

Interactive comment on “The downscaling and adjustment method ADAMONT v1.0 for climate projections in mountainous regions applicable to energy balance land surface models” by D. Verfaillie et al.

Anonymous Referee #3

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General comments

The paper is generally interesting and could provide useful tool to adjust climate data on mountain regions. Especially the adjustment of meteorological variables which affect snow depth is highly welcomed as the accumulation and melting of snow is usually difficult to reproduce even on the areas with relatively constant altitude. Although the paper is promising I have some major comments which I think should be considered before publishing:

1. This paper was hard to read and in some parts to understand as it uses difficult

C1

language and too long sentences.

2. Too many figures. Authors should reduce the amount to half at the actual manuscript and really think through what are the most important figures essential in supplementary material. Despite the authors' good intent the supplementary material with 207 figures is too much. Authors can not assume any reader to have time or willingness to go through those all. It is not good practice to refer to figures 1-207 (!) with every result authors show. 1-3 figures per result should be enough. Font size in figures is too small. It is not stated in every figure caption are the values hourly/daily/monthly/seasonal mean values. "Mean precipitation" does not tell much when the reader is not familiar with the study area and its climatic features.

3. Authors state they have adjusted also wind speed, humidity, and short- and long-wave radiation but do not show any results for these variables. It would have been interesting to see how large effect these variables actually have on snow depth and how much does the bias correction improve the results. This is especially interesting as authors have used hourly data where the variability can be larger than in monthly means.

4. Although the quantile-quantile mapping is well known it is unclear how it is implemented in this study. Especially how is the extreme tail of distributions (>99.5%) handled? Add a short description and clarify the description of ADAMONT method as it is currently hard to follow.

5. Why are RCM's daily values disaggregated to hourly if all results are still presented as daily/monthly/seasonal mean? Authors should make it clear why the hourly data is important for this study.

6. Why are the results shown as mean values for large areas if the downscaling/adjustment is done separately for each massifs? This smooths especially the extreme values from the data and hides partly the true performance of the method.

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7. Be consistent with the names and definitions throughout the paper. Be sparing with acronyms especially if those are used only once.

Specific comments

Lines 67-69: As far as I know the quantile mapping is restricted to the range of observations unless there is added some method to handle the larger values than what was found from the learning period.

Lines 109-112: State clearly that only past climate is studied in this study. I thought also future period was considered here.

Lines 119-120: what about section 4.

Line 165: centroid = center point of some grid point or massif area?

Line 195: What is the range of elevation factor N (0-1, 100-1000 etc.)? How it depends on the altitude?

Lines 201-202 and 214-216: Why is the hourly SAFRAN data first integrated to daily, then used in the quantile mapping function with RCM daily data and then the adjusted RCM daily data is disaggregated to hourly using the same hourly SAFRAN data? Why isn't the RCM data disaggregated to hourly before the ADAMONT adjustment?

Lines 201-202: These integration methods are not clear to me. Have those been shortly explained somewhere? Table 1, method column.

Lines 206-207: Here time period for RCM is 1980-2010 but in figures is used 1979-2010. Why? Describe shortly the quantile mapping method used. There are different variations depending on the treatment of extreme values.

Lines 208-214: I did not understand this step. Is this step 6 supposed to clarify the step 4 or to precede the step 7? Is this step done daily or monthly? And how does it differ from the step 4 where seasonal percentiles were calculated?

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253-254: In Olsson et al. (2015) they found that the separation of temperature to dry and wet days produced unrealistic results compared to observations and they used unseparated temperature data for the final results. Was any comparison made with and without separation of precipitation to rain and snow?

Lines 269-271: How much does this grouping decrease and smooth the extreme values?

Lines 277-278 (throughout the paper): It is not a good practice to ask the reader to go through 207 figures to get some clue what would the conclusion of the results be.

Lines 184-301: Why slightly different periods 1979-2010 and 1980-2010 are used in results?

Lines 293-300: Does this mean the relative proportions of wet and dry days are calculated from the whole period separately for RCM and reanalysis and then used to calculate the specific scores or were these calculated so that it had to be dry or wet in both RCM and reanalysis at the same day(hour)? In RCMs the relative proportions should be similar to observations/reanalysis after adjustment but the same weather will probably not occur in the RCM and reanalysis at the same day.

Lines 313-324: Quite long sentence.

Lines: 345-346: Why isn't the table 2 referred already in section 2.5?

Line 349: evidenced=evidences?

Line 354 (throughout the paper): Please be consistent with names, definitions and acronyms. Here "our method" is ADAMONT method?

Lines 358-360: Why is the average precipitation lower in the longest time period compared to the shorter time periods?

Line 367: 9 figures with sub-figures to display the results for RMSE is too much. Please reduce.

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Line 371: Why? Is the variability of temperature lower in autumn compared to other seasons?

Lines 373-375: Why is that? Is there less data or too large distances between altitudes?

Lines 381-383: If the figures 7-12 also includes the uncorrected values then it should be stated in their legend.

Lines 385-386: I think bias of 150mm/month sounds quite large. Could you give these over/underestimations as percentage values?

Line 392: Also this bias sounds quite large. See previous comment.

Lines 401-402: Why the N50 degrades results at high altitudes?

Line 409: What does this integration time mean?

Line 425 (throughout the paper): Is there difference between SAFRAN and SAFRAN/Crocus?

Line 277: adjusted RCM = adjusted with ADAMONT method?

Lines 480-482: This is not surprising as the quantile mapping should adjust the learning period values close to observed values! There should be stated how close the ADAMONT methods gets the observational data on the learning period and why there will be greater differences on other periods.

Line 489: What is DSCLIM?

Line 490 (and forward): What is figure 10.1?

Lines 525-528: These acronyms have been already defined in section 2.5.

Lines 546-550: Why are the precipitation underestimated with the longest time period compared to the other periods?

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Lines 550-554: How was the extreme tail of distribution handled?

Lines 555-558: Again, the bias correction methods should perform like this and the result is not surprising. How much did these periods differ from each other?

Lines 590-593: ultimate correction = bias correction of rain and snow separately? Please be consistent.

Lines 613-614: No need to explain the acronyms again and again.

Lines 653-667: How does ADAMONT method treat the lowlands where there are no massifs? Gridwise? Table 2: What is the "period considered"? Meaning of RCM APPR?

Figure 18: It is hard to compare the figures as they have different scaling.

Figure 19: The scaling of these figures could be reduced as there is too much white background.

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