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Tulsa Tornado Tribune

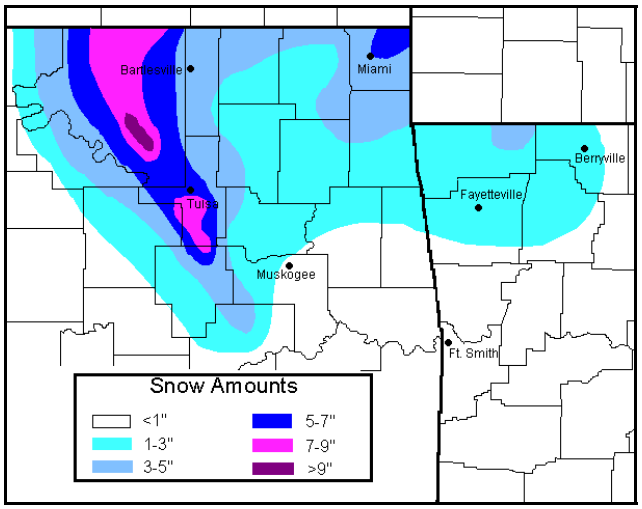
"Where People Who Know The Weather Get Their Weather"

National Weather Service Tulsa, Oklahoma — Spring, 2004

Winter 2003-04 in Review

The winter of 2003-04 once again provided eastern Oklahoma and western Arkansas with a nice variety of weather conditions. Although snowfall was not as plentiful as last year's near record season, there were enough events to make things interesting. In between winter storms, severe thunderstorms struck a few days before Christmas, and 2004 started off with record warmth.

The first snow of the season occurred as a strong upper level system tracked across northeast Oklahoma and northwest Arkansas during the evening hours of December 9. Most areas north of Interstate 40 received at least an inch of snow (see map). A localized band of 5 inches or more accumulation set up from northern Osage County through western and southern Tulsa County. Accumulations of 3 to 4 inches occurred on either side of the main heavy snow band in Pawnee, Washington and Wagoner Counties, and over the far northeast corner of the state in Ottawa and Delaware Counties. Heaviest snow amounts included 9.5 inches 4 miles north of Hominy, 8 inches at Jenks, 7 inches at Foraker, 6 inches at Pawhuska and Bixby, 5 inches at Ralston and Miami, and 4 inches at Coweta, Copan and Grove.



Map of snowfall totals from December 9, 2003

A few days later on the 12th, another system moved northeast out of west Texas and produced snow mainly to the north and west of Tulsa during the late afternoon and evening hours. Points east and south of Tulsa saw precipitation started as rain before changing to snow in the evening, keeping accumulations lower. Some heavier snow accumulations included 10 inches at Pawhuska, 9 inches at Nowata, 8 inches at Bartlesville, and 6 inches at Cleveland and Pawnee.

A shift to springlike conditions occurred on December 22nd, as a line of thunderstorms marched across

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Editor's Notes

We are just about finished with our Spotter Training for the spring of 2004. There are still a number of sessions scheduled during March; please check the events schedule on page 3 for the date and time any training sessions in your area.

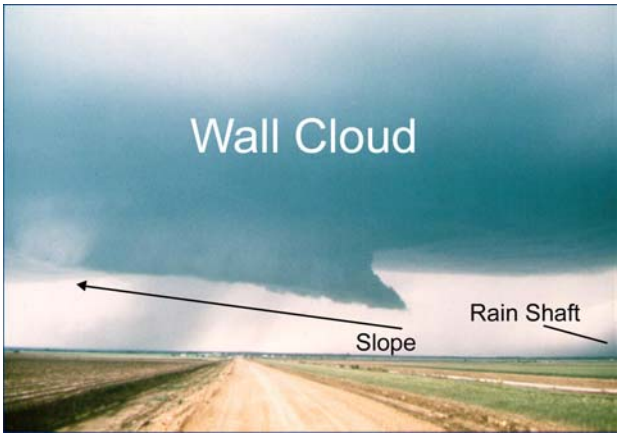
From March 1 through June 1, the Hazardous Weather Outlook will be routinely issued twice a day, at 6 AM and 1 PM.

