Manuscript: "An open-access CMIP5 pattern library for temperature and precipitation: Description and methodology"

Authors: Cary Lynch, Corinne Hartin, Ben Bond-Lamberty, Ben Kravitz

Journal: Earth System Science Data

Date: 12 April 2017

Response to Reviewer #2

Major Comments:

Comment: I had was confused by the description provided in that it discusses the application of methodology to only 12 models that met certain criteria needed for the comparison, and only the first realization. It is not clear what was done for these other models for which there are files are available at the access sites. Does the library contain results for both methods? The netCDF file contained only temperature and precipitation output, seemingly for one method only.

Response: We agree that our sub-selection of models and analysis of patterns generated by both methodologies did not make clear what was contained in the data library.

We realized that we had omitted our reasoning as to why we chose the 12 models we did. For this analysis we did not want to use a large ensemble of models, and we also did not want to arbitrarily choose a multi-model ensemble that would over-represent particular sub-models. For these reasons, we developed a small set of simple performance metrics for a 10-12 model ensemble that realistically produced mean observed spatial/temporal climate.   We have added this to the manuscript.

We have also clarified that although we only analyze the results for one realization from each of 12 models in the text of the paper, in the data repository, we include patterns of all available models. As this is a multi-part issue of clarity, edits were made to the abstract, introduction, data description, and data repository section.

Comment: The paper shows results for temperature, but the library contains precipitation. Since these two variables behave quite differently on a global and temporal scale, it would be worth showing some precipitation examples, and perhaps go less in depth about temperature.

Response: Because the relationship between global mean temperature and local precipitation is complex and requires a more in-depth examination of pattern scaling methodologies, we have written an entirely separate manuscript discussing precipitation pattern scaling (Kravitz et al., 2017). We reference that paper in our manuscript and have

revised some of our description to make clear why the repository contains precipitation patterns.

There should be a clearer explanation about the difference between the two access points. At the doi location (mentioned in the abstract), one can download the entire packaged zipped. Once unzipped, the README is hard to open because it contains scripting language so the laptop software refuses to open it. Only annual patterns are found here. In the github location (mentioned in the section 5), one can download only single files, but the README displays easily. Once downloaded, NetCDF files from both locations open easily. Also, one site appears to have only annual files.

Response: We agree. This was due to a synchronization mistake, which has been corrected. Data from both access points are now the same.

Comment: Rather than merely listing the variables, it would have been more useful to a potential user to get a brief recap of what the variables represent or refer back to the appropriate section. For example, the grid size depends on the original model grid. Why not refer back to Table 1 for the 12 models? What about the other models? Also it was not clear if the patterns were derived on the coarse grid and then remapped, because the comparison was done on a common grid. Where is the description of the analysis done on native grid?

Response: We have edited the Pattern Library section where native model resolution is discussed to clarify that no regridding in the pattern library has been done, and added a reference to Table 1 in the section about regridding.

Comment: I cannot validate this product. The closest thing to a "validation" for this type of product might be a computation of the scaling patterns for the last 20-50 years, using the decades prior to that as the baseline, i.e., an L20C/M20C. In this way, the user can see how a model captured the changes in the last few decades, and compare with actual observed trends. This might help them users decide which model(s) might be more appropriate for this use. If this work has been done by others, a brief review of that literature would be very helpful and should be included in the paper. In re-reading this paper, it appears that the Data and results might actually represent the Validation of the dataset.

Response: We thank the reviewer for the insightful comment, and we agree that the data and results were how we validated the data set

Comment: I would also suggest a polar projected example (Arctic) for temperature, at least.

