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Pluriannual simulations (1996-2001) of mineral dust emission fluxes from Chinese and Mongolian deserts

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Asian deserts are suspected to be among the most intense sources of mineral dusts, but few estimations of the dust amount injected in the atmosphere from these regions are available. Mineral dust emissions were simulated (1996 to 2001) using a physical dust emission scheme over a region extending from 35.5˚N to 47˚N and from 73˚E to 125˚E. The required input parameters characterizing the surface features of the source-regions (aerodynamic roughness length, soil dry texture) were mapped with a resolution of $1/4^{\circ} \times 1/4^{\circ}$. Surface roughness lengths were derived from POLDER-1 data (POLarization and Directionality of the Earth Reflectance Polarized). The surface products and soil dry textures of Chinese and Mongolian arid soils were derived from in-situ measurements. Meteorological data (surface wind fields, precipitation, temperature ...) were obtained from the ECMWF ERA-40 database (European Centre for Medium-range Weather Forecast). The sensitivity of simulated dust emission fluxes and frequencies to the soil moisture and the snow cover was assessed.

The results show a good representation of the important daily events (localisation and intensity) observed by the meteorological stations and by TOMS satellite sensor. Based on six years of simulations, the main dust source regions were identified and their contributions to the total dust emissions were quantified: the Taklimakan desert ($\sim$27 % of total flux; $\sim$59 % of the frequency), northern deserts of China, i.e. Badain Jaran, Ulan Buh, Tengger, Kubqi and Mu Us deserts ($\sim$33 % of total flux; $\sim$37 % of the frequency), and the Gobi desert ($\sim$38 % of total flux; $\sim$2 % of the frequency). The seasonal cycle of the frequencies of dust emissions is well reproduced and mainly controlled in latter spring and in summer by the emissions occurring in the Taklimakan desert, and in winter by those occurring in the northern deserts. The Taklimakan desert appears as the most frequent and constant source of dust emissions during the studied

period. On the other hand, in the Gobi desert only few dust events were simulated, but their emissions are often very important. A very high inter-annual variability of emissions (flux and frequency) is thus observed in the Gobi desert. In the northern deserts of China, dust emissions are frequent but their intensity is variable. When integrated over time and space, these results show an important annual and inter-annual variability of the simulated quantities of mineral dust emitted (between 100 $Mt.yr^{-1}$ and 460 $Mt.yr^{-1}$), mainly due to huge events in the Gobi desert and in the northern deserts of China.