

# More than a decade of GOSAT and GOSAT-2 operations and data products using their unique capabilities of FTS multiplex advantage and target observations

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JAXA has been operating the GOSAT and GOSAT-2 satellites, which have been measuring two greenhouse gases for more than a decade. Over this period, we have accumulated data on radiance spectra of reflected sunlight with two linear polarizations and thermal emissions, thank to updated Level 1 products with radiance degradation correction and the new solar irradiance data set of the Total and Spectral Solar Irradiance Sensor-1 (TSIS-1) Hybrid Solar Reference Spectrum (HSRS). The release plans for the next versions of GOSAT V300 and GOSAT-2 V220 follow.

Utilizing the multiplex advantages of the FTS, the EORC L2 algorithm retrieves the partial column densities of lower- and upper- tropospheric carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>), at roughly 0- 4 km and 4- 12 km, respectively. Thirteen years of total and partial columns data on 2, 2, and 11 vertical layers of CO<sub>2</sub>, CH<sub>4</sub> and water vapor (H<sub>2</sub>O), respectively, and solar-induced chlorophyll fluorescence (SIF) are available at [https://www.eorc.jaxa.jp/GOSAT/GPCG/download\\_v2/](https://www.eorc.jaxa.jp/GOSAT/GPCG/download_v2/). We have examined the lower-tropospheric CO<sub>2</sub> products from GOSAT target observations to estimate emissions over global megacities.

We started the joint ESA-NASA-JAXA #2 dashboard program to relate the stories about the air we breathe and greenhouse gases as a product of combustion. We apply CO<sub>2</sub> data from multiple instruments on GOSAT, GOSAT-2, and OCO-3, using nitrogen dioxide (NO<sub>2</sub>) as a proxy for anthropogenic CO<sub>2</sub> emissions and SIF from TROPOMI over target megacities such as Cairo, Shanghai, New York City and Tokyo. The Committee on Earth Observation Satellites (CEOS) working group calibration and validation (WGCV) has opened the Vicarious Calibration Portal for Space-borne GHGs Sensors at [https://www.eorc.jaxa.jp/GOSAT/GHG\\_Vical/index.html](https://www.eorc.jaxa.jp/GOSAT/GHG_Vical/index.html). Using a seamless dataset from multiple sensors, we provide satellite data and calibration and validation dataset of the ground, radiosondes, airplanes, methodology, and analysis results to contribute to flux estimation, and data assimilation.

Key words: GOSAT, GOSAT-2, CEOS WGCV, TSIS, EO-Dashboard