



Short-term Shoreface Changes along a High-Energy Headland-Embayment Coast

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Abstract: A map of shoreface morphodynamic behaviour, from 2-23 m water depth, off Portstewart Strand, the north coast of Ireland, is presented. The map is generated in order to provide a spatial visualization of shoreface dynamics along a high-energy coastal segment from March to July 2005. The map indicates portions of the seafloor that have either eroded (shown in scales of red), remained unchanged (no color) or accreted (indicated in scales of grey). The change is in the vertical and provided in meters. The map clearly shows that the nearshore zone (2-5 m, O.D.) is the most dynamic, explained by the fact that this is where most energy is concentrated as waves approach and break. The ability to combine Geographical Information Systems (GIS), Global Positioning Systems (GPS) with periodic bathymetric surveys enhances our understanding of nearshore and shoreface morphodynamics.



1. Introduction

The shoreface can be defined as that area which extends from the surfzone to the inner-continental shelf. It is an area of the seafloor that remains poorly understood; its morphodynamic behavior is influenced by ocean waves, wind, tides, currents, surface sediments and underlying geology.

Current modeling of large-scale coastal behavior is useful in identifying possible sea-level scenarios, but is currently inadequate in predicting the complex relationship between geologic, meteorologic and hydrodynamic relationships (Cowell and Thom, 1994; Stive and deVriend, 1995). This investigation is attempting to determine how the Portstewart Strand shoreface responds to different wind and wave dynamics.

2. Methods

The map was generated from shore oblique single-beam echo-sounding surveys (Valeport Ltd.) conducted from 1-23 m water depth (O.D. Belfast) with a survey line spacing of 150 m. The echosounding equipment has a 6 Hz frequency for depth (accuracy 0.10 m) and 1 Hz frequency for position (2-3 m). The raw x,y,z data (latitude, longitude and depth) was filtered for anomalies, corrected for tides (15 minute tide data provided by the British Oceanographic Data Centre) and converted into Irish Grid utilizing Belfast Ordnance Datum (Belfast O.D.), or approximately mean sea level, as our vertical control. The point data were stored as a Triangulation of Irregular Network (TIN) and subsequently converted into a grid, with a cell spacing of 8 m. In order to assess change from one survey to the next, the July 2005 grid was subtracted from the March 2005 grid.

3. Discussion and Conclusions

It is clear that the nearshore zone (1-5 m depth) is the most active (due to wave related stress). Minor to no change takes place from 5-20 m (an area of deep water with abundant sand). Some change is observed from 20-23 m water depth (the outer limits of the surveyed area), and is explained by

rocky outcrops that are periodically covered and uncovered by sand. Empirical data i.e., real time surveying, instead of modeling, provides a better method of assessing the impacts of coastal storms and resulting morphologic response for each particular beach under investigation.

Bathymetric surveys, coupled with GIS and GPS, allows for an effective method of analyzing and presenting the morphologic behavior of shorefaces for different time periods, as well as assessing areas of accretion and deposition from one survey to the next - critical information for any coastal manager. This method provides a relatively fast and easy way of determining coastal areas that might be susceptible to sea-level rise, storm events and human-induced changes in sand-supply.

Software

Latitude, longitude and depth data was converted into Irish Grid format using Grid InQuest (Version 6.0). The point data were imported into ESRI ArcView 3.2 and converted into a grid for further manipulation and map generation.

References

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