The Tropical Rainfall Measuring Mission (TRMM), launched in late November 1997 into a low earth orbit, produced the longest microwave radiometric data time series of 17 years from the TRMM Microwave Imager (TMI). The Global Precipitation Measuring (GPM) mission is the follow-on to TRMM, designed to provide data continuity and advance precipitation measurement capabilities. The GPM Microwave Imager (GMI) performs as a brightness temperature (Tb) calibration standard for the intersatellite radiometric calibration (XCAL) for the other constellation members, and before GPM was launched, TMI was the XCAL standard.

This doctoral dissertation aims at creating a consistent multi-decadal Tb data record that ensures a consistent long-term precipitation record that covers TRMM and GPM eras. As the TMI and GMI share only a 13-month common operational period, the Naval Research Lab’s WindSat radiometer, launched in 2003 and continuing today provides the calibration bridge between the two radiometers. The TMI/WindSat XCAL for their >9 years period (2005–2014), and WindSat/GMI XCAL for one year (CY 2015) are performed using a robust XCAL Double Difference (DD) technique to estimate the Tb bias of one relative to the other. The 3-way XCAL of GMI/TMI/WindSat for their joint overlap period is performed using an extended XCAL DD technique. Thus, a multi-decadal oceanic Tb dataset will be created. Moreover, an important feature of this dataset is a quantitative estimate of the Tb uncertainty derived from a generic uncertainty estimation model (UEM). In the UEM, the overall uncertainty is first partitioned into separate and independent sources. Next, uncertainties from various source is quantified using different methods. Finally, the estimated individual independent uncertainties are combined into a single overall uncertainty using the root sum squared method. This dissertation work is remarkably important because it provides the science community with a consistent oceanic multi-decadal TMI-GMI Tb data record, and also allows the science community to better understand the uncertainty in precipitation products based upon the Tb uncertainties provided.

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The public is welcome to attend.