

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-252

Anonymous Referee #2

Referee comment on "Sea ice concentration impacts dissolved organic gases in the Canadian Arctic" by Charel Wohl et al., Biogeosciences Discuss.,
<https://doi.org/10.5194/bg-2021-252-RC2>, 2021

General comment

In this paper, the authors present a suite of dissolved gases measurements conducted along a three-week transect on the east side of the Canadian Arctic in July-August 2017. This data set gives a rare representation of the vertical and horizontal distribution of methanol, acetone, acetaldehyde, dimethyl sulfide and isoprene in the marginal ice zone in this part of the Arctic. The sampling protocols and the analytic technics are well described and appropriate. The results are well discussed and lead to interesting hypotheses regarding the controlling factors of this gases and how they are influenced by the presence of sea ice. The interpretation of the data is slightly too speculative in few instances (see specific comments), but in general, very convincing owing the excellent grasp the authors have on the literature. Overall, this is an interesting and well written paper.

Here I would like to share with the authors two points deserving attention. First, the area covered during the cruise is very large and encompasses different water masses, water circulation patterns, and marine ecosystems. Different 'regions' have been obviously sampled and pooling all the results together may be misleading. I am not proposing to change the way the results are presented (i.e. figures), but the potential importance of the characteristics of the three main regions (West Baffin Bay, Smith Sound, Lancaster Sound) on the gases measured should be mentioned in the Discussion. Second, the effect of ice edges on the biogeochemistry of the adjacent waters is very much influenced by the water circulation. Water masses moving out, in, or along ice edges will have different biological and chemical characteristics. This should be taken into account when comparing the ice edges sampled west of Baffin Bay, Smith Sound, and Lancaster Sound. The authors touched that aspect when referring to the recent work my Lizotte et al. (2020), but do no discuss how this may influence their ice edge results.

Specific comments

P1, line 21 - ...broadly higher concentrations...

This is vague. Any numbers or statistics to support this interpretation?

P1, line 31 - ...once the ice has melted...

Or when under-ice water masses move out of the ice pack (see General Comment).

P11, line 194 - ...Here we briefly discuss the effect of sea ice concentration (AND WATER CIRCULATION)...

Water masses circulation at the ice edge is also important if one want to understand the impacts of ice edges on water biogeochemistry.

P11, line 202 - ...could be characterised...

Since not measured during this cruise.

P11, line 207 - ...for this region...

Which region? West Baffin Bay? Lancaster Sound? The area covered during this study encompassed different 'regions', even if I admit the that term 'region' is vague...

P11, line 208 - ...that that...(typo)

P11, line 213 - ...in this region...

Same comment as above. Please be more specific about the localisation.

P12, line 227 - ...These may be in part due to under ice phytoplankton blooms...

Under ice phytoplankton blooms take place 'under the ice', so this statement is confusing in respect of the previous sentence stating that Chl a is lower at full ice cover.

P12, line 229 - ...these compounds...

Which ones? All the compounds measured during this study?

P 14, line 271 - ...could be...

The rest of the sentence is missing.

P14, line 275 - ...phytoplankton SPECIES... ,

P14, line 277 - ...to be highly variable...

I suggest deleting the (a), (b) and (c) since this style is not used elsewhere in the manuscript.

P14, line 281 - ...concentrations more strongly...

This paragraph will benefit to have a clear concluding sentence.

P15, line 309 - ...it appears that photochemistry...

The present data set cannot identify processes (sources/sinks) at play since no rate measurements were conducted. This conclusion is not backed by observations.

P16, line 323 - ...SLIGHTLY higher concentrations of acetone...

For clarity I suggest to had 'slightly' since the difference in the mean concentrations of acetone between ice and ice-free waters, although statistically significant, is small.

P16, line 341 - ...which also SHOW...

Replace 'observe' by 'show'.

P16, line 344 - ...by freshwater input from melting sea ice...AND RIVERINE INPUT

As mentioned in the Introduction (P 3, line 73), river runoff is also an important source of turbidity in the Arctic

P17, line 376 - ...These RESULTS suggest common sources...

P17, line 376 - ...qualities are poor...

I suggest deleting 'quite'.

P18, line386 - ...The slightly higher...may be...

This interpretation is very speculative and not supported by the data. In addition, the two sampled regions are separated by many kilometers and were not sampled at the same time. Other processes may be at play.

P18, line 390 - ...This could be related to phytoplankton at the bottom of the ice...

Replace 'phytoplankton' by 'ice algae'.

P18, line 385 - ...We generally observed...

This last statement at the end of the paragraph needs to be discussed. Why mentioning that here and what are the implications?

P18; line 400 - The references to Mungall et al. and Abbatt et al. are appropriate, but the authors should also refer to the more detailed and ocean-focused paper by Lizotte et al. (2020), Biogeosciences.

P18, line 402 – The authors should also compare their results with those reported in the recently published paper by Galí et al. (2021) for the western Baffin Bay ice edge zone.

Galí et al. DMS emissions from the Arctic marginal ice zone. Elementa: Science of the Anthropocene (2021) 9 (1): 00113.

P18, line 408 – Refer to Lizotte et al. (2020).

P18, line 411 – Excluding...however.

I suggest deleting this part of the sentence and to directly state: 'No significant correlation could be observed BETWEEN DMS CONCENTRATIONS AND SEA ICE CONCENTRATIONS DURING THIS STUDY.'

P18, line 413 - ...dependent on biological settings, presence/absence of under-ice bloom, water masses circulation in respect to the ice edge, time of the year, and type of sea ice.

P19, line 423 - ...This frequently...

Any statistics?

P19, line 432 - ...This suggests...

P19, line 442 - ...have suggested...

Replace 'suggested' by 'calculated'.

P20, line 454 - ...These depth profiles...

What is mentioned in this paragraph is relevant to all gases measured in this study. So, it should not be at the end of the section on Isoprene. I see two options: the concerns mentioned here could be addressed in the different sections of the Discussion as relevant, or the whole paragraph (with some modifications) could be moved to the very beginning of the discussion as a warning.

P23, line 535 - ...impact the overlying atmosphere...BY...

This idea should be further developed. What will be the impact?

END