

Interactive comment on “Distributions and climate effects of atmospheric aerosols from the preindustrial era to 2100 along Representative Concentration Pathways (RCPs) simulated using a global aerosol model SPRINTARS” by T. Takemura

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Dear Reviewer,

Thank you very much for taking your time to review our paper. Your comments are very helpful to making our manuscript better. We tried to revise our manuscript so as to answer to your comments. We wish this revised manuscript deserves to publication.

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1. [Comment] Title: why not “using the global aerosol model...”

[Answer] The title has been changed according to your comment.

2. [Comment] p20521 l8: It would be appropriate taking more into account the extended debate on the large variety of cloud microphysical and dynamical responses to changes in the droplet size distribution, beyond the simplistic concept of a cloud lifetime effect.

[Answer] The following sentence has been added according to a comment from another reviewer: “On the other hand, Lebsock et al. (2008) suggested from satellite observations that the higher aerosol concentration may lead to reduced liquid water path in nonprecipitating mixed-phase clouds.”

3. [Comment] p20529 l4: But of course, there is an effect on the AF since the background level changes, and the AF, especially the contribution of the indirect effect, changes subsequently.

[Answer] The following paragraph has been added at the end of Section 2: “The past transient simulation from 1850 to 2005 and the future transient simulations with four RCPs from 2006 to 2100 are carried out in this study, which are the standard experiments (STD). The other experiments with continuous preindustrial emissions for aerosols and transient changes in other conditions along RCPs (AEROPI) are also done to analyse effects of changes in aerosol emissions on radiation and clouds by calculating differences with STD. The AF for the aerosol direct effect is calculated as a comparison of a difference in net radiation fluxes with and without aerosols by a double call of the radiation code between STD and AEROPI, i.e., ((STD with aerosols) – (STD without aerosols)) – ((AEROPI with aerosols) – (AEROPI without aerosols)). It is under the all-sky condition in this study. The AF for the aerosol indirect effect is defined as a difference in the cloud radiative forcing between STD and AEROPI.” The AF of the aerosol direct effect calculated by the above method does not include the influence of natural aerosols. A difference in the natural aerosols between STD and AEROPI in

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the estimation of the indirect effect can be negligible in comparison with a difference in the anthropogenic aerosols. A phrase of the final sentence of the fourth paragraph in Section 4 has changed to "Note that these changes in natural aerosol emissions can be negligible for estimates of adjusted forcing (AF) provided in the following sections".

4. [Comment] p20532 l11: The author should comment on why the forcing from fossil fuel POM at the surface is zero although it is not small at the tropopause.

[Answer] Thank you for your advice. It's a mistake at making the graph. The figure has been revised.

5. [Comment] p20533 l7: It would be useful to comment on the larger ice crystals in the Tropics.

[Answer] The number concentration of ice crystals produced via homogeneous nucleation by which tropical cirrus clouds are mainly formed decreases due to an increase in the temperature in this study using a parameterization of Kärcher and Lohmann (2002), so that the size of each ice crystal increases in the tropics. This sentence has been added to the revised manuscript.

6. [Comment] Fig. 7: "relative to the preindustrial experiment": This statement could be clearer here. In my understanding, it is a transient experiment (i.e., with transient imposed SST and SIC) with pre-industrial aerosol emissions that is the reference.

[Answer] As mentioned in Answer 3, the paragraph explaining the experiment design has been added at the end of Section 2.

Thank you very much for reviewing our manuscript.

Sincerely yours,

Toshihiko Takemura, Dr.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 20519, 2012.

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