

Interactive comment on “Impacts of aerosol indirect effect on past and future changes in tropospheric composition” by N. Unger et al.

F. Raes (Referee)

frank.raes@jrc.it

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General comments

1. The paper elucidates an important aspect of linking atmospheric chemistry, aerosols and clouds. It shows that having cloud characteristics coupled to aerosols characteristics, rather than prescribing them, has an appreciable effect on various aspects of atmospheric gas phase chemistry, aerosols and clouds.
2. The way in which the GISS model links aerosols to clouds is crucial for the analysis. The GISS model does it rather crudely (fitting lognormal number distribution to aerosol mass + empirical relationship to obtain CDNC). A discussion is needed about how good this is compared to other more detailed approaches (E.g. Abdul-Razzak et al., JGR,

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2000, p. 6837 or Lohmann et al, 2007, ACP p. 3425 (in which aerosol size distributions are modeled on-line and used as input to the cloud scheme.)

3. The readability of the paper suffers quite a bit from the fact that Figures 3 to 7 are showing differences of absolute values, rather than percentage changes. The text is in terms of percentage change. The discussion in terms of percentage change is more relevant as it does show the effect of aerosol cloud interactions compared to the effect of emission changes. We suggest that all figures showing the effect of ACI are done in percentage change.
4. We would also expect some more explanation as to why aerosol cloud interactions do have the modeled effects on the various parameters. An explanation in terms of processes. As an example: we would expect that, in the case of J(O1d), increased or decreased multiple scattering would play a role. Say something about this. The same for the other effects.

Specific comments.

We suggest not to use AIE (Aerosol indirect effect, as this is usually understood as the radiative effect), but to use ACI (Aerosol Cloud Interactions, as this is in fact what the paper is studying). ACIs lead to the AIE and the atmospheric chemistry effects shown in the paper.

The text starting on page 4694 line 16, explaining the simulations, should go in section 3.2

Section 3.3 J(O1D). This J(O1D) comes a bit out of the blue. Explain how it relates to OH and Ozone formation.

p. 4702 line 7 “...supplements the decrease”. Unclear. Say differently

p.4708 line 7 Major limitations of the study are not only the emissions, but possibly the way the model describes ACIs. Something must be said about this (see general comment)

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Figures/Tables: In some cases it would be useful to re-define in the captions the acronyms used.

Table 5 / Section 3.2 It requires some explanation why no value is given for the AIE when ACIs are not taken into account? (No value for AIE in between brackets). A value could be calculated since the caption of Table 4 tells how CDNC are prescribed for the runs without ACI couplings.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 4691, 2009.