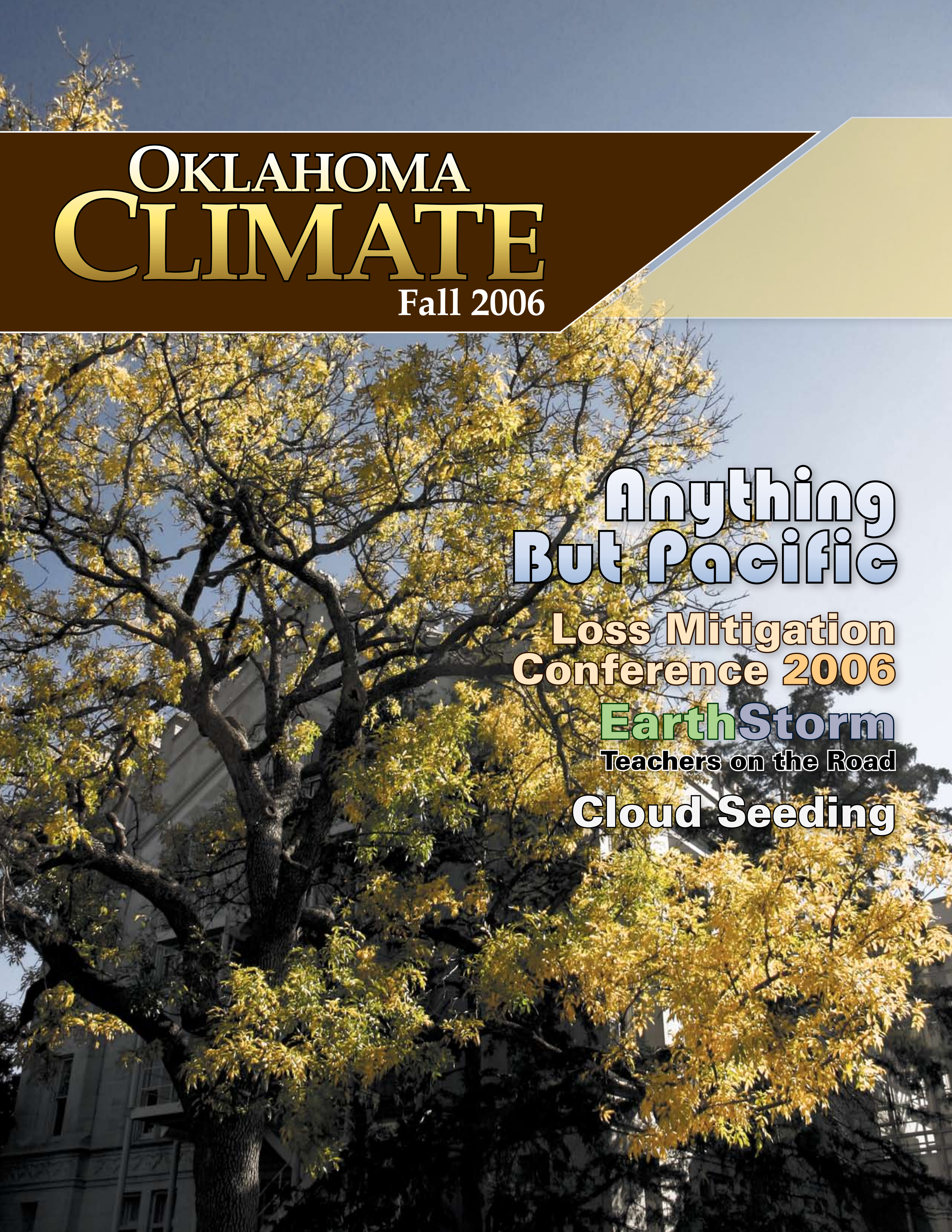
OKLAHOMA CLIMATE

Fall 2006



Anything But Pacific

Loss Mitigation Conference 2006

EarthStorm

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MESSAGE FROM THE EDITOR

Hurricanes are the most destructive weather phenomenon on the Earth, with apologies to our own little terrors of Mother Nature, tornadoes. The awful destruction wrought upon the Gulf Coast by Katrina silenced any arguments on that subject. But in one of the great ironies for a state that has suffered greatly due to hazardous weather, Oklahoma has actually benefited in the past from the arrival of those monster cyclones. They are no longer Hurricanes by the time they pass over Oklahoma soil, of course, merely remnants of their former powerful selves. When they do arrive, however, they bring with them a sizable amount of tropical moisture. Imagine a gigantic sponge floating over the state, waiting to be squeezed. And if there is ever a time that the state could use a good wallop of moisture, it's during the type of drought we've experienced the last couple of years.

We decided to concentrate this issue of "Oklahoma Climate" on hurricanes and their effects on the state. Our historical perspective delves right into the issue with a look back at Oklahoma's previous brushes with tropical cyclones and how they've helped to end droughts. Likewise, our classroom exercise takes a look at the bad side of a visit by a tropical system with a lesson on the flooding caused by Tropical Storm Dean in 1995.

Other stories in this issue include a look at the upcoming Oklahoma Climate and Loss Mitigation Conference which will be held at our new home in the National Weather Center, an examination of the feasibility and usefulness of cloud seeding for drought mitigation, and a recap of the OCS' Earthstorm Conference from July. Finally, be sure to read our regular features on agricultural weather and weather safety, and a recap of the summer's day-by-day weather.

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

Gary McManus – Editor

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

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Once in a while, the great western ocean discharges a tropical storm in the direction of Oklahoma. When the ingredients are right, incredible autumn rainfall can result.

Anything But Pacific

Derek Arndt, Assistant State Climatologist

Autumn is a season of contradiction. Despite its rather mild reputation, it harbors a fleet of extreme possibilities for most of Oklahoma. Temperatures can threaten 100 degrees as late as mid-October, and by mid-November, below-zero temperatures aren't out of the question in the panhandle. Many autumns are dry; some are extremely wet, and few are in between. Likewise, the Pacific Ocean is a place of contradiction. Despite its rather mild name, it can harbor ferocious tropical storms. Together, this under-estimated season and this under-named ocean can combine to produce colossal rainfall events in Oklahoma.

The Ingredients

To pull these huge events off, the atmosphere must summon its highest powers of orchestration to bring together ingredients that don't often cooperate. But when they do, skies will open, rain will fall, streams will swell, and records will collapse.

First, the northeastern Pacific must produce a tropical system. This isn't too difficult: most years are littered with a dozen or more named tropical storms emanating from the northeastern Pacific. The trick is that the storm must curve away from the more typical westward track and make landfall onto the North American continent (if this happens, it is usually in the vicinity of the Baja California).

Secondly, the remnants of the tropical system must survive the mountains of Mexico and/or the southwestern United States. Many storms that make landfall on the Mexican coast offer up most of their moisture on the western slopes of that country's mountains.

Thirdly, if the moisture makes it to Oklahoma with some semblance of organization, it must encounter a front, which serves as a focusing mechanism to enhance rainfall in the area. This is where autumn comes in handy, because it's a transition season. In other words, the annual assault by cooler air from the north begins in autumn, which means cold fronts enter the area frequently. If such a front stalls out, or becomes nearly stationary, rainfall totals can reach extreme values as multi-day totals accumulate.

The Notable Events

Many of Oklahoma's record rainfall and record flood events during autumn are caused by the interaction of Pacific tropical storms with stationary fronts. The following are a few of the more extreme examples.

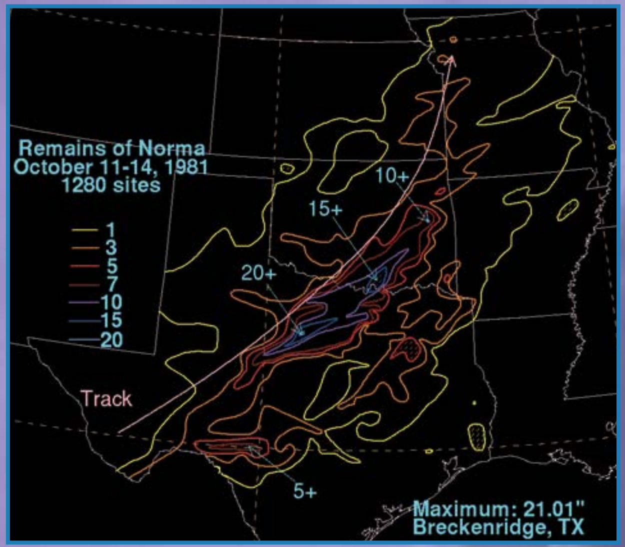
Pacific Hurricane Norma, October 1981
Norma formed off the Mexican coast on the 9th, and quickly became a Category 3 hurricane before weakening slightly and making landfall near Mazatlan. Her remnants made their way into the southern plains by the 11th and encountered a stationary front draped across north Texas. Norma's rains in south-central, southeast and eastern Oklahoma were both torrential and long-lasting. A swath stretching from around the Lake Texoma region to Eufaula saw more than a foot of rain, with local values exceeding 15 inches. The greatest two-day, three-day, four-day, five-day, six-day and seven-day rainfall totals ever recorded in Oklahoma are all related to Norma. Two drowned in the state, with at least $50 in property damage. The system also spawned two F1 tornadoes in southern Oklahoma, causing two injuries. As bad as it was in Oklahoma, it was worse across the border in Texas. Five people drowned in the Fort Worth area due to Norma's floodwaters.

Duration	Record Rainfall	Ending Date	Location
2-Day	18.02”	Oct. 14, 1981	Tishomingo
3-Day	18.68”	Oct. 14, 1981	Kingston
4-Day	22.47”	Oct. 16, 1981	Tishomingo
5-Day	23.12”	Oct. 17, 1981	Tishomingo
6-Day	23.95”	Oct. 18, 1981	Coalgate
7-Day	24.95”	Oct. 18, 1981	Coalgate

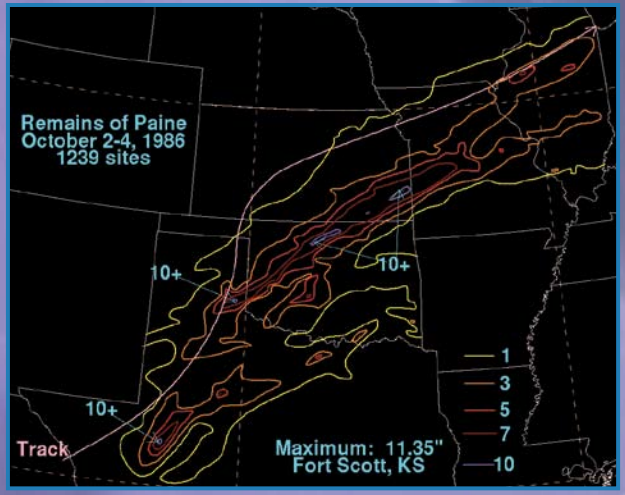
Table A. Oklahoma's multi-day rainfall records associated with remnants of Pacific Hurricane Norma.

