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Tulsa Tornado Tribune

"Where People Who Know The Weather Get Their Weather"

National Weather Service Tulsa, Oklahoma — Summer, 2004

May 29 Tornadoes

Memorial Day weekend 2004 will go in the books as a stormy one across much of the central United States. An upper level low pressure system moving out of the Rockies on the afternoon of May 29 produced a swath of severe weather from the Dakotas to Oklahoma, including 93 reports of tornadoes.

By mid afternoon, supercell storms developed along the dry line in far western Oklahoma. Most of the storms either moved northeast into Kansas or dissipated. However, a single supercell moved off the dry line, producing several tornadoes in western and central Oklahoma.

Shortly after 11 pm, the same storm moved into western Creek County, and spawned four tornadoes in the county. The first one touched down 6 miles west-northwest of Depew and traveled 7.5 miles. A second tornado formed immediately east of first tornado as its circulation occluded and turned left. The two tornadoes produced an almost continuous damage path. In all, five mobile homes and two houses were

Photo courtesy of David Gaede

Large tornado illuminated by lightning near Depew, OK May 29.

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Editor's Notes

We have just about wrapped up another spring severe weather season. As always, the assistance of spotters and Emergency Managers proved vital to our success. The National Weather Service in Tulsa would like to thank all of you for your help!

Craig A. Sullivan - Editor

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Mingo Creek Flooding

A Brief History and Aftermath

It has been 20 years since the City of Tulsa suffered through its worst flooding event in terms of fatalities and destruction. The following is a brief history of flooding on Mingo Creek in Tulsa. A special thanks goes to Ann Patton and the City of Tulsa Public Works Department. Much of the following information was obtained from publications *From Rooftop To River* and *From Harm's Way*.

The history of Mingo Creek flooding begins in the 1960s. Prior to that time, the Mingo Creek watershed was primarily pasture lands. However, during the 1960s, the population of Tulsa grew by 25%, and new construction continued to expand into the lowlands of the Mingo Creek watershed. The rapidly urbanizing watershed was annexed to the city of Tulsa in 1966.

Flash flooding occurred frequently in the Mingo Creek basin, which drains 61 square miles in east Tulsa. Mingo Creek drains about one-third of the city, but has accounted for two-thirds of the city's flood damages in modern times. Notable floods occurred in 1970 and 1974 (*see related story page two*). However, the worst floods occurred in 1976 and 1984, both during Memorial Day weekend.

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Widespread Wind Damage June 2

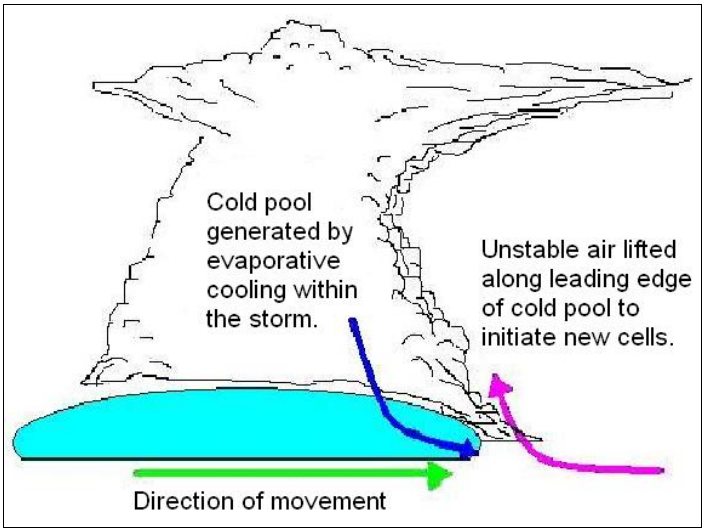
A large complex of severe thunderstorms marched across much of eastern Oklahoma and portions of northwest and west central Arkansas in the mid to late afternoon hours of June 2. By the end of the day, many locations south of a Tulsa to Fort Smith line suffered significant wind damage, with gusts of 60 to 80 mph (equivalent to an F1 tornado) common along the leading edge of the storm complex. Almost 100,000 residents were without power at one point.

