Advanced Spotter Training 2009

Lesson 2: Introduction to Severe Weather Phenomena

From Last Time

- Last time we discussed the rationale for having severe weather spotters.
- We also discussed some of the limitations of the equipment used by the National Weather Service (NWS).
- We also discussed the structure of the course and how the lessons would be presented. You should have decided how you want to end the course by now (which style of exam you want).

This Lesson

- In this lesson we will discuss what severe weather actually is.
- We will also discuss the general types of severe weather.

Homework Review

Go over the homework problems from last time:

- 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?

Homework Review *(continued)*

- Write out the argument supporting the existence of spotters that you think is most important.
- 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.

What is Severe Weather?

The NWS has developed specific criteria for severe weather:

- Winds at or above 50 knots (or 58 mph). This is when light structural damage can be caused. In the old days of the Weather Bureau, when the stations were located at airports, 50 knots was when aircraft sustained damage.

What is Severe Weather? *(continued)*

- Hail at or above an inch in diameter. It used to be 3/4" hail that triggered a severe thunderstorm. This was another throwback to the old days of the Weather Bureau being tied to aviation; 3/4" hail is the point at which aircraft fuselages can begin to sustain light damage.

What is Severe Weather? *(continued)*

- Tornadoes or funnel clouds.
- Flash flooding (while this is not specifically severe weather, there is a class of warnings for this all the same; and we are definitely concerned about this).

What is Severe Weather? *(continued)*

It is also important to know what is *not* severe weather:

- Dark ominous clouds; it doesn't matter if the storm clouds look like they are straight out of Hell, it isn't severe by itself.
- Heavy rain that is not causing flash flooding.
- Poor visibility.

What Do We Report?

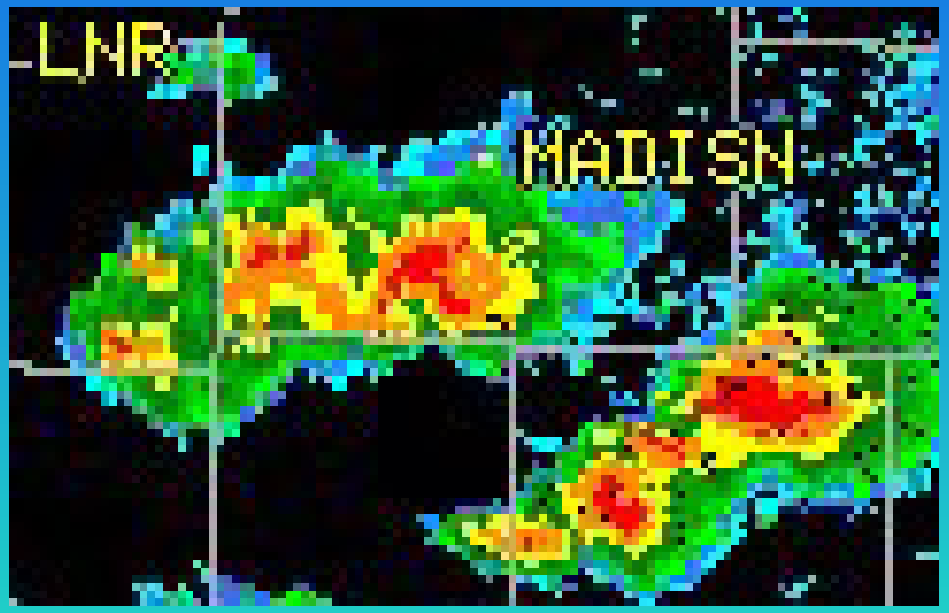
- Winds measured or estimated to be above 45 mph. Especially those 50 knots or higher. These winds will be evident as small branches will be breaking off of trees.
- Any incidence of hail no matter how small. Be sure to report if you are estimatng the hail size or measuring it.
- Any area of slow moving heavy rain.
- Tornadoes.

What Do We Report? *(continued)*

- Funnel clouds.
- Flash flooding.
- Urban or street flooding over the curb.
- Features of storm structure that give us clues that the storm(s) might be developing severe potential. Specifically we are interested in wall clouds, particularly those that show rotation.