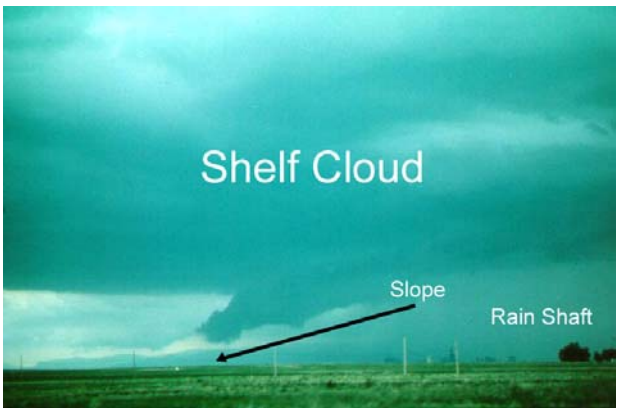
Some changes have been made to the suite of Hydrologic products issued by the NWS. Please see our website for details.

Craig A. Sullivan - Editor

Identifying Wall Clouds and Shelf Clouds

Wall Clouds	Shelf Clouds
Associated with thunderstorm inflow	Associated with thunderstorm outflow
Moves along with rain area	Moves away from rain area
Slopes UP and AWAY FROM rain area	Slopes DOWN and AWAY FROM rain area
Sometimes produce tornadoes	"Never" produce tornadoes





The two pictures above illustrate how to visually tell the difference between a wall cloud and a shelf cloud. This is done by determining the slope of the feature with respect to the main rain and hail shaft. Note the wall cloud in the top picture slopes up as you move away from the rain, signifying an updraft, whereas the shelf cloud slopes down as you move away from the rain, indicating a downdraft.

A wall cloud is defined as an isolated cloud lowering attached to the rain-free base, typically south or southwest of the precipitation area. Wall clouds are roughly two miles in diameter and mark the area of strongest updraft in the storm. As the storm intensifies, the strengthening updraft creates a reduction of pressure and moist air converges into the updraft region. This creates a lowering in the main cloud base that forms the wall cloud. Also, rain-cooled air is drawn in from the main rain shaft, causing further lowering as moisture in the rain-cooled air quickly condenses. This forms the tail structure that often accompanies the wall cloud, and causes the upward slope.

Shelf clouds are examples of "accessory clouds" that you may see beneath the cloud base of a storm. Shelf clouds are long, wedge-shaped clouds usually associated with the gust front, but can develop anywhere an area of outflow is present. In some cases, a shelf cloud can form under the rain-free base and take on the appearance of a wall cloud.

Perhaps your biggest challenge as a spotter will be to discern between shelf clouds under the rain-free base and legitimate wall clouds. Remember that shelf clouds signify an area of downdraft and outflow while wall clouds indicate an area of updraft and inflow. A shelf cloud will tend to move away from the precipitation area. A wall cloud, though, will tend to maintain its relative position with respect to the precipitation area. Shelf clouds tend to slope downward away from the precipitation while wall clouds tend to slope upward away from the precipitation area.

Of course, only a few lowerings observed when spotting will be legitimate wall clouds, and only a few wall clouds will actually produce tornadoes. There are four main characteristics usually observed with a tornadic wall cloud. First, the wall cloud will be persistent; it usually will be there for 10-20 minutes before the tornado appears. Second, the wall cloud will exhibit PERSISTENT rotation. Third, strong surface winds will blow in toward the wall cloud from the south-east or south (inflow). Fourth, the wall cloud will exhibit evidence of rapid vertical motion. Small cloud elements in and near the wall cloud will quickly rise up into the rain-free base. Not all tornadic wall clouds will have these characteristics (and some tornadoes do not form from wall clouds), but these are good rules of thumb to follow.

McReady Oklahoma

April, 2004 has been declared McReady Month in Oklahoma. In an effort to raise awareness of severe spring weather, the State of Oklahoma has teamed up with McDonald's, the National Weather Service and many others in a program called Family McReady-OK. The program combines severe weather preparedness strategies as well as floodplain and weather radio tips and delivers them in a family environment where visitors are likely to take notice and get involved.

The program features preparedness themed tray liners and bag inserts as well as display racks in each participating McDonald's. The display racks will hold neighborhood floodplain maps, tornado path maps and brochures on disaster preparedness. The statewide kickoff of McReady Oklahoma is Friday, April 2.

