

A new user-friendly computer tool for source inversion using regional records

Sokos E.¹, Zahradnik J.²

¹ Institute of Geodynamics, National Observatory of Athens, Lofos Nymfon 1, 11810 Athens, Greece, esokos@gein.noa.gr

² Charles University, Prague, KG MFF UK, V Holesovickach 2, 180 00 Praha 8, Czech Republic, jz@karel.troja.mff.cuni.cz

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Introduction

A computer tool for seismic source inversion was developed with objective to combine finite-extent moment-tensor formulation, computational speed, and easy use. The inversion is based on the iterative deconvolution of multiple point sources, a method first proposed by Kikuchi and Kanamori, 1991, for teleseismic data. The new code (written in Fortran) makes use of the full waveform of regional (or local) records using Green functions calculated by the discrete wavenumber method.

Methodology

The inversion is done in time domain and the algorithm inspects a set of pre-defined point source positions along a fault plane or line. Each point may have several rupture episodes, called subevents. The moment rate of subevents is of triangular shape with a pre-defined duration. Active source positions and their onset times are found by grid search in which we maximize correlation between records and synthetics. The deviatoric moment tensors of the subevents are found by minimizing L2 misfit between records and synthetics. The double-couple constrained solution is optional.

To make the source inversion easy, a Matlab based Graphical User Interface (GUI) was developed. Using the graphical interface the user can load raw data as ascii files and perform various processing steps before starting the inversion (e.g. time alignment, instrument correction, filtering). The Green function calculation can be done through the same interface by simply describing the station positions and the crustal model as a text file or through the specific GUI form. As a next step the coordinates of the possible point sources are calculated and displayed on a map for visual inspection, using Matlab or GMT. Then the inversion can be started through Matlab and finally the results can be plotted using Matlab or GMT. An optional interactive mode allows user to apply some additional constraints, such as rupture velocity, or the first motion polarities. The software has been applied to various earthquakes

in Greece. For example, it revealed the double-event nature of the 2003 Lefkada earthquake. The code is available upon request.

References

Kikuchi, M. and Kanamori, H. (1991). Inversion of complex body waves-III, *Bull. Seism. Soc. Am.*, 81, 2335-2350