Response to Comments by Referee #1 to “Last Interglacial sea-level proxies in East Africa and the Western Indian Ocean"

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1 Summary

We thank Anonymous Referee #1 for their thorough review of our manuscript. In the following, we answer the main comments for the manuscript and database, as well as their corresponding minor comments. The original reviewer comments are in italics while our response is in plain text and the adjusted manuscript text is indented.

2 Main Comments (Manuscript)

Insufficient, detailed description of methodology, in particular how elevation measurement and age errors were dealt with. As this is a stand-alone paper to accompany the data, you should include a summary of your methods (and it can be very brief) to reassure readers what data quality control has been done and to confirm that users are able to compare like-with-like. I found this at the very end of the document, and Section 5.4 should be moved to earlier in the manuscript (i.e., before the discussion of the sites).

Here we have followed Referee #1’s advice and have moved Section 5.4 earlier, into the methodology section of the manuscript. We have also expanded the section to include the quality evaluation table used throughout WALIS for both elevation and age. Below is the text we added, we hope that this addresses properly the issue raised by the referee.

> The aim of WALIS is to provide the most objective evaluation of PRSL data as possible. It therefore must be explicitly noted that each data set is evaluated by a set of quality control standards that are used throughout the WALIS database (Table 1, Rovere et al. (2020)). For the most part, elevation measurements were stated in plain language by the original authors, without describing in detail neither measurement methodologies nor measurement errors. We have therefore applied our best estimate errors in these cases based on the standard accuracy of the survey methodologies employed by the original authors. When we have done so, we mention this in our evaluation of the RSL Proxy Quality inside the database.

As discussed previously (Section 2.3), ^{238}Th/U ages are reliant upon the technique and transparency of metadata. While many earlier studies briefly refer to the methodology used, they often provide little, if any, analytical metadata. Within the database, we have accepted all ^{238}Th/U ages as reported by the original authors and have only reported recalculated ages from Chutcharavan and Dutton (2020) which utilize ^{234}U and ^{238}Th decay constants from Cheng et al. (2013). Each chronological constraint has been rated using the common guidelines provided in the WALIS documentation (Table 2). Additionally, we have reported open-system ages for samples that are derived from mollusks (e.g. *T.Gigga*), which are widely accepted as providing inconsistent ^{238}Th/U age reliability (e.g. Ayling et al. (2017)) and therefore have been assigned a Marine Isotopic Stage designation rather than an outright age. Data with quality higher than 4 (good) are from the most recent studies within this region and are those who have adopted more rigorous sample screening procedures and have access to the most recent advances in mass-spectrometry (e.g. MC-ICPMS).

Table 1. Quality rating guidelines used for evaluating PRSLs. Exported from WALIS (Rovere et al., 2020)

Description	Quality Rating
Elevation precisely measured, referred to a clear datum and RSL indicator with a very narrow indicative range. Final RSL uncertainty is submetric.	5 (excellent)
Elevation precisely measured, referred to a clear datum and RSL indicator with a narrow indicative range. Final RSL uncertainty is between one and two meters.	4 (good)
Uncertainties in elevation, datum or indicative range sum up to a value between two and three meters.	3 (average)
Final paleo RSL uncertainty is higher than three meters.	2 (poor)
Elevation and/or indicative range must be regarded as very uncertain due to poor measurement/description / RSL indicator quality.	1 (very poor)
There is not enough information to accept the record as a valid RSL indicator (e.g. marine or terrestial limiting).	0 (rejected)

Currently it is unclear whether the ages in the data are (1) comparable, or (2) are reliable. For example, comparability of the U-series dates: a) are all the ages recalculated assuming a closed system and using the same decay constants? b) do they include the decay constant error? Given that these fields are blank in the database ("RSL from single coral" sheet) – I take it not? Why not? c) Are they benchmarked (e.g., to 1950), or are they reported with respect to the year of measurement? Rectifying this would only require a couple of paragraphs (max.) to the manuscript, as well as completing/tidying up the database.

Recalculated ages were contributed to the database by Chutcharavan and Dutton (2020). In order to clarify this, we have added the following to Section 2.6 Uncertainties and Data Quality:

Within the database, we have accepted all ^{238}Th/U ages as reported by the original authors and have only reported recalculated ages from Chutcharavan and Dutton (2020) which utilize ^{234}U and ^{238}Th decay constants from Cheng et al. (2013).

