The Dryline

Spring 2012

Such a Nice La Niña

By: John Nielsen-Gammon
Texas State Climatologist/Professor of Atmospheric Sciences at Texas A&M University

After the most severe one-year drought on record for Texas, there wasn't much to look forward to. A weak to moderate La Niña had re-formed in the tropical Pacific, and that meant another dry winter. Perhaps not as dry as the winter of 2010-2011, when Texas had its fourth-driest October through March, but at least drier than normal, as has happened historically with four of every five past La Niñas. My standard line last fall was that some places would get lucky, but that parts of the state would still be dealing with extreme drought in summer 2012.

Well, the past four or five months were about as good as Texas could hope for. Precipitation has been above normal rather than below normal. The past three months (December-February) statewide ranked 11th wettest out of 117. Two-thirds of the state is still in drought ranked as severe or worse, but it could have been much worse even than that. Such a nice La Niña!

What happened? How could one La Niña produce one of the driest winters on record and another La Niña produce one of the wettest?

The short answer is that there's a lot more than La Niña affecting our weather. The details of the sea surface temperature patterns matter, as do the patterns of early season snowfall and the distribution of early season sea ice.

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Severe Weather Safety

By: Christine Krause, Forecaster

Spring is a season characterized by warmer temperatures. In turn, people get rejuvenated and ready for all the delights that warm weather affords us, especially after a long and cold winter. Springtime is also earmarked by wild swings in weather from warm and windy days, to cool evenings, to several rounds of thunderstorms. Thunderstorms are part of life in the Texas and Oklahoma Panhandles. In Amarillo, 87% of the annual rainfall is received from March through October, and almost all of this can be attributed to thunderstorms. Without this beneficial rain, the Panhandles would be a virtual desert.

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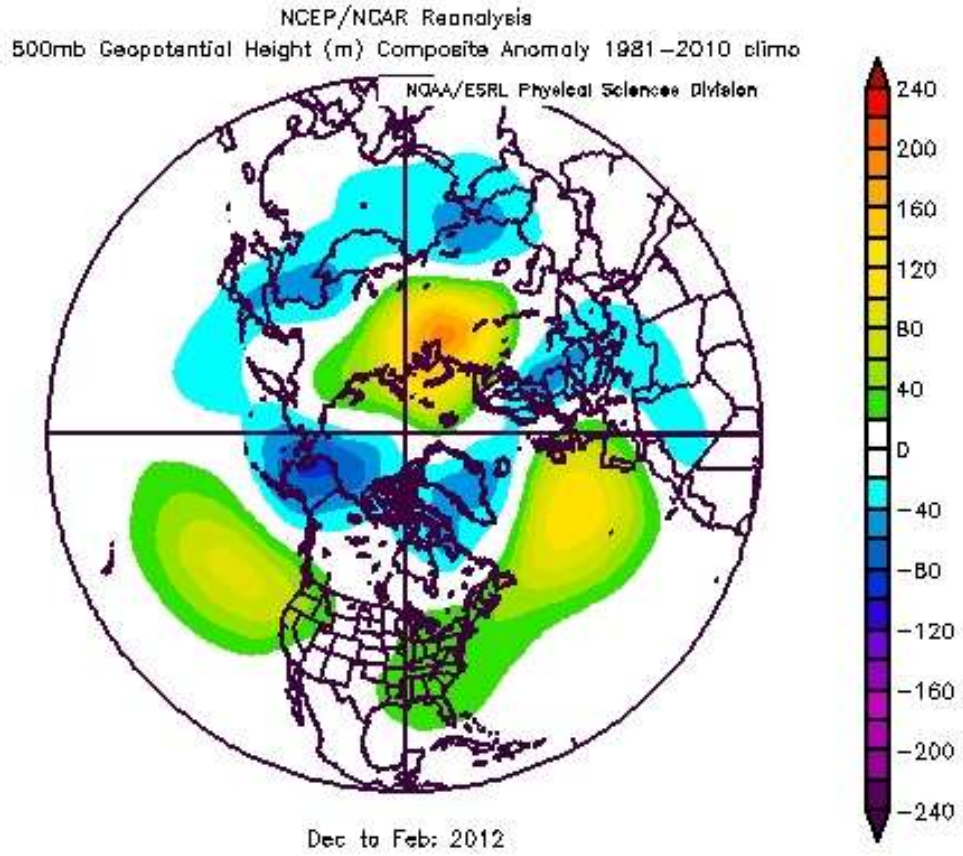
Most of these are subjects of active research, and not very many of them can be predicted more than a few weeks in advance. Besides all that, there's the inherent randomness of the weather. Sometimes things just come together right.

