Geophysical Research Abstracts
Vol. 17, EGU2015-12191, 2015
EGU General Assembly 2015

The perfect storm: Unusual synchronisation of the components of wave energy spectra dominates episodic soft-cliff erosion.

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Between December 2013 and February 2014 the United Kingdom experienced the stormiest winter on record. The persistent low pressure systems arriving from the North Atlantic during this period resulted in some of the most energetic maritime conditions ever recorded along the English Channel. The unprotected soft cliffs which comprise the south west Isle of Wight coastline were highly exposed to these conditions, facing the full force of extreme sea-levels and significant wave heights. Although long term rates of soft-cliff erosion have previously been defined for this coastline, the role of such extreme forcings on rates of soft-cliff erosion has not previously been document, and is therefore relatively poorly understood.
We employed pre-event LIDAR and post-event RTK-GPS shoreline surveys in tandem with hourly sea-levels and significant wave height records from the English Channel to build an unprecedented data set that we use here to determine the response of this soft-cliff coastline to the extreme forcings of the 2013/2014 winter. It was found that the between October 2013 and March 2014, the south west Isle of Wight eroded, on average 4.25 m (σ = 3.6m). Such a high degree of erosion is approximately a factor of nine times greater than the long term average retreat rate of $\sim$0.5 m/yr for this coastline and is the largest recorded erosion event since the start of reliable records began. The extreme erosion observed is shown to be a result of the synchronisation between sea-levels and wave heights. Indeed, we show that a 7-hour lag of the wave height record relative to background sea-level would have resulted in only half (2.1 m) of the observed erosion. An analysis of the historical record implies that previous extreme erosion events were a function of similar synchronisation between sea-levels and wave heights, thus it is likely that future changes in the timing of peak sea-levels and wave heights have the potential to outweigh changes in magnitude in terms of defining future rates of extreme soft-cliff erosion.