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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A method to employ the spatial organisation of catchments into semi-distributed rainfall–runoff models" *by* Henning Oppel and Andreas Schumann

Anonymous Referee #1

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General comments:

The authors introduce a new technique for catchment delineation to minimize the variance of catchment attributes within simulation units and especially to honour their spatial organisation. They propose a so called distance-factor function similar to the width function which relates the spatial distribution of catchment characteristics to the flow path. They hypothesise that the new spatial delineation is beneficial for parameter identifiability in hydrological modelling and therefore should lead to better model performance.

The analyses are done on four large catchments using soil properties and topography as main factors. The results show a significant reduction in variance and allow

interesting interpretation of patterns for catchment characterisation. An application of a semi-distributed hydrological model with conventional and the new basin delineation schemes has shown a better model performance with the latter one.

The paper is quite well written and clear in structure. The conclusions are supported by the analyses. However, the readability lacks a bit of the awkward English. Proofreading by a native speaker would certainly be beneficial here. There is one major question regarding the performance comparison for the different versions of the hydrological model. The number of parameters for the new delineation scheme is 6 to 8 times smaller than for the conventional one. So, the degrees of freedom in calibration are much smaller. Does this not lead automatically to a better performance of the model no matter what kind of variance reduction is reached in the delineation? Otherwise there are only minor comments for improvement (see below). Altogether the paper is very interesting and well worth of publication after the authors have the opportunity do some revisions.

Detailed comments:

1. Page 3, line 30: The computational demands of semi-distributed models with polygon based delineation is nowadays often negligible.

2. Page 4 and Fig. 2: Pore volume and available water capacity should be defined. For instance is with "total pore volume" the "porosity" meant? Usually these variables are given in volume percent? Here they are given in mm, why? Does this not require an information about the soil depth?

3. Page 5, Lines 24-25: I was trying to picture the basin split into stripes. I found Figure 5 as an visual explanation. However, comparing Fig. 5 with Fig. 3 there should be much less points of the distance-factor function in Fig. 3 (only 5 points). Later I realised that Fig. 3 does not belong to Fig. 5. For demonstration purpose I would suggest providing a pair of Figures with distance classes and corresponding distance factor function using a few classes only. May be Fig. 5 needs to come before Fig. 3.

4. Page 5, line 31: (Eq. 1 and 2)

5. Fig. 4: Use the same units on the x-axis as in Fig. 3.

6. Fig. 5: Example input data are on the “left”!

7. Page 12, Eq. 8: I would suggest to explain this equation in words. I also would suggest to exchange the sides of omega and sigma (even if mathematically not necessary) in both numerator and denominator.

8. Page 12, line 15: What are cases with “negative outcome”? Do you mean insufficient variance reduction?

9. Fig. 8, 9 and 12: The distance factor functions are hard to read. Use vector graphics and/or large fonts and/or larger figures.

10. Fig. 10: In the legend of AWC “max” and “min” need to be exchanged.

11. Fig. 11: When resampling of AWC for the Mulde river basin is shown also the original AWC map of the Mulde basin should be shown for comparisons. Why are there some kind of horizontal stripes in Fig. 11?

12. Page 16, line 29, Table 4: Where are the 30 different zones per sub-basin coming from; why so many; how are these zones defined?

13. Page 17, Table 5: As already mentioned in the general comments the comparison of the performance for two model versions with such a large difference in number of parameters needs to be given some more thought. Could the reason for the better model performance not be just because of the smaller number of parameters and therefore the smaller complexity and easier calibration. This might be tested by an additional model version using the same small number of parameters as in the new delineation scheme but applied on the old conventional basin separation (using only 3 zone per sub-basin too)?

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