More information about McReady Oklahoma can be found at the following website:
www.mcready.org

Schedule of Events

- **3/4-3/6 - National Severe Weather Workshop; Norman, OK**
- **3/8 - Spotter Training McAlester, OK Vo-Tech, 7 pm.**
- **3/10 - Spotter Training Fayetteville, AR - University of Arkansas, Old Engineer Building Room 209, 7 pm.**
- **3/11 - Spotter Training Vinita, OK Catholic Church, 7 pm.**
- **3/9 - Spotter Training Tahlequah, OK City Council Chambers, 7 pm.**
- **3/16 - Spotter Training Jay, OK Police Department, 7 pm.**
- **3/20 - Green Country HAMfest**
- **3/22 - Spotter Training Rogers, AR Water Utility Training Center, 6:30 pm.**
- **3/25 - Spotter Training Claremore, OK - Extension Building, 7 pm.**
- **3/30 - Spotter Training Pawhuska, OK Fairgrounds, 7 pm.**
- **3/28 - 4/3 - Oklahoma Severe Weather Awareness Week**
- **4/2 - Oklahoma statewide McReady kickoff.**

Severe Weather Workshop

The National Severe Weather Workshop will be held in Norman, OK from Thursday, March 4 to Saturday, March 6. "Partners Keeping the Public Warned and Informed" is this year's workshop theme. The workshop is designed to enhance partnerships between forecasters, researchers, emergency management, broadcasters and storm spotters, as well as other weather enthusiasts.

The workshop offers a unique opportunity to learn about the National Weather Service's outlook, watch and warning process, severe weather preparedness and safety, StormReady, EMWIN, severe storm risks, lightning effects, wind damage effects and new ways to get radar data. Spotter training will be offered in conjunction with the workshop on Saturday afternoon, March 6.

For more information go to:
www.norman.noaa.gov/nsww2004.

Severe Weather Awareness

The State of Oklahoma and the National Weather Service will conduct the annual Oklahoma Severe Weather Awareness Week from March 28 through April 3, 2004. Please note this is later than in past years; the idea is to generate more interest from the media and the public and to coincide more closely with the beginning of the peak severe weather season in Oklahoma; almost three-quarters of Oklahoma tornadoes have occurred in April, May and June.

For more details concerning Severe Weather Awareness Week, and the activities planned during the week, visit the NWS Tulsa website.

Spring officially begins Saturday, March 20, at 12:49 am CST.

Flash Flood Safety

Flooding is the number one weather-related killer in the United States, with about 130 fatalities recorded each year. The vast majority of these deaths occur during flash floods. Several factors contribute to flash flooding, the two key elements being rainfall intensity and duration. Topography, soil conditions, and ground cover also play an important role. Most flash flooding is caused by slow-moving thunderstorms, or from thunderstorms repeatedly moving over the same area; a phenomena referred to as "training".

Flash floods occur within a few minutes or hours of excessive rainfall, or a dam or levee failure. In extreme cases, rapidly rising water can reach heights of 30 feet or more. Flash flood-producing rains can also trigger catastrophic mudslides in hilly terrain.

When a **FLASH FLOOD WATCH** is issued, be alert to signs of flash flooding and be ready to evacuate on a moment's notice. Continue to monitor NOAA Weather Radio, or local media sources for further information.

When a **FLASH FLOOD WARNING** is issued for your area, or the moment you realize that a flash flood is imminent, act quickly to save yourself. **You may have only SECONDS!**

More information on flash flood safety can be found at:
www.srh.noaa.gov/tadd/index.html

Flash Flood Safety Rules

- Go to higher ground immediately! Avoid small rivers or streams, low spots, canyons, dry riverbeds, etc.
- Do not try to walk through flowing water more than ankle deep!
- Do not allow children to play around streams, drainage ditches or viaducts, storm drains, or other flooded areas!
- **DO NOT DRIVE THROUGH FLOODED AREAS**, even if it looks shallow enough to cross. The large majority of deaths due to flash flooding are due to people driving through flooded areas. Water only one foot deep can displace 1500 lbs! Two feet of water can EASILY carry most automobiles!

