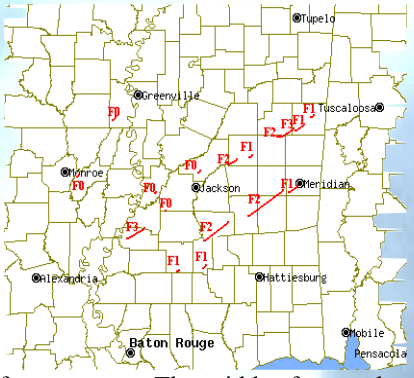
The ArkLaMiss Observer

Fifth Edition, Spring 2005

Back-2-Back

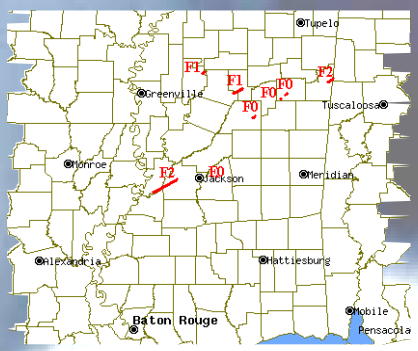
The Outbreaks of November 23rd and 24th
And
December 7th

The unusually quiet fall weather came to an abrupt end in 2004 as a pair of vigorous systems roared through the Ark-La-Miss. The first system, the more significant of the two, was well telegraphed. Unprecedented model consistency and accuracy was observed in advance of this system. For 5 days prior to the historic event, the computer models did not waiver on the strength, track or timing of the system. Each day, the model output suggested a possibility for a historic event occurring on the night of the 23rd.



Recall that for significant severe convective activity to occur, a deep layer of moisture is needed along with surface based instability, a lifting mechanism, and wind shear are needed. All four of these criteria were easily met, and exceeded. For tornadic events, such as this, other atmospheric parameters should be in place as well. Strongly veering winds within the first few thousand feet of the atmosphere help generate strong low-level helicity, which aids in the formation of tornadic supercells (when moisture, instability and lift are present.) Low cloud base heights, usually 3,000 feet or less, are also beneficial. The low cloud bases decrease the distance that is required for a funnel cloud to reach the surface. Both of these additional parameters were in place for the event.

This first event produced an astounding 17 tornadoes across the Jackson forecast area. The width of several tornadoes exceeded 300 yards, and tornado tracks greater than 15 miles were observed. Perhaps the most remarkable thing about this event, given the high numbers of tornadoes experienced, was that no densely populated areas were hit. On the diagram, note how close some of the tornadoes came to impacting the Jackson metro area. Another tornado seemingly stopped on the outskirts of Meridian.



The second tornado outbreak was a little less obvious to discern ahead of time. The model output consistency was not nearly as good as it was for the previous system. There were also timing issues. The different computer models kept slowing the system's approach as the event neared. The degree of instability was also in question. While significant moisture was in place, along with lift and wind shear, the expected instability appeared to be marginal. Other ingredients like low-level veering winds and low cloud base heights were expected to be in place as well. Again the main question was, "Will there be enough instability?" About 24 hours before the event, the models began trending upward in their depiction of surface-based instability.

The event produced a total of 8 tornadoes with one weak tornado, an F-0, causing minor damage to some homes near Brandon. Another tornado, an F-2 in Lowndes County, picked up a large camper, flipped it, and tossed it. This same tornado crushed a mobile home. A 300 to 400 yard wide tornado moved through western Hinds County and produced structural damage to houses and barns.

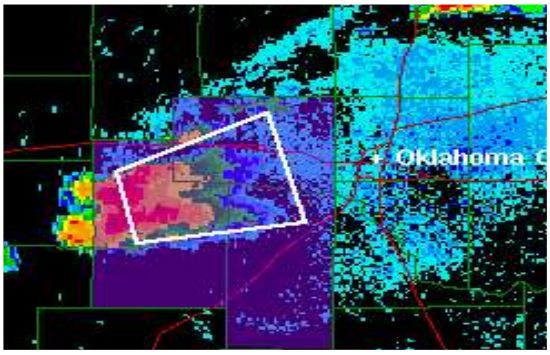
In summary, at total of 25 tornadoes occurred in the Jackson forecast area. There were 2 F-3s, 6 F2s, 8 F1s, and 9 F0s. There was one fatality. It is very possible that some of these tornadoes would have been stronger than this had they tracked over more populated areas. Thankfully, they didn't.

