OKLAHOMA CLIMATE

Spring 2007

Historical Perspective

Flowers · Freezes · Fire · Fury

Oklahoma's First Century of Springs Delivered on Multiple F-Scales

Feature Stories

Spring Tornadoes & ENSO

Oklahoma Mesonet Sites in OKC

The Enhanced Fujita Scale

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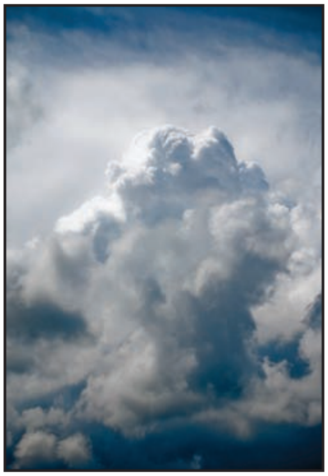


Oklahoma Climate Spring 2007

Cover Photo: by Ryan Davis. If you have a photo that you would like to be considered for the cover of Oklahoma Climate, please contact Gary McManus at gmcmanus@ou.edu.

MESSAGE FROM THE EDITOR

Gary McManus

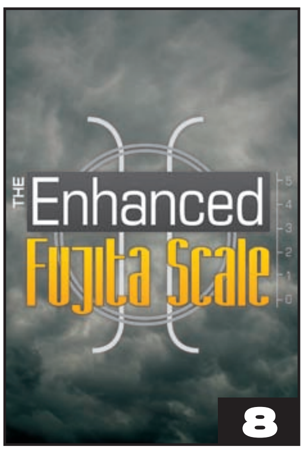
As we detail in our continuing Oklahoma centennial weather series, spring means much more than just tornadoes and severe storms. Now that's what we're world famous for, of course, and rightfully so. But thrown in amongst the tornadoes and hail storms is a good batch of snow, fire and dust. Some of the most famous weather calamities in the world have occurred in our state during spring, from the first F5 tornado to hit a major metropolitan area on May 3, 1999, to the Black Sunday dust storm which helped coin the phrase "The Dust Bowl" on April 15, 1935. Despite our notorious reputation, however, most Oklahoma springs are chock full of days with glorious weather, perfectly suited for spending a few hours along a creek with a fishing pole or sitting under a tree and reading a book. Of course, if a storm should happen along, being under that tree is probably a bad idea.

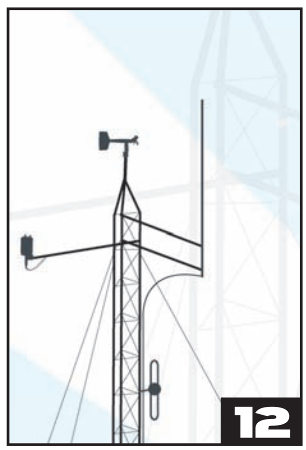
Since spring is our prime tornado season, we solicited the help of National Weather Service tornado expert Doug Speheger to explain the new Fujita Scale to us. The "Enhanced Fujita Scale" is an attempt by meteorologists, along with other disciplines, to measure a tornado's intensity with more accuracy. The scale will now give a better representation of a tornado's actual wind speeds. Keeping with the tornado theme, another of our feature articles details the effects of El Nino and La Nina on our severe weather season. Oklahoma's weather has been influenced in the past couple of years by both El Nino and La Nina, so has that had an effect on the number of tornadoes we've seen lately? This article gives us the answer. In our final feature article, we explore the latest expansion of the Oklahoma Mesonet into the Oklahoma City metropolitan area. Our capitol city will now be covered by three Mesonet sites, along with the existing site at Spencer. This expanded coverage will be a tremendous help in making critical weather-related decisions, such as flood or travel alerts. Our classroom exercise allows students track a major Oklahoma severe wind event, a greatly underestimated severe weather hazard that affects our state.

This edition's agricultural summary provides an excellent recap of the damage that occurred during April's cold snap, whose effects were exacerbated by the 2nd warmest March on record. Plant growth exploded during the warm and wet March, only to be blasted by frigid weather in mid-April.

In addition, be sure to read our regular features dealing with agricultural weather, weather safety, and a weather summary of the previous three months.

I sincerely hope you enjoy this issue of "Oklahoma Climate." If you have any questions or comments, please feel free to contact me at gmcmanus@ou.edu.





Flowers · Freezes · Fire · Fury

Oklahoma's First Century of Springs Delivered on Multiple F-Scales

Derek Arndt Assistant State Climatologist

Spring has sprung in Oklahoma. That short sentence offers so many images to so many people. Optimists see the promise of youth in spring's new calves and the promise of maturity in its soon-to-be-golden wheat. Birds, bugs, and boys leap into a frenzied outdoor symphony. Dreary winter spirits rebound in the robin's proud orange breast and the exploding pink blossoms of the state tree. Creeks and streams percolate with a vigor only dreamed of by the most active of Januaries. One word can sew a common thread among the season's myriad images: active.

And, of course, there's the weather.

It's not that winter isn't active, but winter's activity comes in brute-force pummelings that leave entire patches of Oklahoma snowy, frozen or broken. Where winter's ways are widespread and wicked, spring's are sporadic and spectacular. More focused, yet more elusive, more electric (literally), and a lot less predictable. Spring's systems mix a stew of ingredients that are unique in their near-constant readiness. In any other season, the confluence of an unstable warm sector, a tightening dryline and a menacing upper-air system might be possible, but Oklahoma's weather watchers would call it uncommon. In spring, those same watchers would call it, oh, a Tuesday afternoon.

It's a fact: most of Oklahoma's springtime events spin around a wheel of fortunes represented by a Big Red L on the weather map. That surface low arranges rich and energetic humidity to its southeast, a dry blast to its southwest, a cool punch to the north and a Pandora's Box of possibilities at the boundaries therein. Those possibilities have launched an unparalleled weather industry in the state, from crack forecasters to brilliant scientists to overly-wordy climatologists. And before we take a peek at the contents of the box, let's step back and take a look at spring's general picture, and how spring has evolved over Oklahoma's first century.

The Big Picture

Climatologists classify spring as the months of March through May on the calendar. May is the wettest month on the calendar for all but a very few of Oklahoma's 77 counties, and much agricultural production is geared around the late spring's usually-reliable heavy rains. In the typical rhythm of the typical year in Oklahoma, the most prominent severe weather period wakes up midway through March and rises to a violent peak in early-to-mid May, before falling back to a baseline threat in late June. Freezes are possible, but statistically rare, as late as mid-May for most of Oklahoma, and late May for the far northwest.

Trends in spring precipitation show a slightly irregular wave pattern over the state's first century (Fig. 1). The wet-and-dry eras during spring closely match the 8-12-year cycles shown in Oklahoma's annual precipitation (not shown). This shouldn't be too surprising, considering that nearly a third of the state's annual rainfall falls during the spring months. However, it is interesting to note that the state's severe rainfall deficits of the mid-1950s are nearly non-existent in the spring record, demonstrating that the droughts of this era were largely dominated by summer and autumn episodes. Also notable, the recent dryness since the turn of the 21st Century is much more pronounced in the spring months. Indeed, the recent dry era has been dominated by dry springs.

Temperature patterns demonstrate gradual warming since statehood, with embedded warm and cool periods (Fig. 2). The trend peaked with 2006's average spring temperature of 62.8, the warmest of the statehood (and territorial) years. The main symptom of the recent upward trend hasn't been excessive warmth (2006 notwithstanding), but rather the lack of any pronounced cold springs. In fact, of the twenty coolest springs of statehood, only one has occurred during the last 20 years. The recent spring warmth has been more dramatic in western Oklahoma, particularly the panhandle.

The Events

Climate statistics, like any statistics, hide the individual events that make history. And weather history is made quite often during Oklahoma springs. The season is obviously dominated by severe weather: tornadoes, hail and winds. However, spring paints with several colors on its palette.

The Violent

Severe weather is the spectacle of spring on the plains. And, if severe weather is the main show during Oklahoma's spring, then the tornado is undoubtedly the prima donna. At no other place on earth do tornadoes happen more often than in early May in central and western Oklahoma. Combined with April and March, the three spring months account for nearly two-thirds of Oklahoma's annual tornado total (Fig. 3).

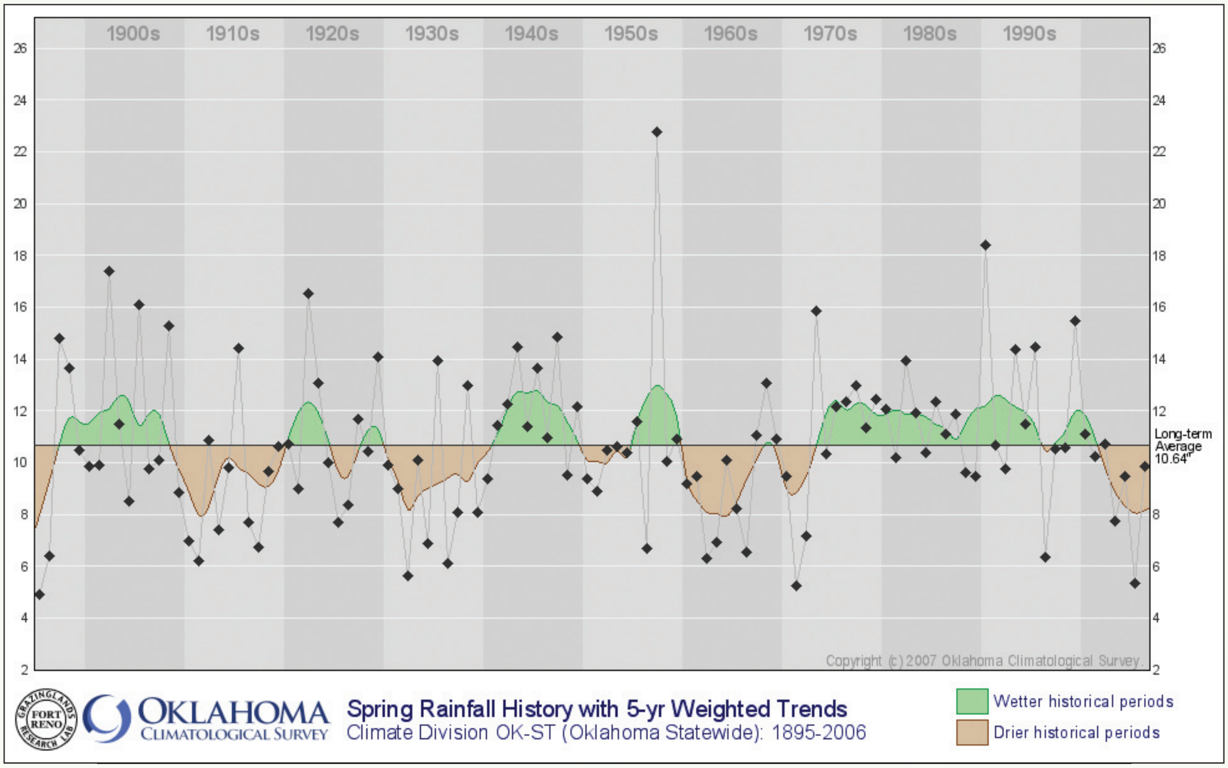
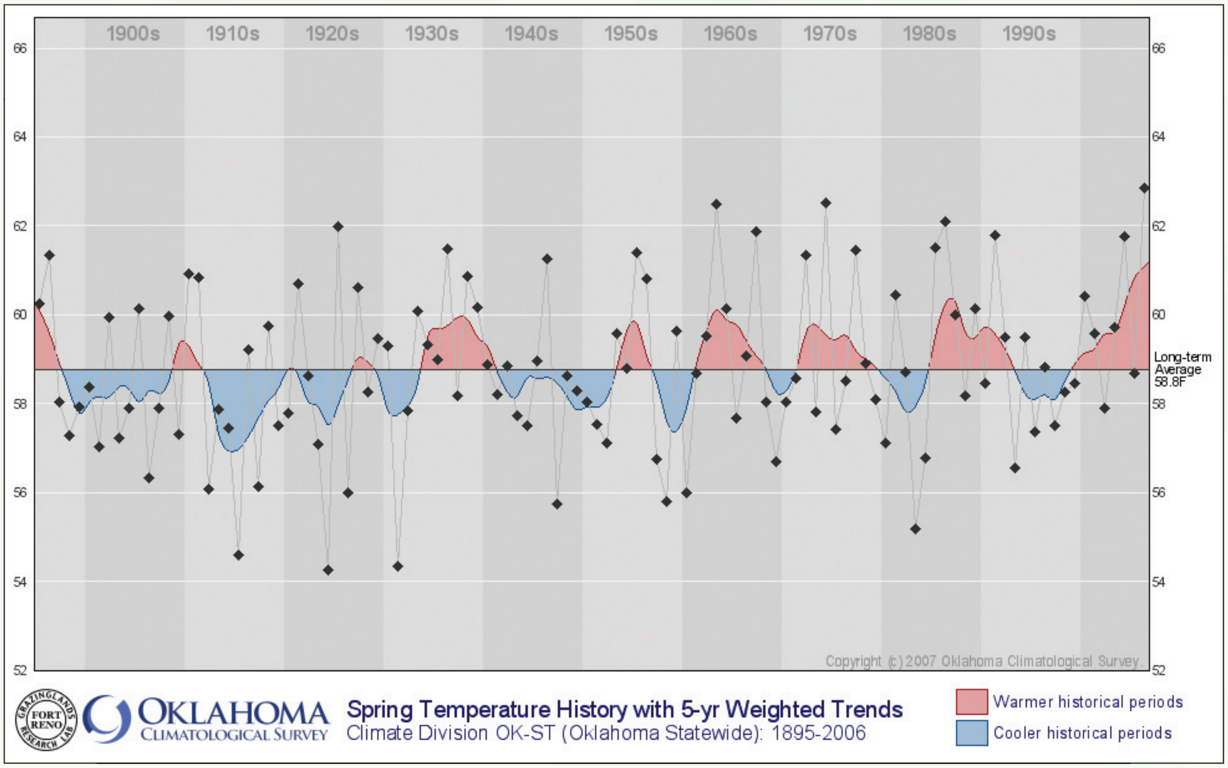


