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Interactive comment on "Late Holocene variations in Pacific surface circulation and biogeochemistry inferred from proteinaceous deep-sea corals" *by* T. P. Guilderson et al.

Anonymous Referee #2

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Summary

This paper by Guilderson et al. investigates the variation of stable carbon and nitrogen isotopic compositions in proteinaceous deep-sea corals in Hawaii and the Line Islands. Based on the datasets, the authors discuss the multi-decadal to multi-millennial variation of ocean environments and biogeochemistry during the Mid to Late Holocene and the late deglacial period. Especially, based on the nitrogen isotope records of Hawai'ian samples (geographical pattern and long-term trends), they suggest that reduction of tradewinds from the Mid Holocene to present would decrease production of mesoscale eddies and entrainment of subthermocline water masses in the North Pacific Subtropical Gyre.

Evaluation

This paper reports new and important datasets to reveal the variation of ocean environments and biogeochemistry in North Pacific Subtropical Gyre and Equatorial Pacific during the Holocene. The manuscript is well written, well organized. The data appear to be of good quality and I feel the scientific interpretation is sound. I feel the manuscript warrants publication in Biogeosciences. I have some comments that, upon consideration by the authors, will hopefully strengthen the manuscript. I recommend acceptance of this manuscript after a minor or moderate revision.

General Comments

1. I could not find the information of the water depths where these samples were collected. Although the general habitat depth of Gerardia in Hawai'ian waters is mentioned in the Introduction, the information of the samples in this study is also needed. There is also little discussion of the dependence of stable isotope data on water depth. Is diagenesis of sinking POM negligible in the water column of these sites?

2. Seasonality would be important for the discussion of the long-term trends. Is there significant seasonality bias in these coral stable isotope records? For example, a recent paper (Karl et al. 2012, PNAS) showed that episodic POM exports events of NPSG in summertime (July 15–August 15). I wondered that the insolation change during Mid to Late Holocene could modify the seasonality of POM export and could impact the stable isotope records of deep-sea corals.

3. The authors discuss reduction of the tradewinds since the Mid Holocene as a cause of the long-term trends in d15N records of Hawaii corals. In addition, I felt that the position of Intertropical Convergence Zone (ITCZ) could be also important. During the Mid to Late Holocene, the ITCZ shifted south due to the weakened orbital forcing in Northern Hemisphere summer (e.g., Wanner et al. 2008, QSR). If this ITCZ shift was also significant in the NPSG area, it could impact the production of mesoscale eddies.

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Specific Comments

Pg 3930 Ln 6: When were these samples collected?

Pg 3930 Ln 15-17: The term “Range finder sampling” was unclear for me. Does it come from some references?

Pg 3931 Ln 3: Is pretreatment of “Radiocarbon samples” same as the stable isotope samples? (decarbonation, rinse, drying, . . .)

Pg 3933 Ln 16: The term “nutrient trapping” in this sentence is unclear. More explanation is needed.

Pg 3937 Ln 18-21: A recent paper (Cobb et al. 2013, Science) suggested highly variable ENSO activity during the last 7000 years, with no evidence for a systematic trend in ENSO variance, which is contrary to model studies such as Clement et al. (2000). Therefore, this Cobb et al. (2013) should be included in the discussion.

Pg 3941 Ln 16: measureeonts -> measurements

Pg 3941 Ln 28-30: Does this reference have same contents as the paper with the same title in JGR? (Jenkins, 1998, Journal of Geophysical Research 103, 15817-15831) If so, the JGR paper would be more suitable to cite.

Pg 3943 Ln 2: Deep-Sea Res. Pt. II -> Deep-Sea Res. Pt. I

References

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Interactive comment on Biogeosciences Discuss., 10, 3925, 2013.