This dissertation deals with the radiometric calibration of a satellite microwave radiometer known as the TRMM Microwave Imager (TMI), which operated on NASA’s Tropical Rainfall Measuring Mission (TRMM). This multi-frequency, conical-scanning, passive microwave, remote sensor measures the earth’s blackbody emissions (brightness temperature, Tb) from a low earth orbit and covers the tropics (±35° latitude). The original scientific objective for TRMM’s 3-year mission was to measure the statistics of rainfall in the tropics. However, the mission was quite successful, and the TRMM was extended for greater than 17 years to provide a long-term satellite rain measurements, which has contributed significantly to the study of global climate change.

A significant part of the extended TRMM mission was the establishment of a constellation of satellite radiometers that provides frequent global rainfall measurements that enable severe storm warnings for operational hazard forecast by the international weather community. TRMM played a key role by serving as the radiometric calibration standard for the TRMM constellation microwave radiometers.

The objective of this dissertation is to improve the radiometric calibration of the TMI and to provide to NASA a new robust, physics-based algorithm for the legacy data processing of the TRMM brightness temperature data product, which will be called TMI 1B11 V8. Moreover, the results of this new procedure have been validated using the double difference techniques with the Global Precipitation Mission Microwave Imager (GMI), which is the replacement satellite mission to TRMM.

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The public is welcome to attend.