

## Point-by-point reply reviewer 1

Very positive about this product! Remarkable compilation addressing a most-urgent topic. I will definitely recommend for publication in ESSD but I need to recommend changes that, in my estimation, strengthen and clarify the manuscript for many readers. Apologies for long list. First, I address cross-cutting issues. Later, I address technical changes in each section.

We would like to gratefully thank the reviewer for the comments, and the time allocated to provide specific recommendations to help improving the manuscript, and below we provide a point-by-point reply to each of the comments.

- 1.) Manuscript seems way too long. 1330 lines from start of title to end of acknowledgements/ financials in this version, compared to 1150 in previous version (von Schuckmann et al. 2020). Nearly 16% increase? Not good for authors nor for ESSD. We might expect a percent or two, from additional relevant materials, but offset substantially by the fact that authors will not need to repeat here what they already described (in detail) in previous version. Many specific comments related to length follow but - overall - possible to easily reduce by > 20%? Readers do not want or need to wander through so much material. We want crisp sharp accurate restatement and update of EEI! Tricky balancing act: you want this one to stand alone, conveying accurate info for any new reader, but you also want to not repeat here background material from v1. See several shortening suggestions under technical comments.

Thank you very much for this recommendation. Indeed, we need to improve the balancing act between a 'stand-alone' manuscript, and the objective for regular update on the Earth heat inventory. A major reason for the increase in length as compared to the first publication is the strengthened collaboration (we have increased the list of expertise), and the new additions we did not cover in the previous analysis (e.g., permafrost, inland water storage). However, we agree with the reviewer's point made on this aspect, and we will follow suggestions by the reviewer as replied also below. We hope that we could with this revision sharpen the messaging, and manuscript.

- 2.) For this reader, way too much GCOS advocacy! I write as a big fan of GCOS, recognizing that WMO dismissed or chased away good people. I endorse every concern about GCOS, but these concerns do not belong in ESSD! One strategy: mention (one sentence) relevant ECVs in each land, ocean, ice, atmosphere section, then summarize concerns in sentence or two of conclusions/recommendations? At a minimum, and assuming time is short, end with a clear simple sentence of concern?

Thank you for the comment. We will sharpen the message for the framework aspect, but we also want to highlight that this activity is endorsed under GCOS, which is a critical aspect of maintaining and soliciting (non-funded) international expertise on this one specific topic. We hope that with the proposed changes we could balance our needs, and adequately replies to the reviewers comment.

- 3.) Likewise, for this reader, way too much IPCC content? Readers will know (will have participated in) AR5 or AR6 or both, plus SR. EEI stands on its own! IPCC will cite it, not the other way around. Use IPCC citations sparingly, remove all IPCC quotes. These do not contribute to crisp sharp update of EEI.

The IPCC quotes have been now removed.

4.) Settle on standard common definitions of time periods.

We would like to thank the reviewer for having spotted this issue, and please find below specific replies, and at the end a synthesis of further revisions to meet this comment.

- Confusion begins in abstract (line 90: 2006-2020 does not constitute a decade), Reworded to ‘most recent period’.

- continues around line 157 (here you bounce between 1971-2018 and 2010-2018),

Not relevant anymore, removed from introduction now.

- emerges again at line 315 (era of Argo floats starts in 2000 but references not until 2016 or 2019?),

Comment not clear, can you please precise ?

- again at line 340 (near-global coverage of Argo floats by 2005 but you already said this slightly differently at lines 318, 319),

Yes, this is important, w state both, 2005 and 2006 – this is to explain why we start in 2006 – best available observing system. Precisely explained later in the text, and in the figure caption.

- at line 391 (legend to Fig 3 where you define 1960-2020 as historical, 1993-2020 as altimeter, and 2006-2020 as recent [= Argo?]),

Yes, this are the periods we use for the heat content estimate, and the legend clarifies that 2006 is the golden Argo era.

