Atmospheric Chemistry and Physics Discussions

Interactive comment on "The sensitivity of aerosol in Europe to two different emission inventories and temporal distribution of emissions" *by* A. de Meij et al.

Anonymous Referee #1

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The sensitivity of aerosol in Europe to two different emission inventories and temporal distribution of emissions by A. de Meij, M. Krol, F. Dentener, E. Vignati, C. Cuvelier, and P. Thunis

The paper presents model results for mass concentrations of various aerosol components and aerosol optical depths for Europe using two different emission data sets. The results for December and June are compared to observations from EMEP measurement stations, MODIS satellite data, and Aeronet measurements. In addition the impact of temporal variations of the emission data is investigated. This is an interesting paper, the topic is highly relevant to current efforts of aerosol modelling. I suggest to

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publish the paper in ACP after addressing some aspects which are discussed in the following.

General comments

Your model currently does not include information on the particle number concentration and size-distribution of the accumulation mode (SO4, NH4, NO3, H2O, BC, POM, MSA). To calculate AOD, you assume a size-distribution from Whitby for sulfate particles, although 60% of the mass emitted (EMEP) consists of BC and POM. Did you check the sensitivity of your results to the chosen size-distribution? This would be an interesting information when comparing absolute AOD values of the model to observations since AOD depends crucially on particle number concentration and aerosol size-distribution. Please add some words on this issue.

Most processes relevant for aerosols are size-dependent such as wet and dry deposition. However, for the most relevant aerosol components in Europe (SO4, NH4, NO3, H2O, BC, POM) your model takes into account aerosol mass only. In contrast, mineral dust and sea salt particles are simulated with more detail including different aerosol modes and particle number concentration. Shouldn't this be the other way round? Please add some words on why you think this doesn't matter when investigating model results for Europe.

BC and POM are known to be (at least partly) hydrophobic upon emission. Please give some information on how you treat the wet deposition of BC and POM. If the hydrophobic properties of these particles are ignored, wet deposition is expected to be overestimated.

p. 3269: The TM5 model is driven by meteorological data from ECMWF. Does this include prescribed data for clouds, precipitation, convection, etc.? Since clouds and precipitation are essential for the simulation of aerosols (in-cloud SO4 production, wet deposition) this would be important to know.

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p. 3276, Sect. 3: Please give some more information on the expected accuracy of the EMEP measurements. What does the NH4NO3 evaporation (T $>$ 20°C) mean for the comparison of NH4 in June?

p. 3278, l.1/2: "...we selected those measurement stations able to represent the model spatial scale..." You excluded EMEP stations with a temporal correlation between model and measurement less than 0.5. But how did you determine which measurement station is representative for the large spatial scale of the model grid boxes. Please give some more information on this issue, which is essential when comparing the coarse model results to individual measurement sites, in particular to only few measurement sites.

p. 3304/3308, Tab.2/6: The standard deviation of the AODs is very large (almost as large as the mean value), in case of S_EMEP (Tab. 2, June) even larger than the mean value. Thus, it is propably worth looking at median and e.g. 10%- and 90%-percentiles, too.

Specific comments

p. 3267, l. 22: "Two major uncertainties of the current regional and global scale emission inventories..." Which major uncertainties? Please be more specific.

p. 3268, l. 13: The AeroCom emission inventory for the year 2000 should be referenced (Dentener et al., 2006).

p. 3270, l. 2: Please explain the abbreviation "EBI".

p. 3270, l. 18: Aerosol components of nitric acid should be NO3 (not HNO3), of sulfuric acid SO4 (not H2SO4).

p. 3270, l. 21: EQSAM v03d is used to calculate gas-/aerosol-partitioning and the aerosol liquid water content of the SO4-NH4-NO3-H2O system. Why do you not apply EQSAM to calculate the water uptake of sea salt particles?

p. 3271, l. 3: What do you mean by "...in relation to the model grid size."?

p. 3270: I guess all aerosol components in the accumulation mode (SO4, NH4, NO3, H2O, BC, POM, MSA) are internally mixed. If so, please say so.

p. 3273, l. 14/20: Reference year of Dentener et al. should be 2006 instead of 2005.

p. 3273, l. 17: Please specify whether SO2 emissions are given in Tg(S) or in Tg(SO2).

p. 3289, l. 3289: "NH3 and NOx emissions by..." Do you mean "concentrations" instead of "emissions"?

p. 3292, l. 16: Please add some information on how you convert between POM and OC (in the model data).

p. 3298, l. 14: Replace "2006b" with "2006".

p. 3318, Fig. 5: "Brown presents AOD by dust, green AOD by inorganic aerosol and the associated aerosol water." This statement does not match the color legend of the individual plots (a-e).

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 3265, 2006.

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