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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Iodine observed in new particle formation events in the Arctic atmosphere during ACCACIA" *by* J. D. Allan et al.

**Anonymous Referee #2**

Received and published: 12 January 2015

Review report of ACPD manuscript:

J.D.Allan et al. "Iodine observed in new particle formation events in the Arctic atmosphere during ACCACIA" ACPD, 14, 28949–28972, 2014

General comments: The manuscript describes observations of iodine in the Artic, measured by aerosol mass spectrometer (AMS), and associated with Arctic new particle formation (NPF) events. While NPF has been observed in the Arctic previously, this is the first time iodine has been observed in the growing particles by the AMS method. The topic is certainly interesting and significantly extends previous observations made in coastal areas and lower latitudes that have identified Iodine as an important component in coastal nucleation events. The iodine observed may or may not have similar



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origins as found in lower latitudes and also this issue is briefly touched in the paper. The manuscript presents qualitative results stemming from current and previous observations and does not try to quantify the issue – in part due to the lack of suitable instrumentation to investigate the composition of the smallest particles. However, these observations, as they are, are significant and supply new information of iodine species in the Arctic and their potential relation to Arctic NPF events. The manuscript is well written and reports an important addition to our knowledge on sources and availability of nucleating precursors on the pristine Arctic areas, which many of the common precursors of atmospheric particle formation are absent. The measurements seem to be carefully performed and the methods used have been previously validated. Principal Evaluation Criteria Scientific significance: Good (2) Scientific quality: Good (2) Presentation quality: Good (2)

Specific comments:

Have the authors considered photolysis of iodocarbons as a source of the observed iodine? Can this be excluded? In addition, it is said that halocarbons were measured from air and water but no iodocarbon data are presented (only CH2Br2). Why is this so? This data could potentially strengthen the presented results.

Iodine emissions have been quite conclusively shown to lead to NPF, but often the halogen chemistries are coupled to each other. Was bromine or its oxidation products sought from the AMS spectra? Same (or similar) algae that produce iodinated species are known to produce even bigger amounts of bromine species.

The time period of the case-study highlighted in Figure S1.2 shows a very large portion of organic matter. Is it, or can it be excluded that some larger (and/or heavier) halogenated organic compounds contribute directly to the phenomena, or is it necessarily I2 and its further oxidation products? I suggest this should be discussed in more length in the text.

in Page 28956, Line 15 it is said that: “The I+ signal was not represented in any of the



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factors derived, only manifested in the residual data, which implies that the particulate iodine had a source that was distinct from the processes controlling the formation of particulate organic matter". Maybe it would be worth to mention here about the size limitation of AMS, and on the timescales the particulate matter has needed to grow to be detectable by the AMS. In addition, I would like to see a sentence about the PMF analysis in the main text describing how the different sources are decided based on the data and the PMF analysis.

I would suggest adding a Figure showing some of the basic meteorological parameters during the case study. I guess these were also routinely measured during the campaign? For example, temperature and humidity could be useful. Even better if solar UV flux measurements are available (as comments above show), or, even just the indication of 'cloudy or sunny' would make the estimation of the importance of photolytic processes easier. Iodine species are known to be especially photochemically active and the study was performed during the Arctic summer, when the sun never sets. Thus it would help to know about these parameters.

Figure 2. The 127 Th signal seems to have a time lag with respect to observed NPF event. If iodine is the initiating compound, then how come its observation has a time lag? Comments?

Page 28950, Line 8: What is a persistent event in this context? Suggest adding an explanation. (cf. Page 28952, Line 21: "a particularly strong and persistent case study.."?)

Page 2891, Lines 22-24: This sentence is hard to understand. Suggest rewriting it.

Page 28952, Line 1: I would add few words explaining the concept of "organic biogel".

Page 28955, Line 14: Suggest giving a short description already here on what is meant by "ice diatom" (this is explained later in page 28958). For people familiar with the topic, this is trivial, but for interested non-specialized reader, especially the word diatom can



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be confusing.

Page 28955, Line 23: To me the presented Figures show quite banana type events. What is meant by saying (Line 25): “result from diurnal modulation of boundary layer dynamics and photochemistry, which is missing under the continuous insolation of the Arctic summer.”? If the meteorological situation is so different, maybe an explanation is required to explain why the observed events look so similar.

Page 28958, Line 24: “There are also sources of atmospheric iodine in the form of iodocarbons, but we do not consider these likely to be responsible for the observations, as it has been shown that these have a much lower NPF potential compared to I2 (McFiggans et al., 2004).” This relates to comment presented already above: Iodine baring hydrocarbons are very photolabile and thus some information on available radiation would be useful to estimate the importance of photochemistry of the iodocarbon species.

Figure 1 The Figure size should be increased to enable better readability.

Figure 1b Include arrows to indicate wind direction for the trajectories.

Figure S2.2. More details on the mass-axis would benefit the reader. At the moment it’s not possible to read the masses of the observed peaks.

Many of the supplemental figures are not mentioned in the text.

Technical corrections:

Page 28951, Line 15: Should it be “atmosphere”?

Page 28957, Line 9: Should it be “Aitken”?

Figure 3 is apparently mislabelled as Figure 4 (mentioned in Page 28957, Line 1).

Supporting Figure S1.4 caption: case study time period is not found on the reported Figure S1.3.



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Add spaces between supplemental references to enable “better browsing”.

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