Geophysical Research Abstracts, Vol. 8, 08818, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08818

Impact of Saharan dust on numerical weather forecasts

C. Pérez (1), S. Nickovic (2), G. Pejanovic (3), E. Özsoy (4), J.M. Baldasano (1)

(1) Barcelona Supercomputing Center. Earth Sciences Division. Barcelona, Spain, (E-mail: carlos.perez-garcia@upc.edu), (2) World Meteorological Organization. Environment Division, Atmospheric Research and Environment Program, (3) South Environment and Weather Agency, Belgrade, Serbia, (4) Middle East Technical University. Institute of Marine Sciences. Erdemli-Mersin, Turkey.

Several studies have suggested that the inclusion of mineral dust radiative effects could lead to a significant improvement in the radiation balance of numerical weather prediction (NWP) models with subsequent improvements in the weather forecast itself. Recently, Kischa et al. (2003) related systematic short-term temperature forecast errors to the absence of dust radiative effects in models over the Saharan region. Also, Haywood et al. (2005) stated that the neglection of mineral dust in a NWP model is the most probable reason for the discrepancy in outgoing longwave radiation between the model and Meteosat-7 observations over northern Africa.

In this context, the radiative effects of mineral dust have been fully incorporated into a regional atmospheric dust model (Eta/DREAM; Nickovic et al., 2001). Dust affects the radiative fluxes at the surface and the top of the atmosphere, and the temperature profiles at every model time step when the radiation module is processed. These changes influence the atmospheric dynamics, moisture physics and near-surface conditions. Furthermore, dust emission is modified by changes in friction velocity and turbulent exchange coefficients; dust turbulent mixing, transport and deposition are altered by changes in atmospheric stability, precipitation conditions and free-atmosphere winds.

The new scheme was tested for a major dust outbreak over the Mediterranean on April 2002 in order to assess dust impacts on regional numerical weather forecasting. It is shown that the newly developed atmosphere-dust feedback scheme increases the accuracy of both atmospheric temperature and mean sea-level pressure forecasts. Both low-level warm and upper-level cold temperature biases are considerably re-

duced when dust affects the atmosphere thermodynamics. The root mean square error of the mean sea level pressure over the whole domain was reduced by almost 20%.

The proposed model with integrated dust and atmospheric radiation represents a promising approach for further improvements in numerical weather prediction practice and radiative impact assessment over dust-affected areas.

References

Haywood, J. M., R. P. Allan, I. Culverwell, T. Slingo, S. Milton, J. Edwards, and N. Clerbaux (2005), Can desert dust explain the outgoing longwave radiation anomaly over the Sahara during July 2003?, J. Geophys. Res., 110, D05105, doi:10.1029/2004JD005232.

Kischa, P., P. Alpert, J. Barkan, I. Kirchner and B. Machenhauer, (2003), Atmospheric response to Saharan dust deduced from ECMWF reanalysis (ERA) temperature increments, Tellus, 55B, 901-913.

Nickovic, S., A. Papadopoulos, O. Kakaliagou and G. Kallos, (2001), Model for prediciton of desert dust cycle in the atmosphere. J. Geophys. Res., 106, 18,113 - 18,129.