REPORT ON WAVE AND TIDE MEASUREMENTS

Compiled by Uwe Dornbusch. Edited by Cherith Moses

1 Aims

The aim of installing two wave recorders in the intertidal zone was to obtain continuous near shore wave and water level data to be used to correlate with beach survey data and to verify offshore-nearshore wave transformation formulae. The water level information is used to measure water level set up directly on type-sites and to calibrate surge models that will be used in Phase 2.

2 Summary

Two Dobie wave recorders have been installed permanently in the nearshore zone, one at Telscombe (October 2003) and one at Cooden Bay (February 2004). Both recorders have been working continuously. Data gaps that exist relate either to premature battery failure or difficulty in accessing the instruments due to environmental conditions. Maximum wave heights recorded are 2.1m at Cooden and 2.2m at Telscombe during periods when offshore wave heights were in excess of 6m at the Rustington buoy illustrating the wave dissipating function of the sandy foreshore at Cooden and the shore platform at Telscombe.

3 Introduction

Two Dobie wave recorders have been installed permanently on the English side of the BAR coast. They measure every 30min for the duration of ~7min the water level using a pressure transducer. The onboard computer calculates from these measurements the average water level and wave parameters like significant wave height, main spectral wave length, wave steepness etc.

Deployment of the first recorder took place in October 2003 (Telscombe), of the second in February 2004 (Cooden). Both recorders have been out uninterrupted except for occasional battery problems or inaccessibility due to unfavourable water levels.

4 Site selection

The site at Telscombe was selected to be representative for long stretches of the frontage from Brighton to Newhaven, encompassing three of the type-site beaches (Saltdean, Telscombe and Newhaven) that were to be surveyed regularly. Deployment took place in an

artificially dug hole to ensure the save anchorage of the recorder. The coordinates for the pressure transducer opening are x = 539146.931, y = 101391.797 and z = -1.482m OD (Figure 1). The vertical position is approximately at mean low water neaps which allows for an access-window of a few hours during spring tides even under surge and storm conditions. The recorder is 39m seawards of the beach toe and 80m seawards of the cliffs backing the beach.

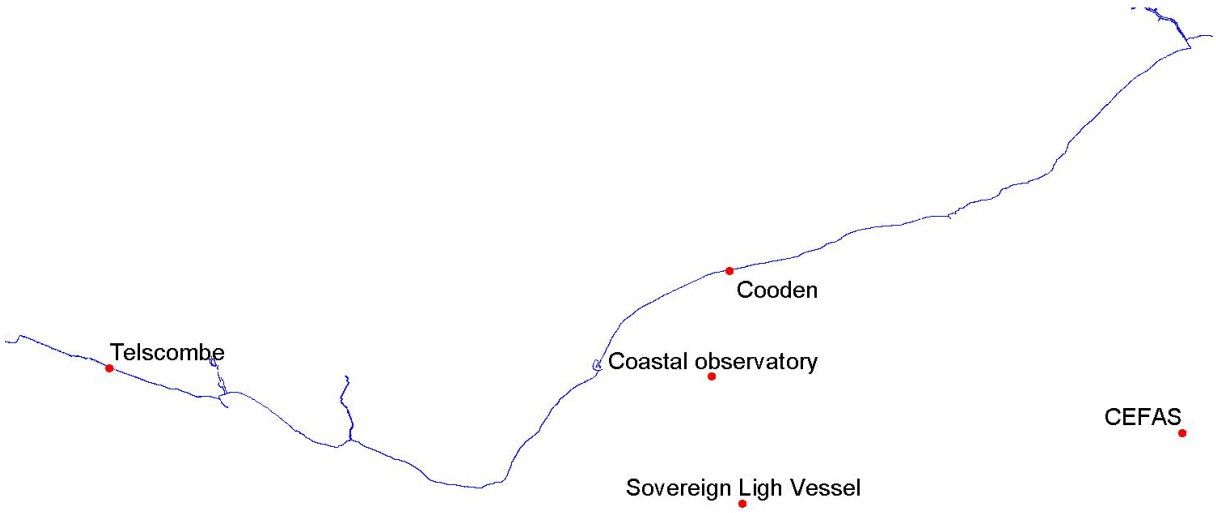

Figure 1: Position of the BAR wave recorders at Telscombe and Cooden in relation to other wave recorders along the East Sussex frontage between Brighton and the Rother mouth (Coastal Observatory, Soverign Light Vessel, CEFAS).

