The ArkLaMiss Observer

Third Edition, Winter 2003

The official newsletter of the Jackson, MS Forecast Office

NWS Jackson Visits Area Emergency Managers

by Alan Gerard

On October 28th, we will hold our first Fall Severe Weather Awareness Day. As you know, our area historically has a peak of severe weather during the fall months, particularly in late October, November, and early December. Of course, last year brought an example of the type of weather that can be seen during the fall months when the South and Midwest were hit hard by a major tornado outbreak on November 10th. To help prepare the public for this threat, we are working with our emergency management partners, as well as surrounding NWS offices, to plan a severe weather awareness day similar to the severe weather awareness week we have each February. Check back to our website for more details on this event.

Our office continues to work to improve our forecasts and services to you, our partners and customers. Over the last month or so, we have resumed our emergency management visitation program. This program involves our staff visiting emergency managers throughout our area to find out what current needs are, and what we can do to serve our emergency managers better. Additionally, we are in the process of developing a new initiative in which we will hold conference calls with emergency managers before significant weather events, to brief everyone on the latest forecast thinking and answer questions.

I would also like to highlight a project that is being done in Hattiesburg, MS, by Forrest County Emergency Manager Terry Steed and his staff. They have worked with HUD to obtain grant money to purchase NOAA Weather Radios for lower income residents of the city of Hattiesburg. So far, they have distributed weather radios to 500 families in the area, and are working currently to distribute an additional 500. This kind of project will undoubtedly pay off in making for safer families when severe weather next threatens the area. Our office is always ready to help out in any way to work on projects which will help improve warning preparedness and dissemination. Please contact us if you have a project in which we can assist you.

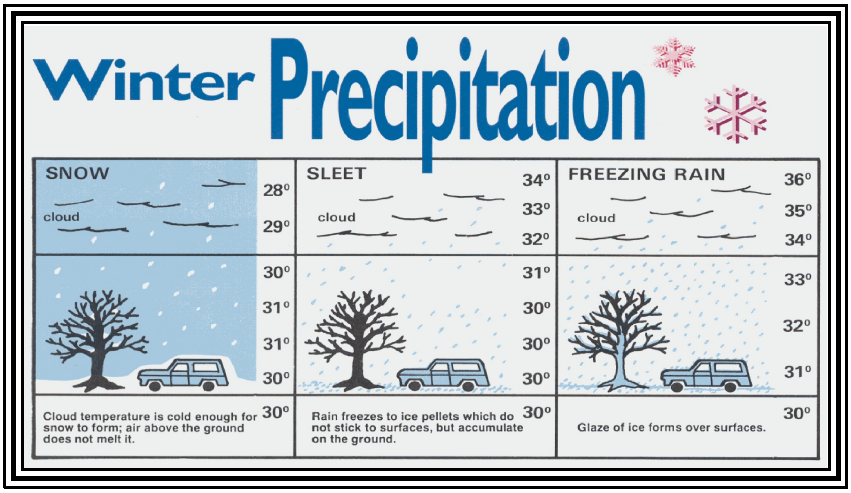
Forrest county Emergency Manager, Terry Steed evaluates radar data.

Winter Weather Formation Processes

by Bryan Henry

Winter weather formation processes are complicated and often misunderstood. Subtle differences in atmospheric temperature and moisture aloft can lead to large differences in both precipitation type and amount. For example, one location might receive 4 inches of snow, while another location just a few miles away may receive sleet or freezing rain. It is the job of meteorologists to interpret these subtle differences in the weather data and provide a forecast that will accurately predict an event. Over the past several decades, meteorologists have gained a wealth of information through research. The knowledge gained has enabled forecasters to better predict these events. The purpose of this article is to share some of the information that has been gained.

It all boils down to what the temperatures and moisture content look like above the surface, particularly in the first few thousand feet. The presence, location and thickness of "warm air pockets", layers of air that are above 32 degrees, dictate the precipitation type (snow, sleet or freezing rain).



The image above illustrates how subtle differences in the atmospheric temperature profile can lead to significant changes in precipitation type.

In general, for snow to occur, it is necessary for temperatures to be below freezing from the cloud layer(s) down to the surface. The lack of a thick "warm layer" keeps the frozen precipitation from melting. With that said, it is possible to have temperatures at the surface that are above freezing. However, this warm layer must be very thin or the snow will melt.

