Response to the comments by Andrea Fischer

The article "Glacier shrinkage in the Alps continues unabated as revealed by a new glacier inventory from Sentinel-2" presents a new compilation of glacier boundaries for the European Alps. The improved resolution of Sentinel data allows a more accurate delineation of glacier boundaries as the Landsat based inventory of 2003. The new inventory is based on remote sensing data acquired during 2 years only, and was based on past national inventories, corrected for inconsistencies at the national borders. Extensive error assessments ensure high data quality, even in shaded and debris covered areas. The data and methods presented are new, and the data will be used for lot of different applications, for example hydrological modelling. Methods and materials are described in sufficient detail. Reference and citation to other data sets are correct and appropriate. A minor side remark concern the climate data cited, see details below (1) with a suggestion to add a data reference. The article is supporting the data set and contains also valuable information on accuracy and limitations. The data set is under review at Pangaea.de, which is the normal process at this platform, I am confident that the data will be available once the ESSD paper is published. I consider the examples given in the Figures sufficient to judge general data quality. I cannot check the completeness of the data, but the total area given seems to support the idea that all glaciers have been mapped. Data processing and format is state of the art. I consider the data to be of highest quality. Regarding the problem of inclusion of small glaciers and the comparison to the 2003 data, I suggest some rephrasing to better distinguish between real area changes and mapping artefacts (2), which is described somehow misleading in the current version (but understandable though knowing the problem, confusing for researcher being data users only). The data set is useful in the current format and size, with appropriate metadata. Length and structure of the article is appropriate, wording is clear. Figures and Tables have high quality and show relevant items. Finally, I understand the data set by reading the article, and will potentially use and recommend it.
Thank you very much for this assessment!

How well do the respective data sets presented by an article and the article itself meet the following criteria (rated 1–4, excellent–poor): Significance 1 The data is useful fulfilling the criteria of - Uniqueness: Much effort has been taken to compile a unique data set of glacier boundaries in the European Alps. Mapping methods have been improved substantially in contrast to earlier data sets. - Usefulness: The data so far available for the glacier boundaries in European Alps have been either spatially very detailed but temporally inhomogeneous or spatially coarse with an accurate time stamp. In addition to that, inconsistencies at national borders have not been corrected so far at a larger scale. The new Alpine inventory is an excellent basis for all types of glaciological, hydrological and climatological studies and will be used quite frequently.
Thank you, we hope it will serve its purpose.

- Completeness: The data set is the completest inventory of European Alps possible and available. Data quality 1 As the data described in the article has been compared to our LiDAR based data set of the same area in cooperation with our staff, I can confirm the data quality although the full data set can not be downloaded right now from Pangaea. Presentation quality 1 The article is very clear and concise and describes strength as well as weaknesses of the data set.
Thank you!

Detailed comments:

(1) line 114: The Histalp instrumental data (Auer et al., 2007) confirms the Alpine ridge as a climate trend divide in terms of precipitation. This is not necessarily a contradiction to the results of Casty et al., as the resolution and accuracy of the data set is very different. For completeness, I would recommend to cite both articles, as the HISTALP result can be used as valid hypothesis for explaining different mass balance responses North and South of the main Alpine ridge conformed by respective mass balance monitoring.

We fully agree and have added the suggested reference.

Line 416: I can confirm that small glaciers are found at all elevations, but I can not confirm that this means that they are independent of climatic parameters. Abermann et al. found that the altitudinal distribution of glaciers depends on precipitation rates also, thus the distribution alone without having a look on the type of snow accumulation and radiative setting must fail. I recommend to add a deeper discussion on climate sensitivity of small glaciers or just skip that very shortened remark. This would also resolve the contradiction to lines 428 ff.

We fully agree that writing 'they are independent of climatic parameters' is incorrect and have actually written that their mean elevation 'does only slightly depend on climatic factors'. However, this might still be perceived incorrect so we have now written: "are also impacted by factors other than climate". We have also adjusted L428, writing now 'of larger glaciers'' instead 'of a glacier'.

(2) lines 466 and 480 I presume that the 125 very small glaciers do not really increase their size as a result of the mapping procedure as written here. I recommend to rephrase like that: The area mapped for 125 glaciers increased by XXX %, but in reality we expect that these glaciers shrinked.

Yes, the growth is (very likely) only due to the different interpretation (that is partly due to the different visibility of details in the 10 m Sentinel-2 images). Unfortunately, we cannot confirm if they have decreased their size or not as this has not been determined. We think so, yes, but this would be rather speculative as some small glaciers show a very limited shrinkage (see point before).

Also for the Suldenferner in line 470 it is not clear if the authors consider the mapping to create reliable numbers or artefacts which they want to discuss here. If the paragraph intends to warn people on working with the inventory analyzing very small samples or single glaciers, this is not entirely clear.

This is more a note that very small differences in interpretation can lead to a very different glacier extent when topological changes (e.g. two parts merging) are not considered. Collectively both extents are very similar, but the automated assessment of area changes via ID comparison cannot be performed due to the new topology. It is thus more a warning on performing such calculations automatically rather than looking in detail at the quality of the input datasets.

Also the remark on the larger (compared to 2003??) glaciers 2015/16 as result of seasonal snow included leaves open if the authors consider this as an artefact or a glacier advance.

As seasonal snow outside a glacier should be excluded, this is an artefact.

In the last sentence, it is not entirely clear what is meant by 'real' area loss: The area loss corrected for mapping artefacts? Maybe it would be easier to understand if we read here that the authors think that their estimate of area loss is rather a lower threshold considering mapping uncertainties tend to diminish the area change?

Yes, this is a good suggestion to clarify what we mean. We have now written: "Overall, glacier extents in the 2015/16 inventory might be somewhat larger than in reality due to the

inclusion of seasonal/perennial snow in some regions. The -15% area loss mentioned above can thus be seen as a lower bound estimate."

Line 561: Missing debris cover in 2003: Have the glaciers been free of debris in 2003, or were debris covered areas not mapped in 2003?
For some very few glaciers in the 2003 inventory a part of the debris cover was not included as a later comparison with higher resolution imagery revealed. For this reason the 2003 area of the mapped glaciers was underestimated. Additionally, several very small glaciers in north-eastern Italy (Venetia/Friuli) were not mapped in 2003.