Geophysical Research Abstracts, Vol. 7, 08525, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08525

Impact of model resolution on the characterization of mineral dust plume over AMMA region. Application to a SHADE campaign events.

F. Minvielle (1), C. Flamant (1), J. Pelon (1) and G. Cautenet (2)

(1) Service d'Aéronomie, Paris, France, (2) Laboratoire de Météorologie Physique, Clermont-Ferrand, France (minviel@aero.jussieu.fr)

AMMA project (African Monsoon Multidisciplinary Analysis) is dedicated to improving our knowledge and understanding of the West African Monsoon (WAM) and its variability on daily-to-interannual times. This variability can have important consequences on ecology and agricultural activities in this place. The evolution of the WAM is influenced by the different forcings (land surface processes, ocean processes and atmospheric composition) that are coupled with one another. Aerosols should have an important implication in the evolution of WAM, by modifying the composition of atmosphere, the cloud cycle and atmospheric radiative balance. The mechanisms of the aerosol actions, which thus can be chemical, microphysical as well as radiative, are complex and still misunderstandood at the moment.

In Saharan region, 1500 Mt of mineral dust aerosols (Andreae, 1995) are emitted in atmosphere each year. Thus, the arid regions constitute largest sources of aerosols emissions in West Africa. Mineral dust emissions present specific characteristics that make difficult their estimation and their description: they are sporadic as they depend on a threshold of wind (dynamical processes) as well as the surface properties (type of soil, soil roughness...).

In this context, the present work deals with the characterization of mineral dust emissions and the vertical and horizontal structure of dust plume during its transport over the West Africa. This particular region has been chosen because we plan to apply the present study to the forthcoming AMMA project. As a consequence; we use data from SHADE campaign (Tanré et al., 2003) which took place in September 2000 over the Atlantic Ocean (between Dakar and Cape Verde). An attempt was made by Myhre et al. (2003) to characterize the properties of the dust plume observed during SHADE using large scale modelling (i.e. with mesh of 100-km). Even though Myhre et al, (2003) reported good agreement between the simulation and the observations in terms of horizontal plume structure and direct radiative impact of dust aerosols (within 10% of observations), their results show substantial differences between the simulation and the observations concerning the vertical distribution of the dust aerosol and aerosol optical depth (AOD) at the scale of the plume. According to Myhre et al. (2003), these discrepancies are intimately related to the coarse resolution of the simulation.

In this work, in order to investigate the impact of model resolution on the dust properties retrieval, we use a high-resolution meso-scale simulation of the transport of mineral dust during a major dust event in September 2000. The model includes the Regional Atmospheric Modelling System (RAMS) model of Pielke et al, (1992) that has been coupled to the Dust Production model of Marticorena et al, (1995) and to the radiative EC3 code (Chomette, 1999) for dust generation and radiative calculations respectively. Here, 20-km resolution domain is nested in a 100-km resolution domain using the 2-way grid nesting procedure described in Walko et al. (1995). 60 vertical levels are used, 35 of which are in the lower 5 km of the atmosphere (the depth of the plume was observed to be about 5 km deep, Leon et al., 2003). The nested grid approach allows a good description of dynamic structures and is expected to allow good quantitative comparison between observed and simulated dust emissions. The next step of this work is a study of direct radiative impact of aerosols and their feedback on atmospheric vertical profiles (temperature, humidity, dynamic…) by comparing two simulations: one with radiative code coupled on-line and one with radiative code on off-line.