The January 2010 Efpalio earthquake sequence in the western part of the Gulf of Corinth, Central Greece.

Ganas A. , Makropoulos K. , Drakatos G. , Chouliaras G. , Papanikolaou M. , Fokaefs A. , Kolligri M.

Institute of Geodynamics, National Observatory of Athens, Greece (http://www.gein.noa.gr)

GREEK DEMOCRACY
MINISTRY OF EDUCATION
LIFELONG LEARNING
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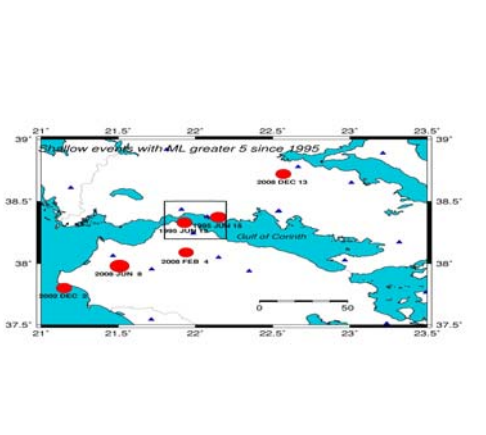
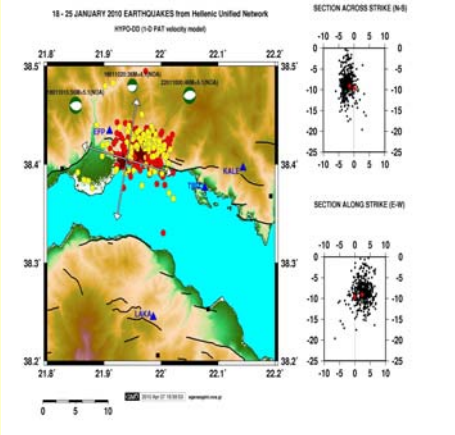
ABSTRACT

The Aegean broader region (Greece) is one of the most active extensional continental regions in the world,located between the two lithospheric plates of Eurasia and Africa, which converge at a rate of about 1cm/yr. The total extension across the Aegean is about 4-5 cm/yr as deduced from satellite geodesy. The Gulf of Corinth is situated in the inner part of Aegean microplate. The Gulf is the most prominent rift in this region and has experienced several destructive earthquakes in recent decades. The geological evidence of normal faulting and the high level of seismicity, both historical and instrumental, implies a high rate of extension.

On 18 January 2010, 15:56 UTC a Mw=5.1 (NOA) earthquake occurred near the town of Efpalion, about 10 km to the east of Nafpaktos, along the north coast of the Gulf of Corinth. Another strong event occurred on 22 January 2010, 00:46 UTC with Mw= 5.1 (NOA) approximately 3 km to the NE of the first event. This sequence ended a 15-year seismic quiescence in this area of Greece. The last major event was the Aigion (June 1995, Ms=6.2), offshore earthquake about 20 km to the east.

The paper will present an analysis of the seismological data of this sequence results that include maps of spatiotemporal variations in seismicity rate and implications for the stress state in the western Gulf of Corinth.

