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Hydrology and Earth System Sciences Discussions

Interactive comment on "The within-day behaviour of 6 minute rainfall intensity in Australia" *by* A. W. Western et al.

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This paper deserves publication in HESS. Although I find the descriptions of the research process very lengthy and at some places too detailed (some details could be removed; some sections could be written in a more compact way), the research is done accurately and is of good scientific level.

Please find below my main comments:

* The discussion on the choice between a two-parameter versus a three-parameter distribution could be complemented with a discussion on the balance between higher uncertainty in the parameter estimates (when more parameters are used) versus higher

potential bias (when less parameters are used). Methods exist to quantify the parameter uncertainties, and the uncertainties on the quantile estimates obtained from the distributions. Because the final aim of the research by the authors is to obtain accurate distribution functions (thus quantile estimates) for applications (e.g. erosion modeling), low uncertainty in the quantile estimates might be a better criterion than the goodness-of-fit to observations (as considered by the authors). The authors might add a limited discussion on that, and add references to existing uncertainty quantification methods.

* Also related to the discussion on the choice between a two-parameter and a three-parameter distribution:

- The EXP can be seen as a special case of the GPT3, where the tail of the distribution is “normal” instead of “heavy” or “light” (shape parameter κ zero, negative or positive; where the EXP equals the GPT3 for κ=0). Methods exist to discriminate between these three classes, based on an analysis of the tail behavior of the distribution (e.g. upper tail in your Figures 2 and 3 asymptotically linear, bending up or bending down).

- Light tail GPT3 distributions would mean that rainfall intensities have an upper limit. This sounds unrealistic (from a meteorological point of view).

- The difference between GPT2 and GPT3 is the application of a location parameter, which typically is taken as a threshold value, above which the distribution is valid. Different methods exist to identify the optimal threshold value. This might be different from the threshold value prior and arbitrarily selected by the authors (probably much higher).

- Another related comment is that the EXP and GPT3 are also commonly applied extreme value distributions (while they are classified as non-EVD by the authors). In fact they are more applicable than the GEV and Gumbel in this case, because GTP3 (and EXP as special case) are limiting extreme value distributions of peak-over-threshold (POT) values.

* The application of the techniques to calibrate the distribution function parameters

HESSD

8, C2655–C2658, 2011

Interactive Comment

to data requires independent data. The authors did not discuss this independence requirement. They neither tested this assumption. Different 6-min rainfall intensities within the same day are probably strongly dependent. Same comment reg. the applicability of the Chi-square test.

* Some additional references that the authors might consider (and which address some of the issues mentioned above) are:

- Claps, P., Laio, F., 2002. Can continuous streamflow data support flood frequency analysis? An alternative to the partial duration series approach. Water Resour. Res. 39 (8), 1216. doi: 10.1029/2002WR001868

- Madsen, H., Rasmussen, P.F., Rosbjerg, D., 1997. Comparison of annual maximum series and partial duration series methods for modeling extreme hydrologic events. 1. At-site modelling. Water Resour. Res. 33 (4), 747–757

- Smith, R.L., 1987. Estimating tails of probability distributions. Ann. Statist. 15, 1174–1207.

- Willems, P., Guillou, A., Beirlant, J. (2007). Bias correction in hydrologic GPD based extreme value analysis by means of a slowly varying function, Journal of Hydrology, 338, 221-236

* On page 3191 lines 11-12, the authors explain the application of their distribution function of 6-minutes rainfall intensities. The application of a threshold to the rainfall intensities will, however, deliver incomplete information on that distribution. The authors may comment on that. The conditional distribution (above the threshold) should at least be complemented with information of the frequency of low 6-min intensities (below the threshold).

* Some minor comments:

- Page 3194 line 17: how was a “valid day” defined?

HESSD

8, C2655–C2658, 2011

- Page 3194 line 26: “the results”: which ones?

- Page 3196 lines 4-5: Whether the rainfall intensity distribution is heavy-tailed depends on the data or location; also for EVDs (see also my previous comment on the discrimination between normal-heavy-light tails).

- Page 3196 lines 6-14 & Page 3199 lines 1-11: Why do you spread the description of the goodness-of-fit statistics over two different sections of the manuscript? It would be better to combine these in one of the sections.

- Page 3197: Should the choice of the rainfall variable under study (e.g. five highest intensity periods) not depend on the application (erosion modeling, urban flood modeling, . . .; e.g. depending on the concentration time of the catchment)? Why did you choose the “five highest”?

- Page 3197 lines 9-10 (and several other places in the manuscript): There is no need to repeat so often to the reader that the focus of your paper is on the high intensities.

- Table 3b: These are well known distributions. There is no need to give an overview of the mathematical formulae.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 3189, 2011.