Quick identification of the fault plane for Mw 6.3, earthquake south of Crete, Greece July 1, 2009

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A strong earthquake occurred south of Crete island on the 1st of July 2009, at 09:30 UTC. We apply the H-C method (Zahradnik et al, 2008) for this event using the information available a few hours after the event, in order to identify the fault plane.

Using CMT solution of Harvard (HRV) and location of EMSC with varied depth we obtain H-C consistent solution with the hypocenter depth of 17km. The fault plane is the nodal plane with strike 285°, dip 31°. The distance of hypocenter from this plane is 1km, while the distance from the other plane is 11km. The distance between H and C is 11km (Fig.1).

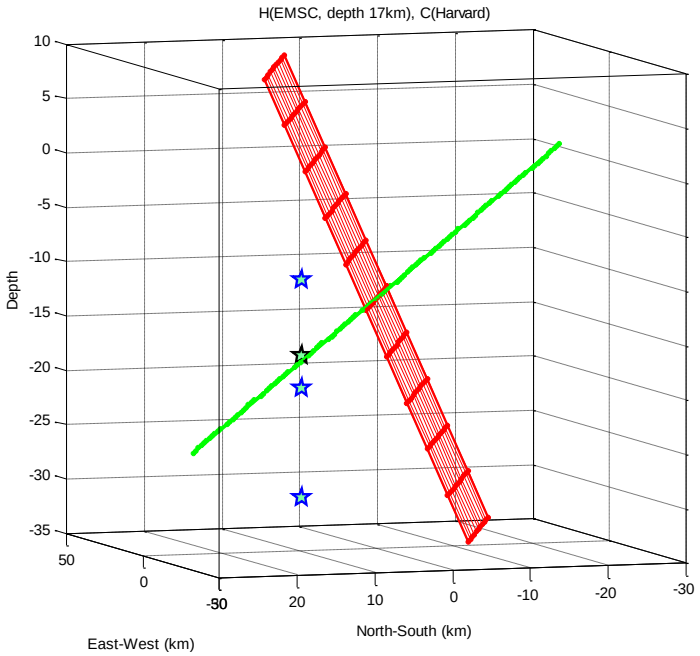
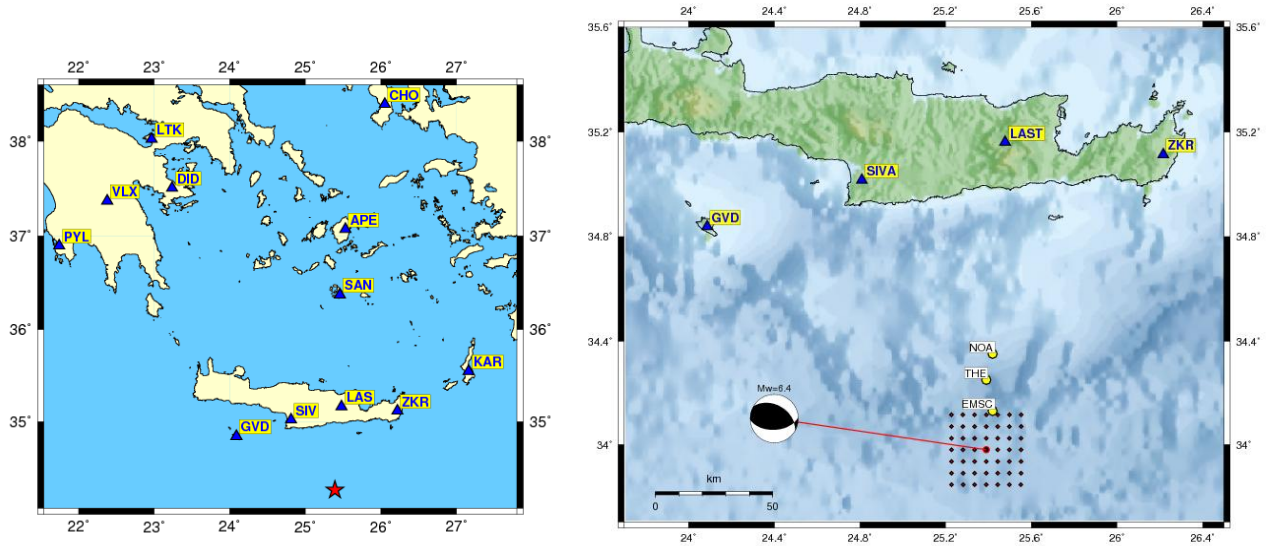


Figure 1. H-C Plot using the EMSC epicenter and varied depth (stars), and the CMT solution of HRV. The C is in the middle of the two crossing planes. The plane plotted in green is the likely fault plane. The North-South axis is positive to North, the East-West axis to East.

