

Interactive comment on “The size distribution and mixing state of black carbon aerosol over Europe” by C. L. Reddington et al.

Anonymous Referee #1

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This paper evaluated a global aerosol microphysics model, GLOMAP, against airborne SP2 measurements, focusing on the size distribution and mixing state of BC. The model simulation shows large discrepancies due to the uncertainties in model input and assumptions. Although the authors could not well quantify all of them, they made efforts to point these out and tried to find possible causes. Such kind of work is of big value for model development and measurement improvement. The manuscript is well written, addressing an important subject in atmospheric sciences, I therefore recommend publication in ACP once the comments and questions below are addressed.

Major comments:

The model has a horizontal resolution of $2.8^{\circ} \times 2.8^{\circ}$, which is on a different scale compared with aircraft measurements. Can aircraft measurements represent the aerosol
C10177

properties in such an area well? Do the authors have any consideration and discussion on this issue?

The discrepancy between modeled and measured BC mass concentration and BC core number concentration are substantially stem from the discrepancy of BC core PNSD. The number concentration and mass concentration of BC core are respectively 0-order and 3-order diameter weighted integration of the BC core PNSD, and are representative of PNSD in different size ranges. It can be found in fig. 6 that there is a evident shift of the modeled BC core PNSD towards a smaller size range compared to the measured one, and the modeled PNSD has a much higher peak (one magnitude). Therefore, the many efforts made to compare the mass and number concentration of BC core in the SP2 size range does not have too much meaning, although there is nothing wrong about it. I would rather see more discussions on the difference between PNSDs.

Minor comments:

About the Title: This manuscript mainly focuses on a comparison between global model results and SP2 measurements, and evaluates the model performance. The pattern and variation of the size distribution and mixing state of BC over Europe is clearly not the main focus. So please consider to revise the title.

P26504, L5: Consider revising "such as mass, number concentration and size distribution." as "such as mass concentration, number size distribution and mixing state."

P26509, L6: Consider revising "during LONGREX using the SP2 instrument." as "during LONGREX using the SP2 instrument (DMT Inc., Boulder, Colorado, USA)."

P26518, L7-8: If M_{BC} is the mass of BC per particle, it should not be divided by N.

P26520, L5: "Predicted concentrations generally lie within one standard deviation of the observations." It seems that only the predicted concentration for $BCOC_{sm}$ lie within 1 sigma of the observations.

P 26528, L8-13: Consider to use median values. Although using observed BC core
C10178

number concentrations divided by the total particle number concentration does yield more reasonable results, such an approach would be wrong in theory.

Table 2: Please define the 'DFF' and 'DBF' in the table caption or in the manuscript.

Fig. 4: Fig. 4(a) and (b) are of different size.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 26503, 2012.

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