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Using satellite data and data fusion techniques for air quality mapping

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Air quality mapping plays an important role in informing the public about air pollution levels in various areas. For this purpose different sources of air quality data can be utilized, in particular in-situ measurements, air quality models and satellite observations. However, none of these data sources is fully sufficient for mapping purposes on its own due to either substantial data gaps, insufficient spatial resolution or large uncertainties. Within the scope of the SAMIRA (SAtellite based Monitoring Initiative for Regional Air quality) project, we have aimed to combine these different data sources using data fusion techniques to provide more accurate information within air quality mapping.

We present first results of the on-going project where we applied multiple linear regression and spatial interpolation of its residuals (residual kriging) to combine data from in-situ measurements, chemical transport models and satellite observations over the Czech Republic and a major part of Europe. We examined mainly three pollutants (NO_2, PM_{10} and $PM_{2.5}$) at different temporal resolutions (annual, daily, hourly).

Satellite data usually suffer from spatial and temporal data gaps. To reduce these gaps we used a combination of data from two different sources, namely products $OMNO_2$ and GOME-2 of AURA and MetOp satellites respectively. The gaps were further filled by spatio-temporal interpolation using the Gapfill package in R language.

Our current results show that including the satellite observations in air quality mapping can provide some improvement in terms of root mean square error and bias compared to mapping using in-situ and model data only. With the availability of higher-quality data from new sources (e.g. the recently launched Sentinel 5-P mission by ESA) we expect a more significant improvement of the results.