Assessment of the quality of TROPOMI high-spatial-resolution NO2 data products

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The TROPOspheric Monitoring Instrument (TROPOMI) on-board the Sentinel-5 Precursor satellite (launched on 13 October 2017) is a nadir-viewing spectrometer measuring reflected sunlight in the ultraviolet, visible, near-infrared, and shortwave infrared spectral ranges. The measured spectra are used to retrieve total columns of trace gases, including nitrogen dioxide (NO2). In this study, Pandora NO2 measurements made at three sites located in or north of the Greater Toronto Area (GTA) are used to evaluate the TROPOMI NO2 data products, including the standard Royal Netherlands Meteorological Institute (KNMI) NO2 data product and a research data product developed by Environment and Climate Change Canada (ECCC) using a high-resolution regional air quality forecast model (used in the airmass factor calculation).

TROPOMI pixels located upwind and downwind from the Pandora sites were analyzed using a new wind-based validation method that increases the number of coincident measurements by about a factor of five compared to standard techniques. Using this larger number of coincident measurements, this work shows that both TROPOMI and Pandora instruments can reveal detailed spatial patterns (i.e., horizontal distributions) of local and transported NO2 emissions, which can be used to evaluate regional air quality changes. The TROPOMI ECCC NO2 research data product shows improved agreement with Pandora measurements compared to the TROPOMI standard tropospheric NO2 data product, demonstrating the benefit of using the high-resolution regional air quality forecast model to derive NO2 airmass factors.