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Climate of the Past Discussions

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Interactive Comment

Interactive comment on "Non-linear statistical downscaling of present and LGM precipitation and temperatures over Europe" *by* M. Vrac et al.

Anonymous Referee #4

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Summary

The authors use generalized additive models (GAMs) to downscale CLIMBER temperature and log-precipitation output. The GAMs are calibrated with present day CRU climatology over western Europe. The calibrated model is tested against present day North America climatology and against LGM climatology.

General comments

It seems that the statistical methodology is suited for the presented application. However, the manuscript still needs considerable work. I strongly support all comments of the other two reviewers; I would have reformulated the comments concerning the BIC

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criterion differently (see below). My contribution in this comment mainly focuses on the statistical aspect of the manuscript.

The typical reader of CP will most likely not have a strong background in GAMs and splines. It is therefore crucial to present the statistical model appropriately. GAMs as well as spline functions need more careful explanation. As far as I know, the GAM, in general has an intercept and can include arbitrary functions f_j, not only spline functions. Strictly speaking the authors touch on the "AM" elements of the GAM only. The link function ("G" element) is not mentioned. Additionally, the paragraph following equation (1) is very obscure. As pointed out, more information about splines is required. Additionally, how where the knots selected? How many degrees of freedom has the final model?

The formula for the BIC needs some more explanation. The variance of ε is not known, correct? Therefore, should the BIC not read

$$n \log(\mathrm{RSS}/n) + d \log(n)$$

The presentation of the results in form of boxplots in Fig. 3g)-h) is of limited use. It would be of much more value to present scatter-plots of the predicted vs observed quantities. Many methods can reproduce the shape of the observations (which can, to a certain extend, be checked using boxplots), but it is also crucial to have a high correlation between the predictions and observations.

I do not quite understand the rational of dividing the available predictors into two groups (physical and geographical), recognizing that both groups are not sufficient (or entirely satisfying) to explain the predictands and later for the LGM using a combination of both.

I wonder, how much the GAM performs compared to "well" interpolated CLIMBER data. For example, take a decent predictor (as found with the monthly GAM analysis) and use a simple kriging approach with one covariable. Does the GAM approach really

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outperform this baseline technique (at least the baseline produces physical values for the North America data)?

Specific comments

Page 904: It might be useful to give the number of the regional-scale data points explicitly. It is roughly $19\,000 \approx 30 \times 18 \times 36$, correct?

Page 908 line 24: What do you mean with “apply GAM in favourable conditions”?

Page 910 top paragraph: Should the null-model also be included? It would probably be easier to present N as $N = 2^{15} = 32\,767$?

Page 910 line 11: Please be more specific what the dimension of the model is in the case of k predictors and L knots.

Page 910 line 5: On a desktop/laptop, I presume?

Page 910 line 16: Why the month of September and not October?

Page 911: The boxplots are constructed from roughly $19\,000$ data points. If the data were normal, we would expect about 132 data points declared as outliers. I would expect some “outliers”. Please comment.

Table 1: The predictors used should definitely be given.

Figures: I need to re-emphasis: the individual panels are often too small and the color schemes should be uniform with a well chosen color range.

Technical corrections

Page 908 line 10: Aco continentality?

Page 919 line 24: NSF-GMC $\rightarrow$ NSF-CMG.

Please also check references for capitalization.

Interactive comment on Clim. Past Discuss., 3, 899, 2007.

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