Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-629-RC2, 2018

Hydrology and Earth System Sciences
Discussions
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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 #2

Received and published: 8 January 2018

General comments

The presented study investigates the differences in hydrological response of 5 mesoscale Swiss catchments to seasonal extremes of temperature and precipitation at two different spatial model resolutions. Therefore, the authors apply the SPHY model at hyperresolution (500m) and at a resolution of 40km, which respresents a lumped model approach. To identify hydrological response they analyse seasonally aggregated runoff and evapotranspiration and conclude that hydrological response simulated with the hyperresolution set up can be more extreme than with the lumped set up. Investigating the effects of model resolution on hydrological response is of scientific significance and is within the scope of HESS. Due to the following specific somments I suggest major revisions before publishing the manuscript.

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Specific comments

P1 L4f: “For four seasonal extremes representing flood and drought/heatwave conditions we investigate the simulated response at both model resolutions.” – What are the four seasonal extremes or do you mean you investigate extremes in four seasons?

P1 L1-L12: In the abstract you mention hydrological responses. An on P1 L8f mention “two simulated responses” – It needs to be stated in the abstract what these responses are.

P1 L1-L12: In the abstract you mention the terms hyperresolution, low resolution, corse resolution and distributed models and compare them to each other. If you use these terms, you need to explain them or provide a scale for the specific resolutions. Why do you compare low resolution model response to distributed model response (P1 L9f)? In P1 L2 you introduce a distributed model. Did you apply a lumped model, too?

P1 L1-L12: Wording and sentences of the abstract need to be revised since they are often distracting.

P2 L1f: “We note the recent trend in hydrological modeling, which convenes coarse global modeling with local high resolution modeling: hyper resolution modeling (Wood et al., 2011; Bierkens, 2015; Bierkens et al., 2015).” – Please be more precise. The sentence is misleading.

P2 L17f: What are the normal, new and old situations? Please define them.

P2 L20f: Please rephrase the sentence.

P3 L1: What are “complex” basins?

P1 L13 – P3 L16 section Introduction: The introduction is rather an overview of the shortcomings of coarse scale global simulations with regard to their validity for local hydrological processes, of the effects landscape and land cover heterogeneity has on hydrological processes and of the issue of spatial resolution of hydrological models.

However, it is not written what your study is about, what your goals are, what you plan to do and how you want to achieve your goals. This needs to be included and the introduction needs to be thoroughly revised.

P3 L6f: "With more than one-sixth. . ." – This sentence does not fit into this section, where is the connection to the content of the section P3 L3 – P3 L16?

P3 L4, L23: Scale is not the right word.

Section 2 "Methods, model and data" should be divided into subsections for better readability.

P3 L29 – P4 L14: The model is described in detail in the cited literature. Please focus on the parameters, routines, etc., which are necessary for your study.

P4 L12: ". . .sparse/bare vegetation (referred to as "other")." Does this mean that rocks is neglegted, or do you neglegt sparse vegetation? Please clarify!

P4 L16f: How did you resample input data?

P4 17f: Do you use measured runoff data for calibration? If so, where is this runoff data measured?

P4 L18f: On what monthly discharge do you calibrate? Mean, sum, median, maximum, etc.? Please clarify!

P6 Formula 1 and 2: It is not necessary to give the formula for the mean and standard deviation.

P6 L11f: "For this study, we are also interested in the difference between lumped and distributed simulations and its implications on the simulated anomalies." Isn't that the core of the study? At least the title suggests that. Please make this clear in the introduction section.

P7 L16f: Do you just propose this metric or do you introduce it? Is there any literature

where this metric has been applied or developed?

P9 L13: You mention the models inability to simulate discharge during low flow periods. Is the model then really suitable for the study, since you focus on extremes? Please explain this.

P9 L13 – P10 L1: You assume that the weak model performance at low flow periods might be related to the coarse monthly calibration time step. Why don't you choose a finer time step? In your work, you focus on extremes and you realize that your model has problems in simulating low flows, which you trace back to the coarse calibration time step, but you don't test another calibration time step. You should definitely check and explain this.

P10 L35: What are "interesting relations"? Please explain.

P11 L1: What is the measure for a possible correlation? Please specify and give a measure for correlation and its significance.

P15 L1f: "Nevertheless, this figure does not provide enough information to draw a frim conclusion about the performance of the lumped model with respect to the distributed model results." – Please rephrase. The sentence is partly unclear. Moreover it raises the question why you show this figure if it is not good enough for what you want to show.

P15 Figure 8: Please give a more informative description. What do the numbers 2056 and 2181 mean?

P16 L21f: "All basins are for large parts covered with snow during the winter month" better: Large parts of the basins are covered with snow during the winter month.

Technical corrections

Entire text: Please check usage of the word "land use". Land use refers to agriculture, industry, buildings and everything where the natural environment is modified by human

activities. Land cover might be a better word in most cases since you do not refer to human activities.

P1 L13, L23, L24: “course” instead of coarse

P1 L20, P2 L23: “relative” instead of relatively

P1 L24: “sign” –> signal would be the better word

P2 L2: “hyper resolution” instead of hyperresolution

P3 L32: It has to be “The model runs on a fixed daily time step. . .”

P4 L17: duplicate of “using the”

P5 Figure 1: Maps need a spatial reference!

P7 L10: an “are” is missing after μ

P8 L1: “In Fig 3b, both . . .” you mention more than two in the sentence.

P10 L1: “relative” instead of relatively

P10 L8: “. . .based on the. . .” –> without “the”

P10 L5: “relations with” –> relation between

P10 L30: “. . .where all models cells. . .” –> where all model cells

P10 L34: “. . .highly spatial variable. . .” –> highly spatially variable

P11 Figure 5: spatial reference is missing; at least the overview map in Figure 1 needs a spatial reference.

P13 L24: “sign” –> signal would be the better word

P14 L3, L5: “extend” instead of extent

P14 L13: “. . . model anomaly sits within . . .” better: “. . .model anomaly is within. . .”

P15 L4: “. . . runoff DWD is Alpine basins. . .” –> runoff DWD in Alpine basins

P16 L3: “. . .values are close the lumped model anomaly. . .” –> values are close to the lumped model anomaly

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