EGU21-7073
https://doi.org/10.5194/egusphere-egu21-7073
EGU General Assembly 2021

Evaluating Satellite Capability in Supporting Traditional Air Quality Monitoring for the Finnish Ministry of the Environment

Henrik Virta, Anu-Maija Sundström, Iolanda Ialongo, and Johanna Tamminen
Finnish Meteorological Institute, Space and Earth Observation Centre, Finland (henrik.virta@fmi.fi)

We present the results of two projects completed for the Finnish Ministry of the Environment that assessed the capability of satellites in supporting traditional in situ air quality (AQ) measurements. These projects analysed the correlation of co-located NO_2 measurements from the TROPOspheric Monitoring Instrument (TROPOMI, measuring in molec./cm^2) and traditional air quality stations (measuring in µg/m^3) in Finland and Europe in 2018 and 2019, and used the results to estimate annual mean ground-level NO_2 concentrations in Finland's 14 different AQ monitoring regions.

We find that the correlation is dependent on the location of the AQ station, with city stations having a higher correlation than rural background stations. This is expected, as the variability of NO_2 levels in Finnish rural areas is usually within TROPOMI's random measurement error. We also find that the estimated annual mean regional ground level NO_2 concentrations compare well to the in situ measurements, as the associated uncertainties provide reliable upper estimates for ground level concentrations. These estimates were used to establish that annual NO_2 concentrations were below the EU limit in two AQ monitoring regions with no active ground stations.

We also analyse TROPOMI's and the Ozone Monitoring Instrument's (OMI) ability to study the spatial distribution of NO_2 over Finland using gridded maps. Oversampled TROPOMI measurements are able to distinguish relatively small sources such as roads, airports and refineries, and the difference in concentrations between weekdays and weekends. TROPOMI is also able to detect emissions from different sources of NO_2 such as cities, mining sites and industrial areas. Long time series measurements from OMI show decreasing NO_2 levels over Finland between 2005 and 2018.

The studies were conducted on behalf of the Finnish Ministry of the Environment, and showcase how satellite measurements can be used to supplement traditional air quality measurements in areas with poor ground station coverage. Launched in 2017, TROPOMI is currently the highest-resolution air quality sensing satellite, and its societal uses are only beginning to be realised. Future Sentinel missions, especially the geosynchronous Sentinel-4, will further extend satellite air quality monitoring capabilities and enable continuous daytime observations in cloud-free conditions.