Sentinel-5 Precursor methane and carbon monoxide column retrievals and assessments related to localized emission sources

Michael Buchwitz, Oliver Schneising, Stefan Noel, Maximilian Reuter, Steffen Vanselow, Heinrich Bovensmann, and John P. Burrows
University of Bremen, Institute of Environmental Physics / Remote Sensing (IUP/IFE), Bremen, Germany
(michael.buchwitz@iup.physik.uni-bremen.de)

The Sentinel-5 Precursor (S-5P) spectral radiance measurements in the shortwave-infrared (SWIR) spectral region permit the retrieval of atmospheric methane (CH$_4$) and carbon monoxide (CO) columns with high spatial resolution and nearly daily coverage. Methane is an important greenhouse gas with increasing atmospheric concentrations contributing to global warming. Carbon monoxide is an air pollutant with emissions originating from, for example, fossil fuel combustion and biomass burning. We have adjusted and optimized the scientific retrieval algorithm WFM-DOAS to retrieve methane and carbon monoxide columns and column-averaged mixing ratios (XCH$_4$ and XCO) from the S-5P spectra. The retrieval algorithm is based on linear-least squares fitting simulated radiance spectra to the observed spectra. For each single ground pixel we determine a quality flag using a Random Forest based machine learning approach and a similar method is also used to bias correct the retrieved methane columns to enhance the accuracy. We present an overview of the WFM-DOAS retrieval algorithm and resulting initial methane and carbon monoxide scientific data products covering the first two years of the S-5P mission including validation and comparisons with the operational data products. We focus on methane and present details on scenes showing elevated atmospheric concentrations originating from localized emission sources. In particular, we present first results from a method developed to automatically identify methane enhancements originating from localized gas, oil and coal emission sources.