Pacific Hurricane Tico, October 1983
Most of Oklahoma was already waterlogged by a very wet autumn when Tico's remnants met a stalled front in Oklahoma in mid-month. More than a foot of rainfall drenched the I-44 corridor. Widespread flooding occurred throughout the state, notably on the irritable Cottonwood Creek in Guthrie, where a man was swept to his death. A train was derailed in Altus when the tracks were washed away underneath it. In subsequent days, several locations on the Red and Washita Rivers recorded all-time high streamflows.

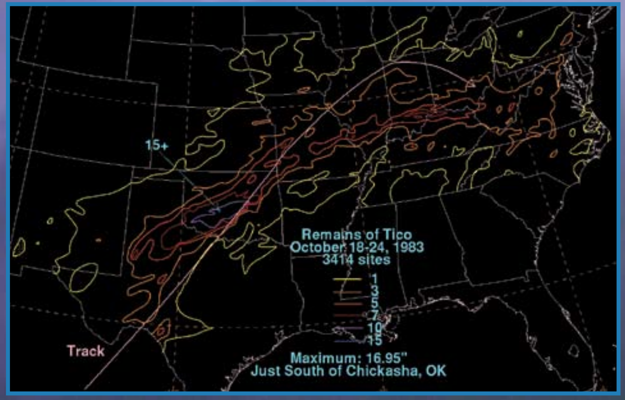
Pacific Hurricane Paine, October 1986
Accumulations in excess of fifteen inches were commonplace in the opening days of October 1986. The Oklahoma epicenter of Paine's downpour lay in the north-central parts of the state, where upwards of ten inches fell in the Perry area and in Kay County. The Cimarron River saw its flood of record at several gages in central Oklahoma, and Tulsa flood damages approached $35 million. Agricultural damages, particularly in the winter wheat belt, were tremendous.



Rainfall totals associated with the remnants of Pacific Hurricane Norma (Courtesy NOAA Hydrologic Prediction Center).



Rainfall totals associated with the remnants of Pacific Hurricane Tico (Courtesy NOAA Hydrologic Prediction Center).



Rainfall totals associated with the remnants of Pacific Hurricane Paine (Courtesy NOAA Hydrologic Prediction Center).

Pacific Hurricane Waldo, October 1985

Far western Oklahoma is not immune to large rainfall totals from Pacific storms. Waldo left a wide swath of rain across the northwestern half of Oklahoma, and the Buffalo area saw more than five inches.

Pacific Hurricane Raymond, October 1989

Interestingly, Raymond was a cousin of catastrophic Hurricane Hugo that battered the Carolinas in 1989. He was spawned in the Pacific by the same traveling tropical wave that ignited Hugo three weeks earlier in the Atlantic. Raymond's rainfall footprint resembled that left by Paine in 1989, but peak accumulations were less than four inches.

Pacific Hurricane Lester, August 1992

A major swath of Oklahoma's wheat belt was the beneficiary of one-to-three-inch rains related to Lester in late August. Lester also caused major flooding in the American southwest, as well as minor flooding days later in the Midwest. Very little of Lester's impact made the news, because at the same time, Atlantic Hurricane Andrew was becoming the costliest natural disaster of the 20th Century.

Pacific Hurricane Ismael, September 1995

After dumping more than half a foot of rain in eastern New Mexico and west Texas, Ismael left few scars on Oklahoma. However, it did provide nearly three inches of rainfall to much of the Arbuckles region.

Footnote

Surely some of the dramatic October precipitation totals in Oklahoma's past were related to tropical storms. However, before the age of satellites, tropical storm tracking was sketchy, especially in the sparsely populated and vast Pacific. El Nino conditions in the fall 1941 probably spawned many tropical systems. These may have contributed to the widespread precipitation and flooding in the southern United States in October of that year, which was Oklahoma's wettest month on record (11.32").

Oklahoma Climate & LOSS MITIGATION Conference: Oct. 18, 2006

BY DR. MARK SHAFER DIRECTOR OF CLIMATE INFORMATION

We are all familiar with the tornadoes and severe storms that – well, in most years – seem to plague Oklahoma. But did you know that Oklahoma is home to other weather hazards? In 2005, Oklahoma's enhanced hazard mitigation plan was approved by FEMA. It cited some of the usual suspects: tornadoes, severe storms (hail, wind and lightning), flooding, winter storms, wildfires, drought and extreme heat. But there were a few hazards which you may have never thought important for Oklahoma – earthquakes, dam failures, landslides, and expansive soils.

Despite our vulnerability to these hazards, there are things that we can do to lessen impacts. This was the subject of a recent conference. The Oklahoma Climatological Survey partnered with the Oklahoma Insurance Department to produce a one-day conference, Oklahoma Climate and Loss Mitigation Conference 2006. The Insurance Department set out to address ways in reducing Oklahoma's rank as the third-highest in the nation in cost of property insurance. Fortunately, they had access to some of the top experts in the nation, housed at the National Weather Center in Norman on the University of Oklahoma campus.

The conference, held October 18th at the National Weather Center, focused on the climate hazards – tornadoes, severe storms, flooding, winter storms, wildfires, drought, and heat. It was divided into two general themes. The morning session focused on climate, climate variability, and climate change, and how it impacts these hazards. The afternoon session focused upon mitigation activities – steps we can take as individuals or as communities to reduce our exposure to risk.

Together, the sessions were designed to not only provide awareness of our risks but also to help us to realize that we need not accept what Mother Nature throws our way. There are actions we can take to reduce risks – through building codes, through community planning, and through common sense – that will reduce our losses when these events occur. For more information on the conference, visit the Oklahoma Insurance Department (www.oid.state.ok.us) or the Oklahoma Climatological Survey (www.ocs.ou.edu).

CLIMATE AND LOSS MITIGATION CONFERENCE AGENDA

- Overview of Weather Hazards and the State Planning Process - Dr. Mark Shafer, OCS
- Oklahoma's Climate: Seasonal and inter-annual variability - what are good rules of thumb for planning - Deke Arndt, Assistant State Climatologist, OCS
- Weather Hazards in Oklahoma: Tornadoes, severe storms, floods, winter weather, fire drought, severe heat - Gary McManus, OCS
- Climate Variations/Change and its Impact on Hazardous Weather - Dr. David Karoly, University of Oklahoma School of Meteorology
- Trends in Tornado Vulnerability - Dr. Harold Brooks, National Severe Storms Laboratory
- Climate Effects on Agriculture - Mark Hodges, Oklahoma Wheat Commission; Scott Dewald, Oklahoma Cattlemen's Association
- Severe Storm Catastrophe Modeling and Vulnerability - Matthew Nielson, Risk Management Solutions
- Trends in Construction: Disaster Resistant Building Material (Fortified Homes, Modern Roofing Materials, Building Codes, Manufactured Homes, etc.) - Chuck Vance, The Institute for Business & Home Safety
- Reducing your risk to Wildfire: Discussion of the National Fire Wise Program and Certification - Dr. Kelly Hurt, American Water Institute

ANSWERS

1. 9.95 in., Alfalfa County
2. Circle the three sites on Map 1 for later reference.
3. Butler 2.3 in., Putnam 4.0 in., Stillwater 2.9 in.,
4. Butler 0.1 in., Putnam 0.4 in., Stillwater 2.3 in.,
5. Stillwater – Observed 2.3 in., 6-hr FFG 2.0 in.; Rainfall for Butler and Putnam was less than their 6-hr FFG values.
6. 3:30 a.m. at Cheyenne
7. Putnam 6-hr rainfall 2.8 in., 3-hr rainfall 2.5 in., 1-hr rainfall 1.4 in.
8. 1-hr FFG is 1.7 in. – rainfall does not exceed FFG; 3-hr FFG is 2.1 in. – rainfall exceeds FFG; 6-hr FFG is 2.4 in. – rainfall exceeds FFG
9. 1.4 in. of rainfall is very close to the 1-hr FFG of 1.7. If it continues to rain at the current intensity (i.e., 1.4 in. in an hour), flash flooding will occur in the next hour (1.4 in. +1.4 in. = 2.8 in. which is above all of the FFG values).
10. Putnam doesn't exceed the 1-hr FFG. Putnam's rainfall from Noon to 2 PM exceeds the 3-hr FFG. By 6 PM, the rainfall total also exceeds the 6-hr FFG. This means flash flooding will occur while even more rain falls.
11. This is a judgment call. The 1-hr rainfall of 1.4 in. from 1 PM and 2 PM is very close to the 1.7 in. needed in an hour to meet the FFG. Then add on the 2.5 in. that fell earlier in the day. The National Weather Service would have issued a Flash Flood Watch earlier in the day due to the rainfall expected from a stalled tropical system. Forecasters would have issued a Flash Flood Warning no later than 2 PM.





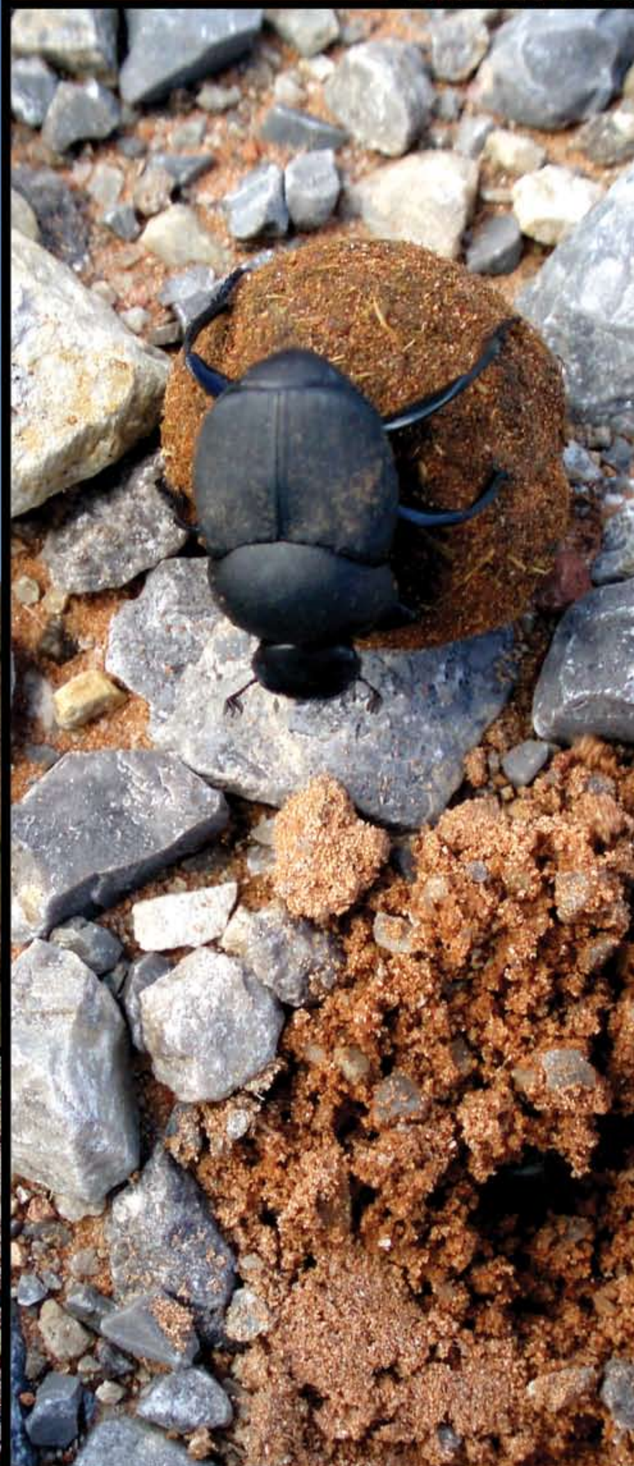
PHOTOS FROM THE FIELD
Oklahoma Landscape

