Summary: This manuscript contributes a reconstruction of paleo sea-level position at 24 points in time throughout the mid to late Holocene. Authors interpret the new sea-level index points from the age, elevation, and paleo-water depth interpretation of fossil fringing reefs across SE Sulawesi near Makassar, Indonesia. In contrast to other coral-based reconstructions of past sea-level changes, but in keeping with other Holocene reconstructions from the SW Pacific (e.g. Hallmann et al., 2018), authors evaluate fossil reef growth in a fascinating morphology – microatolls – highlighting the potential for reconstructing past sea-level in great detail using this approach. Additionally, authors combine new data with previous data from two other islands near Makassar (recalculated results of three previous studies to directly compare them), which demonstrate higher-than-present relative (local) sea-level (RSL) during the late Holocene.

Results and methods described here underscore the importance of evaluating fossil microatolls in the context of nearby living microatolls. Authors directly compare the elevations of fossil microatolls with their modern counterparts to evaluate the relationship between highest living coral (HLC) and the tidal cycle. Similar to previous works, this study finds that this relationship varies greatly on small spatial scales. To reconstruct paleo sea-level from fossil microatoll elevation requires the assumption that the relationship between HLC and the tidal cycle at that site has remained the same since the microatoll formed. Wisely, this study does not attempt to “connect the dots” and provide an RSL curve, but instead provides sea-level index points that can be compared with other Holocene RSL reconstructions and RSL predictions from GIA modeling. The results of this work contribute to scientific progress within the scope of Climate of the Past because they include reconstructions of past climate based on proxy data from a marine archive. Additionally, the data-model comparison may serve as motivation to identify GIA model parameters that accurately reconstruct Holocene sea-level data, and which may be applied to reconcile current sea-level trends and to improve model predictions of future sea-level changes. New paleo-observations of RSL provide critical constraints for models of future sea-level and ice-sheet behavior and the response of the solid earth to that behavior in a warming world.

I appreciate that the authors acknowledge that ages and elevations determined for fossil reefs – even microatolls with the potential for <1m vertical uncertainty – cannot be considered in isolation and directly translated into RSL. Instead, to constrain various sources of age and elevation uncertainty, post-depositional vertical land motion due to regional tectonism or GIA effects, local hydrography and oceanographic factors are considered prior to interpreting sea-level. Authors illustrate the importance of evaluating microatolls in the context of modern analogues to reference elevations to a tidal datum and place them in a precise sea-level reference frame. While they employ GIA modeling to consider the GIA signal in this region, they ultimately do not remove the GIA contribution from sea-level index points to estimate the glacio-eustatic contribution to sea-level. A strength of this manuscript is the transparent explanation of uncertainty calculations.

Overall, authors do not clearly define the main impetus for this work nor do they offer specific insight into future research directions, implications of results for the Holocene sea-level history beyond the Spermonde Archipelago. It is not clear until the conclusion that the purpose of the GIA model-data comparison is not to identify glacio-eustatic contributions to late Holocene sea-level nor to investigate the evolution of late Holocene sea-level but to identify a best-fitting GIA model that could be used to refine predictions of current and future sea-level trends. A best-fitting model is ultimately not identified, nor are future directions. I therefore recommend major revisions to this manuscript to improve clarity.

Introduction:

The introduction does not establish why it is important to reconstruct sea-level changes during the Holocene, a time of transition between glacial and interglacial climates, nor does it emphasize why SE Sulawesi was selected for analysis, the power of microatolls as a proxy for past sea-level position on multiple timescales, and why evaluating data in the context of GIA model reconstructions of past sea-level is critical to evaluating global mean sea-level from local sea-level reconstructions in the past and the present.
While the sea-level index points are combined with 3 previous studies from the vicinity of Makassar, there is no discussion of the results in the context of Late Holocene sea-level reconstructions from SE Asia and the South Pacific (e.g. Hallmann, 2018), or other Holocene SL reconstructions derived from microatolls. How do RSL results compare with other reconstructions and what are the limitations of the previous works? As written, it does not seem to be anchored to a clear history of previous work (regional, global, Holocene) for readers to critically evaluate the importance and significance of the results that it presents, nor is it framed as novel or distinct form previous work in terms of its methods, study site, etc other than the introduction of new index points and extensive GIA modeling.

