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# Aerosol/cloud feedbacks with the most recent version of the German weather forecast model (COSMO LM)

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We apply a new concept that allows an explicit aerosol/cloud coupling to the most recent version of the weather forecast model (COSMO LM) of the German Weather Service (DWD), i.e. the Limited area Model operated for short-term forecasts (LMK), to investigate to which extent Anthropogenic Aerosols Trigger and Invigorate Severe Storms (http://antistorm.isac.cnr.it). The aerosol/cloud coupling is based on a new cloud routine that allows calculating – computationally as efficient as by using the original cloud cover scheme – the area fraction of a grid box covered by stratiform and convective (subgrid-scale condensing) clouds. This routine is further coupled to a two-moment cloud microphysics parameterization for mixed-phase clouds (Seifert and Beheng, 2006). The advantage is that this coupling allows to diagnose/prognose the initial cloud water and cloud ice mass directly from the aerosol water mass, by which the aerosol water mass is derived from hygroscopic growth calculations that are based on the theoretical work presented in Metzger and Lelieveld, 2007.

First results indicate a strong cloud response to aerosol loadings. These preliminary results are quite striking and encouraging as in particular a weather forecast model operated at a rather high horizontal resolution (2.8 km) and using a fully prognostic treatment of the aerosol/cloud water shows the same strong cloud response to aerosol loadings as if this approach is applied to a global climate model (results will be presented in an accompanying presentation). The LMK model can be driven optionally with the global climate model output, or with satellite data. However, further work is required

regarding the coupling of highly localized natural and anthropogenic emissions, or the gas, aqueous and aerosol phase, which determine together with the model meteorology the temporal and spatial aerosol distributions and the related aerosol/radiation/cloud feedbacks. These issues will be addressed as far as possible.

Metzger, S., and J. Lelieveld, Reformulating Atmospheric Aerosol Thermodynamics and Hygroscopic Growth into Haze and Clouds, Atmos. Chem. Phys., Discus., in press, 2007.

Seifert, A., Beheng, K.D.: A two-moment cloud microphysics parameterization for mixed-phase clouds. Part I: Model description. Meteorol. Atmos. Phys., 92, Issue 1-2, pp. 45-66, 2006.