Geophysical Research Abstracts
Vol. 14, EGU2012-5818, 2012
EGU General Assembly 2012

Improved line parameters for CH4 around 1.6 microns

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Methane (CH4) is one of the most important greenhouse gases, also being modified by anthropogenic activity. It can be nowadays monitored globally from space and this is required on the long-term. The critical point for the retrieval algorithms is the knowledge of the spectroscopic parameters. Although a significant amount of spectroscopic data on CH4 is available, the information on the line parameters in near infrared (NIR) and mid infrared (MIR) spectral regions is inadequate for accurate remote sensing applications and there is a need for improved spectroscopic line parameters.

The state of the art database for CH4 line parameters is HITRAN 2008. The CH4 line parameters around 1.6 micron in HITRAN 2008 are based on laboratory measurements of the CH4 spectrum at University of Bremen and an analysis scheme used to improve the line parameters of the previous HITRAN version (see Frankenberg, et al., 2008). However, that analysis was only based on a limited number of measurements (e.g., only room temperature and only using N2 as a buffer gas).

To overcome these limitations, we are performing new laboratory measurements and corresponding data analysis with the goal to further improve the spectroscopic line parameters for CH4 in the critical spectral region around 1.6 microns, which is used to derive methane columns globally by the greenhouse gas satellite sensors SCIAMACHY/ENVISAT and TANSO/GOSAT.

We are using an approach similar to that of Frankenberg et al., 2008, but based on an extended set of measurements at an adequate number of representative atmospheric temperatures and also using air and O_2 as buffer gases in addition to N2.

We perform new measurements and calculations with focus on CH4 spectra within international collaboration between the Molecular Spectroscopy Laboratory at IUP Bremen, Germany, and the Earth Observation Science Group, University of Leicester, United Kingdom. The new spectra will be used to obtain information on the broadening coefficients with the accuracy needed for challenging remote sensing applications. Before release, the new data will be tested on GOSAT and SCIAMACHY retrievals.

Updated spectroscopic information for the CH4 bands in the IR spectral region will be available for reprocessing of the GOSAT and SCIAMACHY data as well as for general the scientific community.