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Structural and Volumetric re-evaluation of the Vaiont landslide using DEM techniques

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On the 9th October 1963 a catastrophic landslide occurred on the southern slope of the Vaiont dam reservoir.
A mass of approximately 270 million m3 collapsed into the reservoir generating a wave which overtopped the dam and hit the town of Longarone and other villages: almost 2000 people lost their lives.
The large volume and high velocity of the landslide combined with the great destruction and loss of life that occurred make the Vaiont landslide as a natural laboratory to investigate landslide failure mechanisms and propagation.
Geological, structural, geomorphological, hydrogeological and geomechanical elements should be, then, re-analyzed using methods and techniques not available in the '60s.
In order to better quantify the volume involved in the movement and to assess the mechanism of the failure, a structural study is a preliminary and necessary step.
The structural features have been investigated based on a digital elevation model (DEM) of the pre- and post-landslide topography at a pixel size of 5m and associated software (COLTOP-3D) to create a colored shaded relief map revealing the orientation of morphological features.
Besides,the results allowed to identify on both pre- and post-slide surface six main discontinuity sets, some of which influence directly the Vaiont landslide morphology. Recent and old field surveys allowed to validate the COLTOP-3D analysis results.
To estimate the location and shape of the sliding surface and to evaluate the volume of the landslide, the SLBL (Sloping Local Base Level) method has been used, a simple and efficient tool that allows a geometric interpretation of the failure surface based on a DEM.
The SLBL application required a geological interpretation to define the contours of the landslide and to estimate the possible curvature of the sliding surface, that is defined by interpolating between points considered as limits of the landslide.
The SLBL surface of the Vaiont landslide, was obtained from the DEM reconstruction of limits of the landslide defined by using geomorphological features and by literature data observed.
Once the sliding plane was defined the potential sliding volume has been calculated in a GIS, considering also six different cross-sections realized along the landslide area before and after the event.