

***Interactive comment on* “Direct evidence for coastal iodine particles from Laminaria macroalgae - linkage to emissions of molecular iodine” by G. McFiggans et al.**

Anonymous Referee #1

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Peer Review for Atm. Chem. Phys. Discussions

Paper: McFiggans et al., "Direct Evidence for Coastal Iodine Particles from Laminaria Macroalgae - Linkage to Emissions from Molecular Iodine"

This paper presents results from laboratory and field experiments related to the production of new particles in coastal areas. It presents the first direct evidence linking the observed particle bursts and coastal macroalgae. It also presents evidence that I₂, rather than organic iodine compounds, is the likely source of the coastal particle bursts.

This paper is clearly of interest for ACP, contains several new important results, and it documents these results appropriately. I recommend that this paper be published in

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ACP after a few minor issues are addressed.

Minor Issues

- Page 1, Abstract, lines 5-6: previous experiments have not been restricted to CH₂I₂. Burkholder et al. used also CF₃I. Although this is mentioned toward the end of the paper, it should be also mentioned in the abstract and throughout the paper (e.g. line 3 of introduction, etc.).
- Page 2, line 4: the statement "behave alike" should be made more precise.
- Page 3, lines 7 and later: the paper states that it has been proposed that the condensable iodine species condense on pre-existing TSCs. However it has also been shown (Burkholder et al., Jimenez et al.) that the condensable iodine species are capable of nucleating new particles at concentrations relevant to the marine environment. Thus TSCs are not needed, even though they may be playing a role. This should be made clear in this section of the manuscript.
- Page 4, line 6: not enough detail is given about "ambient light conditions" used in the experiments. Were the experiments done outdoors? If so, were they performed during sunny or cloudy days or both? If they were done indoors, were the specimens e.g. next to a window?
- Pages 4-5: the description of the experimental apparatus and the results are somewhat entangled. I recommend mentioning Figure 1 at the beginning of this section and proceeding to describe it. Then all the experimental details should be given first, and only then should the results be described. E.g. the three sentences starting by "Total flow rates" should be before Figure 2 is described.
- Page 7, lines 1-3: "The experiments were carried out over several months." Were the same algae used over a period of several months? I suspect not, however this is not clear from this sentence.
- Page 7, line 14: the peak at m/z 96 (SO₄⁺) is normally not observed in the AMS when

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sampling sulfate. Only the peaks at m/z 80, (SO_3^+), 81 (HSO_3^+), and 98 (H_2SO_4^+) are observed prominently, besides m/z 48 and 64.

- Page 8: the formation of particles by the reaction of I_2 and O_3 in the dark has been reported previously by Sunder et al., Sunder and Vikis, and Vikis and McFarlane. A subset of these references should be cited and their reactant levels and results compared to those of the present study.

- Page 10, last sentence of first paragraph: This sentence is unclear. Do the authors mean to say that the TDMA experiment on ambient or algae-generated particles was not done as part of this study? However Vakeva et al. (2002) have published TDMA results during nucleation events at Mace Head. Those results should be compared to the results in this paper.

- Page 12, lines 3-4: it is not clear to me how an additional set of spectra can be used to cancel out interferences and spectral features. Perhaps a little more detail could be given here.

- Pages 15-16: section 6 of the manuscript is somewhat unclear and not well organized. In particular it has already been shown (Burkholder et al., Jimenez et al.) that TSCs are not needed for new particle formation from this chemical system at atmospherically relevant concentrations. Thus the system will produce new particles whether TSCs are present or not. Whether these new particles will grow to CCN sizes or not will be determined by the competition between condensational growth and coagulation loss. This is independent of the TSC question, at least for coastal areas. O'Sdowd et al. (2002) already investigated that process for certain particle populations and source strengths, and their findings should be cited here.

Grammar, Spelling, and Formatting Issues

- Page 6, line 7: "This is not unexpected" should be rewritten as "This is expected."

- Page 9: I think TEM grids are "holy" and not "holey" carbon.

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- Page 9, paragraph 2, line 2: the second author on the reference should be McMurry and not McMurray.
- Page 9, paragraph 2, line 4: I suggest rephrasing "change in a particle's size" as "change in particle size."
- Page 9, paragraph 2, line 4: I suggest rephrasing "on increasing" as "after increasing."
- Page 9, last line: these two sentences, linked by a dash, are awkward. I suggest breaking into two sentences.
- Page 11, line 3: I suggest replacing "(higher than" by "(with higher than"
- Page 12, line 2: should be "spectral analysis."
- Page 12, paragraph 2, line 2: this sentence reads as if the wavelengths (rather than the species) had different diurnal patterns.
- Page 13, line 9: the first author of the reference in this line is given as "Rabinwitch" here and as "Rabinowitch" in the reference list.
- Page 15, line 13: "IO and OIO is" should be replaced by "IO and OIO concentrations are."
- Page 18. The last name of D.J. Rader is misspelled as "Radar."
- Page 19, Table 1: This table is complex and not easy to read. I suggest combining the O3 and ppb columns to simplify the table. Also the "1o" and "2o" indices are not explained. I think these refer to the first and second reaction vessels, but this should be made clear in the table. Finally, the "x" mark can be confusing since it is sometimes used to indicate "yes." I suggest replacing by "no."

References

Vikis, A. C., and R. MacFarlane, Reaction of iodine with ozone in the gas phase, J. Phys Chem., 89, 812–815, 1985.

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Sunder, S., and A. C. Vikis, Raman spectra of iodine oxyacids produced by the gas-phase reaction of iodine with ozone in the presence of water vapour, *Can. J. Spectrosc.*, 32, 45–48, 1987.

Sunder, S., J. C. Wren, and A. C. Vikis, Raman spectra of I_4O_9 formed by the reaction of iodine with ozone, *J. Raman Spectrosc.*, 16, 424–426, 1985.

Vakeva, M., K. Hameri, and P. P. Aalto, Hygroscopic properties of nucleation mode and Aitken mode particles during nucleation bursts and in background air on the west coast of Ireland, *J. Geophys. Res.*, 107(D19), 8104, doi:10.1029/2000JD000176, 2002.

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