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Exposure to the short term indoor particulate matter vs outdoor atmospheric conditions

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The author investigated the relationship between indoor short-term (1-min mean) particulate matter (PM) mass concentrations and outdoor 1-min mean meteorological conditions. Indoor PM mass concentrations, namely particles having aerodynamic diameters less than or equal to 1 μm (PM1), 2.5 μm (PM2.5), 4 μm (PM4), 10 μm (PM10) and total suspended particular matter (TPM) were measured at the Department of Geophysics, Faculty of Science, University of Zagreb, Zagreb, Croatia for the period 12 December 2012 - 26 April 2013. Two DUSTTRAKTM Aerosol Monitors (TSI, Inc., Shoreview, MN, USA), one Model 8520 and the other Model 8533, were placed 1.67 m above the floor, so their inlets corresponded to the average breathing height of 1.7 m. Both monitors were placed in building corridors, adjacent to the stair case. The model 8520, which recorded solely PM1 1-min mean mass concentrations, was placed on the ground floor, while the model 8533, which simultaneously recorded PM1, PM2.5, PM4, PM10 and TPM 1-min mean mass concentrations, was on the first floor. The measuring site is in a residential area of northern Zagreb, approximately 1.5 km north-northeast of the city centre and 8-9 km northwest of Zagreb's industrial zone. Meteorological variables (specifically, 1-min mean surface air temperature, air pressure, relative humidity, global radiation, and three-dimensional wind) were measured in the vicinity of the Department of Geophysics building. It is shown that the PM1 fraction is the largest contributor to indoor TPM, where 51.5 μm m^{-3} and 54.8 μm m^{-3} correspond to the average PM1 and TPM first floor indoor wintertime mass concentrations, respectively. In addition, indoor mass concentrations of all fractions decrease with an increase in precipitation intensity, and outdoor temperature. Considering horizontal wind speed, indoor concentrations for all fractions decrease with an increase of the ambient wind speed, except for the strongest wind speeds. Results clearly exhibit an increase of indoor mass concentrations with the increase of surface air pressure and outdoor relative humidity. Furthermore, indoor PM levels depend on outdoor wind directions with concentrations of all fractions being the highest for ambient southeastern winds. This suggests advection of particles from the industrial zone toward the measuring site and the penetration of particles indoors.

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