Survey analysis for Newhaven

(this report has been written right up to the end of January and remains unfinished)

Though some surveys at Newhaven beach had been carried out in Phase 1, useful surveys have only been carried out since April 2005. Earlier surveys have to be disregarded because they either used profile lines that did not represent the curvature of the beach surface or because the survey did not reach sufficiently far towards low water so that significant portions of the beach remained un-surveyed.

The main problem posed for surveys at Newhaven beach is the fact that the beach toe along the eastern part reaches to below LAT. Surveys therefore can only be carried out at low water spring using waist-high waders. The subtidal profile – when it was surveyed – shows a step which, together with even light wave activity makes surveying the beach toe rather difficult at all times other than equinoxial tides and/or calm sea.

Introduction

Newhaven beach has formed since the mid 1880s when Newhaven breakwater was constructed through intercepting material travelling eastwards along the coast. From calculations using maps carried out during Phase it would appear as if the beach volume has remained stable since the middle of the last century, however, even the maps show that the beach orientation seems to have varied and it was the aim of BAR to survey the beach and to be able to link the changes of beach distribution in the longshore direction to the wave environment.

Method

The survey methodology used has been the same as outlined in Phase 1 reports. The accuracy of the survey method could be verified using a 'dynamic control' area. During each survey, the line between concrete slabs on the car park behind the beach was followed, sometimes twice (Figure 1). The range in the elevation is ~0.06m (see also Figure 2) with a distinctly higher area between 50 and 70m. The average of all measurements across the line during each survey shows variations less than ±0.01m (Figure 2) illustrating the accuracy of the survey set-up using the GPS on a wheel and recording in autotopo mode.

