

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## **Comment on acp-2022-553**

Anonymous Referee #1

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Referee comment on "Diurnal differences in the effect of aerosols on cloud-to-ground lightning in the Sichuan Basin" by Haichao Wang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-553-RC1>, 2022

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### **General Comments**

This paper is reasonably well written and flow well; however, it does have a few errors and grammatical issues that are addressed below. The paper does a very good job of illustrating day-night contrasts in the effects of aerosols on lightning frequency over the Sichuan Basin. However, the conclusions are qualitative and can be quantified better.

### **Specific Comments:**

L1-2: The title could be clearer. Perhaps "Diurnal differences in the effect of aerosols on Sichuan-Basin lightning"

L60-61: The meaning of this sentence is unclear. Are you saying that aerosol radiative effects counter microphysical effects and make it difficult to confirm the modeling results using observations or something else?

L90: Possible contamination by what? IC flashes? If yes, please say this

L90: Since you only discuss CG flashes in this draft, you might replace all references to CG lightning with lightning – after stating once that lightning flash refers to CG lightning flash.

L91: These 2 sentences are confusing. Is this what you mean? Additionally, only the first

stroke is retained if more than one stroke occurs in the next second within the first 10 km of the first stroke as two strokes that occur within 0.5 seconds are assumed to be from the same flash.

L105: You mention 5 factors but discuss 7.

L123-L128: It is unclear how you obtained 564 and later 11408 samples. In addition, the reference to section 3.4 is confusing. Please rephrase this paragraph giving information such as how many grid boxes are in the region of interest? What percent of these grid boxes were excluded by the flash criterion? Also, only mention the 10 flash threshold once in the revised paragraph.

L130: The rectangular study region shown in Figure 1a doesn't match any of the other study regions shown in the paper. Perhaps remove.

L143: Figure 3 does not show the wind field.

L181: Why do we care about hourly variations in the percentage of positive CG flashes?

L203-204: Warm (cold) colours in the figure mean more (less) ... subset. Consider moving this sentence to the caption for Figure 5.

L200-216: Discussion of Figure 5: Could you calculate and show the percent of  $0.1 \times 0.1$  degree grid boxes where the change is positive and also give the mean change (amount and percent) for each of the 8 regions.

L219: You repeatedly refer to Period1 and Period2 over the next several pages. It might be better to replace these terms with morning and middle-of-the-night or something meaningful.

L233-234: It is unclear what you mean by this sentence. Are you saying that you see a 0.3 threshold during the day in this study consistent with other studies? If yes, state this more clearly.

L253-255: Are there any scientific studies of convection in the Sichuan Basin that support this inference? If yes, please reference them.

L256: TCL is negatively i□ Be clear as to whether you mean TCLW or TCIW.

L272-276: Check the captions in Figure 9 and make sure TCLW and TCIW are used appropriately. They probably all should be labeled TCLW.

L296: Rather than stating that more CG flashes are found it would be more interesting if you could give a percent increase range by dividing values from a subset of the bins.

L305: Rather than "more marked" cite a percent change. This should be done throughout L296-305.

L357: Hopefully, you can support this inference by other studies.

L591-595: Figure 4 caption does not match Figure 4.

Figure 5: Be sure to use BJT consistently as opposed to BJ

L604: Here and elsewhere consider replacing " the error was calculated" with "the uncertainty was calculated"

Figures 10 and 11: It might make more sense to show the flash counts with the numbers rather than the number of samples in the cell. This would emphasize your main points and give the reader more interesting numbers to play with.

## **Technical Corrections:**

Abstract\_L10: has been involved  $\delta i^a$  has been examined

Abstract\_L14: on day and night were analyzed  $\delta i^a$  were analyzed during both day and night

Abstract\_L15: found in the diurnal variation of ground flash  $\delta i^a$  found

L1: is a kind of  $\delta i^a$  is an

L39: The radiative effects suggest that aerosols can  $\delta i^a$  Through radiative effects aerosols

L42: convections  $\delta i^a$  convection

L45: aerosols loading  $\delta i^a$  aerosol loading

L45: not fixed  $\delta i^a$  variable

L49: in affecting  $\delta i^a$  to affect

L54: loading conditions.  $\delta i^a$  loading conditions, respectively.

L55: under low  $\delta i^a$  under both low

L58: elevating  $\delta i^a$  increasing

L68: preferential  $\delta i^a$  preferentially

L68: but reverse in the afternoon  $\delta i^a$  but the situation is reversed in the afternoon

L83: were obtained from China □ was obtained from the China

L88: almost all parts □ most

L88: about 80-90% □ 80-90%

L93: calculated at □ aggregated to

L98: last version □ latest version

L133: Intensely anthropogenic □ Intense anthropogenic

L134: the low-pressure system □ the climatological low-pressure system

L135: which is markedly larger □ with markedly larger concentrations

L139:, and the number of CG flashes happens at night, accounting □ accounting

L145: As times goes by, the pattern of this spatial distribution is gradually disappearing.  
The CG □ By afternoon, the CG

L148: and progressively focused on □ with increasing focus

L158: At late night, a cold □ Late night, cold

L162: have not been comprehensively understood □ are not completely understood

L167: in averaged total □ of total

L167: is first examined under ...--. Is first shown for the clean and polluted subset in Fig. 4a.

L172: is most remarkable at night, then in the morning, and the smallest is largest at night and smallest

L229: more significant than is greater than

L268: TTCG?

L273: , CC, is total column cover (CC),

L276: convections in is convection in

L283: two opposite is opposite

L285: are the general – elicit the general

L291: following contents, is following content

L318: Besides, part of aerosols can is Besides, some aerosols

L355: and reverse at night is and enhance it at night

L356: afternoon, it is afternoon, system

L357: it may be overwhelmed by mesoscale is systems may include many mesoscale

L385: model simulation is model simulations

L598: unite i□ units