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Monitoring mass wasting events in chalk sea cliffs using UAV photogrammetry to determine the environmental controls over negative power law scaling parameters and the implications for future recession under the UKCP09 medium emission scenario.

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Coastal cliff erosion represents a significant geohazard for people and infrastructure. Forecasting future erosion rates is therefore of critical importance to ensuring the resiliency of coastal communities. We use high precision monitoring of the chalk cliffs at Telscombe, UK through UAV photogrammetry to generate monthly mass movement inventories between August 2016 and July 2017. Frequency-magnitude analysis of our inventories demonstrate negative power law scaling over 7 orders of magnitude and, for the first time, we report statistically significant correlations between significant wave height (H_s) and power law scaling coefficients (r^2values of 0.497 and 0.590 for β and s respectively). Applying these relationships allows for a quantitative method to predict erosion at the site based on H_s probabilities and sea level forecasts derived the UKCP09 medium emission climate model (A1B). Monte-Carlo simulations indicate a range of possible erosion scenarios over 70 years (2020-2089) and we assess the impact these may have on the A259 coastal road which runs proximal to the cliffs. Results indicate a small acceleration in erosion compared to those based on current conditions with the most likely scenario at the site being 21.7 m of cliff recession by 2089. However, low-probability events can result in recession an order of magnitude higher in some scenarios. In the absence of negative feedbacks, we estimate an $\sim$11% chance that the A259 will be breached by coastal erosion by 2089.