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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Stratospheric aerosol radiative forcing simulated by the chemistry climate model EMAC using aerosol CCI satellite data" *by* Christoph Brühl et al.

Anonymous Referee #2

Received and published: 17 May 2018

This paper compares stratospheric aerosol as simulated by different configurations of the global chemistry-climate model EMAC with satellite data from the Climate Change Initiative.

Although it is potentially interesting for the community, the manuscript has several issues mostly related to the quality of the presentation. The writing needs to be completely revised. Detailed comments and suggestions are given below.

GENERAL COMMENTS:

- The introduction is too short and does not put this study in the context of existing literature. Similar papers on the subject shall be cited and related to the work presented

in the manuscript.

- It is also not immediately clear what are the novelty aspect of this study and what is its added value to the current knowledge in the field. It should be stated that the paper focuses on the evaluation of the EMAC model in different configurations, specifically on the aspects controlling the optical and radiative properties of stratospheric aerosol.

- The description of model setup is also not very exhaustive: it is not clear for example how the SO2 plumes from the data are used in the model (last paragraph of Sect. 3). It is also not mentioned which time period is covered by the simulations (although this can be found out later in the figures) and whether a nudging technique has been used.

- As far as I could understand, the setup has been derived from one of the simulations in Jöckel et al. (2016). If this is the case, I would recommend to write that more explicitely at the beginning of Sect. 3. The rest of the section could then discuss just the differences and the additional features considered for the present study. The choice of particular configuration settings shall also be motivated in view of the analysis which is performed. Summarizing all the performed experiments and the relevant parameters in a table would be helpful.

- The results section is confusing: I miss the connection between Sect 4.1-4.2 (which are quite short) and the rest of the section, which is much more clear and goes into the details of the comparison for the different model configurations and possible reasons for deviations. I would suggest to revise Sect. 4, trying to set a common thread through the whole section.

- The downscaling of dust in EMAC is mentioned in the result section and in the conclusion, but it is not discussed in detail. It seems to be an important issue and shall be discussed in Sect. 3.

- Another interesting point which is mentioned in the conclusions but not discussed in sufficient detail is sea salt composition in the aerosol model and how it can be "tuned"

using satellite data.

SPECIFIC COMMENTS:

There are several sentences which are hard to interpret and more precise statements are sometimes desirable. See detailed suggestions in the following:

P1.L20: this sentence is unclear: a consistent representation of tropospheric and stratospheric aerosol in the model and the good agreement with observations are two different things. You could have a model which represents both domains consistently but compares badly with the observations, and the other way round. I would suggest rephrasing this, stressing that you have a consistent model in terms of aerosol representation (this is a plus) AND that the results reproduce satellite observations well (this is another plus).

P1.L24: you should also explain why radiation is reduced (scattering processes?).

P1.L26: please summarize what are the scope and the goals of this initiative and add a reference, if available.

P1.L31: I would rephrase this as: "like the EMAC model (Bruhl et al., 2015)".

P2.L17: please provide the exact wavelength range.

P2.L33: do you mean that the extinction in cloud-free fraction is attributed to sulfate aerosol? If yes, please rephrase and make it more explicit.

P3.L30: I would mention that AERONET is recognized as the reference dataset for validating satellite products and cite Holben et al. (1998)

P4.L8: please identify the vertical resolutions with a number (L90, L31), that you can refer to in the rest of the paper.

P4.L16: is this the wet or the dry radius?

P4.L18: how are the optical properties calculated? Please provide more details.

P4.L20: given their relevant role in this study, more details on the dust emission parametrization should be given here.

P4.L30: does this generate any inconsistency/discontinuity in the emissions at 200 hPa? Please clarify.

P4.L31: please provide references for the various emission inventories mentioned in this paragraph.

P5.L18: it is not clear what has been downscaled here and why.

P5.L22: please add in which Figure of Bingen et al. this is shown.

P12.L16: which dust size distributions parameter are adopted in the model?

P13.L8: horizontal or vertical resolution? What is the expected outcome of these simulations? Are further publications planned? Please elaborate more on this sentence.

P13.L16: where does this conversion factor come from? It looks like an important issue, but it is mentioned for the first time in the conclusions.

TECHNICAL CORRECTIONS:

P1.L9: "EMAC" acronym is not defined at the first occurrence.

P1.L10: "such as" instead of "like" (you intend inclusion, not comparison).

P1.L13: "the observations".

P2.L6: add "The present paper is organized as follows:" or similar.

Fig.4: red and purple are very hard to distinguish, please consider a different color (or dash pattern).

P12.L24: I would simply write "at T106L31 resolution" and use this notation consistently through the paper.

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