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Hydrology and Earth System Sciences Discussions

HESSD

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Interactive Comment

Interactive comment on "A space-time hybrid hourly rainfall model for derived flood frequency analysis" *by* U. Haberlandt et al.

U. Haberlandt et al.

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GENERAL REMARKS:

We are very grateful for the thorough and detailed review of the anonymous referee #2. We think that his comments helped us a lot to improve the manuscript.

SPECIFIC COMMENTS:

P2463 L10/12: We agree with the referee that modelling of wsi and wsa are not equivalent. We tried to model both variables and found that wsa could hardly be modelled with a unique probability distribution function over the whole range of values from small to heavy events. With wsi however it was easier to fit a single pdf for all events allowing the identification of a more parsimonious approach. So we decided to use the variable wsi here. We commented on that decision in the text now.

P2463 L17/20: The structure of the ARM depends also on the data of the case study. So it was difficult here to separate methodology and data sections completely. We tried to describe the structure in the methodology section 2.1 and the application (now with more details on parameter estimation) and with results in the case study section 3.3. The minimum separation time between two events Dmin influences the model structure on one hand and can be seen as a parameter on the other hand. We moved the discussion about Dmin now to the section 2.1 as suggested. For the decision about the minimum dry spell duration we calculated event time series using different values for Dmin, estimated serial rank correlations and fitted distribution functions. If Dmin $>$ delta t the precipitation intensity for hourly values is underestimated by the model if clustering is not considered. To avoid this we tried to keep Dmin as small as possible. We found good results with one and two hours for summer and winter seasons respectively. A more detailed discussion on the selection of Dmin has been added in section 2.1 now.

P2464-L1: The Frank copula has indeed chosen here mainly for its easy practical handling and the infinite range of the dependence parameter alpha. However, we have done some simple comparisons of different copulas (e.g. including Frank, Ali-Mikhail-Haq and Farlie-Gumbel-Morgenstern copulas) based on values of the Kolmogoroff-Smirnov statistics and found the Frank copula always among the best performing ones. We have not included the results of those investigations in the manuscript to provide a concise paper focussing on the main objective and to avoid lengthy discussions on relative small details in relation to the whole model chain, which has been applied here. This has been mentioned in the text now.

P2464-L10: We have included equations for the probability distribution functions which specify the required parameters of the ARM completely. The first table in the discussion paper has been extended showing now all parameter estimates for the three total year rainfall stations for summer and winter seasons. This is now table 2 and is referenced

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in section 3.3.

P2466-L4: We have chosen Pearson's correlation coefficient because it is the most common measure of linear association and for technical reasons concerning easy updating in the resampling approach. The precondition of normality is not required here, since the correlation coefficient is used here only as a descriptive measure without inference or testing of parametric models. However, applying a rank correlation measure would be theoretically more appropriate and might be more robust, but still cannot handle real nonlinear associations. We will test the rainfall model performance with other measures of dependence like rank correlations as target variables in the resampling procedure in future work.

P2466-L13: Some additional comments have been added in this section to stress the complementary character of the three criteria.

P2470: The representation and discussion about the results concerning the alternating renewal model has been extended and as we hope improved. Especially, QQ-Plots illustrating the fitting of the distribution functions for the three event variables wsd, wsa and dsd have been provided. Also, a table which lists the estimates for all parameters separately for summer and winter seasons for the three all year rainfall stations has been added.

TECHNICAL CORRECTIONS:

All technical corrections have been considered in the revision of the manuscript. Only those comments, which require a special response, are listed below.

P2461-7: A design flood refers usually to a flood with a certain return period (e.g. T = 100 years) or a certain exceedance probability (e.g. P = 0.01). When a single design storm is used to generate the design flood (event based approach compared to continuous modelling) the necessary assumption is that the design storm produces a flood with the same return period or the same exceedance probability as the storm.

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This is usually not given considering e.g. the initial soil moisture conditions in the catchment which may lead to different floods for the same storm. The text has been modified to make this clearer.

REFERENCES:

We have corrected the errors in spelling and bibliographical data as suggested by the reviewer. Concerning the missing issue information we have followed strictly the authors guide from HESS, which does not require issue data. In fact, we have used EndNote with the style sheet "Copernicus Publications" provided by HESS for automatic compilation of our references, which excluded the issue information from our bibliography.

FIGURES:

P2481 Figure 1: The last label on the horizontal axis has been corrected

P2482 Figure 2: The tick labels have been removed.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 2459, 2008.