

Slow-moving landslide damage assessment of historic masonry churches: some case-studies in Italy

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ABSTRACT

Over the world cultural heritage is exposed to several natural and anthropic hazards such as earthquakes, floods, landslides, subsidence and many others. Decades of studies and observations on site showed the high vulnerability of historic masonry churches to seismic actions [1] and allowed for the identification of their most recurrent earthquake-induced damage and collapse mechanisms. Conversely, the vulnerability of these structures to slow-moving landslides as well as the effects that these phenomena may produce have never been deeply investigated by the scientific community. For these reasons, starting from the observation of some case studies, this work aims at analyzing the damage mechanisms induced in churches by slow-moving landslides. The churches under consideration are located in the Liguria region, Italy. Firstly, for each church information regarding both the landslide-affected area and the geological soil configuration was collected and analyzed in order to identify the state of activity, type and direction of the landslide movement. The availability of interferometric data, in-situ soil tests as well as inclinometers or piezometers installed in the surrounding area was also verified. Furthermore, an archival research was performed aimed to gather information regarding history, geometry, structural arrangement and past alterations, which are essential to better understand the structural behavior of each building [2]. Secondly, inspections on site were carried out and the damage patterns and distortions for all the structural elements (i.e. floor, walls, arches and vaults) were surveyed in detail. An inspection of the surroundings was also performed in order to detect any potential evidence of the presence of soil movements. Finally, a detailed analysis of the damage observed in the churches was performed with the aim of attributing cracks patterns and distortions to specific soil movements produced by slow-moving landslides. Despite an accurate prediction of the displacement profiles induced by the landslides was not available, cracks patterns were good indicators of the direction of soil movements [3]. As a result, some recurrent damage mechanisms that could be associated with slow-moving landslide phenomena were identified. In conclusion, based on the observation of some case studies, this work provides a first preliminary assessment of the damage experienced by churches subjected to slow-moving landslides.

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