Fig. 1

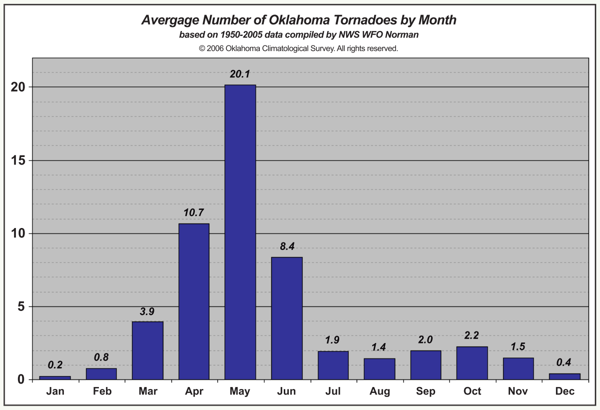
Fig. 2



During the first 40 years of statehood, the death toll from tornadoes was staggering. Peggs was hit directly in May 1921; 71 residents were killed. During the dreadful tornado outbreaks of the 1940s, spring storms claimed 52 lives in Pryor (April 1942), 80+ in Antlers and Muskogee (April 1945), 110+ around Woodward (April 1947) and 10 in Lenna (March 1948).

The modern understanding of tornadoes is best bookended by the state's two most famous storms. The Woodward Tornado of 1947 was the deadliest single storm in Oklahoma history. The storm destroyed nearly 100 city blocks in town, and human suffering lasted for days. A half-century later, during the Great Outbreak of May 3, 1999, a large tornado scoured parts of the southern Oklahoma City metropolitan area. Despite traveling a longer distance through more densely populated areas, and despite delivering the strongest winds ever observed on the planet, the Oklahoma City storm saw less than half the casualties as the Woodward storm.

Fig. 3



Violence isn't measured solely by twisters. The state's worst hailstorm, arguably, was the one that left a 40-mile by 80-mile swath of giant hail in north-central Oklahoma in April 1935. Some stones near Braman measured 12-14 inches in circumference.

The Heavy Snows

Extreme spring weather isn't limited to hailstones and tornadoes. Even snowfall events get amped up compared to winter. March snowfall isn't incredibly common, but to borrow from a warm-season metaphor: when it snows in March, it pours. Fully half of the state's highest-end snow events (16 inches or more) have occurred during March. This is due in some part to non-linear relationship between air's temperature and its moisture capacity: in other words, a few degrees (from January Cold to March's Not-Quite-As-Cold) can make a huge difference in the amount of precipitation that can be produced. And it gets more dramatic as you move northwest. According to a study published by the National Weather Service's Norman Forecast Office, the state's most likely place and time to observe heavy snow (more than four inches per event) is the panhandle in March.

The 1920s might demonstrate the most dramatic example of this effect. March 1924 laid down what might have been the largest monthly volume of snow in the state's history, tacking into account the depth and breadth of the events. By month's end, more than 20 inches of snow had fallen nearly statewide: from 33 inches in Beaver to 37 inches at Alva, to 21 inches on top of Eufaula. The month's events caused agricultural calamity that U.S. Weather Bureau Oklahoma Chief J. Pemberton Slaughter, prone to understatement, described as "very unfavorable for farm activities". Two years later, a 16-inch whopper blanketed most of the panhandle in the closing days of March. The unflappable Slaughter wrote in his monthly report, "It was a cool month."

Not all snow is bad, especially where winter wheat is concerned. Often, a thick cover of snow can protect a young crop from the cold winds that follow a snow-packed storm system. This was the case in Mid-March 1999, when nearly two feet of snow fell on parts of north-central Oklahoma. At the time, the event ranked as the fourth-largest snow event in state history.

The Floods

Storm season is flood season, and some of Oklahoma's most dramatic and most tragic flood events came during the spring months. Spring thunderstorms bring brief fits of extremely heavy rain, and when a downpour is too much for local creeks to handle, flash flooding will occur. Urban areas, where drainage systems are designed to escort water to creeks even more quickly, are especially prone to flash flooding.

Two of the state's deadliest flash floods actually led to improvements in practice and technology. On April 3-4, 1934, heavy rains just across the Texas border helped swell the Washita from its banks and sweep 17 Oklahomans to their death. This event was the most prominent of several that led to a new method of flood control on the prairie. Instead of taming the Washita with one large dam, state officials and some federal engineers convinced the USDA to try using dozens of smaller dams to control its tributaries. The project was a tremendous success, and the model for many North American flood control projects during the next half-century. A May 1984 flash flood claimed 14 lives in Tulsa, and led to a renaissance of sorts in Tulsa's hazard mitigation and emergency communications approaches. The city's turnaround from flood-prone to flood-prepared is astonishing. That flood also indirectly led to the establishment of the Oklahoma Mesonet.

Two weeks of river flooding on the Arkansas below Ft. Gibson left 160,000 acres of farmland in ruin during April 1924. A similar flood slightly upstream from that location in 1943 caused millions of dollars in damage near Muskogee

The Late Freezes

Perhaps spring's most stealthy events are the untimely freezes that cause millions of dollars in agricultural and horticultural damage. These events are made worse when they come on the heels of warmer weather, which encourages early blooming of orchard plants and early maturation of the wheat plant. This year's late freeze in early April 2007 was a reminder of the warm-versus-cold force in play during the spring months. Although final tallies have yet to be determined, the episode caused tens of millions of dollars in impact over various parts of the state.

The Dry Side

Life west of the dryline is, well, dry. The same synoptic forces that encourage strong southerly moisture-laden winds ahead of a storm also encourage strong westerly moisture-less winds behind it. Wildfire is a common occurrence during Oklahoma's windy springs, as evidenced by the giant and tragic fires of March 2006, when several hundred thousand acres burned to cap off a horrific half-year of wildfires in Oklahoma.

There have no doubt been many impressive and important events during Oklahoma's spring months, but perhaps the most important, and certainly the most symbolic, occurred on April 14th, 1935. Black Sunday, the only known named weather day in state history, featured the nation's most notorious dust storm. Most of western Oklahoma (and western Texas) was shrouded in a sun-choking blanket of wind-driven topsoil. It remains one of the most emblematic symbols of the Dust Bowl which gripped the entire region.

The Bottom Line

Simply put, Oklahoma's springs bring activity. If it can be served up in spring, it can be served up with 25-mph winds, rapid changes, and maybe a little lightning and hail. It is quite natural to be dazzled by the seasons' spectacles, and easy to forget that spring, more than any other season, brings surpluses that we invest for future uses. Spring delivers the rains which replenish the state's water supplies, feed the state's crops and livestock, and carry us through the drier and lazier summer months. When we think of spring, we instinctively think of youth, and Oklahoma's weather has much in common with our kids: lively, energetic, non-stop, hard to predict, a little messy at times, and – above all else – investment in great rewards to come.

The Details

	Year	Statistics
Warmest Spring	2006	62.8°F
Coldest Spring	1931	54.3°F
Wettest Spring	1957	22.74 in.
Driest Spring	*1971	5.24 in.

	Year	Statistics
Warmest April	2006	65.5°F
Coldest April	1983	53.2°F
Wettest April	1942	8.50 in.
Driest April	1989	0.58 in.

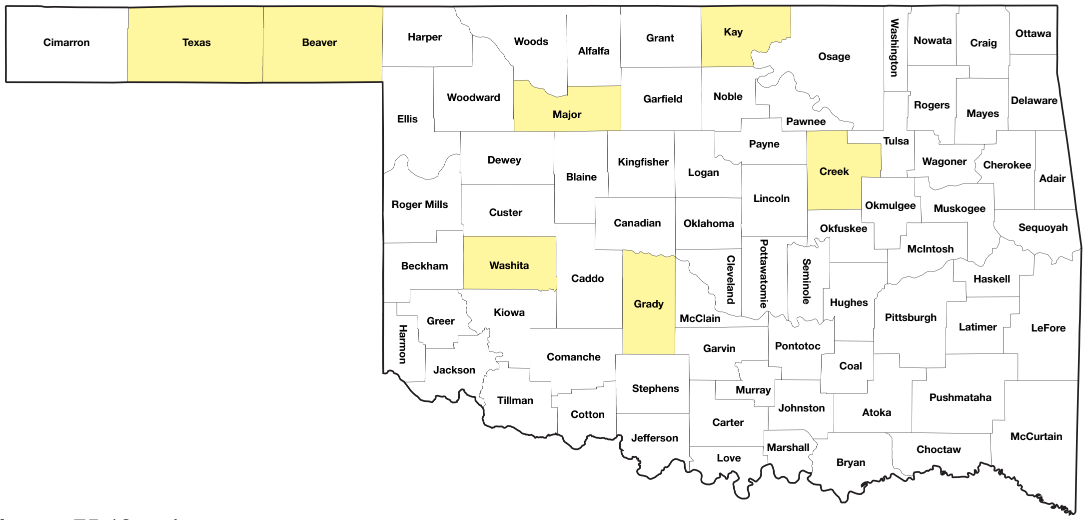
	Year	Statistics
Warmest March	1910	57.9°F
Coldest March	1915	37.6°F
Wettest March	1973	7.46 in.
Driest March	1971	0.38 in.

	Year	Statistics
Warmest May	*1962	73.8°F
Coldest May	*1917	62.1°F
Wettest May	1957	10.68 in.
Driest May	1988	1.30 in.

