SUMMER 2008

OKLAHOMA CLIMATE

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The October 1923 Oklahoma City Floods

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Oklahoma Climate
Summer 2008

Cover Illustration: by Ryan Davis.
If you have a photo or illustration that you would like to be considered for the cover of Oklahoma Climate, please contact:

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The Oklahoma Climatological Survey is the State Climate Office for Oklahoma

MESSAGE FROM THE EDITOR

Gary McManus

As a lot of Oklahomans and tourists alike, I enjoy a nice visit to Bricktown in downtown Oklahoma City (also known simply as "the City" by Oklahomans). As a movie buff, I like to wander the canal area to find something to eat at one of the many restaurants lining its banks before taking in a movie at the local theatre. And the current entertainment district along the river was not even the first attempt at such a venue. Back at the beginning of the 20th century, there was a Coney Island style amusement park, Delmar Garden, near present-day Bricktown. It eventually succumbed to three mighty foes: Prohibition, mosquitoes, and the featured performer of our historical perspective article...the North Canadian River. Most folks that visit Bricktown probably have no idea that the river was once – and often – a major source of misery for early Oklahoma City dwellers. In fact, that area seemed to get more major floods than Moore gets tornadoes. Our historical perspective for this issue takes a look at the flood events of October 1923; the one that re-wrote the history books and changed the face of Oklahoma City forever.

Also in this issue we look back at the Panhandle "Dust Bowl" drought of 2008. Wait, 2008? Unfortunately, that title is correct. The western Panhandle suffered one of its driest periods on record from the summer of 2007 to the summer of 2008, prompting even hard-nosed "Dirty Thirties" survivors to say "Wow, we are dry!" Another feature articles focuses on a new website of the Oklahoma Mesonet designed specifically for Oklahoma's agricultural community (all uses or Mesonet data will enjoy the website, however). Our last feature article in this issue chronicles a very strange but somewhat frequent meteorological visitor to our state, the heatburst.

Our classroom exercise allows students to explore why all cities along our latitude line don't share the exact same weather; blame the oceans! In addition, be sure to read our regular features, including: an interview with a National Weather Center scientist, an agricultural weather summary, the Urban Farmer, a weather safety article, and a climate 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@mesonet.org.

Gary McManus – Editor

OKLAHOMA CLIMATOLOGICAL SURVEY

FLOOD of FLOODS

The October 1923 Oklahoma City Floods

by: Gary McManus, Assistant State Climatologist

The North Canadian River begins as a trickle in the high plateau region of the Sangre de Cristo Mountains in northeastern New Mexico. Fed by snowmelt, it slowly meanders its way through the High Plains of the Texas and Oklahoma panhandles into east central Oklahoma where it empties into Lake Eufaula. A small stretch of the North Canadian that intersects downtown Oklahoma City, about 7 miles worth, was renamed "The Oklahoma River" as part of an economic revitalization package. Now an entertainment district, the area is dammed and rimmed by landscaping, trails and restaurants. Canal tours by gondola are also offered on the tranquil stretch of water. The Oklahoma River has been quite a success, serving as the centerpiece of a rejuvenated downtown Oklahoma City. This is not the first time that the North Canadian has had such an impact on Oklahoma City, however. Long before the restaurants and apartment buildings of today, the river ran unchallenged though the state's capitol city. Flooding was common, and in October 1923, the biggest of those floods forever changed the face of Oklahoma City.

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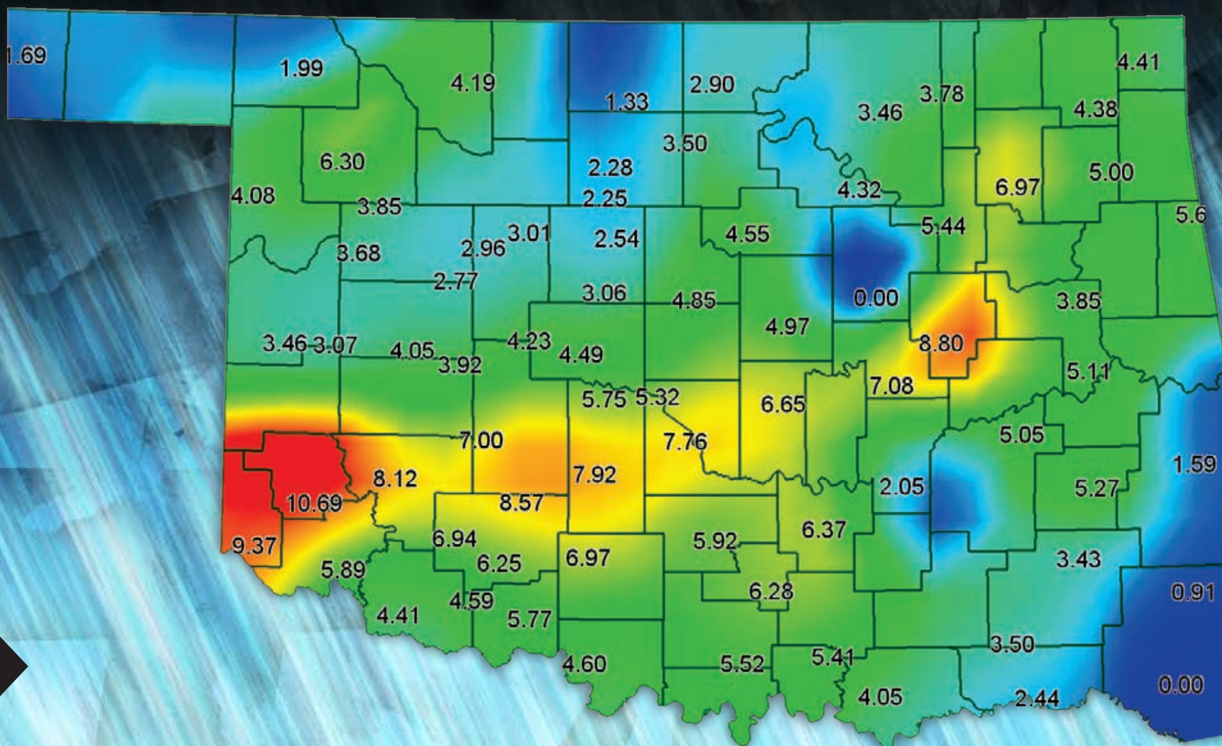

Figure 1: Oklahoma rainfall totals from October 11-15, 1923.

Creating the Flood

The North Canadian is not exactly the Mississippi. A canoe trip down the river would result in more walking than rowing more often than not. However, when heavy rains fall in its watershed, the river can roar to life. The conditions which laid the foundation for the Oklahoma City floods of October 1923 actually began in the weeks and months leading up to the event. Heavy rains had pounded the river's drainage basin in northwestern Oklahoma throughout the first nine months of the year. Major flood events had already occurred in May, June and September. The June flood had already claimed the lives of nearly all the animals of the Oklahoma City Zoo, which was then located at the Fair Park near N.E. 10th and Eastern. Woodward received more than 12 inches of rain in September and another 5 inches during the first week of October. That 18 inches, and similar amounts, across northwest Oklahoma left soils saturated. The additional rains that fell ran quickly into the tributaries and streams which fed the North Canadian. Each new round of heavy rains sent another surge of water down the river, repeatedly inundating flood prone areas.

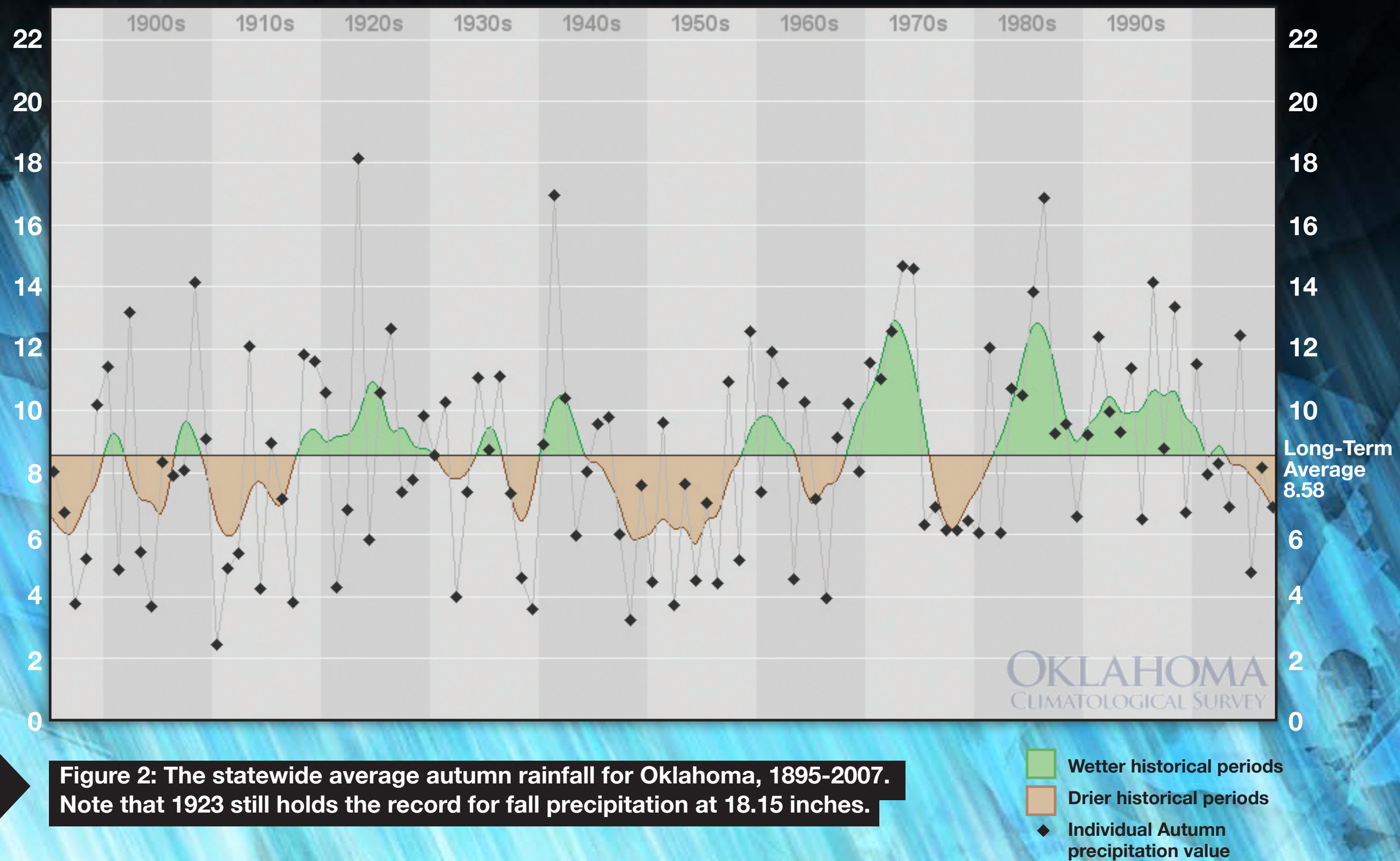

Figure 2: The statewide average autumn rainfall for Oklahoma, 1895-2007. Note that 1923 still holds the record for fall precipitation at 18.15 inches.

Escalating Events

Areas along the river downstream of northwestern Oklahoma awaited another surge of water on the fifth of October. The river rose steadily in Canton and El Reno, and debris from upstream was threatening railroad bridges, still the main transportation industry at that time. The river rose 6 inches in 5 hours on the sixth. The Ringling Brothers circus was set up at Western and Reno and had to suspend operations. A larger surge was still expected on the seventh or eighth. More rains on the seventh added to the coming surge of water. Train service across the entire state was already hampered due to the North Canadian flooding, as well as floods occurring on the South Canadian and Cimarron rivers. The surge finally arrived at the Lake Overholser dam on the ninth. The crest was about 14 feet, still a couple of feet short of the monster June flood which struck Oklahoma City. Wheeler Park was submerged under 6-12 feet of water, and it was noted in news reports that "only buffalo and waterfowl remained". The buffalo were the last remnants of the Oklahoma City Zoo which was flooded during June. The second surge of water arrived on the 11th, but little additional flooding occurred in relative to the flood of the previous day.

The flooding seemed to abate after that, and Oklahoma City residents prayed for a respite from the invading waters. That sanctuary was short-lived, however, when 4 inches of rain fell at Woodward on the 12th. To make matters worse, another 2 inches fell on the 13th. That round of precipitation brought the river at Woodward to a then-record height. All bridges in the western portions of the state were reportedly gone, victims of the raging rivers. Towns in northwestern Oklahoma were cut off from outside contact. The river was roaring over the riverbanks in Seiling. Many of the towns in that section of the state were left with semi-famine conditions. The first word from Woodward concerned food shortages and a destroyed water supply. A run on the local bank closed it with the loss of any outside money. Oklahoma City could only monitor the sporadic news from the northwest and await its fate.

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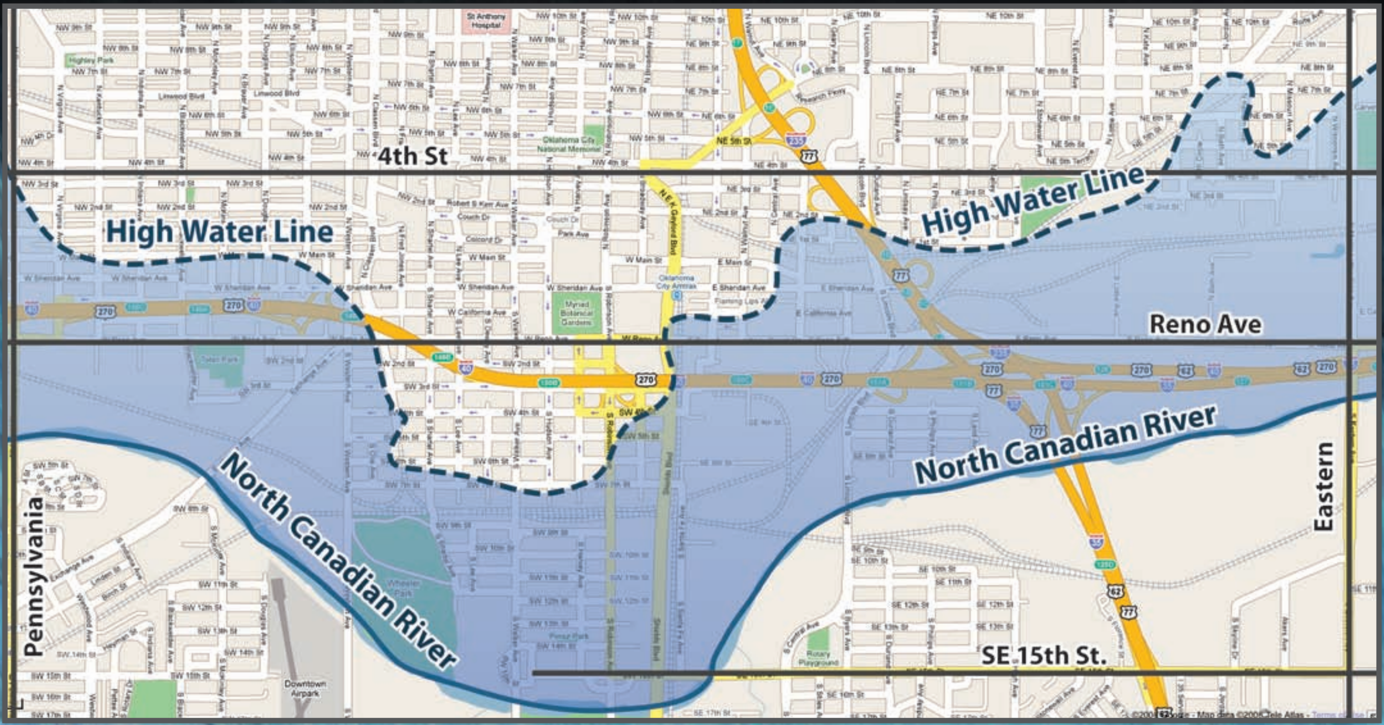

The high water line of the North Canadian River at the height of the flood on October 16, 1923.

