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Real-size rockfall trajectory and derived mechanical quantities from close-range stereo video experiment 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 and at their foot. As a component of rockfall risk assessment, the Land Planning Authority of French Polynesia tasked BRGM to design a real-size rockfall experiment to assess the mechanical interaction of hard basalt blocks tumbling down a weathered volcanic rock slope; no such data set existed in comparable settings prior to this experiment. A set of 86 basalt blocks were dropped on the 150-m-long 36° slope. Three types of monitoring techniques were used to characterize rockfalls: i) orthogonal monoscopic video camera monitoring by CEMAGREF team; ii) stereoscopic 50-frames-per-second video camera monitoring; and iii) single 3 components seismometer recording. This presentation is concerned with the reconstruction of a preliminary series of 19 block trajectories in three dimensions. Instantaneous centroïde block positions, picked by hand, enabled the computation of velocity components, kinematic energy and energy changes at impact. Centroïde location precision is of the order of 3cm in X and Z, and 8cm in Y, which is rather crude compared to photogrammetric standards, but is nevertheless useful for the final application. The trajectory lengths visible in stereoscopy range from 30 to 44 m, blocks reached average linear velocities comprised between 8 and 11.5 m/s. Compared to the monoscopic strategy previously used for such field experiment, stereoscopic camera viewing angle need not be orthogonal to the anticipated block trajectory and produce metric coordinates directly.