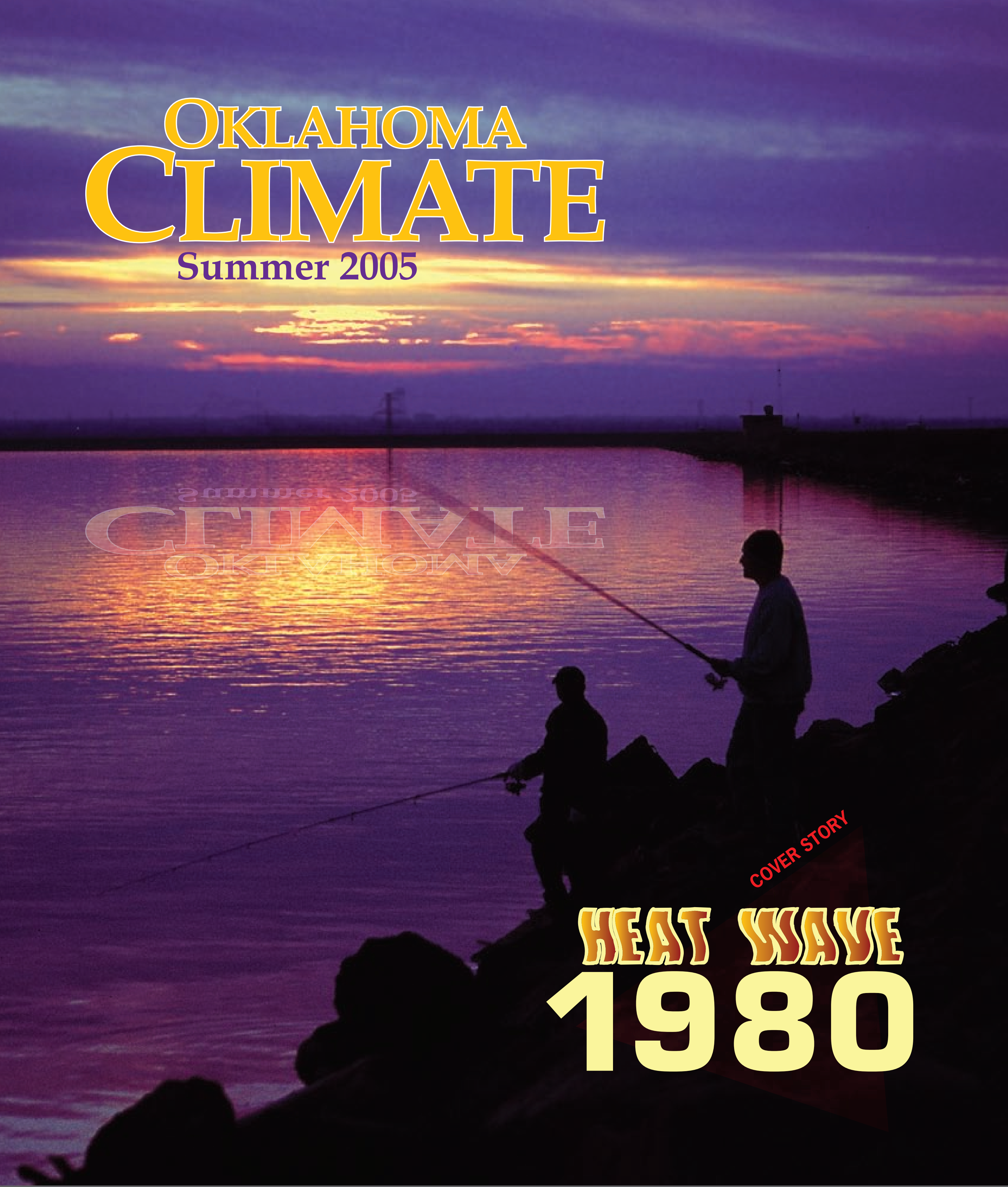
OKLAHOMA CLIMATE

Summer 2005



COVER STORY

HEAT WAVE 1980

ALSO INSIDE: Blackwell Tornado of 1955 • Evapotranspiration: A New Way to Save Water

MESSAGE FROM THE EDITOR

May 3rd. The Dust Bowl. The Woodward Tornado. These weather events have surpassed their own notoriety and become celebrity, instantly recognizable by a single date or phrase. “The Summer of 1980” can be added to that list. Seemingly the summer that would not end, it defines the term “heat wave” for a generation of Oklahomans. I didn’t fully understand the implications of such long-lived heat while it was occurring. Being a kid, I was mostly concerned with the increasing scarcity of fishing holes down at the creek as the 100-degree days accumulated. The toll on Oklahoma, and the nation as a whole, was actually quite staggering, however. In our historical feature, I attempt to quantify just how tough that season really was on the people that suffered through it.

The state of Oklahoma enjoys the best weather coverage anywhere on the globe, thanks in large part to the efforts of the fine folks at the Oklahoma Mesonet, and that coverage just got better. Read about the Mesonet team’s efforts to get data to the state’s citizens and decision-makers even faster than before. Yet another reason why our fair state is the envy of the world when it comes to weather networks! Acting State Climatologist Derek Arndt looks back at yet another weather disaster from Oklahoma’s past, detailing the Blackwell tornado of 1955 on this, the event’s 50th anniversary. This tornado destroyed a large part of Blackwell, adding insult to injury by visiting a flood upon the shell-shocked town only two days later; a fascinating article with lots of great pictures.

Following right along with the heat wave article is an explanation of evapotranspiration and the Oklahoma Climatological Survey’s attempts to help rural and urban water users be more efficient stewards of the state’s water supply. Through data from the Oklahoma Mesonet, models allow farmers to schedule irrigation for their crops, and at the same time tell us city folk when and how much to water our grass. Our photo section is bursting with color this issue, featuring some amazing pictures of Oklahoma foliage.

Also included in this issue are the regular features we provide in each edition of Oklahoma Climate: a weather summary of the spring 2005 season; horticulture tips for gardeners and urban farmers alike; a classroom activity for teachers and students involving heatbursts; and safety tips on how to avoid sunburns, and the dangers of not doing so.

We at the Oklahoma Climatological Survey hope you enjoy this 8th edition of “Oklahoma Climate.” If you have any comments or suggestions, please feel free to contact me at gmcmanus@mesonet.org.

Gary McManus – Editor

Oklahoma Climate
Summer - 2005

Cover Photo: Photo by Jonathan Benge. 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.

Table of Contents

The Oklahoma Climatological Survey is the State Climate Office for Oklahoma

Dr. Renee McPherson, Acting Director
Derek Arndt, Acting State Climatologist

Oklahoma Climatological Survey

The HEAT WAVE of... 1980

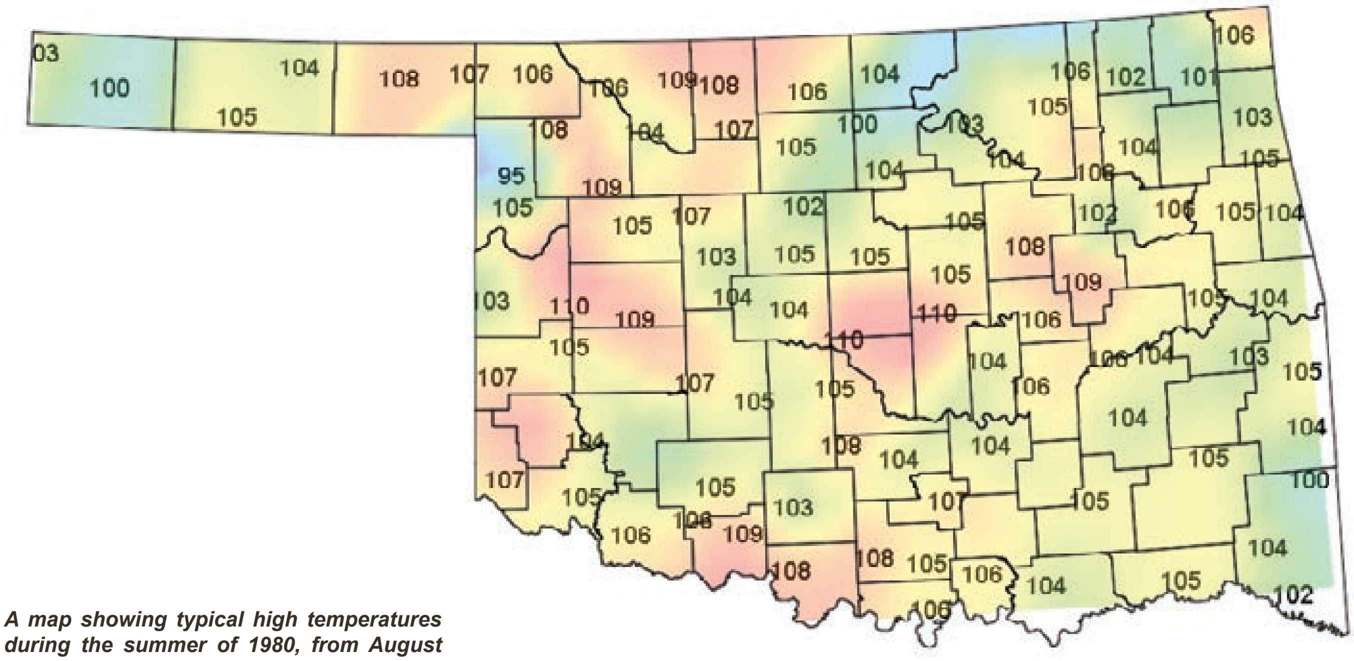
By Gary McManus - Climatologist

The earth, baked for days on end by triple-digit temperatures, became hard and cracked, while topsoil turned as fine as gossamer. Rain was fleeting, and Oklahomans became weary. Beaten upon day after day by the oppressive sun, crops withered and failed, ponds disappeared, and lakes receded. These are not historical accounts from the Dust Bowl, or of the devastating droughts and heat of the 1950s. This is a chronicle of the summer heat wave of 1980, remembered by contemporary Oklahomans as the summer that would not end.

Heat Abounds

The summer of 1980 was not the state's hottest – the Dust Bowl years of 1934 and 1936 were warmer. Nor was it the state's driest – 1936 and 1954 have that dubious honor. Just being placed in the same sentence with those summers is indicative of the insufferable conditions faced by the state that year, however. The problem did not lay with the heat itself; Oklahomans are fully accustomed to sweltering in the summer, biding time until those first cool fronts of fall make their way down from the north. The defining characteristic of the summer of 1980 was the relentlessness of the heat. Healdton reached the century mark 83 times from June through September, an astounding 68 percent of the possible days during those months. In comparison, the Dust Bowl year of 1934 saw Jefferson hit 100 degrees only 70 times, while Hollis did the same 80 times in 1936. For Healdton, the temperature readings first went to triple digits on June 18th, and stayed that way for a couple of days. After a brief respite, high temperatures skyrocketed into the 100s again on June 23rd, staying that way for 42 consecutive days until August 3rd. The heat did not end there, unfortunately. Across the state, high temperatures soared into the 100s as late as September 22nd. At that point, temperatures slowly drifted to more seasonable environs. Finally, a strong cold front late that month put the final nail in the coffin of the memorable heat wave, the triple-digit temperatures but a memory as Oklahomans basked in autumn-like 50s and 60s for high temperatures.

The sea of asphalt that pervades Oklahoma City intensified the heat. Record high temperatures for Oklahoma's capital were tied or broken 18 times during 1980, and the third-highest temperature ever recorded for Oklahoma City was



A map showing typical high temperatures during the summer of 1980, from August 2nd. On this day, Oklahoma City reached its third-highest all-time maximum temperature of 110 degrees.

set on August 2nd with a reading of 110 degrees (113 remains Oklahoma City's highest recorded temperature, from July 11, 1936). High temperatures of greater than 90 degrees occurred on 71 consecutive days, from June 23rd until September 1st (it should be noted that after this one day respite, temperatures elevated above 90 degrees once again for 14 consecutive days).

