

## ***Interactive comment on “Environmental forcing of the Campeche cold-water coral province, southern Gulf of Mexico” by D. Hebbeln et al.***

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Dear Editor and Referee #1, many thanks for the referee #1 comments. We will most definitely update our manuscript based on the valuable comments provided. Our responses to the main points raised are:

General comments - Why do the authors call the structures “ridges” instead of mounds. The transparent reflection observed on the parasound is very similar to cold-water coral mound structures observed on for instance the Irish margin. Are the authors not sure if the whole structure is formed by cold-water corals. Have sediment cores been taken, which show the presence of coral debris downcore? In the discussion (page 18772, L28) the authors do seem to think that the complete ridges are formed by corals and a sediment core was taken. This should be mentioned in the methods section and

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as observation in the results section. Response: In describing the ridges we initially followed the obvious ridge morphology revealed by the CWC structures. However, the reviewer’s comment showed us, that not using the established term “mounds” can be interpreted as we do not consider these structures as classical “mounds”. Well, that is not our intention and to avoid any misunderstandings we will change the term “ridge” throughout the manuscript and use instead “(elongated) mound”. As indicated in the discussion, sediment cores have been taken (page 18772, L28). However, as for this manuscript the only information taken from these cores is that the uppermost 10 m of one of the mounds consist of coral bearing sediments it is only referred to the available cruise report. This little bit of information does in our eyes not justify to include all information about methodology of sediment coring and a more detailed result description into the manuscript. In addition, including the sediment data into this manuscript probably would trigger additional questions, e.g. about the stratigraphy, the composition etc. – which also are beyond the scope of this paper.

- Methods need to be extended, a more detailed description is needed on the interpretation of the video data and on the use of the yoyo CTD profiles (down and up cast data). - Another question that arose is how the video transects were interpreted. Is just a general description given of the most common species observed in the different zones on the ridges or have species been counted and can percentages be given for the different zones. How the video data were interpreted need to be specified in the methods section. To clarify the amount of species present or observations that were made either a table with numbers is needed or most common species/coral coverage needs to be indicated on the multibeam map, using different colours along the transect. At least the different zones or facies as they are called in the captions of Figure 3 and 4 should be explained in more detail at the beginning of the section and a description of the different zones should be made accordingly. What is defined as the life, rubble or pelagic mud zone? References to the different photographs in Figure 3 and 4 need to be specified in the text (refer to 3A, 4D ::: ), see detailed comments below. Response to both points: The focus of this manuscript is on the description of the entire Campeche

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CWC province within the overall environmental setting with some exemplary sea floor photographs and a very general description of the ecosystem and the facies distribution. A detailed small-scale facies/ecosystem analysis is out of the scope of this paper. Such an analysis is presently worked on, but it will take one to two years more, before all the videos will be evaluated in detail. Thus, the requested information in terms of number of species and their relative distribution to the individual zones will come, but in another manuscript to be written later. But, of course, we will link the references in the text not only to the photo-tables but to the individual photographs as suggested. In the methods section we added the information that all presented CTD data refer to the down casts of the CTD deployments.

- The NNE-SSW trending of the ridges cannot be observed from the map in Figure 2. An inset with a zooming in on part of the area would help to show the different orientations/V-shape/moats. Response: Such an inset will be added to Fig. 2.

- Regarding the water column data. Why was chosen to only show data from a small part of the water column in Figure 6B. Especially since the depth of the CTD casts drastically changed. Figure 6b shows at present temporal as well as spatial variation. This might bias the data shown as the ship is moving either with or against the current. My suggestion would be to only make a contour plot of data above 520 m water depth and show a larger part of the water column. Figure 6 needs to be revised in this respect. Response: We will add a temperature contour plot for the entire water column to Fig. 6. However, the original Fig. 6b will be kept in order to highlight the variability in the depth zone of the corals. The spatial variability indicated by changing water depths has been quantified (600 m in N-S and 50 m in E-W direction) and this information will be added as information to the text and to the figure caption. With respect to the observed current speeds, the spatial variation of the individual sampling sites over the 12 hour deployment period is assumed to be negligible.

- Furthermore it needs to be clarified if down and up casts from the CTD were used or if only down casts were used. It has been shown that a difference of 0.5 C can be

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observed between down and up casts due to the fact that water is dragged upwards with the CTD frame. Response: see above, this information will now be provided.

- Furthermore, from the data presented no cycles can be distinguished. For this a longer yoyo CTD station is needed (at least 24 hours). If 3-6 hourly cycles are mentioned it should be discussed in the discussion section what could cause these cycles. Do the authors also observe some sort of cyclicity in the current speed during the 12-hour deployment? Response: we will avoid the term cyclicity and only refer to variability.

- Regarding the change in current direction observed below 460 m water depth is likely related to a deflection of the current by the seabed topography. The density gradient observed around 520 m water depth seems related to the boundary between two water masses. AAIW is observed below 540 m water depth as stated on page 18770, L15 and as is nicely shown in Figure 5. However, this is not mentioned in the discussion, while a comparison is made with upper limit of MOW at the Irish margin. The focus of the present hydrodynamic data should be on the general parameters (T, S, oxygen), the density gradient, high surface productivity, migration of zooplankton and data presented in Figure 8. The authors need to be careful not to over interpret the data and to focus too much on the presence of internal waves, since the measurement period was very short. Response: the discussion will be adjusted to invoke only the term temporal variability (no cycles, no internal waves) when discussing the hydrodynamic regime. Only a weak hint that this variability might be linked to internal waves will remain. We will add a comment on the possible link between the discussed density gradient and the upper limit of the AAIW.

Most detailed comments will be followed accordingly, thus only the detailed comments that we explicitly would like to reply to are listed here:

Page 18763 L7-12 Rephrase Salinity (34.9) and temperature (7) indicate the presence of AAIW between XXX and XXX m water depth (show depth range of the AAIW).

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Salinity and temperature increase towards the salinity maximum of the STUW at 150 m depth. Above 150 m water depth CSW is found, characterised by an increase in temperature and a decrease in salinity. From 50 m depth until the surface both parameters remain relatively constant (seasonal thermocline?). Response: this is very difficult as the available oceanographic literature for the region only defines type settings for individual water masses as given in the text. Thus, clear boundaries between AAIW (7°C, 34.9), STUW (23°C, 36.8), and CSW (26-27.5°C, <36.4) are not obvious as these depending on the amount of mixing between these water masses there are rather boundary zones stretching over >100 m than boundary layers.

Page 18767 L6 Fig 3H? This part on hardgrounds should be moved to the next section on the ecosystem, where all video data are described. Response: well, we are inclined to leave this sentence where it is, as there it is more the physical setting (i.e. outcopping crusts) that is described in contrast to the more "biological setting" described in the following section.

Page 18769 L28 Are the coral branches admixed with sediment or is sediment filling up the coral framework? Response: The text explicitly refers to "coral rubble", so it is clearly about "coral branches admixed with sediment".

Page 18776 L5 delete "tides and" Response: We intend to keep these words here as they refer to what has been described in the literature and there is explicitly spoken also about internal tides.

Thanks again for the very valuable comments! Dierk Hebbeln & co-authors

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Interactive comment on Biogeosciences Discuss., 10, 18757, 2013.