



Vertical concentration gradient of ambient ozone – insight into seven-year continuous measurements at a rural Central European site tall tower

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The vertical representativeness of ambient air pollutant concentration measurements is addressed rarely though it is a very important aspect influencing the use and correct interpretation of measured values. Presently not much information on the vertical distribution of ambient ozone (O₃) from sites representing relatively unpolluted rural areas is available. We explored the daily mean O₃ concentrations measured at four heights above the ground (2, 8, 50 and 230 m) at the rural Central European site Košetice in 2015–2021. We aimed to explore in detail the O₃ behaviour above the measuring point in close vicinity of the ground. We used the semiparametric GAM (generalised additive model) approach (with complexity or roughness-penalised splines implementation) to analyse the data with sufficient flexibility. Our models for both O₃ concentration and O₃ gradients used (additive) decomposition into annual trend and seasonality. Our results indicated consistently increasing O₃ with increasing height above the ground. The vertical O₃ concentration gradient in 2–230 m is not uniform, however, but changes substantially with increasing height and shows by far the highest dynamics near the ground between 2 and 8 m, differing in both the seasonal and annual aspects for all the air columns inspected. Study of O₃ concentrations at one site at several different heights above the ground brings useful results complementing ground-based ambient air quality monitoring, provides a deeper insight into the 3D structure of the atmosphere and the pollution, and provides valuable information for environmental studies exploring processes above the ground (Hůnová et al., 2023). Knowledge on vertical distribution of O₃ concentrations near ground is for example an important input to ecological and environmental studies associating the air pollution with its impact on birds flying tens or hundred meters above the ground or impacts on tree canopies localised some tens of meters above the ground (Reif et al., 2023).

References:

Hůnová I., Brabec M., Malý M., 2023. Ambient ozone at a rural Central European site and its vertical concentration gradient close to the ground. *Environmental Science and Pollution Research* **30**, 80014–80028. <https://doi.org/10.1007/s11356-023-28016-8>.

Reif J., Gamero A., Flousek J., Hůnová I., 2023. Ambient ozone – new threat to birds in mountain ecosystems? *Science of the Total Environment* **876**, 162711. doi: 10.1016/j.scitotenv.2023.162711.

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