Biogeosciences
Discussions

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Interactive comment on "Natural ocean acidification at Papagayo upwelling system (North Pacific Costa Rica): implications for reef development" *by* Celeste Sánchez-Noguera et al.

Anonymous Referee #2

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Overall

The authors present interesting time-series data of pH and pCO2 from an upwelling region of Pacific Costa Rica. These data are much needed and this contributes to our limited understanding of CO2 dynamics in the eastern Pacific. I do believe there is a publication nested within this draft, but there will need to be a significant cutting down and revision based on my comments below. The paper will be considerably shortened and changed slightly in scope, but still is publishable.

Big comments

1)The calculation of TA and DIC from pH and pCO2 is unreliable and prone to large

errors (see Cullison-Gray et al. 2011; Gray et al. 2011, which you cite). This is probably why you are reporting such unbelievably high values of TA (>2600) and DIC (>2300). Not only do these values never occur on coral reefs (to my knowledge), even in strong upwelling zones like the ETP, you are also reporting relatively low salinities of 32.5. This makes these high values all the more suspect because if you calculate salinity normalized for a TA = 2715, you get NTA= 2923! These types of DIC and TA values are unheard of from reef environments.

As such, you need to remove all DIC and TA values that were calculated from pH and pCO2, including the model you generated from some of those values to interpret rates of metabolism driving diurnal changes. Unfortunately, this all has to be deleted from the paper.

2)Please be clear as to what you actually measured versus what you hypothesize, or think is going on. For instance, in the abstract you discuss how calcification is enhanced during the non-upwelling season when saturation states are elevated. This may be true, but at this point it is a hypothesis as you have no data to support it. There are several other instances where hypotheses are discussed as fact, i.e., reef thickness and accretion etc.

3)What is the proximity of the instruments to an actual coral reef? You need to be clear about this because what you are measuring may actually be a result of the metabolism of the carbonate benthos directly under the dock plus the water column processes rather than anything to do with reef dynamics.

4)Finally, the paper is generally well written, but would benefit from being proofread by a native English speaker.

Specific comments

1) P2, line 19. You can't say adaptation without genetics work. Reword to say "adaptation or acclimatization"

2) P2, last line. Thus far there is really no data out there suggesting that OA will directly lead to coral mortality. In fact, in a seminal study, Fine and Tchernov (2007, Science) exposed two coral species to undersaturation and found they stopped growing skeletons and lived in an anemone-like state. Once conditions were raised above saturation, they began producing skeletons again.

3) P3, section 2.2. You discuss taking discrete samples, but do not say how many or how often. Please mention this. The values of TA >2600 and DIC > 2300 have to be calculated from pH-pCO2. You show the result of 8 bottle samples pH relative to the SAMI pH – what about the SAMI CO2 or any other data calculated from the bottles?

4) P5, salinity is a unitless value. PSU describes the scale and is not a unit

5) P5, line 5. Need to say what the number after the plus and minus is the first time you use it.

6) P7, 1st line – why couldn't stimulation of photosynthesis from higher nutrients during upwelling be causing the large amplitude? You can't speak to dissolution without actual TA data and increased photosynthesis seems more likely.

7) P7, line 25. Say adapted and or acclimatized.

8) P7, last line. Reword to say saturation sate is one of the controlling factors in coral growth. Its likely of secondary or tertiary level importance behind temperature and light.

9) P8, delete sentence spanning lines 3 to 5 as well as last sentence of 1st paragraph

10) P8, line 10. Did you measure reef thickness? Also, I'd avoid saying they are growing on the edge of their ecological tolerance. Its not clear what is meant by that.

11) P8, last 5 or so sentences, a lot of conjecture written as fact.

12) Figure 4, your units for pCO2 are incorrect

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