Clim. Past Discuss., 11, C1984–C1987, 2015
www.clim-past-discuss.net/11/C1984/2015/

Climate of the Past Discussions

Interactive comment on "Gridded climate data from 5 GCMs of the Last Glacial Maximum downscaled to 30 arc s for Europe" *by* D. R. Schmatz et al.

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Received and published: 12 October 2015

Referee #2: Review of Schmatz et al "Gridded climate data from 5 GCMs of the Last Glacial Maximum downscaled to 30 arc s for Europe" This manuscript describes a new method to downscale data from GCMs (âĹij300 km in resolution) to a very high resolution ($\leq$1km) grid for Europe and for the Last Glacial Maximum. One of the main problems for this period is that the continents are more extensive because of the lower sea level, so that no reference (i.e. present day) data is available onto which LGM – ref climate anomalies can be added to obtain an LGM climate at high resolution. The authors actually focus on this problem, and the additional problem of the PMIP2 data

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for the reference climate being for the pre-industrial period and not the recent period, for which very high resolution data is available.

While I find the topic of this manuscript very interesting because downscaling is indeed required for “paleo-impact” studies, I was quite disappointed by the manuscript.

Referee #2: 1/ the resulting fields for the LGM for the 5 models are not shown, and therefore not discussed. This is frustrating, as the title of the manuscript announces these results. Most of the manuscript is actually about the present climatology and not the LGM. To be published, I really think that the manuscript should show and discuss the results for the LGM, which would indeed be interesting to a wide community, from biologists to archeologists.

Response: 1/ The results are described in detail, but only shown exemplarily in Fig. 5c & 5d, since input data sets and all results are available for download on http://doi.pangaea.de/10.1594/PANGAEA.845883. To better account for the results and title we will include additional figures, both in the main text (few) and in the appendix (many) showing e.g. maps of annual sums and averages of precipitation and temperature for each of the GCMs for whole Europe.

Referee #2: 2/ the LGM results are not compared to other model results (even the initial coarse resolution ones) or to climate reconstructions (e.g. Bartlein et al, already cited in the manuscript).

Response: 2/ We thank the reviewer for this comment. We agree with him/her in that model comparisons are an important aspect of the development of GCM models, as witnessed in the primary theme of the PMIP studies. However, we believe that it would be of little value, and quite tangential to the focus of the manuscript, to compare the high-resolution layers with the original coarse-resolution maps.

Referee #2: 3/ the methods are generally well explained, but the choices (e.g. the 20 m a.s.l threshold) are not justified.

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Response: 3/ We thank the reviewer for pointing out the need for more clarity here. The threshold of 20m was chosen because it was the minimum amount necessary to remove the coastal effect on the climate in very flat regions like e.g. Yucatán and the Netherlands. If the value is set higher, the inland climate information was lost. If the value was set lower, the correction effect vanished. We will emphasize this more clearly in the methods section.

Referee #2: 4/ PMIP3/CMIP5 data is actually available for the historical period, so there would be no need to adjust the pre-industrial results to the modern era. The method for this adjustment could actually be tested on the PMIP3-CMIP5 data.

Response: 4/ Yes, for PMIP3 the adjustment to pre-industrial results can be omitted, i.e. the intermediate step where "worldclim extended" is adjusted to preindustrial conditions using the reconstructed climate data can be skipped. This remains for a future implementation of the downscaling process.

Referee #2: 5/The authors could actually consider GMD or ESD if they “just” want to publish their data set and downscaling method. But they need to insert the real results from their study and discuss them, and not to just give a method to obtain them. One very inter- esting outcome is the range of results they get for the LGM, not just one example for one month. The authors could also quantify the improvement (or not) with downscaling compared to paleoclimatic reconstructions

Response: 5/ The data are available. It is very unfortunate, that the link to the results vanished from the published version of the discussion paper. The range of results is determined by the combination of (1) the anomalies calculated from the GCMs, (2) the anomaly calculated from the reconstructed data and (3) worldclim extended. (2) and (3) are the same for all GCMs in the downscaling procedure. We will add additional figures showing summary results of the different models.

Referee #2: 6/ At the beginning of the manuscript, the authors discuss possible factors having an impact on fine-scale climate: climate on areas exposed at the LGM and not

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for present day, but also differences in elevation and continentality. Those latter factors are not re- investigated afterwards, while they could be highly relevant, and so would the fine-scale ice sheet cover (especially over the Alps). How did they deal with these factors?

Response: 6/ We thank the referee for pointing out this issue. Fine-scaled climate was accounted for when creating the extension to the LGM coastline by including elevation and latitude/longitude (continentality) in the multiple linear regressions. We will now emphasize this better in the manuscript. Continentality was not reassessed later on. It can be expected that an enlargement of the land mass produces a more continental climate, especially where the enlargement is substantial (e.g. east of the area of the North Sea). But we expect that this, the differences in elevation, and the effect of the ice cover are modelled by the GCMs and thus should be represented by the anomalies. Fine-scale ice sheet coverage, in the Alps for example, is at the limit of the resolution of the original GCMs, and their effects in the data are fully dependent on how such data on ice were incorporated in the original GCMs. Application of an ice cover layer as a mask can remove these areas from consideration in impact analysis. We will provide an ice mask layer so that users of the data can use it to mask LGM or later ice sheet extent from the reconstructed climate data.

Interactive comment on Clim. Past Discuss., 11, 2585, 2015.