The New Warning Philosophy

The Polygon Method

This spring, NWS Jackson will serve as a test site for the new polygon method for forecasting severe thunderstorms. The polygon method is different than the current method in several ways. This article will look at some of the differences between the new method for issuing warnings and the existing method in an effort to show how the new approach will improve service to you, our customer.

Using the current methodology, not the polygon method, severe thunderstorm and tornado warnings are issued on a county by county basis. At any given time, there may only be one severe thunderstorm or tornado warning out for each county. Also if one warning is issued for a storm that is expected to move through three counties, then that one warning will actually count as three separate warnings (one warning for each county affected.)



Using the current methodology, the entire area of both counties in the image above would be warned. Using the new methodology, only the area within the polygon would be warned.

There are three major disadvantages to this current method. First, the entire area of all three counties is under the effect of the warning. This means that areas that may not be in the path of the storm will be covered under the warning, thus creating a false alarm to those not affected. Another disadvantage is that the current process does not effectively draw attention to multiple severe thunderstorms that are moving through one county. For example, there may be a warning out for northern Madison County for a tornadic storm. Now, a second severe thunderstorm may be getting ready to enter southern Madison County. Under the current system, a Severe Weather Statement (SVS) is issued to alert the public to the anticipated track of the second severe storm through southern Madison County, not a new warning. A third disadvantage applies to the storm verification process. Since the one warning that was issued actually counts as three warnings, then that warning has to be verified in each of the three counties individually.

Using the polygon method, these issues are addressed. First, the areas within the polygon box are the only areas that are under the effect of the warning. Therefore, other areas in the affected county(ies) are **not** under the affect of that warning. Secondly, it will be now possible to have out multiple warnings for a single county. For example, it will be possible to have 2 severe thunderstorm warnings in effect for Rankin County simultaneously. The only drawback to this is that it could create some confusion. However, by tailoring the warning text to say something like, “A severe thunderstorm warning is in effect for ***southern*** Rankin County…,” any confusion that might develop would be minimized. Finally, the warning verification would be easier. Consider a warning polygon warning box that covers a storm that is expected to move across three counties. Using the new methodology, it is not necessary to verify that warning in each of the 3 county areas that lie within that polygon. Only one point within the polygon box needs to be verified.

As stated before, the new polygon warning methodology should show an increase in the service rendered by providing more accurate warnings with a lower false alarm rate.

Training for Severe Weather

Being a meteorologist in the Ark-La-Miss is nothing short of exciting. During the Spring and Fall seasons, severe weather affects the area on a regular basis. Strong atmospheric winds, resulting from strikingly different colliding airmasses aid in the formation of intense storms which often produce damaging winds, hail and sometimes tornadoes. It is during these periods of time that warning forecasters draw upon their comprehensive training and experience to accomplish the mission of the National Weather Service which is to "protect lives and property." What does this training involve, and how is it acquired?

Perhaps the most affective training method used is the Weather Event Simulator, (WES). In recent years, the National Weather Service has developed and maintained an extensive database of historical weather events from across the country. For these events radar data, satellite data, storm reports, computer model data and other forms of data have been saved. The data is saved into an archive folder and is given a date, which is usually the date of the event. Each year, the Science and Operations Officer (SOO) at each forecast office across the country choose two to four events for each operational staff member to work through. Since the WES uses the same operating system, AWIPs, that is used in the normal operational environment, warning forecasters are able to look at radar (and other) data to assess storm development and severity just like they would for a "real" event. During a WES simulation, if a storm is deemed severe, then a simulated warning is issued for that county. Since the WES simulates real life situations so closely, it has proven to be a tremendously affective training tool to maintain, and sharpen a warning forecaster's operational skills.

