Coastal Erosion from Space

1999

2011

2015

Coastal Erosion time series in Happisburgh (GB)

Coastal Erosion events:

in Nerja (Spain)

in Kilkee (Ireland)

in St Laurent mouth (Canada)

In-situ information for validation – UK

Ref: SO-TR-ARG-003-055-009-PVP-A8

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Applicable and reference documents

Id	Description	Reference
AD-1	Product Validation Plan	SO-TR-ARG-003-055-009-PVP

Contents

1   Introduction

The United Kingdom includes the island of Great Britain, the north-eastern part of the island of Ireland, and many smaller islands. The coastline has a length of 12,459 km, giving it the 16th longest coastline in the world. Out of this length, 2,500 km are at risk of flooding or coastal erosion, putting 4 million people at risk of coastal flooding and £10 bn of assets. Only in England, it is estimated that by 2100, 1,600 km of major roads, 650 km of railway line, 92 railway stations and 55 historic landfill sites are at risk of coastal flooding or erosion.

2   Perranporth

Perranporth study area is a wide 3km long beach backed by rock cliffs and sand hills, it is a low-tide bar/rip beach type. Among the sedimentation process identified, we count an aeolian transportation of sand from backing dunes to the beach, a supply in mine waste material via the river and the beach system is dominated by cross-shore surf zone driven sediment transport and shore-normal waves.

7-year morphological cycle, fully accreted beach mid-2006, significant erosion during 2006/2007 winter (-165 m^3/m) and alongshore volume standard deviation increasing throughout the beach section (reaching $\sigma = 54$ m^3/m during spring 2008) and development of large-scale three-dimensional sandbar morphology within the low- and sub-tidal regions. Between spring 2008 and autumn 2012 beach recovery/accretion. Intertidal beach volumes recovered to 2006 reference level by late 2010 (3-year sequence) and reached a volume maximum of 12 m^3/m by autumn 2012.

Erosional event during 2013/14 winter, severely depleted beach by spring 2014 (– 243 m^3/m), representing intertidal erosion of 223 m^3/m. Then annual recovery behaviour (+ 112 m^3/m). Due to the extreme level of erosion, by the onset of the 2014/15 winter season only 50% of the pre-storm intertidal volume was recovered.

North and South sections may have different behaviour in term of speed of change. The storm epoch (2011–2016) is characterized by large erosion rates in the South (-150 m^3/m) and lower rates in the North (-50 m^3/m). By contrast, the recovery period (2016–2018) presents larger accretion rates in the South sector of the embayment (300 m^3/m) compared to the North (170 m^3/m).

3   Start Bay

Start Bay area is a semi-exposed 4-km coast with a reflective gravel beach with a rotational behaviour: erosion in the southern and middle beach with hotspots occurring in the south. In the northern end of the embayment, high levels of accretion are observed. But, from historical data analysis, the total budget is relatively stable over the last century.

Long-term net erosion rates are low, with a best estimate over 100 years of 0.1m/year for the centre of the Bay.

The Bay present a quick respond to short-term high-energy storm events/sequences as the embayment reversed the longer-term rotational trend.

During 2000/2001 winter, a series of storms caused the loss of 5m over a length of 1000m. During 2013/2014 storm event, significant sediment was lost.

4   Kent

The area of interest is composed by an extensive dune system behind a sand and shingle beach under a longshore drift from south to north. The annual sediment transport rates are high but decrease towards the north as the foreshore becomes higher and wave energy and incident angle are reduced.

Beginning in 2017, sea flooding protection for 7 km frontage including annual beach recycling works and construction of rock groynes.