I would restructure the first 75% of the introduction as follows:

1. Statement on importance of reconstructing Holocene ice-sheet and sea-level response to an interglacial climate. Succinctly state why this is relevant to accurately and precisely predicting timing and rates of future ice-sheet and sea-level response to the present warming climate. Why are you presenting new Late Holocene sea-level data and GIA models?
2. Briefly, describe state of knowledge from far-field, Indo-Pacific Holocene sea-level reconstructions – any trends or outstanding questions. Why are far-field records important? How you reconstruct sea-level index points using microatolls and what are their advantages/disadvantages relative to other sea-level indicators?
3. How do you expect GIA to influence local sea-level histories in this region and why it is necessary to correct local sea-level histories for the influence of GIA and vertical land motion due to tectonism in ordered to evaluate glacio-eustatic sea-level changes? As you already mention in the introduction, determining rates of subsidence/uplift due to regional tectonics by accurately estimating past sea-level is a circular problem discussed at length in Creveling et al. (2015). *
4. Why was SE Sulawesi selected for analysis and what steps did you take (as written) to generate an accurate RSL reconstruction?

Definitions: In the intro, define terms such as relative (local) sea-level (RSL) (Line 49), and what you mean by “eustatic” sea-level (Line 45 vs 50). On Line 45, you describe “globally averaged” sea-level, or GMSL (which is includes contributions from thermal expansion and changes in global ice-volume), but elsewhere (e.g. Line 50) you use “eustatic” to describe “glacio-eustatic” or “ice-equivalent” changes in sea-level in response to transfer of mass between ice and ocean (Mitrovica and Milne, 2002; Milne, 2015 *Handbook of Sea-level Research*, citations therein). It is my understanding that all three of the phenomena listed in Lines 51-54 to explain the common observation that far-field sea-level reconstructions record a mid-Holocene highstand fall under the definition of GIA (see concise explanation of equatorial syphoning/GIA trends and citations in Dutton et al, 2015 *Science* in addition to Kopp et al., 2015, Mitrovica and Milne 2002, Milne and Mitrovica 2008, etc.). GIA processes include deformational, gravitational and rotational effects driven by the transfer of mass between ice and ocean that can cause local RSL changes to depart significantly from the GMSL curve or the response of the solid Earth and gravity field to the climate-driven surface ice- water mass redistribution (Milne and Shennan, 2013). Syphoning, changes in gravity due to surface ice-water mass redistribution and solid Earth deformation are all driven by GIA.

Minor points:
Line 44: I think that sections must be numbered. https://www.climate-of-the-past.net/for_authors/manuscript_preparation.html
Line 56: You repeat the definition of the RSL acronym again.
Line 65: To reconstruct paleo RSL, we **measured the age and elevation of microatolls,** ie…Line 71: fossil ones, that we **surveyed and** dated using radiocarbon.

Methods:
Lines 119 – 131: A conceptual figure or a reference to one may be useful here to visualize how microatolls are used as a proxy and linked to tidal datums, indicative range, etc. in this study.
Line 124: Please be more specific about what you mean by "extended periods of time" perhaps relative to the growth rate of the coral?
Line 130: Please be specific about what you mean by short-term sea-level fluctuations.
Line 140 – 141. This is an important point.
Line 141: Clarify your definition of indicative meaning.
Lines 117-141 General comment: Methods are clearly outlined. Assumptions made in using microatolls to reconstruct sea-level are not (e.g. as referenced in McLean et al., 1978). What assumptions go into assigning a reference water level to the coral's highest level of survival? Is the relationship between microatoll elevation and tidal cycle the same over time and across areas of the reef? Are all microatolls morphologically similar here and why is this a good field site?
Line 143: FMA's and LMA heights are the maximum (peak) height of the microatoll, correct? Or is it the average elevation surveyed across the top of the microatoll?
Line 167: Replace reducing with relating.
Line 177: How far away were these islands? Did you consider potential variations in the height of the geoid as per Woodroffe et al. (2012)?
Lines 204-222: Please explain further in the section on sampling and dating what kinds of samples you selected (slice of the microatoll? Hand samples?) and where you sampled from on the microatoll (the highest point on the microatoll or across it?). In general, how did you assign a radiocarbon age to a microatoll? Was there one date per microatoll or did you measure multiple dates to interpret an age (see distinction for U-series in Dutton et al., 2017)? Additionally, please clarify what diagenetic screening you employed when analyzing coral preservation in advance of radiocarbon dating and **report your XRD results (see more on XRD reporting in Vyverberg et al., 2018).** This information may also be useful in light of the documented erosion for most fossil microatolls in this study. Clarify your reference age for (a BP) – is the present defined as 1950 CE?

