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Regional Modelling of Saharan Dust as Part of the SAMUM Project: Description of Dust Events using the Model LM-MUSCAT

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Mineral dust produced by aeolian erosion in arid and semi-arid areas contributes considerably to the global atmospheric aerosol. Therefore, it is expected to impact the climate system by direct and indirect effects. Since there are considerable uncertainties in the optical parameters and the variability of the spatio-temporal distribution of mineral dust, the understanding of magnitude and sign of the dust radiative forcing is poor (IPCC, 2001).

In order to clarify these uncertainties and to quantify the radiative effect of Saharan dust the project SAMUM was initiated. It comprises both field measurements in the northern Sahara (Morocco) in 2006 and modelling of the Saharan dust cycle in the mesoscale. The MUltiScale Chemistry Aerosol Transport model (MUSCAT) (Wolke et al., 2004) online-coupled with the regional model LM (Doms and Schättler, 1999) is applied to model individual dust events. An implemented Dust Emission Scheme (DES) (Tegen et al., 2002) following Marticorena and Bergametti (1995) describes the release of dust due to wind erosion. It calculates the erosion threshold velocity and the horizontal and vertical size resolved dust fluxes considering surface properties (e.g., surface roughness, soil size distribution) and “hot spots” of dust emission. The LM is modified to enable interaction of the computed dust load with the solar and thermal radiation and consequently with the model dynamics.

First results from case studies of Saharan dust events are presented. To study the long-range dust transport, two Saharan dust outbreaks directed to Europe in August and October 2001 are simulated. To evaluate the model results, a comparison with observations of the European Aerosol Research Lidar Network (EARLINET), sunphotometer measurements from the AERONET network, and satellite-derived data is performed.

The modelled dust load and the on-line feedback of dust upon meteorology and dust production contribute to investigations on the dust radiative forcing. The mechanisms of dust mobilisation are examined in a near source study of a dust event in the Bodélé depression in northern Chad, the world's biggest dust source (Giles, 2005).

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