Geoscientific
Model Development
Discussions

Interactive comment on "PMCAMx-2015 evaluation over Europe against AERONET and MODIS aerosol optical depth measurements" *by* Antigoni Panagiotopoulou et al.

Anonymous Referee #1

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The manuscript evaluates the PMCAMx model, comparing the aerosol optical depth (AOD) simulated by the model with observations from MODIS and AERONET. The manuscript fits perfectly the goals of the GMDD journal and the methodology and results are clear.

However, as there are no space limitation for this journal, and being GMD(D) dedicated to technical and specific publication I would have expected to have a detail and complete description of the modeling system and the observational datasets used for the evaluation. However, to my point of view, this was not the case.

Although I have no real comments on the methodology and results, the lack of detailed informations raises serious doubts on the scientific relevance of such an evaluation.

The authors should therefore add all the necessary informations to the manuscript before this can be considered for publication.

Major comments:

Aerosol concentration evaluation: The aerosol optical depth can be considered as indirect method to evaluate the model performance, as this is normally estimated from the aerosol composition and the radiative properties of the aerosol components. Therefore I find quite disturbing the absolute lack of any discussion in the capability of the model to reproduce the observed aerosol composition and concentration before to evaluate the AODs. Wrong aerosols compositions could still give reasonable AODs, but for the wrong reasons. Therefore I urge the authors to evaluate also their aerosol composition results. For example, in the introduction the authors stated that "these errors are probably due to an underestimation of sulfates". I expect to be enough sulfate measurements in Europe to validate this statement, as example with the AirBase dataset (http://acm.eionet.europa.eu/databases/airbase/) which present up to hourly observations for single stations. Additionally, only PM1 evaluation of PMCAMx is mentioned, although this was "limited in space" (page 4, line 15). Therefore I would recommend to first have a through evaluation of the aerosols fields against measurements (AirBase, EMEP...) before to dig into the detail of the AOD. If this was probably published elsewhere, it is impossible to find such reference in this manuscript, also in the PCMCAMx description. In the conclusions it has been mentioned that PMCAMx aerosols composition simulation was evaluated, but no publications have been listed.

Period of simulation/analysis: This analysis is focusing on the period 1-29 of May 2008. The first information on the period is on page 8, line 15, under the satellite description, which is possibly not the best location for such information. Nevertheless, it is somehow unclear to me why this period has been chosen. Why not the

entire month of May? Why not another period of the 2008?

Linked to this issue is also the poor description on how PMCAMx has been used to simulate the period of interest. As I am not familiar with the modeling system, is it difficult to me to understand the first sentence of page 6 "To limit the effect of the initial conditions on the results, the first six days of *each* simulation were excluded from the analysis". Are you referring to multiple simulations? Is the model re-initialized? Or was it a continuous simulation from which only May 2008 was extracted? These informations are essential to put the model into context, but they are largely missing in the manuscript. Possibly few references would help the reader to gather the missing informations, if the description of the model set-up would be too tedious. Nevertheless these are simply not there.

Finally, it would have been interesting to make an analysis of an entire year, so to cover the different dynamical and chemical space, such as strong aerosol emissions in winter and strong photochemistry in summer. If that is a difficult task, at least few time-slice analysis for different seasons should be performed.

MODIS data: The author are using MODIS data collection 5.1. Although newer products are available since early 2015 (collection 6), it would be good to know exactly which products you are using. If I am not wrong, in the MODIS collection 5.1 in the AQUA platform both Deep-Blue and Dark-Target algorithm are available. Which one did you used? Additionally, you used "the union of Terra and Aqua MODIS AOD [..]" Could you explain what do you mean with union? How did you unified the two fields? Finally, you are using level 2 data and you calculated the monthly average for May 2008. Which spatial resolution did you used to create such field? How did you merge spatially the observations? As you were using monthly averages, why not using using level 3 data? There is a severe lack of informations here that are important to understand how these sensed AODs have been produced. I strongly suggest to fully rewrite the section with the additional informations.

Minor comments:

Title: Why PMCAMx-2015? Is that a new version of PMCAMx? If so, it would be great to use the same naming convention through all the manuscript.

Page 5, line 16: The PMCAMx model is using results from WRF as meteorological forcing. Which frequency is needed? Could the author add some comments on the possible error introduced by the non exact dynamics? Is there any evaluation of the dynamics?

Page 5, line 20: Same for the emissions: is there any reference and comparison with other emissions dataset?

Page 6, line 1: Would be good to mention here the period covered by the simulation(s). Here reads as there are more than one. Could the author be more specific? (see major comments).

Page 9, line 22 What do you mean with "The PMCAMx AODs have been calculated fir exactly the same period as MODIS retrivals[...]?" Are you using model results at TERRA/ACQUA overpass (local time)? Are you using daily average for the periods where observations are available? Please specify.

Page 10, line 2 Does it make sense to compare this region when most of the data are masked due to the strong presence of dust aerosols there? Your data sample is strongly reduced, probably not allowing a great statistics here. The same is valid for Turkey and North Africa region.

Fig.4 You mentioned that the white areas means that not enough dust-screened AODs are present. However, it seems to me that in the Po valley the white area is much larger that what is present in Fig 3 from MODIS and PMCAMx. Are you sure that here you are not masking additional values?

Remarks:

To my knowledge the author "Meij" should read "de Meij". Please check the references.

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