© Google Maps Data

The Flood of Floods

By the 14th, the river had begun to recede in the northwest, but the worst was yet to come for Oklahoma City. The news spread amongst fearful residents as fast as the water approached, a record flood was headed their way. Officials tried to prepare for the disaster. With society still segregated, whites in flood-prone areas were to report to relief camps run by the Salvation Army and the Red Cross, while blacks were assigned to the Presbyterian Church. The river rose 5 feet in 25 minutes at Canton on the 15th before eventually cresting at a record height. The river was 7 miles wide at Geary and 5 feet above its previously recorded high. Residents in the Oklahoma City lowlands began to flee to higher ground. The waterworks dam at Overholser was still believed to be safe, however, as it had been steadily reinforced over several weeks. By the 16th, the worst was realized. The Overholser dam was breached with ease and a wall of water 25 feet high roared towards downtown Oklahoma City. Sirens were sounded at the dam in warning and residents clogged the streets ahead of the torrent with their belongings. The river could be heard for many miles. Mayor Otto Cargill ordered the evacuation of 117 city blocks south of Grand Avenue. More than 15,000 residents had to seek higher ground. The water spread throughout the lowlands of Oklahoma City before heading to the southeast.

After the waters had receded, the flood left nearly $3 million (1923 dollars) in damage in Oklahoma City alone. A milk famine was feared as the areas dairies had to cease operation. Mail was carried by plane to keep news flowing. About 1,000 residents remained in refugee camps for up to a week and airplanes began arriving with milk on the 18th. The Oklahoma State Fair eventually relocated from N.E. 10th and Eastern to its present-day location near N.W. 10th and May Ave. The zoo found a new home near Lincoln Park in northeast Oklahoma City.

Flood control dams built in the 1930s and 1940s would eventually tame the irascible river, but not before it had transformed Oklahoma's capital city. This flood eventually led to a radical redistribution of housing patterns in Oklahoma City as higher income families moved northward, away from the river and its terrible legacy. Now, the serene Oklahoma River graces downtown, a tourist attraction for thousands each week who flock to the restaurants and entertainment venues along its manicured banks. Few of those visitors know the history of the river, however, and the days in which it raged uncontrolled through the lives of Oklahoma City residents.

Note: Much of the information contained in this story was obtained from the archives of the Daily Oklahoman.

A Return to the Dust Bowl

The Oklahoma Panhandle Drought of 2007-08

By Gary McManus - Assistant State Climatologist for Oklahoma

The Oklahoma Panhandle is not known for its green landscapes, of course, being part of the semi-arid High Plains climate system. Its shortgrass prairie, however – mostly buffalo grass – has sustained a robust cattle industry for more than a century. Irrigation from the Ogallala aquifer supplements normal precipitation to mark the region as an important part of the Oklahoma wheat and corn industry. Generations of farmers and ranchers have endured hard times just as they've enjoyed good times, working the land to earn a living. Commodity prices have never been higher, but skyrocketing costs of feed, seed and fuel have countered any financial bounty. With margins for error already razor-thin, complications from Mother Nature are not welcomed, yet that is exactly what occurred.

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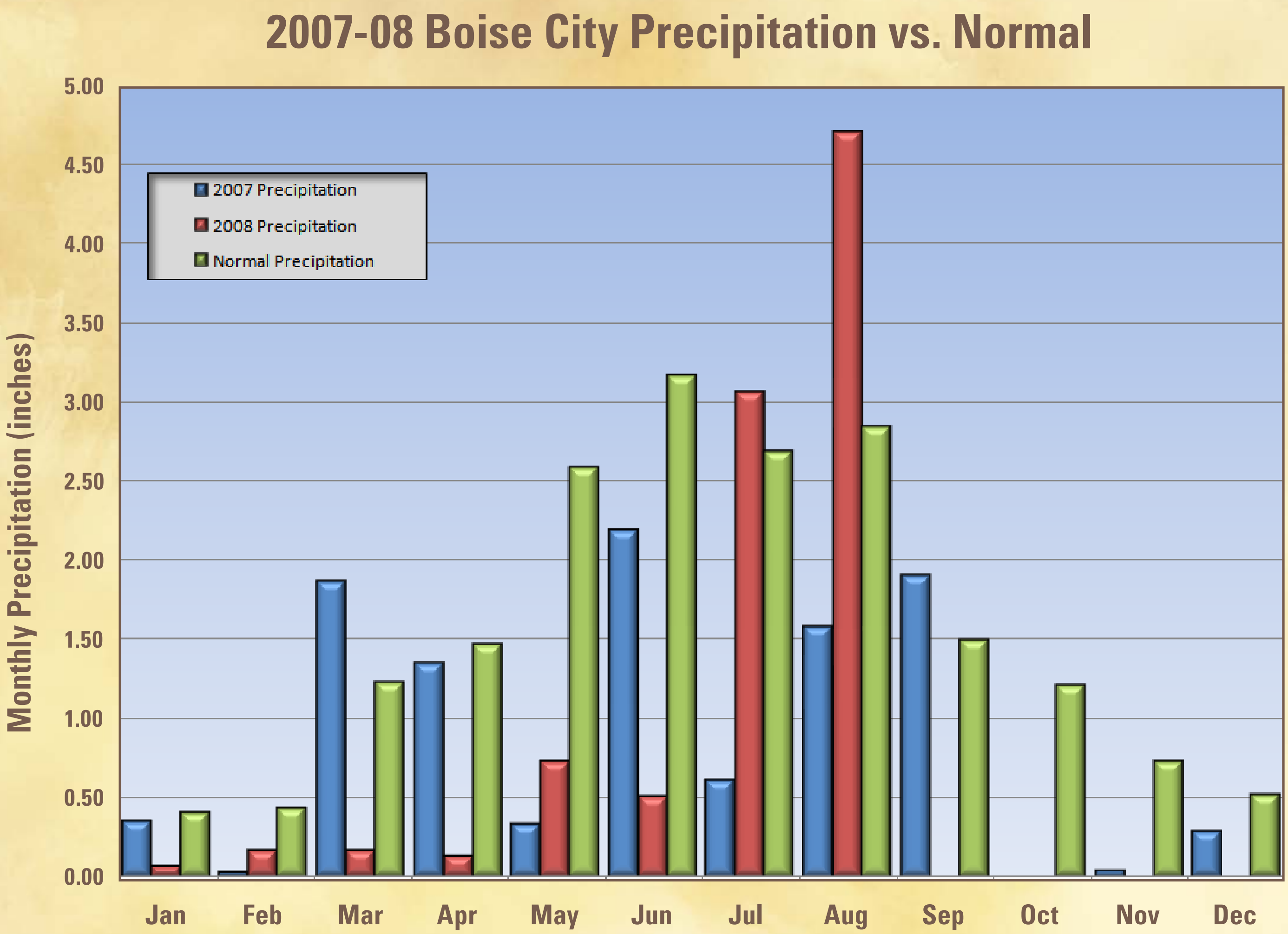
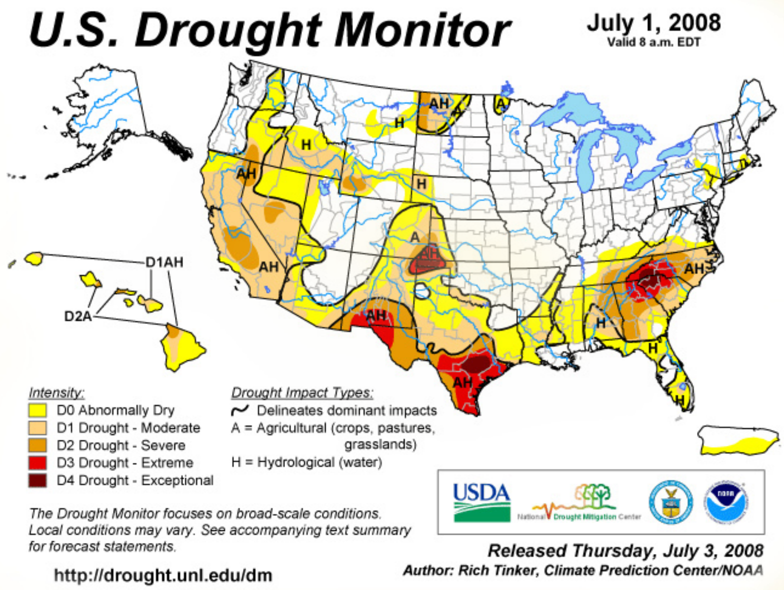


The monthly rainfall recorded by the Boise City Mesonet site during 2007 and 2008.
Normal (1971-2000) Boise City monthly rainfall totals also indicated.

While much of Oklahoma endured flooding and record rains during the past couple of years, the western half of the Oklahoma Panhandle was revisiting one of the world's most famous environmental disasters – The Dust Bowl. The dry times for the region actually began at the turn of the millennium. Despite a few rainy recovery periods in between, the droughty conditions were punctuated with a catastrophic drought that, according to long-time Panhandle residents, harkened back to the dry conditions of the "Dirty Thirties".

The face of the western Panhandle never really greened during the warm months of 2008 as what little moisture present was leeched from the soil by strong winds and heat. The worst of the drought conditions were concentrated in Cimarron County. The Oklahoma Mesonet site at Boise City recorded 1.72 inches of precipitation from January through June, a deficit of over 7 inches and their driest such period on record. Add that to last year's deficit of 8.24 inches and the shortfall grows to more than 15 inches below normal. Nearly 8 inches of rain fell during July and August, relieving the moisture deficit somewhat and giving hope that feed and wheat crops could be planted once again.



The depiction of drought intensity on July 1, 2008, at the height of the drought by the U.S. Drought Monitor (http://www.drought.unl.edu/dm/monitor.html).

Boise City Rainfall Totals
for Various Periods During the 2007-08 Drought
including normal (1971-2000) totals and departures

	Jan-Jun, 2008	Oct 2007-Jun 2008	Jan 2007 – Jun 2008
Rainfall (inches)	1.70	2.00	12.2
Normal Rainfall (inches)	9.25	12.08	27.94
Departure (inches)	-7.55	-10.08	-15.74

Not known for hyperbole, long-time Cimarron County residents agreed that the dryness rivaled the parched conditions of the Dust Bowl. The soil turned to powder and started to blow in places, much like during the "Dirty Thirties". The terrible yet magnificent dust storms of that period did not occur, however, which stands as a true testament to the farmers, ranchers and soil conservationists in the area. Some sacrifice for the good of others and the land, selling herds of cattle to prevent overgrazing. Others practice no-till farming methods which leave soil-saving residue on fields after harvest. Through these methods, the agricultural community has helped save what soil they can and acted as good stewards of the land.

Even with conservation efforts, the soil suffered terrible erosion from winds which have gusted to 70 mph at times. Those winds scoured fields down to the hardpan beneath the soil, leaving a rock hard surface in place to be baked by the sun. Other fields have had their soils turn to fine sugar sand which has the consistency of its namesake. Wheat is sheared off at the base by the wind-driven sand. Buffalo grass is left in clumps on plateaus of soil, exposing the roots and quickening the death of the hardy plants.

By the time significant rains returned to the Panhandle at the end of the 2008 summer season, the devastation was complete. Nearly two years of agricultural activity and income were lost and residents were left with the hopeful yet tired refrain of "maybe next year will be better."

Interview with Dr. Suzanne Van Cooten

By Phil Browder

“She’s a talker.”

That was the first answer I was given by a handful of Dr. Suzanne Van Cooten’s colleagues at the National Weather Center in Norman when I asked them about her. Of course other adjectives soon followed, such as “open”, and “gracious”, but it was her loquacious nature that was repeated by many. After speaking with her myself, I’d have to say I happily agree with the masses: Suzanne Van Cooten is open, and graciously talkative.

For nearly two decades, Dr. Van Cooten, a research hydrometeorologist with the National Severe Storms Laboratory (NSSL), has combined a love of weather, and of people, into an impressive career that has taken this Oklahoma girl around the country. “Weather impacts everything you do”, Dr. Van Cooten says. “There’s not one thing that weather does not impact in our daily lives. The issue is how do you use that info to help people?” The topic of “helping people” would resurface time and time again in our forty-five minute conversation, and every time it did, Suzanne would light up. A sparkle would enter her eyes, and her speech would quicken just a bit, as if she couldn’t wait to discuss the matter further. “We are at such a nexus of so many different fields,” Suzanne says of the National Weather Center in Norman, OK. “We have a real opportunity to start connecting those d ots. And if we can start connecting those dots to make informed decisions, then we’re able to set a foundation. We’re not reactive anymore, we’re proactive”.

The first dot in Suzanne’s long chain of connections came on February 15, 1968, during a brutal snowstorm that covered central Oklahoma, including Oklahoma City. Oh, and did I mention it also happened to be Suzanne’s birthday? “I was actually born in what I understand is one of the heaviest snowfalls ever recorded in Oklahoma City history. Actually, we had to wait a little longer at Oklahoma City Hospital [before we could go home.]” While growing up in Oklahoma City, and then in Norman, OK, Mother Nature put on quite a show for young Suzanne and her family. By the age of seven, Suzanne says she had experienced everything from tornadoes that “made her ears pop” to dust storms that would “turn the sky so dark the street light would come on. There was that red, eerie orange glow. It was just insane.”

“Water isn’t a resource anymore, it’s a commodity. We see that in Oklahoma now, and it’s only getting bigger.”

