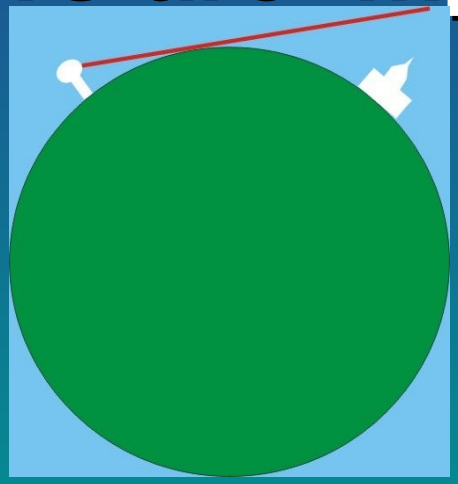
Advanced Spotter Training 2009

Welcome!

Lesson 1: Introduction and Why Spotters are Important



Introduction

- This course is intended to advance the basic training given by the National Weather Service (NWS).
- It is not designed to replace it. Though we do start from first principles, this course is designed to use the NWS training as a basis.
- The goal is to train individuals who are highly motivated to become first-class spotters with a broad background in the technical details of severe weather, spotter operations, and spotter techniques.

Structure of the Course

- Lesson 1: Introduction and Why Spotters are Important
- Lesson 2: Introduction to Severe Weather Phenomena
- Lesson 3: What Conditions Produce a Convective Outlook?
- Lesson 4: The Thunderstorm
- Lesson 5: Severe Precipitation
- Lesson 6: Severe Winds
- Lesson 7: Tornadoes

Structure of the Course *(continued)*

- Lesson 8: Individual Spotter Skills
- Lesson 9: Working as Part of a Group
- Lesson 10: Base Operations

How This Course Will Be Conducted.

- Each lesson will be roughly two hours long and will be broken into three 15-20 minute segments, each followed by a 5 minute discussion period. Questions may be asked at any time by raising your hand. When called upon please state the question clearly and wait for the answer. ***Please ask every question that occurs to you!***

Homework for this course is designed to accomplish three things: (All assigned homework must be completed by the next lesson)

- To tell me how well you are understanding the material I am presenting, i.e. to test my teaching.
- To challenge your understanding and make you think in new ways.
- To present ideas that I did not have time to cover, but that are very important all the same, and have you think about them.

There are three types of final exams to choose from:

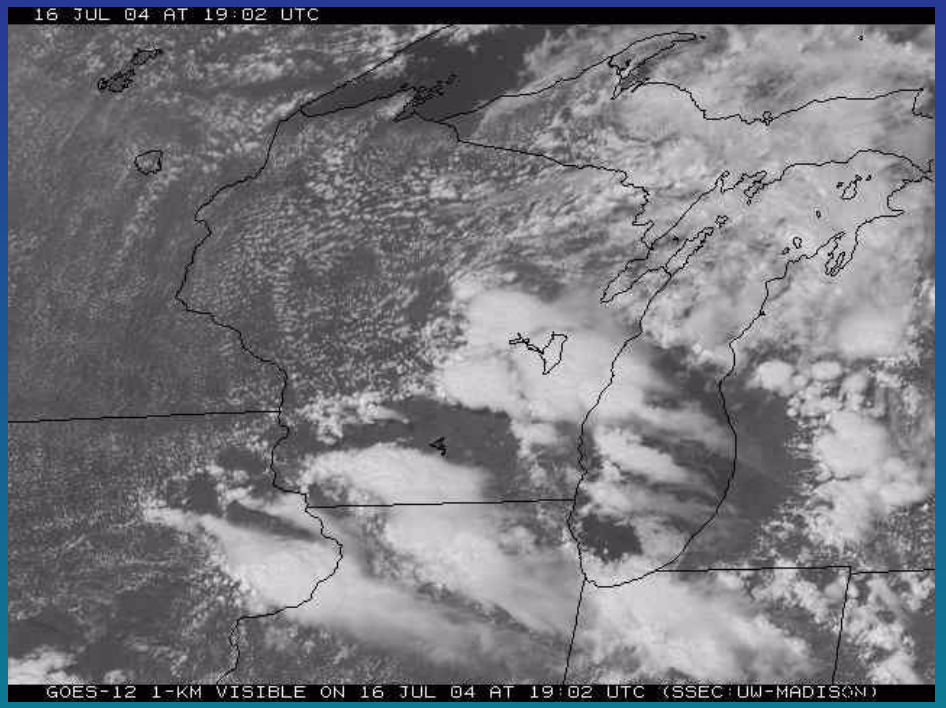
- The traditional timed-written exam. This will be a one hour exam and will require you to perform five tasks.
- An oral exam. This is a one hour exam where you will be required to demonstrate your competence by performing five tasks.
- A written take-home exam. You will have three days to complete this exam, and you will be expected to perform five very difficult tasks.

