# UK Beach Classification: Type, Hazard and Risk

**T. Scott† P. Russell†, G. Masselink∞, A. Wooler§, and A. Short‡**
† School of Earth, Ocean and Environmental Sciences, University of Plymouth, PL4 8AA UK
∞ School of Geography, University of Plymouth, PL4 8AAUK
§ Royal National Lifeboat Institution (RNLI), West Quay Road, BH15 1HZUK
‡ Coastal Studies Unit, University of Sydney, NSW 2006, Australia

Due to its location and geological setting, the UK possesses a very broad spectrum of beach environments around its more recreational appeal, providing pivotal support to the tourism industry in many regions. However, the beach environment is inherently hazardous and exposes people to risk. To understand and manage this risk, a comprehensive understanding of UK beach environments and their associated hazards is needed.


**Figure 1:**
**Image 1.** Spekes Mill Mouth, N. Devon (Shingle-HW/Sand-Intertidal).
**Image 2.** Seaton Beach, S. Devon (Shingle/Boulder)
**Image 3.** Sennen Cove, W. Cornwall (Sand only).

## UK coastal environment

As one of the most diverse coastlines in the world, the UK coastal environment is heavily controlled by the large variety of geological and hydrodynamic settings seen around its coastline. The highly variable pattern of geological outcrops along the UK coastline plays a fundamental role in controlling the shape and characteristics of the coastal topography through rock resistance (Figure 2).

The geological setting of these beach environments includes high hard-rock cliffs, low soft-rocks cliffs, embayed coves and open ocean beaches, river mouths, tidal inlets, estuaries, spits and barriers.

Beach sediments range from fine sand to boulders, and gravel beaches are particularly well represented in the UK due to its glacial history (Figure 1). The UK also experiences a multitude of hydrodynamic regimes around its shores charcterised by Mean Spring tide Ranges (MSR) of 1.5-15 m, and a wave climate gradient from exposed ocean swell to fully protected wind-wave environments where 10% exceedence significant wave heights vary from <0.5m in sheltered limited fetch areas to >5m on some exposed west coast regions (Figure 3). Wind, wave and tidal processes produce dynamic nearshore current systems that play an important part in forming the wide range of beach morphodynamic states that exist around the UK within a wide spectrum of beach environments.

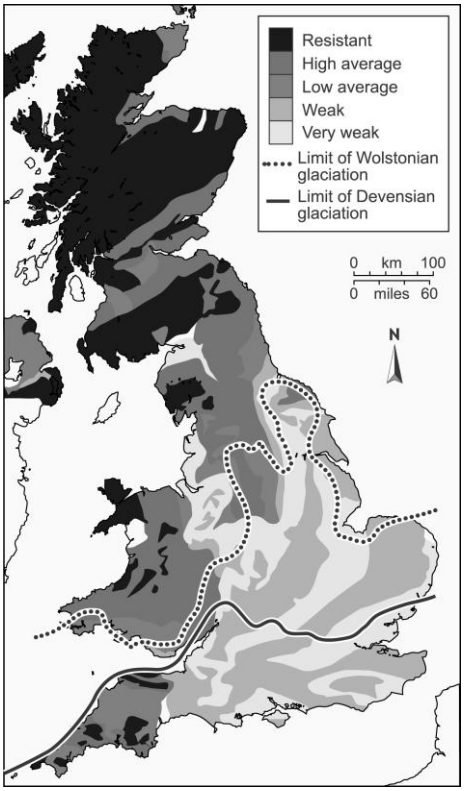
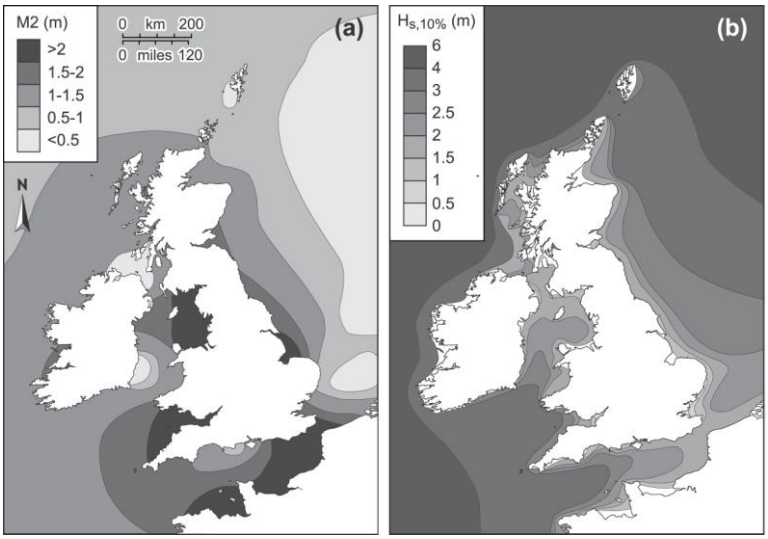



**Figure 2:** Plot illustrating the resistance of geology around the UK




With high population density in coastal areas, human modification is a significant feature around the UK beaches and has acted to alter beach shape and hydrodynamics through the implementation of groynes, breakwaters and sea walls. The total length of man-made coastal protection in England documented by MAFF in 1995 was 860km of a total coastline 3763km in length.

**Figure 3: (a)** Variation of M2 tidal constituent around the UK coast, **(b)** Variation in $H_{s10\%}$ around the UK coast.

