

Interactive comment on “Aerosol-induced changes of convective cloud anvils produce strong climate warming” by I. Koren et al.

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Received and published: 26 February 2010

The paper address a very important issue of the aerosol induced effect on anvils producing positive radiative forcing. This is important because it potentially offsets the comparatively strong aerosol induced negative radiative forcing from low clouds. The net effect is so uncertain because it appears to be a small number resulted by the difference between two large numbers with high uncertainties associated with them.

While the research objective and idea are excellent, there are serious problems with their application. The authors try to use MODIS for obtaining both cloud and aerosol properties from the same 1x1 degree areas. This creates several major problems: 1. Most of the anvil areas cannot be considered at all, because they are fully cloudy. According to Figure B1 this excludes the vast majority of the anvil area. Therefore, the

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methodology cannot inherently quantify the effect.

2. There is still the concern of cloud contamination and aerosol expansion near the clouds, which would enhance the indicated effect. The authors discuss this possibility, but beyond recognizing it they do not account for these effects.

The authors would better in this case follow the path that they themselves portrayed in their recent submission to ACPD (Koren, Feingold and Remer) and use GOCART. This would solve both problems. While doing so, they should validate that GOCART replicate the AOD at the scales of interest, by comparing GOCART to AOD for scenes having similar cloud conditions.

Another or additional possibility is using areas that are much larger than 1X1 degree, which will leave only negligible portion of the anvils unaccounted for. This will require testing whether the aerosols are not changing too much within these larger areas.

I don't understand how the cloudy fraction is constructed in Figure 1c, because it keeps growing to unity at the top of the troposphere. Some higher level of analysis was done here that is not described. Similarly, the very high cloudy fractions in Figure 1d are clearly not representing the full analysis area. This is especially so when the fully cloudy 1x1 degree areas are excluded from the analysis. The authors are missing key information in reporting what they actually did. The paper is very generous in explaining the simple things, for example, what is an anvil, but is lacking on the detail of the scientific analysis to the extent of making it incomprehensible.

The radiative forcing analysis provided in Figure 3d is brilliant. However, here again much background explanation of the assumptions is missing. The assumed vertical profiles of temperature-effective radius for water and ice, and the vertical partitioning of water and ice must be given.

In summary, the methodology is not suitable to the research question, and should be changed to using GOCART, and/or using much larger areas than 1x1 degree.

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