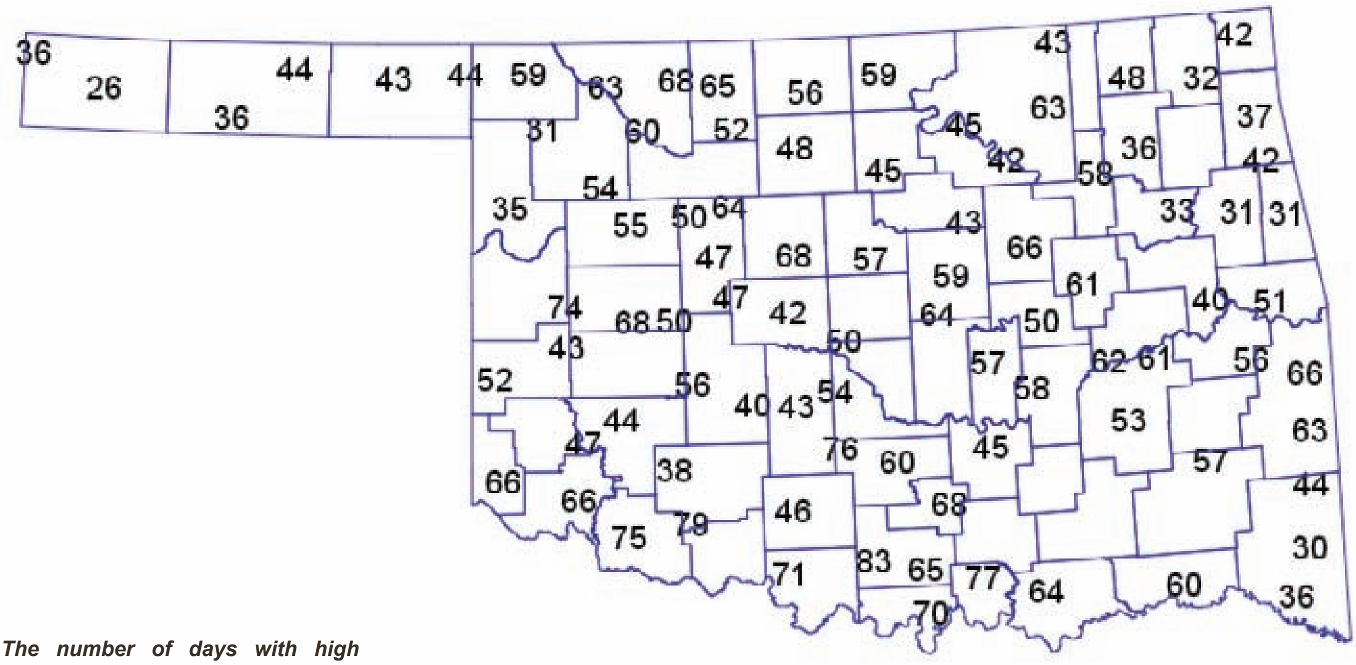
The State Withers

Although nearly impossible to measure accurately, deaths due to extreme temperatures were the largest impact of the 1980 heat wave. Estimates of up to 80 lives were considered lost due to heat-related causes. That figure might be conservative, since many brain strokes and heart failures are also due to extreme heat, yet not labeled so. Nationwide, the 1980 heat wave is blamed for 1,250 deaths.

As an agricultural state, the impacts on Oklahoma were obviously far-reaching. Poultry producers reported massive losses as millions of birds were lost, their inability to sweat along with the added insulation of feathers signing their death warrants. The impact to the cattle industry was similar. As ponds dried up and feed fields withered, ranchers were forced to sell their cattle. The increased volumes of cattle for sale drove prices down, which further exacerbated the cattlemen's cash flow problems.

Crops also felt the double-whammy of heat and drought. The wheat crop, which relies on the weather from September-May more so than the summer months, was the second-largest on record at that time. It was the row crops, such as peanuts and cotton, which bore the brunt of the devastation. Enough precipitation fell during spring for the peanut crop to be planted, but the lack of rain through summer doomed much of the crop. Many farmers had relied on irrigation in the past to survive drought, but even irrigation supplies dwindled by mid-summer.

Excessive water use quickly became problematic for Oklahoma communities. At the height of the summer heat, water shortages struck 273 water systems, which served over 350 communities. Theft of water started to have a severe impact on reserves. A loss of 324,000 gallons to thieves was



The number of days with high temperatures of at least 100 degrees for Oklahoma communities during the summer of 1980.

reported by one community alone. As if the shortages were not bad enough, the water supply infrastructure had begun to deteriorate as the ground dried out and shifted, breaking pipes and mains. Tulsa was forced to implement water rationing for the first time in several decades due to diminishing supplies in

Not all industries were negatively impacted, however. The sale of air conditions units hit an all-time high in 1980, as orders for new and refurbished units often met with delays for days on end as supply struggled to keep up with demand.

An Author's Reminiscence

As a young boy growing up in the small, almost-Panhandle town of Buffalo, I waited impatiently through the cold weather months for the long, hot days of summer. I can certainly understand that the enjoyment of a perfectly lovely 100-degree day is purely in the eye of the beholder. After all, there are plenty of misguided souls that think winter is a fabulous time of the year. In the dry environs of the far northwest, however, the air at sunset always seemed warmly inviting to me.

For all my professed love of Oklahoma heat, however, I will never forget the summer of 1980, when even my enthusiasm for desert-like conditions dwindled. I was but a boy, of course, and like most summers of my youth, my bicycle logged many miles between my house and the creek. But the fishing expeditions became far less frequent as June became July, and even more so when July became August. By the time September rolled around, I was anxious for school to start, where I would be forced to spend my days encased in the deliciously cool air conditioned halls of the Buffalo public school system.

WHEN FIFTEEN MINUTES JUST ISN'T GOOD ENOUGH

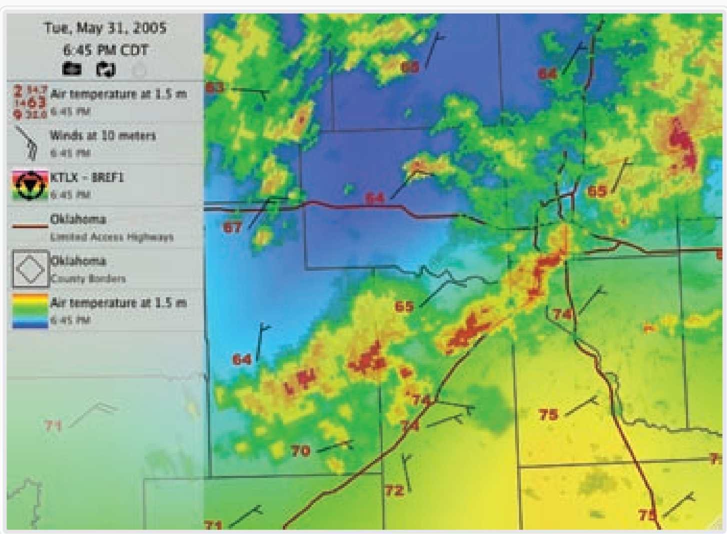
By Dr. Renee McPherson, Chris Fiebrich, and Mike Wolfinbarger - Completed by the Oklahoma Mesonet Team

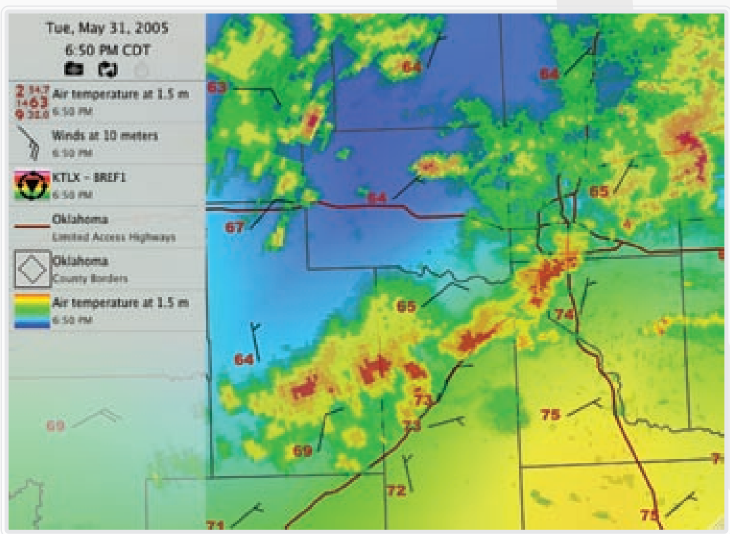
At the beginning of the year, the Oklahoma Mesonet won a special award from the American Meteorological Society for "serving Oklahoma and the meteorological community by providing high-quality data and information used to protect lives, reduce costs, facilitate cutting-edge research, and educate the next generation." This award and others were earned through hard work, long hours, and dedication from a team of state employees and their partners throughout Oklahoma. It demonstrated that Oklahoma values, knowledge, and experience indeed lead to cutting-edge solutions to issues affecting every Oklahoman.

Even as this award was being announced, the Oklahoma Mesonet team continued to strive toward new goals, new innovations, and new services for Oklahomans. The largest new target for the Mesonet team was to provide our customers, especially those who protect the public, with more data even faster than before.

It is not a trivial task to reduce the time it takes to collect, quality assure, and distribute more than 1 million observations per day from every corner of the state. First, through funding from the Oklahoma State Regents for Higher Education, the Mesonet technicians upgraded more than 250 radios across the state. These radios were found in fields near the end of dirt roads, in sheriff's offices of towns that most people don't know exist, and on tall repeaters that are visited regularly only by birds. If you live in Oklahoma, there's a Mesonet radio that was upgraded within 10 miles of your house.

With the upgrade of the radios, the Mesonet could receive observations from the measurement stations faster. Before, computers could 'overhear' both radios from southwest Oklahoma and radios from western Oklahoma





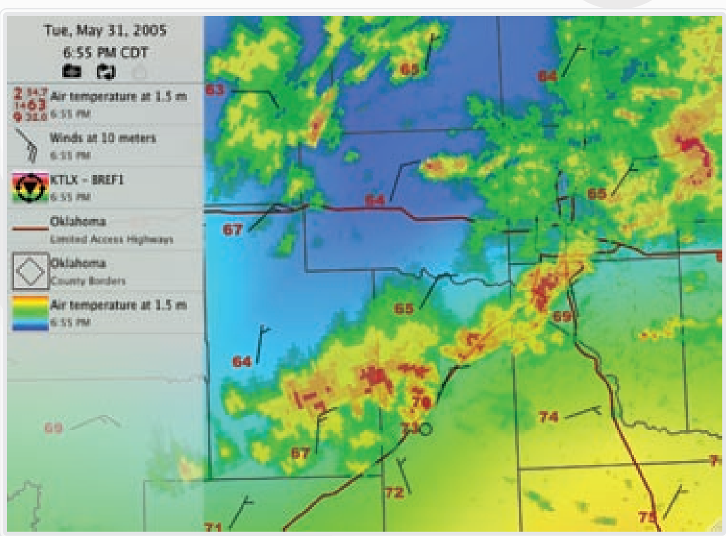
when they 'spoke' at the same time. The computers couldn't understand both conversations, so the radios would have to take turns, slowing down the communication process. Now the radios in neighboring regions of the state can communicate at the same time without confusing the computers. As a result, data now arrive twice as fast as before — in about 3 minutes from all 117 Mesonet sites.

