Geophysical Research Abstracts, Vol. 8, 06495, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06495

Remote sensing and ground-based geophysical techniques for recognition, characterisation and monitoring of unstable slopes.

J. Deparis (1), B. Fricout (2), D. Jongmans (1), T. Villemin (2), L.Effendiantz (3), A. Mathy (4)

(1) LIRIGM, Université Joseph Fourier Grenoble, BP53, 38041 Grenoble Cedex 9, France

(2) LGCA, Université de Savoie, 73376 Le Bourget du Lac Cedex, France

(3) CETE Lyon, 25, avenue François Mitterrand, 69674 BRON CEDEX, France

(4) SAGE, 2 rue de la Condamine F - 38610 Gières, France

Rock falls in cliff areas pose critical problems to the risk management, due to their suddenness and the lack of precursors. The hazard assessment is difficult due firstly to the lack of information about the internal structure of the unstable rock mass and secondly to the difficulty of modelling the triggering causes. We have applied an investigation methodology which aims at giving a detailed description of the 3D structure of the potentially unstable mass. This methodology combines three types of investigations: a structural analysis based on surface observations at the surface and on a remote image analysis, the collection of a dense digital surface model (DDSM) of the cliff obtained from lidar scanning, and several geophysical experiments made on the cliff and on the plateau top behind it. The combination of the DDSM with facing images of the cliff yields to a solid image of the cliff, in which the 3D location of any pixel is known. This allows to easily determine the dip-direction and dip of any discontinuity and to trace the geophysical profiles on the cliff image. This methodology was developed and tested on a 50 m high flake located in the French sub-alpine Vercors massif and showing signs of potential instability. A structural study of the all nearby outcrops, and of the vertical cliff, has shown the presence of three sets of discontinuities: the near-horizontal bedding and a system of two conjugate fracture families. Vertical and horizontal GPR (ground penetrating radar) profiles were performed on the vertical cliff. Classical geological observations and DDSM based

results show very good agreement, highlighting the interest of this last technique that provide results remotely without abseiling along the cliff. The GPR data have pointed out several reflectors inside the rock mass, the orientation of which correspond to the fracture system observed at the surface of the cliff. A strong continuous reflector, corresponding to a major open fracture dipping inside of the massif, was shown on three GPR profiles. This major discontinuity in the rock mass has not been detected by surface investigations highlighting the power of GPR methods in characterizing the discontinuity pattern inside rock mass.