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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Estimating aerosol emissions by assimilating observed aerosol optical depth in a global aerosol model" *by* N. Huneeus et al.

Anonymous Referee #1

Received and published: 22 February 2012

General Comments:

Detailed knowledge on the spatial and temporal distribution of aerosol emissions is required to quality their impact on climate. The present work estimates the monthly mean emission fluxes of several aerosol species (i.e. black carbon, organic matter, sea salt and desert dust) and one aerosol precursor for predefined regions on a global scale for a time period of one year. This is accomplished by assimilating daily total (over land and ocean) and fine mode (ocean only) MODIS aerosol optical depth (AOD) in the global aerosol model of Huneeus et al. (2009). In contrast to previous studies, this work is the first one to estimate the emissions of several aerosol species simultaneously. A

validation is done by comparing the model AOD with (i) the assimilated MODIS AOD and (ii) independent measurements of the AERONET network. The scientific approach and methods applied to verify the results are well described and sound. The overall presentation is clear and well structured. The study focuses on the ACP subject area aerosol physics and covers the ACP research activities Atmospheric Modelling and Remote Sensing. I therefore fully recommend publication of the manuscript in ACP after some minor modifications.

Specific Comments:

L84: The authors mention that Zhang et al. (2005) assimilate AI and TOMS AI. Please clarify where the first AI comes from.

LL185: Concerning the paragraph on the a priori aerosol emission fluxes, I find it a bit inconsistent to repeat the references for most emissions but not for the terpene emissions and the conversion factors (7,1.4 and 1.6, 11%) used. Beside, I suggest to define the term 'organic matter' first. Then it is easier to understand why a conversion is needed and applied.

L245: Who provided the MODIS level 3 data? In addition, the reference of Hubanks et al. (2008) should already be mentioned here.

L253: What is the global coverage of the MOD08_D3 data? Does MOD08_D3 contain daytime data only? What is the reason for the data gaps in the northern latitudes which can be seen in the figures showing MODIS AOD (e.g. Figure 3, left).

L253: Is the information on MOD08_E3 and MOD08_M3 needed? If not, please remove.

L274: Could you provide a reference for the known AOD overestimation, please?

L276: How is the thinning done?

L415: How many AERONET stations were selected?

L592: Could you give the exact number of AERONET stations, please?

L626: I suggest to use the same numbers as given in Table 5 or vice versa (14.5 vs. 15).

L638: I suggest to use either POM (text) or OM (figure caption) here and throughout the text, e.g. in Table 1.

L718: Do studies on the difference between MODIS and AERONET AOD exist? If yes, they should be mentioned and discussed here.

L750: I suggest to give the flux values of Lamarque et al. (2010) either here or before when discussing Figure 10.

L1110: I suggest to refer to Figure 2 in order to clarify which AERONET stations are used here.

L1130: Please explain, here or in the text, what the station indicated with the black and coloured circles are used for.

L1134/1140: Maybe the year (2002) could be given in the figure captions.

Technical Corrections:

L106: Bold full stop. Please correct.

L176: Replace 'causedby' with 'caused by', please.

L446: Please remove full stop

L461: Do you mean 'Central' instead of 'South' Africa (see L477) ?

L514: 'The comparison of the analysis OF total and fine . . .' ?

L536: 'in all regions AS illustrated in Fig.2' ?

L606/607: I might have missed something, but do you want to refer to Table 2 (gridbox-by-gridbox) and Table 3 (station-to-station) here instead?

L880: Please correct typing error

L1127: 'DefinED regions ..' or 'Definition OF regions..' ?

L1162: Please remove 'for'

L1167: Please correct the spelling of deviation

L1184: Add a/b/c which are mentioned in the text (L226), please.

Whole text: Please refer to the 'Textual and Visual Conventions' on the ACP web page (Submission – Manuscript Preparation) for the favoured use of abbreviations (Sect., Fig.,..), capitalisation and the usage of non-english words and phrases (et al., cf., e.g., a priori, in situ, .., should not be italicized).

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 3075, 2012.