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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Antarctic new particle formation from continental biogenic precursors" *by* E.-M. Kyrö et al.

Anonymous Referee #3

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General comments: The paper presents new particle formation in the Antarctic coast during austral summer. Particularly, link between regional new particles and continental precursor sources such as bioactivity in melt-water ponds were focused in this paper. As far as I know, these processes have never been discussed in the Antarctic region. Authors attempted to made large efforts to take physical and chemical properties of sub-micrometer aerosols in the Antarctica. Although this paper has some potential to be a worthwhile reading, I cannot recommend publication unless the following major points can be addressed:

1. Discussion of contamination from human activities in Antarctic coast More careful discussion about influence of contamination from human activities around each station is needed, because many operating stations are located in the coast in 15W – 15E.

Although some stations (Aboa, Neumayer, Sanae, and Troll) were shown in Figure 8, the other operating stations (Halley, Wasa, Novo-air base, Novolazarevskaya, and Maitri) were not shown. Locations of the other stations must be shown in Figure 8. Furthermore, many mobile contamination sources were operated usually around the research areas during summer, particularly, airplane operation in DROMLAN. Without discussion about influence of these contamination sources, new particle formation by other processes cannot be discussed.

As shown in Figures 2-4, new particles formation events must be found at Aboa Station. Authors attempted to discuss influence of local contamination from comparisons between the number size distributions in new particles formation (Figs. 2-4) and those in very local contamination (Fig. 12). It is true that very local contamination from Aboa and Wasa Stations as "point sources" may be insignificant to these events, because large variability (short peaks) appeared clearly. Features of the concentrations of atmospheric species derived from the point sources have usually large variability as shown in Figure 12. In addition, distance among Aboa, melt-water ponds, and the other neighboring stations was similar (scales of several hundred km). Considering that the melt-water ponds and the other neighboring stations are also "point sources", variability of aerosol concentrations derived from both the melt-water ponds and the other neighboring stations is expected to be similar in cases that aerosols and precursors from the melt-water ponds and/or the other neighboring stations were not mixed and diffused well during the transport. When aerosols and precursors from the melt-water ponds and/or the other neighboring stations are mixed and diffused well during the transport, subsequent features might be observed at Aboa Station in both cases. Therefore, more careful discussion about influence of the contamination is needed before discussion about likelihood of contribution of bioactivity from the melt-water ponds to new particle formation.

2. Estimation of growth rate Growth rate was estimated using gaseous H2SO4 concentration in this study. Actually, previous works (referred in this paper) showed the H2SO4

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concentration ranged in 0.60-1.5×106 molecules cm-3. However, this range seems to be underestimated in the Antarctic coast during summer. According to Jefferson et al. (1998a), mean H2SO4 concentration was 1.61×106 molecules cm−3 (highest conc. ∼ 107 mole cm−3). Additionally, gaseous CH3SO3H (MSA) can act as condensable vapor because of the low vapor pressure. Mean concentration of gaseous MSA reached to 9.5×105 molecules cm−3 in the Antarctic coast during summer (Jefferson et al., 1998b). Thus, gaseous MSA should be taken into account in estimation of growth rate. Previous works by Jefferson et al. are as follows.

Jefferson, A., Tanner, D., Eisele, F., and Berresheim, H.: Sources and sinks of H2SO4 in the remote Antarctic marine boundary layer, J. Geophys. Res., 103(D1), 1639–1645, 1998a.

Jefferson, A., Tanner, D., Eisele, F., Davis, D., Chen, G., Crawford, J., Huey, J., Torres, A., and Berresheim, H.: OH photochemistry and methane sulfonic acid formation in the coastal Antarctic boundary layer, J. Geophys. Res., 103(D1), 1647–1656, 1998b.

Minor points 1. Measurement section: Shallow ponds around Aboa station was described in the text. More information about distributions and the number density of both ponds around Aboa station slight-far ponds and should be added in the text and/or Figure to understand circumstances in the Antarctic coast during summer. Because pond-derived precursors were discussed, this information is useful for readers.

2. Section of “Chemical analysis” How large is the yield of each chemical constituent in sample treatment?

3. Page 32751 line 1-3 What are apple-type, bump-type, and banana-type? More explanation (or definition) about them is useful for readers.

4. Page 32752 line 1 Typo: bump type

5. Page 32763 Line 21-23 DMS emission from Nostoc commune was mentioned in “summary and conclusions”. However, DMS emission from Nostoc commune was not

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presented and discussed in “results and discussion” in this study, though micro-algae-origin organics in aerosols were discussed. I suggest to add discussion about DMS emission from Nostoc commune in section of “results and discussion”, or remove the description about DMS emission from Nostoc commune from the text and Figure 17.

6. Page 32763 Line 25-26 Description of DMS emission from snow surface is high speculation. Nutrient concentrations (e.g., nitrates and phosphates) are too low in surface snow around the Antarctic coasts to propagate microalgae to engender significant DMS emission. I suggest that description about DMS emission from snow surface is removed from text and Figure 17, because the processes were not discussed in this paper.

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Interactive Comment