S33B-2829: USING AMBIENT NOISE FOR INVESTIGATING CULTURAL HERITAGE SITES AND EVALUATING SEISMIC SITE RESPONSE

Wednesday, 14 December 2016
13:40 - 18:00
Moscone South - Poster Hall

Recordings of ambient noise as well as use of the HVSR technique represent a common tool for evaluating seismic site response. In this study we applied such techniques to several cultural heritage sites located on the Maltese archipelago (Central Mediterranean). In particular, two of the Maltese watchtowers, built by the Knights of St. John between 1637 and 1659, were investigated together with the megalithic temple site of Mnajdra. Array data were acquired using the Micromed SoilSpy Rosina™ equipped with 4.5 Hz vertical geophones, setting the array in an L-shaped configuration. The Extended Spatial Autocorrelation (ESAC) technique was used to extract Rayleigh-wave dispersion curves. Moreover, single-station data close to the array was collected using a Tromino 3-component seismograph (www.tromino.eu), and the H/V curves were extracted. The dispersion curves and the H/V curves were jointly inverted using the Genetic Algorithm (GA) to obtain the shear-wave velocity profile. A fixed number of layers was used in the inversion and ranges for the layer thickness, P-wave and S-wave velocity, and density were specified. The obtained velocity profiles were used to compute the amplification function for the site based on the square root of the effective seismic impedance, also known as the quarter-wavelength approximation. This was used in the simulation of ground motion parameters at the site for various earthquakes using the stochastic one-dimensional site response analysis algorithm, Extended Source Simulation (EXSIM). In addition, the fundamental period and the damping ratio of the watchtowers was obtained by recording ambient vibrations. In the megalithic temples we were also able to evaluate the coverage of the soil deposits within the structure, comparing our results with previous study that used different geophysical techniques. In conclusion, this study enables us to map the seismic amplification hazard and provides primary data on the seismic risk assessment of each cultural heritage site.

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