Geophysical Research Abstracts
Vol. 16, EGU2014-9730-1, 2014
EGU General Assembly 2014

A retrieval algorithm for approaching XCH4 from satellite measurements: Sensitivity study and preliminary test

Jianbo Deng (1,2), Yi Liu (1), Dongxu Yang (1), and Zhaonan Cai (1)

(1) Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, (2) University of Chinese Academy of Sciences, Beijing, China

Satellite measurements of column-averaged dry air mole fractions of CH_4 (XCH_4) in shortwave infrared (SWIR) with very high spectral resolution and high sensitivity near the surface, such as the Thermal And Near-infrared Sensor for carbon Observation (TANSO) onboard the Green gas Observing SATellite (GOSAT, launched 2009), are expected to provide the large spatial and temporal information on the sources and sinks of CH_4, which would contribute to the understanding of CH_4 variation in global region and its impact on climate change. One of the important science requirements of monitoring CH_4 from hypsespectral measurements is to establish a highly accurate retrieval algorithm. To approach XCH_4efficiently, we developed a SWIR two-band (5900-6150 cm^{-1} and 4800-4900 cm^{-1}) physical retrieval algorithm after a series of sensitivity study. The forward model in this algorithm was based on a vector linearized discrete ordinate radiative transfer (VLIDORT) model coupled with a line-by-line radiative transfer model (LBLRTM), which was applied to realize online calculation of absorption coefficient and backscattered solar radiance. The information content of CH_4, H_2O, CO_2 and temperature in different retrieval band and bands combination was investigated in order to improve the algorithm. The selected retrieval bands retains more than 90% of the information content of CH_4, CO_2, and temperature, and more than 85% of that of H_2O. The sensitivity studies demonstrate that the uncertainty of H_2O, temperature and CO_2 will cause unacceptable errors if they were ignored, for example, a 10% bias on H2O profile will lead to 50 ppb retrieval error, and a 5 K shift on temperature profile will cause 20 ppb error to the result while CO_2 has little influence. The simulated retrieval test shows it is more efficient to revise the influence of temperature and H_2O with a profile model than with a temperature offset and a H_2O scale factor model. A preliminarily retrieval test using GOSAT Level 1B spectral data shows that most of the retrieval error was less than 1%.