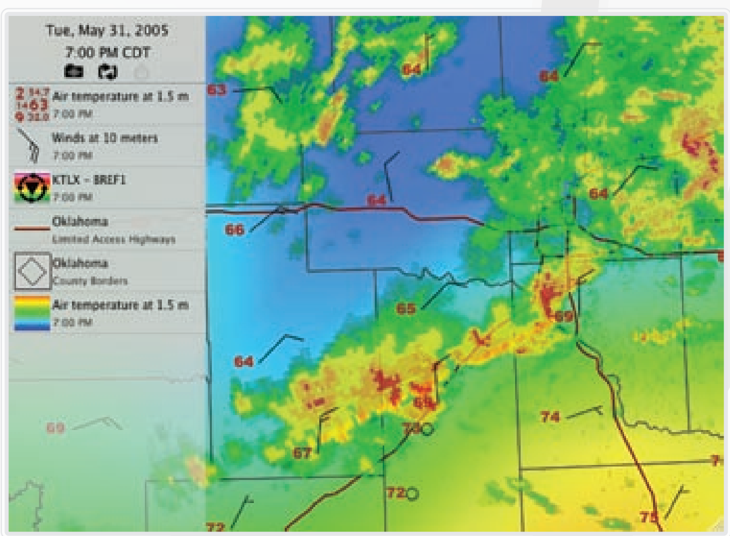
Because the data could be sent in less than 5 minutes, the original, 15-minute transfer of Mesonet data was scrapped after 11 years in operation. Now the measurements are sent every 5 minutes — all through the Oklahoma Law Enforcement Telecommunications System without any negative impact.

After the data arrived at the central collection point in Norman every 5 minutes, then the data needed to be processed faster to arrive at government agencies before the next 5-minute observation was sent. Faster computers were purchased, software was optimized for speed, and a new, simpler database was implemented. As a result, the process to quality-assure the incoming data was reduced from 7–10 minutes to about 2 minutes.

Almost as exciting as this fantastic upgrade was that it occurred without bringing the system down or disrupting the flow of data. And at the same time, regular Mesonet operations continued: sensors were calibrated, maintenance was conducted, and products were provided to both government agencies and individuals alike.

Hey, it's 4:40 PM! You should go to www.mesonet.org and view the 4:35 PM air temperature for your county. You live in the only place in the world where someone can do that today.





ANSWERS TO CLASSROOM ACTIVITY (pg 25):

1. Approx. 11:15 p.m. Mangum
2. Cheyenne (Pulse 2) - 70°F – 62°F = 8°F, Hobart - 68°F – 64°F = 4°F, Mangum – 68°F – 59°F = 9°F,
3. Cheyenne (Pulse 1) - 58°F – 47°F = 11°F
4. Hobart 68mph gust with 55 mph sustained
5. Hobart with 5 pulses
6. 3:30 a.m. at Cheyenne

PHOTOS FROM THE FIELD

Top Photo:
Adult Carolina Mantis on a Purple Coneflower
(photo courtesy of Lauren Illston)

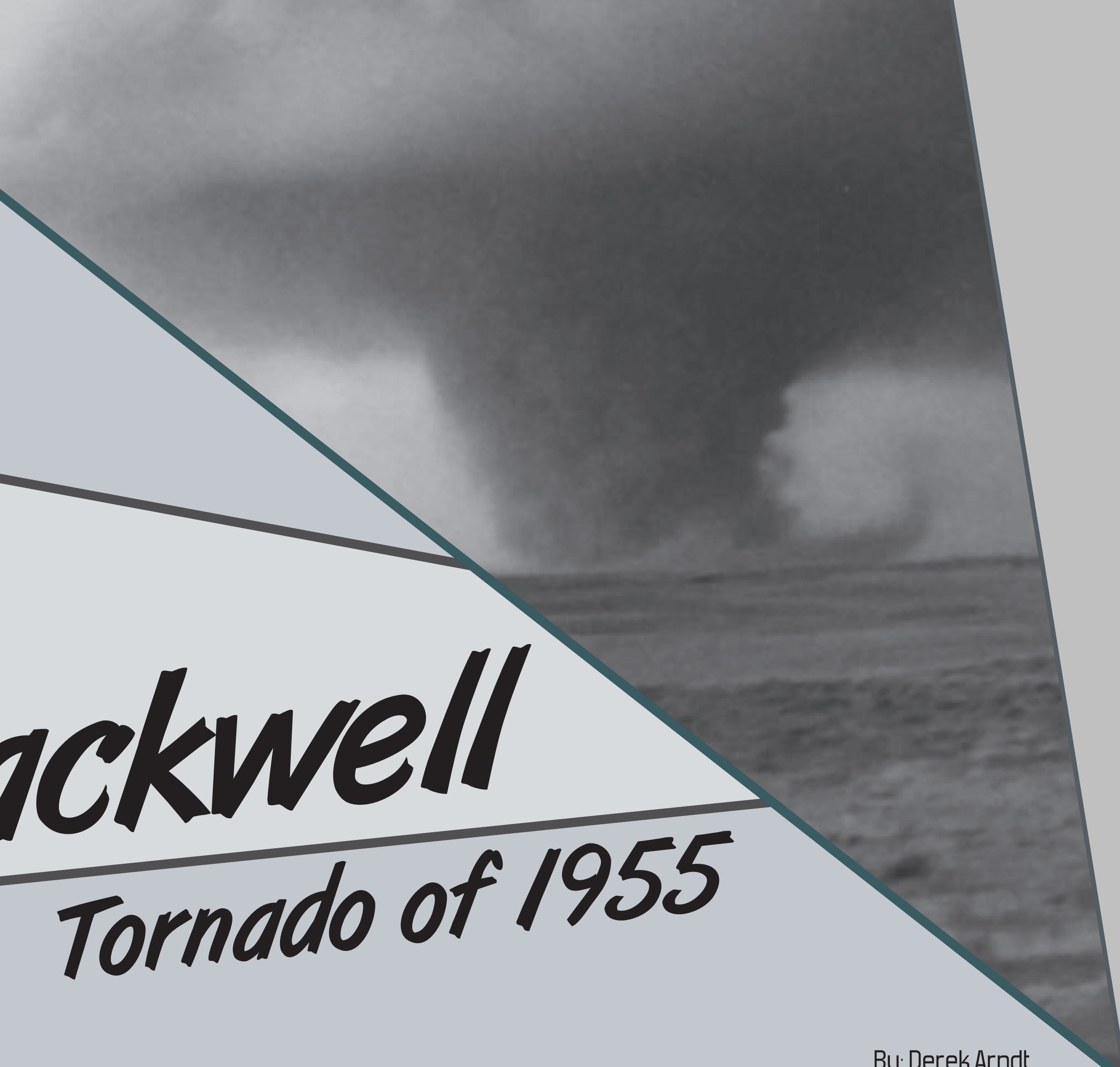
Left Photo:
Purple Prairie Clover and Yellow Gaillardia
(photo courtesy of Lauren Illston)

Bottom Photo:
Orange Poppy
(photo courtesy of Lauren Illston)

Top Photo:
Saucer Magnolia
(photo courtesy of Lauren Illston)

Bottom Left Photo:
Grass of some kind
(photo courtesy of Lauren Illston)

Bottom Right Photo:
Nymph preying mantis on a sunflower
(photo courtesy of Lauren Illston)



Blackwell
Tornado of 1955

By: Derek Arndt
Acting State Climatologist

Shortly after 9 o'clock the evening of May 25th, 1955, Alma Hutton washed clothes in her home on the south side of Blackwell, keeping up with the never-ending demands placed on a mother of five children. The lightning and thunder that Wednesday night was all-too-familiar, for it had been a stormy week in Blackwell. Just that afternoon, a wind-and-hail storm claimed the plate-glass storefront windows of the J.C. Penney's and Central National Bank. As yet another storm shot northward toward Blackwell, few knew that it had produced a tornado just north of Tonkawa, about nine miles away.

Within minutes, huge hailstones fell all around the Huttons' house. Softball-sized meteors crashed from the sky throughout town, escorted by violent winds. Then Mrs. Hutton heard an unmistakable roar, and knew exactly what it was. She shepherded her kids into the dining room. "I grabbed Betty [the youngest] and we all held on to the table and each other for what seemed like forever," she recalls. Chaos reigned just outside their walls for the next few minutes.

When the violence had stopped, the family peered outside. An old and mighty cottonwood tree that once shaded their front yard now lay sideways in it. Their house still stood, but it was obvious that something terrible had happened just blocks to their east. Broken trees and broken houses littered the streets. A fire burned here and there, but the rest of the town had gone dark. In the confusion, one thing was clear: many of their neighbors had lost their homes and needed help.

Thursday morning's sun gave scope to Wednesday night's confusion. The east side of town was gone.

The tornado took with it much of Blackwell's past, and some of its future, as it roared northward across the Chikaskia River and into the countryside. Twenty-one people lost their lives in and around the town, and more than forty city blocks were completely leveled. Just as many homes were heavily damaged. The storm's worst was spent in the eastern portions of town, particularly the Riverside district, where entire houses were gone. A Daily Oklahoman report from the scene described the eastern half of Blackwell as "a mass of kindling wood, mattresses and springs" where houses once stood. Trees, lumber and debris piled ten feet high on some streets.

The storm destroyed nearly 200 homes and ten businesses in Blackwell, plus a handful of homes in Tonkawa and near Braman. Almost 150 additional homes and 18 businesses suffered irreparable damage. Nearly 500 more buildings were in need of repair. Three hundred people in Blackwell suffered serious injuries. The death toll of 21, while horrific, seemed impossibly small to any who witnessed the destruction first-hand. Most of the fatalities occurred in a three-block area just east of D Street. Years later, based on photos and damage assessment, the tornado was classified as F5 in this part of town.

One of the storm's final casualties in Blackwell was the Hazel-Atlas glass plant, near the Chickaskia River on the northeast side of town. The plant was a large, round-the-clock operation most of the year, and more than 70 workers were in the building when it took on the tornado. The building was heavily damaged by the storm; amazingly, nobody at the plant was seriously injured. However, fire from the large kilns spread quickly through building and the plant burned until only the smokestack stood over the charred rubble. Many Blackwell residents reported seeing fire within the tornado, presumably from the Hazel-Atlas ovens.

Fig. 1
Gene Holcomb, local Red Cross volunteer, and two Red Cross nurses from Oklahoma City stand in front of Holcomb_s storm-damaged grocery store on East Bridge Avenue in Blackwell. Photo courtesy of the Blackwell Journal-Tribune.

Fig. 2
Steve Lambert of Blackwell made a delivery to Braman in this Singer Sewing Machine Co. van just hours before the tornado struck the Lambert home in Blackwell. Photo courtesy of the Blackwell Journal-Tribune.

Fig. 3
One of the casualties of the 1955 tornado in Blackwell was Riverside School. After the tornado, a new school, Parkside Center, was built. Photo courtesy of the Blackwell Journal-Tribune.

The heavily damaged Riverside Hospital's ability to accommodate new patients was severely limited, despite heroic efforts from doctors and nurses there. Blackwell General Hospital soon overflowed with patients. Triage centers and shelters at the First Baptist Church and the Armory provided services and housing to dozens of residents. The Riverside school lost its roof and was demolished that summer. Rescue workers from all over Oklahoma used tractors and heavy equipment to clear roads and lots in the hunt for victims. National Guardsmen patrolled the streets, issuing passes to curtail looting and rubbernecking.

