Interactive comment on "Technical Note: Design flood under hydrological uncertainty" *by* Anna Botto et al.

Anonymous Referee #1

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I find the topic and scope of the manuscript appropriate as a technical note in HESS. Simple yet technically sufficient approaches to include uncertainty in hydrologic design are of great significant in practice. However, the technical note is lacking critical details and requires clarification in some areas, which makes the manuscript difficult to fully assess at this time. The manuscript itself does not stand-alone and assumes that the reader is familiar with the details of the Botto et al. (2014) study. I would recommend major revision with additional review before publication in HESS. I have provided specific areas that need to be addressed with additional details or clarification.

More technical details are needed in the following areas:

- Parameters c and d are not well explained in the manuscript (p. 2, lines 17-18). The manuscript only indicates that they are site-specific and "influenced by topography

and land use among others…." A reader should have enough information in order to understand these parameters and how they are estimated without having to refer back to Botto et al. (2014).

- Eqn 15: C_{TOT} is not defined.

- p. 2, line 18: The authors state that setting C_{TOT} to zero gives the "optimal design flood value." Please help the reader connect why this is the case. Is this because this condition gives the local minima for C_{TOT}? Defining C_{TOT} will help with this point.

-p. 2, line 30: Please explain how c and d are related to the known value of the return period T

- The derivation of equation 5 and its relation to the pdf is not immediately obvious. Please provide a more detailed explanation of the origin of this equation and its conceptual meaning.

- The variable y needs to be better explained and defined as it serves as the focus of the contribution of the note, in my opinion. In the manuscript, y is only described as a non-negative number depending only on the pdf used to fit the flood frequency data (p. 3, line 12-13), which seems too simplistic. Please provide additional explanation. Later in line 29, the text states that y is estimated from regression, further confusing the reader as to how to interpret its meaning. The reader should not have to refer to the supplementary information to understand this.

- p. 3, line 20: It is unclear why the reference to Hosking and Wallis is placed at the end of this sentence. The reference placement implies that Hosking and Wallis (1997) have some comment as to the values of the a_j's, which is not the case. Remove the reference here but keep the reference in Table 1.

- More description is needed in the main text to discuss the computation of the a_j's and y values. Also, include in the main text the regressors used in the regression model.

Clarification is needed in the following areas:

- There needs to be a clarification in the introduction regarding the understanding of where uncertainty in the design flood arises. I agree that the design flood can be known as a single value when, as the authors state (p. 1, lines 18-19), "the frequency distribution and its parameters are known without uncertainty." My understanding is that the motivation for this work is because the frequency distribution and its parameters can only be estimated from a sample of flood data. It is for this reason, uncertainty arises and must be considered in practice. I recommend reworking lines 18-22 to something such as this:

"...period T. For practical reasons, Q_T is commonly expressed only as a single value; however, Q_T can only be expressed in this way if its frequency distribution and its parameters are known perfectly. In practice, one can only estimate the frequency distribution and its parameters using a sample of observed data, thereby creating uncertainty in the estimate of Q_T. However, the design of a hydraulic..."

- My understanding is that the authors only consider parameter uncertainty and not uncertainty in the choice of the pdf. Clarify this in the text.

Minor editorial comments:

p. 1, line 5: Avoid using a reference in the abstract.

p. 3, line 4: Change to read: "Botto et al. (2014) shows that the UNCODE..."

p. 5, line 2: Change to "increasing"