

Interactive comment on “Carbonate System Parameters of an Algal-dominated Reef along West Maui” by Nancy G. Prouty et al.

Anonymous Referee #1

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“General Comments” Overall, this is a very nice paper that is scientifically sound and contains very few technical errors. The authors measured seawater carbonate chemistry and nutrients at shallow fringing reefs around a submarine groundwater discharge site to show what’s driving chemical variability at these shallow sites with local anthropogenic stressors. They showed that chemistry (salinity, carbonate chemistry, DO) was highly variable at the vent site and driven by SGD while most parameters had a diurnal signal on the reef due to benthic metabolism. They also showed that areas closest to the vent site experienced a shift in NCC and NCP that may relate to nutrients being discharged from the vent. This study is scientifically sound and addresses a critical knowledge gap of understanding natural drivers of seawater carbonate chemistry variability on reefs, which must be understood in order to predict the effects of long-term

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anthropogenic ocean acidification on reefs. My main critique of this paper is clarification of the terminology in order to more accurately draw conclusions about benthic metabolism from the available data they collected.

“Specific Comments” Introduction This manuscript gave a nice introduction to the research and sets the reader up for understanding and interpreting the results. However, the research goals were stated twice and therefore seemed repetitive. Typically, the research objectives are listed near the end of the introduction. It also was difficult to tie different parts of the introduction together, but hopefully the specific comments below will help address the flow:

Lines 36-37: Need to define OA versus coastal acidification. I assume the authors are referring to OA as a long-term anthropogenic effect owing to uptake of CO₂ while coastal acidification refers to natural processes.

Lines 36-40: These are nice introductions to stressors on reefs and community metabolism; however, the tie between the two is not clear as presently written. Perhaps consider adding a transition between these two statements stating how these stressors are affecting reefs (e.g. decreased calcification, increased dissolution, etc.) and then go into community metabolism

Lines 52-53: Again, I felt like this was an abrupt transition. Could add “which may influence reef metabolism and community composition” at the end of the sentence.

Line 57: add “calcium carbonate (CaCO₃)” in front of dissolution

Methods Lines 95-96: What is the other 90% of cover where there is 10% live coral cover? What is the community composition of the other 49% of hard-bottom area? This would help with interpretation of results and DIC/TA slopes as this relates to the community composition (corals vs algae vs sand, etc. See Page et al 2016 for reference on community composition influence on seawater carbonate chemistry.)

Lines 111-114: What was the approximate depth of the vent site? This would be valu-

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able information in interpreting the variability (measured as daily range) of chemistry since depth can be such a strong control (Falter et al 2013).

I do wonder about any algae, bacterial films, etc. that may have grown on the inside of the tubing and possibly influenced carbonate chemistry and nutrients. Were there any tests (e.g. sampling carbonate chemistry near the intake and at the outtake) to assess whether the tubing was clean throughout the entire field study?

Thanks for providing the approximate precision of the TA and DIC measurements. It would be great to see the actual precision and accuracy (as mean plus/minus sd) of pH, TA, and DIC though.

What carbonate parameters are actually used for the pCO₂ and saturation state calculations? This was unclear to me at this point of the manuscript but later it states they were calculated from TA-pH pairing. Please clarify in the methods.

What kind of filters were used for nutrients and carbonate chemistry sampling? Some filters may alter the values due to reactions between seawater and the material of the filters.

Results The results are very well-written. Just one clarification:

Line 215: What range of dates were used to calculate values for the open ocean site?

Discussion Line 240: Respiration also occurs during the day, not just at night. Could state “net respiration” rather than just “respiration”

Lines 249-251: How can both NCP and NCC dominate? It’s unclear whether the authors are trying to say they are more balanced compared to the 2nd sampling or whether they mean “net photosynthesis (+NCP)” and “net calcification (+NCC).”

Lines 252-254: Please use NEC/NEP or NCC/NCP to maintain consistency with the scales used in this study. Also, please define these terms either here or in the introduction.

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Lines 254-255: These should be “net calcification” and “net photosynthesis” to more accurately reflect what is actually measured. NCC and NCP can indicate net processes (calcification-dissolution or photosynthesis-respiration).

Line 260: The lower NCC:NCP ratio only indicates dominance by organic carbon cycling (vs inorganic carbon cycling), not which process (photosynthesis, respiration, calcification, dissolution) is actually dominating.

Lines 260-262. This statement seems a little out of place and I’m not sure what point the authors are trying to convey. Why are the slopes in this study higher than Heron Island? Does this reflect differences in benthic community composition, ecosystem function, or a combination?

Line 262: Again, “net dissolution” and “net respiration” since actual rates are not measured using this methodology

Does the nitrate end member at the vent site vary temporally? I appreciate using the available data to show the SGD but wonder how closely it represents discharge during the time of this study.

Figures/Figure Captions Line 389: “seep site AND on the nearshore. . .”

Line 393: So were TA and pH used to calculate pCO₂ and saturation state? This was not clear in the methods.

Figure 5: Please show error bars for the open ocean since this presumably represents a mean. NCC and NCP need to be defined either in the caption or text. In part E, these should all be shown as “net. . .” Rather than just showing the arrows for part E, could you put it on a TA/DIC plot? It can even be shown right on the plots for A-D. Given your discussion of the data, I personally would rather see the processes as small arrows on a subplot (or just in the corner of a plot) and then have dashed lines indicating the transitions between +NCC/-NCC and +NCP/-NCP. I think this would make it easier for the reader to go back and forth between the figure and discussion.

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“Technical Corrections” Line 47: no comma necessary Line 97: no comma necessary
Line 112: Is 115 a typo? Should it be 15? Lines 154 and 157: parentheses just around
the year Line 297: no space in SGD-driven

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