Two days after the storm, Mother Nature added insult to injury when heavy rains just across the Kansas border swelled the Chikaskia River. The river engulfed many blocks of the devastated Riverside district, and chased away rescuers, residents and most of what little remained after the storm.

The economic impact on Blackwell was staggering. The tornado, fires, and flood caused more than $8,000,000 (1955 dollars) in damage within the city's borders, twenty times the amount of the previous "big tornado" that struck the town in April 1929. The Hazel-Atlas plant, which had expanded over the years to fill two city blocks, was a total loss. It never reopened, and hundred of jobs slipped away. The Acme Foundry suffered heavy damage, but its operators rebuilt, sparing 175 jobs.

Fig. 5
This two-story home on East Furguson Avenue in Blackwell was damaged by the tornado that devastated eastern portions of the city. Photo courtesy of the Blackwell Journal-Tribune.

Fig. 4
A mangled car testifies to the destructive power of an F5 tornado. Photo courtesy of the Blackwell Journal-Tribune.

Fig. 6
Blackwell Red Cross volunteer Gene Holcomb celebrates his birthday in the midst of the destruction. Photo courtesy of the Blackwell Journal-Tribune.

The Blackwell storm was just one of dozens of tornadoes in one of the century's biggest severe weather outbreaks in the Southern Plains. Three separate waves of severe weather carried a 36-hour rampage from west Texas, across Oklahoma and the Southern Plains. Hours before the catastrophe in Blackwell, a tornadic thunderstorm near Sterling City, Texas, knocked a U.S. Air Force B-37 out of the sky. The plane, on a training mission out of Walker Air Force Base in Roswell, New Mexico, went down in flames. All 15 airmen were killed, and the planes four engines were found 25 miles from the scene of the crash. A few hours later, an Oklahoma husband and wife lost their lives when a long-track tornado crossed the state line from Shamrock, Texas, and into their farm home near Cheyenne. A woman and her child were injured by a tornadic storm the next afternoon in Sallisaw. Nebraska, Missouri and Arkansas each saw three tornadoes on the second day of the outbreak.

But the worst of the entire outbreak occurred in tiny Udall, Kansas. The same storm that leveled eastern Blackwell generated a new long-track tornado as it crossed the Oklahoma-Kansas border. It killed a family of five in a farmhouse near Oxford, Kansas, before engulfing the entire town of Udall within its mile-wide funnel. Seventy-seven of the town's 500 residents were killed, and just about every survivor suffered injuries of some sort. Only three businesses were left standing. This tornado was also retroactively rated an F5. Less than one out of a hundred tornadoes receive an F5 rating. For the same storm to generate two of these top-end tornadoes is exceedingly rare.

The towns of Udall and Blackwell recently commemorated the 50-year anniversary of their tornadoes. Survivors and their descendants dedicated a memorial marker in Blackwell's Memorial Park. Udall residents read the names of each of their 77 victims from a memorial in Udall City Park.

Special thanks to Korina Atchley of the Blackwell-Tribune-Review for her generous help.

SPRING 2005 SUMMARY

By: Gary McManus

Significant drought conditions found their beginnings during the spring of 2005, which ranked as the 2nd driest such period since 1895 for the state of Oklahoma. The lack of rain was most severe in a north-south corridor though the center of the state, but virtually all areas were overwhelmingly dry during the season. Precipitation was not the only weather attribute that was lacking; for the first time since accurate tornado statistics began in 1950, the state of Oklahoma went without a confirmed tornado touchdown during the month of May. The total for the season as a whole ended at 15, well below the average tornado count of 35.

Precipitation

A deficit of well over six inches plagued the state during the spring months. Without question, the hardest hit areas centered on central Oklahoma and radiated outwards from there. The final tallies are depressingly meager, with south central and central areas being more than eight inches below normal for the three-month period, ranking as the 1st and 3rd driest springs on record for those two areas, respectively. In actuality, however, all of Oklahoma suffered a significantly dry spring, save for the far western reaches of the Panhandle. The dry weather actually began in late February, gained a foothold in a relatively dry March, and plunged ahead full steam in April and May. Only three of 116 Oklahoma Mesonet stations active during all three spring months approached double-digit precipitation totals during spring – Cookson, Mt. Herman and Sallisaw, the latter of which failed to actually break the ten-inch barrier. A swath of the state from Woods County northeastward through Alfalfa County were limited to approximately two inches.

Temperature

The statewide-averaged temperature finished near normal for the spring. Generally, central and western Oklahoma were a bit warmer than normal, and eastern Oklahoma and the Panhandle were a bit cooler than normal. As it works out, those areas with low precipitation were warmer, and the areas with more precipitation were a bit cooler. The year's first significant bout with heat occurred in late May, when nearly 50 records were broken throughout the state. The season's last freeze occurred in northwestern Oklahoma on May 4th. The lowest temperature of the spring, 11 degrees, was recorded at Boise City on the 11th, and the highest temperature, 103 degrees, occurred at Altus and Grandfield on May 22nd.

March Daily Highlights

March 1-6: The month's first six days found the state enjoying rather uneventful weather. Temperatures were seasonable, for the most part. There were a few instances of precipitation, but any organized rainfall stayed on the periphery of the state's borders. The winds picked up on the 6th with the approach of an upper-level disturbance from the west. Gusts of over 30 mph were reported in western sections of the state.

March 7-12: A cold front entered the state on the 7th, generating a thin band of light rain. Rainfall amounts were light, with the Mesonet site at Sallisaw leading the way at a paltry 0.32 inches. Temperatures did not fall far after the frontal passage, but the winds charged in from the north at over 30 mph, with gusts reported in the northern half of the state of 50 mph. The weather became much more pleasant the proceeding days, culminating in a very pleasant day on the 12th.

March 13-17: The main highlight of this period was the surprise snowstorm that buried parts of extreme western Oklahoma under a half of a foot of snow on the 15th. An accumulation of seven inches was reported in Durham, and a six inch amount was reported in Reydon. Lesser amounts were reported fanning outward from there. Ground temperatures of up to 50 degrees made quick work of the snow, and light rain was the rule elsewhere.

March 18-21: Spring arrived with a flourish on the 20th, as severe thunderstorms plagued the state for the last two days of this period. Locations in Hughes, Seminole, and Pottawatomie Counties reported rain between one and two inches, and the Oklahoma Meosnet site at Bowlegs recorded nearly three inches of rain. Those same storms spawned two tornadoes, although both were of the "weak" variety. Two more weak tornadoes were reported in Alfalfa County near Amorita and Byron, respectively.

March 22-27: The exit of the upper-level low pressure system to the east preceded improving weather conditions. Low clouds, cool temperatures and drizzle on the 22nd gave way to highs in the 70s by the 24th. Unfortunately, the warmer weather was accompanied by more severe thunderstorms, although nothing to the extent of what occurred on the 21st. Large hail was the main severe threat with these storms, with quarter-sized hail reported near Garber in Garfield County. Cooler weather took hold for the next three days, a bit unseasonable with highs in the 50s and 60s.

March 28-31: The month's final four days were much more spring-like than the preceding few days. Highs in the 70s and 80s on the 28th, along with low humidity and strong southerly winds, prompted fire danger warnings across the state. Winds gusted to over 40 mph on the 29th as well. A cold front entered the state on the month's final day, bringing with it a few scattered thunderstorms and wind gusts over 40 mph in the northwest. The heaviest rainfall was reported from far southeastern Oklahoma; the Oklahoma Mesonet site at Wilburton recorded just under three-quarters of an inch.

April Daily Highlights

April 1-4: A bit of rain generated from an upper-level storm started the month off on the right foot. Eastern Oklahoma was the main target of these wayward showers in a month that ended so dry. Even so, the precipitation totals failed to reach three-quarters of an inch. Pleasant weather was in store throughout this period otherwise, if not a bit windy. By the 4th, surface low pressure in the Panhandle kicked up winds from the south with gusts of over 30 mph. Dangerous fire conditions were exacerbated by unusually high temperatures.

April 5-6: Rain and cooler weather descended on the state for the next two days, in addition to some fairly stout severe weather. Showers and storms formed along a dryline in east central Oklahoma on the 5th, with some of those storms quickly becoming severe. Three weak tornadoes touched down in Latimer and Sequoyah counties, with no official reports of damage. Teacup size hail was reported in Tulsa, and winds of over 80 mph damaged out buildings in the Kinta area.

April 7-11: A ridge of high pressure built in after the previous cold front's passage. Temperatures remained seasonable, however, with highs in the 70s. The weather remained nice through the 10th, when an upper-level storm returned winds from the south, ushering in abundant moisture from the Gulf of Mexico. With added fuel, thunderstorms fired along a dryline in central

Oklahoma that evening. A weak tornado touched down briefly four miles southwest of Harrah in Oklahoma County, damaging utility lines.

April 12-19: The period stated clear and cool. Lows on the 12th fell into the 30s and 40s, but clear skies and abundant sunshine during the afternoon allowed temperatures to climb into the 70s and 80s. The weather remained in that mode for the main body of the state, with a few bouts of storms occurring in the Oklahoma panhandle on the 15th and 17th. An upper-level storm traveled over the state on that day, triggering a round of showers and thunderstorms for southwestern Oklahoma.

April 20-21: A return of warm, humid air signaled a return of storminess to the area. The storms began that afternoon in southwestern Oklahoma, with damaging winds and large hail. Jackson County was particularly hard hit, with winds of over 70 mph being reported, and hail to the size of golfballs. Storms struck the northeast corner of the state on the 21st as a cold front moved through the state. Once again, damaging winds and large hail were on tap. Two weak tornadoes were reported to have touched down in Rogers and Wagoner counties with no official reports of damage.

April 22-24: With the cold front's arrival, cool and dry air replaced the humid airmass of the previous two days. A rainless period, temperatures remained below normal throughout the state. Lows on the 24th were in the 30s, and several locations experienced a late freeze. The Mesonet sites at Oilton and Jay reached a relatively bone-chilling 28 degrees. Highs on the 24th struggled to reach 60 degrees for much of the state.

April 25-30: The month's final six days were cool, with some moisture falling in parts of the state. Storms struck eastern Oklahoma on the 25th, and temperatures remained cool with lows in the 30s and 40s. Highs that day managed to climb into the 70s in central Oklahoma, but remained in the 50s and 60s in the northern sections of the state. Once again, large hail and strong winds were the main hazards associated with the storms. Reports of half-dollar size hail were made in McAlester, and wind damage was reported in LeFlore County.. The month's final few days were cool and mostly cloudy. Highs in northern Oklahoma were unseasonably cool, some 15-25 degrees below normal.

May Daily Highlights

May 1-5: Cloudy and cool conditions dominated the month's first five days. The heaviest rain was concentrated in the west on the 2nd,. The month's last freezing temperatures occurred in the northwest on the 4th; Buffalo fell to 31 degrees and several other Oklahoma Mesonet stations recorded 32 degrees. High temperatures were unseasonably cool throughout this period, struggling to reach 70 degrees. Antlers recorded the highest temperature of the period at 75 degrees on the 1st.

May 6-11: Temperatures became more spring-like during this period, and at times approached early-summer levels. Rainfall was spotty, other than a well-organized system of storms on the 8th. Temperatures had reached a muggy 90 degrees and beyond by the 8th, staying that way throughout the end of the period. Prompted by an upper-level storm system to the west, southerly winds kicked up to near 40 mph in western Oklahoma.

May 12-15: A cold front entered northwestern Oklahoma on the 12th, stalling out and providing a chance for rain the next three days. Hail up to two inches in diameter fell in Harper County near Laverne on the 12th, and a 90 mph wind gust was reported west of Martha in Jackson County the following day. After that stormy period, the state enjoyed tranquil weather for a couple of days. Surface high pressure dominated, with highs in primarily in the 70s and 80s.

