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Geoscientific Model Development Discussions

Interactive comment on "A new dataset for systematic assessments of climate change impacts as a function of global warming" *by* J. Heinke et al.

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We thank referee #1 for the overall positive review and the appreciation of our attempt to transparently and comprehensively document all technical details while keeping the paper readable and accessible.

Replies to specific comments from referee #1:

(1) Although we think that the type of assessment implies the type of the data set we also acknowledge that the title can be made clearer by stating the type of the data set explicitly. We will adjust the title accordingly in the revised manuscript, which could then read for example: "A new data set of climate scenarios for systematic assessments of

climate change impacts as a function of global warming."

(2) We understand that the omission of parameters x, m, and y in equations 4–11 makes it difficult to relate them to equations 1–3. Comment 2 from referee #2 raises the same concern. However, spelling out all parameters in these equations would make them very long and require line breaks in the equations, which we think is undesirable in terms of layout and readability. We will therefore address this issue by explaining the omission of parameters more clearly in the text, or by adding definitions in the form of additional equations. As this part of the paper is particularly difficult to understand we will take care to coordinate text and equations even better.

(3) It is correct that the upper panels in figures 4–6 represent the final outcome after application of all procedures. Although this should be clear from the discussion in the text we acknowledge that it is not explicitly stated in the captions. We decided to show maps for the applied anomalies only because the respective scaling patterns only represent an intermediate step and are visually very similar to the applied anomalies. The crucial information is the difference between the two, i.e. the unavoidable alteration of the derived patterns when applying them to the observation based reference time series, which is shown in the lower panel (also see response to referee's comment 4). However, we plan to add a three-panel figure as proposed by referee #1 together with appropriate equations as proposed by referee #2 in the supplement. We do not agree that the word "multimodel" necessarily implies that original GCM data is shown. The term is generally used in impact assessments to refer to data from an ensemble of GCMs. However, we agree that the caption can be clearer and will address this in the revised version of the paper.

(4) In the methodology described in this paper anomaly time series for the defined scenarios are applied to an observation-based reference time series. It therefore represents a variant of what is often referred to as "delta approach" in the literature. Although Watanabe et al. (2012) categorize the delta approach as a form of bias-correction, bias-correction in a narrow sense is a method that compares GCM data with historical

observations in order to identify systematic errors in the GCM data and design appropriate methods to correct these biases in the GCM time series. The crucial difference is that with this kind of bias-correction each corrected scenario time series corresponds to a specific GCM simulation, while with the delta approach the applied anomaly can be of arbitrary origin. This property of the delta approach allows creating climate scenarios based on the pattern scaling approach described in the paper. But it is this difference, which impedes a meaningful comparison between our approach and the bias-correction approaches discussed in the papers mentioned by referee #1 (Watanabe et al., 2012 and Piani et al., 2011). Even Watanabe et al. (2012) who mention the delta approach as a form of bias-correction only include bias-correction methods in the narrow sense in their comparison. On the other hand, a true validation of the alteration of the absolute change in cases where the delta approach or the bias-correction method involves multiplying by a factor is simply not possible. There is no objective reason why an anomaly should always be interpreted as absolute change. If the anomaly is derived from a biased reference value the alteration of the absolute change might in fact be unavoidable to prevent violation of upper or lower limits of possible values. We therefore believe that the visualization and discussion of the alterations of the absolute signal by the selected application methods is the best way to make them transparent and understandable. We will, however, attempt to further sharpen the discussion in the revised paper.

References

Piani, C., G. P. Weedon, M. Best, S. M. Gomes, P. Viterbo, S. Hagemann, and J. O. Haerter, (2010): Statistical bias-correction of global simulated daily precipitation and temperature for the application of hydrological models. Journal of Hydrology, 395(3-4), 199-215. doi:16/j.jhydrol.2010.10.024.

Watanabe, S., S. Kanae, S. SETO, P. J. .-F. Yeh, Y. Hirabayashi, and T. Oki (2012): Intercomparison of bias-correction methods for monthly temperature and precipitation simulated by multiple climate models, J. Geophys. Res., doi:10.1029/2012JD018192

(5) Because the methodology described in the paper represents a form of delta approach the interannual variability in our data set is inherited from historical observations. It is therefore statistically very similar to historically observed interannual variability and only modified by the multiplicative application of anomalies in case of cloudiness and precipitation [P3546L13]. The application procedures (equations 5–7) are designed to prevent occurrence of unexpected or strange values.

Interactive comment on Geosci. Model Dev. Discuss., 5, 3533, 2012.