

Space-based Carbon Monitoring by GOSAT and GOSAT-2: Towards better accuracy of XCO₂ and XCH₄ observation

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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 X_{CO₂} and X_{CH₄} based on short-wavelength 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 improvements will be required on the future mission to obtain the better spectral quality, and it will be able to lead more accurate X_{CO₂} and X_{CH₄} retrievals. The current retrieval accuracy of X_{CO₂} 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 X_{CO₂} and X_{CH₄} 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.

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