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comment

Interactive comment on "Lightning Data Analysis of the CMA Network in China" *by* Feng Li et al.

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Thank you very much for the reviewers' comments. The questions and suggestions are very good, which will help us to make further improvements. Now we will answer all the questions one by one.

Comment1: "what is actually new and innovation of this paper?"

PS: This is a good question. So far, no scholars (including Chinese scholars) have carried out a comprehensive, systematic introduction, analysis and evaluation of the CMA lightning detection network. This paper mainly introduces the development history of CMA LDN, and analyzes the operational capability of CMA lightning network by using the index used in the service. This paper also introduces lightning location algorithms that can be automatic selected to use by CMA LDN business software, according to the number of detectors which detected same one the lightning signals. Change of

various algorithms use frequency is analyzed to prove the network performance and positioning accuracy improvement from another perspective. Based on the analysis of the CMA LDN, this paper uses the data of 5 years to analyze the temporal and spatial distribution characteristics and climate characteristics of lightning activities in China, these results can be used to compare with abroad similar networks, which should help foreign counterparts to understand China LDN. Otherwise, it would be a pity that there is no recent China's lightning detection network information in the world literatures database.

Comment2: "What is the scope of manuscript?"

PS: First, I'm sorry. Title of the manuscript is modified according to another reviewer's suggestion. Maybe it's not very suitable, but we have accepted it.

As reviewer say, the main content of this manuscript has two parts. a) The first part mainly introduces the basic information, development history and operational capability of CMA lightning detection network, including location algorithm brief description and business application. Referring to the reviewer's comment, we add some basic information about lightning location equipment (line 66-72) in the introduction section. The history of the number of detection stations has been introduced in section 2.1. About future plans, the manuscript has added some information in the line 73-78, the following diagram gives us the basis of the layout design of CMA lightning sites and the distribution plan of the site in 2020. Owing to the length of the article, we are not going to add it to the manuscript. Please see the specific content in revised paper. With regard to data reliability, we think the reliability of lightning data has been proved by analysis of section 1 and 2 in the paper. About algorithm, we added its reference in line 142-143, but I'm sorry, it is in Chinese.

Fig.1 is theoretical distribution map of detection efficiency. fig.2 is CMA LDN station distribution plan map (blue point is existed station, red point is planned station, total station number is 599) .

b) The main content of the second part is to analyze Chinese lightning activity spatial and temporal distribution and climate change characteristics by using 5-year data collected by CMA LDN. The reliable data reveals the fact of Chinese lightning event and inter-annual variation possible reason. Here, according to two reviewers comment, we have added and analyzed the relationship between the number of China's lightning and the ground temperature, precipitation and CAPE, and obtained the climatic reasons for the annual change of lightning. These results can be used to compare with the existing results of other lightning nets. Limited to the length of the article, this article does not make a comparison. Butï̈ijŇaccording to reviewer's comment , we have added an analysis related to other climate variables in section 3.1.

Comment 3: References "Only few references are given to prior work, and many of the given references miss a doi and cannot be found, or are in Chinese language. In particular the general introduction to the topic of lightning completely misses the pioneering works of the last century."

PS: According to the journal requirements and reviewer comments, we have supplemented all foreign reference DOI, but for the Chinese literature, I regret that, due to differences in file system functionality, DOI cannot be provided. About some pioneering works of the last century, many papers have often introduced, and this article no longer describes them. Thank you for your suggestion.

Some responses to detailed comments Comment4: "Abstract: Please carefully revise the abstract after clarifying the overall scope of the manuscript and revising the paper respectively. Try to make the abstract concise, short, but still give one sentence on the scope of the paper in the beginning (before giving any numbers)."

PS: Thank you very much for your comments. We have made a careful revision of the abstract according to your opinion, and more clearly defined the purpose and scope of this study.

Comment5: "Abstract (line 17-18): What does 50% accuracy mean? Lightning oc-

currence has not necessarily increased, might be just caused by increased detection efficiency (as stated later in the text!)"

PS: As we all know, the quality of the lightning detection network depends on the efficiency and accuracy of the lightning location. However, it is very difficult to confirm the efficiency and accuracy of lightning location. Generally, it is accepted that both the hybrid method and the multi-station method are better than the two-station method, the magnetic direction method and the amplitude method in the positioning efficiency and accuracy. Due to the geographical conditions, the number of base stations and network layout, CMA LDN cannot be all unified use multi-station positioning algorithm. Our strategy is to automatically select the location algorithm by the business software based on the number of detectors detected same one lightning signals. From the point of view of spatial distribution, where the higher the usage frequency of multi-station method is, the more reasonable the detection station location is, the higher the quality of lightning data. From the point of view of time variation, the higher multi-station method usage frequency is, the higher the detection ability of the whole lightning network, and the higher the quality of the lightning data, and vice versa. According to statistics, in practical applications, M3 usage frequency has increased year by year, the frequency of use is close to 50% by 2013.Therefore, we believe that the detection accuracy of the whole CMA LDN is improving continuously. Thus, the sentence "50% accuracy"(line 17-18) is not expressed accurately and has been modified in the abstract. According to the analysis of the annual change relationship between lightning number and climatic factors, the number of lightning in China has increased in 2009-2013 years, but it has not always been increasing, and it has annual decreasing variation in 2012. This phenomenon cannot be caused by the increase of detection efficiency. However, this lightning number increase must also be partly caused by an increase in detection efficiency.

