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The Desert Storms Project – Towards an Improved Representation of Meteorological Processes in Models of Mineral Dust Emission

P. Knippertz, J. H. Marsham, K. Schepanski, B. Heinold, S. Cowie, S. Fiedler, and A. J. Roberts

University of Leeds, School of Earth and Environment, Leeds, United Kingdom (p.knippertz@leeds.ac.uk, +44(0)113 343-6422)

Dust significantly affects weather and climate through its influences on radiation, cloud microphysics, atmospheric chemistry and the carbon cycle via the fertilization of ecosystems. It also has important impacts on air quality and human health. To date, quantitative estimates of dust emission and deposition are highly uncertain. This is largely due to the strongly nonlinear dependence of emissions on peak winds, which are often underestimated in models and analysis data.

This contribution serves to introduce the general motivation and approach of the recently started "Desert Storms" project at the University of Leeds. It is funded by the European Research Council (ERC) and runs until 2015. The core objective of this project is to explore ways of better representing crucial meteorological processes in numerical dust models. These include daytime downward mixing of momentum from nocturnal low-level jets, convective cold pools (sometimes referred to as "haboobs") and small-scale dust devils and plumes in the daytime convective boundary layer.

To achieve this, the following steps are currently undertaken: (A) a detailed analysis of observations including station data, measurements from recent and future field campaigns, analysis data and novel satellite products, (B) a comprehensive comparison between output from a wide range of global and regional dust models, and (C) extensive sensitivity studies with regional and large-eddy simulation models in realistic and idealized set-ups to explore effects of resolution and model physics.

The ultimate goal of the project is to develop novel parameterizations that link gridscale quantities with probabilities of winds exceeding a given threshold within the gridbox. Liaising with the regional and global aerosol and dust modelling community right from the outset of the project helps to ensure that results are targeted towards operational and Earth system modelling needs. First detailed results from "Desert Storms" will be presented in several accompanying contributions in the same session.