Geophysical Research Abstracts
Vol. 15, EGU2013-13760, 2013
EGU General Assembly 2013

The role of roughness in predicting transport thresholds on desert surfaces: temporal and spatial variability

James King (1), Karsten Haustein (1), Giles F.S. Wiggs (1), Frank Eckardt (2), David S.G. Thomas (1), and Richard Washington (1)

(1) Oxford University, Oxford, UK, (2) University of Cape Town, South Africa

Dust emission schemes in climate models are relatively simple and tuned to represent observed background aerosol concentrations. A key component of the dust emission scheme is the sediment transport threshold, which is a function of soil size distribution, soil moisture, air and soil particle density, and surface roughness. For a particular region or landform that is not vegetated the variable that controls the transport threshold is soil moisture. This is because it is assumed that the other components vary little (air and soil particle densities) or are kept constant (soil size distribution and surface roughness). This in turn puts the emphasis very heavily on soil moisture and wind stress as the key drivers of dust emission for specific landforms and dust emission schemes. This highlights the necessity for current models to tune their model parameters to observations.

Observations of dust emission were undertaken in 2011 and 2012 on Sua Pan in Botswana, a large, flat, unvegetated salt pan, as part of the Dust Observation for Models (DO4 Models) campaign. The observations consisted of eleven meteorological stations placed within a 144 km^2 region recording wind velocity, soil moisture, soil and air temperature, horizontal transport, vertical transport, and radiative properties. Out of the measured and calculated erodibility parameters responsible for predicting transport threshold within current schemes, surface soil moisture and aerodynamic roughness length varied the most over the duration of the project and spatially across the pan. In some cases, the aerodynamic roughness length of the bare soil increased by three orders of magnitude within a three month period. This increase in roughness would almost double the modelled threshold shear velocity required for this surface to be emissive. The temporal and spatial variability of the calculated transport threshold is explored with observed data and compared with the modelled transport threshold for this region for the campaign duration. These results suggest that for dry saline lakes and other evaporite and unvegetated emissive surfaces a more detailed aerodynamic roughness dataset is required to accurately resolve dust production within this landform classification.