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(Session) A095 - Remote Sensing of CH_4 and CO2 from Space: the Expanding Observing System

(Authors) A. KUZE, Y. NAKAMURA, N. KIKUCHI, T. Oda, F. Kataoka, H. Suto, K. Shiomi, S. Matsuo, M. Matsuda,

(Title) Estimating emissions over global megacities using partial-column density product of the lower-tropospheric CO_2 from long-term GOSAT target observations

(Full abstract, 2000 characters)
The Thermal And Near-infrared Sensor for carbon Observation Fourier-Transform Spectrometer (TANSO-FTS) onboard the Greenhouse gases Observing SATellite (GOSAT, 2009-prsent) has been collecting soundings over global megacities by using a two-axis agile pointing system. The TANSO-FTS has a multiplex advantage of acquiring reflected sunlight with two orthogonal polarizations in the three narrow spectral bands of 0.76 μm, 1.6 μm, and 2.0 μm. It simultaneously measures thermal emissions over a wide thermal infrared band with the same footprint as other bands. From these collected spectra, we retrieved the partial-column densities of carbon dioxide (CO_2) in the lower (LT, typically 0- 4 km) and upper (UT, typically 4- 12 km) (XCO_2^{LT} and XCO_2^{UT}, respectively) troposphere by distinguishing highly polarized aerosol scattering light from the surface reflected light and constraining the total column density of CO_2 (XCO_2). XCO_2^{LT}, which should be more directly affected by the anthropogenic surface emission sources, should be more suitable than regular XCO_2 retrievals for emission analysis. We calculated the concentration enhancements from megacities retrievals of intense target observations and examined the relationship with simulated wind speed in order to provide implications for emission estimates. We demonstrated seasonal and year-to-year XCO_2^{LT} variations over megacities such as Beijing, Riyadh, San Tiago, and Tokyo, where frequent clear skies provide significant amounts of time series of data for analysis. We also compare our emission estimates from correlations between the enhancement and wind speed to the Open-Data Inventory for Anthropogenic Carbon dioxide (ODIAC) inventory. The improved TANSO-FTS-2, onboard GOSAT-2 (2018-present), can specify sampling locations of all the observations and offers an expanded pointing range in the along-track direction. Compared to the first GOSAT, GOSAT-2 can allocate more soundings to target observations and collect more soundings to cover urban areas and their upwind areas. In the presentation, we will also discuss the JAXA's potential roles of our retrieval product and emission analysis in the upcoming Global Stocktake in 2023 and 2028 (GST 2023 and 2028) by the United Nations Framework Convention on Climate Change (UNFCCC).

(Plain-Language Summary)(200 words)
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soundings over global megacities by using a two-axis agile pointing system. The TANSO-FTS has a multiplex advantage of acquiring reflected sunlight with two orthogonal polarizations and thermal emissions with the same footprint. From these collected spectra, we retrieved the partial-column densities of CO_2 in the lower and upper troposphere. We calculated the concentration enhancements from megacities retrievals of intense target observations and examined the relationship with simulated wind speed in order to provide implications for emission estimates. We demonstrated seasonal and year-to-year variations over megacities. We also compare our emission estimates from correlations between the enhancement and wind speed to the ODIAC inventory. The improved TANSO-FTS-2, onboard GOSAT-2 (2018-present), can specify sampling locations of all the observations and offers an expanded pointing range in the along-track direction. GOSAT-2 can allocate more soundings to target observations and collect more soundings to cover urban areas and their upwind areas. In the presentation, we will also discuss the JAXA's potential roles of our retrieval product and emission analysis in the upcoming Global Stocktake in 2023 and 2028 by UNFCCC.