JERICHO TECHNICAL REPORT 13

Application of SWAN in the Holderness region

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1 SWAN at Holderness part 2

Work has continued with the wave model SWAN, testing different options against the three offshore buoys at Holderness. The period studied was the storm of the 1st and 2nd January 1999.

One item of concern is the bathymetry. Figure 1 shows the line offshore close to N1, N2 and N3, and the difference between the model grid bathymetry (blue) corrected to mean sea level and the mean depth measured by the bottom pressure recorder (green). There appears to be a systematic offset between the two. An error of this nature in the bathymetry would cause a systematic underestimate of the wave height in the model due to the bottom dissipation term being too large. The position of N1 is approximately 1km offshore. In the model, however, it appears to be more like 400m offshore. The red crosses show the effect of shifting the coastline so that all the points are 600m further offshore. The results reported in the rest of this document use the original grid positions.

In the previous report, the effect of different formulations of bottom friction was described, and it was determined that the Madsen formulation gave a better approximation to the data. In the next sections the effects of the wind forcing, triad interactions and varying bottom depths are studied.

2 Results and Conclusions

Figures showing the following comparisons are included.

1. With and without wind input (with triads).

2. With and without triad interactions (without wind input).

3. With and without variation of depth (with wind input and triads).

4. With varying depths from the bottom pressure recorder at N1 and POL's hydrodynamic model (with wind input and triads). A uniform variation is applied over the whole grid.

2.1 Wind input

The wind input term has very little effect on the results obtained from SWAN in this example. The winds are North to North Westerly during this particular storm event.

2.2 Triad interactions

The triad interaction term has more effect than the wind input term. It increases the overall wave height and causes small peaks in the frequency spectrum at double the frequency of the main peaks. There is little evidence for such spectral shapes in the waverider data. The difference in the results with and without triads is most marked at N2. It would seem that the triad calculation in the model is poor. Theory and other measurements indicate that normally one requires a bar in the bathymetry to produce triad interactions and they are not expected to be important in greater than 8m water depth. Neither of these factors exist at N2.

2.3 Varying water depths

The inclusion of varying water depths has a marked effect on the results, particularly at N1. The model results show a variation much more in line with that shown by the buoy results. The effect may be over-exaggerated due to the inaccuracy in the bathymetry referred to in the previous section. The spectral results show an effect over the whole frequency range; the changing depth causes strengthening or weakening of the bottom dissipation.

2.4 What next..

In the next stage of JERICHO the effects of currents will be included. If these are significant then they should shift the frequency spectrum. The effect of currents on the bottom dissipation term is not included in SWAN.