For sleet to occur one of two things must happen. The first, and most common formation process is, this: Sub freezing temperatures within the cloud layer allow for snow to form. As the snow begins to fall to the surface, it encounters a thick warm layer. Though this layer is thick enough to partially melt the snow, it is not thick enough to completely melt it nor does it extend downward all the way to the surface. After the snow melts in the warm layer, it encounters another, deep sub freezing layer near the surface. The thickness of this second cold layer is enough to allow for the rain drops to freeze and become sleet. The second formation process for sleet is very similar to the first, except for one step. In this formation process, the cloud layer, in which the precipitation forms, is above freezing to begin with. Therefore, the initial form of precipitation is rain, not snow. The rain falls through the warm layer and encounters a similar thick sub freezing layer near the surface. The rain then freezes into sleet before reaching the ground.

Freezing rain, like sleet, has two formation processes. Both of the formation processes are nearly identical to the two formation processes for sleet, except for one small difference. Recall that for sleet to form, it is necessary for there to be a thick, sub freezing layer near the surface. What if the sub freezing layer near the surface was not thick enough to completely freeze the rain drops before they hit the ground? This is the scenario that develops during freezing rain events. The near surface, sub freezing layer is not thick enough to allow for the complete freezing of the rain before it hits the ground. So, the unfrozen drops instead freeze to the surfaces of roads, trees, power lines, grass, and the like.

Winter Weather Facts and Safety Tips

by Bryan Henry

Whether traveling or staying home it is good to be prepared for winter weather. Winter weather is considered to be a deceptive killer. Most deaths that result from winter storms occur indirectly. The most frequent causes of winter weather-related deaths are automobile related. However, a significant portion of the total deaths occur as a result of exposure to the cold and from heart attacks.

Nearly 70 percent of all winter weather-related deaths occur in automobiles. Often, ice-covered surfaces such as roads or sidewalks are the problem. Of that 70 percent, nearly 25 percent of those deaths stem from people who are caught out in the storms. Though this can happen to anyone, statistics show that most of these deaths tend to occur with males over the age of 40 years.

Ice covered surfaces, such as the one above, are a significant cause of winter weather-related fatalities.

Another major cause of winter weather-related deaths occurs as a result of prolonged exposure to the cold. 50 percent of the people that die from exposure to the cold are over 60 years old. Also, 20 percent of exposure related deaths occur in the home.

The third major cause of winter weather-related deaths occur from snow shoveling. Though significant snowfall in the Ark-La-Miss is infrequent, it does on occasion occur. Snow shoveling is hard physical labor that increases the heart's work load. Additional strain on the heart is produced from trying to keep the body warm in the cold weather, thus further adding to the work load. Overexertion from these two factors can lead to a heart attack if someone is not on good physical condition.

Though winter weather can be a deceptive killer, there are steps that can be taken to better handle and prepare for these events.
If driving a vehicle, slow down. It is better to arrive late than to not arrive at all. Countless times, people hydroplane on ice and wreck their vehicles because they are driving too fast on icy roads. If you happen to lose control of your vehicle, turn the steering wheel slightly in the opposite direction of the way that you are spinning. Do not slam on the brakes. Instead, gently tap them.

If planning a trip during winter time, prepare in advance by constructing an emergency kit. Items that can be included in this kit are: snow shovel, sand or rock salt, first aid kit, matches, fire extinguisher, rope, jumper cables, blankets, extra (heavy) clothes, gloves, flashlights and batteries, food and water, flares, and tire chains. Also, make sure that the car is running properly. Check the fluid levels, lights, tire tread, and brakes. Try not to travel alone. Keep a full gas tank. Finally, let someone know where you are going and when you are expected back.

If you are home, have an alternate source of heat. All too often, weighted down branches break off of the trees and fall onto the already stressed power lines. Sometimes, it can take several days to restore power. A wood stove, fire place, or a space heater can serve the purpose well, but have good ventilation. Stock up on non perishable foods and make sure that there are plenty of candles, flashlights and batteries.

Finally if the driveway needs to be shoveled, take breaks. Not only will this make you less sore the next day, but it will reduce the workload on the heart. Also, it will reduce the amount of sweating which, in turn, will reduce the risk of chill and hypothermia. Dress in layers. By doing this, clothing can be added or removed as needed to obtain maximum comfort.

Preparation for winter weather is the key. By being prepared for these events in advance, a lot of the associated danger can be reduced or even eliminated. Have a safe and enjoyable winter!

