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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Natural new particle formation at the coastal Antarctic site Neumayer" *by* R. Weller et al.

Anonymous Referee #1

Received and published: 13 July 2015

The manuscript "Natural new particle formation at the coastal Antarctic site Neumayer" presents aerosol size distribution data for two experimental campaigns at the scientific research station Neumayer during 2012 and 2014. The authors utilise this data to identify and characterise New Particle Formation (NPF) events in terms of formation and growth rates, as well as a useful parameter of the concentration of sulfuric acid necessary for binary homogeneous nucleation mechanisms. The work is important because of the low number of NPF papers currently found in the literature for the Antarctic region. Although no significant insight into the processes leading to the NPF events present in the paper are presented, the occurrence of the events is valuable enough to warrant publication in my opinion. In saying this, as discussed below, the paper could be strengthened substantially by comparison with co-measured data at

Neumayer.

Specific major concerns:

- 5 day trajectories. The decision on the length of trajectories used should be discussed here in terms of the uncertainty. Authors have mentioned this in passing but a more thorough discussion of the topic should be performed given the high uncertainties present in the input meteorological datasets in this region.
- Detailed analysis/interpretation of the particle formation event isn't presented and would be useful, particularly for the single particle formation event that the authors pick out as a case study.
- Discussion about precursors and conditions leading to NPF events is minimal, and given the other measurements available at Neumayer, could be significantly strengthened. This would significantly strengthen the precursor discussion presented in the paper.
- Discussion of iodine oxide nucleation requires a consideration of the seasonality of the IO concentrations. It should also be described what concentrations are required for nucleation to occur so that the reader is able to determine for themselves if the Antarctic concentrations are high and/or sufficient.

Specific minor concerns:

- Page 15657, Line 1 - the sentence starting with "One focus of interest. . ." should begin a new paragraph
- Page 15657, Line 7 – sentence beginning "Concerning the marine troposphere. . ." should be revised, this currently does not flow nicely.

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- Page 15659, Line 22 – please give a reason as to why 4 consecutive spectra were averaged.
- Page 15660, Line 3 – change “referred to Dal Maso . . .” to, “As in Dal Maso. . .”
- Page 15660 Line 8 – why are ionic composition measurements introduced in the methods section? They are not utilised at all throughout the study. These should be removed.
- Page 15661, Line 15-19 – please revise this sentence, currently it does not make sense. It may also be worth defining what the particle growth criterion is that you are getting rid of and why the spatial distribution of the event is relevant here.
- Page 15661, Line 23-25 – revise sentence grammar.
- Page 15663, Line 2 – please define the units of cvapour and γ
- Page 15663, Line 15 – “striking NPF event happened in 27 January, where a simultaneous” should be changed to “striking NPF event that happened in on 27 January, where a simultaneous”
- Page 15664, Line 14 – please define “bright”. Does this mean “cloud-free”? What were the solar radiation levels?
- Page 15664, Line 18 – “5 days” should be “5 day”
- Page 15666, Line 4 – total particle number concentration increased up to 3000 cm-3 from a background of what?? What was your average?
- Page 15666, Line 10 – Notwithstanding should have a comma after it, so it should become “Notwithstanding, some . . .”
- Page 15667, Line 27 – define a scale for NH4+, and whether 10 ng/m3 is high enough to be involved.

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- Page 15668, Line 2 – as for previous comment, but for WSOC
- Page 15669, Line 5 – please rephrase this to include the idea that this conclusion is achieved primarily through ancillary data, rather that online measurements.
- Figure 1 – labelling the x axis and the color bar. Color bar should be relabelled in linear, rather than logarithmic units.
- Figures in general – it may be useful to include legends, or axis color coding in the figures to enable quick interpretations of the figure (e.g. in Figure 1c, the right axis would be blue).

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 15655, 2015.