

## ***Interactive comment on “Spatial distribution and occurrence probability of regional new particle formation events in eastern China” by Xiaojing Shen et al.***

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The manuscript deals with the spatial extent of new particle formation based on longterm particle number size distribution (PNSD) measurements in China. The work presented here describes the NPF occurrence probability and the possible origin of the nucleating air masses as well. A case study is also performed. The MS is clearly written and formatted. The work gives valuable results on spatial extent of NPF events. The article fits well into the topic of the journal. Thus, after considering the following questions and comments as minor revisions, I recommend the publication of the manuscript. Response: The authors thank the reviewer's comments and try our best

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to address the issues point-by point.

Comments: 1. Page 4., Line 15.: What is the time resolution of the SMPS measurement? It is not included in the text. How were the different systems compared? Were all the instruments running according to the international working standards (Wiedensohler et al., 2012)? Response: The raw data derived from SMPS was 5 min resolution. In order to combine with the TDMPs data, 10 min average data was used for the analysis. SMPS system was only operated for half a year at TS, and there was no overlap between SMPS and TDMPs. We could not compare SMPS and TDMPs result directly, but they were operated under the same conditions. The instrument calibration and data inversion routines followed the standards recommended by (Wiedensohler et al., 2012), which assured the data quality and comparability during the long-term measurement at different sites. We also add the information about the SMPS in the text.

2. Page 5., Line 18.: Title is misleading, since there is nothing about the classification of NPF events. It should be Dynamic parameters of NPF events or similar. Response: We totally agreed with the reviewer's comment and revised the title to be "Parameters describing NPF events"

3. Page 5., Line 24.: Were two lognormal modes enough to fit during nucleation? Is there a missing mode? Response: Based on our calculation results we found two lognormal modes were enough to parameterize the PNSD on NPF days. On NPF days, the particle concentration usually concentrated in the size below 100 nm. The lognormal fitting algorithm constrained two modes in the size range of 3-25 nm for nucleation mode and 25-100 nm for Aikten mode, respectively, which could capture the nucleation and growth process of NPF event. We didn't consider the accumulation mode (100-1000 nm) as the nucleated particle seldom grew out of 100 nm. We also revised the statement in the text to "In this study,  $D_p$  is derived by a fitting algorithm of PNSD based on two lognormal modes (Hussein et al., 2005), which was constrained in the size range of 3-25 nm and 25-100 nm, respectively."

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4. Page 6., Line 6.: Why was the ending height 1500 m at TS? If GDAS does not 'see' the height, then 500 m could be OK as well as it is for the 2 other sites (since it is agl and not msl). If GDAS does 'see' it, then 1500 m agl is too much. Please clarify and reword this. Response: the GDAS data didn't consider the topography of Mt. Tai, with the terrain height is 150 asl. Here we used the ending height of 1500 m agl at TS (equal to 1650 m asl, slightly higher than the evaluation of TS, 1540 m asl) to get rid of the influence by the topography on the air mass calculation. For the other two sites SDZ and LAN, the evaluation was ~300 m asl and ~200 m asl, respectively, which was close to the terrain height in the GDAS data and the ending height was chosen to be 500 m was enough. We also revised the sentences in the text to make it clear.

5. Page 6., Line 12.: One of the crucial questions is the monthly nucleation frequency. There is no data neither in the MS nor the cited paper (Shen et al., 2016b). Do all the 3 sites have the same monthly (annual) nucleation frequency curve? If they do not, it substantially and essentially modifies the whole picture present here. Please provide a paragraph regarding this topic. Response: We supplemented a new figure and sentences in the text to describe the occurrence frequency of NPF events observed at three sites. It showed the monthly variation was similar, which was higher in spring and fall, lower in summer. But for SDZ, the NPF also occurred frequently in winter. Fig. 2 was uploaded separately.

6. Page 6., Line 12.: What is the slight difference? Specify and/or explain this with data. Response: The statistical results of NPF parameters based on different length of dataset might be different. For example, the reported NPF frequency at LAN in Shen et al. (2016b) was 28% based on the measurement in 2013. But based on the three-year measurement, the NPF frequency is 22%, which was slightly lower than 28% in 2013. The formation rate and growth rate also showed an annual variation based on the multi year measurement at SDZ, which was also reported in Shen et al. (2016), but was not focused in this study. We revised the sentences in the text and made the statement more clear.

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7. Page 18., Fig 4.: On the probability plot: moving from SDZ through TS to LAN sites, it seems so, that SDZ had N, LAN had NW influence, while TS was a mixed case both from N and NW directions. At the end of Section 3.3 a couple of sentences should be added to highlight (better) the main message of these plots. Response: we added few sentences in the last paragraph in section 3.3 to highlight the ideas as the reviewer suggested. "It was also found that the high NPF occurrence probability was under the conditions of northerly air masses at SDZ, northwesterly and southerly air masses at LAN. While at TS, the probability was influenced by the mixing of northerly and southeasterly air mass, although high uncertainty existed due to the short length of dataset."

Technical requests: 1. Page 2., Line 25.: Sentence should be reworded, in that form it is not well understandable. Response: The sentence was revised to be "In China, the particle pollution is a serious issue and there have been several studies addressing the importance of NPF events based on long-term field measurement in recent years (Shen et al., 2011...)"

2. Page 5., Line 16.: "was be" should be reworded. Response: in the text, "be" was moved.

3. Table 1.: Missing days should be added with the measurement time interval for specific sites. Response: the missing days with time interval has been added in Table 1.

4. Figure 6.a: This graph is also explained in the text and it does not provide extra info. I recommend to discard this plot. Response: fig. 6a has been removed

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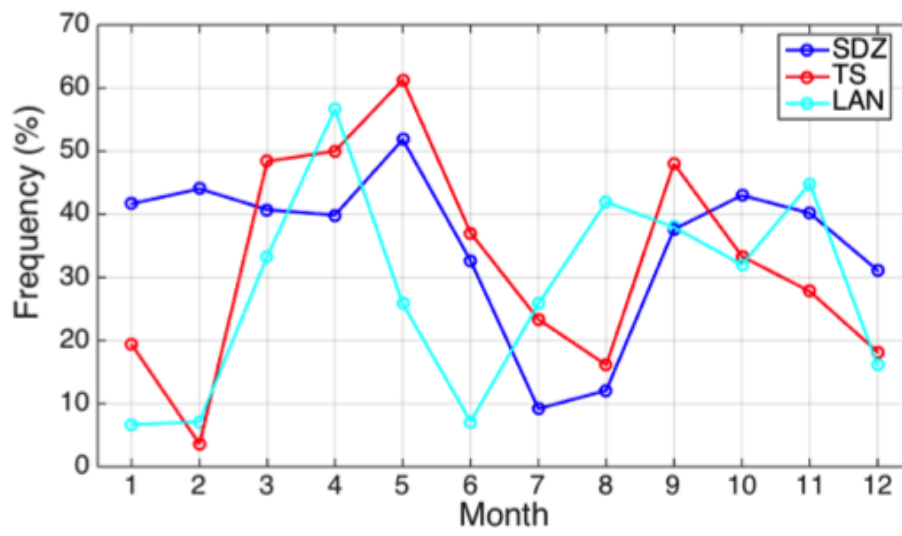


Fig. 1.