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Discussions

Interactive comment on "Reproducing an extreme flood with uncertain post-event information" *by* Diana Fuentes-Andino et al.

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Note to editor and authors: The course "Research Trends in Physical Geography and Hydrology" offered at the Department of Earth Science at Uppsala University, requires that each student select a paper and submit a review as part of the assessment of the course. The instructors also encourage that participants upload their reviews as part of contributing to a scientific discussion. This report is submited in that spirit and supervised by Prof. Giuliano Di Baldassarre.

General Comments:

The main objective of the paper is to reproduce an extreme flood event in a region in Central America where there is both paucity and data uncertainty. A combination of both post-event data regarding water levels and river discharge was used in calibrating;

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Rainfall-Runoff Model (RRM), routing and a hydraulic model for the modelling task. And uncertainties were accounted for using the Generalized Likelihood Uncertainty Estimation (GLUE) Framework.

The structure of the methodology part of the work was presented clearly for the most part, and followed the order at which the task was carried out. Fuzzy set theory introduced by Lofti Zadeh (Zadeh, 1965) was used by the authors to represent uncertainty limits for post-event variables. And also used as a likelihood function to accept behavioral models. This is one theory that is obviously not new in hydrology (Bardossy et al., 1990) but still trailing the classical 'probabilistic methods' for quantifying uncertainty. In my opinion, there should be a short paragraph describing why it was chosen and adapted in this case, and provide references for the interested reader who wants to follow-up on the fuzzy theory.

Major Comments:

The choice of using fuzzy methods to characterize uncertainty made sense, since the objective of the paper is reproduction of a flood event that has occurred in the past, and not looking at the stochastic behavior of observed flood samples. This is clearly captured by Zadeh in his quote "the notion of fuzzy relates to a situation in which the source of imprecision is not a random variable or stochastic, but rather represents classes which do not possess sharp boundaries" (Zadeh, 1990). Following Zadeh's remark as a basis for reasoning, the uncertainty limit around the best estimate of the variable (post-peak discharge), can be represented as a range of possible values. My critique is based on the choice of the membership function.

One of the strong points of fuzzy set theory is that it employs non-complex shapes to characterize uncertainty, however these shapes are still amenable to explanation. The selection of the trapezoidal membership function for this study seems to apply to a phenomenon that, at first approximation, will result to an interval number. For instance, the capacity of a machine to lift a dead weight ranges from 230 - 350 Joules/seconds,

or that the kettle is “hot”, were hot covers a range of values. In reconstructing a flood that happened in the past, the membership function that represents this case is the triangular membership function. This is because in estimating the post-peak discharge using either the rating curve or any other means, a single “best” estimate is arrived at as a first approximation, then the support of the membership function represents the uncertainty or classes of possible values as suggested by Zadeh.

In general the study and the methodology applied is quite useful for catchments with little or no data at all, the so-called “ungauged basins”. The authors’ recommendation of social media data is quite inspiring as a source of information to constrain model prediction uncertainty.

References

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