Dear James Ferguson and Andreas Vieli,

Thanks a lot for your fast response to the last reviewer comments and for updating the manuscript accordingly.

It is my pleasure to accept your manuscript for publication in TC. I had a last careful read, and really enjoyed the quality of the material presented, the very smooth storytelling aspect and the nice and effective visualizations. I have formulated a list of final comments and suggestions that I hope will help to (further) clarify a few elements. It would be great if you could consider these suggestions and incorporate them when submitting the final version of your manuscript:

- l. 19-20: "This debris becomes entrained in the ice...": is this always the case? Sometimes debris can also directly fall on the surface in the glacier's ablation area, no? Possibly consider rephrasing to "This typically becomes..." and mentioning somewhere the possible direct supply of debris on the glacier surface in the ablation area
- l.31-32: mass loss rates similar for some debris-covered glaciers vs. ice-free glaciers. Long list of references here. Maybe good to also have some recent large-scale works that clearly show this from geodetic remote sensing observations? (Shean et al., 2020; Hugonnet et al., 2021) + potentially also add these for your statement at l.387.
- l.41-42: "...provides the only observable record...": are there really no others? Probably not as detailed, but I imagine that similar observations can be derived for other glaciers (e.g. by comparing old maps/paintings/...etc). Consider rewording to e.g. "...provides, to our knowledge, the most detailed observable..."
- l.84: "the thickness evolution": just to avoid any possible confusion, e.g. between ice and debris thickness, would suggest explicitly mentioning "the ice thickness evolution" here
- l.87 + Table 2: why was a value of 1×10^{-24} Pa s^{-1} chosen here? In the literature there is quite a large spread for this value for temperate glaciers, and an often used reference value is the one by Cuffey and Paterson (2010) of 2.4×10^{-24} Pa s^{-1}. Would your results and the response time be very different under such a value? Not suggesting that elaborate analyses should be done at this stage, but would be good to probably mention this somewhere in the discussion, potentially complementing this with a (rough) estimate about how your response times may be affected with this quite different value for the rate factor
- l. 102-103: "...close the the ELA and beyond". Not entirely clear what "beyond" is here. I guess "above" the ELA? Possibly reword to avoid any confusion
- eq. 7: I was a bit puzzled with the definition related to "smaller than" and "larger than x*": intuitively I would expect values "smaller than" to be somewhere at the glacier front, but this is the other way round here. When seeing your figures, I realize that this is because the highest glacier parts correspond to a low x-value. Maybe good to mention here how the x-values are defined, and explicitly state that the upper part of the equation relates to the glacier front and the lower part to the higher glacier parts? Related comment in l.337: where you describe the glacier front as the "last 200 m", while I would intuitively describe these as the "first/frontal 200 m" (+ similar remark for caption of figure 10 + l.342)

- l.131: “several ice thicknesses”: when reading this, I was wondering how many ice thickness this would be and if more information could be provided. Later in the manuscript (l.167) I was happy to read that this information is shared. Maybe good to group this information in order to avoid redundancy?
- l.159: “realistic values taken to be...”: can you give an indication based on what these values are thought to be realistic? (e.g. other modelling studies, observations,...)
- l.163-165: CFL. Could you explain a bit more extensively (e.g. one additional sentence) on what the CFL criterion is based? This is mostly trivial for ice flow modellers, but may be difficult to grasp for others that are not familiar with this concept. Moreover, I found the last phrase, which is most likely entirely correct from a theoretical perspective, difficult to understand: “...which is necessary to... domain of dependence”. So potentially consider replacing this last sentence with a more general explanation about the CFL criterion (+potentially add the original reference also: Courant et al., 1928)
- l.190: why where ELA’s of 3000 and 3100 m chosen? Seems rather arbitrary. Maybe because this typically corresponds to ELA of a well-known glacier (Zmutt) and that the changes correspond to typical changes between LIA ELA and present-day LIA? I am just guessing, so would probably be good to have a hint about how these were chosen, especially given their central importance in your work (all results are directly related to this choice)
- l.200: “almost identical”: I was wondering why they are not entirely the same? Given that you rely on the SIA, and not a solution that accounts for longitudinal stresses, , the local geometry and ice flow do not ‘see’ what happens in the lower glacier parts (which is where the forcing at the surface is different, in the upper parts the forcing is exactly the same, right?). May again be related to my misunderstanding but would be nice to have a hint about why they are not exactly the same.
- l.251: “...because dynamic replacement of ice is close to zero”: this means that the local thinning is then equal to the local mass balance if I understand correctly? If so, may be worth mentioning, as this is a quite ‘intuitive’ / ‘easy to interpret’ finding (potentially also referring to eq. 1). Same in l. 351: maybe also mention this here? (e.g. “...the total amount of thinning, almost equal to the local SMB, is large enough...”)
- Fig. 3+7: why is there a sudden drop in the volume before reaching the lowest value (e.g. for blue curve in figure 3b around year 600)? What process causes an almost instantaneous large ice loss? Or is this a model artefact (e.g. related to space/time discretization)? Would be great if a hint could be given (or maybe this is the case and I missed this?)
- Section 3.3: no comment, but rather an appreciation. I really found this section to be very nicely presented and an important finding. Personally, my ‘highlight’ of your findings!
- l.287-288: why is a range chosen from 0 to 20%? Are there observations that these values are always below 20%? If so, which ones? Or indications from other modelling work? Now this seems to be a rather arbitrary choice, which I guess it is not
- l. 302: “effects” → “affects”?
- l.353: “...amount of thickening at the terminus”: is there also a readvance then? (even if small) If so, mention this?
- l.379: “...and stagnating tongues” → “and have stagnating tongues”?

- l.397: “ability of the terminus to retreat in response to several successive warm periods (several centuries)”: maybe mention the figure where this can be seen
- l.412-413: “stagnation in dynamics”: you are referring to “ice dynamics” here (as opposed to e.g. debris thickness dynamics) right? May be good to explicitly refer to “ice” here
- l.417: “since they are sub-grid scale” → “since they are occurring at the sub-grid scale”?
- l.418: order studies according to publication year
- l.423-426: found this sentence quite long and difficult to read. Consider splitting up in two shorter sentences?
- eq.11 (l.440): the definition of the ice thickness to be used in this equation is generally also a topic of discussion/debate (should the mean/median/maximum be taken). This will also influence the response times you obtain. Maybe worth mentioning this.
- l.506: “near the ELA”: but this is still above the ELA, right? Maybe mention this more explicitly by changing this to “slightly/just above the ELA”. And what about debris that directly falls on the ablation area surface (see also very first comment)
- l.523: “model with the capability to track englacial debris transport”: maybe explicitly mention models which do this (Rowan et al., 2015; Wirbel et al., 2018)
- l.542: “the model is however much more responsive”: compared to length, right? At first, when reading this I thought that this was compared to the observations. Maybe mention this explicitly: “..much more responsive compared to length changes and can...”

Many thanks for choosing TC to disseminate your work. I am convinced that this work will be a very valuable contribution to our community!

Kind regards,
Harry

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