Current status of the calibration for the GPM DPR

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The Global Precipitation Measurement (GPM) mission is an international collaboration mission between the United States and Japan to observe global precipitation using a GPM Core Observatory satellite and some collaborating satellites. The GPM Core Observatory, which was successfully launched in 2014, carries the Dual-frequency Precipitation Radar (DPR) and the GPM microwave imager (GMI).The mission requires that the DPR, which is composed of the Ku-band precipitation radar (KuPR) and the Ka-band precipitation radar (KaPR), be calibrated within ±1 dB because the estimation of precipitation rate depends significantly on the calibration. The calibration method basically follows the method that was used to calibrate the Precipitation Radar (PR) onboard the Tropical Rainfall Measuring Mission (TRMM) satellite. However, both the hardware and data processing method for calibration are improved by taking advantage of the lessons learned from the PR’s calibration. For instance, as to the estimation of radar’s antenna pattern, the effective beamwidths were determined by assuming an antenna pattern created by the Taylor distribution that was used to design the antennas instead of assuming a Gaussian antenna pattern. Four-year calibration including these improvements provides the new precise parameters of DPR’s calibration, and the analysis of calibration data shows that the DPR’s performance is very stable and that the error in the calibration accuracy is within ±1 dB. The new parameters increased the KuPR’s radar reflectivity factor (Z) by about 1.3 dB and that of the KaPR by about 1.2 dB from the pre-calibrated Z values, and the minimum detectable radar reflectivities were 16.41 dBZ, 20.12 dBZ, and 14.66 dBZ for KuPR, matched beam of KaPR and high-sensitivity beam of KaPR, respectively. The calibration methods were applied to the re-examination of the PR’s calibration. After applying the new calibration methods to both DPR and PR, normalized radar cross sections ($\sigma 0$) from the DPR and PR agree with each other.

