WSR-88D Dual-Polarization Radar Decision Aid

Background Information on Using this Document

The following pages contain information on various hydrometeors that can be identified using WSR-88D dual-polarization radar data. For each hydrometeor, likely values for Reflectivity and three key dual-polarization radar products are provided: Correlation Coefficient (CC), Differential Reflectivity (ZDR), and Specific Differential Phase (KDP). Descriptions for the three dual-polarization radar products are provided below to help you remember their significance in discriminating between various hydrometeors.

Correlation Coefficient (CC): The product that helps distinguish precipitation from non-precipitation. These data values range from 0.0 to 1.05, but values of 0.9-1.0 are most likely for precipitation. This product helps determine if precipitation targets have the same shape and type (e.g., pure snow or rain) or if more of a mixture exists (e.g., rain and snow).

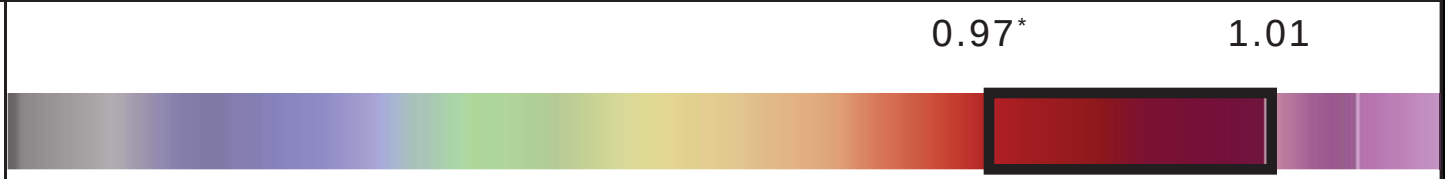
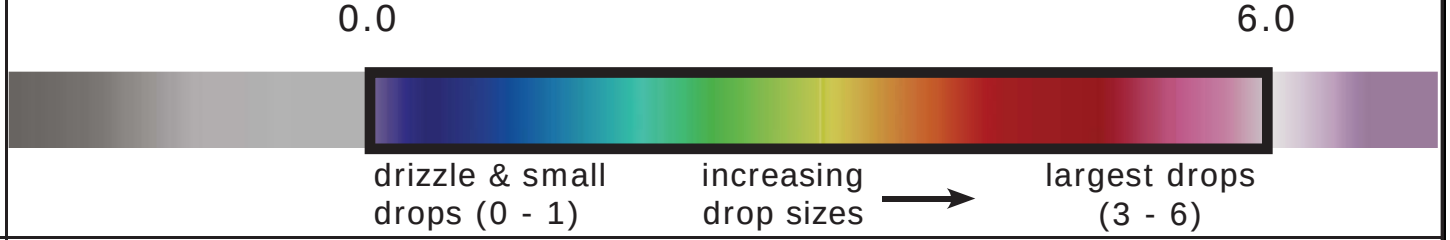
Differential Reflectivity (ZDR): The product that helps identify the dominant target shape. Spherical, randomly oriented targets (e.g., hail, debris, and snow) have values near 0 while horizontally elongated targets (e.g., medium to large rain drops) have larger positive values.

Specific Differential Phase (KDP): Product that identifies regions of heavy rain. The higher the values are, the more intense the rain will be even if hail is present.

When you are unsure about which type of hydrometeor is present at a particular location and elevation scan, use the following pages to aid in your interrogation process. Use the information provided to enhance your confidence in the dominant hydrometeor type present at that location.

