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Interactive comment on "Dynamics of seawater carbonate chemistry, production, and calcification of a coral reef flat, Central Great Barrier Reef" *by* R. Albright et al.

Anonymous Referee #2

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Manuscript bg-2013-170 by Albright et al. provides seasonal measurements of net ecosystem calcification (NEC) and net community production (NCP) on the Davies Reef Flat. Correlations of NEC and NCP to carbonate system parameters including aragonite saturation state and physical factors such as photosynthetically active radiation are examined, and results are compared to similar data collected at One Tree Island, Great Barrier Reef and Kaneohe Bay, Hawaii. The ocean acidification community has recognized that there is a severe deficit of data relating ecosystem processes (such as NEC and NCP) to carbonate system parameters from which future impacts of ocean acidification can be inferred. Primary factors limiting the number of available data sets include the cost and reliability of autonomous sensors to adequately moni-

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tor chemical and physical parameters required to make these measurements and the logistical difficulties associated with taking ample discrete measurements over diurnal time periods. The methods in this study combine the use of autosampler technology for collection of discrete water samples with traditional discrete water sampling; and results demonstrate the value of improving automated sampling technology. This manuscript is both timely and significant as a contribution to a small but growing data base that is critical for understanding the impacts of climate change and ocean acidification on coral reefs. The methods and discussion are lacking some detail, and minor reanalysis of data is needed. I have provided detailed comments and questions that should be answered.

1) The sinusoidal trend is clear for all carbonate system parameters except for total alkalinity. This is curious given the fact that there is a diurnal trend in NEC, and that is typically accompanied by increasing TA at night and decreasing TA during the day. Some discussion should be included as to why this is not the case for these data. As indicated by reviewer 1, there is not a clear sinusoidal curve fit for the NEC and NEP data. This is likely due to the lower sampling resolution (temporal) for the Lagrangian transects as compared to the autosampler measurements. Autosampler measurements were collected every 2 hours while Lagrangian transect measurements were collected approximately 3x per day resulting in 3 clusters of NEC, NEP data (low in the morning, high at mid day, low at night). It is possible that the trend is sinusoidal, but the data do not exist to fill in the gaps to prove it. Discussion should be expanded to address this point.

2) Given the consistent trends in autosampler carbonate system data, the broad scatter in the NEC and NCP data suggests there is considerable error in one of the Lagrangian drift parameters. I am assuming that NEC and NCP rates were normalized to transect length because results are reported per meter squared. The equations on page 7649 do not indicate that (and they should). If not, then perhaps some of the error is due to variable transect lengths. Also as suggested by reviewer 1, there can be considerable

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inconsistency in drogue versus dye tracking of water masses. If concurrently collected drogue and dye data are available, then some discussion of consistency and potential error using these methods should be included. Discussion should be expanded to recognize the inconsistencies in transect data and these potential sources of error.

3) There is no indication as to how pCO2 in air was measured or at what frequency for calculation of gas exchange. Methods should be included. If a constant value for pCO2 in air was assumed, then include it.

4) If there is a technical reference for the autosampler that was used to collect water samples on the reef flat, that should be included. If not, then a technical diagram would be helpful if this is new instrumentation.

5) Were all of the Lagrangian transects located within the 200m x 200m boundary defined by the benthic community structure surveys?

6) What was the distance of the IMOS weather station from the study site?

7) Average net daily calcification was based on a 12:12 light dark cycle. What was the actual duration of the light dark cycles? And why not use that for your calculations?

8) The outlier NCP measurements on 1/24/12 and 1/25/12 are curious given that respiration is typically relatively constant throughout the night. A review of the supplementary data shows no anomalous physical parameters associated with those measurements. Please comment on any other factors that may have resulted in these anomalous data points.

9) It would be a worthwhile exercise to plot daytime and nighttime NEC and NCP data separately to see if it improves the relation between these parameters. The differences in dominant process (calcification vs. dissolution) from day to night may “muddy” the trend in the combined data set.

The recommendations above represent minor modifications to the paper. I have therefore recommended publication of the manuscript after minor revisions.

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