

Abstract:

This bachelor thesis evaluates the impact of local heating on PM_{2,5} concentrations monitored in a village Zadní Třeboň in Central Bohemia between 21. 12. 2021 and 3. 2. 2022. It also examines the effect wind speed and temperature have on the PM_{2,5} concentrations.

The PM_{2,5} concentrations were measured using both stationary and mobile monitoring. For the stationary monitoring, 7 DustTrak 8520 monitors (integration time 1 min) were used. A network of these monitors was built to cover different settlement (village edge, village center) as well as geological types of locations (valley, hill).

The mobile monitoring took place 31. 1. 2022 over the course of 7 walks during which PM_{2,5} and PNC concentration were measured. Portable monitors were used for mobile measurements – DustTrak DRX for measuring PM_{2,5} concentrations and P-Trak for measuring particle number concentrations (PNC). The integration time for both of these monitors was 1 s. The aim of the mobile monitoring was to supplement knowledge gained from the stationary monitoring.

The highest average 24h PM_{2,5} concentrations were measured on the 22. and 23. 12. 2021. On the 22nd the US EPA limit of 35 $\mu\text{g} \cdot \text{m}^{-3}$ was exceeded on almost all measuring sites except Stations 4 and 7. On the 23rd the limit was exceeded on all measuring sites except Station 7. Contributions to the 24h concentrations of PM_{2,5} were between 10 to 28 μg (31 to 75 %). The trend of low temperatures and higher average PM_{2,5} concentrations was also recorder at a national level, hence why a direct impact of local heating cannot be determined.

The US EPA limit was exceeded the second time on 15. 1. 2022 on Stations 1 and 6, but the average 24h PM_{2,5} concentrations weren't as high (on Station 1 the average 24h concentration was 35 $\mu\text{g} \cdot \text{m}^{-3}$ and on Station 6 it was 38 $\mu\text{g} \cdot \text{m}^{-3}$). The contribution of local heating on average 24h concentrations of PM_{2,5} were 27 μg (77 %) and 28 μg (74 %) respectively. A nearby source has been identified in the vicinity of both stations.

Another important contributing factor to PM_{2,5} concentrations is wind speed. It was confirmed that at wind speeds higher than approximately 1 $\text{m} \cdot \text{s}^{-1}$ the PM_{2,5} concentrations started to drop significantly (to values between 4 and 12 $\mu\text{g} \cdot \text{m}^{-3}$). The PM_{2,5} concentrations in the village were also indirectly affected by temperature. In general, on days when the temperature was higher, PM_{2,5} concentrations were lower and vice versa. In case of both of these factors combining a higher PM_{2,5} concentrations is to be expected.

During mobile monitoring, no hot spots (i.e. places repeatedly affected by the same source) were detected, although the mobile monitoring revealed locations with repeatedly higher PM_{2,5} concentrations. These locations were the streets Na Vrážku, Na Kaplanci and K Voškovu. Several possible sources of PM_{2,5} were identified in these locations.

No sites with repeatedly high PNC values have been identified. Continually highest PNC values were measured during walk No. 7, which took place from 7 to 8 p.m.

The concentration field of PM_{2,5} in Zadní Třeboň was generally low, the US EPA limit was exceeded on less than 1 % of all measuring days.

Key words: Aerosol, PM_{2,5}, small settlement, solid fuel, combustion heating, stationary versus mobile PM_x measurement, particle number concentration - PNC