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Implementation of Integrated Multi-Channel Analysis of Surface Waves and Waveform Inversion Techniques for Seismic Hazard Estimation with Emphasis on Associated Uncertainty: A Case Study at Zafarana Wind Turbine Towers Farm, Egypt

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Abstract : In this study, an integrated multi-channel analysis of Surface Waves (MASW) technique is applied to explore the geotechnical parameters of subsurface layers at the Zafarana wind farm. Moreover, a seismic hazard procedure based on the extended deterministic technique is used to estimate the seismic hazard load for the investigated area. The study area includes many active fault systems along the Gulf of Suez that cause many moderate and large earthquakes. Overall, the seismic activity of the area has recently become better understood following the use of new waveform inversion methods and software to develop accurate focal mechanism solutions for recent recorded earthquakes around the studied area. These earthquakes resulted in major stress-drops in the Eastern desert and the Gulf of Suez area. These findings have helped to reshape the understanding of the seismotectonic environment of the Gulf of Suez area, which is a perplexing tectonic domain. Based on the collected new information and data, this study uses an extended deterministic approach to re-examine the seismic hazard for the Gulf of Suez region, particularly the wind turbine towers at Zafarana Wind Farm and its vicinity. Alternate seismic source and magnitude-frequency relationships were combined with various indigenous attenuation relationships, adapted within a logic tree formulation, to quantify and project the regional exposure on a set of hazard maps. We select two desired exceedance probabilities (10 and 20%) that any of the applied scenarios may exceed the largest median ground acceleration. The ground motion was calculated at 50th, 84th percentile levels.

Keywords : MASW, seismic hazard, wind turbine towers, Zafarana wind farm
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