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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Evaluating seasonal hydrological extremes in mesoscale (pre-)Alpine basins at coarse 0.5° and fine hyperresolution" *by* Joost Buitink et al.

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The authors present a comparison between the application of a model at two different scales in terms of discharge and evapotranspiration response to seasonal extremes. The main conclusions are that the coarse resolution model fails to represent the complex internal response of Alpine basins, and that hydrological response can locally be significantly more intense than what predicted at coarse resolution. The paper presents an interesting application, but with few major flaws in the presentation and in the analysis. For this reason, I suggest that the paper could be accepted after major revision.

Main comments:

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Discussion paper

- One of my main concerns is the metric introduced: DWD. High values of this statistic may mean that the low_res model performances are far from the high_res OR that the high_res model has high internal variability. Even if low_res is perfectly representing the cumulated catchment response, if the high_res has high variability you will still have high DWD results. This has strong implications on your results. P17L21: "the low resolution model misses on average more than 2 standardized anomalies compared to the high resolution model." To me sentences like this are confusing: the distributed model range is about 2 standardized anomalies away, but that's not the low_res model fault in any way. Another concern about the DWD metric: if we consider DWD, as you say "a difference in terms of number of standardized anomalies" then we can consider P_low-0.05 and 0.95-P_low as weights. The sum of these weights however is different from 1 and it is a function of the threshold chosen. The consequence, as you point out, is that this statistic is very affected by the threshold chosen. By absurd, if we take the range around the 50th percentile DWD would always be = 0.

- If the point above is valid, right now the main conclusion of the paper is that the low_res model fails to describe the internal variability of the catchment, which seems trivial. When I first read the paper I was expecting more a comparison between the catchment-scale response from the two models, and if the low_res model is able to capture the aggregated catchment response during seasonal extremes. Because of the metric used, this is shadowed by the failed representation of the internal variability. In addition to the current analysis, I think that the results aggregated at catchment scale should also be compared.

- As you say, scale issue in hydrological models is a major issue, and has been extensively studied. However, you give completely no background about this field of research which, I think, is very closely related with your objectives and results. I think that this aspect should be emphasized both in the introduction and in the discussion.

Hydrological model issues:

- There is no verification of the intra basin response, only on the outlet discharge. Still, you take the internal variability of discharge and evapotranspiration as reference. Some verification would significantly strengthen the results.

- Related to the point above: in your model is each cell independent? In steep catchments soil moisture in the valley is often fed by the hillslopes. A result like fig.6, where higher cells evaporate more while lower cells are water-limited and evaporate less, can be a direct consequence of this model limitation. This could have important consequences on your current results.

- In the model description you don't talk about runoff propagation, but in calibration you compare runoff measured at the outlet. Does your model include runoff propagation?

- I don't understand why you calibrate on the square of residuals and then use KGE to evaluate model simulations. Why you don't use KGE from the begin?

- No statistic on validation is presented, despite having 21 years of data. Why?

Minor comments:

- P12L26: to me more ET does not necessarily result in more uniform response across the basin.

- Fig 7: dangerous to compare a dimensional variable between basins with different mean annual precipitation. Also, table 1 is missing info on mean annual precipitation.

- Figure 4: where is the simulated anomaly in hydrological response mentioned in the caption?

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