

EGU22-9387

<https://doi.org/10.5194/egusphere-egu22-9387>

EGU General Assembly 2022

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Assessing local site response using earthquake data: The case of thick buried low-velocity layers

Daniela Farrugia, **Pauline Galea**, and Sebastiano D'Amico

Department of Geosciences, University of Malta, Msida, Malta

In the past decade, studies to determine amplification effects due to the local geology have been conducted in the Maltese islands (Central Mediterranean) by means of ambient noise techniques. Particular areas of interest include the north and north-western areas of the islands which are characterised by clay, that can reach a thickness of 75 m, buried beneath limestone. This introduces a velocity inversion in the stratigraphy and consistent, characteristic peaks in the H/V spectral ratios. With the expansion of the Malta Seismic Network (MSN) to these geological areas of concern, the possibility of confirming and further investigating the results using empirical data arises. Here we present results, mainly in terms of Standard Spectral Ratio (SSR) and earthquake H/V, using 3 years of earthquake data at three stations of the MSN. In particular we note that the amplifications obtained using the SSR technique are significantly higher than those obtained using both noise and earthquake H/V techniques. While the peaks observed in the H/V spectra are also reproduced in the SSR curves using earthquake data, the latter exhibit important additional peaks at frequencies below 1 Hz, whose amplitude may be as high as 30. By separating the earthquake data set on the basis of distance from the islands, we show that the amplification is source-dependent, and that the high amplification values originate from larger, more distant earthquakes in the Hellenic arc. This has important implications for seismic hazard determination.