Table 2. Quality rating guidelines used for evaluating age information. Exported from the WALIS (Rovere et al., 2020)

Description	Quality Rating
Very narrow age range, e.g. few ka, that allow the attribution to a specific timing within a substage of MIS 5 (e.g. 117 ± 2 ka)	5 (excellent)
Narrow age range, allowing the attribution to a specific substage of MIS 5 (e.g., MIS 5e).	4 (good)
The RSL data point can be attributed only to a generic interglacial (e.g. MIS 5).	3 (average)
Only partial information or minimum age constraints are available.	2 (poor)
Different age constraints point to different interglacials.	1 (very poor)
Not enough information to attribute the RSL data point to any pleistocene interglacial.	0 (rejected)

With regards to the second (reliability), screening criteria are not discussed, despite their widespread use within the community. Establishing a reliable age is crucial for our understanding of sea levels during the Last Interglacial, and yet this is not dealt with in sufficient detail in sections 3 or 5 of the manuscript. Given that this is a paper/dataset concerns the Last Interglacial, but many of the ages quoted in the text (and in the dataset) are outside of the canonical age for the Last Interglacial (and MIS 5e), a very short discussion of age reliability is needed, particularly to help non-specialists appreciate some of the subtleties of the stratigraphy and age data (screening only mentioned in passing around line 349).

We have looked to answer this shortcoming of the manuscript by adding additional clarification to the Dating Techniques subsection as well as expand on the screening fields within the database

Further, some clarification is needed on age determinations (e.g., U-series dates) and RSL indicators, for example the discussion of the Seychelles data. You need to specify how these replicate ages have been averaged (and screening criteria to give "accepted ages", line 283) to give the age of the unit.

We have clarified that the averaging was done by the original authors.

> Each sample was sub-sampled in triplicate and ages have been variance-weighted averaged from the sub-samples(Dutton et al., 2015).

Tectonic setting – it would be very useful to stress that most(?) (hard to tell from the database, data largely missing and this is known rather than unavailable) of the sites are tectonically stable, or to highlight those that are considered largely stable within your short site summaries in the manuscript.

We had originally omitted Tectonic setting because there was no vertical land movement (VLM) stated in literature that was independent from sea-level. This requirement needs to be met when entering metadata into the database in order to make the Tectonic section available. We have gone back through each PRSL proxy and added the tectonic setting (without VLM) when mentioned by the original authors. We have also added an introduction to tectonics of the region in our methodology section (see below). For each site that is not considered stable, we briefly mention whether the PRSL is uplifting or subsiding.

The tectonic setting of PRSL indicators plays a significant role in their interpretation. Active faulting is found throughout the EAWIO (Figure 1a). For example, the majority of the East Africa coast is sitting atop the Somalia Plate that is slowly moving eastward as the East African Rift Zone (EARZ) slowly opens. Spreading rates in the EARZ decrease from north to south, 4.5 mm/a in Ethiopia to 1.5 mm/a along the Mozambique coastal plain (Stamps et al., 2008). While to the north, the Gulf of Aden is home to the Arabia-Danakil-Somalia triple junction.

When reported in literature, tectonic categories (stable, uplifting, or subsiding) are recorded within the database as to give the best possible picture of each sea level indicator setting. However, the magnitude of vertical land movements (VLM) are not explicitly included in the database. This is done because the VLM rates that were reported in literature tend to be derived from several different assumed eustatic sea levels from the LIG. As this is directly tied to sea level, it does not meet the strict “sea-level independent" criteria for insertion into the database.

The inclusion of the Gulf of Aqaba (Red Sea, Bar et al 2018, Yehudai et al 2017) within the geographic region is curious - what is the rationale for this given the different (tectonic and oceanographic) setting of the Red Sea? The region is also not discussed in the manuscript. It’s fine, but the you have not included several key studies from the region on the Last Interglacial terraces (dates and elevation). Why are these not also included? An oversight perhaps, especially since the manuscript lays out the historical context for many of the study sub-regions. I appreciate that the dating of these reefs is difficult (they are often diagenetically altered) but it is curious that some of these studies are included (i.e., in the north, Bar, Yedudai, all highly recrystallised) and others not. Can you explain? Please include, for example, the Eritrean (Walter et al., 2000; Bruggemann et al., 2004), Egyptian (Plaziat et al., 2008, 1998, 1995), and Yemi (Al- Mikhlafi et al., 2018) Red Sea Last Interglacial terraces (see also the references within Lambeck et al., 2011), as well reference the marginal basin method (Red Sea) record (Siddall et al.,2003, 2004; Rohling et al., 2008, 2019; Grant et al., 2014). The latter doesn’t need discussing, since it won’t be included in your database, but it should be referenced if this region is included in the current compilation. Given the difficulty in unraveling the (potential) tectonic and age difficulties of the preserved fossil terraces, I would simply remove the Bar and Yehudai studies from your compilation.