What is a severe weather spotter?

- Before we take our first break, we should understand what we mean by a spotter. Anyone who attempts to locate severe weather with the intent to warn the public is a severe weather spotter.
- A storm chaser is someone who, for any of a variety of reasons, attempts to locate and intercept severe weather.

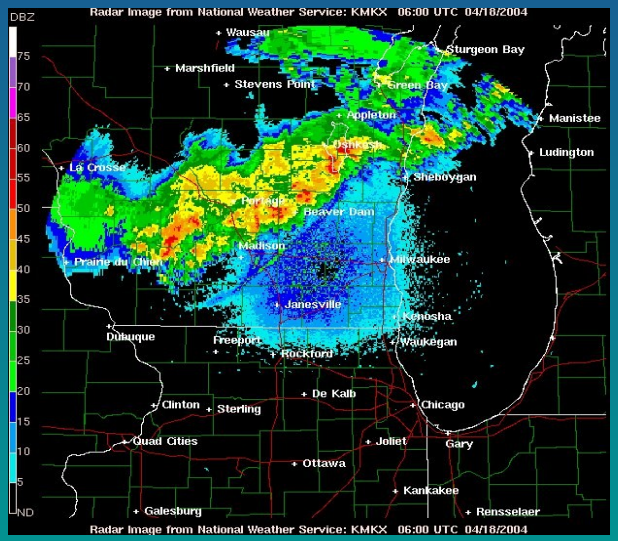
First Discussion!

- I want you to think about the definition of a spotter.
- During the discussion I want you to consider the question, "What do you think being a spotter entails?"



Section 2

Why Are Severe Weather Spotters Necessary?



Is Severe Weather Really a Threat?

- If you didn't think severe weather was a threat you wouldn't be here. My goal with this question is to list some pertinent facts. (These facts are based, in part, on information provided by Rusty Kapela of the National Weather Service's Sullivan Weather Forecast Office)

Is Severe Weather Really a Threat?

- Flash Floods cause an estimated 129 deaths each year (on average) and an average of $4 billion in damage.
- Lightning kills an average of 76 people each year and causes $34 million in damage (and I don't know if that counts lost data through computer disasters caused by lightning).

Is Severe Weather Really a Threat? *(continued)*

- Tornadoes kill an average of 69 people each year and cause an average of $871 million dollars in damage.
- In 1999, the Oklahoma City tornado was the first billion-dollar tornado.
- Every time a tornado warning is issued, it can cost the community several million dollars in lost revenue, as business grinds to a halt!

Is Severe Weather Really a Threat? *(continued)*

- Last year Dane County had 2 confirmed tornadoes.

Why Not Just Rely Upon Public Reports of Severe Weather?

- The public is largely untrained and there are lots of things in a thunderstorm that look like a tornado. Every year many reports are made by well-meaning individuals who think they see something that isn't really there. It takes a lot of training and experience to be able to identify severe weather effectively. It isn't something you can do after a couple of hours of training. I am constantly surprised by things every time I go out in the field, and I have been at this for thirty years.

Why Not Rely Upon Law Enforcement or other Emergency Responders to Make Severe Weather Reports?

