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Estimation of high return period flood quantiles using additional non-systematic information with upper bounded statistical models

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Abstract. This paper proposes the estimation of high return period flood quantiles using upper bounded distribution functions with Systematic and Non-Systematic information. The aim of the developed methodology is to reduce the estimation uncertainty of these quantiles assuming the upper bound parameter of these distribution functions as a statistical estimator of the Probable Maximum Flood (PMF). Three upper bounded distribution functions, firstly used in Hydrology in the 90's (referred to in this work as TDF, LN4 and EV4), were applied at the River in Spain. Different methods to estimate the upper limit of the distribution functions have been merged with the Maximum Likelihood method. Results show that it is possible to obtain a statistical estimator of the PMF value and to establish its associated uncertainty. The behavior for high return period quantiles is different for the three evaluated distributions and, for the case study, the EV4 gave better descriptive results. With enough information, the associated estimation uncertainty for very high return period quantiles is considered acceptable, even for the PMF estimate. From the robustness analysis, the EV4 distribution function appears to be more robust than the GEV and TCEV unbounded distribution functions in a typical Mediterranean river and Non-Systematic information availability scenario. In this scenario and if there is an upper limit, the quantile estimates are clearly unacceptable.

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