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Experiences from the monitoring of the large landslide of Aliano (Basilicata, Italy)

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The Aliano landslide is located on the South-East side (SE) of the Aliano small town, situated in Basilicata in Southern Italy. The first activation of landslide movement dates back to 1998. The large and active landslide is 110 m wide, 400 m long and thick from 15 to 45 m. The total volume is about 1,000,000 m3.
The causes of the Aliano landslide lie mainly in stratigraphic and structural-tectonic features of the area. The unstable slope is made out of cemented sands overlying a siltly clay bedrock. The bedding planes are inclined of about 21° and a thin layer of uniform clean sands is present at the shift from cemented sands to siltly clays. In this layer, the failure surface of the landslide has been localized. Cemented sands are covered by two families of tectonic fractures with direction angle of 15°N and 100°N respectively. The whole area suffered from the Pleistocene tectonics, which faulted and divided the area in large monoclinalic blocks and gave them the present bedding slope. As effect of the first activation on December of 1998, the landslide body was divided in large fragments of cemented sand surrounded by loose sand. The landslide body has always moved at constant rate of fraction of mm/day, with increases during winter rainfalls. The interaction between rainfalls and the landslide occurs through piping mechanisms of loose sands and subsequent variations of stresses between the main blocks. The water table has never been detected.
The relevance of the landslide is due to the presence, near its top, of the town built-up area and of a bridge which connects Aliano to the valley. The first activation of the landslide caused the failure of the old connection road, with a settlement of about 15 m. Therefore, several investigations have been carried out in the Aliano landslide since 1999, aimed to the complete understanding of the geological frame and monitoring the landslide activity.
The monitoring system includes different approaches: conventional techniques (topographical, for measurement of superficial displacements, geotechnical, for assessment of deep displacements, meteorological, and hydrogeological devices) and specific technologies (Single Beam Laser and Acoustic Emission (AE) detecting systems).
The Aliano landslide has been equipped with laser control and early warning system since 2009. The results of topographical and laser monitoring show that the central body of landslide is still moving, with displacement rates of about 2 millimeters per day.
Acoustic Emission (AE) is used to investigate the activity within the landslide body. The working scheme used by the Authors is characterized by a single point noise detection with the counting of the noises which are directly related to the landslide activity.
The monitoring of AE is currently in progress in the Aliano landslide, where part of the recordings has been contextual to a notable mobilization of the landslide, so that it has been possible to compare the released acoustic emission with the recordings of the surface movements. Data analysis revealed that the first significant acoustic activity preceded mass movements of almost 24 hours.