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Discussions

Interactive comment on "Groundwater and porewater as a major source of alkalinity to a fringing coral reef lagoon (Muri Lagoon, Cook Islands)" *by* T. Cyronak et al.

Anonymous Referee #2

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The manuscript addresses the fluxes of TA from ground water and pore water to coral reef lagoon in the Cook Islands. The methods for quantifying the fluxes seem reasonable although I would guess that removing a 150 ml sample from the chamber with simultaneous seawater replacement could lead to mixing that will alter the TA of sample either up or down depending on whether the TA of the seawater is higher or lower than the chamber water. The chamber advective pore water and ground water flux measurements were made at a single location. Observations were made over a single 28 hour period. I realize that these measurements are state of the art and very difficult to make but the introduction stresses that these fluxes can be quite variable in time and space and that leaves me wondering how much confidence should be attributed

to the daily fluxes that result from this study and I further wonder about whether there is justification for extrapolating the flux measured at one location to the entire lagoon.

The authors estimate a ground water TA flux of 1080 mmol/m2/d. This flux dwarfs the advective pore flux of -1.6 to 7.8 mmol/m2/d. The TA demand for corals in typical lagoonal environments from Kinsey 1983 is 26-42 mmol TA equiv/m2/d. This is far lower than the 400 mmol/m2/d that the author's assume. By the way this number seems high even for reef flat environments. A review of recent papers gives Shamberger et al. 2012 Kanehoe Bay 236-292, Falter et al. 2012 Ningalo Reef 380, Silverman et al. 2012 One Tree Is 148, Shaw et al Lady Elliot Is 290, Gattuso et al. 1998 give an average of 14-340 mmol TA equiv/m2/d. Given the residence time of 6 days that the authors estimate and the slow removal rate by coral calcification if the ground water TA flux is really 1080 mmol/m2/d the TA in the lagoon waters would be very much higher than the observed 2350-2550 umol/L. Either the residence time is very much shorter than estimated or the ground flux has been greatly over estimated. Since a six day residence time in a lagoon seems reasonable I left to conclude that the ground water flux can not be as great as 1080 mmol/m2/d. It would have been good if the offshore TA had been measured but it likely about 2350. The fact that the average TA of lagoon waters exceeds this value supports a flux of TA into the system from somewhere that exceeds the calicification rate of the system. Lagoons typically have quite low calcification rates with Kinsey 1983 finding that they fall in the 26-42 mmol TA equiv/m2/d range. Therefore a groundwater TA flux of >50 mmol/m2/d would be believable but not 1080.

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