## Lifeguarding and hazards

The beach is a highly dynamic environment, with constantly changing morphology and hydrodynamics, both spatially and temporally. Due to this, it is an inherently hazardous place for humans in many ways. Historically, beach hazards have been addressed in terms of the vulnerability of coastal areas to damage, often financially with regard to loss of property or infrastructure. Since the late 1980's, interest within the scientific community for developing understanding of hazards and risk to the beach user has grown and the application of our improved knowledge of beach dynamics to the public domain and safety has begun. Nearshore currents such as rip current have long since been documented as significant hazards to beach users swimming in the surf zone (figure 4). Lascody in 1998 stated that in Florida, rip currents, on average, result in more deaths in than hurricanes, tropical storms, lightning and tornadoes combined and in the UK the significance of beach hazard have been considered serious enough for lifeguard provision to be deemed necessary around the nations coasts for the past 50 years.

Therefore, the attention of the scientific community to this application of knowledge is long overdue. With increased professionalism within the lifeguarding community and availability of advanced remotely sensed data of the coastal environment, a higher quality dataset of the state of beach risk is becoming available. Risk to the beach user entering the coastal/beach environment become a product of the physical hazards present within the surf and nearshore zone and their severity, and the number of beach users interacting with the beach system. Identification of these hazards is site specific and varies depending on a number of environmental factors.

**Figure 4:** Photo of Perranpoth, Cornwall, UK. Illustrates the low tide bar/rip systems that presents some of the greatest hazards to beach users in the UK.

## Project objectives

The objectives of this research project are:

- to develop a comprehensive beach and hazard database for the UK and Ireland
- generate a hazard referenced UK beach classification
- and contribute to the advancement of an applied beach risk assessment model
- to advance the scientific understanding of UK rip current systems and investigate their driving dynamics in the context of risk to the beach user.

**Beach and Hazards Database:** Generated through a program of data collection of UK beach types and hydrodynamic conditions, the development of a comprehensive, standardised and scientific information base of all UK beaches (UK Beach and Hazard Database), based on their location, physical characteristics, access, facilities, usage, rescues, physical hazards, and level of public risk under various wave, tide and weather conditions will form a database that will act as a source of base line information that, supports further investigation into a hazard referenced UK beach classification and underpins an applied beach risk assessment model.

**UK Beach Classification:** A selection of sites representing a wide spectrum of tidal, wave and morphodynamic settings throughout the UK will be subjected to a detailed investigation to improve understanding of various specific physical hazards highlighted in the UK Beach and Hazards Database; to develop a hazard referenced UK Beach Classification System, building and expanding on earlier work in the 80's and 90's by Masselink and Short in Australia (figure 5). The new classification system will aim to provide an improved representation of UK beaches that integrates beach hazard indicators and encompasses high energy macrotidal and mixed wave environments, shingle beaches, coastal defense and beach structures, throughout a variety of sedimentary and geological settings that are not at present represented in the development of the previous Australian beach state models.

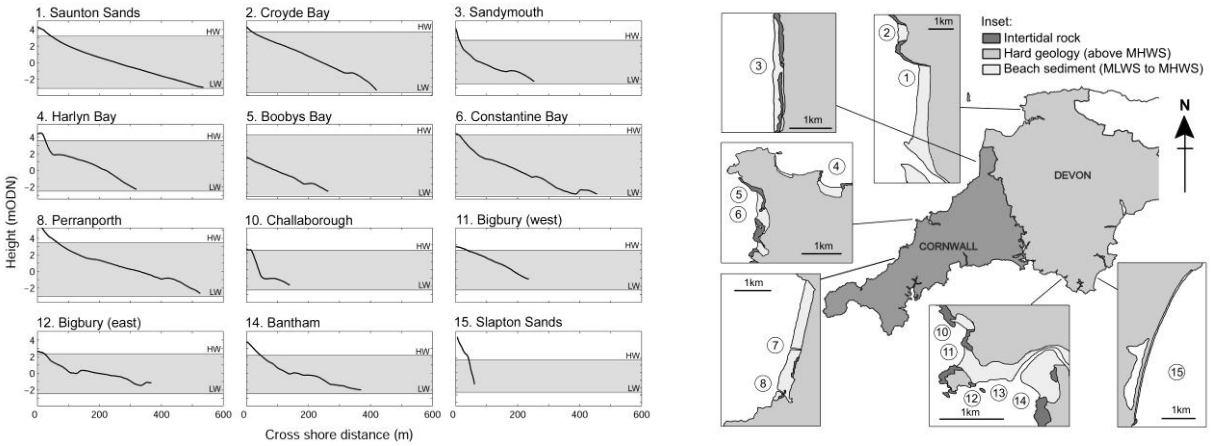



**Figure 5:** Summary of cross shore profiles and tide ranges at selected locations around Devon and Cornwall (height measured in meters above Ordnance Datum Newlyn), and schematic plan views of each site indicating beach shape, aspect of the coast and intertidal geology.

**Beach risk assessment model:** Contribute to the ongoing advancement of a risk assessment model for UK beaches, for use by the RNLI (Royal National Lifeboat Institution) through rollout to new beaches and development of ongoing beach safety ratings.


**Figure 6:** Two sets of panoramic photographs illustrating the dynamic nature of some of the higher energy UK coastline, highlighting the complex problems in classifying the coast (**above left:** Chapel Porth, Cornwall, **above right:** Sandymouth, Cornwall).