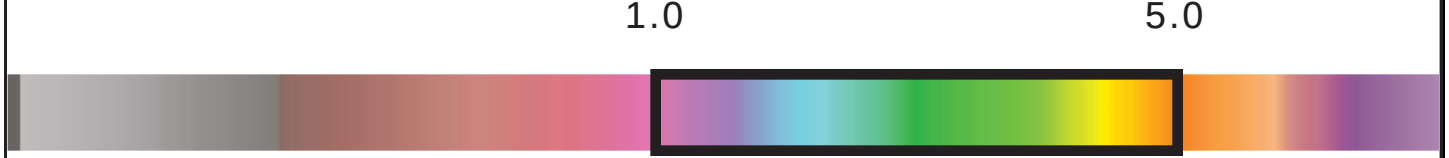
Light-to-Moderate Rain

This category consists of purely liquid hydrometeors that result in rain rates of 1”/hour or less. Pure light rain is characterized by values of low to moderate Reflectivity, high Correlation Coefficient, and low Specific Differential Phase. As rain rate increases, Reflectivity and Specific Differential Phase generally increase in value. Differential Reflectivity will vary depending on the dominant drop size present in the radar volume from drizzle (low) to large rain drops (high).

Reflectivity (dBZ)	
Correlation Coefficient	 * Correlation Coefficient values shown are for pure rain; Expect lower values if multiple precipitation types are present
Differential Reflectivity (dB)	
Specific Differential Phase (deg/km)	 * Specific Differential Phase values below zero are possible, but not likely

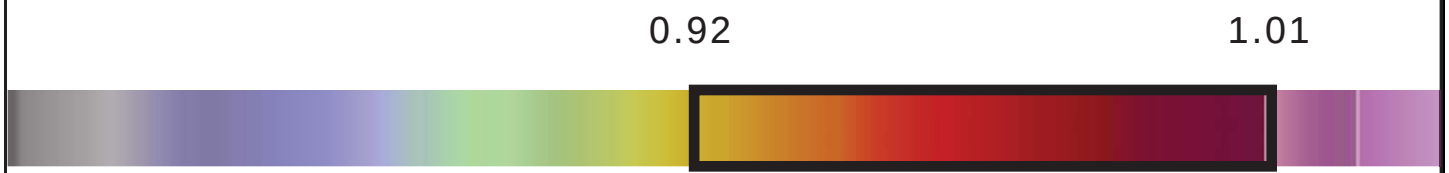
Heavy Rain

This category constitutes large concentrations of liquid hydrometeors that result in rainfall rates greater than 1”/hr. Pure heavy rain is characterized by medium to high values of Reflectivity, high Correlation Coefficients, and medium to high Differential Reflectivity and Specific Differential Phase. As rain rate increases, Reflectivity and Specific Differential Phase generally increase in value. Large values of Differential Reflectivity in heavy rain likely indicate the presence of some small, melting hail.

Reflectivity (dBZ)	
Correlation Coefficient	 * Correlation Coefficient values shown are for pure rain; Expect lower values if multiple precipitation types are present
Differential Reflectivity (dB)	 * Differential Reflectivity values tend to be lower in tropical rain environments
Specific Differential Phase (deg/km)	

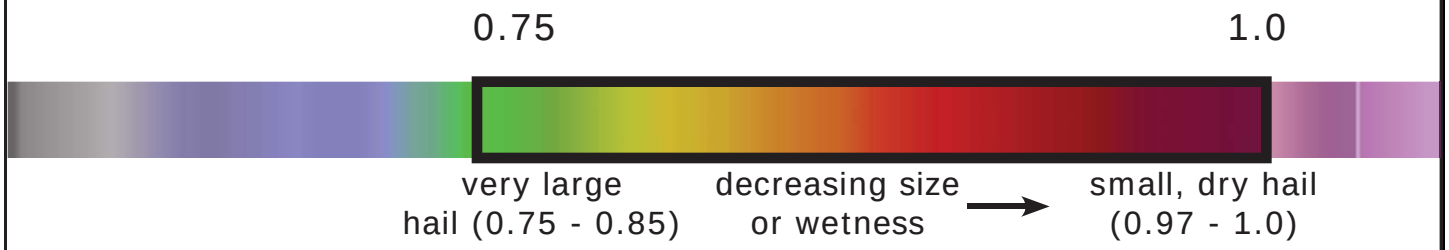
Big Drops

Big drops describe areas typically located near thunderstorms that contain a small number of very large, liquid drops. Very light rain rates define the area of big drops. Big Drop regions are characterized by values of low to midrange Reflectivity and medium-to-high Correlation Coefficient. Differential Reflectivity will vary, but be weighted towards the largest drops in the volume. Specific Differential Phase should be relatively low since the number of drops is few.

