



EGUsphere, referee comment RC1
<https://doi.org/10.5194/egusphere-2022-325-RC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on egusphere-2022-325

Anonymous Referee #1

Referee comment on "Seasonal study of the small-scale variability in dissolved methane in the western Kiel Bight (Baltic Sea) during the European heatwave in 2018" by Sonja Gindorf et al., EGU Sphere, <https://doi.org/10.5194/egusphere-2022-325-RC1>, 2022

General Comments

The present paper is dealing with an important scientific topic in marine science: the impact of heatwaves on methane fluxes from coastal waters. It presents a long term temperature and methane dataset combined with a dataset obtained during the summer season 2018 (data includes CH₄, T, O₂), a year in which northwestern Europe experienced a pronounced heatwave. Studies were conducted in the Kiel Bight and Eckernförde Bay (Baltic Sea) and compared with methane datasets from summer 2018 obtained in the North Sea and northern Baltic Proper. In contrast to the last two publications, the present manuscript could not find any significant water column methane enrichments related to the heatwave induced temperature increase (enhanced sedimentary methanogenesis). This makes in my opinion the dataset very valuable, even though the authors do not have any explanation for their differing observation.

The work is complemented by (1) the description of an improved Purge and Trap (P&T) method to measure methane concentrations in high quality and (2) high resolution surface water data to show the inhomogeneity in the distribution within the upper 2 m of the water column. Part (1) is quite interesting, whereas Part (2) is a bit disconnected from the main story (heatwave-CH₄), but nevertheless quite interesting. I suggest discussing the high resolution CH₄ measurements in context to the methane distribution in the deeper water. Also some parts regarding the surface water sampling in the discussion section could maybe moved to the method section.

Altogether, the work addresses a relevant scientific topic and presents a novel and valuable dataset. The paper is well written, structured and clearly outlined (written in a focused way). The method section (especially the description of the new P&T method) is precisely described and the recent literature cited in the text. The abstract reflects the overall work, the summery seems to my opinion a bit too long and could be shortened (maybe a bit repetitive for such a short paper). The figures are excellent but the authors should take care with the size of the letters, they are sometime difficult to read (e.g. Fig.

10).

Overall, the paper is of good and solid quality and I recommend publication after minor revision.

Detailed comments

Title

“Heat Wave” or Heatwave (as written I the following text)?

Introduction

Line 20

“with a significantly improved precision” Compared to what? Do you mean, compared to other P&T systems described so far in the literature. If so, a direct comparison is missing in the manuscript.

Line 44

What about photochemical reactions that leads to the formation of CH₄ in surface waters?

Line 85

Florian Roth et al. (2022, Global Change Biology) showed in a recent paper that a high

sampling intensity is required to capture coastal CH₄ variability. Do you think it is likely that you missed something with your sampling strategy?

Line 86

I could not find Ho et al. (2019) in the reference list.

Line 94

“higher resolution” What does it mean: mm scale? Not clear at this point.

Methods

Line 124

Can you be sure that no methane is left in the gas phase of the emptied bottle? Or will the gas phase also be transferred into the purge bottle with the gas stream. Was this tested?

Line 135

Why do you need a filter?

Line 170

You mentioned before that the new P&T is characterized by a “significantly improved precision”. Do you mean in comparison to the headspace method? What is the main difference of the new system in comparison to already published systems?

Line 217

„25m water depth“ Here and elsewhere (see Fig. 8), please do not forget the space between „25 m“.

Line 227ff

“ ΔCH_4 i, avg” is not described in the text.

Line 284

“oversaturation” is not displayed in Figure 5.

Discussion

Line 305

“However,...” I do not really understand this sentence. May this needs to be rephrased or your thoughts better explained.

Line 320

Even if it is difficult from your dataset to explain the differences between the two published works and your own observations, it would be interesting to extend the discussion here: What could be the reason for this discrepancy and the lack of methane enrichment in the Kiel Bight during the heatwave.

Line 332ff

Do you mean that the increase in ΔCH_4 after 2013 is displayed by the three peaks in Figure 8 in 2014, 2016 and 2018? Or are these peaks related to storm events and the concurrent release of sedimentary methane by methane bubble emissions (Lohrberg et al. 2020, SRep)?

Line 336

As I mentioned above, this part is interesting but a bit disconnected from the main story. The presented methane concentration data is not discussed in context to the heatwave and the methane data set presented in the deeper water (Figure 4 and 5). Not really sure if this is needed for the manuscript or if this could be better moved to the method section (or supplement).

Do you have any suggestion how the sampling of surface water should be performed in the future? What kind of process could drive the inhomogeneity of methane concentrations in the uppermost part of the water column (wind, temperature, oxidation,...)?

Line 346

Are the 2 m samples in Figure 10 taken with a Niskin bottle or UW ship sampling as mentioned in the figure caption?

Line 350

Might be good to explain what you mean with "carry over effect".

Summary

Maybe a bit too long for such a short manuscript. I suggest a shortening of the conclusion.

Line 365

Is this paragraph really needed in a conclusion?

Line 417

„HB“ should be „HWB“

Figures

Figure 1

An overview map of the Baltic Sea is missing.

Figure 4 and 5

Station numbers are displayed for B but not for A. Why? It might be good to mention that the color scales in Figure 4 and 5 are different.

Figure 9

Might be better to mention the months instead of the cruise name in the figure caption.

Figure 10

Not sure, if the samples at 2 m water depth were taken with the UW ship sampling and not with the Niskin bottle? The time lag between zodiac and UW sampling is relevant and might have a crucial impact on the methane concentrations. What you see is maybe not

indicating a real gradient but rather variability as indicated by your error bars. Size of the letters is too small.