Statewide Rainfall Deviation: 1895-2012

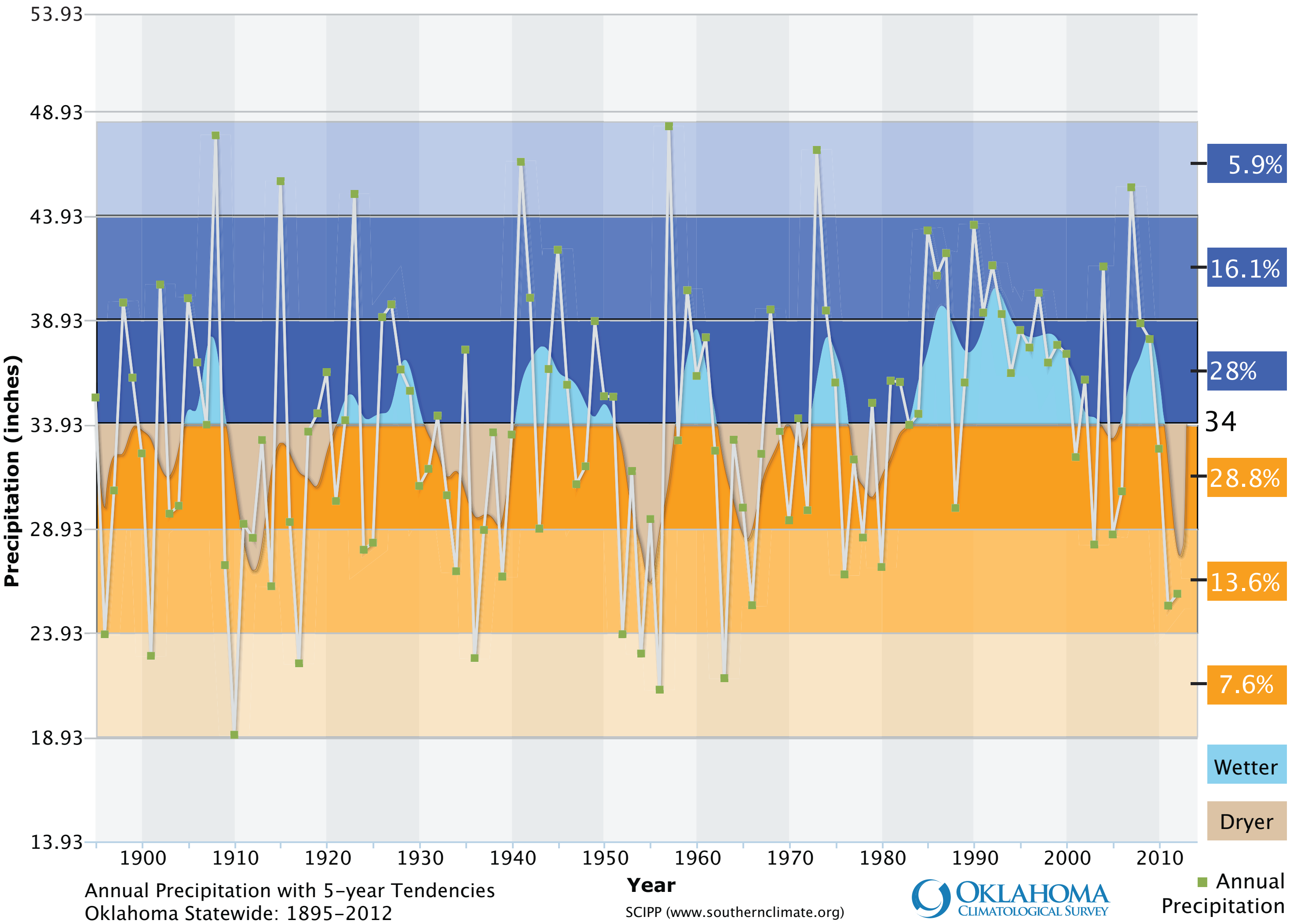
