



CIE 598: Data Analytics for Coastal Systems - Exam #2 (Fall 2025)

1. After extreme-value analysis, we find that for a coastal region the 100-year extreme wind event is 40 m/s. This means that we observe a wind speed of 40 m/s once in 100 years in that coastal region:

TRUE

FALSE

2. An event with a return period $T = 5$ years has an annual probability of exceedance equal to:

0.20 (20%)

0.02 (2%)

3. An event with a return period $T = 10$ years has an annual probability of non-exceedance equal to:

0.90 (90%)

0.10 (10%)

4. The Generalized Extreme Value (GEV) distribution, used to model block maxima, has the following parameters:

scale (σ) & shape (ξ)

location (μ), scale (σ) & shape (ξ)

5. The shape (ξ) parameter of the GEV distribution is typically between the following two values:

$-1 \leq \xi \leq 1$

$-0.5 \leq \xi \leq 0.5$

6. A seawall is designed to last 50 years, i.e., its design lifetime is $D = 50$ years, and its crest provides protection from the 100-year extreme sea level. The probability of overtopping within the seawall's design lifetime is greater than 0.50 (50%):

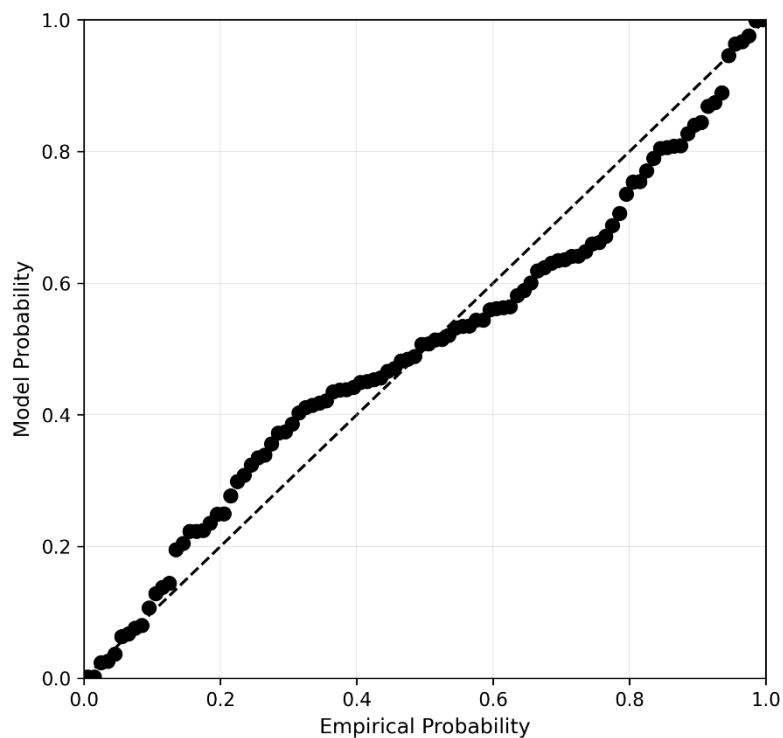
TRUE

FALSE

7. The following graph shows a probability plot obtained after we fit a GEV distribution to annual maximum storm surge data. The model provides a good fit for our data:

TRUE

FALSE



8. We fit a GEV distribution to annual maximum daily precipitation data and find that $\xi = 0.01$. It is likely that if we fit a Gumbel distribution to the same data, then $AIC_{\text{Gumbel}} < AIC_{\text{GEV}}$:

TRUE

FALSE

9. An empirical estimate of non-exceedance probability is given by $\frac{i}{n+1}$, where n is the sample size and i is the rank given to each data point after sorting them from highest to lowest:

TRUE

FALSE

10. The Generalized Pareto (GP) distribution, used to model peaks-over-a-threshold u ($y = x - u$), reduces to the Exponential distribution when:

$\xi \rightarrow 0$

$u \rightarrow \infty$

11. We are working with a GP distribution and have selected a threshold so that we end up with 150 exceedances in total. The number of years in the data record is 30. Then, the recurrence rate (λ) is:

5 events/year

Cannot be determined from the information given

12. If the GP distribution is an appropriate model for peaks-over-a-threshold u ($y = x - u$), i.e., $y \sim GP(\sigma_u, \xi_u)$ then for every other threshold v for which $v > u$ the peaks $y^* = x - v$ follow:

