Review of tc-2020-320, revised manuscript version

I have read the new revised manuscript and congratulate the authors for their thorough revisions, which has resulted in a clear and compelling manuscript. I believe that this study will be a valuable contribution to the community and well-received by readers of TC. I have a few minor and technical comments, which I think should be addressed before the paper can be published. These are not too substantial in nature, and I will therefore recommend that the manuscript is accepted subject to minor revisions.

l8. ”Therefor,” – typo

l29-31. Great addition for background. I would put the newly introduced terms ”*surface mass balance*” and ”*specific mass balance*" in italics

l35. "satellites able to observe Earth’s surface did not yet exist for a large portion of the 20th century." Good point, but I think you can be more specific here what you mean by ”large portion” (i.e. letting the reader know roughly for how long back in time we have remotely-sensed observations of glaciers)

l180. Do you mean “inaccuracy” or “uncertainty” here?

l199. Would rather use “elevation” than “height” here to be consistent

l200-207: do you mean ”scaling factor” not ”scale factor” ?

l212: Not sure what you mean by “random variable” here. Does this mean that it has to be empirically derived?

l214-215. This is important information, how do you estimate the 40% and 100% errors in the volume-area and volume-length scalings, respectively? Does these numbers matter at all for the errors derived in the global model?

l307. “parameter combinations/sets” – I think it’s enough to write either “parameter combinations” or “parameter sets”, you don’t need both

l497: Holding the temperature constant resulted in a mass change decrease of 65 %, while the constant lower precipitation increased the glacier mass change by 5 %.

I would change to ”Holding the temperature constant resulted in 65 % lower mass loss, while the constant lower precipitation increases mass loss by 5 %.” I think this is what you mean? (looking at your new Fig A1)

l508: "... applied scaling and relaxation laws," - perhaps include cross-references to the relevant equations/section here.

l509-510. ” is the positive ice-elevation feedback: as a glacier loses mass, it’s thickness, and thereby surface elevation decreases, causing it to experience higher temperatures.” I think you can write this in a more concise way. I would also call it a “mass balance – elevation feedback” or “surface mass balance – elevation” feedback. Although this feedback is well known, it doesn’t hurt to add a reference (e.g. Harrison et al., 2001).

Reference:
Harrison, W. D., Elsberg, D. H., Echelmeyer, K. A., & Krimmel, R. M. (2001). On the characterization of glacier response by a single time-scale. *Journal of Glaciology*, *47*(159), 659-664.

l536-539. Great point, please add a reference if this point has been raised in the literature before.

l575. “to small” – typo

l610. “making it unpractical to use them in validation framework we applied.” - missing “the”

l619. I don’t think using “e.g.” in-text reads well, would change sentence to “… the application of a robust initialization method (e.g. Eis et al., 2019; 2021) … “

l630. “Finally, all ensemble members agree that around the 1930s mass loss rates from glaciers were comparable to those of today.” – this is what you find, but something that can easily be misinterpreted by other scientists only reading the Conclusion, as well as by the broader public/news media. I think you should clarify/add the caveat that you discuss at the end of Section 4 (l507-512), specifically the neglected mass balance-elevation feedback, and state that, most likely, mass loss rates are actually greater today than around the 1930s.

l632-633. “They were followed by a phase of mass loss deceleration roughly between 1940 and 1980, which has been accelerating since then” – this could be written more clearly. First, it is not clear what “They” refer to (the mass loss rates?). In the last part, “which has been”, this needs to be clarified as well. What has been accelerating (the deceleration? the mass loss?). From reading the paper I know what you mean, but I’m being a bit picky here because these lines will be among the most read in the paper, so it’s great if they cannot be misinterpreted.

l633-635. Perhaps a personal preference, but I would reduce/remove the use of i.e. in-text (similar to e.g. above), and try to describe what you mean in words. In my opinion this makes the text flow better.

l634. “… this is partly driven by … “ – do you mean here that reduced solid accumulation partly explains the acceleration found since the 1980s? If so this is an important point. Also Fig 8 shows that the amount of precipitation has increased since the 1980s, so I guess Fig 8 suggests that due to air temperatures being warmer, precipitation increasingly falls as rain

instead of snow. So, the main driver is still air temperature, right? You don’t want people to confuse your finding that air temperature is by far the main driver of global glacier mass loss (cf. your new Fig. A1). I think you can end stronger and clearer here.

Figures

Figure 1. New flowchart is great, but with the small font size hard to read, I had to zoom to 200% on my screen. Please increase font size/redesign flowchart (extend vertically?) to become more readable, also in print-out format