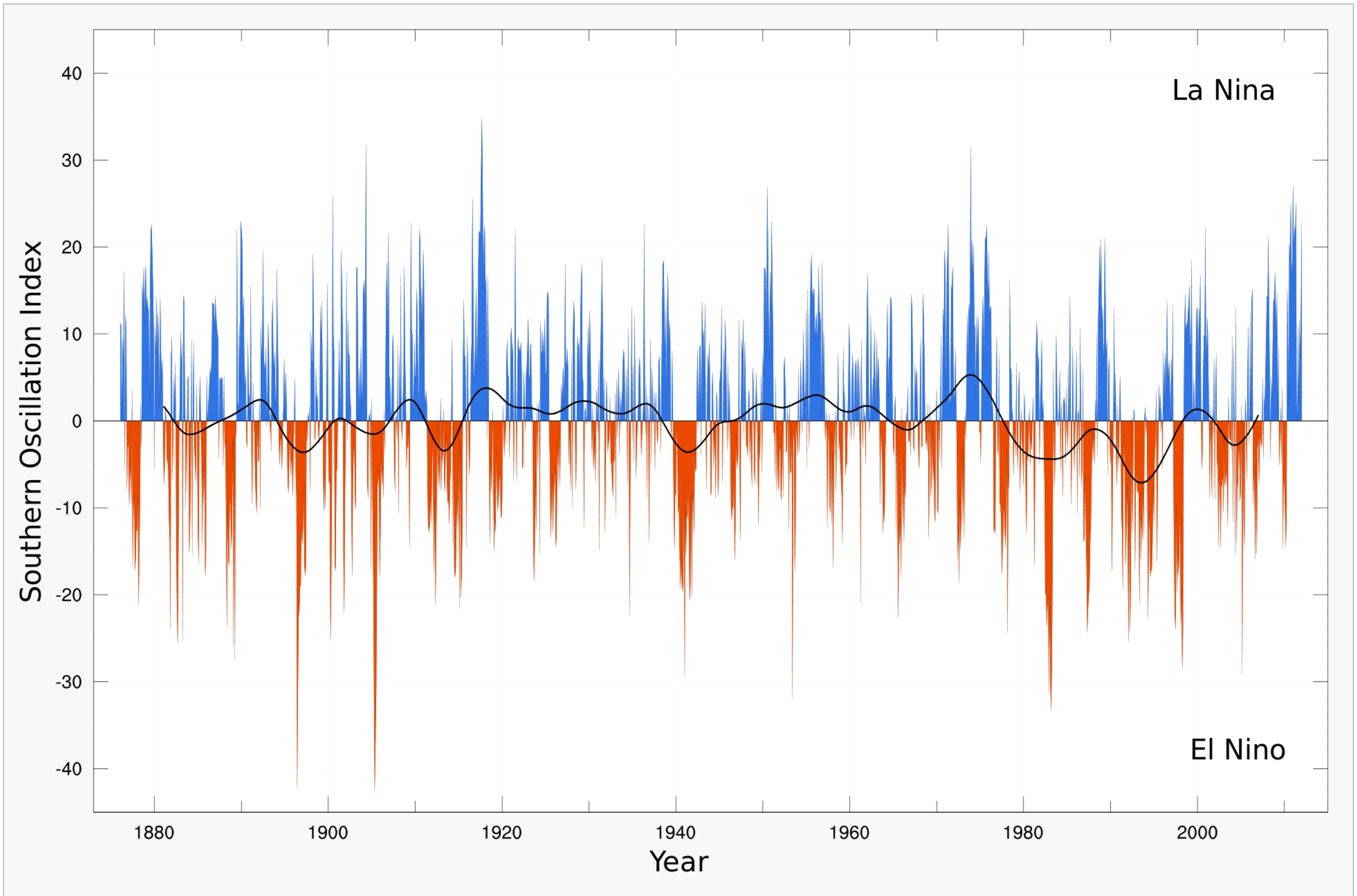