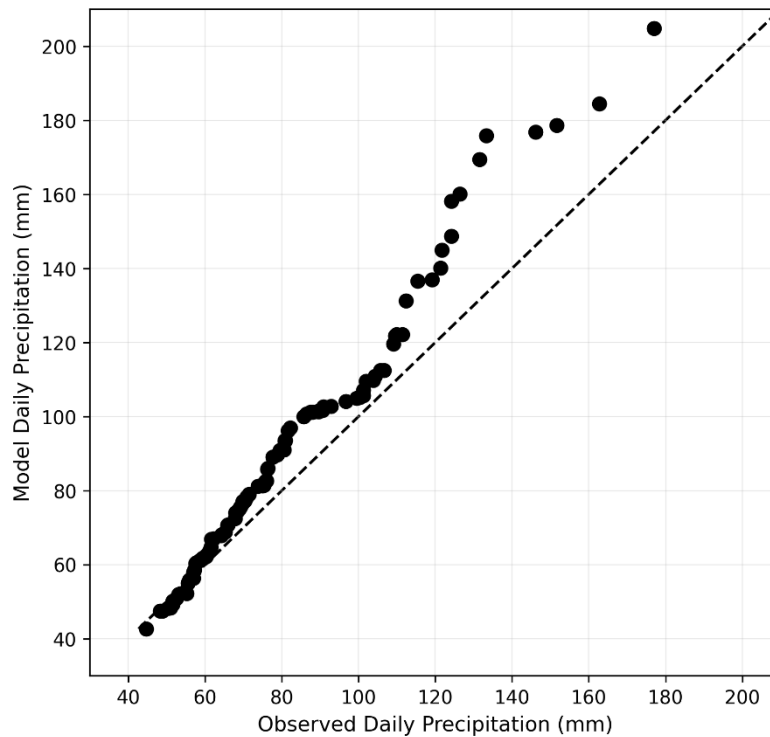
$y^* \sim GP(\sigma_v, \xi_u)$

$y^* \sim GP(\sigma_u, \xi_v)$

13. The following graph shows a QQ plot obtained after we fit a GP distribution to peaks-over-a-threshold from an observational record of daily precipitation. The model is shown to underestimate the observations:

TRUE

FALSE



14. The concept of Mean Residual Life (MRL) plot for selecting an appropriate threshold for the GP distribution is based on the fact that:

$E[Y] = a + b * u^2$

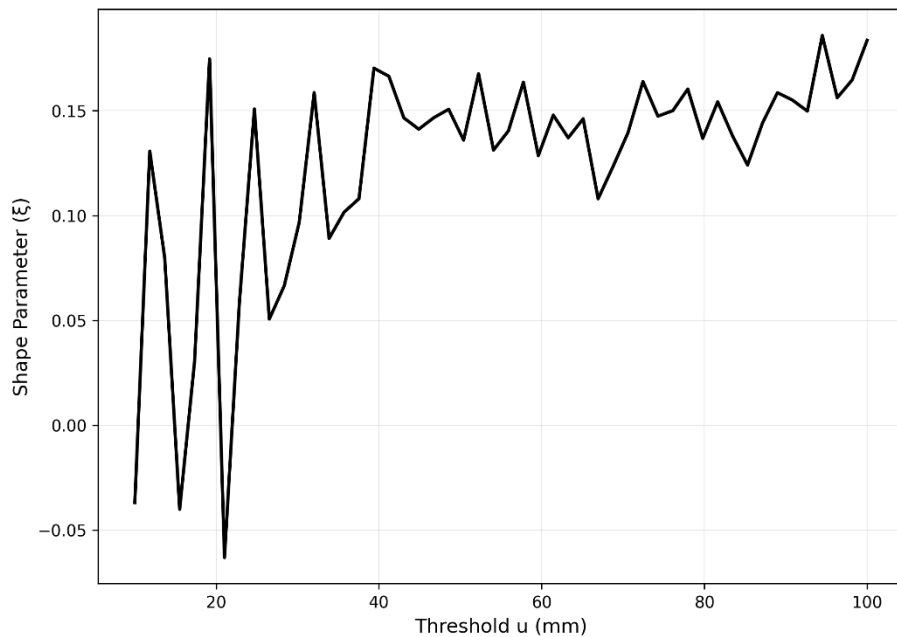
$E[Y] = a + b * u$

where Y is the random variable for peaks-over-a-threshold u ($X - u$) and $E[\bullet]$ denotes the expectation.

15. We are working with a GP distribution for peaks-over-a-threshold from an observational record of daily precipitation and we are trying to select an appropriate threshold. Based on the graph below, which one is a better threshold:

$u = 25$ mm

$u = 45$ mm



BONUS QUESTION

16. A rubble mound breakwater has a design lifetime of $D = 20$ years, and it can withstand the 40-year extreme wave event. If our tolerance for the probability of failure is 0.10 (10%), does the design of the breakwater meet our standards?

TRUE

FALSE