

Interactive comment on “Impacts of climate and forest changes on streamflow and water balance in a mountainous headwater stream in Southern Alberta” by V. Mahat and A. Anderson

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Before providing comments, I would like to clarify that I am not a hydrologist, but more of a civil/river engineer. I am therefore unfamiliar with the models and procedures used in the study, but have done my best to try and understand the process. I should also make clear that this is the first paper I have ever refereed. Please consider this background when reading my comments.

Water scarcity in the oldman catchment and much of southern Alberta is a very important issue. I applaud the two authors for attempting to quantify how climate change

C4381

may affect the region such that proper measure can be taken. I am also impressed at the amount of work done in this paper. I believe the paper is relevant, but would like to see some changes prior to it being published.

General comments: As I understand it, precipitation of the region is driven by the so called "pineapple express". I would love to see a short section describing the hydrology of the region which could validate whether or not the GCM is able to capture the relevant processes. This "pineapple express" is a relatively thin ribbon of moist air and I am not sure if the GCM grid of 200 km²? (the actual GCM grid size is not clarified in the paper) is able to capture this phenomenon.

There is also the affects of the Pacific Decadal Oscillations that may or may not affect future precipitation in the region. I am not sure if the GCM is able to capture that. Certainly the climate station used with only 32 years of data will not be able to pick up this Pacific Decadal Oscillations phenomenon.

The methodology seems to make sense, but as the other two referees pointed out, it would be nice to have more detail in this section.

There is some repetition in the text that could be removed to save space and make it more readable.

Specific Comments: ABSTRACT: Defining stream flow in mm must be a hydrologist thing, but I find it confusing. Also with out providing a mean flow, an increase or decrease of x mm is not helpful. P8504 Line14 - You mention the decrease in June, which is when typical high flows occur. Perhaps in the abstract you should talk about the flow decrease in July and August when irrigation is occurring and reduced river flows could impact agriculture production.

1 INTRODUCTION: P8504 Line 23 - "regional" is subjective and not helpful. They are mountains, therefore have high runoff ratios. P8504 Line 18 - Most of your sources are for much larger river basins (eg. mississippi, Missouri, Columbia, North Sask). Is it

C4382

worthwhile clarifying the differences in applying this procedure on a small catchment vs a large one? I guess there is a difference when it comes to downscaling.

P8506 Line 24 - this sentence is not useful. "may" is not definitive. I could not see in your methodology how you selected your model?

2 STUDY WATERSHED AND DATA Furthering Cindy's comment. Snowfall data can be very variable, comparing readings or combining the readings for the years available from the other regional climate stations will help strengthen your data.

3 METHODOLOGY You define three distinct steps. In order to make your work easily reproducible it would be nice to have several more sub steps included

3.1 P8509 Line 2 - No clarification on how it was downscaled is given. I am pretty ignorant on the subject and maybe its fine, but going from 200 km² to 1 km² without losing accuracy seems hard to believe.

3.2 This LARS-WG is pretty amazing.

3.3 P8512 Line 21 – You have a 1500 m elevation difference, is 5 elevation zones (each 300m) enough? P8513 Line 13 – You have over 100 different parameters! This is amazing, I guess you used the monte carlo technique to come up with the best set, but the amount of runs you must have done is daunting. I assume it was automated somehow. Can you provide more info on how this was done? Is it a built in part of the program?

DISCUSSION P8518 line 5 – Some information on the uncertainty of all aspects of the process should be provided so that we can believe your work. In all honesty, because of the inherent uncertainty in the downscaling, I find it hard to believe your results. When combined with all the other similar studies, they make sense, but on its own it makes me uncomfortable.

In closing, I hope at least one of my comments will be useful to you. I enjoyed reading your paper and learnt much from it. Thank you for your hard work.

C4383

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C4384