What is Your Spotter

I.Q.

By Bryan Henry

It's that time of the year again. Severe weather season is on hand and, as usual, is expected to unleash its arsenal of potentially dangerous weather over the area. Are you prepared? Below is a test to access your knowledge of severe weather.

1. What is the difference between a watch and a warning?

   a) A watch means that an "event" is imminent or is occurring, and a warning means that conditions are favorable for an "event" to occur.
   b) A watch means that conditions are favorable for an "event" to occur, and a warning means that an "event" is occurring or is imminent.
   c) A watch means that an event is imminent, and a warning means that it is occurring.

Though lightning does not make a thunderstorm severe, it is still a leading cause of thunderstorm-related deaths.

2. How long are severe thunderstorm and tornado warnings usually valid?

   a) 30 minutes to 1 hour
   b) Greater than 1 hour
   c) Less than 1 hour

3. What makes a thunderstorm severe?

   a) Continuous Lightning and wind gusts to 50 mph
   b) Pea sized hail and wind gusts to 50 mph
   c) 3/4" hail (penny sized) and wind gusts to 58 mph

4. A wall cloud is a…

   a) low-hanging, circular shaped cloud that hangs beneath some thunderstorms. It is an indicator of strong updrafts and possible rotation.
   b) Is a towering cumulus cloud that can extend up to 25,000 to 30,000 feet into the atmosphere.
   c) A dissipating thunderstorm that is being dominated by downdrafts.

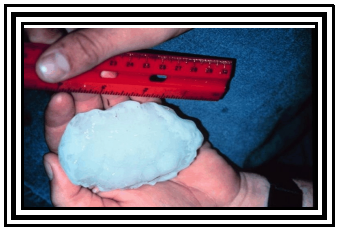
5. What should you do if you see a tornado approaching?

a) Call your local weather service office to report it immediately.
b) Seek shelter immediately in the innermost room of a building. Report it to the local weather service office after the storm has passed and you are absolutely sure of that you are safe.
c) Grab the video recorder and record the event for posterity.

6. What phenomena are often mistaken to be funnel clouds?

a) Smoke
b) Scud Clouds
c) A narrow rain shaft or Virga
d) All of the above

7. Which of the following should be reported to your local weather service office (if you observe them occurring)?



a) Wind gusts 58 mph or greater, penny sized hail or greater, and tornados
b) Flash flooding
c) Trees down on power lines (from winds)
d) All of the above

8. If caught outdoors during a thunderstorm, you should...

a) go stand underneath a tree to keep dry until the storm passes
b) get low to the ground by squatting, cover your head with your arms, and avoid being the tallest object around.
c) ignore the thunderstorm if it is only producing occasional lightning and thunder.

9. The majority of winter weather related deaths occur where?

a) While driving a vehicle
b) Outdoors (from prolonged exposure to the cold)
c) Indoors (from the loss of electricity during the winter storms)

10. To schedule a Skywarn Spotter training session, you can…

a) Contact your local National Weather Service Office
b) Contact your local Emergency Management Office
c) both a and b

***Answer key**: 1: b, 2:a, 3:c, 4:a, 5:b, 6:d, 7:d, 8:a, 9:a, 10:c*

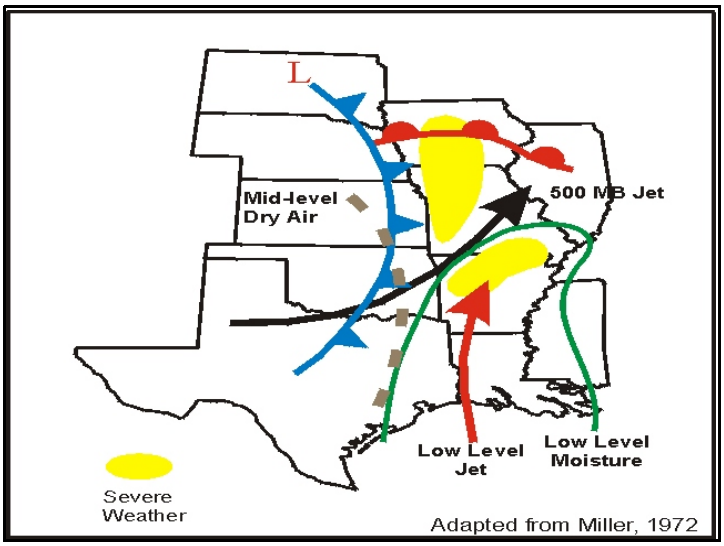
Weather Patterns That Produce Organized Severe Thunderstorms