In addition to the WES, other training methods are used to develop forecaster knowledge and skills. Usually each month, the SOO will choose computer model data from a past event to use as a training exercise. The purpose of each exercise is to enhance severe weather forecasting techniques. During such exercises, forecasters are given enough model and upper air data to construct a forecast. Given the data, the forecasters are asked several questions like: Are severe thunderstorms expected, and if so how widespread will the coverage be? Where will the activity be focused? What modes of severe thunderstorm activity are expected (hail, winds, or tornadoes?) Do you expect any other significant weather from this event, like flooding? Unlike the WES, which trains the forecaster to deal with ongoing severe weather, these training exercises teach the meteorologists on how to be better forecasters of severe weather.

The training doesn't stop here though. In house seminars, teletraining sessions, and online training sessions further develop the skill set by sharing experiences from lessons learned across the country. Case studies are performed on significant events to gain additional knowledge. Map discussions are given daily to share knowledge with staff members. These discussions often serve as "real time" learning tools when an event is approaching.

Given the rapid advances in science and technology, this intense training regime is critical to the accomplishment of the NWS mission.

IMET Program Goes All-Hazards

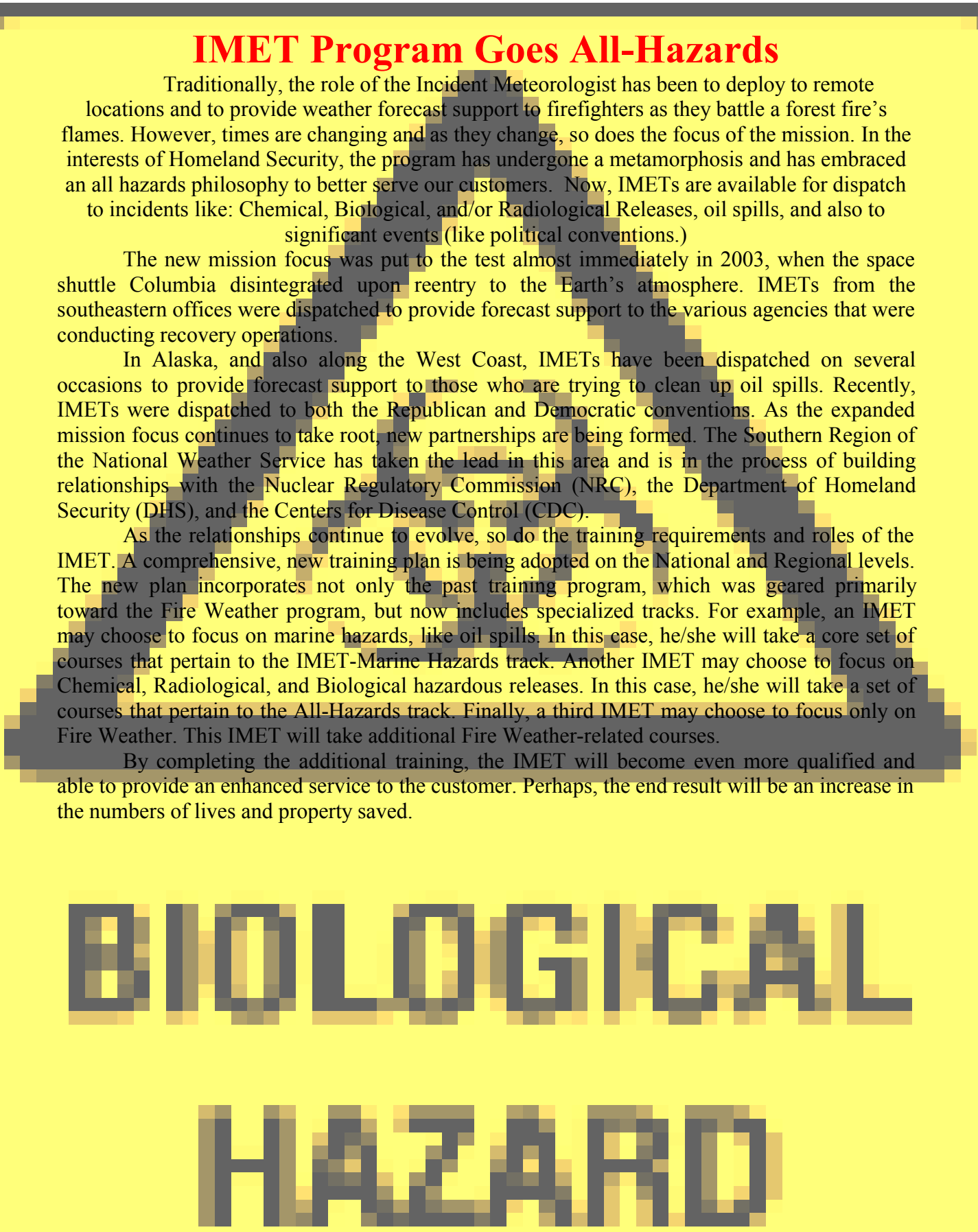
Traditionally, the role of the Incident Meteorologist has been to deploy to remote locations and to provide weather forecast support to firefighters as they battle a forest fire's flames. However, times are changing and as they change, so does the focus of the mission. In the interests of Homeland Security, the program has undergone a metamorphosis and has embraced an all hazards philosophy to better serve our customers. Now, IMETs are available for dispatch to incidents like: Chemical, Biological, and/or Radiological Releases, oil spills, and also to significant events (like political conventions.)