The inclusion of the Red Sea was an oversight in the database exportation process as the sites were automatically exported because the lead author had inserted them into WALIS. We have removed these sites from the newest version of the database.

3 Minor Comments (Manuscript)

Line 91: strange phrasing, unclear what you mean by “. . .external irreproducibility that can be puzzling high. . .". Please clarify and consider rephrasing.

This sentence has been removed for better flow within the paragraph.

Line 212: can you explain the discrepancy between the elevation reported in the original publication (i.e., + 10 m) and that given in your database? This just needs a few words of clarification as to why the community should use your revised elevation for this indicator.

The point at Zengueleme is a Terrestrial limiting point and its elevation is not explicitly stated in Armitage et al. (2006). We have therefore deduced the approximate elevation of from the depth of the sample and the elevation of the dune. This uncertainty is reflected by the elevation uncertainty of $\pm$ 5 m.

Line 141: terraced near Merka – is this thought to be of Last Interglacial age? What's its elevation, and reference for the stud- Carbone and Accordi (2000)? Please clarify.

We have adjusted the text to better clarify that the Merka terrace elevation and age are in the database as WALIS ID# 351.

> Approximately 65 km down the coast from Mogadishu, near the small city of Merka,Carbone and Accordi (2000) describe a sheltered, well-developed reef with massive corals in growth position. We calculated PRSL of +6.4 $\pm$ 1.5 m and a correlated age to the terraces to the north of between 105 and 131 ka (WALIS ID# 351).

Line 184: fix the "(missing citation)" in the text.

We have added the correct citation reference.

Lines 192-3: not sure I follow the logic of this sentence about erosion surface age and erosion rates now and during the Last Interglacial – could you clarify, please.

We have modified the text to more clearly highlight erosion rates are too low for the terrace to be of Holocene age.

> Arthurton et al. (1999) argues that the erosional surface of the marine terrace is of late-MIS 5 age because necessary erosion rates for the terrace to be of Holocene age far outpace the observed modern rates on Zanzibar as well as the lack of geological evidence for rapid sea-cliff retreat (i.e. talus deposits).

Lines 220 to 222: remove "slight" from "slight issues", and insert "of the age" to "underestimation of the age of the aeolianite sedimentation". Is the inference here that the notch is therefore older than MIS 5e? Please clarify.

We have followed the Reviewer's recommendation to remove slight as well as adjust the text to highlight the issues in regards to the OSL age and the 2-σ value reported.

> This gives a maximum age constraint to the notch, and is therefore inferred to be of MIS 5 age. However, Armitage et al. (2006) indicate issues with the reliability of the OSL age, suggesting that this is possibly an underestimation of the age of the aeolianite sedimentation. This is highlighted by the 2-σ of $\pm$ 24 ka.

Lines 222: Is there any other useful information in the Hobday (1977) work – are they thought to be Last Interglaical? What elevation?

We have added additional reference to information provided by Hobday (1977) however there is not enough information to include this information as PRSL indicators within the database.

Line 320: add age given in Veeh (especially as there is only one)

The PRSL indicator from Veeh (1966) was stated in the following sentence. We have modified the text for better flow.

> The morphological description of the reefs was accompanied by one U-Series Alpha-Spectrometry age from Veeh (1966). This index stands between +1.5 and +2 m MSL, representing a PRSL of 3.1 $\pm$ 2.3 m at 110 $\pm$ 40 ka (VE66-012-001, WALIS ID# 427; Table 4).

Line 364: note, a fall in sea level was also suggested by Israelson and Wolfarth, (1999). Figure 2 caption: granitic does not need to be capitalized.

We have not included Israelson and Wohlfarth (1999) within this section because they do not reference fluctuations during MIS 5e rather only a single peak followed by a fall. We have, however, added some additional mentions of fluctuations even though they are poorly constrained.

