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Buildings located in valley cities : An original study for the characterization of the human exposure to the infiltrated outdoor air with measurements of oxidative potential

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Valley cities may be exposed to important particles concentration in the ambient air, especially with the common low wind speed (Drudi *et al*, 2024). And in winter, it gets worst with fossil-fuel and biomass-combustion-based heating. Field measurements were carried out in six different buildings, for two campaigns, between January and early March 2024 and from mid-December 2024 to February 2025 respectively. Black carbon, eBC (Chakraborty *et al*, 2023), was measured in one room at each site, PM_{2.5} in each room and on one point of the façade of each case study. The material used was: two micro-aethalometers MA300 from AethLabs, one aethalometer AE31 (Magee Scientific), optical PM_{2.5} counters (IQAir). Additional eBC and PM_{2.5} data were gathered from urban air monitoring stations (AE33, both campaigns).

Before launching the campaigns, the PM_{2.5} sensors and the two MA300 devices were put into inter-comparaison indoors. An inter-comparison of our three aethalometers was also performed with the AE33 aethalometer of the air monitoring station.

The chemical compounds of the particle matter, have different health impacts (El Haddad *et al*, 2024), and black carbon itself has been emerging as an indicator in the matter (Nezis *et al*, 2022). Many studies help getting a better understanding of the chemical composition of PM (Garbarienè *et al*, 2022, Drudi *et al*, 2024). As the oxidative potential (OP) is a good indicator of the biological response of the body to pollutants of the air (Yang *et al*, 2024), offline dithiothreitol and ascorbic acid depletion assays (OP^{AA} and OP^{DTT}) were carried out for two case studies of the 2^d campaign. Additionally, OP^{AA} and OP^{DTT} were also measured online at one case study of each campaign, with an innovative prototype called ROS-Online, developed at the IGE laboratory.

The OP^{AA} results of the online method can be seen on Figure 1. With this online technology, OP peaks occur between school classes and the highest peaks have risen above 100 pmol.min⁻¹.m⁻³. As OP peaks seem to be in agreement with PM_{2.5} and black carbon peaks (eBC), this possible correlation must be analysed further. Moreover, the 2nd campaign will allow an indoor-to-outdoor OP

dynamics analysis, and an intercomparison of online OP with offline OP (one case study in common).

The source apportionment of BC (fuel fossil BC_f and wood burning BC_{wb}) is another indicator of the health impacts of infiltrated outdoor air analysed in the study.

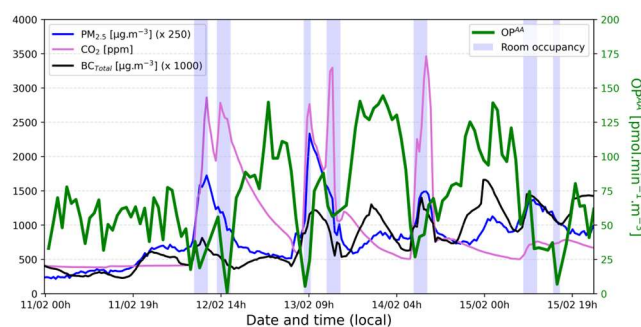


Figure 1. Oxidative potential (OP^{AA}) time series in a classroom (right-hand axis) and relative timeseries of PM_{2.5} ($\mu\text{g}\cdot\text{m}^{-3}$ - blue line), CO₂ (ppm - pink) and eBC ($\mu\text{g}\cdot\text{m}^{-3}$ - black). Note that the PM_{2.5} and eBC values have been multiplied by 250 and 1000 respectively, to facilitate reading.

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