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Decision Support System for hydrological extremes

Bernard Bobée (2) and Salaheddine El Adlouni (1)

(1) Professor, Département de Mathématiques et Statistique, Université de Moncton, Canada (Salah-eddine.el.adlouni@umoncton.ca), (2) Emeritus Professor INRS-ETE, 490 de la Couronne, Québec, Canada G1K 9A9 (Bernard.Bobee@ete.inrs.ca)

The study of the tail behaviour of extreme event distributions is important in several applied statistical fields such as hydrology, finance, and telecommunications. For example in hydrology, it is important to estimate adequately extreme quantiles in order to build and manage safe and effective hydraulic structures (dams, for example).
Two main classes of distributions are used in hydrological frequency analysis: the class D of sub-exponential (Gamma (G2), Gumbel, Halphen type A (HA), Halphen type B (HB)...) and the class C of regularly varying distributions (Fréchet, Log-Pearson, Halphen type IB ...) with a heavier tail. A Decision Support System (DSS) based on the characterization of the right tail, corresponding low probability of excedence p (high return period T=1/p, in hydrology), has been developed. The DSS allows discriminating between the class C and D and in its last version, a new prior step is added in order to test Lognormality. Indeed, the right tail of the Lognormal distribution (LN) is between the tails of distributions of the classes C and D; studies indicated difficulty with the discrimination between LN and distributions of the classes C and D. Other tools are useful to discriminate between distributions of the same class D (HA, HB and G2; see other communication). Some numerical illustrations show that, the DSS allows discriminating between Lognormal, regularly varying and sub-exponential distributions; and lead to coherent conclusions.

Key words: Regularly varying distributions, subexponential distributions, Decision Support System, Heavy tailed distribution, Extreme value theory