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Interactive comment on "Investigation of new particle formation at the summit of Mt. Tai, China" *by* Ganglin Lv et al.

Anonymous Referee #2

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This study focused on the new particle formation at a mountain site in Easter China. The manuscript for sure provides very large and valuable dataset referring to new particle formation at a mountain site in China. However, the current manuscript is not well organized and there is few in-deep thoughts on the determinants and mechanism of the NPF events at this site. Besides, some of the conclusions drawn in the mu manuscript are questionable. Therefore, major revisions are needed before publication should be considered.

Specific comments:

1. The language of this manuscript is far from a scientific publication. It is strong recommended that the manuscript should be carefully revised, probably by a native English speaker. There are many grammatical mistakes, incorrect omissions and collocations,

even in the abstract, including but not limited to the following items.

(1) Page 1, line 17, "appeared" should be "appears"

(2) Page 2, line 3, there is a "that" missing after "exhibited".

(3) Page 2, line 6, "Recent decades" should be "In recent decades".

(4) Page 2, line 17, should "after then" be "after that"?

(5) Page 3, line 10, does the author want to say "What's the contribution of estimated gaseous sulfuric acid on nucleation and growth processes?"

(6) Page 5, line 17, "in Table 3 it also exhibited the characteristics comparison between Mt. Tai and some other typical recent researches in China." should be "In table 3, it is also exhibited that the characteristics. . ."

(7) Page 6, line 1. "the sampling season".

(8) Page 6, line 15. "Although gaseous sulfuric acid formed through sulfur dioxide photochemical reactions was involved in NPF, neither high sulfur dioxide being strong NPF nor low value limiting NPF burst." This sentence is too vague to be understood.

(9) Page 7, line 18. "Figure 3 picked 40 days continuous data from. . .." can be revised as "Figure 3 exhibits the continuous data from . . .".

(10) Page 7, line 21, "exhibited" should be "exhibits". "This result was in accordance with. . ." should be "This result is in accordance with. . ."

(11) Page 7, line 23, better to substitute "improve" with "increase".

(12) line 29, "Existent of ozone could quantify the oxidation capacity and photochemical activities in the atmosphere, directly reacting with related species such as VOCs and indirectly affecting sulfuric acid formation via hydroxyl radical production". Incorrect adverbial use.

(13) Page 8, line 1. Should be "it is found that . . .". "revealed" should be "experienced".

(14) Page 8, line 3. What does “made for” mean here?

(15) Page 8, line 6. “Day-to-day analysis revealed that” should be “reveal”

(16) Page 8, line 10. “it meant” can be revised as “This suggests’

(17) line 12, “Particle number concentrations depending on wind direction in each mode were not obvious, and none of directions always showed significantly higher or smaller particle concentrations and it had clear difference with reports in Nanjing.” This sentence is too vague to be understood.

(18) line 14, should be “this suggests that few direct. . .”

(19) line 18, “illustrated” should be “illustrates”.

(20) Page 9, line 2. Revised as “Fig. 6 illustrates the data from. . .”

(21) Page 10, line 5. “In contrast” instead of “by contrast”.

(22) line 11, what does “background total nucleation particles” mean?

(23) line 30. “It revealed that . . .” What does “it” here stand for?

2. Page 1, line 25, “PM2.5 variation was always in accordance with particle total volume concentration.” This is nearly common sense. I don’t understand why this can be a conclusion in this paper.

3. Page 3, line 10. I am not sure whether the third point the author made here can be a real “scientific question”. The author may need to contribute some in-deep thoughts here.

4. Page 4. The author need to define all the parameters used in the equations.

5. Page 4, line 15. Why the Fgrowth can be neglected in this study? Does the author have evidence on this?

6. Page 4, line 23. The paper written by Mikkonen et al. has provided a more precise

H2SO4 estimation equation, in which another two parameters, CS and RH were used. Why don’t the author use this one?

