

Response to community comment 1 (Robert Gieseke)

Thanks to all authors and contributors for this valuable and important resource. Thanks also for opening up the peer review discussion process to the community. Given this opportunity I have the following comments you might consider for the final version.

Page 6, lines 6-16: This paragraph was a bit confusing to me trying to understand where numbers came from. I probably wouldn't say that the remaining carbon budget has shrunk but rather only say that emissions from 2020 and 2021 used up 77 GtCO₂ of the remaining carbon budget as assessed in IPCC AR6. The 2021 cumulative CO₂ emissions from 1850 - 2019 (2393 Gt CO₂) are closer than the 2020 version (2411 Gt CO₂) to the historic emissions shown in Table SPM.2 (2390 ± 240 Gt CO₂), so if a newer assessment (like this study) of historical emissions had an effect on the remaining carbon budget calculation, the 2021 version would actually be in better agreement with the IPCC AR6 assessment than before. As noted by anonymous reviewer 1 in their comment for page 47, line 24 with regards to 'hard' targets of the Paris Agreement it might be clearer to simply state the remaining budget in relation to the temperature of 1.5 degrees.

We slightly rephrased this paragraph to clarify that the remaining carbon budget is now reduced to 120GtC, etc. We also removed the reference to the Paris Agreement. Note that the estimate of the remaining carbon budget is independent of the estimate of the historical carbon budget. The remaining carbon budget only depends on the warming to date, the given climate target (ex 1.5°C), the transient climate response to cumulative CO₂ emissions (TCRE) and the contribution from non-CO₂ agents.

The Excel sheet proposes a conversion factor for carbon to CO₂ of 3.664. The numbers shown here appear to use different factors, probably due to rounding?

We use a conversion factor of 3.664 indeed. If there are apparent discrepancies, it is because of rounding.

Page 12, line 21: Is it planned to publish Andrew and Peters (2021) as a separate publication? It is a very valuable resource containing interesting and important points. The information could also be part of this peer reviewed publication, maybe as supplementary material.

Andrew and Peters (2021) dataset is already available online: (<https://doi.org/10.5281/ZENODO.5569235>) and is referred in this paper.

Page 24, line 21, line 27: PRIMAP-hist 2.3.1 does not seem to include bunker emissions either, see https://www.pik-potsdam.de/paris-reality-check/primap-hist/PRIMAP-hist_v2.3.1_data-description.pdf

"Emissions from international aviation and shipping are not included in the dataset."

Thank you. We have added the following clause to the sentence finishing on line 29 of that page: "and omits emissions from international transport entirely".

Page 53, lines 13-22: The data availability section and the header information in the Excel files should probably be updated to include a reference to the data being released under a CC-BY 4.0 license. The ICOS page and file metadata include it but it would be clearer to write this in the manuscript and Excel files as well.

As for all ESSD papers, it is clearly indicated on paper's home page: This work is distributed under the Creative Commons Attribution 4.0 License." We are not aware of references to CC-BY licenses being mentioned in manuscripts.

Figures: Some figures have very light gray text which is hard to read.

Done, thank you