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The historic landslide of Sottrù (Badia Valley, Italy) reactivated on December 13, 2012 - a geomorphological interpretation

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On 13 December 2012, after a long period of dormancy, the historic landslide of Sottrù, located in the Badia Valley (Autonomous Province of Bolzano, Italy), was reactivated, destroying a few houses and almost damming the Gadera torrent. According to historic documents, the previous activation dates back to June 1821. At that time, the slope was mobilized after a period of persistent rain and snow melt, causing the damming of the Gadera torrent. After snow melting, in June 1827 the natural dam collapsed, flooding meadows and villages down valley. In December 2012, the landslide was partly reactivated, showing the first slow movements on the 13th and more rapid displacements on the 14th. A detailed geomorphological survey of the landslide was carried out during summer 2014, aiming at identifying the instability causes, mapping the landslide in detail and investigating the hydrological and hydrogeological characteristics of the slope. A surficial highly permeable level (in-situ or reworked till) was found lying on top of a thick sequence of clays, shales, sandstones and marls, both over the landslide body and the surrounding areas. The permeability contrast existing between the till and the bedrock is thought to extend to larger portions of the slopes of the Gadera valley and it could reasonably be considered as one of the main predisposing factors for the onset of the several landslides that characterize the area. From the landslide scar uphill, the hydrographic pattern is extremely irregular, made of discontinuous drainage lines indicative of higher infiltration rate than superficial run off. The comparison between the current morphology and the pre-2012 one has not evidenced any movement within the historic source area, while relevant displacements occurred at two lateral zones and at the central part of the landslide, originating a second, lower crown. Since the previous activation (1821), the landslide has been dormant for 191 years, and the 2012 event occurred during a period in which landslides are not frequent. Temperature and precipitation time series, recorded at the nearby meteorological station of La Villa, were analyzed for the last 27 years. It was found out that November 2014 had many rainy days, three of which with precipitation ranging from 30 to 50 mm. The rainiest day (November 29) was suddenly followed by a dramatic drop below 0°C of maximum and minimum air temperatures, lasting until the 13th of December. This air temperature drop probably caused the freezing of the soil top, at that time snow free and likely completely saturated, and of a spring located in the lower part of the slope, nearby the village of Sottrù, blocking groundwater drainage and leading to the onset of a confined-aquifer condition which is likely to have caused a rapid increase of pore water pressure inside the clay-rich landslide material. This hypothesis was made also in consideration of similar events occurred in the Dolomites (e.g., in Zoldo Valley, 1991) but, in order to prove this, in-depth geophysical and geotechnical analyses would be needed.