The storms initially developed during the late morning over southwest Kansas, eventually organizing into a line of storms across north central Oklahoma. In the meantime, the airmass over eastern Oklahoma and western Arkansas was becoming increasingly unstable. A deep pool of cold air developed in the wake of the storms, which helped generate new cells and allow the complex to sustain itself for several hours. The complex of storms intensified further as it encountered the increasingly unstable airmass and interacted with a surface boundary lying across northeast Oklahoma.

The storms moved through the Tulsa metropolitan area between 2:30 and 3 pm, causing widespread damage throughout the city. The downtown area was particularly hard hit, with the 15-story WilTel building suffering significant structural damage. A potion of the building frame bowed out from the force of the wind, and many windows were blown out of the glass facade. The Adams Mark Hotel downtown also had several windows blown out. Elsewhere in the Tulsa area, the Concorde Building at Tulsa International Airport had its roof blown off, and widespread tree damage was reported.

The storms continued their southeast trek, downing trees and power lines across much of eastern Oklahoma. Two people were injured near Inola in Rogers County, OK, when a tractor-trailer was blown over on Highway 412. A brief gustnado was reported near Beggs in Okmulgee County, OK at around 3 pm. One of the hardest hit counties in Oklahoma was Haskell County, where widespread damage to trees and power lines was reported.

The storms went on to cause extensive damage in the Fort Smith area between 4:30 and 5 pm, as wind gusts to 80 mph were reported in the towns of Jenny Lind and Mansfield. Significant damage occurred in the city of Fort Smith, where a Radio Shack store suffered structural damage. Multiple trees were also uprooted at the Fort Smith Regional Airport.



Schematic showing how forward propagating MCS's, much like the one that moved across eastern Oklahoma on June 2, sustain themselves.

If the degree of evaporative cooling is sufficient, the complex of storms will develop a strong cold pool. As the cold pool spreads forward and displaces the warm moist air ahead, it creates lift to develop new storms.

If enough instability is present, new storms will develop quickly enough to remain above the advancing cold pool. The cold pool will then be further enhanced by new downdrafts as the storms mature.

On June 2, a very strong cold pool was generated, as evidenced by temperatures dropping into the 60s in the rain-cooled air. The airmass ahead of the storm complex became extremely unstable, with Lifted Indices of –10 to –12 °C and CAPEs of 4000 to 6000 J/Kg, so new convective development occurred very quickly over the cold pool.

The cold pool spread south faster than any discrete cells could be moved by the steering winds aloft. The extreme airmass instability and intensity of the cold pool caused new storms to develop as fast as the cold pool was moving. In effect, the line "propagated" or developed southward.

Ozone Alerts

Hazy skies are a part of summer, but sometimes the haze may indicate an unhealthy concentration of Ozone in the lower atmosphere. Ozone is an odorless, colorless gas that occurs naturally in the Earth's upper atmosphere and forms a protective layer to shield us from the sun's harmful ultraviolet rays. Conversely, ground-level ozone is created when pollutants known as "Ozone precursors," react with oxygen in heat and sunlight to form ozone. Pollution from cars, industrial facilities, power plants, gas-powered mowers, and evaporation of paints and other chemicals are all Ozone precursors.

Scientists have found that Ozone, in high enough concentrations, can irritate the respiratory system, reduce lung function. (i.e. the volume of air you draw in when you inhale and the speed at which you are able to exhale), aggravate asthma, or even inflame and damage the lining of the lung. Most of these are short-term effects because they eventually cease once the individual is no longer exposed to elevated levels of ozone. However, scientists are concerned that repeated short-term damage from ozone exposure may permanently injure the lung.

When high levels of Ozone are expected, the Health Department will issue an Ozone Alert for a particular area. The National Weather Service will then issue a Public Information Statement. Ozone Alert conditions typically occur during prolonged periods of stagnant weather common in the summer months, when sunshine is abundant and pollutants do not disperse easily.

We can all help reduce Ozone levels by taking the following steps:

- Drive less or carpool. (For example, walk, use mass transit, or ride a bike).
- Make sure your car is well-tuned.
- Take care not to spill gasoline when you fill the tank of your car or lawn or recreation equipment.
- Make sure that you tightly seal the lids of chemical products-such as solvents, garden chemicals, or household cleaners-to keep evaporation to a minimum.

For more ideas about what you can do, visit

www.epa.gov/airnow/consumer.html.