With such a wild beginning, you may think it’s no wonder she chose a career in weather. However, Suzanne began her career at the University of Oklahoma on scholarship for electrical engineering and music performance. Along with her excellence in academics and first chair status as a cellist, she also excelled at multiple sports in high school, including basketball and soccer. “Sports, music, academics: I’ve always liked all of them. I’ve always been a very eclectic mix”. In fact, she credits the relationships she forged while pursing her various interests with much of her career success. “It was a matter of, ‘how do you communicate to varied groups and varied audiences?’ because I had friends that ran the gambit.” While attending OU, Suzanne was met with resistance in electrical engineering, not because of her schoolwork, but because of her gender.

“First, you’re just angry. Second, you’re in denial—‘how could they be so stupid?’ Third, is ‘should I really be here?’”

Fortunately, and true to form, Suzanne turned opposition into motivation, and decided to wrap her love of math, science, and the weather into one by transferring to the meteorology department at OU. She quickly flourished, and graduated in May of 1991 with a Bachelor of Science degree in meteorology. Soon after, Suzanne was recruited to work for the National Weather Service (NWS) Forecast Office in Stephenville, Texas. From there, she moved to New Orleans, LA, where she acted as a hydrometeorological support forecaster, a career move that proved to have the added benefit of introducing her to a different field of study. Says Suzanne, “That [job] gave me hydrology experience that I didn’t even know I enjoyed!” She enjoyed her experience so much, in fact, she decided to pursue Masters and PhD degrees in hydrologic sciences at the University of New Orleans. “It’s a nice interface with meteorology,” Suzanne recalls thinking at the time. “It’s hydrology, it’s civil engineering, it’s GIS (Geographic Information Systems). So, let’s do that!” When it was all said and done, after nine years in New Orleans, Suzanne graduated with a Masters of Science degree in civil and environmental engineering, and a PhD in engineering and applied sciences.

After serving as Chief Scientist with the National Data Buoy Center, Suzanne returned to the Sooner State to work for NSSL, and is also currently serving as the National Sea Grant Climate Extension Specialist for the Cooperative Institute for Mesoscale Meteorological Studies (CIMMS). Her current work lies with the Inland Sea Grant, which studies the impacts on high rainfall rates and flash flooding in coastal zones during land falling hurricanes. Suzanne works as a liaison between NSSL and coastal researchers, helping to funnel information on impending hurricanes and their associated downpours from “a national laboratory, to an area, to a county, and finally, to a neighborhood.” In the end, Suzanne says it’s a matter putting the best, most current information in the hands of those who need it most. “You get this conduit of communication going of what’s going on in the lab transferred out to the people that are actually working in the coastal zone.”

When asked what the future holds for Oklahoma, Suzanne wastes no time summing it up in two words: water conservation. “Water isn’t a resource anymore, it’s a commodity. We see that in Oklahoma now, and it’s only getting bigger”. Despite plenty of doom-and-gloom reports on water and its forecasted shortages across the southwestern United States, Suzanne says Oklahoma can not only rise to the occasion, but can also be a model for the rest of the region because of the unique weather emphasis we have here. “It’s the whole continuum,” Suzanne says, “from the research, to the social scientists, plus all of those varied agencies inside that. You don’t have that anywhere else in the country.” Suzanne points to organizations like OU, Oklahoma State University, the Oklahoma Climatological Survey, NSSL, and the Oklahoma Water Resources Board as leaders in her home state that can help Oklahoma set an example of how taking action before a water crisis occurs can help erase the mistakes of the past, when poor conservation techniques led to one of Oklahoma’s most lasting memories. “Let’s face it, we have everything to lose. As a state, our water legacy is the Dust Bowl! What a tremendous opportunity and a story it would be!” An opportunity, Suzanne says, we can’t afford to pass up. “If we can’t set this model of how we are going to work past this, I don’t think anywhere else is going to be able to.”

AGWEATHER

New Agweather - Better Agricultural Service

Oklahoma Agweather was built around the concept of providing agriculture and natural resource management producers and professionals online weather tools needed to move from calendar-based management to weather-based management. The Agweather Web site, http://agweather.mesonet.org, does this by providing information and products grouped by weather interest and farm commodity group.

Products and information directly related to weather are broken into five groups. Each of these is a tab in the top "always present" main menu. Products directly related to livestock, crop, horticulture, rangeland and forest management are the last four top menu tabs.

by Albert Sutherland, CPH, CCA
Mesonet Agriculture Program Coordinator

WEATHER

Under "Weather" users have access to weather data for a variety of recorded and calculated weather variables. Weather variables include: air temperature, rainfall, wind, relative humidity, air pressure, dispersion, inversion and sunlight. Weather data for this section comes from the Oklahoma Mesonet network, an automated weather monitoring system with 120 tower locations across the state of Oklahoma that send in new data every 5 minutes.

Statewide maps and graphs are used to display current weather data. Some weather variables are combined on the same map, such as air temperature, relative humidity, wind speed, and wind direction. There are also products that show the change in air temperature and relative humidity from the last 3 hours and 24 hours.

The presence of a temperature inversion increases the risk of pesticide drift. Times when an inversion is present can be identified by comparing the 1.5-meter (5 feet) air temperature to the 9-meter (30 feet) air temperature. An inversion occurs when the 9-meter sensor reading is higher than the 1.5-meter sensor. Inversions act like a blanket to hold small pesticide particles near the earth's surface. These particles can move as a small, invisible cloud and if they move to sensitive plants, they can cause crop damage.

The "Dispersion Advisor" is another tool that estimates the likelihood of gas movement vertically and horizontally in the atmosphere. When dispersion conditions are good, smoke or pesticides dissipate rapidly. Poor conditions can lead to poor visibility from smoke or pesticide injury from drift.

Weather graphs are available for single and multiple weather variables. The user can choose to graph Oklahoma Mesonet data over the last 6 hours or as far back as the last 120 hours. Past weather data charts are also included as part of the "Climate" section.

Screenshot of the agweather homepage welcome area

SOIL/WATER

Data available in the "Soil and Water" section include soil moisture, soil temperature, reference evapotranspiration, rainfall, and drought maps. Soil moisture data is reported as Fractional Water Index from 2, 10, and 24-inch depths. Data is displayed on statewide maps and in graphs.

Soil temperature data is collected under native sod at 2, 4, and 12-inch depths. Under bare soil, soil temperatures are collected at two depths, 2 and 4 inches. Soil temperature averages are used to decide when soils have warmed enough in the spring or cooled enough in the fall for planting. Soil temperature averages are reported for 24 hours, 3-day and 7-day periods for each depth and under bare soil and native sod.

Evapotranspiration is a calculated value for short and tall crop canopies using the American Society of Civil Engineers reference evapotranspiration formula. The short crop reference evapotranspiration is used to calculate water use for agronomic and horticultural crops.

Products in the "Drought" group include Oklahoma Mesonet rainfall and Oklahoma climate rainfall data from the Oklahoma Climatological Survey (OCS). The Keetch-Bryam Drought Index is an index of how dry it is in the top eight inches of soil. Links are also included to access national maps of drought conditions and drought outlook.

RADAR/SATELLITE

Agweather users have access to a wide range of National Weather Service (NWS) NEXRAD radars, featuring different formats and geographical perspectives. Radar views range from nationwide down to individual radar sites. By displaying radar in WeatherScope, users can zoom and/or animate all radar views. There is also a new radar product from the NWS's Advanced Hydrologic Prediction Service that uses rain gauges to "ground truth" radar data.

Satellite views provide a "birds-eye" view of regional and North American areas. Visible, water vapor and infrared products are available, along with loops of visible and infrared satellite images.

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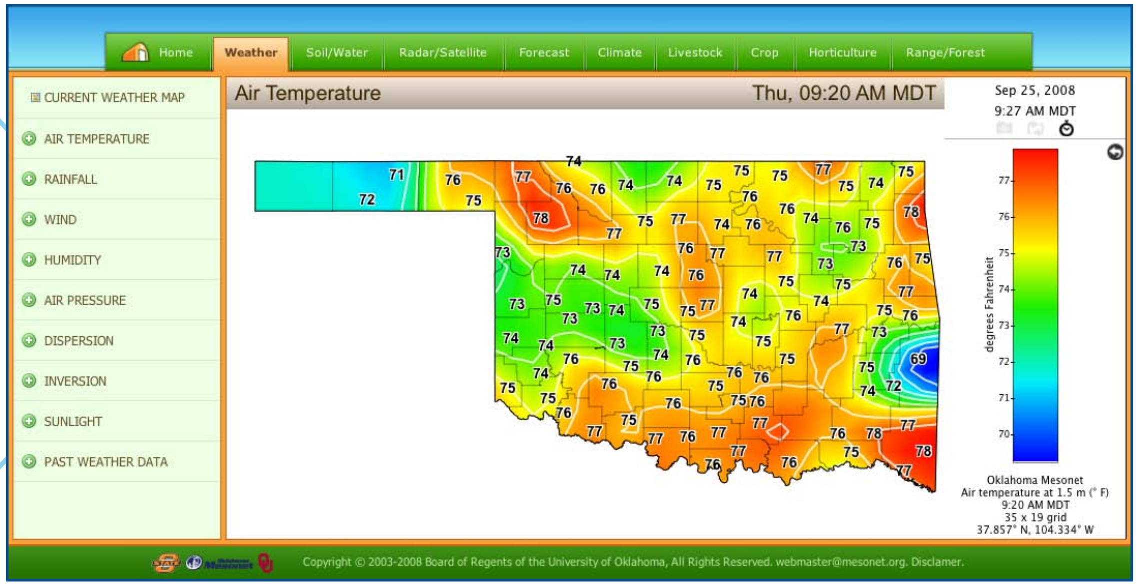


Screenshot of the weather data section on Agweather.

FORECAST

The Oklahoma Mesonet is a weather-monitoring network. The forecast products on Agweather come from the NWS through their forecast offices and the Climate Prediction Center.

Agweather has been set up to make NWS forecast products available with just a mouse click or two. On the front page of the Agweather Web site, users select their Mesonet site of most interest to them. The forecast products are tied to this Mesonet site selection. So when a user clicks on the "Forecast" tab, they get the NWS point forecast linked to the Mesonet site selected on the Agweather home page. The "Hour-by-Hour Forecast" is a set of hourly forecast tables for each weather variable and is tied to the Mesonet site selected.

Other short term forecast products include: county "Watches and Warnings" in text format, 84-hour North American Model forecasts in a table format, dispersion conditions forecast, drought outlook and the NWS Aviation Forecast.

Available long term forecast products from the NWS Climate Prediction Center include: 8-14 days, 30 days, 90 days and beyond 90 days. Maps are included for both air temperature and precipitation.

CLIMATE

There are four groups of past weather data in the "Climate" section. Oklahoma Mesonet data makes up the first group. Data is displayed in both chart and table formats.

Climate data in the "County Climate" and "Oklahoma Climate" sections are provided by OCS. These products use data collected through the NWS Cooperative Observer program. Data are displayed in maps, tables and graphs. While most of the data focuses on air temperature and precipitation, there are county climate summaries and tornado count products as well.

National Climate data are maps of air temperature and precipitation 30-year normals. A link is provided to the NWS Web site on El Nino, since changes in the central Pacific Ocean temperature can have an impact on precipitation patterns in Oklahoma and the rest of the USA.

LIVESTOCK

Weather products and information for seven livestock animals are included in the "Livestock" section. These are cattle, poultry, swine, dairy, horse, goat and sheep. A "Cattle Stress Index" is included for cattle and dairy that indicates times of heat and cold stress. Other menu items provide links to market and professional resources.

Research is in progress to develop a real-time "First Hollow Stem Advisor." The current product is a best estimate of when first hollow stem will occur, from Dr. Gene Krenzer, retired OSU Wheat Extension Specialist.

CROP

The “Crop” section includes pest advisories and weather data important for producing the major Oklahoma agronomic crops. Agronomic crops included are: wheat, grass hay, alfalfa, corn, cotton, sorghum, soybean, and peanut. Weather data and advisories are organized into subgroups reflective of farm management. These farm management subgroups include: planning and planting, grazing, fertilization, irrigation, pest control, harvest, marketing and professional resources.

Unique pest advisories in the “Crop” section include the “Alfalfa Weevil” and “Peanut Leaf Spot Advisories”. These advisories alert producers when the risk of pest activity is high. The intensity and timing of pest risks can vary greatly from year to year. Pest advisories are a tool to quantify pest risk and provide growers more pest management lead time.

A degree-day heat unit calculator is available to determine current and past growing season heat unit accumulation. A count of days with positive heat units is provided as a product for wheat to support data needed for GreenSeeker nitrogen fertilizer recommendations.

Irrigation planners are available for all of the agronomic crops. These models use reference evapotranspiration and crop coefficients adjusted by planting date for crop stage to calculate daily crop water use. When a trigger water deficit – as determined by the producer – is met, irrigation water is applied. The amount of water supplied through an irrigation system is based on the amount of water that needs to be replaced for the crop and efficiency of the water delivery system.

A “Dry Down Indicator” map has been created to help with harvest and baling decisions. It shows 3-hour changes in air temperature and relative humidity.

“Marketing” and “Professional Resources” menu items provide links to USDA marketing summaries, commodity associations and OSU resources.

HORTICULTURE

Products in the horticulture section are similar to those for agronomic crops. Irrigation Planners are available for pecan, peach, grape, watermelon, tomato, garden vegetable, and turfgrass.

Turfgrass irrigation recommendations are provided through the Simple Irrigation Plan Web site at:

http://sip.mesonet.org

This site allows users to determine how long to run their sprinkler by selecting the sprinkler they use. Evapotranspiration is used to determine water used by the turfgrass. Sprinkler run times are based on the water use of the grass and how much water a sprinkler supplies.

For pecans, there are two pest advisories. One for pecan casebearer based on degree-day heat units, and a “Pecan Scab Advisor” that logs optimum hours for scab development. A “Watermelon Anthracnose Advisor” is available that logs hours that have an air temperature and relative humidity that lead to anthracnose disease outbreak.

As with agronomic crops, “Marketing” and “Professional Resources” menu items provide links to USDA marketing summaries, commodity associations and OSU resources.

RANGE/FOREST

The primary model available on Agweather for rangeland and forestry management is the “Fire Danger Advisor.” This product provides fire professionals maps to identify locations of high fire danger across Oklahoma. Current and past fire danger conditions maps are also available.

CLASSROOM ANSWERS PG. 25

1. One reason that Oklahoma City is cooler than New Bern in the winter is that the ocean near New Bern (the Atlantic Ocean) is still warm. The water keeps areas nearby warmer than if there were no large body of water. Oklahoma City is not near a large body of water, so it does not experience this moderating effect in the winter.
2. (a) In the summer, Sioux Falls should be warmer, since it is in the middle of a continent. (b) In the winter, Portland should be warmer, since it is near the ocean, which should keep its temperatures warmer than those in Sioux Falls.
3. (a) See Answer Figure1.