> Sea-level fluctuations during the LIG, subsequent rises and falls within MIS 5, have been alluded to by several studies in the EAWIO region. For example Montaggioni and Hoang (1988), argue for two peaks, one between 139-133 ka and another at about 123 ka based on the distribution of their U-Series Alpha-Spectrometry ages across the granitic Seychelles. Brook et al. (1996) also identify apparent fluctuations in LIG sea level. Both the 8 m terrace and 16 m terrace they identified along the northern coast of Somalia (Section 3.1.1) are both most likely from the LIG. Here, there is stratigraphic evidence that regression occurred following the formation of the 16 m terrace before the 8 m terrace incised this alluvial unit. However, the magnitude of this fluctuation is overshadowed by two caveats: this coastal region is tectonically active and the 16 m terrace age is base on one sample (BK96-009-001, WALIS ID# 702) that Brook et al. (1996) call, “extremely questionable."
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> It has not been until recently that surveying methodology and chronological constraints have achieved an accuracy that enables the documentation of such fluctuations. Vyverberg et al. (2018) conducted a multidisciplinary investigation of the Seychelles record of Dutton et al. (2015). Across multiple outcrops around the main islands, reef growth is interrupted by discontinuities within the paleo record. Vyverberg et al. (2018) argue that this interruption in coral growth is the possible result of subaerial exposure during a fall in sea level or a still stand. Braithwaite (2020) revisited Braithwaite et al. (1973) and describes evidence of variations in sea level during the LIG on Aldabra. However, both studies conclude that higher resolution dating is needed in order to confirm this hypothesis.

4 Main Comments (Data)

Missing values: A considerable number of the fields are blank, including the basic site descriptions (“Nation”, “Region”) – is this because this data doesn’t exist (e.g., % calcite determinations for the U-series ages), not applicable (e.g., uplift rates for stable locations), or incomplete data entry (e.g., blank “indicator descriptions” in the “RSL proxies” sheet, “Screening”, “Location” ,“Site” in the “U-series (corals)” sheet). For users, it’s vital to know which of these (not exist, not applicable, incomplete) these blanks are, especially as it could have an impact on how data is ‘seen’ for subsequent data analysis (e.g., training and validation in machine learning in R, Python etc.). As the author of this compilation, end users will rely on you to be clear as to whether these blanks are meaningful (rather than just incomplete data entry) and to stipulate what that meaning is. Please consider this carefully (sentinel i.e., -9999 or masking i.e., none, null – missing data or NA – not available, and NaN – not a number, recognized by most systems - might help but would need to be documented somewhere – project schema perhaps?), AND address those that arise from incomplete data entry (location, tectonic setting etc.).

We agree that this as a very important point and have amended the database to reflect whether information is not available (NA) or not reported. In some instances, though, the database structure does not allow inserting text values (e.g., where numerical values are necessary.) Thus, every blank cell in the database will have to be treated as NA. A. Rovere made a note to highlight this point in the final editorial that will describe the database.

(Re)calculated ages?: (see also previous comments) within the database, it is apparent (only after some digging) that some of the ages have been recalculated and others not (no information given in the manuscript); there is a mix of originally reported ages (some of which are detrital Th, or open system corrected) and recalculated (closed system?) ages. This inconsistency is confusing to the user, especially as this is not dealt with in sufficient detail in the accompanying manuscript. At the moment, non- specialists would find it difficult to decipher which age to use (and how reliable that age is) from the various sheets in the spreadsheet (even in the "Summary of RSL datapoints" it's unclear). Similarly for the age reliability (see comments above), there is a very opaque mention of a "flexible protocol" in the "Screening" column of the "RSL from a single coral" sheet of the database but no details as to what this refers to. Please clarify.

We have added a brief overview of U-Series dating within the methodology of the manuscript, including the difference between open- and closed-systems, as well as throughout the text added whether stated ages are recalculated or open-/closed-system ages. Also, we have added an explanation of the "flexible protocol" used in Dutton et al. (2015).

