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Review of the revised manuscript submitted to Biogeosciences, MS No.: bg-2020-313. "Enhancement of the North Atlantic CO₂ sink by Arctic Waters" by Olafsson et al.,

Review invitation: 2/1/21

Review accepted: 2/1/21

Review sent: 3/1/21

General comment:

Authors attempted to reply to almost all questions, suggestions from both reviewers. I find the revised version much easier to read, including the presentation of the data and methods, the results, discussion and interpretations. The conclusion has been also revised and the discussion indicates that these preliminary results certainly call for new analyses as mentioned by the authors in their first replies. Interesting new figures have been added (e.g. TCO₂/S, TALK/S, new Figure 6) that should be redrawn (a curve for Atlantic water is apparently missing in these figures).

I think the paper is suitable for publication in its present form (pending few corrections).

I do have few comments (mainly minors) on the revised MS listed below.

;;;;; Comments on revised manuscript

C-01: Line 25: In the abstract add uncertainty associated to the number listed (flux).

C-02: Line 58: "The North Atlantic is a relatively well observed region of the ocean". Lauvset et al (2016) reference is for a climatology. For pCO₂, TALK and DIC surface observations in the North Atlantic maybe refer to Takahashi et al (2009), Bakker et al (2016) and Reverdin et al (2018) for recent observation synthesis in this region (see comment from reviewer 2).

C-03: Line 205: typo: carrbonic.

C-04: Line 301: typo: and and continued...

C-05: Figure 5a and 6: there is no data in January (correct ?).

C-06: Table 2, Figure 6 and text: for TCO₂/S and TALK/S ratios specify units (e.g. $\mu\text{mol}.\text{kg}^{-1}/\text{psu}$).

C-07: Figure 6: Red horizontal lines for Atlantic Waters specified in the legend but not seen in figures.

C-08: For a reader not familiar with this topic, would it be nice to show also TCO₂ and TALK data (not only the ratio with S; maybe add plots of TCO₂ and TALK data in sup mat).

C-09: Line 390: Reference to Figure 6e ?

C-10: Line 395: "Representative annual long term TCO₂/S and ALK/S means would be more realistic but are not available". Would that be possible to get this information from GLODAP in this region or using TCO₂ and TALK climatological fields (Takahashi et al 2014; Broullon et al 2019, 2020), although this might not change the results.

C-11: Line 399: reference to Table 1 or 2 ?

C-12: Line 402: Like in the submitted manuscript there is confusion here: "Polar waters having an increasingly higher alkalinity/salinity and alkalinity/TCO₂ ratios". The ratio TCO₂/ALK in Polar water is higher than in Atlantic (Table 2). Please rephrase.

C-13: Lines 410 and 448: Typo: Arcipelago

C-14: Line 434: Not clear to see in Figure S3 that pCO₂ unchanged for the ratio 0.85. Could this be clarified ?

C-15: Line 445: Not sure how you derive the value of 34.8 10**12 mol CO₂/yr and 0.058 PgC/yr. I suspect a typo here: maybe this is 4.8 10**12 mol CO₂/yr (as correctly listed in the supplement).

C-16: Line 445: The effect of excess alkalinity of 0.058 PgC/yr is a number that could be recalled in the abstract. Would it be possible to associate an uncertainty for this number ?

C-17: Line 457: Typo: thTCO₂/Alk

C-18: Figure S3: legend: typo: contours in in....

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