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Multi-level approach analysis of liquefaction susceptibility: an application to three municipalities of Ischia Island

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The Emilia-Romagna seismic sequence in 2012 has increased the interest among Italian researchers in predicting liquefaction under seismic shaking, and in the evaluation of damage induced to structures. A number of studies were carried out during the last decade to evaluate the liquefaction susceptibility of different areas of the Italian Peninsula. Some of these studies have been focused on the territorial analysis of Naples (Evangelista & Santucci de Magistris, 2011; Silvestri & d'Onofrio, 2014), which highlighted how saturated pyroclastic soils present along the coastal areas may be interested by liquefaction phenomenon. On such a basis, the present study aims at evaluating the liquefaction susceptibility throughout the area of three municipalities (Casamicciola, Lacco Ameno and Forio) of Ischia Island in the gulf of Naples (Italy), recently hit by a Ml 4 earthquake. The coastal zones of these municipalities are characterised by the predominance of saturated pyroclastic granular deposits. The assessment was performed through a multi-level approach, i.e. by increasing level of complexity. First, the potentially liquefiable areas were delimited by combining in a Geographic Information System (GIS) data on the average seasonal depth of the water table (Piscopo et al. 2019) and on the lithological classification of the surface deposits (Seismic Microzonation, 2017). At some representative sites in these potentially liquefiable areas, simplified analyses were carried out using SPT-based semi-empirical methods (Idriss & Boulanger, 2014). The results of such analyses led to choose a specific site on which to perform non-linear 'coupled' dynamic analyses in time domain with the SCOSSA code (Tropeano et al. 2019). The results of the coupled analyses in terms of excess pore water pressure ratio (r_u) then allowed the evaluation of the 'Induced Damage Parameter' (Chiaradonna et al. 2020), related to the free-field post-seismic volumetric consolidation settlement, which was classified as 'moderate' in this case. The procedure adopted may be a valid proposal for prompt evaluations of the liquefaction susceptibility, which allows to pass from a semi-qualitative assessment at a territorial scale to a quantitative assessment at the scale of a specific site.

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