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Modeling the regional dust emissions in central Europe and their contribution to urban PM levels

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Windblown dust, emitted from the surface of the earth to the atmosphere as a result of the disintegration of material due to wind drag, can have a significant impact on the atmospheric concentration of PM, especially over (semi-)arid areas. They however may be important occasionally also over non-arid regions with considerable precipitation (e.g. over midlatitudes). Therefore their contribution to the total PM pollution cannot be neglected, especially considering the increasing potential of droughts in a changing climate, when long dry periods occur between precipitation events.

Here, we investigate the regional impact of PM emissions from wind erosion on urban PM levels for a central European domain using a well-established windblown dust module (called "WBDUST") for the 2018-2019 period. As driving meteorological data, we used WRF simulations. Before applying WBDUST, we made some modifications which ensured that the surface heterogeneity for vegetation cover is taken into account. This is important as for grid cells, where the average leaf-area-index (LAI) is higher than a certain threshold, zero emissions would be produced. However, if we take into account the fractional character of LAI, emissions will be more realistic. The obtained emission fluxes were comparable to anthropogenic ones indicating the great importance of windblown dust even over such non-arid areas. WBDUST emissions were implemented into the CAMx chemistry transport model and we performed simulations with and without these emissions. Our results showed that urban PM levels are significantly higher if wind-blown dust is considered and match better with observations.