Figure 3. Southern Oscillation Index Monthly Data 1876-2011



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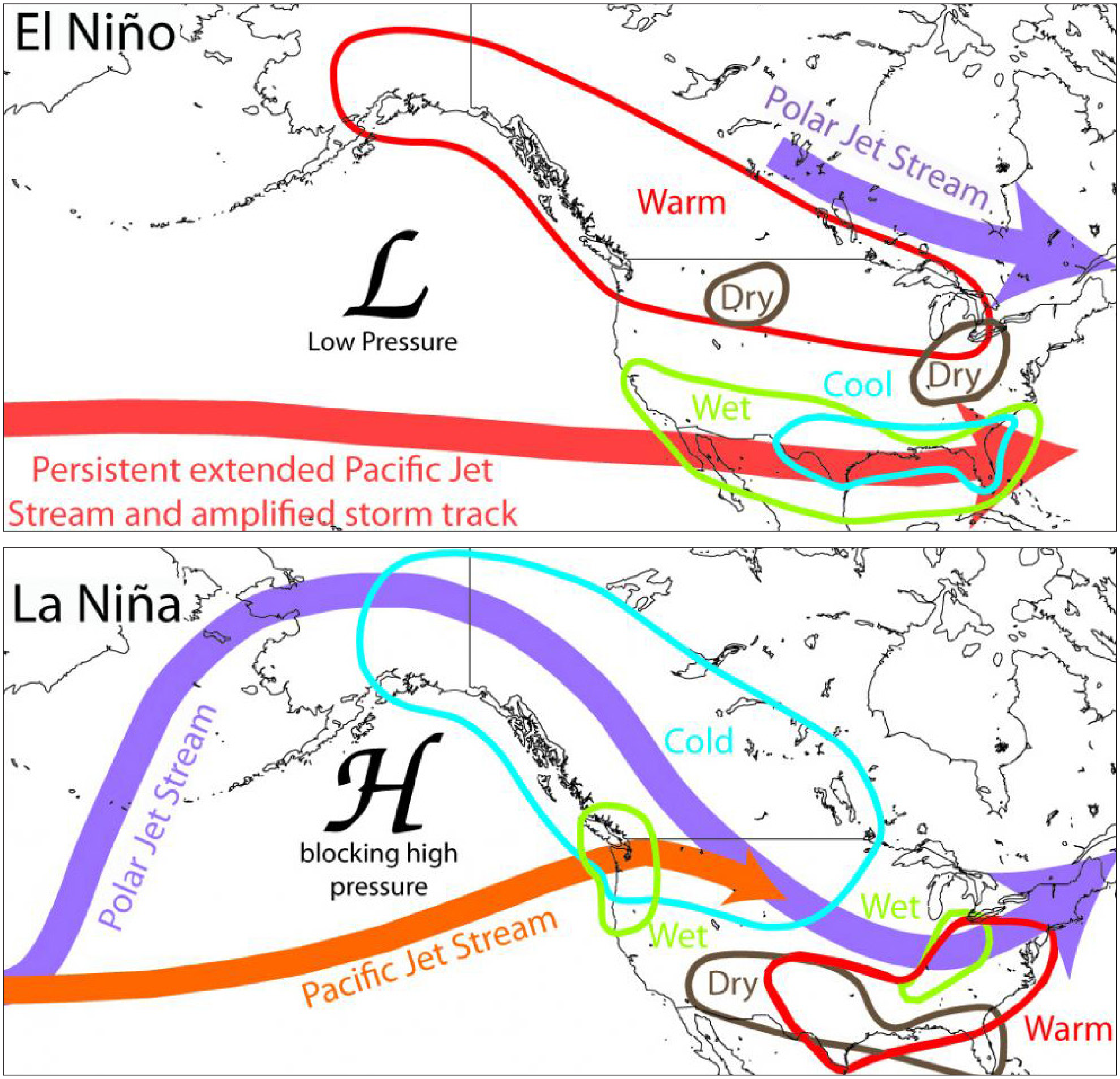
So what happened to cause the Oklahoma weather pattern to be abnormally wet for 30 years and what is in store for the state's future? Many are somewhat familiar with the El Niño Southern Oscillation (ENSO) from the news and popular press. El Niño is Spanish for "the boy," in reference to the Christ child, because periodic warming of the Pacific Ocean near South America is usually noticed around Christmas. Periodic cooling of these same waters was originally called "Anti-El-Niño" until it was realized this literally meant the "Anti-Christ" and so was renamed "La Niña" or "the girl."

