Geophysical Research Abstracts
Vol. 13, EGU2011-412, 2011
EGU General Assembly 2011

A New Approach to Constrain Aerosols in Retrievals of Atmospheric CO2 from GOSAT

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Satellites observations, if acquired with high accuracy and precision, have the potential to overcome the limitations of in-situ ground-based measurements by providing globally densely-sampled datasets of column CO2. The Japanese Greenhouse gases Observing SATellite (GOSAT) provides global measurements of total column CO2 from its shortwave infrared (SWIR) bands and of mid-tropospheric sub-columns from its thermal-infrared bands.

Observations of total column CO2 are well suited to improve our knowledge of greenhouse gas surface fluxes. However, inferring the surface fluxes from these total columns requires stringent levels of measurement precision and accuracy, representing a major challenge for trace gas retrieval algorithms mainly due to spectroscopy and spectral interference from atmospheric aerosols and clouds.

Here we present a new approach to treat aerosols in the retrieval of CO2 columns from the GOSAT SWIR channels using an optimal estimation retrieval algorithm based on assimilated aerosol datasets from MACC. We validate the approach with column observations from ground based stations and satellite coincidences over a number of key regions of interest. We compare our retrieval approach to other aerosol approaches and we investigate the sensitivity of the retrieval to clouds. Furthermore, we show comparisons of our retrieved CO2 columns and aerosol optical depth to calculations of global transport models.