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Dust emissions: variability and modelling

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At the beginning of the nineties, many attempts have been made to simulate the desert dust cycle and its impacts at a global scale, mainly by using general circulation models. However, these simulations generally failed in reproducing the present data or the information retrieved for the Last Glacial Maximum. According to the authors, deficiencies in the source parameterization accounted for a large part of the observed discrepancies. Generally, in those simulations, the dust production function was only dependent on the extent of the desert regions and on the wind velocity. Indeed, dust emissions were always defined as a continuous function of the wind velocity, whereas many experiments clearly indicate that the dust mobilization occurs only for wind velocities higher than a threshold value and that the production is not linearly dependent on the wind velocity. In fact, it has been experimentally shown that the erodability depends strongly on the soil texture, the soil type and the ground surface characteristics (vegetation cover, rocks, and pebbles). The lack of such soil features dependence in the source parameterization may explain shortcomings in the simulations concerning the underestimation or overestimation of dust production for specific regions.

Indeed, these surface features control both the aeolian erosion thresholds and the intensity of the dust fluxes. As a result, dust emissions are sporadic and spatially heterogeneous, making difficult any assessment of their impacts. This paper reviews what we have learn from observations on the temporal and spatial variability of the dust emissions and the way by which the major dust emission processes are presently accounted for into regional or global scale dust models.