Category	UVI	Precautions
Low	1-2	Wear sunglasses on bright days. If you burn easily, cover up and use sunscreen.
Moderate	3-5	Take precautions such as covering up and using sunscreen. Stay in shade near midday when sun is strongest.
High	6-7	Reduce time in the sun between 11 am and 4 pm. Cover up, wear a hat and sunglasses, and use sunscreen.
Very High	8-10	Avoid the sun between 11 am and 4 pm. Seek shade, cover up, wear a hat and sunglasses, and use sunscreen.
Extreme	11+	Take all precautions. Unprotected skin can burn in minutes. Avoid the sun between 11 am and 4 pm. Seek shade, cover up, wear a hat and sunglasses, and use sunscreen.

To get the UVI for your location, go to:
www.epa.gov/sunwise/uvindex.html

UV Index

The Environmental Protection Agency (EPA), in partnership with the National Weather Service, has adopted new international guidelines for UV Index reporting based on recommendations from the World Health Organization. The Ultraviolet (UV) Index, developed in 1994 by the NWS and the EPA, helps Americans plan outdoor activities to avoid overexposure to UV radiation and thereby lower their risk of adverse health effects. The EPA and NWS report the Index as a prediction of the UV intensity at noon, though the actual UV level rises and falls as the day progresses.

30 Years Ago - June 8, 1974

Saturday, June 8, 1974, began with a round of thunderstorms bringing heavy rains to portions of eastern Oklahoma and northwest Arkansas. Torrential rains of up to 5 inches in a very short time turned dry washes into roaring rivers in potions of Adair County. One person was killed in the town of Chewey when a wall of water came down Scott Branch and demolished her store. Another 2 1/2 inches fell later that evening, forcing the evacuation of 40 people. A two-year-old girl drowned in the overflow of Town Branch Creek in Tahlequah that afternoon, after 9 inches of rain fell that morning. Torrential rains of up to 11 inches near Siloam Springs, Arkansas, produced a wall of water that caused considerable flash flooding in the downtown area. About two-thirds of the businesses downtown were affected, some inundated by up to seven feet of flood water. The force of the water knocked walls out of several buildings and bent parking meters to the ground, and may cars were washed away. Fortunately, no one was injured.

The initial round of storms was only a teaser for what was to happen later that day. A second round of storms developed over central Oklahoma that afternoon, ultimately becoming one of the more significant tornado outbreaks in state history, and producing, at that time, the most costly natural disaster in the city of Tulsa's history. By the end of the day, 22 tornadoes touched down, eight rated as F3 and one F4. The tornadoes and flash flooding killed 18 people, injured nearly 300 others, and caused millions in property damage.

The first reported tornado of the afternoon occurred on the southwest side of Oklahoma City around 2:45 pm near Will Rogers World Airport, ironically touching down just a few feet to the southwest of the National Weather Service office. A gas leak caused evacuation of the office, at which time the NWS Tulsa office assumed back-up responsibility for a short time. This tornado caused considerable property damage on the southwest side of the city, and injured several people. Four other tornadoes touched down in the Oklahoma City area over the next hour.

The first tornado to strike NWS Tulsa's warning area unfortunately proved to be the most deadly, and was rated as an F4. The tornado initially touched down about 3 miles southwest of Drumright in Creek County just before 5 pm. It proceeded northeast and devastated the town of Drumright, leveling a nursing home and destroying or severely damaging at least 100 homes on the northwest side of town. Six people were killed in the nursing home, and six others elsewhere in town, with numerous injuries and nearly 1000 left homeless. Residents reported that the sirens did sound, but left very little time to react. The death toll could have been much greater had the storm hit a few minutes later, when many residents would have been in the dining hall. As the tornado continued northeast on its 55 mile path, it struck the town of Olive, killing one person and severely damaging the school and several frame homes. Considerable damage was also reported at Pier 51 on Lake Keystone, and 7 miles west-southwest of Sperry, where another person died. The tornado eventually lifted near Skiatook, where several homes were damaged.

Two supercell storms moved through the Tulsa metropolitan area between 7 and 8 pm, producing two tornadoes (both rated F3) and torrential rains. The storms killed three people, injured 122, and severely damaged about 300 homes and several businesses, with an estimated 30 million dollars in damage. Over 1500 Tulsa area residents were left homeless.
The first tornado touched down just west of Tulsa about 6:50 pm and moved east-northeast across the city, causing considerable damage near 51st and Union, in the Brookside area near 41st and Peoria, and at 21st and Garnett on the northeast side of the city, where one person died. After leaving Tulsa, the tornado produced additional damage near Catoosa and Claremore in Rogers County, and Big Cabin in Craig County along its 45 mile path.

