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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The relevance of aerosol optical depth to cumulus fraction changes: a five-year climatology at the ACRF SGP site" *by* E. I. Kassianov et al.

Anonymous Referee #2

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This paper tries to assess the relationship between aerosol optical depth and cumulus fraction at the ARM SGP site. The major problem is that the title suggests that 5 years of data were taken but it boils down to roughly 240 hours of data only. Moreover, no physical explanations were given for the correlations obtained such as for the difference in correlation between morning and afternoon or small vs. large clouds. Also, some conclusions contradict themselves. Hence, the doubt remains whether differences in dynamics/thermodynamics rather than aerosols could be responsible for the findings. As such the paper is not acceptable for publication in ACP in its present form.

Detailed comments:

p. 11800, line 23: Why should fair-weather cumulus clouds be more susceptible to aerosol effects than stratocumulus clouds?

p. 11805, line 23: LWP would only not be sensitive to aerosol loading if the increase in the cloud optical depth exactly balances the decrease in effective radius, which would be fortuitous.

p. 11805, line 27: The generalization that the clouds suddenly disappear in the afternoon is not warranted given that this is a case study of just one event.

p. 11807/11808: Instead of eliminating the lowest AOD bin, it would be more appropriate to discretize the data non-uniformly with an equal number of data points per bin. This would avoid the question of why you only eliminated the lowest AOD bin because of insufficient data but not the largest two AOD bins.

p. 11808, line 7: Why should the role of aerosols on fair weather cumuli increase in the afternoon?

p. 11814, line 23: What physical mechanism do you suggest that explains why polluted clouds should have larger droplets but a smaller horizontal extent?

p. 11815, line 16: This is a contradiction to your earlier statement. Before you said that LWP is fairly insensitive to AOD. Now you are saying that the cloud optical depth is independent of AOD. Given that the effective radius decreases with AOD, this would suggest that LWP also decreases with AOD.

p. 11817, item 1: Why should the role of aerosols in the evolution of fair weather cumuli increase as the clouds mature? One would think that the role of aerosols is most pronounced via the activation of aerosols, which would primarily be important in the early stages of the cloud evolution.

p. 11817, item 2: How do you explain the opposite trends, the negative or near zero trend in the morning and the positive trend in the afternoon? How could aerosols cause both? Changes in the dynamics/thermodynamics are more likely for something

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Interactive Comment

like this.

p. 11818, item 4: Why should large clouds be rather insensitive to aerosols if you claim in item 1 that the role of aerosols increases as the clouds mature. That is a contradiction.

Minor points:

p. 11801, line 1: Define how you selected “relatively non-absorbing aerosols”, what is your criterion?

p. 11802, line 19: I would settle on one expression for aerosol loading, burden and concentration throughout

The paper would benefit from a thorough English language and grammar check.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 11797, 2007.