Short Term Statistics during ITOP

Clarence O. Collins III 11.09.2015 14th Waves Workshop

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Rayleigh Distribution

Most Probable
Average
Common Waves
Significant Wave Height
Design Waves
Uncommon Waves

AI = H/H_{m0}

Individual Wave Height [m]
Percent Occurrence

0 1 2 3 4 5 6 7 8
0 0.5 1 1.5 2 2.5
\[ \sqrt{- \log[EDF]} \]
Motivation

- speculation on EDF environmental dependencies

- EDF dependence on U
  - Gibson et al. [2014]
Methodology

11091 - 30 min. blocks
~231 days
Significant Wave Height
Steepness - ak

- Rayleigh
- Boccotti
- $ak \leq 0.008$
- $0.008 < ak \leq 0.20$
- $0.20 < ak \leq 0.36$
- $ak > 0.36$
Directional Spread – $\sigma(f_p)$ [°]
Benjamin-Feir Index
Wave Age – $C_p/U$
<table>
<thead>
<tr>
<th>Platform</th>
<th>$H$ [m]</th>
<th>$H_{mo}$ [m]</th>
<th>$H_c (H_t)$</th>
<th>$H/H_{mo}$</th>
<th>$H_c/H_{mo}$</th>
<th>Date</th>
<th>Storm</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>EASIN (1)</td>
<td>20.7</td>
<td>9.2</td>
<td>11.8 (9.0)</td>
<td>2.26</td>
<td>1.28</td>
<td>299.82</td>
<td>Chaba</td>
<td>PS</td>
</tr>
</tbody>
</table>

![Graph showing various parameters over time with a vertical red line at Day of Year 299.82.](image-url)
<table>
<thead>
<tr>
<th>Platform</th>
<th>H [m]</th>
<th>H_m [m]</th>
<th>H_c (H_t)</th>
<th>H/H_m</th>
<th>H_c/H_m</th>
<th>Date</th>
<th>Storm</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>EASI S (2)</td>
<td>21.2</td>
<td>8.9</td>
<td>13.8 (7.4)</td>
<td>2.37</td>
<td>1.55</td>
<td>290.16</td>
<td>Megi</td>
<td>PS</td>
</tr>
<tr>
<td>EASI S (1)</td>
<td>17.6</td>
<td>8.5</td>
<td>8.4 (9.2)</td>
<td>2.07</td>
<td>0.98(1.08)</td>
<td>290.11</td>
<td>Megi</td>
<td>PS</td>
</tr>
</tbody>
</table>

![Graph showing wave height and direction over time.](image-url)
Lian and Haver [2015] – this conference!
Why?

- Reduced breaking strength
  - Wind is supporting high frequency energy which increases breaking, limiting wave height, once the wind is suppressed, the breaking reduces and wave height is less limited
- Delay due to dynamic time scale
  - $O \left(\frac{1}{(k_p m_0)^2 f_p}\right) \sim 30$ mins
Follow up

- Do uncommon waves from different populations have different shapes?

- Compare with HOSM
Conclusions

- EDFs most sensitive to BFI
- Wind speed/wave age important
- Absolute values of parameters not the whole story
- Large, extreme waves tend to occur after the min/max events in parameter space
Thank you for your attention

Questions?