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# Evaluation and analysis of TROPOMI XCO daily variability at high Northern latitudes

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Sentinel 5-P TROPOMI is the first instrument to retrieve column-averaged carbon monoxide (XCO) daily and globally using the SWIR wavelength region. Over high Northern latitudes, several TROPOMI overpasses are ideally available every day during summer because of the polar orbit. In this study, we concentrate on these observations with three objectives: 1) we evaluate the diurnal variability of TROPOMI XCO through comparisons to ground-based instruments; 2) we analyse XCO variability over several boreal regions including those with anthropogenic CO emissions, and 3) we show selected case studies of boreal wildfires during summer 2018.

We evaluate the accuracy and diurnal variability of TROPOMI XCO against the XCO retrieved by the Fourier Transform Spectrometer (FTS) hosted at the Arctic Space Centre in Sodankylä, Finland (67°22' N). The Sodankylä FTS participates in the Total Carbon Column Observing Network (TCCON) and has been operational since 2009. We evaluate co-located satellite and ground-based retrievals for year 2018 and assess if TROPOMI can reliably reproduce any short-term, diurnal variability shown by the TCCON retrievals. We will also compare TROPOMI XCO to in-situ CO profile measurements (e.g., AirCore measurements) when available. Ground-level in-situ measurements are used as an additional source to test how the variability in the total column measurements reflects the ground-level mixing ratios.

After the evaluation at Sodankylä, we investigate the XCO variability over several boreal regions including areas with potential anthropogenic CO sources from traffic and/or industry, such as Norilsk and Murmansk. In addition, we show a few case studies of wildfires to demonstrate the ability of TROPOMI to detect boreal pollution sources and to follow the transport at high Northern latitudes during summer 2018. The cases include a small-scale forest fire in Russia close to the Finnish border near Raja-Jooseppi in late July 2018. As an example of long-distance transport, we follow the CO emissions from wildfires in Canada reaching Finland in August 2018. All selected cases highlight the importance of these unprecedented data that now enable such investigations over the remote high-latitude regions.