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Simulation of wet deposition in the CTM REM-CALGRID using a diagnostic and a prognostic meteorological driver

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Wet deposition is an important removal process in the pollution budget of the atmosphere. Wet deposition processes refer to the uptake of gaseous pollutants and aerosol particles into cloud water and precipitation, and its subsequent transfer to the ground. The description of clouds and the effective precipitation are therefore of high importance in order to obtain a correct chemical air pollution mass balance.

Prognostic weather prediction models simulate next to the precipitation field the atmospheric field of cloud water content which is needed for a detailed description of the pollutants' wet chemistry. At the same time prognostic weather prediction models often fail to describe the local precipitation and cloud fields in space and time. They over- or underestimate precipitation rates in different regions. Diagnostic analysis systems on the other hand are based on a statistical interpolation of meteorological observations. That leads to very reliable precipitation fields given that the monitoring network is adequate concerning temporal and spatial resolution and quality. At the same time the diagnostic scheme implies the limitation that only operationally measured variables can be interpolated to form the diagnostic model-output. Additional variables must be derived using the available interpolated fields.

The objective of this investigation is the assessment of advantages and disadvantages in using a diagnostic or a prognostic meteorological driver for wet deposition modelling.

For this purpose wet deposition was simulated with the Chemistry Transport Model REM-CALGRID (RCG) using a diagnostic as well as a prognostic meteorological driver. Calculations were performed for selected periods in 2005 on a 7x8 km2 grid over Germany. The resultant wet deposition output-fields were compared to each other and to wet deposition measurements.

The diagnostic meteorological driver used in this study is TRAMPER. Within the Optimal Interpolation scheme 3D-clouds are generated by using synoptic observations from WMO and cloud parameter statistics. As a prognostic meteorological driver the COSMO-EU model of the German Weather Service is applied.

The results again show that a correct description of precipitation fields is of high importance for wet deposition modelling. Furthermore the investigation suggests that a combination of diagnostic and prognostic meteorological fields would be a benefit for wet deposition modelling.