Reflectivity (dBZ)	
Correlation Coefficient	
Differential Reflectivity (dB)	
Specific Differential Phase (deg/km)	

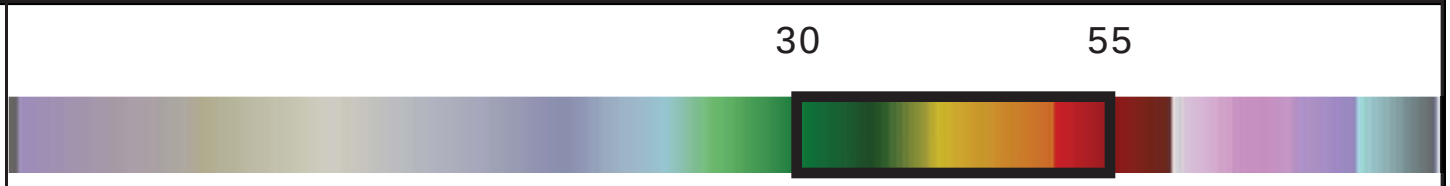
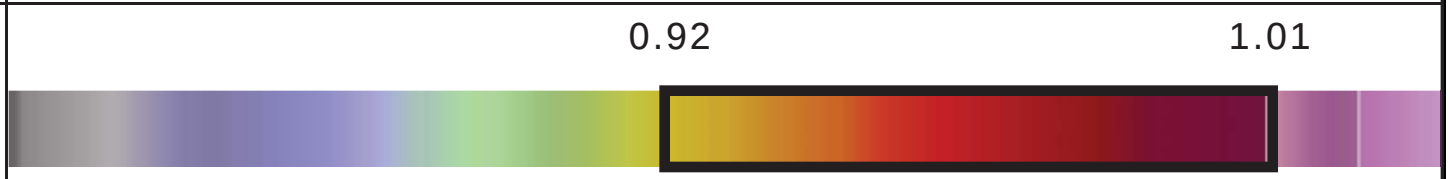
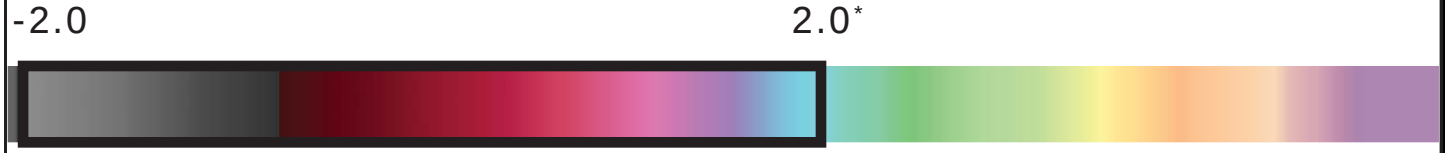
Hail and Hail-Rain Mixtures

When hail is present, Reflectivity values are high. Correlation Coefficient is generally lower than with liquid precipitation alone, with extremely low values a possible indication of very large hail stones (i.e., larger than golf ball size hail). Dry, frozen hailstones usually have Differential Reflectivity and Specific Differential Phase values near zero. Smaller hail, when melting, is covered with water and has Differential Reflectivity and Specific Differential Phase values similar to heavy rain.