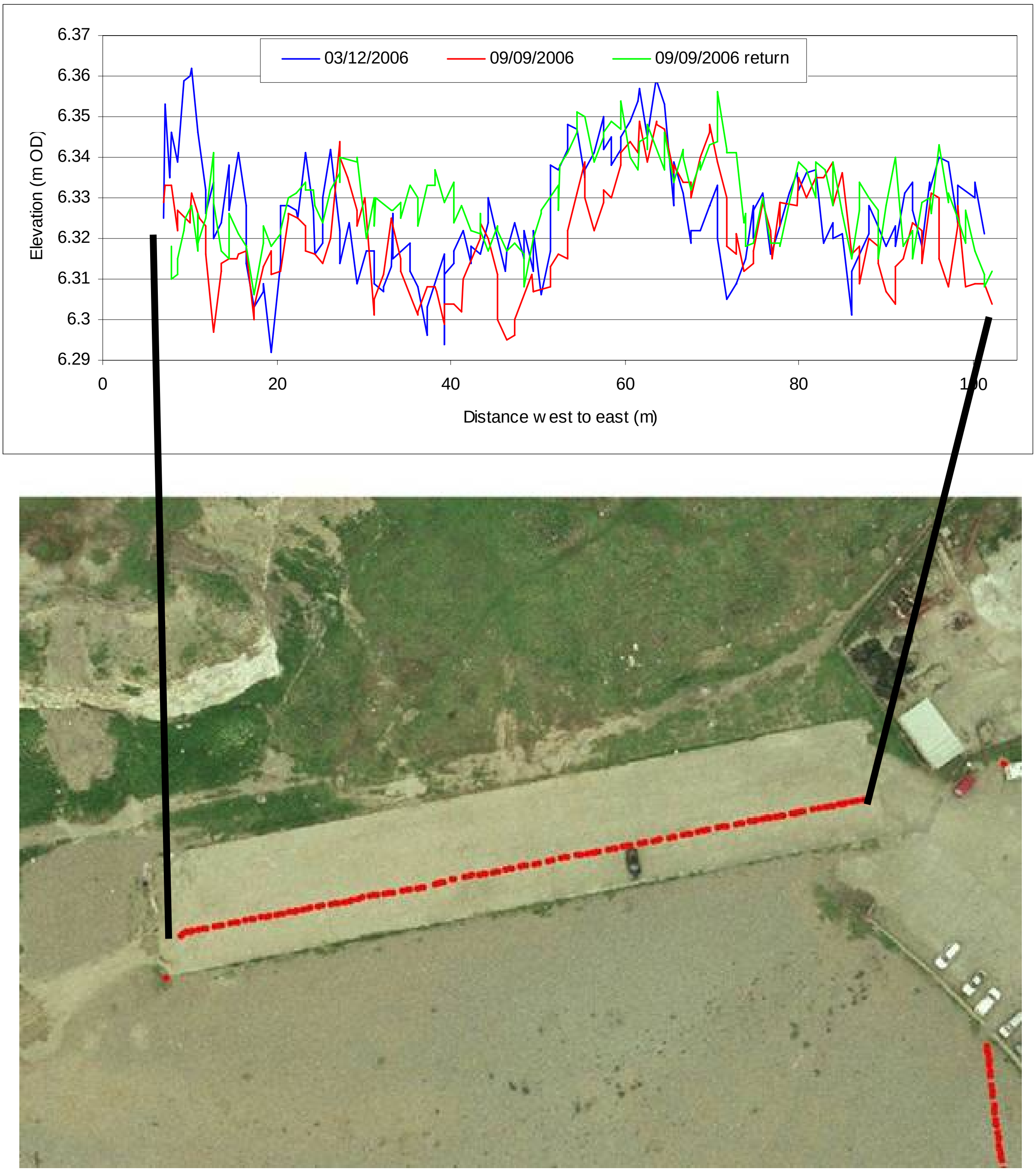

Figure 1: Location and elevation of ‘dynamic control’ area at the back of Newhaven Westbeach. Graph shows point elevations for surveys separated by several months and by ~20 minutes.

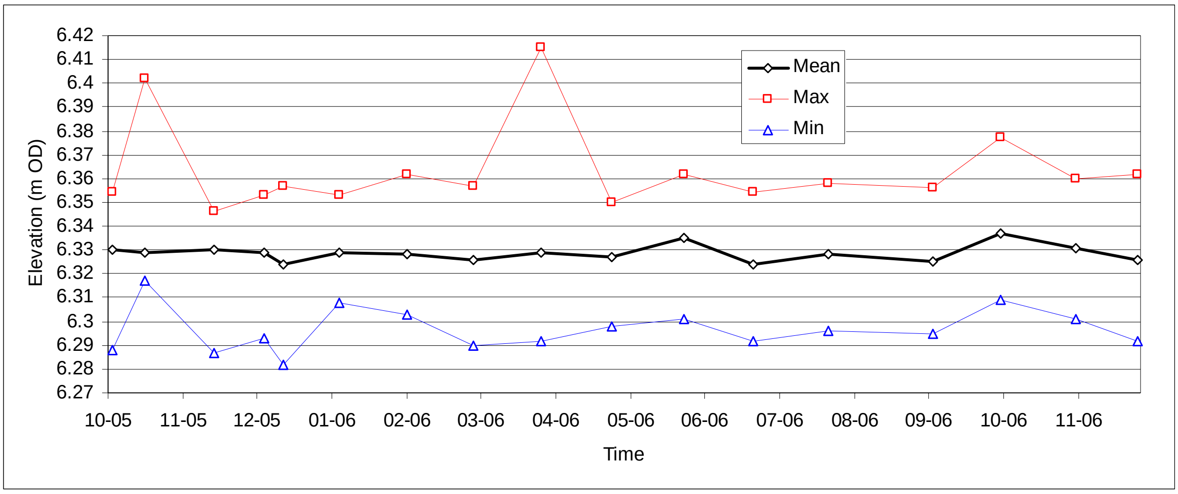

Figure 2: Mean, maximum and minimum values of the points recorded during each pass along the line shown in Figure 1.

Results

Newhaven Westbeach

Figure 3 shows for 25 surveys the average elevation above the minimum surface. The maximum elevation variation is 9cm. This is twice the range found at Saltdean. However, contrary to Saltdean, surveys of Newhaven beach did not always have the same extent due to the problems surveying the beach toe in the eastern part. This is illustrated by comparing the elevation with the maximum depths achieved during the surveys. Low elevations coincide with surveys that terminated above ~-3.5m. Those surveys that have been carried out to below –3.5m have a more comparable range of ~5cm, confirming results from the much smaller beach at Saltdean that if the whole beach can be surveyed total volume variations can be calculated with an accuracy corresponding to a surface elevation change of ~±0.02m.

