Global and local flux estimation of carbon dioxide and methane by GOSAT satellites

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GOSAT and GOSAT-2 have provided long-term radiance spectral data using Fourier transform spectrometer technology since 2009 and 2018, respectively. With the advantage of FTS multiplexing, they can simultaneously measure carbon dioxide (CO_2) and methane (CH_4) absorption bands of reflected solar light with two linear polarizations and thermal emission. Radiance spectra with two polarizations can distinguish between less-polarized reflections from the Earth’s surface and highly polarized scattering by aerosols and thin clouds. The infrared band can add information to vertical profiles. By combining all these spectra data, partial column densities of the upper (4-12 km) and lower (0–4 km) troposphere can be retrieved, even under thick aerosol regions such as Africa, India, and South Africa. Two-layer vertical information enhances measurements of near-surface emission and uptake and reduces errors in transportation, therefore improving global flux estimation. With two-axis pointing systems, they can target large point sources and mega cities and have enhanced measurements of CO_2 and CH_4. However, local flux estimates by GOSAT may be problematic because of too large a footprint, a lack of proper upwind reference observations, and insufficient wind information. To contribute to the global stocktake of the Paris Agreement, we need a system to observe and estimate local flux from individual source sectors. We will present the status of flux estimation and discuss how to reduce such uncertainties.

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