

## ***Interactive comment on “Climate pattern scaling set for an ensemble of 22 GCMs – adding uncertainty to the IMOGEN impacts system” by Przemyslaw Zelazowski et al.***

**Anonymous Referee #2**

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GMD-2016-221 Zelazowski et al., Climate Pattern Scaling Set for an Ensemble of 22 GCMs

As it stands, this paper is a simple implementation of the idea of pattern scaling and EMB calibration to a multi-model ensemble. I do not think any of this is new per se, and the choice of presenting this work based on a by now obsolete CMIP ensemble, CMIP3, does not help making the case for publication as is. That said, I think the value of the work resides in the provision of a multivariate set of fields/patterns, for the use in impact work, effectively exemplified by the motivating application through the IMOGEN system. This is in my opinion the real contribution of this work, but the focus of the paper is not adequately trained on this aspect.

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I would recommend major revisions, but I would hope that my request would not be a show stopper: what I would like to see is the application section expanded, not because I want to see the results of the impact analysis for their own value, but because I think we need to see how the pattern scaling performs in the application context, compared to results obtained from using the actual GCM output (by the way, I do think the use of ESM here is not appropriate, I don't think any of the CMIP3 models was an ESM in the sense of including a representation of the carbon cycle). My main concern is to be able to assess how the differential performance of the pattern scaling approach across variables and across models impacts the results of a multi-model impact assessment. I do not think the application section at this time addresses that. A particular concern is how the performance on individual variables translates into a performance across variables, i.e., in their joint behavior, for different models' output. In fact, in this regard, even the section about “Explanatory power of linear approximation” needs a better description: What is the meaning of the sentence (and I summarize) “Overall, climate patterns explain one third of regional climate change”. How is the joint variability/covariability of the variables evaluated? Is the covariance patterns among all variables taken into account? I would like to see a more rigorous and formal definition of how the variance of the joint set of variables is represented by the emulation.

If the authors are willing to show how the use of the pattern scaling solution compares to the use of the original output from the multi-model ensemble I think the article will become more informative and valuable to the impact research community, within and beyond IMOGEN users. In this respect I also agree with Dr. Emori that the potential is larger than just the IMOGEN application and it would be good to point that out.

Last, two very minor points: I think throughout the paper the word “assembly” has been erroneously substituted for “ensemble”, my guess because of an auto-correct program. The other word, which I think is used instead deliberately but I question, is “meteorology”. I think what the pattern scaling approach produces is still “climatology”. These are after all ten-year means. The use of a weather generator may then produce

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meteorology at the time scale needed by the impact model, but that is an add-on to the method that this paper focuses on.

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