

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-125

Anonymous Referee #1

Referee comment on "Local-scale variability of seasonal mean and extreme values of in situ snow depth and snowfall measurements" by Moritz Buchmann et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-125-RC1>, 2021

General Comments

In their manuscript "Local-Scale uncertainty of seasonal mean and extreme values of in-situ snow depth and snow fall measurements" Buchmann et al. present a detailed analysis of local bias in snow depth measurements and snow climate indicators from a set of 30 station pairs. They provide a comprehensive overview on differences between snow measurements for different winter periods to half year season of an up to 77 year long time series. They discuss the results in relation to climate trends and local impact of station surroundings on snow accumulation. The work gives a good basis for estimating the uncertainty in snow related parameters induced by local station setting. In general the manuscript is concisely written and the results are appropriately discussed. Considering the supplementary material the presentation of the results in figures and tables is substantial. Just the discussion and conclusion section should be revised for better comprehensibility (see specific and detailed comment).

Specific Comments

- (1) I would suggest to change the title to "Local bias of..." and to avoid the term "uncertainty" here and in the discussion. "Local bias" is used most in the manuscript, and is in terms of locally specific characteristics in snow accumulation at the station just a part of the overall uncertainty in local snow measurements in addition to e.g. measurement errors. A complete analysis of the uncertainty in terms of variability of the local bias might include not only the mean values, but also max/min/range/sigma of the seasonal values (see detailed comments/ L98). "Local variance" or "Local variation" might be another options more presenting the local effects of station setting as mentioned in the manuscript (e.g. soil, buildings, ...).
- (2) The presented analysis is an update of the work published by Buchmann et al. (2021) with an increased number of station pairs for a longer time period. Nevertheless, basic methods are the same, and results do not differ fundamentally. I recommend the authors to accordingly present the new findings and differences between both studies.
- (3) In the current version of the manuscript, results and discussion are presented right

together. I suggest to separate both and to align the discussion linking the different results (some biases are related to the same source of error). Further, the conclusion are rather to long and can be shortened by several sentences (see specific comments) to be more condensed. The conclusion might present aspects on the order of local biases, that might be negligible and what the local station bias means for the interpretation of climatologies (trends) based on single (mountain) stations.

Detailed Comments (L = line)

L10: Remove daily scale and change to: "Daily measurements of snow depth..."

L22: Here and throughout the manuscript: for me it was difficult to follow with the shortening with the brackets. At least it stopped the flow in reading. Please consider to present in two separate sentences.

L47: Here and throughout the manuscript: there appears on redundant pair of brackets in the citation using e.g. L48: Please add "half year" in front of period

L56ff: the research questions are announced but not formulated as such. In addition methods are presented here (point 2). Please rephrase this part to list the analysed parameters or formulate the RQs

L72: remove the brackets and write: "...within a distance of 3 km horizontally and 150 m vertically..."

L72/73: 1 km: Please fix the space between number and unit such that it is not seperated at the line break (here and in the entire manuscript)

L74: 1770m: This might be a high elevation for station pairs, but it is not in context of mountain stations and snow measurements. Would be nice to see a discussion if and how the results are expected to be scaleable to higher located mountain stations.

L75/76: Shift the dates of the 77 year time period (1943 to 2020 ;

L76) directly to this number (L75). End the sentence after "station-pairs" in L76.

L86: since all measurements are made in the past, please present more detail here. L98: since time periods are presented, the analysis of the distribution of seasonal/monthly values within the time span would be of interest, too. Please consider to give those numbers.

L104: To my knowledge the standard hydrological year of mid Europe is defined by 1.10. to 31.09.. Why did you use the period from 1.9. Please give at least a citation.

L121: Consider to use an abbreviation of "local bias" for further use in the manuscript

L138: The finding that all outliers are produced by the same station pairs should be discussed in terms, if such station-pairs are representative at all.

Figure 1: The RPD for all HN parameters is between 10 and 20%. Please present this in the results. It would be interesting to see the statistics on the variability of the parameters when moving a 30-year period over the entire time series of the three station pairs with most parallel years.

L152: Replace "entire" by "half-year"

L207: Replace "uncertainty" by "local bias"

L208: Figure A2: Please consider to put the Figure in the manuscript.

L219: I did not get the sentence starting with "Among...". Please rephrase.

Figure 4: Here and in the text: Consider to use Dend instead of Dstop.

L238-244: This is a good example to open a separate discussion

Figure 5: What do the error-bars show? Please present in the caption.

L259: "Analysis..." This is a result and has not to be mentioned in the conclusions again. Please revise the conclusion section and avoid to present redundant results and discussions.

L264: Which estimation uncertainty is meant here?

L291: What is the threshold to neglect local biases? This might be an interesting discussion for the discussion section, too.

References: Buchmann, Moritz, Aschauer, Johannes, Begert, Michael, and Marty, Christoph: Snow climate indicators derived from parallel manual snow measurements, <https://doi.org/10.16904/envidat.218>, 2021.