

Interactive comment on “Impacts of climate change on temperature, precipitation and hydrology in Finland – studies using bias corrected Regional Climate Model data” by T. Olsson et al.

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The paper presents a comprehensive assessment of the impact of bias-correction techniques on the assessment of climate change on hydrology in Finland. This is an area of research currently very much debated amongst the impact community as current outputs of Global or Regional Climate Models are associated with high bias and they are not believed to be accurate enough to be used as such as input of impact models. However, very few articles have been published attempting a robust comparison

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of the impact of bias correction on the magnitude of resulting impacts and whether BC is necessary or not.

The paper is well written and includes an informative discussion. It is worth publication after the authors have addressed the following comments.

Main comments

In general I don't follow the fitting methods and results described in Section 3.1. and specifically: how is the double gamma distribution fitted? How does it perform compared with single gamma distribution in the middle and tail of the distribution using quantified metrics? Moreover end of section 3.1 suggests double Gamma is better for precipitation and presented in Fig 8; and in some following figures (Fig 9; Fig 13) a single gamma distribution is used, which is inconsistent. This needs clarification and requires careful proof reading. Please also specify which type of BC method (wet/dry day; Gamma 1 or 2) in all table and figure captions.

The paper would also benefit from a comprehensive comparison of all BC options (temperature or precipitation or both) considered in this paper to quantify which one is the most effective. This could be easily achieved by the following sensitivity analysis on hydrological impact using : 1) uncorrected climate; 2) BC temperature uncorrected precip; 3) uncorrected temp BC Gamma 1 precip; 4) uncorrected temp BC Gamma 2 precip; 5) BC temperature and Gamma 1 precip; 6) BC temperature and Gamma 2 precip. This could be done under control and future climate; similar control results but different future results would certainly shed light on uncertainty added by BC procedures. I believe this has never been done at this level and would improve the manuscript.

Finally the paper needs to be proof read to make sure of consistency of acronyms throughout including figure and table captions and headings

Minor comments/ questions

Section 2.2: What is the spatial resolution of observed gridded temperature and pre-

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precipitation time series? Page 2663 suggests 1-km grids but this would merit clarification
Section 2.3. The method describing the bias correction step 2) is not clear – a schematic would be helpful. Why a 5 harmonics equation was used? What is the number of time step used? It could be 12 (one per calendar month); 12x50: one per month of the time series; 12x2x50: one per 15-days of the TS?

Section 2.3 – p2664 lines 14-17: rephrase for better flow. It is not clear either if there is a single CDF used for the whole TS or if there is one per season/ month.

P2664 l 24 to p2665 l2: The sentence starting 'The enable the scenario ...' needs to be changed. I guess the assumption used is that the wet/dry bias is independent on radiative forcing but due to the rainfall parameterisation.

P2667 last paragraph section 2.4: Are independent calibration/ evaluation periods used for the hydrological model calibration? Which periods the NSE correspond to?

The last sentence of p2668 is unclear and needs to be rephrased. How many values/ proportion of series were available?

It would be good to justify the point of discussion of p2679 with quantified errors

Typos

P2663 l 1: converted from 1km?

Equation 2: clarify the notation 'sken' in the text

P2665 l 8: remove 'also' between 'events' and 'a' and add 'also' between 'was' and 'used'

P2665 l 9: remove 'partitions'

P2666 l 12: remove 'also'. After hydrological model, add 'it is assumed that'

P2667 l 15-16: make sure of consistency of dates

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P 2669: I would not qualify of 'torrential' rainfall of only 20 mm in a day... Can this be changed throughout the paper?

P2670: table 3.

P2672 l5: -6.7 not -4.6 largest change

Table 3: discuss the slightly worse errors in Loimijoki using REMO in winter after BC

Table 5 Loimijoki results for HIRHAM inconsistent with Table 4

Figure 1: edit to capture comparison of results using corrected/ uncorrected RCM outputs

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