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GOSAT operation and data processing toward a decade-long observation in orbit

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Since its launch in January 2009, the Greenhouse gases Observing SATellite (GOSAT) has been leading the observation of greenhouse gases from space. Multiple teams from more than 10 countries have been working on independent CO_2 retrievals, with errors of 2 ppm, over much of the globe. These datasets not only reduce the uncertainty regarding the global CO_2 flux but also detect plant fluorescence using high resolution spectra, presenting patterns of gross primary productivity. This has provided a new viewpoint on the carbon cycle.

After its 5-year designed life operation, GOSAT has enough propellant for orbit control to extend its operation and no significant degradation has been detected in both the satellite-bus systems and mission instruments. In May 2014, one of the two solar paddles stopped its rotation causing a reduction in the power supply, but the solar paddles and four batteries still provide enough power to operate both the Thermal And Near infrared Sensor for carbon Observations Fourier Transform Spectrometer (TANSO-FTS) and the Cloud and Aerosol Imager (TANSO-CAI). From September 2014, the pointing settling down of TANSO-FTS became unstable due to lubricant aging and on January 26, 2015, the primary pointing system was switched to the backup one. After a two-month interval, GOSAT returned to normal operation with target and glint observations. Despite two anomalies in 2014, after calibration and correction in the level 1B data processing, TANSO-FTS has been continuously providing constant-resolution spectra.

After the successful launch of OCO-2 in July 2014, measurements from the two independent instruments can be compared to distinguish common forward calculation errors such as line parameters, aerosol scattering, and ocean glint reflections from instrument-specific errors. This capability provides additional constraints on aerosol scattering, which is the largest uncertainty in CO_2 retrieval from space. During the first 5-year operation in orbit, GOSAT has demonstrated the effectiveness of satellite greenhouse gases (GHG) observation with careful calibration and validation. Now, the GOSAT observation pattern has been modified for new findings that are only possible with satellite measurements. GOSAT has an agile pointing system, permitting a large number of custom targets per orbit at the expense of spatial context. Regional monitoring, such as for CO_2 from mega-cities, CH_4 from oil fields, and volcanic CO_2 by target modes, will help to determine the GHG emissions in more detail. By extending glint observations over the sea, more data can be obtained to compare the off-shore background and densely populated land areas.

Keywords: greenhouse gases, Carbon Dioxide, methane, calibration, mega city, regional emission monitoring