The manuscript addresses a critical science question, i.e. how aerosol particles affect extreme weather phenomena like lightning. The ample amount of data from ground-based lightning network and reanalysis during 2005-2017 were analyzed to reveal the causal relationships between aerosol, lighting, and meteorological factors in Sichuan, China. This region in Southwest China is highly polluted but with large spatial variability of aerosols, and is understudied in previous researches. The findings about the aerosol microphysical invigoration effect over the plateau and the aerosol radiative suppression effect over the basin lend support to the notion about the non-linear (competing) aerosol effects on the deep convective systems. The study echoes the importance of taking aerosol effects into account for extreme weather analyses and predictions. I recommend its publication with ACP, while I also have comments below for the authors to address.

- L99-106, radiation absorption by aerosols can either suppress or enhance convection via altering CAPE depend on the heating vertical profile and the elevation where the convection initiates. Please see the discuss and the schematic of Wang et al. (2013, "*New Directions: Light Absorbing Aerosols and Their Atmospheric Impacts*").

- L178-179, it is not surprising to see good agreement between MERRA2-Aero and MODIS AOD, as MERRA2-Aero assimilates MODIS AOD product. Can the authors obtain the AOD from an independent satellite, such as MISR, to confirm the variability of the AOD near Sichuan?

- The uncertainty of cloud product from ERA5 over Southwest China seems unclear. Can the author make comparison of liquid/ice content between ERA5 and MODIS?

- Figs. 3,5-7. for the correlations between the time series of monthly mean data, do they mainly reflect the seasonality? Are they still significant if you remove the seasonality and look at anomalies (interannual variability) only?

- Figs, 6 and 7, how are the partial correlation coefficients calculated and how are they different from the total correlation coefficient? My understanding is the partial correlation is a measure of the dependence between two variables where the influence from other possible controlling variables (like meteorological parameters in this case) is removed. This method has been used in many previous aerosol-cloud studies (e.g. Zhao et al., 2019, "*Ice nucleation by aerosols from anthropogenic pollution*"). It seems the definition of partial correlation here is somewhat different with my understanding.

- L318-319, Liu et al. (2019, "*Non-Monotonic Aerosol Effect on Precipitation in Convective Clouds over Tropical Oceans*") examined satellite data and also reported a tipping point of precipitation response to aerosol perturbations, which occurs at AOD of 0.3.

- L330, please remove "Compared with the effect of aerosols on lightning activity", as there is no comparison in this sentence.

- Section 3.5 is confusing. The observed monthly and regional means of lightning density were used to build the multi-variate linear regression model. Then what's the point to compare the modeled lighting density with the observed one again? Please clarify.

- L574, please be specific what are the thermodynamic differences.