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Simulating mineral dust transport in West Africa: A case study

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Between 200 and 1000 million tonnes of soil-derived dust particles are transported annually by winds on Earth (e.g. Goudie, 1983). The Sahara could account for about half of the global total of soil-derived aerosols (e.g. Prospero and Carlson, 1972). To simulate the spatial and temporal distribution of mineral dust particles it is necessary to describe the source term in an accurate way. Based on the work of Shao (2001) and Alfaro and Gomes (2001) Vogel et al. (2005) combined two parameterisations of the threshold friction velocity and the vertical flux of mineral dust to a new microphysically detailed parameterisation to calculate the mineral dust emission. We coupled this emission scheme (MADEdust) to the Lokal Model (LM) of DWD, implemented a calculation of the sedimentation and deposition velocities and simulated the dust transport over West Africa with a high spatial resolution.

At the beginning of March 2004 a big mineral dust event occured over Africa. It is possible to detect the dust plume quite well in satellite images during this period. The structure of the dust front and the differences in the horizontal distribution can be clearly seen on these images. The dust appears to be most dense in a region of Africa known as the Bodele Depression, which is the largest source of wind-blown dust on Earth. In the afternoon of 6th of March the dust storm covers about one-fifth of the Earth's circumference. The dust plume depicts a frontal character which can be followed several days. Therefore it gives a good case study to validate the parameterisation of the dust plume and the dynamics of the model.

We will show a comparison of our simulated dust distribution and satellite images for the respective period. The presentation of our model results will focus on the calculated sedimentation and deposition of dust particles.