Interactive comment on "A long-term study of aerosol–cloud interactions and their radiative effect at a mid latitude continental site using ground-based measurements" *by* E. T. Sena et al.

Anonymous Referee #1

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Overall summary:

This manuscript studys how the cloud radiative effect responds to changes in aerosols (aerosol index) and meteorological parameters, including cloud fraction fc, cloud optical depth τ , decoupling index Di, lower tropospheric stability LTS, and turbulence w'2 by using long-term ground-based measurements from the Atmospheric Radiation Measurement (ARM) Program over the Southern Great Plains. Herein, the cloud type was constrained to shallow liquid water clouds. This work presents valuable information that the impact of macroscopic variable on aerosol-cloud interaction is stronger than the impact due to aerosol particles. Some minor questions/suggestions need to be solved are listed in the following:

Comment and Question:

1. Page 2, Line 4: Absorbing aerosol could also modify the atmospheric temperature profile and stability, and reduce cloud amount via the semi-direct effect (e.g., Koren et al., 2008). Koren et al. (2008) just provide the cloud amount change with aerosol optical depth but didn't show absorbing aerosol could modify the atmospheric stability. Huang et al. (2009) use the Fu-Liou radiation model and CERES radiation flux to derived the heating rate of aerosol layer and directly show the changes in temperature profile.

Huang J., Q. Fu, J. Su, Q. Tang, P. Minnis, Y. Hu, Y. Yi, and Q. Zhao, 2009: Taklimakan dust aerosol radiative heating derived from CALIPSO observations using the Fu-Liou radiation model with CERES constraints,Atmos. Chem. Phys., 9, 4011-4021.

2. Authors used the aerosol index instead of CCN concentration in this study. As the SGP site do equipped with the Cloud Condensation Nuclei Particle Counter, why do not use this data directly?

3. Authors mentioned that all of the relevant variables were averaged to 1-minute resolution. Does this time resolution is suitable for this study?

4. Koren et al. (2008, ACP) show ω (550 hPa) and RH(350 hPa) yielded the highest correlations with the satellite-derived cloud properties, these parameters will be used to represent the primary meteorological controls on the cloud system. Herein, authors examined the impact of cloud macroscopic properties (fc and τ) and meteorological variables (Di, LTS, and w'2) on cloud radiative effect. How did authors choose those variables?

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