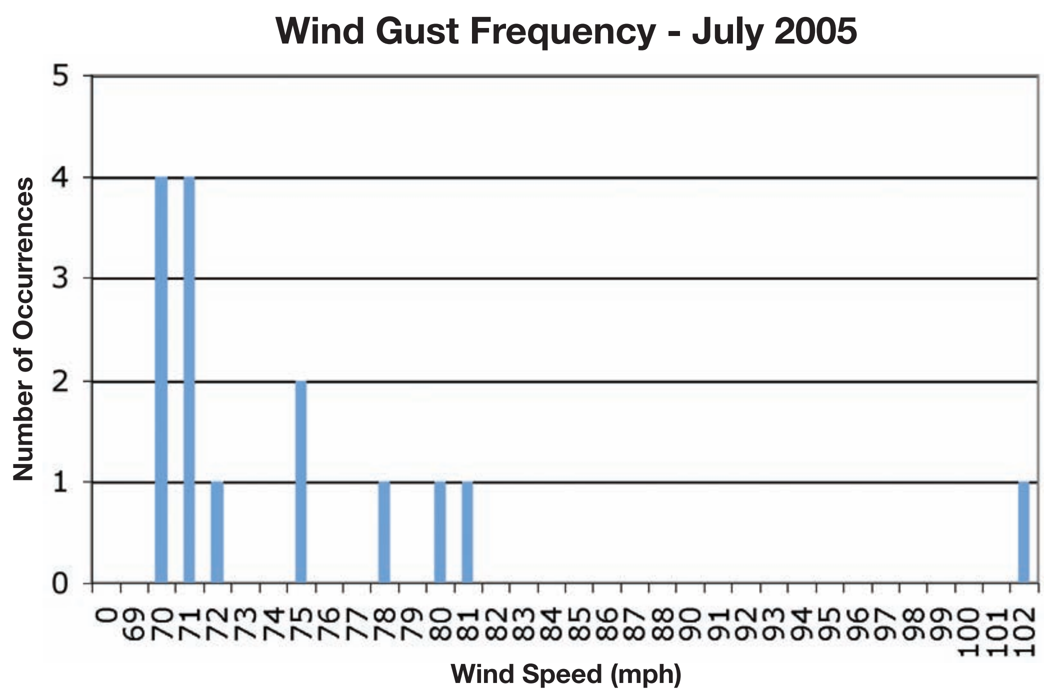
* more extreme values were observed during pre-statehood springs

CLASSROOM ACTIVITY ANSWERS [From Page 22]

1.



2. Mean = 75.13 mph
3. Median = 71 mph
4. Mode = 70 mph and 71 mph
5.



6. Yes, 102 mph is an outlier.
7. Mean excluding outlier = 73.21
8. Median. The data contains an outlier. When an outlier is present the median is the correct measure of central tendency.

THE Enhanced Fujita Scale

By: Doug Speheger, Meteorologist
National Weather Service

Most Oklahoman's are familiar with the Fujita scale for rating the intensity of the damage caused by tornadoes. But this year, the Fujita scale is being modified, and the National Weather Service has begun using this modified scale called the "Enhanced Fujita Scale."

Dr. Fujita from the University of Chicago created the Fujita scale (or F-scale) in the 1970's. The scale rates tornadoes on a scale from F0 that produces very minor damage, to an F5 tornado that creates incredible damage. Examples of F5 tornadoes include the May 3, 1999, Bridge Creek-Moore-Oklahoma City tornado. The scale included an estimated degree of damage of tornadoes to frame houses and a wind speed scale. Of course, very few tornadoes have actually had wind speed measurements taken, so the Fujita scale in practice has been a damage scale, where the rating of the tornado is estimated based on the damage that the tornado causes. For example, a house where the roof had been removed by the tornado would typically indicate a tornado rating of F2, while if the house had some of its exterior walls destroyed, it may indicate a higher rating of F3.

The F-scale has been a useful way to classify the estimated tornado intensity based on the damage. But it has also had some problems. One issue is that the primary type of structure that is used to investigate tornado damage and assign an F-scale rating is a well-built frame house. But there are a number of tornadoes that do not hit a frame house. For these tornadoes, the F-scale assigned is probably lower that the tornado's actual intensity since it is difficult to assign a proper rating when there were no houses damaged. Also, when the most significant damage occurs to buildings that are not frame houses (such as the Outlet Mall in Stroud damaged by the May 3, 1999, tornado, or the General Motors plant in Oklahoma City on May 8, 2003), the F-scale is not equipped to assign an accurate F-scale rating to these structures.

Another problem is that the wind speeds assigned to each F-scale rating were never scientifically compared to the degree of damage that Dr. Fujita assigned to each rating. For example, the minimum wind speed assigned to an F5 rating is 261 mph, but many structural engineers have argued that the damage associated with an F5 tornado (a frame house being destroyed and the debris swept away) can be caused by much lower wind speeds than 261 mph.

F-scale rating	Fastest 1/4-mile wind speed (mph) used by F-scale	EF-scale rating	3-second gust wind speed (mph) used by EF-scale
F0	40-72	EF0	65-85
F1	73-112	EF1	86-110
F2	113-157	EF2	111-135
F3	158-207	EF3	136-165
F4	208-260	EF4	166-200
F5	261-318	EF5	greater than 200

Wind speed comparison between F-scale and EF-scale ratings. Note: The fastest quarter-mile wind speed refers to the wind averaged over the time it would take to go one quarter of a mile. This would range from 3 seconds for a wind of 300 mph to 9 seconds for a wind of 100 mph.

To address these issues, beginning in 2001, meteorology damage assessment experts and structural engineers began the process of developing an "Enhanced Fujita Scale" (or EF-scale). The main goals were to identify items that can be damaged (not only frame houses, but also commercial structures, mobile homes, barns, etc.), correlate the appearance of various degrees of damage to these structures to estimate wind speeds, and to preserve the historic tornado database for some degree of consistency between the F-scale and the EF-scale. In 2004, this EF-scale was introduced to the meteorology and engineering communities.

The results of this process are impressive. Instead of damage to frame houses being almost the sole basis of F-scale as before, there are now 28 different structures (many different types of buildings, electrical poles, and trees) that can be used to estimate the strength of the tornado. For each of these 28 types of structures, a table has been created to estimate a wind speed range that would have been capable of producing various degrees of damage to that structure, ranging from minor superficial damage to complete destruction. But the degree of damage that is visible can be a result of not only the tornado winds, but also how well built the structure was. So for each degree of damage, there is a range of expected wind speeds. For example, if a large section of a frame house's roof is removed, but most of the walls remain standing, the expected wind speed associated with this damage is about 122 mph. The wind speeds can actually range from 104 mph to 142 mph, however, depending on how well the roof has been attached to the walls of the house. So a damage surveyor will use not only the degree of damage to estimate the winds, but will also investigate how well-built the structure is.

Once the most significant points of damage of the tornado path have been surveyed, then the wind speed assigned to these points will be converted to an EF-scale rating between EF-0 and EF-5. The wind speeds assigned to F-scale and EF-scale ratings are listed below.

One of the first things you will notice is that the wind speeds associated with the EF-scale rating categories are much lower than F-scale categories. The new speeds are believed to be better estimates of the wind speeds necessary to cause the damage associated with each rating category.

Over the last 20 years, researchers have used portable research radars to measure the wind speeds of tornadoes, but these wind speeds are not directly comparable with the wind speeds of the rating scales. First, the radar measurements are "instantaneous" wind speeds, or the speeds that the radar detects the instant that the radar beam hits a target. These wind speeds will be lower if averaged over 3 seconds, which is the duration used for EF-scale winds. Second, the radar beam is almost always measuring the wind at a height at least a few hundred feet above the ground, which does not necessarily represent the wind speed within a few feet above the ground where the damage is occurring. So while the wind speeds measured by radar have been somewhat comparable to those assigned by the F-scale rating, these wind speeds have likely overestimated the wind speeds that were occurring closer to the ground and being averaged over a few seconds. These radar-derived wind speeds are likely to be higher that the wind speeds of the EF-scale rating determined by damage nearly all of the time.

The National Weather Service implemented this new scale on February 1, 2007, and has begun to rate tornadoes with this new EF-scale. Three Oklahoma tornadoes have been rated preliminarily as EF-2 during March, including the tornado near Elmwood on March 28, and in northwest Oklahoma City on March 29.

Flowers from the field

Photos by: John Humphrey, Graphic Designer

Oklahoma Mesonet Sites in OKLAHOMA CITY

BY: DR. JEFF BASARA. DIRECTOR OF RESEARCH

Have you ever had an experience that made you look at something that was so familiar in a totally new light? I remember a specific instance as a child when I was invited to a birthday party by a friend from school. We had driven by his house nearly everyday, but I never knew where he lived. However, once I went to the party my view of the neighborhood changed because of a simple experience. From that point on, a house that had been simply another house on the block was now the house of my friend, and I always remembered it as such.

A similar experience occurred a few years ago in 2003 when Oklahoma City hosted the largest urban dispersion experiment ever conducted: Joint Urban 2003. For six weeks scientists from around the world converged on Oklahoma City with a myriad of sensors designed to measure atmospheric conditions in an urban zone. On one occasion, I distinctly remember a scientist from outside Oklahoma telling me how much he appreciated the Oklahoma Mesonet because it provided so many observations of the atmosphere outside of Oklahoma City that they did not need to deploy any of their sensor equipment beyond the urban zone. In short, his comment could have been summarized as “You have the rural areas covered and we have the urban area covered”. While I appreciated the compliment concerning the respect for the Oklahoma Mesonet, I became acutely aware of a very simple fact: the Oklahoma Mesonet did not have any sites that were truly urban. Basically, I saw the Oklahoma Mesonet in a whole new light.

Since Joint Urban 2003, I have envisioned the day when Oklahoma Mesonet sites would monitor atmospheric conditions in urban areas. That day has finally come. With funding provided by a capital bond issue and the University of Oklahoma, three Mesonet sites have been deployed across the Oklahoma City metropolitan area. The first, Oklahoma City north (OKCN) was installed on the grounds of the Oklahoma Publishing Company in late February approximately seven miles north of the central business district. Two other sites were installed in April, one (OKCW) approximately four miles west of downtown Oklahoma City at Oklahoma State University at Oklahoma City (OSU-OKC) and the other (OKCE) approximately four miles east of downtown Oklahoma City on municipal property.

The Oklahoma Mesonet has a distinguished history of collecting observations of soil and atmospheric variables across Oklahoma. It is anticipated that the Oklahoma City sites will serve as well as those in rural areas. At the same time, the location of the sites will provide a new opportunity to meet the weather and climate needs for an area that boasts the largest population in the state. For example, each site is situated near major thoroughfares or interchanges and could provide critical road weather information. Similarly, the sites will provide additional rainfall information that may be needed by public works or emergency management information to address potential flooding issues.
Whatever the case may be in the future, the Oklahoma Mesonet has, and will continue to meet the needs associated with weather and climate monitoring both in the rural and now urban areas across the state.

OKCW

OKCE

OKCN

WINTER 2006-2007 SUMMARY

By: Gary McManus

Lingering drought conditions which began nearly two years earlier were dealt a major blow by an active winter storm season. The state was visited by a multitude of systems which brought a winter climate more suited for the 1970s than the warmth of the last decade. The frequent bouts with snow, ice and rain helped the winter to finish as the 21st wettest on record. The balmy temperatures of the previous year's winter were also a distant memory as the state experienced the 49th coolest December-February on record. Unfortunately, the winter storms brought widespread damage, including power and travel disruption, to parts of the state. The Panhandle was hit hard during December with a major mid-month ice storm and a late-month blizzard. The first storm snapped power poles and left thousands without power. The second storm a couple of weeks later brought snow drifts of up to 20 feet deep which paralyzed the area and created havoc for area ranchers. Another ice storm affected eastern Oklahoma in mid-January, knocking out power to over 125,000.

Precipitation

Virtually the entire state enjoyed a precipitation surplus during the winter season. The Panhandle in particular had a surplus of just over two inches, significant for that part of the state, and finished with the 6th wettest December-January on record. The east central region had a surplus of more than two inches to finish as the 16th wettest winter period on record in that area. North central and south central Oklahoma had localized minor deficits signifying the portions of the state which remained with droughty conditions at the end of the season.

Temperature

Most of Oklahoma had slightly above normal temperatures with the exception of the far western Panhandle, which was more than four degrees below normal. The average temperature over the entire Panhandle region was nearly two degrees below normal, the 29th coolest winter on record in that area. That helped drop the statewide average temperature to near normal for the season.