Line 223: Please clarify here or in methods why you are predicting RSL with GIA modeling. Later, in the discussion, perhaps touch on the following: *Do you intend to convert RSL to

GMSL via the extraction of the GIA signal at this location? Can any inferences of GMSL be made here? What steps would be needed to determine GMSL from your RSL results, and what are the challenges faced in converting RSL to GMSL via the extraction of the GIA signal at this location? Why don't you attempt to remove the GIA signal - provide clarification (e.g. further discussing implications of Fig. 11) as to why not. Elaborate on why evaluating GIA matters for Holocene/modern sea-level reconstructions and what the limitations to evaluating the GIA signal are here or in general.

Results:

Line 240: I see now that these are average radiocarbon ages as opposed to raw dates. I would clarify how many samples (dates) were analyzed to determine an age and how that data was evaluated for diagenetic alteration.

Line 178, 248, 551: Please revise phrasing of "For which concerns" to "concerning …"

Line 240: **Table 2:** Following the equation on line 172, RSL estimates in Table 2 appear to be off by ~ 0.01 – 0.02 m. (ex – PS_FMA1 Suranti: RSL = -1.46 – (-0.74) + 0.2 = -0.52 m. In Table 2 it is reported as -0.53 m and using the numbers in Sheet 9 of SM1 RSL = -0.54 m. The excel sheet reads -0.53m using whatever rounding rules were applied in excel and the data correction of +0.014m. Furthermore, the Reference Water Level reported in SM1 is not always comparable to that reported in Table 2. For Suranti and Tambakulu it is as -0.72 m in SM1 but reported as -0.74 in Table 2. Please address rounding and reporting discrepancies.

Table 3: Why is erosion error not included in Table 3, when it is included in SM1 Sheet 4 for FMA8 – 11 (Panambungan)? The erosion factor seems to be incorporated into RSL for those points in Table 3; without it the RSL values calculated in Table 3 are lower by 0.2m.

Discussion:

Line 318: Please clarify by how much HLC changes instead of "HLC changes substantially."

Line 345: I would mention what "sea-level data" refers to. It is only mentioned in the caption of Figure 7 that the earlier works used different sea-level proxies.

Line 349: Be careful about the use of "significantly" here and throughout. Is the difference statistically significant?

Line 358: I would elaborate on the differences between the proxies used in these different studies. How does the precision vary between them? Looking at the uncertainty bars in figure 3, the De Klerk and Tjia sea-level index points tend to be higher than those reported in Mann and this study, but they are also less precise. Several points from this study/Mann fall within the bounds of vertical error for points from De Klerk and Tjia.

Line 368: What additional data would need to be explored to evaluate the tectonics hypothesis?

Line 373: Are the De Klerk coral data collected from coral in growth position? (in situ)

Lines 519 – 560. It is to be expected that there is a range of highstand predictions that vary in space and time depending on GIA model ice and earth parameters, and it is clear that the fit between predicted and observed RSL also varies depending on the GIA model parameters as well as the assumed tectonic history. Is the main takeaway that the ICE5g model is not a good fit because, regardless of the tectonic history, the peak highstand predicted by ICE5g does not match the peak in the observed RSL data? What is the main outcome of this data-model comparison, or what steps can be taken to better compare them in future studies? The purpose of this comparison was not clearly defined in the first place, though the importance of identifying

GIA models that best fit Late Holocene data to improving model predictions of current and future sea-level changes is explained on line 553.

How does the choice of GIA model affect the interpretation of RSL index points made in this study? What can the reader conclude about late Holocene sea-level form the data-model comparison described in these latter sections and the earlier comparison of data between this and previous RSL reconstructions? See previous comments on line 223 regarding inferences of GMSL at this location. The discussion of Late Holocene RSL and Fig. 12 seemed to end abruptly. Please elaborate on why the results in Fig. 12 are widely relevant to modern sea-level estimates.

Line 572: Specify a gradient in elevation

Figures:

General comment: All figures have simple and elegant layouts. Fonts are legible and colors are clear. Sections are clearly marked and figures are overall helpful and easy to follow.

Figure 1: in 1b, I would not combine red and green-colored dots to make the figure accessible to color-blind readers. Perhaps try a dark boarder to yellow dots in c – i to make them more legible.

Figure 3a: Have you tried making the symbols slightly different between datapoints from this study and from Mann? As mentioned earlier do not include red/green together.

Figure 4a: I would identify the sites analyzed in this study with a (*) next to the name. Specify in the caption at least once that you mean individual microatolls instead of “individuals.”

Figure 5: Change Red/Green combination.

Figure 11: Change Red/Green combination. The four boxes in this figure are missing panel letters (a – d).

Figure 12: I would mark the position of the Spermonde Archipelago on the map for reference.