Comment6: "Introduction: Please provide appropriate references, i.e. the pioneering studies on the respective topic, or easily accessible, english review articles on lightning

in general. Sections 2.1/2.2: Add appropriate references to previous work. What is the physical principle of the lightning detection (frequency, antennas)? Please discuss similarities and differences to other networks like NLDN, WWLLN, LINET). What about IC flashes? Are they detected as well? Can they be discriminated from CG? Discuss! Provide references for M1/M2/M3 methods."

PS: First, thank you for suggestion. According to the subject and the length of the present content, we will not add too many references, some classical literature, many articles are often introduced, and we do not no longer repeat them. Sections 2.1/2.2: we add location algorithm reference. We add Chinese lightning detector ADTD information in introduction section (line 64-70), including physical principle of the lightning detection (frequency, antennas). I'm sorry, we don't discuss similarities and differences to other networks like NLDN, WWLLN, LINET in this manuscript. We only provide CMA LDN information, which can be used to compare with other networks by other interested researchers. According to ADTD mechanical structure and physical principle, most of IC strokes weak signal are filtered out. Of course, lightning information also contain a small amount of cloud flash pulses information, but the results can not accurately distinguish IC flash and CG flash, they also cannot be discriminated from CG. M1/M2/M3 methods detailed algorithms are described in the reference book "principles and techniques of lightning monitoring" (Ma,Q.M 2015). (Ma, Q.M, 2015: Principle and technology of lightning monitoring. Science Press, Beijing, 101-181.)

Comment7: "Which algorithm was used for the results shown in section 3?"

PS: According to explanation in Comment5, I believe reviewers have already understood that the lightning data used in section 3 is the result of various algorithms. The location algorithm of each lightning event is chosen automatically according to the number of stations.

Comment8: "Summary: revise according to general comment 2"

Ps: summary has been revised.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2016-380/amt-2016-380-AC4-
supplement.pdf

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-380, 2017.
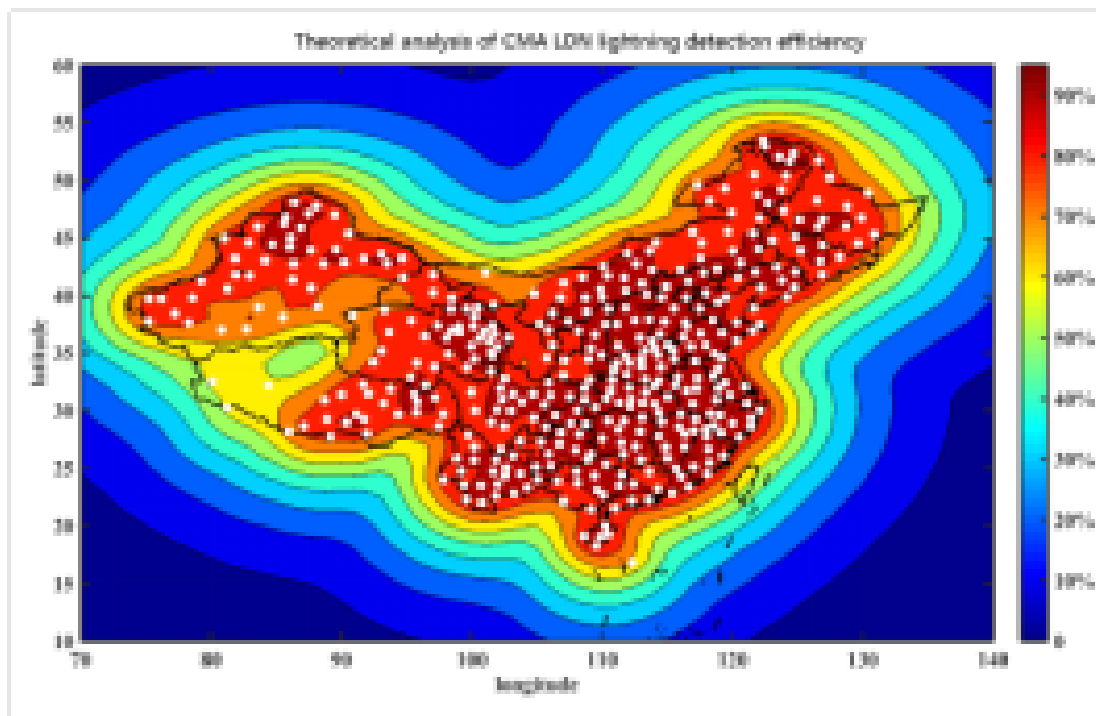
Fig. 1. Fig.1 theoretical distribution map of detection efficiency

Fig. 2. fig.2 CMA LDN station distribution plan map