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Comment on hess-2021-92

Mojca Sraj (Referee)

Referee comment on "Future changes in annual, seasonal and monthly runoff signatures in contrasting Alpine catchments in Austria" by Sarah Hanus et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-92-RC2, 2021

General comments

The paper investigates the influence of climate change on timing and magnitude of future runoff extremes (maxima and minima) in six Alpine catchments in Austria using a process-based semi-distributed hydrological model and projections from 14 different regional climate and global climate model combinations for two future emission scenarios, namely RCP 4.5 and RCP 8.5. The selected catchments differ in elevation ranges as well as in hydrological regimes. The influence of climate change was quantified by comparison of the projected modelled runoff for the period 2071-2100 to the runoff of the reference period 1981-2010. The main aim of the study was testing the hypothesis that future changes in magnitude and timing of annual runoff extremes differ between high- and low-elevation Alpine catchments. The paper is in the scope of the journal. It is well written and structured. The data seem to be of appropriate quality. References are up to date and appropriate. Below there are only some minor suggestions that could further improve the manuscript.

Specific comments

- Data: The authors should explain the reason of using Thornthwhaite method (one of the simplest methods) for daily evaporation estimation since the choice of the method affects the results.

- Data: Authors could give at least a basic description of both applied scenarios RCP4.5 and RCP8.5 (e.g. moderately optimistic scenario RCP4.5, worst-case climate change scenarios RCP8.5).
- Methods: Please, elaborate the decision for the selection of the period 2071-2100 and not the period 2041-2070 for the investigation of the influence of climate change on future runoff extremes. The uncertainty of the results for such a distant future (2071-2100) is much greater and therefore confidence in the results is much lower.
- Results, Figure 5 caption: It could be useful for readers to add colours to the explanation in the brackets: "Red and grey lines represent the mean flow regime….. "
- Results: Section 3.3.2: I would suggest to change the order of the words in the title (timing and magnitude) to follow the structure of the section. The same goes to some other sections (i.e. 3.3.3, 4.3, 4.4)
- Discussion, lines 339-340: The statement that the increase in projected future precipitation compared to the past is in contrast to other climate projections for Austria is not elaborated enough. What are the possible reasons? Did other authors (e.g. Stanzel and Nachtnebel, 2010) use the same scenarios for the same catchments/regions?
- Discussion: In my opinion the section 4.5 is redundant. The societal impacts were not evaluated in the research; therefore, the discussion about the topic is not relevant.
- Discussion: Section 4.6 (Climate model uncertainty) should be a part of the next section Uncertainty & limitations, where all other uncertainties are discussed.
- Discussion, line 495: "….in the largest increases in magnitudes". Of what? Annual minimum and maximum flows?
- Discussion, line 500: It would be useful for readers to define the model 10 more precisely.

Technical corrections

- Page 12, Figure 5 caption: One bracket is missing after shaded area.
- Page 20, line 310: "is" is repeated twice. One should be deleted.