- likewise and expanded at line 412),
- at line 421 (25 years for historical [!?!?] and altimetric and 15 years [not = decadal!] for Argo), at line 453 (Table 1, in which 1971-2020 emerges again),

The 25 year are linked to the bandwidth of the LOWESS approach, not the actual time period.

- at lines 482 and 490 (introduces 1990 as boundary for deep OHC except at line 495 you use 1993),

Thank you, and we have corrected this 1990.

- at line 512 atmosphere (now using 1980 to 2020),

Note that this is not yet a discussion of the atmospheric datasets used; it is a sentence as part of the introductory paragraphs of the atmosphere section 3 that reports on other published results which refer to this period.

- line 561 (still AHC, now back-extended 1980 to 1960),

This first paragraph to the dataset subsection 3.2 explains, as an overall intro relative to the previous von Schuckmann et al. (2020) paper, that this backward extension is needed to now achieve the improved 1960 onwards estimate, and that we now have 1960 to 2020 data.

- line 574 (talking about coverage periods of reanalysis products including specifically ERA-5), line 582 (RO and RS products 2002-2020 and 1996-2000 respectively),

Yes, these paragraphs concisely introduce the individual datasets and their timespans; in one sentence each. We consider it simplest this way (though would contribute to an overall table in a next updated energy inventory paper version), to have these dataset timespans of subsection 3.2 clearly separate from the important selected time periods that we use in the following AHC results subsection 3.3. In this results subsection, we clearly state the chosen analysis & results time periods at the very beginning, to have this clear and used it consistently over Figure 4, Figure 5 and Table 2, throughout the section (see answers to the next three comments).

- line 618 (Fig 4, all panels using 1960-2020),

See comment on line 561 above and please note that the entry sentence to this subsection 3.3 “Atmospheric heat content change since 1960 and its amplification” clearly states that the inventory shown in Figure 4 spans in total over 1960 to 2020; plus that it shows “trends for selected periods” that “align with those for ocean data” (Fig. 3 data) and available atmospheric datasets. These selected time periods used in Fig. 4 (see panel legends and trendlines shown) were then consistently used as well for the other AHC-related results highlighted in Fig. 5 and summarized in Table 2.

- line 645 (Fig 5, now using time periods 1993-2020, 2001-2020 and 2006-2020 without categorization but as anomalies from 1961-2000?),

This evaluation has been applied with respect to the atmospheric analysis for specific discussions on the evolution and change of AHC. As noted in the previous comment, the time periods are exactly the same as the ones selected for showing the exemplary trends in Fig. 4. We also note at this point that a typo in line 633 was corrected; the sentence is correctly saying now “highlighted in Figure 5 and summarized in Table 2” (rather than “in Figure 4”).

- lines 656 and following and line 672 (still for AHC, settled on 1993-2020, 2001-2020 and 2006-2020?),

See previous two comments; these time periods for Table 2 are again exactly the same as used in Fig. 5 and introduced in Fig. 4 before.

- line 718 (now referencing ERA-Interim rather than ERA-5?),

This land-related analysis of Section 4 for estimation permafrost thawing, cited from Nitzbon et al. (2022), had used ERA-Interim reanalysis data for part of its surface climate forcing over the last four decades; a work independent from the AHC estimates reported in the Section 3. The sensitivity of the land heat storage estimation results to the specific choice of atmospheric reanalysis data is very small within the estimation uncertainties, though, since the heat increase from permafrost thawing itself is of a size of 2 ZJ, less than 10% of the total estimate dominated by continental heat storage (see discussion in last paragraph of Section 4).

- line 728 (Fig 6, land [continental?] Heat content 1960-2020,

Our goal was to present time series for all components for the period 1960 onwards if possible – which is limited for some (particularly for the cryosphere).

For the wording: we use: ‘Heat to warm land’, and we use ‘continental heat storage’)

- line 790 (Fig 7, heat to melt ice, now using 1979 [first satellite measurements of sea ice?] to 2020),

Yes, as clarified in the text, this is due to measurement availability.