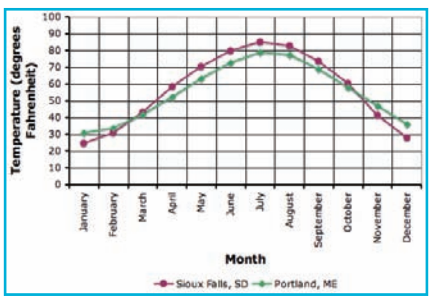
   (b) The overall pattern of the continental city warmer than the coastal city in the summer and cooler in the winter is seen in both plots.

   (c) The Sioux Falls and Portland seasonal differences are greater than those in the Oklahoma City and New Bern curves. There is a more rapid change in temperature with the former than with the latter. Sioux Falls appears to have a longer period than Oklahoma City where the continental city is warmer than the coastal city in the warm months. Sioux Falls is warmer from March through October, while Oklahoma City is only warmer from June through September.
4. (a) Answers will vary, but Figure 5a in the activity shows a sample.

   (b) Sample answer: Sioux Falls has a higher max temperature than Portland in this summer week. There is a general warming trend in this particular week.
5. (a) Answers will vary, but here is one sample answer, based on Figure5b: In general, the Portland highs for the week are less than the normal max temperature for July, though there are a few temperatures around or above the average. The Sioux Falls highs are almost all below the normal max temperature for July.

   (b) Answers will vary, but here is one sample answer, based on Figure5b: Sioux Falls weekly average: (84+73+79+86+83+84+87) / 7 = 82.3 ºF. Portland weekly average: (76+71+75+77+82+78+82) / 7 = 77.3 ºF. The average July max temperature for Sioux Falls is 85.2 ºF, so the weekly temperature is somewhat close to the normal, but is definitely cooler. The average July max temperature for Portland is 79.1 ºF, so the weekly average is cooler than the normal. This matches what we recorded in question 5a, where the overall trend was cooler than normal temperatures.

Answer Figure1 - Monthly Normal High Temps (Sioux Falls vs. Porland)



SPRING 2008 SUMMARY

by Gary McManus

Extremes in precipitation were the story of spring with the western Panhandle enduring extreme drought conditions and the eastern half of the state getting unwanted swimming pools. The Oklahoma Panhandle's deficit of more than 4 inches helped that region to its fourth driest spring on record, exacerbating dry conditions that had set in nearly a year earlier. The northeast and southeast, on the other hand, enjoyed surpluses of more than 8 inches and experienced their fourth- and sixth-driest on record, respectively. The statewide average precipitation total of more than 13 inches ranks the spring as the 20th wettest on record. As for temperature, the state was near-normal and had its 49th warmest on record. Severe weather reports were numerous, as is customary during an Oklahoma spring. The worst of these reports was the 10 significant (EF-2 or higher) tornadoes which touched down within the state. One of those tornadoes was an EF-4 that struck Picher, killing six. In all, 63 tornadoes touched down during the spring months, according to preliminary data.

MARCH DAILY HIGHLIGHTS

March 1-3: A warm start to the month was in store with high temperatures rising into the 70s and 80s on the first. The second saw increasing humidity due to an approaching storm system. That increased moisture fueled powerful thunderstorms during the next two days. The storms moved to the east overnight and into the third and turned into proficient rain producers. Flooding reports were prevalent in east central Oklahoma near the Arkansas border. The cold front that the storms developed along eventually moved through and dropped temperatures into the 30s. The rains became snow in the southeastern half of the state. Amounts varied between a half of an inch and six inches. Several locales reported snowfalls of five inches and Octavia and Morris measured six inches.

March 4-7: The storm system, along with the rain and snow, moved to the east on the fourth and skies cleared overnight. A trough of low pressure developed in the Texas Panhandle, kicking up strong southerly winds. Temperatures rose into the 40s and 50s for highs along with a few 60s. Another front moved through on the fifth and switched winds around to the north. Temperatures dropped below freezing for the sixth just in time for a major winter storm to impact the southeast. A strip in the southeast received 4-8 inches of snow with localized amounts of more than a foot. Hodgen in LeFlore County had an estimated 14 inches of snow. Drier and colder air moved in on the seventh behind yet another arctic front. High temperatures managed to reach into the 40s and 50s before falling once again into the 30s.

March 8-12: The frigid weather held for another morning. Lows on the eighth were from the single digits to the 20s. Temperatures rebounded into the 50s that afternoon. Southerly flow produced a big warm up on the ninth. Highs reached the 60s and 70s. The southerly flow also brought more moisture and rain developed that night in far southern Oklahoma. Amounts were generally less than an inch. The next several days were warm and windy. The dry weather and strong winds produced dangerous wildfire conditions. Another front approached the northwest late on the 12th.

March 13-16: The next four days were typically March. A couple of frontal passages produced sporadic thunderstorms with very little widespread rainfall. Temperatures were pleasant for the most part in the 60s and 70s, including a few flirtations with 50s and 80s. Winds were strong throughout, creating high fire danger.

March 17-19: A strong low pressure center approached the state on the 17th and generated three days of heavy rains. By the end of the period, the southeastern half of the state had rainfall totals between 4-8 inches. Flash flooding reports were numerous from the area. Amounts tapered off to the northwest once again. Due to the clouds and rain, high temperatures remained in the 40s and 50s for the most part. By the 19th, highs reached into the 60s and 70s.

March 20-26: The easiest way to describe this seven-day period would be "dry". There were of course ups and downs in the temperature as wayward fronts found their way across the state. Winds were often quite strong with gusts over 40 m.p.h. on several days.

March 27-28: Low-level moisture increased on the 27th as southerly winds kicked up in advance of a storm system. A strong cold front came through that afternoon, dropping temperatures 10-20 degrees in its wake. Strong to severe storms fired along the front with the biggest threat being large hail. A weak tornado touched down in Muskogee County but did little damage. The 28th was cool and gray with strong northerly winds.

March 29-31: The 29th was quiet compared to the 30th and 31st. Temperatures were in the 60s and 70s and the moisture continued to surge northward, adding plenty of fuel for storms. Two very large supercells formed in west central Oklahoma and marched to the east. One of those storms dropped an EF1 tornado in Edmond right after midnight. Storms fired once again the morning of the 31st and paraded across the state in the span of the final day. Four more possible tornadoes were spotted on the 31st. Lots of hail greater larger than golf balls was reported along with many flood reports, mostly from eastern Oklahoma.

APRIL DAILY HIGHLIGHTS

April 1-4: Temperatures fell below freezing behind a cold front on the first, and then rose into the 50s and 60s that afternoon. An approaching storm system brought rain for the next three days beginning on the second. Storms formed along a dryline on the third. Some of the storms exceeded severe limits with large hail and strong winds. The rain fell mainly on the southeastern half of the state with the extreme southeastern corner recording between 2-4 inches. Temperatures were mainly in the 50s and 60s on the fourth behind a cold front that ushered in cool air.

April 5-6: The fifth and sixth were sunny with temperatures warming into the 60s and 70s after lows in the 40s and 50s. A weak cold front entered northwestern Oklahoma early on the sixth and passed through the remainder of the state later in the day. Winds kicked up late on the sixth due to an approaching upper-level storm system.

April 7-10: Storms fired along a dryline late on the seventh and continued through to early morning on the eighth. Large hail was the main severe threat with these storms to go along with flooding rainfall. A more stable air mass followed the frontal passage on the eighth. More storms on the ninth and 10th as another surface low and associated dryline entered the state. A microburst generated winds estimated at 100 mph in Muldrow on the evening of the ninth, damaging 477 homes. Rainfall totals from the four days exceeded seven inches in the northeast. The storms moved off to the east which allowed for sunny skies on the 10th. Strong winds gusting to 55 mph blew an old fashioned dust storm over the state later that day from the southwest.

April 11-16: This six-day period saw a whole lot of nothing happen – mainly clear skies, cool mornings and warm afternoons. Strong winds arrived on the 15th and 16th to help increase the fire danger. Lows on the 16th were in the 50s with highs in the 70s and 80s.

April 17-18: A slow moving cold front on the 17th kicked off a round of thunderstorms later that day in the south and east. One-to-two inches fell in eastern Oklahoma with no rain being reported in about the western half of the state. Lots of sunshine later that day helped temperatures rise into the 60s and 70s.

April 19-21: An unseasonably warm few days, high temperatures rose into the 90s in some areas of the state each day. A cold front entered the northwest late on the 21st to signal a return to stormy weather.

April 22-24: More rain fell as another cold front moved into the state and stalled. The rains fell from the 22nd through the early morning hours of the 24th. The storms cleared the state on the 24th and were replaced by a hot and humid afternoon. Highs rose into the 90s and the month's high temperature of 96 degrees was set – and later tied – at Altus.

April 25-27: This three-day period was marked by strong winds which followed a cold front on the 25th. Winds gusted to 40 mph on both the 25th and 27th. Temperatures were seasonable the first two days but dropped to about 10 degrees below normal on the 27th with 50s and 60s for highs.

April 28-30: The month finished with a roller coaster temperature pattern. Temperatures dropped to 27 at Boise City on the 28th and 32 at Goodwell on the 29th. Temperatures rebounded to late-April territory on the month's last day with lows in the 50s and highs in the 80s.

MAY DAILY HIGHLIGHTS

May 1-2: Preliminary reports from the NWS indicate at least eight tornadoes touched down the evening of the first and overnight into the second. Hail up to the size of grapefruits fell in parts of the state from these dryline-fired supercells. Wind and hail damage reports were widespread. Precipitation amounts from the storms were rather light with most reports from the Oklahoma Mesonet falling between a half-inch to an inch.

May 3-7: More substantial rains fell during this five-day period. The third and fourth were relatively calm if not a bit chilly in the mornings. Low temperatures fell into the 30s and 40s for the most part, although 29 degrees was recorded on the third and fourth at various locations in the northwest. High pressure at the surface moved to the east on the fifth as a storm system moved in from the west. Storms formed in the northwest, dropping hail to the size of quarters in Woods County. Three-to-four inches of rain fell on the seventh in several areas, including a maximum of 4.46 inches at the Nowata Mesonet site. All areas of the state received at least a half-inch of precipitation during this period.

May 8-10: A cold front moved through late on the eighth and into the ninth and kicked off another round of storms across northern Oklahoma. The real action occurred on the tenth as an upper-level storm approached from the west. Moisture from the Gulf of Mexico streamed up and over the state that afternoon. Supercells formed in eastern Oklahoma around noon and quickly became tornadic. Ten tornadoes, with four being rated "significant", touched down in the eastern third of the state. A violent EF-4 tornado brushed the extreme northeastern corner of the state and supplied misery to the town of Picher, killing six. The Picher tornado reached a mile wide at times and also brushed the edge of Quapaw before moving into Missouri.

May 11-12: Nary a drop of rain fell during these two days, a blessed respite from the previous rough weather. It was rather chilly in the mornings, however, with lows in the 30s and 40s for the two days. The afternoons warmed up into the 70s and 80s, however.

May 13-15: A cold front moved into the state on the 13th and brought more rain, mainly in eastern Oklahoma. A strip from central Oklahoma down to the southeast had between 1-3 inches during the three days, but nearly all the state got at least a bit of rain. The weather was a bit cooler than normal with highs in the 60s and 70s.

May 16-21: Another bone-dry period for the state with just a bit of rain registered by the Oklahoma Mesonet in the south. The weather turned downright hot at times during these six days, especially on the 19th when 102 degrees was recorded at both Walters and Grandfield – along with a few more 100s in southern Oklahoma.

May 22-24: The last nine of May's preliminary count of 31 tornadoes occurred on the 23rd and 24th. The severe storms began on the 22nd, however, and dropped baseball size hail. A heat burst produced severe winds near Alva up to 62 mph. The storms continued overnight in the north before building once again the next afternoon. An EF-3 tornado damaged homes and crops in Harper County and other storms contained baseball size hail. The remaining eight tornadoes all occurred the evening of the 24th in Kingfisher and Garfield counties.

May 25-28: While the tornadoes for the month were done, the severe weather was not. Storms formed at varying times during the first three days before finally yielding to a pretty nice day on the 28th. The highlights, or lowlights, would be 3-6 inches of flooding rainfall across Kay County and softball size hail in Roger Mills County on the 26th. The rainfall during this severe period was more widespread in the northeast and south central than other sections. The 28th was the anomaly of the four days as the weakening cold front that brought all the rain and storms moved to the southeast. The day ended sunny and warm with highs in the 70s and 80s.

May 29-31: The month's final three days were a welcome relief from the violent weather found in the first 28. Sunny skies and warm afternoons were punctuated by a downright hot day on the 31st with Hollis reaching the century mark.

