

Geophysical Research Abstracts
Vol. 16, EGU2014-10365, 2014
EGU General Assembly 2014
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Velocity and structural model of Lower Tagus Basin (Portugal) derived from ambient seismic noise measurements

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The Lower Tagus Valley, in Portugal, has a complex tectonic history and a seismic activity determined by the proximity to the Eurasian – Nubian tectonic plate boundary. Some of these earthquakes were destructive and produced in large ruptures in offshore structures located southwest of the Portuguese coastline; other moderate earthquakes were produced by local (onshore) sources. In the last years, various studies have successfully obtained strong-ground motion synthesis for the Lower Tagus Valley using the finite difference method. To improve the velocity model of this sedimentary basin obtained by geophysical and geological data, we analyse ambient seismic noise measurements by applying the horizontal to vertical spectral ratio method (HVSr). The study reveals the dependence of the frequency and the amplitude of the low frequency peaks (0.2-2 Hz) of the HVSr with the sediments thickness. We have obtained the depth of the basement of the Cenozoic basin by inversion of such ratios imposing constraints from seismic reflection, boreholes, seismic sounding, and gravimetric and magnetic data. The obtained velocity model was confirmed by comparison between real HVSr curves with synthetic ones obtained by 3D seismic wave simulation using a finite-difference method. This technique proved to be practical and useful to improve the subsurface structures and the three-dimensional model of the basin.