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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Climate change impacts on the hydrologic regime of a Canadian river: comparing uncertainties arising from climate natural variability and lumped hydrological model structures" *by* G. Seiller and F. Anctil

Anonymous Referee #2

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This is an interesting paper looking at the hydrological impacts of climate change for a catchment in Canada with a significant snowmelt contribution to flows. It takes a slightly different angle to that of many impact uncertainty studies, by not including climate modelling uncertainty per se but looking at the effects of natural climate variability via an initial condition ensemble of a climate model. The conclusions on the relative importance of natural climate variability, hydrological model structure, potential evaporation (PE) formulation and snowmelt formulation are very interesting.

My main comment would be that, while a relatively large number of PE formulations are compared, there is no consideration/discussion of other possible sources of uncertainty related to PE. For example, page 14197 line 16 mentions the need to set empirical PE coefficients for the catchment, but if different coefficients are needed for different locations under the current climate, then it is conceivable that different coefficients would also be appropriate for possible future climates in a catchment. Similarly, in more process-based PE formulations, crop coefficients like canopy resistance may change in future climates, as plant stomata react to changing levels of carbon dioxide (see e.g. Bell et al. 2011). These and other factors relating to PE and climate change are discussed by Kay et al. (2013). Such factors should at least be acknowledged in this paper.

Minor comments:

1. I believe that the references to Kay et al. 2006 (page 14191) should be Kay et al. 2009.

2. In the Intro discussion on natural climate variability (page 14193) it needs to be made clearer that only the initial conditions are varied between the ensemble members (i.e. make clear the distinction between an initial condition ensemble and either a perturbed parameter ensemble or a multi-model ensemble).

3. I don't understand what the penultimate sentence of the Intro (page 14193 lines 20-22) is trying to say - please reword more simply.

4. Figure 3, the list of PE formulations, should be presented as a table, as for the lists of hydrological models (Table 1) and snow modules (Table 2).

5. In the text description (page 14201) and caption of Figure 5, the 'pale' and 'dark' blue are transposed - 'pale' describes the 5-95% range and 'dark' the 25-75% range. The same goes for the captions of Figures 7 and 8.

6. Page 14203 line 24 - should be '25% and 75% quartiles' (not 2 and 75)

7. In Table 3, you could perhaps highlight the best and worse performing options in each column.

Terminology:

Some of the wording doesn't seem quite right. For example,

'confronted' or 'confronts' when I think you mean 'compared' or 'compares' (pages 14192, 14193 and 14199)

'alternates' to describe the precipitation partitioning (page 14198), when I think you just mean that there are two formulations, and which one is used depends on altitude (but not in an alternating manner, i.e. one, then the other, then the first again, and so on?).

'synthetizes' when I think you mean 'summarises' (page 14200)

'propose' when I think you mean 'present' (page 14202)

Also be careful with use of the word 'mean' (e.g. page 14192 line 3 and page 14207 line 21); it should be 'means', but something like 'way' would be better, to avoid any confusion with the statistical definition of 'mean'.

References

Bell, V.A., Gedney, N., Kay, A.L., Smith, R., Jones, R.G. and Moore, R.J. (2011). Estimating potential evaporation from vegetated surfaces for water management impact assessments using climate model output. Journal of Hydrometeorology, 12, 1127-1136, doi:10.1175/2011JHM1379.1.

Kay, A.L., Bell, V.A., Blyth, E.M., Crooks, S.M., Davies, H.N. and Reynard, N.S. (2013). A hydrological perspective on evaporation: historical trends and future projections in Britain. Journal of Water and Climate Change, 4(3), 193-208, doi:10.2166/wcc.2013.014.

Kay, A.L., Davies, H.N., Bell, V.A. and Jones, R.G. (2009). Comparison of uncertainty

sources for climate change impacts: flood frequency in England. Climatic Change, 92(1-2), 41-63, doi: 10.1007/s10584-008-9471-4.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 14189, 2013.