Answers to Referee 1

Thank you very much for your repeated review of our manuscript. We deeply appreciate your comments and your recommendation to accept our manuscript after minor revisions. Below we have listed your comments and how we addressed them. You comments are stated in black, our answers in blue.

This may be part of my ignorance, but I feel the causal trend results can use some more contextualization in section 3. We feel that contextualizing the meaning of a positive/negative causal trend between the trigger variable and the target variable is important, especially with regards to the actual directions of the variable trends. This can get especially confusing once the causal trends are contextualized with the actual variable trends. Adding some clarifying statements will greatly improve and help readers understand what these results imply/mean.
Specifically:
• Section 3.2: A summary sentence describing what the positive/negative trend means between SWE-Discharge and Rain-Discharge would be helpful to the reader.

Thank you very much for this comment. We added the following statement in section 3.2:

"A positive trend means that the causal effect of snowmelt (or rain) on river discharge increases over time, so that variations in river discharge are increasingly linked to variations in snowmelt (or rain). A negative trend means the opposite. The sign of the trend therefore describes the change in the causal effect and not the change in the variables themselves."

• Section 3.3: In this section, the author combines the results of section 3.1 and 3.2 to describe water stress. However, how these results align with water stress is not described adequately. How does the totality of the trend results relate to water stress in the different regions regions? The statements in lines 380-381 (really 377-381) state the trends, but don't really contextualize how these trends are indicating water stress. The authors do this in the conclusions in lines 776-779, but these are important results that should also be stated in the results section as well, and adding similar sentences to this section will greatly improve how these results are indicating water stress. We suggest including a couple of clarifying statements in this section will greatly help contextualize these results and highlight important insights that this analysis is capable of.

We highly appreciate your suggestions to clarify our section water stress identification. We added the following clarification:

“In these 38 basins, SWE and river discharge both decline, while the causal effect of snowmelt on river discharge increases. River discharge is thus increasingly influenced by snowmelt, even though the snow resource is shrinking and discharge is already decreasing. Therefore, declining discharge points to drier conditions and thus water stress, and the increasing causal effect of snowmelt indicates that this water stress appears to be increasingly snow-driven. In the 7 basins with a decreasing causal effect, discharge declines although its link to snowmelt weakens.”

• Section 3.4.1-3.4.6: Again, a statement of what the positive or negative trend means for the causal effect might help improve the readability and contextualize these results further. It could also be “increasing causal coupling of snowmelt and discharge (positive coupling trend”.

We appreciate the referees ideas to support the understanding of our causal trends. We added the following statement to the introductory part of section 3.4:

“In the following, a positive trend denotes an increasing causal effect and a negative trend a decreasing causal effect.”

Additionally, we added parentheses “(increasing causal effect)” or “(decreasing causal effect)” in each basins section to support the trend statements.

Technical Comments:

• Line 350-351: “detected a continuous effect and therefore trend” . Suggest rewording.

Thank you very much for this suggestion. We changed the wording as following:

“Causal effect trends were derived wherever the method detected a continuous effect. For the causal effect of snowmelt on river discharge, this was the case in 73 basins. Of these, 60 had a positive trend, 12 of which were significant. For the causal effect of rain on river discharge, this was the case in 114 basins. The effect of rain on river discharge was positive in 67 basins (51 significant), and negative in 47 basins (31 significant).”

• Figure 11: The 15 basins in green have no causal trend detected, correct? Maybe this can be highlighted either in Section 3.3 or in the legend?

The green basins are basins with diverging SWE and Discharge trends, where we did not assess the causal effect trend for this part of the analysis. The basins with no causal trends are shown in purple. We adjusted the caption of figure 11 to clarify:

Basins with negative river discharge and negative SWE trends, classified by the trend in the causal effect of snowmelt on river discharge. Blue basins show a positive trend

(increasing causal effect), red basins show a negative trend (decreasing causal effect). Purple basins have no causal trend identified. Light green basins show a negative discharge trend despite an increasing SWE trend. Causal effect trends were not analysed for these basins in this figure.

• Figure 4: y-axis label includes “Riverdischarge”
• Lines 321-323: Figure is just referred to as “5B” or “5C”
• Line 342: “60° and 20° North”. Suggest change to 20°N to 60°N
• Figures 9 and 10: The word Strength in the Coupling Strength panel is misspelled. Also, in the caption of Figure 9, “Anomaly magnitude” is used while Figure 10, “Anomaly Size” is used. The captions and panel label should be consistent.
• Line 695: The citation style is inconsistent

We changed all these issues as suggested by the referees.

We hope that these changes are align with the intention of the referees and thank you again for your time and valuable feedback.