To diagnose season weather patterns, meteorologists rely heavily on what are quaintly called "500 mb anomaly maps". These maps show jet stream patterns, wave energy propagating from the tropics to higher latitudes and back again, and at the same time provide a good indication of where temperatures have been warmer or colder than normal.

Here's the 500 mb anomaly map for this past December through February:



500 mb height anomalies (departures from normal), December 2011 through February 2012. From NOAA's Earth System Research Laboratory

The greens, yellows, and reds are positive anomalies, the blues and purples are negative anomalies. So, for example, a large positive anomaly is located off the west coast of the United States. As for winds, you can read these things much as you would a surface pressure map, with winds rotating clockwise around the positive centers and counterclockwise around the negative centers.

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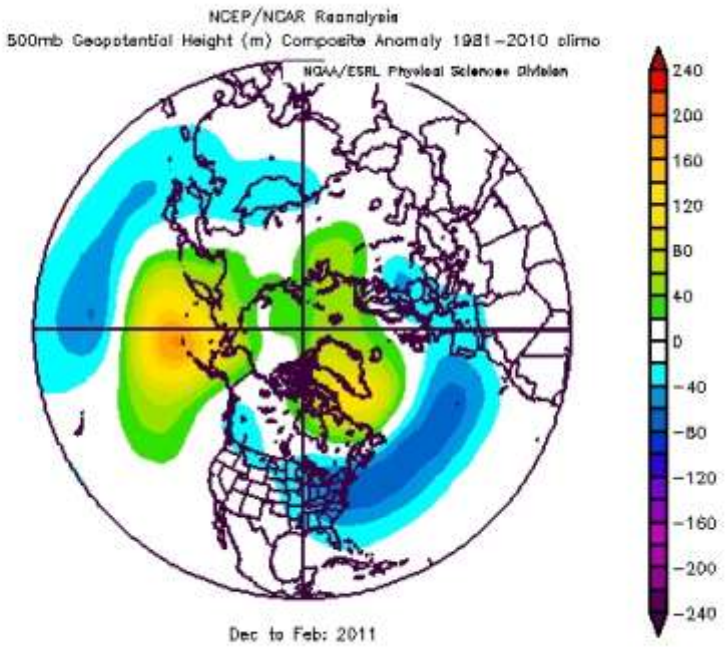
In midlatitudes, the jet stream generally blows from west to east. You can think of the winds associated with the anomalies on the map as something to be added to the normal jet stream winds to get the actual winds for that season. So, north of the positive anomaly off the West Coast, the clockwise winds reinforce the jet stream, meaning it was stronger than normal. South of the anomaly, the clockwise winds blow from east to west, cancelling out part of the jet stream and making it weaker than normal.

The jet stream pattern is intimately related to the storm tracks and rainfall. To get extra rain on the West Coast, you'd want the jet stream to be stronger than normal and preferably to be blowing partly from south to north, to tap into some of the tropical moisture. This year, the anomaly map shows that at the latitude of California, the jet stream was much weaker than normal and (since the clockwise anomalous winds are blowing from north to south across California) it tended to be blowing from northwest to southeast rather than from southwest to northeast. [Did you get to vector addition in high school? When you add a vector pointing to the south (the anomalous wind) to a vector pointing toward the east (the normal wind), you get a vector pointing toward the southeast (the full wind). C'mon, pay more attention next time you're in high school.]

Whether or not you can do the vector math, this map plainly illustrates to a meteorologist why California has been ridiculously dry this year.

Such a positive anomaly is normally caused by La Niña. The change in the pattern of tropical convection leads to unusually low 500 mb heights over the equator near the dateline, and this triggers a compensating wave response (trust me on this) that produces a positive anomaly over the subtropical or midlatitude North Pacific.

