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The 17 October 2005 earthquakes at the Gulf of Siğaçik (western Turkey): directivity and slip models for the strongest events

C. Benetatos , **A. Kiratzi**

Aristotle University of Thessaloniki, Department of Geophysics, 54124 Thessaloniki, GREECE

(kiratzi@geo.auth.gr / Fax: 00302310998528 / Phone: 00302310998486)

The October 2005 series of earthquakes that occurred in the Gulf of Siğaçik (western Turkey) reveal the operation of pure strike-slip faults in a region dominated by N–S extension and bounded by well-documented graben structures. The sequence is characterized by the occurrence of three moderate size events (17 October 2005, 05:45 UTC, M_w 5.4; 17 October 2005, 09:46 UTC, M_w 5.8; and 20 October 2005, 21:40 UTC, M_w 5.8) with an eastward propagation of occurrence and close spatial separation ($<$6 km). Aftershocks obtained from high-quality local network (Aktar et al., 2006 *in review*) generally are aligned along an ENE-WSW direction, however they also revealed activation of NE-SW trending structures, close to the epicenter of the 1^{st} event, which imply sinistral strike-slip sense of motion. Thus, the identification of the fault plane, at least for this event, is crucial for the interpretation of the sequence. As the distribution of aftershocks was puzzling, because it is not clear whether the NE-SW aftershocks cloud should be considered as off-fault aftershocks, or aftershocks related to the fault plane, here we explore the presence of any directivity effects related to the propagation of these events that would shed light to the identification of the fault plane.

Thus, at first we estimate source time functions through an empirical Green's function approach to examine the variation of their shape with azimuth around the source and afterwards we invert their shapes to examine the spatial and temporal distribution of the slip on the main fault. Due to the location of these events at the cross-boundary between Greece and Turkey we used broadband records from the National Seismographic Networks of both countries that provided adequate coverage in azimuth of

the activated area. The shape of the source time functions (STF's) of the first event of 17 October 2005, 05:45 UTC, M_w 5.4, exhibit clear directivity towards SW, which strongly implies that from the two nodal planes the NE-SW trending one is the fault plane, whereas the STF's for the stations lying on the north and south of the epicenter are similar, exhibiting no directivity effects. No clear directivity effects were observed for the two other strong events of the sequence.

The distribution of the slip onto the fault planes for the three strong events revealed that in all cases the moment was released in one significant slip patch extending in depth from $\sim$2 km to $\sim$10 km. The maximum slip was $\sim$40cm for the first event and $\sim$2 m for the other two events of the sequence. The existence of geothermal activity in the activated region implies that it is in an unstable state, with the fault systems close to rupture and very sensitive to stress perturbations and supports the simultaneous activation of multiple structures.