Hydrology and Earth System Sciences Discussions

Interactive comment on "How extreme is extreme? An assessment of daily rainfall distribution tails" by S. M. Papalexiou et al.

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This is a well-written paper that makes a clear contribution to the difficult but very important question of deciding upon which distribution to use to represent precipitation extremes. One of the key strengths of the study is that it has considered a massive data base (15 029 stations) of very varied daily rainfall series. And it is interesting that the shape parameter of 0.134 is the mode of the distribution of Pareto distribution shape paramaters, since this valus has been found independently in a study by Koutsoyannis.

I think the study has been well led, with efficient quality control of the data, followed by a fitting method taylor-made for the focus upon extremes. One could have included weights in the chosen objective function, to reflect the greater confidence one has in

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the relatively lower return periods, but I don't think this is a crucial point.

Interestingly, the study implies that moments of order larger than $1/0.134 = 7.5$ are infinite. The divergence of moments is, of course, a feature which can be predicted using multi-fractal rainfall models, and such models do imply the need to use thick-tailed distributions for extremes. Looking at the literature, it turns out that such models tend to predict that the divergence of moments will however happen for lower exponents, namely around 3 to 3.5. Given the strong empirical basis for the figure of 7.5, it would be interesting to examine how this information could be incorporated into the fitting of such a stochastic rainfall model (e.g. a multifractal model).

In conclusion, most important certainly, is the fact that this paper has produced results that will potentially make a big impact upon design practice.