

## ***Interactive comment on “Streamflow input to Lake Athabasca, Canada” by K. Rasouli et al.***

### **Anonymous Referee #1**

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This paper that extends from prior analyses of river flow patterns along the Athabasca River, and other regional rivers that contribute to Lake Athabasca. As indicated in the paper, there is substantial current interest in flow trends for the Athabasca since it provides the primary surface water supply for the large and growing Athabasca oil sands projects. While the paper also refers to the globally significant Peace-Athabasca Delta, that complex system is particularly dependent on the larger Peace River, which was not analyzed and has a hydrologic complexity due to the massive Williston Reservoir.

The study analyzed historic river flows and particularly mean annual discharges. Seasonal analyzes were not considered and some prior analyzes have indicated that seasonal changes have been proportionally greater than changes in the annual patterns. The current analysis considered trends across different time intervals but due to the chaotic interannual variation, the analyses of shorter time series ('Trend 4') are rather

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uncertain. This also relates to the 'regime shift' and again, the interpretation and emphasis on the recent, 13-year interval seems excessive.

The longest time series extended from 1960 to 2010, representing a 51-year interval. A half century consideration is longer than for many prior hydrologic analyses but it will still suffer if multi-decadal oscillations are relevant. The paper discusses the prospective influence from the Pacific Decadal Oscillation (PDO, p. 9076). It would strengthen the analysis to increase this consideration relative to the PDO and also to consider the Arctic Oscillation relative to the particular half century interval. As there was apparently some coordination with the PDO, a linear extrapolation would be less appropriate than a composite projection, with a long-term linear trend superimposed on the cyclic oscillation. At the least, the complication from the PDO should be recognized in the Abstract as a factor that confounds the simple linear analysis and extrapolation.

Most critically, a weakness in the statistical consideration is the application of an unusual standard of  $p < 0.1$ . This would normally be regarded as a statistical 'trend' (recognizing the different use of this term for hydrologic patterns) and the normal international standard for statistical significance is  $p < 0.05$ . There are considerations for both alpha and beta errors and it would strengthen the study to include the standard  $P < 0.05$  standard as well as the  $P < 0.1$  criterion for Table 2, for the regime shift analysis, and for other considerations – and preferably even the  $P < 0.01$ . It would be worthwhile to reconsider the paper after the normal statistical standard is applied – what statistical effects persist?

Also related to the statistical treatment, for the Figures 3 to 6, associated with the plotted lines, at least for the half-century interval, there should be indications of the  $R^2$  and  $p$ . It is recognized that this implements a parametric analysis, but since the authors did provide linear extrapolation, the linear analysis should be more fully presented.

Finally, the text doesn't really indicate why this analysis and outcome would be of international relevance. There is obvious applicability relative to Alberta and Western

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Canada but why would this paper be suited for an international journal rather than a journal such as the Canadian Water Resources Journal? I think the case might be made for the investigation of sequential time series to detect regime shifts and this aspect might have greater prominence in the Discussion, while the regional aspects might be shortened.

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