Geophysical Research Abstracts, Vol. 8, 09356, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09356

Development and validation of the DPR products for GPM

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After the great success of the Tropical Rainfall Measuring Mission (TRMM), Global Precipitation Measurement (GPM) started as an international mission and follow-on mission of the TRMM project to obtain more accurate and frequent observations of precipitation. The accurate measurement of precipitation will be achieved by the Dual-frequency Precipitation Radar (DPR) installed on the GPM core satellite. DPR on the GPM core satellite is being developed by Japan Aerospace Exploration Agency (JAXA) and National Institute of Information and Communications Technology (NICT). The core satellite is planned to be launched in 2010.

JAXA/EORC is responsible for the algorithm development for precipitation estimation and the quality of the products. We are now discussing the Japanese GPM products. JAXA is in charge of developing GPM/DPR algorithms as the sensor provider and we will mainly focus our efforts on DPR algorithm development. We also have to take part in producing and delivering 3-hourly global precipitation map in order to make useful for various research and application areas, (i.e., the prediction of the floods). To secure the quality of estimates, the mission must place emphasis on validation of satellite data and retrieval algorithms. It must be directly linked to algorithm development. This is a very difficult issue and needs careful consideration and strategy.

Japanese calibration and validation activities will focus on DPR in GPM. One of the important findings in TRMM validation is that simple conventional rain data comparison is not enough. We need validation for radiometrically consistent rain retrievals.

The required data might be very similar to those required from microwave radiometer algorithms. The detailed comprehensive three-dimensional precipitation structure is required. For DPR, the so-called surface reference technique could be more complicated and improved from TRMM PR. The surface backscattering cross sections should also be measured. For the surface observation, dense gauge network is essential. From the comprehensive observations, a simulation of satellite measurements can be performed using forward calculations. Rain profiling algorithms for DPR and GMI can be applied to the simulated measured quantities, such as measured radar reflectivities at two wavelengths, microwave brightness temperatures. Comparing the results, error characterization could be performed. Another advantage of this method is that the simultaneous observation of precipitation from both ground and space is not required. TRMM experience tells us that simultaneous rain observation is only about once a month at one ground site. The above concept is different from a simple conventional end-to-end direct comparison.

The validation methodology for three-hourly rain mapping from constellation is different from the instantaneous estimates. For the TRMM case, comparisons with other ground/space data, such as GPCP data were performed. Similar methodology is expected for GPM. For the surface observation, dense gauge network is essential. The spatial and temporal matching in space and ground observations is critical. For the upscaling of the GV site observation not only in space but also in time, the super site and/or dense gauge networks should be embedded in the operational radar/raingauge networks.