Comparison of Observations from the GPM Dual-frequency Precipitation Radar and the NEXRAD & CASA Radars over the Dallas-Fort Worth Region

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The Global Precipitation Measurement (GPM) core satellite was launched by NASA and JAXA as a joint mission after the successful Tropical Rainfall Measurement Mission (TRMM) for more accurate observation and measurement of precipitation over a wider range of latitude. This is achieved by a Dual-frequency Precipitation Radar (DPR) on board the GPM core observatory. Operating at the nominal frequency of Ku-band (13.6 GHz) and Ka-band (35.5 GHz), DPR is expected to provide a global picture of precipitation though the dual-frequency observations.

Ground validation of the space based observations from DPR is a critical part of the GPM mission since it helps in evaluation and development of the dual-frequency ratio (DFR) based algorithms used for microphysical retrievals. In this study, we use the well-calibrated ground based dual-polarization radar for validation of the GPM DPR observations and precipitation products. The ground based radar data is collected by the S-band National Weather Service (NWS) Weather Surveillance Radar – 1988 Doppler (WSR-88DP) located in Fort Worth, Texas, as well as the X-band radar network deployed by the center of Collaborative Adaptive Sensing of the Atmosphere (CASA) in Dallas-Fort Worth (DFW) Metroplex. However, direct comparison on a point-by-point basis is very challenging due to mismatch between resolution volumes of the space and ground radar. In addition, the difference in operating frequencies, geometric distortions, attenuation and non-Rayleigh scattering at high frequency, can also introduce errors to the cross comparison studies. To this end, Bolen and Chandrasekar (2002) have proposed a methodology to align TRMM Precipitation Radar (PR) and ground radar measurements, which will be implemented for GPM DPR and ground radar data alignment.

In this paper, detailed comparisons are performed between the ground radar and DPR observations collected during the GPM satellite overpasses over DFW region. The radar reflectivity measurements from GPM DPR will be evaluated quantitatively based on the ground radar observations. In addition, the GPM rainfall products will be evaluated based on the S-band KFWS and X-band CASA dual-polarization radar rainfall estimates. The S-band and X-band data sets are in different temporal resolutions and the impact of temporal resolution on the inter-comparison is also evaluated.