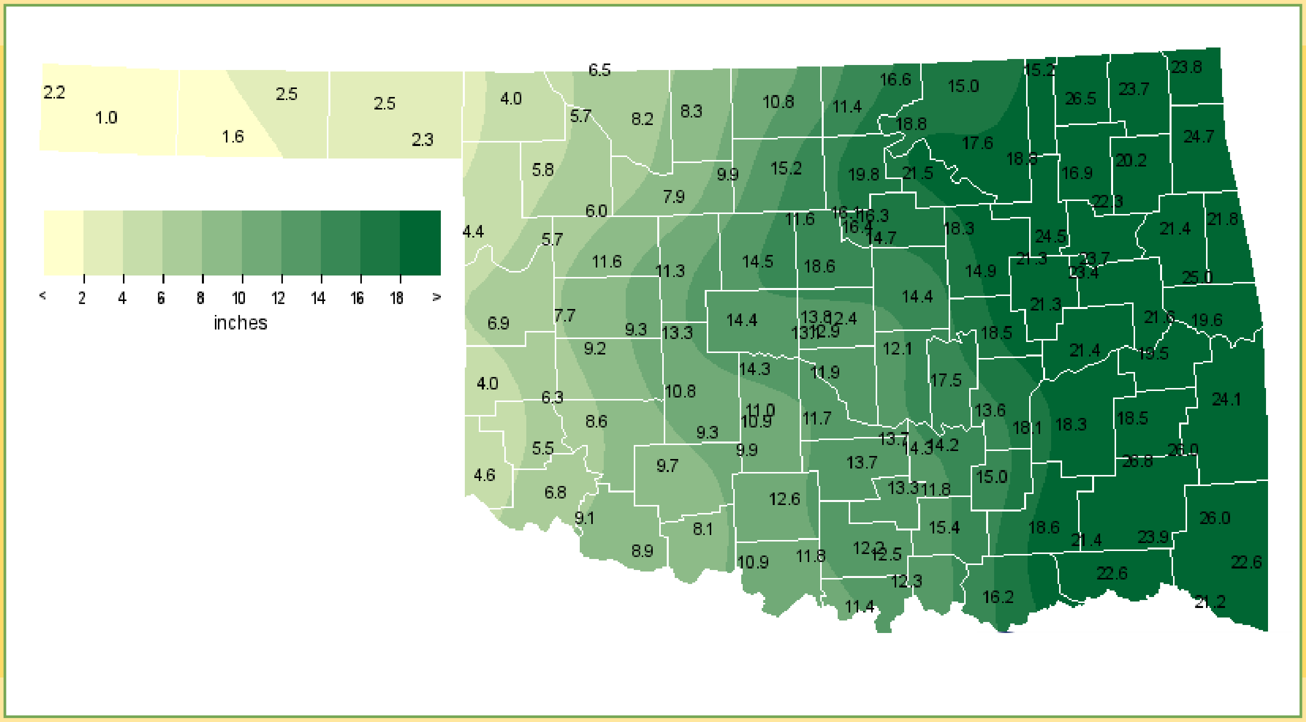
Spring 2008 Statewide Extremes

Description	Extreme	Station	Date
High Temperature	102°F	Walters	May 19
Low Temperature	7°F	Seiling	March 8
High Precipitation	26.79 in.	Clayton	
Low Precipitation	1.00 in.	Boise City	

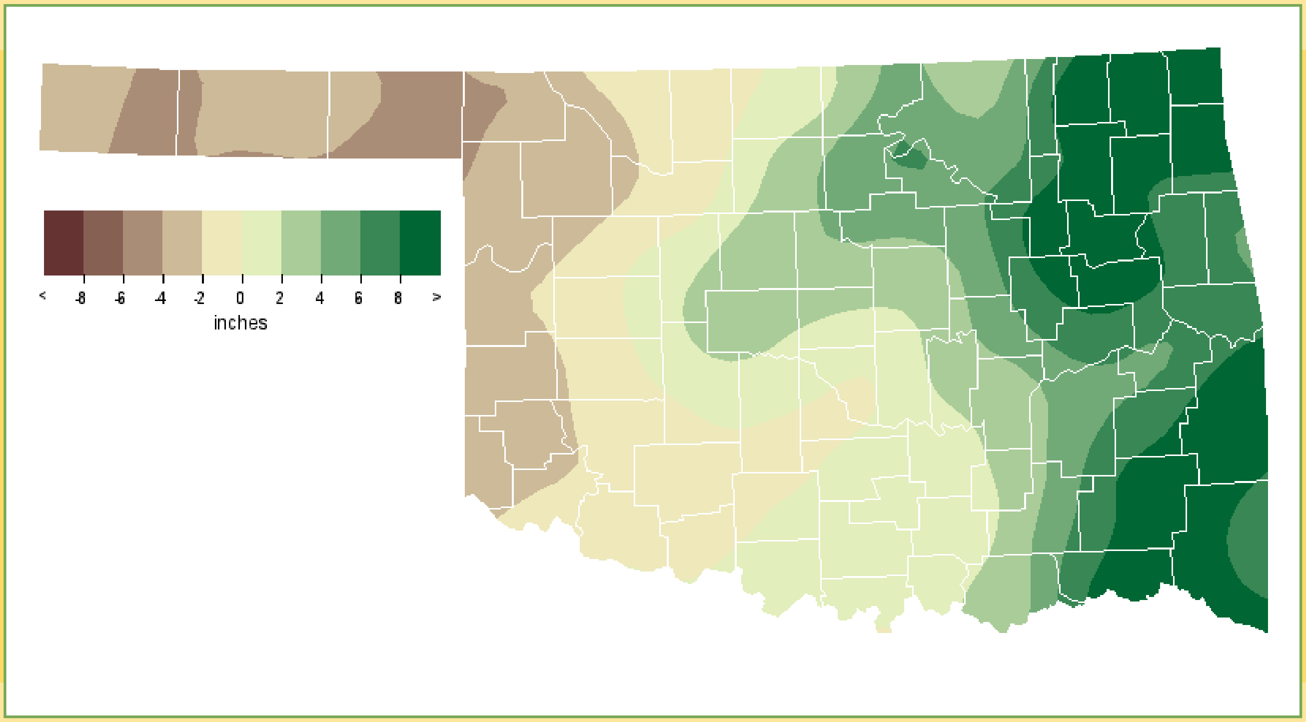
Spring 2008 Statewide Statistics

	Average	Depart.	Rank (1895-2008)
Temperature	58.9°F	-0.1°F	49th Warmest
	Total	**Depart.**	**Rank (1895-2008)**
Precipitation	13.52 in.	1.84 in.	20th Wettest

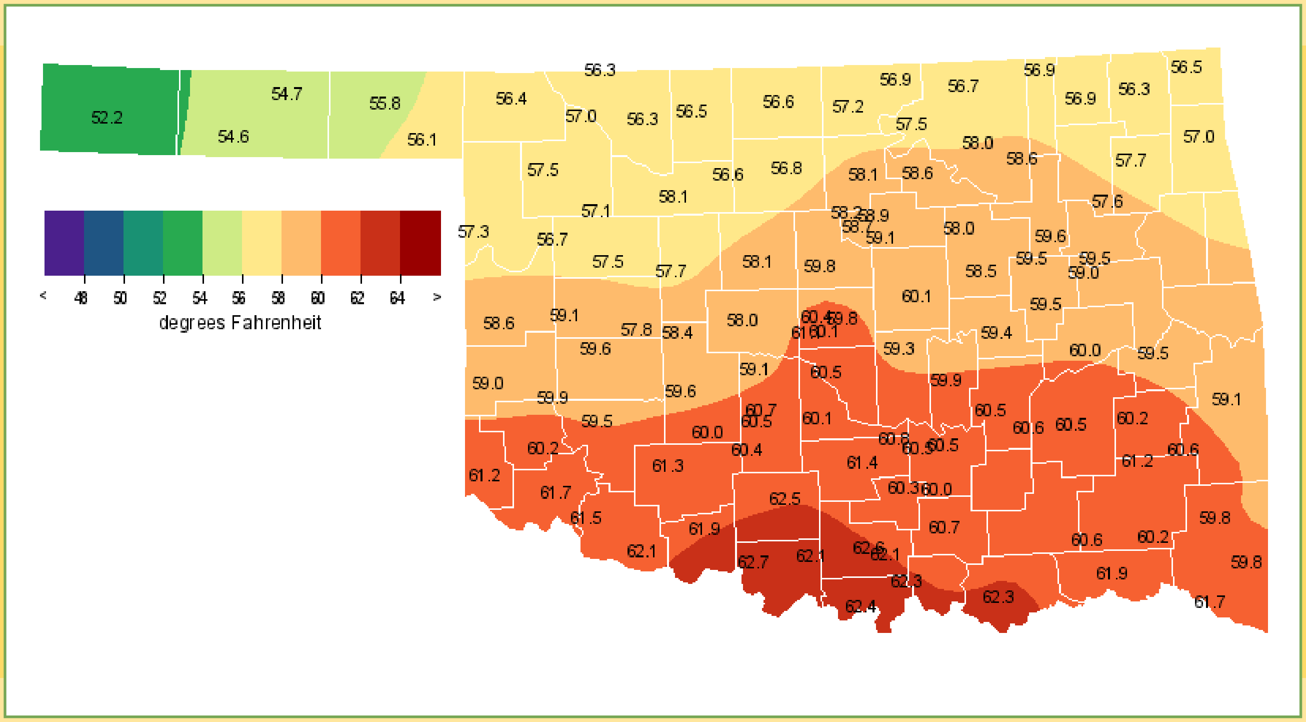
OBSERVED RAINFALL



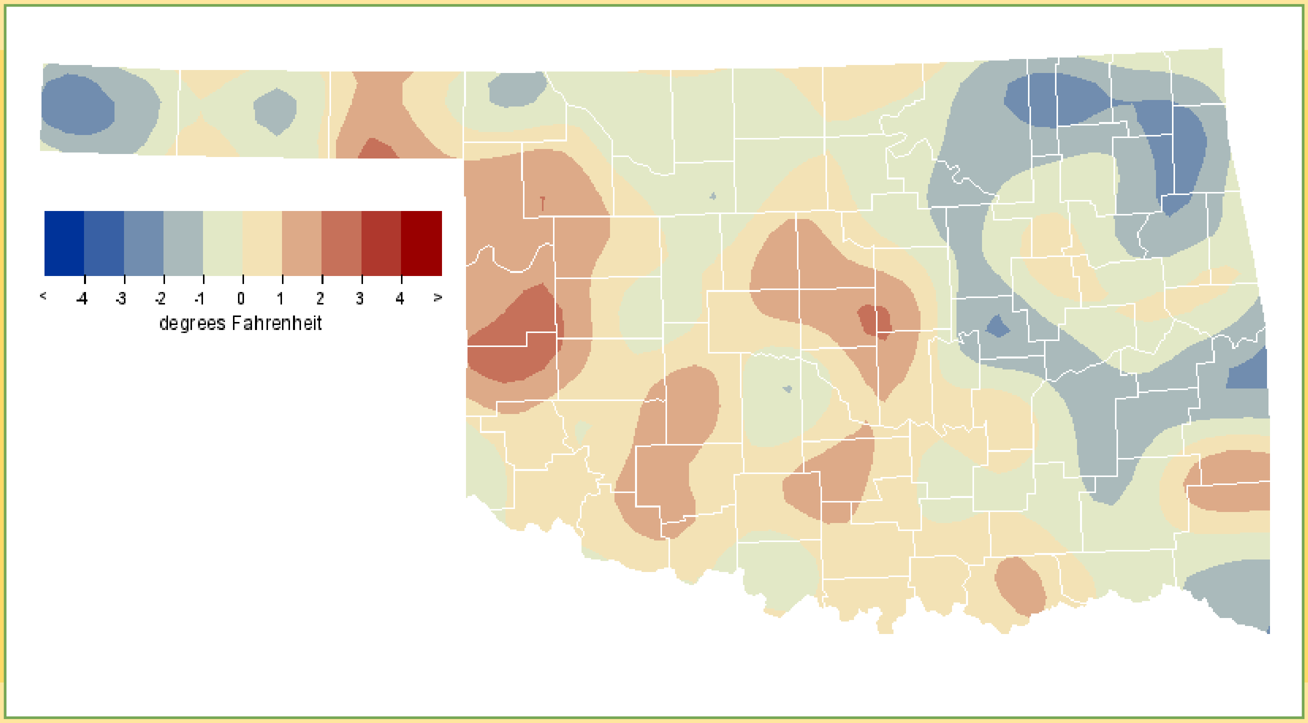
RAINFALL DEPARTURE FROM NORMAL



AVERAGE TEMPERATURE



TEMPERATURE DEPARTURE FROM NORMAL



SPRING 2008 MESONET PRECIPITATION COMPARISON

Climate Division	Precipitation (inches)	Departure from Normal (inches)	Rank since 1895	Wettest on Record (Year)	Driest on Record (Year)	2007
Panhandle	2.57	-4.28	4th Driest	13.27 (1957)	1.15 (1966)	7.14
North Central	10.16	-0.20	40th Wettest	21.31 (1957)	1.77 (1895)	14.73
Northeast	21.16	8.01	4th Wettest	25.15 (1957)	3.12 (1895)	14.28
West Central	8.01	-1.89	56th Driest	19.30 (1957)	1.86 (1971)	15.60
Central	14.25	1.85	17th Wettest	22.89 (1957)	3.74 (1932)	17.22
East Central	19.99	5.68	11th Wettest	30.36 (1990)	4.49 (1936)	10.39
Southwest	8.61	-1.29	57th Wettest	20.48 (1957)	3.28 (1971)	13.18
South Central	13.49	0.58	35th Wettest	27.30 (1957)	4.50 (2005)	14.67
Southeast	23.53	8.20	6th Wettest	30.18 (1990)	7.12 (1936)	12.21
Statewide	13.52	1.84	20th Wettest	22.74 (1957)	4.89 (1895)	13.40

SPRING 2008 MESONET TEMPERATURE COMPARISON

Climate Division	Average Temp (F)	Departure from Normal (F)	Rank since 1895	Hottest on Record (Year)	Coldest on Record (Year)	2007
Panhandle	55.3	0.0	44th Warmest	59.5 (1963)	49.4 (1915)	56.3
North Central	57.0	-0.6	49th Coolest	61.6 (1963)	52.8 (1924)	59.7
Northeast	57.7	-0.9	49th Coolest	62.1 (2006)	53.5 (1924)	61.2
West Central	58.5	0.5	45th Warmest	62.8 (2006)	52.9 (1915)	59.6
Central	59.5	0.0	44th Warmest	63.8 (2006)	54.5 (1924)	61.4
East Central	59.9	-0.1	51st Warmest	63.7 (1974)	55.1 (1931)	61.9
Southwest	60.7	0.2	45th Warmest	64.9 (2006)	55.1 (1915)	61.4
South Central	61.6	0.2	46th Warmest	65.6 (2006)	56.5 (1931)	62.8
Southeast	60.5	-0.2	51st Coolest	64.6 (2006)	56.8 (1924)	62.2
Statewide	58.9	-0.1	49th Warmest	63.1 (2006)	54.3 (1924)	60.7

SPRING 2008 MESONET EXTREMES

Climate Division	High Temp	Day	Station	Low Temp	Day	Station	High Monthly Rainfall	Station	High Daily Rainfall	Day	Station
Panhandle	96	May 19th	Goodwell	9	Mar 8th	Arnett	4.41	Arnett	1.14	Apr 23rd	Arnett
North Central	97	May 31st	Fairview	7	Mar 8th	Seiling	19.79	Red Rock	3.19	May 24th	Red Rock
Northeast	94	May 19th	Bixby	10	Mar 8th	Burbank	26.47	Nowata	5.93	Mar 18th	Porter
West Central	99	May 31st	Erick	8	Mar 8th	Camargo	11.59	Putnam	3.03	Mar 17th	Bessie
Central	99	May 19th	Chickasha	10	Mar 8th	El Reno	18.61	Guthrie	4.69	Apr 9th	Guthrie
East Central	95	May 19th	Calvin	17	Mar 8th	Calvin	23.88	Cookson	6.47	Mar 18th	Haskell
Southwest	102	May 19th	Walters	10	Mar 8th	Mangum	13.35	Hinton	4.08	Apr 9th	Medicine Park
South Central	99	May 19th	Waurika	14	Mar 8th	Sulphur	18.57	Lane	5.06	Mar 18th	Sulphur
Southeast	93	May 19th	Antlers	22	Mar 8th	Hugo	26.79	Clayton	5.20	Mar 18th	Hugo
Statewide	102	May 19th	Walters	7	Mar 8th	Seiling	26.79	Clayton	6.47	Mar 18th	Haskell

AgWatch

by Albert Sutherland, CPA, CCA
Mesonet Assistant Extension Specialist
Oklahoma State University

The Oklahoma growing season in 2008 was one of feast for many and famine for some. As wheat harvest progressed many elevators piled wheat outdoors, as they ran out of silo space. With intense drought in the Panhandle, growers watched wheat dry to a crisp before it ever set a grain and grass pastures that never greened at the end of winter.

