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Interactive comment on "Controls on zooplankton methane production in the central Baltic Sea" *by* Beate Stawiarski et al.

Anonymous Referee #2

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Stawiarski et al. present measurements and experimental data, which they obtained to identify the origin of elevated methane concentrations in the oxic subsurface water of the Baltic Sea. They tested a hypothesis forwarded by Schmale et al. (2018), if spatial heterogeneity of subsurface methane concentrations result from differences in the copepod community and the associated food web. Therefore, they sampled zooplankton and phytoplankton. They incubated zooplankton communities of different surface and subsurface waters, fed them specific phytoplankton, and derive the methane production rates. Their experiments show that fed zooplankton generate methane and additional methane might be generated by microbial turnover of DMSP.

Overall, it is a well-designed study and manuscript. I found it very interesting to read and have only a few comments.

The spatial heterogeneity of the subsurface methane peak is partly discussed as the result of upwelling (page 14). In figure 4, the authors show the development of the surface water temperature indicating upwelling along the Swedish coast and southeast of Gotland. They relate the high methane concentrations in the surface water at station TF0284 to the upwelling, but do not discuss the other stations. If I consider the positions of the stations, upwelling might have influenced the waters at station TF0283, too. Therefore, I suggest 1) to add the locations of the other stations to figure 4 (longitudes and latitudes are missing on the maps, too) to identify where upwelling might have affected the subsurface methane concentration and 2) consider the increased mixing to modify the plankton community. Therefore, the spatial heterogeneity might be mainly due to upwelling and not a consequence of different plankton communities.

The calculation of the specific activity of the phytoplankton (page 9) includes three terms that are constants, thus, can be ignored and only the first term, i.e. disintegration filter, which is the activity of the phytoplankton, should be presented in table 1. The three constants are the constant for converting DPM to MBq, the added activity, and the specific activity of the tracer. Besides, how was the constant for converting DMP to MBq derived? It appears as if a quench correction is included, but usually, the quench of each sample is slightly different and is corrected by applying a quench curve. How was the quench determined? Furthermore, how did you derive the specific activity of the tracer (SAtracer)? Did you measured it or did you use the value provided by the manufacturer? In my experience, the latter is erroneous and should be validated by own measurements. Anyway, the activity of the phytoplankton is needed to calculate the methane production rate, but an equation of the rate is not included in the manuscript. Therefore, please review equation 1 and include an equation of the methane production rate.

Are there any more accurate numbers for the percentages of Cryptophyceae and N. spumigena (page 10)? It is a very broad statement to distinguish between minor and dominant percentage to the total phytoplankton.

Please include if the incubations were done in the dark or not (page 10).

The difference between the measured methane production rates and the ones reported by de Angelis and Lee (1994) (page 16) might not be due to stressed copepods, but might result from filtration of the seawater (page 25). De Angelis and Lee (1994) most likely set up a similar experiment; therefore, their copepods were similarly stressed. Nevertheless, did they use filtered or unfiltered seawater? Could this explain the difference?

Typos: P2L6: space missing between $\pm$ and 6.1 P6L26: space missing between 1.5 and L P6L29: Did Schmale et al. (2018) study the migration of copepod T. longicornis as suggested by citing the paper? Table 1: It appears as if the duration of experiment 1 with surface zooplankton community is missing. P10L3: space missing between Fig. and 8 P12L21: subthermocline, the r is missing

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