Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-249-RC3, 2019

Hydrology and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Regional scenarios of change over Canada: future climate projections" *by* Zilefac Elvis Asong et al.

Anonymous Referee #3

Received and published: 19 August 2019

Review for 'Regional scenarios of change over Canada: future climate projections'

Summary: The authors present projected 21st century changes in daily precipitation and temperature over Canada, and several indices derived from these variables, based on GCM output taken from the CanESM large ensemble. The GCM output is dynamically downscaled with a regional climate model and bias-corrected with a multi-variate bias correction method before analysis. The authors report that temperature-related characteristics are expected to warm, and the warming is more pronounced in more northerly regions. Warming is also expected to be more pronounced in minimum temperature rather than maximum temperature. Precipitation is overall expected to increase; and heavy precipitation extremes might increase faster that the mean.

Overall, the paper presents climate projection results that are qualitatively well-known

Printer-friendly version

Discussion paper

from previous literature and from IPCC reports, and my main concern is that it remains unclear what the scientific novelty or innovation of the present manuscript is thought to be (my concerns are similar to other reviewers' concerns, with which I agree). In many places the manuscript reads like a report that presents a laundry list of various temperature/precip. characteristics and how they are expected to change, but it largely fails to focus on a more specific scientific topic or novelty/innovation. In a similar vein, the authors don't really discuss their findings much in light of previous literature, or in light of processes that might occur in other boreal regions. In addition, it remains unclear how the chosen climate indices (that are defined and computed in a purely climatological framework) relate to the paper's basic premise, namely to study quantities related to the hydrologic cycle (e.g., (a) in what way do you consider land surface characteristics and/or vegetation characteristics that determine evapotranspiration or runoff? (b) How are temperature characteristics, in particular highly idealized daily extreme indices, relevant for the hydrologic cycle?). Finally, while the paper claims to provide an assessment of the bias correction method, it fails to provide some *basic* description of how the multivariate bias correction works in the Methods section. On a positive note, the manuscript is written such that it is well understandable and accessible; and on a technical level, the climate modeling and analysis of results appears sound. However, based on the outlined concerns, I don't think that the manuscript could be published in HESS at this stage.

Given the (large) amount of work to create the presented ensemble, I feel there would be indeed ample opportunity to engage more with a more focussed and more exciting scientific question rather than outlining a laundry list of temp./precipitation change. For example, based on the present paper I feel these could be related to (a) a more in-depth physical understanding of the processes that lead to projected precipitation change, (b) the role of land surface feedbacks vs. dynamics in the projected summer drying, (c) the processes behind the amplification of temperature extremes; (d) whether the projected changes are robust across other models, or (e) the differences that are induced by the GCM-RCM-bias correction chain, (f) using the spread of the ensemble (which has not

Printer-friendly version

Discussion paper

been done so far) to diagnose internal variability vs. forced changes; etc. ...

Other comments:

l. 240.: You write that downscaled simulations inherit biases from the driving large-scale GCM simulation. While this is reflected in previous literature, one would hope that higher-resolution regional modelling would at least alleviate some of the biases, possibly related in particular to processes that are not resolved in the GCM. Is this not the case (at least to some extent)?

l. 250 and following paragraph: Would it make sense to test whether the biases have been reduced (compared to the original simulations) against an "independent dataset" (not WFDEI), or at least against an independent period? Does the bias correction change the low-frequency variability or trends of the system, or are these preserved?

l. 299 you write "[...] most of the warming will likely concentrate on the Prairies, over the Rocky Mountains, and most of southern British Columbia in the 2080s". Clearly, from Fig. 6 the whole domain is warming, i.e. not "most of the warming over X"; it just seems that Southern British Columbia and the Prairies are warming a bit more, right?

l. 389: "Regarding spatial patterns of warming, there is a general south-north heating trend with the polar (arctic) regions projected to warm the most under RCP8.5". There is ample research on polar amplification and such statements should be placed clearly within previous research.

l. 392: "With regard to wet and warm extremes, the derived climate indices will probably increase more than the mean." -> What does "probably" mean here? Does your model show it, but you don't know whether this is going to happen in the real world? Or does probably mean that you don't know for sure whether your model shows it? In any case: What is the reason for this amplification?

l. 479: "In terms of the probability distribution of extremes, across the MRB and SRB, larger tails are projected for the JJA compared to other seasons, and more so for the

2080s" What is the physical reason for these changes?

Fig. 3 and Fig 5: it looks like the observational time series shows more variability than the spread produced by the (bias-corrected?) ensemble. Is this just a visual impression?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2019-249, 2019.

Printer-friendly version

Discussion paper