Atmos. Chem. Phys. Discuss., 13, C9797–C9799, 2013
www.atmos-chem-phys-discuss.net/13/C9797/2013/

Atmospheric Chemistry and Physics Discussions
Open Access

ACPD
13, C9797–C9799, 2013

Interactive comment on "WRF-Chem simulations of a typical pre-monsoon dust storm in northern India: influences on aerosol optical properties and radiation budget" *by* R. Kumar et al.

Anonymous Referee #2

Received and published: 6 December 2013

The paper investigates the radiative impact of a pre-monsoon dust storm event. A small impact was found, certainly because the nudging imposed to the thermodynamic fields over the whole depth of the atmosphere. It is very unusual and does not permit the PBL to evolve freely. This strongly constrains the surface wind, therefore the dust emission. At least, the reasons for this choice should be given. It is recommended to investigate the nudging effect on the dust emission by letting the thermodynamics to evolve freely within the PBL.

Specific comments

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

Introduction

Page 21838, first paragraph. The dust also impacts on the dynamics of the atmosphere through radiative effects. There is a growing number of papers on that topic. For example, Tompkins et al. (2005) have shown that a revision of the aerosol climatology in the forecasting system at ECMWF significantly improved the ECMWF 5-day forecasts of the African Easterly Jet, the central dynamical feature over West Africa. Chaboureau et al. (2011) did a study of sensitivity to the radiative effect of dust that showed a better prediction of precipitation when a dust prognostic scheme was used rather than climatology or when dust effects were ignored. Stanelle et al. (2010) have shown that the temperature changes caused by mineral dust modified near surface winds. Further, they found a feedback on total emission fluxes with an increase of 25% during the dust episode under scrutiny.

Section 2 The WRF-Chem model

Page 21841, line 17. "... at a spatial resolution of 30 x 30 km2". This is the grid mesh size. What about the effective resolution?

Page 21843, line 16. The choice to nudge the thermodynamical fields over the whole troposphere needs to to be explained and justified.

Page 21844, line 4. Is the C value dependent on the grid spacing?

Section 4.1 General meteorology

Page 21848, line 14. How do you define the PBL height?

Section 4.2 Spatial and vertical distribution of dust

Page 21848, line 24. Figure 4. It is not clear whether the two images cover the same domain or not. If yes, the spatial pattern differs between the simulation and the observation.

Page 21851, line 12. Plotting the mean vertical profile of extinction would provide a more quantitative comparison between retrieval and simulation. The CALIPSO retrieval shows extinction values at 3 km altitude larger than those simulated. Is it a nudging effect that damps the PBL development?

Section 4.4 Impact of dust storm on radiation budget

Page 21856, line 4. It should be recalled that the radiative forcing computed here is limited by the nudging effect. The feedback on the dynamics was not taken into account.

Typos

"evalauted" (21850/18), "retrived" (21851/9)

References

Chaboureau J-P, Richard E Pinty J-P, Flamant C, Di Girolamo P, Kiemle C, Behrendt A, Chepfer H, Chiriaco M, Wulfmeyer V., Long-range transport of Saharan dust and its radiative impact on precipitation forecast: a case study during the Convective and Orographically-induced Precipitation Study (COPS). Q. J. R. Meteorol. Soc. 137: 236–251. doi:10.1002/qj.719, 2011.

Stanelle, T., Vogel, B., Vogel, H., Bäumer, D., and Kottmeier, C., Feedback between dust particles and atmospheric processes over West Africa during dust episodes in March 2006 and June 2007, Atmos. Chem. Phys., 10, 10771-10788, doi:10.5194/acp-10-10771-2010, 2010.

Tompkins, A. M., C. Cardinali, J.-J. Morcrette, and M. Rodwell, Influence of aerosol climatology on forecasts of the African Easterly Jet, Geophys. Res. Lett., 32, L10801, doi:10.1029/2004GL022189, 2005.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 21837, 2013.