

Reviewer 1

Summary

This paper presents an analysis of the runoff contribution, past, present and future, of glaciers in the western Kunlun Shan depending on which of the two currently available global ice-thickness datasets is used to initialise the ice-flow model (OGGM). The authors find substantial differences in the timing of peak water depending on the dataset used, as well as the meteorological forcing used for the future portion of the simulations. I think this is a well-executed paper that fits the format of a brief communication. The method is solid and the findings well-supported, meaning the paper provides a nice illustration of the importance of model initial conditions in an under-studied region. I have a few minor comments that should be fairly easy to fix, so I recommend the paper be returned to the authors for minor revisions.

Page and line numbers refer to those in the clean version of the revised manuscript.

Authors: We would like to thank Reviewer 1 for the constructive overall comments on our study. We provide below a detailed response to each comments.

Major Comments

- Language: I confess that at some point on page 7 I got slightly fed up of noting down all the minor grammar points (and even then, I'd let some small ones slide already) and stopped. I hope that the journal's own proof-readers will pick up any remaining ones when it comes to publication, but I'm putting this here just to suggest to the authors that it might be worth having a re-read of the paper before submitting the final version. Mostly, it's all pretty small stuff (a lot of it is singular-plural disagreements between nouns and verbs), but the cumulative effect on some sentences makes them very hard to follow.

Authors: We are sorry for the inconvenience caused by all grammar errors and we tried to correct all of these in the revised version.

Minor Comments

- p.1, l.16: 'as other sectors such as'

Authors: Done.

- p.1, l.17: 'on the timing of peak water'

Authors: Done, with the sentence being changed to *"Inversion of ice thicknesses is a major source of uncertainty, influencing modeled ice volumes and consequently the timing of peak water"* at L19-20.

- p.2, l.29: 'but is not yet applicable at a large scale.' Also, is this true? There have been a couple of recent IGM papers at a regional scale, most recently the Leger et al. (2025) paper for the Alps at the LGM (Leger, T.P.M., Jouvett, G., Kamleitner, S. et al. A data-consistent model of the last glaciation in the Alps achieved with physics-driven AI. Nat Commun 16, 848 (2025). <https://doi.org/10.1038/s41467-025-56168-3>). By 'large', I assume the authors mean 'global', so I would reformulate this as 'but have not yet been applied at a global scale'.

Authors: We changed the introduction section (see response to Reviewer #2's major comment) and therefore removed the model review part.

- p.2, l.33-34: This is a very brief and generic exposition of what the paper is going to do, and also does not at all follow naturally from what went before. There need to be a few more lines here to bridge the gap from the global-scale application of global models talked about in the preceding paragraph to the regional-scale

study this paper is doing, and then some more details about exactly what it is this paper is doing (such as the region of concern and why there in particular! Obviously, it's explored in more detail in the following section, but a brief mention here is necessary)

Authors: Agreed. We have added a more comprehensive paragraph at L32-38, detailing the region and the framework of the study:

"In this study, we examine how uncertainties in ice thickness estimates and temperature affect the timing, magnitude, and duration of peak water in a region with strong variability between existing datasets and strong vulnerability to climate change in terms of water supply (Immerzeel et al., 2020): the Western Kunlun Mountains on the Tibetan Plateau. We first propose a methodology to assimilate ice thickness inversions into the OGGM model, with an approach that can be applied globally. We then perform sensitivity experiments by perturbing both initial ice volume and climate forcing to quantify their combined effects on peak water. Finally, we illustrate the role of glacier geometry by comparing two widely used ice thickness datasets that differ substantially in this region."

- Introduction generally: Sure, makes sense, but this feels like an introduction to a paper that's doing something on a global scale – everything is couched in terms of, despite their limitations, global-scale glacier models being the only sensible thing to use at a global scale. But this is a regional-scale paper, so there's a bit of a disconnect between the thrust of the introduction and what the paper's actually doing. See my previous comment for one suggestion on how to fix that

Authors: Agreed. Considering a similar comments from Reviewer #2 we have removed the description on global vs regional models, and are now focusing on the following points in the introduction : (1) why the problem matters globally, and (2) regionally, (3) what is uncertain, (4) what the study does to address this.

- p.2, l.49: 'were mostly positive'

Authors: Done.

- p.3, l.73: 'One of the common approaches in these models...'

Authors: Done.

- p.4, l.90: 'correcting for...average...compared to...'

Authors: Done, sentence was changed to *"differences after correction for glacier mass change average 6 km3 compared to the original MIL22 estimate"*.

- p.4, l.95: 'projects'

Authors: This specific sentence was removed from the revised manuscript.

