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Validation of satellite OClO products from S5P/TROPOMI and MetopA and B/GOME2

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Chlorine dioxide is an indicator for chlorine activation in the stratosphere, of importance for understanding spring-time ozone depletion processes in the polar regions of both hemispheres. Within the EUMETSAT AC SAF working group, chlorine dioxide (OClO) was retrieved from the GOME-2 instruments on MetOp-A and MetOp-B platforms, respectively over the time periods 2007-2016 and 2012-2016. Moreover, recent work performed as part of the S5p+ Innovation programme has led to the creation of an additional dataset derived from the TROPOMI instrument, extending the OClO time series in 2018-2020.

This study analyses the quality of both OClO slant column (SCD) datasets by comparing them to ground-based DOAS zenith-sky measurements at a selection of 8 stations in Arctic and Antarctic regions: Eureka (80°N), Ny Alesund (79°N), Kiruna (68°N), Harestua (60°N), Marambio (64°S), Belgrano (78°S), Neumayer (71°S) and Arrival Heights (78°S). To allow for comparison with satellite data, ground-based OClO spectral analyses are performed using yearly fixed reference spectra recorded at low SZA in the absence of chlorine activation. Furthermore, an additional bias-correction is applied in post-processing to generate a consistent long-term OClO data record covering the 2007-2020 period.

Daily comparisons of satellite and ground-based SCD data pairs corresponding to similar SZA conditions are performed, assuming similar stratospheric light paths in satellite nadir and ground-based zenith-sky geometries. Daily mean OClO SCD time-series show that satellite and ground-based observations agree well at all stations in terms of short-term variability and seasonal variation. Linear regression plots show a correlation coefficient R of about 0.97, a slope of 0.9 and an intercept of less than $1x10^{13}$ molec/cm² for TROPOMI, while for GOME-2 results are more noisy and tend to be biased low, with correlation coefficients between 0.76 and 0.88, slopes between

0.65 and 0.74 and intercepts up to 2.4 x10^{13} molec/cm^2.