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# *Interactive comment on* "Monsoonal forcing controlled cold water coral growth off south-eastern Brazil during the past 160 kyrs" *by* André Bahr et al.

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Response to Referee 2 First we would like to acknowledge Reviewer 2 for his/her constructive evaluation of our manuscript. Below we provide a point-to-point response ("R") to the original comments ("C").

[C] The manuscript submitted here investigates the impact of monsoonal variability on CWC growth in last 160 Kyrs. While the authors present a manuscript with compelling arguments; that is likely to be of interest to readers of Biogeosciences, I have a few of concerns that should be addressed before publication. 1. Authors try to show how the monsoon impacted CWC growth without providing any direct correlation between the



two, which is a simple statistical analysis to do. [R] We thank Reviewer 2 for the suggestion of performing a statistical test to validate the proposed monsoonal impact on the CWC growth. For this purpose we computed the linear correlation between CWC occurrences (as shown in Figure 5H) and the Ti/Ca ratio of Core M125-95-3 using the Monte-Carlo-based SurrogateCor function implemented in the "astrochron" package in R (Meyers, 2014), which has been specifically designed for correlation of time series with a different temporal resolution. The resultant correlation coefficient r = 0.56 (p=0.01) corroborates a significant correlation even considering potential mismatches due to age model uncertainties and non-linear proxy behavior. We include these new statistical results in the caption of Fig. 5: "Note the good match between CWC occurrences and enhanced monsoonal activity on the continent (correlation between Ti/Ca and CWC frequency: r = 0.56, p = 0.02; computed using the SurrogateCor function of the R-package "astrochron"; Meyers, 2014)". Notably, these results also support the already stated results of a discriminant analysis which showed that proxies reflecting terrigenous run-off (Corg/Ntotal) and weathering (albite/kaolinite) are good predictors for CWC occurrences (cf. end of Section 5.1.3 "Influence of the continental hydrological cycle").

[C] 2. The discussion section needs to be streamlined towards the main objective of the manuscript, which now rather seems to be a collection of different points without the central theme. It's difficult for a reader to go through the whole discussion and find exactly where the authors prove their central claim. While discussing many proxies is necessary for a paper like this, it's also important to stress how these proxies help to prove your central claim, which is something lacking in the manuscript.

[R] We recognize the concern by Reviewer 2 (partly also raised by Reviewer 1), and put more emphasis on the main message of the paper, i.e. the direct link between continental hydroclimate and CWC growth at the continental slope. We now stress this link right at the onset of Section 5 "Results and Discussion": "...We argue that the most dominant environmental factor for triggering CWC growth was elevated river run-

off during periods of strong monsoonal rainfall in the coastal hinterland, which provided nutrients and organic matter that enhanced the food supply of CWC colonies." We further emphasize the role of monsoonal rainfall as a decisive factor for CWC growth as also requested by Reviewer 1 (this affects Abstract, Section 5.2, and Conclusions).

[C] 3. While the growth of CWC during HS events is very evident visually, why the CWC growth was not observed during MIS3 and MIS4 is still not clearly explained. While TOC is the only proxy that was different during these stages but high TOC didn't promote CWC growth at 20-40m [REMARK: this likely refers to 20-40 cm] depth. So it seems that TOC is not a singular factor affecting CWC growth. While authors have explained water currents and terrigenous input as some other proxies to impact CWC growth, they seem to be fluctuating a lot in all the MIS stages and hence fail to shed any light on what stopped CWC from growing during MIS3 and MIS4.

[R] The Reviewer refers here to the CWC barren interval between 20–40 cm core depth. We note that this interval is characterized by intermediate TOC contents that are not as high as during the main CWC growth phases between 70-180 cm and below 530 c (Fig. 6A). As already stated in the original text (see section 5.1.2: "However, as suggested in the previous section, there are multiple factors necessary for stimulating coral growth at Bowie Mound"), we assume a multi-factorial control of CWC proliferation phases. Organic matter supply likely played a major role but other factors such as hydrodynamic conditions might have interfered as well. In this line the absence of CWC during large portions of MIS 4 could be well explained by the generally low TOC contents that point to the lack of organic matter supply inhibiting CWC growth. We now state this connection explicitly in Section 5.1.2: "...while the long CWC-barren interval between 200–460 cm is characterized by relatively low TOC contents...". According to the stratigraphic assignment this specific interval encompasses early MIS 4, not MIS 3; to make this distinction clearer we modified the age assignments in Figures 4 and 6 and modified the respective paragraph in Section 4: "The section between EII and EIII on the other hand has relatively uniform d18O values around 4.3 ‰ (d18OUvi) and 3.4 ‰