May 16-22: The ridge of high pressure lingered across the state on the 16th and 17th, providing the state with pleasant spring-like conditions. An upper-level storm approached overnight on the 18th, bringing thick cloud cover along with it. Showers and storms on the 19th brought beneficial rainfall to north central Oklahoma. The May 20th-22nd amounted to the hottest weather seen in the state since September, 2004. Fifty records for heat were either tied or broken at various locations around Oklahoma according to National Weather Service data. Temperatures climbed into triple-digit territory across a significant portion of the state all three days. The state's highest temperature of the month, 103 degrees, occurred at both Altus and Grandfield on the 22nd.

May 23-25: A stationary front generated showers and thunderstorms in north central Oklahoma on the morning of the 23rd. More severe weather was in store on the 24th, as storms fired up in the high plains of Kansas and Colorado and made their way southeast into the state. The hardest hit area was the northeast, where flooding due to heavy rainfall was exacerbated by tennis ball size hail and winds of at least 70 mph. Locales north of the front had highs in the 80s, while south of the front temperatures soared into the upper 90s and 100s. On the 25th, however, highs across nearly the entire state remained in the 80s.

May 26-31: The month's final 6 days were similar to the first five; cloudy, below normal temperatures and plenty of rain for select portions of the state. A cool front which passed through the state early morning on the 26th triggered showers and storms in northwestern Oklahoma, which later moved into central and southwestern parts of the state. Heavy storms finished off the month with a nice soaking rain the southwestern Oklahoma. Daytime highs behind the front on the 31st remained in the 60s and 70s, 10-20 degrees below normal for that time of the year.

Spring 2005 Statewide Extremes

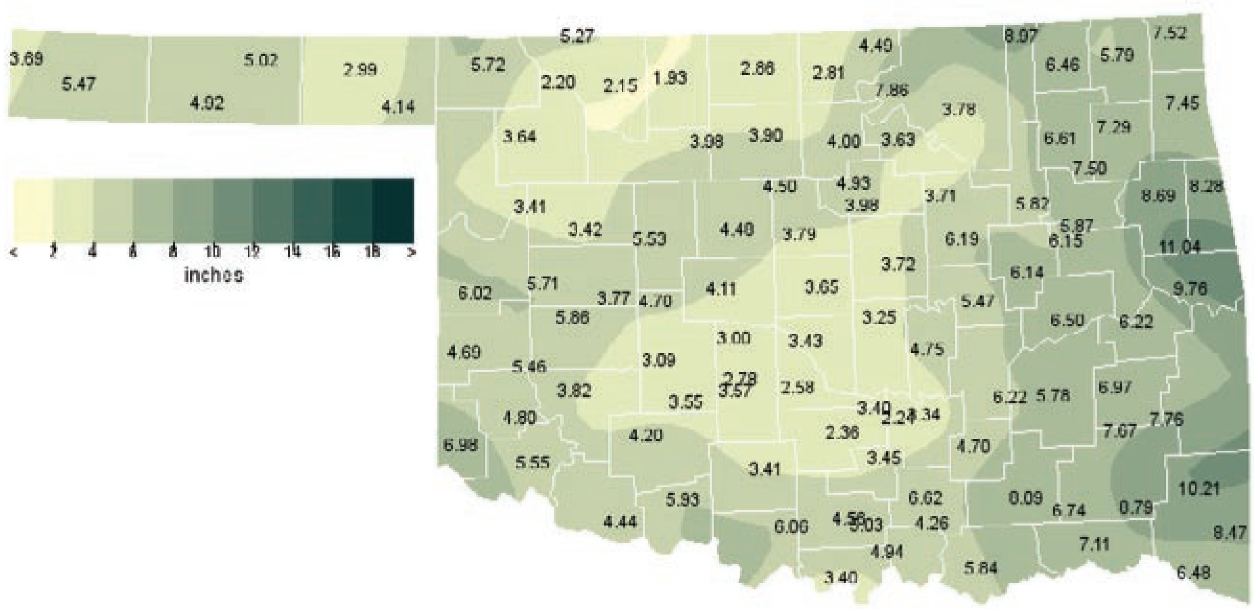
Description	Extreme	Station	Date
High Temperature	103ºF	Altus, Grandfield	May 22nd
Low Temperature	11ºF	Boise City	March 16th
High Precipitation	11.14 in.	Cookson	
Low Precipitation	1.93 in.	Cherokee	

Spring 2005 Statewide Statistics

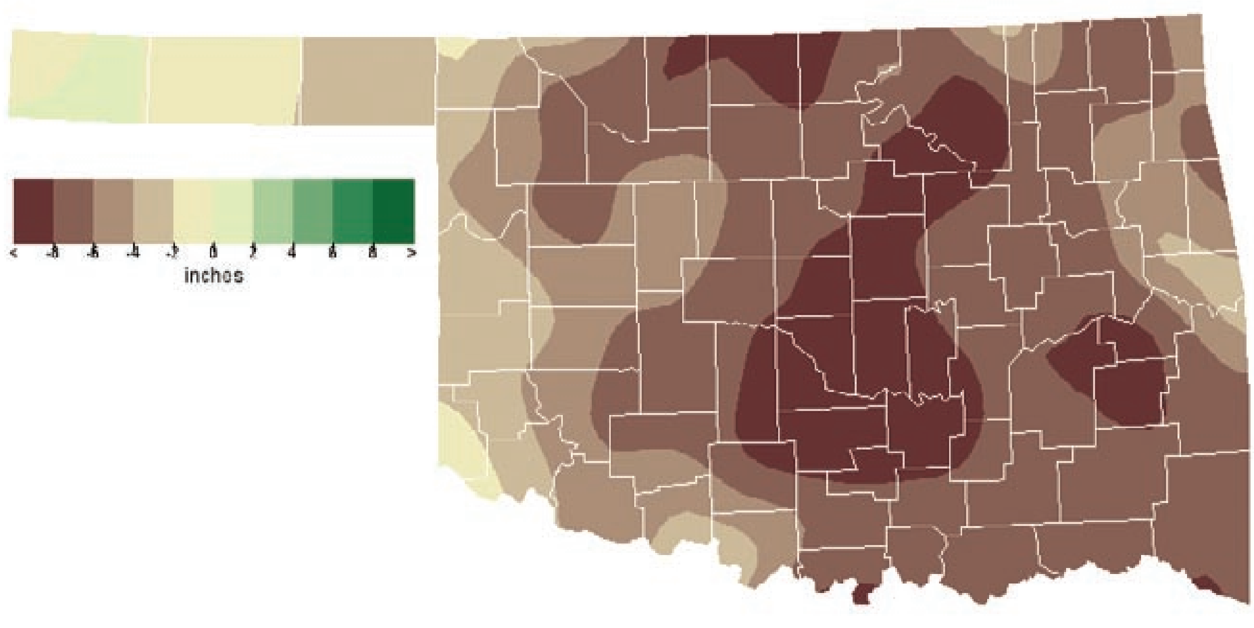
	Average	Depart.	Rank (1892-2005)
Temperature	58.8ºF	-0.3ºF	52nd Warmest
	Total	**Depart.**	**Rank (1892-2005)**
Precipitation	5.20 in.	-0.63 in.	2nd Driest