The new mission focus was put to the test almost immediately in 2003, when the space shuttle Columbia disintegrated upon reentry to the Earth's atmosphere. IMETs from the southeastern offices were dispatched to provide forecast support to the various agencies that were conducting recovery operations.

In Alaska, and also along the West Coast, IMETs have been dispatched on several occasions to provide forecast support to those who are trying to clean up oil spills. Recently, IMETs were dispatched to both the Republican and Democratic conventions. As the expanded mission focus continues to take root, new partnerships are being formed. The Southern Region of the National Weather Service has taken the lead in this area and is in the process of building relationships with the Nuclear Regulatory Commission (NRC), the Department of Homeland Security (DHS), and the Centers for Disease Control (CDC).

As the relationships continue to evolve, so do the training requirements and roles of the IMET. A comprehensive, new training plan is being adopted on the National and Regional levels. The new plan incorporates not only the past training program, which was geared primarily toward the Fire Weather program, but now includes specialized tracks. For example, an IMET may choose to focus on marine hazards, like oil spills. In this case, he/she will take a core set of courses that pertain to the IMET-Marine Hazards track. Another IMET may choose to focus on Chemical, Radiological, and Biological hazardous releases. In this case, he/she will take a set of courses that pertain to the All-Hazards track. Finally, a third IMET may choose to focus only on Fire Weather. This IMET will take additional Fire Weather-related courses.

By completing the additional training, the IMET will become even more qualified and able to provide an enhanced service to the customer. Perhaps, the end result will be an increase in the numbers of lives and property saved.



ReachOutReach

Recently, members of the outreach teams at WFO Jackson met to develop an expanded vision for the office outreach program. In expanding the vision, it was determined that we needed to find innovative ways to reach new customers while maintaining and deepening existing relationships with the current customer base. By the end of the meeting, it was determined that the outreach program needed to be expanded into three arenas. First, it was determined that we needed to reach out to the non-English speaking community. Secondly, we wanted to develop new partnerships with other government and private agencies (such as DHS, NRC, and area hospital emergency managers). Finally, we wanted lay groundwork in reaching out to travelers that drive through the forecast area on the local interstates. By the end of the meeting, we realized that we had quite a task ahead of us. How did we plan to accomplish these innovative goals? The following discussion highlights the plan that was laid and the course that we have since chartered.

Research was done to estimate the first non-English speaking ethnic group to reach out to. Based on US Census Bureau statistics, it was shown that the non-English speaking Hispanic community was the people group that needed to be reached first. In an effort to launch the outreach program in this arena, numerous brochures written in Spanish, relating to weather safety, were ordered. Next, the diversity team created a Spanish translation of our office brochure. With the help of MIC Alan Gerard, it was determined that the best way to reach the non-English speaking Hispanic community was to target area missions. A plan has since been developed to travel to the various missions across the state in order to raise awareness to issues like, tornado safety, flooding, and lightning. Some interest has been expressed in developing a Spanish version of the NWS Jackson website.

