

Interactive comment on “Phytoplankton and dimethylsulfide dynamics at two contrasting Arctic ice edges” by Martine Lizotte et al.

Martine Lizotte et al.

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Anonymous Referee #1 Received and published: 7 January 2020 “Phytoplankton and dimethylsulfide dynamics at two contrasting Arctic ice edges” by M. Lizotte et al. was reviewed.

In this paper, the authors focused on the relationship between phytoplankton and DMS dynamics at the different type of icescapes, i.e. ice edges dominated by first-year and multi-year ices. The authors well documented the different characteristics for DMS production between the icescapes. In general, this paper is suitably written and I totally agree with the authors’ discussion. I recommend that this paper will be published in this journal after small correction of technical issues. Author’s response. We thank any-

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mous referee #1 for their constructive review of the manuscript. Below we address each point brought up by referee #1.

Note from the authors. Because a phrase was added on L70 following the comments of referee #2, the numbering of the lines has changed. We take into account this new numbering in our response to both referees.

Specific comments Page 4, Line 115: “Sound” → “sound”. The same errors can be found. Please correct it. Author’s response. Yes, the word “sound” on its own should not be capitalized. Author’s changes in manuscript. A search for “Sound, as a stand-alone word (not part of a name such as Lancaster Sound) was made throughout the text and replaced with “sound”. L115 (now L118) “Sound” was changed to “sound” L362 “Sound” was changed to “sound” L418 “Sound” was changed to “sound”

Page 4, Line 148: The term “chl a” is firstly mentioned here. The authors mentioned the abbreviation at Page 5 Line 155, but it should be shown here. Also, the abbreviations are shown as both “chl a” and “Chl a”. Please unify the abbreviation. Author’s response. We agree with the referee: on L148 (now L151), chlorophyll a should be written out and there were different forms of the abbreviation of chlorophyll a. Author’s changes in manuscript. On L148 (now L151), the word “chlorophyll a” was added and we changed “chl a” for “(Chl a)”. On L158, we changed “chlorophyll a (chl a)” to simply “Chl a”, Throughout the text we kept the capitalized form Chl a, just as can be found in other papers published in Biogeosciences, e.g. “Dutkiewicz, S., Hickman, A. E., and Jahn, O.: Modelling ocean-colour-derived chlorophyll a, Biogeosciences, 15, 613–630, <https://doi.org/10.5194/bg-15-613-2018>, 2018.”

Page 5, Line 156: “onto 25-mm filters” → “onto a 25-mm filter” Author’s response. We agree to the modification. Author’s changes in manuscript. On L156 (now L158-L159), the words “onto 25-mm filters” were changed to “onto a 25-mm filter”.

Page 5, Line 156: Phytoplankton pigments were extracted. . . → Phytoplankton pigments on the filter were extracted. . . Author’s response. We agree with the

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proposed modification. Author's changes in manuscript. On L156 (now L159), we modified "Phytoplankton pigments were extracted..." by "Phytoplankton pigments on the filter were extracted..."

Page 5, Lines 168-170: This sentence should be reconsidered. The authors may merge the measurement steps of both natural sample and standard in error. GC column: Please indicate the type of GC column of two GC systems. Author's response. We agree that precision about GC columns can be added. Author's changes in manuscript. Information pertaining to the type of GC columns used was added to the text.

L173-174: Gaseous samples were then analyzed using a Varian 3800 gas chromatograph (GC), equipped with a Pulsed Flame Photometric Detector (PFPD) and a capillary column (DB-5ms, 60m x 320um x 1um) L195-L196: Once separated by the GC capillary column (DB-5ms, 30m x 250um x 0.25um), volatile compounds were ionized and directed to the mass selective quadrupole of the MS.

Page 6, Line 189: What is the "proprietary trap" here? Please explain the detail. Author's response. The trap mentioned on L189 (now L192) is "proprietary" meaning that Teledyne Tekmar has the proprietary rights to its composition. We suggest taking this word out to avoid confusion and add extra details instead. Author's changes in manuscript. On L189 (now 192), the words "u-shaped proprietary trap" were changed to "u-shaped trap for volatile organic compounds (Teledyne Tekmar Stamp 9 Trap)."

Figure 2: The size of letters on the map are too small. Please resize it. Author's response. Yes, we agree with both the comment and the suggestion. Author's changes in manuscript. The size of the letters on the map were made larger. A new version of Figure 2 was added to the manuscript.