Reflectivity (dBZ)	
Correlation Coefficient	
Differential Reflectivity (dB)	 * Differential Reflectivity values will be near 0-1 dB when hail is frozen, but may be significantly higher when smaller hail melts
Specific Differential Phase (deg/km)	 * Specific Differential Phase values will be low when liquid content is low, but could be high when smaller hail melts and sheds liquid drops

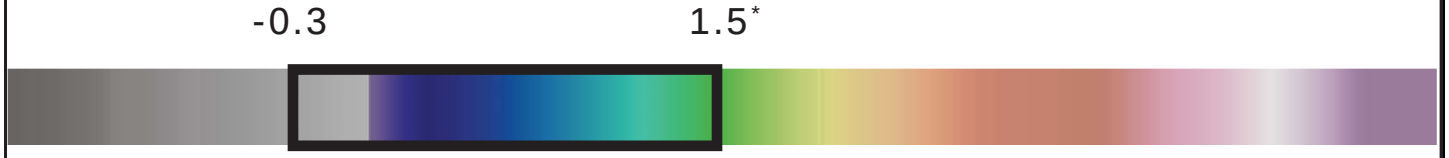
Graupel

Graupel will look similar to hail on a dual-polarization radar. Reflectivity values are lower and Correlation Coefficients are generally higher than with hail. Dry graupel will usually have Differential Reflectivity and Specific Differential Phase values near zero. As graupel melts, it will be covered with water and have Differential Reflectivity and Specific Differential Phase values similar to rain.

Reflectivity (dBZ)	
Correlation Coefficient	
Differential Reflectivity (dB)	 * Differential Reflectivity values will be near 0-1 dB when graupel is frozen, but may be significantly higher as graupel melts
Specific Differential Phase (deg/km)	 * Specific Differential Phase values will be low when liquid content is low, but could be higher when graupel starts to melt and sheds liquid drops

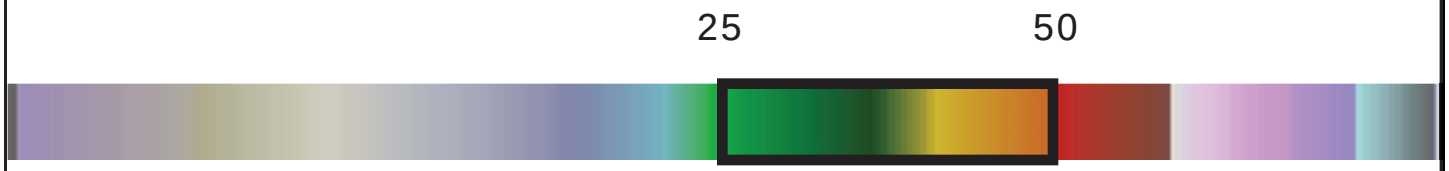
Dry Snow

Dry snow includes aggregated snow flakes devoid of any liquid water coating. Reflectivity is low, while Correlation Coefficient is high. Dry snow will usually have a Differential Reflectivity value near 0-0.5 dB, but can be higher when flakes are less aggregated (i.e., approaching ice crystals). When dry snow starts to melt, expect Reflectivity, Differential Reflectivity, and Specific Differential Phase to increase and Correlation Coefficient to decrease.

Reflectivity (dBZ)	
Correlation Coefficient	
Differential Reflectivity (dB)	 * Differential Reflectivity values will usually be between 0-0.5 dB, but could be higher if snow flakes are less aggregated
Specific Differential Phase (deg/km)	 * Specific Differential Phase values will be low, but may increase as dry snow melts

