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Atmospheric Chemistry and Physics Discussions

Interactive comment on "New particle formation events observed at the King Sejong Station, Antarctic Peninsula – Part 2: Link with the oceanic biological activities" *by* Eunho Jang et al.

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We thank Referee 2 for providing valuable suggestions that improved the readability of our revised manuscript. Our responses to this Referee's scientific and technical comments are stated below. The revised manuscript was uploaded in the form of a supplement.

Scientific issues

1. Need to provide more comprehensive discussion on how this result build upon earlier findings and what exactly is the new scientific message: The key finding of this study is

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that the formation of nanoparticles was strongly associated with not only the biomass of phytoplankton but also, more importantly, its taxonomic composition in the Antarctic Ocean; therefore, changes in the taxonomic composition of marine phytoplankton (i.e., DMS(P)-rich species vs. DMS(P)-poor species) may have a significant impact on the aerosol properties in the remote marine environment. In the revised manuscript, we have added a paragraph explaining earlier finding and the key results of this study. Furthermore, the limitations of the present study and the scope of future studies have also been added (P9, line 29 – P. 10, line 8).

2. Add more recent published work: In the revised manuscript, we have added recent findings that report the roles of diverse environment factors affecting the formation of new particles (P3, line 10; P3, lines 17–24).

3. Typical lifetime of PM is generally longer than 2 days that used to identify the origin of measure air mass: We agree with this referee that the retention time of PM10 is known to be >2 days in the lower troposphere. The retention time for aerosol particles with a diameter <10 μm is known to be 3–5 days in the low troposphere (Mishra et al., 2004; Budhavant et al., 2015). Therefore, we have applied 3-, 4- and 5-day air mass back trajectories to identify the potential origin of MSA in the revised manuscript. When applying 3-, 4-, and 5-day air mass back trajectories, the number of samples that satisfy >90% retention in the Bellingshausen and Weddell Seas was less than 20% of the total MSA samples owing to its longer transport pathway. Inevitably, the air mass origin of MSA was divided into two sectors i.e., the Bellingshausen Sea sector (<58.8oW) and the Weddell Sea sector (>58.8oW) by selecting the air mass back trajectories with >50% retention in a given sector. We have added these explanations in the revised manuscript (P4, lines 21–24; P8, lines 20–25; P8, lines 30–33).

Minor scientific and technical issues

4. Need to modify some terminologies: We have changed “aerosols” to “aerosol particles” (P1, line 15) and “secondary organic aerosols” to “new particles” (P1, line 35) in

the revised manuscript.

5. The paper written by Kim et al. (2018) is a companion paper submitted to ACP and is under review (Kim et al., New particle formation events observed at the King Sejong Station, Antarctic Peninsula – Part 1: Physical characteristics and contribution to cloud condensation nuclei, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-1180, in review, 2018).

6. Why there are only 6 measurements points in the figure, although the measurements cover 8 year? Unfortunately, we could not obtain the CN data during the summer period in January and February 2014 owing to a malfunction of the analytical system. As we started observation in March 2009, the CN data for January and February 2009 were not included in the analysis. Therefore, six measurement points are represented in Fig. 5.

7. Clarify the meaning of DMSP-to-chlorophyll ratio: The conversion of cellular DMSP into DMS is controlled by not only the concentration of DMSP but also, more importantly, the DMSP cleavage enzyme. The phytoplankton species containing high cellular DMSP (i.e., high DMSP-to-chlorophyll ratio) mostly possess an enzyme that can convert cellular DMSP into DMS, whereas phytoplankton species containing low DMSP content (i.e., low DMSP-to-chlorophyll ratio) do not have a DMSP cleavage enzyme. Therefore, the DMSP-to-chlorophyll ratio is commonly used to explain the differences in taxonomic compositions affecting the oceanic DMS-production capacity (e.g., Belviso et al., 2000; Stefels et al., 2007; Tison et al., 2010; Park et al., 2014b and 2018). We have added more description to clarify the meaning of the DMSP-to-chlorophyll ratio in the revised manuscript (P4, line 34 – P5, line 4; P7, lines 15–40).

8. We have changed “DEB” to “DEC” (Figure S3 and S4 in the revised supplement).

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2018-1181/acp-2018-1181-AC2-

supplement.pdf

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