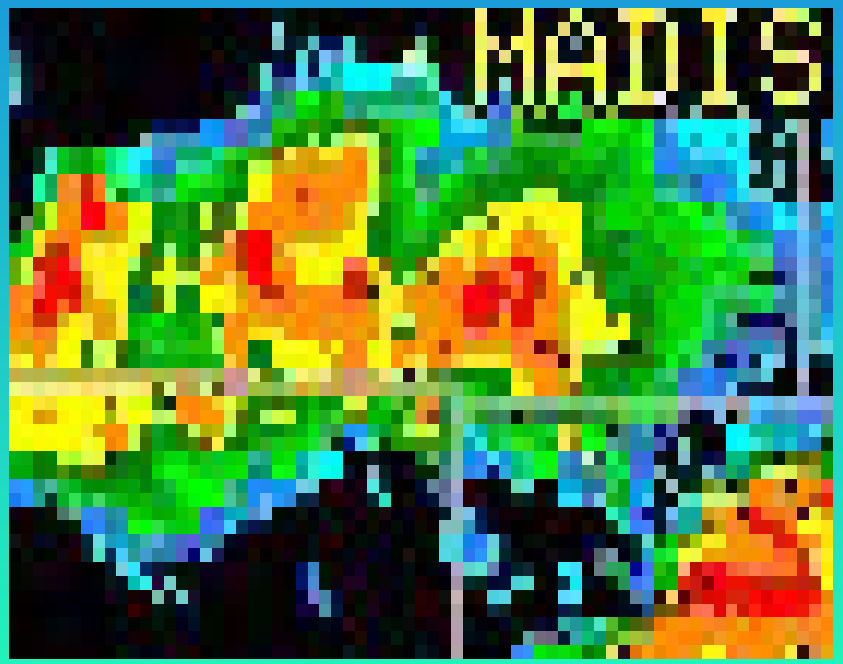
First Discussion!

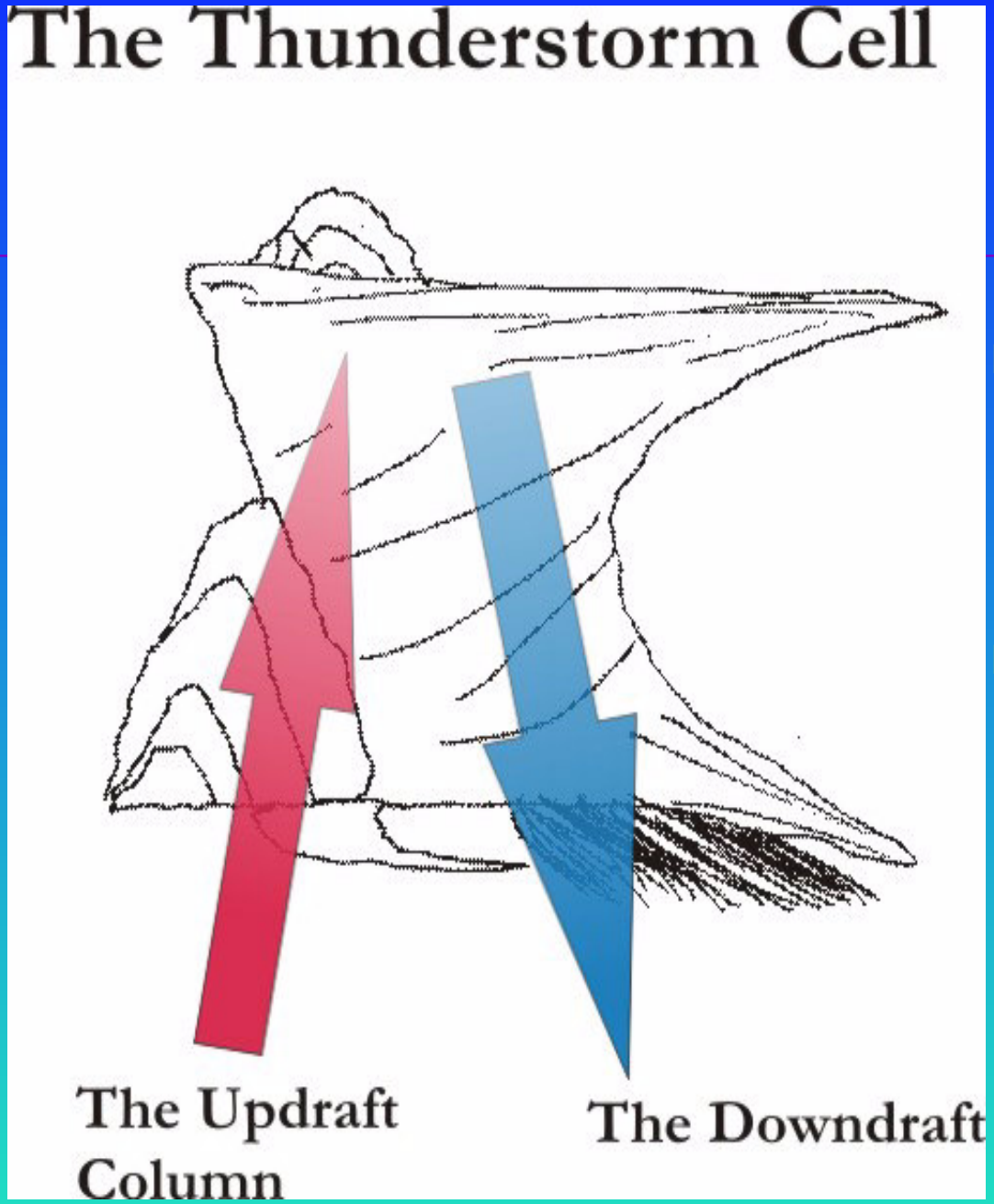
- Discuss the definitions of severe weather and think about why we have the criteria we have listed.



