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Numerical modeling of the seismic response of a large pre-existing landslide in the Marmara region

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Turkey is one of the geologically most active regions of Europe prone to natural hazards in particular earthquakes and landslides. Detailed seismological studies show that a catastrophic event is now expected in the Marmara region along the North Anatolian Fault Zone (NAFZ). On the shores of the Marmara sea, about 30km East of Istanbul and 15km North from the NAFZ, urbanization is fastly growing despite the presence of pre-existing large landslides. Whether such landslides could be reactivated under seismic shaking is a key question. In the framework of the MARsite European project, we selected one of the most critical landslides namely the Büyükçekmece landslide in order to assess its local seismic response. Based on detailed geophysical and geotechnical field investigations, a high-resolution engineering-geological model of the landslide slope was reconstructed. A numerical modeling was carried out on a longitudinal cross section of this landslide with a 2D finite difference code FLAC in order to assess the local seismic response of the slope and to evaluate the consistency of conditions suitable for the earthquake-induced reactivation of the landslide. The obtained ground-motion amplification pattern along the slope surface is very complex and is strongly influenced by properties changes between the pre-existing landslide mass and the surrounding material. Further comparisons of 2D versus 1D ground-motion amplifications on the one hand and 2D versus topographic site effects on the other hand will shed light on the parameters controlling the spatial variations of ground-motion amplifications along the slope surface.