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Geoscientific Model Development Discussions

Interactive comment on "Bias correction of multi-ensemble simulations from the HAPPI model intercomparison project" *by* Fahad Saeed et al.

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First of all, we thank the referee for his time and effort to review this manuscript. We are also thankful to him/her for recognizing the in-depth analysis we carried out for this study.

The referee has also correctly pointed out that the bias-correction methodology was developed and extended in the two previous studies (Hempel et al. 2013, Lange 2017), however this methodology (or other such methodologies) has never been applied to the HAPPI style experiment before. As mentioned in the manuscript that in HAPPI experiments, an ensemble is developed using each GCM with perturbed initial conditions. Here we try to answer the outstanding question that whether the application of

ISIMIP2b bias correction keeps the ensemble spread of the original simulations or not. This is very important for the impact modeling application, because if bias correction remains unable to keep the spread of the original simulation, the very idea of HAPPI simulation which is designed to separate the impact of an additional 0.5°C of warming against the internal climate variability of the models, will be compromised.

As can be seen from Figure 3 (and associated figures in Supplementary material), the bias correction has kept the spread of the ensemble at a very satisfactory level. Besides keeping the ensemble spread, the application of bias correction has also corrected the shape of the spread in some cases (e.g. precipitation result in Figure 3). These results are further complemented by the application of hydrological model which also show a marked improvement in correcting the river discharge for different basins (Figure 8). Furthermore, this bias corrected data will be used in various studies based on impact models as input. As already pointed out by the referee that in addition to the spread, we have done an exhaustive analysis of the simulation by looking at mean, variability, extremes etc. The exhaustive nature of the analysis will help the impact modelers to draw conclusions based on the strength and weaknesses of the applied bias correction method.

Based on the above-mentioned arguments, we believe that the current study merits publication in GMD.

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