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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of absorbing aerosols in cloudy skies: a satellite study over the Atlantic Ocean" *by* K. Peters et al.

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We thank the reviewer for the critical review and the constructive comments.

The method consists on the identification of overcast pixels using some MODIS retrieved cloud property (presumably cloud fraction or cloud optical depth) not explicitly mentioned in the paper.
We mention the MODIS cloud products used in the "Data" section of our paper, but we acknowledge that a more specific description is needed in the "Methods" section as well. We have included an explanation of the cloud fraction product and references to more published details in our revised version of the manuscript.

Although the proposed methodology seems reasonable, the outcome of the analysis is totally counter-intuitive. The obtained results indicate that the largest reduction in local planetary albedo (presumably associated with aerosol absorption effects) takes place over the Northern Hemisphere's West Atlantic Ocean, a region between 10N - 35 N and 50W-95W (or TNWA region using the authors naming convention). The aerosol absorption effect on the TNWA region is about 5 times larger that the effect on the TNEA oceanic region counterpart (10N-35N, 15W-50W). These results are so counter-intuitive (and possibly wrong) that a physical explanation is urgently needed.

Indeed we agree that in the previous version of our study, a detailed analysis of the physical explanation for our results was lacking. At a closer look at the results, we agree that they do not look physically reasonable. To clear this issue, we have checked our analysis again. Doing this, we found that the data going into the analysis did not fulfill the requirements we thought we imposed. Specifically, the cloud fraction product we used previously ("Cloud_Fraction" of the MODIS Level2 data, but without using Quality Assurance Information) failed to assure that MODIS pixels were indeed overcast with liquid water clouds. In the revised study, we screen the data going into the analysis using the quality assurance flags provided with the MODIS dataset.

The analysis was repeated, using only MODIS pixels which are determined as "Cloudy" by the "Cloud_Mask" and "single layer liquid water cloud" by the "Cloud_Quality_Assurance" flag. Additionally, a threshold concerning the liquid water path (LWP) was applied: Only scenes having a LWP greater than 20 g m^{-2} are included (a threshold approximately equivalent to cloud optical depth larger than 4, from which on cloud microphysical property retrieval can be considered more accurate; Nakajima and King, 1990). Doing this, the amount of data going into the analysis was significantly reduced. Table 2, showing the amount of measurements, is updated in the revised version of the manuscript. In the revised manuscript, we also have included information on the performed quality checks.

The main result of the repeated analysis is, that the albedo-AOD relationship for scenes

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with UV-AI $>$ 0.7 calculated for the region TNWA is now almost identical to that calculated for the region TNEA. Concerning the region TSEA, the calculated radiative effect of scenes having an UV-AI $<$ 0.7 has changed from positive to negative. This is also in better accordance with what would be expected from the UV-AI.
We have modified the physical explanation of the observed effects.

Comment on the restructuring of some parts of the paper

From February 22-26, the first author took part in the workshop "Advanced Scientific Writing", held by Dallas Murphy and Jochem Marotzke, at the Max Planck Institute for Meteorology in Hamburg. The input received there lead to the need of rewriting and restructuring some parts of the paper in order to improve readibility. These modifications included (1) a shortening of the "abstract", (2) restructuring of the "introduction", (3) giving the description of the UV-AI it's own section, (4) restructuring of the "methods", (5) restructuring and refinement of the "summary and conclusions" as well as (6) rewriting of several sentences to enhance clarity.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 20853, 2009.