JERICHO progress report
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JERICHO TECHNICAL REPORT 08 - J.Wolf, CCMS-POL

(i) There has been some discussion between POL and HALCROW on the workplan for the modelling, general agreement was reached, although not all issues have been resolved. A list of tasks was drawn up by the POL group. It was agreed that a study of processes at Holderness be carried out, based on POL observed data from that area. Initially the most extreme event observed (1-2/1/95) will be modelled at 3-hour intervals. This event was a combination of wind-sea and swell and will be a good test of the validity of the model. The offshore boundary will be represented by N3 and output compared at N1. The time-varying water level and current are also available from observations and the POL tide and surge model. A comparison of the SWAN and STORMS model will be made for that period. Further tests should be based on projected changes in sea level (e.g. IPCC projections) and the assessment of changes in wave height derived from the analysis of satellite and buoy data.

(ii) The models for Lyme Bay and Carmarthen Bay have been set up and tested with an idealised JONSWAP input spectrum, consisting of a 3.5m significant wave height (peak period 8 seconds), approaching from the SW. Some observed wave data has now been obtained for Lyme Bay and Carmarthen Bay from David Cotton and David Carter, but its potential use in driving the wave models has not yet been assessed.

(iii) The SWAN Holderness model has been run for 1-2 January 1995 using directional spectral observed at station N3 data as the boundary forcing and winds from the coastal station at Donna Nook and comparing output at station N1. Some tuning of the bottom friction coefficient may be necessary. (Julia will be reporting on this work). The model will be run with and without currents.

(iv) Some tests have been carried out with the 3 models, to investigate the effects of increasing the wave height at the offshore boundary. Due to dissipation effects, as expected, the increase in waves offshore does not lead to a corresponding increase nearshore, there is a depth-related limit for the maximum wave height.

Technical Report Part 2

1. Holderness model - idealised test cases
   (a) rectangle - tests of cross-shore boundary conditions (reported earlier)
   (b) constant slope - tests with an arbitrary constant slope, increasing slope reduces amount of dissipation (depth-limited breaking presumably controls this)
   (c) increased wave height at offshore boundary, see Figure 1.

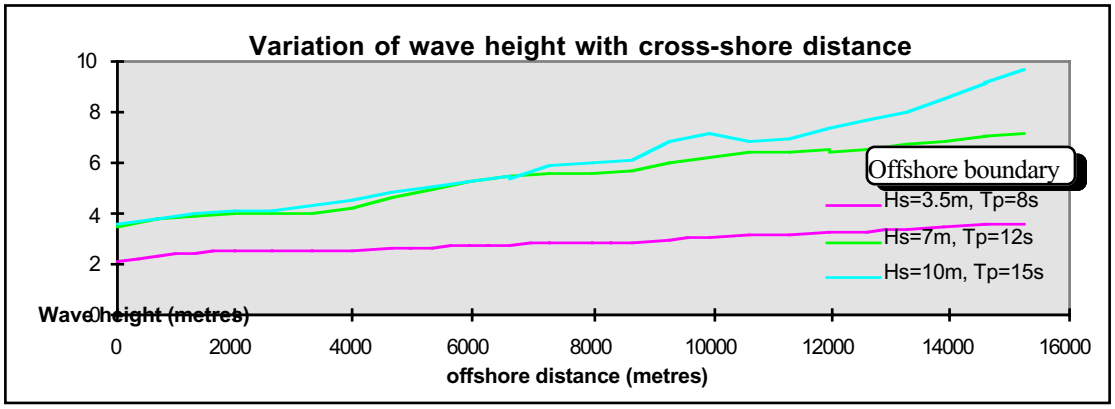

Figure 1: Effect of increasing offshore wave height

Doubling the wave height at the offshore boundary does not increase the wave height at the shore by the same amount. Increasing the wave height further does not increase the wave height beyond a certain limiting value.

2. Lyme Bay and Carmarthen Bay
   (b) Initial set up.
   (c) Standard test case Hs=3.5m, Tp=8s.
   (d) Hs/h versus cross-shore distance - comparison of all 3 models, effect of bottom slope.

