Atmos. Chem. Phys. Discuss., 8, S785–S787, 2008
www.atmos-chem-phys-discuss.net/8/S785/2008/

Atmospheric Chemistry and Physics Discussions

ACPD

8, S785–S787, 2008

Interactive Comment

Interactive comment on "Simulation of aerosol optical properties over Europe with a 3-Dsize-resolved aerosol model: comparisons with AERONET data" *by* M. Tombette et al.

Anonymous Referee #1

Received and published: 17 March 2008

Tombette et al. presents a comparison of modeled and measured aerosol optical thickness (AOT), and single scattering albedo (SSA) over Europe. It also investigates the sensitivity of the simulated optical properties to the aerosol treatment in the model. The two main conclusions of the study are

1) The model reproduces the observed hourly AOT values relatively well over year 2001 (correlation varies between 0.419 and 0.849 depending on the station). The simulated SSAs lie within observed values.

2) Modelled AOT and extinction coefficients are not sensitive to chosen model treatment of aerosol, whereas modeled SSA depends quite strongly on the assumption

made on the absorbing component of the aerosol.

Several earlier studies (many combined with satellite data) have shown that chemical transport models are capable of simulating AODs from AERONET with reasonable accuracy in a variety of environments, including Europe (e.g., Chin et al., 2002; Hodzig et al., 2006; Matichuk et al., 2007; Roy et al., 2007). Therefore, conclusion 1 cannot be regarded a new scientific finding but merely a step in the evaluation of the SIREAM-Polair3D model performance. In my opinion such an evaluation is a basic procedure in any model development and does not merit publication on its own unless discrepancies between the model and observations can be explained by or point to errors in mechanisms/sources etc. previously not understood. The current work lists some potential reasons for discrepancies (e.g., weak vertical discretisation, lack of resuspension or some emission sources, 'bad computation of the concentrations and aerosol chemical composition for specific points and times') but does not attempt to isolate or quantify their effects. Nor does the model perform significantly better than the ones in earlier literature.

The questions behind conclusion 2, on the other hand, are well worth studying. Many simplifying assumptions are necessary in large scale models in order to make them computationally viable and we currently lack a comprehensive understanding of the model parameters that the obtained results are most sensitive to. The current study evaluates the sensitivity of optical properties to

1) mixing state of black carbon

2) calculation of complex refractive index (CRI)

3) calculation of particle wet diameter

While giving valuable information, these sensitivity studies can be considered only (in the words of the authors; first sentence of section 6) preliminary, and (again in the words of the authors; last paragraph of the manuscript) a more precise sensitivity study with respect to fine physical processes has to be performed. I fully agree with this. In its current form, the sensitivity investigation is not extensive enough to allow quantifying the main factors affecting the calculated value of the AOD from large scale models.

In my opinion, the current form of the manuscript does not present enough new scientific information to be published in ACP. I do, however, encourage the authors to continue the work outlined in the section 'Conclusions and perspectives';. Further comparisons to satellite and lidar data together with AERONET comparison presented in this manuscript give a possibility to study the regional/local effects and the reasons behind them in much more detail. Furthermore, a well designed and quantitative sensitivity study of a large number of model aerosol properties and treatments in a 3-D set-up would be extremely valuable and welcomed by many model groups.

References:

Matichuk et al. (2007), Modeling the transport and optical properties of smoke aerosols from African savanna fires during the Southern African Regional Science Initiative campaign (SAFARI 2000), JGR (D8), D08203

Roy et al. (2007), A comparison of CMAQ-based aerosol properties with IMPROVE, MODIS, and AERONET data, JGR, 112 (D14), D14301

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 1321, 2008.

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