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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.

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We thank the Anonymous Referee for Their valuable comments concerning the discussion paper. We have carefully considered all of the comments given by the Referee and acted accordingly. The authors are especially grateful for the first comment concerning the different event types, since it is important for the reader to understand the differences between them.

Comment 1 *(section 2.3. The "banana, apple, bump" need more explanation. Is this jargon necessary?)*

The naming of different events into bananas, apples etc. is commonly used in NPF studies and thus important to include to the text. We have now written a more de-

tailed description of different event types to the revised version of the text and the first paragraph of section 2.3 is now as follows:

NPF events can be visually classified based on the shape of the particle size distribution into different types (Dal Maso et al., 2005; Yli-Juuti et al., 2009; Manninen et al., 2010; Kulmala et al., 2012). The different types of events are signatures of NPF happening on different spatial and temporal scales and their shape is caused by the Eulerian way of measuring the air mass. Traditional "banana"-events are typically observed when NPF happens over geographically large area. A "banana" event appears in the size distribution as a wide band which starts from the lower limit of the size distribution and curves smoothly towards higher sizes. This kind of appearance requires formation and growth that lasts over several hours or even days. Other types (e.g. "apple", "bump" and "wind-induced" all of which were observed at Aboa during FINNARP 2009 expedition) represent more local NPF. Common for each of these is that they appear as round- or obscure shaped short-time increases in particle concentration in the lowest particle sizes. Due to their shape, it is not possible to obtain growth rate for these events.

Comment 2 *(Section 2.4. define BSTFA and TMCS.)*

BSTFA and TMCS are now defined in the text.

Comment 3 *(Section 3.2.1 line 4. . . .origin of particles. . .)*

Corrected.

Comment 4 *(Table 4. Define AHvap)*

AHvap (rewritten as ΔHvap) is now defined in the caption of Table 4.

Comment 5 *(Figure 17. The authors go to great length to exclude sulfuric acid nucleation as the source of these particles. However, figure 17 gives DMS top billing as the source of new particles. I suggest taking DMS out of this figure (DMS is an organic compound so by just saying organics it is included in the figure). The point here is*

ACPD

12, C13035–C13038, 2013

that meltwater ponds that form during the summer in Antarctica are enriched in organic compounds as a result of blooms of blue-green algae Nostoc commune. The flux of these organics from the ponds to the atmosphere leads to the formation of new particles that are observed to grow by condensational growth to particles sufficiently large to serve as CCN.)

Our aim in the paper is not to exclude H2SO4 nucleation as the source of the observed particles, but to show that the majority of the observed growth is caused by organics, which has not been thought to be valid in Antarctica. The Figure and Figure caption 17 as well as corresponding text in the Summary and Conclusions (Section 4) have now been revised followingly:

SECTION 4: "Figure 17 summarizes our current understanding of the continental new particle formation in Antarctica. Meltwater ponds release organics that are after oxidation in the atmosphere, capable of increasing the condensational growth of aerosols enough for them to have climatic effects via CCN activation and probably increasing the nucleation as well. It has also been suggested (Antony et al., 2010), that the bromine emissions from coastal ice caps would increase the oxidation of DMS and could therefore increase the nucleation even in areas with no meltwater. "

FIGURE CAPTION: "Figure 17 Continental new particle formation in Antarctica: meltwater ponds that form during summertime hold lots of organics inside – including blue-green algae Nostoc commune. These ponds are found close to nunataks and blue-ice areas. The organics are oxidized in the atmosphere and increase locally the condensational growth of particles and can have an influence in the nucleation as well. The oxidized organics play a key role in growing the aerosols enough – up to 50-100 nm in diameter – for them to have climatic effects. This growth takes only few hours, whereas with only sulphuric acid growing the particles, the timescale would be days and the particles would be scavenged from the atmosphere before reaching sufficient sizes. The bromine emissions from coastal ice caps, as suggested by Antony et al. (2010), increase the oxidation of DMS and can therefore increase the nucleation even in larger

ACPD
12, C13035–C13038, 2013

scale."

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 32741, 2012.

ACPD

12, C13035–C13038, 2013

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