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Interactive comment on "Methodological aspects of a pattern-scaling approach to produce global fields of monthly means of daily maximum and minimum temperature" *by* S. Kremser et al.

Anonymous Referee #3

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Review of "Methodological aspects of a pattern-scaling approach to produce global fields of monthly means of daily maximum and minimum temperature." By Kremser et al.

This paper applies pattern-scaling to mean monthly maximum and minimum temperatures. Pattern-scaling has been adopted by many authors now, as a way to interpolate between existing compute-intensive GCM simulations for alternative pathways in atmospheric gas concentrations. However most of these have concentrated on monthly means. This paper is novel because it applies to monthly maximum and minimum temperatures.

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Interactive Discussion
Discussion Paper

The Introduction suggests that one way to train pattern-scaling is against measurements, which of course removes any model biases. I particularly liked Figure 2 in that regard, but this only gets the shortest of mentions before moving on to using a GCM instead. Possibly for a future paper, but Figure 2 could be readily extended to many other areas where CRU data exist and there are sufficient weather stations. Or possibly even use ECMWF re-analysis data?

I realize this paper is a more a description of technical developments, as appropriate for this journal. However a little more background would be appropriate in the Introduction. Why are we interested in max / min daily temperatures (risk of heat stress, changes in overnight ice conditions, impactions for crop resilience)?

Extremes are of major interest now, and how these may change in to the future. Given the data analyzed is daily, would the authors be prepared to speculate as to whether patterns could be built to capture maximum and minimum daily temperatures for each month? Certainly the recent SREX IPCC report could provide a steer on what might be needed, even if this is only mentioned in the paper Discussion. Figure 2 shows very noisy data, so maybe patterns are not possible for that quantity?

It was slightly disappointed that only one GCM was analyzed, given the availability of models across the CMIP5 database. I do realize that the CMIP5 database isn't always as easy to work with at times, and to cover the complete set of AOGCMs would be a relatively time-consuming task. Additionally, I guess the methodology could also be applied to other variables? It might be worth mentioning that (e.g. mean maximum windspeed?). A discussion part of a paper is always more interesting when it points out additional things that need doing.

Ultimately pattern-scaling of course requires applications. Hence if the authors want to use this for different emissions scenarios (and thus radiative forcings) to obtain T'_global, then some sort of (1) Energy Balance Model will be needed along with (2) a carbon cycle model. Again, might be nice to at least mention this in the Discussion,

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even if only to point out available models (MAGICC for instance) – and to cite them.

Some plant physiological responses might depend heavily on the range of daily temperatures. Hence this analysis has implications for ecosystem impacts modelling for alternative future changes to atmospheric GHG composition. This could be a suggested addition i.e. include the patterns of this paper, and in to models where pattern-scaling has been combined with land surface models (e.g. IMOGEN: Huntingford et al 2010, GMD).

Figure 4 shows a property of pattern-scaling that other authors have found for precipitation at least (papers by Good, Lowe etc of the UK Met Office, Exeter). That is pattern-scaling can start to fail when moving away from business-as-usual situations. This is clearly evident in the more stabilization RCP2.6 curves of Figure 4, and is deserving of more mention – including in the Discussion. It may be that things are even more difficult to predict with pattern-scaling when looking at "overshoot" scenarios. It is good (and honest) that Kremser et al have used one GCM simulation to train data, and then tested against other simulations for different RCPs.

The analysis of patterns is comprehensive and very well presented. The statistical assessment appears robust.

In summary, this paper should be published. It is one of the first attempts to take pattern-scaling beyond just climatological mean changes, and as such will be useful – and thus cited – by future researchers.

Minor thing: I would recommend that the running title mentions this is about daily maximum and minimum temperatures.

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