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New Evaluation Algorithm for Methane Retrieval from TROPOMI Measurements

Andre Galli, Andre Butz, Otto Hasekamp, Jochen Landgraf, Paul Tol, and Ilse Aben
Netherlands Institute for Space Research (SRON), Utrecht, The Netherlands (a.galli@sron.nl)

The TROPOsphericMonitoring Instrument (TROPOMI) will be part of ESA's Precursor Sentinel-5 satellite platform scheduled for launch in late 2014. One of TROPOMI's primary goals will be to accurately monitor methane concentrations in the Earth's atmosphere by measuring spectra of sunlight backscattered by the Earth's surface and atmosphere. Methane absorption along the lightpath allows for the spectroscopic retrieval of its atmospheric abundance given accurate knowledge of the lightpath. Scattering by aerosol and cirrus particles, however, can modify the lightpath substantially, causing retrieval errors if not appropriately taken into account.

We have developed an inversion method to minimise these errors by simultaneously retrieving methane total column concentrations and scattering properties of the atmosphere. The method exploits observations by TROPOMI's shortwave-infrared and near-infrared channels and is based on a parameterization of particle amount, height distribution, and size distribution. The retrieval performance is tested for a trial ensemble of simulated observations that cover a realistic range of aerosol and cirrus loaded scenes. For more than 90% of the trials, residual scattering induced methane errors are less than 1%. Retrievals with larger errors and non-convergent retrievals typically occur for difficult scenes with high particle load or very small surface albedo. The processing time for one ground pixel is about 7 seconds on a standard PC, which means the retrieval algorithm is very efficient for an algorithm based on online radiative transfer calculations. Therefore, the code is suitable for operational processing of data from the Precursor Sentinel-5 mission.