The site in Pevensey Bay was chosen as there are already 2 offshore buoys in the bay (Figure 1) so that together with the Cooden recorder they form an almost linear array that will allow the determination of shoaling effects as the waves move inshore. Due to problems of securing the recorder in the intertidal zone of the extensive sandy foreshore in Pevensey Bay the recorder had to be attached to a groyne. The terminal groyne at Cooden was the most suitable because it is in a good state of repair, reaches furthest seaward and is easily accessible from a road. The coordinates of the pressure transducer opening are x = 571224.380, y = 106372.617 and z = -1.397m OD. The recorder is secured to the end on the terminal groyne and is ~40m seawards of the beach toe. The end of the groyne is usually surrounded by water which, it was hoped, would prevent access by the public. However, as this water is usually connected to a runnel landward of a sand ridge, the altitudinal and positional fluctuation of the ridge has caused, in two instances, a delay in downloading data as the water level in the runnel had not receded sufficiently to allow access to the recorder.

5 Wave recorder settings

The DOBIE reorders are set to record every 30minutes for 2048 bursts at a sample interval of 0.2hz (ie for almost 7 minutes). The periods during which data has been recorded are shown in Figure 2.

6 Results

Due to the time necessary for the preparation of reports at the end of phase 1 of BAR, data analysis only occurred up to mid-November 2004 though the data collection is still continuing.

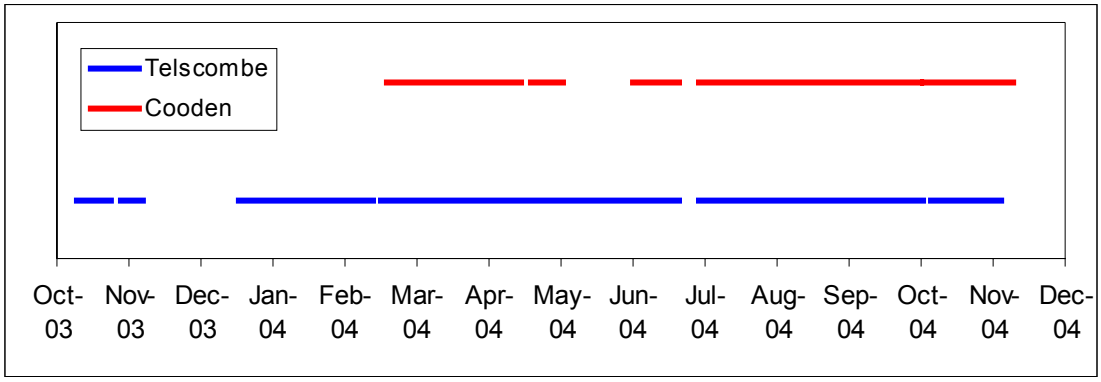

Figure 2: Periods for which data has been recorded. Gaps in recording are due to battery problems, temporary inaccessibility or maintenance.

6.1 Water levels

The only official tide gauge in the proximity is situated at the Newhaven harbour entrance which is at a distance of 6km to the site at Telscombe and 32km to the site at Cooden. Water levels are calculated for every 30 minutes for the DOBIE recorders and every 15 minutes at the Newhaven tide gauge.

As expected due to the close proximity of the recorders with the tide gauge, the tidal pattern is almost identical (Figure 3) with regard to heights and timing. Small differences in the timing would not be distinguishable due to the sampling interval of 30min for the Dobies and 15min for the Newhaven tide gauge. Figure 4 shows the difference in the water level of the recorders that coincided with the highest water level at Newhaven. On average, the high tide is 13cm higher at Telscombe and 42cm higher at Cooden. Variations around the average are due to atmospheric pressure variations (Figure 4), i.e. high atmospheric pressure increases the pressure on the sensor leading to the recording of higher water levels and therefore increased difference between the recorder and the tide gauge. These variations are only recorded with the pressure transducers of the recorders but not with the tide gauge.