Section 2

The First Type of Severe Weather



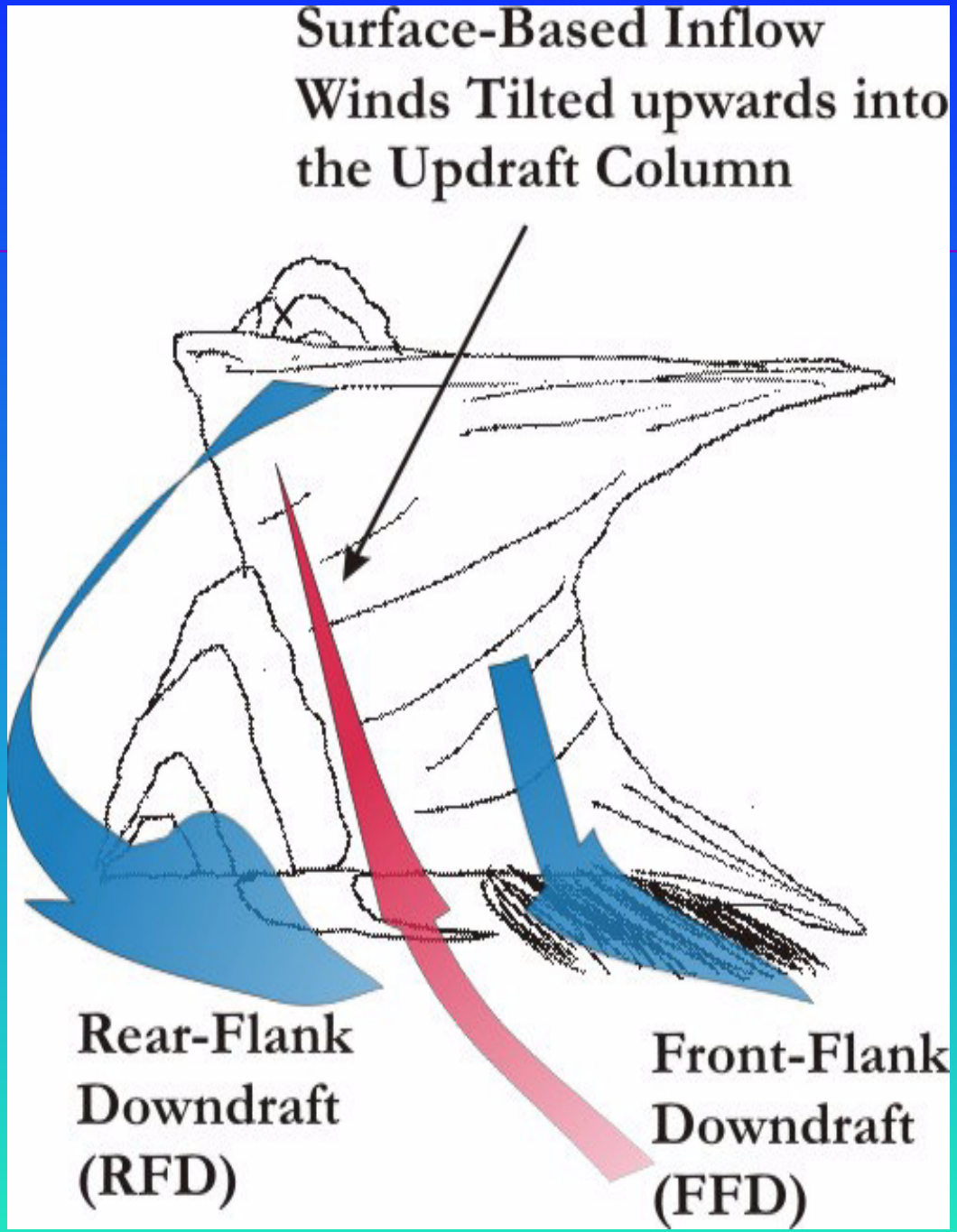


The Thunderstorm

- Here is a side view of a thunderstorm.
- Whenever you see this view