Overview, Update and Science of the GPM Validation Network Radar Database

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Abstract. A critical component of the Global Precipitation Measurement (GPM) Mission validation strategy involves use of dual-polarimetric (DP) ground-based radar (GR) products. Both operational and research DP radars across the U.S. and several international locations are used with coincident GPM dual-frequency precipitation radar (DPR) data in a significant expansion of the original TRMM-based "validation network architecture" (VN; Schwaller and Morris, 2011, J.Tech.). The VN radar databases consist of millions of geometrically matched DPR and GR precipitation volumes. Not only does it serve as a tool for validation of satellite-based precipitation retrieval algorithms and GR calibration but also a valuable resource for precipitation science and for complimenting future convective precipitation-related satellite missions.

Overview of VN

2ADPR (Iguchi et al. 2018)

Attenuation Correction

G.V. Retrievals

Retrieval of GV's (Pippitt et al. 2015)

RainRate

Hydrometeor ID

Quality Control (Pippitt et al. 2013)

Automated

Manual

DPR+GR Volume Matching (Schwaller & Morris 2011)

Years: 2014-2019

Total number of GR bins Matched: 6,339,462

HID=Drizzle/Rain: 36.8%

HID=Ice Crystals/Vert. Ice: 27.2%

HID=Wet Snow: 9.9%

HID=Aggregates: 7.0%

HID=Hail/HDGR: 7.9%

HID=Big Drops: 1.7%

Number of Matched Profiles (DPR+GR): 2,022,983

Stratiform: 75.5%

Convective: 12.8%

Based on "100-in-100" criterion: ≥ 40x40km2 of DPR pixels with rain ≤ 100-km of GR

Validation of Satellite Radar Algorithms

Attenuation Correction (2ADPRv6a)

Rainfall Retrieval (DPR/GMI)

DSD Retrieval (2ADPRv6a)

Before

After

DPR Sensitivity

• About 35% more matched volumes included at 3 dB lower DPR sensitivity threshold

• Very slight reduction in Dm bias

Example of Science Use

• The VN captures both the rich information provided by the GR and higher vertical resolution provided by the DPR. As a result it is being used to improve the representation of microphysical processes in retrieval algorithms.

• The example at left shows a DPR overpass of intense precipitation in northern Oklahoma when the 2ADPR rainfall retrieval was severely underestimated. Using the geo-matched DPR+GR measurements, we find a relatively large portion of the DPR profile consists of graupel/hail. Such information can help better identify and correct for such multiple scattering effects.

Coming Soon... Vertical Motion

3-D winds will be added to the DPR-GR matchups in the VN database.

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