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Influence of topographic roughness and surface rheology on the stress state in a sloped rock-mass.

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Although stress states in the ground are seldom well known with precision, such is especially true in slopes where the boundaries and initial conditions as well as topographic variations are difficult to grasp. As with other sites, it proves difficult to replicate the history of the tectonic stages the ground has undergone and the different rheology the material has gone through.

The stress state close to the topographic surface is quite heterogeneous and strongly correlated with the topographic fluctuation, i.e. the so-called topographic "roughness". Moreover, stress measurements in slope are also rare, particularly close to the surface. In order to better understand rockfalls, a multidisciplinary study is being conducted on the "*Rochers de Valabres*" slope (France's Southern Alps region). One component of this study will focus on both stress and stress variation measurements. To appropriately design this experiment, computations of the influence of "topographic roughness" and rheology on the stress state have been undertaken.

The primary results derived from this purely-computational step of the analysis show the influence of topographical variation. Simple computations on the steady roughness show that to evaluate stresses caused by the entire slope, it becomes necessary to seek a position under a "limit plane", located beneath the topographic roughness.

Several 2D cross-sections generated from a 3D Digital Elevation Models (DEM) of the site have allowed estimating a topographic roughness on the order of $\pm$ 10 m around the average plane. The limitations inherent in this analysis (2D, cross-correlation not taken into account, etc.) are discussed, along with as a comparison of steady roughness and an actual cross-section of the topography.

In November 2005 stress measurements were conducted on a horizontal borehole.

These measurements have not yet been totally analyzed as of the present day, but initial tests reveals that at a depth of 2 meters the major principal stress exceeds 5 MPa which is somewhat surprising for surface measurements, but this finding still complies with the modeling set-up. The initial stress measurements results serve to confirm both the significance of topographic roughness and the need to incorporate topography until reaching the summit of the mountain.