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Scale parameters in stationary and non-stationary GEV modeling of extreme precipitation

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The generalized extreme value (GEV) distribution is often fitted to environmental time series of extreme values such as annual maxima of daily precipitation. We study two methodological issues here. First we compare methods of selecting the best model among a set of 16 GEV models that allow non-stationary scale and location parameters. Results of simulation studies showed that both the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) correctly detected non-stationarity but the BIC was superior in selecting the correct model more often. The second issue is how best to produce confidence intervals (CIs) for the parameters of the model and other quantities such as the return levels that are usually required for hydrological and climatological time series. Four bootstrap CIs - normal, percentile, basic, and bias corrected and accelerated (BCa) - constructed by random-t resampling, fixed-t resampling and the parametric bootstrap methods were compared. CIs for parameters of the stationary model do not present major differences. CIs for the more extreme quantiles tend to become very wide for all bootstrap methods. For non-stationary GEV models with linear time dependence of location or log-linear time dependence of scale, coverage probabilities of the CIs are reasonably accurate for the parameters. For the extreme percentiles, the BCa method is best overall and the fixed-t method also gives good average coverage probabilities.