Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-629-RC1, 2017


Hydrology and Earth System Sciences
Discussions



# *Interactive comment on* "Hydrological response to climate extremes in mesoscale (pre-)Alpine basins at 0.5° and hyperresolution" *by* Joost Buitink et al.

**Anonymous Referee #1**

Received and published: 22 December 2017

## General comments

The manuscript aims at investigating the hydrological response (in terms of evapotranspiration and runoff) to seasonal extremes of temperature and precipitation in five Swiss mesoscale catchments with varying elevation and glacierization. To assess the influence of spatial model resolution, the authors run the SPHY model in both high (500 m) and low ( 40 km, corresponding to a lumped simulation with a single grid cell) resolution and find that in the the distributed simulations model responses to climatic extremes can be much more pronounced.

The topic fits the scope of HESS and is of scientific interest. The article is well written and both the methodology and the results are generally well explained and presented. I would therefore recommend publication of this article after considering a few, mostly



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minor, comments.

**Specific comments**

P1 L4: It would be helpful if "hyperresolution" could be specified quantitatively (500x500 m) already in the abstract. Possibly the corresponding value in km could also be added for the coarse resolution.

P1 L23f: Do you intend to say here that it is assumed that the coarse-scale anomaly matches the average fine-scale anomaly, or that the signs of the coarse-scale and the average fine-scale anomaly match?

P4 L11: In which spatial resolution are the meteorological data sets originally provided?

P4 L16: When resampling to the coarse scale, did you average only over the basin interiors or did you consider the entire data within the 40x40 km grid cell?

P4 L19f: A calibration period of only two years seems very short, especially considering that you calibrated on monthly values. Is there a reason why you did not choose a longer calibration period, or why did you choose exactly these two years? In any case I would recommend to include a table with some performance measures (e.g. NSE, PBIAS, . . .) for the calibration and validation periods and both resolutions. Also, a plot showing observed and simulated discharge (either as a time series e.g. for a period encompassing the four extreme events, or average monthly discharge over a given period) for all basins could be helpful.

P9 L13f: "This might be related to the relative coarse monthly calibration time step": possibly also a combination of the coarse calibration time step, the short calibration period, and the choice of optimization function. Minimizing the sum of squares between observed and simulated runoff favors calibrating the model towards the periods with high runoff volumes, whereas larger relative (but smaller absolute) errors in low-flow periods tend to be suppressed. In basins with a strong runoff seasonality (as in the snow- and glacier melt dominated Alpine basins) this could be especially prevalent and

might be one reason for the low DJF performance. Including a plot with the average discharge seasonalities (see my comment above) might also be insightful here.

P10 L6: Parts of the sentence are missing here.

P10 L28-31: In the case of summer 2003, the areas with positive anomalies are probably only the glacierized areas?

P16 L1-4: As you describe the results for the Rhone basin here, maybe consider showing this basin also in Fig. 8.

Fig. 1: Please consider also showing the land cover distribution of the basins here (this could be helpful for, e.g., better interpreting Fig. 5).

Fig. 6: Looking only at the figure it is easy to overlook that not the absolute quantities but their standard deviations are shown. Maybe you could make this more clear by e.g. labeling the y-axes with "sd(ETa)" or similar.

Fig. 8: Please label the basins here also with their names instead of the IDs.

**Technical corrections**

P1 L12 and L23f: course -> coarse (3x)

P3 L32: runs *on* a fixed daily time step and a user defined *spatial* resolution

P7 L16f and P14 L3-5: extend -> extent (4x)

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