**Climate
of the Past
Discussions**

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 #1

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Summary

This paper presents a methodology for downscaling results from the CLIMBER EMIC. The method is calibrated over Western Europe relative to CRU data. It is then applied to other geographical regions (N America, N Europe), and to a different time period (LGM). The methodology does not work well for the different regions, but performs resaonably for the LGM compared to paleo data.

General Comments

The manuscript presents a novel and potentially powerful methodology for downscaling coarse-resolution EMIC output. The paleo aspects of the work are particularly interesting. However, in my opinion the manuscript needs quite a bit of work before it can be

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published:

(1) The English used in the manuscript is poor. I gave up correcting mistakes and grammatical errors at Page 901. The whole manuscript should be checked by someone with good written English skills. At present the manuscript is very hard to read, especially the abstract and introduction.

(2) I think that the abstract and conclusions do not reflect the content of the paper. The downscaling methodology is found to perform reasonably for the W. Europe region, but does not translate well to N America or N Europe (i.e. outside of the domain for which it was calibrated). This is one of the main findings of the work, and should be stated much more clearly. I don't thnk that only those plots which show good agreement should be presented.

(3) My other main problem is with the paleo aspect of the work. This is the most interesting section, but the results are rather confused and should be made clearer. In particular, the 'added-value' of the downscaling should be made much clearer, by direct comparison of the downscaled results with the 'raw' CLIMBER data. In addition, I am very uncomfortable with the rejection of sites 8 and 9 in the analysis, with little or no scientific justification. If the model performs badly in this region, then that is a feature of the methodology, which should be commented on. If the methodology were being used in a predictive sense (e.g. future climate change), then this sort of 'retrospective' rejection of certain regions could not be carried out.

(4) The figures in general need a lot of work (see comments below).

Specific Comments

Abstract

The abstract needs to be understandable in isolation from the paper. i.e. What is a geographical vs. a physical descriptor?

Introduction

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P901, line 18: lower scales? Temporal or spatial?

Section 2 P903, line 7: A plot of the region considered would be useful.

P904, lines 1-7: This section (from NeverthelessĚ) is unfortunately written in very poor English and so it is hard to understand what is being said.

P905, line 7: piece of what?

P905, lines 5-9. It is not clear how it is decided if the spline function will be second order or third order etc. Is the order always the same for each predictor/predictand? Is this decision made at the outset, or based on experimentation? And how are the intervals ('pieces') decided?

P905, line 14: Reference needed for lognormal distribution of precip.

Section 3 3.1: It seems very odd that CLIMBER-modelled precip is not used as one of the predictors! Is the modelled precip so bad that it cannot be used in the downscaling? If this is the case then this should definitely be commented on.

3.1) Why is longitude used as a predictor? This seems like a very odd predictor, especially given that continentality is already used. Also, see comments below regarding use of LON for other domains.

P907: A geographical plot of Aco and Dco over western Europe would greatly aid the explanation of these variables. Aco could be shown for annual mean winds.

P908: The description of the dynamics behind the W slope is very poor. Again, a map of W-slope for western Europe would greatly aid the discussion. What is the basic assumption - that the prevailing wind is westerly and that air masses rise and then precipitate? This should be explained.

P909, line 15: Maybe reiterate that temp and precip are the predictands.

P909, line 17: Variance in what? Do you really mean variance? Isn't this the percent-

age of the climate signal (i.e. the predictand) which is captured? Do you mean spatial variance? An equation showing exactly what is plotted in Fig 2 would help - there must be an average over all the grid boxes at some point? Does a value of 80% mean that 80% of gridboxes are predicted correctly to within a certain tolerance? Also for the 'residual'. We really need a definition of this term in this context, and preferably an equation.

P910: The method for selecting the most explicative predictors should arrive at a unique solution, so it would be useful to have a table showing what predictors are selected for each month. Ahh, I see that this comes later in page 912, but maybe it should be earlier?

