EVALUATION OF TRAFFIC'S INFLUENCE NEARBY SCHOOL FRONT DOORS WITH LOW-COST $PM_{2.5}$ MONITORING

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Nowadays, in Belgium, traffic and heating systems are the main sources of PM in cities (Service Public de Wallonie, 2017). In Wallonia, the urban planning of the streets nearby schools is modified to allow area for "kiss and ride". During school activities, dropping off the children to school slows down the traffic. A lot of parents don't turn off the motor of their vehicles for this short time. This behaviour affects negatively the air quality while children, persons at risk, are present (Requia et al, 2018).

A $PM_{2.5}$ measurement campaign on the surrounding of a school located in Arlon (a small rural city in Wallonia) was realized with low-cost sensors. The sensors are fixed on the building walls, above the entrance doors. The purpose of this study was to measure the concentration of $PM_{2.5}$ to which the children are exposed when they access the school. The criteria for the selection of the school are: the presence of (i) several entrances, (ii) several streets surrounding the school and (iii) a schoolchildren population (between 6 and 18 years old). The school has 3 entries and is surrounded by 3 streets. The establishment comprises an elementary school and a high school for a total of 1950 students. The streets are configured as follows: the first is one-way street and serves the main entrance with a "kiss and ride" area, the second is a two-way street and serves the second entrance, the last, a one-way street with a "kiss and ride" area, is sloping and serves the elementary school.

Lab made devices, called 3PM, consisting of 3 low-cost sensors $PM_{2.5}$ (Honeywell HPM Series – HPMA115S0-XXX, laser-based light scattering particle sensing), one climate sensor (temperature, relative humidity, pressure), a data acquisition system, an SD card and a battery, are used in this study. The data recording is done every minute and in this case, the battery life is approximately 9h.

Firstly, an intra-comparison of each 9 PM sensors is performed in order to check the reproducibility of measurements. The sensors are located in ambient air next to each other during 7 days. The data sets show a Pearson correlation coefficient, r, close to 1.

In a second step, sensors are compared to an air quality monitoring station equipped with a GRIMM EDM180 instrument for PM, in the field during 3 days. Linear relations are obtained and used to evaluate the low-cost sensors with the reference measurements.

After these preliminary checks, the devices are fixed above each entrance of the school at a height of about 3m. The campaign was realized during a total of 14 days including week-end, holiday and school days between the end of May 2018 and June 2018. The devices were working from 7h30 to 17h (±9h). Typical traffic profiles were derived from measurements made with radars TMSSA for the 3 streets during the different periods. They give the number of vehicles and their speed.

The traffic profile shows 4 categories of profiles: school days, school holidays, Saturdays and the last category comprises Sundays and public holidays. Data analysis shows an increase of $PM_{2.5}$ concentrations of about a factor 2 during school days. The $PM_{2.5}$ values seem to indicate that the main entrance is the most used and that the additional $PM_{2.5}$ pollutions due to traffic is more than 25 $\mu g/m^3$ during the peak hour.

In the case of this school, the dropping off children impacts the air quality. It induces that people being there are exposed to concentrations higher than 25 $\mu g/m^3$ (1hour) while background concentration is 20 $\mu g/m^3$.

Due to the results of this preliminary study, a new campaign is planned during more days including different seasonal periods and various school activities.

REFERENCES

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