Review of "Undercatch corrected gridded precipitation data to improve hydrological modeling in high-alpine orography" by Philipp Maier et al.

This manuscript presents a methodology to derive spatially continuous correction factors intended to account for wind-induced precipitation undercatch. The authors first apply established undercatch correction equations to hourly precipitation measurements at surface stations and then aggregate corrected and uncorrected precipitation totals at the monthly scale to derive station-based monthly correction factors (CFs). These CFs are subsequently interpolated over Austria using generalized additive models (GAMs) with static spatial covariates describing terrain and wind exposure. The resulting gridded CF fields are then used to adjust an existing gridded precipitation product.

The impact of this correction is evaluated through snow and hydrological modelling. The authors show that, for two catchments investigated in detail, increasing precipitation at the appropriate time of year improves simulated snowmelt dynamics and leads to better runoff simulations compared with the raw precipitation product. Across a larger set of Austrian catchments, the corrected forcing also improves some performance metrics, although the benefits are not systematic.

Overall, although the level of methodological novelty is moderate, I found the manuscript clear, well written, and scientifically honest about the strengths and limitations of the proposed approach. I also appreciated the authors effort to evaluate the correction framework from multiple perspectives. I nevertheless have several comments that I believe should be addressed before publication.

General comments

- A central assumption of the study is the aggregation of hourly undercatch-corrected precipitation into monthly station-wise correction factors, which are then spatially modelled. Because undercatch is fundamentally an event-scale process that depends on wind conditions, precipitation phase, and likely also precipitation intensity, this monthly aggregation is a strong structural simplification. Did you look at the information lost when moving from hourly corrections to monthly multiplicative factors? For example, a 10mm event could occur with and without high wind conditions but the proposed approach will apply the same CF if the event occurs at the same elevation/month.
- Did you consider fitting a more parsimonious model in which seasonality is represented directly, for example by including month through sine/cosine terms, rather than fitting a

separate GAM for each month? This would reduce model complexity and may help regularize the seasonal structure.

- The strongest corrections appear to occur in high-elevation regions, which are also the region with the least dense observation network. Do you think your GAM models could extrapolate more strongly there? Could you address this point in the discussion more explicitly?

Specific comments

Major comments

- Line 238: Are you comfortable with the level of independence between calibration, methodological development, and detailed hydrological evaluation? Please clarify this point
- Fig 5: It would be useful to add, as an additional subplot to Fig. 5, a map of station-based undercatch correction factors for one representative winter month (for example December or January). This would help the reader visually assess whether there is an obvious spatial structure in the station values before interpolation, even if, as the authors later note, spatial structure is not the only driver of the correction factors.
- Fig 7 and Lines 299 to 301: from the figures it is hard to statute that the error "increases with elevation" is sufficiently well supported. Above 1500 m, the number of stations becomes limited, and a range of exposure values is still represented. Plus, the stations with the largest relative errors do not seem to correspond clearly to the highest positive exposure values.
- Fig 9: I appreciated this figure, but I found the discussion too brief. Are these values expected or not? It would help the reader to extend the discussion to understand whether these values are plausible, surprising, or consistent with prior knowledge.
- Section 3.4: why starting with the hydrology and not the snow modelling in the description of the results? Following the modelling chain illustrated in Fig. 4, I would have expected the reverse order. Since undercatch corrections should primarily affect solid precipitation and snow accumulation first, and runoff only afterward through melt, presenting snow-related impacts before hydrological impacts would seem more natural.
- Line 373-… : why using snow depth and not snow water equivalent for the evaluation? The SWE is generally more directly relevant for hydrology and, in many contexts, more informative for assessing the impact of precipitation corrections on water storage.
- Line 390…: I found the evaluation on the glacier very interesting.
- Line 524-525: Could you add a reference or two on the "lagrangian precipitation frameworks with high resolution framework" ?

- Conclusion:
    - Which parts of the framework can or cannot be generalized to other mountain regions (data availability, network metadata, etc.) ?
    - I think it would be interesting to mention that alternative correction approaches could also be explored, for example transfer functions that depend more explicitly on snowfall intensity rather than on air temperature. One potentially relevant reference is: *Impacts of Adjusting Solid Precipitation Amounts in the Canadian Precipitation Analysis System*, Journal of Applied Meteorology and Climatology, 64(7), 2025.

Minor comments

- Line 40: misplaced parenthesis
- Line 141: Explain what patch interpolation is?
- Line 229: Missing the word “Fig”
- Fig 8: could you consider having an organization of maps of (2, 2) instead of (4,1) ?