List of Modifications made to: Glider-Based Observations of CO2 in the Labrador Sea

Nicolai von Oppeln-Bronikowski et al., 2020

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Abstract:

I would recommend the addition of some key figures from the text…

- Addition of key numbers (sensor accuracy, response time, scales) from results section to engage reader

I also think that the questions posed in the introduction could be summarised more clearly in the abstract

- Summarizing of the main paper goals in more clear way

The justification of the IR sensors only being used on the SeaCycler is not needed
The few lines discussing the Pro CV also adds to the confusion in the last few sentences when referring to "this" and "the" sensor.

- Clarity of text improved by reworking sentences and editorial suggestions as per Reviewer 1 and 2.

Introduction

I would also suggest the author look at the weather vs climate objectives for sensor performance as defined by GOAON (2nd edition).

- Added additional references from GOAON report (Newton et al., 2015).

Line 63 – perhaps the author could make reference to the term "foil"
Line 76 – the term "extended" perhaps the author could use re-deployed

- Editorial suggestions as per Reviewer 1 and 2.

Data and Methods

Figure 1 – the caption could clarify the importance of red vs. blue boxes around the profile data.

- Improved the Figure 1 layout, labels for clarity and the captions

What is the PCO2 sensorCO2 Prototype 4797? Is this the optode? Or is it the SN57?

- Improved clarity here and elsewhere to distinguish CO2 Pro CV and CO2 Optode.

Winkler titrations to not to my knowledge allow you to determine DIC/TA only oxygen Please can you clarify the instruments used to measure DIC/TA as this may influence the precision/accuracy of these data. In addition, any information on the collection of DIC/TA (e.g. poisoning, storage medium etc). - Line 156– please quote the constants you used for CO2SYS

and the errors associated with the calculated pCO2. These will compound any instrument specific offsets.

- Added Appendix section to explain in detail the reference samples taken in the tank test at DFO and uncertainty for the measurements.

L158. You present T, S, O2 offsets – what about the other variables?

- Added table to summarize the tank-test results. Added more sensor accuracy information including Pro CV

L141. Profile of temperature to capture this?

- Figure 2 was improved to include T-S data from Trinity Bay

Glider Data Processing

Was the calibration curve used to calculate pCO2 from the foils from the pre-trinity bay mission testing or from Dariia's paper? - Was the same correction used for both VITALS and trinity bay?

- Improved the clarity on different calibration models applied to the CO2 optode (VITALS vs. Trinity Bay).

Fig3. labels

- Figure 3 labels were improved

Glider CO2 Optode Performance

I find the figure 4 (the authors way to display this) confusing. perhaps the p-values could also be shared to demonstrate Perhaps the author could expand the sentence that refers to the VITALS glider profiles vs. Trinity Bay step profiles

- Improved Figure 4 distinguishing clearly between VITALS and Trinity Tests
- Figure 4b was modified as a box plot for the 2 deployments. The plot complement Table 2.
- Fit was modified to simple linear-least squares with more information on the figure. The fit ignores the VITALS data with large scatter about the origin.

L239. Could tabulate some of the response time findings

A table was added to summarize more clearly the figure and response time from each deployment

I am also not clear on the fitted t95 – is this from the equation listed in the text in line 233? I would suggest the author rephrase to focus on the sensor response (as a whole) rather than the time taken to respond (as I think this may be their intention). I am not sure what value figure 4a brings as it is not discussed in the text in any detail.

- We reworded the discussion for clarity and brevity.
- All discussion focussed around improved Figure 4 and Table 2.

I am also concerned by the sentence in 246 which states there was a significant temperature dependence on response time. The previous paragraph does not demonstrate this, nor in my opinion figure 4.

- We fixed the wording with regards to the temperature bias that is shown in Figure 4.

