Hydrology and Earth System Sciences Discussions

Interactive
Comment

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

Anonymous Referee #2

GENERAL COMMENTS

This article is an interesting contribution to the problem of flood frequency analysis. A method is presented which integrates rainfall data at different time scales, considers spatio-temporal structure of rainfall and regionalises some parameters, while remaining applicable to many practitioners.

The paper is structured in three main parts. The first one concerns a simple single-site model of rainfall. Wet, dry period durations and intensity of wet periods are modelled by various distributions which consider the dependence between storm duration and intensity. The second part deals with the space-time rainfall structure by incorporating

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Discussion Paper

directly spatial autocovariance of rainfall intensity, i.e. by resampling the rainfall events. The resampling must minimize an objective function which considers the spatial co-variance of rainfall occurrence and amount between two sites. Finally, as indicated in the title, the final purpose of the rainfall synthesis in this work is to derive a flood frequency analysis. The objectives and conclusions are clearly outlined. However, I would suggest several clarifications and improvements prior to publication (see specific comments).

SPECIFIC COMMENTS

P2463 L10/12 I am not certain that wsa and wsi are equivalent in term of modelisation since the distribution of wsi must have a heavier lower tail than the distribution of wsa. P2463 L17/20 I recommend to move the comment on the required minimum time that is necessary to separate two events in the third section with the case study. Moreover, I do not understand how the authors could justify the choice of one hour and two hours for the summer and winter seasons by the adjustment of the marginal distributions since the events must be separated in order to fit the marginal distributions. P2464-L1 Frank copula has several advantages. It covers the entire range of dependence, the couple of quantiles are easy to simulate and Kendall's tau related to this copula can be easily obtained (whether by approximation or by numerical integration). That is why De Michele and Salvadori (2003) used it to link rainfall duration and intensity. However, it has not been compared to other copula families in terms of performance. In this paper, this copula family is mostly chosen for practical reasons. P2464-L10 Table 1 does not contain any parameter estimations. I think that a table is missing. P2466-L4 I would like to know why Pearson's coefficient of correlation is applied. Is there really a linear relationship between the rainfall intensities at different sites ? P2466-L13 The authors should comment how the three criteria complement each other. P2470 The results related to the alternating renewal model must be enhanced (illus-

tration of the different adjustements, for example dsd, wsi and wsd, parameter estimates,...).

TECHNICAL CORRECTIONS

P2460-L6 I suggest to replace 'Univariate' by 'Single-site'.

P2460-L8/10 The sentence 'In the second step...structure of rainfall' could be moved after the brief description of the ARM, i.e. at the line 14 before 'In the second step resampling...'.

P2461-L7 When the authors talk about 'equal probabilities of the design rainfall' do they mean equal probabilities of the rainfall event occurrences ?

P2461-L26 Newman->Neyman.

P2463-L23 Nelson-> Nelsen.

P2463-L24 Notation must be changed. C=[0,1] could be replaced by $C : [0,1]^2 \to [0,1]$, $u \in [0,1]$, $v \in [0,1]$. There are confusions between domain, codomain, random variables and scalars with the current notation.

P2464-L3 'with C[0,1], u[0,1], v[0,1]' is meaningless and useless, since it has already been defined. The domain of α is missing ($\alpha \in \Re - \{0\}$).

P2464-L10 The Table 1 does not give any estimation of the parameters.

P2464-L17 is a event -> is a**n** event. The domain of λ is missing.

P2464-L23 The notation for the parameter α should be changed to avoid confusion with the copula parameter, even if it is quite clear. The domain of α and β are missing.

P2465-L15 I suggest to replace 'does not destroy' by 'preserves'.

P2465-L25 The subscript of z must be defined.

P2466-L15 The definition of the objective function (10) is using latin letters to represent the weights while the Greek letter omega is employed at line 15. To be completely rigorous, w must be defined or used with a subscript.

P2467-L10 calculated/ updated -> calculated/updated. I would remove 'calculated'.

P2469-L15-16 The references must respect the alphabetical order.

P2469-L26 is the aggregated -> is then aggregated.

P2469-L12 Rainfall runoff -> Rainfall-runoff.

P2470-L24-25 I think that the sentence 'Then several realisations...for all stations' should be reformulated.

P2471-L4 don't -> do not.

P2471-L15-16 I think that the sentence 'Before in the next step...have to be estimated' is difficult to read. It could be rephrased.

P2475-L5 Rainfall runoff -> Rainfall-runoff.

REFERENCES

P2476-L1 Simulated Annealing and Boltzmann Machines: ->Simulated Annealing and Boltzmann Machines: A Stochastic Approach to Combinatorial Optimization and Neural Computing.

P2476-L5 Issue is missing : 2.

P2476-L8 Issue is missing: 1-2.

P2476-L10 Issue is missing: 7.

P2476-L12 Issue is missing: 1.

P2476-L16 Issue is missing: 1-4.

P2476-L19 Issue is missing: 1-4.

P2476-L21 Issue is missing: 3-4.

P2476-L24 Issue is missing: 3-4.

P2476-L26 Issue is missing: 4.

P2477-L1 Issue is missing: 3.

P2477-L6 Issue is missing: 3.

P2477-L8 Issue is missing: 3.

P2477-L12 Issue is missing: 7.

P2477-L14 Issue is missing: 3.

P2477-L16 Issue is missing: 5.

P2477-L18 Issue is missing: 9.

Interactive
Comment

P2477-L20 Issue is missing: 5.
P2477-L24 Issue is missing: 5.
P2477-L25 Nelson -> Nelsen.
P2477-L27 Issue is missing: 1.
P2477-L31 Issue is missing: 6.
P2477-L33 Issue is missing: 1-2.
P2478-L1/2 Rodríguez-Iturbe, I., Febres de Power, B., Valdès, J. B.: Rectangular pulses point process models for rainfall : Analysis of empirical data. Journal of Geophysical Research, 92(**D8**), 9645-9656, 1987.
P2478-L12 Issue is missing: 1-4.

FIGURES

P2481 Figure 1 wsd2 -> wsd3 for the last label on the horizontal axis.
P2482 Figure 2 Are the tick labels necessary since there is no unit ?

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