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Effects of improved interpolation in the wet-scavenging scheme of FLEXPART

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The Lagrangian dispersion model FLEXPART v10.4 uses cloud water content, temperature, and precipitation rates to calculate wet scavenging. Currently, only precipitation fields are interpolated spatially to the particle positions. A simple nearest-neighbour approach is used for cloud parameters and temperature. This is made worse by the fact that precipitation fields from the European Centre for Medium Range Weather Forecasts (ECMWF) are temporal integrals whereas all the other parameters refer to a specific time. The pre-processor flex_extract disaggregates the precipitation fields to construct point values that can preserve the integral quantity when interpolated in FLEXPART. However, this method does not preserve precipitation in each time interval, leading to smoothing, or even shifting precipitation into dry periods.

We have implemented interpolation of all fields relevant for wet scavenging in FLEXPART v10.4 as well as the option to use our improved precipitation disaggregation scheme (<https://doi.org/10.5194/gmd-11-2503-2018>). It introduces two additional subgrid points within one original time interval. This secures consistency, continuity and mass conservation of precipitation within each time interval.

These updates lead to a massive improvement of the wet deposition fields in a specific test case where we applied a high-resolution outgrid that makes the effects of interpolation issues more visible. Originally, a kind of checkerboard pattern was visible, as well as a banded structure due to the finite time interval between meteorological input fields. Both features are mostly eliminated now. Additionally, the influence of varying the temporal and spatial resolution of the ECMWF input fields was investigated, and the benefit of using the ECMWF cloud water content instead of parametrised values. We also look at the impact of the new version on other, previously used test cases, for example, a lifetime analysis of aerosol particles as well as transport of mineral dust and black carbon.