Figure 10: For FYI diagram, the relationship between phytoplankton bloom and light availability is clearly indicated, but I'm afraid that the reader may not catch what the authors would like to show in MYI diagram. Please modify the MYI diagram to show

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the relationship of phytoplankton abundance and light availability. Also, the second sentence (How these physical changes. . .) may be omitted from the figure caption. Author's response. We thank the referee for the insight and agree that the figure should be made clearer. Author's changes in manuscript. The following modifications were made to Figure 10. On the first panel (MYI) the arrow (light) going from the sun and through the thicker ice was presented as discontinued (dotted arrow) to signify reduced intensity of light reaching the surface of the water and available for phytoplankton growth. Part of the light is absorbed by the ice (one arrow ending in the ice), and another part of the light is reflected back (2 arrows pointing upwards). On the second panel (FYI) the arrows (light) going from the sun and through the thinner ice and the melt ponds at the surface of the ice show scattering and an increase in the amount of light reaching the surface of the water and available for phytoplankton. Part of the light is absorbed by the ice (one arrow ending in the ice), and another part of the light is reflected back (1 arrow pointing upwards).

Furthermore, as suggested, we modified the caption as follows and took the second sentence out. Initial version: Figure 10: Conspicuous alterations in the Arctic Ocean are underway and include reductions in snow cover, sea ice extent and thickness, and increase in melt pond areal coverage, the occurrence of which is linked to profound modifications in light availability in surface waters below the ice and at its margin. How these physical changes will impact the dynamics of bloom-forming microorganisms and their production of the biogenic climate-active gas DMS are still unknown. The conceptual diagram depicts two types of ice edges (top panel MYI and lower panel FYI) and their potential role in modulation light penetration under the ice pack and the development of phytoplankton blooms and associated DMS dynamics.

Modified version: Figure 10: Conspicuous alterations in the Arctic Ocean are underway and include reductions in snow cover, sea ice extent and thickness, and increase in melt pond areal coverage, the occurrence of which is linked to profound modifications in light availability in surface waters below the ice and at its margin. The conceptual

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diagram depicts two types of ice edges (top panel MYI and lower panel FYI) and their potential role in modulation light penetration under the ice pack and the development of phytoplankton blooms and associated DMS dynamics. In this very simplified diagram, reduced light penetration (dotted arrow) and greater light reflection (arrows pointing upwards) occurs in the presence of MYI (top panel) whereas increased light penetration occurs through thinner and ponded FYI (lower panel) allowing phytoplankton to develop under the ice and potentially produce DMS.

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2019-422>, 2019.

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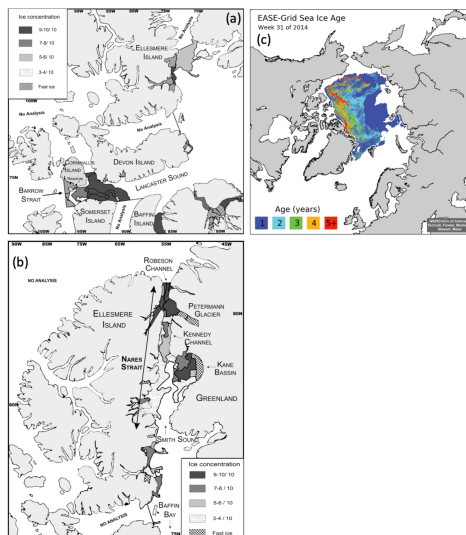


Fig. 1. Figure 2. Lizotte et al. Biogeosciences

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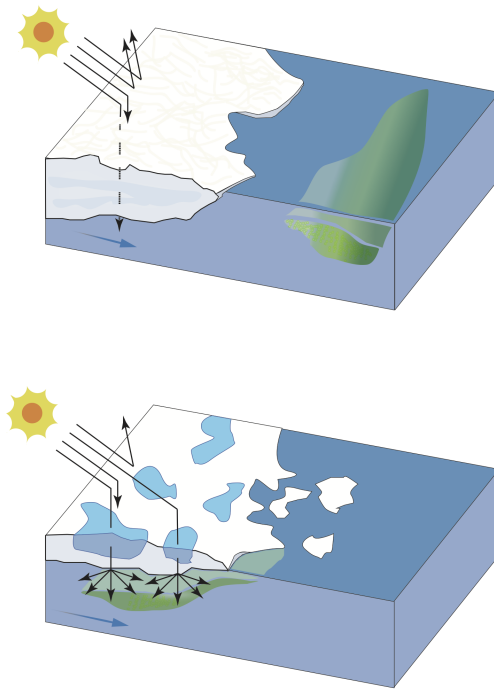


Fig. 2. Figure 10. Lizotte et al. Biogeosciences