Geophysical Research Abstracts
Vol. 15, EGU2013-9839, 2013
EGU General Assembly 2013

Imaging 3D geological structure of the Mygdonian basin (Northern Greece) with geological numerical modeling and geophysical methods.

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The Mygdonian basin, located 30 km E-NE close to Thessaloniki, is a typical active tectonic basin, trending E-NW, filled by sediments 200 to 400 m thick. This basin has been chosen as a European experimental site since 1993 (European Commission research projects - EUROSEISTEST). It has been investigated for experimental and theoretical studies on site effects.
The Mygdonian basin is currently covered by a permanent seismological network and has been mainly characterized in 2D and 3D with geophysical and geotechnical studies (Bastani et al, 2011; Cadet and Savvaidis, 2011; Gurk et al, 2007; Manakou et al, 2007; Manakou et al, 2010; Pitilakis et al, 1999; Raptakis et al, 2000; Raptakis et al, 2005). All these studies allowed understanding the influence of geological structures and local site conditions on seismic site response. For these reasons, this site has been chosen for a verification exercise for numerical simulations in the framework of an ongoing international collaborative research project (Euroseistest Verification and Validation Project - E2VP). The verification phase has been made using a first 3D geophysical and geotechnical model (Manakou, 2007) about 5 km wide and 15 km long, centered on the Euroseistest site. After this verification phase, it has been decided to update, optimize and extend this model in order to obtain a more detailed model of the 3D geometry of the entire basin, especially the bedrock 3D geometry which can affect drastically the results of numerical simulations for site effect studies.
In our study, we build a 3D geological model of the present-day structure of the entire Mygdonian basin. This "precise" model is 12 km wide, 65 km long and is 400 m deep in average. It has been built using geophysical, geotechnical and geological data. The database is heterogeneous and composed of hydrogeological boreholes, seismic refraction surveys, array microtremor measurements, electrical and geotechnical surveys. We propose an integrated workflow, adapted to heterogeneous geological, geophysical and geotechnical data in order to integrate this database in 3D. This database is integrated in 3D in a geomodelling software (gocad). We build 3D surfaces with constraining data, using DSI method (Discrete Smooth Interpolation).
This 3D geological model led to the 3D geometry of the main geophysical/geological boundaries (bedrock, boundaries in the sedimentary filling) and to a precise quantification of the 3D volume of the sedimentary filling of the basin. The results of this study will be used in the second phase of the E2VP project for numerical simulations at the scale of the entire Mygdonian basin.