

Interactive comment on “Complexities in the First Aerosol Indirect Effect over the Southern Great Plains” by Sam Pennypacker and Allison L. Steiner

Anonymous Referee #2

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In the study the effect of aerosol particles, in terms of PM_{2.5} mass concentration, on cloud properties is studied over the Southern Great Plains. Expected results are found, where the increased aerosol load will decrease the cloud droplet effective radius, but does not have clear effect on cloud optical depth. In case of ice clouds there is no clear aerosol signal on cloud properties. Also the roles of MODIS retrieval uncertainty and regional meridional flow are discussed.

There are several issues related to methods used. 1) PM_{2.5} is used as a proxy for cloud condensation or ice nuclei concentration. I see no reason why this should hold. More evidence is needed that the CCN concentration in the low PM_{2.5} cases is considerably lower than during the high PM_{2.5} cases. Especially because it is speculated that aerosol sources are different for different directions of air flow. Thus also the aerosol size distribution contributing to the PM_{2.5} could be totally different. 2) PM_{2.5}

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is measured at the surface, and connected to clouds higher in the atmosphere. Why should surface concentration affect cloud freezing at high altitude? It is not enough to state more work is needed to test the strength of this assumption as it is the main assumption in the manuscript. 3) There exist several studies where surface measured aerosol concentration, or even CCN concentration is connected to MODIS retrieved cloud properties, but none of these is cited in the current work. Using PM_{2.5} instead of aerosol number concentration as a proxy for CCN concentration is poorly justified and thus I do not see why the study merits publication based on PM_{2.5} measurements and MODIS cloud retrieval comparison. 4) The number of samples compared in high and low aerosol cases seems to be surprisingly low due to long averaging time of aerosol collection. Thus I am not surprised that MODIS retrieval uncertainty is playing a big role in the analysis. This part should be clearly strengthened to make any new conclusions or recommendations.

To conclude, I cannot recommend manuscript publication with the current scope and scientific content. Much more work is needed, and probably the scope of the manuscript should be reconsidered.

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