ENSO events tend to cycle in duration from eight to 18 months. An El Niño event occurs when the three-month running average temperature of the tropical Pacific is at least 0.5 degrees C warmer than average for a total of five months. These events are classified as weakly (0.5 to 0.9 degrees C), moderately (1.0 to 1.5 degrees C) and strongly (>1.5 degrees C) warmer than average. The opposite is true for La Niña events. The stronger the event, the longer it tends to last and the greater its effects on global weather. El Niño and La Niña episodes typically occur every three to five years. El Niño events typically last nine to 12 months and La Niña events one to three years. The fluctuations in ocean temperatures during El Niño and La Niña are accompanied by even larger scale fluctuations in surface air pressure between the western and eastern tropical Pacific, known as the Southern Oscillation. During El Niño, higher than average air pressure covers the western tropical Pacific and below average air pressure covers the eastern tropical Pacific. These departures are reversed during La Niña. Figure 3 shows the indexed value of the change in air pressure in the Southern Oscillation dating back to the late 1800s. A negative value represents an El Niño episode while a positive value is representative of a La Niña episode.

Figure 4. Typical January-March Weather Anomalies and Atmospheric Circulation During Moderate to Strong El Niño and La Niña



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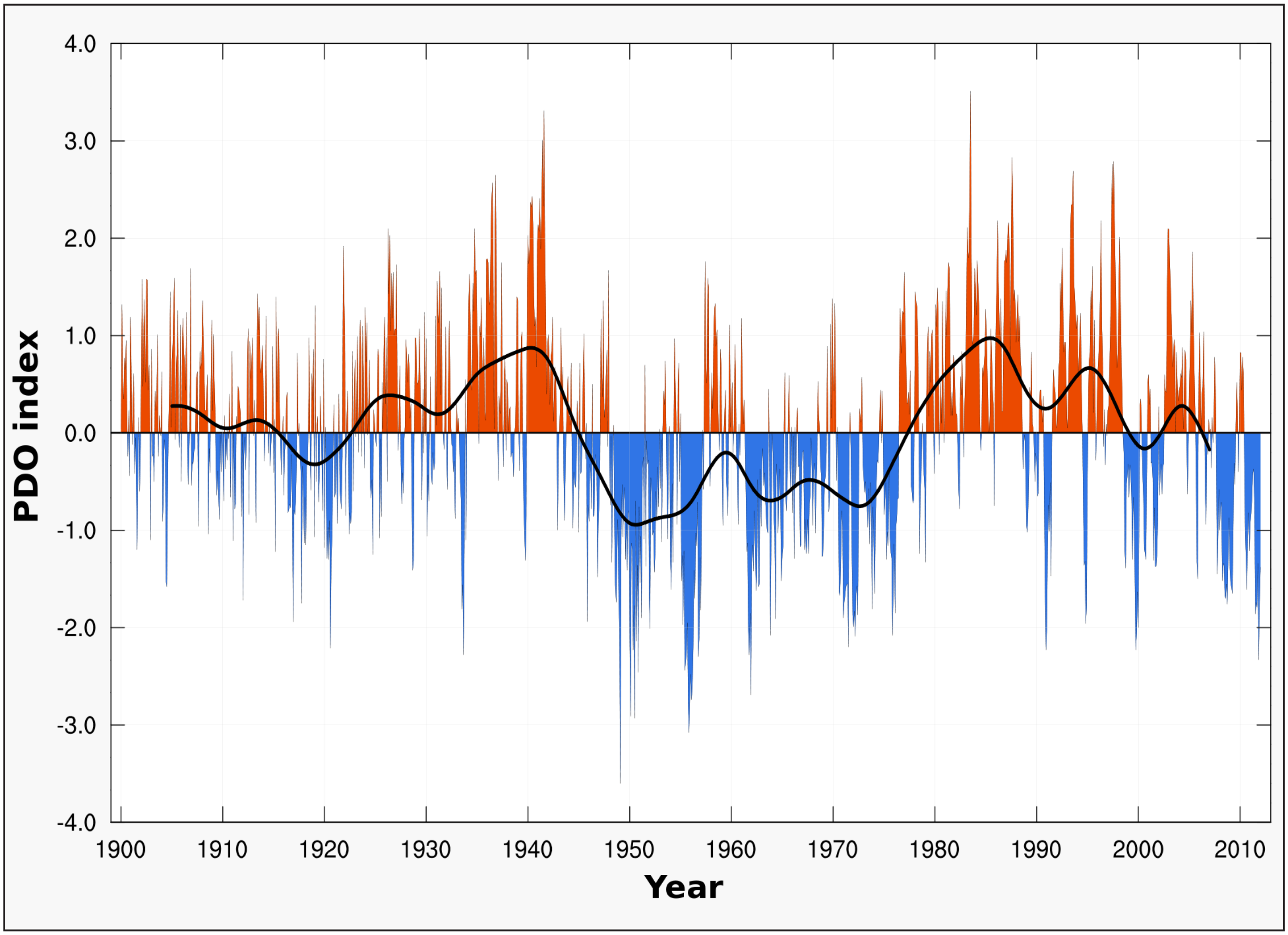
During an El Niño winter, the warmer than average sea surface temperatures (SST) combined with lower than average surface air pressure in the eastern tropical Pacific allows the moisture-filled air to be picked up in the Pacific Jet Stream and carried across the southern U.S. and northern Mexico. This creates conditions that are supportive of cool, wet winters (Figure 4). However, under these same conditions, winters are warmer and drier than average in the Pacific Northwest, the northern Midwest and the northern Mideast United States. During a La Niña winter event, snowfall is typically above normal across the Pacific Northwest to the Great Lakes while the south-western U.S. is dry.

