Hydrology and
Earth System
Sciences
Discussions

Interactive comment on "Technical note: Changes of cross- and auto-dependence structures in climate projections of daily precipitation and their sensitivity to outliers" *by* Jan Hnilica et al.

A. Sharma (Referee)

a.sharma@unsw.edu.au

Received and published: 29 October 2018

This is a well written paper. I have a few problems with it though. There seems to be an underlying vein in the paper arguing that the approaches for correcting lag and cross-dependence in GCMs and RCMs may be improper as the corrections are based on improperly estimated correlations. This, if it is the case, is incorrect, because if those correlation biases are genuine, they are very relevant to the planning and design of hydrologic systems such as reservoirs. Perhaps the focus of the paper should be, could those correlation based approaches be improved if the proposed measures of correlation are used instead of the routine ones adopted. I feel that would be a great contribu-

tion to the literature and add value to a range of future users who need estimates of how climate change will impact hydrologic systems and especially lowfrequency variability extremes. I have a few detailed comments below in the order I read the paper. However, my request to the authors is to use the multivariate bias correction software now publically available and described in [Mehrotra, R., F. Johnson, and A. Sharma (2018), A software toolkit for correcting systematic biases in climate model simulations, Environmental Modelling and Software, 104, 130-152, doi:10.1016/j.envsoft.2018.02.010.] to show the impact these robust correlation metrics have on results. Detailed comments: l79 - Using the block approach will alter the lag-one correlation at the end of year boundaries. I presume the impact will not be much but should be stated by the authors. On the same point, I would expect the cross dependence to remain unchanged, and the lag 1 correlation to only slightly be changed. And I am unable to figure out how these confidence intervals are finally used? Were all the correlations from the raw data and the resampled opnes pooled in deriving the results in Figs 3 and 4? Usually one does bootstrap tests to assess the significance of correlation from zero - here it seems the idea is to assess the significance of correlation from what it would be if the year to year dependence is made null. Some clarification is needed. l98 - it would be nice to know what is the fraction of zeroes and non-zeroes in the data used, and how that might be impacting the binary cross-correlation results. here. From my experience, storms in warmer climates are getting smaller in size, hence the fraction of zeroes is increasing. What I think the authors are doing is to estimate sample correlations of the current and the future independently (i.e. taking their respective sample means and standard deviations). As a result of which they may be finding the change is insignificant, whereas the change with respect to a faxed reference (sat the historical climate) may be more. At the very least, some clarification on how the correlations are estimated as well as the change in the first order statistics that are used in its estimation is needed. l110 - the negative change in autocorrelations is consistent with my experience. If one were to consider changes in the associated means and standard deviations this becomes even greater. Additionally, these changes manifest themselves at longer time scales as

well, as a AR1 model structure is not a great characterisation of the system. This has formed the argument for the range of "nesting" approaches in the literature for rainfall generation and bias correction. This needs to be discussed somewhere in the paper at the very least. l115 - The figure title states 95% confidence of correlations. Does this mean 95% of the 66 correlations, or all the resampled correlation estimates as well? l180 - I believe the authors need to write a simple equation to show how they will ascertain their dependance outlier, and give us results of some tests that help argue these are genuine outliers and not examples of real extremes that would be of interest in hydrology. This is kind of important as this seems to be the key contribution the paper is making.

Ashish Sharma a.sharma@unsw.edu.au The MBC software above can be downloaded from our software page - http://www.hydrology.unsw.edu.au/download/software.