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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Exploring the differences in cloud properties observed by the Terra and Aqua MODIS sensors" *by* N. Meskhidze et al.

**Anonymous Referee #2**

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This paper analyzes the diurnal variation in cloud cover and its relation with the aerosol load. The diurnal variation is based on the difference between the two MODIS sensors onboard Terra (morning) and Aqua (afternoon) satellites. Over the oceans, it is shown that the cloud fraction tends to decrease during the day, and that this decrease is enhanced with aerosol load. Results are more contrasted over land and the authors focus on the Amazon regions where string interactions between biomass burning aerosols and clouds have been observed.

The paper is very clear, well focused and concise. It does show an interesting an innovative use of satellite products to study aerosol-cloud interaction. There is no doubt that the paper should be published with little changes. I have a few comments however that should be taken into account by the authors.



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Interactive Discussion
Discussion Paper

I have one question on terminology. The authors use the terms "semi-direct effect", "indirect effect", "radiative effect"; and "microphysical effect". I believe they refer to only two processes. I suggest the authors use consistent terminology throughout the text (I;e. not two terms for the same thing).

It is well known that aerosol layers may be well above the cloud deck, in particular off the Coast of Namibia. In such case, the layer at which air warming is expected is not the same as that of the cloud layers. Such cases, that are rather frequent, should cancel the observed correlation. Please comment.

I suggest the authors provide a "back of an enveloppe" estimate of the atmospheric warming due to absorbing aerosols between the Terra and Aqua overpass as a function of optical depth, using typical values for the aerosol single scattering albedo, layer thickness and solar angle. This would provide an indication of the temperature difference range that results in the observed cloud burn-off.

In the discussion about the effect of aerosol on stratocumulus clouds, it is said that the observed diurnal variation is the result of two competing effects, i.e. microphysical and radiative. In my understanding, the radiative processes lead to a diurnal effect, while the microphysical one does not. Then, the microphysical effect has no impact on the Terra-Aqua difference. Please correct or comment. Further in the text, it is concluded that the semi-direct effect dominates the indirect effect. I assume semi-direct is the radiative effect, while the indirect is the microphysical. But again, I believe that the microphysical effect has no diurnal signal, so that one cannot conclude on the importance of one process versus the other based on the diurnal signal. This should therefore be corrected or better explained. Note that the claim of the predominance of the semi direct effect is also in the abstract.

Other comments: Line 98: What is the range of possible time difference between the two satellite paths ? I expect a large range due to observation swath. Line 120: For overcast cases, there is no aerosol estimate in the 1° box. The authors use surrounding



**ACPD**

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estimates of AOD. How frequent are these cases and are the results changed if these cases are discarded rather than interpolated ? Line 136-137: Not clear what is meant here. Are pixels "boxes" ? What kind of data are you talking about ? Figure 1: The limits of the regions are hard to see. Could be shown for all 4 seasons. Figure 3: I do not think that line plots are appropriate as they assume a linear variations between the points. Bar plots are more appropriate for such figures.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 1489, 2009.