SPRING 2005 SUMMARY

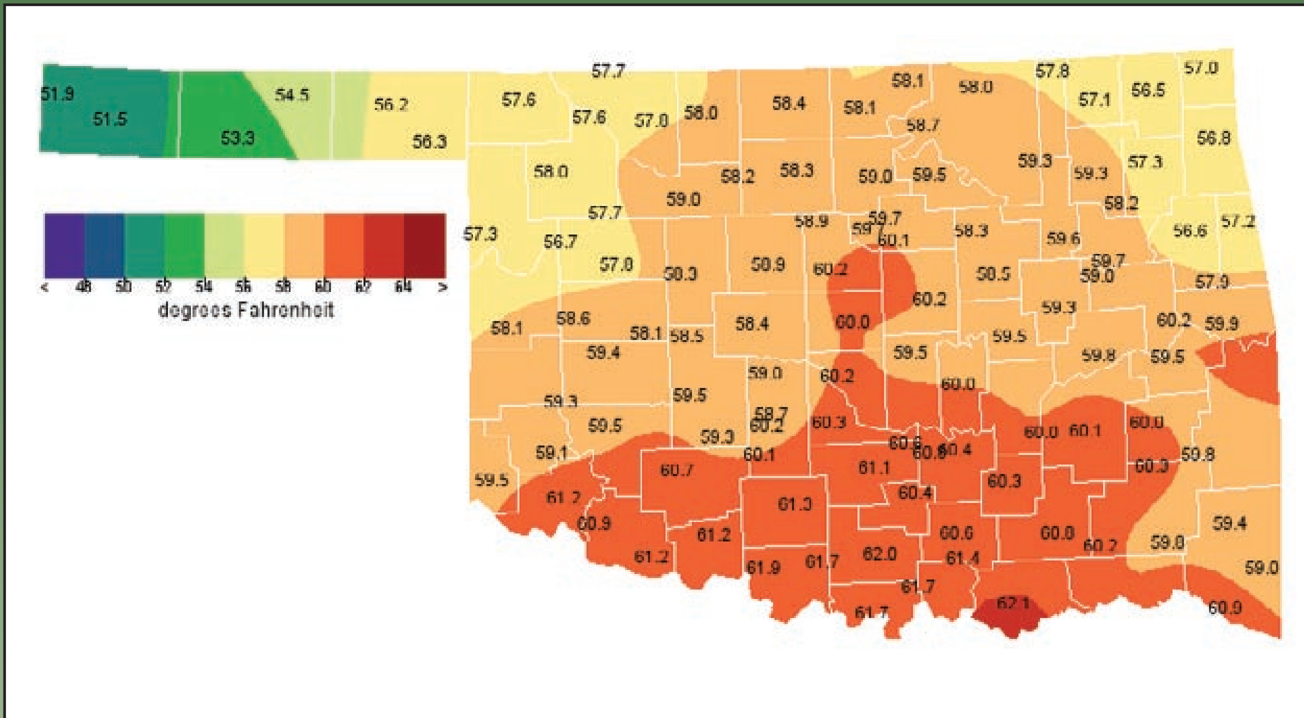
Observed Rainfall



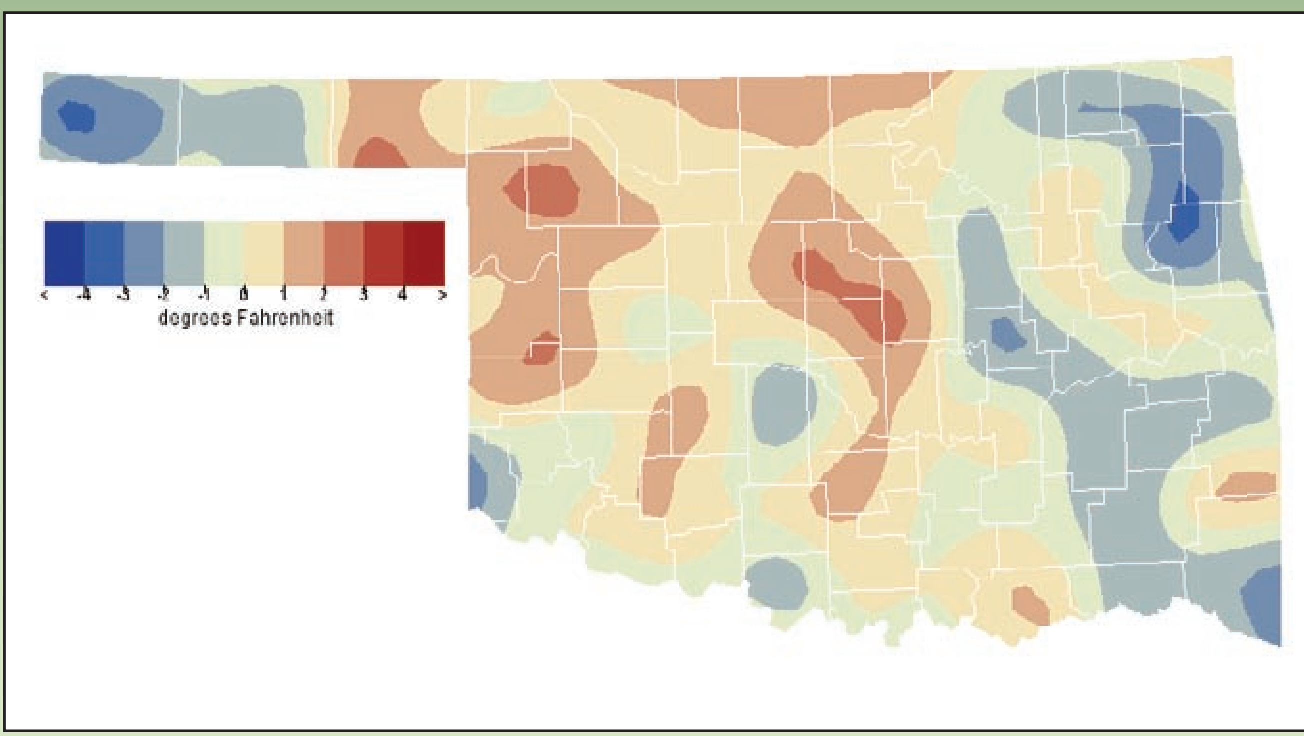
Rainfall Departure from Normal



Average Temperature



Temperature Departure from Normal



Spring 2005 Mesonet Precipitation Comparison

Climate Division	Precipitation (inches)	Departure from Normal (inches)	Rank since 1895	Wettest on Record (Year)	Driest on Record (Year)	2004
Panhandle	4.56	-2.29	34th Driest	13.27 (1957)	1.15 (1966)	5.12
North Central	3.38	-6.98	3rd Driest	21.31 (1957)	1.77 (1895)	9.50
Northeast	6.50	-6.65	6th Driest	25.15 (1957)	3.12 (1895)	14.75
West Central	4.87	-5.03	11th Driest	19.30 (1957)	1.86 (1971)	8.18
Central	3.99	-8.41	3rd Driest	22.89 (1957)	3.74 (1932)	9.05
East Central	7.48	-6.83	4th Driest	30.36 (1990)	4.49 (1936)	12.69
Southwest	4.71	-5.19	7th Driest	20.48 (1957)	3.28 (1971)	6.81
South Central	4.48	-8.43	1st Driest	27.30 (1957)	5.07 (1896)	8.16
Southeast	7.80	-7.53	3rd Driest	30.18 (1990)	7.12 (1936)	10.81
Statewide	5.20	-6.48	2nd Driest	(1957)	4.89 (1895)	9.47

Spring 2005 Mesonet Temperature Comparison

Climate Division	Average Temp (F)	Departure from Normal (F)	Rank since 1895	Hottest on Record (Year)	Coldest on Record (Year)	2004
Panhandle	54.8	-0.5	49th Warmest	59.5 (1963)	49.4 (1915)	59.1
North Central	58.2	0.5	40th Warmest	61.6 (1963)	52.8 (1924)	60.4
Northeast	58.2	-0.4	51st Warmest	61.7 (1977)	53.5 (1924)	60.8
West Central	58.3	0.3	48th Warmest	61.9 (1963)	52.9 (1915)	61.4
Central	59.5	0.0	42nd Warmest	63.1 (1974)	54.5 (1924)	62.1
East Central	59.0	-1.0	41st Coolest	63.7 (1974)	55.1 (1931)	62.9
Southwest	60.1	-0.4	51st Warmest	64.4 (1963)	55.1 (1915)	63.5
South Central	61.2	-0.2	55th Warmest	65.0 (1974)	56.5 (1931)	63.8
Southeast	59.9	-0.8	34th Coolest	64.3 (1938)	56.8 (1924)	62.1
Statewide	58.8	-0.3	52nd Warmest	62.5 (1974)	54.3 (1924)	61.8

Spring 2005 Mesonet Extremes

Climate Division	High Temp	Day	Station	Low Temp	Day	Station	High Monthly Rainfall	Station	High Daily Rainfall	Day	Station
Panhandle	101	May 21st	Hooker	11	Mar 16th	Boise City	5.72	Buffalo	1.49	May 29th	Boise City
North Central	101	May 22nd	Fairview	19	Mar 1st	Blackwell	5.27	May Ranch	1.77	May 19th	Newkirk
Northeast	94	May 21st	Pawnee	17	Mar 1st	Foraker	8.97	Copan	3.76	May 19th	Burbank
West Central	99	May 22nd	Weatherford	23	Mar 2nd	Butler	6.02	Cheyenne	1.93	May 13th	Watonga
Central	101	May 22nd	Kingfisher	18	Mar 1st	Oilton	6.19	Bristow	3.17	May 13th	Stillwater
East Central	95	May 22nd	Calvin	20	Mar 1st	Westville	11.04	Cookson	2.89	May 24th	Sallisaw
Southwest	103	May 22nd	Grandfield	22	Mar 17th	Mangum	6.98	Hollis	1.86	May 13th	Walters
South Central	100	May 22nd	Burneyville	22	Mar 17th	Sulphur	8.09	Lane	3.14	May 31st	Ringling
Southeast	96	May 22nd	Antlers	22	Mar 17th	Antlers	10.21	Mt Herman	2.08	May 29th	Broken Bow
Statewide	103	May 22nd	Grandfield	11	Mar 16th	Boise City	11.04	Cookson	3.76	May 19th	Burbank

Agriculture Weather Watch

By Albert Sutherland, CPH, CCA
Mesonet Assistant Extension Specialist
Oklahoma State University

Farming in Oklahoma is like a continuous ride on a roller coaster. Just when a farmer thinks it is time to relax, the weather crests at the top of one trend and dives down into another.

Keeping to the Oklahoma normal of seldom being normal, wheat plants went from a winter of water plenty to a spring of water stress. Farmers anxiously checked weather forecasts this spring, only to be disappointed over and over again as sparse rain fell in much of the Oklahoma and other states in the Great Plains wheat belt.

From a distance, the ripening wheat fields in late May were a beautiful sight with the rich promise of a lush harvest. Unfortunately once out in most wheat fields, it was easy to see the wheat heads were filled with shriveled wheat kernels. This will lead to lower kernel quality and wheat with low test weights. Too many Oklahoma farmers will see lower yields and less than normal quality, leaving them feeling like they're hurtling down the track with no upturn in sight.

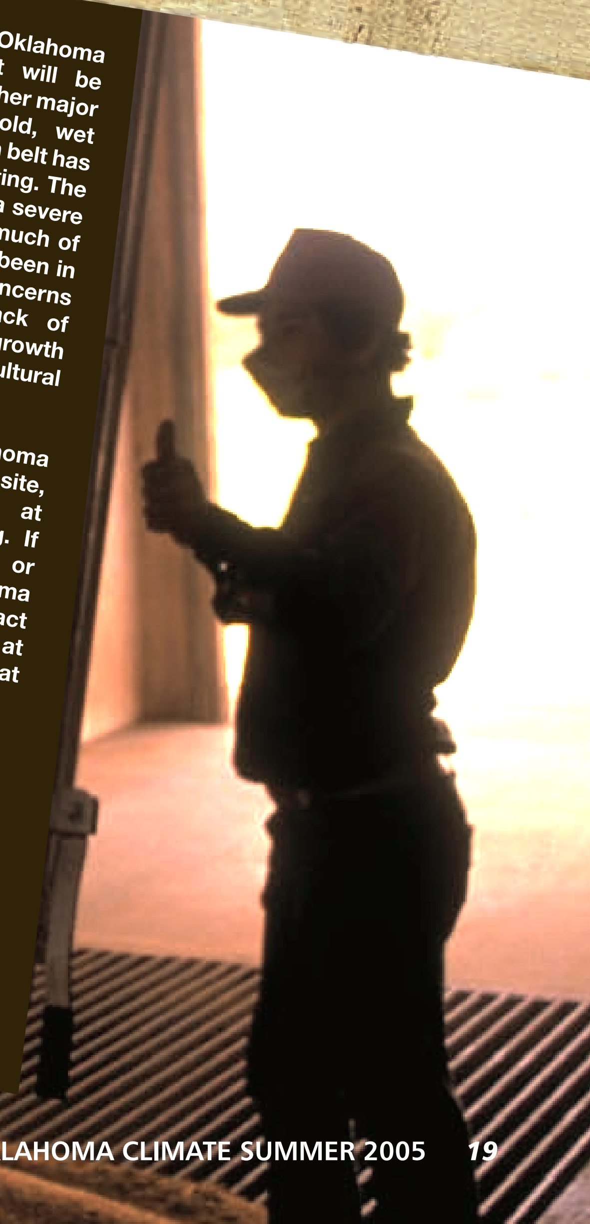
Farmers to the east fared a little better, with a few more rains to help sustain pastures as the spring rolled along. Still even for eastern Oklahoma farmers, over the last 90 days much of eastern Oklahoma has had only 60% or less of their normal rainfall.

As of late May, row crop planting and emergence was running about a week behind a more typical year. Just when warm weather looked like it was pushing the crop ahead in mid-May, the weather turned cool and rainy delaying crop planting and slowing seedling emergence.

While it is easy to be overly pessimistic when the roller coaster is heading downward, it looks like farm gross receipts and thus, net farm income will be down this year for Oklahoma farmers. Growers are likely to be hit with the double jeopardy of lower grain yields and higher energy costs. We can only hope the cattle market continues to remain strong and that other crops can offset some of the early 2005 crop losses. We may yet see the roller coaster climbing to new heights, just when it is least expected.

The downturn for Oklahoma farmers looks like it will be shared by farmers in other major USA crop regions. Cold, wet weather across the corn belt has made for a lot of replanting. The northwestern USA is in a severe drought situation. Over much of the central USA rain has been in short supply, raising concerns that there will be a lack of sufficient rainfall for crop growth in this major agricultural production region in 2005.

Please, check out the Oklahoma Mesonet agricultural website, Oklahoma AgWeather at http://agweather.mesonet.org. 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

June

- Fertilize turfgrass areas. Apply fertilizer ahead of a good rain or before watering lawn areas.
- Control broadleaf lawn weeds with a product containing 2,4-D type herbicides 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.
- During times of high humidity and warm nights, apply an approved fungicide on tall fescue to control brown patch disease.
- 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 causes the gardener.
- Apply an approved fungicide for the pine needle blight disease, Dothistroma Needle Blight.
- Check plants for sucking insect pests and treat as needed.

July

- Spray dormant oil to control insect pests on ornamentals and fruit trees. Apply when the daytime temperature is above 50∞F and the nighttime temperatures above freezing for 3-4 days. Use the summer rate for evergreen shrubs.
- Roundup can be applied to dormant bermudagrass areas to control green winter weeds. For best results, apply on a day when the air temperature will be in the upper 40s or higher.
- Prune trees that are prone to excessive sap flow. These include pines, willows, elms, and maples. Do NOT apply pruning paint. It will not stop excessive sap flow and will slow callous growth over branch cuts.
- Plan spring landscape projects.
- Peruse plant and seed catalogs or websites. These colorful catalogs and websites will provide you many ideas for landscape projects and brighten a cold weekend.
- Collect seed trays, media, and seeds to start transplants. Start seeds for hardy herbs (cilantro, dill, parsley) and hardy vegetables (broccoli, cabbage, onion) to be transplanted after mid-March.
- Water, water, water.
- Control lawn white grubs with an approved insect growth hormone or systemic insecticide product.
- If needed, light pruning of ornamental trees and pines can be done. The heat of July will help 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 surface.
- 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.
- 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.