December Daily Highlights

December 1-6: Snow remaining on the ground from a late-November winter storm helped keep northern Oklahoma temperatures below normal for the first few days of December. While the rest of the state was enjoying high temperatures in the 40s and 50s, areas with snow pack in northern Oklahoma remained in the 30s. Low temperatures suffered a similar fate, dropping into the single digits and teens in northern Oklahoma, but in the 20s and 30s elsewhere. The lowest temperature of the month, -2 degrees, occurred at Nowata on the 4th. The entire state began to warm on the 5th and 6th with the help of strong southerly winds in advance of an approaching cold front. Highs in the 50s and 60s quickly melted the snow and gave the state a couple of pleasant days.

December 7-16: The next ten days were fairly uneventful, marked by a cold front passage on the 7th followed by unseasonably warm weather the 10th through the 16th. Lows were mostly in the 20s and 30s the first three days of this period, with highs struggling to reach 50 degrees. Strong southerly winds on the 10th ushered in more mild weather with highs in the 60s. Lows remained in the 40s and 50s on the 11th before temperatures rose into the 60s to near 70 degrees. High temperatures for the remainder of this period were 10-20 degrees above normal, mainly in the 60s and 70s. Very little precipitation fell during this period, other than a few light rain showers in eastern Oklahoma from the 9th through the 11th.

December 17-20: A cold front moved into the state early on the 17th, dropping temperatures into the 30s behind it. Temperatures rebounded in that region to the upper 40s, while south of the boundary highs reached into the mid-70s. The front pushed through the state on the 18th, in time for the approach of a powerful upper-level storm on the 19th. Heavy rains occurred in western Oklahoma, with freezing rain and a bit of snow falling in the far northwestern corner of the state. The area around Butler and Cheyenne received nearly three inches, with 1-2 inch totals further north and east. The weather in the Panhandle turned into a major winter storm. More than an inch of ice coated the landscape during the initial ice storm. Later, the precipitation turned to snow, dropping up to five inches in some areas. The ice accumulation brought travel to a standstill and snapped power poles and lines, leaving thousands without power. Large tree limbs succumbed to the ice's weight, falling onto cars and structures. The precipitation shifted to the south and east during the nighttime hours. Amounts from 1-3 inches were reported across the state on the 20th.

December 21-27: Fairly seasonable weather ensued for the next seven days, with highs generally hovering in the 50s and lows in the 20s and 30s. A cold front on the 25th brought light rain to the east and a few snowflakes to the west. High temperatures that day only reached into the 40s, and northerly winds gusting to 35 mph made it seem much colder. Highs had warmed back up into the 60s by the 27th, accompanied by southerly winds gusting to 30 mph.

December 28-31: A powerful upper-level storm barreled its way towards Oklahoma on the 28th, increasing clouds and pumping moisture up on strong southerly winds. The upper-level storm arrived on the 29th and promptly slowed down, which resulted in a heavy rain event in eastern Oklahoma and another major winter storm for the Oklahoma Panhandle. The rain began early on the 29th and by the time it had ended on the 30th, more than four inches had fallen in the southeast. Most of the southeastern half of the state recorded at least an inch of rainfall, with totals tapering off to the northwest. Amounts once again increased in the extreme northwest. While freezing rain fell farther to the east, the western Oklahoma Panhandle was in the grip of a full-fledged Plains blizzard. Officially, up to 18 inches fell in Cimarron County. According to the NWS office in Amarillo, unofficial amounts of up to four feet were reported in western Cimarron County. Drifts of up to 20 feet were reported in the area, and most roads in Cimarron County were closed. Twenty families had to be dug out and rescued by emergency crews due to snow drifting over their houses. Farther to the east in Texas County, an ice storm warning was issued as freezing rain felled power poles and lines, leaving thousands without power. The month's final day was chilly with highs in the 30s and 40s and northerly winds gusting to over 30 mph.

January Daily Highlights

January 1-5: The New Year began clear and cold with lows in the teens and 20s as high pressure at the surface settled over the state. High temperatures reached seasonable levels in the 40s and 50s under sunny skies. An upper-level storm system traveling west across northern Mexico and southern Texas provided the state with cloud cover for the next few days. The clouds hampered high temperatures somewhat, which managed to reach 60 degrees in some areas on the 3rd. The upper-level storm helped kick winds up from the south at 10-20 mph. A few showers formed in southern Oklahoma on the 4th. The cloud cover helped keep low temperatures in the 40s that morning. High temperatures reached the 50s and 60s in the south, but low clouds in central and northern sections kept highs in the 40s and low 50s in those regions. A cold front entered northwestern Oklahoma on the 5th and dropped lows into the 30s in its wake. High temperatures struggled in the 40s behind the front but high temperatures ahead of the front climbed into the 60s.

January 6-11: The cold front of the previous day made it through the entire state overnight, resulting in a cooler morning and northerly winds of 10-15 mph. A few sprinkles and flurries were scattered across the state, but amounts were on the light side. Another front on the 7th ushered in northerly winds of up to 40 mph in western Oklahoma. The clear skies allowed highs to reach into the 50s and 60s, about five degrees above seasonal normals. Surface high pressure produced clear skies and light winds for the next several days, along with lows in the 20s and highs in the 50s and 60s. The 11th even saw a few 70s scattered across the state.

January 12-16: A powerful upper-level storm approached from the west early on the 12th as a strong cold front plunged into the state, setting the stage for a major icing event. Precipitation was often convective in nature, complete with thunder and lightning. Two-to-four inches of sleet fell in the northwestern half while 2-3 inches of freezing rain blanketed areas to the southeast. In the far southeastern corner, temperatures stayed above freezing long enough to keep the rain from freezing, allowing 3-5 inches of liquid precipitation in that area. The heavy coating of ice left 125,000 without power at the storm's peak, and contributed to a preliminary total of 32 fatalities in Oklahoma, the majority of which were traffic related. The upper-level storm spun out three separate waves of precipitation which allowed for nearly 72 hours of continuous precipitation. A reinforcing shot of cold air followed the initial cold front and dropped temperatures into the single digits in the northwest. Highs in that area struggled to eclipse the teens through the 14th. Meanwhile, the extreme southeastern corner continued with highs in the 50s. The next two days were bitterly cold across the ice-coated state. Lows on the 15th and 16th reached zero degrees in the Panhandle and the mid-20s in the southeast, while highs remained in the 20s and 30s. Southwesterly winds on the 16th allowed temperatures to reach 40 degrees in western Oklahoma.

January 17-19: A weak upper-level disturbance passed over the state and brought scattered light snow to the southwest. Temperatures barely eclipsed freezing that afternoon due to the associated cloud cover. Temperatures finally broke the freezing mark over most of the state on the 18th with mid-40s in the south and mid-30s in the north. The Panhandle remained below freezing. More pacific moisture kept skies overcast on the 19th. The cloud cover helped low temperatures to remain in the 20s and 30s, but also kept highs down in the 30s and 40s. A bit more moisture fell from the sky ahead of another approaching storm system, but amounts were once again light.

January 20-21: Another powerful upper-level storm crossed the state from the west, laden with moisture. This storm lacked the intense cold air that generated the previous weekend's ice storm, so rain was the main precipitation type. High temperatures on the 20th were in the upper 30s for most of the state but cold air in the northwestern third allowed for a decent snowstorm. Two-to-four inch amounts were common across the northwest. Totals of up to seven inches were reported in Cheyenne and Woodward, and over eight inches fell in Vici and Mooreland. Rainfall amounts farther to the southeast were between one and two inches, although a pocket of more than three inches was indicated by the Oklahoma Mesonet in east central Oklahoma. The precipitation ended overnight, replaced by cold high pressure on the 21st. Northerly winds of more than 20 mph made the temperatures feel colder than the 20s and 30s on the thermometer.

January 22-26: Low clouds kept skies overcast early on the 22nd. High pressure at the surface moved in shortly thereafter and produced clear skies and light northerly winds. The temperatures remained cold, basically in the 30s statewide. The snow pack in the northwest subtracted about five degrees off the temperatures in that area. The weather warmed up over the next several days, becoming a bit more seasonable. By the 26th high temperatures were in the 60s, 10-15 degrees above average, on the strength of the warm southwesterly winds gusting from 25-30 mph.

January 27-31: A couple of snow events ended the month's final week, with below average temperatures on the plate as well. An upper-level low tracked across the state on the 27th. With little moisture to work with, light rain changed over to light snow as the day progressed. High temperatures were in the 30s behind a cold front traversing the state, while 40s and 50s were recorded ahead of the front. The 28th was cool and fair, with lows in the teens and 20s and highs about 10 degrees below normal in the 40s. A couple of cold days on the 29th and 30th were culminated by yet another upper-level storm system on the month's last day. A mixed bag of precipitation occurred on the 31st, with snow early and then a snow/sleet/freezing rain mix later in the day. The snow tapered off around mid-evening with another bout forming in the Texas Panhandle and moving towards Oklahoma. Highs across the state were well below normal in the mid-20s to low 30s.

February Daily Highlights

February 1-6: A frigid start to the month came complete with snow showers and plenty of gray skies. Highs were in the 30s across the state after plunging to the teens and 20s that morning. The light snow continued into the 2nd with northerly winds gusting to over 25 mph, making the day seem much colder. The state's low temperature of minus-six degrees was recorded by the Kenton Mesonet site on the 2nd (and also at Hooker on the 15th). Another front on the 3rd split the state from west to east. Areas north of the front languished in the 20s and 30s, while areas south enjoyed the 40s and 50s. The state warmed up over the next couple of days with high temperatures eventually reaching the 60s and 70s on the 6th.

February 7-11: A "back door" cold front entered the state from the northeast overnight on the 7th. The front slowed as it approached the southeast, splitting the state with 70s for highs in the south and 30s and 40s behind. Winds behind the front gusted to 30 mph from the northeast. Patchy drizzle and freezing drizzle fell the next morning although amounts were very light. Temperatures in the 20s and 30s were aided by strong northerly winds to produce wind chills down to 20 degrees. More freezing drizzle for the south on the 9th as a cold dome of high pressure at the surface continued to dominate the state's weather. Two more cold days followed through the 11th as southerly winds increased ahead of an approaching upper-level storm system. Highs were in the 30s and 40s on both days with lows in the 20s.

February 12-16: Showers and thunderstorms fired ahead of an approaching upper-level storm system. More than an inch of rain fell in east central areas of the state. A warm front moved north and allowed high temperatures to reach near-seasonal levels in the 40s and 50s. A cold front overnight on the 13th brought very cold temperatures and high winds which combined to drop wind chill values close to zero degrees. Temperatures continued to fall throughout the day, bottoming out in the 20s. Light snow fell throughout the next several days. Low temperatures dropped below zero in the Panhandle and northwest with minus-six degrees in Hooker on the 15th. Southwesterly winds gusting to over 40 mph allowed temperatures to rise into the 50s and 60s on the 16th after a frigid start in the single digits and teens that morning, including below-zero temperatures in the northwest.

February 17-22: Another cold front moved into the state on the 17th. This offender was of pacific origin, however, which meant much less of a cool-off. Low temperatures were in the 20s and 30s, but highs still rebounded into the 40s and 50s. Northerly winds gusting to over 40 mph made the day seem much cooler. The next several days were warm and windy with highs predominantly in the 70s. A cool front passed through the state on the 20th but had little effect on high temperatures. The boundary acted more as a wind shift, and the surface high pressure system that followed produced clear skies and pleasant temperatures.

