Atmos. Chem. Phys. Discuss., 10, C11394–C11402, 2010
www.atmos-chem-phys-discuss.net/10/C11394/2010/


Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "The European aerosol budget in 2006" *by* J. M. J. Aan de Brugh et al.

**J. M. J. Aan de Brugh et al.**

joost.aandebrugh@wur.nl

Received and published: 21 December 2010

In the answers to the reviewers: A. De Meij and the second anonymous reviewer, we already addressed some changes we are going to make. The most important changes involve addition of some analysis. For this analysis, the following new figures have been made. Finally, we list a few additional minor changes.

*Topographic map with model evaluation of annual mean concentrations at EMEP stations ((Fig. 1 of this document).*

Figure 3 of the original manuscript shows all EMEP stations in a graph with observations on the X-axis and model results on the Y-axis. This does not show the topographic structure of the results. Some components (like total PM) are measured at a lot of stations, so putting all of them on the map would result in a far too crowded



map. Therefore, we chose to look at country-averaged results. The number of stations (number of point in Fig. 3) represented by one point is indicated by the size of the point as shown in the legend of the new figure. Like usual in these kind of figures, the inner circle represents the model result while the exterior represents the observations. We used the same maps and color scale as in Figs. 1 and 2, though the color scale is made continuous. Iceland is too far north-west for our map, so we put it in a box at the maps where Iceland is represented.

*Topographic map with model evaluation of annual mean AOD and Angstrom parameter at AERONET stations (Fig. 2 of this document)*

This is the same as for the EMEP stations, but as we only evaluated at 18 stations, there is no need to use country-averaged data. Therefore, all points are of equal size and the size scale is not present in the legend. As we do not use country-averaged data, we put the points at the correct locations instead of just in the relevant countries. Here, Svalbard (with Hornsund) is put in the box in the north.

*Time series of January 2006 for four EMEP stations (Fig. 3 of this document)*

In order to better evaluate the ability of TM5 to reproduce synoptic events, we analysed time series of a winter month. This winter month is January 2006. We found four EMEP stations with hourly data of PM10 for this month. The interpretations of the resultsare added to the manuscript. It is also quoted in the reply to A. De Meij.

*Seasonal cycle of the AOD (Fig. 4 of this document)*

There is a considerable seasonal cycle in the AOD. In the original manuscript, we wrote one line about this. This diagram shows the average observed an modelled AOD of all 18 AERONET stations, per month. This is also a key to why the modelled AODs in Table 5 are much larger than the modelled AODs presented in Fig. 2, a descrepancy not yet adequately addressed. The reason is that in the evaluation (Table 5), we sample the times at which there were observations, while in Fig. 2, we present a simple yearly average. In summer, when the AOD is highest, the days are longer so there are more observations. So, summer AOD values, when AOD is relatively large, received a relatively large weight in the averages presented in table 5. This declaration has been added in the manuscript.

*Addition to Fig. 3 of the original manuscript: Black carbon and organic matter (Fig. 5 of this document)*

First, we did not evaluate the concentrations of black carbon and organic matter, because there were very few observations of these components in 2006. We now evaluate our model with observations from the EC-OC campaign of 2002 and 2003. When taking the annual mean, we assume that the meteorological error of having a different year is small. The EC-OC campaign lasted a full year, from July 2002 up to and including June 2003. We added the following interpretation:

"As we mentioned in Sect. 2.3, we compare our modelled results with observations from the EC-OC campaign of 2002 and 2003. Black carbon is represented well, as is the case in Vignati et al. (2010b). There is a huge (factor 3 or more) underestimation of particulate organic matter, though there is still a good correlation between observations and model results. Secondary organic aerosols (Volkamer et al., 2006) and resuspended (Sternbeck et al., 2002) aerosols, which are rich in organic matter, are significantly underestimated by TM5. An earlier evaluation of organic matter (Vignati, personal communication, 2010) also shows such an underestimation."

Some minor issues:

- In Fig. 6 of the original paper, we added a legend which says what the black stars and the red triangles are. The statement is removed from the caption.



- Some legends have been made more clear with a border, so it is clearly a legend.
- The word 'Sources' in Table 4 was not properly centered. The mistake has been corrected.

---

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 21391, 2010.