Winter Review

(Continued from page 1)

eastern Oklahoma into western Arkansas on the evening of the 22nd. Numerous reports of penny to nickel sized hail were received from throughout the area. One report of 2 inch hail came in from 2 miles east of Hartford in Sebastian County, Arkansas. In all, 14 severe thunderstorm warnings and one tornado warning were issued by the National Weather Service in Tulsa.

The break from winter continued into January as strong southwest winds brought unseasonably warm air into the area, with record high temperatures in the 70s on the 2nd and 3rd. Not only that, the morning lows on the 3rd only dropped into the 60s in most areas. In fact, the low temperature of 65 degrees at McAlester was the warmest low temperature ever recorded in January. The rest of the month was relatively mild, but a system brought widespread 1 to 3 inch snow amounts on the 26th, again generally north of I-40.

February saw a return to a winter pattern, with a storm on the 4th bringing generally 1 to 3 inches of snow to northeast Oklahoma, with 4 inches reported in Pawnee. Sleet and freezing rain accompanied the snow in northwest Arkansas, with up to a quarter inch of ice accumulation in Carroll and Madison Counties making roads nearly impassible. Southeast Oklahoma finally got in the act on Valentine's Day, with up to 4 inches of heavy wet snow, generally south of a McAlester to Fort Smith line. As much as 6 inches of snow fell in both Antlers and Albion in Pushmataha County.

Storm Data compiled by Mark Abbas - Meteorologist

Weather History - Spring Snowfall

When we think of spring, we most often associate it with warmer temperatures and the peak severe weather season. During the spring months, the jet stream is typically in a favorable position to bring frequent storm systems across the plains states which produce our outbreaks of severe thunderstorms. However, these systems will be occasionally accompanied by a cold enough airmass to produce heavy snow, especially in early March. The likelihood of significant snowfall decreases considerably after mid March, but measurable snow has fallen as late as mid April in both Tulsa and Fort Smith.

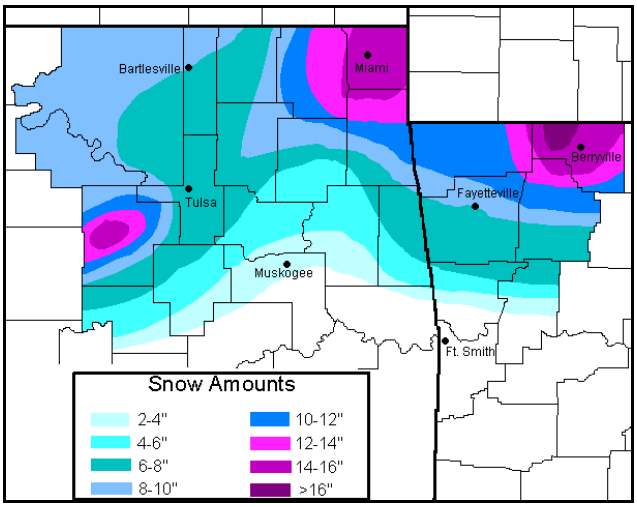
In fact, several of the biggest snow storms ever recorded in eastern Oklahoma and western Arkansas have occurred in March. The record 24 hour snowfall in Tulsa occurred in March, 1994, and the snowiest month in Tulsa history was March, 1924, when 19.7 inches was recorded.

Ten years ago, on March 8, 1994, heavy snow fell in much of northeast and east central Oklahoma. Thunderstorms accompanied the snow in many areas, adding to the accumulations. Snowfall amounts ranged from 4 to 18 inches, with heaviest amounts across southern Osage, Pawnee, northern Creek, Tulsa, Wagoner, and eastern Delaware Counties. The town of Pawnee had the greatest official snowfall with 15 inches, but unofficial amounts up to 18 inches were reported in eastern Delaware County. The 12.9 inches of snow which fell at the Tulsa International Airport was an all-time record daily snowfall. The previous record of 11.5 inches occurred on March 20, 1924. Numerous accidents occurred as a result of the snowfall, and several power outages also occurred.

Five years later, on March 13 and 14, 1999, a powerful upper level system moved eastward along the Red River valley and produced one of the most significant winter storms on record. After heavy rains in advance of the system on the 12th, colder air moved in the afternoon of the 13th and changed the rain to snow. The heaviest snowfall amounts were generally in the northeast corner of Oklahoma through the northwest corner of Arkansas, although a snow "burst" associated with thunder and lightning over Creek County, OK caused very high amounts of snow there as well.

