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Ground-based techniques for imaging coastal change

M.R. James, I.W. Marshall, S. Ilic, and P. Bannon
Lancaster Environment Centre, Lancaster University, Lancaster, United Kingdom (m.james@lancs.ac.uk)

Due to their spatial extents and diverse environmental conditions, coastal areas provide challenging environments for measurements of change sufficient to enable process understanding. Data covering suitable spatial extents can be readily provided by aerial or space-based techniques but important processes operate over timescales much shorter than can be assessed with usual overflight frequencies. Here, we assess a range of ground-based imaging techniques for measuring coastal change in Morecambe Bay, U.K..

Morecambe Bay is a highly dynamic macrotidal environment, with several shifting fluvial and tidal channels in intensively reworked sands, silts and muds, and with areas of both coastal deposition and erosion. Over the last few decades, whilst there has been deposition along parts of the northwestern segment of the coast, eastern areas have been undergoing severe erosion and flooding. Furthermore, there is recent evidence that these erosional processes are accelerating, with cliff deterioration and the appearance of Devensian glaciogenic deposits once buried under post glacial alluvia.

Little is known about the complex interplay of natural and human processes responsible for change in environments like Morecambe Bay, due to the wide range of temporal and spatial scales applicable. Hence, an integrated measurement approach is required in order to resolve the complexities involved. We report results from a combination of remotely captured time-lapse imagery (hourly), digital photographs obtained on foot (weekly) and laser scanner data obtained at multi-month intervals. The use of image-based techniques allows appropriate ranges of both spatial and temporal scales (from centimetres to hundreds of metres, over hours and longer) to be covered and, importantly, the smaller scale changes are recorded along with the wider context. An initial methodology for combining such data, and the analysis techniques employed, will be discussed.

As an example, indicators of change such as the gradual exhumation of bedrock as sand is lost, are captured qualitatively in digital photographs. The changes can be then quantified by combining this information with dimensional data obtained either by laser scanner or dGPS. With the imagery highlighting points of interest, the collection of detailed topographic data can be optimised into the most appropriate areas and hence efficiently completed with significantly reduced time cost.