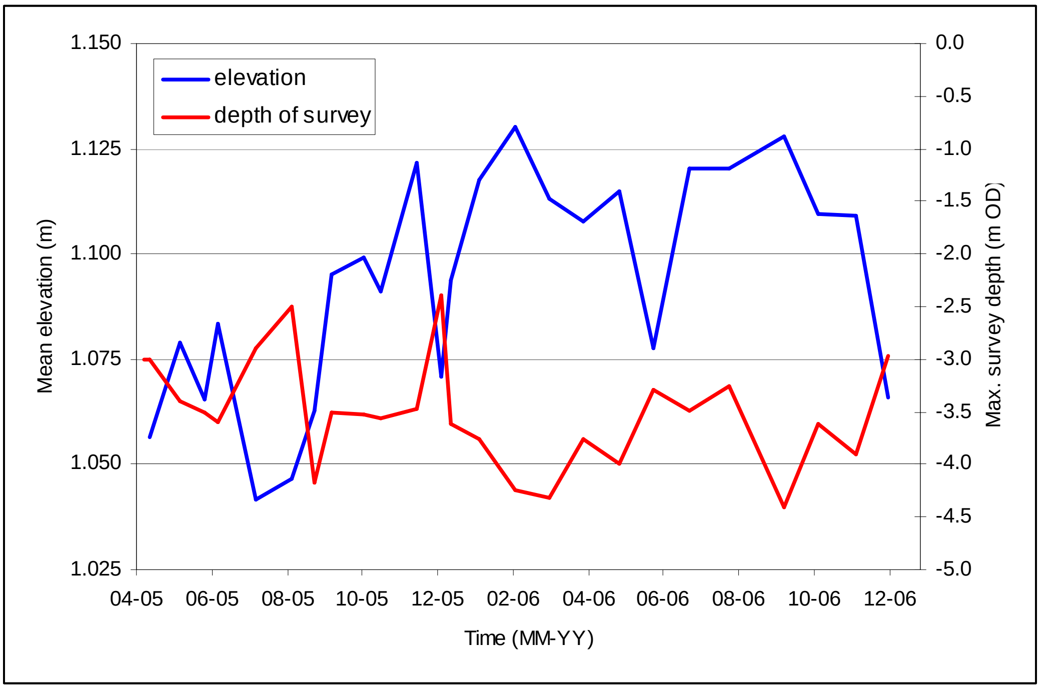

Figure 3: Times series plot of the average beach elevation above the minimum surface and the maximum depth achieved during each survey.

Figure 4 shows the configuration of the beach, the areas that have undergone change over the period of the surveys and also the range recorded. The maximum range with over 7m (almost the change between the beach toe and beach crest) has occurred next to the breakwater in cell 0. A second maximum of just over 5m has occurred under the cliffs towards the western end in cell 13. A notable minimum in the range of changes (only up to 2m) can be seen ~150m west of the breakwater across the beach in cell 3. The higher values towards the beach toe along the eastern half relates to the problems in surveying the beach toe mentioned above. The surface grids used are composites consisting of the surveyed surface plus a subsurface that is based on the lowest measurements. Where the beach toe could not be surveyed, the beach surface drops vertically down to this subsurface, creating an artificially high range.

