The upsampling technique for the GSMaP by the new generation IR images of geostationary satellites

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The GSMaP is one of the most reliable global precipitation map made from microwave radiometers (MWRs) on low earth orbit and infrared radiometers geostationary weather satellite (GWS). A time and spatial resolution of the current GSMaP is a one-hour and 0.1-degree grid, respectively. A MWR on low-earth orbit go around once or twice in an hour. A MWR scan width is several hundred kilometers. A MWR cover region is limited in an hour. Thus, satellite base precipitation map uses many MWRs. However, there are gaps in earth coverage of PMWs in one-hour. The GSMaP algorithm fills the gaps from GWS Infrared (IR) image data. The GSMaP use the NOAA NCEP/CPC unified global IR dataset as the purpose. The IR dataset is globally unified calibrated and constantly produced by real time, But the IR dataset include only single,11-micrometer-wavelength IR channels. The new GWS is launched or planned in current. The Himawari-8 and 9 and the GOSE-R series are already operated. The new-generation Meteosat is developing. The new GWS’s sensors have many channels and higher special and temporal resolution than old sensors. Near future the new GWS sensor will cover whole globe.

Precipitation is main source of pure water. Precipitation amount information is primitive data for human activity, ground observation provide good quality and short term interval data. ground observation is not cover whole region, such as ocean, mountainous region, and developing country. Disaster control requested more high-spatial-resolution precipitation information than satellite-based precipitation maps.

The final goal of our research is to develop high resolution technique for the GSMaP. The algorithm uses information of the new GWS sensors. We are developing the algorithm in two steps. The first step is an spatial up sampling of the GSMaP. The step uses high-spatial-resolution IR brightness temperature(TB) images in multichannel. The technique makes arbitrary resolution precipitation map from IR signals. Next, the technique combines the previous time step precipitatiop map of the current GSMaP MVK and IR precipitation by the Kalman filter. The second step is a short-term moving precipitation by the atmospheric motion vector (AMV). The AMV is information of wind speed and direction, The step estimates next-time-step precipitation map from previous time precipitation map by the kalman filter.

In this study, we apply the algorithm the GSMaP MVK and the Himawari-8 data. The Himawari-8 data are available every 2.5 minutes in Japan region. Our method estimates precipitation map by the IR-TBs of Himawari-8. We estimate precipitation from the IR signals, hereafter IR precipitation, by a look up table. The look up table was made from IR signals and ground radar data.

The result of the technique shows reduces rain error in radar rain pixels. The detection of rain pixels is improved. The amount of estimated rain is, however, underestimation. False rain pixels are increase. The cause of the degrades is detection of the IR precipitation. IR precipitation has many false rain pixels and is large under estimation. Thus, the high-resolution precipitation includes many false rain pixels. If IR precipitation is improved, if the IR estimation is better result, the technique will lead better high-resolution precipitation map.