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## Validation of TROPOMI nadir ozone profile retrievals: Methodology and first results

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Part of the space segment of EU's Copernicus Earth Observation programme, the Sentinel-5 Precursor (S5P) mission is dedicated to global and European atmospheric composition measurements of air quality, climate and the stratospheric ozone layer. On board of the S5P early afternoon polar satellite, the imaging spectrometer TROPOMI (TROPOspheric Monitoring Instrument) performs nadir measurements of the Earth radiance within the UV-visible and near-infrared spectral ranges, from which atmospheric ozone profile data are retrieved. Developed at the Royal Netherlands Meteorological Institute (KNMI) and based on the optimal estimation method, TROPOMI's operational ozone profile retrieval algorithm has recently been upgraded. With respect to early retrieval attempts, accuracy is expected to have improved significantly, also thanks to recent updates of the TROPOMI Level-1b data product. This work reports on the initial validation of the improved TROPOMI height-resolved ozone data in the troposphere and stratosphere, as collected both from the operational S5P Mission Performance Centre/Validation Data Analysis Facility (MPC/VDAF) and from the S5PVT scientific project CHEOPS-5p. Based on the same validation best practices as developed for and applied to heritage sensors like GOME-2, OMI and IASI (Keppens et al., 2015, 2018), the validation methodology relies on the analysis of data retrieval diagnostics – like the averaging kernels' information content – and on comparisons of TROPOMI data with reference ozone profile measurements. The latter are acquired by ozonesonde, stratospheric lidar, and tropospheric lidar stations performing network operation in the context of WMO's Global Atmosphere Watch and its contributing networks NDACC and SHADOZ. The dependence of TROPOMI's ozone profile uncertainty on several influence quantities like cloud fraction and measurement parameters like sun and scan angles is examined and discussed. This work concludes with a set of quality indicators, enabling users to verify the fitness-for-purpose of the S5P data.

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