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Modelling soil dust aerosol in the Bodélé depression during the BoDEx campaign

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Abstract. We present regional model simulations of the dust emission events during the Bodélé Dust Experiment (BoDEx) that was carried out in February and March 2005 in Chad. A box model version of the dust emission model is used to test different input parameters for the emission model, and to compare the dust emissions computed with observed wind speeds to those calculated with wind speeds from the regional model simulation. While field observations indicate that dust production occurs via self-abrasion of saltating diatomite flakes in the Bodélé, the emission model based on the assumption of dust production by saltation and using observed surface wind speeds as input parameters reproduces observed dust optical thicknesses well. Although the peak wind speeds in the regional model underestimate the highest wind speeds occurring on 10–12 March 2005, the spatio-temporal evolution of the dust cloud can be reasonably well reproduced by this model. Dust aerosol interacts with solar and thermal radiation in the regional model; it is responsible for a decrease in maximum daytime temperatures by about 5 K at the beginning the dust storm on 10 March 2005. This direct radiative effect of dust aerosol accounts for about half of the measured temperature decrease compared to conditions on 8 March. Results from a global dust model suggest that the dust from the Bodélé is an important contributor to dust crossing the African Savannah region towards the Gulf of Guinea and the equatorial Atlantic, where it can contribute up to 40% to the dust optical thickness.

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