

ABSTRACT

The recent seismic activity in 3 different areas of Central Greece is analysed to investigate seismicity rate changes prior to strong crustal main shocks. The statistical methodology uses the earthquake catalogue of the Institute of Geodynamics of the National Observatory of Athens (NOA) and the ZMAP software to investigate the models of precursory seismic quiescence and precursory accelerated moment release. This approach has been recently developed to complement the investigations that use the newly developed concept of 'natural time' in order to forecast the epicentral area and the time of occurrence of strong ($M_s > 6$) main shocks in Greece.

Methodology and Results

The earthquake catalog of the region of investigation is compiled from the monthly bulletins of the National Observatory of Athens is used as database in this study. The homogeneity and completeness of the catalog has been previously evaluated in detail¹.

Seismic quiescence² and accelerated moment release³ (AMR) has shown promising results in identifying precursory anomalies related to crustal main shocks.

This investigation uses ZMAP⁴ to identify seismic quiescence and AMR using with a recent methodology^{5,6} before the occurrence of 3 strong crustal earthquakes that took place in Central Greece.

The z-value method is used to rank the significance of quiescence by the spatial mapping of z-values and the time-to-failure hypothesis is used to estimate the time of occurrence of the main shocks.

The results of the quiescence investigation in cases 1 and 2 show that the quiescence period began some years before the main shock and lasted a few years. Following the quiescence an acceleration period began and lasted until the occurrence of the main shock. In case 3 the quiescence period ended with the main shock. The spatial extent of the quiescence areas in all cases covers several kilometers around the epicentral area.

This acceleration period is modeled using the time-to-failure empirical technique that hypothesizes that the rate of earthquake energy release is proportional to the inverse power of the remaining time to failure. The time-to-failure equation was applied to the cumulative event curve that surrounds the epicentral area by fixing the value of $m=0.32$. The result is a successful estimation of the occurrence time of the main shock within a few days. The origin of this success is attributed to the proper selection of the 'm' value.

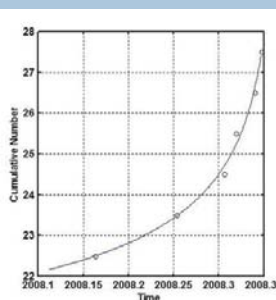
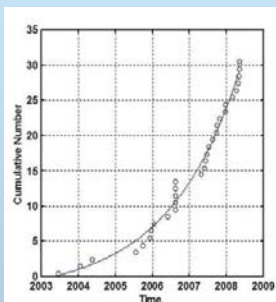
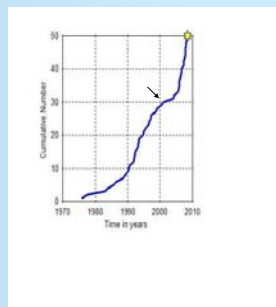
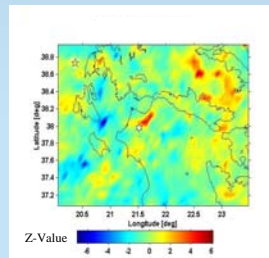
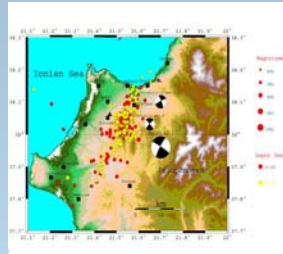
Recent research in Greece⁷ and Japan⁸ reported the success of associating the pre-seismic electric anomalies with the "natural time" analysis of the on going seismicity as a new tool in evaluating the occurrence of the impending main shock. The coincident reporting of successful forecasts by independent investigators that employed different methodologies seems to encourage further cooperative multidisciplinary investigations for earthquake prediction research in Greece.

References

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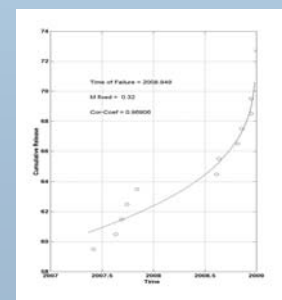
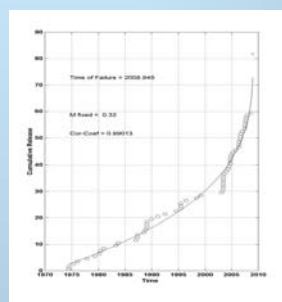
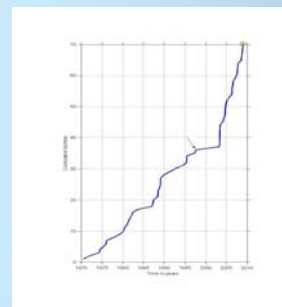
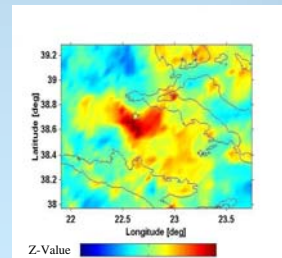
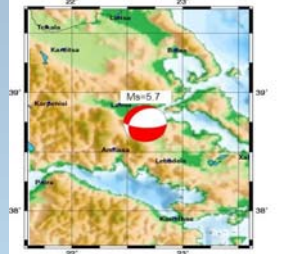
CASE 1

8-6-2008, $M_s=6.4$



CASE 2

13-12-2008 $M_s=5.7$



CASE 3

18-1-2010, $M_s=5.7$; 22-1-2010, $M_s=5.6$