Response: Excellent suggestion. We have recreated Figure 5 with the polar projection (for the Northern Hemisphere, see figure below), and we do not believe at this point that it adds new information. We do note that there is some distortion at high latitudes with a Robinson projection, a problem which is addressed with a polar projection.
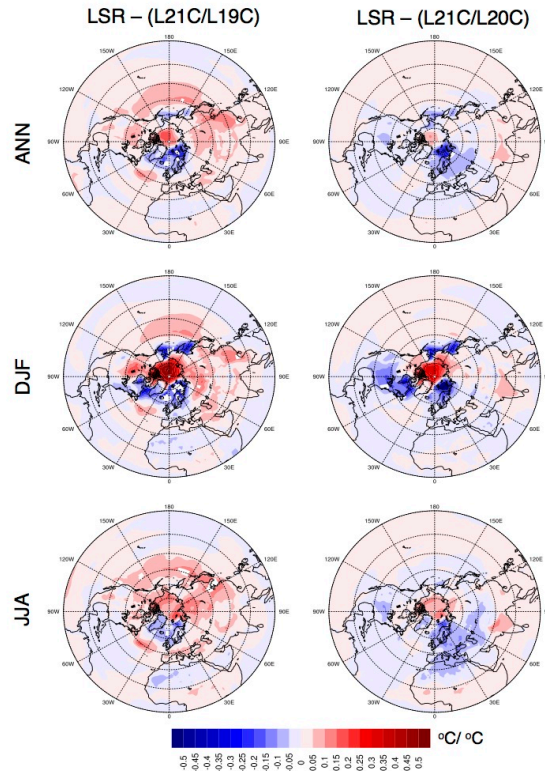
Figure 5. Ensemble mean regression method pattern and delta method pattern differences in °C/°C for L21C (2071-2100)/ L19C (1861-1890) and L21C/ L20C (1971-2000) for annual, DJF and JJA for future forcing scenario rcp8.5. Significance values below the 95% confidence interval using a Student's t-distribution probability statistic were masked.

<mark>Comment:</mark> The dataset is not complete in the sense that it only analyzes the for each model, it only analyzed one run, as stated in the paper. Thus, the library has limited value than if they analyzed all runs. Not all users will want the results for only one run, so they will have to re-compute the patterns anyway.

<mark>Response:</mark> The issue of multiple realizations is complicated, especially considering that only 14 (out of 41) modeling centers released more than 1 realization. For the high forcing scenario, we found that the differences in patterns across realizations are not statistically significant, and the patterns were highly correlated, so a single realization provides sufficient information. This may not be true for lower forcing scenarios, so if we provide patterns for those lower forcing scenarios in the future, we will address this issue.

<mark>Comment:</mark> I cannot determine if the dataset is of high quality that but it is reassuring that error fields and statistics are provided.

<mark>Response:</mark> Thanks! We have supplied the error fields exactly for that purpose.

<mark>Comment:</mark> I pasted the link listed under associated files listed for the climatology variable. It did not go anywhere.

Response: Thanks for pointing that out. We have fixed the broken link.

Comment: I am surprised SI units are not used. Perhaps there is a specific reason for this? It should be explained in the manuscript.

Response: We opted to keep the units in °C for easier interpretation for non-climate readers (e.g., impact analysis and other applied purposes), which is one of our target audiences. We do not anticipate a great deal of difficulty in converting between °C and K for those users who wish to do so.

Comment: I didn't do a detailed list of the typos, which are few. However, the paper will need to be re-organized.

Response: We would like to thank the reviewer for their suggestions. After thoughtful consideration and many edits to the manuscript, we believe the manuscript is clearer and cleanly describes our analysis and the resulting pattern library.

Minor comments:

Comment: Page. 4 1861 -1990 ...should be 1861-1890?

Response: Yes, good catch. It has been corrected.

Comment: Introduction: Please clarify if the patterns are purely spatial, not temporal.

Response: Thank you. The patterns are purely spatial and this has been made clear in the Introduction.

Comment: Table 1. What are the units? Is it longitude X latitude or vice versa?

Response: Good suggestion. We have added units to this table.

Comment: Table 2. Need more clarity on what this represents..difference in RMS?

Response: Yes, we agree that this caption is vague. It is the root mean square difference between the actual and pattern predicted output. We have edited this caption.

Revision: Table caption: Root mean square difference between actual and pattern predicted global mean anomalies in °C/°C for each pattern methodology at the end of the 21st Century.