7. Page 6, line 10. “NPF events could be observed in each month, and frequent NPF occurrence was in campaign ĐŸ which showed the frequency of 56 % (others were only 21 % by contrast). It could be interpreted that campaign ĐĘ and ĐÍ were in rainy and foggy season, and such wet condition seemed adverse to NPF.” The campaign ĐĘ, ĐŸ and ĐÍ should be defined before.

8. Page 5, line 24. “Another notable period was from 10 October to 18 October 2014, during which it had frequent NPF events and most of formation rates were larger than 75th percentile (20.61 cm-3 s-1). It could be associated with specific atmospheric conditions because of sudden temperature drop.” Why the sudden temperature drop increased the frequency of NPF?

9. Page 6, line 1. “Reasons for our large value were possibly not only related to geographically wide mountaintop location, but also sampling season impacts and size range difference for calculating formation rate.” What does the “geographically wide mountaintop location” mean? What specifically are the “season impacts” and “size range difference”?

10. Page 6, line 20. Why it didn’t exhibit significant distinction in the condensation sink values between NPF and non-NPF days? The author needs to provide a clear explanation.

11. Page 6, line 30. The uncertainty is not only from the solar radiation data, but also from the calculation itself as all the parameters for the equations are estimated based on the data in EU, not in China.

12. Page 8, line 1. “it found ozone concentration revealed slight drop during nucleation process on many NPF days and ozone consumption reactions might take place.” What does the author mean here? The ozone concentration decreased because of the

reactions during nucleation process? Why is that?

13. Page 8, line 3. “our statistical results showed that NPF preferred to occur on clear or partial cloudy daytime.” What is the statistical evidence here?

14. Page 8, line 6. “Day-to-day analysis revealed that temperature and relative humidity always had cyclic variation, and NPF events preferably occurred on high temperature and low relative humidity conditions. High temperature and low humidity could promote vertical transportation and photochemical reactions in the atmosphere.” I don’t think this is something that can be “revealed”. NPF always occurs in the middle of the day when temperature is higher and humidity is lower, because it is driven by photochemistry. This phenomenon cannot be logically concluded as high temperature and low relative humidity favour the NPF.

15. Page 8, line 15. “It could suggest that few direct particle pollution sources existed around observation site and nucleation might be the primary source for particles on Mt. Tai.” I don’t understand how the author made this conclusion. If there is no local sources nearby, particles can be from transport from other regions.

16. Page 8, line 24. “Compared with air masses coming from cleaner western parts of China, air masses going through Beijing et al. polluted areas had more complicated components and enhanced NPF events.” Is there any evidence in this paper to say so?

17. Page 8, line 29. “Hence NPF events with local continental backward trajectories were more vulnerable to local point sources.” This is confusing. The author just discussed that there is few direct sources around the observation site. How does the author make this conclusion then?

18. Page 9, line 9. Why “the higher atmospheric humidity in campaign ĐĘ might enhance the sticking possibility of particles for molecules”? Does the author refer to liquid phase or the phase change due to water content?

19. Page 9, line 17. “But particles recombination in close sizes could contribute to

the growth after nucleation and higher PM2.5 within limiting values possibly increased this possibility.” Coagulation of particles within the nucleation mode is always negligible under ambient condition. The author needs to provide strong evidences to prove that it is important in this study.

20. Page 10, line 10. The author try to calculate the particle density on clean days here. In this case, the author needs to prove that the PM2.5 measurement was very accurate at low concentration level. Also, the particle growth factor should be considered if there is no dryer before the PM2.5 monitor.

21. Page 10, line 17. “NPF had small impact on total volume concentration on polluted day, which might be related to large background fine particles.” I don’t know what the author wants to express here.

22. Page 10, line 23, is there a definition of “haze day” before? If it means PM25 > 75 ug m-3, why the average was only 64 ug m-3?

23. Page 11, line 8. “Reason for the former was possibly clusters recombination, and the latter decrease might be on account of energy threshold (i.e., nucleation barrier) and 10 atmospheric scavenging.” Again, the author need to provide very strong prove that the coagulation of clusters is very important in this study.

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