Abstract

Many cities suffer from poor air quality as they concentrate a large number of anthropogenic sources of air pollution, especially aerosol particles with an aerodynamic diameter of less than 10 μm, PM_{10}. Due to high urbanization, more than 50 % of the world population is exposed to urban PM_{10}. Exposure to elevated PM_{10} can cause respiratory and cardiovascular diseases or premature deaths. Therefore, the Prague 7 city district concluded an agreement with the Laboratory for Air Quality Studies (Charles University, Faculty of Science) to perform detailed spatial and temporal PM_{10} concentrations survey on its territory. For this purpose, mobile measurements of PM_{10} were performed in Prague 7. The study area was divided into 6 smaller localities. One fixed route (3,4–4,5 km) was determined at each locality. In the period from December 2019 to May 2020, a total of 174 errands were performed during 10 days, regularly at 8:00, 12:00 and 17:00. The team members conducted prescribed walks with DustTrak and Garmin GPS devices, which detected every second the PM_{10} mass concentrations and the exact location for a purpose to synchronize the PM_{10} data with the detection site. Meteorological conditions were recorded by a professional meteorological station. During most of the observed days, PM_{10} concentrations in Prague 7 were below the 24-hour limit (50 $\mu g \cdot m^{-3}$). Above-limit concentrations were detected on 16.01.2020, which was a critical day for the whole Prague, because the daily limit for PM_{10} was exceeded. Spatial variability of PM_{10} showed that the levels of PM_{10} in Prague 7 are dependent on the current meteorological conditions rather than the position of the localities because meteorological conditions are prone to affect the air mass above the territory as a whole. However, localities vary in PM_{10} maximums, as these are directly affected by specific sources of pollution near the routes. In an urban green spaces, PM_{10} concentrations were always several units of $\mu g \cdot m^{-3}$ lower than in the city streets. A trend of decreasing PM_{10} concentrations was also observed with increasing wind speed. Analysis of PM_{10} temporal variability revealed that PM_{10} concentrations were lower in spring (median 4 $\mu g \cdot m^{-3}$) than in winter (median 20 $\mu g \cdot m^{-3}$) and on weekends than on weekdays. Daily variations were detected only on days with median of PM_{10} concentrations > 20 $\mu g \cdot m^{-3}$. The campaign did not reveal any hot-spot, but some problematic areas originated in anthropogenic activities such as construction, transport, residential heating or smoking were identified and characterised. Improving air quality in Prague 7 can be achieved primarily by preventing dustiness from construction sites, cleaning or watering busy roads, controlling revisions of boilers and used types of fuels and controlling compliance with the smoking ban at public transport stations.

Key words: air pollution, PM_{10}, urban microscale, mobile monitoring, exposure