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Inter-calibrating brightness temperatures of a constellation of radiometers

E. Stocker (1), W. Berg (2), C. Kummerow (2), J. Stout (3)
(1) NASA/GSFC Code 610.2 (2) Colorado State University (3) George Mason University

In 2010, the National Aeronautics and Space Agency (NASA) of the U.S.A. and the Japanese Exploration Agency (JAXA) of Japan in cooperation with other U.S. and international partners will launch the Global Precipitation Measurement (GPM) mission. The mission center-piece is a core U.S. provided satellite holding a scanning microwave imager provided by the U.S. A. and a dual-frequency precipitation radar provided by Japan. The core satellite is in a 65 deg inclination (the current Tropical Rainfall Measuring Mission -TRMM is in a 35 deg inclination). Joining the core satellite are a constellation of approximately 8 satellites containing scanning radiometers. The purpose of the constellation is to increase the global sampling capability of the mission. One constellation satellite will be provided by NASA. Some of the constellation radiometers will provided by other U.S. agencies with existing (e.g. SSMI/S) or planned (NPOESS) radiometer assets. International groups have also expressed interest in contributing to the GPM mission including providing radiometer data for the GPM constellation.

The use of a heterogeneous group of scanning radiometers each with its own unique purpose, characteristics and calibration offers a significant challenge for combining brightness temperatures or rain retrievals to create meaningful combined global radiometer products. However, the availability of active dual precipitation radar on the GPM core in combination with a well-calibrated radiometer on the same platform offers the possibility of inter-calibrating the constellation radiometers using the core satellite as a calibrator. This paper describes a joint NASA/GSFC and Colorado State University prototype effort at inter-calibrating existing radiometers using such a “core” calibrator approach. In the prototype, existing radiometers (i.e. SSM/I and AMSR-E) are inter-calibrated, as required, using the TRMM Precipitation Radar (PR) and TRMM Microwave Imager (TMI) as the calibration core.

This prototype includes four basic steps: provide the data in a normalized-common logical radiometer format, convert all data to a granule that stops and starts at the southernmost latitude rather than at the equator, perform basic processing and finally inter-calibrate the radiometers with the TRMM “core” as appropriate. Basic processing includes quality control, cross-track bias correction as well as the core action of converting Ta to Tb. The purpose of the inter-calibration step is to provide consistent brightness temperatures for the various SSM/I sensors, TMI and AMSR-E. The C appended to the level of the product indicates “common” brightness temperature (Tc). The paper provides a summary of each of these actions. The details of the processing as well as data format and tools can be obtained by connecting to the website at mrain.atmos.colostate.edu/LEVEL1C.