

Validation of GOSAT cloud judgement by using Himawari-8 data

*Kitamura Katsuki¹, Naoko Saitoh²

1. Chiba University Graduate School of Science and Engineering Division of Earth Environmental Science , 2. Center for Environmental Remote Sensing Chiba University

In the retrieval processing of greenhouse gases from the Thermal and Near Infrared Sensor for Carbon Observation (TANSO)–Fourier Transform Spectrometer (FTS) on board Greenhouse Gases Observing Satellite (GOSAT), cloud contamination in the field of views (FOVs) of TANSO–FTS has been judged by TANSO–Cloud and Aerosol Imager (CAI) in the daytime and by the thermal infrared (TIR) band of TANSO–FTS in the nighttime. This study has compared the cloud detections in the TANSO–FTS FOVs by TANSO–CAI or TANSO–FTS TIR band with cloud detections by the Advanced Himawari Imager (AHI) on board Himawari–8.

For each of all TANSO–FTS observations over the ocean in January and July in 2016, we first selected all coincident Himawari–8 data when their center positions were located in the TANSO–FTS FOVs and they were obtained within one minute before or after the TANSO–FTS observations. Next, we conducted cloud detection tests for each of the selected Himawari–8 data based on their reflectance and brightness temperature values, and then judged each of TANSO–FTS FOVs as a clear or cloudy scene by combining the cloud detection tests of the Himawari–8 data in the TANSO–FTS FOVs.

About 90% of cloud judgements by TANSO–CAI and Himawari–8 agreed with each other. TANSO–CAI used only reflectance data in visible bands for their cloud detections, whereas Himawari–8 used both reflectance and brightness temperature data in visible and infrared bands, respectively, which may cause their ~10% disagreements. In contrast, agreements in cloud judgements between TANSO–FTS TIR band and Himawari–8 got worse by 13–20% compared to the TANSO–CAI and Himawari–8 cloud judgements. This is because that the FOVs of TANSO–FTS (10.5 km) is larger than those of TANSO–CAI and Himawari–8 (0.5 km and 2 km), and cloud detections by TANSO–FTS TIR band used only brightness temperature data.

In addition, GOSAT cloud judgements (TANSO–CAI or TANSO–FTS TIR band) tended to judge TANSO–FTS FOVs as “clear”, whereas Himawari–8 judged the same TANSO–FTS FOVs as “cloud” in most cases of disagreements in their cloud judgements. This is partly because of “clear conservativeness” of our cloud detection algorithm by Himawari–8. As for TANSO–FTS FOVs judged as “clear” by TANSO–FTS TIR band and “cloud” by Himawari–8, small-scale clouds partly existed in the TANSO–FTS FOVs judging from relatively low brightness temperature values of the coincident Himawari–8 data. This suggests the possibility that TANSO–FTS TIR band cannot detect such small-scale clouds.

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