photos by: Ken Meyers, Senior Electronics Technician



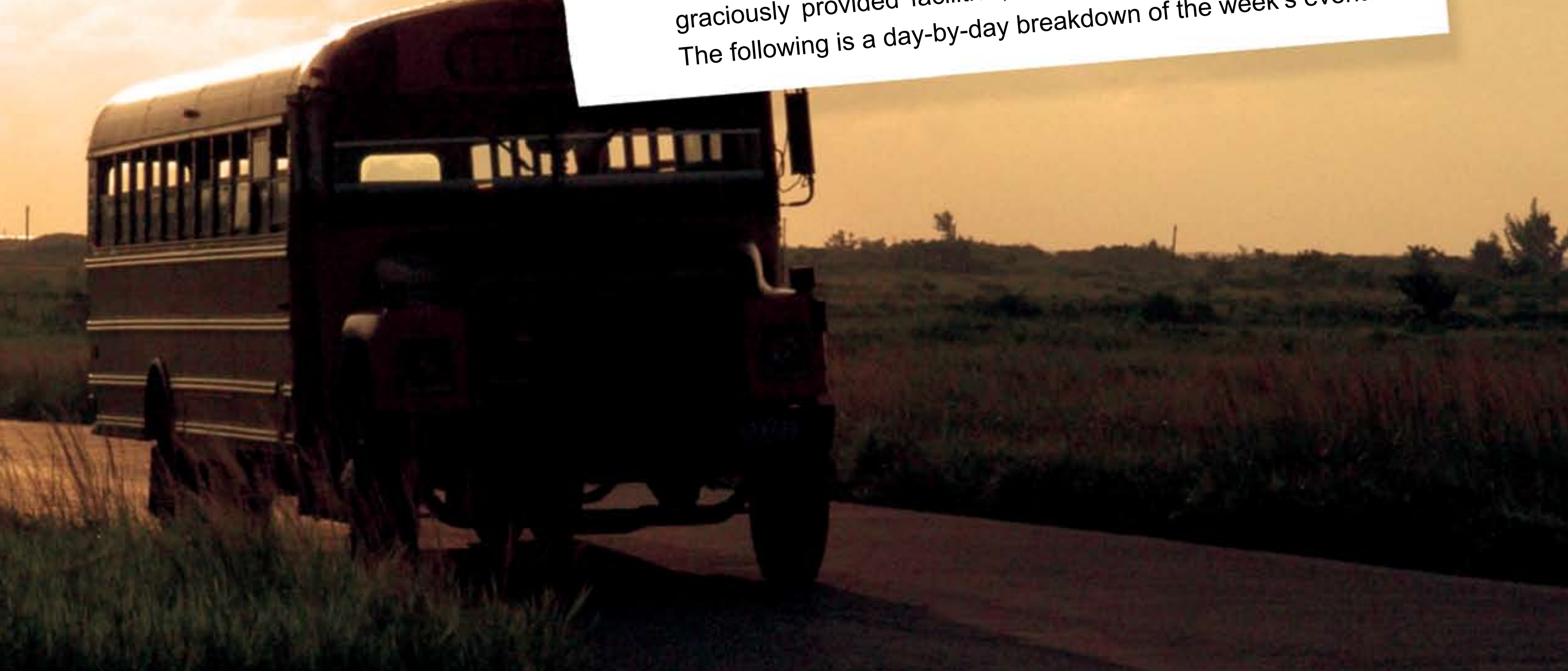







EarthStorm Teachers on the Road in North Central Oklahoma

Twenty-nine teachers from Oklahoma and Kansas and one from Arizona spent a week learning why researchers study Oklahoma weather. Oklahoma is unique in the number of weather instruments scattered around the state to monitor our ever changing weather. From the 116 Oklahoma Mesonet stations to the National Weather Service NEXRAD Radar network to the Atmospheric Radiation Measurement (ARM) Program's Climate Research Facility, billions of weather observations are taken daily. Teachers were treated to tours of the Medford Mesonet site, the ARM Central Facility, and an up-close look at a SMART-R radar. The workshop was held July 18-21 at Coolidge Elementary in Enid, Oklahoma. Enid Public Schools graciously provided facilities, a coach bus, and a computer lab. The following is a day-by-day breakdown of the week's events.



Day 1

The new teachers were introduced to basic meteorology concepts like state variables, observing systems, air masses, fronts, global weather patterns and forecasting. OCS' Dale Morris demonstrated the new Relative Humidity and Dew Point distance learning module. These two concepts are not well taught in K-12 classrooms. The module included Flash animations and recorded audio for each slide. The teachers loved the module and offered a few suggestions for improvement. Once the suggestions have been incorporated the module will be placed on both the EarthStorm and SGP ARM Outreach sites for anyone to use. We hope to develop other modules in this format over time.

Day 2

Veteran teachers joined the group to tackle climate, severe weather, and radar topics. Teachers were divided into small groups and given a climate question. They used tools available at http://climate.ocs.ou.edu/ to answer their questions. The teachers enjoyed this activity because it helped them better understand the types of products available and how to use them effectively. Next, we tackled severe thunderstorms and the products issued by the Storm Prediction Center and National Weather Service. Two OU School of Meteorology undergraduate students led the teachers through the fundamental principles of radars. To end the day, the teachers were again divided into groups. While one group went outside to see the SMART-R radar truck the others were treated to an extended weather briefing jointly produced from the collective expertise of the day's speakers. In addition, we were happy to include two visitors from New Jersey. The New Jersey State Climatologist and an Earth Science teacher spent the day at the workshop. They were in Oklahoma along with technicians to see the Oklahoma Mesonet in action. The team is working to implement a Mesonet in New Jersey and is interested in developing an outreach program.

Day 3

Touring North Central Oklahoma through Garfield, Kay, and Grant counties. Our first stop was at the ARM Central Facility near Lamont. Dan Rusk provided an overview of ARM programs and the unique instruments used by scientists. We spent about 30 minutes walking around looking at the instruments. Questions were answered by Rusk and John Harris. Next, we were off to Ponca City for lunch. Before leaving Ponca City, we stopped at the Pioneer Woman Museum. Our last stop was the Medford Mesonet site, but we made a slight detour to Wakita to visit the Twister Movie Museum. It is a small converted garage which contains memorabilia of the movie including Dorothy I. After Wakita, we stopped in Medford to see an Oklahoma Mesonet station up close. Throughout the bus ride, the teachers watched "The Weather in the Classroom" DVD series produced by The Weather Channel. Teachers were provided copies of these DVDs in their workshop packets.

Day 4

We finally made it through the content lectures. The teachers spent the day using the computers and learning to use the WeatherScope software. Many of them had not seen the software before. Others were pleased by the expanded graphing features. The software greatly impressed them. The speaker could barely be heard above the side conversations occurring around the room. Each time someone found a new feature there was a gasp then a cry of "Show me!" You could literally feel the steam engine of ideas pick up speed. They were all very excited about how they could use the software with their students. Many of them were pleased that it was user-friendly enough that most students would be able to figure out how to use it on their own. The teachers finished the day anticipating the start of the new school year.

The 2007 edition of the workshop will be held July 17-20 in Norman, Oklahoma, at the new National Weather Center. Teachers will be able to see the collaborative environment between NOAA forecasters and researchers, university academics, and a rather unique state agency like the Oklahoma Climatological Survey.

An additional bonus to the 2007 workshop will be the partnership with the Collaborative Adaptive Sensing of the Atmosphere (CASA) Project. CASA will hold their 2007 teacher workshop the week after EarthStorm (July 23-27) in Norman at the National Weather Center. Teachers will have the chance to participate in both workshops. Previous CASA workshops have rotated through the partner universities (U. of Massachusetts at Amherst in 2004, University of Puerto Rico at Mayaguez in 2005, and Colorado State University in 2006.)

For more information on EarthStorm visit http://earthstorm.ocs.ou.edu/.
For more information on the CASA workshop visit http://www.casa.umass.edu/educationandoutreach/k-12/kci.html.

Typical Teacher Comments about the 2006 EarthStorm Workshop

"I learned so much! This has been overwhelming. I know what I need to study before next summer. I realize how important weather study is for all ages for the safety of the public"

"I learned so much! This was my first time to be exposed to an 'extensive' amount of weather information. Enjoyed seeing the ARM and Mesonet. Thank you so much!"

This workshop has given me an enormous amount of information that covered basic meteorology to useful teaching strategies. This complete package is wonderful. I look forward to applying the software to my curriculum. The hands-on concept gives the authentic learning needed with so much info. I have enjoyed and learned so much in these four days that I would like to have a continued and more in-depth study. Additional workshops would be fantastic."

"I learned about the presence of the ARM facility. I wasn't aware this was here. Also learned about new resources that are available to us and how to use the WeatherScope program. I would like to learn more about how to get weather speakers into my classroom."

By: Gary McManus

Heat and drought combined to make the summer weather fairly unpleasant across the state. The season was not the hottest on record, finishing 11th on that list, but there were significant stretches of triple-digit temperatures that made it seem a 1980-style heat wave. The season was also the 27th driest on record, which continued one of the worst droughts in Oklahoma history. The highest temperature reached during summer was 109 degrees, which occurred a total of 11 times at eight different sites. Only six tornadoes were reported during June, July and August according to preliminary statistics, 50 percent of normal for those three months.

Precipitation

The dry summer compounded ongoing drought across Oklahoma. Of course, not all areas of the state were desperately dry. The Panhandle and a good chunk of central Oklahoma from the southwest to the northeast were near or above normal. Southern and north central Oklahoma, however, were extremely dry. A significant portion of south central and southeastern Oklahoma was between 6-8 inches below normal. The south central region was more than six inches below normal, on average, the 3rd driest summer on record for that area. The Panhandle received over eight inches of rainfall, on average, while the southeast recorded less than seven inches, more than four inches below normal. The Oklahoma Mesonet site at Inola reported the most rainfall for the state with over 13 inches. Newport brought up the rear with a measly 2.11 inches.

Temperature

The entire state was warmer than normal, save for the far western reaches of the Panhandle and the southeastern corner. Portions of central, south central, and northwestern Oklahoma were above four degrees above normal. The statewide average temperature was just under 82 degrees, more than two degrees above normal.

June Daily Highlights

June 1-6: The month began with typical early-June weather – warm with a few showers and thunderstorms. The heaviest rainfall on the 1st was in northeastern portions of the state, along a slow-moving cold front. Skies cleared overnight on the 2nd, allowing temperatures to drop into the 50s. The high pressure that filled in behind the front meant sunny skies, and with the sun came the heat. High temperatures quickly built into the 90s over a large portion of the state. A weather oddity occurred on the 4th in the form of a heat burst. This overnight phenomenon struck Beckham, Ellis, and Roger Mills counties. Temperatures in that area quickly warmed from the 60s to the mid 80s just after midnight. Spotty showers during the 4th and 5th were a prelude to some stronger storms on the 6th, with a few reports of high winds and large hail in the northeast.

