IDEA mobile measurements of UFP and PM10 in Antwerp

Mobile platforms are increasingly used to acquire air quality data at a high spatial and temporal resolution in a complex urban environment. Mobile measurements provide a solution for short-term studies to acquire a spatially spread data set that would not be feasible by stationary measurements.

However, mobile measurements provide snap-shots of pollutant concentration in space and time. They are very sensitive to short accidental variations and bias (e.g. when the mobile measurement platform is stuck behind a bus in slow moving traffic), the representativeness of the mobile measurements is a major issue. In comparison to stationary measurements spatial resolution is increased at the expense of temporal resolution. Data have to be aggregated both in space and in time in a meaningful way.

In the IDEA project several mobile measurements have been carried out in Antwerp with the **Aeroflex sensor bike**. The **Aeroflex sensor bike** is a regular bicycle equipped with high-tech but easy to operate instruments that measure local air quality including components such as PM10, PM2.5, black carbon and ultra-fine particles (UFP). We investigated if it is possible to use a **mobile air quality monitoring platform**, such as the Aeroflex, to map urban air quality in a systematical way.

In a **first monitoring campaign** in March 2009 a route of approximately 5 km long in Antwerp was repeated about 20 times. Streets of differing configuration and with differing traffic dynamics were included.

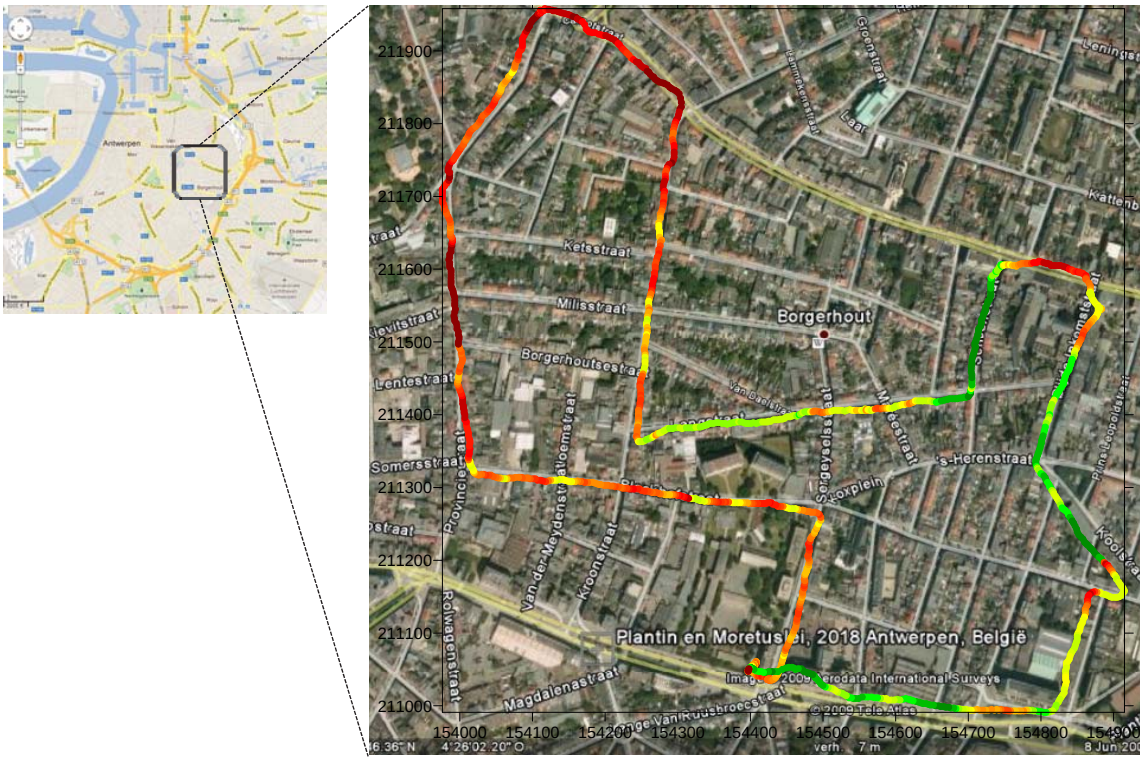

Fig. Example of a map of UFP concentration measured on one ride on the north side of Plantin en Moretuslei, Antwerp. Color codes indicate lowest (green), intermediate (yellow) and highest (red) measured concentrations. This map only gives the measured concentrations at the moment of the ride. It is not necessarily representative for the situation at other moments.

The measurement runs were not systematically spread over the days of the total campaign neither over a specific time frame of the day. This resulted in a sparse data set as it comes to temporal coverage. This data set might be thought of as a data set collected by volunteers that often take the same route but not necessarily every day, neither always at the same moment of the day. The measurements allowed to distinguish streets with significantly differing levels of UFP.

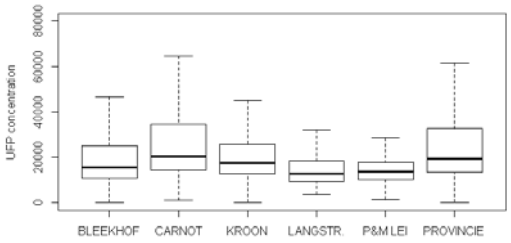

Fig. Boxplots of measured UFP concentration for a selection of streets in Antwerp.

Surprisingly, UFP concentrations in the street with the highest traffic volume (Plantin en Moretuslei) were comparable to the streets with the lowest traffic volume (Langstraat), and significantly lower than streets with intermediate traffic volumes (Carnotstraat and Provinciestraat). This is probably caused by the street lay-out with a separate biking lane at several metres distance from the traffic lanes and rather smooth traffic, whereas in Carnotstraat and Provinciestraat cyclists ride right next to or even in the wake of the cars and traffic gets easily congested.

A **second mobile monitoring campaign** was carried out in February 2012 in the same area. In this campaign we used a similar approach but we collected a much denser and systematic data set. 366 measurement runs were carried out on two routes. We simultaneously took measurements at two fixed locations along the route, and at two background locations. This campaign will allow us to finetune the monitoring approach.

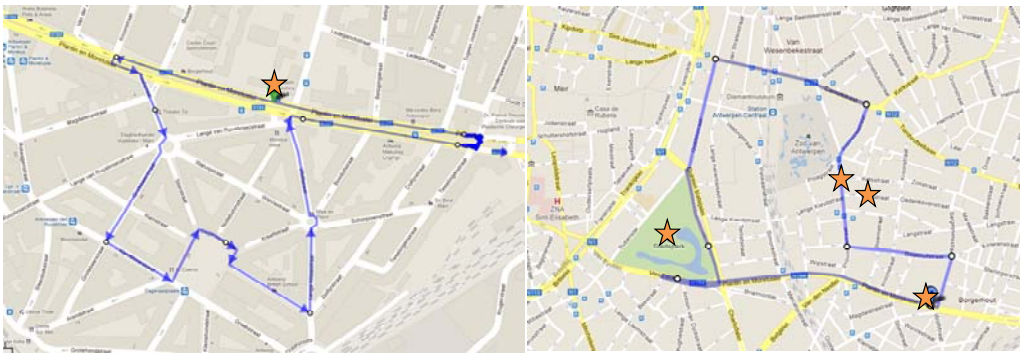

Fig. The two routes taken in the second measurement campaign; the stationary measurement locations are marked with a star.