Algorithm for rainfall rate from AMI onboard GEO-KOMPSAT-2A satellite: Replacing proxy a-priori databases with AMI observation

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An operational rainfall rate algorithm has been developed for the Advanced Meteorological Imager (AMI) onboard the GEO-KOMPSAT-2A (GK2A), the second Korea's geostationary satellite, launched in December 2018. The rainfall rate algorithm uses the a-priori information including the microwave rainfall data from the low-earth orbiting satellites and infrared (IR) brightness temperatures from geostationary satellites. The algorithm may better perform with a variety of a-priori information describing all possible precipitating systems. In addition, separation of physically different precipitating systems likely to improve the accuracy of retrieval process. However, it has been well known that such the separation can be hardly achieved based on the measurements of cloud top temperatures. This algorithm tried to utilize the radiative characteristics observed differently for different wavelengths in IR spectral regions. The characteristics include the different emissivity as a function of wavelength and cloud thickness. Using the brightness temperature difference (BTD) between IR channels the algorithm determines the thresholds of the BTDs discriminating two types of precipitating clouds: shallow and non-shallow types in reference to the Global Precipitation Measurement Dual-frequency Precipitation Radar (DPR) level 2 data. Non-shallow clouds are further classified into four cloud types including: non-shallow-tall-cold, non-shallow-tall-colder, non-shallow-taller-cold, and non-shallow-taller-colder clouds. In addition to the separation of cloud types in the databases, the algorithm also uses databases classified by latitudinal bands. The bands are separated with four latitudinal zones. The separation of database based on latitudes may have an effect of distinguishing the cloud types that can occur regionally. The a-priori databases are thus classified with 20 different categories. Once the a-priori databases are constructed, the algorithm inverts the AMI IR brightness temperatures to the surface rainfall rate based on a Bayesian approach. The Bayesian approach has advantages on using multi-channel brightness temperatures simultaneously and utilizing the probability of rainfall reserved in the a-priori databases. The initial databases were constructed from the Advanced Himawari Imager (AHI) data as a proxy for the AMI before the launch of GK2A. The initial databases in the algorithm have been replaced by those based on one year data of AMI from September 2019 to August 2020. Furthermore, the algorithm tests the databases with four types of clouds classified by Gaussian mixture models. Results for clouds classification and rainfall rate estimation will be discussed.