February 23-24: A decidedly unpleasant two-day span, the 23rd saw the approach of a vigorous upper-level storm system from the west. Strong southerly winds ushered in low level moisture from the Gulf of Mexico in the form of low clouds and increased humidities. Thunderstorms developed in the Texas Panhandle during the late afternoon and quickly moved into far western Oklahoma. The thunderstorms were moving at nearly 50 mph, so rainfall amounts were truncated somewhat. The storms raced to the east overnight and into the next morning. Several Oklahoma Mesonet sites were fortunate enough to record more than an inch of rainfall, but the bulk of the state received less than a half of an inch. As the dryline and cold front passed through the state, severe non-thunderstorm winds gusted to over 50 mph, with some locations experiencing wind gusts of over 60 mph. Blowing dust and power outages resulted. Light rain and snow fell in the far northwest as the center of the upper-level low pressure system passed over, but amounts were extremely light.

February 25-28: Another slow warm up during this four-day period. The 25th was sunny and cool with the arrival of surface high pressure. High temperatures rose into the 50s and 60s after 30s for morning lows. By the 28th, high temperatures were once again into the 70s and 80s with southerly winds gusting to over 40 mph. The state's high temperature of 84 degrees occurred at Altus and Grandfield on the month's final day.

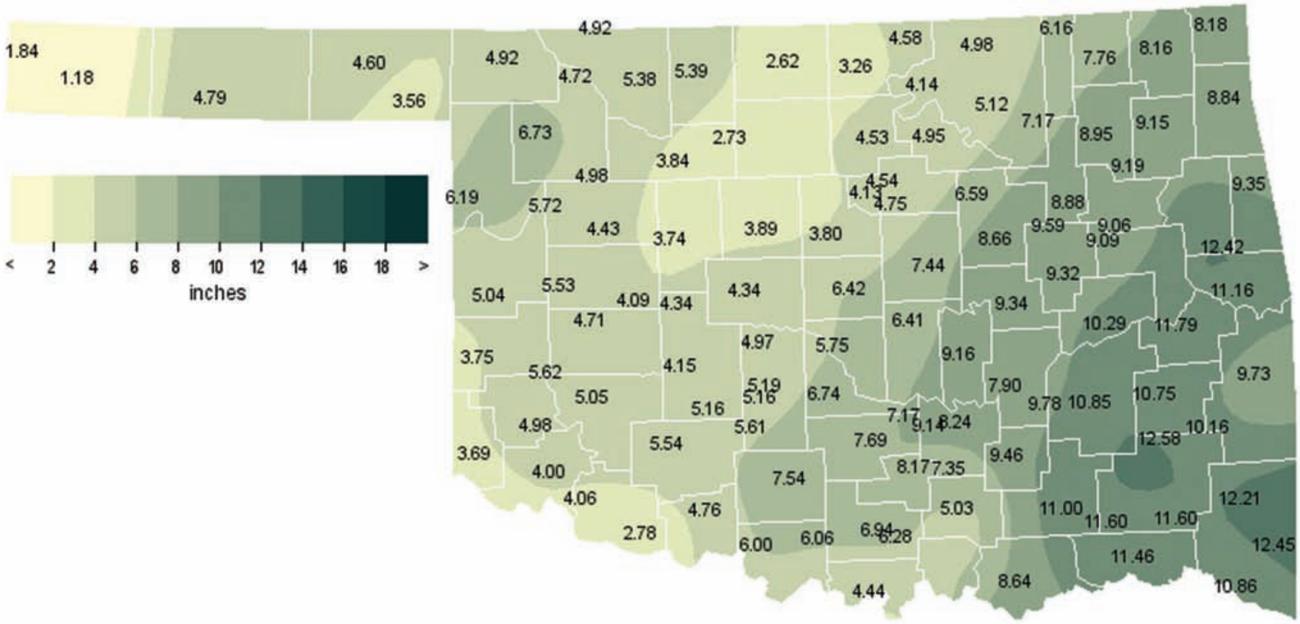
Winter 2006-2007 Statewide Extremes

Description	Extreme	Station	Date
High Temperature	84ºF	Altus	Feb. 28th
Low Temperature	-6ºF	Kenton, Hooker	Feb. 2nd, Feb. 15th
High Precipitation	12.58 in.	Clayton	
Low Precipitation	1.18 in.	Boise City	

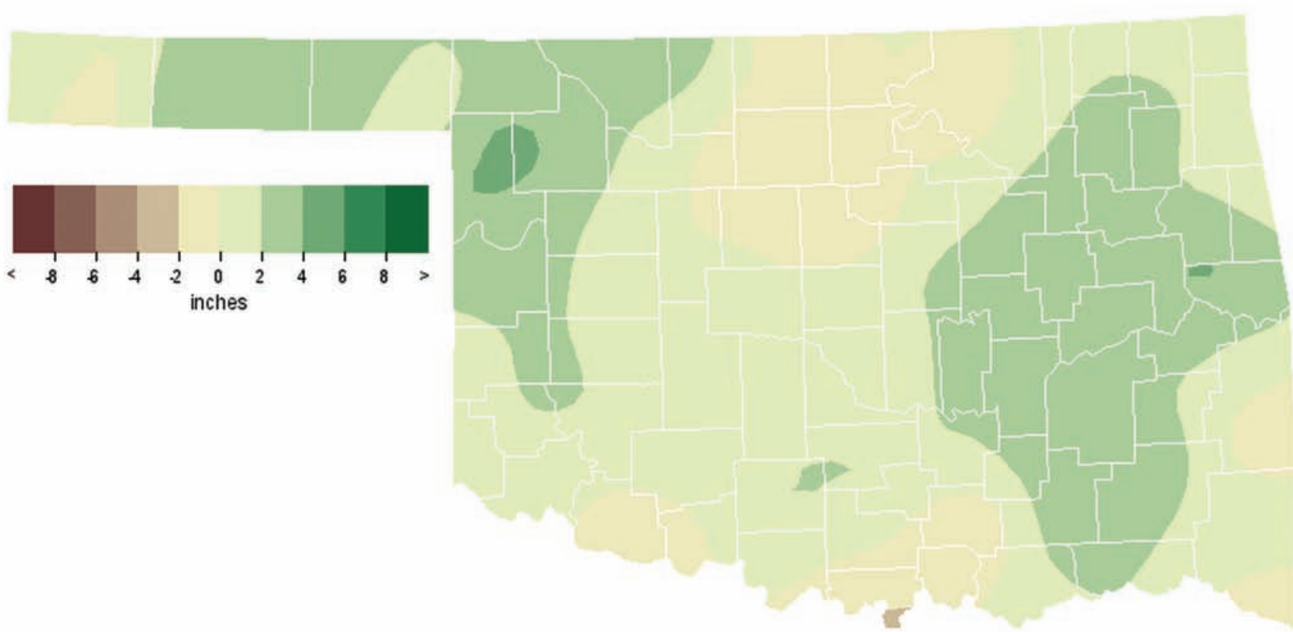
Winter 2006-2007 Statewide Statistics

	Average	Depart	Rank
Temperature	38.7ºF	-0.1ºF	49th Coolest
	Total	**Depart.**	**Rank**
Precipitation	6.56 in.	1.33 in.	21st Wettest

