

Author's response

One reviewer was wondering in how far your data compare to the 2019 heatwave. I can only speculate that the Bocknis Eco Time series data of that period are used for something else. It would, however, be good to mention in the text that there were other heatwaves in subsequent years and that future studies need to elucidate the effects that these imposed on CH₄-dynamics.

REPLY: In the Section 3.5 we discuss that, apart from the 2018 heatwave, heatwaves in previous years did not affect the CH₄ anomalies, too. So, our argument is not only based on one single heatwave event. We do not see the point that leaving out the 2019 heatwave is weakening our argumentation and thus the impact of our article.

We added a sentence “Boknis Eck experienced heatwaves after 2018. However, CH₄ concentrations measurements from BE after 2018 were not available at the time of writing of this article.” In line 392ff at the end of section 3.5.

The other reviewer mentioned the following points:

Line 292

I think the cruise number is not that important here. Better to mention the respective month “June”.

REPLY: we changed all cruise numbers into the respective months.

Line 295ff

Not sure why the cruise numbers are so important here. Better relate the results to the investigated months: June (AL510)- September (AL 516). Please change that (as you did it in 3.4.).

REPLY: we changed all cruise numbers into the respective months.

Line 365

The sentences here “They conclude...” and above (Line 361) “They conclude...” are very similar. I suggest combining the two sentences.

REPLY: These two sentences refer to different studies, therefore, we prefer not to combine them. One starts with they hypothesized and one with they concluded:

“[...] **They hypothesized** that the high dissolved CH₄ surface concentrations might have been caused by a temperature-driven enhancement of both methanogenesis and sedimentary release of CH₄. Humborg et al. (2019) measured dissolved CH₄ surface concentrations in

the coastal waters of southern Finland after the heatwave in September 2018 (Figure 1). They concluded that the heatwave caused higher CH₄ emissions to the atmosphere from near shore sites which, in turn, might have been fueled by temperature-driven sedimentary release of CH₄. [...]"

Line 386ff

Above you mentioned that the heatwave T-signal was not visible at 25 m water depth. I like the extended discussion here but if the T-signal is not reaching the sediment, it can also not impact the sedimentary microbial methane production.

Are you talking about methane production/consumption in the sediment or water column or both?

REPLY: The significant temperature anomalies associated with heatwaves are indeed not seen in 25 m depth. However, the usual seasonal temperature signal is clearly visible every year in the bottom layer. So, we can expect an impact of temperature on the microbial processes in the sediment.

We refer to both water column and sedimentary processes. We added in Line 380 'in both, the water column and the sediments'.

Line 394

I would delete "gas flares". This is just the acoustic signal. The same in Line 399.

REPLY: We deleted gas flares.

Conclusion

In my opinion still too long. But that might be a matter of taste.

REPLY: We decided leave the Conclusion section as it is.