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EGU22-4538, updated on 17 Apr 2023
https://doi.org/10.5194/egusphere-egu22-4538
EGU General Assembly 2022

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The Sentinel-5P TROPOMI instrument provides unique observations of atmospheric trace gases at a high resolution of about 5 km with near-daily global coverage, resolving individual sources like thermal power plants, industrial complexes, fires, medium-scale towns, roads and shipping routes. These datasets are especially well suited to test high-resolution regional-scale air quality (AQ) models and provide valuable input for regional emission inversion systems. In Europe, the Copernicus Atmosphere Monitoring Service (CAMS) has implemented an operational regional AQ forecasting capability for Europe based on an ensemble of 7 up to 11 European models. In the presentation we show comparisons between TROPOMI observations of nitrogen dioxide (NO2) and the CAMS AQ forecasts and analyses of NO2. We discuss the different ways of making these comparisons, and present the quantitative results for time series for regions and cities between May 2018 to March 2021, for summer and winter months and individual days. We demonstrate the importance of the free tropospheric contribution to the tropospheric column, and include profiles from the CAMS configuration of the ECMWF's global integrated model above 3 km altitude in the comparison. The models generally capture the fine-scale daily and averaged features observed by TROPOMI in much detail. In summer, the quantitative comparison of the NO2 tropospheric column shows a close agreement, but in winter we find a significant discrepancy in the average column amount over Europe. Recently a new TROPOMI NO2 reprocessing with processor version 2.3.1 has become available, and impact of this new version on the comparisons is discussed.

As spin-off, we present a new TROPOMI NO2 level-2 data product for Europe, based on the replacement of the original TM5-MP generated global a priori profile (1x1 degree resolution) by the regional CAMS ensemble profile at 0.1x0.1 degree resolution. This a-priori replacement leads to significant changes in the TROPOMI retrieved tropospheric column, with typical increases at the emission hotspots in the order of 20%.

The European NO2 product is compared with ground-based remote sensing measurements of 6

PANDORA instruments of the Pandonia global network and 8 MAX-DOAS instruments. As compared to the standard S5P tropospheric NO2 column data, the overall bias of the new product is smaller owing to a reduction of the multiplicative bias linked to the profile shape.