

## Response to Reviewer #1:

The authors of the present manuscript acknowledge the reviewer for carefully reading and providing constructive comments that have led to an improved paper. Responses are written in blue text.

1. Page 6, Line 23, “700 hPa and LTS is. . . . .” should be “700 hPa and LTS are.....”.

**Response:** Done.

2. Page 7, Line 13, “Figure 2 shows.....” should be “Figure 2 shows. . . . .”.

**Response:** Done.

3. What’s the meaning of “P” in Figure 6?

**Response:** P is the statistical probability. This information has been added to Figure 6’s caption.

4. Page 8, Line 4-5, “This indicates that strong surface wind speeds transported smaller aerosol particles with no optical sensitivity from the continental interior to over the site”, how to get the conclusion that the smaller aerosols are transported from the continental interior?

**Response:** We found that this statement is not fully supported by the current dataset and analysis. We have thus removed the sentences “However, relatively large aerosol number concentrations were measured. This indicates that strong surface wind speeds transported smaller aerosol particles with no optical sensitivity from the continental interior to over the site.” from the revised manuscript.

5. Why do the periods shown in red box in Figure 5 represent the periods of new particle formation and growth?

**Response:** From an observational point of view, atmospheric new particle formation and subsequent particle growth are seen as the emergence of new aerosol particles into the lower end of the measured particle size spectrum (e.g., particle sizes below 50 nm), followed by the growth of these particles into larger sizes (Kulmala et al., 2012). The periods outlined in red show that aerosol particles start off small then grow larger.

[ Kulmala, M., et al., 2012. Measurement of the nucleation of atmospheric aerosol particles. Nat. Protoc. 7, 1651–1667.]

6. Page 9, Line 15. Actually, as shown in Nakajima et al (2001) and Liu and Li (2014), aerosol index is defined as the product of AOD and AE. However, in this study, aerosol index is defined as the product of the surface-measured aerosol scattering coefficients and AE in this study?

**Response:** We have changed the term “aerosol index” to “scattering aerosol index”, which has been used in related studies (e.g., Liu and Li, 2014; Sena et al., 2016). We have also deleted the reference to Nakajima et al. (2001) because they define the scattering aerosol index differently.

[Liu, J., and Li, Z.: Estimation of cloud condensation nuclei concentration from aerosol optical quantities: influential factors and uncertainties, Atmos. Chem. Phys., 14(1), 471–483, <https://doi.org/10.5194/acp-14-471-2014>, 2014.

Sena, E. T., McComiskey, A., and Feingold, G.: A long-term study of aerosol-cloud interactions and their radiative effect at the Southern Great Plains using ground-based measurements, *Atmos. Chem. Phys.*, 16, 11,301–11,318, doi:10.5194/acp-16- 11301-2016, 2016.]

7. The linear regression slopes need be given in Figure 7.

**Response:** The slopes have now been given in Figures 7 and 8.

8. Page 10, Line 30, “Figure 8c and 8d suggests ...” should be “Figure 8c and 8d suggest ...”

**Response:** Done.

9. Page 11, Line 6, “Figures 8 ...” should be “Figure 8 ...”

**Response:** Done.

10. Page 11, Line 10, “... suggests that ...” should be “... suggest that ...”

**Response:** Done.

11. What is the lack of samples for cluster II air-mass condition? Why cannot use the cluster II to calculate FIE?

**Response:** As shown in Figure 10, combined cloud and aerosol data need to be separated into narrow LWP bins to calculate the FIE. There were not enough cloud and aerosol samples in each narrow LWP bin for the cluster II air mass to avoid large uncertainties in the FIE estimates. Furthermore, only cases with sample numbers greater than 50 and with calculated values of FIE that are statistically significant at the 95% confidence level ( $P = 0.05$ ) are discussed in the study. To make things clearer, we have changed the sentence “Due to the lack of samples ...” to “Since there were not enough samples under cluster II air-mass condition ...”. We also added the sentence “Only those cases with sample numbers greater than 50 per bin and where the calculated values of FIE are statistically significant at the 95% confidence level ( $P = 0.05$ ) are analyzed here.” to the revised manuscript.

12. Page 13, Line 6, “... can is possibly because ...” should be “... can be possibly because ...”

**Response:** Done.

13. Page 14, Line 12-15, “... more inorganic compounds that when ...” should be “... more inorganic compounds than that when ...”

**Response:** Sentence corrected.