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Toward an accurate detection of Rockfall sources in Yosemite Valley

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To assess rockfall hazard, it is necessary to locate the most probable rockfall source areas and to establish the frequency of activity from these areas. Rockfalls and rockslide locations are strongly linked to geometrical and mechanical characteristics of discontinuity sets and, especially in Yosemite Valley, to the widespread occurrence of surface parallel sheeting joints. Therefore, the dominant joint sets must be correctly characterized from a geometrical point of view, which means that their orientation, persistence, spacing, roughness and opening must be determined. Inspection of many rockfall scars provides valuable information about these features. This was achieved using terrestrial laser scanning (TLS) and field surveys of specific rockfall sites.

During this study we focused (1) on improving knowledge of rock discontinuity characteristics in relation to topography, orientation and rock type; and (2) on the detection of the external factors that trigger rockfalls (e.g., precipitation, freeze/thaw cycles, earthquakes, etc.).
A complete structural analysis was performed for Yosemite Valley on the field and using the software Coltop 3D on a base of aerial laser scanning (ALS) and of local TLS data. With the software Matterocking and the 1m cell size DEM, we calculated the number of possible failure mechanisms (wedge sliding, planar sliding, toppling) per cell, for the entire valley. Areas with a high density of possible failure mechanisms are shown to be more susceptible to rockfalls, demonstrating a link between high fracture density and rockfall susceptibility. First results indicate that many rockfalls are due to the coupling of sheeting joints and other joint sets. Case studies results in a better understanding of rockfall failure mechanisms and the regional structural study provides important details about the most probable future rockfall sources (location, volume,. . .).