> Early observations of paleo-shorelines relied primarily on chronostratigraphic constraints to try and piece together a regional narrative. Two formations are primarily used in early studies: the Aldabra Limestone (Aldabra, Seychelles) and the Karimbolian Limestone (Antsiranana, Madagascar). The Aldabra Limestone is characterized by reef limestones with large corals in growth position. Similarly, the Karimbolian Limestone, first described by Guilcher (1956), refers to massive reefs overlain by red aeolianites. Both of these formations have since been chronologically constrained using U-Series Alpha-spectrometry (Thomson and Walton (1972) and Battistini and Cremers (1972) respectively).
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> As with elevation measurement techniques, dating techniques within the EAWIO have advanced dramatically since the first chronologies became available in the early 1960s, thanks to U-Series ages from coral samples (Barnes et al., 1956; Thurber et al., 1965). In general terms, U-Series ages are derived by measuring the disequilibria between ^{238}U, ^{234}U, and ^{230}Th radioisotopes (Edwards et al., 2003). The reliability of ^{230}Th-ages relies on a closed-system behavior that can be compromised by post-depositional processes that lead a re-mobilization of uranium –or thorium- within the coral skeleton. Several mineralogical and isotopic screening criteria are generally applied to detect any opening of the ^{230}Th-^{234}-^{238}U system. The coral samples should show no evidence of diagenetic alterations such as recrystallization or transformation of primary aragonite to secondary calcite. This is generally assessed by quantification of secondary calcite. In most recent studies, coral samples showing a calcite content of more than 1% are usually discarded. The uranium content of fossil corals should ordinarily be similar to modern ones (about 2.8 ppm). The back-calculated [^{234}U/^{238}U]$_0$ ratio that represents the [^{234}U/^{238}U] ratio at the time of coral growth should reflect the [^{234}U /^{238}U] of seawater. Due to the long oceanic residence time of uranium,

this ratio is supposed to be similar to the modern seawater. For this reason, fossil corals showing a [$^{234}U/^{238}U]_0$ significantly different from modern seawater were generally discarded (Hamelin et al., 1991; Bard et al., 1991). This isotopic criterion is not always strictly applied since 1) there are many evidences that the [$^{234}U/^{238}U$] ratio of seawater may have varied through time (see discussion in Chutcharavan et al., 2018) and 2) some models, assuming decay-dependent redistribution of ^{234}Th and ^{230}Th were developed to correct for the "open-system" behavior highlighted by anomalous [$^{234}U/^{238}U]_0$ ratios (Thompson et al., 2003; Villemant and Feuillet, 2003). Although these open-system ages are questionable, some of the ages reported here are calculated using such model (Thompson et al., 2003). Here, we state whether if ages were originally reported as closed- or open-systems. It is important to note that the application of the screening criteria presented here are quite recent and that most of the studies reported in this review were carried out before these criteria became common practice in the U-Th community.

Precision of U-Series ages relies upon the analytical method used to measure the isotopic ratios of the sample. U-Series Alpha-spectrometry dating was the first utilization of ^{238}U decay, detecting and counting the ejected alpha particles. The counting statistics are on the order of a few precents of the $^{230}Th/^{238}U$ ratio, resulting in a best-case 2σ internal errors of ± 10 ka for an age ranging between 70 ka and 150 ka and more often than not 2σ internal errors closer to ± 20 ka (Broecker and Thurber, 1965; Thurber et al., 1965). Therefore, the majority of early chronologies within the EAWIO have limited accuracy, and can only be generally assigned to one Marine Isotope Stage. It was not until the 1990s that mass-spectrometry, particularly thermal ionization mass spectrometry (TIMS, Edwards et al., 1987, 2003), began to bring down the 2σ error allowing MIS sub-stage discernibility. Additional advancements such as multi-collector inductively coupled plasma mass spectrometry (MC-ICPMS) have brought the 2σ uncertainties under ideal conditions down to ± 100 a at 130 ka (Cheng et al., 2013). Besides biogenic carbonates, two terrestrial limiting chronologies from lithified dunes were established through the use of Luminescence (OSL). All uncertainties are stated at 2σ and, when needed, they have been converted from the 1σ values reported in the original papers.

You need to be very careful on this point to ensure the utility of your compiled dataset, and reduce the potential for confusion (particularly for non-specialists). One way in which you could deal with these concerns is to include within your "read me" sheet, or as a separate sheet or appendix to the manuscript, a table which describes in detail all the fields within the database..? That way, this becomes a stand-alone piece of work that has enough detail, without burdening the non-specialist with unnecessary detail.

A "wiki-style" page for the WALIS interface is available for download, we have added the url for this page in the about section on the Zenodo (database host) page for the database for easier reference.

