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A ten year Moment Tensor database for Western Greece

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ABSTRACT

Moment Tensors (MTs) provide important information for seismotectonic, stress distribution and source studies. It is also important as a real time or near real time information in shakemaps, tsunami warning, and stress transfer. Therefore a reliable and rapid MT computation is a routine task for modern seismic networks with broadband sensors and real-time digital telemetry. In this paper we present the database of Moment Tensor solutions computed during the last ten years in Western Greece by the University of Patras, Seismological Laboratory (UPSL). The data from UPSL broad band network were used together with the ISOLA Moment Tensor inversion package for routine MT calculation. The procedures followed and the comparison of UPSL derived solutions with the ones provided by other agencies for Western Greece region are presented as well. The Moment Tensor database includes solutions for events in the magnitude range 2.8–6.8 and provides a unique insight into the faulting characteristics of Western Greece. Moreover it paves the way for detailed studies of stress tensor and stress transfer. The weak events' Moment Tensor included in UPSL's database are important for the comprehension of local seismotectonics and reveal the role of minor faults, which may be critical in seismic hazard estimation.

1. Introduction

Since 2002 the University of Patras Seismological Laboratory (UPSL), has began an effort to upgrade its permanent seismic network in Western Greece. The main target was to upgrade the existing stations from analog to digital and install new stations in critical sites as regards the network geometry. Within two years the analog stations of the so called PATNET seismic network were substituted by digital ones while new stations were installed completing the new network called PSLNET (code HP, Fig. 1). Since 2008 PSLNET joined the three regional seismic networks of Greece to establish the new Hellenic Unified Seismic Network (HUSN); this fact increased enormously the availability of high quality broad band data, which could be used in standard seismological applications (i.e. location, magnitude determination, source inversion etc).

Western Greece (Ionian Islands and Western Peloponnese) represents one of the most seismically active regions in the Mediterranean (Hatzfled et al., 1996). Within a small geographic area all faulting styles are found, moreover, the plate boundaries aren't clearly defined in many places, leaving the space open for speculations on the existence of a microplate at the area (Vassilakis et al., 2011; Serpetsidaki et al., 2014; Pérouse et al., 2011). The major tectonic features are the subduction of the African plate beneath the Aegean microplate along the western Hellenic trench, the Cephalonia transform fault at the northwestern end of the Hellenic arc and the Corinth Gulf continental rift.

The Cephalonia Transform Fault (CTF) is a major strike-slip fault that links the subduction boundary to the continental collision between the Apulian microplate and the Hellenic foreland (Fig. 1) (Louvari et al., 1999). The Corinth Gulf is an asymmetric graben and the fastest-spreading intra-continental rift on Earth, with the geodetically measured extension varying from~5 mm/yr at the eastern part, to ~15 mm/yr at the western part (Briole et al., 2013), characterized by a high level of microseismicity.

In this paper, the results of a ten year (2005–2015) routine determination of MT solutions in the area are presented. The solutions are determined for seismic events occurring for a wide range of magnitudes from weak Mw~3.0 to strong events Mw~6.8. In detail we present the uncertainty of the solutions in terms of quality factors such as variance reduction, condition number, inversion stability (Sokos and Zahradník, 2013) and compare the solutions to those published by other institutes. Similar attempts to routinely determine the Moment Tensor for Greece have been done

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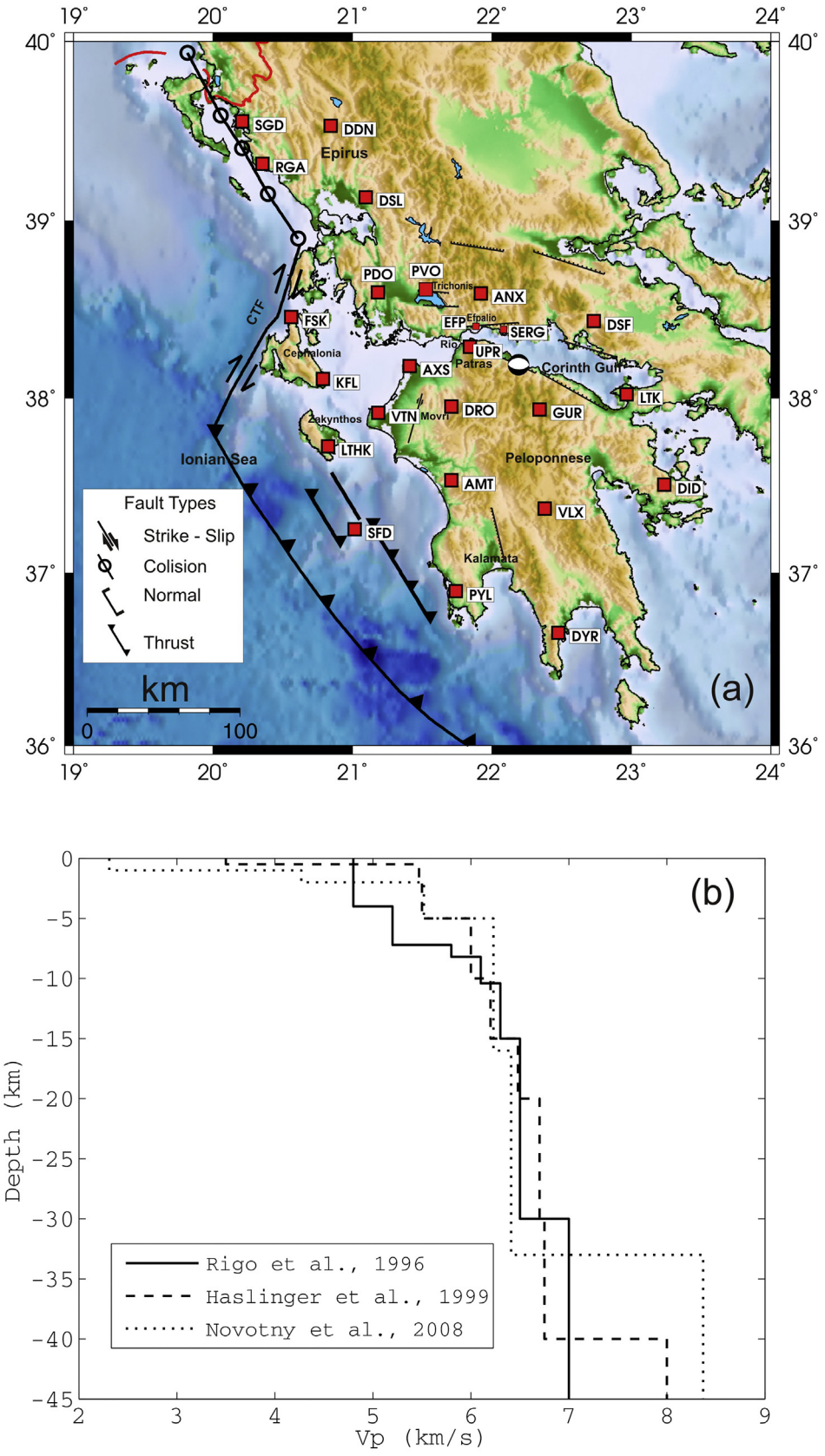

Fig. 1. a) Map showing the main tectonic features in Western Greece; red squares represent the seismic stations operated by UPSL during the last ten years. The focal mechanism corresponds to the event of Fig. 2. The cities discussed in the text are also shown b) crustal models used in Green function calculation determined by Rigo et al., 1996 (solid line), Haslinger et al., 1999 (dashed line) and Novotny et al., 2008 (dotted line). (For interpretation of the references to colour in this figure caption, the reader is referred to the web version of this article.)