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Hydrology and Earth System Sciences Discussions

Interactive comment on "A look at the links between drainage density and flood statistics" *by* B. Pallard et al.

Anonymous Referee #3

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General comments

The paper addresses the question, whether information about flood statistics in a catchment can be gained from its drainage density. The drainage density depends on climatic parameters and catchment properties (e.g. soils, geology and topography). Within the same climatic region, differences in drainage density might therefore be an indicator for differences in runoff generating processes. Since drainage density is an easy to determine catchment parameter, better knowledge about the relationship between drainage density and flood runoff generation would be very valuable, especially in the framework of the current PUB (prediction in ungauged basins) initiative. The paper therefore addresses an actual and important research topic and is in the scope of

HESS. The paper is clearly written and structured. However, in part the methods used are not adequate (See specific comments about Chapter 2) and questionable modeling assumptions are used (See specific comments about Chapter 2 and 3). Additionally, the results of the modeling studies are not supported by the case study. The case study itself needs improvement. Therefore, major revisions are needed before publication.

Specific Comments

Chapter 2 p 2903-14 to p 2906-15. The authors investigate the link between drainage density and flood statistics through numerical simulation with the rainfall-runoff model AFFDEF. For this purpose, the authors conducted several model runs with varying drainage density (determined by model parameter Ao) while all other model parameters were held constant. As explained above, the reason for using the parameter drainage density is that it is an easy to determine parameter, which partly depends on the runoff generation processes in a catchment. However, the link between runoff generation and drainage density is missing in the model. Therefore, Chapter 2 is basically a sensitivity analysis of model parameter Ao. From my point of view, it would be more valuable to investigate whether the authors could identify a relationship between their model parameters determining runoff generation and the actual drainage density in their 44 test catchments.

Chapter 3 p 2905-16 to 2910-9 I support the modeling philosophy of using simple, conceptual models. The authors use the unit hydrograph approach and introduce drainage density via the concentration time. Here the problem is again that drainage density only influences the runoff concentration but has no influence on effective precipitation and thus on the runoff volume. However, for prediction in ungauged basins, getting good estimates of the runoff volumes might be the more important part. Since the results are later compared to rather large catchments, I wonder why the authors did choose the Horton approach instead of a multiplicative approach (e.g. runoff coefficients) to determine the effective precipitation. Additionally, a comparison between observed runoff coefficients and drainage densities in the 44 test catchments would be very interesting.

HESSD

5, S2129–S2131, 2008

Interactive Comment

It would strengthen the conceptual model approach, if an empirical relationship of that kind could be introduced, even though such a relationship might be very weak.

Chapter 4 p 2910-10 to p 2913-3 I appreciate that the authors conducted a case study but I am disappointed about the way it was done. In Fig. 4 discharge is displayed on the y axes, however I think specific discharges would be more adequate. Since catchment area is included in the runoff data but not in the drainage density data, an interpretation of the graphs is nearly impossible. Additionally, in my opinion, the scatter in the plots is too large to support the modeling results. Generally, I expected a much more extensive analysis of the data, including a comparison of drainage density and parameters of flood statistics with other parameters like catchment area, geographical location of the catchment, catchment properties like geology, soils, CN number distribution, topography, climatic parameters etc.

In my opinion, an extended data analysis should be the backbone of a revised paper. In a next step the numerical and conceptual models could then be used as data analysis tools and to test hypotheses. Special care should be taken not to change the parameter drainage density alone. The related changes in runoff generation processes always have to be considered as well.

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5, S2129–S2131, 2008

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