I am not sure if figure 5 a and b are useful plots, as the glider profiling would presumably match less precisely to the CTD-style sea cycler profiles where they remain at the same depth for 20 minutes. The scatter in the data (creating the low r2 on the linear fits) I suspect is also due to the binning implemented to try and maintain a match in data records

- We took out original Figure 5 – agreeing that the figure does not add value in the context of this discussion.

I note the difference in the dphase range between the VITALS and Trinity bay data, yet a not dissimilar CO2 range. The temperature range is significantly wider in trinity bay yet there is no overlap in the dphase values. I was wondering if the author could additionally comment on this (is it a result of the conditioning to local conditions, indicator bleaching?) as it is mentioned only in passing in line 260.

- Mention of the difference added into the text, mentioning possible bleaching.

O2 and CO2 Observations

Fig6 and Fig7. You switch to DO2 without explanation or reference elsewhere in the text and use just O2 in the caption. Also colour bars/legend required Figure 7 – the K1 mooring and SeaCycler locations are denoted I think by red and blue lines respectively – these are used within the colour scheme-perhaps white or gray could be considered as alternatives? The O2 data doesn't have the glider profiles used for plotting on?

- Figure labels were modified in (original Figures 6, 7) now Figure 5,6, including color choices and adding location of oxygen glider data on Figure 6.
- Accuracy of glider data from the SeaCycler-glider comparison added
- Table to summarize residuals added

Glider Observed Spatial and Temporal Variability

Take care as figure 9/10the legend appears to obscure data points at the start of a track. Perhaps the legend would be better suited on the right-hand side, or outside the plot.

- Figure 8 – Hovmüller Diagram improved, removing legend and using text labels consistent with the rest of the text
- Added uncertainty into the qualitative variability discussion

Please rephrase line 276, as "weak in an average sense" doesn't make sense to me.

- Used numbers in the text to improve clarity of the arguments

Spatial and Temporal Variability Line 310 – please remove the word “somewhat”. I would also advise using numbers to make your point clearer. The following sentence is also a bit vague – potential CO2 cycling? Perhaps the authors could clarify what they mean by this.

- Improved legibility of paragraphs when referring to the different scales and interpretation

Conclusions

I would also suggest that the author summarise some of the extra work, mentioned throughout the rest of the paper as a forward look(e.g. more tests to evaluate the influence of flow field on sensor performance in situ and a response time model?)

- Reworked second paragraph to summarize extra work done in the study with regards to the goals of the paper

I would also suggest the author clarify the timescale of the temperature change in line 392

- Improved clarity of numbers mentioned in the text.

Following editorial changes were directly implemented in the text

- L3. Remove repeat of ‘capable’
- L43. Use carbon sink (not carbon sinks)
- L44. Plural gliders to remove
- L56. ‘Periods’
- L59. Insert ‘a’ (from a..)
- L87. Fall of 2016
- L91. VITALS is an acronym? Fig1 caption requires more detail
- L102. Clarify that 4797 is the CO2 optode
- L106. Selected stop depths
- L108. Validate rather than calibrate
- L114. Would be good to know precision too?
- L136. Use cold instead of frigid
- Line 179 – remove Also.
- L195. Remove duplicate of ‘the’
- Line 198– correct to “ the sensor began to display inconsistent behaviour...” (or similar)
- Line198 – I would also change the word last to final, as this is clearer as the end of the experiment, rather than a relative statement.
- L270. To a depth of large change in O2 and CO2?
- L318. Change ’another’ to ‘from each other’
- L327 add year to the Chatfield reference(1998)
- L337. Its OK to switch to T and O2 but be consistent (in full again on L334)
- Line 360 -I think it should read “highly variable changes” not “highly varying”.
- Line 363 – I don’t think you mean CO2 solubility - do you mean strength of uptake? Or are you referring to the changing T&S increasing or decreasing the solubility?
- Perhaps the term “staircase missions” could be used in the sections where the authors refer to step profiling to maintain consistency with the conclusion.