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Atmospheric Chemistry and Physics Discussions

Interactive comment on "New particle formation in the Svalbard region 2006–2015" *by* Jost Heintzenberg et al.

Anonymous Referee #1

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The paper "New particle formation in the Svalbard region 2006-2015" is exploring environmental parameters facilitating or promoting new particle formation events. The parameters considered by the authors are all pretty well known to be behind new particle formation in one form or the other. However, the extent of the database explored by the authors is immense and the effort put by the authors is commendable. The paper would be most valuable for its statistical value despite the absence of a new information behind reasons or mechanisms of new particle formation. I am in favor of publishing the paper after the comments were adequately addressed.

Major comments

1. Considering that Svalbard region represents oceanic environment, authors may want to consider the following two papers on open ocean new particle formation (Ehn

et al., 2010; O'Dowd et al., 2010) phenomenon in the neighboring North Atlantic region. I would like to point at seasonal occurrence of new particle formation events – similar to the one authors presented as well as the spatial extent of the events.

2. My other major concern is related to the algorithm of MEV events. What was likelihood that sporadic anthropogenic emissions were included in this category, considering persistence of particles and multiple sizes at relatively large concentrations? I suggest that authors briefly describe their approach in terms of excluding pollution from nearby sources including ships.

3. The most novel aspect is a hypothesis implicating gel-forming phytoplankton in NPF events. It should be more elaborated whether they are primary or secondary. I believe gel-type of material must be primary and contain some sea salt which would unlikely contribute to NPF. How dominant the mechanism of gel break-up may be on regional scales, especially when requiring entire break-up of not so numerous gel particles which must have originated as primary?

4. I suggest that authors emphasize that most of the environmental parameters were derived from HYSPLIT model and their accuracy may not be very high. If authors tried to validate some of the model derived parameters with measurements (at least one or two) that would greatly enhance the impact of the findings. For example, can it be cross-checked against ceilometer data that modelled precipitation was accompanied by ceilometer cloud detection?

Minor comments

Abstract

Line 29. "winter to early spring feature", not event.

Line 30. What is sensitive – event occurrence of the search algorithm?

Line 34. "Notably, the seasonal distribution of....follows that of . . ..although it peaks before..."

Introduction

I suggest moving the last paragraph to Methods, but finish Introduction with brief description of the aim of the study.

Database

Solar flux is not described in Database, but used in data analysis.

Line 200. “We utilized number size distributions, pressure and temperature taken from our database for this calculation.”

Line 217. “NssSO4 was determined from total sulphate correcting for sea salt sulphate as 0.25xNa (Keene et al., 1986)”

Line 235. Trajectories extending backwards for ten days are inaccurate at origin due to the trajectory uncertainty of 25-30% of its length. (refer to HYSPLIT model website)

Line 249. “The most important. . ..was cloud cover. No direct record...”

Line 255. Use singular “cloud”. At any given moment a single cloud is sufficiently large to engulf the station.

Line 258. condensation sink.

Line 275. "Once in the atmosphere DMS is..."

Line 277. Authors should mention important temperature dependence in forming sulphate versus MSA. Arctic environment is facilitating MSA production while tropical environment facilitates sulphate.

Line 438. State the criterions for NPF classification and refer to following sections for details (e.g. Section 3.1). Do the same for other classes.

Line 509. Was 93% percentile the result of NPF overlap? Have you tested various percentile thresholds? Please relate the number of events to the total number of days in dataset, e.g. 240 events over 2000days of the dataset. Same for other events. Refer

to Table 2 as well.

Line 654. “both”.

Line 755. Pure stratus clouds are rare, most often they are Stratocumulus despite having flat cloud base as of stratus.

Line 764. Biogenic nssSO4 would resemble similar pattern to MSA, but without isotope analysis discrimination between biogenic and anthropogenic components is not possible.

Line 787. “yields several pieces of information”.

Line 827. “increased by a factor of 1.7”.

Line 847. “less satisfactorily”.

Line 868. Even if sun never sets during late spring - summer months, solar flux varies significantly, so one should not expect flat diurnal pattern as authors introduce at the beginning.

Conclusions

Conclusions are too long and descriptive. Move some information to discussion and leave only most important statements.

Line 912. Change or link?

Figure 6. Are the number of events per month were summed up over the whole period of 9 years (specify)? Same in Figure 9&10.

Ehn, M., Vuollekoski, H., Petaja, T., Kerminen, V. M., Vana, M., Aalto, P., de Leeuw, G., Ceburnis, D., Dupuy, R., O’Dowd, C. D., and Kulmala, M.: Growth rates during coastal and marine new particle formation in western Ireland, J. Geophys. Res.-Atmos., 115, -, Artn D18218 Doi 10.1029/2010jd014292, 2010.

O’Dowd, C., Monahan, C., and Dall’Osto, M.: On the occurrence of open

ocean particle production and growth events, Geophys. Res. Lett., 37, L19805 10.1029/2010gl044679, 2010.

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