August

- Keep up with water demand. Consider the whether you want to add a drip or sprinkler irrigation systems for the garden or lawn watering.
- If you missed white grub control in July and you still need to treat for grubs, it is better to use an approved fast acting insecticide when treating in August.
- Plan for new plantings with water efficiency in mind. Plan to group plants with similar water needs together. Consider reserving areas closer to the water valve for high water demand plants.
- With children returning to school, trim shrubs or trees as needed to improve driver visibility.
- Continue control of rose black spot with an approved fungicide.
- Add plants to the fall vegetable garden. You can 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 watering, spraying weeds with glyphosate, waiting 7-10 days, and then tilling the area.
- If a moderate to heavy rain event occurs, check pecan trees for emerging pecan weevil.

Evapotranspiration

A New Way to Save Water

By Albert Sutherland

As we know in Oklahoma, water is a precious resource. It is sometimes easy to fall into complacency about water with Oklahoma's dependable urban and rural delivery systems. But when water is in short supply, it can have dramatic consequences on municipal use and crop production.

FEATURE ARTICLE

The Oklahoma Mesonet has a new set of tools to help rural and urban water users be more efficient. This set of tools is known as the Oklahoma Mesonet Evapotranspiration Models. Farmers now have models for alfalfa, corn, cotton, grass hay, peanut, sorghum, soybean and wheat. Horticultural producers can use the models to schedule irrigations for grape, peach, pecan, tomato or watermelon. For urban use, there are models for cool or warm season turfgrasses.

Evapotranspiration, now that's a mouthful of a word. Evapotranspiration is the term used for the combined water loss from the soil surface and plant leaves. The "evapo" in evapotranspiration is for water evaporation from a soil surface. The "transpiration" ending is for the water that a plant takes up by its roots and loses through its leaves.

Once you get comfortable with evapotranspiration, you'll find it offers a whole new way to consider watering. Oklahoma evapotranspiration water loss is calculated from air temperature, relative humidity, wind, and sunlight values from the nearest Oklahoma Mesonet tower. So as the weather changes, so does the evapotranspiration rate. Evapotranspiration rates are also adjusted to best estimate water loss for each agronomic or horticultural commodity.

By irrigating based on evapotranspiration, water can be supplied in the right quantity just as the plant needs it. Additionally, water users move from a calendar or guess approach to a weather-based watering method. This means water is replaced when and in the amount needed by the plant to maintain healthy growth. This avoids water waste from over-watering and water stress from mistiming or under-applying the water needed.

Access to all the new Evapotranspiration Models is FREE via the Internet. Simply go to the Oklahoma AgWeather website at http://agweather.mesonet.org. Click on "CROPS" for agronomic commodities or choose "HORTICULTURE" for consumer and commercial horticulture use. Under each commodity, select "Evapotranspiration."

Once you're on the evapotranspiration page for the crop desired, select the closest Oklahoma Mesonet tower, commodity type or maturity, the "Relative Maturity Days," if known, and "Planting Date or Season Start Date." There are default settings for relative maturity and planting dates that can be used if exact crop information is not known. Lastly, click on the "Get commodity Data" button. A table will appear with values calculated from the information entered for the crop and field.

The Evapotranspiration Model table has eight columns. These columns are:

Station	Mesonet tower code
Date	Calendar date going backwards in time
Number of Days	Count of days going backwards in time
Evapotranspiration	Water loss for each day in inches of water
Accumulated Evapotranspiration	Cumulative water loss in inches of water
Rainfall	Inches of rainfall recorded at the Oklahoma Mesonet tower selected
Accumulated Rainfall	Cumulative rainfall in inches of water
Water Balance	Accumulated Rainfall subtracted from Accumulated Evapotranspiration in inches of water

Photo courtesy of Al Sutherland

Evapotranspiration for turf for Norman							
Station	Date	Number of Days	Evapotranspiration (inch)	Accumulated Evapotranspiration (inch)	Rainfall (inch)	Accumulated Rainfall (inch)	Water Balance (inch)
NRMN	2005-06-01	1	0.14	0.14	0.00	0.00	-0.14
NRMN	2005-05-31	2	0.08	0.22	0.36	0.36	0.14
NRMN	2005-05-30	3	0.10	0.33	0.00	0.36	0.03
NRMN	2005-05-29	4	0.10	0.43	0.00	0.36	-0.07
NRMN	2005-05-28	5	0.10	0.53	0.00	0.36	-0.17
NRMN	2005-05-27	6	0.05	0.58	0.21	0.57	-0.01
NRMN	2005-05-26	7	0.11	0.69	0.05	0.62	-0.07
NRMN	2005-05-25	8	0.07	0.76	0.02	0.64	-0.12
NRMN	2005-05-24	9	0.17	0.94	0.11	0.75	-0.19

The Water Balance, showing inches of water loss, is similar to a checkbook balance. (Refer to the example table.) When more water is lost by the plant than replaced by rainfall, the number is a red colored, negative value. When there has been more water from rainfall than water lost by the plant, the number is a blue colored, positive value. By going down the Water Balance column until you reach the date of the last irrigation or of the last major rain event, you can see how much water the crop used. When the negative value of the Water Balance is equal to the amount of water that can be lost by your crop, it is time to irrigate.

How much water can be lost before you water again should be based on the crop's rooting depth and field soil type. Soils vary in water holding capacity from a low of 0.96 inches of water per foot of soil for sand to a high of 2.16 inches of water per foot of soil for loam.

For most crops, the recommendation is to irrigate when 50% of the water holding capacity of the soil is still in the soil profile. For example, if the crop was growing in a clay loam with a water holding capacity of 1.80 inches per foot and had a rooting depth of 3 feet there would be a total 5.4 inches of water available for use by the crop. When the evapotranspiration water balance reached -2.7, then 50% of the available water would be have been lost and 50% would remain. This would be the time to irrigate to be sure the water in the soil profile did not get too low. For a more water sensitive crop, a person might choose to water when 70% of the water holding capacity level was reached. For the soil and crop example above, the crop would be watered when the evapotranspiration water balance reached -1.62.

Another consideration when scheduling irrigation is the ability of the irrigation system to replace the water lost. If the system cannot replace all of the water lost by evapotranspiration at one time, it may be better to use a more conservative water balance value, such as -1.0 or -1.25 given the example from the previous paragraph.

For consumers interested in watering their lawn, here are some general guidelines that apply to all but the most extreme Oklahoma soils.

Grass	High Maintenance	Moderate Maintenance	Low Maintenance
Bermuda	-0.5	-1.0	-1.5
Zoysia	-0.5	-0.75	-1.0
Tall Fescue	-0.5	-0.75	-1.0
Kentucky Grass	-0.5	-0.75	-1.0
Perennial Rye	-0.5	-0.5	-0.75

When you water turfgrass, apply enough water to wet the soil at least 6 inches deep. This is the typical rooting zone for Oklahoma turfgrasses. You may choose to water deeper to supply the same amount of water lost through evapotranspiration. To do this run the sprinklers long enough to equal the evapotranspiration water balance loss. It may be necessary to run your sprinklers, turn them off, wait until the water soaks in, and run them again, to supply the right amount of water and avoid water runoff.

When there is a large rainfall discrepancy between your location and the Oklahoma Mesonet tower adjust the water balance accordingly.

Using the Oklahoma Mesonet Evapotranspiration Models to water or irrigate allows all Oklahomans to be better water stewards.

HEATBURSTS by Andrea Melvin

The concept of a heatburst was introduced by Cline in 1909 after an unusual event in Cherokee, Oklahoma. For eighty-five years, heatbursts were considered rare events. But in 1994, scientists gained a tool that resulted in new research. Loyal readers will recognize this date as the launch of the Oklahoma Mesonet.

Scientists quickly realized that their lack of knowledge about heatbursts wasn't due to the rarity of the events but because they are small-scaled and short-lived. The National Weather Service weather monitoring stations are spaced several tens of kilometers apart. A heatburst would have to occur directly over an NWS station for scientists to notice it. The stations are so far apart that it is nearly impossible for more than one station to record the event. Additionally, the NWS stations take hourly measurements. The hour interval is too large to record a heatburst event unless the event occurred at the top of the hour. The NWS network would record only one measurement spike. Most heatburst events contain a series of spikes. Heatbursts, generally, last anywhere from 15 minutes to several hours.

In the first five years of operations, the Oklahoma Mesonet detected 51 separate heatburst events. Only 10 events had been documented in the scientific literature between 1909 and 1994. The 30 km station spacing and 15-minute observations of the Oklahoma Mesonet make it much easier to record these events. Now that the Oklahoma Mesonet takes 5-minute observations, we may see another increase in the number of heatburst events.

Current Accepted Causes for Heatbursts

Heatbursts occur when a downdraft of air rushes to the surface. As the air is compressed it warms and dries out. The winds increase in speed as they move toward the ground. When the air reaches the surface it is forced outward in all directions.

Researchers are working to gather enough data to determine the cause of these intense downdrafts. The most common source of downdrafts is a supercell thunderstorm. When these storms suddenly collapse all the molecules suspended in the updraft fall quickly to the earth. The updraft reverses to a downdraft. However, there have been cases of heatbursts occurring in the downdraft region of a rear inflow jet, in mesoscale convective systems along with several other theories.

Effect on Vegetation and Trees

The intense temperature spike and plummeting dew points result in major damage to vegetation and trees. Just like on a hot summer day, the lack of moisture in the air forces the plants to increase their rate of transpiration. The water lost by the plants can be so severe that the plant will wilt and lose its leaves. This process is similar to the effect of heat stroke on a person. The internal systems of the body/plant are stuck in overdrive. The duration and intensity of the heatburst event damages the internal systems of flowers and vegetables beyond repair.

Temperature and dew point are not the only problems for plants during a heatburst event. Strong heatburst winds knock down trees, power poles and sever plants at the stem.

References

Lane, Justin D. (2000) A Climatology of Heatbursts as Detected by the Oklahoma Mesonet: October 1993 Through September 1998, M.S. Thesis, The University of Oklahoma, 141 pp.

Classroom Activity

A heatburst event occurred on April 19, 2005. Several Oklahoma Mesonet stations were effected including Cheyenne, Hobart and Mangum. The location of these stations are shown in Figure 1. This particular event lasted several hours. Use the meteograms provided (pg. 26-27) from each of the three stations to answer the following questions.

1. What time did the heatburst event begin? Which station recorded the event first?

2. For each station, how much did the temperature increase?

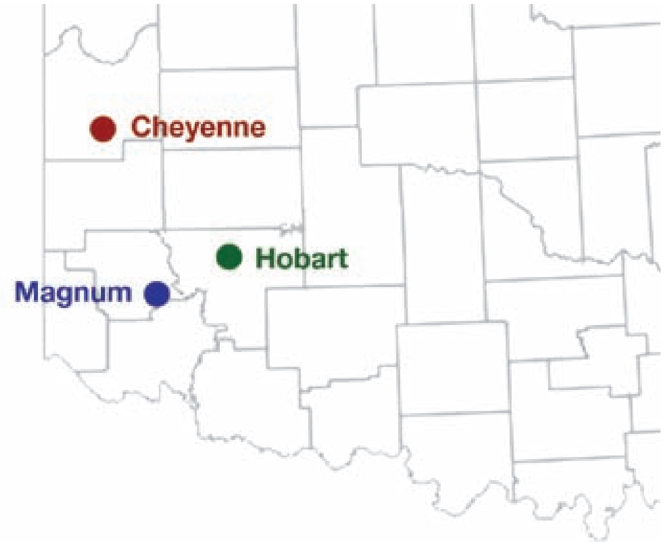
3. What was the lowest dewpoint temperature observed? At which station?