June 7-15: This eight-day period was an early glimpse of the lazy day of summer normally found in July. For the most part, the days were sunny and hot, 10-15 degrees above normal, and the nights were clear and warm. Several records were set for warm weather at Oklahoma NWS observing sites. A few showers along a stalled cold front cooled things down briefly across the north on the 12th. The period ended with hot and windy weather. Triple-digit temperatures combined with wind gusts of over 40 mph in the northwest to greatly increase fire danger on the 15th.

June 16-20: An approaching upper-level storm kicked winds up from the south, ushering in moist air from the Gulf of Mexico. Strong to severe storms struck the state on the 16th and 17th. Hail to the size of golf balls and wind gusts of over 60 mph were common across the state during this two-day period. Over three inches of rain was reported in Wilburton, and other amounts of 2-3 inches were common. The weather dried and warmed considerably following that storminess. Triple-digit temperatures were the norm, with several Mesonet sites in the Panhandle reaching 105 on the 20th.

June 21-23: Light rain visited the northwestern corner of the state early on the 21st due to an approaching cold front. Heavier storms formed later in the Oklahoma Panhandle, bringing severe weather to that area. Large hail and gusty winds were the main threat, although preliminary reports indicate a couple of possible tornados touchdowns in Beaver County. Regardless, winds above 70 mph and hail up to two inches in diameter provided an adequate severe punch. The storms continued into the 22nd. The Freedom Mesonet site recorded over three inches of rainfall on the 22nd, prompting a flood warning early on the 23rd for the Cimarron River in Woods County. The weather cooled considerably following the frontal passage, with highs in central Oklahoma only reaching the 70s. Low temperatures dropped into the 50s.

June 24-27: A remarkably pleasant few days for late June, high temperatures basically remained in the 80s, with even some 70s thrown in each day. Northerly winds following the cold front allowed low temperatures to drop into the 50s. A few showers popped up intermittently on the 24th and 25th, but amounts were generally light.

June 28-30: Summer returned just in time for July as the winds switched back to southerly and the temperatures returned to the 90s. The 28th and 29th saw mostly clear skies, while the 30th saw plenty of fair weather cumulus clouds dotting the sky.

July Daily Highlights

July 1-3: The month's first three days were mostly sunny and hot with lows in the 60s and 70s and highs in the 90s. There were a few light showers on the 2nd and 3rd but rainfall totals were very light.

July 4-5: Much-needed rain fell over some portions of the state along a stalled cold front during these two days. Hooker reported well over two inches of rain, with Guthrie garnering over two inches. High temperatures remained in the upper 90s, but the Panhandle enjoyed temperatures in the 70s due to the aforementioned cold front. Goodwell and Hooker only reached 72 degrees on the 5th to tie for the lowest high temperature of the month.

July 6-8: The state cooled considerably after the cold front. Highs struggled into the 80s in most areas, with 70s and a few 90s elsewhere. Widespread lows in the 50s were reported all three days for a welcome respite from the heat. By the 8th, temperatures were creeping back towards the triple-digit mark in the south. A few light showers in the northwest dropped around a quarter of an inch in that area, although the Mesonet site at May Ranch came in with about six-tenths of an inch.

July 9-14: The only true rainy period during the month, the precipitation that fell during these six days was very well received due to the ongoing drought. The rain began on the 9th in the Panhandle with amounts reported in the half-inch to inch range. The heat began in earnest on the 9th as well, with highs shooting into the 100s. Heavy rain fell on the 10th, especially in the northeast. The Wynona Mesonet site recorded over four inches of rain, with several more stations in the northeast receiving over three inches. The northeast was the lucky recipient of the heaviest totals the next couple of days as well with more amounts between 1-2 inches. Severe weather accompanied the storms with large hail and high winds quite common across the northern half of the state. High temperatures crept even higher through the 14th from low 100s to upper 100s.

July 15-20: There is no other way to describe this six-day period other than “hot.” High temperatures peaked at 109 degrees on the 17th through the 20th. Cherokee reached that mark on three of those days, with a 108-degree reading on the other. Low temperatures struggled to drop below 80 degrees during this period. Fairview was still a stifling 85 degrees at its coolest point on the 20th.

July 21-24: A much too short respite from the heat occurred during these four days following an unseasonably strong cold front. A few storms fired along the front on the 21st; most amounts were light, although Washington recorded over an inch. High temperatures on the 21st still shot well about 100 degrees ahead of the front, but the next several days saw temperatures in the 80s and low 90s for the most part.

July 25-31: The heat once again built into the state and stayed until the end of the month. Highs were in the upper 90s and mid-100s statewide, and lows only dropped into the mid-70s to low 80s for the most part. The only saving grace of the month’s last week was a couple of days of decent localized rainfall on the 27th and 28th. Over two inches fell in Blackwell and Fairview, with several more amounts between 1-2 inches.

August Daily Highlights

August 1-4: August started much as the rest of the summer before it – hot and dry. Highs soared into the triple-digits statewide. A cold front entered the Panhandle on the 2nd and generated a light shower, but the rest of the state continued to bake. Oklahoma City tied its record for highest minimum temperature at 81 degrees. The cold front provided the state with much-needed rainfall for the next couple of days, accompanied by a bit of severe weather. Most of the severe weather consisted of high winds. Reports of quarter-sized hail were scattered across the state. Freedom received over two inches of rainfall on the 4th.

August 5-10: The state returned to the hot and dry weather after the wayward cold front’s exit. Highs once again soared into the 100s nearly statewide, while lows struggled to fall below 80 degrees. There were scattered showers and storms each day, with occasional bouts of severe weather. The rainfall from those storms was hit and miss, however, which is often the case with summertime storms.

August 11-16: A weak frontal boundary was followed a few days later by a stronger cold front, both of which triggered more showers and thunderstorms. Severe weather was a bit more widespread with these storms as high winds were once again the primary culprit. Several instances of winds greater than 70 mph were reported on the 14th and 16th. Kenton received nearly three inches of rain on the 13th, and nearly five inches total for the six-day period. That was in addition to Kenton’s high temperature of 67 degrees on the 14th, a 24-degree drop from the previous day’s high temperature. Behind the cold front, which stalled in central Oklahoma, high temperatures were an autumnal 70-80 degrees. Temperatures ahead of the front remained in triple digits, however.

August 17-24: A return to the heat for all areas besides the Panhandle. A couple of days of quiet, albeit hot, weather were interrupted by another cold front. Scattered rain and cooler weather was a result. The Mesonet site at Retrop recorded well over three inches of rainfall to lead the state, with other amounts widely varying between 1-3 inches in northern Oklahoma. The severe weather was largely confined to high winds, with a few reports of nickel- to quarter-sized hail. As with the previous fronts, those areas north of the stalled cold front were quite pleasant with highs in the 70s and 80s, while the area south of the front continued very hot.

August 25-31: A slow moving cold front brought relief in the form of showers, thunderstorms, and cooler temperatures during this last week of August. A secondary and even stronger cold front brought more relief on the 28th, lowering high temperatures into the 70s and 80s, over 10 degrees below normal for that time of the year. Several rainfall reports from central Oklahoma exceeded three inches on the 26th, while flash flooding was reported in Wagoner County. High temperatures on the 29th were in the 70s and 80s statewide as the rainfall ended and cooler high pressure built in from the north. The month’s final three days were quite pleasant with calm conditions, sunny skies, and high temperatures in the 80s.

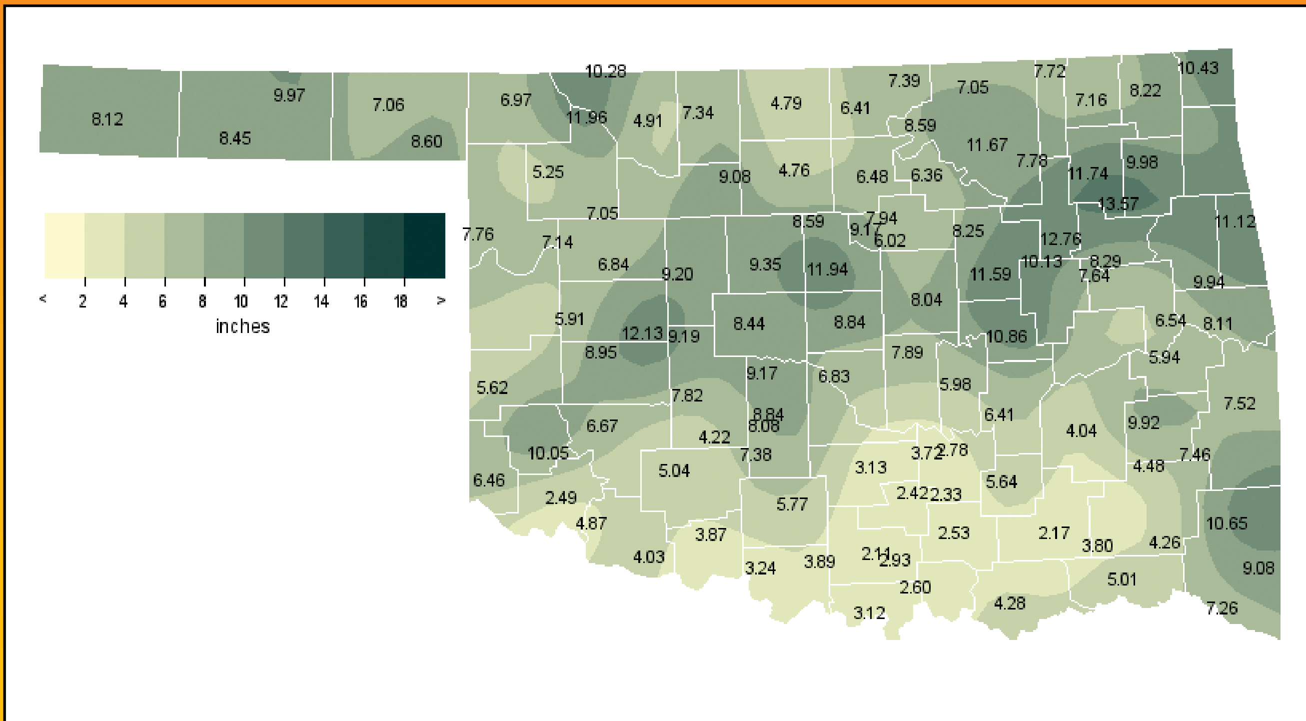
Summer 2006 Statewide Extremes

Description	Extreme	Station	Date
High Temperature	109ºF	11 sites	Multiple
Low Temperature	50ºF	4 sites	Multiple
High Precipitation	13.57 in.	Inola	
Low Precipitation	2.11 in.	Newport	

