SH-P2: Long term analysis of wave crest using «random storm approach»

In the is project a long term response analysis shall be done using "random storm approach". Target variable for the long term analysis are storm maximum crest height, X_s. Hindcast data are available at course web page.

The project can be divided in the following sub-projects:

1. As introductory work correct spectral peak period for wind sea according to the recipe given in Appendix D of Compendium.

2. Import the hindcast file (Nora10). Consider wind sea and identify all storms with a peak significant wave height of wind sea exceeding a threshold of 8m. Present the joint scatter for the peak significant wave height and the simultaneous spectral peak period of all storms. Show a scatter diagram for storm peak significant wave height and associated spectral peak period for all storms. Fit a distribution to the peak significant wave height for wind sea and estimate 10^{-2} – and 10^{-4} – annual probability significant wave height.

3. Establish the "exact" distribution of storm maximum crest height for all storms above threshold, $h_0 = 8m$. Estimate the most probable largest crest height. Determine also the standard deviation of the storm maximum crest height from the "exact" distribution. Establish a long-term distribution of most probable largest storm crest height. (Hint: Try with a 3-parameter Weibull model and use method of moments for estimating parameters.) Compare fitted distribution and empirical distribution in a Gumbel probability paper.

4. Assume that the storm distribution of crest height can be written as a Gumbel distribution as shown in Eq. (9.37). Estimate β such that the Gumbel model has the same standard deviation as the "exact" model. Assume that β can be approximated by its mean. Establish the long term distribution of storm maximum crest height using "random storms approach". Estimate 10^{-2} – and 10^{-4} annual probability crest heights.

5. If time permit, fit a distribution to the sample of β. Establish the distribution of storm maximum crest height accounting for the uncertainty in β. Estimate 10^{-2} – and 10^{-4} annual probability crest heights for the case that uncertainty in β is accounted for.

Prepare a scientific report presenting the work. The report shall include an abstract, conclusions, discussion of further work and list of references.