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Seasonal variation of particulate matter (PM10 and PM2.5) concentrations in Serbia

Air pollution is a major concern in modern society and a leading contributor to global health issues. Among the various pollutants, exposure to ambient PM2.5 is the primary factor driving the burden of disease related to air pollution worldwide. Although estimates suggest that nearly the entire global population is exposed to PM2.5 concentrations exceeding the WHO recommended limits to protect public health, some countries have implemented regulations to control emissions and pollution levels. In contrast, others experience poor air quality. Central and Southeastern Europe are considered hot spots in Europe, especially regarding the PM concentrations. In Serbia, the observed levels of PM (PM10 and PM2.5) concentrations reached alarmingly high values. However, there is great variability in the intra-annual distribution of concentrations with higher values in the colder part of the year and lower values in the warmer part of the year. This study aims to determine the differences in the measured concentrations of PM particles at the seasonal level in Serbia in the period 2011–2020. In addition, the relative impact of the seasonal component was assessed using a boosted regression tree model. For certain stations, the difference between January and July concentrations can reach up to 77.50% for PM10 and 87.6% for PM2.5. The average daily PM10 concentrations in January range from 16.26 μg/m3 to 141.51 μg/m3, while in July, they vary from 17.94 μg/m3 to 32.0 μg/m3. Regarding PM2.5, these ranges are from 23.27 μg/m3 to 107.69 μg/m3 in January, and from 9.05 μg/m3 to 15.34 μg/m3 in July. The estimated impact of seasonal components reaches up to 37% for PM10 and up to 29,9% for PM2.5. The highest measured values of PM concentrations were determined for the stations Valjevo, Užice, and Kosjerić. These results suggest the need for further discussion regarding the sources and contributions to PM emissions. The largest contribution comes from the burning of fossil fuels for the needs of energy production, household heating, and industrial production. The results can assist public policy creators in defining activities that protect public health.

Keywords: Air quality, particulate matter, seasonal component, Serbia