- at line 899 (specifying temporal coverage of satellite products 1980-2011 and 2011-2020), line 934 (total heat gain cryosphere now 1971-2020),

Yes, we are aligned with observing system availabilities.

- line 954 (total heat inventory 1971-2020 but summary Fig 8

Yes, we show what we could obtain from 1960 onwards, and as stated in the text we provide the trend values from 1971, i.e., aligned with IPCC periods.

- at line 964 clearly shows 1960-2020 and references to 1960),

We use the longest period possible for the reference period.

- line 1014 (now three periods 1985-2020, 1993-2020 and 2006-2020,

We start in 1985 only as we do not have TOA data available before. However, we have now decided to remove this figure to further avoid confusions. The results for the increase aspect of EEI will be discussed elsewhere (another publication in preparation).

- lines 1037, 1038 (now 2006-2020 represent a GCOS golden age where earlier we had those years as Argo “golden age”,

Thank you, and we move this back to ‘Argo golden age’

- lines 1089 and following (concluding at 1971-2020 and “recent era” 2006-2020),

This is the evaluation period chosen for the inventory.

- line 1130 (Fig 10 overview appropriately references in fig legend but now covering 1955-2020),

Not applicable anymore, figure removed.

- and line 1139 (excellent Fig 11 now back to 2006-2020 and 1971-2020).

Yes, core evaluation period.

Substantial effort to compile this list. We would not want to burden readers with same task, but they will need a clear summary! If composite inventory ends up covering 1971-2020 and 2006-2020, then same period should flow down to all individual components? But manuscript started with 1960-2020, 1993-2020 and 2006-2020? Authors need to provide guidance for readers to get from starting time periods to concluding time periods? Not clear at present! Given ocean dominance of global heat inventory, adopt ocean time periods throughout? However, recognizing different sources, reanalyses available for some components for some time periods, major role of satellite products for other components, etc., authors may not agree (or, have time to agree) on common time periods? If not, readers need a table or graphic somewhere to show major overlap periods. And, from abstract to conclusion, clear statement by authors of which time periods the inventory will cover and why. Even for a knowledgeable reader, this seems confusing at best. Help the readers with explicit clarification? Perhaps a time (multiple) line chart with observational emphasis periods for each component with final inventory periods super-imposed? Readers deserve some help, graphic or otherwise, to sort these multiple time periods.

Again, we would like to thank the reviewer for this support and comment. The strategy is to present for each component what is today available for each component, and to then move

ahead with one common period, which is additionally aligned with IPCC standards (e.g., 1971 onwards) on the one hand, and best available data on the other hand (from 2006 onwards). We have now established a clear statement at the bottom of the introduction, at the top of each section, and in the inventory section. Moreover, we have added a table for the cryosphere component for more clarity.

5) At many locations throughout text authors make reference to prior version; good! But (and thinking ahead) should authors in this version start a table to explicitly list and track changes/ improvements from prior version? Perhaps not so important for v2 but by v4 or v5 you would need such a list/table?

We thank the reviewer for this comment, and we agree that such a ‘living table’ for upcoming issues would be an assessed in an appendix. For this version we agree that more specific actions are needed, and hence we have added missing specifications in the final paragraph of the introduction.

### **List of technical changes / questions:**

Line 80, abstract: Rewrite this after you made / considered all other changes, including shortening and removals? Needs work .... Present confusion about rates (W/m<sup>2</sup>/decade) vs imbalance amounts. Too much advocacy, particularly wrt GCOS?

Thank you, and we have revised the abstract, considering the reviewers comments, and comments from the second reviewer. We have improved the wording so that the use of the different rates is improved, and we have removed messaging about W/m<sup>2</sup>/decade, and we have removed GCOS advocacy, and hence link to the observing system in general.

