Statistics Homework **name:** Braidon Duffy

OCE 3521–Waves

1. A wave train consists of 1000 waves, with a RMS wave height , $H_{rms} = 4m$.

    a. What is the probability that a wave will exceed 8m?

$P(H \geq \hat{H}) = e^{-(\hat{H}/H_{rms})^2} = e^{-(8/4)^2} = e^{-4} = 0.0183 = \boxed{1.83\% = P(H \geq 8)}$

    b. How many waves will exceed 8m?

$n = Ne^{-(\hat{H}/H_{rms})^2} = 1000 \cdot 0.0183 = 18.3 = \boxed{19 \text{ waves} = n}$

2. A 200 second time series of surface elevations is given in the figure, perform a **wave-by-wave analysis** on the time series given.

a) ***Directly on the Figure*** identify and number each "wave" in the signal based on the method stated in part a.

b) Record the **wave height, H**, in the provided table on the next page, and then rank order from largest to smallest is the adjacent column.

c) Find: H_1 , H_{max}, H_{min}, H_{RMS} *and* $H_{1/3}$ From the time-series data by ***directly computing*** the values from the data.

d) Now, using Eq. 7.16, compute the probabilistic wave height that exceeds the average of the highest $\frac{1}{3}rd$ and highest of the waves ($\frac{1}{N}th$) in the signal. (Base the calculation on the H_{RMS} **calculated in your wave-by-wave analysis**, and the total number of waves that you count in your signal.) ***How do the probabilistic values differ from the actual data and why***?

c) Determined w/ MATLAB Code

$H_{max} = 1.25$ m

$H_{min} = 0.10$ m

$H_{rms} = 0.63$ m

$H_{1/3} = 0.92$ m

$H_1 = 0.55$ m

Heights imported to workspace and computed with.

d) $\hat{H} = H_{rms}\sqrt{\ln 1/P}$

$= 0.63\sqrt{\ln 3}$

$\boxed{\hat{H} = 0.66 \text{ m}}$

e) $\hat{H} = H_{rms}\sqrt{\ln N}$

$= 0.63\sqrt{\ln(3.30)}$

$\boxed{\hat{H}_{max} = 1.14 \text{m}}$

$\sigma = \left(\frac{|\hat{H}_{max} - H_{max}|\,2}{\hat{H}_{max} + H_{max}}\right)100 = \left(\frac{|1.14 - 1.25|\,2}{1.14 + 1.25}\right)100 = 9.21\%$

Diff. caused by Statistical assumptions and wave super position.

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Wave #	Wave Height H(m)	Rank Order
1	0.80	6
2	0.35	19
3	0.20	24
4	1.00	2
5	1.25	1
6	1.00	3
7	1.00	4
8	0.80	7
9	0.70	8
10	0.60	10
11	0.30	20
12	0.60	11
13	0.50	13
14	0.50	14
15	1.00	5
16	0.25	23
17	0.10	26
18	0.55	12
19	0.30	21
20	0.40	17
21	0.20	25
22	0.40	18
23	0.50	15
24	0.10	27
25	0.70	9
26	0.50	16
27	0.30	22