You might consider some ranking system for the reliability of the indicator (cf. Shennan), and this is what you seem to have in the "AK" and "AL" columns of the "Summary" sheet, but why is the data entry incomplete? Where is the information on these criteria (no mention in the datafile, nor the manuscript)? End users currently have no idea what the numbers (the scale *is hidden in a footnote of table 4) in these fields relate to. This needs addressing. Is there some over-arching schema from the WALIS project that can be referenced here and in the manuscript (ditto age recalculation)? If not, it might be worth considering producing one given that it would provide a permanent object (DOI?) to which you could refer in subsequent publications.*

We have provided the evaluation/quality control guidelines within out manuscript as exported from WALIS (see above, Tables 1 and 2

Consider adding a "tectonic setting" field to the summary (see comments in section above). This is vital information, and it was excruciating to have to flick between the various sheets to find the info, and even then it was largely missing (i.e., incomplete data entry) in the "RSL proxies" sheet. Please complete the data fields and consider adding this field to your summary.

While we agree with the overall idea of this point, in conversation with the WALIS team we have decided to not change columns within the database export so that all database exports within the special issue are of the same format. Nevertheless, see our additional text provided on tectonics.

Some language may be unclear for non-native English speakers, for example, "sketchy" (I grasp what you are driving at, but there is also an implicit value judgment) in elevation comments. Consider revising to e.g., "uncertain" or "unclear"

We have looked throughout the text and addressed the colloquial English language to suit a more international audience.

References

Armitage, S. J., Botha, G. A., Duller, G. A. T., Wintle, A. G., Rebêlo, L. P., and Momade, F. J.: The formation and evolution of the barrier islands of Inhaca and Bazaruto, Mozambique, Geomorphology, 82, 295–308, 2006.

Arthurton, R., Brampton, A., Kaaya, C., and Mohamed, S.: Late Quaternary coastal stratigraphy on a platform-fringed tropical coast: a case study from Zanzibar, Tanzania, Journal of Coastal Research, pp. 635–644, 1999.

Ayling, B. F., Eggins, S., McCulloch, M. T., Chappell, J., Grün, R., and Mortimer, G.: Uranium uptake history, open-system behaviour and uranium-series ages of fossil Tridacna gigas from Huon Peninsula, Papua New Guinea, Geochimica et Cosmochimica Acta, 213, 475–501, 2017.

Bard, E., Fairbanks, R. G., Hamelin, B., Zindler, A., and Hoang, C. T.: Uranium-234 anomalies in corals older than 150,000 years, Geochimica et Cosmochimica Acta, 55, 2385–2390, 1991.

Barnes, J., Lang, E., and Potratz, H.: Ratio of ionium to uranium in coral limestone, Science, 124, 175–176, 1956.

Battistini, R. and Cremers, G.: Geomorphology and vegetation of Iles Glorieuses, Atoll Research Bulletin, 1972.

Braithwaite, C.: Last Interglacial changes in sea level on Aldabra, western Indian Ocean, Sedimentology, 2020.

Braithwaite, C. J., Taylor, J., and Kennedy, W. J.: The evolution of an atoll: the depositional and erosional history of Aldabra, Philosophical Transactions of the Royal Society of London., Biological Sciences, 266, 307–340, 1973.

Broecker, W. S. and Thurber, D. L.: Uranium-Series Dating of Corals and Oolites from Bahaman and Florida Key Limestones, Science, 149, 58–60, https://doi.org/10.1126/science.149.3679.58, https://science.sciencemag.org/content/149/3679/58, 1965.

Brook, G. A., Cowart, J. B., and Ford, D. C.: Raised Marine Terraces Along the Gulf of Aden Coast of Somalia, Physical Geography, 17, 297–312, 1996.

Carbone, F. and Accordi, G.: The Indian Ocean Coast of Somalia, Marine Pollution Bulletin, 41, 141–159, 2000.

Cheng, H., Lawrence Edwards, R., Shen, C.-C., Polyak, V. J., Asmerom, Y., Woodhead, J., Hellstrom, J., Wang, Y., Kong, X., Spötl, C., Wang, X., and Calvin Alexander, E.: Improvements in 230Th dating, 230Th and 234U half-life values, and U–Th isotopic measurements by multi-collector inductively coupled plasma mass spectrometry, Earth and Planetary Science Letters, 371-372, 82–91, 2013.

