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Atmospheric
Chemistry
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Discussions

Interactive comment on "Radiative forcing estimates in coupled climate-chemistry models with emphasis on the role of the temporal variability" *by* C. Déandreis et al.

Anonymous Referee #2

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General comments The paper give a good overview of the possible variations caused by off-line and on-line calculations and the effect of temporal variability. It goes through a number of methods on calculating radiative forcings, and a thorough documentation and validation of the method. As expected there are some effects of temporal variation of aerosols, although surprisingly small, despite the focus on this. -0.2 W out of 200 is a number well below the uncertainty threshold. It should of course be taken into account however and the metoods may be taken into account when calculating the effect of aerosols on climate in general, not only the effect on changes in aerosols. Actually, although to some extent shown in other papers, finding that PD-PI aerosol forcing is not very dependent temporal variability is just as interesting and important than the the temporal variability in total aerosol forcing. If this is the case also for a more complex aerosol, this will simplify most forcing calculations.

What I do not like however is that the use of word "radiative forcing" is sometimes ill-defined. Sometimes it is taken to be present day - pre-industrial. With regard to temporal variability it is taken to be the difference between variability and monthly mean values. I think it is especially problematic in the description of the initial extension method (4.1) that give a larger deviation from PD-PI forcing than any of the other. Online -0.73 W/2 ; Off-line -0.70, Off-line monthly means -0.64 and then the extended method (before the improvement is -0.49)

Also I think that the authors should consider making a test or at least discuss whether they expect their conclusion to be different in case of a more complex aerosol representation, in particular in the presence of an absorbing aerosol.

Details:

Title: The title is too general, taken into considerations that all variations in forcing is connected to sulphate. Suggest that "of sulphate" should be added after radiative forcing

line 17 p 24314. "than that" not needed ?

p 24314 It is unclear to me what the 60 % refer to.

p 24315 line 9. " It causes a surface cooling" This is generally not true on a local / regional scale. The sentence should be replaced by negative radiative forcing on top of the atmosphere. line 22 estimation –> estimate ? line 26 "few days" delete few ? A few days is a relatively long life-times for many aerosols.

24316 , line 2-3 I do not understand the first part of this sentence their large size —> large differences in size ?

line 8-10, Possibly true for sulphate, but unsubstantiated for other type of aerosols,

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absorbing aerosols, coarse aerosols?

line 26-27. I do not understand this sentence. Many models has calculated off-line aerosol effects, e.g. IPCC 2007, page 162, or is the point that few or none? has done a off-line model for a long model simulation, e.g. 20th century run.

24317, line 26 resolved –> resolve ?

24319 line 8-10. The high end of the Polder numbers are quite small compared to a number of other sources, e.g. Hegg et al. ACPD 11, 28663–28687, 2011, which give a CDNC of 300-400 in clean maritime regions.

24320 line 19 Is size distribution taken into account for calculation of direct effect?

24321 line 18. Full stop before "They .."

24323 line 2-11 The use of the word "higher" confuses me "Fm_pd is higher than than Fvpd" From figure 2 Fm_pd = 240.57 Fvpd = 240.72 At the same time "DF_M is 12 % higher than DFv" DF_M = -0.64, DFV = -0.73. DF_M is less negative yes, but the aerosol effect is higher in the on-line simulation.

24323 / Figure 2: As far as I can understand the on-line radiative perturbation is closer to the calculated off-line aerosol effect than the off-line perturbation.

Does not this mean that you get almost identical on-line and off-line forcing perturbation. (0.73 – 0.70) ?

24323 line 25 -> / figure 4 Is it possible that the areas of positive in-direct effect is caused by a decrease in so2 emissions numbers from PI to PD in these regions. Check e.g. the aerocom sets for so2 from biomass burning. If that is the case you can mention this?

24324 / Figure 5. It is a bit unclear to me how the meteorological trajectory is included. Based on figure 5 I assume that all 4 simulations is based on present-day fully variable sulphate aerosols, and then all other results is calculated off-line wrt to this meteorology? I suggest that you specify this also in the text and remove the sentence about using the same physical forcings etc, since this looks like you have stored and read in some forcing data into the model?

24327 line 10 et –> and

24344 Table 2 Partly written in French

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