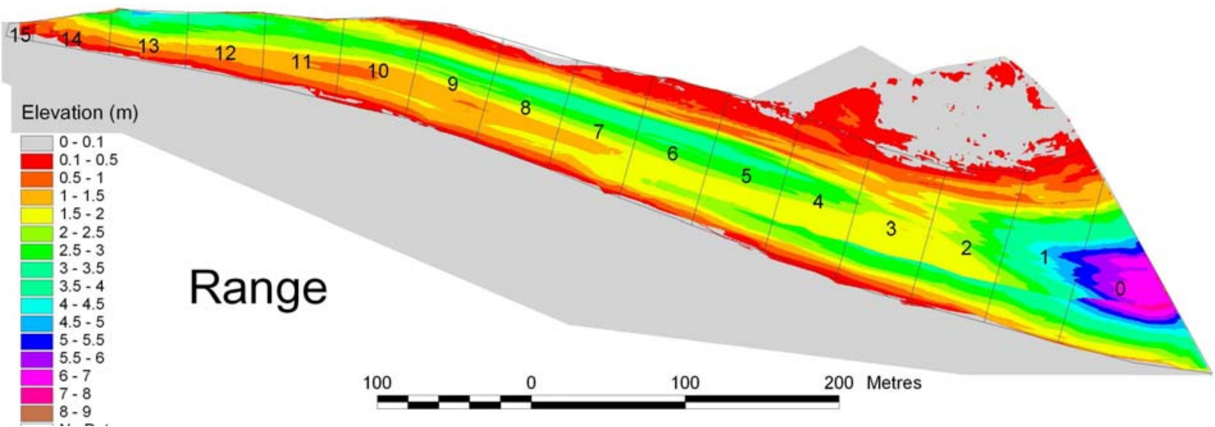

Figure 4: Overview over the area that has changed over the period of the surveys showing the elevation range recorded. Also shown are the beach cells 0-15 used in the later analysis.

Figure 5 shows the changes in beach volume above the minimum surface for each beach cell for each survey between 4th August 2003 and 3rd December 2006. The two extreme position during this period can be found on 3rd October 2005 and 3rd December 2006. The first shows the beach with its most eastward sediment distribution while the second shows the lowest beach volumes in the eastern part. The largest sediment movement event took place between 14th November and 5th December 2005 when cell 0 lost 11,000m³ and cell 1 6,000m³ (Figure 6, see also BAR Newsletter No 3)

