

***Interactive comment on “Total aerosol effect:
radiative forcing or radiative flux perturbation?”
by U. Lohmann et al.***

Anonymous Referee #1

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This paper investigates the applicability of radiative flux perturbation (RFP) as a valid way to compare different climate forcing agents. In the paper 5 GCMs are used to simulate RFP for four different forcing agents and to compare the results to standard radiative forcing calculations. The paper concludes that RFP is a useful tool for comparing forcing agents and this can allow better quantification of indirect aerosols effects beyond the cloud albedo effect. This is a very useful study and I highly recommend publication of the paper after the following comments have been considered.

Main comment: In the results the semi-direct effect is only discussed for CO₂ and in this case it is difficult to judge whether this is a semi-direct effect or related to the problem of the calculation of the radiative forcing (see comment below). The semi-direct aerosols effect is not mentioned in the result section at all and it should certainly be discussed.

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It would also be useful if you state why semi-direct for CH₄ is not discussed.

Minor comments:

Page 25634-25635, Introduction: It is very useful with the discussion of indirect aerosol effects beyond the cloud albedo effect in the introduction. I think the semi-direct effect as well as the direct aerosol effect could be described somewhat further. This comment follow up to the main comment above that direct aerosol effect and semi-direct aerosol effect is hardly mentioned in the text.

Page 25635, line 6: Change ‘larger’ to ‘stronger’ since the value is actually lower only the magnitude is larger.

Page 25635, line 13: IPCC 2007 or Haywood and Schulz (2007) would be appropriate to add as reference here.

Page 25639, line 4-5: Same as above change ‘smaller’ and ‘smallest’ to weaker’ and ‘weakest’

Page 25641, line 13-22: I found this part of the description unclear and it would be useful if this was explained better.

Page 25642, line 1-5: Hansen et al., JGR, (1997) show that instantaneous radiative forcing at the TOA differs substantially from instantaneous radiative forcing at the tropopause (and then also to adjusted radiative forcing). This could be a useful reference to include in this part of the text.

Page 25642, line 14-16: I am not sure if it is correct to say that the deviation from the 1:1 line for CH₄ is dominated by the LW contribution.

Page 25642, line 19-28: How can you be sure this is a semi-direct effect and not related to the calculation of RF? This estimation should be better justified, since the calculations for CO₂ is far from the 1:1 line. Andrews and Forster, GRL, (2008) show that CO₂ has a semi-direct effect also in the clear sky.

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Fig 2: I think it would be useful if the same notation in Fig 2 and Table 1 had been adopted. IAE is not defined elsewhere in the paper and it should be made clear in this figure that only cloud albedo effect is included. DAE should also be defined in the figure caption.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 25633, 2009.

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