

Interactive comment on “Learning about precipitation orographic enhancement from snow-course data improves water-balance modeling” by Francesco Avanzi et al.

Anonymous Referee #1

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The study introduces a way of implementing snow course data to get a better estimate of precipitation gradients in high elevations. Therefore the authors hypothesize the snow course data to serve as additional precipitation gauges (totalisators) and test this with runoff ratios as well as in the performance of predictions of a snow-hydrologic modelling chain. The paper is written clear and is well structured. I have only some minor comments to be clarified before I recommend publication.

- snow course representatively: 1. Are there concave features in the snow courses that influence snow depth and as consequence the calculated lapse rates and if are these representative for the hypsography of the catchment(s) or could they introduce

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a bias in the estimation? If that is the case how could that be accounted for? Please add some words on this issue in the discussion. 2. How about wind drift effects in the snow courses? Do the courses under- or overcatch or do the authors think that wind drift is covered well with the courses used (considering also that wind drift might vary depending on the weather pattern)

- ephemeral snowpack: how are these accounted for in the calculation of the elevation gradients? If the precipitation reaches the ground and infiltrates the assumption of the snowpack as totalizator does not hold anymore

- glacier melt: the authors mention that the catchments are influenced by glaciers. Please add some information on how much the melt water might influence the observed streamflow

- application of lapse rate for summer period: The authors discuss that their use of the estimated lapse rate also in summer (full year simulation) is not optimal. I see that this is problematic particularly because of the different dominant precipitation type during summer. Can this not be disentangled in the interpretation or can this in the simulation not be changed in the first place?

Please, find the line by line comments below.

Minor comments: L27 the impact on societies is not obvious, please add a short example or a better explanation here

L120 filtering regarding which aspects? please add

L125-127 please add based on what (which evaluation) that was found to be best

L297 ephemeral snowpack: how are these accounted for in the calculation of the elevation gradients? If the precipitation reaches the ground and infiltrates the assumption of the snowpack as totalizator does not hold anymore

editorial comments: L2 switch on and both

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L6 add "of" after "upstream"
L10 remove "quite"
L13 "and importantly precipitation vs. observed streamflow" not clear does that belong to remedy still?
L14 "to year that" -> "to year than"
L23 add "to" after "contribute"
L24 Is there a "as" missing at the beginning of the sentence?
L28 add "add" before "better and "of" before "how"
L37 showed -> shown
L82 then -> secondly
L128 add "the" before "measurement"
L148 add "the" after "from"
L157 add "the" before "location"
L160 add "the" before "derive"
L194 necessarily -> expected to be
L217 dynamical -> dynamic
L257 remove "will"
L262 add "the" before "water years"
L264 add "the" before "original"
L294 with -> to
L305 add "during winter" after "higher"

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L306 "in Valpelline during winter and summer, respectively" -> "during summer in Valpelline"
L306 "is favor" -> "in favor"
L312 remove "these two"
L317 "peak SWE date occurs" -> "SWE peaks"
L460 remove "the" after "see"
L509 here you could refer to innovative measurement developments that make the snow course measurement much more easier and effective such as the study by Griessinger et al. 2018
References Griessinger, N, Mohr, F, Jonas, T. Measuring snow ablation rates in alpine terrain with a mobile multioffset ground-penetrating radar system. Hydrological Processes. 2018; 32: 3272– 3282. <https://doi.org/10.1002/hyp.13259>

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