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The first year of Sentinel-5p: Assessment of the quality of tropospheric ozone data

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Ozone in the troposphere damages ecosystems and triggers health problems for humans. The large spatio-temporal variations of tropospheric ozone fields pose a clear challenge to refine our understanding of the processes involved in the production and transport of ozone. The TROPOMI instrument on the Sentinel-5p platform, launched in October 2017, combines a high spatial resolution, a large swath width and the spectral measurement characteristics required to deliver tropospheric ozone data records at unprecedented detail. The first of these products was released in early 2019. It consists of 0.5° (latitude) by 1° (longitude) resolved daily maps of 3-day moving mean values of the tropospheric ozone column between 20°S and 20°N, computed using the convective-cloud method (CCD). A second product consists of maps of tropical upper tropospheric ozone mixing ratio at coarser spatio-temporal resolution. It is based on a cloud slicing algorithm (CSA) and is currently being fine-tuned for public release in the near future. A third data product, also under development at the time of this abstract, consists of vertical profiles of ozone concentration in the global troposphere and stratosphere, retrieved with a classical Optimal Estimation (OE) technique.

Here we present the first assessment of the quality of the initial tropospheric ozone data products retrieved from Sentinel-5p TROPOMI measurements, carried out within the context of ESA's Sentinel-5p Mission Performance Center (MPC) and the S5PVT AO project CHEOPS-5p. We first inspect the tropospheric ozone maps for artificial features introduced by the measurement process. The CCD product is derived from binned TROPOMI total ozone column data, so sampling effects are a potential source of uncertainty. The satellite data are also confronted with quality-assured ozonesonde and lidar measurements from the NDACC, SHADOZ and TOLNET ground-based networks. These well-characterized observations are used as a reference to estimate the uncertainty of the TROPOMI data and their dependence on influence quantities. We conclude by assessing the compliance of the data products with mission and user requirements for key data applications.