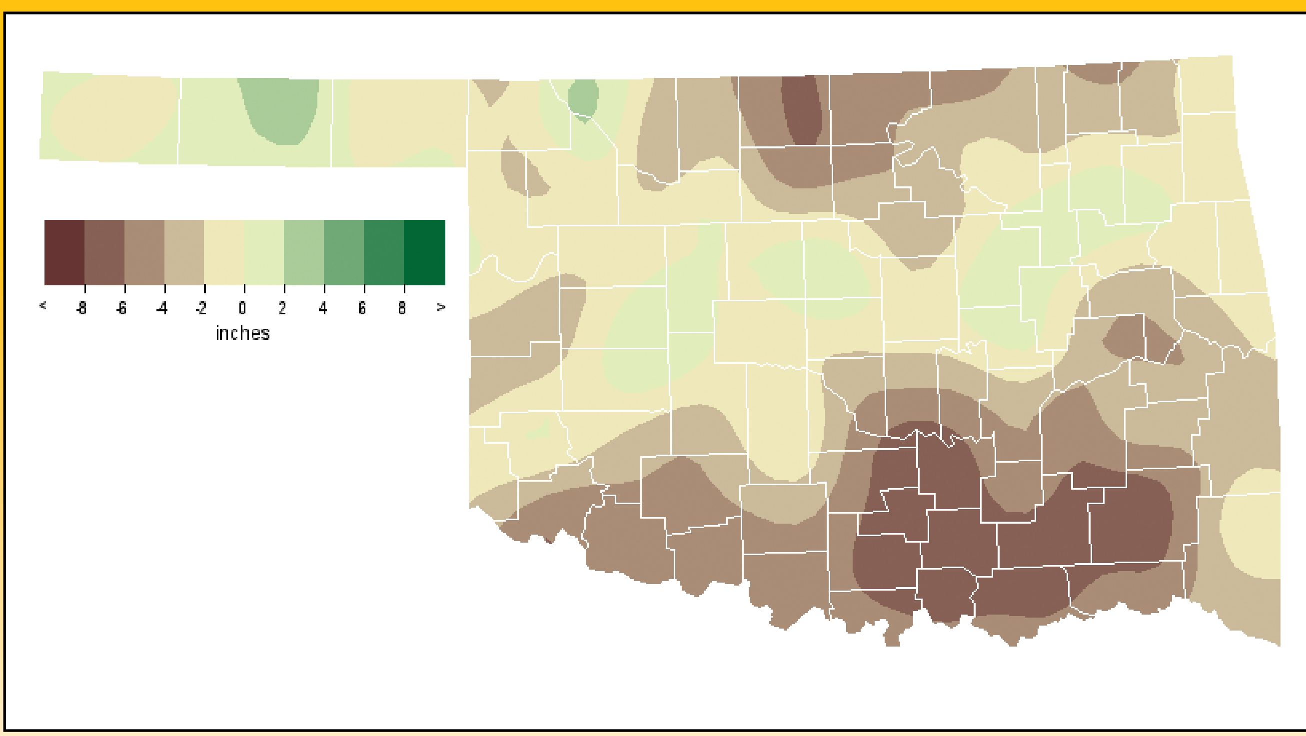
Summer 2006 Statewide Statistics

	Average	Depart.	Rank (1892-2006)
Temperature	81.9ºF	2.3ºF	11th Warmest
	Total	**Depart.**	**Rank (1892-2006)**
Precipitation	7.27 in.	-2.50 in.	27th Driest

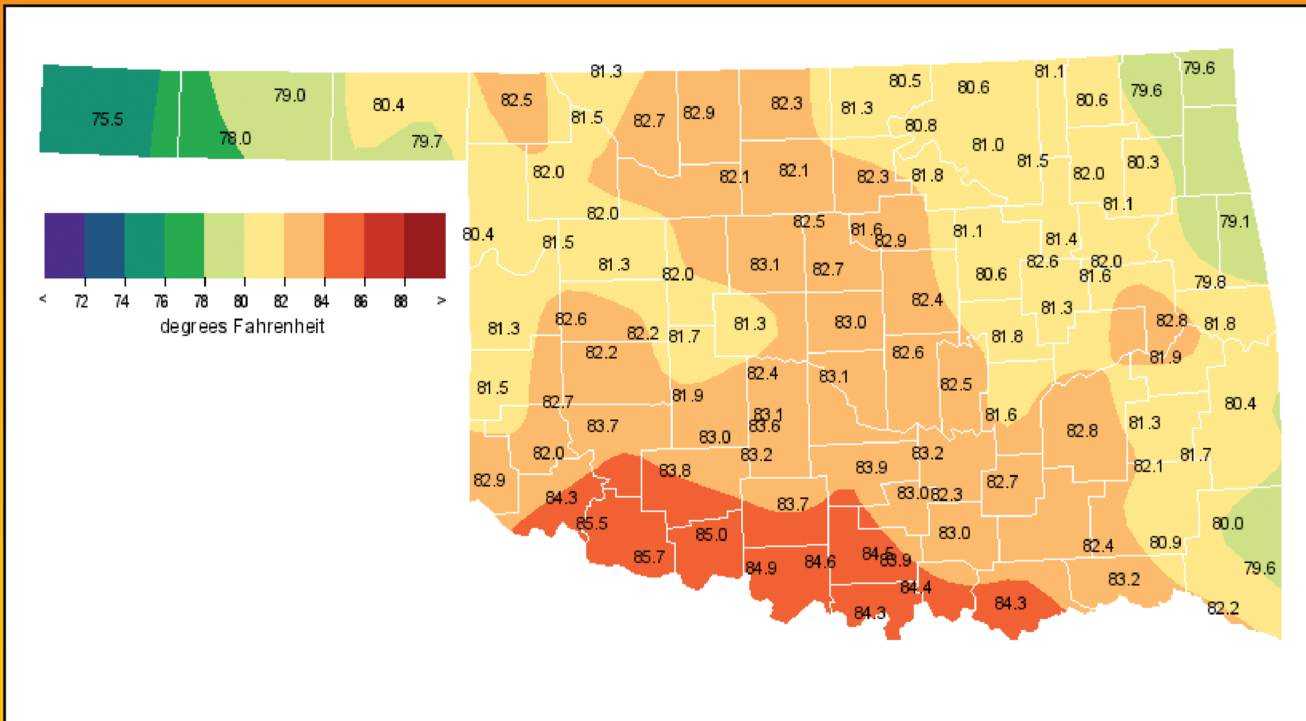
Observed Rainfall



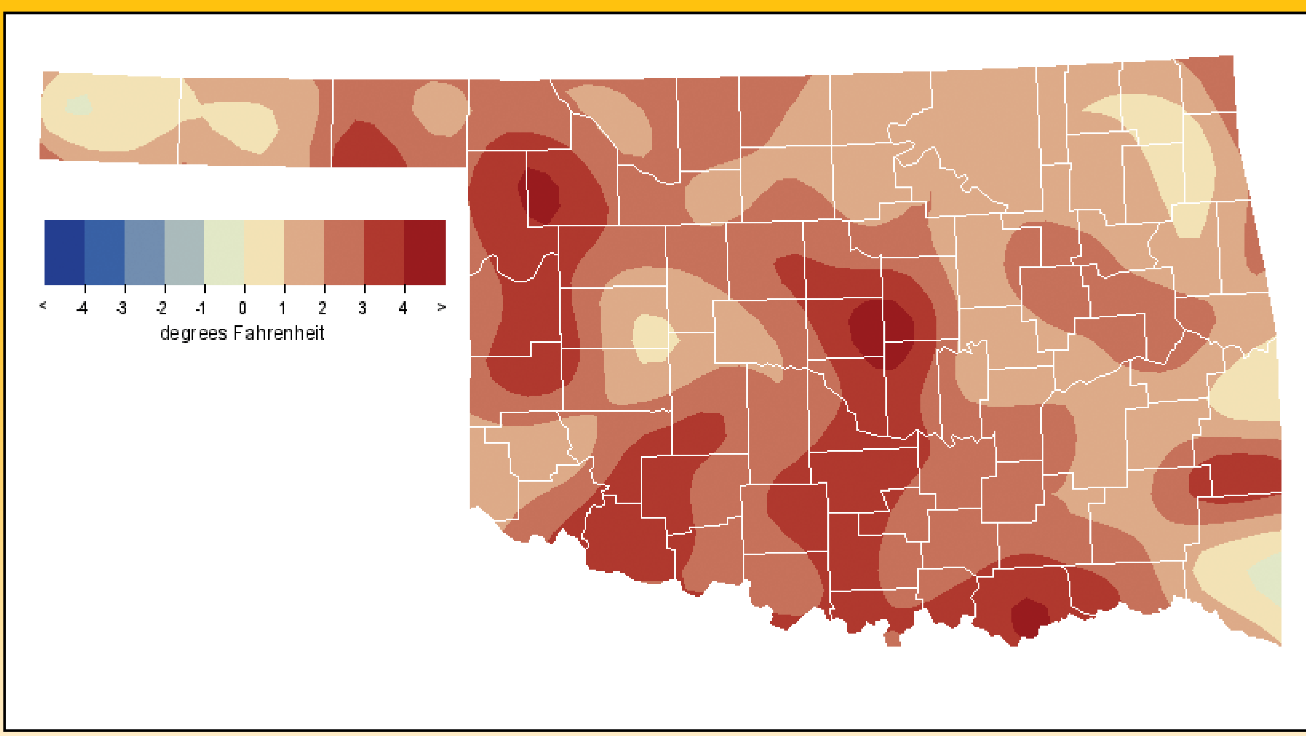
Rainfall Departure from Normal



Average Temperature



Temperature Departure from Normal



Summer 2006 Mesonet Precipitation Comparison

Climate Division	Precipitation (inches)	Departure from Normal (inches)	Rank since 1895	Wettest on Record (Year)	Driest on Record (Year)	2005
Panhandle	8.13	0.17	55th Wettest	17.32 (1950)	2.66 (1936)	11.10
North Central	7.14	-2.83	26th Driest	17.45 (2005)	3.73 (1936)	17.45
Northeast	9.38	-1.58	36th Driest	23.78 (1948)	2.97 (1936)	13.71
West Central	7.97	-0.74	56th Driest	16.53 (1995)	2.79 (1980)	14.59
Central	8.59	-1.18	45th Driest	17.61 (1992)	1.97 (1936)	16.15
East Central	7.76	-2.95	24th Driest	20.53 (1958)	1.54 (1936)	9.33
Southwest	5.88	-3.15	29th Driest	16.22 (1996)	2.15 (1980)	10.73
South Central	3.29	-6.43	3rd Driest	19.72 (1950)	2.58 (1980)	13.41
Southeast	6.94	-4.05	15th Driest	21.23 (1945)	3.50 (1934)	7.26
Statewide	7.27	-2.50	27th Driest	17.26 (1950)	2.79 (1936)	12.91

