Comment on os-2021-85
Anonymous Referee #2

Referee comment on "Autonomous methane seep site monitoring offshore western Svalbard: hourly to seasonal variability and associated oceanographic parameters" by Knut Ola Dølven et al., Ocean Sci. Discuss., https://doi.org/10.5194/os-2021-85-RC2, 2021

Dølven et al. present two very interesting time-series of bottom water measurements of physical and chemical parameters from two autonomous in-situ ocean observatories at methane seeps west of Spitsbergen. The study shows high short- and longer-term variations, as well as higher methane concentrations compared to previous studies. Discussion and conclusions are refreshingly kept cautious and focusses on the temporal variability which might be caused by various factors. The study is generally well written and sections are clearly structured. However, I do have some major concerns about the quality of the methane data. By this, I recommend this study for publication after major revisions based on the comments, I listed below:

Methane sensor
Measuring methane and other gases in the water column is very challenging and prone to errors, especially when sensors are deployed over a longer period. The authors base the results of their study on CH$_4$ concentration data obtained by two HydroC CH$_4$ sensors. These “simple” sensors are known to have strong limitations for providing quantitative measurement, due to its low selectivity and strong dependency to changes in the physical conditions (e.g. biofouling, hydrostatic pressure, water temperature, salinity and dissolved oxygen content). How did the authors manage to calibrate and validate their measurements, e.g. by discrete sampling and subsequent laboratory analysis before, during and after deployment? The material & methods section of this study is rather weak concerning these measurements. I miss information about the accuracy, precision, resolution, and sensitivity of the deployed sensors. How do the sensors (especially for methane) behave during the power-on-off-cycles, so during the measurements for an hour every day, concerning the reproducibility? Here, the measurement accuracies and precision certainly deviate from a 24h measurement cycle. These deviations should also have a significant impact on the data and the calculated correlation coefficients. In addition, I wonder if the choice of sensors might result in the large offset from the other studies, as Gentz et al. used a calibrated (by discrete samples) in situ underwater mass spectrometer and Silyakova et al. based their study on discrete sampling of the water column (btw: correct the doi for this study).

Methane inventory
In the introduction, the authors emphasize the urgent need of continuous measurements
to detect the temporal variability and by this validate or correct the CH$_4$ budget of seabed seepages (with which I strongly agree). And in addition, the authors state “We highlight uncertainties in methane inventory estimates based on discrete water sampling” whereas the discussion part only focus on comparing minimum and maximum CH$_4$ concentrations and remains extremely unspecific with “...CH$_4$ concentration at our locations can change by up to 2 orders of magnitude within hours...”. Their study, however, lacks any statement and calculation on how their findings will impact these budgets. Here, I miss at least some basic calculations of CH$_4$ inventories and e.g. its variation over time. Furthermore, I would recommend to add a figure (or sub-figure) showing the mins, max and means (or medians) of this study along with results from previous studies (e.g. simple box-plot).

**Figure 2**

Figure 2 is the main figure of the manuscript and needs urgent revision: 1) This figure contains all obtained data and should make use of the entire page. Please adjust the height, which will give the reader the chance to recognize some details as well. 2) Data from August 3$^{rd}$ are missing in Figure 2d. 3) Use the same axis scales for O91 and O246 or make the reader aware of different scales. 4) Note the problems with the sensors at O246 in the annotations of the figure. 5) Use identical font and font properties (e.g. boldness) over the entire figure.