Geophysical Research Abstracts
Vol. 17, EGU2015-13948-1, 2015
EGU General Assembly 2015

Use of multiple relocation techniques to better understand seismotectonic structure in Greece

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The identification of the structure of seismicity associated with active faults is of great significance particularly for the densely populated areas of Greece, such as Corinth Gulf, SW Peloponnese and central Crete. Manual analysis of the seismicity that has been recorded by the Hellenic Unified Seismological Network (HUSN) for the recent years provides the opportunity to determine accurate hypocentral solutions using the weighted P and S wave arrival times for these regions. The purpose is to perform precise event location and relative relocation so as to obtain the spatial distribution of the recorded seismicity with the needed resolution. In order to investigate the influence of the velocity model on the seismicity distribution and to find the most reliable hypocentral locations, different velocity models (both 1-D and 3-D) and location schemes are adopted and thoroughly tested. Initially, to test the models, the hypocentral locations, including the determination of the location uncertainties, are obtained applying the non-linear location tool, NonLinLoc. To approximate the likelihood function, the much more robust in the presence of outliers, Equal Differential Time (EDT) is selected. To locate the earthquakes the Oct-tree search is used. Histograms with the RMS error, the spatial errors and the maximum half-axis (LEN3) of the 68% confidence ellipsoid are created. Moreover, the form of density scatterplots and the difference between maximum likelihood and expectation locations is taken into account. As an additional procedure, the travel-time residuals are examined separately for each station as a function of epicentral distance. Finaly, several cross sections are constructed in various azimuths and the spatial distribution of the earthquakes is evaluated and compared with the active fault structures. In order to highlight the activated faults, an additional relocation procedure is performed, using the double-difference algorithm HYPODD and incorporating the traveltime data of the best fitting velocity models. The accurate determination of seismicity will play a key role in revealing the mechanisms that contribute to the crustal deformation and to active tectonics.

Note: this research was funded by the ASPIDA project.