Origins of heavy precipitation biases in the TRMM PR and TMI products assessed with CloudSat and reanalysis data

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This study aims to characterize the background physical processes in the development of heavy precipitation clouds over the global tropics. The properties were characterized in the way of TRMM active and passive sensor identify heavy rainfall. The combined global observation data from the TRMM, CloudSat, and ECMWF Reanalysis (ERA) Interim datasets from 2006-2014 were utilized in the analysis. Heavy rainfall events were extracted from the top 10% of the rain events from the PR and TMI rain-rate climatology. Composite analyses of CloudSat and ERA-Interim were conducted to identify the detailed cloud structures and the background environmental conditions. Over tropical land, TMI tends to preferentially detect deep isolated precipitation clouds for relatively drier and unstable environments, while PR identifies more organized systems. Over the tropical ocean, TMI identifies heavy rainfall events with notable convective organization and clear regional gradients between the western and eastern Pacific Ocean, while PR fails to capture the eastward shallowing of convective systems. The PR-TMI differences for the moist and stable environments are reversed over tropical land.

Keywords: Heavy rainfall, TRMM biases, Precipitation organization

