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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Rainfall disaggregation for hydrological modeling: Is there a need for spatial consistence?" *by* Hannes Müller et al.

A.E. Sikorska (Referee)

as@annasikorska.eu

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This manuscript deals with the problem of disaggregating daily rainfall records into an hourly resolution and particularly assesses the added value of considering the spatial correlation between neighboring stations. The problem of rainfall disaggregation is particularly relevant for hydrological modelling when only daily data are available but high resolution simulations are still required as for flood forecasting or flood predictions in case of fast reacting catchments (with the concentration time smaller than a day). Thus, the manuscript is certainly of a broader interest. Generally, it is also well written. However there are several issues that need more explanations and thus I recommend a major revision.

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Discussion paper

Major comments:

1. One of my major comments is related to the hypothesis tested by the authors. The authors assume that differences apparent between differently disaggregated rainfall series (V1, V2, V3) will also be present in runoff simulations with a hydrological model. For testing this hypothesis, they use a bucket-type model (HBV). From their results, the authors did not observe any significant difference between these three different rainfall series when fed into the model. I think this is not surprising because this type of model, due to its rather simple structure, may smooth slight differences between different time series present at instant steps, as it reacts to the cumulative rainfall sums over the event rather than to its small variation in time. Despite that, I would expect that you could still see some differences if you analyze instantaneous flows (e.g. event peaks). Yet, if you look only at cumulative statistics of runoff such as monthly average discharges or flow duration curve, you most likely cannot see any differences because these statistics are derived from averaged runoff values. Consequently, these differences could indeed be minute. The only visible effect could be expected on summer and winter extremes. However, these extremes most likely occur in your catchments due to large (and most likely long lasting) rainfall events, for which an exact rainfall distribution within a day is less important. This may explain why you do not observe any differences in these statistics neither. I think these issues should be at least discussed in the manuscript, and particularly the choice of the runoff statistics for the method evaluation.

2. The authors use throughout the manuscript terms: recording and non-recording stations. It is however never explained what they mean with that and I assume this is not a generally used term and thus should be explained as it is significant for this manuscript. It appears that by recording stations they mean stations with hourly records and by non-recording - stations with daily records only. To my understanding, daily stations could also be assumed as recording. Consider

using different terms or provide an explanation to the terms used.

3. Not all important details regarding the calibration of the hydrological model is given. Particularly, the fact that the model is calibrated independently with three different disaggregated datasets appears only in the discussion. These independent calibrations obviously lead to different parameter sets which are then used for simulating runoff. As these calibrated parameter sets compensate for possible errors in the model structure and in rainfall data, these errors are propagated on the simulated runoff (and computed statistics). This makes a direct comparison of runoff simulated with these three different time series difficult. Although the authors are aware of that, in my opinion, it would make more sense to use the model with the same set up. In this way, you could focus only on the effect of different rainfall time series and minimize the possible effect of parameter and model errors. Indeed, it could be worth a try to use only parameter sets derived from one calibration, e.g., with the V1 data set, and use it for both other disaggregated sets, i.e., V2 and V3 and in this way assess the gained effect of introducing the spatial consistence between stations into the set V1.

4. The figure 1 and the Table 1 suggest that each of three studied catchment is divided into smaller sub-catchments. Do you actually use these sub-catchments for hydrological modelling or do you model the catchment as one unit? I expect that the spatial representation of rainfall may play a role when using sub-catchments instead of the entire catchment.

5. The disaggregation scheme (p. 8): how exactly do you decide which time step is considered to be wet and which as dry? Also, is the same disaggregation scheme used for all three catchments (i.e., the same scheme of distributing daily totals into hourly intervals) or is that adapted for each catchment independently? In addition, the authors write in lines 16-17 p. 8 that parameters of the disaggregation (which exactly?) are extracted directly from the observed high resolution

data, which data do you mean exactly (the most recent hourly data)?

6. The disaggregation V3 uses the station with the highest values per day for deciding on an exact disaggregation way. Can you somehow verify that, i.e. how good it works for other stations? or could you justify this choice?

Minor comments:

1. P. 5 l. 12-13: change the sentence into: An overview of rain gauges used in this study is given in Fig. 1 while their measuring periods in Tab. 2.
2. Table 2; it could be a good idea to add the intervals of rainfall recording.
3. Use “rainfall-runoff model” instead of “rainfall-runoff-model” throughout the manuscript.
4. P. 6 l. 12-13: could you give a reference for the finding regarding the non-sensitivity to potential evapotranspiration?
5. P. 6. L. 7-9: is temperature data corrected for the elevation and if yes how exactly?
6. p. 7 l. 9-10: do you mean here “hourly” observed time series? From the table 3 it appears that some records are available from much longer period.
7. p. 7. L. 13-14: it is not clear which data sources were used to extract the maxima over half of year (hourly, daily, monthly)?
8. Use terms “section” and “subsection” instead of “chapter” and “subchapter”.
9. The paragraph in lines 18-21 on p. 7 could also be removed.
10. p. 10, l. 15: how many different realizations of the disaggregated time series did you use for these simulations?

11. P. 10. L. 26, R1 is not explained before.

12. Table 5. The values for the HBV parameters: $k1$, $k1$, $k2$ and $kperc$ are given in days. If the model is run at an hourly time interval, should not these parameters be expressed in hours?

13. Fig, 5 and next: one realization from how many?

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