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Discussions

Interactive comment on "Multivariate bias corrections of climate simulations: Which benefits for which losses?" *by* Bastien François et al.

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This is a timely paper providing an overview about the plethora of newly emerging multivariate bias correction approaches that have been developed over the recent years. The authors provide recommendation about which approach should be used under which conditions. The paper has the potential to become a key reference for multivariate bias correction approaches. It has an easy to follow clear structure, is well written and falls into the scope of ESD. I have a few minor recommendations which should help to improve its accessibility and impact.

Introduction: I miss some strong arguments why and in which situations we need MBC. For many impacts, univariate BC is (probably) enough and MBC does not provide

are large boost in performance. Indeed a number of studies have argued over the last years that for their application domain MBC does not outperform univariate BC (Yang et al., 2015; Casanueva et al., 2018; Räty et al., 2018). However, I would argue that these results cannot be generalized. One particularly relevant field of application where MBC should be highly beneficial is the area of compound events, where multiple climate drivers result in a large impact (Zscheischler et al., 2018). Arguably, a bias in the dependence structure of the drivers can result in unknown biases of the modelled impacts, which may even be aggravated by univariate BC (Zscheischler et al., 2019).

I'm not sure I entirely agree with the interpretation of Section 5.5.2 and figure 7. As I understand it, Wd only measures a distance. Hence if one obtains a similar value >0 it is unclear whether the change goes into the same direction. One might obtain a similar value for Wd but very different changes in the underlying distributions (though I admit that this would be coincidence and might not be very likely). I think this caveat should be mentioned.

L 604: Other examples for changes in dependence that might be highly relevant for impacts are: - increases in the dependence between storm surge and heavy precipitation in US coasts in the historical period (Wahl et al., 2015): affects the risk of compound floods; - increase in the strength of dependence between seasonal summer temperature and precipitation of most land regions with increasing warming (Zscheischler & Seneviratne, 2017): affects the likelihood of compound hot and dry events with a large array of impacts

L 642: This is easier said than done. The largest challenge in evaluating impact modelling output is the availability of impact data. It will therefore be difficult to decide which BC approach is more appropriate. That said, I agree that creating an ensemble of different approaches might help to cover uncertainties that are not only related to the choice of the GCM and forcing scenario but also the choice of BC method.

Figure 2 and 4: The correlations could be plotted as difference to the reference to

highlight the differences.

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