

## ***Interactive comment on “Emission of iodine containing volatiles by selected microalgae species” by U. R. Thorenz et al.***

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Received and published: 13 October 2014

We thank the Referee for reading our study and for the comments, however, we disagree with the comment that the paper is not suitable for ACPD. We take the points the referee raises to clarify the connection of the study to atmospheric science and to highlight the importance to the atmospheric science community. We try to answer to the different statements one after the other, first showing the referee statement/question in bold and then our answer.

1. In my opinion, the paper titled “Emission of iodine containing volatiles by selected microalgae species” by Thorenz et al., is not suitable for publication in ACPD without major revisions.

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We revised the paper taken the points raised by the referee into account. We have also clarified the connection to atmospheric science and highlighted the importance of I<sub>2</sub> emission from the air /water interface.

2. This is a biological incubation study of various phytoplanktons for the detection of many iodocarbons produced under conditions that are not normal in seawater.

We revised the paper to make clear that this study is not a classical incubation study, which investigates the production of trace gases from phytoplankton as function of e.g. their growth rate/phase/nutrient limitation, but that it is an (gaseous) emission study performed under conditions mimicking the natural environment. We investigated the emission of different iodine species (organic = iodocarbons and inorganic = I<sub>2</sub>) from natural sea water and micro algae suspensions at the air/water interface under conditions where the iodide and iodate content in the water phase are representative of those in seawater. Molecular iodine is an important contributor to reactive atmospheric iodine, and to date emissions studies have focused either on coastal macroalgae, or on the abiotic source. This is the first study that we are aware of that has investigated I<sub>2</sub> emissions from microalgae, which are widespread across the global oceans.

3. The link of this work to either atmospheric physics or atmospheric chemistry is weak.

We disagree that iodine emission from seawater at the air/water interface is not relevant for atmospheric chemistry. Modelling and observational studies (e.g. Read et al., 2008; McFiggans et al., 2010; Saiz-Lopez et al., 2012) show that iodine significantly reduces tropospheric ozone and in certain regions constitutes an important particle nucleation mechanism. We have modified the abstract, introduction and conclusion to more clearly and explicitly state how this study is relevant for atmospheric research.

4. There is specialist jargon used in the paper that is not defined, like “F/2 aqueous media”. What are the advantages and disadvantages of using this type of media?

“F/2 medium” is now defined and explained in the experimental section. It has been

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removed from the abstract.

5. As the authors point out, it is extremely difficult to compare the emissions measured in the incubation studies to those in the real world. Usually, emissions in incubation studies are greater than those measured in the real world, but here the study yields emissions two orders of magnitude lower than measured in the real world.

The previous studies referred to here are iodocarbon emissions from a coastal region strongly influenced by macroalgae and from marine aggregates. The latter was not a “real world” study but an incubation study (Hughes et al., 2008). Macroalgae are the strongest known emitters of halogens and it was expected to find much lower (per area) emissions from microalgae.

6. I would recommend that the authors submit the paper to a specialist journal in microbiology, because it is hard to interpret this work for the atmospheric science community.

We disagree with this statement; the emission of I<sub>2</sub> from seawater under natural conditions (O<sub>3</sub> mixing ratio in air and iodide concentration in seawater) is interesting for the atmospheric science community (e.g. Lawler et al., 2014). In particular, the change in emission of the natural plankton concentrate compared with the cultures is interesting, since the latter samples clearly show the abiotic formation of I<sub>2</sub> from iodide and O<sub>3</sub> and the natural plankton sample does not. In this case the formation of HOI instead of I<sub>2</sub> is indeed interesting for the atmospheric science community, as pointed out in (Carpenter et al., 2013).

