How To Interpret Doppler Radar

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We turn to a very valuable weather tool to track precipitation and approaching storms. While some may not fully understand the intricacies of weather radar, most have at least seen several varieties of weather radar either online or on your local news channel. While radar is quite important to a meteorologist in the midst of tracking a winter storm, there are times when radar can be deceiving. If a snow plow contractor relies solely on what they see on radar, it may wind up hurting their bottom line over the course of a winter season. Throughout this article, we will discuss what radar is, how it works and provide some insight into some misconceptions and limitations of radar.

RADAR, an acronym for RAdio Detection And Ranging, was fully developed around World War II and was primarily used to detect the presence of enemy fleets. The objective of weather radar is to detect the presence of atmospheric moisture or precipitation in the form of rain, snow, sleet and/or hail. First, a radar transmitter sends out electromagnetic radio waves into the atmosphere and waits for the return signal. The strength of the return signal as it bounces off the atmospheric particles provide a clue to the type and intensity of the precipitation detected. The strength of the return beam is then color coded on the radar and helps distinguish the density and intensity of the detected precipitation. Another very important aspect of radar is the use of the "Doppler Effect." The commonly referred name, Doppler radar provides the ability to detect how fast precipitation is moving in a certain direction. This is most useful in severe thunderstorm detection but a recent technology upgrade to dual polarization radar has greatly improved detection of winter precipitation types. A radar profile that now provides both a horizontal and vertical profile allows meteorologists to understand the potential size and shape of the object which increases confidence on the type of wintry precipitation and where the rain/snow may be setting up over a given area.

There is a vast coverage of approximately 160 Doppler radar sites across the United States and U.S. territories, known as the NEXRAD network. It is important to note that even with an expansive network, there are known gaps in radar coverage (most prevalent in the western U.S. and high elevation areas). It is a good idea to know where the nearest Doppler radar is to your location (https://radar.weather.gov). A collection of all the individual Doppler radars across the country are combined to produce three common composite views often shown at the national, regional and state levels. These views are good to capture an understanding of what is occurring on a large scale but often over estimate precipitation amounts. Since, some broader views often overestimate precipitation, it is best to view a high resolution local Doppler radar to see what is happening at your exact location.

RADAR Limitations

Although radar can be a great weather tool for tracking the approach of storms and precipitation, there are some unavoidable limitations. Understanding these limitations can help you better prepare your operations when winter weather strikes.

The first misconception is that radar detects everything that reaches the ground. This is actually false. The radar beam is oriented at a half degree angle which has implications for locations that are farther away from the transmitter. Nearly all precipitation is detected within 80 miles of the radar site. However, the greater the distance from the transmitter, the greater the vertical distance between the ground and the radar beam. So in the case of distant location, the radar beam may overshoot and not detect low level or light precipitation like drizzle. In addition, there are times when precipitation is detected on the radar but is not reaching the ground. “Virga” is not a stranger during the winter months and defined as precipitation that falls from a cloud at high altitudes but evaporates before reaching the ground. It is true that the radar is detecting precipitation, but the cold, dry air mass below the radar beam evaporates the falling snow before it reaches the ground. So, if you are just relying on a radar screen to call out crews without supplementing with actual ground observations, it may wind up costing you a few hours of standby time before the snow actually begins at your location.

Next, the user of the Doppler radar should understand that there are two viewing modes available, clear air and precipitation mode. The intensity scale and colors may look the same on both modes, but they are labeled at different decibels (dBz). Often times you will find the mode of the radar just above the intensity scale. Clear air mode ranges from -28 to +28 dBz and is commonly used when there is little to no precipitation detected in the area. Clear air mode is very sensitive and useful for detecting very light precipitation (flurries or drizzle). Due to the sensitivity, it has been known to also detect atmospheric phenomena like smoke, dust and even migrating birds. Precipitation mode ranges from 5 dBz to 75 dBz and is the most commonly used mode available on the internet and local news channels when actual precipitation is detected. This radar mode helps to determine the intensity and/or density of the precipitation.

USEFUL RADAR VIEWING TIPS:

Learn where the nearest Doppler RADAR site is located.

Start at national & regional levels for an overview.

Check the date and timestamp on the RADAR.

Know the mode the RADAR is operating in.

Follow the animations over the last several hours.

Identify higher intensity areas, shifts and patterns.

Understand limitations of Winter Mosaic RADAR.

Use ground observations, web cams and/or consultation services to verify what you see is correct.

Finally, there is winter mosaic radar. Your local news channels will often refer to this eye appealing, colorful radar depicting the precipitation type over a given area (blue = snow, pink = sleet or mixed precipitation and green = rain). Keep in mind, this radar also has its limitations. The first concern is that winter mosaic radar only occurs at the national, regional or state composite level which often leads to an overestimation of precipitation. Next, the depiction of colors come from a computer algorithm and the actual rain/snow line can often differ by 5-10 miles. Finally, local topography (elevation differences) may affect the radar presentations. Actual ground observations and dual polarization radar should be utilized to determine what is actually occurring at the ground surface.

Even with its downfalls, radar still remains one of the most valuable tools when tracking incoming weather and can be a huge boost to your winter operations when utilized correctly. Knowing what to look for on radar and understanding some of its limitations can certainly provide a leg up on your competition this winter. When it comes to utilizing weather radar in the snow removal industry, practice makes perfect.