the storm is moving from left to right.

The Thunderstorm *(continued)*

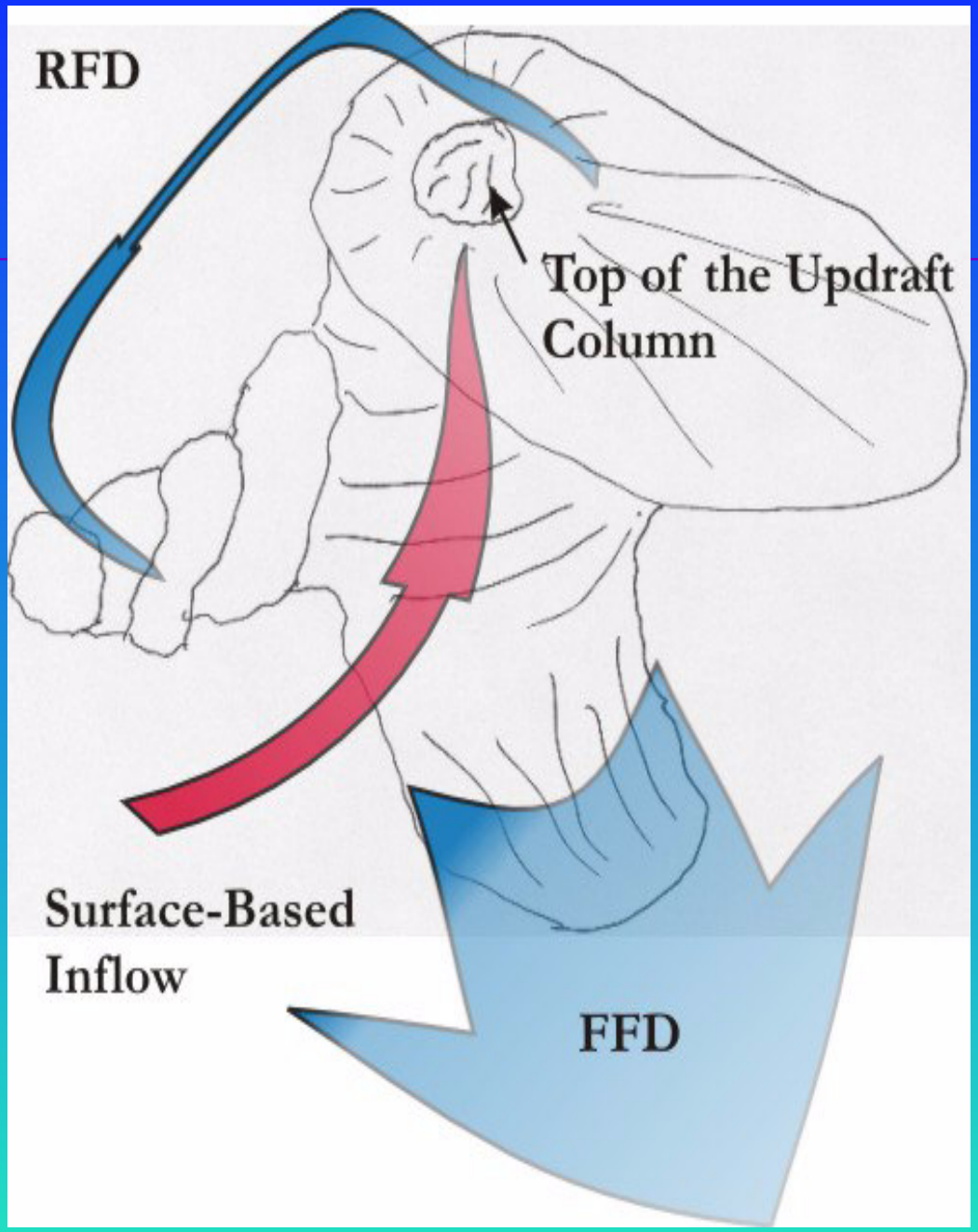
- Any updraft-downdraft couplet is called a *thunderstorm cell*.



