A tropospheric NO2 research product from TROPOMI for air quality applications in Europe

3. Exploring the applications and impacts of new satellite data

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This study focuses on a tropospheric NO? research product from TROPOMI measurements over Europe based on an improved retrieval algorithm. We present an overview of the DLR NO? algorithm and validation with ground-based measurements. In addition, the use of TROPOMI tropospheric NO? columns for air quality purposes in Europe will be discussed. The DLR NO? retrieval algorithm for TROPOMI consists of mainly three steps: (1) the spectral fitting of the slant column based on the differential optical absorption spectroscopy (DOAS) method, (2) the separation of stratospheric and tropospheric contributions, and (3) the conversion of the slant column to a vertical column using an air mass factor (AMF) calculation. To calculate the NO? slant columns, a 405-465 nm fitting window is applied in the DOAS fit for consistency with other NO? retrievals from OMI and TROPOMI. Absorption cross-sections of interfering species and a linear intensity offset correction are applied. The stratospheric NO? columns are estimated using a directionally dependent STRatospheric Estimation Algorithm from Mainz (DSTREAM) method to correct for the dependency of the stratospheric NO? on the viewing geometry. For AMF computation, the climatological OMI surface albedo database is replaced by the geometry-dependent effective Lambertian equivalent reflectivity (GE_LER) and directionally dependent (DLER) data obtained from TROPOMI measurements with higher spatial resolution. As surface albedo is an important parameter for accurate retrieval of trace gas columns, the effect of surface albedo in TROPOMI NO? retrieval was investigated by comparing results applying different surface albedo datasets. Mesoscale-resolution a priori NO? profiles obtained from the regional chemistry transport model POLYPHEMUS/DLR and LOTOS-EUROS are used. The cloud correction in this TROPOMI NO? retrieval is improved using the Clouds-As-Layers (CAL) model from the ROCINN cloud algorithm which is more representative of the real situation than the Clouds-As-Reflecting-Boundaries (CRB) model. Validation of the TROPOMI tropospheric NO? columns is performed by comparisons with ground-based MAX-DOAS measurements at nine European stations with urban/suburban conditions. The improved DLR tropospheric NO? product shows a similar seasonal variation and good agreement with MAX-DOAS measurements. In particular, the retrievals applying a priori NO? profiles from the regional model with a high spatial resolution and recent emission inventory improve an underestimation in TROPOMI tropospheric NO? columns in polluted urban areas. Finally, we present the use of the TROPOMI tropospheric NO? research product in the regional POLYPHEMUS and LOTOS-EUROS chemistry transport models to analyse the effect of

traffic emission on air quality in Germany with the framework of the S-VELD project.