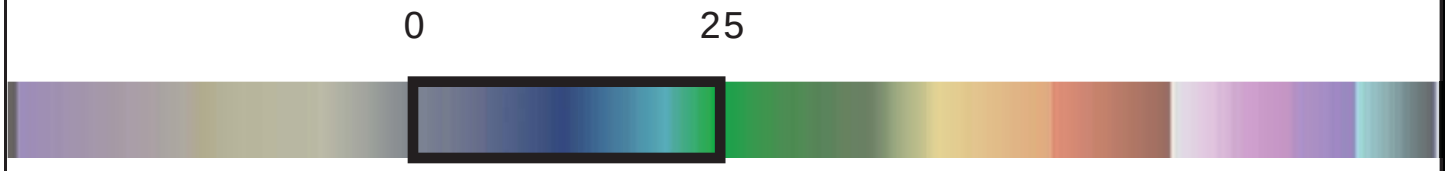
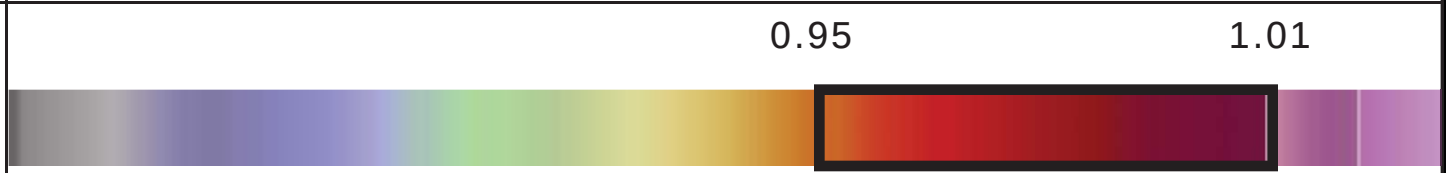
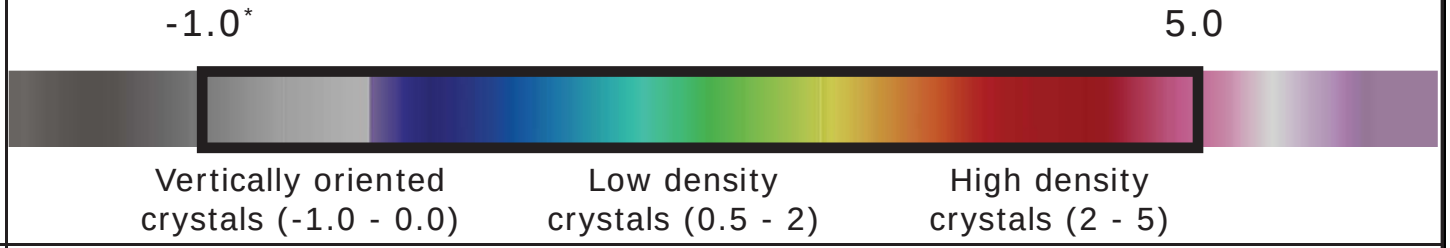
Wet Snow

Wet snow includes areas with water coated snow flakes (i.e., near the wet bulb zero height). Reflectivity values are midrange with Correlation Coefficients values lower than dry snow. Wet snow will also have higher Differential Reflectivity values, usually 1-2 dB. Specific Differential Phase values remain low with wet snow. When wet snow starts to melt, expect Reflectivity, Differential Reflectivity, and Specific Differential Phase to increase and Correlation Coefficient to decrease.

Reflectivity (dBZ)	
Correlation Coefficient	
Differential Reflectivity (dB)	 * Differential Reflectivity values will usually be around 1-2 dB as long as the snow melt is minimal, but will increase as snow melts more
Specific Differential Phase (deg/km)	 * Specific Differential Phase values will be low, but may increase as snow melts

Ice Crystals

Ice crystals are individual, non-aggregated frozen hydrometeors often found in drier areas of precipitation. Reflectivity is low, while Correlation Coefficient is high. Differential Reflectivity values are often high, but values depend on the density of the dominant crystals (i.e., density typically increases from needles to columns to plates). Likewise, Specific Differential Phase values will be low with dry snow.

Reflectivity (dBZ)	
Correlation Coefficient	
Differential Reflectivity (dB)	
Specific Differential Phase (deg/km)