Figure 5. Pacific Decadal Oscillation (PDO): 1900-2011



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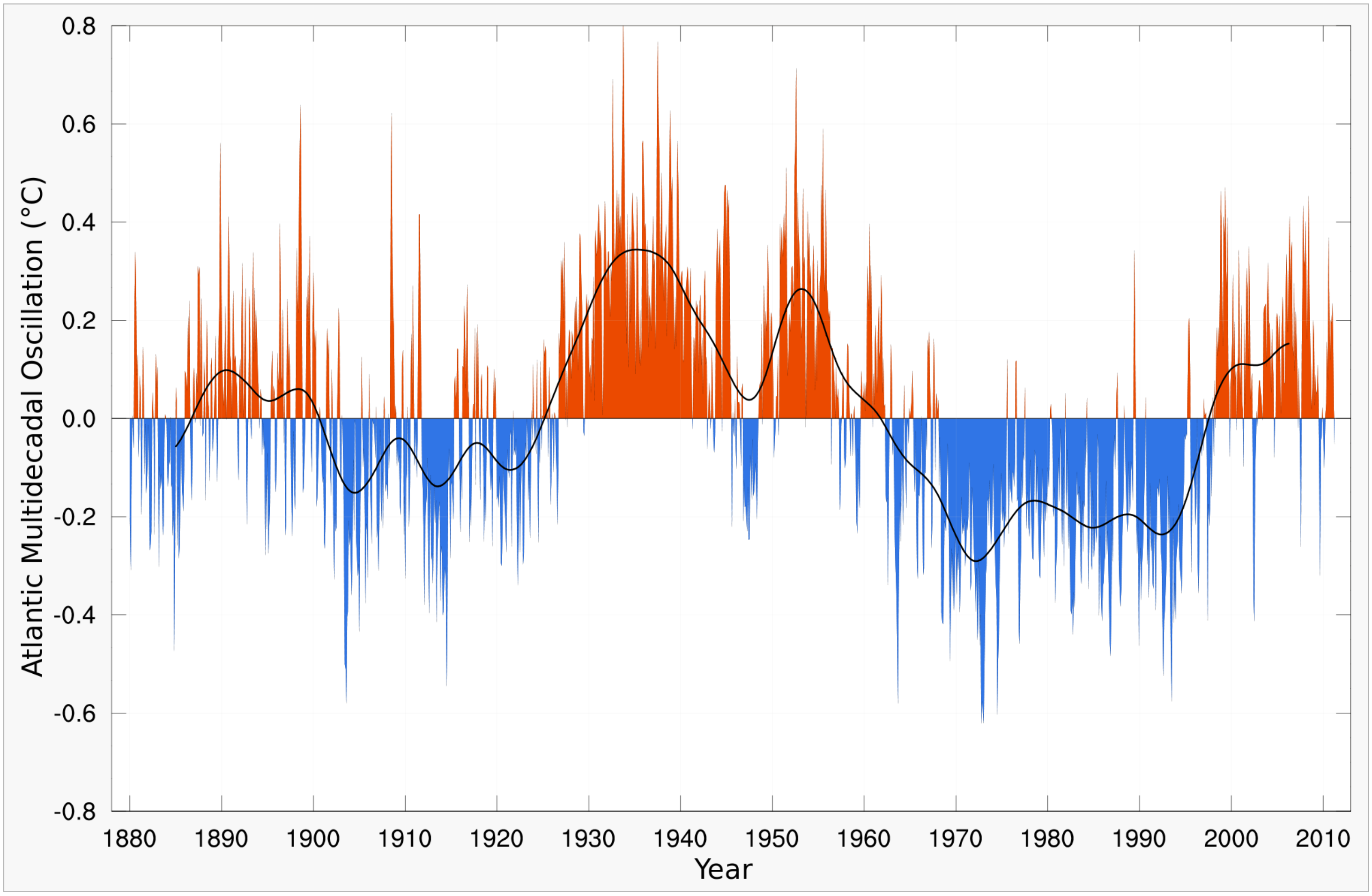
But this is just a piece of the puzzle and only provides insight and guidance into the coming months. What about the coming years? Other significant oceanic oscillations need to be taken into account. These additional conditions are the Pacific Decadal Oscillation and the Atlantic Multidecadal Oscillation.