Severe Winds

There are three kinds of wind associated with most thunderstorms:

- Inflow winds.
- FFD (Forward-Flank Downdraft).
- RFD (Rear-Flank Downdraft).

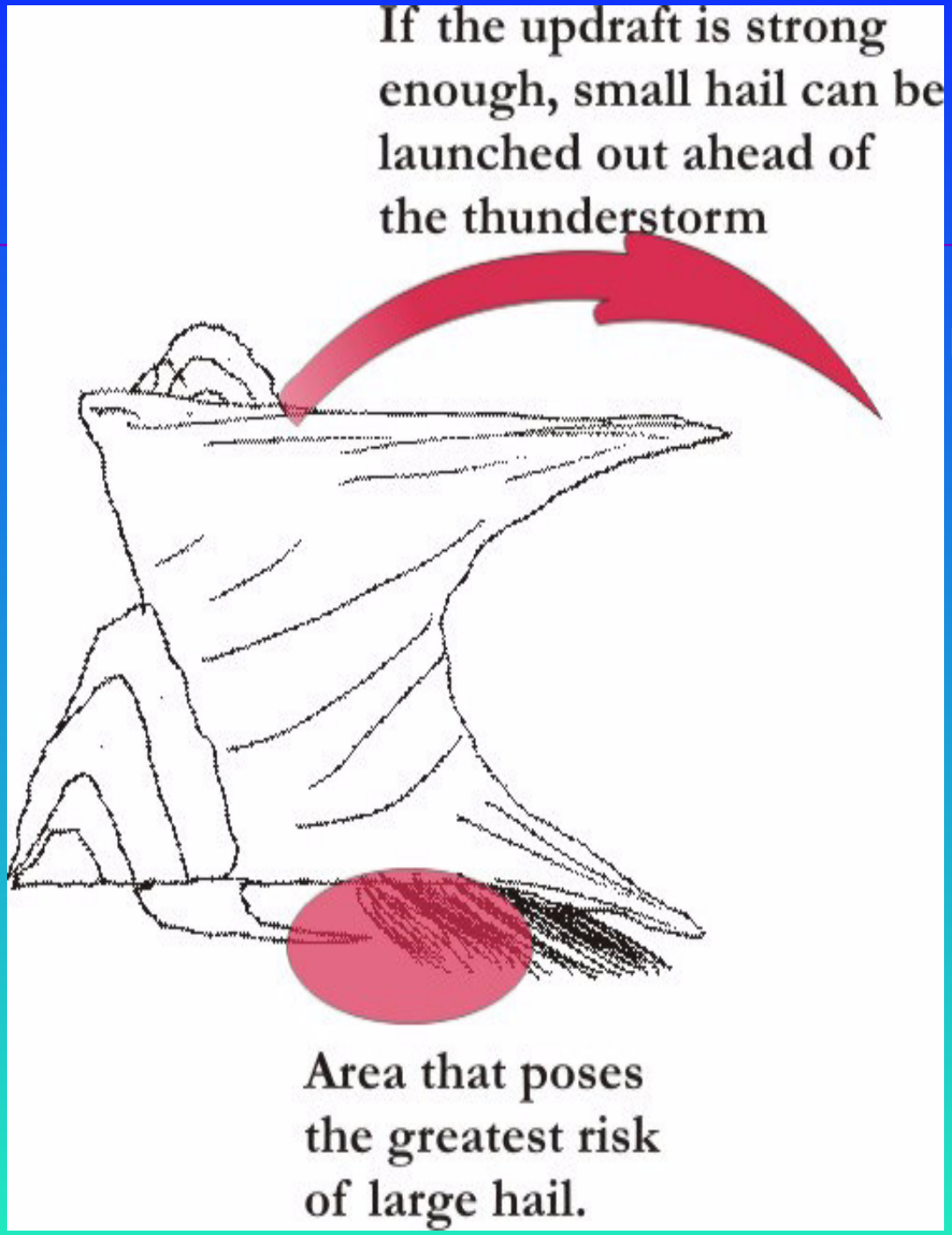


An Oblique View

The places most likely to experience severe winds are in the vicinity of the FFD and the RFD. In extremely rare cases you might have near-severe winds in the surface-based inflow region.

More About Severe Winds

Here is an example of what can happen to the NWS when a severe RFD hits their radar:



Severe Hail

- By a process that we will discuss at great length (in Lesson 5) hail can form at the top of the updraft column.

Flooding Rains

We will discuss how precipitation forms in Lesson 5. Here we are simply concerned with the threat posed by rain.

