

This paper by Zhao et al. presented a detailed analysis of the aerosol effects on CG lightning in the plateau and basin regions of Sichuan, China, respectively. Results revealed that the aerosol effects on CG lightning are distinct between in the plateau and basin regions through microphysical effects and radiative effects, respectively. These findings can provide scientific insights for improving our understanding of the microphysical and radiative effects of aerosols on CG lightning in mountain-basin areas. Overall, this paper is well written and clearly describes the analysis, which addresses relevant scientific questions within the scope of ACP. I recommend this article to be published after these comments as below are addressed.

Specific comments

(1) From a general point of view, I would suggest the authors to maybe underline more efficiently the novelty of the study and its interest. Maybe that authors need, to do so, to modify the section of introduction. For instance, authors need to revise the aims of the study based on the results and conclusions. At least, it is necessary to highlight the different aerosol effects on CG lightning between in the plateau and basin regions of Sichuan, Southwest China.

(2) Both Lines 120-126 in the introduction section and Lines 138-143 in the Data and methodology section describe the complex topography around Sichuan province. Thus, I suggest that the authors move the contents of Lines 138-143 to the introduction section and rewrite the parts related to the complex topography around Sichuan Basin.

(3) Lines 128-132: “Previous studies have suggested that ...” belongs to future research plane and not to the research goal of this study, which is not suitable to appear in the section of introduction. These sentences should be moved to the discussion or conclusion section to indicate the limitations of this article that need to be solved in future research.

(4) Lines 275-279: the correlation between aerosol loading and lightning is negative in the basin region but is positive correlation in the plateau region. According to the above correlation coefficients, the authors concluded that aerosols stimulate lightning in the plateau region, but suppress lightning in the basin region. I think this conclusion is unconvincing. I thus suggest that the authors need to provide more sufficient evidence.

(5) Lines 288-289: ‘Since sulfate AOD accounts for more than 80% of the total AOD in Sichuan, ...’, while as shown in Figure 2, sulfate AOD accounts for about 60-80% of the total AOD over the basin region and 40-55% of the total AOD over the plateau region. Please check it.

(6) I suggest that the authors need to perform a significance test on the curve fitting results in Figure 4.

(7) Lines 442-445: “From the joint ... , an increase in CAPE inhibits the vertical wind shear in the lower to middle troposphere...” Why does an increase in CAPE inhibits the vertical wind shear?

(8) In the sections 3.5, the multiple linear regressions of CG lightning have been developed in the plateau region (as shown in EQ.6) and in the basin region (as shown in EQ.7), respectively. However, the positive or negative values of the regression coefficients in front of each regression factor (such AOD, RH, CBH, TCIW, and TCLW) are inconsistent with the Pearson correlation coefficients between these factors and CG lightning in Figure 3 and Figure 5. For instance, the Pearson correlation coefficients between sulfate AOD and CG lightning are opposite between in the plateau region and the basin region; while the values of the regression coefficients associated with AOD are both positive in EQ.6 and EQ.7. I suggest authors to check the above results based on the multiple linear regression and give

reasonable explanations. In addition, the similar situations are also observed in EQ.9.

Minor comments

(1) It is better to give a table of acronym because there are many abbreviations in the manuscript.

(2) Line 123: ‘diffusion’ -> ‘dispersion’

(3) Lines 122-124: “The Sichuan basin is an area with high areosol loading and with terrain ... (X. Zhang et al., 2012; L. Sun et al., 2016; Wei et al., 2019a, b)” is suggested to be changed to “The Sichuan basin is an area with high areosol loading and with complex terrain ... (Zhang et al., 2012; Sun et al., 2016; Wei et al., 2019a, b; Ning et al., 2017, 2019)” .

(4) Line 127: ‘influence’-> ‘influences’

(5) Line 176: “E. Sun et al. (2018, 2019) employed ...” -> “Sun et al. (2018, 2019) employed ...”

(6) Line 192: “S. Lee et al. (2018) compared the ...” -> “Lee et al. (2018) compared the ...”

(7) Line 270: ‘influenced’-> ‘affected’

(8) Line 395: ‘over 1000’ -> ‘greater 1000’

(9) Line 567: ‘influence’ -> ‘influences’

(10) Line 577: ‘diffusion’ -> ‘dispersion’