Geophysical Research Abstracts,
Vol. 11, EGU2009-8218, 2009
EGU General Assembly 2009

Five seasons of chalk cliff face erosion monitored by terrestrial laser scanner: from quantitative description to rock fall probabilistic hazard assessment

T. Dewez, G. Chamblas, E. Lasseur, and R. Vandromme
BRGM, Natural Risks Department, Orleans, France (t.dewez@brgm.fr)

Coastal cliffs are ubiquitous landforms around the world and cliff recession is a major subject of concern to coastal communities. These elements argue for a better understanding of processes occurring along coastal cliffs. The purpose of the study is to carefully describe the phenomenology of erosion on an evolving chalk coastline. Six repeated terrestrial laser scanner surveys were carried out for 2.5 years on a 700-m-long coastal chalk (Lewes Chalk – Upper Cretaceous) cliff site at Mesnil Val in Normandy, a setting representative of about a quarter of the English Channel's chalky coast. We describe the methodology used to process digital surface models and the novel technique developed to discriminate erosion from noise and to build a catalogue of eroded patches. Terrestrial Laser Scanner surveys permit the detection of any erosion patch thicker than ca. 3 cm. The catalogue of erosion patches contains more than 8500 objects with volumes spanning eight orders of magnitude, from 10^{-4} m^3 up to 10^4m^3. The average erosion rate is 0.13 m/a if one excludes a rare single massive cliff collapse event of 70 000 m^{3}that occurred in March 2008, or 0.94 m/a if this event is included. A scaling power law relationship exists between event volume and chalk production that implies that erosion is not dominated by any characteristic event. This scaling relationship is different for summers and winters showing clearly that more chalk is eroded in small patches in the winter than in the summer, whereas erosion of blocks larger than 10m^3 are just as probable in the summer as in the winter.

Probabilistic block fall hazard relationships were derived in order to predict the recurrence of events of a given size. The relationship between block fall volume and frequency takes the shape of a negative power law : F = a V $^{-b}$, with F being the frequency, V the volume of a block, a = 53.568 and b = 0.51.

We draw the conclusion that repeated topographic surveys with terrestrial laser scanners are appropriate tools for assessing block fall hazard on a given cliff face, much like seismometers are for seismic hazard assessments.