

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

Anonymous Referee #1

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Environmental forcing of the Campeche cold-water coral province, southern Gulf of Mexico

Hebbeln et al.

Overall this is a very well written and interesting manuscript describing a newly discovered cold-water coral province in the Gulf of Mexico. This area likely is a key area regarding the distribution of coral larvae in the Gulf of Mexico, the Caribbean basins and along the US West coast. Water masses passing the Campeche CWC province will become part of the Loop Current which will in the end form the Gulf Stream. This manuscript definitely needs to be published. However, some questions arose during reading and several interpretations of the data need to be clarified in more detail, see remarks below.

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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 as observation in the results section.

- 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.

- 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.

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- 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. 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 observed between down and up casts due to the fact that water is dragged upwards with the CTD frame. Figure 6 needs to be revised in this respect. 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? 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.

Detailed comments

Page 18759 L12 Delete “internal waves” There is not enough evidence from the data presented in this manuscript that specific cycles are present, see general comment above

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L14 Rephrase “strong hydrodynamics” The above mentioned hydrodynamic processes drive the “delivery” of food particles to the corals, which are potentially supported by the diel vertically migration of zooplankton. Two different processes are present: The settling of phytodetritus (inactive process, but likely influenced by local hydrodynamics) and zooplankton that actively migrates.

L15-18 Rephrase unclear what is meant here. Hydrography is mentioned here, while in the previous sentence hydrodynamics are mentioned as driving processes for food supply.

L25 “except only” double up, delete “only”

Page 18760 L7 Remove “the” in front of CWC

L19 insert coral The scleractinian “coral” LP...

L23 delete “and”, add “to” between a few tens of meters to over 2000 m

L25 Rephrase, what is meant by the strength of the bottom current regime, maybe better to mention the “the local nature of the bottom regime” Processes in most coral areas seem to strongly differ, since most of the processes are linked to stratification of the water column and the local/regional topography.

Page 18761 L20 insert “the” through the Yucatan Strait

L23-24 Community = communities, delete “an”

Page 18762 L2 replace indicate by “be”

L25 replace triggers by “induces”

Page 18763 L1 delete “can”

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). Salinity and temperature increase towards the salinity maximum of the STUW at 150 m depth.

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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?).

L19 replace in by "at" at 200 m

L20 remove "at 23.8° N"

L21 insert reference, remove "21.5° S"

L25 sampling of what? Water or sediment or both

Page 18764 L2 replace has been by "was" check all verbs in the methods section and use the past tense consequently.

L3-4 replace has been by "were"

L8 replace operates by "operated"

L23 replace operates by "operated"

L24 replace of by "with a"

Page 18765 L4 replace were by "was"

L18 insert "a" in a horizontal direction

Page 18766 L1-2 Repetition page 18764 L2-3

L3 replace measurement by "measurements" and 1250 m by 1246 m (see Table 1)

L4 replace was by "were"

L13 replace in by "at"

Page 18767 L2 insert "the" the WNW

L3 Fig 3C? (where are the angles shown, more obvious from the parasound profile)

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L6 Fig 3H? This part on hardgrounds should be moved to the next section on the ecosystem, where all video data are described.

L7 Fig 3A and B?

L17 replace and by "- 510-580 m

L26 exposition = exposure?

L27-28 Repetition of L19-20 this page

L28 rephrase "in the lower parts and in between the ridges"

Page 18768 L2 current exposed side, indicate orientation SSE side?

L8-10 rephrase "thus. ...area", where corals have formed thickets of up to 60 cm high.

L13 Fig 4A and B? Refer to the different photographs individually.

L24-28 Part of the discussion

Page 18769 L10 replace we by "was"

L11-12 What is the meaning of this sentence, why is this important or were the crinoids just observed occasionally.

L27 "Elsewhere common", which species are referred to here

L28 Are the coral branches admixed with sediment or is sediment filling up the coral framework?

Page 18770 L12-13 Rephrase delete "by the occurrence of", insert "which is" indicative. ...

L15 Replace In by "At", delete "(at least some)"

L16 Delete "during video observation"

L17 Replace temperatures range between 9.5 and 7.5 by "temperatures range between

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7.5-9.5 °C and salinity between 34.9-35.1.

L20 Small but significant variations of what?

Page 18771 L1-3 Why is this not shown in the figure. Would be clearer to show a larger part of the water column to also show the differences as indicated in the text.

L7-13 Refer to Figure 8. Figure 7 does not show data below 460 m and only shows backscatter values. Delete velocity, insert "speed".

Page 18772 L10 Replace reaches up by "is comparable with"

L12 What is meant by largest mapped structures? This is just the surface area that was mapped and does not say anything about the number of structures, height, volume or the amount of coral cover.

L23 Rephrase "Large seafloor structures formed by CWC"

Page 18773 L1-3 Remove sentence or explain why it is "relevant"

L12 Add reference. Where does this data come from. Most mounds even with cemented sections show a completely transparent reflection pattern, since cemented layers are usually very thin and will not show up on parasound profiles.

L15-17 Rephrase "bottom current activity" Ridge like or elongated features are often related to the presence of a unidirectional current regime or at least they are orientated in the direction of the strongest currents. This is not necessarily the main current direction.

L16 Did Correa et al have proven that the complete structures they found were built by corals. It could also be the case that CWC have started to grow on existing structures that already had a specific orientation.

L22 Fig 7 = Fig 8

L23 delete "in the depth layer of the change in current direction" by "below 460 m"

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L27-28 Repetition L22

Page 18775 L26 add reference to Becker et al., 2009 DSR I

Page 18774 L18 add reference

L20 Why is this the case? Lack of oxygen, limited food supply, suspended matter in the water column. . . .

Page 18776 L3 Living "at" intermediate water depths

L5 delete "tides and"

L8-9 How is the topography influencing the strength of the water circulation. Topography influences on a local scale hydrodynamic processes, e.g. internal waves, down or upwelling.

Page 18777 L9 As described in the results section the wave amplitude is only 10-20 m. How are these waves transporting particles to the corals? Wave amplitudes in other areas are way larger, several 100 m.

Figures: Figure 3: refer in the text to figure 3A, 3B, 3C. . . to highlight the observations. Same for Figure 4.

Figure 8: Modify units ml l-1 cm s-1. Check if current speed is really given in cm s-1, seems that it is plotted in m s-1

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