Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2019-523-RC2, 2019

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Flood trends in Europe: are changes in small and big floods different?" *by* Miriam Bertola et al.

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Received and published: 20 November 2019

The paper makes an interesting and valuable contribution to the large volume of literature on trends in flood magnitude. The pan-European focus is particularly valuable, as is the separation by flood rarity and catchment size.

Main comments The paper acknowledges that no allowance is made for spatial correlation of floods, and that this may affect the estimation of uncertainty. It claims that the regional model is more robust than the at-site trend analysis. This raises the question of the extent to which the apparent increase in robustness is due to the same information being repeated several times over, if trends at nearby gauges are reflecting essentially the same flood events. I recommend that the authors consider ways

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of accounting for spatial correlation when quantifying uncertainty, such as a spatial nonparametric bootstrap or a likelihood correction (Sharkey and Winter, 2019). The authors quote a cross-correlation length of about 50km (section 4) which seems rather short in comparison with the spatial scale of some flood-producing weather systems.

The discussion (Section 4) makes various statements that go some way towards attributing trends. These vary from confident assertions (flood trends in the Mediterranean are negative due to . . .) to more informal or speculative comments using wording like "linked with", "suggest that", "could be found". I think many of us tend to use language like this when discussing trends, but in this context I would suggest the authors state more explicitly whether they are attempting a formal attribution of the trends or merely providing some hypotheses (or somewhere in between).

Minor comments The paper makes frequent use of the return period terminology. This is conceptually awkward in non-stationary conditions. I would suggest that the authors at least acknowledge this, and perhaps refer to some of the literature on alternative ways of expressing flood rarity.

The Gumbel parameters are modelled as varying with time according to a log-linear relationship. Perhaps the authors could comment on any alternative ways they considered of modelling trend, such as other mathematical forms of the relationship with time, or inclusion of physical covariates in an attempt to improve the identification of the time trends.

The meaning of gamma and S in the equations around lines 103-4 was not clear to me.

The assumption of homogeneity of the windows (section 2.3) seemed to me to need some justification.

I was impressed with the design of Figs 2 and 3, which pack in a great deal of information. I would suggest that the authors either remove or justify the extrapolation of the

model to catchment areas ten times smaller and ten times larger than those included in the dataset.

The description of Fig 5 mentions larger positive trends in NW France for big floods than for small floods. I could not see that effect from comparing the pairs of maps.

Reference Sharkey, P., & Winter, H. C. (2019). A Bayesian spatial hierarchical model for extreme precipitation in Great Britain. Environmetrics, 30(1), e2529.

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