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

Anonymous Referee #1

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Allan et al. present an interesting, important and well-written study of new particle formation in the Arctic which they argue is related to iodine. As the authors point out iodine mediated particle nucleation has been known about for some time, but the majority of work has been on particle production in coastal regions where macro-algae release iodine at low tide. The authors present new measurements which show that there may be another source of iodine particle precursors possibly related to diatoms in sea ice. They correctly acknowledge that more work is needed and provide a compelling case for this future work. I recommend this paper for publication in ACP once the authors have addressed the following points to the editor's satisfaction:

1. The authors have written a concise article focused on a specific point, but I think more figures could be included in the main text which are currently included in the

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supporting information. Specifically, I think the hygroscopicity data in S1.4 should be included in the main paper since this data is central to the conclusion that this aerosol is consistent with particles being composed of an iodine oxide. Also consider bringing S1.1 and 1.2 into the main paper.

2. The fact that the growth factor was relatively small for this aerosol is used in the conclusions and elsewhere to make the case that the aerosol are consistent with being composed of a large fraction of iodine oxide. However, this topic is only addressed briefly in the paper on p28957 ln18-20. It is argued that the low growth factor of the aerosol is consistent with iodine oxide, I₂O₅. It is also stated that the growth factors ‘...are consistent with a dense by low-hygroscopicity substance such as iodine oxide (I₂O₅...)’. The authors need to expand the discussion here. I₂O₅ is a well-known highly hygroscopic material (hygroscopic in the traditional sense – affinity for water). I understand that it is used in chemical synthesis as an agent to remove water vapour because it is so hygroscopic. But, it appears that I₂O₅ has some unusual properties for a hygroscopic material. Despite having a very high solubility and a great affinity for water, its growth factor (at 90% RH) has been shown to be small (~1.3) (Murray et al. *Atmos. Chem. Phys.*, 12, 8575–8587, 2012; <http://www.atmos-chem-phys.net/12/8575/2012/acp-12-8575-2012.pdf>). In this article the mass growth factor was measured and is consistent with the growth factor measured in systems where iodine oxide aerosol were generated from gas phase precursors. Hence, I agree with the interpretation by Allan et al. that the low growth factor is consistent with I₂O₅, but more discussion is needed and also suitable references included.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 14, 28949, 2014.

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