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Impact on hydrological confidence intervals on floods damage potential estimations

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Hydrological knowledge is essential for the production of flood hazard maps, the base of flood risk evaluation processes. Hydrological analyses including uncertainty quantification are necessary for understanding river flow variations overtime and determining floods occurrence probability. Beyond flood maps production, flood frequency analyses are necessary for quantifying the flood risk, i.e. combination of the flood events probabilities of occurrence and the associated consequences. These evaluations of floods damage potential and their economic risks are essential for flood management studies. Even though hydrologic uncertainty is considered the major source of uncertainty on flood damage evaluations, few studies analyze how they are propagated into the damage evaluation process. No standards exist for determining uncertainty acceptance levels for hydrological analyses. In France, the confidence interval of 70% and 90% of the peak discharge value is generally used for rural areas and urban areas, respectively. Despite that the choice of the confidence interval is determinant to the results of hydrological analyzes, no studies were developed for quantifying the impact of this choice on flood damages estimations.

This work presents how the methods used for analyzing measured gauged series and the considered confidence interval influence the results of future floods damage evaluations. The Bruche's River case study, in France, was retained with this purpose. Firstly, we analyzed how discharge and frequency forecasts were affected by the statistical distribution retained. Four statistical distributions were compared during the analyses: GEV, Gumbel, Lognormal, and Pearson distribution. Two confidence intervals were adopted for determining flood flow return periods, 70% and 90%, respectively. We analysed uncertainty propagation, linked both to the choice of the statistical distribution and its confidence intervals, in the production of flood maps and further on the evaluation of flood damages. 108 flood maps produced using the different approaches were used for quantifying flood damages and expected annual damages. The choice of statistical distributions strongly influenced the results of damage evaluations, e.g. the expected annual damage estimations may double depending on the distribution used. The variability of results induced by the choice of the confidence intervals was higher than that associated to statistical distributions, e.g. when using different confidence intervals, expected annual damages were 6 times higher using different methods. Therefore, the uncertainty acceptance levels for hydrological analyses should receive more attention when producing flood maps, especially when those maps are used for quantifying monetary damages of floods.