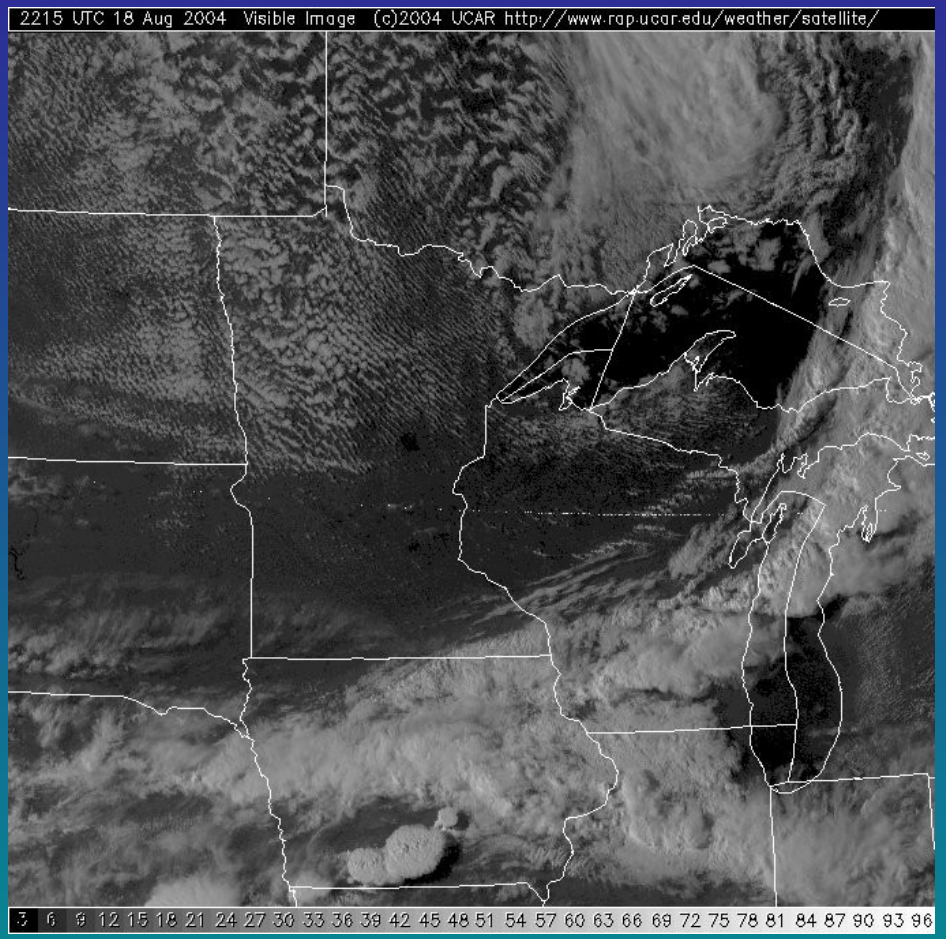
- While we accord these individuals authority, there is no reason to believe that they have any higher degree of training or background in severe weather than the general public.
- When properly trained, these individuals are effective spotters.

Why Not Rely On the NWS?

- While the members of the NWS certainly have the training and background, they are fixed at a specific location. Even with satellites and radar they are unable to know what is going on at the ground level, more than ten miles from their weather forecast offices (WFO), due to the limitations of their equipment (we will cover such limitations later).

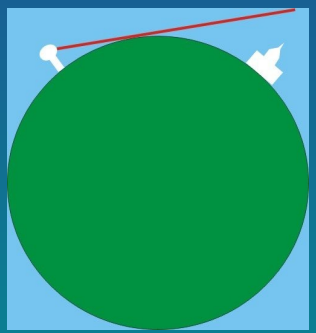
Discussion Time!

- Consider the sorts of arguments to make when confronted by those who do not understand why we need spotters.



Section 3

Technical Limitations of the NWS



What Instruments Does the NWS Use?

- Standard Meteorological Sensors (Thermometer, Hygrometer, Barometer, Rain Gauge, Anemometer, etc.)
- Doppler Radar.
- Weather Satellites.
- The National Lightning Detection Network.

What is Radar?

- Radar is a device that uses radio waves to detect objects at great distances from the device. Radar stands for RAdio Detection And Ranging.

What is Radar? *(continued)*

- Radar sends out radio waves that collide with objects and then are bounced back. The length of time it takes for the bounceback determines the range to the target. The direction of the target is recorded, too. The combination of range and direction gives the position of the target.

What is Radar? *(continued)*

- Doppler radar operates like a normal radar. It also uses something called the Doppler effect; the radar waves bouncing off something moving towards you will have their frequency shifted in a different way than something moving away from you. This allows you to know the speed and direction of travel of a target relative to the position of the radar.

Limitation #1: The Myth of the Mesocyclone

A rotation about a vertical axis that occurs within a thunderstorm updraft that is both strong and persistent is called a *mesocyclone*.

Mesocyclones can only be detected by radar (though there may be visible clues of its existence).

Limitation #1: The Myth of the Mesocyclone *(continued)*

- It was once thought that mesocyclones produced tornadoes.
- All we had to do was find the mesocyclone and we could tell where a tornado would occur.
- Doppler radar can detect these rotations, so there was great hope that this kind of radar would be a wonder device to warn of approaching disaster long before it occured.

