Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-318-RC2, 2020

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Identifying robust bias adjustment methods for extreme precipitation in a pseudo-reality setting" *by* Torben Schmith et al.

Jorn Van de Velde (Referee)

jorn.vandevelde@ugent.be

Received and published: 14 September 2020

General comments In their contribution, Schmith et al. (2020) discuss the robustness of different bias-adjusting methods for (sub)daily rainfall extremes. This yields interesting results and strong links with the context of convection-permitting models and emergent constraints. Yet, there are some aspects about whom I'd like a deeper discussion.

The first aspect is the practical use of this study. This is foremost linked with the choice of bias-adjusting methods. Although the use of return periods is perfectly justified from a hydrological point of view, I've seen few studies that actually use bias adjustment directly on the return periods. As such, I'd like to see a larger discussion on the choice of bias-adjusting methods. Given a well-justified choice, I understand the use of these

Printer-friendly version

Discussion paper

simple methods, yet I'd like to see more discussion on how this relates with more complicated, but related bias-adjustment methods, such as e.g. CDF-t (Michelangeli et al., 2009), standard QM, QDM (Cannon et al., 2015), ... Would it be possible to discuss possible consequences for the use of these methods for the adjustment of subdaily precipitation extremes? This could fit in the second paragraph of Section 5.1, which seems rather limited and abrupt at this point. A last point related to the practical use is that I missed a more thorough explanation of why the observations perform well, why this version of quantile mapping performs poorly. Although this is discussed slightly in Section 4.3, I wonder if more details or, if possible, practical guidelines could be given in the discussion.

A second aspect is that some concepts in the Introduction seem to be accepted as-is, whereas they could deserve a deeper discussion. A first example of this is the discussion of stationarity in the introduction. The references are limited in time, whereas more recent papers expanded this subject, such as Kerkhoff et al. (2014) and Van Schaeybroeck and Vannitsem (2016) on the type of bias relationship and Chen et al. (2015), Velázquez et al. (2015), Wang et al. (2018) and Hui et al. (2019), who discussed the uncertainty introduced by bias nonstationarity. As the stationarity of the bias is an important part of the discussion, I think the paper could benefit from these perspectives. A second, smaller example is the use of a delta change based method. While the method isn't completely discredited, there has been some discussion whether it's use for climate change is not too dependent on the assumption that the temporal structure of the time series will not change from present to future (e.g. Johnson and Sharma (2011), Kerkhoff et al. (2014)). It would thus be interesting to read a deeper discussion on the limitations of the methods.

Specific comments

L. 37: 'quantile-mapping' is used here, whereas in the remainder of the abstract (and the paper) 'quantile-matching' is used. I'd suggest to edit this for coherence, but to also use 'quantile mapping' throughout the paper, as it has been the most used term for this

type of bias adjustment during the last few years.

L. 75-82: this paragraph is very scarce on references. Although some of the necessary references are given in the discussion, I think it would be good to also have the reference to the papers about CPMs in this paragraph.

L. 84-91: The terminology in this paragraph could be reconsidered. Although it is debatable whether or not to consider delta change as a bias adjustment approach (the latest textbook, Maraun and Widmann (2018), is on the edge), it feels very strange to read 'bias correction' as a subset of 'bias adjustment' approaches. The use of 'bias adjustment' as a replacement of 'bias correction' has been rising during the last few years, as it is clearer that the methods are statistical and cannot correct all climate model biases. Thus, I would withhold from the use of 'bias correction'. Better terminology seems MOS, with delta change and bias adjustment as possible subcategories, or bias adjustment with delta change and bias adjustment s.s., although the exact choice is personal.

L. 253- 286: Although the method described here is indeed based on the same principles as XCDF-t as used by Kallache et al. (2011) and Laflamme et al. (2016), it's not entirely clear how the new method is created by adapting the former. I think the link between both methods should be more detailed, so users can retrace it more easily and infer the strengths and limitations. Especially as it is specifically mentioned that the method 'will be adapted to our needs below', the adaptation seems rather limited.

