Geophysical Research Abstracts, Vol. 7, 10278, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10278
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Bias analysis on the tail properties of flood frequency distributions

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The Generalized Extreme Value (GEV) and Generalized Pareto Distributions (GPD) are most commonly used in hydrological extreme value analysis. Calibration of these distributions above limited threshold levels may, however, lead to a significant bias in the asymptotic properties of the extreme value distribution's tail. The extreme value index (or k parameter) reflects the most important of these properties, because it shapes the distribution's tail. It consequently most strongly affects the accuracy of extrapolations made with the distribution.

A method is proposed for bias correction based on the calibration of a so-called slowly varying function. The accuracy and robustness of the method is demonstrated for rainfall-runoff discharge series. Peak-over-threshold (POT) extremes were extracted from the series on the basis of a hydrologic independency criterion. Discrimination between Gumbel/EXP (normal tail) and GEV/GPD (heavy tail) and optimal threshold selection in the POT method are based on regression in Q-Q plots (QQR method). It is found based on these methods that the bias and slowly varying functions are strongly dependent on the independency level considered.

Flooding influences also may cause bias in the distribution's tail. Bank storage and inaccurate rating curve extrapolation are two examples of flooding influences, and are often underlooked in the current hydrological practice. An approach is worked out to eliminate the influence of flooding on the extreme value analysis; by censoring based on the asymptotic properties of the extreme value distribution. In this way, separate distributions are identified and calibrated for the rainfall-runoff discharges and

the river discharges. Both types of distributions have different applications in water engineering.