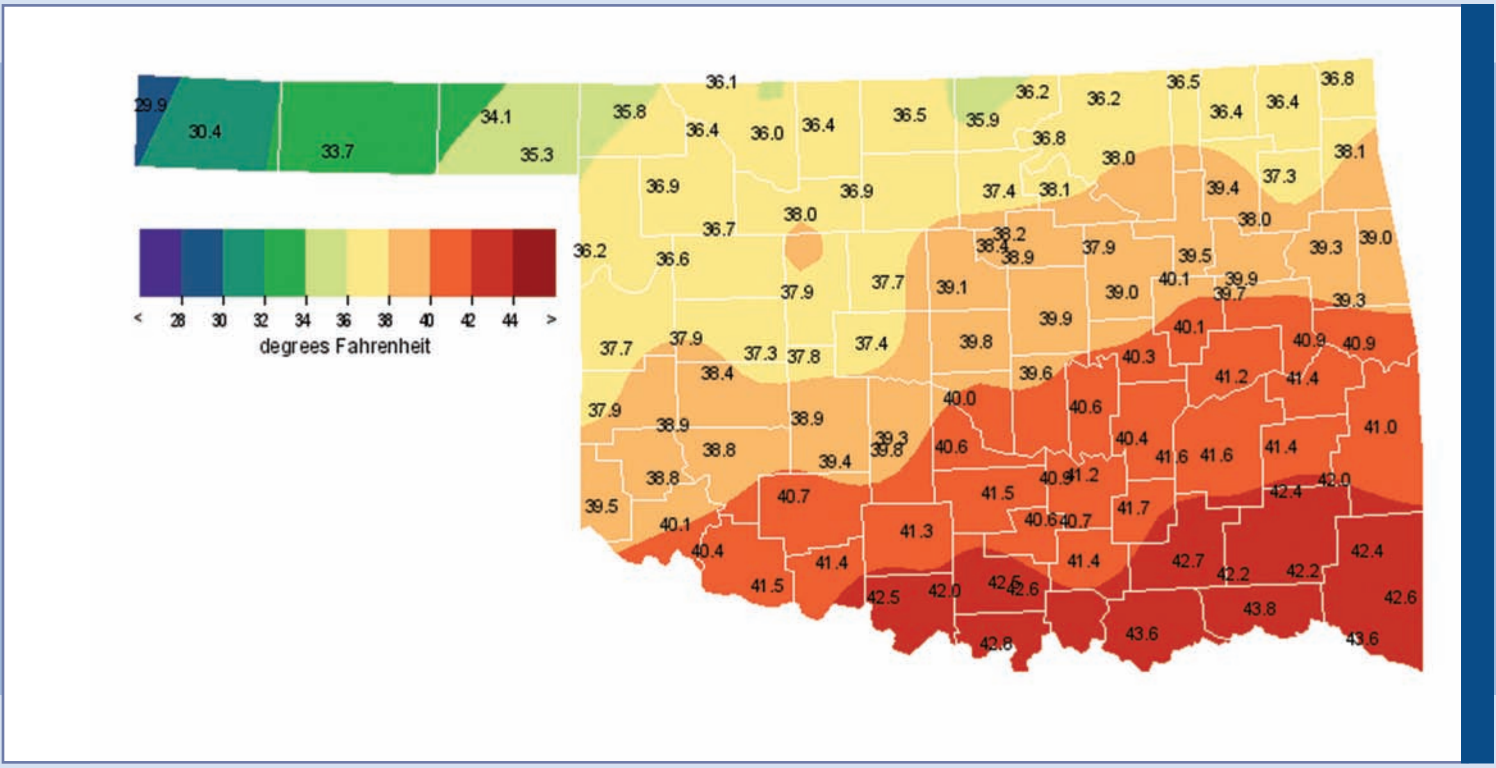
Observed Precipitation



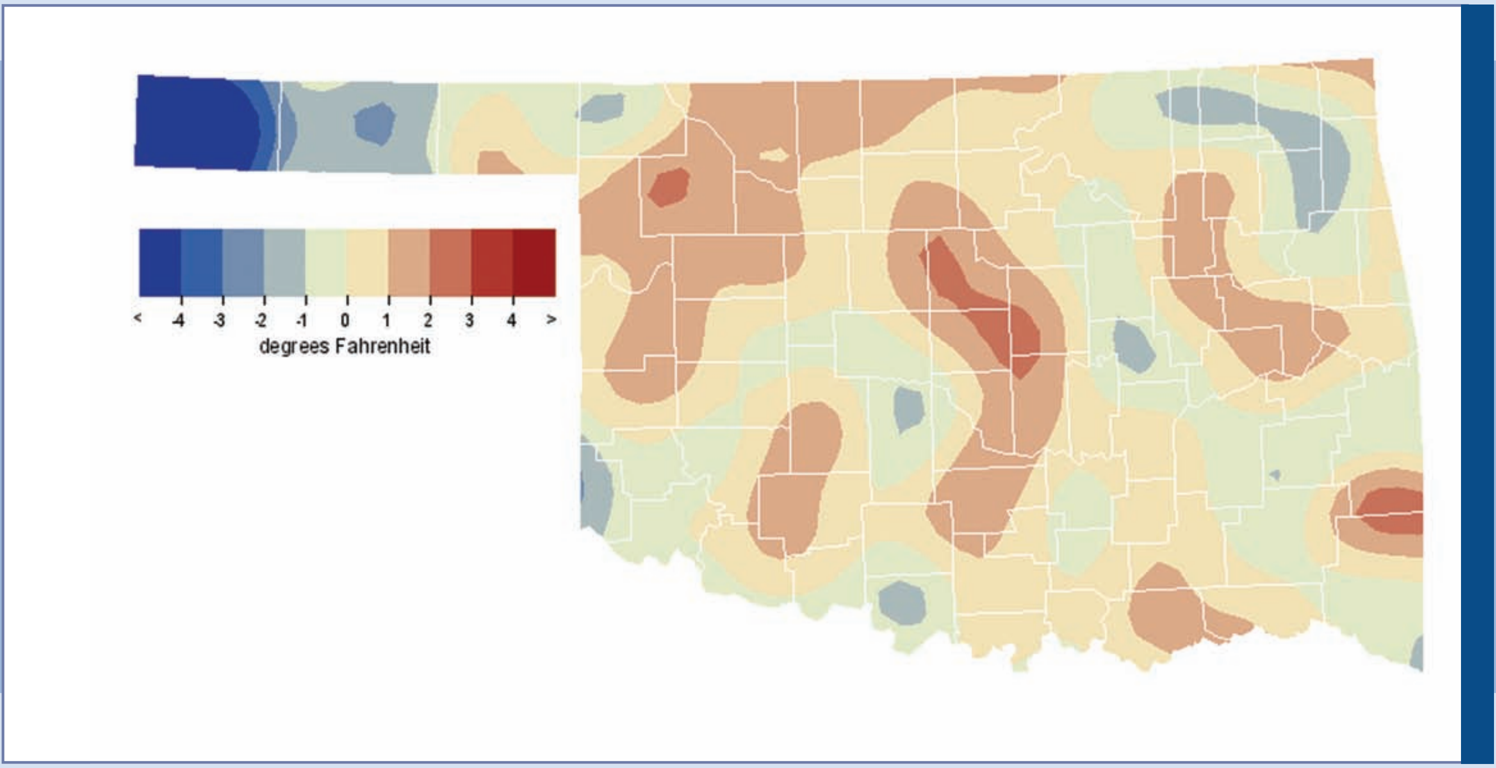
Precipitation Departure from Normal



Average Temperature



Temperature Departure from Normal



Winter 2006-2007 Mesonet Precipitation Comparison

Climate Division	Precipitation (inches)	Departure from Normal (inches)	Rank since 1895	Wettest on Record (Year)	Driest on Record (Year)	2006
Panhandle	3.87	2.01	6th Wettest	5.13 (1960)	0.10 (1904)	0.30
North Central	4.47	1.02	26th Wettest	7.78 (1985)	0.52 (2006)	0.52
Northeast	7.38	1.55	24th Wettest	15.24 (1985)	1.64 (2006)	1.64
West Central	4.74	1.58	15th Wettest	7.83 (1960)	0.21 (1909)	0.57
Central	5.94	0.70	24th Wettest	13.80 (1985)	0.38 (1909)	0.91
East Central	10.14	2.60	16th Wettest	14.59 (1938)	1.97 (1918)	2.29
Southwest	4.41	0.64	37th Wettest	9.05 (1985)	0.14 (1909)	0.38
South Central	7.45	0.81	32th Wettest	13.36 (1998)	0.53 (1909)	2.23
Southeast	11.34	1.32	36th Wettest	20.47 (1932)	3.13 (1963)	4.86
Statewide	6.56	1.33	21st Wettest	10.37 (1985)	1.24 (1909)	1.47

Winter 2006-2007 Mesonet Temperature Comparison

Climate Division	Average Temp (F)	Departure from Normal (F)	Rank since 1895	Hottest on Record (Year)	Coldest on Record (Year)	2006
Panhandle	33.6	-1.7	29th Coolest	40.1 (2000)	27.1 (1899)	38.1
North Central	36.6	0.3	54th Coolest	43.0 (1992)	27.5 (1979)	39.7
Northeast	37.7	0.0	50th Coolest	43.9 (1932)	29.4 (1979)	40.5
West Central	37.8	0.3	55th Warmest	43.4 (1992)	29.5 (1979)	41.3
Central	39.2	0.2	54th Warmest	44.7 (1992)	30.8 (1905)	42.3
East Central	40.4	0.3	55th Coolest	45.6 (1932)	32.7 (1978)	42.9
Southwest	39.8	-0.3	48th Coolest	44.9 (1952)	32.4 (1899)	43.2
South Central	41.9	0.0	47th Coolest	47.6 (1952)	34.7 (1905)	44.9
Southeast	42.4	0.2	48th Coolest	48.4 (1932)	35.3 (1978)	44.0
Statewide	38.7	-0.1	49th Coolest	44.0 (1992)	31.2 (1905)	5441.8??

Winter 2006-2007 Mesonet Extremes

Climate Division	High Temp	Day	Station	Low Temp	Day	Station	High Monthly Rainfall	Station	High Daily Rainfall	Day	Station
Panhandle	78	Feb 28th	Buffalo	-6	Feb 2nd	Kenton	6.19	Arnett	2.66	Dec 29th	Beaver
North Central	79	Feb 28th	Fairview	-1	Feb 16th	Seiling	6.73	Woodward	1.88	Dec 19th	Seiling
Northeast	79	Feb 28th	Burbank	-2	Dec 4th	Nowata	9.19	Inola	1.91	Dec 20th	Vinita
West Central	81	Feb 28th	Retrop	2	Feb 15th	Cheyenne	5.72	Camargo	2.94	Dec 19th	Butler
Central	81	Feb 28th	Ninnekah	2	Feb 16th	Marena	9.34	Okemah	1.78	Dec 20th	Chandler
East Central	77	Feb 20th	McAlester	3	Feb 16th	Cookson	12.42	Cookson	2.71	Dec 29th	McAlester
Southwest	84	Feb 28th	Altus	5	Dec 1st	Mangum	5.54	Medicine Park	1.46	Dec 20th	Hobart
South Central	81	Feb 22nd	Waurika	7	Feb 16th	Vanoss	11.00	Lane	3.75	Dec 29th	Lane
Southeast	79	Feb 20th	Antlers	4	Feb 16th	Wister	12.58	Clayton	4.14	Dec 29th	Hugo
Statewide	84	Feb 28th	Altus	-6	Feb 2nd	Kenton	12.58	Clayton	4.14	Dec 29th	Hugo

AGRICULTURE WEATHER WATCH

BY: Albert Sutherland, CPA, CCA
Mesonet Assistant Extension Specialist
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As this article is being written, growers and agricultural professionals across Oklahoma have begun early damage assessment from the 2007 Easter weekend freeze. The first cold from this freeze arrived in the state during the early hours of Friday, April 6th. Cold temperatures continued on the morning of April 7th and in eastern Oklahoma dropped into the low 20s the morning of April 8th, Easter morning (see air temperature chart for Tahlequah in Figure 1). Damage has been reported on wheat, rye, peaches, grapes, pecans, corn and watermelons.

The areas of Oklahoma with crops most at risk are the locations on the map in Figure 2 with more than two hours of air temperatures at or below 28˚F. In western Oklahoma, these areas are north of Oklahoma Highway 51 that passes through Seiling, Hennessey and Stillwater. After Stillwater, the demarcation of freeze damage lies just to the south of a line from Stillwater to Bristow to Okmulgee to Stigler to Poteau. Damage north of the Stillwater to Poteau line was severe.

From early damage assessments, it appears the hardest hit wheat fields had early maturing varieties or were planted in September. Later maturing varieties or wheat planted in October had far less damage.

Figure 2 - Hours below 28˚F from April 5 to April 9, 2007

The most noticeable wheat injury symptoms were damaged leaves, but while this may be the most notable, it is the least likely to impact yield. One has to open up the individual wheat glumes to look for a big yield buster. If the anthers are whitish or brown, they will not produce pollen. No pollen means no pollination and no grain. Another yield killer comes from split or weakened stems. While heads on some plants came through in good shape, the stem below the head suffered freeze damage. On these plants, stems are split or bent. As the wheat matures and the head gains weight, these damaged stems will break off and fall to the ground. Rye had damage similar to early maturing or September planted wheat.

Statewide the freeze has likely reduced the wheat crop by 10%. Individual fields range from minimal loss in the northwest to essentially a total loss in the northeast. The excellent fields in southwest Oklahoma dodged the cold, but maybe at risk for wheat rust disease due to all of the rain this spring.

Developing peach fruit and grape berries were extremely susceptible to freeze damage. Unless protective measures were taken, these crops in the north central and northeast parts of the state are likely be a total loss. A Porter peach producer used a helicopter to drive warmer air down into one of his orchards. While this “protected” orchard appears to have suffered little damage, other nearby orchards were expected to be a complete loss.

Pecan trees in the northeast also suffered extensive damage. The primary flower bud was frozen and even some secondary buds showed internal discoloration. As with other crops, trees in southern areas are in good shape.

Fields of newly emerged corn in the coldest areas, suffered severe damage. The worst damaged corn was frozen below ground level and will likely be a total loss Growers were weighing their choices between replanting the corn or switching to another crop. Late planted corn runs the risk of low yield due to hot weather during pollination.

While freezing temperatures can kill watermelons outright, long periods of temperatures below 55˚F can greatly reduce plant vigor. This loss of vigor leads to a dramatic drop in production. So like many other growers, watermelon producers are left with trying to estimate how much yield potential is left in their crop and what they should do next.

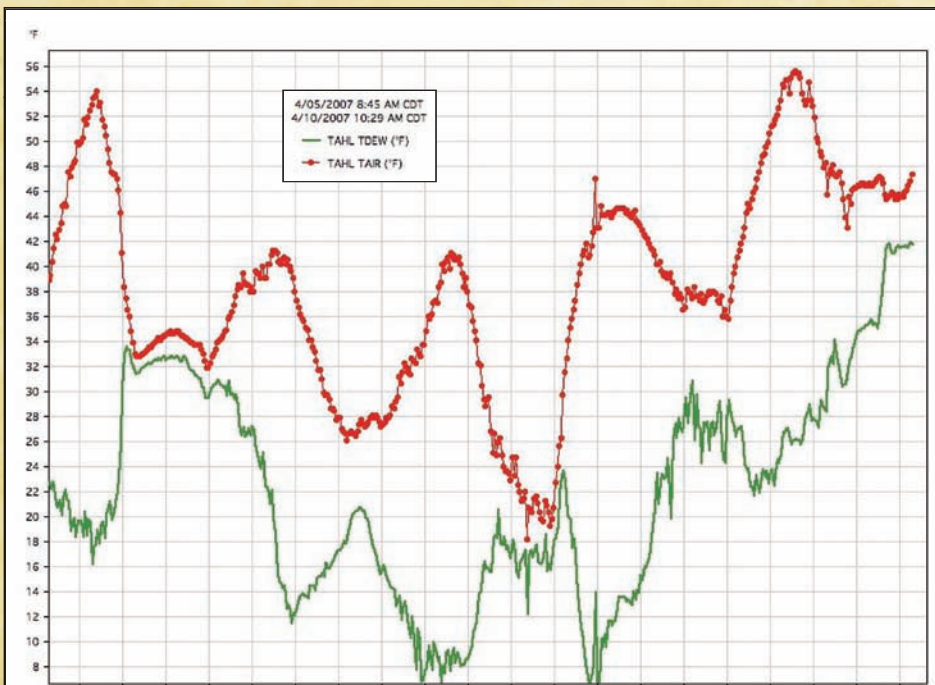


Figure 1 - 1.5m (5 ft) Air Temperature for Tahlequah from April 5 to April 10, 2007.

To access the products mentioned in AgWatch go to Oklahoma AgWeather at **http://agweather.mesonet.org**. Data on the Oklahoma Agweather Web site is from the Oklahoma Mesonet, managed in partnership by the University of Oklahoma and Oklahoma State University and operated by the Oklahoma Climatological Survey.

