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Engineering-geological model of the landslide of Güevejar (S Spain) reactivated by historical earthquakes

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Landslides are a common ground effect induced by earthquakes of moderate to large magnitude. Most of them correspond to first-time instabilities induced by the seismic event, being the reactivation of pre-existing landslides less frequent in practice. The landslide of Güevejar (Granada province, S Spain) represents a case study of landslide that was reactivated, at least, two times by far field earthquakes: the Mw 8.7, 1755, Lisbon earthquake (with estimated epicentral distance of 680 km), and the Mw 6.5, 1884, Andalucia event (estimated epicentral distance of 45 km), but not by near field events of moderate magnitude (Mw < 6.0 and epicentral distances lower than 25 km). To study the seismic response of this landslide, a study has been conducted to elaborate an engineering-geological model. For this purpose, field work done included the elaboration of a detailed geological map (1:1000) of the landslide and surrounding areas, drilling of deep boreholes (80 m deep), down-hole measurement of both P and S wave velocities in the boreholes drilled, piezometric control of water table, MASW and ReMi profiles for determining the underlying structure of the sites tested (soil profile stratigraphy and the corresponding S-wave velocity of each soil level) and undisturbed sampling of the materials affected by the landslide. These samples were then tested in laboratory according to standard procedures for determination of both static (among which soil density, soil classification and shear strength) and dynamic properties (degradation curves for shear modulus and damping ratio with shear strain) of the landslide-involved materials. The model proposed corresponds to a complex landslide that combines a rototranslational mechanism with an earth-flow at its toe, which is characterized by a deep (> 50 m) sliding surface. The engineering-geological model constitutes the first step in an ongoing research devoted to understand how it could be reactivated during far field events. The authors would like to thank the ERDF of European Union for financial support via project "Monitorización sísmica de deslizamientos. Criterios de reactivación y alerta temprana" of the "Programa Operativo FEDER de Andalucía 2007-2015". We also thank all Public Works Agency and Ministry of Public Works and Housing of the Regional Government of Andalusia.