- p.4, l.96: 'whose source...and can be either...'

Authors: The entire phrasing was changed to *"topographical data from various sources (NASADEM, COPDEM, GIMP, TANDEM or MAPZEN depending on the glacier location)"* at L101-102.

- p.5, l.105 'cross-section'

Authors: This specific sentence was removed from the revised manuscript.

- p.5, l.129: 'the OGGM inversion method'

Authors: The entire phrasing was changed to “OGGM uses a flux-based ice flow model to solve a mass conservation equation along flowlines, under the SIA hypothesis, deriving ice thickness at each cross section.” at L111-112.

- p.6, l.136: I don't think there's any need to write OGGM out in full again here.

Authors: Done.

- p.6, l.140: 'ice thickness models'

Authors: Done.

- p.6, l.145: 'datasets'

Authors: Done.

- p.6, l.148: 'simulation'

Authors: Done.

- p.6, l.154: 'use'

Authors: This paragraph was removed in the revised version in accordance with Reviewer #2's comments on the model framework used.

- p.6, l.156: The reference isn't properly formatted

Authors: See above response.

- p.7, l.166: 'often reach...which remains...'

Authors: Done.

- p.7, l.170: 'regional'

Authors: Done at L156.

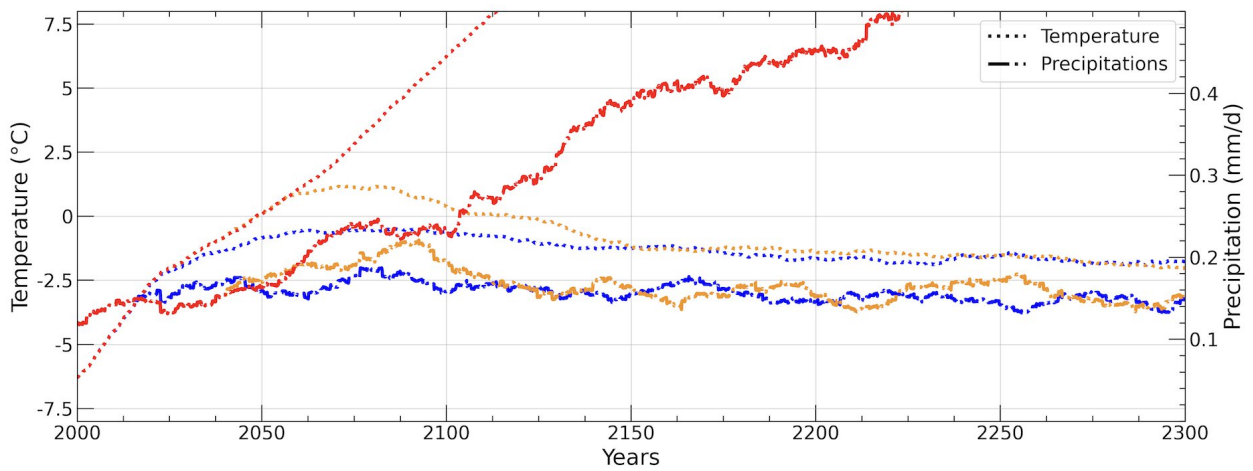
- p.7, l.171: I'm not quite sure what the authors mean by "'enough" high' here. I think this sentence might need reworking.

Authors: Agreed. We have rephrased the entire sentence at L163-165 to :

"It is worth noting that, starting from glacier equilibrium and considering a climate that has warmed enough to cause substantial glacier retreat, peak water represents the tipping point beyond which any additional warming leads to a decline in glacier contribution to basin runoff (Huss and Hock, 2015)."

- p.7, Section 2.6: OK, fair enough, the study is only interested in the difference caused by the initial ice thickness, but there needs to be an extra line here to explain why the authors picked that one particular GCM out of the several available.

Authors: Agreed. In the revised version we now use 5 different GCMs. Out of the 5 GCMs available in OGGM that extend until 2300, one (CanESM5) was put aside because presenting very sharp temperature increase in the region (see figure below).



Temperature and precipitation in the region under GCM CanESM5 under SSP1-2.6 (blue), SSP5-3.4-OS (yellow) and SSP5-8.5 (red).

- Figure 3: It's a long way from where it's referenced in the text. Maybe move it to be a bit closer? It's also rather small – I might suggest having a single column of four panels and thereby allowing each panel to be rather easier to read!

Authors : Done. Figure 3 was moved to section 3.2 ("Future projection of evolution using existing ice thickness models"). We have also modified the figure accordingly into a single column of four panels. Considering that we now use 5 GCMs we included also included error bars in Figure 3.