

Interactive comment on “New particle formation in marine atmosphere during seven cruise campaigns” by Yujiao Zhu et al.

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Anonymous Referee #1

This manuscript combines measurements conducted over several marine cruises to investigate atmospheric new particle formation (NPF) and growth in the marine atmosphere. The paper appears scientifically sound and original enough to merit publications. In its current form, the paper requires, however, important revisions, especially what it comes to the technical quality of the paper.

Response: The authors thank the reviewer's comments and try our best to respond and revise our manuscript accordingly.

Scientific issues

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The second paragraph of Introduction gives a background on NPF in the marine atmosphere. It contains a sentences discussing the role of amines in NPF (lines 22-23 on page 2) which is no way related to marine NPF. I recommend this sentence to be removed from here. The discussion on role of ions in coastal NPF does not include the paper by Sipila et al (2016, Nature) that gives the most detailed molecular view on this process published so far.

Response: Ocean is one of the important sources of atmospheric amines. The authors will revise the sentence to “Moreover, amines, which can be produced through excretion and metabolism by a variety of marine organisms, were reported to enhance H₂SO₄-H₂O nucleation and promote the growth of newly formed particles”. The reference of Sipilä et al. (2016) will be added in the revised manuscript.

Page 6, line 9: the numbers appear too accurate. I suggest writing: ...event to be at least 50-500 km.

Response: We corrected the sentence accordingly.

Page 6, line 26: the selected border between the Aitken and accumulation mode (50 nm) is very untypical. Normally in a scientific literature, it is assumed to be between 80 and 100 nm. Please correct or give a reason for this choice.

Response: Agree. On basis of those highly cited references, e.g., Kittelson, 1998, Kulmala et al., 2004, Kumar, et al., 2010; Seinfeld and Pandis, 2012, we revised the sentence as “The Aitken mode (30-100 nm) and accumulation mode (100-500 nm) were usually overlapped at the size range of 30-500 nm, with a minor nucleation mode at sizes below 30 nm”.

Page 11, lines 7-8: this statement requires a couple of more, and more recent, references.

Response: In revision, the authors added the reference of Buzorius et al. (2004, J. Geophys. Res.), Quinn and Bates (2011, Nature) and Meng et al. (2015, Atmos.

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Environ.), which reported that new particles can be formed above the marine boundary layer and mixing downward.

Page 13, lines 12-13: I am confused about this assumption. Do you mean that there should be no sulfate in nm sized particles?

Response: In the revision, we added “Note that appreciable amount of SO₄²⁻ should exist in <56 nm particles, but the amount might be probably much smaller than sampling artifacts.”

Page 14, line 12: dozens of minutes to one hours sounds a very strange range because dozens corresponds to several tens of minutes and one hour is the same (60 min). Please correct or modify.

Response: The authors revised as “from 17 minutes to one hour” in revision.

The paper has several sentences that are either difficult to understand or written in bad style, so they need to be rewritten. They are in the following places: page 4, lines 1-2; page 5, lines 30-31; page 7, lines 20-22; page 7, lines 27-31; page 8, lines 23-29; page 9, lines 2-3; page 9, lines 24-26; page 9, lines 29-30; page 10, lines 1-5; page 11, line 4-5; page 11, lines 12-15; page 12, lines 11-13; page 14, lines 10-11; page 10, line 14-15; page 14, lines 22-28.

Response: The authors have rewritten these sentences and double-checked the language using a profession service.

Technical issues

The paper refers to figures and tables marked as S1, S2 etc. They are in Appendix, so A1, A2 etc would be more logical way to refer to them.

Response: The original paper contain the Appendix in text and the Supplementary as attachment. Figure and table in appendix marked as Fig. A1 and Table A1, and the figures and tables in supplementary marked as Fig. S1 and table S1. We have double

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check it.

The following grammatical corrections are needed (the text below give the correct way to write them):

page 3, line 32: . . .monsoon prevails. . .

page 6, line 10: . . .sinks are two. . .

page 6, line 20: . . .first classified. . .

page 6, line 26: We first discuss category I data over the marginal. . .

page 7, line 1: . . .lower than that over the marginal. . .

page 7, line 2 : . . .as over the marginal seas (20%), indicating. . .

page 7, line 5: . . .altitudes

page 7, line 9: . . .with diameters lower than 20 nm

page 7, line 11: . . .higher than that reported in previous. . .

page 7, line 16: a comparable

page 7, line 27: over the. . .during the three. . .

page 8, line 1: . . .with a high. . .

page 8, lines 2-4: . . .intermittent occurrence of nucleation. . .here were much higher than those observed in previous. . .Altogether, considering both. . .

page 8, line 6: we next compare. . .

page 8, line 8: . . .larger mean values

page 8, line 9: . . .whereas comparable. . .

page 8, line 10: over the marginal. . .

page 8, lines 12-13: precursors, such as... vapors, were...

page 8, line 17: ...no obvious

page 9, line 1: ...24 NPF days, except on one day when it was 77 nm. ...could be identified

page 9, line 5: ...were able to grow...

page 9, line 18: ...event occur in regional

page 9, lines 19-20: ...event are mostly local phenomena reported in a few studies made over...

page 9, line 21: ...in an urban...

page 10, line 11: ...were accompanied

page 10, line 16: ...zoomed in (Fig. 6a).

page 10, line 17: ...high relative humidity of 74% and low wind speed of ...

page 10, line 18: ...characterized by a low

page 10, line 19: during the first hour

page 10, line 21-22: ...during the first 30 minutes... fluctuated... during the following 3 hours...

page 10, line 28: ...suggests a strong

page 11, line 3: and it lasted... the total particle

page 11, line 16: ...compounds may be involved in

page 11, line 17: day was analyzed

page 11, line 18: particles smaller than 10

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page 11, line 19: ... (derived... respectively, higher than in other

page 11, line 22: ... involved in... moderately high

page 11, line 31: lower than

page 12, line 6: ... at an initially high relative humidity of

page 12, line 17: we found that the

page 12, line 25-26: implying that the majority of... particle were able to grow to CCN at

page 12, line 28: to act as CCN

page 13, line 5: to play

page 13, line 12: errors in

page 14, line 18: Moderately good... were obtained

Finally, please check out carefully the language of the abstract

Response: The authors thank the reviewer's grammatical comments. We corrected all of the errors above and double-checked the language using a profession service throughout the manuscript.

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