L. 448-453: the explanation of the use of the index by Maurer et al. (2013) should be expanded. Firstly, it's unclear to me where the terminology 'measure of relative spread' is derived from, as it is not named as such in the original paper. Secondly, the interpretation of the R-values is not discussed, although this is quite important: values < 1 indicate that the difference in biases is smaller than the mean bias of both periods, whereas values >1 indicate that the difference in biases is larger, which could have a potentially large impact. As both values are quite far < 1, the bias seems quite

stationary, but in your discussion you state that the 24h duration is 'less stationary'. Without giving this numerical explanation, this statement is hard to interpret correctly.

L. 504-505: This last sentence does not seem to fit with the rest of the paragraph. I think that, with some rewriting, this could become clearer.

Technical comments

L. 48: 'Global climate models (GCMs) is . . .' -> are

L. 110-111: 'Only a few examples has . . .' -> have

L. 112-113: '. . . applying bias adjustment improve projections' -> improves

L. 142: the section marker should be corrected

L. 194: I can't find the source of this problem, should not be referenced with co-authors. The official webpage by Springer (https://link.springer.com/book/10.1007%2F978-1-4471-3675-0#about) only mentions one author (Stuart Coles) and there is no mention of other authors elsewhere in the book. So unless I'm missing something, I think the more correct reference is Coles (2001).

L. 232-243: 'Hosking and Wallis (1987) . . . warns . . . . Instead, he recommends . . .'. Shouldn't these sentences be plural, or are you referring to 'the paper' in these sentences instead of 'the authors'?

L. 254: 'Kallache et al. (2011) and Laflamme et al. (2016) applies' -> apply, as this verb is referring to multiple papers and authors.

L. 265: 'ths' -> 'the'

Figure 6 and Figure 8: Would it be possible to remove the underscores from the plot titles?

References

Cannon, A. J., Sobie, S. R., and Murdock, T. Q.: Bias correction of GCM precipitation by

quantile mapping: How well do methods preserve changes in quantiles and extremes?, Journal of Climate, 28, 6938–6959, https://doi.org/10.1175/JCLI-D-14-00754.1, 2015

Chen, J., Brissette, F. P., and Lucas-Picher, P.: Assessing the limits of bias-correcting climate model outputs for climate change impact studies, Journal of Geophysical Research: Atmospheres, 120, 1123–1136, https://doi.org/10.1002/2014JD022635, 2015

Hui, Y., Chen, J., Xu, C.-Y., Xiong, L., and Chen, H.: Bias nonstationarity of global climate model outputs: The role of internal climate variability and climate model sensitivity, International Journal of Climatology, 39, 2278–2294, https://doi.org/10.1002/joc.5950, 2019

Johnson, F. and Sharma, A.: Accounting for interannual variability: A comparison of options for water resources climate change impact assessments, Water Resources Research, 47, W04 508, https://doi.org/10.1029/2010WR009272, 2011

Kerkhoff, C., Künsch, H. R., and Schär, C.: Assessment of bias assumptions for climate models, Journal of Climate, 27, 6799–6818, https://doi.org/10.1175/JCLI-D-13-00716.1, 2014

Maraun, D. and Widmann, M.: Statistical Downscaling and Bias Correction for Climate Research, Cambridge University Press, https://doi.org/10.1017/9781107588783, 2018

Michelangeli, P.-A., Vrac, M., and Loukos, H.: Probabilistic downscaling approaches: Application to wind cumulative distribution functions, Geophysical Research Letters, 36, L11 708, https://doi.org/10.1029/2009GL038401, 2009

Van Schaeybroeck, B. and Vannitsem, S.: Assessment of calibration assumptions under strong climate changes, Geophysical Research Letters, 43, 1314–1322, https://doi.org/10.1002/2016GL067721, 2016

Velázquez, J. A., Troin, M., Caya, D., and Brissette, F.: Evaluating the time-invariance hypothesis of climate model bias correction: implications for hydrological impact studies, Journal of Hydrometeorology, 16, 2013–2026, https://doi.org/10.1175/JHM-D-14-

0159.1, 2015

Wang, Y., Sivandran, G., and Bielicki, J. M.: The stationarity of two statistical downscaling methods for precipitation under different choices of cross-validation periods, International Journal of Climatology, 38, e330–e348, https://doi.org/10.1002/joc.5375, 2018

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-318, 2020.

Printer-friendly version

Discussion paper