2008 will go down in the Oklahoma crop history books as a pretty good one for most of the state. For the far western Panhandle, it has been one of the worst years on record. 2008 was a reminder that when the weather and markets are great for some, it is rare indeed when those in agriculture share equally. Producers are left hoping that the bad times are few and the good times come around more often.

This basket of plenty versus a cupboard of woe is illustrated in the September 1, 2008 soil moisture across Oklahoma. The map in Figure 1 shows the soil moisture 10 inches deep across Oklahoma on September 1, 2008. This map shows a marked difference between those areas with good soil moisture and those without. There are 18 out of 91 locations with Fractional Water Index (FWI) values above 0.8. These are areas with good soil moisture for sustaining wheat over the long haul. FWI ranges from a low of 0.0 to a high of 1.0. There are 20 out of 91 locations that are too dry for plant growth with a FWI of 0.4 or less.

It's interesting that the dry locations are often right next to locations with good soil moisture. The map really points out places that have had good rainfall events compared to nearby areas that have received little rain.

The 10-inch FWI is good to assess water available for the long term, but the 2-inch depth shows the moisture available to swell wheat seeds and carry them through germination. Once young wheat plants have emerged, adequate upper soil moisture is critical, so that roots can grow down to draw on deeper soil moisture. Figure 2 is a map of the 2-inch soil moisture on September 1, 2008. It shows that 34 of 91 locations have a FWI at or less than 0.4. This map also shows the same deeper soil trend of locations with good soil moisture adjacent to Mesonet sites with very low soil moisture.

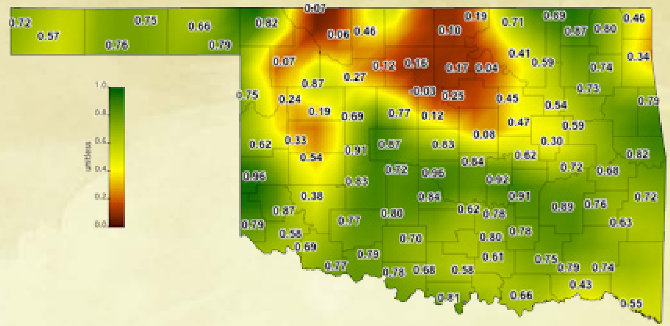


Figure 1: Soil Moisture – 10" Fractional Water Index – September 1, 2008.

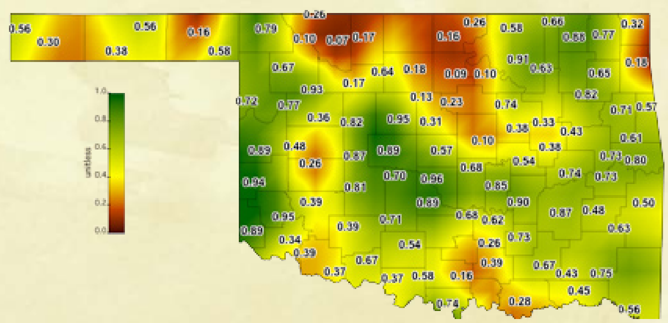


Figure 2: Soil Moisture – 2" Fractional Water Index – September 1, 2008.

It has been a good summer for row crops, although cotton is slightly behind. August was wetter and cooler than normal. While cooler weather slows cotton growth, it is just what soybean and corn growers hope for. They know that cooler August weather improves pollination, setting the stage for better yields. Cotton farmers are looking for a long, mild fall to allow enough time for bolls to mature.

Turning to hay and pasture, this has been a good year for alfalfa, grass hay and pasture growth. In areas of adequate rain and with a cooler August, hay and pastures have responded with better than average production. With a summer of good hay supplies there is plenty for feeding livestock this winter.

To access the products mentioned previously and connect to the latest agricultural weather information, go to Oklahoma AgWeather at **http://agweather.mesonet.org**. This web site is a joint project of the University of Oklahoma and Oklahoma State University. It uses the latest information from the Oklahoma Mesonet and the Oklahoma Climatological Survey. If you have any questions or comments about the Oklahoma AgWeather site, please, contact Albert Sutherland by phone at **405-224-2216** or by email at **albert.sutherland@okstate.edu**.

Urban Farmer

by Albert Sutherland, CPA, CCA
Mesonet Assistant Extension Specialist
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August

- Keep up with water demand. The height of the watering season is a great time to decide if you need a new drip or sprinkler system.
- Plan for new plantings with water efficiency in mind. Group plants with similar water needs together. Reserve areas closer to the water valve for high water demand plants.
- Children head back to school in mid-August. Make sure they are safe by trimming shrubs or trees near streets to maintain good driver visibility.
- Continue control of rose black spot with an approved fungicide.
- If you missed or skipped white grub control in July, you can apply an approved fast acting insecticide in August.
- Divide iris and replant or share the rhizomes with a friend.
- Plant frost hardy and short season vegetables. In August, plant cucumber, beet, broccoli, cabbage, Chinese cabbage, carrots, cauliflower, collards, Irish potatoes, leaf lettuce, parsnip, green peas, radish, Swiss chard and turnip.
- Prepare new garden areas by: 1) watering, 2) spraying weeds with glyphosate, 3) waiting 7-10 days; and 4) tilling the area.
- If a moderate to heavy rain event occurs, check pecan trees for emerging pecan weevil.

September

- Apply a lawn pre-emergent by mid-September for winter annual weed control; popular products include Princep, Barricade, Balan, Surflan or Team.
- Fertilize tall fescue in late September. Tall fescue needs nitrogen in the fall, as it grows more in cooler air temperatures. Use a quick release fertilizer at a rate of 1 pound of actual nitrogen per 1,000 square feet.
- Broadcast tall fescue seed mix for grass in shady areas or to thicken existing stands. Mix ¼ to ½ pound of improved Kentucky bluegrass with 4 pounds of tall fescue per 1,000 square feet.
- After mid-September, plant pansies for fall, winter and spring color. Pansies will produce new blooms throughout the winter, when the air temperature goes above 40°F.
- Divide and replant spring-flowering perennials.
- In the garden, plant garlic, rutabaga and spinach. You can still plant radish, Swiss chard and turnip.
- To increase garden soil organic matter, plant Austrian winter peas, vetch, wheat or rye as a winter cover crop. Mark your 2009 calendar to till green plants into the soil a couple of weeks before you want to plant next spring.

October

- Plant deciduous trees and shrubs. Fall planting gives young shrubs and trees all winter to develop new roots leaving them in better condition to deal with summer heat and drought.
- Plant most bulbs. Wait until November to plant tulips.
- Take a soil test to determine soil nutrients. Take your soil sample to your county OSU Cooperative Extension Service office for analysis. There is a fee for analysis.
- Rake leaves as they fall. This is especially true for fescue lawn areas, as the leaves can smother the grass if left too long. Raked leaves can be composted.

INTERPRETATION ARTICLE

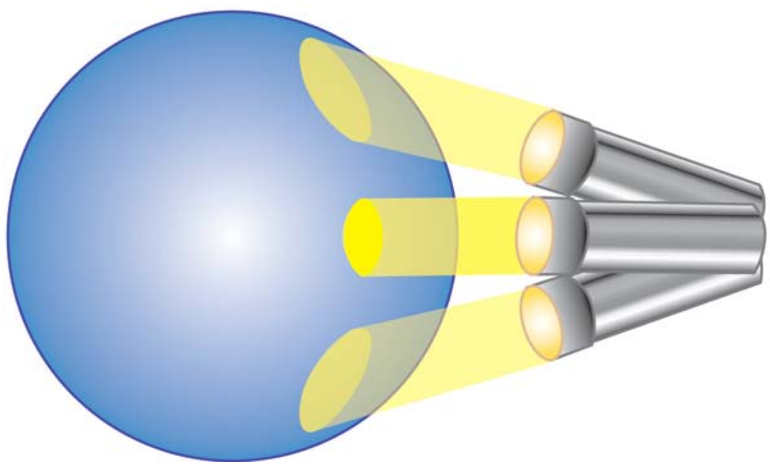
Nicole Giuliano

Crispy on the Continent, Cool on the Coast

As you swelter in the oppressive Oklahoma heat in the summer, do you dream of a vacation in Canada, where you can jump into chilly lakes and breathe in cool, crisp air? To experience cooler weather, you don't need to leave the country—you can just follow your latitude line toward either the Atlantic Ocean or the Pacific Ocean. In the summer, temperatures are usually at least several degrees cooler along the coasts than in the middle of the country.

First, we look at our main energy source—the sun—for possible hints as to why areas near large bodies of water tend to be cooler in the summer than areas that are land-locked. The sun heats the Earth unevenly, with more energy hitting near the equator and less energy falling at the poles. This pattern is similar to when we shine a flashlight on a sphere (Figure 1). The same amount of energy comes out of the flashlight, but the energy is spread out differently, depending on the path. Near the poles, the light appears to spread out and is dimmer (due to a more slanted path), while at the equator, it is brighter and more concentrated (due to a more direct path). Thus, if areas along an east-west line (a line of latitude) receive the same amount of energy, we would expect that temperatures along a latitude line should be the same. However, this is often not the case.

Figure 1 - Uneven Heating of the Earth



The same amount of energy is spread out differently: a direct path results in more intense energy (warmer temperatures), while slanted path results in less intense energy (cooler temperatures).

To understand why areas at the same latitude have very different temperatures, we need to understand a property called specific heat. Specific heat is a measure of the heat energy required to increase the temperature of an object by a certain amount. Water has a very high specific heat, which means that it takes a lot of energy to heat it up or cool it down. Since this property is also related to the amount of the material (water in this case), it takes longer for a large body of water (such as an ocean) to heat up or to cool down than a smaller body of water (for example, a lake). Of course, we are assuming that both the larger and the smaller bodies of water receive the same amount of solar energy. Also, it takes longer for the temperature of a body of water to change than it takes for an area of land, because the ground has a lower specific heat than water. This means that when the sun rises, the land warms much faster than a body of water, and when the sun sets, the land cools much faster than a body of water. So, in the summer, the land is warmer than the ocean because land has a lower specific heat than water. Since the water is cooler than the land at this time, the ocean keeps cities near the coast cool. As our tilted planet makes the transition from summer to fall, land temperatures drop rapidly because the Northern Hemisphere receives less direct light (less direct energy) when it begins to tilt away from the sun. However, the ocean surface, which has been absorbing energy and slowly warming all summer, reaches its maximum temperature in the autumn. Since water cools much more slowly than the land, the ocean tends to warm coastal cities in the winter.

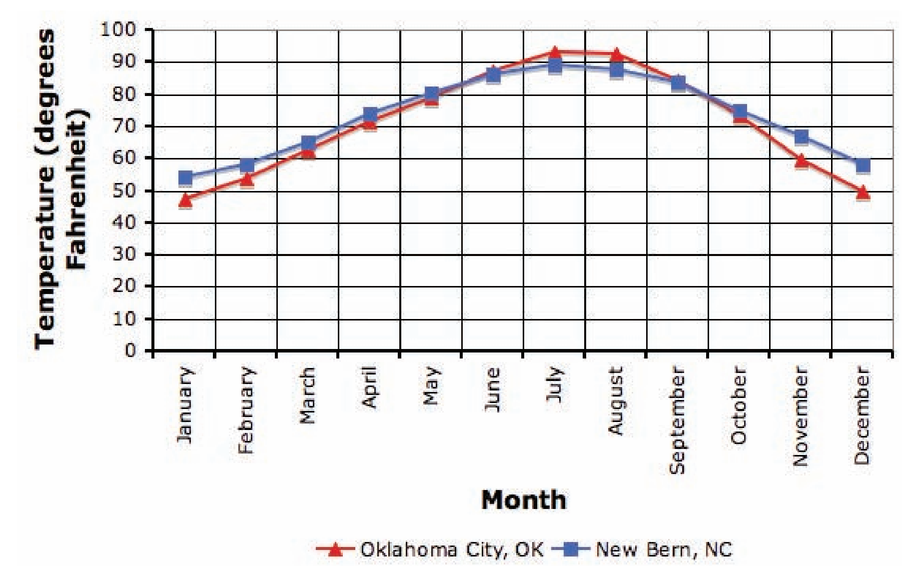
Continued >>

Let's look at two cities along nearly the same latitude: Oklahoma City, Oklahoma and New Bern, North Carolina (Figure 2). Oklahoma City is a land-locked area (there are no large bodies of water nearby), while New Bern is near the Atlantic Ocean. As you can see in Figure 3, Oklahoma City's normal high temperatures in the summer (June, July, and August) are warmer than the normal high temperatures at the same time in New Bern. [Note: The normal high temperature for July is simply the average of the high temperatures in July for the past thirty years (1971-2000 is the current 30-year period scientists use). "Normal" does not mean that it is the expected or typical value; it is just a baseline to define current weather events. In fact, the temperature on any given day rarely matches up with the normal!] Since water takes longer to warm up (and cool down) than the land, the ocean stays relatively cooler than the land and the coastal city of New Bern is cooled down. Since Oklahoma City is not near a large body of water, it does not receive this cooling influence and so its maximum temperature is higher than that of New Bern, even though they are at the same latitude.

Classroom >>

■ Figure 2

■ Figure 3 - Monthly Normal High Temperatures (OKC vs. New Bern)



CLASSROOM ACTIVITY

Nicole Giuliano

Questions

Climate data across the United States are available from the National Weather Service, at:

http://www.weather.gov/climate

Table 1 contains the monthly normal high temperatures/max temperatures for two cities near the same latitude: Sioux Falls, South Dakota and Portland, Maine (Figure 4 shows their locations). If you would like to get the data online, visit the above link and click on the map near the town that you want (e.g., Sioux Falls). Next, click on the NOWdata tab and choose:

Product: Monthly avgs/totals
Location: Sioux Falls area
Variable: Max temperature
Year: 1971-2000 (for the 30-year normal
Click on "go" under View

If you would like to see the past week's data, to compare with the normal temperatures for the current month, visit http://www.weather.gov/climate. Click on the map near the town that you want, click on the NOWdata tab, and choose:

Product: Daily data for a month
Location: Sioux Falls area
Month: Current month
Click on "go" under View

For those who are only interested in the maximum temperatures, only the first two columns are needed (date and max temperature). "M" indicates missing data or data that have not been collected yet.

1. Why is it cooler at Oklahoma City than at New Bern in the winter?

2. Which city (Portland, ME or Sioux Falls, SD) do you think will be warmer (a) in the summer? (b) in the winter?

3. (a) Using Table 1, plot the monthly normal max temperatures on Plot 1. When you are done, you should have two curves on the same plot—one for Portland and one for Sioux Falls. You may want to use two different colors or symbols to differentiate between the two curves.