BY: ALBERT SUTHERLAND, CPA, CCA
MESONET ASSISTANT EXTENSION SPECIALIST
OKLAHOMA STATE UNIVERSITY

MAY

- Early May is a super time to plant all of those heat loving perennials and annuals. These plants like warmer soil temperatures and the warmer May weather. While you're picking out flowering plants at your favorite nursery or garden center, remember to take home some colorful foliage plants, such as caladiums and coleus too.
- Vegetables that do best planted in May (when soil temperatures are close to 70ºF) include okra, southern pea, sweet potato, cantaloupe, and watermelon.
- Bermudagrass will be ready for its second fertilizer application in late May. Consider using a slow release nitrogen product that will give your grass more uniform growth and color, while reducing the risk of nutrient runoff.
- After mid-May, soils have typically warmed up enough to seed bermudagrass or buffalograss.
- After warm-season lawns have "greened-up" and "filled-in," control broadleaf and grassy weeds with the appropriate weed control material.
- Clean out the water garden. Divide and repot water garden plants.

JUNE

- Fertilize turfgrass areas in mid-June. Apply fertilizer ahead of a good rain or before watering lawn areas.
- Control broadleaf lawn weeds with a product containing 2, 4-D hormonal herbicide on days when the air temperature stays below 90°F and the wind will not cause drift to nearby landscape plants. For best results, apply on days following a good rain or watering.
- Control young crabgrass plants with a MSMA product when daytime air temperatures are above 80°F and below 90°F.
- Apply an approved fungicide on tall fescue to control brown patch disease during times of when the nighttime air temperature is consistently above 60°F and the nighttime humidity is above 80%.
- Mulch flower and shrub beds. Use finer mulches around flowers and coarser bark mulches for shrubs and trees. Leave a gap between a plant's main stem or trunk and the mulch.
- Keep an eye out for powdery mildew on ornamental plants and treat as needed.
- Control rose black spot with an approved fungicide.
- Take out weeds while they are still small. The larger the weed the more work it takes to pull or cut.
- Apply an approved fungicide for the pine needle blight disease, Dothistroma Needle Blight.
- Check plants for sucking insect pests and treat as needed.

JULY

- Water, water, water.
- Control lawn white grubs with an approved insect growth hormone or systemic insecticide product.
- July is a good time for light to moderate pruning of ornamental trees and pines. The July heat helps reduce sap flow from branch cuts. Make your pruning cuts on the branch side of the branch collar to hasten callus growth over the cut surfaces.
- Continue treatments for rose black spot with an approved fungicide.
- Check plants for spider mites and treat before populations get too high.
- Divide and replant hybrid iris.
- Harvest garden vegetables in the morning, the coolest time of the day.
- Prepare and plant the fall vegetable garden. This is the month to plant frost sensitive vegetables, such as sweet corn, cilantro, pepper, and summer squash.

CLASSROOM ACTIVITY [Severe Winds]

Not all severe thunderstorm winds are caused by tornadoes. "Straight-line" thunderstorm winds can also cause widespread damage and occasional fatalities. Damaging wind from thunderstorms is much more common than tornadoes. In fact, many people mistakenly blame tornadoes for the damage caused by these "straight-line" winds.

July 1-5, 2005 was a perfect example of non-tornadic damage, beginning with the overturning and sinking of a boat on Tom Steed Lake in Kiowa County on the 2nd. Winds from 60-80 mph were reported in many areas on the 4th, peaking with a 102 mph wind gust at Blackwell. Widespread wind damage was reported with these storms, including downed power lines, tree damage, and damage to structures. A brick storage building and several car ports were destroyed in Braman, and roofs were blown off in Blackwell. The police station's antenna in Blackwell was another casualty for the storms.

Table 1 - Wind Gusts (70 mph or greater) for July 2005

Speed in mph	Location	County	Day
71	Elmwood, OK	Beaver	1
70	Hooker, OK	Texas	1
70	Near Bessie, OK	Washita	1
71	Near Kaw City, OK	Kay	3
70	Near Milfay, OK	Creek	4
72	Near Minco, OK	Grady	4
75	Near Minco, OK	Grady	4
70	Near Blackwell, OK	Kay	4
71	Ponca City, OK	Kay	4
71	Ponca City, OK	Kay	4
78	Ponca City, OK	Kay	4
80	Blackwell, OK	Kay	4
102	Blackwell, OK	Kay	4
75	Near Meno, OK	Major	4
81	Near Meno, OK	Major	4

Figure 1 - Oklahoma Counties

CLASSROOM QUESTIONS [Severe Winds]

Use the data from the chart on the previous page to answer the following questions.

1. Highlight on the map (Figure 1), the counties where winds greater than or equal to (≥) 70 mph occurred.
2. What is the mean of the wind gusts shown in Table 1?
3. What is the median of the wind gusts shown in Table 1?
4. What is the mode of the wind gusts shown in Table 1?
5. Draw the frequency histogram for the wind gusts listed above.
6. An outlier is a value that is either much lower or much higher than all the other data values. Are there any outliers in the wind gust data? List the outliers.
7. If the 102 mph value were removed from the set of data above, how is the mean affected?
8. Which method (mean, median, or mode) best describes the data set in Table 1? Why?

SPRING TORNADOES & ENSO

...Is there a connection?

Ashton Robinson Cook: Storm Prediction Center SCEP student

Photo by Mark Shafer

Spring can be the most violent season for Oklahoma weather. With spring in full swing, Oklahomans may be wondering about the prospects of the upcoming tornado season and whether El Nino or La Nina can increase or decrease probabilities of a tornado in an area.

El Nino and La Nina are part of a more complex climate system termed El Nino Southern Oscillation (ENSO). This climate phenomenon is driven by abnormal sea surface temperatures in the equatorial Pacific, with shifts in weather around the entire world attributed to ENSO. El Nino is the warm phase of this climate phenomenon, denoted by abnormally warm sea surface temperatures. La Nina is the opposite; it involves significantly cooler than average sea surface temperatures in the region. The third ENSO phase, Neutral, indicates sea surface temperatures that are near the climatologically normal level.

ENSO has its most pronounced effects on U.S. weather during the winter months. In a winter El Nino, warming of the equatorial sea surface temperatures forces a

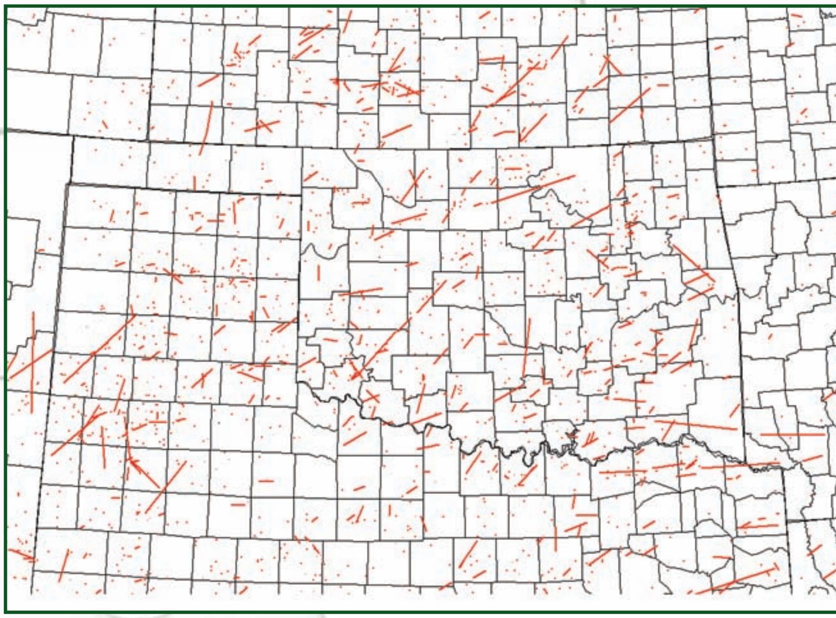


Figure 1: Oklahoma Tornadoes during the EN phase. Graphic created using Severe Plot v. 2.0 (Hart and Janish 1999)

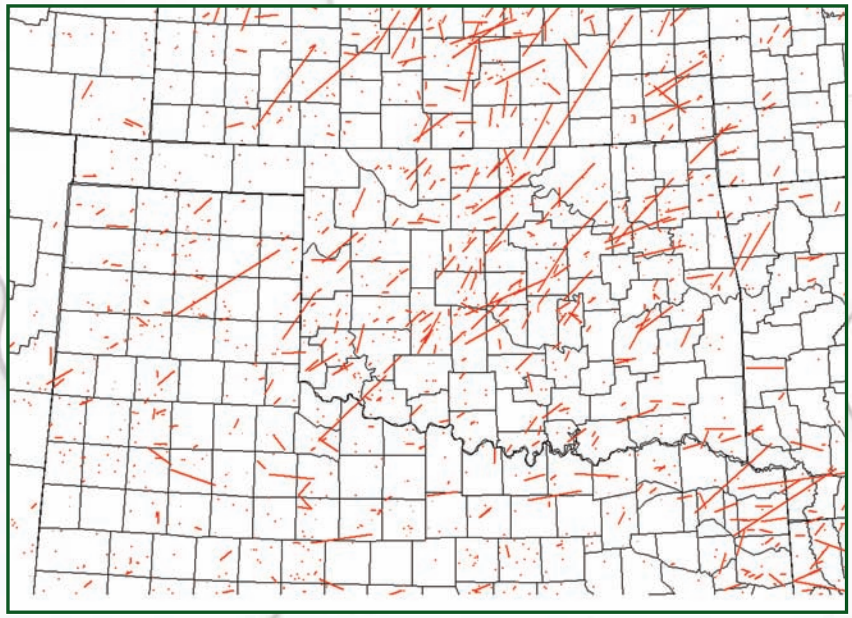


Figure 2: Oklahoma tornadoes during the LN phase. Graphic created using Severe Plot v. 2.0 (Hart and Janish 1999)

stronger than average subtropical jet to develop across the southern tier of the U.S. The jet tends to bring cooler, wetter conditions to the southern tier of states, including Oklahoma. In contrast, winter La Nina conditions tend to diminish the presence of the subtropical jet and displace it farther to the north. Generally, this results in drier, warmer conditions in Oklahoma. Although the effects are less clear during the spring months, cooler and wetter conditions generally prevail throughout the spring in El Nino months, with drier conditions noted during La Nina and Neutral months.

So are there similar shifts noted in spring tornado activity?

There is very little evidence that ENSO is responsible for shifts in spring tornado activity in Oklahoma. A brief analysis of tornadoes occurring in Oklahoma during spring and early summer (April, May, and June) between 1950 and 2005 reveals only very small shifts in tornadic activity across the state. Figures 1 and 2 indicate that some of the tornadoes during the La Nina phase seem to have longer tracks compared to tornadoes in El Nino phase events, especially across central and northern Oklahoma. Although the shift is evident, it is not very pronounced. Tornadoes occur in all parts of the state regardless of ENSO phase. In addition, it is difficult to determine a solid meteorological basis for this shift as distinct shifts in weather patterns (such as the climatological positions of jet streams, fronts, and drylines) during the spring months have not been determined.