Line 90: as noted, 2006-2020 does not constitute a decade. Check punctuation marks in ‘et al.’ Mostly correct but occasionally (e.g. line 96) not.

Thanks, we have changed decade to period, and checked the punctuation throughout the document.

Line 105, Introduction: Too much IPCC and GCOS text here. Start introduction instead at line 139 or even at line 163. Good place to save space by citing v1 as much as possible/ reasonable?

Thanks, and we have followed the recommendation, and strongly cutted – we have just kept 2 sentences from the ‘GCOS paragraph’ for context.

Line 167: Forster et al reference represents your primary much-used IPCC WG1 Energy Budget chapter; you know this but readers may not. On first use of Forster citation, label it as AR6 WG1 Energy Budget paper so that, in subsequent use of Forster et al. readers will (we hope) recognize it as the WG1 reference? E.g. here (or at line 142) use ‘as itemized in energy chapter of AR6 WG1 (Forster et al., 2022)’. (Or something similar, authors will know best what they want.)

Thanks, but as we have now removed this sentence, and then the Foster ref. will appear within a list of others, it is challenging to follow the reviewers suggestion, and the link to IPCC is provided in the reference list.

Lines 189-192: Good statement, basic motivation of this product. This (or something similar) should appear in abstract?

We agree with the reviewer that this is a very important, and we have now included this statement in the abstract as well.

Line 195, Figure 1: Nice graphic but not needed, not useful, in this data description. Only four numbers here, without reference to time period. All numbers repeated multiple times in subsequent text, tables, figures. Save this one for poster or presentation? Not useful here.

We disagree with the reviewer, and do not fully follow the line of argument why this figure should be removed. Such a graphic has been developed as there had been a strong demand from a non-scientific audience, such as the science-policy interface, and makes nicely the case for the importance of the Earth heat inventory, and implications of heat accumulation in the Earth system. It provides the fully picture to introduce into the subject, which had been never published before, and we think that this figure will become an essential tool for this knowledge transfer. We hence would like to keep this graphic included. Also, it nicely underpins the multidisciplinary aspect of this inventory, and the multidisciplinary collaboration.

Line 214: Cheng et al. 2022. But, you have two Cheng et al. 2022 listed in reference, one in J. Climate and one under review at Nature. Not sure how Copernicus deals with papers in review but authors will need to specify via 2022a, 2022b?

Thank you, we have fixed that, and the paper is also now accepted.

Line 225: Permafrost warming / degradation does not only lead to ground subsidence. Might also lead to fracturing, ponding, heaves, erosion, etc. Better to say here: leads to disruptive changes in ground morphology?

The reviewer is right, permafrost thawing leads to a set of varied phenomena altering the land surface. We have included the suggested change in the new version of the manuscript.

Line 232: here you reference recent AR6 WG2 report (and cite as IPCC product). Something like this should also appear back at line 142 or 167? Need consistency in how you report AR6 chapters, e.g by author name or by IPCC chapter?

Thank you, and we follow the IPCC guide for citing the report, and to avoid further confusion, we have removed here ‘as assessed in detail in the recent IPCC Working Group II report’.

Line 239 and following: This bulleted list is new to this version. Good summary, but high redundancy with preceding text? This reader finds the list useful, so perhaps scrub overall introduction to ensure minimal redundancy with this list.

Thank you for the comment. We agree, and hence we have now removed this list, and transferred it into an opening paragraph of the conclusion.

Lines 275 to 287: Good outline! Here, add explicit note (including, perhaps, a Table) of changes from prior version (see comment #5 above)? Note that outline includes discussion of future evolution of GCOS as a topic for the end conclusions / recommendations. Appropriate here (there) as opposed to too much discussion throughout introduction.

Thanks, and as already mentioned above, we have strengthened the information on ‘what is new’ here.

