Maximum Individual Wave Height and Crest Height

The program evaluates Borgman's (1973) integral:

$$Pr(H \leq h) = \exp \int_{t_a}^{t_b} \log \left[1 - e^{h^2/a^2(t)} \right] \frac{dt}{T(t)}$$

where H is the largest wave height; a^2 is the mean square height taken as a function of time, t; t_a and t_b are the beginning and end of the storm; and $T(t)$ is the wave period, taken here as the significant wave period.

Maximum Individual Wave Height (Forristall, 1978):

$$Pr\ \{H > h\} = \exp \left[-1.08311 \left(\frac{h^2}{8 M_0} \right)^{1.063} \right]$$

$T = M_0/M_1$

Maximum Crest Height (Haring and Heideman, 1978):

$$\Pr\{H > h\} = \exp\left[\left(-\frac{h^2}{2M_0} \right) \left(1 - 2.4909 \frac{h}{d} + 4.37 \frac{h^2}{d^2} \right) \right]$$

where h is elevation and d is water depth

$T = .74\ TP$

TP is the reciprocal of fpeak, found by solving $\frac{\partial^2 S}{\partial f^2} = 0$

by inverse interpolation

The median of the resulting distribution was taken as the maximum expected single peak in the storm.

Maximum Crest Height (Forristall, 2000):

$$P(\eta > \eta^* \mid Hs) = \exp\left[-\left(\frac{\eta}{\alpha Hs} \right)^{\beta} \right]$$

Where α and β are empirical functions of the wave steepness (S_1) and the Ursell number (U_r). S_1 and U_r are given by the following equations:

$S_1 = 2\pi Hs / g\, T_1^2$

$U_r = Hs / (k_1^2 d^3)$

Where

g	is the gravity constant, 9.81 m/s^2
T_1	is the mean wave period calculated from the ratio of the first two moments of the wave spectrum, m_0 / m_1
k_1	is the wave number for a wave frequency $2\pi / T_1$
d	is the water depth

For a spread sea the expressions for α and β are given by the following equations:

$$\alpha = 0.3536 + 0.2568\, S_1 + 0.0800\, U_r$$

$$\beta = 2 - 1.7912\, S_1 - 0.5302\, U_r + 0.284\, U_r^{\,2}$$

References:

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Haring R.E. and J.C. Heideman, 1978. Gulf of Mexico Rare Wave Return Periods. OTC 3230, 10th Annual Offshore Technology Conference, Houston, TX May 8-11 1978.

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