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Interactive comment on "A statistical approach to refining snow water equivalent climatologies in Alpine terrain" *by* S. Jörg-Hess et al.

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Summary

The research article presents a statistical method for refining snow climatologies, applied to a longer time series of 101 stations, and set up with a short time series of HS measured at 203 stations. The calibrated SWE maps deviated from the original values mainly for short periods and single grid cells. The analysis of three different regions showed largest effects of the calibration at elevations above 2000 m. The added value of the refined climatology is illustrated with three examples: 1) verification of a hydrological model, 2) estimate of SWE anomalies and 3) run-off prediction.

General comments

The method presented in the manuscripts improves the calculation of long-term snow climatologies in complex terrain, which is of special importance for e.g. hydrological applications and represents a progress in analysing sparse long-term HS data. The purpose of the work is clearly articulated and the conclusions deduced from the analysis. The article is well developed, technically sound and presented in a clear language. The Figures and Tables are well selected and clearly presented, with room for improvement in helping the reader to follow the analysis. The reading flux would benefit from fewer abbreviations, for example by writing CP and VP in full.
The article would benefit from restructuring some parts. The description of the validation method in the validation section is clearly too short, and the text which would fit in this section is split across several paragraphs of the result section. This brings some confusion to the samples used for validation: in some paragraphs, d203 is used for the validation sample, in other sections d133 appears in addition to d110 and d203. In other paragraphs, 23 selected stations are mentioned, or validation results are presented which reference to 4 stations. This would be easier to follow if the presented method and samples were not spread across the results, but brought together in the sections on validation methods.
Some open question remain open after reading the article, which could have been answered quite easily:
For potential users of the algorithms, a hint on the number and length of records needed for the calibration sample would be helpful. For example, would it make sense to calculate SWE climatologies from three 20 year long records and 20 one year records? It would be interesting to see the altitudinal distribution of the stations, at least for the three test regions. What did the SWE/altitude curve look like, indicating also the elevation of the stations used? How did you calculate the SWE for not measured areas (elevations above 2100/2700 m)?
How long should the calibration period be? What is the estimated accuracy of the

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measurements used for calculating the grids, and how accurate can the resulting grid then considered to be?
Some of the results are presented without error bars, assuming a higher accuracy than the input data. Is this plausible, and why? Or can an error bar be added to some of the presented numbers, to reflect the assumed accuracy of the results? The state of the art is well presented by the selected references.

Detailed comments
Page 4246 line 10: For which period are these values calculated? Is this the mean of grid cells, or values for a mean elevation?
Page 4247 line 10: It would be helpful to read the number of stations used in Table 1, together with the mean and maximum elevation of the measurements.
Page 4249: How much of the area of the test regions is located above 2100 and above 2700 m? How did you calculate the SWE above the highest stations?
Page 4250: The description of the validation method is very short, the section is a bit short; which gridded SWE maps were compared to which ones? Line 17: Add a short reason why map 203 is assumed to be more accurate.
Page 4251 line 6: Wouldn't the description of the validation method fit much better in the section 3.3., Validation methods?

Line 11: is this a 1 km by 1 km grid, or what does 1x1 grid mean? Line 14: Blöschl, not Bloschl
Figure 4: It would interesting to see the number of stations in this Figure.
Page 4256 line 12: The description of this validation method would fit better into section three. How did you select the 23 stations, and how was their altitudinal distribution? What is the unit of the given differences - is it mm?
Page 4258: Please explain ME? Is 29 mm significant compared to the measurement uncertainties of the input data?
Page 4261: are 10-4Line 29: Why global (i.e. worldwide?)

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Page 4262 line 15: -18mm , 7*10-3 mm: are these numbers and accuracies significant compared to measurement uncertainties?
Table 1: please give all area ratios at the same accuracy Table 2: add abbreviations to the caption 0.70 instead of 0.7
Figure 1: The application of the d133 is unclear, where are the 23 selected stations? The caption and the legend do not fit together (color descriptions). The text states that 23 stations were used for validation?
Figure 4: label y axis
Figure 13: Describe Q 1-99, Q25-75 in the caption
References: Blöschl, not Bloschl

Interactive comment on The Cryosphere Discuss., 7, 4241, 2013.