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Hydrology and Earth System Sciences
Discussions

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

Anonymous Referee #2

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The paper introduces a method to combine snow-course data with precipitation gauges to improve the water balance modelling in complex terrain. The mapper is very well written and the results are well presented. Please find minor comments listed below: Title: I would suggest changing the title as I think the snow course data are used to get more information on lapse rates of precipitation affected by a lot of different processes at the mountain and the ridge scale rather than only orographic enhancement.

Introduction: the spatial variability of precipitation and in particular of snow can be caused by different processes acting at different scales. At mountain to ridge scales orographic enhancement but also the effect of preferential deposition of precipitation

can drive the spatial distribution of precipitation and can also have large effects on the snow course measurements as well as snow gauges. I would ask the authors to shortly add a discussion on that to the Introduction part as many previous studies could show that preferential deposition of solid precipitation might have strong effects on snow distribution at high elevations (.e.g Gerber et al., 2017; Gerber et al., 2019).

L 156: please provide some details on the typical location of those snow courses - are those similar to snow stations typically located at wind-sheltered locations? Please also provide more details how the transects f such snow courses were selected. This might have an important effect on the representative of such snow courses.

Figure 3 – how did you classify between low snow medium snow and high snow. Does low snow class also include ephemeral snowpack?

L 180: there are studies such as Grünewald et al., 2014 or Colladon-Lara et al., 2018 who showed a decrease in snow height at very high elevations - i.e. inverse trend above a certain elevation. Did you also account for that? This might have a strong effect on your factors if using elevations above 3000 m ASL as natural precipitation gauge.

Figure 7: no colour blind-figures are used.

L 195: as convection driven storms will totally change precipitation distribution I would suggest only using peak-season SWE measurements for solid precipitation

Could you elaborate on measurement accuracy of precipitation gauges in case of solid precipitation (i.e. wind drift on falling snow flakes)

L 229: I not fully understand why at this point the elevation threshold of 2700 m is used

L 306: in favour L 475: please list also preferential deposition of snowfall which might have an effect on your measurements Suggested references: Gerber, F., Mott, R., & Lehning, M. (2019). The Importance of Near-Surface Winter Precipitation Processes in Complex Alpine Terrain, Journal of Hydrometeorology, 20(2), 177-196. Gerber, F.,

Lehning, M., Hoch, S. W., and Mott, R. (2017), A closeâĂŘridge smallâĂŘscale atmospheric flow field and its influence on snow accumulation, J. Geophys. Res. Atmos., 122, 7737– 7754, doi:10.1002/2016JD026258. Grünewald, T., Bühler, Y. and Lehning, M. (2014) Elevation dependency of mountain snow depth. The Cryosphere, 8, 2381– 2394. https://doi.org/10.5194/tc-8-2381-2014. ColladosâĂŘLara, AâĂŘJ, PardoâĂŘIgúzquiza, E, PulidoâĂŘVelazquez, D, JiménezâĂŘSánchez, J. Precipitation fields in an alpine Mediterranean catchment: Inversion of precipitation gradient with elevation or undercatch of snowfall? Int J Climatol. 2018; 38: 3565– 3578. https://doi.org/10.1002/joc.5517

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