DATE	LOCATION	DESCRIPTION	REPAIR WORK
1949 PRESENT	OLDSTAIRS BAY	EROSION OF SHORELINE BY APPROXIMATELY 100M	CONTROL AND MAINTENANCE STRUCTURES IMPLEMENTED INCLUDING GROYNES, A SEAWALL AND BEACH RENOURISHMENT
JAN 1990	KINGSDOWN	LOSS OF UP TO 20,000M³ OF BEACH MATERIAL	
OCT 1996	KINGSDOWN	1M DROP IN HEIGHT OF BEACH AT SEAWALL	EMERGENCY WORK TO INCREASE PROTECTION AGAINST WAVE SCOUR
2003	KINGSDOWN	APPROX. 50M OF SEA WALL DAMAGED, SEA WALL UNDERMINED.	WALL REPAIRED, BEACH RECHARGE
DEC 2006	DEAL AND KINGSDOWN	LOSS OF ~11,000M³ OF BEACH MATERIAL	
2013/ 2014	OLDSTAIRS BAY, KINGSDOWN, WELLINGTON PARADE	12,000M3 BEACH MATERIAL LOST. COLLAPSED SEA WALL, BEACH LEVEL DROPPED BY 2.4M AT KINGSDOWN	BEACH, PROMENADE AND GROYNE WORKS

Deal has a tidal range of 2.9m during mean neap tides and up to 5.4m during mean spring tides.

5   Spurn Head to Hunstanton

This area contains two main features, first the Humber estuary and the Wash.

The estuary is about 60 km long and its width varies about 13km at the mouth to 1.5 km. It has the second-highest tidal range in Britain, 7.2m. Net longshore sediment transport is from north to south.

Strong tidal flows intersect the north-south sediment transport pathway along the open coast, limiting the entry of gravels and sands into the estuary mouth.

An accretion phase characterized the period between 1851 and 1936, and since 1936 the trend is more about erosion and sediment loss. From 1850 to present, the estuary has maintained a dynamic equilibrium with sedimentation keeping balancing the sea level change. Local erosion is governed principally by local current speed and intensity of wave action. Dynamic bathymetric morphology (1976-2000).

The low-lying Lincolnshire coast, south of the Humber, is characterized by sandy beaches and saltmarshes. Offshore sand banks are present from Donna Nook to Mablethorpe, and not only protect the shore against wave attack, but also provide a source of sand to the beaches which are up to 3.5 km wide and backed by dunes.

Retreating sectors account for ~50.1 km out of 98.5 km (50.8%) of the 391 coastline, whereas naturally accreting sectors extend for ~25.4 km (25.8%) and artificially 392 (nourished) accreting or stable sectors represent ~23 km (23.4%). Holderness cliffs retreated -28 m between mid-1990 and 2010, but changes along this stretch of the coast varied from cliff retreat (erosion) of -89.8 m to an advance (accretion) of +36.9 m at the P127 profile near Spurn Head between 1997 and 2010.

Along the Lincolnshire coast, coastline change (1994-2010) varied from retreat of -11.3 m to an accretion of +191.3 m due to saltmarshes extension. Further south, changes range from 413 -2.9 m to +54.6 m between 1994 414 and 2010.

The volume of sediment incorporated into the accreting beaches represents around 29% of that eroded from the Holderness cliffs. Erosion on sandy beaches is often an outcome of storm surges.

In the north-western part of The Wash, at Gibraltar Point, the coast is dune-fringed, and on the eastern edge, a gravel storm beach ridge up to 6 m higher than the adjacent sandflat stretches 11 km south from Hunstanton. The present-day Wash has an area of about 670 km and an average depth of less than 10 m.

The large-scale land-claims have reduced the tidal prism of The Wash causing a loss of tidal energy within the embayment.

6 Chesil Beach

Chesil Beach is a linear, pebble and cobble storm beach. A continuous supply of material no longer exists. Shoreline transport is regulated by landslide activity occurring at the main headlands of Golden Cap and Doghouse Hill.

The present-day volume of Chesil Beach is estimated at 15 to 60 million m^3.

There were brief periods of erosion, as for example between 1961 and 1964. Patterns of accretion immediately east of the pier at West Bay in about 1982, to erosion, which resulted in retreat at mean high-water level by 40 m by March 1990.

Storm event of 2013/2014, for Chesil protected, -36m^3/m, for natural -124 m^3/m.

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