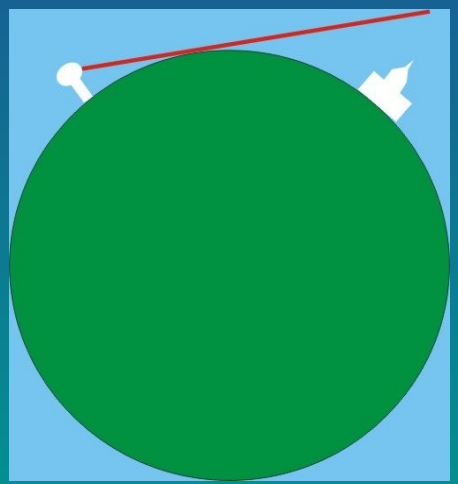
Limitation #1: The Myth of the Mesocyclone *(continued)*

We now know that only 10-25% of mesocyclones are associated with tornadoes, so Doppler is not the wonder cure it was hoped.

Additionally, a fraction of tornadoes (no one is sure how high the fraction is) occur away from mesocyclones.

Limitation #2: The Earth Falls Away from the Radar Beam

- The radar beam goes out in straight lines. There are special cases where the beam can be deflected (we will get into this more in a later lesson). Beyond about ten miles, the radar can no longer see the ground.



Limitation #3: Planar Resolution

- The radar has a computer that does all of its processing. This chops the data up into chunks that are displayed as tiny squares called pixels.
- For the WSR-88D, the NWS Doppler radar, the pixels are roughly 500 yards on a side.

Limitation #3: Planar Resolution *(continued)*

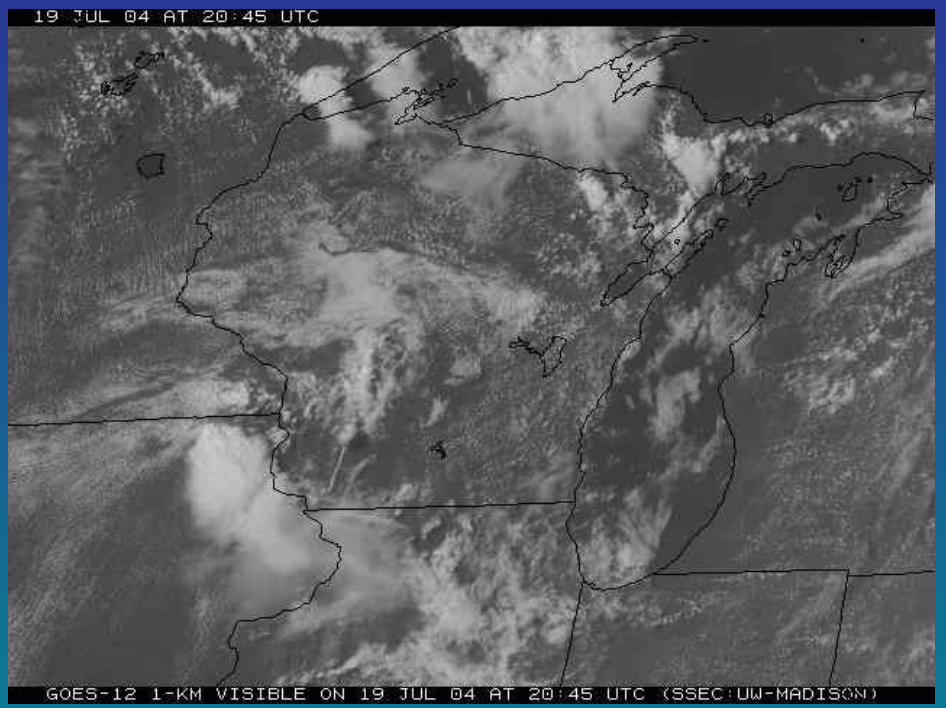
- It is not possible for the computer to see a tornado or downburst smaller than 500 yards wide.
- The average tornado is only 100 yards wide.

Other Limitations

- The other sensors of the NWS also have their limitations, and I will leave it as an exercise for you to think about those.

Final Discussion!

- Discuss the ramifications of these limitations.



Homework Due Next Week

- Decide on how you want to take your exam, explain why.
- What skills do you think a spotter should have? From this list, what skills do you have? What skills do you need to work on?
- Write out the argument supporting the existence of spotters that you think is most important.

Homework Due Next Week *(continued)*

- Think of at least one other technological limitation that the NWS has. There are many I left out. If you have to, look up some information on radar or satellites, etc.