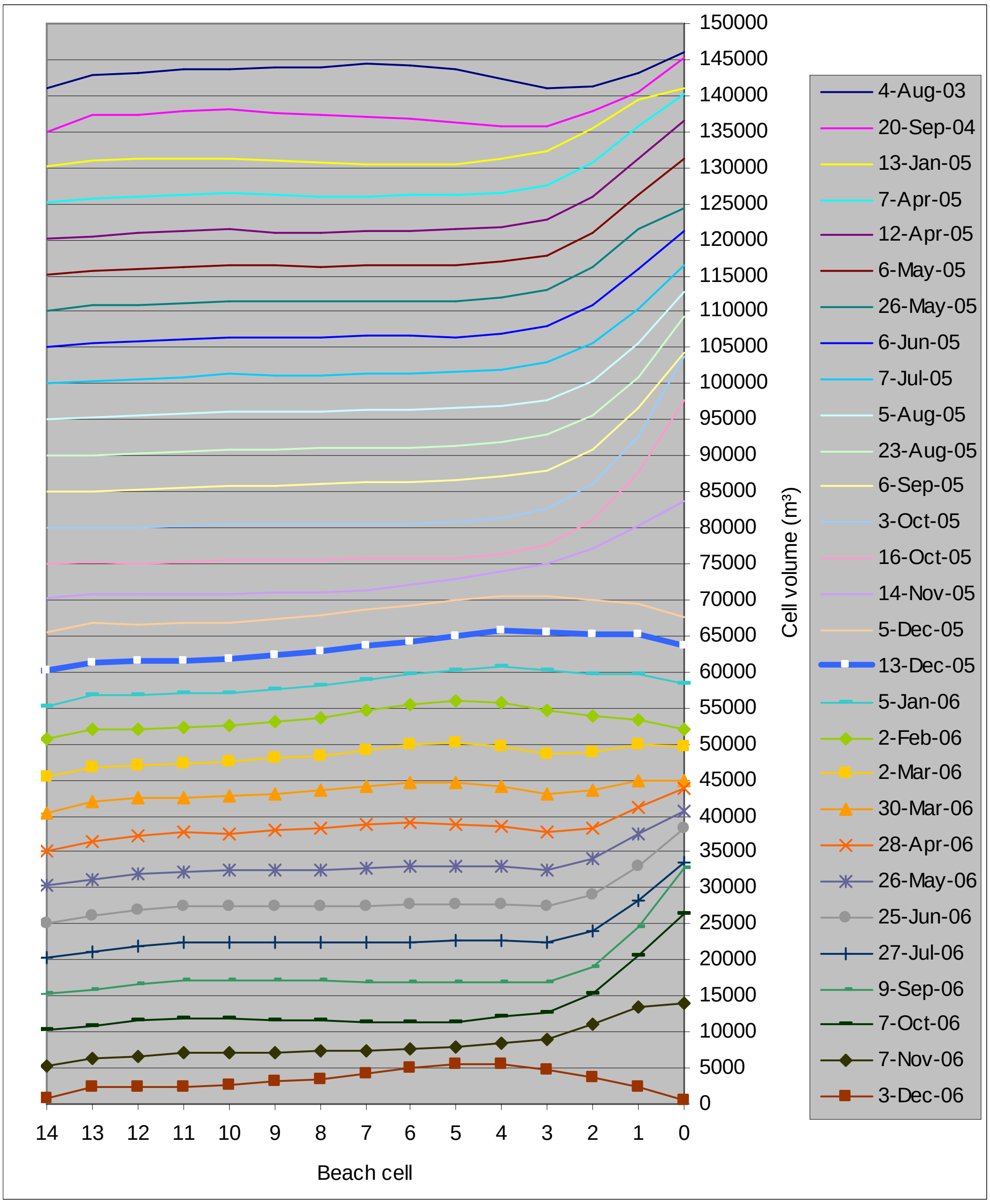

Figure 5: Volumes above the minimum surface in each beach cell. Subsequent surveys are offset by 5000m³ with level of the line in the legend corresponding to 0m³ for each survey.

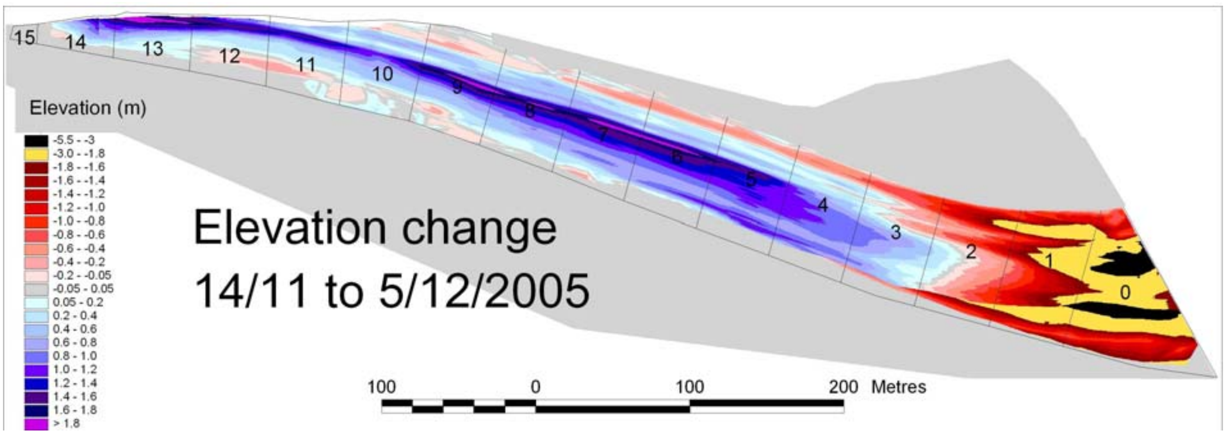

Figure 6: Maximum change event between 14th November and 5th December 2005 totaling material loss of 17,000m³ from cells 0 and 1.

Sand in the intertidal harbour basin

Since August 2005, two profile lines of >140m length have been surveyed across the intertidal sands of the harbour basin. The first profile runs from the bottom of the western access steps (Figure 7) in the direction of the lighthouse at the end of the harbour arm. At the seaward end the profile is set off towards the east by ~30m (30 paces) and the return is made in the direction of the eastern access steps.

Figure 7a shows the typical distribution of sand in the harbour with the highest levels reaches west of the steps. Due to the limited time available, only the two profile lines were surveyed subsequently (Figure 7b). The elevation range of the profiles is <0.2m for most of the profile but increases towards the seawall for the last 40m, reaching almost 1m at the bottom of the western access steps.