P910: The 'strength' of the penalty term in Eq. 6 seems completely arbitrary. Its value needs to be justified. This is especially important given the fact that precip improves significantly when more predictors are used. Someone with more computing power may wish to use more predictors!

P910, line 26. The fact that altitude is a good predictor is not surprising seeing as much of the so-called 'high resolution' CRU 'data' is actually just a linear interpolation using a lapse rate and the orography!! This should be commented on.

P912, line 13: On what grounds is the sentence 'Indeed, a model based on LON would stay too close from [sic] the present climate' based? I am uncomfortable about the use of LON anyway. Surely the main reason for not using it is that it is completely based on the European region!! When you move to N America it will mess up the results (i.e. be outside its calibrated range)! This is a good basis for rejecting LON, more then other arguments?? I am more uncomfortable about rejecting Wu. More justification has to be given for this.

P914: I think that the N European data SHOULD be shown. If it is poor then this is just as important as the good comparison in W Europe. Same for physical predictors in N America. This makes a lot of plots, so they should be shown for one month only,

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or put into supplementary information. In itself, this is an important result. It shows the limitations of the methodology.

P914, line 19-29. I don't understand this paragraph at all. E.g. Similar to what??, line 19, line 21. +120oC!! Is this correct?? Doesn't this rather invalidate the methodology over this region? This should be stated more clearly.

P914. In conclusion, the methodology does not work at all well outside of the geographically tuned region!! Isn't this is the conclusion of this section?

P915, line 8: I am again surprised that CLIMBER-modelled precipitation is not one of the predictors for precipitation!

P917: I find the summary, lines 14-24, rather misleading. For a start, why is the CLIMBER predicted temp and precip not included in table 2? This would clearly demonstrate the added-value of the downscaling. It would be much clearer in table 2 to have anomalies from the data, rather than absolute values. I can't agree with showing the data excluding sites 8 and 9. This seems to have been done just to get a better fit than the GCMs!! It is not properly scientifically justified. If anything, one of sites 1 and 2 should be neglected (or not included in the study at all) as they are close to each other, therefore giving a bias to the mean error.

Conclusions P918, line 10-14. I disagree with this sentence. The method did not perform well for N America and N Europe (well, it seems that way, but many of the results were not shown so it is hard to be sure).

P918, line 22: 'selected with care'!! Little rationale was given for their selection. Without more justification one might wonder that they were chosen retrospectively to give the best results, out of many tested?!

P918, line 24: It is not really surprising that a decrease in temp was shown - this is the LGM after all!

P919: I don't understand the final sentence! What is the 'large set of downscaled

values'? How would they be disposed of?

Figures

Figure 2: Key needed for predictors. Some of the yellow lines are very hard to see.

Figure 3: (1) The colour scale in (c) and (f) is misleading. You need to highlight what is +ve and what is -ve. It could be white around zero, and maybe red=positive, blue =negative.

(2) The geographical plots would really benefit from equivalent plots of the CLIMBER-predicted temp and precip, to highlight the effect of the downscaling.

(3) The fact that this is January should be highlighted more clearly in the figure itself.

(4) g and h need y-axis labels.

Figure 4:and 5:

Plots are much too small. Colour scale needs improving to highlight the zero (see point 1 for figure 3). The colour scale of these plots should be the same as (c) and (f) of figure 3., to aid comparison.

Figure 7, again, a better colour scale could be chosen to differentiate +/- for (a-d). Again, the CLIMBER-predicted temp and precip is needed.

Figure 8: A much better quality image is needed. It is hard to read the numbers even though they are big.

Figure 9: The x axis should be labelled 1-10 rather than 0-40! Using different colour for the different symbols would aid readability, as would clearly demarking the different sites (e.g. with a vertical line).

Technical Comments (up to end page 901)

Abstract: The first sentence needs re-writing in clearer English

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P900, line 15: - GCMs -> GCM.

P900, line 26: lies -> relies

P901, line 3: of the world -> representing the Earth's

P901, line 5: get -> obtain

P901, line 26: an other -> another.

P901, line 26: 'outburst of interest' is not a usual English phrase.

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

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