

General comments

This manuscript describes a study in which the authors used river discharge data, landcover, and other data to understand effects of permafrost thaw on changes in streamflow seasonality and storage-discharge relationships. The presentation is generally good and figures and tables are understandable. The robustness of the changes describes lack a great deal of certainty or clarity. There are a few concerns about attribution. Missing data in the river discharge time series may be a contributor.

The authors point to early winter increases in streamflow evidenced by Parde coefficients in Figure 7. There appears to be no significant shift change in Nov and Dec at most sites. There are also inconsistencies that may be due to missing data. The analysis should include some caveats and statements that better enable the reader to understand the confidence level and uncertainties with the analysis and described.

There are other elements of the analysis that raise uncertainties. Stronger streamflow seasonality in upstream catchments could be mostly attributable to more snowfall in the colder and more mountainous areas producing greater runoff ratios. More water per unit area. Permafrost coverage also plays a role as described here. But runoff efficiency and higher rates due to more snow in colder snowier upstream catchments seems to be a factor not incorporated in this analysis. Moreover, more seasonal flow in upstream catchments could be attributable to increasing precipitation, perhaps more so in the colder mountainous upstream catchments. This factor is not analyzed or discussed.

This paper would be strengthened with additional information and/or analysis that increases confidence in the salient conclusions.

Specific comments

Line 71-74 the statement is awkward as written. Also, the meaning of “which does not include the current polar amplification occurring” is not clear.

Line 75 not clear if “that temperature threshold” refers to 0 C or -5 C.

Line 86 The meaning of “round-about way” is unclear.

Line 150 statement not consistent with map. Figure 2b shows no sporadic or isolated in downstream part of Yukon. Just discontinuous. Statement should be rewritten.

Line 196 how do the gaps influence the results? That is, what uncertainties arise because of these gaps? Is there high confidence in some of the results, but lower confidence in other results because of the data gaps?

Line 241-242 interpretation would be aided by having ymax value (1.7 ?) shown in figure 5 chart.

Line 270-273 this statement is awkward given that the second part (after “but we also found...”) is unrelated to the first part of sentence, and also doesn’t fit well. It is more background appropriate for discussion elsewhere.

Line 306 Meaning of the statement is unclear: “and this freshet has not consistently changed its magnitude compared to the older period.” Looks like freshet (May) magnitude is higher in panels g, i, j.

Line 309 Looks like statement true just for Stevens Village and pilot Station. The statement may not be broadly valid for “downstream” of Yukon River.

Line 311-312 why the conflicting change in streamflow for Rampart and Ruby? They are close to one another. This is another indication that the analysis looking at shift in flow across these catchments, assumed by examining early and late periods, is not very robust.

Line 313-314 Ruby does not show late fall and early winter increase. The differences in coefficients in Nov and Dec for Stevens Village, Ruby, and Pilot Station are likely not statistically significant. Some statements about the very small shift in winter for these downstream stations should be made.

Line 333 To help orient read, table 3 should be called out in sentence where Beta statistics on early/late period are first mentioned.

Line 337 Rapart shows a decrease in Beta. None of the others do. This is not mentioned. Yet Rampart is mentioned with Pilot Station as having the largest changes. This seems odd. Also the meaning of “few recession points is hard to comprehend. Does that mean missing data? Could this be clarified in another way?

Line 401 Suggest the authors consider whether higher runoff amounts due to more precipitation in recent years could be causing a more abrupt freshet. There is no mention of influence from precipitation changes.