EGU21-12886
https://doi.org/10.5194/egusphere-egu21-12886
EGU General Assembly 2021


# Influence of morpho-evolution on the earthquake-induced mobility of the Albuñuelas landslide (Granada, Spain)

**Mara Mita**[1], Céline Bourdeau[1], Jose Delgado[2], Luca Lenti[1], and Salvatore Martino[3]
[1]G. Eiffel University, Geosciences Department, 5 Boulevard Descartes, 77420 Champs-sur-Marne, France
[2]Dpt. Ciencias de la Tierra y del Medio Ambiente, Universidad de Alicante, Ap. Correos 99, E-03080 Alicante, Spain
[3]Earth Sciences Department of "Sapienza" University of Rome and CERI - Research Centre for Geological Risk, P.le Aldo Moro n.5, I-00185 Rome, Italy

The morphological evolution of landslide slopes is generally controlled by the combination of weathering, tectonics, gravity and river erosion. Among them, seismic shaking plays a fundamental role in landslide activity and mobility in high seismicity regions. It can result in important modifications of landslide geometry and consequently, of its response to external loadings. In particular, morphological changes in landslide slope can imply changes in the interactions between seismic waves and landslide mass, which could theoretically modify the hazard related to the earthquake-induced effects. This study aims at pointing out the effects of slope morpho-evolution on the long-term modification of earthquake-induced landslide dynamics, which is here quantified in terms of expected seismically induced displacements, considering unaltered seismic hazard conditions. The Albuñuelas landslide was selected, located in Andalusia (South Spain) which is one of the most seismic regions of Spain. This landslide is a large roto-translational process whose last earthquake-induced reactivation occurred during the 1884 Andalusia Earthquake ($M_w$ 6.5), causing relevant damages to the Albuñuelas village. Data available from field surveys and geophysical investigations, allowed to derive the current engineering-geological model of the landslide slope. According to the available geological and geomorphological data, the slope shape was back-deformed to reproduce the landslide geomorphological evolution sequence over time, until its first-time failure. The reconstructed sequence is consistent with a geomorphological evolution mainly driven by the combination of earthquake-induced re-activations and low rates of deformation caused by the intense incision of the Albuñuelas River, responsible for the valley deepening. 2D-dynamic stress-strain numerical simulations were performed on several stages of such sequence applying 17 equivalent signals derived following the LEMA_DES (Levelled-Energy Mutifrequential Analysis for Deriving Equivalent Signals) approach with an Arias Intensity of 0.1 m/s, according to the Andalusia regional seismic hazard. The outputs were expressed in terms of seismically induced displacements vs. characteristic periods diagrams, in order to highlight the role of signal frequency content as well as the effect of the landslide 2D-geometry ($T_l$) and thickness ($T_s$) on the resulting displacements. Since the morpho-evolution resulted in a progressive increasing of the landslide mass length and its dislodgment into several blocks since the first-time failure, the landslide mobility was analysed over time at each single-block scale. The comparison revealed a not neglectable modification of the Albuñuelas landslide

susceptibility to the local seismic hazard over time, highlighting the necessity to understand the mechanisms driving the natural system evolution to provide more reliable earthquake-induced hazard scenarios.