Biogeosciences Discussions

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Comment on bg-2021-61

Anonymous Referee #2

Referee comment on "Will daytime community calcification reflect reef accretion on future, degraded coral reefs?" by Coulson A. Lantz et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-61-RC2, 2021

General Comments

Overall, the theory of the study is great, and inter-disciplinary work like this is great to see. However, the linking of study elements (for example, quantification of the relationship between Symbiodiniaceae densities or photosynthetic yield and NEC) could be more deeply explored. Importantly, I find the methodology lacking necessary information to determine the validity of the results and many facets of the methodology and further analyses require justification. In the supplementary material, the equations used to calculate metabolic rates are not well defined and in their current state may be incorrect. The authors should take care with the accuracy of information presented from the literature and with the appropriateness of citations to fit the manuscript's narrative. I find the results interesting, but their main point seems oversold and broadly declarative with the data that is presented.

Specific Comments

Line 67-69 this information is incorrect. The bleaching event year is 2016, and the 2016 survey by Pisapia et al. cited here occurred after the bleaching event occurred in 2016. The 2018 survey showed an increase in NEC compared to 2016, but was still depressed related to pre-disturbance rates (see Abstract and Table 1 in cited paper).

I disagree with the sentence from Line 74-76: A community transitioning to algal dominated from a coral dominated community would likely demonstrate changes in NEC and NEP, as indicated by many prior studies. The citation here (Courtney et al., 2018) is inappropriate because this paper does not indicate that NEC will become less effective with reef state transitioning. Rather, the authors state ". . . bleached coral reefs that recover quickly likely experience ephemeral reductions in reef NEC while systems shifting to alternative non coral-dominated states are likely to face lasting decreases in NEC." Reduced or low NEC, regardless of the cause or the dominant benthic class, is what is useful when investigating reef state.

Line 84-85, this statement is incorrect. The Kayanne et al. 2005 abstract states 'All the metabolic parameters, Pg, R, E and calcification (G) were reduced by half after the bleaching,', and no pre-bleaching rates were estimated.

Methods:

Overall, I found the methods do not provide enough information or justification to assess the validity of the rates or to undertake a follow-up survey. One major concern is that the time window stated (1100-1500) is not representative of calcification over a diel cycle (which is what is typically used when discussing reef state). Different stressors can affect calcification/dissolution differently depending on the time of day. Prior studies have shown that impacted corals show a significantly higher rate of low-light dissolution than non-impacted corals, even when daytime or peak sunlight calcification is not affected.

Why were coral fragments gathered for PAM fluorometry rather than assessment in situ? More information is needed on PAM measurements. How were those fragments chosen, how many of 'bleached' and healthy? Was there a control for PAM measurements or Symbiodiniceae densities during the bleaching? Were pre-bleaching yield or Symbiodiniceae densities measured, it does not appear so in Fig. 3.

Equation 1 & 2 in the Flow Respirometry Approach: I am making assumptions here because I don't understand these equations. If u u is current speed (cm s^{-1})(not stated), then in the context of these equations, you are multiplying current speed by 3600 to transform from per second to per hour and dividing by 100 to transform from cm to m. However, if I am correct, this means that you have divided out your length component (m/m). The residence time is the term that needs to be on the denominator to provide the unit of mmol/m^2/hr. If I am incorrect here, then more definition needs to be put into your equations to show that you are calculating the correct values. Typically, residence times are calculated separately than metabolic values using transect length, current speed, and length/time averaged depth (See Supplementary Information in DeCarlo et al., 2017, or Davis et al., 2020).

'Slack water' sampling is not made under the correct conditions. Slack water indicates no (or very slow) water movement, so this may be an issue of semantics and you really mean Eulerian sampling (see Silverman et al., 2014 and McMahon et al., 2019 for examples and comparisons). More information is needed here. If you are looking at changing water chemistry in the same place, you need either 1) and end member (an initial value), or 2) More specific calculation of your depth-averaged residence time over space. Did you have a current meter? If so, where was it placed? Maybe add to site map?

'Slack water' Methods state: water samples were collected from the same three locations (n = 3 day-1) two hours before 84 peak low tide and one hour following." Where were these locations and at what interval were they taken? Were they taken at the same time/place as the 'flow' samples were taken?

Figure 4: More information is needed on where the calcification rates were taken from in the literature. How were differences in calcification rates determined for different specific temperatures? Is this what's described in L285 – 288? If so, is the 1.1 degree change in temperature determined from absolute differences in temperature or for corals which bleached after 1.1 degree increase? If the bleaching temperature was 29.1, the calcification rate indicated here at 29.1 degrees should represent calcification rates under bleaching. Please specify.

Lines 306–308: How does this 9.8% expected decline in NEC compare with your observed

results?

L 312–316: This is a good description of this result, and it is an interesting result. However, I think the wording in the abstract and conclusions are too strong with the data provided to support the argument.

Technical Corrections

Fig.7 is referenced a few times but no figure 7 is included, change to Fig. 4.

Information in the table 2 caption should be placed in the methods.