EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

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SPACE-BASED CARBON MONITORING BY GOSAT AND GOSAT-2: LESSONS AND LEARNED FROM GOSAT IN-ORBIT OPERATION AND TOWARDS BETTER ACCURACY OF XCO2 OBSERVATION

Abstract

To observe the global column concentration of carbon dioxide (CO2) and methane (CH4) from space, the Greenhouse gases Observing SATellite (GOSAT) was launched on January 23, 2009, and has started the operational observation. Thermal and Near Infrared Sensor for Carbon Observation – Fourier Transform Spectrometer (TANSO-FTS) has been continuously measuring CO2 and CH4 distributions globally, and the retrieved column CO2 and CH4 data have been distributed to the public. Over four-years operational periods, the useful scientific data sets and interesting articles for carbon source/sink evaluation were produced and published, and these results have been supporting to well understanding of carbon cycle. Currently, the importance of space-based carbon observation has been approved and desired the continuous observation in toward. Through the TANSO-FTS operation with the radiometric, geometric and spectroscopic characterizations, we learned how to improve the accuracy of XCO2 and XCH4 based on FTS. The correction procedures for micro-vibration from companion components, non-linear response of analogue and digitizing circuit are key role on the current on-board operating TANSO-FTS. These procedures were applied on operational level-1 processing algorithm. On instrumental aspects, the robustness and reliability will be required on the future mission to obtain the better spectral quality, and it will be able to lead more accurate XCO2 and XCH4 retrievals. The current retrieval accuracy of XCO2 by GOSAT spectra is around 2 ppm, which is determined by comparing with ground- and aircraft- sampling measured dataset. It suggests that the accuracy of space-based carbon observation is much smaller than 4 ppm of the GOSAT mission target. The improvement of retrieval algorithm for XCO2 and XCH4 is also important both of the accuracy and the processing speed. To elucidate the carbon cycle more precisely, our experiences have to be summarized and applied in the future missions. To continue and improve the space-based carbon monitoring, the conceptual design work of GOSAT-2 has been started. The science and technical highlight of GOSAT and the preliminarily design of GOSAT-2 will be presented with current status.