A second tornado touched down west of Sapulpa, also around 6:50 pm, and moved east into Tulsa near 91st and Elmwood Avenue. This tornado caused considerable damage on the Oral Roberts University

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Tornadoes

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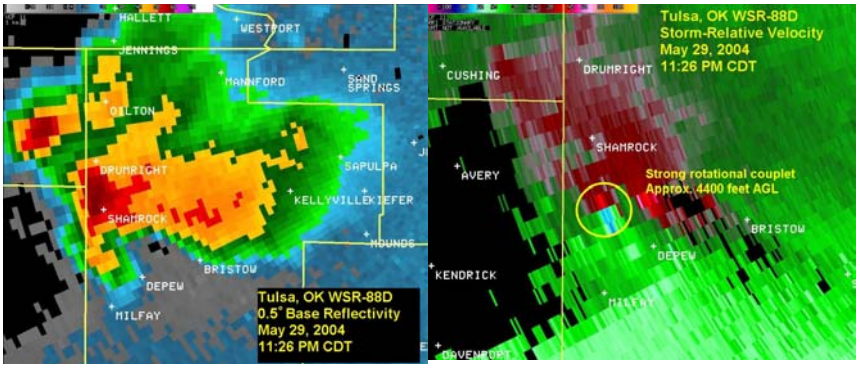
destroyed, and four houses had significant roof damage. The first tornado was rated F3 based on a 20 foot section of a concrete anchored iron-pipe cattle gate being removed from the ground and displaced 30 feet. The gate was anchored by 3 posts, all set in 24 inches of concrete. Two other tornadoes touched down in Creek County, one passing north of Kellyville and the other destroying a barn 3 miles southwest of Sapulpa.

One of several homes in the Depew, OK area that were severely damaged by an F3 tornado on May 29. The tornado was one of six that touched down in northeast Oklahoma that evening, all from a single supercell.

The same supercell continued to the east-northeast and produced two more tornadoes. A small tornado was reported 7 miles north-northwest of Wagoner just before 2 am, and damaged a number of trees and a few outbuildings. Another tornado touched down just southeast of Murphy in Mayes County and lifted 6 miles southwest of Locust Grove. This tornado damaged and uprooted numerous trees along its path, while damage to inhabited structures was mainly shingles and broken windows. Structural damage was mainly confined to outbuildings.

The storm finally dissipated over Delaware County a short time later. Amazingly, this single supercell storm essentially traveled across the entire state of Oklahoma, nearly 300 miles, and had a lifespan of almost 12 hours!



Radar base reflectivity and base velocity images taken from the Tulsa radar (about 50 miles away) at the approximate time of the tornado near Depew, OK. The storm showed classic supercell structure throughout its life cycle, with the rotation signature on the velocity image corresponding nicely with the "hook echo" seen in the reflectivity image.

30 Years Ago

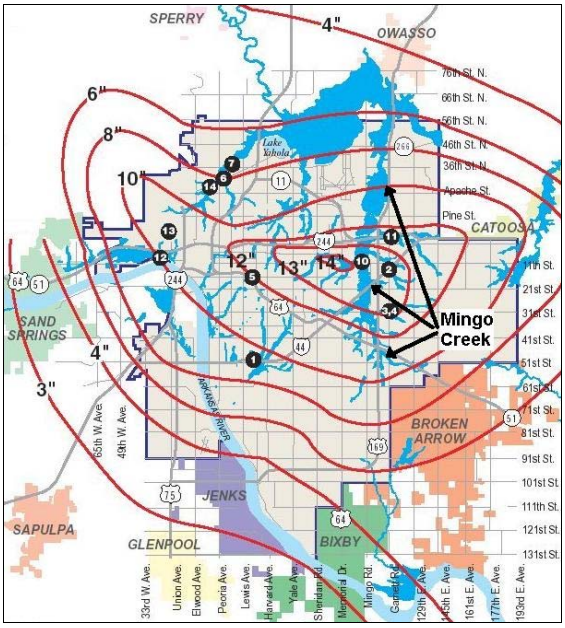
(Continued from page 4)

campus in southwest Tulsa. The administration building and a fine arts theater under construction were destroyed, and two dormitory roofs were damaged. Numerous homes were damaged nearby in the Walnut Creek and Southridge Estates subdivisions, and in the Park Player housing addition north of 71st Street. The tornado continued on a northeast track for nearly 50 miles, causing additional damage in the towns of Broken Arrow, Inola and Chouteau.