Line 291 and following: A lot of this text on history of ocean observations repeats almost verbatim what you wrote already in v1. Cite that version for all historical recounting; save this version for accurate detailed summary of current best data sources? Too much credit given here to GCOS, who basically passively benefited from Argos? Better to not engage in that discussion here?

We agree, and benefitted from cutting here.

Line 302: Introducing IQuOD here, new to this version (could have been listed in change table, comment #5) but not yet a community-wide standard. Hopeful, with notable goals, but not yet widely adopted? Only at V0.1? Many other versions of ocean thermodynamic data sets in play, e.g. GLODAP (much used and cited in ESSD); CLIVAR colleagues will know this field. Present status of IQuOD not clear to this reader, not needed here? Could list IQuOD as hopeful new QC product in conclusions/recommendations? Fits in category of promotion rather than of detailed data description? Same for ocean mass data: mention in Conclusions/Recommendations as future enhancement?

According to the recommendation above this has been removed here, and is more discussed in the provided references.

Line 315: Argo represents a remarkable community technology and data achievement. Credit GCOS for establishing ocean heat ECV and for advocating open access but, technically, GCOS did not initiate Argo system? E.g Argo system web pages may reference one or two ECV but carry few or no references to GCOS? Some overlap (post-project) in personnel but otherwise independent? Much of this discussion of ocean data developments could be cited from v1, rather than reproducing here?

This comment is well taken, and we have removed large parts of this paragraph here.

Line 372: Figure 2, excellent essential graphic, Uncertainty ranges, all nominally 2-sigma, appear much larger here than in v1? Due to different (more recent) climatology: 2005-2020 rather than 2005 to 2017 used previously? With different prior climatology period, would current anomaly uncertainties grow larger or smaller? No discussion or explanation provided? Note that here reader encounters three time periods with most recent (2006-2020) called “golden Argo era” (re: comment #4 above).

For version 1, 1-sigma had been used, whereas 2-sigma has been used for version 2. This is now coherently applied to all components, as well as the inventory.

Line 419: Trend analysis using LOWESS also new to this version (again, which Cheng et al. 2022?), this change could have been listed in change table?

We have precised this now in the final paragraph of the introduction.

Line 454, Table 1: Extra significant figure(s) in many numbers of this version compared to prior version? Not consistent with wider uncertainty ranges? No explanation? A consequence of LOWESS?

As explicitly explained in the text, we have moved to another method (LOWESS) and in addition, 2-sigma levels have been used.

Line 501, Section 3: Discussion of tropospheric thickening coupled with stratospheric cooling and shrinking represents another addition to this version. Good, but would also deserve mention in a ‘changes’ table?

Yes, we have updated the introductory discussion to the atmospheric section, to cite also newer relevant results that point specifics of atmospheric warming (we have now added one more very recent result again; Ladstädter et al. Sci Rep 2023).

And as mentioned above, we do not consider to include an overall change table in this version, as this appears to be fairly difficult to coordinate and coherently introduce to the present paper at this point now, but we definitely consider this for upcoming versions.

Line 525 and following: Much of this is identical to v1 but most readers will need to have these equations and this explanation at hand. No changes.

Ok !

Line 552: ECMWF-IFS, 2015 - this reference not defined!

The reference was inadvertently missing and is included in the list of references now.

Line 560: Additional changes described here that one could / should list in a ‘changes’ table? Changes include different treatment of JRA products, different use of radiosonde and radio-occultation products, drop the MSU, etc. All positive, but list them so readers will know! AHC figure (Figure 4) much improved in this version!

See answer to Line 501 comment above.

Line 670: Strongly agree with sentiment in this paragraph but I worry about the term “at an unprecedented rate”. Unprecedented compared to what? To other components of the EEI? To undefined past time periods? Readers will need context here; I suspect you might need to change wording.

We agree that “unprecedented” should be used as the wording here only if there is a suitable (past-time context) reference. As such one is not yet available specifically for AHC (work including long-term natural variability estimations is prepared but not yet published), we toned down and changed to “has strongly increased over the recent decades.”

