

Comment on “Aragonite saturation states and pH in western Norway fjords: seasonal cycles and controlling factors, 2005-2009” by A. M. Omar et al.

General comments:

The present paper under review for Ocean Science describes seasonal cycles and controlling factors on Aragonite saturation states and pH and proposes a nice way to monitor Ocean Acidification from continuous underway $p\text{CO}_2$ measurements. I appreciate the effort to maintain the VOS line for so long and the extra sampling cruise. Together, makes a valuable dataset! It is also really easy to read as it flows. I will recommend the publication after moderate corrections/clarifications.

However, I have two major concerns about the current version of the manuscript:

1. Statistical analysis need to be better explained and improved to have more robust conclusion. For example, fig. 2 B (8-249, 9-264) explain that they are UW and RF are really similar but I would like to know the slope and if this slope is statistically different than 1 (same apply for B and D). I would add other stats comments and the list of general comments.
2. I would like to know more about interannual variability. This is also somehow what I expect after reading introduction (3-91). But still we only have some sentences at the end of section 3.3. Related to this, I don't understand why you choose VOS data since 2009 but then you have CS since 2010, a cruise in 2015 and a sensor in 2012. I understand it's not easy to treat data from VOS as quick as they are generated but at least some words of cautions will be nice.

Specific comments:

My comments will be with format page-line (so 5-3 means page 5, line 3); page-line:line (so 7-7:9 means page 7 from line 7 until line 9).

1-17 What coherent means in this contest?

1-21 (and elsewhere in the ms) Please choose as many decimal place you want to report according to your method accuracy and error propagation and stick to them. Here you start with 2 and then past to 1 but further in the ms, suddenly there is 4-5 digits (9-272, 10-284).

2-36 What is Peters reference referring to? It looks strange.

2-51-54 Long paragraph

2-61 “Only few studies” I expect at the end of the sentence some citation

3-75:80 I think that should flow better with a bit of rearranging to avoid repetition together with 1-61:2-68

I really like this part where it is explain the importance of the study, to “fill the gap”. It is indeed extremely important to fill these coastal gaps. I think it will also be nice to mention that this study set the baseline for future studies to evaluate OA and how this change could affect.

5-130 “coastal open ocean” is somehow misleading, although I understand might be good to rephrase.

5-143:146 Economic important could be also tourist and other ecosystem functions?

5-149 “of” is double CO₂ is without subscript (also in equation 3 and 4 and 12-360 and some references)

5-151 webpage without hyperlink, like for example 6-166 (some happens in 7-197)

6-166 knowing the authors, I suppose there are plan to submit the remaining data to SOCAT, right?

6-176 (and elsewhere in the ms, for example table 1 or 7-195), unify dates format

7-197 It will be nice to state here a few details from sensor, like accuracy or/and precision, as it is important to propagate the other uncertainties in the calculations.

7-217 Here an important point, TA-SSS algorithm comes only from summer values, right? Please clarify and add some sentence of caveat about it.

8-222 Which other ancillary parameters? Where they come from?

8-244 You haven't describe RMS before. Salinity is undimension. It will be nice to have some idea here of what this 0.81 could means in terms of pH or OmegaAr, with initial error propagation

10-281 Fig. 2 should read Fig. 3. Also normally better to start the sentence in more direct way. I would like to know more details how is this data collapsed: what we see is means? What about std? This comment is together with this interannual variation maybe.

10-284 text said maximum is 8.2 but figure goes until 8.35

I like this comparison with C-CAN ☺

10-311 Could you add a sentence in methodology or somewhere explaining how DIC is normalize, which salinity has been used, which reference? Also note OmegaAr (sst) has something between t and). Also extra space before brakets ini 11-313

11-314 State the table or fig that is showing that (I think Fig. 4)

11-315 Maybe nice to state the basics about Lauvset methods. Also note extra brakets before Lauvset and missing before the year.

11-316 Left panels maybe better for state the letters (a, c...)

11-319 Fig. 4 c, d, e (mismatch of figure number, spaces missing after comma and letters in the figure are capital and in the text are not, please unify). Also amend for 11-321,11-333, 12-369 and 11-322.

11-324:325 This sentence need more explanation. Although I agree, somehow contradict the idea of if we measure $p\text{CO}_2$ and temperature we can estimate OA parameters.

11-329 Fig. 4 (B, D)

11-332 Refer to the figure (Fig. 4G and salinity data not shown)

11-334 I think that should read Fig. 4F

After reading this twice, an idea can be to do some “Multiple linear regression” to support your analysis in a statistical way.

11-337 impact. (extra space before point) Also in 11-342 before sst).

12-359 equations 5 and 6 or equation 3 and 4 (somehow not easy to understand)

12-366 another stats comment, how significantly is this significantly?

12-371 there are two commas before R2

13-372 there is extra point after (6)

13-373 or somewhere else, just though that another importance to use VOS $p\text{CO}_2$ is that they are more frequent that normal oceanography cruises in winter, especially in these regions.

A note of caution about the slopes, we need some +/- because if we took the slope of red square will be really different. But still I like the comparison with RCP scenarios.

13-387 cannot

13-401 extra : at the end of captions

14-420:423 I miss some words of what this low omegaAr 1.3 could mean for calcifying organism. Some studies point that there's no need to be below 1 to have some affect in organism. Some “bio”-words could expand the readers-users of these nice results.

14-424:425 Maybe I miss something but this sentence is not really new or surprising, right?

Table 1 What's the different between 1 and 5 m. Are they both underway water?

22-607 Should be table 2

Figure 1 may benefit from a more global map, for non-European readers. Also if possible add the meaning of the arrows (NCC) in the figure, so we don't have to read legend.

Fig. 2A, is colour scale and x-axis the same SST

Fig. 3 is missing A-D and parameter and unit on the colour scale. Also unify decimal units

Fig. 4 You explain good that SST and TA are not independent. So question is, could you still use this method with dependent variables? Also careful because labels are cutting x-axis