The concept of developing new partnerships with other agencies could not have come at a better time. Unknowingly, the office outreach teams tapped into a new vision that was in the process of making its way down for the national headquarters. The national vision was to expand the Fire Weather program to become an All-Hazards program. This meant that Incident meteorologists (IMETs) could now be dispatched to incidents other than wildfires. In other words, an emergency manager was now able to request the dispatch of a forecaster to a significant event such as a large-scale chemical release to provide forecast support. In order to accomplish this expanded mission, new partnerships were forged with agencies like the Nuclear Regulatory Commission (NRC) and the Department of Homeland Security (DHS) to not only advise them on products and services that were now available to them, but to obtain needed training in regard to the expanded role of the IMET.

Furthermore, it was determined that we needed to develop a partnership between our office and the emergency managers at local hospitals. Shortly after realizing the need, the tornado outbreak of November 23rd and 24th occurred. That night, a tornadic supercell moved through Hinds county toward Madison county. The path of the storm came dangerously close to Saint Dominic hospital (within about 6 miles.) While the storm was moving through the county, the emergency manager from the hospital telephoned us with us many times. Listening to every word that we said, she determined the next courses of action to take in order to provide the best safety possible for her staff and patients. Needless to say, this event accentuated a very important need for a new relationship.

Finally, the expanded vision wanted to reach out to those traveling on the roads and highways that stretch across the area. Given the high frequency of severe weather in the Ark-La-Miss, it was determined that travelers are often unknowingly at risk while driving on area roads and highways. Using the innovative technological tool Hun-TV, which was created at WFO Huntsville, Alabama, a plan was developed to install Hun-TV at the welcome centers across the state. (Hun-TV is a program that flashes the current weather maps, watches, and warnings across a television screen.) In doing this, drivers would have a heads up on any inclement weather that they were about to drive through. Details on how to get Hun-TV installed are still in the works, but should be resolved over the next several months.

As WFO continues to expand the outreach horizon, the formation of these new relationships should enhance the products that are provided to you, the customer. Through the establishment of these new communication lines, not only will the quality of our products continue to improve, but also the timeliness of the relay of critical information (like storm reports) will improve also.

Weather Trivia

Courtesy of the Southeast Regional Climate Center

Are you looking for some strange discussion topics to talk about around the old water cooler at work? If so, check out these strange factoids…

Just like warm air ascending mountain slopes can create clouds as it is cooled, the pyramids of Egypt have been known to generate clouds from hot air rising up along their sides.

Although we rely on oxygen to survive, only about 21% of the air we breathe is oxygen. The majority of our atmosphere (78%) is made up of nitrogen. The remaining 1% is a mixture of other gases, such as argon, neon, and helium.

Cars can be carried away in only two feet of water.

Lightning has been known to kill people talking on the telephone.

Although it poses the most danger to people, cloud-to-ground lightning represents only about 20 percent of all lightning strikes.

The wettest city in the United States is Hilo, Hawaii, averaging 128 inches of rain annually.

Tornadoes have been known to occur on every continent except Antarctica.

Believe it or not, humid air is lighter than the same volume of dry air because water vapor molecules are less dense than the nitrogen and oxygen they displace.

A cyclical increase in solar activity occurs as the sun's magnetic field reverses every 10 or 11 years. Besides causing blackouts and blocking radio communications, solar flares occurring during peaks of solar activity can also contribute to the formation of the Northern Lights.

German physicist Gabriel D. Fahrenheit developed the temperature scale that bears his name in 1714. The 'zero point' on his scale was the lowest temperature he could attain with a mixture of ice, water and salt.

Believe it or not, it has been hotter in North Dakota than it ever has been in Florida. North Dakota's all-time record high temperature is 121 degrees F, while the highest temperature ever recorded in Florida is 109 F.

The deadliest Atlantic hurricane to occur in the 20th century struck Galveston, TX on September 8, 1900, claiming 6,000 lives.

