

Response to **RC1**: ['Comment on tc-2020-376'](#), Anonymous Referee #1, 21 Feb 2021

RC1

[Response 29.03.2021](#)

This is well written and interesting paper that describes glacier disintegration in a region in Austria based on an extensive data set of DEMs and orthophotos. The glaciers in question are all rather small (a few km² or smaller) and some have disintegrated into partly or fully debris-covered patches. The authors point out the need for a scientific discussion about the proper aim and suitable methodology for monitoring small, totally debris-covered cryogenic geomorphological structures that are remnants of recently active glaciers. At some spatial scale and degree of debris-cover, monitoring of such remnants might not be within the proper scope of glacier monitoring as such but should be considered as a task for monitoring and studies of rock glaciers and permafrost. Setting a hard threshold in terms of the size of very small glaciers for including them in glacier inventories and considering then glacier monitoring is, however, not straightforward.

[We thank reviewer 1 for their very constructive and helpful comments.](#)

Comments:

p. 14, l. 246: The authors use the area at the first point in time $A(t_1)$ to compute the area-averaged specific mass balance b_{geo} . I would have thought that the average of the areas at the beginning and end of the period $(A(t_1)+A(t_2))/2$ would be more suitable? This would be consistent with the description on p. 92 in the IACS glossary of glacier mass balance (Cogley et al., 2011).

[We will add \$b_{geo}\$ calculated with averaged areas and shift the original version based on the area at the beginning of the period to the supplements.](#)

p. 22, l. 340-353: It might be worthwhile to add the IACS (Cogley et al., 2011, p. 45) and GLIMS (Raup and Khalsa, 2010, p. 4) definitions of glaciers in this list of definitions of the term "glacier" since these have an "official" status in the glaciological community.

[We will include:](#)

"A perennial mass of ice, and possibly firn and snow, originating on the land surface by the recrystallization of snow or other forms of solid precipitation and showing evidence of past or present flow... In contrast to what is natural in dynamic glaciology and glacial geomorphology, for mass-balance purposes the glacier consists only of frozen water. Sediment carried by the glacier is deemed to be outside the glacier."

[Cogley et al., 2011](#)

[and the GLIMS definition of glaciers](#)

“A glacier or perennial snow mass, identified by a single GLIMS glacier ID, consists of a body of ice and snow that is observed at the end of the melt season, or, in the case of tropical glaciers, after transient snow melts. This includes, at a minimum, all tributaries and connected feeders that contribute ice to the main glacier, plus all debris-covered parts of it. Excluded is all exposed ground, including nunataks. A stagnant ice mass still in contact with a glacier is part of the glacier, even if it supports an old-growth forest...All debris-covered parts of the glacier must be included.... Rock glaciers and heavily debris-covered glaciers tend to look similar, but their geneses are different. GLIMS does not currently deal with the former, but does include the latter.”

Raup, B. and Khalsa, S.J.S., 2010. GLIMS Analysis Tutorial. GLIMS, Global Land Ice Measurements from Space, NSIDC, www.GLIMS.org
https://www.glims.org/MapsAndDocs/assets/GLIMS_Analysis_Tutorial_a4.pdf

Regarding the definition of "glacier" on p. 22 and 23, it might be mentioned that definition (1), that includes dead and buried glacier ice, would also include ice-cored morains, even with deeply buried ice that may last centuries, which would presumably greatly complicate the creation and management of glacier inventories.

Yes, this is correct. We will add this point to the discussion and add one example of an ice cored moraine.

Minor and editorial comments:

The superscripted power of 2 in "km²" is missing in the pdf I am reading (many places).

We have to check this in the next proof-reading version.

The "-" hyphen in negative numbers and number ranges should be changed to en-dash or a minus sign ("--" in LaTeX), for example "2002-2004" should be "2002--2004"

will be corrected

p. 12, l. 197: "between 1000 to-2000 m" --> "between 1000 to 2000 m"

will be corrected

p. 15, l. 269: "lower than" --> "lower in magnitude than"

will be corrected

p. 19, l. 305: "... if there is any ice left." --> "... whether there is any ice left."

will be corrected

p. 20, l. 315: "Without keeping them in inventories, we lose track of these transient states." --> "We lose track of these transient states by dropping these glaciers from the inventories."

will be corrected

p. 24: "The annual change rates of area and volume change indicate ..." --> "The annual rates of change of area and volume indicate ..."

will be corrected

p. 26: "The glacier inventory data in <https://doi.org/10.1594/PANGAEA.844988>" --> "The glacier inventory data are available at <https://doi.org/10.1594/PANGAEA.844988>"

will be corrected