

## ***Interactive comment on “Snowfall in the Alps: Evaluation and projections based on the EURO-CORDEX regional climate models” by Prisco Frei et al.***

**Anonymous Referee #1**

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Review of “Snowfall in the Alps: Evaluation and projections based on the EURO-CORDEX regional climate model” by P. Frei, S. Kotlarski, M. A. Liniger and C. Schär.

Recommendation: acceptance with minor revisions

The authors evaluate snowfall from 14 high-resolution EURO-CORDEX simulations. They use a method to re-calculate snowfall based on near-surface temperature conditions and designed to account for subgrid-scale topography, and a method to correct biases. Interestingly, they also analyse the raw snowfall from EURO-CORDEX simulations when available. They assess the performance of their methods by comparing several snowfall indices to the ones derived from observational products, which is an interesting approach. Then, they consider projections under the RCP85 scenario, and

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explain changes in the aforementioned indices.

This is a nice piece of work, the paper is well written and the model analysis is robust. I had several important questions while reading sections 3 and 4, but all of them were addressed in section 5 (Discussion). So I recommend this paper for publication in TC. I just have a bunch of minor comments that are listed below.

Minor comments:

- L. 65-66: replace “the GCM provides the lateral boundary conditions to the RCM” with “the GCM provides the lateral and sea surface boundary conditions to the RCM”.
- L. 88-89: the fact that “a gridded observational snowfall product that could serve as reference for RCM evaluation does not exist” is not a good reason for not using raw outputs, it can actually be evaluated as in Fig. 13 of this paper. . . - L. 133-135: the RCMs also have an effective resolution that is larger than their grid resolution, see e.g. Skamarock et al. (Mon. Wea. Rev. 2004), Lefèvre et al. (Mar. Pol. Bull. 2010).
- L. 151: the authors should make clear that what they refer to as “control” is based on the CMIP5 historical simulations (not the one based on reanalyses).
- Section 2.2: it is worth mentioning that daily-averages from EURO-CORDEX are used (or specify what other time sampling/averaging is used).
- Fig. 1: which topography is shown? - L.246-249: it is not clear to me why the explanation cannot be reversed: coarse cells with grid temperature lower than  $T^*$  should overestimate snowfall at some locations covered by the cell, don't they? If it's not zero on average, is it because elevation distribution is generally skewed within the coarse cell? - L. 463: I think that “Rhone Valley” would be more appropriate than “Western France”.
- L. 485: typo “change sin”.
- Fig. 11: indicate what the grey area represents.
- Section 5.3: that relative changes in snowfall from raw model outputs are very similar to separated and bias-corrected fields is a very interesting finding and should definitely be reported in the Abstract.
- L.656-658: It is indeed a pity that no evaluation is performed based on datasets from other alpine countries. It would also help validate the overall methodology since the methods tuning is undertaken over the Swiss Alps.

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