Chutcharavan, P. M. and Dutton, A.: A Global Compilation of U-series Dated Fossil Coral Sea-level Indicators for the Last Interglacial Period (MIS 5e), Earth System Science Data Discussions, pp. 1–41, 2020.

Chutcharavan, P. M., Dutton, A., and Ellwood, M. J.: Seawater 234U/238U recorded by modern and fossil corals, Geochimica et Cosmochimica Acta, 224, 1–17, 2018.

Dutton, A., Webster, J. M., Zwartz, D., Lambeck, K., and Wohlfarth, B.: Tropical tales of polar ice: evidence of Last Interglacial polar ice sheet retreat recorded by fossil reefs of the granitic Seychelles islands, Quaternary Science Reviews, 107, 182–196, 2015.

Edwards, L. R., Chen, J. H., and Wasserburg, G. J.: 238U-234U-230Th-232Th Systematics and the Precise Measurement of Time Over the Past 500,000 Years, Earth and Planetary Science Letters, 81, 175–192, 1987.

Edwards, L. R., Gallup, C. D., and Cheng, H.: Uranium-series dating of marine and lacustrine carbonates, Reviews in Mineralogy and Geochemistry, 52, 363–405, 2003.

Guilcher, A.: Etude géomorphologique des récifs coralliens du Nord-Ouest de Madagascar, Ann. Inst. Oceanogr. (Paris), 33, 65–136, 1956.

Hamelin, B., Bard, E., Zindler, A., and Fairbanks, R. G.: 234U/238U mass spectrometry of corals: How accurate is the UTh age of the last interglacial period?, Earth and Planetary Science Letters, 106, 169–180, 1991.

Hobday, D.: Late Quaternary sedimentary history of Inhaca Island, Mozambique, South African Journal of Geology, 80, 183–191, 1977.

Israelson, C. and Wohlfarth, B.: Timing of the Last-Interglacial High Sea Level on the Seychelles Islands, Indian Ocean, Quaternary Research, 51, 306–316, 1999.

Montaggioni, L. F. and Hoang, C.: The last interglacial high sea level in the granitic Seychelles, Indian Ocean, Palaeogeography, Palaeoclimatology, Palaeoecology, 64, 79–91, 1988.

Rovere, A., Ryan, D., Murray-Wallace, C., Simms, A., Vacchi, M., Dutton, A., Lorscheid, T., Chutcharavan, P., Brill, D., Bartz, M., Jankowski, N., Mueller, D., Cohen, K., and Gowan, E.: Descriptions of database fields for the World Atlas of Last Interglacial Shorelines (WALIS), 2020.

Stamps, D. S., Calais, E., Saria, E., Hartnady, C., Nocquet, J.-M., Ebinger, C. J., and Fernandes, R. M.: A kinematic model for the East African Rift, Geophysical Research Letters, 35, https://doi.org/https://doi.org/10.1029/2007GL032781, https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2007GL032781, 2008.

Thompson, W. G., Spiegelman, M. W., Goldstein, S. L., and Speed, R. C.: An open-system model for U-series age determinations of fossil corals, Earth and Planetary Science Letters, 210, 365–381, https://doi.org/https://doi.org/10.1016/S0012-821X(03)00121-3, http://www.sciencedirect.com/science/article/pii/S0012821X03001213, 2003.

Thomson, J. and Walton, A.: Redetermination of chronology of Aldabra Atoll by 230 Th/234 U dating, Nature, 240, 145–146, 1972.

Thurber, D. L., Broecker, W. S., Blanchard, R. L., and Potratz, H. A.: Uranium-series ages of Pacific atoll coral, Science, 149, 55–58, 1965.

Veeh, H. H.: Th230/U238 and U234/U238 ages of Pleistocene high sea level stand, Journal of Geophysical Research, 71, 3379–3386, 1966.

Villemant, B. and Feuillet, N.: Dating open systems by the 238U–234U–230Th method: application to Quaternary reef terraces, Earth and Planetary Science Letters, 210, 105–118, 2003.

Vyverberg, K., Dechnik, B., Dutton, A., Webster, J. M., Zwartz, D., and Portell, R. W.: Episodic reef growth in the granitic Seychelles during the Last Interglacial: implications for polar ice sheet dynamics, Marine Geology, 399, 170–187, 2018.