

Author response to reviewer #2 comments for HESS manuscript "Modelling the effects of climate and landcover change on the hydrologic regime of a snowmelt-dominated montane catchment" [Paper #: hess-2024-361]

Dear Reviewer,

We would like to thank you for taking the time once again to complete a thoughtful review of our manuscript submission. Addressing your comments will undoubtedly result in a stronger submission. Please find below a list of responses to your comments. We hope our responses satisfy the spirit and intent of your remarks.

Sincerely,

Russell Smith

Reviewer #2 comments

General Comments

Dear authors of the manuscript, thank you very much for revising the manuscript. The current version has undergone substantial enhancement in terms of content and presentation.

The manuscript is generally well-written, with figures and tables that are well-placed and clearly illustrate the results. The manuscript provides insights on annual and seasonal hydrological changes, as well as on the development of extreme summer low flows and peak flows under a range of climate scenarios and landcover conditions. The conclusions drawn are supported by the findings of the model. The in-depth analysis of potential future changes is informed by the CSIRO85 model. However, I still have some minor comments that should be addressed:

- Thank you for the very positive comments, and for acknowledging our large effort with the revisions.

Minor comments

L 12-14: what does “two to nine times more” mean in absolute terms? Absolute figures would provide more clarity here.

- Good point. We propose revising the text to the following: "The combination of climate change and stand replacing landcover disturbance in the middle and high elevations is predicted to advance the timing of the peak flow two to nine times (depending on emission pathway) more than the advance generated by disturbance alone (7 days)."

L 26-27: are the “values at risk” related to the society as mentioned in the first sentence of the abstract? This needs clarification, also in the conclusions section.

- Yes. We are referring to values of concern to society, as changes in hydrology cascade into changes to watershed risk. We will work on clarifying the wording in the manuscript.

L 267-268: which parameters have “substantial uncertainty and/or sensitivity”? Please name them. Although these parameters have been calibrated simultaneously, the issue of equifinality should be discussed (at least in section 6.4 on uncertainties).

- Parameters with the greatest uncertainty were conceptual model parameters, including those related to:
 - soils / runoff routing (HBV_BETA, MAX_PERC_RATE, MAX_INTERFLOW_RATE, BASEFLOW_COEFF, BASEFLOW_N; see Table A.3 in Craig and the Raven Development Team, 2022)
 - snowpack cold content and patchiness (CC_DECAY_COEFF, SNOW_PATCH_LIMIT; Table A.4)
 - potential evapotranspiration (PET_VEG_CORR; Table A.5)
- Parameters that were particularly sensitive include those related to:
 - short-wave radiation (CloudTempRanges, UBCCloudPenetration, MAX_LAI, SVF_EXTINCTION)
 - air temperature distribution (AdiabaticLapseRate, WetAdiabaticLapse)
 - precipitation distribution (PrecipitationLapseRate)
 - snowpack albedo (P0ALBMAX, P0ALBREC)
 - runoff routing on the soil surface and in the shallow soil (impacted flashiness during spring freshet; HBV_BETA, MAX_PERC_RATE, MAX_INTERFLOW_RATE)
 - runoff routing in deeper soil / groundwater (impacted rate of flow recession and maintenance of low flows; BASEFLOW_COEFF, BASEFLOW_N)

- potential evapotranspiration in the middle and high elevation areas (PET_CORRECTION, PET_VEG_CORR)
 - canopy interception for snowfall (TFSNOW)
 - stream channel roughness (RoughnessZones)
- We believe the model was constrained well by the calibration process. This issue was discussed extensively in our response to Reviewer #1. We invite you to review those comments. We will address these concerns in greater detail within the discussion of uncertainties in the manuscript (Section 6.4).

L 303: I am still struggling with the meaning of these BEC variants. It would be nice if the BEC variants were explained in a table.

- We propose simplifying our description to the following: “Seven plots were established in mature forests ranging in elevation from 649 m (dry, ponderosa pine forest) to 1930 m (wet, sub-alpine forest) (locations provided in Figure 1).”

Table 5: would be helpful to split the numbers of net P into P and ET. The precipitation data given in other tables to not coincide with the aggregation used in Tab. 5

- We believe it is more important to present net precipitation in the main body of the manuscript, as it is more directly related to the availability of water for generating runoff. We’re also hesitant to add another similar sized table to the main body for presenting precipitation and evapotranspiration, as the manuscript is already long; however, we propose adding a table to the supplement to present this additional information.