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Distributed Earthquake Faulting in the Aegean Sea and Kinematic Analysis of Strong Events

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Intense earthquake activity in the Aegean Sea and the surrounding lands provide abundant data, of continuously increasing quality as high technology instruments are installed. The Aegean Sea lying in the crossroads along the belt of the ongoing collision between the Eurasian plate and the African plate, and also responding to the westwards intrusion of the Anatolian plate from the east, not to mention the counterclockwise rotation of Adria in the west, has all the reasons to be considered a natural "geophysical laboratory".

Nearly 2,000 earthquake focal mechanisms in the Aegean Sea and the surroundings for the period 1912- 2006, for $1.5<Mw<7.5$, and depths from 0 to 170 km, indicate a uniform distribution and smooth variation in orientation over wide regions, even for the very small magnitude earthquakes. $\sim$ 60% of the focal mechanisms show normal faulting, that mainly strikes $\sim$E-W. However, a zone of N-S normal faulting runs the backbone of Albanides-Hellenides Mountain Range. Low-angle thrust and reverse faulting is confined in western Greece (Adria-Eurasia convergence) and along the Hellenic trench (Africa-Eurasia convergence). In the central Aegean Sea the effect of the propagating tip of the North Anatolian Fault into the Aegean Sea is pronounced and strike-slip motions are widely distributed. Shearing does not cross central Greece. Strike-slip motions reappear in the Cephalonia-Lefkada Transform Fault zone and in western Peloponnese that shows very complex tectonics, with variable fault structures operating and favorably oriented to the presently acting stress-field. In western Peloponnese the sense of the observed shearing is not yet clear, whether it is dextral or sinistral, and this lack of data has significant implications for the orientation of the earthquake slip vectors compared to the GPS obtained velocity vectors.

The occurrence of the 1999 Mw7.8 Izmit earthquake has increased the rate of background seismicity in the broader Aegean Sea and a number of strong Mw>5.9 earthquakes, shallow and intermediate depth, have occurred since then: e.g. 07 Sep 1999 Mw5.9 Athens earthquake; 26 July 2001 Mw6.4 Skyros; 22 Jan. 2002 Mw6.1 h=105km Karpathos; 21 May 2002 Mw5.8 h=105km Milos; 14 Aug. 2003 Mw6.4 Lefkada; 08 Jan 2006 Mw6.7 h=65km Kythira. Using teleseismic, as well as regionally recorded waveforms we have been able to study the source process and the details of moment release for these events. Indicatively we refer to 2003 Lefkada earthquake, for which the multiple character of the source was revealed, as well as to the intermediate depth 2006 Kythira earthquake, for which additionally to the multiple character, the focal mechanism exhibited significant (>40%) non-double couple component. Significant observations for engineering purposes is the fact that in most cases we observed considerable number of off-fault aftershocks, which resulted from the activation of a whole nearby zone of smaller faults, and also the fact that usually the locus of the slip patch with the highest moment release, is away from the mainshock epicenter.