

Interactive comment on “Net loss of CaCO₃ from coral reef communities due to human induced seawater acidification” by A. J. Andersson et al.

Anonymous Referee #2

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This paper provides interesting calculations on “net ecosystem calcification” under ambient and reduced pH using flow-through mesocosm experiments and TA data. The study shows a very clear and significant negative effect of pH reduction on the mesocosm community calcification. Although, this is as such interesting, the main data set and part of the figures are recycled from 2 previous publications. The present manuscript is therefore already at the “smallest publishable unit” and the results of the 2 other publications need to be taken into more thorough consideration when interpreting results presented in this manuscript. Apart from this, I would recommend the manuscript for publication after revisions.

More detailed comments in the following:

The title is not appropriate and should be changed to indicate that studies are based

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on mesocosm experiments which do not necessarily well represent a coral reef community. The “human induced” is not needed.

Abstract: The term “transition from net accumulation towards net carbonate dissolution” in the context of this data set is rather misleading. This terminology suggests a process as function of time which has not been measured or addressed in the experiments. Also, the statement in the abstract, that this is due to decreased calcification and increased carbonate dissolution is not supported by the data presented by the authors and should be clarified.

Methods:

The authors claim, that mesocosms are well mixed, but how homogenously are they mixed? I wonder if a square tank acts as a good flow-through system and would appreciate, if authors could specify in the manuscript on in- and outflow position and how tanks were mixed, if there are potentially stagnant regions and regions of faster flow?

The results/discussion section would profit from sub-headings.

As authors use the term “net ecosystem calcification” I would appreciate a short paragraph in the discussion on how well the composition used in the mesocosms represents the “real ecosystem” from where corals and other organisms were sampled (density and diversity of organisms used).

In the results chapter, absolute numbers of variables would be more appropriate to start with, than giving % changes.

Table 1 is far too small and it is hard to depict numbers from. The information of delta is rather superfluous and the % delta notation strange (and superfluous). Statistics should be in a separate table.

Fig. 4 Instead of repeating figures presented in 2 other manuscripts and the data available in table 1, a correlation plot between omega and NEC would be more interesting

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(using original data from each mesocosm tank). I would specifically be interested if correlations of control and treatment have similar regression lines or if there might be an offset or different slope.

Results on nutrients should be more elaborate where significant differences are noted. Are ammonium, phosphate and silicate significantly higher in ambient or in reduced pH conditions? The statement that the differences are small and had no major effect because natural variability is large is not valid since there are significant differences (this means differences go beyond natural variability)? The nutrient data are a real addition with respect to data presented in the other 2 manuscripts and should therefore be discussed more thoroughly. If nutrient excretion is not thought to impact TA and NEC the order of magnitude of estimated change should be given to illustrate the statement is true.

The results of the 2-way ANOVA should be discussed in more detail. Posthoc comparisons should reveal where differences are significant and implication of this should be discussed.

Page 2172: line 12 ff: ...“thin sediment layer that accumulated in the bottom of the tanks. This material is very fine-grained and thus has a high specific surface area making it very susceptible to dissolution.” This is highly speculative. If this is true, the grain size should be smaller in the treatment tanks? Is there any evidence for this? May be the fine grained sediment just comes in through the inflow pipe? In the following, again the term “transition” is used. This reads as if at the very beginning of mesocosm experiments there would have been no or less dissolution in pH-reduced conditions. Is there evidence for that? I guess no TA samples are available to demonstrate this? The only time, that the term “transition from net accumulation to net loss” is valid, is in on page 2173, when authors explain on the process going on for thousands of year.

In the discussion on page 2172 the authors should use estimates on calcification of other organisms (corals and rhodoliths) already published and subtract from total NEC

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to estimate the “remaining” calcification/dissolution rates not attributed to corals or rhodoliths. . Same page, line 22 ff – this is a very long sentence. Should be rephrased.

I really like the supplementary table S2. It allows to re-calculate and thus understand how TA changes over time at inflow and outflow can be used to estimate the mesocosm community calcification in a flow through system. I would just suggest to use respective abbreviations used in the equations of figure 3 also in this supplementary table (e.g. add to 1. measured total alkalinity (“TAout”) and to seawater input (“TAin”). The units in 2., 3. and 4. should be mmol, not mol).

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