CO total column retrieval from SCIAMACHY and TROPOMI Earthshine measurements in the shortwave infrared spectral range

Tobias Borsdorff (1), Jochen Landgraf (1), Ilse Aben Aben (1), Jason Williams (2), and Jos de Laat (2)

(1) Netherlands Institute for Space Research (SRON), (2) Royal Netherlands Meteorological Institute (KNMI)

ESA's Scanning Imaging Absorption Spectrometer for Atmospheric Chartography (SCIAMACHY) was operational from 2002 until April 2012 when the contact to its host ENVISAT was finally lost. In this period, an almost continuous long-term record of 10 years Shortwave Infrared (SWIR) measurements of the 2.3 μm spectral range from space has been recorded.

Beginning of 2016, this dataset will be continued with the launch of ESA's Sentinel 5 Precursor (S5-P) mission with the Tropospheric Monitoring Instrument (TROPOMI) on board measuring also the 2.3 μm spectral range but with improved radiometric performance and spatial resolution. For the S5-P mission, the highly efficient Infrared CO Retrieval algorithm (SICOR) is developed as part of the operational data processor. Using a common retrieval approach for the two satellite instruments is desirable to ensure comparability and consistency of a long-term CO dataset. For this study, we processed the entire SCIAMACHY dataset with the SICOR algorithm and by that derived a new SCIAMACHY CO dataset for the entire ENVISAT mission, preliminary limited to land and cloud free scenes. For the SCIAMACHY dataset, it is necessary to account for the time dependent instrument degradation due to a growing ice layer on the detector array and a considerable loss of detector pixels due to radiation damage in the later years of the mission. For this purpose, we use cloud-free measurements over the Sahara region as a natural calibration target to identify the time dependence of detector male functions and the loss of radiometric accuracy. The 10-year CO dataset is validated with on-ground TCCON and NDACC measurements at 10 sites. To demonstrate the ability of the new SCIAMACHY CO dataset, we compare the spatial and temporal variation of SCIAMACHY CO fields over biomass burning areas with model fields of a global chemistry transport model (TM5).