The snow quickly ended around sunrise of the 14th, and most of the snow had melted off by the end of the next day. Heavy snow in Creek County caused numerous traffic accidents on I-44, and the interstate had to be closed. Several churches in Bristow opened their doors to a total of 450 stranded motorists. The heavy wet snow weighted down and broke numerous trees and tree limbs throughout northeast Oklahoma. Trees falling onto power lines caused scattered power outages throughout the area. Some 8,000 electrical customers in Tulsa lost their electricity, while 2,300 customers around Grove suffered power outages. Vinita was one of the hardest hit communities in terms of downed trees and power outages.

Northwest Arkansas was equally hard hit by this storm. The heavy wet snow weighed down and broke many tree limbs, some of which fell onto power lines, causing interruptions in electrical service. At the peak of the storm, 8,000 customers were without power across northwest Arkansas due to broken power lines. Newspaper reports indicated that the area near Beaver Lake was the hardest hit, where whole trees fell and had to be cleared off of roadways.



Map of snowfall totals from March 13-14, 1999

Spotter Video Tips

Many people like to capture the beauty of weather on video tape. For some, the stronger the storm, the more beauty it beholds. Good video of severe weather can help National Weather Service meteorologists document an event and learn more about the storms they are forecasting.

If you take storm video, it is important to do the best job possible. I have compiled a list of 20 simple rules that you can apply to assure that your video is the best that it can be. Although many of the rules are obvious, it is amazing how many people forget or neglect them. Breaking **even one** of these rules can lessen the quality of your video. Breaking enough of these rules can make your video useless.

Keep The Horizon Level - Don't be one of those people who take storm video with the horizon rising and falling like it was shot from a ship in the Atlantic during a Nor'easter. No one should have to suffer sea sickness while viewing your storm footage. It's amazing how many people shoot video without even looking through the viewfinder. They seem to think that the camcorder will magically capture a level picture. Guess what, it won't! Use your viewfinder or view screen to compose your picture, imagining that you are viewing it on a large TV screen. Keep the horizon level at all times. A good general rule is to have the ground compose the bottom 20% of the picture. The main interest in storm videography is the sky so you want it to make up most of the picture. However, you do need to have some of the ground in the picture to set the frame of reference.

Spring Reporting

- Tornadoes
- Funnel Clouds
- Rotating Wall Clouds
- Hail - penny size (3/4") or larger
- Wind Gusts > 50 mph (estimated/measured)
- Flooding
- Any weather related damage
- Any life-threatening event

NOTE: Do NOT Report heavy rain or lightning.

Hold the Camcorder Steady - Many a potentially great storm video has been made useless because the camcorder was shaking like it was in a California earthquake. Even though most camcorders have an image stabilization feature (which you should use), it is not enough to overcome this sort of movement. Whenever possible use a tripod. Or, at least try to steady the camcorder on something solid or brace your arms against a steady object. It is quite acceptable for you to shake like a leaf while watching that tornado but it is best if the camcorder remains steadfast.

Shoot Storm Structure - Don't get so involved with close ups of tiny scud clouds racing into the updraft that you neglect to shoot the larger aspects of the storm. Much information is contained in the structure of the storm as a whole, so try to get at least some video of the "big picture". If the wide angle setting on your camcorder does not capture the whole image, pan slowly around to give the viewer a sense of the enormity of it all. You may also invest in a wide angle lens attachment for your camcorder.

Turn Off the Date/Time Function - The date and time function of your camcorder should be used sparingly. If you use this feature at all, you should briefly record the date and time at the beginning of a scene and then promptly turn it off. It is better to verbally note the time while you are shooting. Also verbally note your location and direction you are looking, along with any other pertinent details.

Share Your Video - The National Weather Service would really appreciate a copy of your video. We will have monitored the weather event that you recorded and likely issued warnings for that particular storm. It is of great benefit for forecasters to be able to see "ground truth" of what they detected by Doppler radar and other means. Your video may also be utilized by the NWS in training other storm spotters on what to look for in recognizing the onset of a significant weather event. This will in turn benefit everyone!

Bruce Sherbon - Meteorologist

For the complete list of video tips, please visit our website at **www.srh.noaa.gov/tulsa**.