



Monitoring the degradation of weathered volcanic man-made escarpments by close-range photogrammetry in Tahiti, French Polynesia

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Urban growth on the extinct volcanic island of Tahiti, French Polynesia, induces developers to build houses on steep mountain sides. To increase horizontal building space, workers end up cutting extensive horizontal benches delimited by steep taluses. Such man-made escarpments have a typical gradient of 5/2 (i.e. 70°) and heights reaching locally 15 m, some are protected by nets and spray-crete but most remain unprotected. Such steep artificial slopes, dug in tropically weathered volcanic material and exposed to tropical rainy climate have become a source of concern to inhabitants and land planning authorities: the scarps are progressively degraded through time, thus diminishing usable horizontal surfaces and eroded sediments eventually pollute the lagoons downstream. BRGM was put in charge by French Polynesia's Land Planning Authority to develop a practical means of monitoring talus degradation and quantify talus erosion rates. In the absence of very costly terrestrial laser scanning equipment, we proposed the rather less costly technique of ground-based photogrammetry. A Pentax K200D with 21-mm-calibrated lens was used along with Photomodeler Scanner version 6 to compute 3D models of escarpments. Two strategies were followed : first a set of 17 different escarpment profiles originally surveyed in 1991 were measured anew in January 2009 to address decadal scarp profile evolution; and second, the monthly evolution of a fresh section cut into so-called Mamu 3-4, a heavily argilized basaltic section with pockets of scoriae. This presentation addresses the field photogrammetric setup used to measure the topographic evolution of escarpment profiles, and discusses the erosion rates gathered from this study. 75% of observed profile erosion rate are contained between 5 mm/a and 56 mm/a. Monthly surficial evolution of the monitored road cut showed that the escarpment behaved as a detachment limited system.