Comment on hess-2021-47

Anonymous Referee #2

Referee comment on "Impact of detention dams on the probability distribution of floods"
by Salvatore Manfreda et al., Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2021-47-RC2, 2021

The paper presents a mathematical framework for deriving the probability distribution of peak outflows from a detention basin from the probability distribution of incoming flood peaks. The authors first derive a relationship between the peak outflow from a detention basin and the peak inflow assuming a rectangular inflow hydrograph. This involves the definition of an equivalent delay constant that depends on the properties of the detention basin, and an equivalent flood duration that depends on the lag-time of the river basin. The mathematical framework is applied assuming that the undisturbed flood peaks follow a Gumbel distribution, but the formulation can potentially be applied to any other probability distribution of inflows. The authors also present results from Monte Carlo simulations in which most of the simplifying assumptions are relaxed, and show that the proposed formulation provides a good approximation of the mitigated flood peak distribution in river basins with relatively small concentration time.

The paper is well written and organized, and the mathematical derivations are presented in a clear and logical manner. To the best of my knowledge, the proposed approach is novel, and can be useful for design and environmental impact assessment of flood detention basins.

I recommend some minor changes before publication.

Specific comments:

I believe the reference to "flood control systems" in the title raises the expectations beyond what is presented in the paper, as there are other types of flood control systems that cannot be treated with the same mathematical framework proposed by the authors. I therefore recommend changing the title to refer more specially to "flood detention basins".

The symbol D is not defined in the notation list.

Given that the symbol q is used for discharge, I recommend using a different symbol for the height of the low-level opening instead of qf.

P80,90: Use italic style for mathematical variables.

P10: "the undisturbed flood distribution is assumed to be Gumbel distributed" => "the undisturbed flood peaks are assumed to be Gumbel distributed"

P50: "see i.e., Manfreda et al." => "e.g." not "i.e."

P165: "... mathematically inverting Equation..." => "mathematically by inverting Equation..."

P140: "computed comparing... and setting..." => "computed by comparing... and imposing..."

P255: Remove "realized"

P235: "the impact due to the approximation adopted by the rectangular hydrographs" => I suggest changing this as follows: "the impact of the assumption of rectangular inflow hydrograph"

P235: "allowed to reproduce correctly the flood mitigation that looks very similar to those..." => "produced probability distributions of the outflow that look very similar to those...".

L375: 15,000.00 => 15,000