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Assessment of TROPOMI HCHO Vertical Columns: evaluating the use of CAMS vertical profiles and new TROPOMI surface albedo climatologies for air mass factor determination

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The ESA Climate Change Initiative (CCI) Ozone and Aerosols Precursors project is developing long-term climate data records (CDRs) of the Global Climate Observing System (GCOS) Precursors for Aerosol and Ozone Essential Climate Variables. These precursors include short-lived atmospheric trace gases such as formaldehyde (HCHO), glyoxal (CHOCHO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), carbon monoxide (CO), and ammonia (NH₃). The project aims to create consistent and harmonized CDRs from multiple satellite missions, including GOME, SCIAMACHY, GOME-2, OMI, TROPOMI, IASI, and MOPITT.

This work presents selected findings of a round robin exercise conducted for UV-VIS retrievals. We focus on two key factors that influence HCHO air mass factor determination: the surface albedo climatology and the model a priori profiles. The impact of these factors on the HCHO vertical columns is evaluated by comparing the use of recent auxiliary datasets. Results are presented for TROPOMI HCHO columns and compared to the operational product.

The recent reprocessing of TROPOMI Level 1 data has enabled the development of new albedo climatologies in the UV, offering a finer spatial resolution than the previously used OMI albedo climatology. Additionally, we evaluate the use of a priori vertical profiles from the CAMS reanalysis dataset (spanning the 2003-2022 period) instead of the current TM5-MP profiles used in the TROPOMI operational product. We assess the impact of these alternative datasets on the TROPOMI HCHO vertical columns and on their validation towards ground-based data.

The generation of the ESA CCI HCHO CDR will be based on these findings. This comprehensive assessment not only contributes to the ongoing improvement of TROPOMI data quality but also provides deeper insights into the factors influencing HCHO vertical columns.