

Interactive comment on “Black carbon absorption effects on cloud cover, review and synthesis” by D. Koch and A. Del Genio

Anonymous Referee #1

Received and published: 1 April 2010

There has been a lot of (apparently) inconsistent results on the semi-direct effect due to black carbon aerosols. This makes this review paper quite useful and timely. I recommend publication in Atmospheric Chemistry and Physics. My comments follow below:

The authors describe the increase/decrease in cloudiness due to the semi-direct effect as a “radiative forcing”. I think it would be useful to better differentiate what is a forcing and what is a feedback. The change in cloudiness can be seen as a (fast) feedback in response to the black carbon forcing (ie heating of the atmospheric column by absorption of solar radiation). There is a growing body of literature on this (e.g. T. Andrews and P. M. Forster (2008), CO₂ forcing induces semi-direct effects with consequences for climate feedback interpretations, Geophys. Res. Lett., 35, L04802,

C1170

doi:10.1029/2007GL032273). The feedback can still be quantified in Wm⁻² as it is done nicely at the end of the paper.

The review paper discusses low- and high-level clouds. What about mid-level clouds? Can low- and high-level clouds be defined upfront, especially in the context of Figure 1?

The flow in Sections 4-5-6 could be improved. Section 4 starts with a description at the process level but quickly moves into describing results from global models. This is because understandingly the process can only be looked at in large-scale models; however it does not flow very well with Section 6 which is about the semi-direct effect in global models.

It would be useful to summarise the local and global model experiments / processes / results in a Table.

Can the authors explain what a Qflux climate experiment is?

I suspect that some of the experiments described in Section 6 are not for black carbon aerosols but for carbonaceous aerosols. Carbonaceous aerosols also scatter radiation, and the cloud and climate response to those can be different. It would be good to stress which experiments are for carbonaceous aerosols and not black carbon aerosols. Likewise some experiments may include an aerosol indirect effect, which again can lead to a different cloud response than the one expected from just a semi-direct effect.

On lines 4-5, page 7337, I'm not sure where the -0.18 Wm^{-2} comes from. Shouldn't it be $(0.7-1) \cdot 0.33 = -0.10 \text{ Wm}^{-2}$?

I'm not sure what is meant by a “positive cloud climate sensitivity” on page 7340, line 4 and “cloud-climate forcing response” on page 7340, line 17? Do the authors mean “positive cloud feedback”?

Page 7342, lines 30-31: reference title is missing.

Page 7343, line 21: “Perlwitz” should be “Perlwitz”.

C1171

Should the authors discuss the results presented in Jacobson's papers?

Figures 1f and 1g: if the model concentrations have been divided by 100 to fit the color scale, then the unit should be "100 ng / kg" rather than "ng / kg /100". Same with RH on Figure 1h.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 7323, 2010.

C1172