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Interactive comment on "A novel bias correction methodology for climate impact simulations" *by* S. Sippel et al.

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The paper presents a novel bias correction technique for use in climate change impact assessment studies. The technique is claimed to preserve the physics as well as multivariate dependence structures. Benefits of the proposed technique in comparison to the existing methods are categorically brought out and an end-to-end application is also illustrated using an impact-assessment study. The paper is overall very well written and will be of interest to a wide range of researchers. Therefore, I would favor its publication. However, I have a few comments/suggestions as I detail below and would like to see the authors' responses to them.

Since the proposed bias correction methods leads to a decrease in effective ensem-

ble size, large ensembles such as the weather@home experiment is necessary for its application. In my opinion, this is a strong limitation of the method as such large experiments are rare, particularly for developing regions. Is the proposed technique also effective on GCM simulations directly?

I also have concerns with the quantile mapping based technique for more general applications of the proposed bias correction method. The retention of an ensemble member depends on q_mod as given by the transfer function. Therefore, if a model simulated value does not correspond to a quantile of the observed record, that value is rejected, thereby indirectly defining a prescribed range of possible values of the variable based on certain number of years of observations. For bias correction of future values, clearly, there is no way to ensure that the actual values belong to that range.

Further, selection of Gaussian Kernels seem somewhat arbitrary. It is a subjective choice, and so is the choice of Cubic Hermite splines.

Additionally, in my opinion, more clarity is solicited in the description of the proposed bias correction methodology. For example, do the authors simply concatenate observed data listed in Table 1? How do they fit the kernel density 'over the observed meteorological constraint. . .in various observational datasets' (blue cdf in Figure 2(a)? How are the 800 ensemble members merged to obtain the red cdf of Figure 2(a)? The authors also mention that they derive a bias-corrected sample by 'randomly resampling n times from f_obs': what is the length of the sample? Further, q_mod_X and q_obs_X represent a given quantile in the model ensemble and observation, respectively. Does this then imply that bias correction is carried out individually for each quantile?

For fitting the GEV distribution, though the length of all the observed records listed in Table 1 is greater, the authors mention about a 'relatively small sample size (1901-2014)'. I did not understand why (why not all 26 years?). Also, statistical extreme value theory requires certain conditions to be held true for application of the GEV dis-

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tribution to the block maxima. If 10-year samples are 'randomly concatenated', the tail behaviour may change, thereby questioning the application of extreme value theory to the concatenated datasets. Another, more fundamental issue concerns the random nature of the model output. The bias corrected variables are afterall output of models that are deterministic in nature; therefore, whether they can be considered as random variables remains a question.

Other points: Abstract, last line: 'uptake of our methodology. . .for accurately quantifying past. . .extremes' – how is bias correction important for quantifying past extremes which have been already observed? Perhaps the authors mean 'quantifying changes in past extremes'?

Page 2011, first sentence – this information is repeating for the third time here.

Page 2021, Para 15: 'Although more sophisticated. . .in this study' – perhaps a 'that' missing?

All references listed contain two years of publication each – please correct this. Also, Coles, 2001 is a single-author book. The reference to Coles, 2001 is incorrect in the list.

Figure 3 (and similar figures) and Section 4.1 – Figure 3 is not self-explanatory. If the x-axis doesn't consist of values/units, then what to the width of each shape represent?

Interactive comment on Earth Syst. Dynam. Discuss., 6, 1999, 2015.