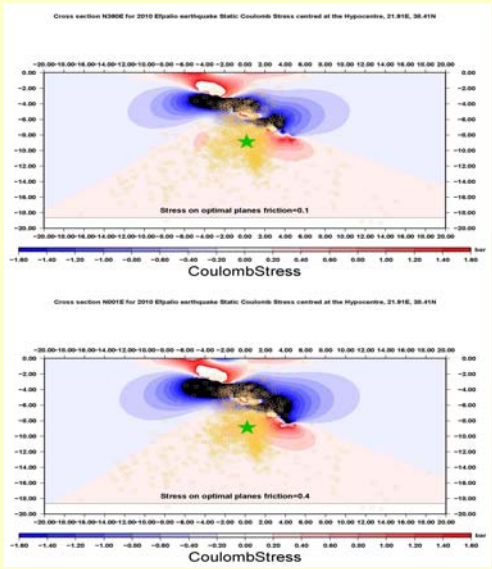


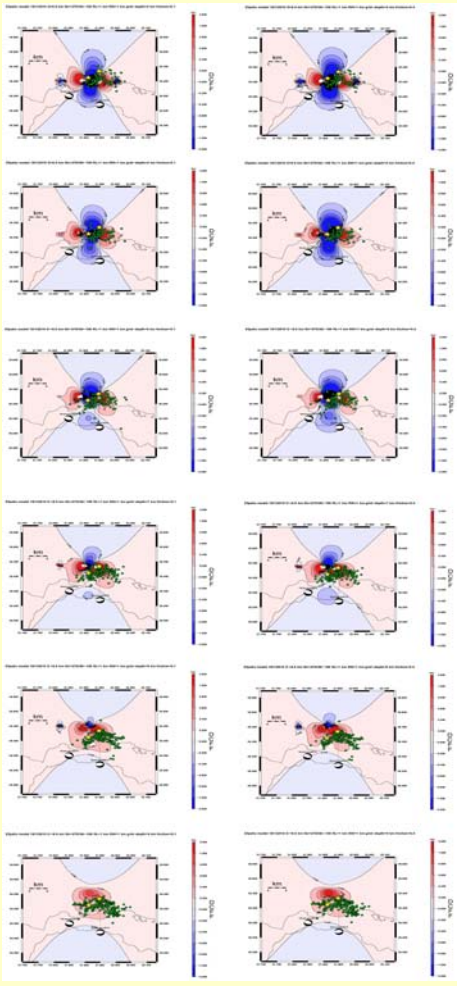


Coulomb Stress Results

Cross – sections of Coulomb Stress following the 18 January 2010 Efpalio earthquake (Mw = 5.2) heading North – South. Reddish colours indicate loading, bluish colours indicate unloading, respectively. The upper section assumes a coefficient of friction of 0.1 along the fault plane; the lower section assumes a friction of 0.4. Coulomb stress has been calculated for optimal planes to regional extension (N187°E). Orange circles represent aftershock hypocentres. It is clearly seen that the majority of aftershocks occurred on loaded areas of the crust. Aftershocks were relocated using HypoDD software.

Maps of Coulomb Stress following the 18 January 2010 Efpalio earthquake (Mw = 5.2) at various depths inside the upper crust (from top to bottom the maps are at depths of 4, 5, 6, 7, 8 and 9 km). Reddish colours indicate loading, bluish colours indicate unloading, respectively. The left frame assumes a coefficient of friction of 0.1 along the fault plane; the right frame assumes a friction of 0.4. Coulomb stress has been calculated for optimal planes to regional extension (N187°E). Green circles represent aftershock hypocentres at the depth of the map plus or minus 500 m to account for hypocentral error. It is clearly seen that the majority of aftershocks occurred on loaded areas of the crust. Aftershocks were relocated using HypoDD software.

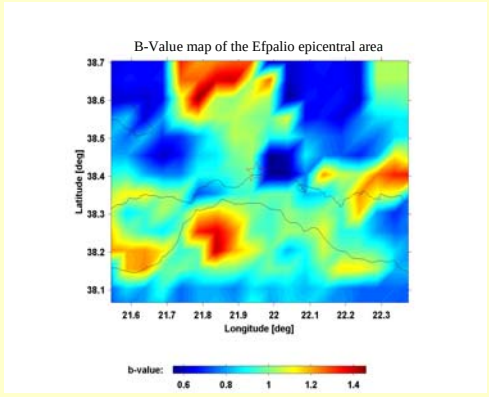


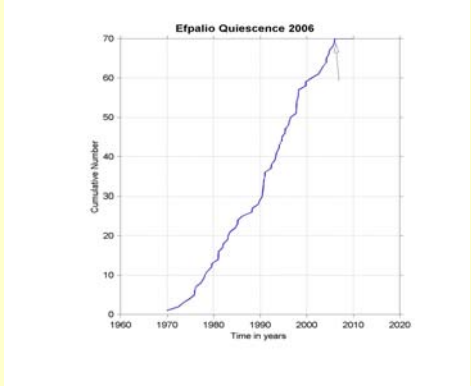


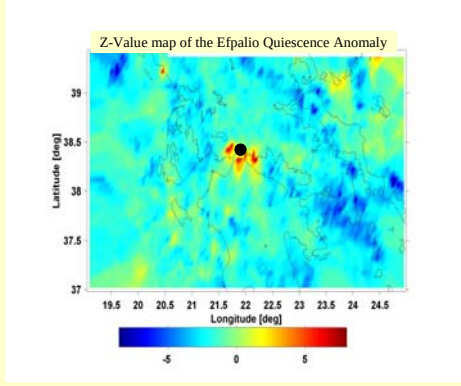
b-Value and Z-Value Results

The mapping of the frequency–magnitude relationship represents a self-organized critical system and it is used in identifying differences in the stress regime and the heterogeneity of the investigated area. It is generally found that the *b*-value is a kind of a 'stress meter' since a plethora of studies have found that the *b* -value is inversely proportional to stress. In addition it is found that for many earthquakes, the ruptures are initiated in low *b*-value regions (asperities) and preferably stop in high *b*-value regions. This is confirmed for the Efpalio earthquake since the rupture is found to propagate towards the low *b*-value region.

Seismic quiescence has shown promising results in identifying precursory anomalies related to crustal main shocks and the z-value is used to rank the significance of quiescence. The spatial mapping of z-values for the Efpalio earthquake indicates a significant quiescence anomaly surrounding the epicenter which is shown to begin almost 4 years prior to the main shock.







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