



Change detection over a period of more than 30 years: the Val Pola landslide (Italy)

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Landslide monitoring requires multiple data acquired over a period of many years. Monitoring is defined as a comparison of different conditions (extension, velocity, topography, soil humidity, and others) to understand, simulate and assess the landslide activity. Landslide investigation is a field where satellite images have become one of the primary data sources. Applications of remote sensing techniques are divided into three groups: (1) landslide recognition and production of inventories (maps and databases); (2) landslide monitoring; and (3) spatial analysis and hazard zonation.

It is well known that satellite remote sensing is a powerful tool to analyze, inspect and monitor natural hazards. Satellite images feature several advantages with respect to standard aerial data. Indeed, aerial images have to be processed following a standard and time consuming production workflow. A single high-resolution satellite image can replace several aerial images. Although the modern technology adopted in aerial photogrammetry overcomes some limitations thanks to new airborne digital cameras, GNSS/INS sensors, and automatic orientation procedures, aerial surveys still depend on the organization of the flight mission. Moreover, if the target is located far from the aircraft base data acquisition cannot be easily accomplished.

For these reasons, the use of satellite images makes data acquisition simpler, less dependent on logistic aspects and not very expensive (in some cases free-of-charge). The thematic (multispectral) capability of satellite sensors is superior to that of airborne digital cameras. Finally, historical data can be included in the analysis thanks to the availability of large archives collecting satellite images regularly gathered over the past decades.

The case study illustrated in this contribution is the Val Pola landslide in Italy. Here, a sequence of satellite images was used to analyze the changes occurred in the area, located in Valtellina, Lombardy Region, Italy.

On Friday 17 July 1987, the Italian Meteorological Service forecasted heavy rain over the North of the country. In Lombardy, the bad weather had affected the Provinces of Sondrio, Bergamo, Brescia, Como and Lecco. The flood emergency in Valtellina started in the second half of July and lasted until the beginning of September. Heavy rainfall and the melting of glaciers resulted in the flooding of various rivers and torrents which had in turn brought about severe destruction in many villages and towns. On Tuesday 28 July 1987, the landslide occurred in Val Pola. More than 40 million m³ of rock debris came off from the flank of Monte Zandila, reaching the bottom of the valley and making an artificial dam. This artificial dam stopped the flow of the River Adda and created a lake with 6 million m³ of water. A multi-temporal time-series of Landsat images acquired over Valtellina (Rhaetian Alps) from 1984 to 2015 was downloaded from the USGS archive (<http://glovis.usgs.gov/>). Recently, Landsat images were integrated by Sentinel-2 images. Such image collection allows to track the changes occurred in the area with a time-series of more than 30 years. Today, the method is still used to monitor the area and to track the still on-going risk-prevention interventions.