

# ***Interactive comment on “Examining controls on peak annual streamflow and floods in the Fraser River Basin of British Columbia” by Charles L. Curry and Francis W. Zwiers***

**Charles L. Curry and Francis W. Zwiers**

cc@uvic.ca

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We thank Reviewer 1 for their helpful comments. In response to the major comments, we offer the following:

1) We should clarify that our work is not focused upon predictability of APFs in an operational sense, i.e. flood forecasting on the annual or seasonal time scale. Our objective is instead to discover and quantify relationships between the interannual variability of APF, large-scale climate indices, and various basin-averaged variables within the FRB. We regret that the last sentence of the Abstract led the Reviewer to believe that the former was the primary motivation. However, we maintain that this statement, as it

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stands, clearly distinguishes between what we did ("identification of these controls") from possible applications of the work ("may be of use in the context of seasonal prediction or..."). Moreover, only the former is emphasized earlier in the Abstract (lines 18-22).

As for our use of the word "predictor", this term has a clear, if broadly applied, meaning within the context of physical and statistical models. It simply denotes a quantity that covaries with some other variable of interest, the predictand. Moreover, it retains this meaning in either a retrospective (past) or prospective (future) sense. The usage of "predictor" and "predictand" thus parallels that of "independent" and "dependent" variables, but is better suited to the statistical model used here to uncover the relationships between physical variables. Hence, we feel that our use of the term "predictor" is well-suited to the methods of the study.

Moving to the remainder of the Reviewer's comment, we agree that the predictors we chose might not be suitable for the prediction of APF in an operational context. But as stated above, we are interested instead in a more retrospective approach that accepts that any predictor, at any lag, might have explanatory value for the predictand. Indeed, there is a physical reason why a NINO3.4 index based on concurrent SSTs would not be expected to be an effective predictor of APF: namely, because teleconnections between tropical SST anomalies and the climate of the FRB operate with a lag of ~2-6 months (Gurrapu et al. 2016). So even in an operational context, using a lagged SST index as a predictor makes sense.

The potential use of our results in the context of future projections was also a question raised by Reviewer 2, which we address in that Response.

2) We thank the Reviewer for this suggestion. Using the observed data, we regressed both autumn (Sept-Nov) and summer-autumn (Jun-Nov) rainfall on the following year's APF over the 1950-2006 period. Neither correlation was significant at the 10% significance level.

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3) We appreciate the Reviewer's opinion on this matter, and see considerable overlap between it and the first major comment of Reviewer 2 – see that Response, which details the significant revisions made. We feel that the three case studies exhibited in Sec. 4 effectively illustrate phenomena highlighted in the preceding regression analyses and that, consequently, are likely to extend beyond the specific context of the FRB. This is encapsulated in the subsection titles, which point to the climate drivers underlying the different hydrographs seen in the sampled years. Finally, as we have argued against expanding the analysis in connection with point 1) above, we feel that there is no pressing need to make cuts to existing material elsewhere in the manuscript.

Response to minor comments of Reviewer 1:

- Changed "APDF" to "APF" in Table 3

- p.11, line 9: We thank the referee for this question, which makes a valid point. We have redefined R<sub>APF</sub> to span only the 15-day period immediately prior to the date of APF, with no change in the conclusions.

- Figure 4 and the CRI: The CRI is introduced in an attempt to track short timescale influences of multi-day rainfall on daily streamflow. These intra-annual influences, if present, will not be detected by the interannual regressions described earlier in Sec. 3, which involve longer-term means of R versus annual peak flow only. This motivation is now clearly explained in the third paragraph of Sec. 3.3.3. Fig. 4 summarizes these intra-annual covariations, as opposed to the interannual relationships examined thus far in the paper. Fig. 4 also identifies the ENSO state corresponding to the year prior to that of each (rainfall, discharge) data point on the graph, consistent with the convention defined in Sec. 2.1.

- p.15, line 16-17: We agree that this phrase is unsubstantiated. It has been replaced with a clearer sentence reinforcing the relationships found via regression.

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