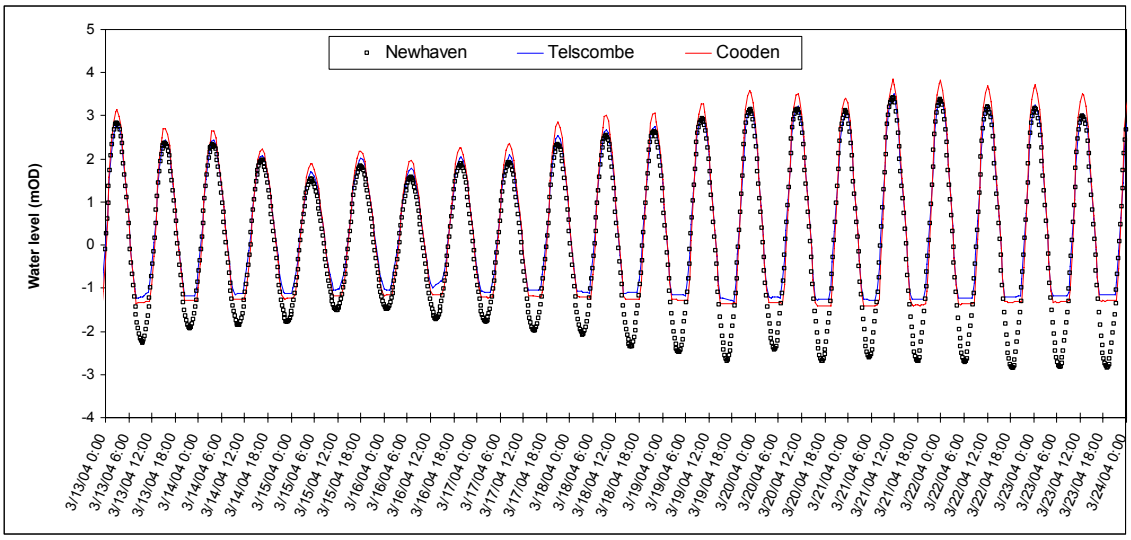

Figure 3: Example of tidal data from Newhaven, Telscombe and Cooden. Heights are converted to a common datum of mOD.