(Part 1)

by Bryan Henry

Recall that for thunderstorm formation to occur, it is necessary to have adequate moisture, instability, and lift present. However, these three factors are usually not enough to create organized severe thunderstorm activity. For organized severe thunderstorms to occur, two additional elements are needed, wind shear and a boundary. Wind shear is a change in wind speed and/or direction with increasing height. It is wind shear that induces the rotation necessary to create mesocyclones, which are better known as supercells. In addition, updrafts are enhanced. Boundaries, such as frontal boundaries, serve as focusing mechanisms on which convective initialization and organization occur. This article is part of a series that will explore several weather patterns that produce organized severe thunderstorm activity across the Ark-La-Miss.

The first and most well known pattern for organized severe thunderstorm activity is known as the Frontal Pattern. In the illustration below, several distinct features jump off of the page. Beginning at the surface and working upward into the middle to upper troposphere, let's carefully examine the roles of each feature and their interaction with the surrounding environment.



This image shows a common severe weather pattern affecting the Ark-La-Miss. Frequently, and as shown above, these systems approach the area from Arkansas and Louisiana.

At the surface, there is a well developed area of low pressure northwest of the area of interest, in this case over South Dakota, and a strong frontal system over the Great Plains. The approaching cold front serves as a focusing mechanism and a source of lift for thunderstorm development. Ahead of the cold front, and just above the surface, there is an inflow of warm, moist, and unstable air from the Gulf of Mexico. The red arrow indicates a strong low level jet stream (LLJS) that is located within the first 4000 feet of the surface. The strength of the jet stream during these events is usually above 20 knots, or 23 mph, and serves two primary purposes. The first purpose is to pump warm, moist and unstable air in from the Gulf of Mexico. (On the image above, this airmass is shown as the area that is to the right of the green line.) The

second purpose of the LLJS is to provide low level wind shear. Low level shear is an important ingredient for tornado formation. The black arrow indicates the presence of a strong middle (to upper) level jet stream (MLJS). The first thing to note about the MLJS is that it does not flow from the same direction as the LLJS. The direction that the MLJS blows from during these events is always to the left of the LLJS. Meteorologists call this phenomena "wind direction **veering** with increasing height." The speed of the MLJS is normally greater than the speed of the LLJS. During an event, the speed of the MLJS is at least 40 knots, or 46 mph. This shearing of the wind with increasing height induces rotation and allows for the thunderstorms to become supercells. The final feature in the diagram above, which has not been discussed, is the encroachment of middle level dry air into region of interest. This feature is needed for strong downdrafts to occur. The necessity for this can best be explained using an argument based on evaporative cooling and air density. As rain drops or hail stones fall through the troposphere, they encounter the dry (unsaturated) middle level airmass and the outer edges evaporate/sublimate. As this occurs, the air immediately surrounding the drops/hail stones cools. As the air cools, it becomes more dense (heavier than the air immediately beneath it). In response, the heavier air accelerates downward under the influence of gravity creating an enhanced down draft. During severe thunderstorm outbreaks these thunderstorm downdrafts equal or exceed 58 mph upon reaching the ground. As the wind reaches the ground it spreads out in all directions creating a pool of colder air that serves as a miniaturized cold frontal boundary. In turn, this boundary can serve as a focus for new thunderstorm development, and the cycle repeats.

Thunderstorm downdrafts, also called downbursts, can produce tornado-like damage by blowing down trees, flipping cars, and flattening hourses.

In the coming months, the pattern discussed above will likely come to fruition. By recognizing these warning signs in advance, we will be able to better anticipate and prepare for these events.

Severe Weather Awareness Day

Tuesday, October 28th, is Severe Weather Awareness Day. Help us in our mission of protecting lives and property by encouraging local schools and businesses to participate in tornado drills. Emergency managers are also encouraged to participate by reviewing their severe weather operating plans and also by conducting tornado drills as well.

Ask the Forecaster

by Brad Bryant and Bryan Henry

Welcome to the debut of ***Ask the Forecaster***! In this section of the Spotter News Letter we answer the questions that you submit. Each issue, we will answer 3 to 4 questions. You may be thinking "What are the ground rules for this column?" We're glad you asked.

