Storm Wave Inundation of Uplifted Marine Terraces

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# ABSTRACT

Storm wave inundation of shore platforms and marine terraces is an important driver of erosion. On tectonic coastlines, where shore platforms have been uplifted to present as the youngest in a sequence of marine terraces, (in)frequent access by storm waves can contribute to terrace removal. However, the frequency and ability of wave action to remove terraces remains uncertain in numerical models of terrace construction and destruction. Here, two case study sites are used as examples of how storm-elevated water levels can interact with terraces in one of three ways: accessing and potentially eroding the terrace riser; overtopping, where water height exceeds the height of the terrace; or inundating, where the terrace surface is flooded. Kaikōura Peninsula was uplifted in 2016 creating a new supratidal terrace that is subjected to inundation from only storm waves. Under moderate offshore wave conditions, inundation of the surface is possible and 9 cm of water depth was measured for a maximum of two hours. Simple inundation-frequency modelling showed that if waves were congruent with high tide, inundation of the fore-portion of the terrace occurred on 13% of tides, whereas inundation of the full terrace extent is rare, occurring on only 0.05% of tides. Inundation of the youngest marine terrace at Kahutara Point, Māhia Peninsula, was determined by reconstructing water level since 1980. The marine terrace at its lowest elevation (2.4 m) has been inundated 17 times, whereas inundation of the highest elevation (2.6 m) has not received any inundation in the last 40 years. An assessment of wave energy at both locations during field deployments showed that during storms infragravity energy dominated the wave spectra, which may be contributing to the backwear of the marine terrace. In the reconstructed record, there was no evidence of a 1-in-100 year storm event occurring. This work illustrates that sub-annual storm events are important drivers of terrace erosion. Predicted changes in storm incidence and sea-level rise may, therefore, accelerate terrace removal processes in the future.