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Interactive comment on "Recent trends and variability in river discharge across northern Canada" *by* S. J. Déry et al.

S. J. Déry et al.

sdery@unbc.ca

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We sincerely thank Anonymous Referees #1 and #2 for their constructive comments on our manuscript (Reference # HESS-2016-461). We fully recognize and appreciate the reviewers' efforts in providing these informative reports on our research focused on river discharge in northern Canada. Indeed, their insights are undoubtedly leading to an improved paper through this online discussion and ensuing revision process. We are thus taking into full consideration all of the comments from the referees and are preparing detailed responses to these as well as information on how the paper is being revised according to the two anonymous referees' suggestions. A complete and detailed response document will be submitted once a decision has been made on our discussion paper. In the meantime, we provide here a general overview of our responses to the comments submitted by each referee:

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Discussion paper

Anonymous Referee #1:

First, we are updating Table 1 in our paper to include information on the number of reservoirs and their total storage capacity in each of the river basins under study. This is particularly important in interpreting seasonal trends in river discharge to the coastal ocean in systems such as the Nelson and La Grande Rivière that are highly fragmented. Second, the construction of the river discharge time series is based on daily hydrometric data. As such it is straightforward to include climatological hydrographs for the six regions of interest. To that end, the new section 4.4 will provide the mean annual cycles of daily river discharge for the six regional basins under study as well as comparisons of hydrographs between regulated and unregulated systems. Third, we acknowledge that some important references on the variability and trends in streamflow across northern Canada are absent in our paper. Those suggested by the referee and a few other recent publications are now being added to our revised manuscript (see below). Fourth, we agree with the referee that climate change signals are more robust and easier to detect in unregulated rivers. A statement to that effect is now being included in the Conclusion. Finally, we are clarifying the text in the Conclusion describing ongoing modeling work the Arctic-HYPE model, which is indeed considering human activities (and climate change) on flows reaching polar seas.

Anonymous Referee #2:

The first comment from Referee #2 relates to the strategy used to in-fill gaps in the time series of river discharge in northern Canada, namely streamflow timing changes and their impacts on filling missing daily discharge data. Inclusion of this possible factor on the trend analysis is now being added to Section 3.2.2 in the Methods where caveats of our gap-filling strategy on our analyses are discussed. While the referee recommends inclusion of this point in Section 5 (Discussion), there is no discussion on some of the assumptions or potential shortcomings of the gap-filling strategy there and impacts on the trend analyses. As such, this comment is being addressed in the second paragraph of Section 3.2.2. Permafrost degradation is a possible factor influencing ob-

served streamflow in northern Canada (St. Jacques and Sauchyn 2009). Further text is therefore being added in the paper given the possible impacts of permafrost thaw in northern Canada's hydrology. Identification of the effects of flow regulation and climate variability and change on streamflow in northern Canada remains a goal of ongoing research. Section 5 now therefore includes a brief summary of an ongoing modelling exercise aimed at attributing the impacts of both climate change and anthropogenic activities on streamflow input to Hudson Bay.

New References:

St. Jacques, J.-M. and Sauchyn, D. J.: Increasing winter baseflow and mean annual streamflow from possible permafrost thawing in the Northwest Territories, Canada, Geophys. Res. Lett., 36, L01401, doi: 10.1029/2008GL035822, 2009.

Tananaev, N. I., Makarieva, O. M., and Lebedeva, L. S.: Trends in annual and extreme flows in the Lena River basin, Northern Eurasia, Geophys. Res. Lett., 43, doi: 10.1002/2016GL070796, 2016.

van Vliet, M. T. H., Franssen, W. H. P., Yearsley, J. R., Ludwig, F., Haddeland, I., Lettenmaier, D. P., and Kabat, P.: Global river discharge and water temperature under climate change, Glob. Planet. Change, 23, 450-464, 2013.

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Discussion paper