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Comment on bg-2022-150

Anonymous Referee #1

Referee comment on "Concentrations of dissolved dimethyl sulfide (DMS), methanethiol and other trace gases in context of microbial communities from the temperate Atlantic to the Arctic Ocean" by Valérie Gros et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-150-RC1, 2022

Review of the paper: "Variability of dimethyl sulphide (DMS), methanethiol and other trace gases in context of microbial communities from the temperate Atlantic to the Arctic Ocean"

by Valérie Gros et al.

General comments

The paper by Gros et al. makes a substantial contribution to our understanding of the spatial distribution of climatically important trace gases and their potential underlying drivers. I would highlight the finding of very high DMS and significant MeSH concentrations under ice, the uncoupled DMS and MeSH distributions, and the distinct correlations between each VOC and bacterial ASVs at quite fine taxonomic resolution. Strong relationships between MeSH and bacterial ASVs in comparison to other VOCs is indicative of widespread bacterial DMSP metabolism. The paper is clearly written and well structured, and its messages are well supported by the observations. In the specific comments below I make some small criticisms that should be addressed. I suggest several additional citations, which I find important to both support the authors' findings and give fair credit to previous studies. I was also a bit disappointed by the little use authors make of HPLC data. My feeling is that they are missing an opportunity to assess the relative importance (even if based only on correlation patterns) of phytoplankton vs. heterotrophic bacterial diversity in controlling VOCs distribution in the area north of 80N that they sampled from Niskin bottles. My main criticism is with regards to the figures: they should be improved to make them more self-descriptive.

Specific comments

L39: Please add more up-to-date references, given that major advances in understanding of DMSP catabolism pathways have been made since 2007.

L41: suggested citation: Kiene, 1996. Production of methanethiol from dimethylsulfoniopropionate in marine surface waters

These articles may be of interest to provide a more complete view:

L45-48: Rodríguez-Ros et al. 2020. Distribution and drivers of marine isoprene concentration across the Southern Ocean

L49-50: Fichot and Miller, 2010. An approach to quantify depth-resolved marine photochemical fluxes using remote sensing: Application to carbon monoxide (CO) photoproduction

L56: Acetaldehyde is also photoproduced: Zhu and Kieber, 2020. Global Model for Depth-Dependent Carbonyl Photochemical Production Rates in Seawater.

L65: Lewis and Arrigo, 2020. Changes in phytoplankton concentration, not sea ice, now drive increased Arctic Ocean primary production

L65: Galindo et al. 2014. Biological and physical processes influencing sea ice, under-ice algae, and dimethylsulfoniopropionate during spring in the Canadian archipelago

L65: Wohl et al. 2022. Sea ice concentration impacts dissolved organic gases in the Canadian Arctic

L66: Galí et al. 2019. Decadal increase in Arctic dimethylsulfide emission

L68: Two good examples of changing phytoplankton species distribution

Oziel et al. 2020. Faster Atlantic currents drive poleward expansion of temperate phytoplankton in the Arctic Ocean

Orkney et al. 2020. Bio-optical evidence for increasing Phaeocystis dominance in the Barents Sea

L259-260: I don't see how the correlation between DMS and Chl is connected to diatoms being the main photosynthetic group. Please rephrase.

L261: I cannot see the cyan squares of station 43 in the CO panel.

L305: Perhaps mention that Arctic waters feature much higher CDOM content than typical oceanic waters. The approach used by Conte et al. (2019) estimated CDOM using a bio-optical relationship between CDOM and Chl developed for typical (case I) oceanic waters (Morel et al., 2009). Arctic waters do not conform to this bio-optical type and are typically seen as optically complex waters with compound influence of oceanic, riverine and ice-melt waters with distinct signatures in terms of CDOM and particle loads. Failing to account for the high CDOM content is likely to result in underestimation of CO photoproduction.

L332: A note of caution: the values reported by Davie-Martin et al. (2020) for the NAAMES expedition are not credible in the case of DMS production rates. The highest DMS production they found in May, around 43 nM h-1 (1000 nM d-1), is about 15 times higher than any previous measurement (Galí and Simó, 2015, their figure 3a). This might have been caused by the bubbling in their experimental setup, which is known to induce DMS production in stressed cells (eg Wolfe et al., 2002. Dimethylsulfoniopropionate cleavage by marine phytoplankton in response to mechanical, chemical, or dark stress). Similar artifacts may have affected measurements of the production rate of other VOCs in that study.

L349: Suggested citation: Hayashida et al. 2020. Spatiotemporal Variability in Modeled Bottom Ice and Sea Surface Dimethylsulfide Concentrations and Fluxes in the Arctic During 1979 – 2015. Quoting from their abstract: "...model results indicate that the bottom ice DMS and its precursor dimethylsulfoniopropionate production can be the only local source of oceanic DMS emissions into the atmosphere during May prior to pelagic blooms".

L350-351: this view can be nuanced. At high latitudes, the seasonal correlation between

DMS and Chl is typically positive and quite high. See e.g. Lana et al. (2012) Re-examination of global emerging patterns of ocean DMS concentration, their fig. 4. Also:

Galí et al., 2018. Sea-surface dimethylsulfide (DMS) concentration from satellite data at global and regional scales. Table 1 and Fig. 7.

Wang et al., 2020. Global ocean dimethyl sulfide climatology estimated from observations and an artificial neural network. Table 1, section 3.

Figure 1: It would be very helpful to see the main currents and the different water masses on this map. For example, this would support the description given in L180-186, several parts of the Results and Discussion, the summary given in Table 1, etc.

Figure 2: I strongly recommend to depict somehow the water masses along the transect, for example with colored horizontal bars on top of the plot.

Figure 3: It would be useful to provide more commonly used taxonomic classifications/levels for some bacterial genera. For example, *Yoonia-Loktanella* and *Ascidiaceihabitans* tell nothing to me, but I immediately associate *Rhodobacteraceae* with certain types of reduced sulfur metabolism.

Figure 4: Please indicate (for example in the legend) whether stations are in pre-bloom or bloom stage, perhaps distinguishing the shelf stations as well.

Figure 5: same as Fig. 2.

Technical corrections and typos

L156: “at their” repeated

L254: “but the here found concentrations” sounds a bit awkward, please reword

L292: “as already been found”, please remove “been”

L324: nM, not nm