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\textbf{Mesoscale simulations of pollen and agricultural soil dust containing bacteria as ice nucleators}

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One of the greatest uncertainties in climate impacts is the one caused by atmospheric aerosols. This is because of the variety in aerosols as well as in their influences. Little is known about the contribution of primary biological aerosol particles (PBAP).

This project focuses on PBAP influences on mixed phase clouds simulated with the regional atmospheric model COSMO-ART. PBAPs are directly emitted into the atmosphere from different sources and are pollen grains, fungal spores, bacteria or leaf fragments for example. A suggested influence of PBAPs on clouds consists in their ability to act as ice nuclei, which are required to initiate freezing of atmospheric cloud droplets at temperatures above homogeneous nucleation. In laboratory experiments some PBAPs have been identified as efficient ice nuclei at relatively warm temperatures.

Here we present simulations including birch and pine pollen grains as well as agricultural soil dust containing bacteria. The emission fluxes are weighed with the individual coverage of birch or pine trees or cropland, respectively. For soil dust all cropland area is assumed to lie follow and is allowed to contribute to the emissions. Thus, this simulation is a sensitivity study to estimate the maximum possible contribution of dust particles from agricultural areas.

The model domain includes most part of Europe with a horizontal resolution of 13.4 km and terrain-following model layers. The selected time period, beginning of April 2008, falls into the birch pollen season as determined from observed pollen counts.

An empirical ice nucleation parameterization is implemented into the model, assuming that heterogeneous freezing follows the singular hypothesis. This implies that each particle has a distribution of actives sites depending on temperature. The ice active surface site densities are based on measurements for ice nucleation on soil dust and different pollen at the local AIDA chamber.

In our simulations diagnostic ice nuclei from pollen grains are below one per liter due to the relatively low pollen number concentrations on cloud level. Soil dust particles (with the maximal assumption that all cropland lies fallow) occur in high number concentrations even at cloud level, resulting in ice nuclei number concentration of more than 1000 per liter. This demonstrates the potential importance of biological ice nuclei if they are able to be transported in high atmospheric layers. Future work will contain fully coupled simulations of the impact of PBAPs on clouds, a more realistic assumption for soil dust emission and free-living bacteria from other sources.