Comparison of the Performance of L-moments with the Maximum Likelihood Method in Estimation of Extreme Value Distributions

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Two commonly employed statistical approaches to the estimation of parameters of extreme value distributions, the maximum likelihood method and the method of L-moments, are compared as to their performance in the analysis of extreme temperature and precipitation events. The methods are utilized to estimate parameters of the Generalized Extreme Value (GEV) distribution and the Gumbel distribution for annual maxima of air temperature and 1-day to 7-day precipitation amounts at several dozens stations covering the Czech Republic over 1961-2005. Both statistical models are applicable according to three tests on the value of the shape parameter of the GEV distribution at a large majority of sites. Estimates of quantiles (i.e. design values for given return periods) of the GEV and the Gumbel distribution are closer to one another if L-moments are used. Simulation experiments are carried out to highlight the superiority of estimates of distribution parameters and design values obtained using L-moments. For moderate sample sizes (which are usually dealt with in practical applications) the main advantages of the method of L-moments over the asymptotically optimal maximum likelihood method seem to be a smaller bias of estimates of design values, and, in cases when the true model is unknown and both the GEV and Gumbel distributions are acceptable, considerably reduced dependence on the model chosen.