A further analysis reveals that stronger tornadoes (rated F2 or higher in the Fujita Scale) occur slightly more frequently in the La Nina phase of ENSO (30.9%) compared to the El Nino phase (21.6%). While strong tornadoes are also a more frequent occurrence in Neutral phases (29.6%), it is difficult to draw valuable comparisons between Neutral ENSO phases and others because the Neutral phase occurs nearly twice as often (28 spring seasons) as both El Nino (13 spring seasons) and La Nina phases (15 spring seasons). As expected, the Neutral phase contains nearly double the tornadoes (1015) that either the La Nina (525) or El Nino phase (547) contains,

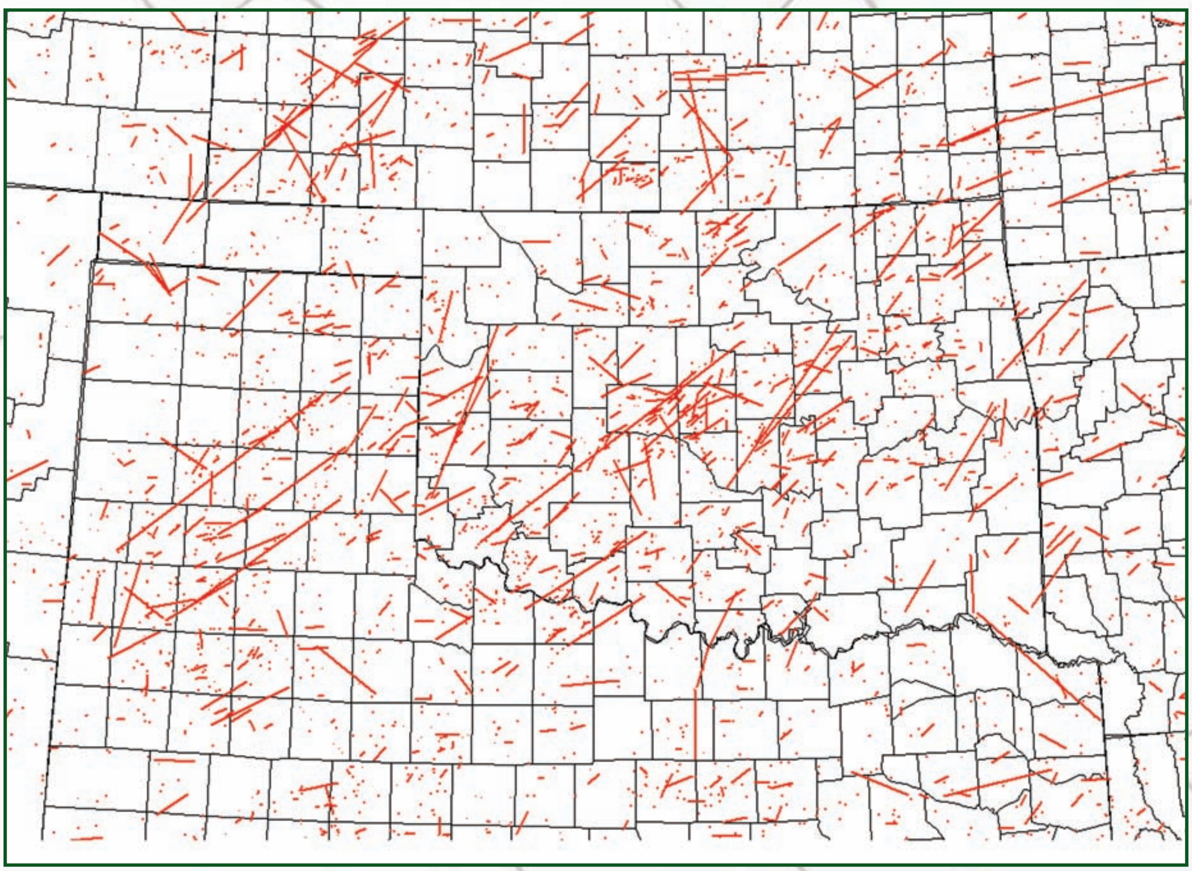


Figure 3: **Oklahoma tornadoes during the N phase. Graphic created using Severe Plot v. 2.0 (Hart and Janish 1999)**

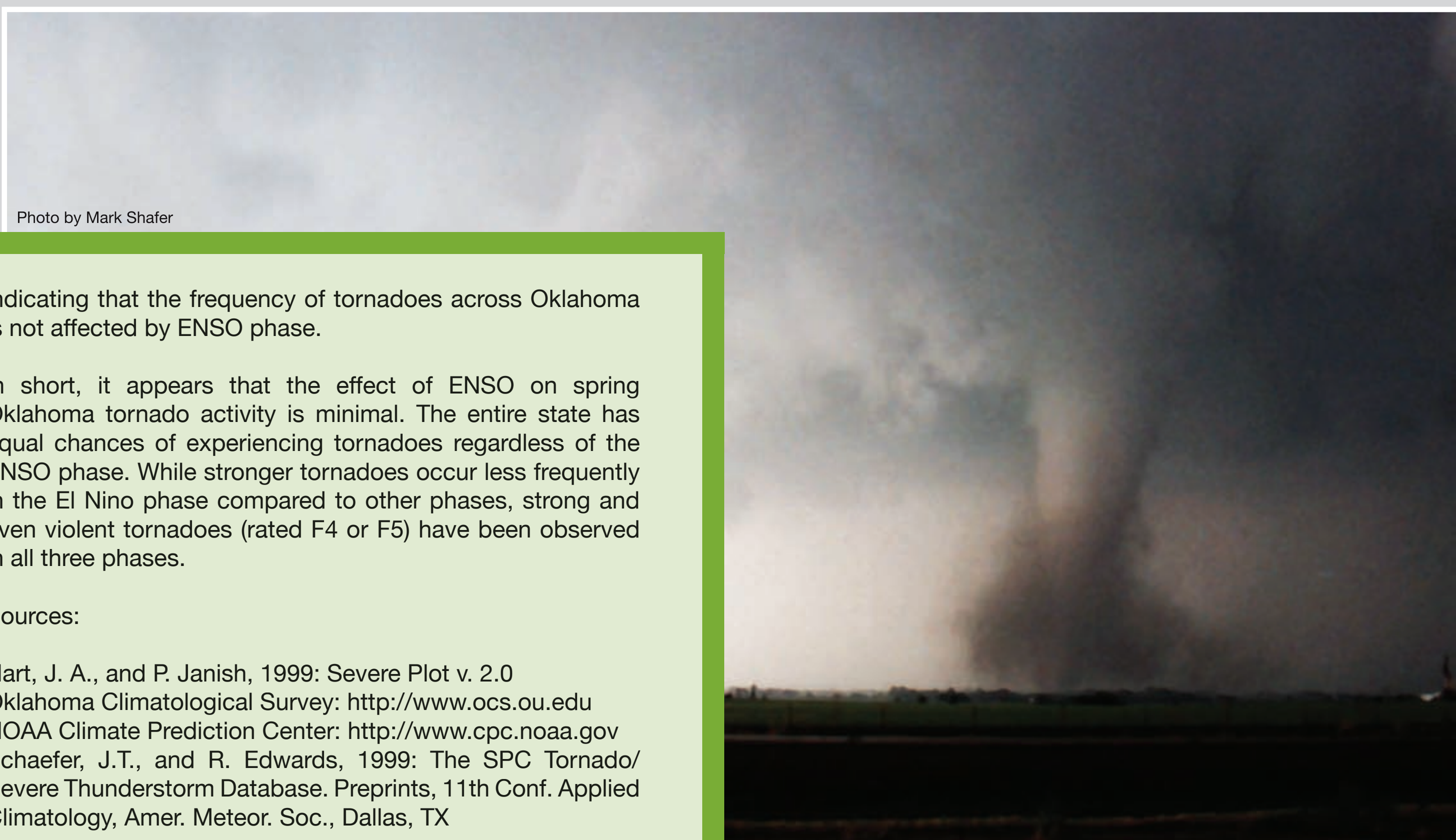


Photo by Mark Shafer

indicating that the frequency of tornadoes across Oklahoma is not affected by ENSO phase.

In short, it appears that the effect of ENSO on spring Oklahoma tornado activity is minimal. The entire state has equal chances of experiencing tornadoes regardless of the ENSO phase. While stronger tornadoes occur less frequently in the El Nino phase compared to other phases, strong and even violent tornadoes (rated F4 or F5) have been observed in all three phases.

Sources:

Hart, J. A., and P. Janish, 1999: Severe Plot v. 2.0
Oklahoma Climatological Survey: http://www.ocs.ou.edu
NOAA Climate Prediction Center: http://www.cpc.noaa.gov
Schaefer, J.T., and R. Edwards, 1999: The SPC Tornado/Severe Thunderstorm Database. Preprints, 11th Conf. Applied Climatology, Amer. Meteor. Soc., Dallas, TX

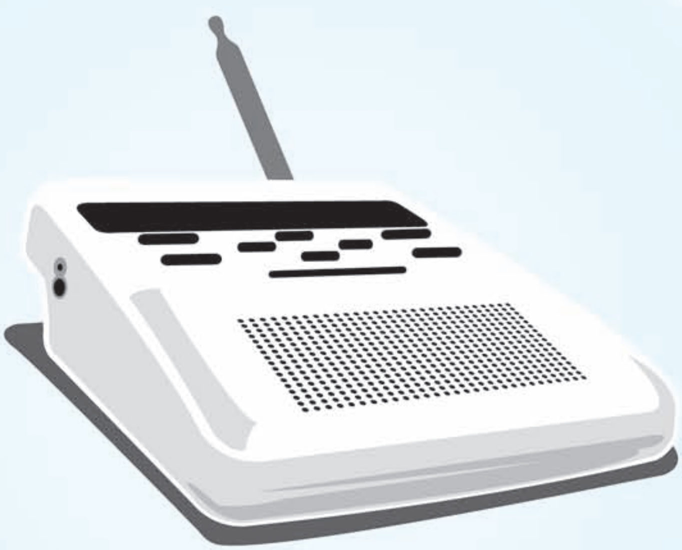
Did you know that the latest generation of weather radios can be programmed to filter out warnings and statements from distant counties?

For years, NOAA Weather Radio (NWR) network has informed listeners about developing weather situations. However, one of the very few knocks on the system was the annoyance of being “alerted” for weather events occurring many miles away. For example, the NWR transmitter in Enid broadcasts warnings for seven counties, including Logan and Woodward. The people of Logan County have nothing against Woodward County’s dwellers, but they don’t like waking up to Woodward County warnings!

Technology has offered a solution to this situation. Today’s weather radios often feature county-by-county specification called SAME (Specific Area Message Encoding). This protocol allows users to program specific “alert me” counties into their weather radios. Many models allow multiple counties, and some even allow the user to program for specific alerts! The technology also allows the reception of many EAS alerts, such as civil emergencies or Amber Alerts.

In order to receive county-specific alerts in Oklahoma, you’ll need a SAME-enabled weather radio, available at many retailers of electronic products. To program your SAME weather radio, a six digit number is required to identify your location (in Oklahoma, each county has its own SAME code). We’ve listed these codes below. Consult the manufacturer’s guides for specific instructions on how to program your SAME-enabled radio.

Much more information is available from the National Weather Service, at http://www.weather.gov/nwr/



List of County-specific SAME codes

County	SAME Code
Adair	040001
Alfalfa	040003
Atoka	040005
Beaver	040007
Beckham	040009
Blaine	040011
Bryan	040013
Caddo	040015
Canadian	040017
Carter	040019
Cherokee	040021
Choctaw	040023
Cimarron	040025
Cleveland	040027
Coal	040029
Comanche	040031
Cotton	040033
Craig	040035
Creek	040037
Custer	040039
Delaware	040041
Dewey	040043
Ellis	040045
Garfield	040047
Garvin	040049
Grady	040051
Grant	040053
Greer	040055
Harmon	040057
Harper	040059
Haskell	040061
Hughes	040063
Jackson	040065
Jefferson	040067
Johnston	040069
Kay	040071
Kingfisher	040073
Kiowa	040075
Latimer	040077
Le Flore	040079
Lincoln	040081
Logan	040083
Love	040085
McClain	040087
McCurtain	040089
McIntosh	040091
Major	040093
Marshall	040095
Mayes	040097
Murray	040099
Muskogee	040101
Noble	040103
Nowata	040105
Okfuskee	040107
Oklahoma	040109
Okmulgee	040111
Osage	040113
Ottawa	040115
Pawnee	040117
Payne	040119
Pittsburg	040121
Pontotoc	040123
Pottawatomie	040125
Pushmataha	040127
Roger Mills	040129
Rogers	040131
Seminole	040133
Sequoyah	040135
Stephens	040137
Texas	040139
Tillman	040141
Tulsa	040143
Wagoner	040145
Washington	040147
Washita	040149
Woods	040151
Woodward	040153

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