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Simulations of mineral dust concentrations over Western Africa with ChimereDUST model

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Mineral dust is a major component of the tropospheric aerosol in Western Africa, the Sahara desert and sahelian region being considered as the main source regions of the world. One of the main dust issues in the AMMA project is to quantify the variability of their emissions and concentrations at the seasonal and interannual timescales in relation with the variability of the monsoon system. Regarding the sporadicity of the dust emissions and the spatial and temporal variability of their transport from and over Western Africa, modelling is a relevant approach. However, it requires the development of a dedicated tool allowing the simulation of the mineral dust cycle at various time scale, i.e. from an individual event to the interannual time scale. We have thus developed a model derived from the chemistry and transport model Chimere to perform simulations of the mineral dust cycle with a temporal resolution ˜1 hour over long time periods (5 to 10 years) and spatial resolutions ranging from ˜10 km to 1°. Specific parameterisations of the various terms of the mineral dust cycle have been implemented in the ChimereDUST model: emission fluxes, atmospheric transport, d ry and wet deposition. In particular the mineral dust emission model allows the on-line simulations of the dust emissions fluxes and the associated size-distribution. The size-distributed emissions are transported as independent tracers using a bin-scheme for dry deposition. Preliminary simulations of the atmospheric dust cycle were performed with ChimereDUST forced with the ECMWF(European Center for Medium-Range Weather Forecasts) meteorological fields with a 1°x1° resolution. As a first quantitative validation, simulated dust concentration fields are compared to SeaWiFS images and AERONET data (Holben et al., 2001)for selected dust storms that occurred over western Africa.