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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Organic aerosol concentration and composition over Europe: insights from comparison of regional model predictions with aerosol mass spectrometer factor analysis" *by* C. Fountoukis et al.

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(1) *The paper by Fountoukis et al. presents advances and insights of regional model performance over the European domain using the most advanced AMS measurements for validating their model. The paper is well written and easy to follow. Significant attention is given to sensitivity analysis with multiple aspects addressed and problems highlighted. I recommend publication of the manuscript in Atmospheric Chemistry and Physics after the following comments have been addressed.*

The major comment relates to giving adequate attention to cases of major disagreement between the model and the measurements. It is not to say which one is right, especially when it comes to fragmented organic matter, but rather that we learn from mistakes more than we do from success. The encouraging result of two thirds of data agreeing within a factor of two which is within 100 percent is good, but what about the remaining one third of data where disagreement is really large? What are those sites, what are the periods, what are the synoptic situations, etc.? There is simply no discussion of those data at all.

This is a valid concern. An examination of the data that were not reproduced by the model suggests the following. The largest discrepancies are during the winter and autumn periods. The largest and most frequent (during each simulation period) errors are seen at Barcelona and Chilbolton during the February/March 2009 period and at Vavihill during the September/October 2008 during which the model underpredicts fine OA concentrations by more than a factor of 3 during certain days. This is mostly due to an under prediction of the primary OA concentrations at these sites. The reasons for this are discussed in Section 4. The rest of the problematic predictions are scattered over all other sites and simulation periods and include both over- and under-predictions. These rather random errors could be due to errors in the meteorological fields, the use of the same anthropogenic emissions during all weekdays instead of a day-specific anthropogenic inventory, the use of the same diurnal emission profile for anthropogenic emissions split for all countries, model grid resolution limitations, etc. We have added text discussing these issues in both Sections 4 (Results) and 5 (Conclusions) of the revised version.

(2) *The use of state-of-the-art AMS measurement data is commendable, but why model validation is limited to daily resolution? Comparison at hourly resolution may be poorer, but again we learn from mistakes more. In relation to hourly data I have to note that the predicted diurnal patterns are pretty flat, partly due to unnecessarily extended Y scale. If diurnal profiles are flat at most of the sites I would not be surprised about*

models low sensitivity to the most investigated parameters (except biomass burning emissions) and possibly one third of data disagreeing more than 100 percent due to model not being able to capture dynamic changes. I have to admit that asking for model validation at hourly resolution may be too much, but then the authors should omit diurnal profiles.

The performance of PMCAMx at hourly resolution is quite similar to that in daily resolution. The FERROR=0.68 and FBIAS=-0.06 for the hourly data while FERROR=0.57 and FBIAS=-0.09. We have added the corresponding statistics in the revised paper. The scatter plots with all the data points (8,650 of them) are too busy and most of the information is hidden as the data points overlap with each other. We prefer not to use them and show instead the ones with the daily averages as they convey better the same information. We have increased the y-scale in the diurnal profile plots as suggested by the reviewer.

(3) *The conclusion that biomass burning emissions inventory underestimates those emissions is sound and should be highlighted as all other sensitivity tests showed little impact. As it stands, the most significant finding is buried among other minor findings.*

We have restructured the conclusions to highlight this finding. In the abstract this is also one of the main findings.

Minor comments:

(4) *Use preposition "at" when referring to sites "at Cabauw, at Mace Head", not "in".*

Done.

(5) *Fig. 5 omit semicolon after PM1 or change to "Comparison of predicted vs. observed PM1 OA components:..."*

Done.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 7597, 2014.