Summer 2006 Mesonet Temperature Comparison

Climate Division	Average Temp (F)	Departure from Normal (F)	Rank since 1895	Hottest on Record (Year)	Coldest on Record (Year)	2005
Panhandle	79.4	2.1	13th Warmest	81.9 (1934)	71.5 (1915)	76.6
North Central	81.9	2.0	15th Warmest	86.2 (1934)	74.3 (1915)	78.9
Northeast	80.9	2.1	14th Warmest	85.4 (1934)	73.8 (1915)	79.4
West Central	81.9	2.5	13th Warmest	85.4 (1934)	74.6 (1915)	78.2
Central	82.4	2.5	10th Warmest	85.6 (1934)	75.0 (1915)	79.3
East Central	81.5	2.2	14th Warmest	85.4 (1934)	75.0 (1915)	80.4
Southwest	83.6	2.4	11th Warmest	86.0 (1980)	77.1 (1915)	80.1
South Central	83.8	3.0	9th Warmest	86.2 (1934)	77.0 (1906)	80.3
Southeast	81.4	2.1	19th Warmest	84.8 (1934)	75.3 (2004)	79.1
Statewide	81.9	2.3	11th Warmest	85.2 (1934)	74.9 (1915)	79.2

Summer 2006 Mesonet Extremes

Climate Division	High Temp	Day	Station	Low Temp	Day	Station	High Monthly Rainfall	Station	High Daily Rainfall	Day	Station
Panhandle	109	Jul 20th	Buffalo	50	Jun 17th	Beaver	9.97	Hooker	2.88	Aug 13th	Kenton
North Central	109	Jul 19th	Cherokee	55	Jun 26th	Newkirk	11.96	Freedom	3.35	Jun 22nd	Freedom
Northeast	109	Aug 10th	Claremore	50	Jun 27th	Nowata	13.57	Inola	4.33	Jun 10th	Wynona
West Central	107	Jul 18th	Weatherford	54	Jun 27th	Butler	12.13	Weatherford	2.67	Jun 16th	Weatherford
Central	107	Aug 10th	Kingfisher	51	Jun 27th	Oilton	11.94	Guthrie	3.88	Jun 10th	Bristow
East Central	109	Aug 10th	Webber Falls	51	Jun 27th	Tahlequah	11.12	Westville	2.29	Jun 10th	Hectorville
Southwest	109	Jul 17th	Walters	53	Jun 27th	Mangum	10.05	Mangum	1.90	Aug 21st	Mangum
South Central	108	Jul 18th	Waurika	52	Jun 27th	Burneyville	5.77	Ketchum Ranch	1.68	Aug 27th	Burneyville
Southeast	107	Aug 18th	Antlers	50	Jun 8th	Wister	10.65	Mt. Herman	3.53	Jun 17th	Wilburton
Statewide	109	Jul 19th	Cherokee	50	Jun 17th	Beaver	13.57	Inola	4.33	Jul 10th	Wynona

AGRICULTURE WEATHER WATCH

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

photo: laura mckay

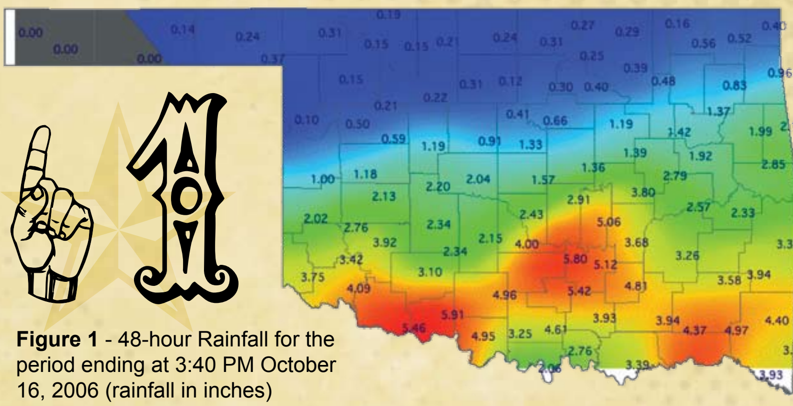


Figure 1 - 48-hour Rainfall for the period ending at 3:40 PM October 16, 2006 (rainfall in inches)

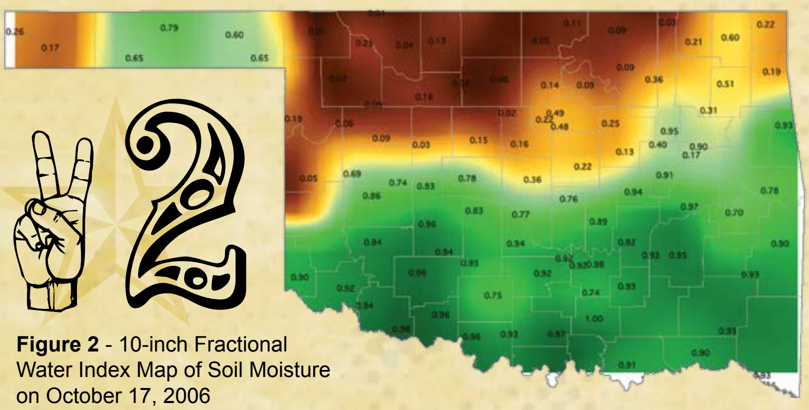


Figure 2 - 10-inch Fractional Water Index Map of Soil Moisture on October 17, 2006

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 or Laura McKay by phone at **405-325-3126** or email. Al's email is **albert.sutherland@okstate.edu**. Laura's email is **laura.k.mckay@okstate.edu.**

Oklahoma is a state divided. Divided into areas blessed with recent rainfall and areas that have seen little rain. Take a look at the 48-hour rainfall totals from October 14 and 15, 2006 in Figure 1. In the areas north and west of a line from Tulsa to Oklahoma City to Elk City, far less rain fell. South and east of this line, heavy amounts of rain fell from the sky.

In the areas where lighter rains have occurred, the low soil moisture levels are keeping growers from planting their fall wheat crop. Figure 2 shows the deeply divided soil moisture situation across Oklahoma. This is a map of Fractional Water Index values from the Oklahoma Mesonet 10-inch deep soil moisture sensors. Ideally, we would like to see the soil moisture in the 10-inch zone at or above 0.75 Fractional Water Index value.

In those areas that received good rainfall, Oklahoma pastures are greening up. Along with the rains has come a break in the summer heat creating an ideal environment for pasture grass growth. This is especially true for the eastern half of the state that has more cool-season grass pastures.

It has been a tough weather year for much of the Great Plains wheat producing areas. The year of 2006 started with dry soils. Then critically needed rain never materialized and drought conditions intensified. Wheat growers saw the poorest wheat crop in fifty years. There was no summer pasture growth for livestock grazing. Virtually no hay was produced for winter-feeding. In estimating 2006 agricultural losses for wheat, corn, cotton, rye, soybeans, sorghum and peanuts, Mark Hodges, Executive Director for the Oklahoma Wheat Commission, sets the total loss to agriculture at over $500 million dollars.

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

SEPTEMBER

- Apply a fall lawn preemergent for winter annual weed control, popular products include Princep, Barricade, Balan, Surflan or Team.
- Fertilize tall fescue in late September to stimulate growth as air temperatures cool, use a quick release fertilizer at a rate of 1 pound of actual nitrogen per 1,000 square feet.
- Broadcast tall fescue seed for new shady lawn areas or to thicken existing stands. Mix _ to _ pound of improved Kentucky bluegrass with 4 pounds of tall fescue per 1,000 square feet.
- Plant pansies for fall, winter and spring color. Pansies will produce new blooms when the air temperature goes above 40ºF.
- Divide and replant spring-flowering perennials.
- In the garden, plant garlic, radish, rutabaga, spinach, Swiss chard, radish, and turnip.
- To increase garden soil organic matter, plant Austrian winter peas, vetch, wheat or rye as a winter cover crop. Till green plants into the soil a couple of weeks before you want to plant next spring.

OCTOBER

- Plant deciduous trees and shrubs.
- Plant most bulbs. Wait until November to plant tulips.
- Take a soil test to determine the nutrient status of your soil. Collected soil can be dropped off at your county OSU Cooperative Extension Service Office for analysis.

NOVEMBER

- Once the 4-inch 3-day average soil temperature under sod drops below 55ºF, plant tulip bulbs 6 inches deep.
- Fertilize tall fescue in early November. Use a quick release fertilizer at a rate of 1 pound of actual nitrogen per 1,000 square feet.
- Rake leaves, clean up flower beds, and build a compost pile. A simple recipe for making a compost pile is to use 50% green and 50% dry plant material in alternating layers 3-4 inches thick.
- Prune trees after the majority of its leaves have turned color or dropped to the ground.
- Dig and transplant young trees or deciduous shrubs that need to be moved.

INTERPRETATION ARTICLE: Flash Flood Guidance by Andrea Melvin

Tropical systems are heavy rain producers for not only coastal regions but for inland states, especially if the system slows down and becomes stationary. Some of Oklahoma's most significant flooding events have occurred due to a stalled tropical system.

National Weather Service (NWS) River Forecast Centers routinely issue Flash Flood Guidance (FFG) throughout the day for every county in their area. The river forecast centers determine 1- 3- and 6-hour flash flood guidance values for all counties. The NWS Weather Forecast Offices use this guidance when issuing flash flood watches and warnings to the public. Flash Flood Guidance estimates the average number of inches of rainfall for given durations required to produce flash flooding in the indicated county. These estimates are based on current soil moisture conditions. Note, in urban areas, less rainfall is required to produce flash flooding.

On August 3, 1995, the following Flash Flood Guidance values were issued for Custer County, Oklahoma: 1-hr FFG 1.0, 3-hr FFG 1.4 and 6-hr FFG 1.7. FFG values are reported in inches. So how do you use FFG values to make decisions? Let's say it rained 1 in. from 5 PM to 8 PM in Custer County. Our time interval is 3 hours. Compare the actual rainfall (1 in.) measured with the 3-hr FFG value (1.4 in.). The actual rainfall is less than the 3-hr FFG value so you would not expect there to be any flash flooding in Custer County. But what if the 1 in. of rain fell from 6 PM to 7 PM? The time interval has changed to 1 hour. The rainfall equals the 1-hr FFG value. A flash flood has begun in Custer County.

The FFG values are generated by a computer model. The model keeps track of past rainfall to decide how much more rain an area can receive before flooding will begin. A heavy rainfall in a short period of time or several days of constant rainfall can contribute to flash flooding. The soil can only absorb a limited amount of water. Raain that falls faster than the soil can absorb will cause flooding. Once the soil becomes saturated (the point where the soil can no longer absorb any more water), any additional rainfall will contribute to flooding conditions.

The computer models are updated throughout the day with any rainfall that has occurred since the last time the FFG values were created. Emergency managers and local officials keep an eye on daily rainfall totals throughout the day. They then compare the total to the latest FFG values. The FFG model is run three times a day at 0Z, 12Z, and 18 Z. In Central Standard Time, the Z times convert to 6 PM the day before, 6 AM, 12 PM.

Important Terms

(Source - http://www.weather.gov/glossary/):

Flash Flood
A flood which is caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Also, at times a dam failure can cause a flash flood, depending on the type of dam and time period during which the break occurs.

Flash Flood Guidance
Forecast guidance, often produced by computer models, specific to the potential for flash flooding (e.g., how much rainfall over a given area will be required to produce flash flooding).

Flash Flood Warning
Issued to inform the public, emergency management, and other cooperating agencies that flash flooding is in progress, imminent, or highly likely.

Flash Flood Watch
Issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain or imminent.