In the winter of 2010-2011, this positive anomaly was a bit farther to the northwest, centered near the dateline southeast of Alaska. The anomalous northerly jet level winds that we found along the West Coast this winter were farther offshore last winter. Indeed, along the West Coast, there are few height anomalies to be found, indicating that the jet stream was similar to normal, as indeed was the West Coast precipitation.



500 mb height anomalies, December 2010 through February 2011. From NOAA's Earth System Research Laboratory

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What of Texas? Our 500 mb anomalies appear to be connected to something happening over the Atlantic Ocean rather than the Pacific Ocean.

Over the Atlantic, this winter and last winter seem to be exact opposites. This winter, there was a massive positive height anomaly sitting over the central Atlantic. This means that the jet stream was farther north than normal. Last winter, there was a massive negative height anomaly in roughly the same place. This means that last year the jet stream was farther south than normal.

This change in pattern over the Atlantic is called (not unreasonably) the North Atlantic Oscillation (NAO). It has a major influence on weather over Europe, and it's been studied for decades or even centuries, but it's still not possible to predict whether a particular phase will last for two weeks or three months. For the last three winters, the NAO has been strong and persistent, leaving its mark not just on European weather but also North American weather.

There was some speculation after two years of negative NAO winters in 2010 and 2011 that the recent Arctic sea ice loss was causing negative NAOs to become the new normal. This winter's positive NAO illustrates that it's not so simple.

This winter, Texas was near the upstream end of the positive anomalies. Thus, the jet stream was blowing more from south to north than normal. This is the opposite of California, and it had the opposite effect. Disturbances along the jet stream would often move south along the West Coast, intensify, and move northeast across Texas, picking up extra Gulf moisture along the way. This upstream influence of the NAO is one reason we managed to be wet this winter despite the influence of La Niña.

Last winter, we had the opposite situation. The upstream end of the NAO put Texas in a region of anomalously northerly flow, like California this year. With the jet stream blowing more from north to south, any disturbances that came along were dry and had not yet had an opportunity to intensify. So last year the NAO compounded the local effects of La Niña, while this year it more than cancelled them out.

Picture of a thunderstorm outside the NWS Amarillo office, a rare site in 2011 and one that many in the Panhandles have seen plenty of already in 2012.

Severe Weather Safety continued…

By: Christine Krause, Forecaster

However, when thunderstorms do occur there are many hazards that can damage property or threaten lives. It is important that everyone be aware of these hazards and know how to protect themselves and their property.

Lightning is a part of EVERY thunderstorm and often strikes without warning. Lightning kills dozens of people and injures hundreds more each year in the United States. Most deaths occur when people are caught outside with no shelter. It is important to remember that lightning can strike several miles away from the thunderstorm, so the best place to be is indoors. If you hear thunder, you are close enough to be struck by lightning and should seek shelter immediately!

Flooding causes more than 100 deaths each year in the United States and can occur almost anywhere. Most flood related deaths occur in automobiles. Even if you don't live near a river or stream, you can still be affected by flood waters. Flash flooding is an increased concern in the Texas and Oklahoma Panhandles during the summer months when thunderstorms produce very heavy rainfall in a short amount of time. Drainage systems may not be able to handle all the water at once and roads and underpasses can quickly flood. If you run across water covering the road, you should turn around and find an alternate route. It only takes a foot or two of water to cause your vehicle to stall or float.

Severe Thunderstorms can produce large hail and damaging straight line winds. A severe thunderstorm is defined as having hail one inch in diameter (the size of a quarter) or larger. (The straight line wind criterion of 58 mph or higher also defines a severe thunderstorm.) When severe thunderstorms approach, seek shelter in a sturdy building to avoid injury. Large hail can damage property and can cause injury to those caught outside. Strong straight line winds can occasionally exceed 100 mph and cause widespread damage equivalent to that of a tornado. These winds can destroy mobile homes and damage sturdy buildings.

Tornadoes are a very rare natural phenomenon associated with thunderstorms but occur in the Great Plains region of the United States more than anywhere else in the world. In the Texas and Oklahoma Panhandles, tornadoes are most common in late spring and early summer. The strongest tornadoes can produce some of the strongest winds ever recorded at the Earth's surface and completely destroy well-built structures. The best place to be during a tornado is in a basement or inside a small room inside a sturdy building and away from outside walls and windows. If caught outside with no shelter available, lie face down in a ditch or other low spot and cover your head.

