**REFINING PM EXPOSURE USING LOW-COST PORTABLE SENSOR DATA AND HUMAN RESPIRATORY TRACT DEPOSITION MODELLING**

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**ABSTRACT**

The current work presents the results of the implementation of a personal exposure assessment methodology, which involved a personal sensor campaign, aiming to refine PM exposure using low-cost portable sensor data, exposure and human respiratory tract deposition modelling. A custom-made monitoring device was developed for measuring 3 fractions of PM (1, 2.5 and 10 μm), enabling direct assessment of personal exposure. The device is based on an Arduino microcontroller where small sensor-modules are connected. In addition, participants wore a physical activity wristband (Garmin Vivosmart 3) that records steps, distance, type of activity, heartbeat and sleeping patterns. Finally, participant positions were recorded using a GPS sensor, integrated into the PM sensors. After validation, the sensors were used to capture daily variability of PM exposure. Exposure was further refined by estimating inhalation adjusted intake rate, as well as PM deposition across human respiratory tract (HRT) using the Multiple Path Particle Deposition (MPPD) model. The above methodology was applied in the personal sensors campaign of the HORIZON2020 EU Project ICARUS, where exposure and intake to PM of almost 100 individuals in seven cities across Europe has been carried out. The integrated methodology outlined above, allowed us to highlight larger differences than the ones attributed to the spatial differentiation of the fixed station air pollution (difference of ambient PM levels of 50% were translated in intake differences up to 110%). These differences are the result of the differences in PM size fractions that are captured by the sensors and the capability of the HRT model to translate the differences in PM size distribution.

The capability of the exposure methodology outlined herein to differentiate intake among participants that are phenomenally exposed to similar air pollution levels, is the result of individualised intake assessment which is greatly facilitated by the additional information that is provided by the personal sensors. The combination of activity tract sensors enhances the time-space information, by introducing physiology based personalised information, such as the heart rate that is translated into inhalation rate, while HRT deposition, further allows to differentiate the participant characteristics, not only based on their sociodemographic characteristics, but also accounting for individual physiology.

**KEYWORDS:** Sensors, air pollution, human exposure, particulate matter