CLASSROOM ACTIVITY

As discussed in the historical article on hurricanes, tropical systems can produce heavy rains for Oklahoma. In August of 1995, Tropical Storm Dean traveled north through Texas and stalled over western Oklahoma. Examine the rainfall for August 1st and 2nd to see where flooding may have occurred.

Oklahoma Mesonet Stations - http://www.mesonet.org/sites/
Oklahoma County Names - http://climate.ocs.ou.edu/statewide/CountyNames.gif

1. During the 6 days shown on Map 1, what was the maximum rainfall total? Which county was this station located?

2. Find the following locations on Map 1: Custer County (Butler, OK), Dewey County (Putnam, OK) and Payne County (Stillwater, OK). The Butler site recorded 7.0 in. while Putnam and Stillwater received 9.25 in. and 4.65 in. respectively.

Use Graph 1 to answer questions 3-5 and Graph 2 to answer questions 6-8. The graphs show the accumulated rainfall at each station. Notice at 7 PM the rainfall value resets to zero. This marks the end of the Universal Time Coordinate (UTC) day.

3. How much total rain fell at each location on August 1st?

4. How much rain fell at Butler from Noon until 6 PM? (Hint: Subtract the Noon rainfall from the 6 PM rainfall.) At Putnam? At Stillwater?

5. Compare you answers from Question 4 to the 6-hr Flash Flood Guidance (FFG) values in Table 1. Which stations observed more rainfall than their FFG value?

6. How much total rain fell at each location on August 2nd?

7. How much rain fell at Putnam from Noon until 6 PM (6-hr)? Between Noon and 2 PM (3-hr)? Between 1 PM and 2 PM (1-hr)?

8. Compare you answers from Question 7 to the 1-hr, 3-hr and 6-hr Flash Flood Guidance (FFG) values in Table 1.

9. If it was 2 PM and all you knew were the 1-hr rainfall total and FFG value, would you expect to have flooding in Putnam soon?

10. How does your flooding expectation change when you look at the longer guidance intervals?

11. Let's say the National Weather Service had forecasted 1.5 in. of rain by 1 PM in Putnam. Has the criteria been met to issue a Flash Flood Watch or Flash Flood Warning? At what time would you issue your watch and/or warning?

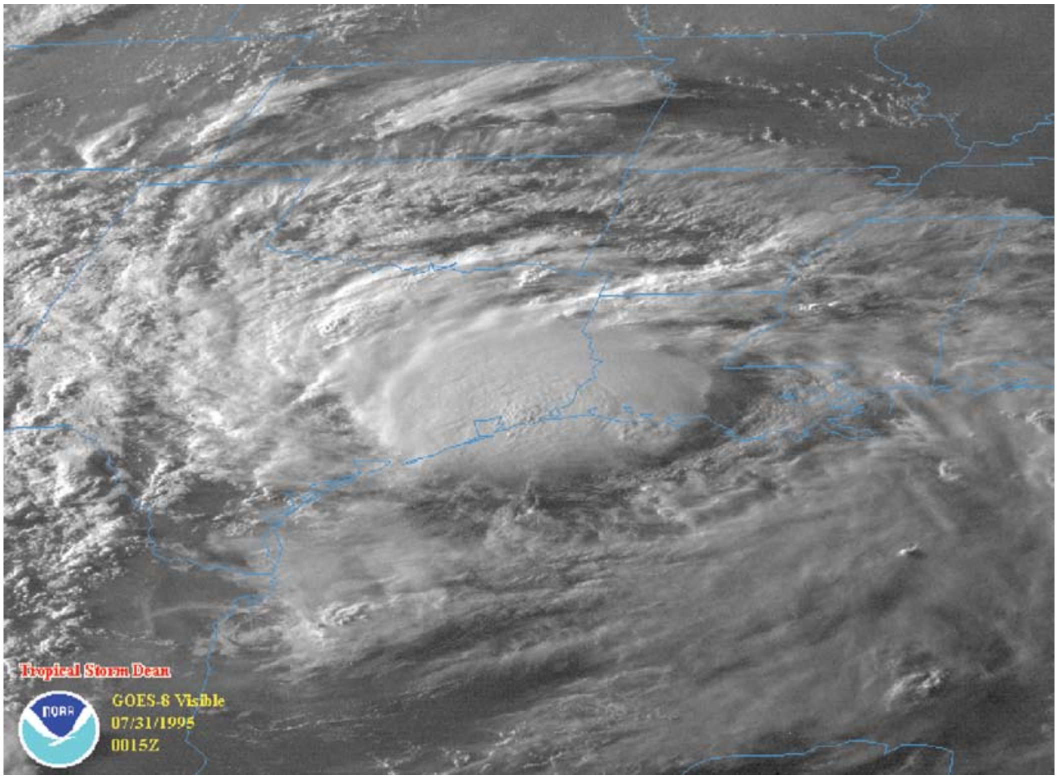
Table 1 - Selected Flash Flood Guidance values issued by the Arkansas-Red Basin River Forecast Center during the time remnants of Tropical Storm Dean were stalled over Oklahoma.

ARKANSAS-RED BASIN RIVER FORECAST CENTER...TULSA OK

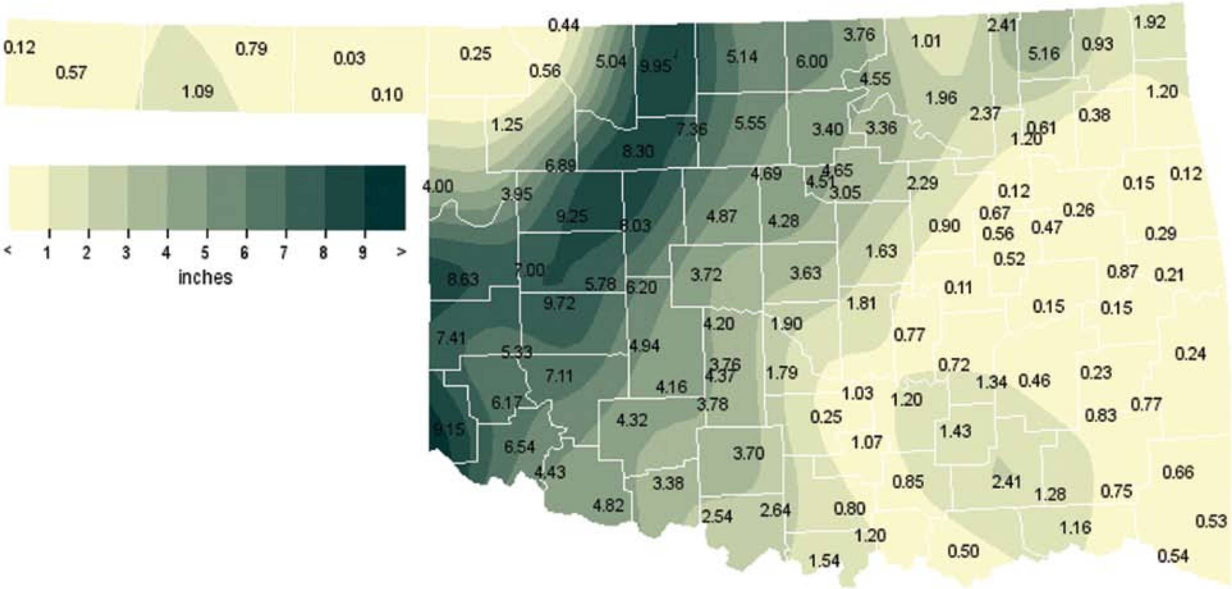
AVERAGE INCHES OF RAINFALL FOR GIVEN DURATIONS REQUIRED TO PRODUCE FLASH FLOODING IN THE INDICATED COUNTY FORECAST AREAS. LESS RAINFALL REQUIRED IN URBAN AREAS.

Date	Time	County Name	1 HR (inches)	3 HR (inches)	6 HR (inches)
Aug 1, 1995	9:22 AM	Custer	2.5	3.0	3.3
		Dewey	2.1	2.5	2.7
		Payne	1.2	1.7	2.0
Aug 2, 1995	11:00 AM	Custer	1.7	2.2	2.6
		Dewey	1.7	2.1	2.4
		Payne	0.7	1.2	1.5

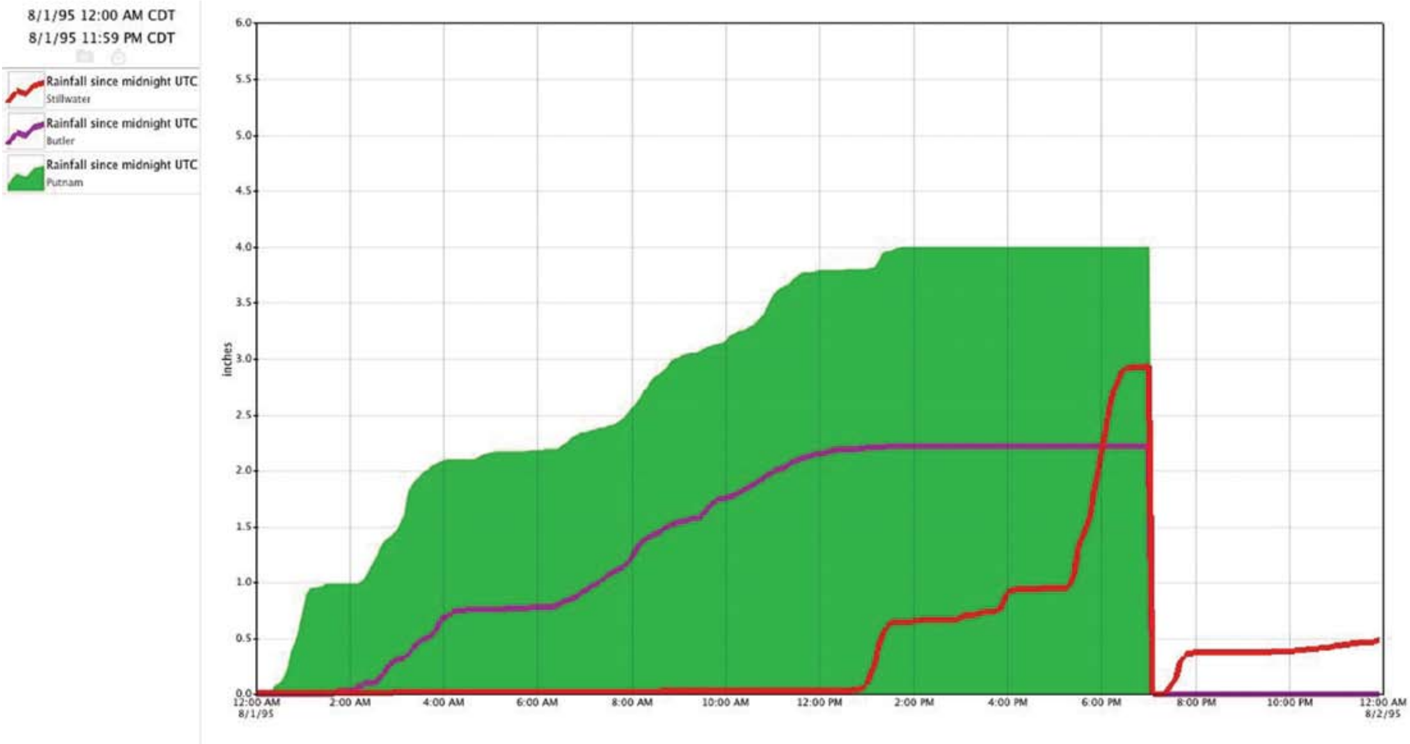
Image 1 - Visible satellite image of Tropical Storm Dean on July 31, 1995 as the system moves inland.



