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Discussions

Interactive comment on "Upwelling-induced trace gas dynamics in the Baltic Sea inferred from 8 years of autonomous measurements on a ship of opportunity" *by* Erik Jacobs et al.

Anonymous Referee #2

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Jacobs et al. present 8-years of underway surface CO2 and CH4 measurements from the Baltic Sea. They assess the role of upwelling on surface gas concentrations and fluxes on seasonal time-scales, and describe typical annual cycles, as well as anomalies. The paper is very well written, and thoroughly describes regional and temporal differences in CO2 and CH4 concentrations, showing clearly the influence of upwelling and temperature. The methods used appear to be robust, and well-explained, with careful consideration of potential sources of error. The dataset itself is of tremendous value, and the interpretation is well-done and could be applied to other regions with underway CO2 and/or CH4 systems.

Although it could be argued the paper lacks clear objectives or motivation, I propose the value of this paper is in the methodological development used to extrapolate discrete underway data, thus improving its already high-resolution. Additionally, the development of a robust technique for identifying upwelling and linking it with observations on these spatiotemporal scales is well done and could be of value to others interpreting similar datasets, which could facilitate more robust extrapolation of such measurements in regions sorely lacking data. This makes for a valuable contribution to understanding the importance of upwelling on temporal and spatial variability in CO2 and CH4 flux, and a delight to read.

I have only minor suggestions to improve clarity of figures (especially regarding choice of colors), and text. I recommend publication of the manuscript.

Fig. 2-. The profile colors are hard to distinguish, and likely would be near impossible for anyone with color-blindness. I suggest using more easily discernable colors.

Fig. 2. Is oxygen available? I suspect it would be relevant especially for CH4.

Line 41: 'two minima' are mentioned, but the subsequent text implies a minima during the spring bloom, and several subsequent minima throughout summer. Not clear when the second surface pCO2 minima typically occurs, or if there are several more? Perhaps revise 'two minima' to '. . .a minimum during spring and one or more subsequent minima throughout summer. . .'

Lines-41-47 – could you clarify when the surface CO2 is typically under-saturated vs. super-saturated when describing the spring/summer surface pCO2?

Line 48-49 – '..vertical redox..' would be helpful to add oxygen profile to fig 2.

Fig. 6 –colors are difficult to distinguish.

Line 332-335 You state that the estimated +0.4degK warming from atmospheric heat flux is insufficient to account for the observed warming. Can you remind the reader what the total surface warming was, and/or how much additional warming needs to be

accounted for by mixing? (this could be included in this paragraph, or in the paragraph at the start of this section that describes temp relaxation after upwelling).

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