   (b) How are these curves similar to the ones for Oklahoma City and New Bern? (c) How are they different?

4. Look at the past week's data for Sioux Falls and Portland by following the steps outlined above.

   (a) Plot the max temperatures for the past week for the two cities on Plot 2. You may want to use two different colors or symbols to differentiate between the two curves. Figure 5a shows an example. NOTE: The temperature scale is from 50 to 100, not from 0 to 100, in the example.

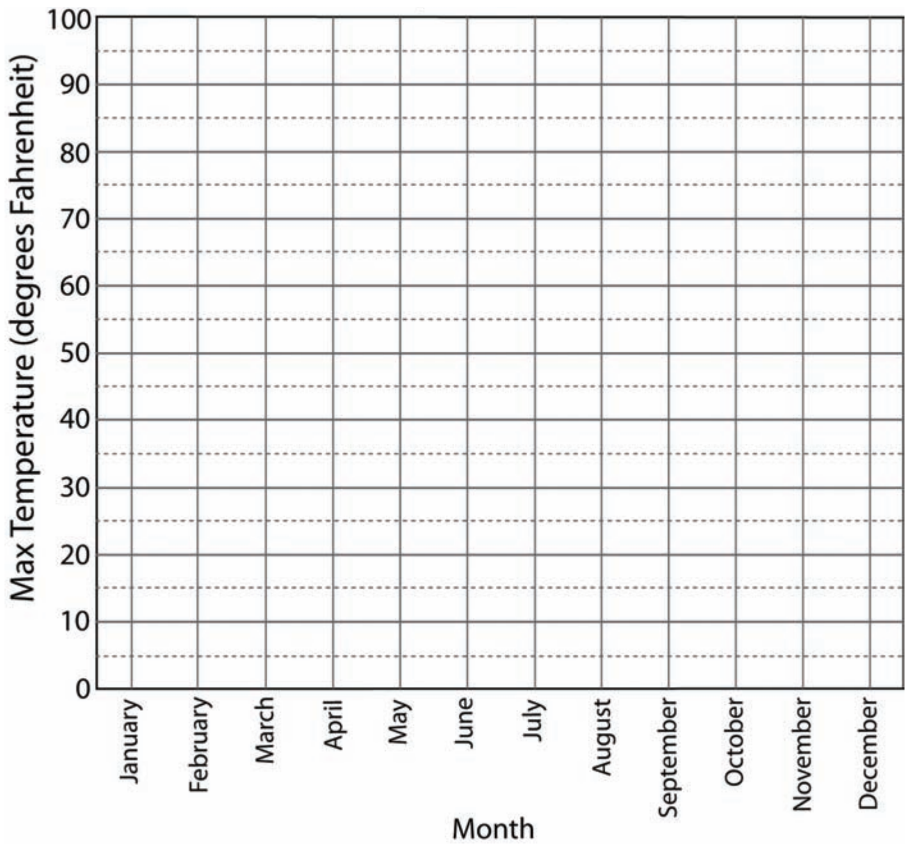
   (b) Compare the two curves.

5. (a) Are the weekly temperatures close to each site's monthly normal max temperatures? In terms of "above, below, or near normal", describe how the weekly temperatures relate to the monthly normal max temperatures. HINT: Plot the normal monthly max temperatures for each site on your plot (like in Figure 5b).

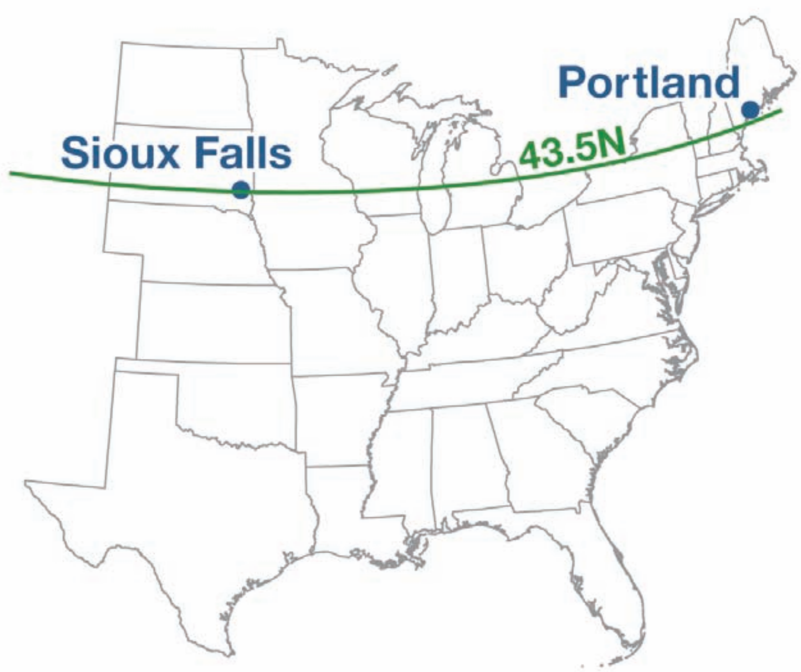
   (b) Add up the weekly temperatures for Sioux Falls, then divide by 7 (the number of days) to get the average weekly temperature. Do the same for Portland. Are the averages close to the monthly normal for this month (use Table 1 for the monthly normal) at each site?

Classroom (Figures, Tables, and Plots) >>

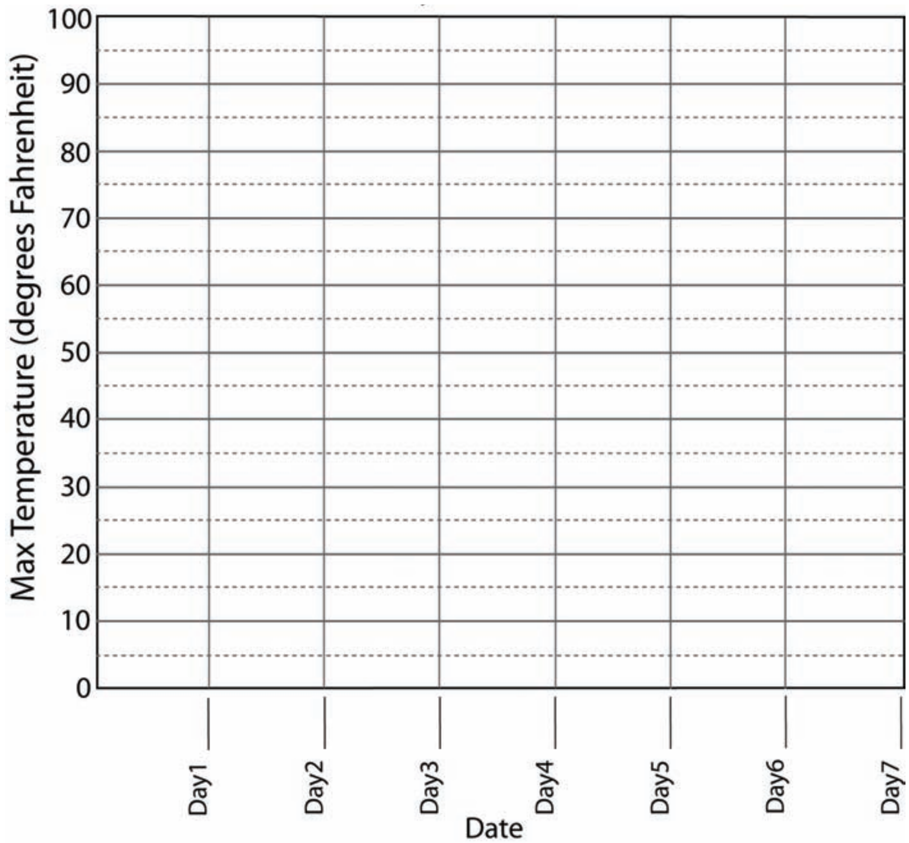
■ Plot 1 - Monthly Normal Max Temps for Sioux City, SD and Portland, ME



■ Figure 4



■ Plot 2 - 1 Week of Max Temps for Sioux City, SD and Portland, ME

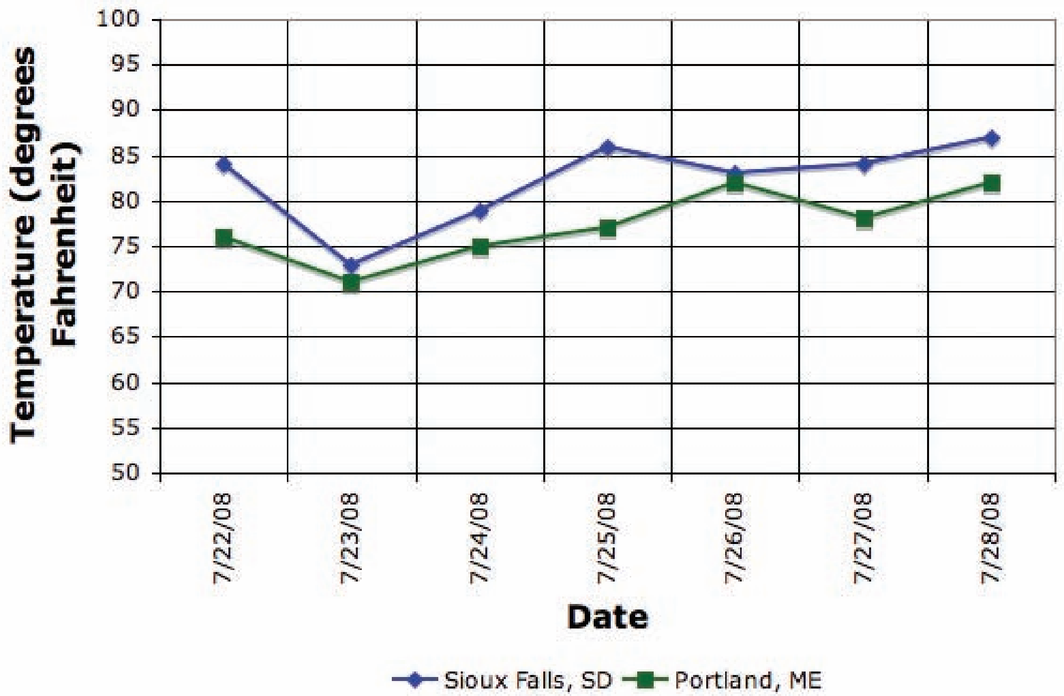


■ Table 1 - Monthly Normal Max Temps (°F) 1971-200

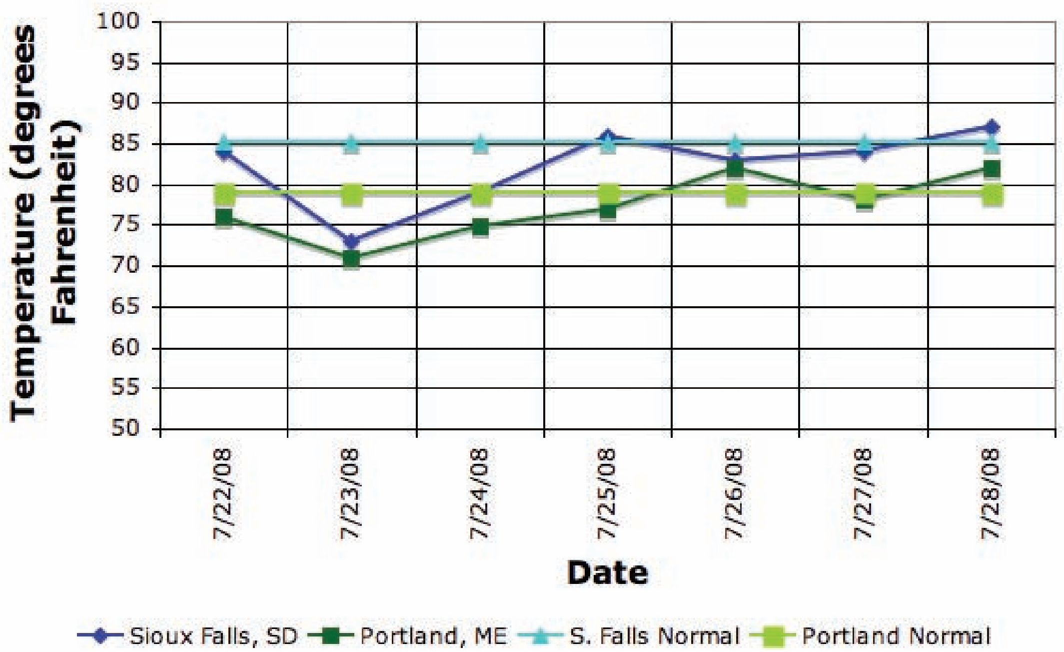
	Sioux Falls, SD	Portland, ME
January	24.6	30.8
February	31.1	33.9
March	43.3	41.9
April	58.4	52.5
May	70.7	63.2
June	80.2	72.9
July	85.2	79.1
August	82.7	77.6
September	73.7	69.2
October	60.7	58.2
November	41.5	47.3
December	28.3	36.4

Classroom (Figure 5a and 5b) >>

■ Figure 5a - Sample Weekly Plot



■ Figure 5b - Sample Weekly Plot with Normals Comparison



WHAT ARE HEATBURSTS?

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Decaying thunderstorms can produce hot, dry, and gusty surface winds called "heatbursts." Most of the few documented cases of heatbursts occurred in the Great Plains of the United States at night during the warm season and were associated with weak or dying thunderstorms. Heatbursts are characterized by a sudden and highly localized increase in air temperature, a simultaneous decrease in relative humidity, and strong gusty winds. Heatbursts have occurred on time scales that range from several minutes to several hours.

A prolonged heatburst event on May 23, 1996, caused severe winds that resulted in $18 million in damages across southwest and central Oklahoma. Although such events are rare, this episode revealed that heatbursts could significantly affect public safety and property, especially private and commercial aviation. Using data from the Oklahoma Mesonet, scientists at the University of Oklahoma examined the climatology of the heatburst events across Oklahoma from January 1994 to June 2008. They identified 156 heatburst days, defined as one or more individual heatbursts detected at one or more Mesonet station during a 24-hour period. On 61 of these 156 heatburst days, multiple Mesonet sites were affected by heatbursts. In all, 203 individual heatburst events were identified.