The reason why we have seasons is that the earth's axis of rotation is tilted 23.5 degrees off its orbital plane. This means that when the Northern Hemisphere is tilted more toward the sun, its summer here, while in the Southern Hemisphere its winter and vice versa.

The earth's atmosphere is estimated to weigh about 5 million billion tons. This weight exerts an average of about 14.7 pounds per square inch of pressure on the surface of our planet, which is equal to about 29.92 inches of mercury in a standard barometer.

How much does a cloud weigh? That depends on the size and type of cloud, but a 1 km x 1km x 1km (0.6 miles x 0.6 miles x0.6 miles) cumulus cloud weighs about 1.4 billion lbs.

Tornadoes in the United States have an average path length of about 5 miles and an average width of 160-170 yards.

One unusual tornado story from 1894 tells of a twister that struck a farm, hurling a chicken coop into the air and wedging it between two trees. When people arrived to clean up the mess, they found all of the chickens alive and well and not a single egg broken.

Keraunophobia, also known as brontophobia, is the irrational fear of thunder and lightning.

Although it seems much wider, the current channel of a typical lightning bolt is only about the size of a pencil.

Hurricanes never form within 5 degrees latitude of the equator. Although the ocean waters near the equator do get warm enough to fuel hurricanes, the effect that the earth's rotation has on winds and ocean currents, known as the Coriolis effect, is too weak near the equator for hurricanes to form.

The Next NEXRAD

The WSR-88D (NEXRAD) will undergo some improvements in the next few years. Perhaps the most significant will be an upgrade to dual-polarimetric Radar.

The WSR-88D system is a network of over 150 Doppler weather radars jointly developed and operated by the National Weather Service (NWS), the Department of Defense (DOD), and the Federal Aviation Administration (FAA). The word Radar is an acronym for Radio detection and ranging. Therefore, as implied by the name, energy transmitted by weather radars is essentially a radio wave with a frequency at the high end of the radio spectrum. The radio wave frequency used by weather radars is specifically chosen for its ability to "interact" with cloud and precipitation particles. Radio waves with lower frequencies, such as those transmitted by radio stations, tend to pass through clouds. Therefore, they are not well suited for weather radar applications. Currently the WSR-88D receives radio waves with a single, horizontal polarization. However, dual polarimetric radars transmit and receive two polarizations of radio waves, and are thus referred to as dual-polarization radars. These polarimetric radars transmit and receive both horizontal and vertical polarization radio wave pulses. Therefore, they measure both the horizontal and vertical dimensions of cloud and precipitation particles.

The accurate estimation of precipitation type and accumulation has been a long standing problem for operational meteorologists who use the current version of Doppler radar. The Dual Polarimetric radar will help with both of these problems. Since the Dual Polarimetric Radar measure the reflected power returned from both horizontal and vertical pulses, these reflected power returns are measured in different ways thus, we are able to obtain information on the size, shape, and ice density of cloud and precipitation particles. By measuring the raindrop in both the horizontal and vertical we can use this information to get a measure of the average drop shape and, in turn, dominant drop size. This information will enable the forecaster to give better rainfall estimates. With better rainfall estimates the forecaster will be able to better predict areas of flash flooding during heavy rain events. Also the River Forecast units will get more accurate rainfall estimates into there computer models to better predict river flooding events.

In addition to better rainfall estimates there are also several potential applications of this information including:

1. Improved estimation of rain and snow rates.
2. Discrimination of hail from rain and possibly estimating hail size.
3. Identification of precipitation type in winter storms.
4. Identification of electrically active storms.
5. Identification of aircraft icing condition.

Another problem that frequently plagues radar measurements is the presence of anomalous propagation (commonly referred to as AP). AP refers to a "ground return contamination" that sometimes occurs in the radar data when a warm layer of air forms above a cold layer of air. This phenomena, which is called an inversion layer, essentially bends the radar beam back towards the ground resulting in a ground return contamination that makes it very difficult, at times, to distinguish the location and intensity of clouds and precipitation. Polarimetric radar signatures also aid in the elimination of AP.

While deployment of the dual polarization Doppler radar is still a few years away, it arrival is expected to yield a significant step toward accomplishing the mission of the National Weather Service which is protecting your lives and property.