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An improvement of the dust emission scheme in the global aerosol-climate model ECHAM5-HAM

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The mineral dust is an important component of the global aerosol cycle and the climatic system. An aerosol-climate modeling system ECHAM5-HAM is able to reproduce and predict the distribution, evolution and climate impacts of dust aerosols, by the ensemble of micro-physically interacting internally-mixed and externally-mixed aerosol populations as well as their size distribution and composition. However, the parameterization of the dust emission in current ECHAM5-HAM is still rather crude. Some key parameters such as surface roughness, soil moisture and soil properties at various locations are not very well included to calculate the threshold wind friction velocity for aeolian erosion and to simulate the emission of mineral dust aerosols. In this study, the aforementioned parameters are realistically included in ECHAM5-HAM, in order to improve the simulation of global dust aerosol emissions. The surface aerodynamic roughness length is derived from the European Remote Sensing (ERS) scatterometer measurements in dust source regions. The parameterization of soil moisture and detailed soil properties in Asian dust source areas are also added. The model results show that the changes of aerodynamic roughness length and soil moisture in arid and semi-arid regions greatly decrease the global dust emission. The simulation results of the ECHAM5-HAM with an improved dust emission scheme are compared to the in-situ measurement data over China, in order to examine whether the spatial distribution of surface dust source is realistically predicted.