Geophysical validation of two years of Sentinel-5p tropical tropospheric ozone columns

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Tropospheric ozone damages ecosystems and causes human health problems. The high spatial and temporal variability of ozone concentrations in the troposphere challenges global observing systems to monitor ozone at all relevant scales. TROPOMI is a nadir-viewing UV-Vis-NIR-SWIR sensor that combines a high spatial resolution, a large swath width and the spectral measurement characteristics required to deliver trace gas data records at unprecedented detail. The first tropospheric data product was publicly released in Fall 2018, a year after launch on the Sentinel-5p platform (S5p). It is based on the convective-cloud differential technique (CCD) to infer 0.5°x1° resolved daily maps of 3-day moving mean values of the tropospheric ozone column (surface to 270 hPa) between 20°S and 20°N in clear-sky conditions. This makes it the highest resolved tropospheric ozone data set currently available for the tropical belt. About two years of data have been collected since the end of the commissioning phase in April 2018.

We present an assessment of the quality of the Sentinel-5p TROPOMI convective-cloud differential tropospheric ozone column data products (O3_TCL OFFL v01.01.05-01.01.07), carried out within the context of ESA’s Sentinel-5p Mission Performance Center (MPC) and the SSPVT AO project CHEOPS-5p. Our assessment of the first two years of TROPOMI data is based on comparisons with (a) quality-assured co-located in-situ measurements by the SHADOZ ozoneonde network, and (b) satellite data by the GOME-2 and OMI sensors. These well-characterized observational data records serve as references to evaluate the bias and the dispersion of S5p data, and their
dependence on influence quantities. Additional visual inspections of the S5p tropospheric ozone maps unveiled non-geophysical structures introduced by the sampling pattern of sensor and clouds. We conclude by assessing the compliance of S5p tropospheric ozone data with respect to mission and user requirements for key data applications.