Figure 8 shows the profile evolution through time. The main changes happened around the middle profile between 75 and 100m where the convex profile from the autumn of 2005 has been replaced by a very straight profile for almost the entire period surveyed in 2006. However, more pronounced are the changes in the upper ~25m of the profile, especially between October 2005 and February 2006 (unfortunately, no profiles were recorded between October and January).

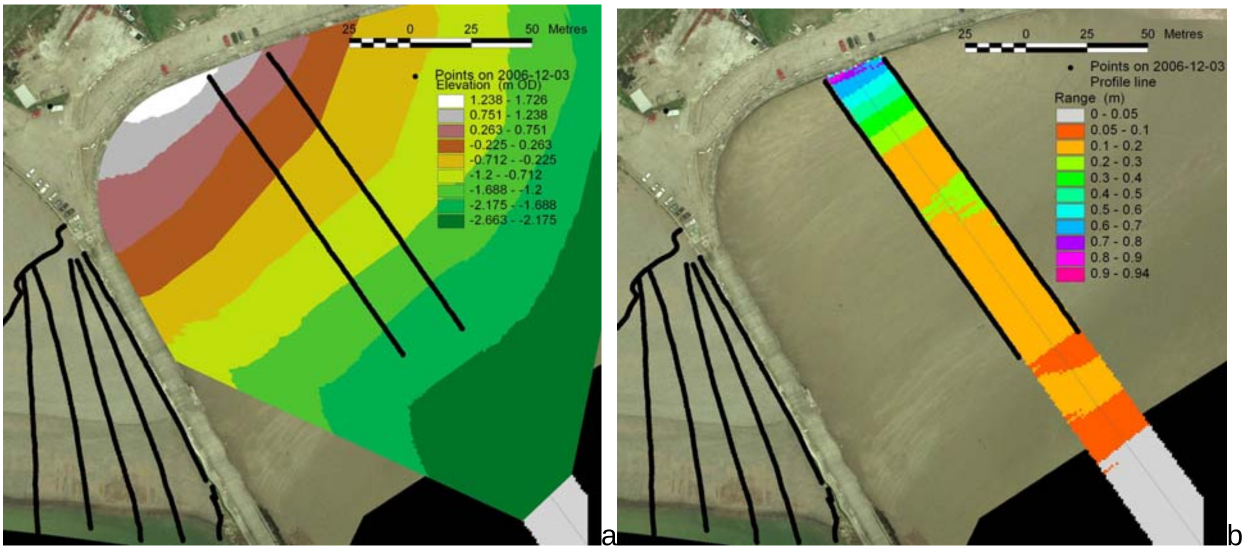

Figure 7: Location of sand surface at Newhaven. a) Surface based on survey on 23-08-2005 and showing points from survey on 03-12-2006 for reference. b) Elevation range on all surveys showing points from survey on 03-12-2006 for reference. Thin line in the middle is the profile line used for Figure 8.

