2015_35: Will climate change make coastal erosion rates faster?: Comparing historic and Holocene sea cliff retreat rates

Supervisors: Dylan Rood (d.rood@imperial.ac.uk), Martin Hurst (BGS), Mike Ellis (BGS)

Department: Earth Science and Engineering

Coastal zones and associated populations and industry infrastructure are particularly vulnerable to future climate change. Current models of coastal evolution under scenarios of future climate change need to be both informed and trained by antecedent conditions. Historical records of cliff retreat rates are typically limited to a few decades. This period may often be shorter than the return frequency of coastal landslides and therefore such observations have limited use in establishing baseline conditions against which to assess the impact of environmental change. Additionally it is unclear the extent to which human intervention at the coast may have influenced rates of coastal change, with large-scale coastal engineering and the onset of historic record collection coinciding. Uncertainty of the extent to which recent observations of cliff retreat may reflect long term average rates in the face of stochastic coastal processes, sea level rise, climate change and human modification of the coastline, motivate alternative approaches to quantifying long-term (centennial to millennial) rates of coastal erosion. This project will combine numerical modelling and the use of cosmogenic radionuclides (CRNs) to achieve this goal.

Cosmogenic radionculides (CRNs) are a versatile tool for dating rock surfaces and measuring the rates at which erosion processes operate over geomorphically significant timescales (100s-1000s years). Recently, the PIs have successfully measured CRN concentrations in diagenetic flint from chalk platforms in East Sussex from which they were able to interpret cliff retreat rates over several thousand years using a numerical model. These data suggest that long-term averaged cliff retreat rates may be slower than those derived from historical surveys of cliff positions, implying that the magnitude of coastal change may be increasing.

This studentship will apply CRN analysis to quantify Holocene-averaged rates of sea cliff retreat for the world famous white chalk cliffs of the south eastern UK and around the globe. The student will perform quantitative analysis of coastal topographic and bathymetric data, map cliff line positions and look at event scale changes in response to recent severe storms. Observed differences between long- and short-term trends in coastal change will be explored though analysis of the magnitude-frequency relationship of coastal landslides. Numerical modelling of coastal evolution will seek to quantify coastal sensitivity to varying boundary conditions, e.g. scenarios of sea level rise/increased storminess and wave climates, informed by both historic and geomorphic (i.e. CRNs) records of coastal change.