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Sensitivity of desert dust modeling to spatial scales: a numerical study

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Atmospheric aerosols are known to play an important role in the Earth's climate system. However, the quantification of aerosol radiative impact on the Earth's radiative budget is very complex because of the high variability in space and time of aerosol mass and particle number concentrations, and optical properties as well. In many regions, like in desert regions, dust is the biggest contribution to aerosol optical thickness [*Tegen et al.*, 1997]. Consequently, it appears fundamental to well represent mineral dust emissions to reduce uncertainties concerning aerosol radiative impact on the Earth's radiative budget.

Prospero [1990] found that the Sahara is a major source of dust aerosols and, more recently, *Washington et al.* [2003] determined that the Bodélé depression, in northern Chad, is the most important limited source of mineral dust in Sahara. Dust emission is a threshold phenomenon driven by the intensity of horizontal wind. In numerical modeling, horizontal wind speeds must be well known in order not to underestimate (or overestimate) dust emissions. Recently, *Koren and Kaufman* [2004] revealed that the reanalysis data (NCEP) that can be used as an input data in numerical model underestimates wind speeds in the Bodélé region by up to 50%. Such an uncertainty on horizontal wind speeds is not acceptable to well represent dust emission. In some models, like in the Regional Atmospheric Modeling System (RAMS), reanalysis datasets are used to constrain the models whereas wind speeds are calculated by the model itself. Nevertheless, the question arises concerning the precision of the wind speeds calculated by the model.

Using the mineral dust source established by *Laurent et al.* [2005] and the RAMS model, we show the importance of the scale at which horizontal winds are computed in order not to underestimate dust emissions. This numerical study focuses on a dust event that occurred during the 2005 dry season over the Niger-Chad region.