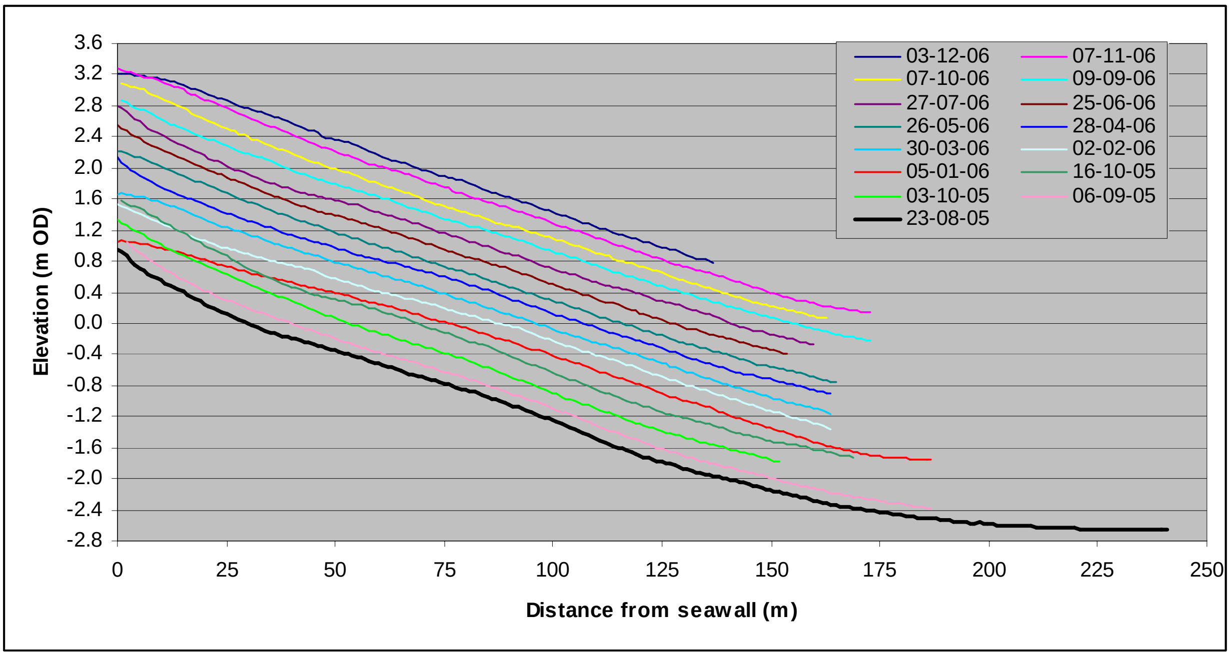

Figure 8: Stacked inertidal profiles of the sand surface in the Newhaven harbour basin. Profiles are 0.2m offset from each other.

It is increasingly acknowledged that intertidal sand levels in front of seawalls show significant elevation changes during one tidal cycle with little change observed at subsequent low tide surveys. The data collected from the sand surveys cannot contribute to this discussion but shows that the volume of sand in the harbour basin can be relatively stable over several months but than changes quite substantially from one month to another (Figure 9). However, the fact that the data is based only on narrow cross profile band rather than the whole basin should restrict this interpretation because it is possible that sand was only redistributed within the basin rather then that material actually entered or left the basin.

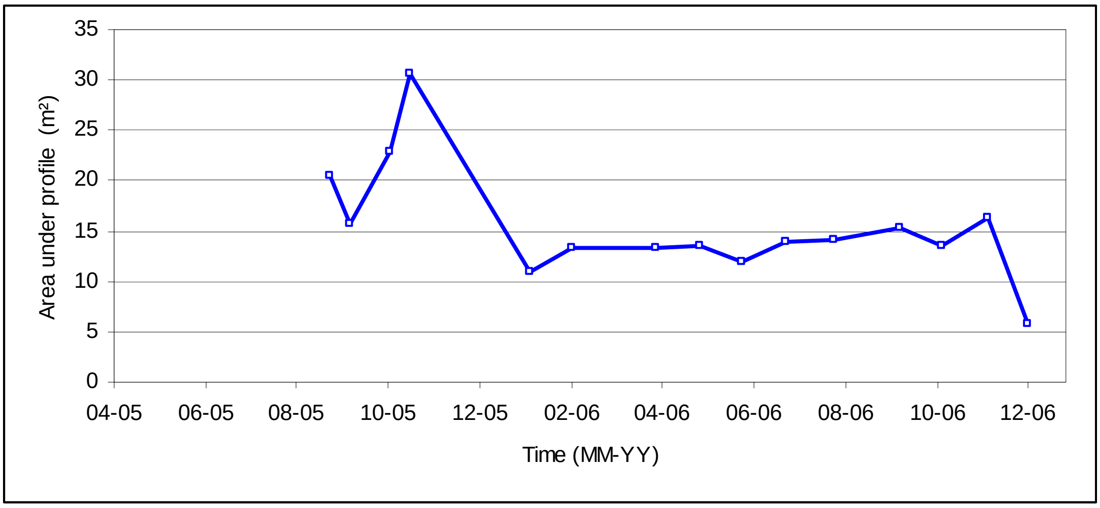

Figure 9: Area under each profile shown in Figure 8 between the seawall and 136m (limit of shortest profile) in relation to the lower boundary of the profile sweep zone.

30-01-2007 Uwe Dornbusch