Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

ACG09-P02 Room:Convention Hall Time:May 27 18:15-19:30

Improvement of GSMaP with multi-channel geostationary meteorological satellite observation for oceanic precipitation

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The Global Satellite Mapping of Precipitation (GSMaP) produces accurate precipitation data with high time and spatial resolution (per 1hour, 0.1 degree) by utilizing the satellite microwave radiometer. At the time and place which all microwave radiometer satellites are not available, the GSMaP estimates where the precipitation area observed before that time will moves by using a cloud moving vector retrieved from the infrared brightness temperature (IR Tb) observed by the geostationary meteorological satellite (GMS). However this method has some possibility of mistaking a destination of precipitating cloud with vertical shear of environmental wind, and uses only IR1 channel of the GMS observation to calculate the cloud moving vector. Therefore, we made a new data which can estimate precipitation probability globally with high temporal and special resolution by using IR1 and water vapor (WV) channel of GMS observation, called precipitation potential map (PPM), and then improved the accuracy of GSMaP precipitation areas by utilizing the PPM (JpGU meeting, 2014).

Since it is difficult to distinguish small precipitating cumulus from non-precipitating stratus only with cloud top height information obtained from IR1 and WV channels, the past PPM has low accuracy of estimating precipitation area for low cloud. Therefore this study first tried to improve the accuracy of PPM for low cloud by adding multi-channel information obtained from Meteosat Second Generation (MSG2). The utilization of GMS multi-channel observation is important from the point of view of preparing next-generation GMS, Himawari-8, Himawari-9, GOES-R series, and Meteosat Third Generation. Next we included the modified PPM into GSMaP precipitation detection algorithm to improve GSMaP precipitation area and precipitation intensity product, and investigated the accuracy of modified GSMaP precipitation product by comparing them with precipitation radar (PR) of Tropical Rainfall Measurement Mission (TRMM) as it is truth. We will intend to explain the result of case study of tracking precipitation system over the ocean under vertical wind shear with modified and non-modified GSMaP. In these areas and conditions, we can expect that the GSMaP estimates the precipitation area more accurately by utilizing the potential map. In these circumstances, we can expect that the GSMaP precipitation estimation becomes more accurate by utilizing the PPM.

We used five geostationary satellites, MSG2, METEOSAT, GOES-West, GOES-East, and MTSAT-1R. All geostationary satellite data is released from the Center for Environmental Remote Sensing, Chiba University (CEReS). Global Satellite Mapping of Precipitation (GSMaP)_MVK and GSMaP_NRT (v6.000.0) was used as satellite observation of precipitation with the microwave sensor. The GSMaP products are produced by Earth Observation Research Center (EORC) in Japan Aerospace Exploration Agency (JAXA). We used near surface rain observed by the precipitation radar of the Tropical Rainfall Measurement Mission (TRMM PR; 2A25, V7) as truth.

Keywords: geostationary meteorological satellite, precipitation, GSMaP