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Interactive comment on "Paleo-hydrologic reconstruction of 400 years of past flows at a weekly time step for major rivers of Western Canada" *by* Andrew R. Slaughter and Saman Razavi

Anonymous Referee #2

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Using a statistical approach (multiple linear regression and a disaggregation framework) the study generates reconstructed flows at weekly temporal scale based on tree-ring chronology data. This approach is shown to retain the variation and persistence of the observed flows of the Saskatchewan River Basin over the reference period of 1912-2001. I thought this was a concise paper, which presents the methodology and data clearly. I recommend publication after the following comments are addressed.

Specific comments: 1. The authors use R2 to select the best MLR model. Did they consider possible over-parameterization and multicollinearity? Analyzing the standard

errors and metrics such as information criteria (e.g. AIC) can identify the optimal models more reliably.

2. It is mentioned that "weekly flow distribution of the selected reference flow period can be used to construct the weekly flows". By doing so, the variability in the reconstructed flow will be similar to the reference flow variability, correct? Please discuss how/if this assumption can undermine the estimated variability of reconstructed flows? How does it account for possible recent trends due to the anthropogenic climate change effects?

3. The study focuses on matching the variation and persistence between the observed flow in the reference period and the reconstructed flow. I wonder whether historical/recent physical processes could have distorted this similarity? For example, recent climate change trends are much stronger compared to the historical periods (prior to the reference period)

4. P5/L8: I suggest discussing briefly the cause(s) for persistence in tree-ring chronologies and based on that justify why the multi-year approach will overcome the problem. Related to this, how about the role of teleconnection signals, which can affect the records over multiple years.

5. P6/L15-16- It matches the first moment (i.e. the mean). How about higher moments like the variance? 6. Figure 2, step 3- I wonder how much the yearly average is affected by seasonal variations? i.e. it is possible that larger flow values have the highest influence

Technical corrections: 7. P2/L22- Please clarify the "effects of past climate change" as the anthropogenic effects are mainly observed after the 20th century. Related to this, the next line indicates "high long-term variability" of reconstructions, which should be mainly representative of internal variability. 8. P2/L32: Please remove "that must be confronted" 9. P3/L2: Use either "streamflow" or "stream flow" throughout the paper 10. P3/L2: Is an R2 value of 0.76 low considering that it is based on an indirect estimate of streamflow? 11. P3/L23: What does "many uncertainties" imply? Large uncertainties

or many sources of uncertainties? If the latter, please provide a few others and add references 12. P5/L20: What are the chronology predictors? 13. P6/L9-10- Statement is not clear 14. P7/L6-7- I suggest rephrasing this statement for example "...smaller variability compared to...because of ..." 15. P8/L7- the frequency of what? 16. P8/L12- I think qstd should be in the denominator and qmean in the nominator 17. Table 1- Please spell out the predictors before or after the table. How was the predictor selection performed? and how did the authors consider multicollinearity? 18. P15/L4- In the introduction, it is mentioned that one of the challenges of current approaches is the low R2 values (0.37–0.76). It implied that this issue was addressed in the study, however current results are within this range. Please clarify

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