Estimating local GHG emission amount using GOSAT

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High spectral resolution spectrometers such as the Greenhouse gases Observing SATellite (GOSAT) have successfully retrieved column-averaged dry air mole fractions of CO_2 and CH_4 globally with an accuracy of 2 ppm or 0.5% and 13 ppb or 0.7%, respectively. However, spatial coverage is sparse, and a spatial resolution of 10.5 km is not sufficiently high for detecting local greenhouse gas (GHG) enhancement. Several research groups have been trying to estimate the GHG emission amount from different sources, which are not uniformly distributed. To estimate the emission flux quantitatively from space, the satellite footprint should cover an entire emission area to the extent and wind speed information is required. Therefore, a combination of sampling pattern and frequency should be optimized. Here, we discuss the time-scale and seasonal variation of both point and area emission sources.
Using the GOSAT target observation capability with an agile pointing, we demonstrate enhanced GHG measurement associated with (1) extremely high emissions from a gas leak at the north end of the Los Angeles (LA) basin, (2) a widespread megacity and point source at the west end of the LA basin, and (3) seasonal variations in the seven-year data set.
Satellite remote sensing has high precision but usually has bias and requires appropriate proper reference points. We selected three reference points near LA: the Railroad Valley, NV (remote desert); the Armstrong Research Center (desert close to the LA basin); and Catalina Island (isolated ocean). We used the XCO_2 product of ACOS B73 and the XCO_2 and XCH_4 product of RemoteC from GOSAT level 1B V201.202
In this study, we also show the quantification limit obtained from the present GOSAT observation and propose an idea to modify the instrument suite by improving spatial resolution and spatial coverage, adding mapping capability and observing other short lived atmospheric trace species.

Keywords: GOSAT, CH4 Emission, CO2 Emisson, TANSO-FTS, Satellite, Greenhouse Gases