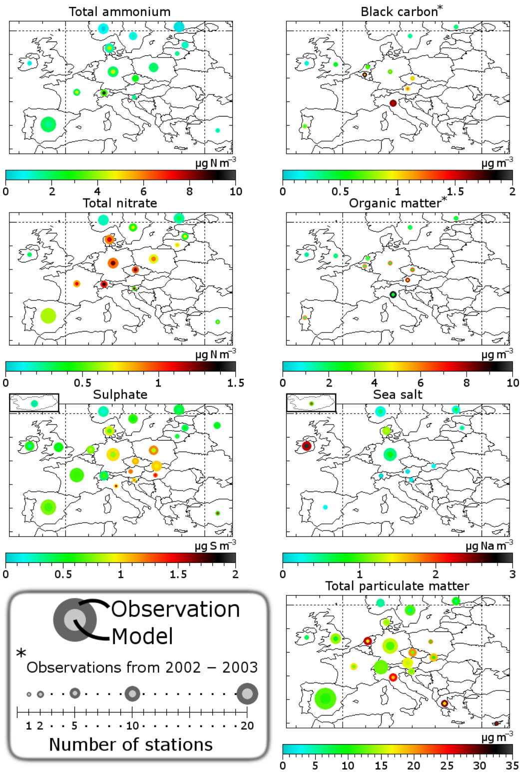


**Fig. 1.** Graphical overview of the comparison between modelled and observed average concentrations over 2006 for total ammonium, total nitrate, sulphate, black carbon, organic matter, sea salt and total partic



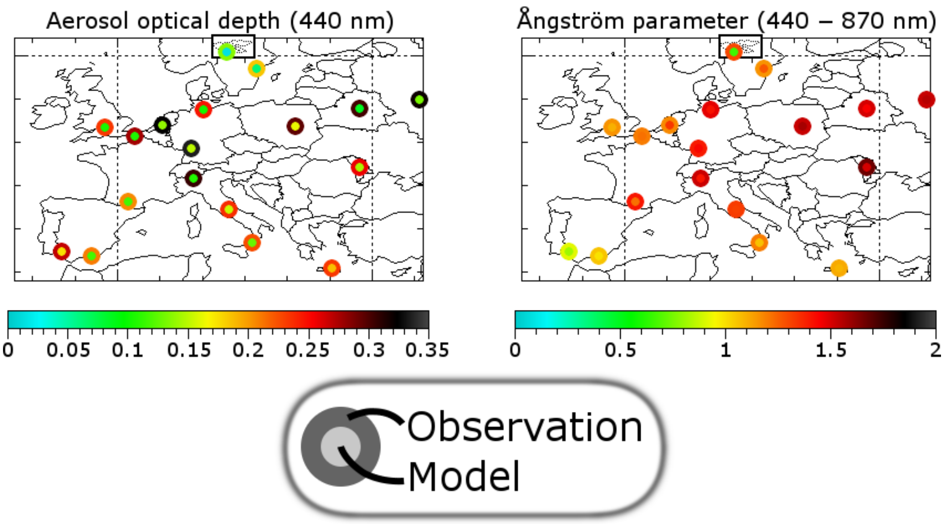


**Fig. 2.** Graphical overview of the comparison between modelled and observed AOD (440\,nm) and {\AA}ngstr\"om parameter (440–870\,nm). The country in the upper box is Svalbard (Norway).

