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The Role of Deep Convection and Low-Level Jets Forcing Dust Emissions in West Africa: A High-Resolution Regional Dust Modelling Study

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West Africa is the world's most important source of atmospheric mineral dust, which impacts weather and climate through its contribution to the direct and indirect aerosol effects. Mineral dust also has an impact on the biogeochemical and hydrological cycle, and affects human health and air quality. Quantitative estimates of the various effects require an adequate representation of modelled peak-wind generating mechanisms that cause dust emissions.

Daytime downward mixing of momentum from nocturnal low-level jets (LLJs) and convective cold pools (haboobs) have been identified as important meteorological drivers of dust emissions in the Sahel and Sahara. Previous work using 10-day continental-scale convection-permitting simulations of summertime West Africa, performed using the UK Met Office Unified model as part of the *Cascade* project, has shown that these processes dominate the modelled dust-generating winds, with haboobs being very poorly represented in models with parameterised deep convection. This previous work did not, however, model dust emission explicitly. As part of the "Desert Storms" project (funded by the European Research Council), we expand on this work here using newly available 40-day *Cascade* runs with dust emissions calculated in an offline model driven with the modelled surface winds at 40, 12, 4 and 1.5-km horizontal grid-spacings (6 days only at 1.5 km). These calculations include different versions of dust emission parameterisations and soil surface properties, allowing separation of meteorological and land-surface effects. A major focus is on the statistical analysis of the diurnal cycle of wind speed and dust emission, for which the long simulation period provides a robust basis. The diurnal cycle gives insight into the role of different meteorological processes and is expected to affect the subsequent dust transport in the boundary layer.

The high-resolution results show dust emission patterns in fascinating detail. For the first time it could be shown how dust mobilisation is characterised by both long-lived large propagating haboobs and numerous smaller-scale short-lived microburst-like events. The results suggest that the role of moist convective processes is sensitive to land surface characteristics in the southern Sahara and Sahel region, where convective outflows are most frequent. The findings will ultimately lead to a better representation of these dust-generating processes in global and regional scale dust models.