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# Effective aerosol scavenging scheme for dispersion modelling

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The global budget of aerosols in the atmosphere depends heavily on their deposition. For global scale transport models this presents great challenges, as especially the wet deposition of aerosols is a nonlinear sub-gridcell process. With a uniform precipitation rate in space and time, the aerosol concentration decreases exponentially. However, the precipitation is generally not spread evenly across a model gridcell, and in case the model relies on offline meteorological data, it is not spread evenly over the time step either. These inhomogeneities will easily lead to overscavenging, and effective parametrized methods are thus required to reduce it. We have developed simple limits for the scavenging rate based on the convective available potential energy and on the horizontal wind speed, assuming that these quantities limit the mixing rate of aerosols between the precipitating and non-precipitating parts of the gridcell. We have implemented the method within the global transport and chemistry model SILAM (silam.fmi.fi), and present an evaluation of the method against measurements of aerosol optical depth (AOD), surface particulate matter concentrations and depositions of various aerosol species. Specifically, we focus on the long-range transport of Saharan dust. AOD measurements over Sahara are overwhelmingly sensitive to dust emission, largely independent of scavenging or other aerosol species, which means that the modeled emission may be adjusted independently of the modeled deposition. On the other hand, the long-range transport of dust plumes across the Atlantic and the Mediterranean depends heavily on the scavenging model, with incorrect scavenging leading to greatly reduced skill scores against AOD and in situ measurements. Application of the method has led to model skill scores that are competitive with online models that assimilate satellite-retrieved AOD. However, finding out how the effective scavenging rate scales properly with the grid cell dimensions and the length of the model time step remains a challenge.