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Tropical cyclone rainfall retrieval algorithm for passive microwave radiometers based on a-priori databases considering various microphysical assumptions.

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Physically based rainfall retrieval algorithms for passive microwave radiometers usually depend on the quality of a-priori information including assumptions on microphysical properties and distributions of hydrometeors. This study makes a-priori databases based on various microphysics (MP) schemes from the Weather Research and Forecasting (WRF) model. The tested MP schemes include Thompson, Morrison two moment, WRF Double Moment (WDM6), National Severe Storms Laboratory 2 moment (NSSL-2), and Thompson aerosol aware schemes. Emission and scattering signals in the databases were simulated by considering microphysical properties of hydrometeors including hydrometeors' density and size distributions for each scheme. The simulated radiometric signatures are then compared with the observation data from the Global Precipitation Measurement (GPM) Microwave Imager (GMI) for several tropical cyclones. Rainfall retrievals for the tropical cyclone cases are also performed with different MP scheme-based databases. In comparison with the GPM Dual frequency Precipitation Radar (DPR) rainfall data, results show that better matching rainfall intensity tends to be produced by WDM6-based a-priori database for weak to moderate rainfall regions, and by Thompson and Thompson aerosol aware schemes-based databases over strong rainfall regions. However, this study suggests it is incomplete to use only one MP scheme for constructing a-priori database, but rather a variety of microphysical assumptions should be taken into account to describe various characteristics of precipitating cloud systems.