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Monitoring the Corniglio Landslide (Parma, Italy) before and after the M=5.4 earthquake of December 2008

S. Viridis, E. Guastaldi, A. Rindinella, L. Disperati, and A. Ciulli

Centre for GeoTechnologies and Earth Sciences Department, University of Siena, San Giovanni Valdarno (Ar), Italy
(viridis@unisi.it)

In this work we present the results of monitoring the Corniglio landslide (CL), a large landslide located in the Northern Apennines, by integrating traditional geomorphologic and geological surveys, digital photogrammetry, GPS and geostatistics. The CL spreads over an area of about 3 km x 1 km, close to Corniglio village (Parma, Italy). We propose a new kinematic framework for the CL as Deep-Seated Slope Gravitational Deformation (DSGSD). Surveys were carried out in six periods, in July and September 2006, March and August 2007, July 2008 (after a M=4 earthquake of 28 December 2007, 10 km far from Corniglio), and finally January 2009 (after several earthquakes occurred in the last days of December 2008, with magnitude from 4 to 5.4 and epicentres located less than 30 km far from Corniglio).

Geological survey, interpretation of orthophotographs related to 1976, 1988, 1994, 1996, 1998, 2005, and satellite imagery related to 2003 were integrated for analysing the state of activity of landslide from 1976 to 2009, quantifying the ground displacement vectors. A RTK GPS survey was periodically carried out in order to locate the crown of the main landslide scarp and to identify reactivation of the CL after the earthquakes of the end of December 2008. Then, kriged multitemporal maps representing azimuth and module of ground displacement vectors were built, by evaluating the displacement with time of homologous ground targets on the multitemporal remotely sensed images. Measuring of ground deformations was performed on imagery related to the periods between December 1994 to July 1996, between October and November 1996, as well as the recurrent activity from October 1998 to 2003. In some sector of the main body of the landslide we estimated 70 m of total of ground displacement. The fieldwork results and photogeologic interpretation performed along the the Bratica valley, to the east of the CL, suggest that the occurrence of rigid behaviour lithotypes (Mt. Caio calcareous flysch of Upper Campanian - Maastrichtian and Oligocene Arenarie del Bratica) over both the plastic low - shear strength chaotic deposit of brownish clays ("Melange di Lago" formation, upper Campanian - middle Eocene) and marly clays ("Argille e Calcari" formation, middle Lutetian) represent a critical setting for the stability of the area.

Furthermore, relevant east-west trending lineaments seem to be involved into slope movements. These evidences suggests that the CL may be part of a larger DSGSD also including the hill among the Bratica river, the CL main body and the Parma river. The earthquakes involving this area periodically reactivate the main body of landslide.