Author response to Editor comment:
Our replies to editor comments (black italics) are provided below in blue.

This reviewer is very critical about the scientific (added) value of the paper and recommends rejection in the formal reviewer report. This overall assessment is motivated by the statement that "the manuscript fails to describe in a robust, quantitative, and convincing way how water moves through this landscape in response to both rainfall and snowmelt.".

This statement is motivated by two main critics:

"i) the focus on catchment resilience and disturbance, that do not appear to be logically linked to the paper investigations carried out and sounds out of context;

ii) the presence of hydrochemical data only: despite the powerful nature of hydrochemistry as hydrological tracer, the combination of racer data and hydrometric data can help to unravel the complexity of hydrological processes at the catchment scales."

The authors' response to the second point does not contain any detailed plans at this stage. I am waiting for a third editor report but I already invite the authors to provide a more detailed planned how you plan to address the above second point before I can give a recommendation on the submission of a revised version.

Reply: We thank the editor for their comment and clarification on this issue.

We agree that hydrometric data are an important part of this story. The published manuscript we refer to in our first reply (Spencer et al., 2019) includes estimates of dynamic storage by water balance method, a hydrograph recession analysis to infer groundwater contributions, snowfall-runoff ratio relationships to understand the influence of pre-winter storage, and hydrograph response (event rise) at the storm scale in wet and dry seasons. These analyses were used to develop a conceptual model of storage and runoff generation for alpine and subalpine/montane regions in Star Creek. This was the first step in understanding runoff generation in regions with glacial till overlaying permeable sedimentary bedrock. The aim of this draft manuscript submitted to HESS is to develop further lines of evidence to address the complexity of runoff generation in this region. While Harder et al. (2015) postulated that this region has complex subsurface flow pathways, to our knowledge, no studies have characterized runoff generation in the subalpine region of Alberta's Rocky Mountains. The Introduction of the present draft manuscript will be reformulated to stress the connection with Spencer et al. (2019) and position this research in context with other regions with shallow soils and impermeable bedrock.

A figure (such as the draft in Figure 1 below) will be added to address the lack of hydrometric data in the draft manuscript. It was an oversight not to include any data that shows the runoff patterns in the draft manuscript. This figure will help show the link between observed inputs (daily precipitation and continuous snow depth) to observed responses (specific discharge, stream water chemistry, and shallow groundwater levels). It will also address other comments/concerns from both referees. Similar figures are often presented along with hydrochemical data in other publications (e.g., Blumstock et al., 2015; Barthold et al., 2017; Ali et al., 2010; Cowie et al., 2017; Inamdar et al., 2013; Hoeg et al., 2000; Sueker et al., 2000; Correa et al., 2019). A table with precipitation event characteristics is also often presented in conjunction with the hydrographs; however, storms are not the focus of our study so other metrics such as average annual discharge, percent of streamflow that occurs from May to July, and annual peak flow will also be added to further characterize the hydrological setting.

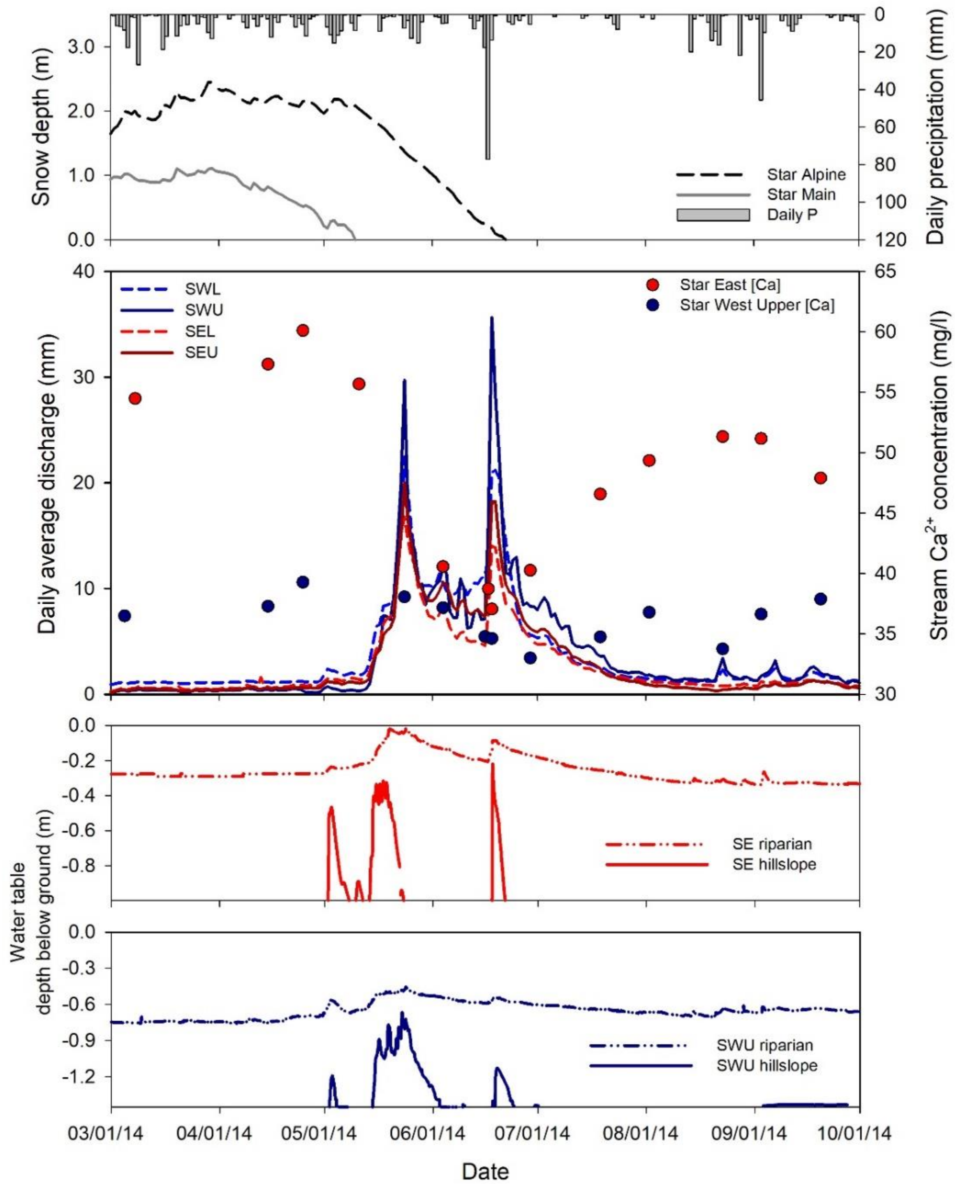

Figure 1. Draft of a figure that will be added to the draft manuscript. It is a work in progress but we wanted to attach it as an example of what we would like to include.

We would prefer not to include the unmixing model results because of the violation of multiple EMMA assumptions. We had explored this option before and decided that the errors associated with the percent contributions outweighed the contributions. This is similar to Hoeg et al., (2000) who found geographic hydrograph separations did not lead to conclusive results, and Inamdar et al., (2013), who suggested that caution should be applied when calculating percent contributions where there is large variation in end members and assumptions are violated. If the critical assumptions of EMMA were not violated, we would also have examined model accuracy using virtual mixtures of the sampled water sources since model tests using such mixtures are becoming more commonplace in the international literature using source apportionment methods. However, as we state above, assumption violation precludes inclusion of such work.