

Using Low-cost Air Quality Sensors for Personal Exposure Assessment

Philipp Schneider¹, Nuria Castell¹, and Alena Bartonova¹

¹ Norwegian Institute for Air Research, Kjeller, Norway, E-mail: Philipp.Schneider@nilu.no

Quantifying human exposure to air pollutants is a challenging task. In urban areas, air pollution exhibits very high spatial and temporal variability. At the same time, every individual has unique activity-patterns that will result in a different exposure to air pollution. Here we explore how recent developments in sensor and mobile phone technology can enable us to monitor personal exposure to air pollutants while people are performing their daily activities.

We present two methods for assessing personal exposure using low-cost air quality sensors. The first approach involves direct measurement of air pollution using a portable sensor device while a person is moving through the environment. The location information is at the same time provided by the geolocation functionality of the user's mobile phone. The second approach is based on an indirect assessment where only the location information from a mobile phone is required to extract air quality information along a given path from sensor-based up-to-date high-resolution air quality maps. Such maps are typically produced using a static network of low-cost sensors whose observations are combined with information from a high-resolution air quality model.

In both approaches the personal exposure is computed by averaging the air pollutant concentration along a line segment and multiplying it by the time spent on this segment. Moreover, if we measure or otherwise make some reasonable assumptions about the heart rate of the individual it is possible to estimate the inhalation rate (ventilation) and subsequently to assess the inhaled dose over a track. This is important because differences in the ventilation will influence the inhaled doses of air pollution. We demonstrate both approaches with examples from recent projects in both Oslo and other parts of Europe.