Geophysical Research Abstracts
Vol. 12, EGU2010-13005, 2010
EGU General Assembly 2010

Quantifying rock mass strength degradation in coastal rock cliffs

Matthew Brain, Michael Lim, Nick Rosser, David Petley, Emma Norman, and John Barlow
Institute of Hazard and Risk Research, Department of Geography, Durham University, Durham, UK
(matthew.brain@durham.ac.uk)

Although rock cliffs are generally perceived to evolve through undercutting and cantilever collapse of material, the recent application of high-resolution three-dimensional monitoring techniques has suggested that the volumetric losses recorded from layers above the intertidal zone produce an equally significant contribution to cliff behaviour. It is therefore important to understand the controls on rockfalls in such layers. Here we investigate the progressive influence of subaerial exposure and weathering on the geotechnical properties of the rocks encountered within the geologically complex coastal cliffs of the northeast coast of England, UK. Through a program of continuous in situ monitoring of local environmental and tidal conditions and laboratory rock strength testing, we aim to better quantify the relationships between environmental processes and the geotechnical response of the cliff materials. We have cut fresh (not previously exposed) samples from the three main rock types (sandstone, mudstone and shale) found within the cliff to uniform size, shape and volume, thus minimizing variability and removing previous surface weathering effects. In order to characterise the intact strength of the rocks, we have undertaken unconfined compressive strength and triaxial strength tests using high pressure (400 kN maximum axial load; 64 MPa maximum cell pressure) triaxial testing apparatus. The results outline the peak strength characteristics of the unweathered materials. We then divided the samples of each lithology into different experimental groups. The first set of samples remained in the laboratory at constant temperature and humidity; this group provides our control. Samples from each of the three rock types were located at heights on the cliff face corresponding with the different lithologies: at the base (mudstone), in the mid cliff (shale) and at the top of the cliff (sandstone). This subjected them to the same conditions experienced by the in situ cliff forming materials, which were also monitored using an array of environmental sensors. This experiment forms the basis of a long term investigation into the effects of varying environmental conditions on rock mass strength degradation over time. Ultimately, we aim to develop rock mass strength degradation curves to build a quantitative understanding of the interaction between coastal rock cliff behaviour and environmental processes.