The first step in protecting yourself and your property is to know when a severe thunderstorm or tornado is approaching. Understand the statements and warnings issued by the National Weather Service and have a reliable means of being alerted when these statements are issued. One of the best ways to make sure you know when a warning is issued is to have a NOAA All Hazards Weather Radio. These devices are inexpensive, are available at local electronic stores, and can be specially programmed to alert you when threatening weather is approaching.

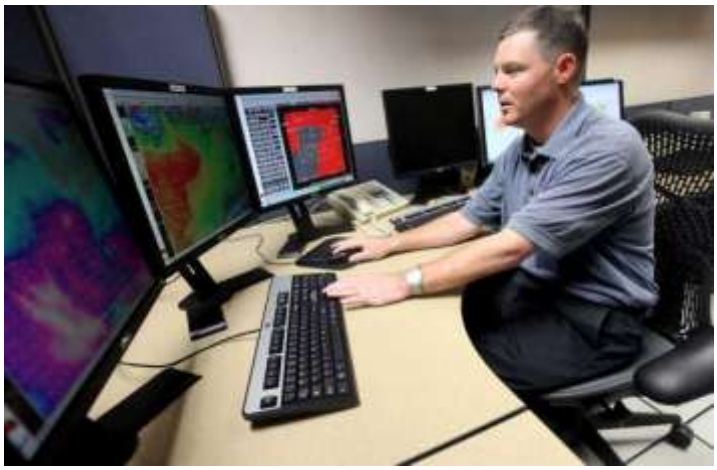
WEATHER HAZARD	WATCH	WARNING
SEVERE THUNDERSTORM	Conditions are favorable for the development of severe thunderstorms in and close to the watch area.	Quarter size hail or winds greater than 58 mph is imminent or has been indicated by Doppler Radar or reported by storm spotters.
TORNADO	Conditions are favorable for the development of tornadoes in and close to the watch area.	A tornado is imminent or has been indicated by Doppler Radar or reported by storm spotters.
FLASH FLOOD or FLOOD	Conditions are favorable for flash flooding or flooding in and close to the watch area.	Flash flooding or flooding is imminent or has been reported by storm spotters.

Once again, we have had to say goodbye to a couple of excellent forecasters in our office. We wish the best for Michael Scotten and Todd Beal. Michael has transferred into a Senior Forecaster position at our neighboring office in Norman, Oklahoma to pursue his love of severe weather while Todd has been promoted to a Senior Forecaster position in Corpus Christi, Texas. Both forecasters will be sorely missed as they both added significant knowledge and experience to our staff. Michael did excellent work in our scientific research program and Todd oversaw our Decision Support Services program.

Micheal Scotten

Todd Beal

It is a pleasure to announce the selection of Todd Lindley as the new Science and Operations Officer for the National Weather Service office in Amarillo. Todd hails from Clarendon, Texas and actually began his NWS career as a student employee in our office. He went on to complete his degree in Meteorology at the University of Oklahoma as a SCEP (Student Career Experience Program). He interned at the National Weather Service office in Tulsa, OK and was a Journeyman forecaster in Midland, TX. His latest assignment was as Senior Forecaster at our sister office in Lubbock, TX. Todd has a wealth of experience. He has completed 16 scientific publications, papers and conference proceedings and has nearly 60 technical and instructional presentations under his belt. Todd is also one of the recent recipients of a National Cline Award in Hydro-meteorology for research, accurate forecasting, outreach and relationship building in mitigating impacts from the historical 2011 west Texas drought and wildfires. Todd was also recently awarded a Department of Commerce Bronze Award for his work in researching weather patterns conducive to wildfire outbreaks in west Texas and applying conclusions that mitigated losses to life and property. We very much look forward to working with Todd in his new position!



Todd Lindley

The Dryline.....

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weather.gov/ama

Picture of a firefighter in northern Potter county on April 11, 2012 standing by accumulations of hail that measured over 4 feet deep! This picture led to quite a bit of buzz including skeptics questioning the authenticity of the photo-graph. To find out what led to hail drifts this high and to see more pictures from this storm see our storm survey at:

http://www.srh.noaa.gov/ama/?n=apr11survey