- Rain that causes visibility to drop to a quarter of a mile or less is termed *heavy*. This is most likely to occur just ahead of the region where the greatest risk of hail can be found.

Flooding Rains *(continued)*

- Flash flooding occurs when so much rain falls within a period of time that existing waterways cannot handle it all.

Flooding Rains *(continued)*

If a storm has any combination of the following factors, it carries the risk of flash flooding:

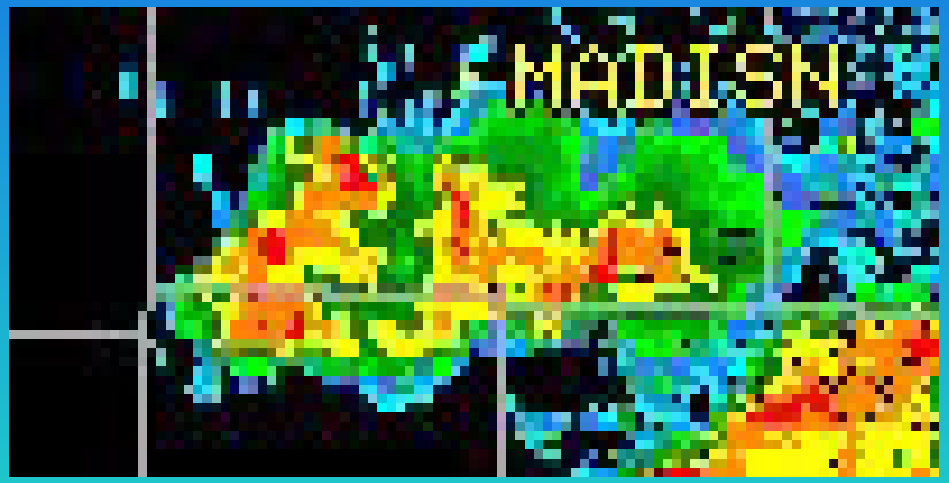
- The storm is developing in a region of high dew points (this tells us that there is lots of moisture in the air near the ground).
- The storm is slow moving and can deposit large amounts of heavy rain over a specific place.

