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Statistical estimators of high return period quantiles obtained using no systematic information and an upper bound distribution

B. Botero, F. Francés

Department of Hydraulic Engineering and Environmental, Universidad Politécnica de Valencia, Spain.

Flood frequency analysis with no systematic information and upper bound probability distribution functions has been explored in order to improve high return period quantile estimates and PMF (Probable Maximum Flood) estimates.

No systematic information types considered are CE and BC. First case corresponds to a censor threshold and floods above it, with known magnitudes. Second case occurs when there is a threshold and only the number of floods exceeding this threshold is known, but not the flood magnitudes.

For statistical analysis, the four parameters Extreme Value distribution function (EV4) is proposed combined with different parameter estimation methods which depend on the no-systematic information type. In cases when there is BC information only, parameters are estimated by two methods: 1. All parameters are estimated by Maximum Likelihood (ML), 2. An alternative method is proposed in which the upper bound is prefixed at the value of deterministic PMF previously estimated, and then, the other parameters are estimated by ML. This method is called G=PMF. On the other hand, when only is available CE information, the parameter estimation methods are: 1. G=PMF method, described above. 2. ML method mixed with a Generic Equation for the upper bound estimation, called ML-GE.

The accuracy of the quantiles estimates has been assessed by MonteCarlo simulations. From a parent distribution EV4 with parameters resulting in a high skewsness coefficient, many series with systematic and either with information CE and information BC were generated. The criterion of accuracy was the relative error in percent.

Results of these simulations show that with CE information the ML-GE estimates of quantiles and PMF have less error than the estimates by the other method. For BC information, quantiles with less error are obtained when method G=PMF is used.

Model's descriptive capacity is compared with other two models without upper bound (TCEV and GEV) by MonteCarlo simulations. When the parent distribution is EV4 and information type is CE, the EV4 distribution with estimation method ML-GE performs better than the other two models. When the parent distribution is GEV, EV4 model gives similar errors to TCEV and GEV models for the two types of information.