

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## **Comment on acp-2021-51**

Anonymous Referee #1

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Referee comment on "Aerosol absorption in global models from AeroCom phase III" by Maria Sand et al., Atmos. Chem. Phys. Discuss.,  
<https://doi.org/10.5194/acp-2021-51-RC1>, 2021

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## **Referee report regarding the manuscript: Aerosol absorption in global models from AeroCom Phase III**

**Authors:** M. Sand et al.

### **General comments**

In my opinion this manuscript is not suitable for publication in Atmospheric Chemistry and Physics. I do not think it contains enough new and interesting material within the Aims & Scope of ACP. The area of aerosol absorption is certainly of interest for ACP, but the manuscript is mainly a model intercomparison of technical character, with no clear scientific conclusions or substantial new concepts, ideas, methods etc. regarding the subject of the paper.

It would be more suitable as a Technical report (or it would have been useful as Supplementary material to the large AeroCom III Model intercomparison already published in ACP; Gliß et al., 2021,  
<https://acp.copernicus.org/articles/21/87/2021/acp-21-87-2021.html>).

Since some of the material presented in the manuscript could be of some interest to other modellers it could perhaps have been acceptable in a more technical journal (possibly Geoscientific Model Development), if a much more substantial discussion of the results was added, but since it has already been published as a preprint in ACPD — and will thus remain permanently archived, citable, and publicly accessible — I do not think a submission to GMD would be worthwhile. The Preprint in ACPD can, in a sense, be considered an "extra Supplement" to the article by Gliß et al. (2021).

My suggestion is thus that the manuscript is **not accepted** for publication in ACP.

Since I do not think the manuscript is suitable for ACP I have not made a full in-depth review of all the details, but I noted a few minor things when reading it, and I list these below.

### **Some specific comments**

Page 2, line 60: Stier et al. 2017 — I guess this should be Stier et al. 2007

Page 3, line 69: Textor et al., 2006 — should be Textor et al., 2007?

Page 4, line 97: Randells et al. 2013 — missing in reference list?

Page 5, line 119: What do you mean by "dust (OA)"?

Page 6, Table 1 is essentially a copy of Table 2 in Gliß et al. (2021) — not necessary to duplicate here (a reference to Gliß et al. would be enough)

Page 6, Table 1: References Bauer et al., 2008 and Bauer et al., 2020 are missing in the reference list

Page 10, Figure 3: The resolution of the subfigures is quite poor (at least on my screen)

Page 10–11, Table 3: Half of the data in this table (BC MAC, BC Burden, BC lifetime, OA lifetime, Dust lifetime) were included already in Gliß et al. (2021) [Table 3]. Perhaps it is not necessary to include the same information here. However, some of the data clearly disagree with Gliß et al. (2021) and this needs an explanation:

- Large difference for BC MAC for NorESM2; here  $5.2 \text{ m}^2 \text{ g}^{-1}$ , but  $3.2 \text{ m}^2 \text{ g}^{-1}$  in Gliß et al.
- BC MAC for OsloCTM3 is  $12.4 \text{ m}^2 \text{ g}^{-1}$  here, but  $13.0 \text{ m}^2 \text{ g}^{-1}$  in Gliß et al.

- BC lifetime in EMEP is substantially different here (2.2 days) compared to in Table 3 of Gliß et al. (2.9 days)
- BC lifetime in TM5 8.6 days, compared to 8.4 days in Gliß et al.
- OA lifetime in GFDL 4.1 days, compared to 4.5 days in Gliß et al.

Page 20, line 264 — the Section header is “BC MAC values” but this section also includes MAC for OA and dust.

Page 20, line 275: Reference (Yttri et al 2014) is missing in the reference list (and I suspect it should rather be Yttri et al?)

Page 20, line 275: Fig 8 — should be Fig 9

Pages 21–22 I found the discussion of “partial sensitivities” of AAOD to “variations in emission, lifetime, and MAC” confusing, and I do not see how it actually give any clear explanations of the AAOD differences between the models. A much more detailed discussion would be needed to understand this (I think). Also, I do not understand why Figure 10 is made as line plots? I think it just messes up the diagrams and make them less clear — perhaps bar diagrams would have been better?

Page 25, line 335: Fig. 10 — should be Fig. 13?

Page 25, lines 337–338: “Many of the AeroCom models have not updated their OA refractive indices to include BrC.” — Be more specific! Which models have, and which have not, included the BrC?

Page 27, line 356: “and for the first time 11 (10) these models have reported” — What do you mean by (10)? Also, I guess there should be an “of” in the sentence (i.e. 11 of these models).

Page 27, line 374:  $8.6 \text{ m}^2 \text{ g}^{-1} \text{ a}$  [3.1-15.0] — remove a

Page 27, line 385: “BC lifetime (ranging from 4 to 9 days)” — I guess the range should be 2 to 9 days? According to Table 3 the BC lifetime in the EMEP model is only 2.2 days (but 2.9 days according to Table 3 in Gliß et al. 2021)

References (pages 29–36): In addition to the missing references mentioned above, a couple of references are not in the correct alphabetical order.

Supplement:

Figures S1, S3, S5 and S6 need to be larger or at least to be of better resolution.

Figure S2: The figure caption and legends lack information about the “fat” line and dots (measurements I assume).