(d18OPlan), respectively, which matches M125-50-3 d18OUvi values during MIS 4 to 2. A Th/U date at the top of this section at 117 cm reveals an age of 34 ka, while CWC ages from slightly deeper in the core (between 131-190 cm) fall within the range of 60–63 ka (MIS 4). As d18OUvi values between EII and EIII are less depleted than MIS 5 samples of reference site M125-50-3, we infer that those sediments were most likely deposited during MIS 4 and did not reach into MIS 5. Hence, it hence appears that deposits of MIS 2 and large parts of MIS 3 are not present in core M125-34-2, either due to non-deposition or subsequent erosion (note the prominent erosive surface EII). This age assignment would also imply that the extended CWC-free portion from 200 to 465 cm was deposited within a short period of approximately 8 kyr during MIS 4 (62.2 ka as the oldest Th/U dates and $\sim$70 ka as the MIS 4/5 boundary)."

[C] 4. The figures captions throughout the manuscript describe what is shown in the figure, but don't provide the reader with any additional information such as calling attention to the significant result. The message shown by the figure is left entirely up to the reader to decipher.

[R] We are aware that the figures and the associated discussion of the factors influencing CWC growth phases are quite complex. We therefore acknowledge the suggestion by Reviewer 2 to provide more information on the interpretation of a Figure's content in the respective caption. We hence added the following sentences to the captions: Fig. 4: "Phases of CWC proliferation appear to require background state of high hydrodynamics conditions (elevated ln(Zr/Al) and (SS) ÌĚ) but do not show an influence of deep-water mass variability (d13C).." Fig. 5: "Note the good match between CWC occurrences and enhanced monsoonal activity on the continent (correlation between ln(Ti/Ca) and CWC frequency: r = 0.56, p = 0.02; computed using the SurrogateCor function of the R-package "astrochron"; Meyers, 2014)." Fig. 6: "Note that high CWC abundances fall into intervals of high TOC and increased weathering due to an intensified continental hydrological cycle."

[C] Moreover, in some figures authors have added depth and in some age. It would be

best if authors add age and depth in all the figures.

[R] We would like to note that we already provide depth and age scales on Figures, when appropriate (Figs. 3, 4, 6). For Figure 5 we followed the reviewer's suggestion and added the depths intervals denoting the phases of CWC proliferation at Bowie Mound on top of the figure; a respective comment has been added to the caption ("Red bars indicate periods of enhanced CWC growth at Bowie Mound, with the respective depths in Core M125-34-2 annotated").

[C] 5. Line 48: "The most common framework-forming CWC comprise. "This sentence doesn't make sense. It is either incomplete or needs to be restructured.

[R] This sentence has been rephrased (see also reply to respective comment by Reviewer 1).

[C] 6. The next sentence in line 49 "Changes the species. . .." Is also incomplete and hence doesn't provide context.

[R] This sentence has been rephrased (see also reply to respective comment by Reviewer 1).

[C] 7. Line 55: "in" repeated "similar studies in the feeding in the properties. . ."

[R] We rephrased the sentence to ". . . similar studies on the feeding preferences of S. variabilis, the dominant framework-building CWC discussed in this study, are still pending".

[C] 8. Line 72: It should be "adapted" instead of "adopted".

[R] Corrected.

[C] 9. Line 77 -79: "This setting allows us. . ... growth at Bowie mound". It is a repetition of what has been already said in previous sentences.

[R] This sentence has been removed (see also reply to respective comment by Re-



viewer 1).

[C] 10. Line 369: "AAIW seemed to had an insignificant" It should be "to have had" or "AAIW had" depending on what authors want to say exactly.

[R] Corrected to "seemed to have".

[C] 11. Line 384: "does not necessarily led to". It should be "lead"

[R] Corrected.

REFERENCE Meyers, S., 2014. Astrochron: An R package for astrochronology. Available at http: org/web/packages/astrochron/index.html.

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