Biogeosciences Discuss.,
doi:10.5194/bg-2017-58-RC2, 2017

Biogeosciences Discussions

Interactive comment on "Daily variation in net primary production and net calcification in coral reef communities exposed to elevated pCO_2" *by* Steeve Comeau et al.

Anonymous Referee #2

Received and published: 30 March 2017

Comeau et al. conduct flume experiments to examine the effects of elevated pCO2 on reef community calcification, photosynthesis, respiration, and the parameters of the mathematical fits of these response variables under varied irradiance, as well as the relationships among Pnet, Gnet, and PAR. While portions of the data have been reported previously, the data from the experiments on O'ahu are new, as are many of the analyses and Pnet data. Overall I think this is a nice paper which deserves to be published. My comments are largely for minor revisions, as detailed below.

First, Tahitian and Hawaiian names are consistently misspelled throughout the manuscript and should be corrected:

Hawaii should be Hawai'i Oahu should be O'ahu Kaneohe should be KÄĄne'ohe

(hmmm, the conversion software seems to be rendering Kane'ohe in a strange way here...the "a" should have a kahako, or macron, above it, indicating stress) Moorea should be Mo'orea

Line 225, I believe that the authors may have convoluted CO2-eq (CO2 equivalents, which includes the radiative forcing provided by CO2, CH4, N2O, SO2, etc. in common currency that is proportional to the radiative forcing provided by an equivalent concentration of CO2) under RCP 8.5 with atmospheric CO2 concentration. Under RCP 8.5, the projection for the end of this century is for CO2-eq to reach nearly 1300 uatm (e.g., Moss et al., 2010), but only a portion of that forcing is provided by CO2. Under RCP 8.5, the projection is for atmospheric CO2 to reach about 930 uatm at the end of this century, and to reach 1300 uatm around the middle of next century. See, for example:

Meinshausen et al. 2011. The RCP greenhouse gas concentrations and their extensions from 1765 to 2300. Climatic Change.

Line 230, It's commendable that the authors allowed the pH to vary somewhat over the diel cycle, similar to what happens in nature, but it's also important to consider that acidification results in *non-linear* changes in pH. This non-linearity is related to reduced seawater buffer capacity under acidification. OA results in an offset in seawater DIC, and this offset translates into variable changes in pH depending on the starting conditions. Given the daytime treatment chemistries listed in Table 1 and a 0.1 pH reduction at night under present-day conditions (similar to conditions in the field), I used co2sys to estimate that the corresponding pH reduction in the acidified treatments (in order to maintain the equivalent DIC offset) would be about 0.15 at night. See:

Jury et al. 2013. Buffer capacity, ecosystem feedbacks, and seawater chemistry under global change. Water.

Shaw et al. 2013. Anthropogenic changes to seawater buffer capacity combined with natural reef metabolism induce extreme future coral reef CO2 conditions. Global Change Biology.

Line 255, Since pH was kept stable by the controllers while TA was varying due to calcification/carbonate dissolution, DIC was not constant during the incubations. Perhaps provide some estimate of how much DIC and TA varied during the course of the incubations?

Line 345, Please report the AIC values that justify the use of hyperbolic tangent function over log or linear functions. The hyperbolic tangent fit seems sensible for experiments 1 and 2, but for experiment 3 the relationship looks much closer to linear, and surprisingly flat actually. Also, I would suggest using AICc (corrected AIC) as it reduces the chances of overfitting with finite sample sizes. Since AICc converges to AIC with very large sample size anyway, AICc is probably best used as the default between the two.

Is Fig. 1 showing the Pnet values from the daytime only (and none from the night)? If yes, why aren't the nighttime data included as well? Either way, please clarify and add this information to the figure legend. You'd expect that Pnet should be negative at night (net respiration) under zero irradiance and it should eventually rise to Pnet=0 at some low level of irradiance (the compensation point). That pattern pops out in experiment 1 and to a lesser extent in experiment 2, but it looks like in experiment 3 the fits show positive Pnet even under zero irradiance. At a minimum, that seems strange. . .

Line 350, Ditto the above on AIC, AICc, justifying the model selection, daytime vs. nighttime data, and modifying the legend for Fig. 2 to clarify.

Line 380, I believe "back reef communities" should be "fore reef community", correct?

Line 448, Should be, "an increase in [carbonate] dissolution".

Line 453, Carbonate dissolution would be detectable by changes in chemistry measured, but mechanical bioerosion would not be.

Line 456, Likewise, changes in mechanical bioerosion can't be detected via chemical methods.

Line 472, Physiological acclimatization to high pCO2 in KÄĄne'ohe Bay is a possible

explanation for reduced sensitivity to acidification, but so is local adaptation.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2017-58, 2017.