Delta diagram based test for the Halphen (A and B) and the Gamma distributions

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The most used statistical distributions to fit extreme value data in hydrology, can be regrouped in three classes: class C of regularly varying distributions and class D of sub exponential distributions, depending on their tail behaviour. The Halphen distributions (Halphen type A (HA) and Halphen type B (HB)) have both the Gamma (G2) distribution as limiting case and all these three distributions belong to the class D and can be displayed in the (Delta1 = ln(A/G); Delta2 = ln(G/H)) moment ratio diagram based on Geometric (G), Arithmetic (A) and Harmonic (H) means. In this study, a statistical test for discriminating between HA, HB and the Gamma distribution is developed. The methodology is based on Monte Carlo simulation for (1) the determination of the confidence regions around the Gamma curve for each fixed couple (Delta1 , Delta2) and (2) the study of the power of the proposed test for both alternatives HA and HB distributions and comparison with the Likelihood Ratio Test (LRT).

Results showed that the test is powerful especially for high values of skewness and is far better than the LRT. This test will be included, shortly, in Decision Support System (DSS) of the HYFRAN-PLUS software.

Key words: Halphen distributions, Gamma distribution, Heavy tailed distribution, Monte Carlo simulation, (Delta1 , Delta2) diagram, power of the test, HYFRAN-PLUS.