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How to model aeolian dust emission from hot spots for climate assessments? The example of the Bodélé depression (Chad)

C. Bouet (1), G. Cautenet (1), R. Washington (2), M. C. Todd (3), B. Laurent (4), B. Marticorena (5), and G. Bergametti (5)

(1) Laboratoire de Météorologie Physique, UMR CNRS 6016, Université Blaise Pascal, 24, avenue des Landais, 63170 Aubière Cedex, France (C.Bouet@opgc.univ-bpclermont.fr / Fax: +33 (0)4 73 40 51 36 / Phone: +33 (0)4 73 40 52 76)

(2) Climate Research Lab, Oxford University Centre for the Environment, South Parks Rd, Oxford, OX1 3QY, UK

(3) Department of Geography, University College London, Pearson Building, Gower St., London, WC1E 6BT, UK

(4) Leibniz-Institute for Tropospheric Research, Permoserstrasse 15, 04318 Leipzig, GERMANY

(5) Laboratoire Interuniversitaire des Systèmes Atmosphériques, UMR CNRS 7583, Universités Paris 7- Paris 12, 61, avenue du Général de Gaulle, 94010 Créteil Cedex, France

Desert dust is one of the most important contributors to the atmospheric aerosol burden (some Gt/year). For long term climate investigations, it is particularly important to accurately model the global cycle of these aerosols. For regional studies, a satisfying solution consists in using a mesoscale model coupled online with a comprehensive dust production model (DPM). Nevertheless, a severe difficulty arises when dealing with intense dust sources located in regions characterized by a small extension and a complex topography. These particular points are called “dust hot spots” and deserve special attention as their contributions to the annual dust cycle are far from being negligible. Famous hot spots are, for instance, the Owens Lake (United States) or the Bodélé depression (Northern Chad).

The Bodélé depression is believed to be the single largest source for the Saharan dust

transported over the Atlantic Ocean, especially that emerging in the Gulf of Guinea in boreal winter. During the Bodélé Dust Experiment 2005 (BoDEx 2005), which was performed in February-March 2005, a severe dust event was observed and some of its main characteristics (surface wind, dust concentrations, radiation) were recorded.

We show the capability of a mesoscale model coupled online with a DPM to reproduce the small scale features associated to this dust event. These simulations clearly show that well resolved wind fields are required to reproduce the observations satisfactorily. For climatologic studies, this small scale method may be used, for instance, to design simple corrective algorithms when using global circulation model, which are, for the moment, unable to properly represent the aeolian dust uptake in such regions.