Improving Precipitation Retrieval by Brightness Temperature Temporal Variation ($\Delta T_B$): Definition, Computation, and Application

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Current microwave precipitation retrieval algorithms utilize the instantaneous brightness temperature ($T_B$) from a single satellite to estimate the precipitation rate. This study proposed to add the time-dimension into the precipitation estimation process by using the $T_B$ (or emissivity) temporal variation ($\Delta T_B$ or $\Delta e$) derived from the Global Precipitation Measurement (GPM) microwave radiometer constellation. Results showed that (1) $\Delta T_B$ can improve the precipitation estimation over the cold surfaces (i.e., snow-covered region) through minimizing the microwave land surface emissivity’s influence; (2) $\Delta e$ under the clear-sky conditions can accurately estimate the daily rainfall accumulation; and (3) $\Delta T_B$ can be used to identify the liquid raindrop signature over the low surface emissivity areas. This study highlights the importance of maintaining the current passive microwave satellite constellation.