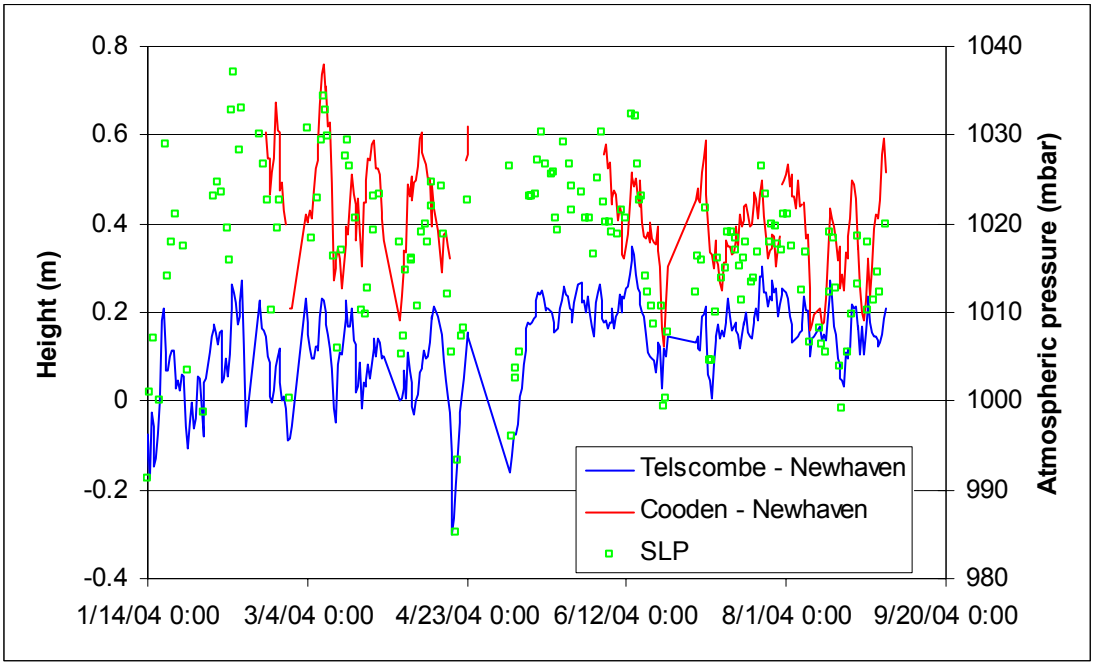

Figure 4: Example for the difference in the high tide level between the DOBIE recorders and the Newhaven tide gauge. Also shown is sea level pressure (SLP) as recorded at the Greenwich Light Ship.

6.2 Wave heights

Maximum wave heights recorded by the recorders are between 1.5 and 2.2m with higher wave heights generally recorded at Telscombe rather than Cooden (Figure 5). However, these maximum wave heights have most likely been in the form of breaking waves so that much of the wave energy has been spent before impacting on the beach.

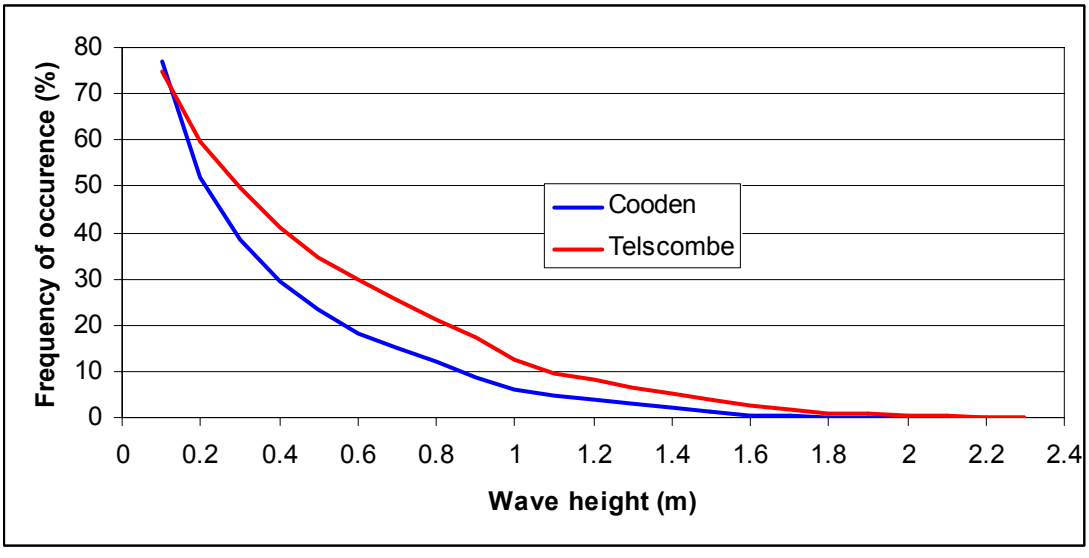

Figure 5: Frequency distribution of the highest waves during every tide. Differences between Cooden and Telscombe can be attributed to the different period of time during which the recorders operated.

7 Discussion

The wave recorders provide a near continuous record of nearshore wave conditions over a long time period. Maximum wave heights appear to be somewhat less than half the offshore wave heights but from observations in the field the highest waves are breaking waves indicating that wave attenuation has under storm conditions occurred to a large degree even seaward of the wave recorders. From first qualitative comparisons with changes in beach morphology it would appear as if the maximum wave heights have less influence on the geomorphology of the beach than medium size waves that actually break onto the beach.

8 Outlook for Phase 2 of BAR

Apart from continuous data collection during Phase 2 detailed analysis of the data will be carried out. This will include:

- analysis of the wave types associated with the higher waves (i.e. these are likely to be breaking waves) to assess whether the highest or maybe the intermediate waves will have the largest impact on the beach.
- corrections of water levels based on atmospheric pressure to identify wave set up and local surge components
- comparison with measured wave run-up heights to feed into wave run-up models
- analysis to model the inshore wave heights based on the waves and winds measured offshore.