Research project objectives

Ambient air pollution is a major health risk, leading to various health problems worldwide. A recent cohort study for Europe suggests that the annual excess mortality rate from ambient air pollution is 790 000, up to 80% of which are due to cardiovascular events that dominate health outcomes. Particulate matter (PM) with an aerodynamic diameter below 2.5 μm (PM2.5) or below 10 μm (PM10), along with the tropospheric ozone (O3), are Europe's most problematic pollutants against health.

Atmospheric transport models (ATMs) are widely used to provide spatial and temporal information on atmospheric pollutants' concentration and deposition input for health-related studies. However, various studies have shown that the ATMs often strongly underestimate the observed PM concentrations. As the PM2.5 and PM10 are the main drivers of health impacts, this bias introduces a considerable uncertainty in health impact estimates and, furthermore, in the estimates of economic valuation of air pollutants' impacts. In this project we propose a method which aims for reduction of ATMs' results uncertainty.

Research project methodology

The proposed method will use the ratio between the ATM-estimated PM2.5 and PM10 concentrations and station measurements. It will extrapolate this ratio spatially using several different local Geographically Weighted Regression (GWR) methods supported by spatial predictors. Wide range of spatial predictors will be tested, including: altitude, landuse based predictors, road and traffic based predictors, population density and emission-based spatial predictors.

Expected impact of the project on the development of science, civilization and society

The project will answer the following questions, which are relevant both for air pollution modellers and health risk researchers:

- How much can the ATM model bias be reduced by the application of GWR algorithms?
- Which GWR method will be the most suitable for ATMs' bias reduction if the bias is non-stationary in time and space?
- Will there be any added value if we increase the spatial resolution of ATMs' model output by application of the GWR methods supported by the high-resolution explanatory variables?
- Can we improve emission inventory by analysing the ATMs' model errors with GWR?

Both health impact assessment and estimation of economic costs of air pollutants will become more reliable in time and space. This will further support more effective strategies for reducing population exposure.