Geophysical Research Abstracts, Vol. 8, 08496, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08496

Moment tensor inversion in a 3D a priori earth model for the Alpine-Apenninic region

D. Stich, S. Pondrelli, and A. Morelli

Sezione di Bologna, Istituto Nazionale di Geofisica e Vulcanologia, Via Donato Creti 12, 40135 Bologna, Italy (daniel@bo.ingv.it)

In routine moment tensor projects, propagation effects on the wavefield are computed for significantly simplified earth models. Consequently, the inversions are restricted to a relatively long-period band of observed waveforms, which is less sensitive to lateral heterogeneity in earth. We may expect a better resolution of source parameters, and often observe a better quality of the recorded signal, using shorter period bands, however this may require more careful modeling approaches. We synthesize an a priori 3D model for the complex Alpine-Apenninic region from available studies of the lithosphere, and use the spectral element method for numerical simulation of regional 3D seismic wave propagation on a cluster of parallel Linux PCs. We compute Fréchet derivatives with respect to the 6 independent moment tensor elements, at several trial depths, for 3D moment tensor inversion. We show the example of the 2004 Salò (northern Italy) earthquake, using 24 seismic stations out to 530 km epicentral distance. Observed waveforms can be matched in a broad period band from 100 s to 15 s. We obtain moment magnitude M_W = 5.0 and a reverse faulting source (strike N225˚E, dip 32˚ and rake 68˚) at 7.5 km depth, with negligible 2% isotropic and 1.5% CLVD contributions. The resolution of depth, fault angle parameters and non-double-couple components improves significantly for shorter periods, indicating the potential of 3D modeling to obtain better constrained source estimates for moderate and small earthquakes in structurally heterogeneous environments.