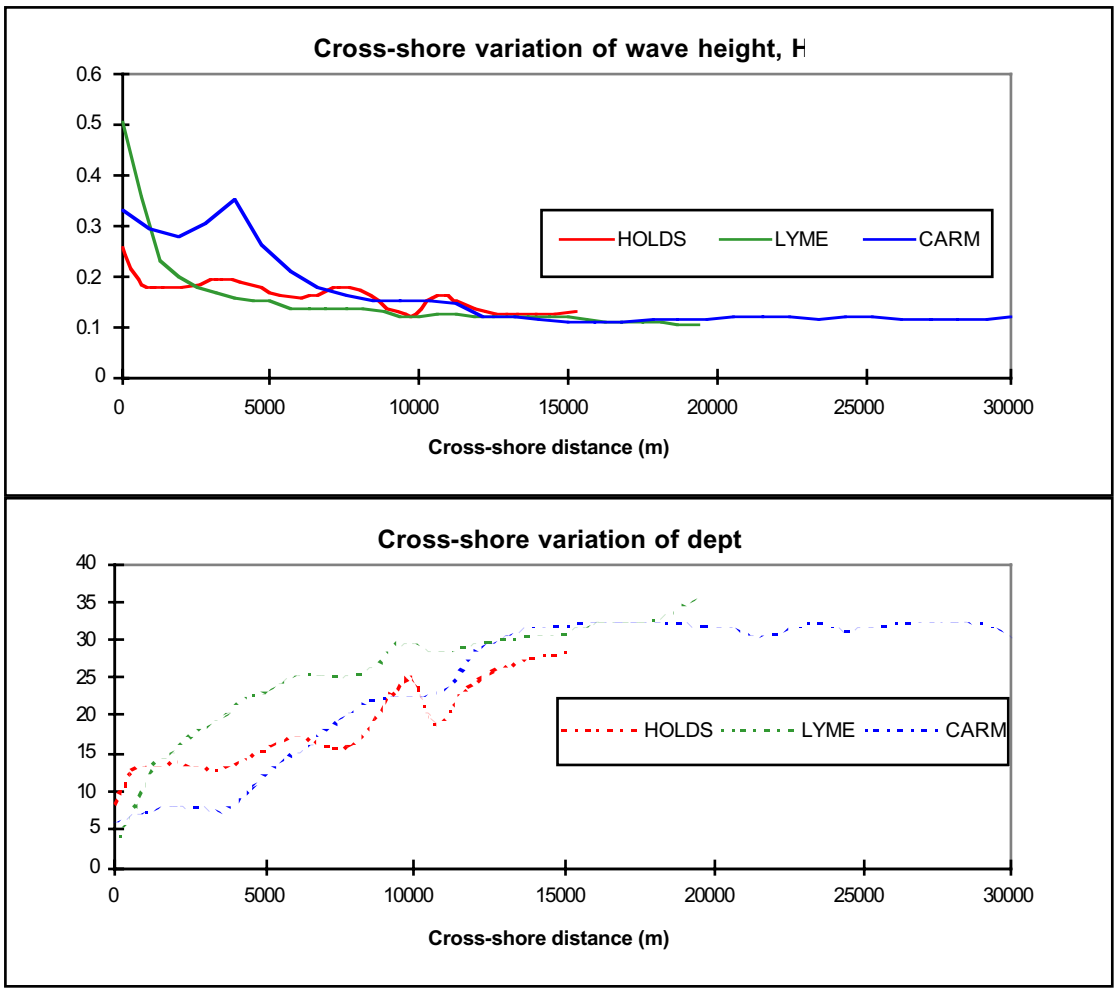

Figure 2: Cross-shore variation of wave height for 3 different models

The Lyme Bay model reaches a higher near-shore value of Hs/h than the other two models, due to its bottom slope configuration. Relatively deep water reaches close to the coast, compared to the other two sites. Carmarthen Bay, in particular has a large extent of shallow water inter-tidal flats. A 'rule-of-thumb' states that the waves should not exceed 0.4 of the water depth, however this may depend on the distance over which the waves can adjust to the bottom conditions. This is one of the questions we can investigate using the fine-grid SWAN models.

Observations

Data for West Bexington, Lyme Bay, St Gowan and Channel Light Vessel has been acquired from David Carter and David Cotton. The following data appears, from a first inspection, to be reasonable quality:

Station	Instrument	Dates	Longest continuous record
West Bexington	Bottom pressure gauge	Dec. 1994	1 month
Lyme Bay	UKMO	Apr-Aug 1994 Jan-Nov 1997	11 months (gaps)
Channel Light Vessel	UKMO	Sep-Dec 1992 1993-1996 (inc.) Jan-May 1997	3.5 years
St Gowan	SWR	1977-1983 (inc.)	7 years
St Gowan	UKMO	Sep-Oct 1992 Sep-Dec 1994 1995-1997 (inc.)	3 years

The conclusions so far are:

(i) The Holderness data already analysed at POL, will be used to validate the model. A useful cross-section from N3 to N1 is available. The model will be driven initially by observed waves at N3 and the output at N1 and N2 compared with the observed data at those stations. Tests will be made with varying water level and currents provided from the POL tide and surge model.

(ii) The Lyme Bay data is the most limited. In December 1994 a month of good nearshore data (from a bottom pressure sensor) was collected, during which waves reached 5m. This period is probably the best one on which to focus. Some wave and wind data is available simultaneously from the Channel Light Vessel, although in general the latter is rather far away to provide boundary conditions. An alternative would be to use another coarser grid wave model such as WAM on the continental shelf model grid, the WASA data set or the UKMO wave model.

(iii) The St Gowan data is long enough to derive some useful statistics. The station is also suitably located to provide the offshore boundary conditions for the Carmarthen Bay model. However, there does not appear to be any nearshore point within the model for validation. If the model is proved at Holderness, it may be possible to assume its validity for other coastal situations such as Lyme Bay and Carmarthen Bay, in which case these models can be used to examine the effects of other coastal configurations, such as exposure to larger waves and swell, stronger tidal currents and different bottom slope. The statistics derived from St Gowan should be useful in determining the range of offshore conditions which may be experienced and possibly any trends.