

Optimizing Channel Selection for Passive Microwave Precipitation Measurement: A GPM Study
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The Global Precipitation Measurement Mission (GPM) has exceeded 10 years in operation, building a legacy of unprecedented advances in understanding the global distribution and characteristics of rain and snow. The GPM core satellite, with coincident active dual-frequency radar and passive microwave radiometer ranging from 10-183 GHz, acts as the cornerstone of this mission, providing a calibration source for radiometers of opportunity and allowing for a consistent global precipitation product every 30 minutes. The resulting 10-year dataset offers unique applications for optimization of global passive microwave retrievals, using the coincident radar as a local comparison. Considering precipitation mapping in the 2030 timeframe, a key future issue will be the character of the constellation members. To date, smaller radiometers such as TROPICS as well as commercial contributions have been limited to the higher frequency microwave channels. While these PMW channels present excellent opportunities for understanding clouds, ice, and snow, the relationships to precipitation are more indirect than for lower-frequency channels, and therefore more uncertain, which will have an effect on global precipitation mapping as well as applications value. In this work we quantify how lower-frequency window channels (particularly 19, 37, and 90 GHz) provide key information that underpins accurate retrievals across a range of global climatic zones, using the GPM core satellite. A Bayesian retrieval scheme is employed and results computed using variable channel selection. These are then compared as a function of surface type, meteorology, intensity, and other environmental parameters, as well as for specific events such as a tropical storm. Results indicate that removing the lower frequencies decreases correlations with radar values by 0.3-0.4 over the oceans and up to 0.25 over land. This work aims to provide information to aid in planning for the future constellation in a way that emphasizes Earth system science and applications continuity.