

Appendix A: GEV frequency analysis

For large samples, the cumulative distribution function for the maximum values of many probability distributions converges to one of three extreme value distributions (EV type I, II, or III) described by Gumbel (1958). The Generalized Extreme Value (GEV) distribution is a general mathematical form which incorporates Gumbel's type I, II and III distributions for maxima (Stedinger et al., 1993). The parameters of the GEV distribution are ξ (location parameter), α (scale parameter) and κ (shape parameter). The Gumbel (EV type I) is obtained when $\kappa = 0$. For $\kappa > 0$, the distribution has a finite upper bound at $\xi + \alpha/\kappa$ and corresponds to the EV type III distribution for maxima that are bounded from above. For this study, GEV parameters were estimated using the method of L-moments (Stedinger, 1993; Hosking and Wallis, 1997) and are shown in Table A-1. GEV goodness-of-fit was confirmed using a probability plot correlation coefficient (PPCC) hypothesis test (Chowdhury et al., 1991) and an *L*-moment diagram. The PPCC hypothesis test indicated that the GEV adequately fit the annual maximum time series for all sites except Boston. However, the *L*-moment diagram indicated that the GEV could reproduce the moments of the detrended Boston data. In addition, a visual inspection of PPCC plots (Figure A-1) showed that the GEV fit the upper tail of the Boston time series reasonably well after the largest (1991) data point was removed; hence the GEV was deemed appropriate for all sites. For the Atlantic City and Boston sites, parameters were estimated both with and without trend removal.

Table A-1: GEV parameters estimated using the method of L-moments, following Hosking and Wallis (1997).

GEV parameters ¹	Boston ²	Boston ³	Woods Hole	New London	New York City	Altantic City ²	Altantic City ³
ξ	0.937	-0.054	0.698	0.759	0.935	0.690	-0.097
α	0.236	0.219	0.157	0.224	0.260	0.285	0.178
κ	0.434	0.465	-0.079	-0.034	0.030	0.198	0.031

Notes: ¹GEV parameters estimated from anomaly data in units of meters and later converted to mm.

²linear trend was not removed prior to estimating GEV parameters.

³linear trend was removed prior to estimating GEV parameters.

Using the parameters estimates in Table A-1, GEV quantile estimates, x_p , for specified cumulative probabilities, p , were computed from

$$x_p = \xi + \frac{\alpha}{\kappa} \left\{ 1 - [-\ln(p)]^\kappa \right\} \quad (\text{A-1})$$

Cumulative probabilities (p) were converted to exceedance probabilities, $p_e = 1 - p$. The return periods shown in Table 3 are $1/p_e$.

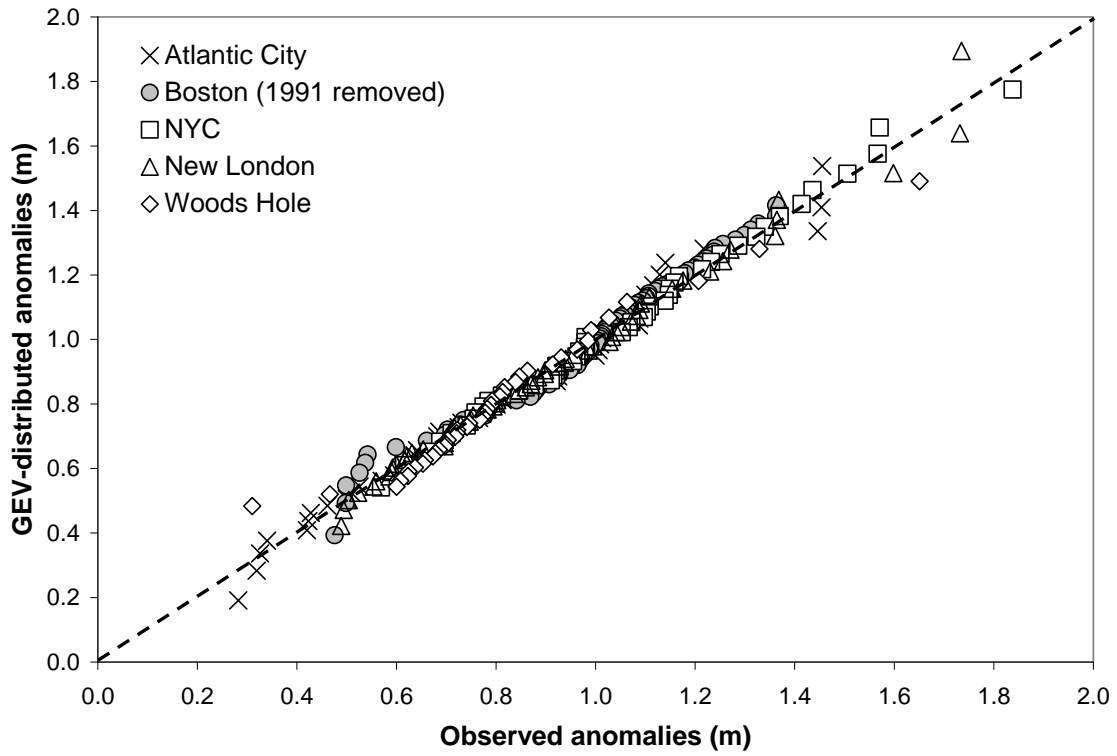


Figure A-1: Probability plot correlation coefficient (PPCC) plots for annual maximum time series. The Generalized Extreme Value (GEV) distribution was selected based on the results of the PPCC test and L-moment diagrams.