How Does Radar Work?

- **As the radar antenna rotates 360°, it sends out bursts of energy travelling at the speed of light.**
    - **The radar keeps track of the time it takes for the burst of energy to leave the antenna, hit the 'item of interest', and return to the antenna.**
        - **With that information, the radar can determine how far away the 'item of interest' is located.**

What is Doppler Radar?

- **'Doppler radar' provides an advantage in that not only does it give information about the location of the 'item of interest', but in their movement as well.**
    - **Radar can determine if the 'item of interest' is moving toward or away from the radar.**

Limitations of Radar

- **Since the burst of energy from the radar goes upward and outward from the antenna and the fact that the Earth is curved, the burst of energy will eventually overshoot the precipitation it is meant to detect.**
    - **Therefore, the maximum range of weather radar in terms of detecting precipitation is 248 nautical miles.**

Radar Products

- **Weather radar produces a number of different products.**
- **Base Reflectivity (BR)**
    - **The product most people are familiar with.**
    - **Shows the radar 'echo intensity', or reflectivity.**
    - **Generally, heavier precipitation will show up as darker colors and weaker precipitation as lighter colors.**
    - **Sometimes base reflectivity can give a false reading as sleet and hail will show up as very dark colors because they both exhibit high reflectivity values.**
- **Vertically Integrated Liquid (VIL)**
    - **Basically a measure of the amount of precipitation in a column of air.**
    - **A *general* rule of thumb is the higher the VIL (especially if its over 50 kg/m^2), the more likely it is to be a severe thunderstorm.**
- **Echo Tops (ET)**
    - **The highest above the ground the precipitation echo reaches.**
    - **Note that this is *not* the same as cloud tops.**

- **Generally the higher the echo tops, the heavier the precipitation.**

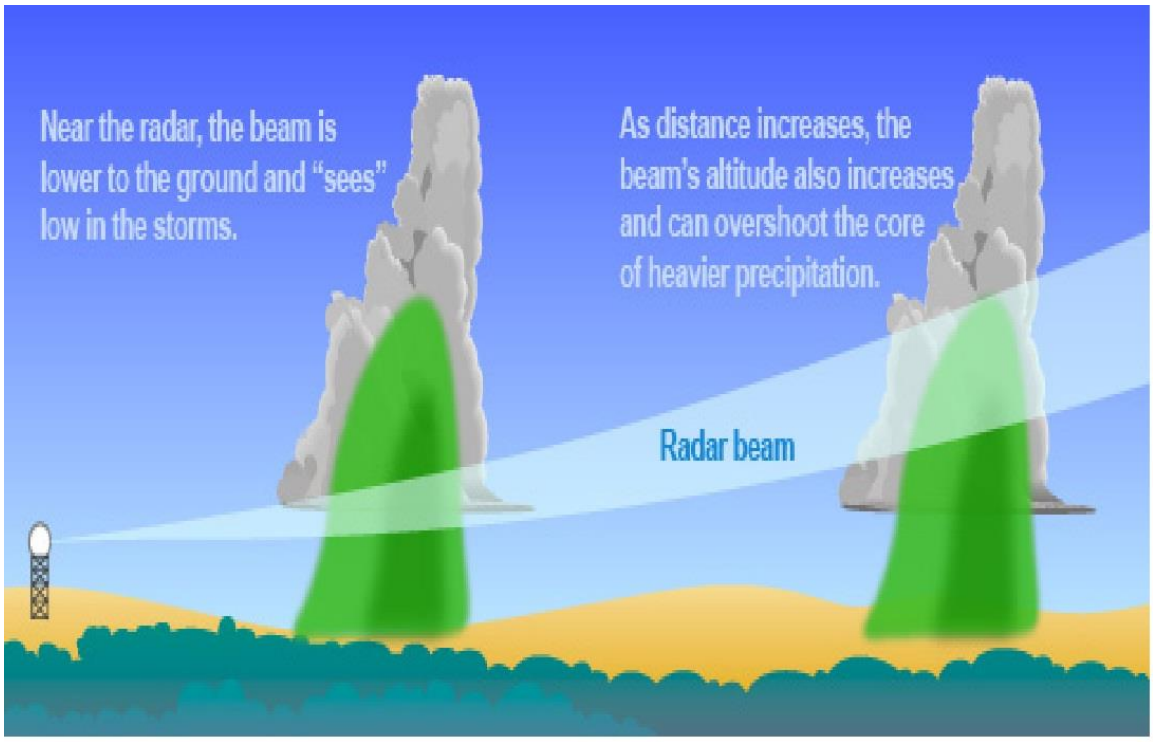
- **Probability of Severe Hail (POSH)**
  - **The radar calculated percentage probability of hail size meeting official severe criteria.**
- **Maximum Expected Hail Size (MEHS)**
  - **The radar calculation of the maximum expected hail size.**
- **Storm Relative Velocity (SRV)**
  - **Doppler radar is able to measure the relative motion of precipitation echoes.**
  - **On most radar color tables, the color red means moving *away* from the radar, and the color green means movement *towards* the radar.**
  - **When the red and green colors meet in a 'couplet' or 'notch' type fashion, that is usually a sign that a mesocyclone is forming.**
    - **It is important to note that not all radar detected mesocyclones produce tornadoes.**

False Radar Echoes

- **Not all radar returns actually represent precipitation.**
  - **On the small scale, insects and birds can create false echoes.**
- **At night, especially during the warm weather months, the ground cools off much more rapidly than the atmosphere right above it. This creates a 'boundary' right above the surface where there is warm air just above the cooler surface of the Earth. As a result, the burst of energy from the radar antenna bounces off the 'boundary' and returns back to the radar site. The radar erroneously interprets this as precipitation.**
  - **This is formally known as 'Anomalous Propagation' (AP).**
  - **AP is easy to detect on a radar loop as those 'false echoes' will remain stationary.**
    - **Generally, most precipitation east of the Rocky Mountains will rarely remain stationary.**
- **When the radar antenna points directly at the sun, the suns radiation interferes with the antenna so that the radar produces false echoes.**
  - **This is known as a 'sunburst'.**
  - **Most likely to occur just after sunrise in the east and just before sunset in the west.**
  - **They only last for one or two radar frames.**

<u>Helpful Link</u>:

http://www.weather.gov/jetstream/how



Credit: http://www.srh.noaa.gov/jetstream/doppler/baserefl.htm