Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2018-57-RC3, 2018

Biogeosciences Discussions
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Interactive comment on "Coral reef carbonate budgets and ecological drivers in the naturally high temperature and high total alkalinity environment of the Red Sea" *by* Anna Roik et al.

Anonymous Referee #3

Received and published: 19 April 2018

This is a comprehensive study that provides valuable baseline data for reef growth in the central Red Sea. The study covers the timely and relevant topics of climate change and OA and assesses drivers of reef growth in a unique area (the Red Sea) that is of growing interest owing to the health of corals in an extreme environment. The study uses an extensive dataset to assess the relationships between reef growth and various abiotic (carbonate chemistry parameters, temp, phosphate) and biotic (bioeroders, coral cover, etc.) drivers. The study shows that reef growth is positively correlated to parameters indicative of carbonate ion availability (e.g., At, omega, carbonate ion concentration) and to phosphate concentrations; while growth is negatively correlated to temperature, pCO2, and pH variability (biotic feedbacks). Reef growth was also

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highly correlated to parrotfish abundance. Overall, this is a well-designed, comprehensive study. The manuscript is clear and well-written (though beware of numerous minor grammatical errors). I do have some concerns that should be addressed before publication (below).

Detailed Comments: Starting at Line 69: suggest including 1-2 sentences explaining what a census-based calcification budget approach is and explaining how Perry's Caribbean-based methods were modified for the Red Sea (supplemental).

Line 371: what's the cause of the PO43- enrichment in winter?

Line 386: average, not averages

Line 402: ". . .manipulations on reef communities in situ. . ." –add in recent manipulative field experiments (e.g., Albright Nature 2016 and 2018).

Suggest a glossary to help readers keep track of various terms (e.g., Gnet, Gbenthos, Gnetbenthos, etc.)

It's somewhat surprising that relatively small changes in carbonate chemistry explain such a large variation in Gnet (even from net accretion to net erosion). According to Table 1, the delta At is < 50 umol in summer, and even less in winter.

Is there a plot of discrete pH versus, or plotted on top of, continuous pH – to see how these two methods compared? CTD pH sensors typically aren't very reliable. Further, two different pH scales are used?

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