Flooding Rains *(continued)*

- The storm has a very strong updraft, this tells us that the storm will get very tall (in general) and will have a lot of moisture within it for precipitation.

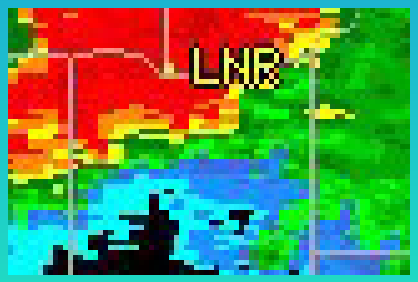
Second Discussion!

- Think about what we have discussed and how it can help you to understand where you should look in thunderstorms for precipitation.



Section 3

The Second Type of Severe Weather



The Tornado

The official definition of a tornado is:

- A violently rotating column of air in contact with the ground and the thunderstorm base.

The Tornado *(continued)*

- Please note that nowhere in this definition is there mention of a funnel-shaped cloud. This is because you need not have such a cloud. The photograph above is from 6 June 2006, north of the town of Barneveld.
- Notice that there is no visible funnel anywhere.
- There is a pronounced debris cloud.

The Classification of Tornadoes

Ted Fujita, a meteorologist who was active in tornado meteorology research from the 1950s through the 1980s, created a system for categorizing tornadoes by the damage they do. This has recently been modified into the *enhanced Fujita scale*. We will go into more detail about this in Lesson 7. Here is a brief introduction:

The Classification of Tornadoes *(continued)*

- EF0: The weakest type of tornado. This type is unlikely to cause much structural damage to homes, but it can cause damage to mobile homes and vehicles.
- EF1: The top of the weak-scale of tornadoes according to the NWS. This can cause minor structural damage to homes, and it can destroy mobile homes and small vehicles.

The Classification of Tornadoes *(continued)*

- EF2: The bottom of the strong classification of tornado. This can cause substantial damage to walls and roofs in homes. This type of tornado will completely annihilate a mobile home.
- EF3: The top of the strong classification of tornado. This type of tornado will completely wreck a home, but there will still be internal walls standing.

The Classification of Tornadoes *(continued)*

- **EF4: The bottom of the violent classification of tornado. This type of tornado leaves only a pile of rubble behind.**
- **EF5: The most violent type of tornado! This type of tornado will sweep a foundation completely clear. There may be nothing left but the foundation to indicate a house had ever been there!**

The Classification of Tornadoes *(continued)*

- A slow moving weak tornado can do strong tornado damage.
- A fast moving strong tornado can do weak tornado damage.
- A slow moving strong tornado can do violent damage.
- A fast moving violent tornado can do strong damage.

Where Do We Look for Tornadoes?

- Unlike the other forms of severe weather we have discussed, the tornado requires a strong updraft in order to exist. This is most often found in the inflow region of the thunderstorm.

Final Discussion!

- Discuss the ramifications for spotters of not needing a visible funnel to have a tornado.

Homework Due Next Week

- Make a list of the types of severe weather on a 3" x 5" card and carry it around with you until you memorize it.
- Speculate on how to estimate wind speed. If you do not have an anemometer (a device for measuring wind speed) list how you will make such estimates.

Homework Due Next Week *(continued)*

- Carry a tape measure with you to measure hail. Wrap the tape measure around the biggest hailstone you can find. Divide this number by 3 and you will have a rough estimate of the diameter. Why does this work?
- Hand draw a diagram of a thunderstorm. Make photocopies of it, or get some acetate overlays, or tracing paper.

Homework Due Next Week *(continued)*

- Using a photocopy of your diagram, or an overlay, develop a diagram showing where you are most likely to find severe hail, severe winds, and tornadoes.