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Technical Note: Simulation of detailed aerosol chemistry on the global scale using MECCA-AERO

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Abstract. We present the MESSy submodel MECCA-AERO, which simulates both aerosol and gas phase chemistry within one comprehensive mechanism. Including the aerosol phase into the chemistry mechanism increases the stiffness of the resulting set of differential equations. The numerical aspects of the approach followed in MECCA-AERO are presented.

MECCA-AERO requires input of an aerosol dynamical/microphysical model to provide the aerosol size and particle number information of the modes/bins for which the chemistry is explicitly calculated. Additional precautions are required to avoid the double counting of processes, especially for sulphate in the aerosol dynamical and the chemistry model. This coupling is explained in detail.

To illustrate the capabilities of the new aerosol submodel, examples for species usually treated in aerosol dynamical models are shown. The aerosol chemistry as provided by MECCA-AERO is very sumptuous and not readily applicable for long-term simulations, though it provides a reference to evaluate simplified approaches.

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