Atmos. Chem. Phys. Discuss., 11, C12617–C12621, 2011
www.atmos-chem-phys-discuss.net/11/C12617/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model – Part 1: Model description, annual simulations and evaluation" *by* C. Pérez et al.

C. Pérez et al.

cperez@giss.nasa.gov

Received and published: 1 December 2011

We thank referee 2 for the review. Below we respond to the questions/comments raised by the referee.

Referee: "General Comments: - One of the most important strengths of this approach is its online capability. However, throughout the paper there is no application of this approach. Namely, all the calculations are made in the off-line mode. I would encourage the authors to include such modeling exercises to improve the quality of the paper."

Response: From this general comment, we understand that the referee defines "off-line" as a simulation not allowing for dust radiative feedbacks. The NMMB/BSC-Dust is a coupled "online" model. An "online" model does not necessarily imply that feedbacks between radiation and aerosol are allowed. For the definition of "online" and "offline" models we refer to Grell et al. (2005): Until recently, the chemical processes in air quality modeling systems were usually treated independently of the meteorological model, i.e., "offline", except that the transport was driven by output from a meteorological model, typically available once or twice per hour. In "online" systems the air quality component of the model is fully consistent with the meteorological component; both components use the same transport scheme (mass and scalar preserving), the same grid (horizontal and vertical components), and the same physics schemes for subgrid-scale transport. The components also use the same timestep, hence no temporal interpolation is needed. This is exactly what the NMMB/BSC-Dust is about. It is an online model and the simulations shown in the paper are done in an online mode.

With respect to the referee's concern, the NMMB model's operational radiation scheme is the GFDL scheme, which doesn't include aerosol treatment. While we also implemented the RRTM radiation scheme allowing feedbacks between dust and radiation, for this first contribution of description and evaluation of the model we decided to run our simulations with the GFDL operational scheme, which is the version of the model planned to be operational this year. Future specific studies on dust interaction with radiation will be performed with the RRTM scheme, but it is not the goal of this contribution to evaluate this feature of the model.

Referee: Is the year 2000 representative of the climatology of what the measurements are representing? An normalization of the concentrations can be done in order to avoid features of the particular year and then compare with the normalized observations.

Response: As we indicate in the paper, we evaluate monthly and annual means from a global model run for year 2000 against a variety of global observations making use of the tools developed at the LSCE within the AEROCOM project (Kinne et al., 2005;

ACPD

11, C12617–C12621, 2011

Interactive Comment

Textor et al., 2006) (http://nansen.ipsl.jussieu.fr/AEROCOM/). We use part of the AEROCOM dust benchmark data set used for global dust model evaluation and intercomparison, which can be considered as a standard in the global dust modeling community. Within AEROCOM each model simulated year 2000 using independently selected simulation conditions. A detailed description of the observations and other global dust model evaluations can be found in Huneeus et al. (2011). While the referee's suggestion is interesting we decided to be consistent with Huneeus et al. (2011) since the evaluation of the model for year 2000, including plots and statistics can be compared directly with other global dust models. Future evaluation standards need to better address this inconsistency and the referee's suggestion may be explored within the community.

Referee: The deposition calculation is within a factor of 10 of the measured values? That is not very encouraging. Please include some references to put this comparison in perspective. Is this value generally obtained by this kind of models?

Response: The answer is yes. Hunneus et al (2011) includes a discussion about this issue that perfectly responds to the referee's concern: "The models perform better (smaller errors and biases) in simulating the climatology of vertically integrated variables in dusty sites than they do with deposition and surface concentration measurements. The modeled AOD is within a twofold range of the observations at most sites, whereas model under/overestimations of surface concentrations and total deposition are more typically within a range of a factor of 10. Differences in the data can explain this since the AERONET climatology includes the simulated years whereas the deposition and surface concentration climatology do not. The surface measurements were considered as climatology in this study although, in a strict sense of the term, they were not. Furthermore, surface concentration and deposition require that the model correctly simulates the vertical distribution whereas for vertically integrated parameters such as AOD and AE the vertical distribution is less relevant (assuming that they are clear-sky measurements of non-hygroscopic particle such as dust)." We added these

ACPD

11, C12617–C12621, 2011

Interactive Comment

considerations in the conclusions section.

