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Comment

Interactive comment on “Interpreting the cloud cover – aerosol optical depth relationship found in satellite data using a general circulation model” by J. Quaas et al.

Anonymous Referee #1

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The study tests various hypotheses that relate the observed aerosol optical depth (AOD) to the total cloud cover (TCC). It does so by direct satellite measurements of AOD and TCC and by global circulation model (GCM) simulations with and without the aerosol impacts on cloud microstructure, and with and without aerosol expansion by absorbing water in high relative humidity. The subject is potentially of great importance to understanding the climate sensitivity to radiative forcing.

The GCM does not resolve clouds, and therefore its parameterization cannot possibly be expected to represent realistically the impact of aerosols on cloud cover. The authors admit to that effect, but still keep using the generated model results, in line with

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the rest of the GCM community. This process feeds directly into the IPCC and makes the estimates of the aerosol indirect effect (AIE) look much less uncertain than they truly are. This, in turn, makes the uncertainty of the climate sensitivity to greenhouse gasses look much less uncertain than it truly is. The fact that this practice is shared by many colleagues and having passed most other reviewers does not make it right. Here, I would expect the authors to put a well justified uncertainty range on their estimates of the various components of the model calculations. This is very different than merely calculating the standard deviations of the results, which are given as the error bars in Figure 1. If well justified quantification of the uncertainty of the model cannot be given INDEPENDENTLY of satellite observations, the model results cannot be used for estimating the AIE.

It seems to me that the main value of the simulations is in quantifying the effects of the aerosol humidification on the AOD and its contribution to the AOD-TCC relations. Here resolving the clouds is not necessary. The substantiation of additional claims with respect to the AIE requires rigorous quantification of the model uncertainty in calculating TCC and its dependence on aerosols, as already stated above.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 26013, 2009.

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