Seasonal and regional dependence of rain estimation from the Himawari-8

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Rain observation with microwave radiometer satellites is essential to make global rain observation data with high temporal resolution. However microwave satellites cannot cover the global area since the number of them is limited. When all microwave satellites are unavailable, utilization of geostationary meteorological satellites (GMS) with high temporal resolution may lead to improvement of rain estimation. Kühnlein et al. (2014) reported that they could estimate rain with high temporal resolution same as GMS by using a statistical method called Random Forest (RF). The machine learning method associates 10 channels information of brightness temperature observed from METEOSAT Second Generation (MSG-2) GMS to rain observation from ground-based radar in Germany. In this method, first some channels are selected randomly from GMS observations to make a small learning sample for rain / no rain classification, called a classification tree. Then the number of tree is increased in the same way, and finally rain / no rain result is classified by majority of all tree' s results. In addition rain type classification and rain rate estimation are possible in the RF method. In previous study, analysis area was limited in Germany due to the limit of ground-based radar observing range, but this study applied the RF method to the third generation GMS, Himawari-8, which can cover the East Asia region widely. Moreover we used precipitation radar of the Global Precipitation Measurement (GPM) main satellite instead of the ground-based radar used by the previous study for the truth of rain. As a result we can estimate rain only from satellite observation and expanding the analysis area to not only mid-latitude region but also tropics.

As compared with Europe region in the previous study, the East Asia region analyzed in this study has various seasonal changes. Therefore this study analyzed seasonal and regional dependence of accuracy in the Himawari-8 –GPM rain product. As a result, accuracy of rain area estimation was higher in JJA including rainy season, and was lower in DJF including snowfall. Accuracy of rain rate estimation was higher in MAM and SON including frontal rain, but was lower in JJA including frequent heavy rain and JDF including snowfall. Moreover we applied the machine learning only in sub-tropic region, and then accuracy of both rain area and rain rate estimation was most high, this result suggested that it was important to limit the learning sample into particular rain system for improvement of rain estimation. In the sub-tropic ocean or summertime land region, Himawari-8 –GPM rain product can detect very smaller rain than a few km scale which is difficult to detect by microwave sensor of the GSMaP. This result shows an advantage of high spatial resolution of the Himawari-8 –GPM rain product.

Himawari-8 GMS data is released from the Center for Environmental Remote Sensing, Chiba University. We used near surface rain observed by GPM (Ku PR) and rain intensity observed by ground-based radar in the Japan Meteorological Agency as the truth of Rain

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