



EGUsphere, referee comment RC2
<https://doi.org/10.5194/egusphere-2022-325-RC2>, 2022
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Comment on egusphere-2022-325

Anonymous Referee #2

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-RC2>, 2022

The authors report a valuable time-series of CH₄ in Eckernförde Bay. Such a data-set is precious because long time-series of CH₄ are very rare in marine environments. Yet, surprisingly, the data-set of CH₄ concentrations shows little inter-annual variations and no clear response to the heat-wave of summer 2018.

Is there a variability in salinity during the time-series from 2006 to 2018 (Figure 8) ? Could strong variability of water masses "obscure" signals due to other factors (e.g. heatwave) ?

While the authors have analyzed inter-annual variations and response to the heatwave of 2018 for CH₄ concentration they did not analyze the variability of the fluxes. Would it be possible to compute the fluxes and check if inter-annual changes in wind intensity lead to inter-annual changes of emissions of CH₄, even if this is not the case of concentration as suggested by Figure 8 ?

Could it be possible to add information on air temperature close to study site and check if the heatwave of 2018 affected air temperature in the region ? If this is not the case, then it provides an explanation of the absence response of water temperature to the heatwave of 2018. If this is the case, however, it could be useful to try to figure out why the water temperature did not increase in response to a warmer air mass.

L110 : what was the delay before analysis ? There could be issues related to long storage of samples (Wilson et al. 2018).

L320 : Borges et al. also showed that water temperatures were distinctly higher in July 2018 than the previous 14 years. So there was a very distinct increase of water

temperature during the 2018 heatwave off the Belgian coast. They also showed a very strong relationship between CH₄ and water temperature. I'm unsure the reasoning of Borges et al. can be qualified as "speculation" as stated here. They hypothesized that the response of CH₄ was related to higher temperature because it is well established in literature that methanogenesis strongly increases with warming.

However, I suggest to try to discuss the reasons for such a difference. The coastal area studied by Borges et al. is very shallow and does not stratify thermally even in summer (permanently mixed). This might explain the different behavior with Eckernförde Bay where thermal stratification occurs in summer. This leads to a strong physical decoupling between mixed layer and the bottom water and sediments. Such decoupling does not occur in the very shallow area off the Belgian coast, so that warming of surface water directly impact the bottom sediment, and conversely, enhanced CH₄ production in sediments directly propagates to an increase of CH₄ concentration in surface waters.

I'm unsure that you can conclude that "Thus, CH₄ emissions to the atmosphere at Boknis Eck does not seem to be affected by the heatwaves." The data show that there is no response to the heatwave of 2018. Based on your data you cannot conclude that the site is not affected by heatwaves in general.

In summer 2019, there was also a very strong heatwave in Europe that set all-time high temperature records in several EU countries including Germany (Sousa et al. 2020; Vautard et al. 2020). Any chance that CH₄ was also measured in 2019 and to add this information to the analysis ?

There are several references missing from the reference list.

References

Sousa, P. M., D. Barriopedro, R. García-Herrera, C. Ordóñez, P. M. M. Soares, and R. M. Trigo, 2020: Distinct influences of large-scale circulation and regional feedbacks in two exceptional 2019 European heatwaves. *Commun. Earth Environ.*, 1, 48, <https://doi.org/10.1038/s43247-020-00048-9>.

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Wilson et al. (2018). An intercomparison of oceanic methane and nitrous oxide 545 measurements. *Biogeosciences*, 15(19), 5891–5907.
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