

## **Improving microwave precipitation retrieval using total lightning data: A look into GOES-R and GPM multisensor and multiplatform era**

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Distinct features of cloud-precipitation structures and properties are being observed from a variety of satellite instruments nowadays. Each of these satellites provides valuable information about cloud processes with different degree of strengths. A combination of multi-platform and multi-sensor satellite observations can provide a more complete view of the precipitation processes and aid the procedure of rainfall retrievals.

GOES-R major weather instruments will be the Advanced Baseline Imager (ABI) and the Geostationary Lightning Mapper (GLM), defining remarkable advances in spatial, temporal and spectral resolutions from today's satellite constellation. GOES-R ABI rainfall algorithm requires microwave-based rain rates as a calibration target, where the upcoming Global Precipitation Mission (GPM) satellite will be of great value. The microwave rainfall retrievals have their own shortcomings and, therefore, the better the microwave rain rate estimates the better will be the ABI estimates. Microwave signals are sensitive to the presence of ice which is the key parameter for lightning generation. Lightning activity is also a good indicator of deep convection, which in turn is a good indicator of convective rainfall. The main difficulty of microwave rain retrievals relays in distinguishing convective and stratiform precipitation from a cold-iced cloud top point of view. In this matter, collocated total lightning observations can improve the microwave segregation of precipitation in convective and stratiform, and also refine the rainfall retrievals necessary for the GOES-R quantitative precipitation estimation.

We propose to improve the GPM microwave convective-stratiform index (CSI) by using the GLM total lightning measurements to provide a constraint on the CSI. To achieve this goal, we use TRMM Microwave Imager (TMI) and Lightning Imaging Sensor (LIS) as proxy data for GPM and GLM, respectively. Currently, the TMI CSI is trained against the TRMM Precipitation Radar (PR) rain type using radiometer radiances and polarization inputs as predictors described in the background. The PR has the advantage of higher resolution and the ability to actively

sense precipitation through the depth of the column. The LIS sensor operates as a lightning event detector, where several events are grouped in space and time to determine a “flash”. Flash initiation rate is related to the recharging rate of a local electric field, which happens most readily where active inter-hydrometeor charge separation is taking place, i.e., in deep convective cores. The total flash and group footprint are related to the overall flash extent, and so may indicate important information about ice hydrometeor trajectories into stratiform or anvil regions. Based on this reasoning, we will examine, in conjunction with the TMI and PR co-located data, LIS centroid densities and extents of flashes and groups, as well as density of events, total radiances from events and flashes, and group-flash and radiance-flash rates. Determination of final CSI predictors based on top contributors will be made.