

## ***Interactive comment on “Last interglacial sea levels within the Gulf of Mexico and northwestern Caribbean Sea” by Alexander R. Simms***

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Short Comment: In an attempt to improve our scientific approach, I wish to make the following comment regarding the data reported for the northern Gulf of Mexico coast. These are listed here and published in Simms et al. (2013). Alexander Simms state that a number of sedimentary features indicate “an old barrier-beach system” that would maintain the topography of “old beach ridges”.

My Response: I thank the reader for taking interest in my work and providing some insightful comments. I am sorry if I was misleading. What I meant is that some of the old “barrier islands” preserve “beach ridges” ontop of them.

Short Comment: For estimating the LIG elevation of the Gulfport barrier the modern

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analogue approach was used: The elevation “was determined by subtracting the average elevations of the closest modern barrier islands from the average elevations of the five segments of the Gulfport Shoreline dated”. “LIG beach ridges were 4-5 m in height while the modern beach ridges were 2-3 m in height”. “We thus assign a modern analogue value of  $2.5 \pm 1.0$  m and a LIG elevation of  $4.5 \pm 0.5$  m for the LIG beach ridge elevation.” “This suggests a LIG RSL of  $+2.0 \pm 1.1$  m”.

My Response: We are using two different approaches. The text above is specifically for the Morgan Peninsula case, where true “beach ridges” of both LIG and modern have been identified. Thus unlike the estimates from Simms et al. (2013), the modern analogue used is a beach ridge rather than a “Barrier Island.” Antedontly, we are quoting Rodriguez and Meyer (2006) who collected GPR over both the LIG beach ridges as well as three phases of Holocene beach ridges. They were using specific stratigraphic contacts (the contact between eolian and foreshore) for their sea-level comparisons. For the rest of our Ingleside and Gulfport comparisons we compared the elevations of the entire barrier island features.

Short Comment: For the northwestern coast OSL samples were collected from “the core of the barrier”, i.e. from sand in core depths of 140 cm, 250 cm and 380 cm. These ages were “obtained for the Ingleside shoreline”. I think this approach delivers inaccurate sea-level index points for the following reasons:

My Response: This was used for the ages not the elevations of the LIG. The importance to the “core” of the feature in this context is that we are dating the actual Pleistocene feature and not the reworked upper sandy veneer of the feature. Unfortunately due to the coring apparatus used (a Geoprobe) very little sedimentary structures were preserved due to the percussion of the instrument. In addition, some of the recovered cores were water saturated and thus largely homogenized for each individual core section recovered (<100 cm).

Short Comment: 1 - The height of a barrier is controlled by local parameters such as

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sand supply, accommodation space, wind regime and high-energy events. Instead, the beach/uppershoreface facies overlying the uppermost flooding surface should be the sea-level indicator. The surface marks the latest rollover or overstepping event and the overlying shoreline-related deposits provide the indicative meaning (IM). In the Holocene barrier the uppermost flooding surface is at ca 160 cm depth in the barrier where it truncates back-barrier and fluvial-deltaic deposits (Odezulu et al., 2018, in: Barrier dynamics and response to changing climate. Springer, p.147ff).

My Response: I agree but the identification of specific beach facies such as upper shoreface, foreshore, or backshore are only described for a couple locations (e.g. Paine, 1993; Burdette et al., 2013). When available, we have utilized those with their indicative meanings. Unfortunately for the rest of the mapped and in many places dated Ingleside and Gulfport features, no such detailed stratigraphic information or surveyed elevations are available. Thus I was left with the average elevation of the barrier islands approach.

Short Comment: 2 - The modern analogue is a great tool for first-order approximating the usefulness of a sea-level indicator, but it is mostly not sufficient for quantifying the LIG shoreline position. Blum et al. (2008; Geology) show how post-glacial sediment re-distribution impact on the lower Mississippi valley and this, in turn, should influence the sediment supply to the Ingleside shore during the Holocene.

My response: You are correct, but that is all that is available. I have highlighted these assumptions and applied a liberal error along with noting that within the “Quality of the data” portion of the WALIS database. The poorly constrained data are better than no data as long as its limitations are acknowledged.

Short Comment: 3 - There is no evidence that the OSL ages were obtained from the sea-level indicator, i.e the beach facies. 4 – There is an unfortunate mix of terms: beach ridge seems to be used synonymously to shoreline, shoreline synonymously to barrier and barrier island synonymously to barrier. However, each of these coastal

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features have a different IM (e.g. Rovere et al., 2016; QSR, for beach ridge) and a shoreline is an undatable theoretical line.

My response: The ages were obtained from the sand deposits of the Ingleside feature but yes due to liquefaction of the cores we were not able to deduce any detailed sedimentology and thus facies. As for the mix of terms, thank you for the comment. I have tried to be clear what I am referring to. I use “beach ridge” to describe the specific geomorphic ridge features (sensu Otvos, 2020) developed ontop of the modern barrier islands or LIG features (See Figure 2). We use “shoreline” as a general term for the Ingleside and Gulfport features as mapped with no concept of what type of specific landform (e.g. barrier island, mainland-attached beach, strandplain, etc.) they represent other than old sandy, presumably shallow marine features. We use “barrier island” when interpreting the landforms as official geomorphic features of a sandy narrow and long depositional features separating the open ocean from some sort of backbarrier environment such as a lagoon or coastal marsh. We have done away with the term “barrier”, it was originally used to suggest that the LIG features may not have been true “barrier island” but potentially shore attached beaches or the “mainland barriers” of Otvos (2020).

Short Comment: The barrier complex is a high-quality indicator with a well-defined IM and IR and, because it occurs on a microtidal coast, IR/2 is small. This should be explored for Gulfport and Ingleside.

My response: That is what I did – the average elevation of the LIG barrier island (or complex) minus the elevation of the modern barrier island (or complex). We have tried to be more clear about that (“Assuming the Ingleside was a LIG barrier island (Price, 1933; Paine, 1993) similar to the modern barrier islands of the Texas Gulf Coast, which is still a matter of discussion (Otvos, 2018, 2020), Simms et al. (2013) subtracted the average elevation of the closest modern equivalent barrier island from the elevation of each of the Ingleside shoreline segments of the Texas Coast.”)

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