4. Which station experienced the most extreme winds? What was the maximum wind gust?

5. Which station experienced the most number of pulses (Note: Pulses refer to the number of temperature increases accompanied by dew point decreases.)?

6. What time did the heatburst event end? Which station recorded the last pulse?

FIGURE 1 - Oklahoma Map



Answers (See page 7)

FIGURE 2 - Radar Image

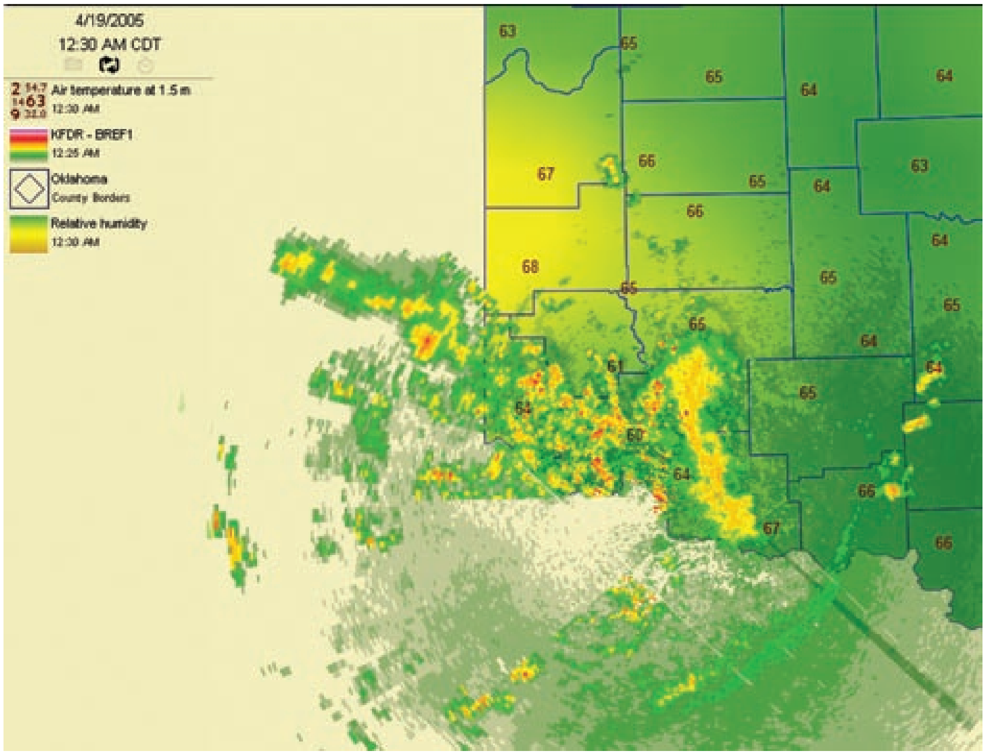


FIGURE 3 - Cheyenne Meteogram

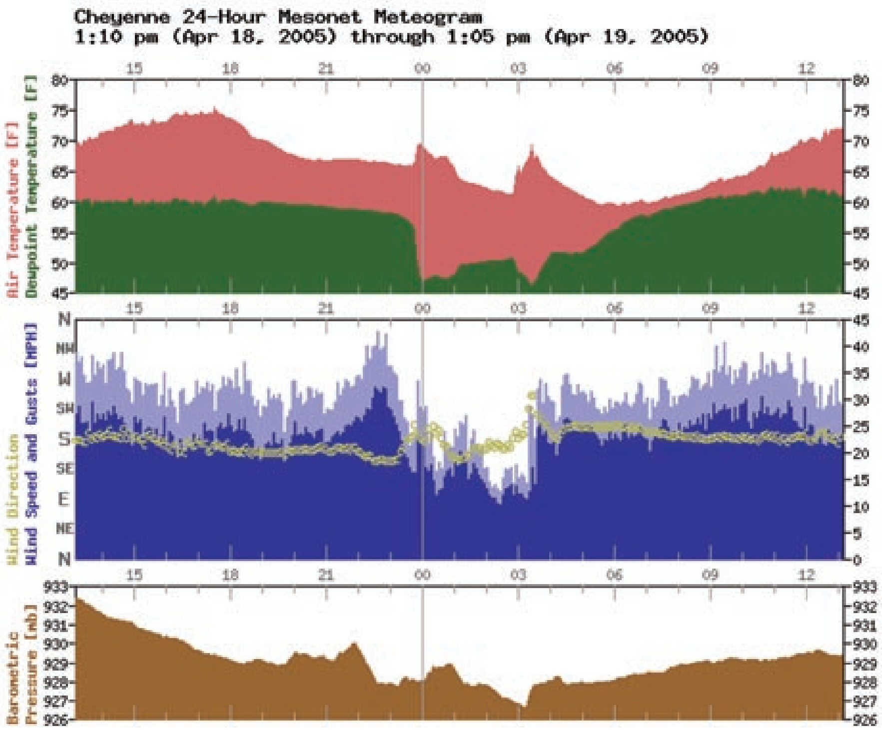


FIGURE 4 - Hobart Meteogram

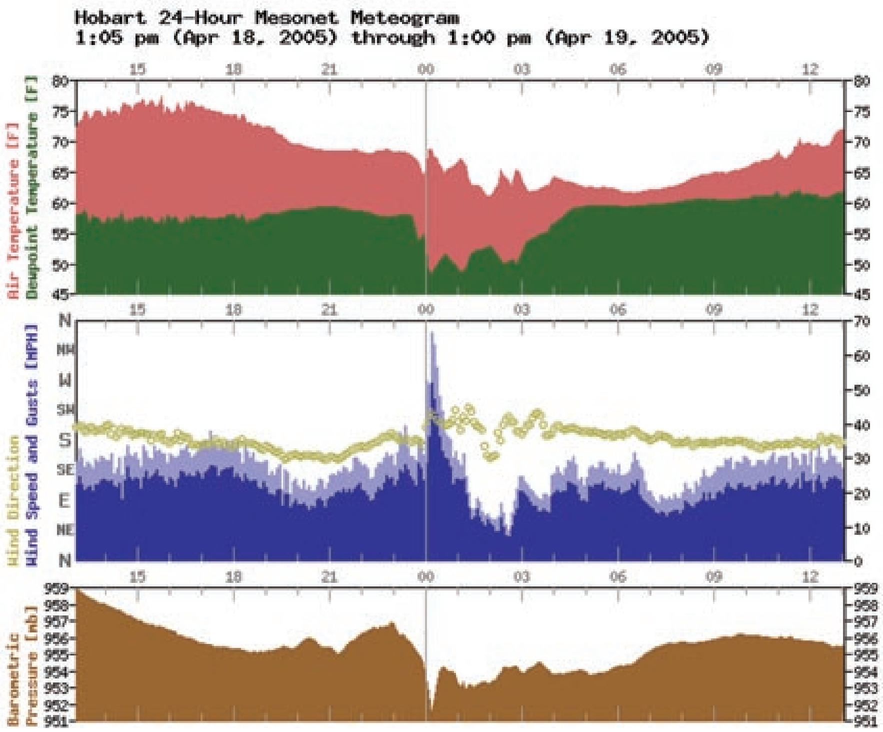
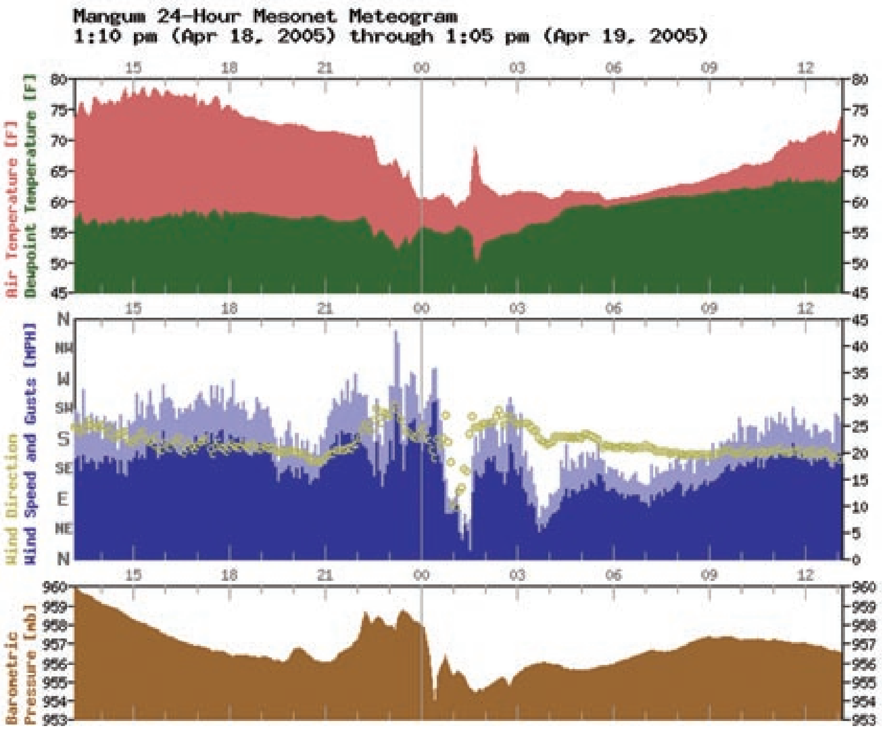


FIGURE 5 - Magnum Meteogram



Summer

UV Safety:

by Andrew Reader

Protection from sun exposure is important all year round, not just during the summer. Any time the sun's ultraviolet (UV) rays are able to reach the surface of the earth, you need to protect yourself from excessive sun exposure. UV rays can cause skin damage during any season or temperature.

Relatively speaking, the hours between 10 a.m. and 4 p.m. are the most hazardous for UV exposure in the United States. UV rays reach you on cloudy and hazy days, as well as on bright and sunny days. UV rays will also reflect off any surface like water, cement, sand, and snow.

How to protect yourself from UV rays:

Avoid outdoor activities during midday, when the sun's rays are strongest. This usually means the hours between 10 a.m. and 4 p.m. You can also wear protective clothing, such as a wide-brimmed hat, long-sleeved shirt, and long pants. For eye protection, wear wraparound sunglasses that provide 100 percent UV ray protection. Always wear a broad-spectrum (protection against both UVA and UVB rays) sunscreen and lipscreen with at least SPF 15. Sunscreens come in a variety of forms such as lotions, gels, and sprays, so there are plenty of different options. There are also sunscreens made for specific purposes, such as the scalp, sensitive skin, and for use on babies. Regardless of the type of sunscreen you choose, be sure that you use one that blocks both UVA and UVB rays and that it offers at least SPF 15.

What does tanned skin mean?

The penetration of UV rays to the skin's inner layer results in the production of more melanin. That melanin eventually moves toward the outer layers of the skin and becomes visible as a tan.

A suntan is not an indicator of good health. Some physicians consider the skin's tanning a response to injury because it appears after the sun's UV rays have killed some cells and damaged others.

UV information can be found at:

Center for Disease Control and Prevention (CDC)

http://www.cdc.gov/
http://www.cdc.gov/ChooseYourCover/qanda.htm

Environmental Protection Agency (EPA)

http://www.epa.gov/sunwise/

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