Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-227-RC2, 2017

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Future extreme precipitation intensities based on historic events" *by* Iris Manola et al.

Anonymous Referee #2

Received and published: 20 October 2017

Many studies purport the best way to project rainfall for a future climate. In this study an honest and unambiguous assessment is presented comparing different methods of storm projection. As far as I am aware, this is the first study of its kind, and will be of interest to both the research community and practioners alike. The commensurable results are very promising, and the uncertainty in the results presents a need for a greater understanding in this field. This is a very worthwhile contribution.

My suggestions are very minor and primarily focus on expanding the literature cited and ensuring all assumptions have been documented. I look forward to seeing the published manuscript.

Minor comments:

I think you need a reference or two and a sentence on the assumption of constant humidity. I have no doubt that this assumption is fine but on Page 3, Line 32 you state you assume constant humidity and then in Line 21 of Page 10 you state humidity is expected to change. I would insert a sentence or two on the predicted changes of humidity on Page 3 and reference accordingly (say from the IPCC reports) so the reader can then make an assessment of the validity of this assumption. I stress that this assumption is valid – it just needs to be communicated.

Section 3 would read better without the subheadings. It currently feels a little disjointed and repetitive. The reason is that you start by comparing the results of the Pi-Td scaling to the Harmonie model and then repeat the presentation of the Harmonie results in Section 3.2. This could all be synthesised into one section. Presenting all the panels up front in Section 3 would read better and grouping the results for the overall precipitation intensity in one paragraph would also read better.

I think somewhere in the discussion or conclusion the fact that storms may change in their duration/type/frequency should be acknowledged as something that isn't considered here e.g. Molnar et al., (2015).

The conclusion (and assumption) of non-changing spatial patterns/size needs to be discussed with in line with the current literature. See Guinard et al., (2015); Wasko et al., (2016) ; Lochbihler et al., (2017). This will help strengthen the findings presented here.

None of the figures have the panels labelled (e.g. a, b, c, d) – Figure 5 is not top/bottom. Line by line comments:

Page 1, Line 20: The line break isn't needed.

Page 1, Line 31: Changing antecedent conditions is also important to understand in this context and should be acknowledged, e.g Ivancic and Shaw (2015) and Wasko and Sharma (2017).

Page 2, Line 20: I would cite Fowler et al (2007) here.

Page 3, Line 9: I think Lenderink and Attema (2015) needs to be cited alongside this reference.

Page 5, Line 1: A reference to these changes in storms would be beneficial here.

Page 7: Line 5: Global studies could be cited here, see the following papers: 10.1029/2011GL048426; 10.1002/2016GL071354

Page 7, Line 9 and Line 21: Both Molnar et al., (2015) and Wasko et al., (2015) show different types of artefacts related to increased short duration convective rainfall at higher temperatures resulting in higher scaling.

Page 7, Line 28: The statement that the sample size is large is vague – maybe state the number. Also state explicitly that all precipitation pixels were used. I couldn't tell from the text but I assume this is the case.

Page 8, Line 5: Another manuscript which comments on this explicitly is Bao et al (2017)

Page 8, Line 15: I think you need a reference on the statistical artefacts – one such paper is Wasko et al., (2015) which relates to embedded storms, another is Molnar et al., (2015) relates to mixing of storms. Also Hardwick-Jones et al (2010) is usually cited in relation to moisture limitations.

Page 8, Line 17: remove "the"

Page 8, Line 25: Again also cite Lenderink and Attema (2015).

Page 10, Line 32: The unchanged spatial pattern is also true for the delta change method – could be stated here.

Page 14, Line 14: Around here a reference back to Figure 5 would be beneficial.

References:

Bao, J., S. C. Sherwood, L. V. Alexander, and J. P. Evans (2017), Future increases in extreme precipitation exceed observed scaling rates, Nat. Clim. Chang., 7(2), 128–132, doi:10.1038/nclimate3201.

Fowler, H. J., S. Blenkinsop, and C. Tebaldi (2007), Linking climate change modelling to impacts studies: recent advances in downscaling techniques for hydrological modelling, Int. J. Climatol., 27(12), 1547–1578, doi:10.1002/joc.1556.

Guinard, K., A. Mailhot, and D. Caya (2015), Projected changes in characteristics of precipitation spatial structures over North America, Int. J. Climatol., 35(4), 596–612, doi:10.1002/joc.4006.

Hardwick Jones, R., S. Westra, and A. Sharma (2010), Observed relationships between extreme sub-daily precipitation, surface temperature, and relative humidity, Geophys. Res. Lett., 37(22), L22805, doi:10.1029/2010GL045081.

Ivancic, T. J., and S. B. Shaw (2015), Examining why trends in very heavy precipitation should not be mistaken for trends in very high river discharge, Clim. Change, 133(4), 681–693, doi:10.1007/s10584-015-1476-1.

Lochbihler, K., G. Lenderink, and A. P. Siebesma (2017), The spatial extent of rainfall events and its relation to precipitation scaling, Geophys. Res. Lett., 44(16), 8629–8636, doi:10.1002/2017GL074857.

Molnar, P., S. Fatichi, L. Gaál, J. Szolgay, and P. Burlando (2015), Storm type effects on super Clausius–Clapeyron scaling of intense rainstorm properties with air temperature, Hydrol. Earth Syst. Sci., 19(4), 1753–1766, doi:10.5194/hess-19-1753-2015.

Wasko, C., A. Sharma, and F. Johnson (2015), Does storm duration modulate the extreme precipitation-temperature scaling relationship?, Geophys. Res. Lett., 42(20), 8783–8790, doi:10.1002/2015GL066274.

Wasko, C., A. Sharma, and S. Westra (2016), Reduced spatial extent of extreme storms at higher temperatures, Geophys. Res. Lett., 43(8), 4026–4032, doi:10.1002/2016GL068509.

Wasko, C., and A. Sharma (2017), Global assessment of flood and storm extremes with increased temperatures, Sci. Rep., 7(1), 7945, doi:10.1038/s41598-017-08481-1.

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