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Atmospheric Chemistry and Physics Discussions

Interactive comment on "European air quality modelled by CAMx including the volatility basis set scheme" *by* G. Ciarelli et al.

Anonymous Referee #1

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This paper presents a series of sensitivity tests with varying volatility and emission parameters to assess the performance of the CAMx model with VBS, regarding OA over Europe. The innovative elements of this paper can be significantly enriched and this work could provide an useful insight into the VBS approach. The first part of the paper is well-written but several issues emerge in the second part. The aim of the paper stated in the introduction (OA model performance with the use of VBS) is not served properly in the discussion section.

General comments:

1. The main part of the discussion is performed over the base case S3. I recommend changing the base case to S1 and build S2 and S3 upon that. Emissions scenarios applied in section 3.3.2 could be named S1a and S1b. The authors could skip the

re-naming if the structure of the manuscript changes to focus on OA performance with and without VBS. In that context the S1 (no VBS) to S3 (VBS) sequence is proper in that it shows the improvement when utilizing volatility schemes (see Figure 7).

2. The statistical analysis of the model performance could be enhanced by metrics that show the evolution of a process. Timeseries and correlation could add to the manuscript.

3. Figure 1 of supplemental material denotes several areas of poor performance like complex terrain areas, coastal zones, Eastern Europe (specially of SO2) and heavily industrialized/populated areas. The emissions are named as the culprit for the poor performance of the model regarding all gaseous species but O3. This leads to thoughts about the quality of the emission dataset and/or model resolution. Either which, this has to be somehow elaborated on, because the limitations of the emissions also affect the OA discussion and the overall aim of the paper. Other reasons could be nitrates overestimation in the case of NO2 (if the results shown in figure 5 can be generalized) and insufficient conversion to sulfates in the case of SO2 or even transport,wet and dry deposition of aged aerosols.

4. From the moment that the authors have discovered the reason for the 'good' performance of total PM2.5 (overestimation of inorganic aerosol fraction and underestimation of the organic one) I believe there is no merit in focusing on it in the discussion section (second paragraph of 3.1). This also goes for the abstract and conclusions section.

5. The compensating effect (inorganic versus organic) has been confirmed for the period February - March 2009. Can the authors provide some arguments on whether this model behavior is effective on the other periods too and therefore affecting PM2.5 performance throughout the year?

6. Paragraph 3.2 includes a discussion on the PM2.5 performance and sensitivity to ammonia and NOx emissions, large parts of which can be seen in Aksoyogly et al, 2011. Please consider omitting parts or all of the analysis of paragraph 3.2 and redirect

focus to the initial scope or include a satisfactory analysis of the new elements it has to offer.

7. The scope of the paper is to assess what VBS scheme has to offer to OA modelling. The relative analysis is (very) limited to the small paragraph 3.3 (specifically only 3.3.1 since 3.3.2 is related to emissions).

Specific comments:

1. Definition of the statistical metrics can be put in appendix if needed.

2. Paragraph 3.1 needs splitting depending on the species. Also more discussion on the performance is needed (now based only on MB and ME).

3. Figure 1 could be left out as it gives a schematic display of statistics already arithmetically mentioned in Table 2 (column 3 and 4 - observed and modelled means).

4. Please specify the time period that Figure 5 refers to (in figure caption).

5. P35659 line 4. Please change 'Cypro' to 'Cyprus'

6. Please restructure paragraph 3.2 if considered necessary to be included in the manuscript. It is very large and hard to follow.

7. Figure 6 Please increase the font (Axis, numbers)

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 35645, 2015.