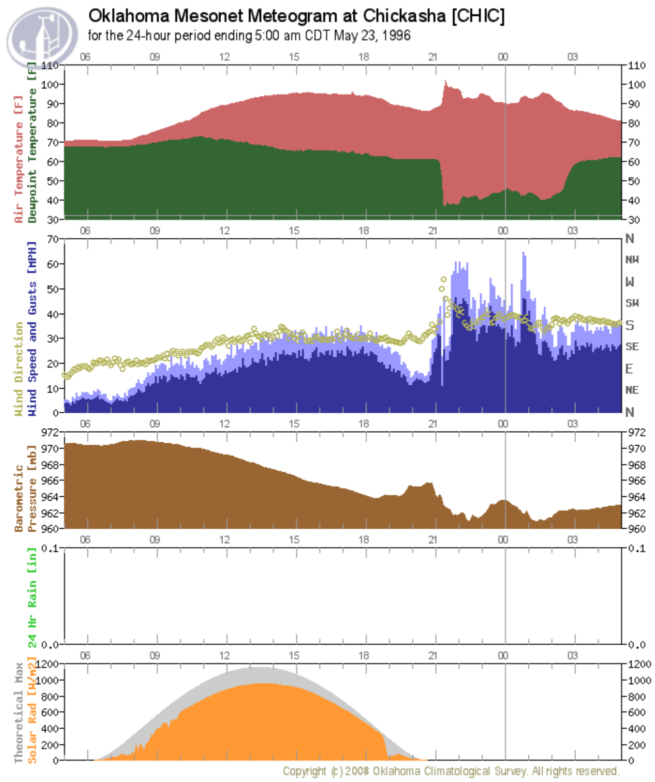


Figure 1. A 24-hour meteogram from the Oklahoma Mesonet station at Chickasha capturing the evolution of a heatburst event in southwest Oklahoma. A sudden rise in temperature from the upper-80s to the low-100s can be seen shortly after 2100 with associated spikes in wind speeds and pressure, and a drop of the dewpoint temperature.

CLIMATOLOGY OF OKLAHOMA HEATBURSTS

To be considered a heatburst for this study, all three of the following conditions were required:

1. an increase in air temperature of 5 degrees Fahrenheit (˚F) during a 10-minute period,
2. a simultaneous decrease in dewpoint temperature (a measure of atmospheric moisture) of 5˚F, and
3. a maximum wind gust of at least 22 miles per hour five minutes prior to, during, or 5 minutes after the changes in temperature and moisture.

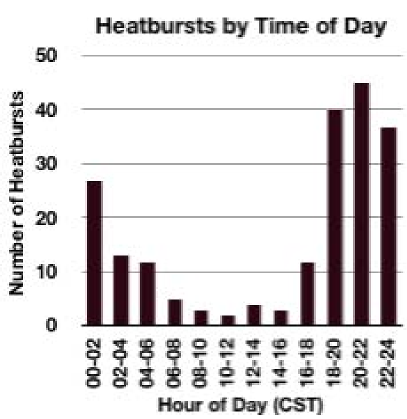


Figure 2. Number of heatburst events by time of day (e.g., 01 = 1 AM Central Standard Time; 13 = 1 PM CST), as measured by the Oklahoma Mesonet. Data are for January 1994 through June 2008.

Continued

FREQUENCY BY TIME OF DAY

Figure 2 shows heatbursts in Oklahoma by time of day, revealing a peak of activity between 8 PM and 10 PM CST. Seventy-three percent (73%) of the events occurred between 6 PM and 2 AM CST. Heatbursts were once thought to be exclusively nocturnal in nature. As indicated in Figure 2, however, heatbursts did occur in Oklahoma during the peak of sunshine.

The peak of heatburst activity during early evening corresponded to the timing of thunderstorm decay during spring and summer across Oklahoma. During the warm season, large thunderstorms often form during the afternoon. As the sun sets and surface temperatures cool, the atmosphere becomes more stable and thunderstorms rapidly dissipate. In addition, during the late spring, large thunderstorm complexes (called mesoscale convective systems) develop and move across Oklahoma, typically during the night. The circulations within a decaying thunderstorm complex can create heatbursts.

MONTHLY DISTRIBUTION

Figure 3 depicts Oklahoma heatbursts by month. Seventy-four percent (74%) of heatbursts occurred during May, June, and July. With 58 of the 203 events, June was the most active month for heatbursts. At the other extreme, only one event per month occurred during October, November, and December.

SPATIAL DISTRIBUTION

Figure 4 displays the number of heatbursts detected at each Mesonet site during the 14.5-year period. The graphs are divided by climate division (CD), with climate division #1 (CD1) in far northwestern Oklahoma and the Panhandle and climate division #9 (CD9) in southeast Oklahoma. Heatbursts were practically non-existent in southeast Oklahoma; yet, they were relatively frequent in the northwestern and Panhandle sections.

This geographical distribution of heatburst detections corresponds to the climatological gradient in atmospheric moisture between southeast and northwest Oklahoma (e.g., as represented by annual precipitation; Figure 5).

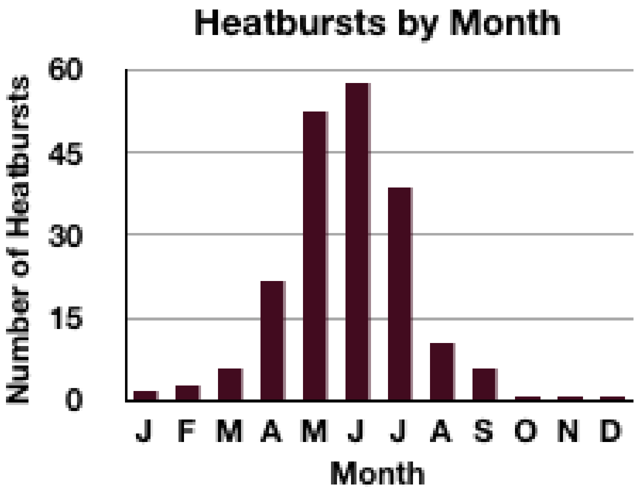


Figure 3. Number of heatbursts by month (J, F, M ... for January, February, March,...) for 14.5 years, as measured by the Oklahoma Mesonet.

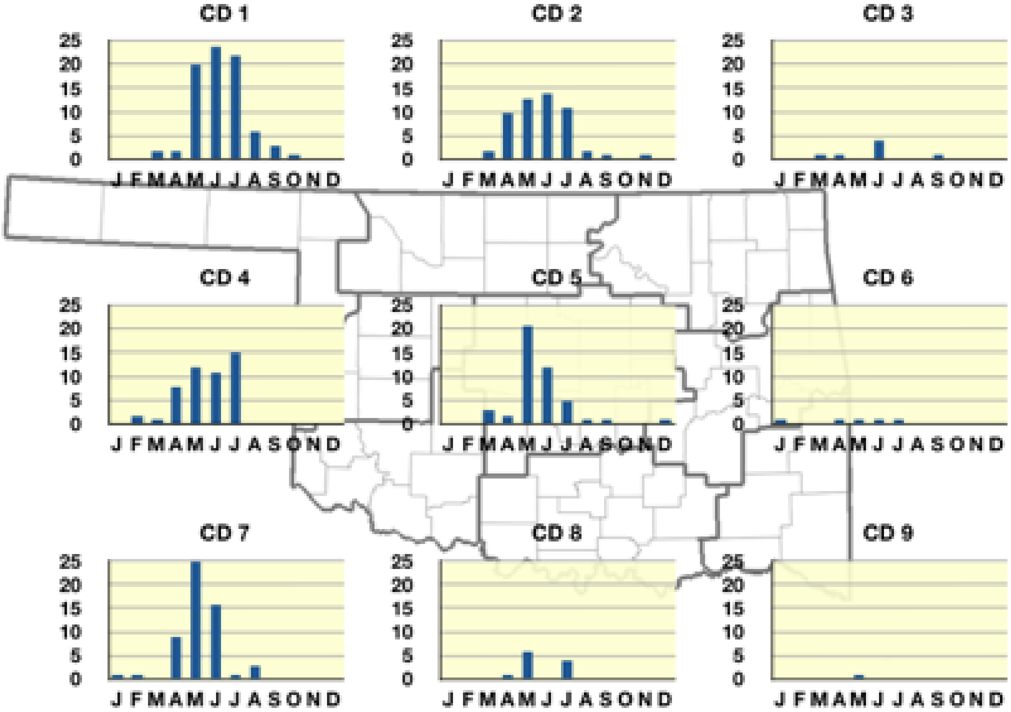
FIGURE 4

FIGURE 5

SUMMARY

Though rarely captured by traditional weather networks, heatbursts appear to be somewhat common in semi-arid western Oklahoma, as measured by the Oklahoma Mesonet and its 5-minute observation interval. Typically, these events occurred during the evening or night from May through July.

Figure 4. Geographical distribution of heatburst detections by climate division (CD) across Oklahoma and by month (J, F, M ... for January, February, March...) for 14.5 years. If a heatburst event was measured at 10 Mesonet sites, then it was counted as 10 detections.



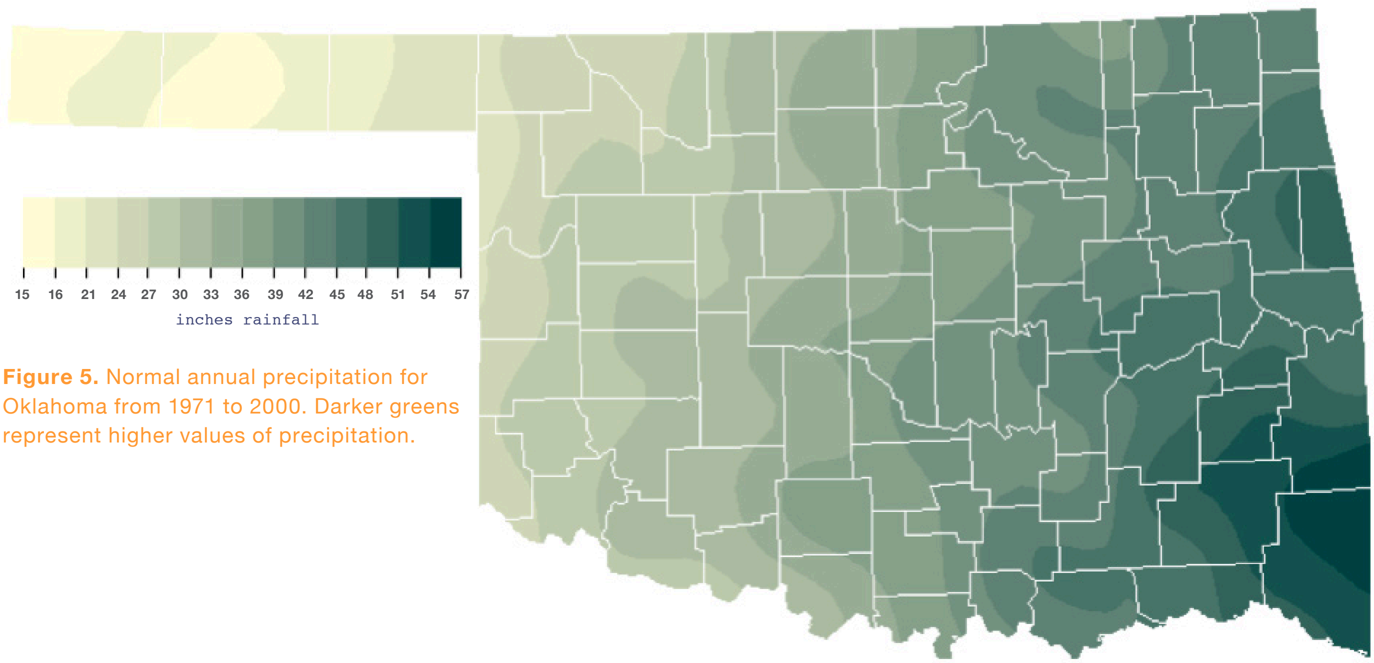


Figure 5. Normal annual precipitation for Oklahoma from 1971 to 2000. Darker greens represent higher values of precipitation.

Learn *not* to Burn

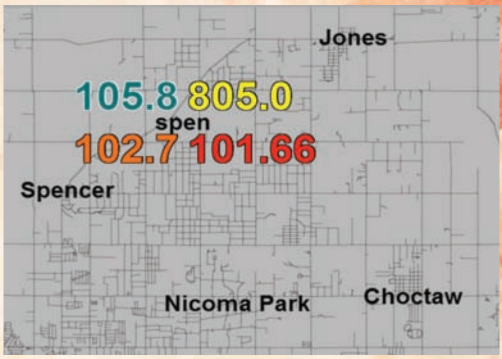
By: Robert Heck, Electric Technician

"The U.S. Consumer Product Safety Commission (CPSC) advises parents to check for hot surfaces on metal playground equipment before allowing young children to play on it. Solid steel decks, slides, or steps in direct sunlight may reach temperatures high enough to cause serious contact burn injuries in a matter of seconds. CPSC knows of incidents in which children suffered second and third degree burns to their hands, legs, and buttocks when they sat on metal stairs, decks, or slides. Young children are most at risk because, unlike older children who react quickly by pulling away their hands or by getting off a hot surface, very young children may remain in place when they contact a hot surface."

- U.S. Consumer Product Safety Commission

"Babies are not born with a developed skin protection system, so they burn more easily. The outermost layer of their skin in particular is much thinner. Even children born to parents with very dark skin need maximum protection."

- American Burn Association



Data from Spencer Mesonet Site viewed in WeatherScope

Green - Bare Soil Temp at 5 cm in °F
Yellow - Solar Radiation in W/m2
Orange - Heat Index in °F
Red - Air Temp at 1.5 m in °F

In an article published by the Gainesville Daily Register:

"A two-year-old boy was hospitalized last Friday [July 21th, 2006] with third degree burns to his feet after stepping on a metal maintenance cover at a park in south Oklahoma City."

Experts say temperatures of more than 140 degrees can burn children in less than 30 seconds. Armed with a thermal imager, the Oklahoma City Fire Department recorded the temperatures of objects found on a playground." The thermal imager showed:

- 158 °F - Black plastic rail around playground
- 147 °F - Metal maintenance cover
- 145 °F - Metal electrical box
- 143 °F - Plastic play seat
- 140 °F - Swing seat
- 135 °F - Metal drain grate
- 125 °F - Plastic slide.

(158 °F through 140 °F: Contact burns in less than 30 sec.)

According to the Royal Society for the Prevention of Accidents (RoSPA), the recommended maximum surface temperature limit values, based on healthy skin of adults, are:

Surface	Time	Temperature
Metal / Plastic / Wood	10 min	118.4 °F
Metal	10 sec	131 °F
Plastic	10 sec	158 °F
Wood	10 sec	192.2 °F

RoSPA also notes that "significantly lower temperature limit values apply when considering the safety of children, elderly people and those with physical disabilities."

Using the skin exposure times and temperatures given by RoSPA, and the thermal imager results from the Oklahoma City Fire Department we can see that adults, let alone children with their more sensitive skin and very young children without a withdrawal reflex , could easily suffer contact burns from playground equipment. The temperature measured by the Oklahoma City Fire Department on the black plastic rail around the playground (158°F) is the same as the RoSPA 10 sec maximum for plastic.

So, the next time you decide to take the kiddies to the playground, please follow the recommendations of the U.S. Consumer Product Safety Commission and check for hot surfaces before allowing children to play.

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