Response to comments from reviewer #2

L25–29, 40–41: As far as I can tell from this discussion, these studies do not directly address glacier length variability, rather temperature variability. Please clarify this.
Thanks for pointing this out. We have changed the text to read "... was mostly attributed to natural forcing of temperature".

L47–53: Since the results of the paper rely on the fact that the ensemble spread can be used as a proxy for internal climate variability, I would like to see some more discussion of this. Have other studies used the LME for this purpose? How realistic is the magnitude of variability in LME? It would be good to cite some other papers that have similarly used ensembles of climate models for the purpose of disentangling forced and unforced variability.
Large initial condition ensembles have been widely used in other contexts to separate internal from forced variability. So our method is pretty standard; it's just the application of it to glaciers that is new. However, we agree it's important to provide more context. We have therefore added a citation of Deser et al., 2012 (Nature Climate Change) that explains this approach in detail.

Eq. 6: Please make clearer exactly how you compute this. The numerator is clear enough, but L90 "total variance across all ensemble members" is not totally clear.
Thanks for pointing this out. We have added the following parenthetical to the end of the sentence: (i.e., as if all 13 time series were concatenated into a single time series)

L140–144: There are a few studies that have looked at the dependence of response time on size on a global scale; see Raper and Braithwaite (2009), Bach et al. (2018).
Thanks, we have added these references.

L142: The reference Barth et al., 2017 is missing from the bibliography.
Thanks for pointing this out. We have added the reference.

L161–163: Why was the SNR computed for the industrial era for the mass balance but not for the length fluctuations?
The main reason we did not compute SNR values for glacier length over the modern period is that it is too short: the glacier length time series have too few degrees of freedom to compute SNR with any statistical confidence. However, we now state more explicitly in our revised draft that our focus is on glacier variability over the pre-industrial period.

L169–171: There appears to be a negative trend in L' for South Cascade at tau=30 as well. More generally, however, it seems too strong to claim an "absence of 20th-century retreat in the Northern Hemisphere" based on the sample of three glaciers. Do you find this also when you look at the larger sample of 76 glaciers?
We agree that "absence" is too strong here, and have replaced it with "lack". We do not find this behavior everywhere, but these two glaciers are fairly representative of the Northern Hemisphere overall. Figure A1 helps illustrate our main point, which is that the retreat is weaker than has been observed due in part to weaker-than-observed warming in the simulations over the last century in much of the Northern Hemisphere.

L242: Are the ratios similar when you choose a larger tau?

Good question. We have revised the paragraph and added two sentences which now address the dependence of our results on tau:
“Averaged across all glaciers, temperature accounts for 67\% of the total variance in annual mass balance, and 83\% of the total variance in glacier length when $\tau=10$ years. Temperature's share of the variance continues to increase with increasing τ, but more modestly (to 86\% when $\tau=30$ years and 89\% when $\tau=100$ years).”