Torrential rainfall followed the tornadoes that evening, with as much as 10 inches of rain in parts of the city. The rains forced many creeks out of their banks, with as much as six feet of water flooding a mobile home park near Mingo Creek. Flooding damaged an additional 300 homes in the Tulsa area.

The storms continued well into the night. Around 10 pm, a tornado touched down near Lake Eucha in Delaware County and damaged homes west of Jay. Extensive damage was also reported to roads and bridges in the area due to heavy rainfall. Shortly thereafter, a tornado struck near Ketchum in Craig County, causing extensive damage to the REA plant and to Port Ketchum on Grand Lake. The tornado moved east-northeast and touched down again near Grove in Delaware County, causing considerable tree and roof damage.

Several other communities in eastern Oklahoma suffered damage from flooding, including Sapulpa, Coweta, Chelsea, Claremore, Bixby, Jay and Okmulgee. In the aftermath of the storms, over 200 Oklahoma National Guardsmen were deployed around the state to seal off damage areas while clean-up operations took place.



Map courtesy of The Tulsa World

Map of Tulsa metropolitan area affected by the Memorial Day weekend floods of 1984. The blue shading represents areas affected by flooding, numbers represent fatality locations, and red contours show storm-total rainfall.

Mingo Creek

(Continued from page 1)

May 30, 1976— The 1976 Memorial Day Flood was caused by a 7 to 10-inch deluge centered near the present-day Woodland Hills Mall area. Most of this torrential rainfall occurred within a 3-hour interval. Severe flash flooding hit areas along Mingo and Haikey Creeks, and along Joe Creek south of 41st Street. There were 3 fatalities and the flooding caused $40 million in damages ($75 million in 1994 dollars).

May 27, 1984— The 1984 Memorial Day Flood was caused by a 12 to 15-inch deluge centered near McClure Park. All of the Mingo Creek basin received at least 9 inches of rain during this event. However, there was widespread flash flooding and small stream flooding throughout the entire city. There were 14 fatalities and 288 injuries. Nearly 7000 buildings were damaged or destroyed. The damages were set at $180 million ($257 million in 1994 dollars).

The 1984 flood sparked an aggressive program by Tulsa civic leaders. The city acquired and cleared some 875 buildings (including about 500 homes) from floodplains. They began a floodplain maintenance and stormwater management program funded by a utilities fee. New developments had to meet more stringent standards. A local rainfall monitoring and flood warning system (ALERT) was set up, and a public awareness program was instituted.

What a change! In the 1960s and 70s, Tulsa led the nation in numbers of federally-declared flood disasters. Now FEMA has given Tulsa a Model Community Award. In 2003, FEMA promoted Tulsa to be the nation's first Class 2 community under its Community Rating System for the National Flood Insurance Program.

Al Hong - Service Hydrologist

Is an Abrupt Climate Change Possible?

What is abrupt climate change?
Abrupt climate change is the earth's climate system shifting into a new climate state over a period of years to decades. The new climate state lasts long enough to distinguish it from a singular extreme event.

Climate vs. Weather
Weather is the day-to-day changes in the atmosphere that happen in short-term increments from seconds to minutes to weeks. *Climate* is the synthesis of this short-term weather information and a description of any variations in weather at a given place for a specified time frame, like months, years, decades and centuries. Climate scientists look for trends or cycles of variability and study them in context of the bigger picture and over the long term.

Does Climate change affect local weather?
We are still studying the complicated climate system to find out whether long-term climate change is affecting local weather. We have been successful in studying and predicting short-term climate changes like El Niño, and know they have measurable impacts on regional and local weather patterns. There is not enough evidence to determine whether long-term climate change increases the frequency or intensity of storms, hurricanes or tornadoes.

Can abrupt climate change happen in days?
No. Paleoclimatological records show the most rapid changes in our climate happen over a span of years or decades – not days. It is impossible for the global climate to change within a span of days, weeks or even months.