The Pacific Decadal Oscillation (PDO) is a pattern of Pacific climate variability that shifts phases on at least an inter-decadal time scale – usually about 20 to 30 years (Figure 5). When the PDO is negative, the southwestern U.S. has a higher probability of drought. Such was the case in the 1950s. When the PDO is positive, conditions are favorable for wet periods, as was the case during the "new normal" time frame. However, a shift to negative is believed to have occurred in 2007, so it is likely that a higher probability for drought in the southwestern U.S. will persist through at least 2027. The PDO appears to have greater impact across the southwestern U.S. than the High Plains. A case in point was during the Dust Bowl of the 1930s when the PDO was positive, but the High Plains experienced devastating drought while the far southwestern U.S. was not affected as severely.

Figure 6. Atlantic Multidecadal Oscillation (AMO): 1880-2011



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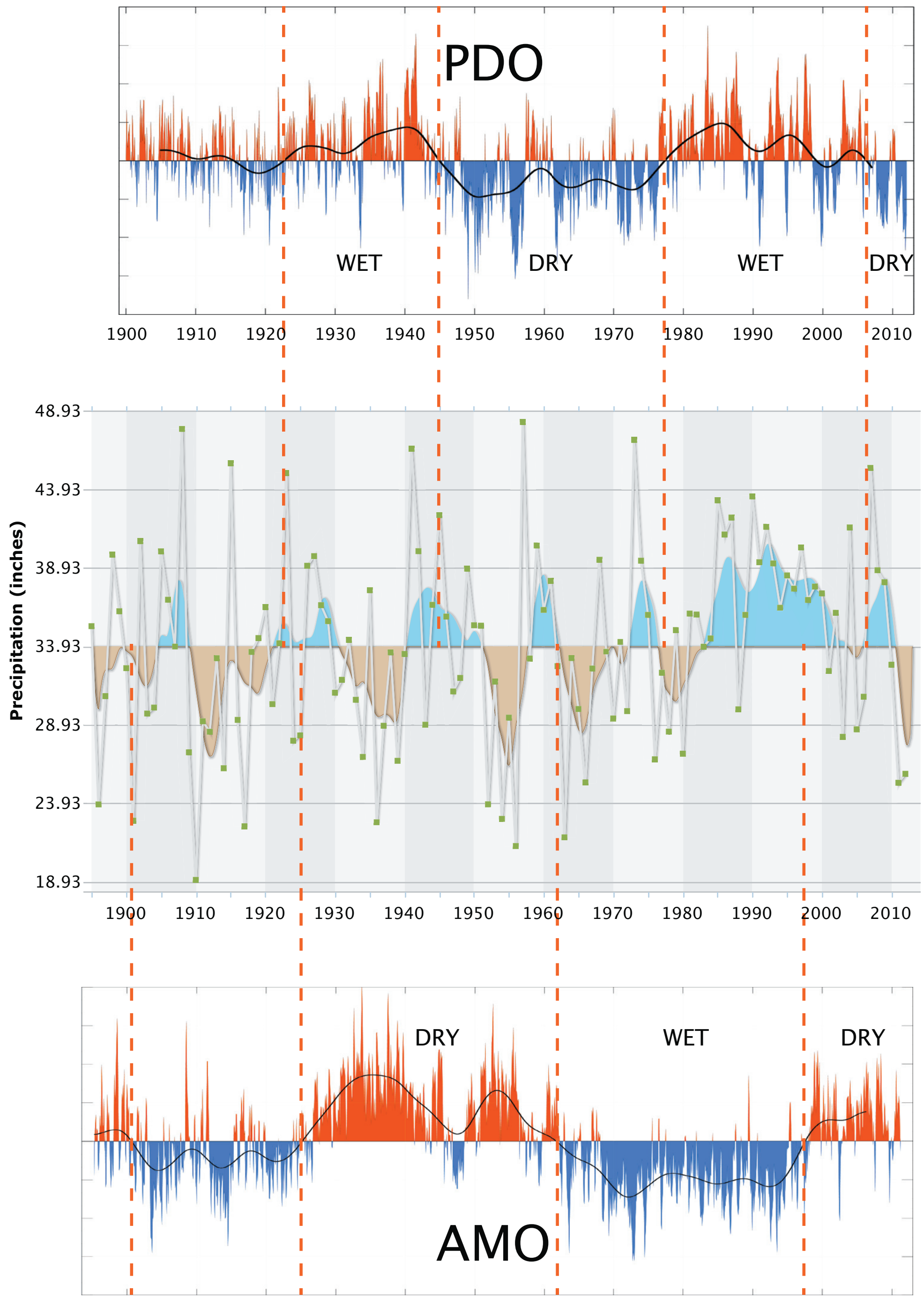
The Atlantic Multidecadal Oscillation (AMO) is a pattern of Atlantic climate variability that also shifts phases on at least an inter-decadal time scale – usually about 20 to 40 years (Figure 6). Recent research suggests the AMO is related to the past occurrence of major droughts in the United States' Midwest and Southwest. When the AMO is in its warm phase, these droughts tend to be more frequent or prolonged. Two of the most severe droughts of the 20th century, the Dust Bowl of the 1930s and the 1950s drought, occurred during the positive phase of the AMO between 1925 and 1965. However, the extreme southeastern U.S. and the Pacific Northwest tend to experience the opposite conditions and receive more rain during the positive phase of the AMO. During the "new normal" period (1981 to 2010), the AMO was in the negative (wet) phase until 1997, when it shifted to positive (dry). Looking at the past, the AMO will likely not shift in our favor until sometime between 2017 and 2037.