Referee: The comparison with daily and monthly averages is really interesting. However, it would strengthen this work if you can produce a comparison with hourly measurements.

Response: We appreciate the suggestion of the referee but we believe that the contribution contains already a robust evaluation of the model at global and regional scales, from yearly to daily time scales. The goal of the paper is not evaluate the model with hourly measurements. In Part 2 of this contribution (Haustein et al., submitted) the regional configuration of the model is evaluated in detail with data from SAMUM I and BODEX campaigns.

Referee: In the conclusions you use the term "pre-operational". What is that exactly means?

Response: Operational forecasts can be defined as routine forecasts for practical use. The pre-operational mode refers to the stage when the model is routinely run in experimental mode and the results are not yet released for practical use. This stage is necessary before the model becomes operational. The model is currently run in pre-operational mode.

References:

Grell, G. A., S. E. Peckham, R Schmitz, S. A. McKeen, G. J. Frost, W. Skamarock and B Eder (2005), Fully coupled "online" chemistry within the WRF model, ATMOSPHERIC ENVIRONMENT, 39(37), 6957-6975, 10.1016/j.atmosenv.2005.04.027.

Huneeus, N., M. Schulz, Y. Balkanski, J. Griesfeller, S. Kinne, J. Prospero, S. Bauer, O. Boucher, M. Chin, F. Dentener, T. Diehl, R. Easter, D. Fillmore, S. Ghan, P. Ginoux, A. Grini, L. Horowitz, D. Koch, M.C. Krol, W. Landing, X. Liu, N. Mahowald, R.L. Miller, J.-J. Morcrette, G. Myhre, J.E. Penner, J.P. Perlwitz, P. Stier, T. Takemura, and C. Zender, (2011): Global dust model intercomparison in AeroCom phase I. Atmos. Chem. Phys.,

ACPD
11, C12617–C12621, 2011

Interactive Comment

doi:10.5194/acp-11-7781-2011

Kinne, S., Schulz, M., Textor, C., Guibert, S., Balkanski, Y., Bauer, S., Berntsen, T., Berglen, T., Boucher, O., Chin, M., Collins, W., Dentener, F., Diehl, T., Easter, R., Feichter, H., Fillmore, D., Ghan, S., Ginoux, P., Gong, S., Grini, A., Hendricks, J., Herzog, M., Horowitz, L., Isaksen, I., Iversen, T., Kirkevag, A., Kloster, S., Koch, D., Kristjansson, J. E., Krol, M., Lauer, A., Lamarque, J. F., Lesins, G., Liu, X., Lohmann, U., Montanaro, V., Myhre, G., Penner, J., Pitari, G., Reddy, S., Seland, O., Stier, P., Takemura, T., and Tie, X. (2005): An AeroCom initial assessment - optical properties in aerosol component modules of global models., Atmospheric Chemistry and Physics Discussions, 5, 8285–8330.

Textor, C., Schulz, M., Guibert, S., Kinne, S., Balkanski, Y., Bauer, S., Berntsen, T., Berglen, T., Boucher, O., Chin, M., Dentener, F., Diehl, T., Easter, R., Feichter, H., Fillmore, D., Ghan, S., Ginoux, P., Gong, S., Grini, A., Hendricks, J., Horowitz, L., Huang, P., Isaksen, I., Iversen, T., Kloster, S., Koch, D., Kirkevag, A., Kristjansson, J. E., Krol, M., Lauer, A., Lamarque, J. F., Liu, X., Montanaro, V., Myhre, G., Penner, J., Pitari, G., Reddy, S., Seland, O., Stier, P., Takemura, T., and Tie, X.: Analysis and quantification of the diversities of aerosol life cycles within AeroCom. (2006), Atmospheric Chemistry and Physics, 6, 1777–1813.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 17551, 2011.