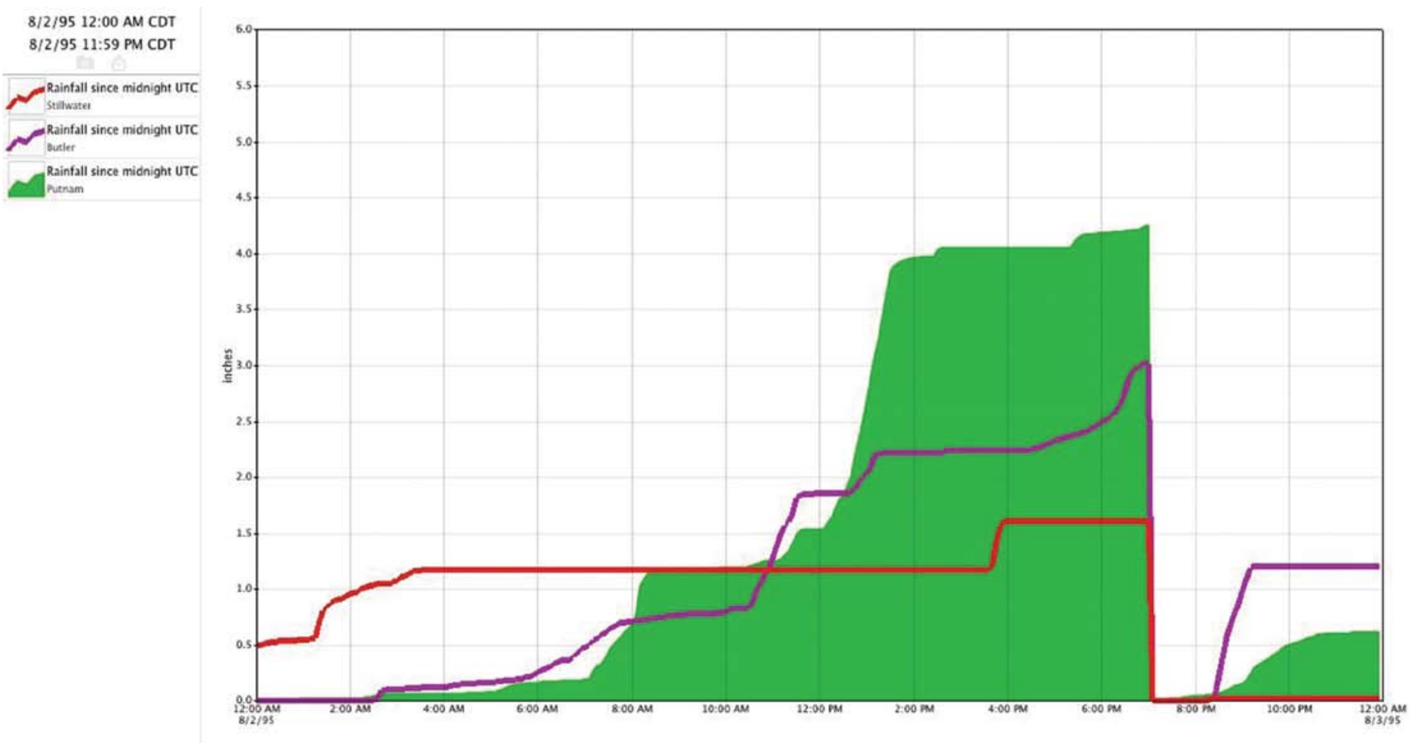
Map 1 - Total rainfall observed during the time remnants of Tropical Storm Dean was stalled over Oklahoma.



Graph 1 - Rainfall at Stillwater (red), Putnam (green), and Butler (purple) on Aug 1, 1995.



Graph 2 - Rainfall at Stillwater (red), Putnam (green), and Butler (purple) on Aug 2, 1995.



WEATHER MODIFICATION FROM CLOUD SEEDING

The following is a statement from the Oklahoma Climatological Survey.

Oklahoma appears to be transitioning once again into a decadal-scale period of below-average precipitation. Measured precipitation during three of the last five years has been below the average of the past 111 years. In the past year, drought conditions across portions of the state have approached levels similar to the droughts of the 1930s or 1950s.

Among the proposed solutions to drought pursued in years past has been the use of cloud seeding in an attempt to increase precipitation. Cloud seeding has proven controversial over two questions: (1) is precipitation actually increased, and (2) are the benefits worth the cost of the program? Based upon a review of cloud seeding studies in Oklahoma, we conclude that a targeted cloud seeding program may have merits, but further studies are needed to establish its effectiveness, appropriate operational considerations, and economic benefits. Furthermore, consideration should be given to longer-term activities that assess future needs and promote water conservation.

We conclude that a targeted cloud seeding program may have merits, but further studies are needed to establish its effectiveness, appropriate operational considerations, and economic benefits. Furthermore, consideration should be given to longer-term activities that assess future needs and promote water conservation.

Previous studies conducted by the Oklahoma Climatological Survey (OCS) and others have demonstrated a response within clouds to seeding activities. A 1997-1998 study concluded that "in most cases, precipitation and increased cloud development are present after and downwind of the rainfall enhancement seeding activities." However, the study concluded that while there was a relationship, it could not be determined if changes in cloud structure were a direct result of cloud seeding; nor could it determine the magnitude of precipitation enhancements. The study did find that if precipitation could be increased at key times in crop development cycles, resultant yield increases would generate substantial increases in revenue to the local and state economies.

OCS recently completed a climatological evaluation of cloud seeding activities for 14 regions in Texas and Oklahoma. This study sought to extend previous studies by comparing areas of seeding activities to nearby areas where no seeding operations were conducted. Key findings include:

- Of the 14 regions studied, 7 showed an overall (total rainfall) increase when compared to nearby locations without cloud seeding, while 7 showed an overall decrease.
- Overall precipitation enhancement was generally marginal (less than 5% increase in total rainfall), although some programs consistently produce more rain than others.
- Due to large-scale favorable rainfall patterns, the likelihood of successful rainfall enhancement was greater during the months of May and September than it was during typically dry, intervening summer months.
- Oklahoma was among the regions showing a higher likelihood of increased rainfall when compared with neighboring regions, although southeastern Oklahoma responded more poorly than did southwestern or south-central Oklahoma, perhaps a result of minimal cloud seeding.
- Areas that showed an overall increase in precipitation also showed an increase in the total number of days with rainfall greater than established thresholds (e.g., 0.10 inch to 0.50 inch or greater).

Recommendations

Based upon these studies, OCS concludes that cloud seeding activities provide minimal relief to drought conditions. Oklahoma's approach has been to target all areas of the state over all months from May through September. This approach stretched limited resources too thin to allow confidence that the activities produced any significant positive benefit.

While results are mixed, cloud seeding efforts may have merit if performed within a more regimented structure. More seeding does not necessarily equate to more precipitation; rather, targeted opportunities suggest greater likelihood of significantly increasing precipitation. This includes targeting the times of year when programs operate, specifically May and September, with limited or no activity during summer and winter months.

OCS also encourages the continued evaluation of any ongoing cloud seeding activities. Evaluation provides valuable feedback on program operations that can improve the likelihood of success of current and future programs. Further, OCS recommends that a benefit-cost analysis be completed in advance of any new program to determine how much of an increase in precipitation is needed to produce economic benefits sufficient to offset program costs.

These studies were limited to examination of cloud characteristics and measured precipitation only. They do not include measurements of soil moisture – a critical factor for the growth of vegetation – or measurements of groundwater depth. Light precipitation may evaporate before entering the deeper layers of the soil or aquifers. However, a small increase in heavier precipitation events, which already saturate the soil, may generate additional runoff that could be captured in ponds, lakes, and reservoirs. Further studies should address changes to soil moisture and groundwater to increase confidence that cloud seeding activities will have the intended effects.

Silver Iodide flares are commonly used to spread seeding material into the cloud.

Other Options for Drought Management

OCS supports a host of other options available to government officials to help mitigate the effects of drought in Oklahoma. These options include better educating citizens regarding use of water resources, expanding groundwater depth monitoring statewide, providing information via OSU's Cooperative Extension Service to producers regarding drought-tolerant crop varieties when drought conditions are anticipated, and development of community-level plans and infrastructures for better management of water resources. OCS also endorses a review and update of the Oklahoma Comprehensive Water Plan, last updated in 1997. As we anticipate entering a significantly drier decade when compared to the past two decades, we must recognize that cloud seeding efforts likely cannot provide enough water to maintain current usage demands.

For Further Information:

Research Questions
Dr. Jeff Basara
Director of Research

Other Inquiries
Dr. Renee McPherson
Acting Director

Fire Safety "Around" Your House

Wildfires and forest fires are threats during droughty conditions across Oklahoma. To decrease the chances that your home will be damaged or destroyed by outdoor fires, follow these safety tips:

Create a safe zone around your home. Maintain at least 30 feet of space around your home that is free of dead wood and leaves, dry grass, and firewood. Prune shrubs and trees, especially within 15 feet of your chimney. Remove branches that overhang your house. Keep the landscape within 30 feet of your home well watered.

Remove all Eastern red cedars (Juniperus virginiana) from your land. Although these plants may look like Christmas trees, their volatile oils and low-hanging branches provide explosive fuel for wildfires in Oklahoma. In addition, Eastern red cedars extract water from the soil at an excessive rate, leaving other vegetation dry, dying, and prone to fire.

Listen for fire advisories and alerts. A Fire Weather Watch is issued by the National Weather Service (NWS) to alert fire and land management agencies that there is a high potential for conditions to become favorable for extreme fire behavior with any fire that ignites within the next 24 to 72 hours. A Red Flag Warning is issued by the NWS when current or forecasted future conditions are capable of making fighting fires extremely dangerous and controlling fires nearly impossible. When red flag conditions exist, extreme fire behavior can be expected with any fire that ignites. Red Flag Fire Alerts are issued by the Oklahoma Department of Agriculture, Food, and Forestry if weather conditions favorable for unusual or extreme burning conditions are occurring and are expected to continue for a prolonged period. Red Flag Fire Alerts, which should not be confused with Red Flag Warnings, serve as an advisory to the need for added safety precautions prior to burning anything outdoors.

For more information, visit the Oklahoma Department of Agriculture, Food, and Forestry (http://www.ok.gov/~okag/), the National Weather Service (http://www.nws.noaa.gov/), or the Firewise (http://www.firewise.org/) web sites. In addition, monitor fire danger across the state using the Oklahoma Fire Danger Model at http://agweather.mesonet.ou.edu/models/fire/.

OKLAHOMA
CLIMATOLOGICAL SURVEY

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