Line 687 and many following lines in Section 4: Readers will appreciate and eventually read and use the many Cuesta-Valero references but - for the moment - most of those references remain submitted only. I suspect, as for other publishers, Copernicus does not allow ‘submitted’ references? Although many of the Cuesta-Valero references carry delineating characters (e.g. 2002a, 2020b, etc.) in the text, the same references remain very inconsistently referenced in the formal list. Need some serious fixes here.

Thanks for pointing this out, and this is fixed now. The references provided are papers which have been developed in parallel of this study, and to support the initiative but to assure at the same time visibility of those performing in-depth and new analysis, which should be published in an individual paper, and we are very grateful that these champion authors have undertaken this work at such a short time window. So we hope that the papers will become in an accepted form before publication. For format, we use the Mendelay tool, and further editing will be performed during the draft processing period.



Line 713: “generated using various global ground datasets” not detailed enough for a data journal? You want to provide information sufficient so that readers can duplicate your outcomes,

We have included the references for the datasets in the new version of the manuscript.

Line 718: the CSIRO land modeling effort relies on ERA-Interim where elsewhere (e.g. atmosphere) authors specifically chose ERA-5. Reconcile if possible?

We are aware that using ERA-Interim is a limitation of our estimate, as ERA5 is now available. Unfortunately, we cannot change the reanalysis version and redo all the simulations to estimate permafrost degradation now, but we plan to include this upgrade in the next iteration of the collaboration.

Line 750 and following: Confusing. Outcomes here use same input data as in v1 but produce the same patterns? In next sentence, similar outcomes derive from differences in processes? Awkward at best, most readers will need revision and clarification.

What we meant here is that the lower ground heat storage reported in this analysis is compensated by the newly added permafrost heat storage and inland waters heat storage, thus obtaining a value of total continental heat storage that is similar to the value in von Schuckmann et al. (2020). We have changed the text in the new version of the manuscript to improve the clarity of this part.

Line 767 and previous: Perhaps explain the term “continental” as it differs from ‘terrestrial’? Readers may not understand the distinction and will not yet have access to Cuesta-Valero papers.

The paper explaining the estimates for continental heat storage is now available as a preprint in “Earth System Dynamics” (Cuesta-Valero et al., 2022b). In any case, we have included an explanation about the wording in the new version of the manuscript.

Line 782: Northern Hemisphere seasonal snow cover on land has a pretty good time series. Snow on ice (glaciers or sea ice) remains very difficult to quantify.

Thank you very much, and stated in the text we aim for inclusion for the next update.

Line 793: Reader encounters 95CI where earlier we saw 2-sigma. Similar uncertainty range but two different statistical naming conventions? Assumes normal distribution of random errors?

Thanks for spotting this, and we have adjusted at OHC level.

Line 802: As for prior equations, this equation should carry an ID number?

No numbering is provided for the formula as not further referenced to in the text.

Line 936: Strange punctuation around the von Schuckmann citation?

We apologize, but we do not understand the comment.

Line 955: obtained, obtained? Please revise.

Thanks, and fixed.

Lines 960, 961: “challenging to be quantified with respect to gaps in the observing system”? Not sure what the authors intend here?

Thanks for having spotted this – and we have revised.

Lines 975 to 977: clear statement here of EEI over 1971 to 2020 and 2006 to 2020. Please extend this clarity back to the abstract?

Thanks, and added.

Line 999: Awkward as written. Need caution - I agree. Perhaps: “Rate of heat accumulation across the Earth system”? Needs slight revision. Citation punctuation problems throughout the paragraph. Authors handled this point more accurately and more gracefully in v1.

Thanks, and we have followed the reviewer’s suggestion. For the brackets, this is linked to challenges for Mendeley use, and we will exchange with the editor if this can be tackled for the final article processing.

