

## **A new GSMP MWI algorithm considering the frozen precipitation depth and the convective precipitation fraction**

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We investigated the relationship between the precipitation bias of the conventional GSMP GMI retrievals and the DPR precipitation characteristics and other factors. The results show that the precipitation bias is highly correlated with the frozen precipitation depth (FPD). The larger the convective precipitation fraction (ratioCP), the larger the variation of the precipitation bias.

Based on this, we developed a new GSMP algorithm that considered FPD and ratioCP. We estimated index of FPD from the temperature lapse rate and relative humidity in the middle and lower troposphere and index of ratioCP from the index of FPD, the non-uniformity of precipitation, and the GMI polarization difference at 89 GHz. Then, using the index of FPD, we introduced the variation of precipitation profile and density of frozen precipitation particles in the forward calculation part. Precipitation retrievals were statistically corrected using the ratioCP and FPD indices for each pixel.