

5.033 New perspectives on atmospheric chemistry from the Sentinel-5P TROPOMI sensor and the 23-year QA4ECV climate data record.

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Abstract:

The TROPOMI spectrometer on board the Copernicus Sentinel-5P satellite was launched in October 2017 to measure atmospheric composition from space using ultraviolet, visible, and infrared spectroscopy (www.tropomi.nl). TROPOMI allows the retrieval of trace gases O₃, NO₂, SO₂, HCHO, CO, CH₄ and information on aerosols. With its global daily coverage and spatial footprint of 3.5×7 km², TROPOMI's observations are anticipated to be of great relevance for monitoring pollutant concentrations, emissions from small-scale towns, individual power plants, wildfires, and major infrastructures. In this presentation we will showcase some striking observations of various atmospheric constituents collected in the first months of operation.

TROPOMI is the successor-in-line of the suite of instruments initiated with the launch and operation of GOME (1995-2003), SCIAMACHY (2002-2012), GOME-2 (since 2007), and OMI (since 2004). Within the EU FP7 QA4ECV project (www.qa4ecv.eu), we developed an improved, quality assured retrieval algorithm for NO₂ that we applied for all five sensors, culminating in a consistent climate data record that now spans a period of 23 years, and is continued by TROPOMI. We will evaluate the quality of the TROPOMI NO₂ retrievals based on an evaluation with QDOAS spectral fitting retrievals, validation with independent MAX-DOAS measurements, and comparisons against the OMI QA4ECV NO₂ product.

We will then highlight some of the new and exciting benefits of the new datasets. In particular, TROPOMI NO₂ columns shows great potential to trace back distinct plumes of

pollution observed on a single clear-sky day to their hotspot origins. This allows the direct quantification of emissions and lifetime of nitrogen oxides on a daily basis. Analysis of the multi-year QA4ECV NO₂ record suggests that NO_x emissions have reduced substantially over Europe, but also that the economic ups and downs between 2008 and 2013 have left a clear imprint on the pollution levels.