

Public justification (visible to the public if the article is accepted and published):

Essential compilation; thanks for using ESSD.

A few suggestions, yours to accommodate or not, in this version or next. Cumulative changes should still result in fewer total lines/words, always a positive for ESSD:

We would like to thank you for the opportunity of further adjustments for the manuscript thanks to these comments, and we provide a point-by-point reply below.

Lines 183, 184: EEI causes increase in Global Mean Surface Temperature (GMST). New definition? Not used again in this manuscript? Cited elsewhere? Later (line 189) you mention heat accumulation warming the (full tropospheric) atmosphere. Redundancy?

Thank you for the comment, and we have removed the abbreviation as it is not used again in the manuscript. For the second part of the comment we did not add further change as the GMST part is linked to the surface response, and the L189 aspect is linked to the impact of heat accumulation on atmospheric warming.

Line 197: decrease in 'lake' ice cover? At line 657 you call them 'inland' water bodies.

Thank you, and we have included 'lake'.

Line 200 (and many following examples): please check punctuation as introduced by bibliometrics software. The example here seems wrong.

We have used Mendeley for the references, and we hope that there is further iteration possible during the editing process.

Line 202, 203: here you summarize changes in terrestrial, freshwater and ocean ecosystems but you have already listed some of these changes (stratification, algal blooms, microbial emissions from permafrost, etc. Do not repeat unless in clarification or by way of summary?

We have removed 'terrestrial, freshwater and ocean' to remove repetitions.

Line 222: We present, rather than 'we will present'? Affirmative!

Yes, agreed, and changed accordingly, thanks for having spotted this!

Line 241: Do you really mean past century sensu stricto? E.g back to 1920? Or during current century, e.g. back to 2000?

Agreed, and we have changed to 'decades'.

Line 247: Small changes (reduced text) can improve fit between statement and references. E.g end sentence after 'methodologies' then move to list of references.

Thank you, and done.

Line 257: Second time to mention global Argo by 2006 in one paragraph. Reduce?

Thanks and we have removed '2006'.

Line 444: Un-needed extra words here. Use instead 'small compared to other Earth subsystems' Too much redundancy in this paragraph; please reduce. With careful re-writing, this entire introduction to atmospheric heating could reduce by 20%?

We have reduced the first paragraph according to the comment, but we think that the following parts are essential for further discussion in this section, and not yet discussed in the introduction.

Line 501: most of us consider reanalyses as a necessary model assimilator of observational data, with periodic outputs (e.g ERA5) as QC-d observations in gridded format (you specify this starting from line 506). If so, this apparent distinction between ‘observation-based and reanalyses’ seems confusing?

Thank you and we have removed this accordingly.

Line 560: sorry to toot my own horn, but original identification (jointly with Vaisala) of humidity bias in RS80 comes from Wang et al. 2002? Holger will admit that his work (cited here as Vömel et al., 2007) derives from earlier work. (Too) Many people on 2002 paper no longer active (or, alive) but we should ensure they (especially June) get proper credit? Lines 619, 620 repeat the caution about RH bias? You do not need both?

Thank you for pointing to this reference. We included Wang et al. 2002 in the reference list and cite it in the text. On the caution about the RH bias, we would like to keep it because we find it important to state it at this place again.

Line 745: here again authors refer to ‘lake ice cover’ which they have earlier itemized as ‘inland’ ice cover. Please clarify, using consistent terminology.

Thank you and we have replaced lake and river ice by inland water body ice (e.g., lake, river).

For this reader, a collection of system-specific recommendations, now found scattered among earlier sections, would very much complement the more generic recommendations around line 1220. You would not need to rewrite, merely copy from source and paste near here (near Figure 9) somewhere. Not decorative, but serious: what you recommend or need to close important uncertainty gaps. A list to check against in future versions?

Thank you for this comment and according to a reviewer comment, and this comment we have already started a detailed table internally to track the specific updates from the 2020 paper compared to this study which we aim to include in an appendix-style for future versions.