Figure 7 depicts the Pacific Decadal Oscillation and the Atlantic Multidecadal Oscillation compared to Oklahoma weather from 1895 to 2012. Any correlation is obviously open to interpretation. It may be assumed that drought is a normal event since it occurs about 25 percent of the time. However, with both these oscillations working against the Southern Great Plains, the probability of drought could increase to 30 to 40 percent of the time until one or both of these oscillations shift to the region's favor.

In short, at least two major multidecadal oscillations affect weather in the United States, and both are indicating an increased probability of drought for years to come. It will be especially important to monitor La Niña events, since a strong La Niña combined with a negative PDO and a positive AMO could cause the perfect storm. The next 10 to 20 years will confirm or disprove these prognostications, but agricultural producers are encouraged to prepare for the worst and manage accordingly. The "new normal" was *not* normal – it was a welcomed anomaly and may not occur again for decades.

Dr. E.J. Dyksterhuis, a professor of range management who lived through the drought of the 1930s and the 1950s has been quoted as saying, "A man whose pastures are short needs rain the most, but a man whose pastures are in good condition makes the most of the rain he gets." Ranchers should stop thinking animal numbers can rival the capacity of the "new normal" time frame and, therefore, adjust stocking rates to match the long-term average of the last 118 years. In the near term, most producers should consider reducing stocking rates even further due to the severity of pasture stress caused by the drought of 2011-2012. In the future, it will be even more important for producers to closely monitor forage resources and adjust stocking rates accordingly, develop reliable sources of water, and use risk management tools like drought insurance to offset any future loss of forage production. Agricultural producers should always have a plan and be prepared to adjust their plans during good times and bad. And remember, a wrong decision is usually better than no decision at all! ■

Figure 7. Pacific Decadal Oscillation and Atlantic Multidecadal Oscillation Compared to Oklahoma Rainfall: 1895-2012



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