Line 1019: very helpful figure with good explanation of time periods but we must regard 2006-2020 as the ‘Argo golden era’ as the author did in prior descriptions rather than a ‘GCOS’ golden age? GCOS itself general does not identify specific periods as ‘golden ages’?

Thanks, and we have removed the wording ‘GCOS’.

Line 1023: The opening phrase of this sentence, referencing GCOS, seems irrelevant to the remaining content of this paragraph.

Done and removed.

Line 1036 and following paragraph: Readers will not understand in this paragraph whether authors refer to generic global climate observations or to formal GCOS organization. If authors intend to add expressions of concern about GCOS with reinforcing statements about GCOS ECVs (for example) in their Conclusion / Recommendation section which follows (as this reviewer recommends) then this paragraph should refer more to the generic need for careful time series of precise observations with perhaps a final point about coordination by GCOS proper in the final sentence?

We have changed the wording from GCOS to observing system to avoid confusion.

Line 1059 and following: Provision of separate files for ocean, atmosphere, land and ice components seems useful and appropriate, with 5th file reporting the composite energy budget. This reader does not understand (and, does not remember reading a reason) why permafrost data exists in a separate file? Earlier we read about data held at DKRZ, presumably under DOI. Those long-term files will replace these short term Handle-labelled files? Someone, presumably at Copernicus, will ensure that transition? This reader notes that clicking on links results in error but that copy/paste of full Handle ID works. Registration barrier imposed by WDCC at DKRZ (similar to v1) approved by ESSD?

We have proposed the different author teams to publish their dataset individually if they wish to assure ore visibility to the working groups who have invested substantial amount of time in their contribution – which is not that clear for the long author list mostly in alphabetic order. So this way a chance had been provided to do so, and this is the why are some separated, and others not. In recognition of their support to this (non-funded), including early career scientists, international initiative we would like to keep this organized in this way. Concerning the IDs – yes, this is now fixed and replaced by the respective dois – an issue we faced to balance time schedules and data publication

delays. Thank you for having handled this situation for the review process, and we hope that with the doi the data publication part is more straightforward to access to.

Line 1084: Sentence beginning “Moreover, this study succeeded to improve” reads as awkward and run-on. Authors can do much better.

Thank you, and we have removed this part from the sentence.

Line 1100: Paragraph about Glasgow outcomes not relevant and not useful to most readers. Delete. Issue of including EEI in global stocktake addressed quite well in following paragraph.

We follow the reviewers advice and start the paragraph with the part on the paris agreement, and merged then with the following paragraph.

Line 1130: Figure 10, new to this version. Utility / information content not clear to this reader? If authors and/or editors intend to keep this graphic, it needs substantial revision (even for final downloaded version) to make it readable / legible. May remind many readers of a similar temporal evolution of sea level projections figure but without similar information impact. Combination of EEI total with OHC, while understandable, also adds confusion? Not a useful addition from the perspective of this reader.

We agree with the reviewer that this figure holds complexity. This from of synthesized assessment has received lot of positive feedback during the 2020 publication. We have however decided to remove the figure from this draft, and include it in an advanced version into another publication.

Line 1139: Figure 11 (formerly, Fig 8), excellent, comprehensive, a fine graphic take-home summary. Legend in prior version referenced needed CO2 reductions, not included here; I leave that one to authors.

Thank you. We have not included the link to the CO2 discussion in this version as we are working on another publication in parallel which is not yet ready to go, and hence we prefer to work on this study, and potentially include this discussion for v3.

The following paragraphs, outlining needs and recommendation for most (atmosphere, land, ice) component, seem helpful. This reader misses (and, authors miss a great opportunity to promote) an equivalent conclusion / recommendation focused on ocean? No shortage of ocean observation issues raised earlier; most of those would fit very well here! If authors wanted to delineate ‘official’ recommendations, those could start at line 1255.

Thank you, and we have made a focus for the ocean in the synthesis here.