Review:

Reanalysis of a ten year record (2004-2013) of seasonal mass balances at Langenferner / Vedretta Lunga, Ortler-Alps, Italy

Stephan Peter Galos et al. The Cryosphere Discussions

General comments

The authors reanalyze a 10-year record of mass balance of a small glacier in the Italian Alps. They use previously applied approaches combined with new approaches. They present a thorough error calculation. The methods and results are in general carefully described. They make use of pseudo-observations to reanalyze the data and calculate the glacier wide mass balance. This study is thus not only a modelling experiment, but presented as a reanalysis of mass balance providing updated series of glacier mass balance. Such mixing of modelling and field-data is not unproblematic, but the authors do not discuss this. I miss a section in the paper discussing this choice. Furthermore, I miss a paragraph where the authors discuss the implementation of their results and flagging of the series. Information on number of pseudo stakes used for every year and which years that used modelled pseudo points in the calculation is lacking from the table. If some years need to be modelled and not others, this should be more clearly stated and flagged in the paper and resulting tables. A comment field in the table could be useful to so the series are marked with reanalysis and comment on modelling degree. Fig 2 could be extended with all 10 years so the data sources are shown.

Data availability. According to TC journal instructions, "Authors are required to provide a statement on how their underlying research data can be accessed". A section on Data availability therefore needs to be added to the paper with information on where to find the underlying data. The World Glacier Monitoring Service is the appropriate data service for much of the glaciological data.

Specific comments

Units. I suggest using m w.e. or m w.e. a-1 instead of kg/m2. Alternatively, mm w.e. Kg/m2 is not standard in the literature.

P2. L30. Very long sentence.

P3. Study site and data could be divided in 2 chapters.

P3. L27. Could mention the mean value for the period.

P4. 'The current stake network October 2016' is not that relevant here as the study period is up to and including 2013. Rather give the information for 2013. In 2.1. or in the introduction objectives (P3) the study period could be mentioned explicitly.

P4. 15. Add 'of remaining snow from the previous winter' or something similar to be clear to not mix up with winter balance/accumulation. Same for L18. Could mention how large area (in %) that had snow remaining in 2010 and 2013.

P4. L26. Mention the first mass balance year reported, e.g. 2003/2004, it may not be very clear since measurements began in 20002 (L5).

P5. L12. On 'Around', I assume also on the glacier since this is not specified. Replace around with covering or take out and just state the point density. Would it be better to resample to a 5 m model? The section 2.3 was quite brief.

P5. GPS should probably replace with GNSS (Global Navigation Satellite System) throughout the manuscript.

P5. L23. How much of the glacier is debris covered? This is not stated here or in chapter 2. A picture or aerial photo could have been a nice addition to the paper. Orthophotos are available according to the text. Could be added in an improved figure 1. The section and the referencing is a bit unclear to me, was the approach done following Abermann et al (2010) or was is it done by Abermann et al (2010).

P5. L28. Changes in ice divide is negligible. Could this be quantified?

P6. Ch 2.5. Could the extraction of snow line information be illustrated. Maybe add a table to the supplementary material? How were the imagery georeferenced and stakes identified on the imagery? Some more information could be added.

P6. L21. Write what you did instead of 'we accounted for this problem' to be specific.

P6. L28. This issue -> this melt …L29. Respectively -> for the additional melt

P7.L2-3 Unclear, do you mean that 'Whereas measurements were carried out close to the … and thus reported as fixed date in the original data, the….

P7. L10. When correcting accumulation: How are melting episodes accounted for?

P7. L17. L 21. L23. Is -> was

P7. L32. Add that is also justified by available data to run the model (this is not always the case)

L29. Generated (use past tense on work carried out in this study)

P8. L 1. Provide to whom? 'Instead of …only' -> 'in addition to glacier wide balances' One must be careful not mixing measured and modelled point data as this can add confusion, data should be clearly marked.

P9. L33. What does 'After the individual extrapolation of point measurements mean here? Interpolation could be a better word.

P10. L26. Mean manually drawn? Add this information.to be clear.

P10. L28. What does the latter method refer to here? Specify the method to be clear.

P11. Suggest to call this paragraph be called interpolation. Usually one refer to interpolation methods in general, not extrapolation methods. E.g., the Topo to Raster tool is an interpolation method

P11. L15. Why the e.g. reference here, unclear.as follows (Zemp et al., 2013) -> following Zemp et al. (2013).

P11. L19. Is-> was

P13. L13. Serves -> servedP14. L29. Substitute 'the above problem' with 'uncertainties in points'

P14. L10-12. Rough surface topography may give errors when measured differently by field observers. Uncertainties in identifying summer surface gives also uncertainties in point data.

P14. Line 29. Instead of starting a subchapter 'Similar to the above problem', state what the problem is.

P15. L10 due to the fact that it.. -> as it..

P15. 4.2.1. Could give some more details on the coregistration.

P17. L5. Specify why it could not be used.P20. L20. Than -> as

P18. Line 8. Are the original ELA and AAR values changed from the original record? Please make a comment addressing changes in ELA and AAR and add the original values to Table 1 if changed.

P19. L14. Add the value found by Galos et al. (2015).

P19. L15. Could add some results in the text for the short periods, not just referring to the table. Comment on the density conversion factor and uncertainty used for the short period, as short periods (1-3 yr) may have a different conversion factor. (Huss, 2013)

P20. L4. What do you mean with further calibration, do you consider some of the presented work as calibration?

P20. L20. Than -> as

P20. L21. Specify by adding 'reanalysed' summer balance values?

P20. L23. Add 'total', thus 'a total value

P20. L25. Specify what you mean with individual contributors.

P20. L28. Could add 'reduced discrepancy' after recalculating.

P20. L31. Name the two methods. What does it mean not acceptable.

P21. L1. Specify where you recommend it to be used.

P21. L4. Is it not the glacier wide averages that are calculated based on pseudo observations? Check L2-5.

P22. L8. As well as related -> of. Inter-annual mass balance variability has indeed been considered before. Suggest rewriting.

Figure 1. Add source and year of glacier outlines. The map should be fitted to either one-column or two-column width. Could be extended in east to allow some more space around Weissbrunnferner. Borderline on inset could be refined and the inset would probably look better without the shaded background.

Figure 2. Same comment as 1, could be extend to 2-column width. The dense outer outline could be thinned.0,5 -> 0.5   Suggest to add all years here.

Figure 7. Add 1:1 lineFigure 8. Add (orig) and (ref) to the text.

Table 1. Add ELA and AAR if different from the original record. Add Area used in the original record. Add a comment field stating if modelled pseudo stakes are used for each year. Suggest having an additional table stating the data source available for each year including pseudo stakes used.

In general, there are numerous 'in order to' in the manuscript. 'in order to' can be replaced by 'to' in many (if not all) occurrences.

Reference
Huss, M.: Density assumptions for converting geodetic glacier volume change to mass change, The Cryosphere, 7, 877–887, doi:10.5194/tc-7-877-2013, 2013.