Earth System
Dynamics
Discussions

Interactive comment on "Bias correction of surface downwelling longwave and shortwave radiation for the EWEMBI dataset" *by* Stefan Lange

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Responses by the author (in italics) to comments (not in italics) by anonymous referee #1

General comments

[. . .]

My main concern is that the author provides some improvement to the description of results, particularly in terms of figures. I am aware that comparison among 8*3 methods, adopting different parameters over LW and SW radiation fields separately,

requires a challenging effort in terms of clarity and conciseness. In some parts of the manuscript I found difficult to benchmark arguments described in the text with the mentioned figures. I will be more specific in the next section.

The figures will be clearer in the revised manuscript, see my responses to your specific comments.

Another aspect that I think might be improved is a discussion of the implications of using a deterministic parametric method, rather than a stochastic one, for bias correction when a downscaling/upscaling is made necessary. A reference to Maraun, 2013 (JCLI) might be helpful in this respect. Related to this, a further appendix may be suitable, not only including such a discussion but also a basic description of the quantile mapping methodology for those who are not familiar with it. In the current draft, this is left to references although, as far as I could check, none of the mentioned papers explicitly addresses for the quantile mapping methodology.

I appreciate that not every reader is familiar with the quantile mapping (QM) methodology. Since also anonymous referee #2 asked for it, there will be an appendix in the revised manuscript that shall include a general description of QM and touch on parametric versus non-parametric as well as deterministic versus stochastic QM.

Specific comments

Figure 2: it was very difficult to me to distinguish among the various lines shown in the panels. The dotted red and dashed blue lines are almost indistinguishable (particularly in (b) and (c)) and the light blue line in (a) can hardly be seen. I would suggest to split this figure in two, separately showing the beta and advanced distributions respectively, with the related parameters. As for the caption, I would suggest to explain in first place on which data the computation of the distributions and their parameters is based.

As to the caption, I will follow your suggestion. I would not want to split the figure in two as suggested because the figure is supposed to illustrate similarities and differences

between the different QM methods and that would be difficult if different methods were shown in different figures. However, I will simplify the plot by removing the lowermost and uppermost dotted red and dashed blue lines as these are a mere bonus (they just show that the distribution fitting works well). Also, I will make the light blue line green and add the following sentence to the figure caption: "Note that the basic and advanced estimates of mean values and standard deviations only differ in panel (c) near the beginning and end of polar night (cf. Table 1)." This should clarify that it is not a bug but a feature that the dotted red and dashed blue lines are mostly indistinguishable.

Table 2: I wonder if one could improve the notation for distribution parameters and arrange it with a more mathematically appropriate symbols. Rather than plain text and footnotes, you may want to introduce a consistent notation with brackets and apostrophes to indicate means, running means and variances, as well as apexes and subscripts referring to the length of the window and the amount of years to be considered.

Thank you very much for this suggestion. I will introduce such a mathematical notation in the revised manuscript.

l. 32-33, p. 9: it may be worth mentioning here how the common factor for the aggregation of bias-corrected values in the SRB-grid cell is chosen.

I will rewrite this paragraph using a g_{ij} notation similar to the f_{ij} notation around equations (1) and (2) such that it becomes clearer how the common factor is determined.

l. 22, p. 10: As far as I understood the common factor f(i,j) is not the same as for the aggregation to the SRB-grid cell, given that it depends on whether the bias correction is applied on the lower or higher resolution. If it is not the case, it is once again not clear to me how the value of this common factor is chosen (see previous comment).

As replied to your previous comment, I will rewrite the paragraph that provoked your previous comment and in that new paragraph use the new notation g_{ij} for the "common factor" that is indeed different from the "common factor" f_{ij} mentioned here. After this

adjustment it should be clear how both g_{ij} and f_{ij} are calculated.

l. 33-34 p. 12: the limits of parametric methods are here correctly mentioned. As stated in the General Comments section, this is a critical issue, and I think it would be worthwhile a few more arguments. If it is not too much work, I wonder if it would be possible to apply a non-parametric quantile mapping (e.g. using a cubic spline empirical CDF) to be compared with these parametric methods.

The number of QM methods compared in this study is already quite large. Also testing non-parametric QM methods is beyond the scope of the article. However, I will add a paragraph to Section 5 that discusses potential benefits of using non-parametric QM methods compared to the parametric QM methods tested here.

l. 15-16 p. 14: looking at Figure 6 is very hardly distinguishable that the BCvmp1 at the daily time scale outperforms the same methods at the monthly time scale. This is in my opinion because Figure 6, as well as Figure 2, contains too much information that prevents from emphasizing the key points that are described in the text. The uncertainty range masks the differences among the bars. Furthermore, having five bars for every months makes very difficult to distinguish them, particularly the ones in lighter colours (BCvmp1 methods). I would suggest to split the figures in order at least to separately consider original and bias corrected p-values.

Again, I think that it would not help to split the figure as suggested because plotting p-values before and after bias correction using the same scale is needed in order to illustrates the effect of the bias correction. Yet I appreciate that there are quite many box-whisker plots in the figure, so I will reduce the plot's temporal resolution from monthly to seasonal. Also, I will reduce the range of the y-axis from [-14, 0] to [-10, 0], which will make differences between the individual box-whisker plots more easily distinguishable. Lastly, I will add a sentence to the text stating that results for BCvmb1 and BCvma1 are virtually identical.

l. 9-11 p. 16 and l. 1-2 p. 18: I found very challenging to carve out the important

information from Figures 7-8 and link it with the arguments in the text. It seems to me that the only clear information that can be driven from them is that BCvdax methods outrank BCvdax at the daily resolution for what concerns rlds, and the other way round for what concerns rsds and rlds in the monthly mean. The author refers to a tropical/extratropical asymmetry that to my best effort is barely distinguishable. Furthermore the seasonal dependence (if any) is not mentioned in the text, still making the clarity of the two figures even more arguable. I would suggest either to restructure the layout of Figures 7 and 8 or removing this part, since it does not add much to the discussion of results.

Since referee #2 also revealed several substantial shortcomings in this part of the manuscript, the entire validation against BSRN observations will be removed from the revised manuscript.

Technical corrections

l. 6 p. 7 (and elsewhere in the text): replace "Sect." with "Appendix", when you reference to appendices.

I will do as suggested.

l. 5 p. 9: correct "it".

I will do as suggested.

l. 8 p. 10: maybe "be" is needed between "to" and "made".

I will do as suggested.

l. 11 p. 14: "that" is repeated twice.

I will substitute "this" for the second "that".