Geophysical Research Abstracts
Vol. 16, EGU2014-12411, 2014
EGU General Assembly 2014
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Impact of the O_2 A and B band in full physics retrievals of CH_4 and CO for the future Sentinel 5 mission

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In the frame of the EU Copernicus (formerly GMES) atmosphere service, future satellite missions include Sentinel 5 Precursor (S5p, LEO), Sentinel 4 (S4, GEO) and Sentinel 5 (S5, LEO). The aim of the S5 mission is to provide atmospheric observations of the troposphere at several spectral ranges from the Ultraviolet Visible Near-Infrared (UVN) to the shortwave infrared (SWIR), with spectra in the thermal infrared (TIR) provided by the EUMETSAT EPS-SG IRS mission. Next to many trace gases in the UVN, the S5 will monitor methane (CH_4) and carbon monoxide (CO) in the SWIR region to assess climate forcing and pollution at two wavelength ranges around $1.6\,\mu m$ and $2.3\,\mu m$, respectively.

Knowledge of aerosol induced radiative scattering is mandatory for accurate retrievals of trace gas columns in the SWIR region. Common full-physics retrieval approaches for these trace gases incorporate a spectral window in the near infrared (NIR) to account for aerosol scattering by fitting the O_2-A band around $0.76\,\mu m$. Important additional information e.g. on aerosol type could potentially be obtained from additionally including the O_2-B band around $0.69\,\mu m$ which should help to improve the greenhouse gas retrievals in the SWIR.

We present a detailed investigation of the expected retrieval performance for CH_4 and CO from S5 observations with dedicated retrieval simulations experiments for different proposed instrumental configurations for S5. A main focus of this investigation is on assessing the added value of the O_2-B band for characterizing aerosols related to the CH_4 and CO retrievals in the SWIR. The study also includes the effects of plant fluorescence which is present in both O_2 bands which adds to the complexity of the retrieval problem.