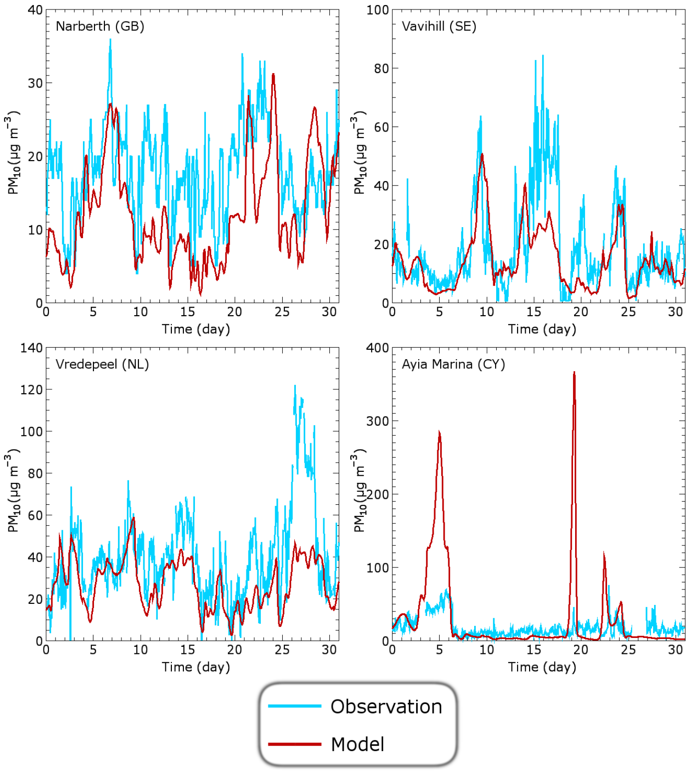


**Fig. 3.** Comparison between modelled and observed PM$_{10}$ concentrations of January 2006 for Narberth (GB), Vredepeel (NL), Vavihill (SE) and Ayia Marina (CY).



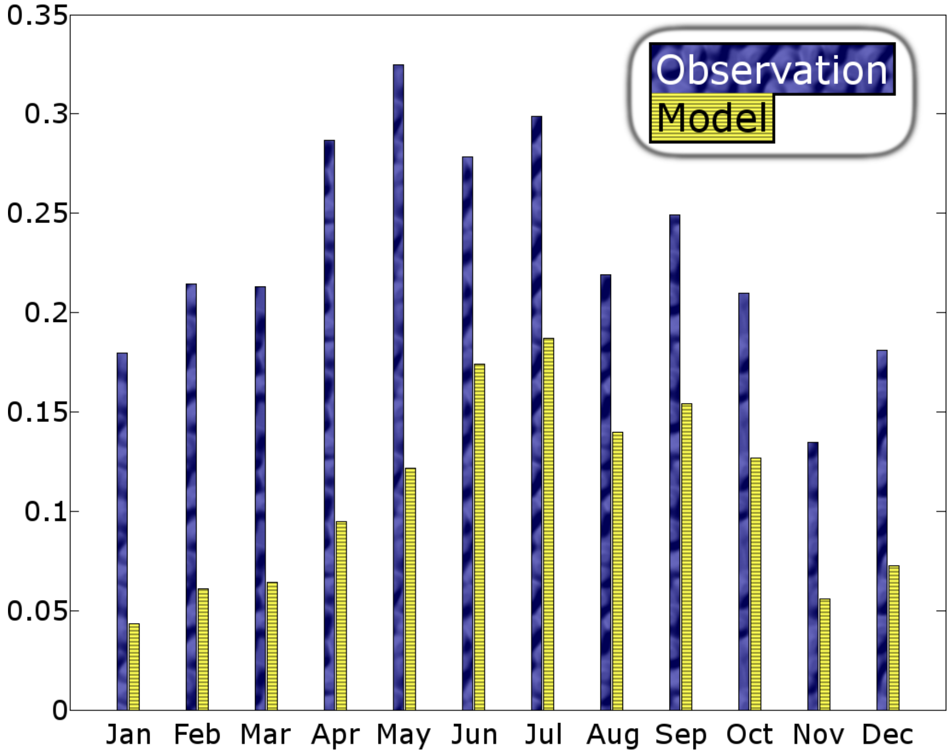


**Fig. 4.** Comparison between modelled and observed AOD per month. All good data of all stations are averaged.

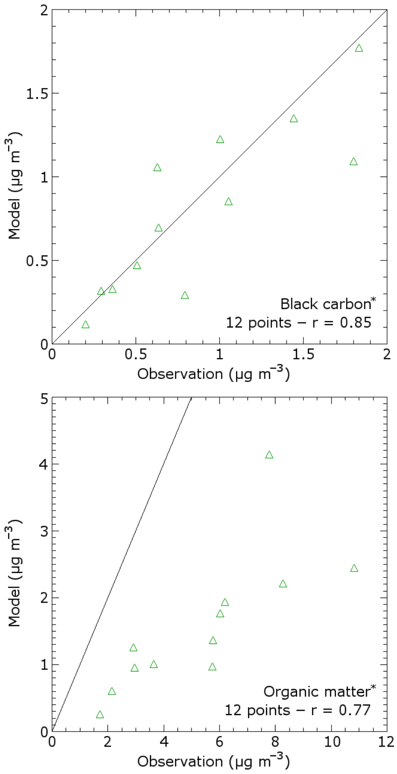


**Fig. 5.** Comparison between modelled and observed average concentrations over 2006 for black carbon and organic matter at ground station. These graphs wiill be merged into Fig. 3 of the original manuscript