The subject matter of the questions must be somehow related to weather or related to the National Weather Service. For example, it could cover such topics as "How does frost form?" to "What month(s) of the year do the most tornadoes occur in Mississippi?" to "what types of careers are there avaliable in meteorology?". The choice is yours. Using our crack staff of meteorologists, we will comb the realm of science to find the answers to your questions. Email your questions to the following address: **sr-jan.webmaster@noaa.gov**

Just to get you thinking, we decided to answer the questions that we mentioned above.

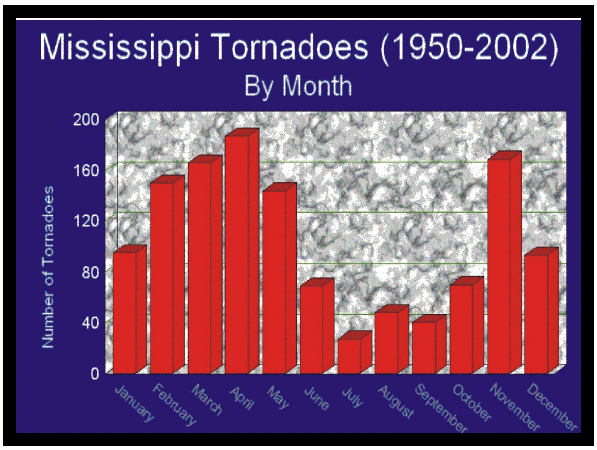
Why does it sometimes frost when the measured air temperature is above freezing?

To answer this question, let's first discuss how "surface" temperatures are measured. Automated recording stations (known as ASOS) are operated by the NWS and are distributed across the country. These stations record temperatures at a height of 2 meters - or roughly 6 and a half feet. The NWS also employs "weather observers" that operate smaller weather stations which record temperatures at heights around 5 to 6 feet above the surface. In both cases, the thermometers and other temperature sensors used are kept away from direct sunlight and are in a ventilated enclosure. An easy to make is that the temperature at the height of 5 to 6 feet above the ground represents the temperature at ground level. In most cases, this is a fair assumption, but in some cases, like on a cold morning, this assumption fails.

In order to get frost to form, the atmosphere has to be set up for good radiational cooling (i.e. typically clear skies and calm winds.) When these conditions occur, some surfaces, like grass blades and car windows, quickly "radiate" away the heat energy stored in them. The efficiency of this transfer of heat from the surface to the atmosphere allows for the surfaces to cool quickly, more fast than the air at the 5 or 6 foot level. Often, surface temperatures will fall to several degrees below the recorded temperature of the air at the 5 to 6 foot level. In some cases, this loss of heat energy means that the temperature of the rsurfaces (and a thin layer of air immediately next to them) falls to or just below 32 degrees Fahrenheit, while the temperature of the air at roughly 5 to 6 feet does not.

What month(s) of the year do the most tornadoes occur in Mississippi?

Mississippi experiences the most tornadoes during the months of November, March, and April (see graphic below.) With that said, the single most prolific month for tornadoes is April with over 180 recorded in the state. These more active months correspond to times of year in which the jet stream is most often found over the Lower Mississippi at the same time as the moist and unstable surface air needed to fuel thunderstorms.



In the image above, note that the increase in activity actually begins in November.

What type of careers are available in meteorology?

Career types are generally operationally or research based. Operational meteorologists tend to work in one of four fields. They are: The National Weather Service (NWS), military, media, and private sector firms. All of which, except the military, require at least a bachelor's degree. Some television forecasters have degrees in other fields, like broadcasting, and have taken additional courses in meteorology to gain practical knowledge. The NWS and most private sector firms require at least a bachelor's degree (if not higher). People in the research meteorologists generally tend to have at least a master's degree in either meteorology or in Earth and Atmospheric Science.

If winter weather comes, don't be caught unprepared like this guy.

Are You Ready?

By Bryan Henry

Winter Weather Awareness Week is December 1st through 5th. Now is the time to prepare for winter weather by ensuring that your vehicle and home are ready for the onset of inclement weather.

Make sure that tire tread and breaks are within the legal limits. This will help in navigating icy and snowy roads. Keep the gas tank at least half full at all times and have emergency supplies in the car. In the home, make sure that there is always several day's food on hand. Winterize your house by making sure that all windows are sealed (caulked) and by making sure that the heating system is working properly. Just in case the electricity goes out, it's always good to have flashlights and batteries and/or candles and matches on hand. Keep combustable objects away from space heaters at all times.