

Vertical profile retrieval of greenhouse gases from GOSAT TANSO-FTS SWIR and TIR spectra

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TANSO-FTS onboard GOSAT is the only sensor that measures Short Wavelength InfraRed (SWIR) and Thermal InfraRed (TIR) spectra at the same time and footprint, providing a unique opportunity to retrieve atmospheric CO₂ and CH₄ concentrations from space. Since the launch of GOSAT in January 2009, TANSO-FTS continues to observe greenhouse gases. Nevertheless, the simultaneous use of SWIR and TIR to extract more information on the greenhouse gas concentrations is limited to theoretical studies (e.g., Herbin et al. 2013).

We have developed a greenhouse gas retrieval algorithm which uses SWIR and TIR simultaneously by adding a TIR module to the existing SWIR algorithm of Kikuchi et al. (2016). The algorithm is now evaluated by analyzing GOSAT measurements over Railroad Valley Playa in Nevada during the vicarious calibration campaigns in 2009-2015 for which various validation data are available including the Alpha Jet Atmospheric eXperiment (AJAX) measurements.

Currently, the gas concentrations are retrieved using a small number of vertical layers (2 layers for CO₂ and 4 layers for CH₄) to reduce the influence of a priori, forward model errors and/or possible L1B spectral biases. An example of the retrieved CO₂ profile is shown in Figure 1 together with the a priori profile (a flat profile of 380 ppm) and the AJAX measurement. Figures 2 and 3 show water vapor and temperature profiles, respectively. Also shown in these Figures are the a priori profiles taken from NCEP and in situ measurements by radiosonde. These results demonstrate a synergy effect of SWIR and TIR in retrieving greenhouse gas concentrations.

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