

The Cryosphere Discuss., author comment AC1
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Reply on RC1

Jakub Małeckı

Author comment on "Recent contrasting behaviour of mountain glaciers across the European High Arctic revealed by ArcticDEM data" by Jakub Małeckı, The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-165-AC1>, 2021

Dear Reviewer,

Thank you very much for constructive criticism, your comments are much appreciated and will certainly improve the quality of the manuscript. I read all your questions and suggestions with great interest. Regarding your general comments, please let me respond below.

Comment #1 - about the impact of spatial coverage (limited to only 23% for one of the sites) on the reliability of the results

The uncertainties estimated for overall glacier elevation change rates for different sites, dh/dt , range from 0.04 to 0.19 m/y. However, these values might be much higher for individual elevation bins. This commonly results from the small size of elevation bins, which automatically increases the uncertainty, further boosted to metre-scale values at low data coverage. However, large uncertainties typically refer to only a few bins with very low proportion of the overall glacier area at a given site. For this reason, these do not have a large impact on the overall dh/dt uncertainty.

In order to show how reliable the estimates of dh/dt are, a sensitivity test suggested by the Reviewer will be applied to the final version of the manuscript.

Comment #2 - questioning whether glaciers studied in the paper (accounting to ca. 20% of the whole population of mountain glaciers of the three study regions SV, NZ and FJ) are representative of the whole population

The map of sites studied in the manuscript evolved from less than 20 sites at earlier stages of work, up to 29 in the version submitted for the review. New sites were progressively added to the analysis to 'catch' the gradients described in the manuscript and this process was eventually finished when sufficient level of detail was achieved. Moreover, I think I could not add much more sites due to the limited availability of useful

ArcticDEM data from summer seasons and to a lack of larger clusters of mountain glaciers over large areas of SV, NZ and FJ.

More importantly, I do consider the sites presented in the manuscript as representative of the wider population of mountain glaciers in the Barents Sea sector. One argument is that the study sites cover the regions rather uniformly and represent different glacier settings. The stronger argument is, in my opinion, that glacier elevation changes are relatively homogenous between sites within larger subregions (see e.g. Figure 4). This suggests that a denser array of study sites would not necessarily bring much new information, however, smaller anomalous sites might still remain undetected with the presented data.

Therefore, the revised version of the manuscript will make more use of the wonderful dataset by Hugonnet et al. (2021), where one might compare dh/dt of glaciers studied in this manuscript against the overall population of mountain glaciers. This might also answer some of the specific comments by the Reviewer.

Comment #3 - about missing references from the most recent literature, including the mass balance model for SV by van Pelt et al. (2019)

I agree, this will be corrected in the revised version of the manuscript. The excellent work by van Pelt et al. (2019)(or "vP19") was omitted by a mistake and this will be corrected. However, interpretation of the mountain glacier changes observed in my analyses in the background of vP19 outcomes would require caution. Note that vP19 calculates generally positive long-term balances in many areas dominated by mountain glaciers in SV, e.g. central Nordenskiöld Land, Bunsow Land and Nathorst Land, being in contrast with their retreat over the past decades. This is quite common for regional mass balance models and that is why I personally consider regional simulations the best for giving an overall picture, rather than for providing adequate reproduction of details, such as the mass balance of small mountain glaciers.

Again, please let me thank you for your time and effort.

Kind regards,

Jakub Małecki