

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Referee Comment on hess-2021-92

Anonymous Referee #1

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-RC1>, 2021

This is a well written paper on projected hydrologic change in Alpine catchments through a conceptual rainfall-runoff model. I appreciated the fact that many different runoff signatures are discussed (actually the title could state that not only extremes are considered) and the results are compared to the existing literature. Also, the non trivial differences obtained comparing RCP4.5 and RCP8.5 is interesting and point out how mountain areas are peculiar. CMIP5 climate projections are used here, which will be soon become obsolete given the CMIP6 simulations already available (the Authors should also discuss this limitation). I also would have expected a more critical questioning on how well this modelling approach can capture runoff changes (e.g. based on the discussions in Duethmann et al., 2020, HESS). There are two subsections dedicated to that which could maybe be expanded. Regarding the attribution of runoff changes to the causes (precipitation, evapotranspiration and snowmelt), a more quantitative analysis would have made the paper even more interesting. These are just some minor suggestions/comments that I hope can help to improve the discussions in this paper that, overall, I liked reading. Some detailed comments follow.

Line 85: what could be the bias introduced by scaling the runoff data, rather than the precipitation data, for consistency with Budyko? Since the Authors are interested in percental changes, wouldn't this choice exacerbate the changes in magnitude for runoff in those catchments?

Line 104: what is the advantage of transferring the precipitation and temperature data from the EUROCODEX pixels to the ground stations and not working with the pixels themselves?

Line 115: is Table 1 the right table?

Line 170: has the glacier extent in the Pitztal a linear decrease till 2100?

Page 20: the Gailtal catchment seems special, in terms of annual maxima. Apart from the double peak season, what could explain the largest change in magnitude for RCP8.5?

Line 346: one interesting reference on observed trends in evapotranspiration in Austria and possible causes is Duethmann and Blöschl (2018, HESS).

Section 4: the section contains a lot of attribution statements. Are these statements confirmed by simulations, e.g., increase in precipitation keeping temperature unchanged and vice-versa? Or is it just an expert interpretation of the simulations with all variables changing?

Section 4.7: this section could be linked to the hypotheses for potential causes of the

divergence between observed and simulated discharge changes in Duethmann et al. (2020, HESS).

References:

Duethmann, D. and Blöschl, G.: Why has catchment evaporation increased in the past 40 years? A data-based study in Austria, *Hydrol. Earth Syst. Sci.*, 22, 5143–5158, <https://doi.org/10.5194/hess-22-5143-2018>, 2018.

Duethmann, D., Blöschl, G., and Parajka, J.: Why does a conceptual hydrological model fail to correctly predict discharge changes in response to climate change?, *Hydrol. Earth Syst. Sci.*, 24, 3493–3511, <https://doi.org/10.5194/hess-24-3493-2020>, 2020.