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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Multivariate bias adjustment of high-dimensional climate simulations: The "Rank Resampling for Distributions and Dependences" (R^2D^2) Bias Correction" *by* Mathieu Vrac

Anonymous Referee #1

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This paper proposes a novel Multivariate bias correction methodology. The author presents this methodology, referred to as R2D2, as the extension of a formerly developed and published methodology (EC-BC). R2D2 is meant to ameliorate some identified weaknesses in EC-BC. These are the "excessive constraint on temporal properties" and the lack of "stochasticity" in the adjustment. These are both laudable endeavours. The results are very interesting and, as I see it, deserving of publication. I have one major comment that, I believe, should be addressed by the author along with a series of minor and/or typographical comments that the author may wish to consider

when editing the manuscript.

Major comment 1: The author tests R2D2 on ERA-interim vs SAFRAN. These are both reanalysis datasets. This may be very interesting per se but is it really a good measure of how R2D2 will perform when applied to RCM data vs reanalysis or observations? I understand that the author does apply the new BC methodology to RCM data but not in a cross validation setting. I would like to understand why he has chosen not to apply R2D2 to RCM data, using SAFRAN as observations, calibrating with one part of the reanalysis data while cross-validating using another. Much like he did with ERA-Interim. In other words, why was ERA-Interim used at all? I find the tests using reanalysis data encouraging to be sure but not as satisfying as a test with RCM data would have been.

Minor comments: Page 1, âĂć Line 10, "allowing to deal" might be "making it possible to deal" or similar?

Page 3, âĂć Line 15, "Whose the quality is not equivalent" could be " with different qualitative results". In any case the sentence might me rewritten. âĂć Line 25, I do not believe this is not the only problem with the Schaake Shuffle. The main problem is not that it is deterministic. The main problem, in my view, is that is unlikely to be robust in time. Why should the rank chronology be the same? This is why I think the authors should cross-validate with a RCM instead of reanalysis data. Page 4, âĂć Line 6, Conclusion, perspective and discussion. The word "Perspective" does not translate identically from French :) . Perhaps "Conclusions, future work and discussion" or simply "Conclusions and discussions". âĂć Line 17, "co-located" could be "regridded" by simple association to nearest neighbour.

Page 6, âĂć Line 2, "R2D2 looks for the time step tâĹŮ in the calibration time period for which the rank of the reference dimension is the same as the current rank of the reference dimension" should add "Please refer to Appendix A for a detailed mathematical description of the R2D2 algorithm". âĂć Line 15, "wad" should be "was" âĂć Line

27, “needed” could be changed to “necessary” âĂć Line 30, If I understand correctly, this last step explains how restrictive the assumption of stationarity is in R2D2. In most BC methods “stationarity” means the “bias” stays the same. Here “stationarity” means the inter variable and inter site structure of the climate stays the same. . . This is a lot more restrictive I think. But these considerations do not matter if a cross-correlation with RCM were performed.

Page 7, âĂć Line 12, Is the parenthesis in “step 1.)” needed here? I found it a bit confusing. Also “others” might be “other” Page 10, âĂć Line 27, “Materials” might be “materials” Page 13, âĂć Line 31, The word “perspectives” here is a bit confusing. See above.

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