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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 #1

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General comments

This manuscript summarizes research to assess the major sources of uncertainty in projections of future streamflow conditions in the au Saumon River in southern Quebec, Canada. The authors try to determine the uncertainty associated with model structure relative to that associated with variability in climate change model forcing data. It is an interesting question, one that has not necessarily been explicitly answered for many watersheds, particularly in Canada. The authors conclude that much of the uncertainty

could be attributed to selection of some aspects of hydrological model structure, and not variability in climate model output. This is a notable result that would be a useful contribution to the literature. However, I found the manuscript lacking in several aspects that need to be addressed. These specifically include how the authors define, describe and discuss the categories of uncertainty. Furthermore, the manuscript has contradictory explanations of how the uncertainty associated with climate change was assessed, so the reader is left without a clear answer of the relative uncertainty from different sources. The introduction, in particular, does not include explanations of the sources of uncertainty as strong as those in Section 3.2.1, much to the detriment of the manuscript.

Specific comments

Page 14191 Line 20: The choice of words throughout the manuscript meant I remained unsure of what the authors meant by "natural variability" and how its impact on uncertainty was assessed. Did the authors consider natural variability to be the variability among the output from the several GCM members under different runs with different initial conditions? I don't consider that "natural variability", I consider that bias or inaccuracy associated with boundary conditions placed upon the model. I suppose that means I disagree with Kay et al (2006) in how they address natural variability and assess change. Either way, the manuscript would benefit greatly from clearer definitions and more in-depth discussion of the levels and types of uncertainty.

Page 14192 Line 18: Is "global" uncertainty meant to mean overall/total, or global vs. local?

Page 14193 Line 8: It is unclear what is meant by "under climate change". This, along with the phrase "natural variability" makes it difficult to assess exactly what sources of uncertainty are being evaluated. Maybe be very explicit with the definitions of the uncertainty categories.

I've never felt that summary paragraphs like that at the end of the introduction are

necessary, but that is just me.

Page 14195 Line 18: Should read "This procedure assumes that these corrections. . ."

Section 2.5: The content here needs to be elaborated upon as this seems to describe how the relative degrees of uncertainty were evaluated among all the different sources. The manuscript should include much more detail of this key methodological information. For instance, it is confusing that the difference in the REF and FUT time series is used to highlight the uncertainty associated with climate change, but this is different than evaluating the effects of initial conditions on GCM output, which is how descriptions of the evaluation of the uncertainty associated with climate change are explained earlier in the manuscript.

Section 3.2.1 Paragraph 3: Some of this should be in the methods section. The manuscript would benefit from an explanation of how the authors used the confidence intervals to definitively determine if there has been a change in streamflow.

Figures 7 and 8: Only a suggestion, would overlapping these hydrographs within one figure better illustrate the changes?

Page 14203 Line 15: What is meant by overall mean flow? Is this mean annual flow or the average flow for the entire simulation period.

Page 14205 Line 28: How could the methods as described definitively determine how various hydrological processes are responsible for the observed uncertainty? The authors have not provided any data or information to support this statement.

Technical corrections

Page 14190 Line 10: I do not understand what the authors mean by "Uncertainties are commented on the observation period and on simulated and projected climates." Maybe say "Uncertainty in simulated streamflow under current and projected climates is assessed."?

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Interactive Discussion

Discussion Paper

The English grammar and language often seems out of sorts. Another example from the abstract is the second last sentence. It ends with ". . . . propagating this uncertainty on reference and future projection(s), while climatic members add over it." Perhaps the authors could say the "with wide variability in projected future climates further increasing uncertainty". This is an example of a pervasive problem throughout the manuscript that could be addressed with a thorough proof read.

Page 14191 Line 3: Should read "Quantifying the uncertainties associated with the modelling . . ."

Page 14192 Line 3: Should read ". . . .offer a simple means for unravelling. . ."

Page 14192 Line 18: Should read "However, scant research addresses . . ." Similarly, at the beginning of Section 2.3.1.

Page 14193 Line 4: Could read ". . . . but the literature targeting snow melt estimates in climate change model projections . . ."

Page 14196 Line 19: Watch the verb tenses. "were tested"

Page 14202 Line 27: Do the authors mean to say the spring flood is arriving fifteen days earlier?

Page 14203 Line 20: Much of this detail belongs in the figure caption and not the text of the paper.

Section 3.3.2: Much of the content in this section is constructed as a series of short paragraphs, but should be amalgamated into one or two larger paragraphs. A paragraph is meant to contain several thoughts that convey an idea. This section is constructed like a newspaper article.

Page 14206 Line 3: Could be rephrased from "The importance . . . .." to: "The example of this application to the au Saumon demonstrates the limit of our ability . . . .."

Page 14207 Line 4: Perhaps the authors should define the acronym behind the QBIC3

project.

Table 1: I am not sure "inspiration" or "inspired by" is the appropriate term. I would suggest "reference".

Figure 4: Again, no need for the word inspired. The terms PG and P2 need to be defined.

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