7. I think that further work is needed to understand why their observed emissions are so low.

As we point out in lines 21-27 on page 14587, the emissions of I<sub>2</sub> not unexpectedly low, rather, they are in good agreement with the model for the background seawater and the diatom cultures. The I<sub>2</sub> emission of the plankton concentrate is low, but also the iodide is low, therefore it is in agreement with the model. We have expanded the discussion to

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include iodide uptake by the natural occurring plankton. The emissions of iodocarbons are low compared to shoreline water in a kelp field. Kelps are known as big producers of iodocarbons, especially during tidal dryness. We agree with the referee that there should be further studies to understand iodocarbon emission rates from different kind of seawater/planktons, but the iodocarbon emission of phytoplankton was not the main goal of this study (See statements two and five).

References Carpenter, L. J., MacDonald, S. M., Shaw, M. D., Kumar, R., Saunders, R. W., Parthipan, R., Wilson, J. and Plane, J. M. C.; 2013. Atmospheric iodine levels influenced by sea surface emissions of inorganic iodine, *Nat. Geosci.*, 6(2), 108–111, doi:10.1038/ngeo1687 Carpenter, L. J., Malin, G., Liss, P. S. and Küpper, F. C.; 2000. Novel biogenic iodine-containing trihalomethanes and other short-lived halocarbons in the coastal east Atlantic, *Global Biogeochem. Cycles*, 14(4), 1191–1204, doi:10.1029/2000GB001257 Lawler, M. J., Mahajan, A. S., Saiz-Lopez, A. and Saltzman, E. S.; 2014. Observations of I<sub>2</sub> at a remote marine site, *Atmos. Chem. Phys.*, 14(5), 2669–2678, doi:10.5194/acp-14-2669-2014 Read K.A., Mahajan A.S., Carpenter L.J., Evans M.J., Faria B.V.E., Heard D.E., Hopkins J.R., Lee J.D., Moller S.J., Lewis A.C., Mendes L., McQuaid J.B., Oetjen H., Saiz-Lopez A., Pilling M.J., Plane J.M.C.: Extensive halogen-mediated ozone destruction over the tropical Atlantic Ocean, *Nature*, 453, 1232–1235, 2008. McFiggans, G., Bale, C. S. E., Ball, S. M., Beames, J. M., Bloss, W. J., Carpenter, L. J., Dorsey, J., Dunk, R., Flynn, M. J., Furneaux, K. L., Gallagher, M. W., Heard, D. E., Hollingsworth, A. M., Hornsby, K., Ingham, T., Jones, C. E., Jones, R. L., Kramer, L. J., Langridge, J. M., Leblanc, C., LeCrane, J.-P., Lee, J. D., Leigh, R. J., Longley, I., Mahajan, A. S., Monks, P. S., Oetjen, H., Orr-Ewing, A. J., Plane, J. M. C., Potin, P., Shillings, A. J. L., Thomas, F., von Glasow, R., Wada, R., Whalley, L. K., and Whitehead, J. D.: Iodine-mediated coastal particle formation: an overview of the Reactive Halogens in the Marine Boundary Layer (RHAMBLE) Roscoff coastal study, *Atmos. Chem. Phys.*, 10, 2975-2999, doi:10.5194/acp-10-2975-2010, 2010. Saiz-Lopez, A., Lamarque, J.-F., Kinnison, D. E., Tilmes, S., Ordóñez, C., Orlando, J. J., Conley, A. J., Plane, J. M. C., Mahajan, A. S., Sousa Santos, G., Atlas,

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E. L., Blake, D. R., Sander, S. P., Schauffler, S., Thompson, A. M., and Brasseur, G.: Estimating the climate significance of halogen-driven ozone loss in the tropical marine troposphere, *Atmos. Chem. Phys.*, 12, 3939-3949, doi:10.5194/acp-12-3939-2012, 2012. Hughes, C., Malin, G., Turley, C., Keely, B., Nightingale, P., Liss, P.: The production of volatile iodocarbons by biogenic marine aggregates. *Limnol. Oceanogr.*, 53,867-872.2008.

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 14, 14575, 2014.

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