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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The scale problem in quantifying aerosol indirect effects" *by* A. McComiskey and G. Feingold

Anonymous Referee #2

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General Comments:

This study examines the scale dependency of the correlation statistics between aerosols and clouds. This is an interesting study that attempts to quantify three different effects on the aerosol-cloud correlation statistics that tend to vary with spatiotemporal scales. The three different effects the authors examined are (i) the purely statistical effect associated with data aggregating scale, (ii) the bias due to the space separation between aerosols and clouds happening in satellite remote sensing analysis and (iii) the contamination of meteorological effects due to the lack of constraint with LWP. The authors try to interpret the wide range of the correlation slope (or ACI) found in literatures of observational analysis in terms of these three factors. I think the idea of this paper is valuable to the community for improving the estimate of aerosol indirect effect.

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Interactive Discussion
Discussion Paper

The analysis shown here, however, lacks maturity due to insufficient quantification of the three effects in a common data set. I would recommend the authors to quantify the three effects using the common WRF data and to show how the correlation slope or ACI tends to be changed due to each effect when analyzing the WRF data. I'm wondering if the authors can show a sort of bar graphs that compare these three effects in terms of the correlation slope (ACI) or the correlation coefficient. Such a quantification would help understand how the three effects tend to compete with each other in determining the overall (net) correlation slopes found in literatures.

Specific comments:

Section 3.4, First paragraph: I couldn't understand how the cloud optical depth was computed from the WRF output and the assumed aerosol number concentration. Is the optical depth (and other cloud properties) thus determined consistent with the original WRF data? Please provide more details of the description on how to compute the optical depth.

Section 4.1: The WRF data has not been employed here for the authors' examination on effects of the aerosol-cloud space separation, while the other two effects (i.e. the statistical effect and the LWP-constraint effect) are quantified with the WRF data. I'm wondering why the authors didn't use the WRF results here. Can the authors quantify the separation effect also using WRF to compare it to the other two effects examined with the WRF data? I would think it is useful to provide estimates of the three effects (statistical, aerosol-cloud space separation and LWP-constraint) in a common platform (here WRF) and to compare them with each other in more consistent manner.

Fig. 12: How are the constrained ACI values computed? Are they the weighted average, such as described in Lines 19-20, Page 26760? Do the unconstrained ACI values correspond to the correlation coefficient in Fig. 7? The authors should put some sentences that explain how Fig. 12 relates to Fig. 7.

Technical comments:

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It looks like that there are a bunch of errors in referring to figure numbers. The below includes some of what I have found. The authors should check through the manuscript to confirm the figure numbers are correct.

Equation (1d): ACNN < 1

Page 26752, Line 4: derive -> derived

Page 26754, Line 3: Fig. 4 -> Fig. 5

Page 26754, Line 22 and 25: Fig. 5 -> Fig. 6

Page 26757, Line 16: “Co-located” -> “The number of co-located”

Page 26757, Line 20: that -> than

Page 26760, Line 13: Fig. 5b -> Fig. 4b

Fig. 12 caption: Fig. 5 -> Fig. 4

Fig. 13 caption: Fig. 5 -> Fig. 4

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 26741, 2011.

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Interactive Comment