The same plane was identified independently using the centroid obtained from waveforms of 12 regional stations (distance range 100 to 470km). Data from the following networks were used, MEDNET (MN), GEOFON (GE), NOA (HL), THE (HT) and UPSL (HP) and are gratefully acknowledged. Moment tensor solution of UPSL is posted at EMSC at the following link (http://www.emsc-sem.org/index.php?page=current&sub=mtfull&id=GOKZ4). Space position of centroid position was found by grid search (http://seismo.geology.upatras.gr/isola/, Sokos and Zahradnik, 2008) (Fig.2). The solution was stable using two different crustal models and various selections of stations.

In this case (H-EMSC (17kmdepth), C-UPSL) the distance from the likely fault plane (strike 300^{o}, dip 43^{o}) is 1km, from the other plane 10km and the H-C distance is 10km (Fig.3).



(a) (b)

Figure 2. a) Stations used for the waveform inversion, b) Grid search for the centroid position.

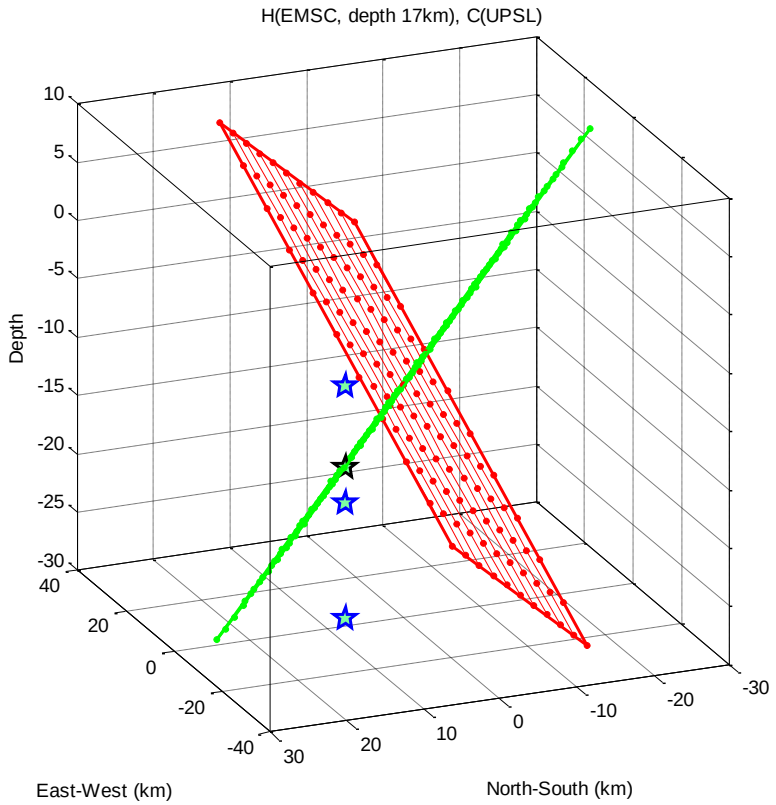


Figure 3. H-C Plot using the EMSC epicenter and varied depth (stars), and the moment tensor solution of UPSL. The C is in the middle of the two crossing planes. The plane plotted in green is the likely fault plane. The North-South axis is positive to North, the East-West axis to East.

Summary

Although the station distribution is not favorable, both teleseismic (HRV) and regional data (UPSL) are consistent in position of centroid and preference of fault plane. The likely fault plane is the one dipping to the north, with rupture propagating predominantly updip. The identified fault plane is the one expected based on geometry of subduction in the southern part of the Hellenic arc. This conclusion was obtained without use of the aftershock distribution.

References

Sokos, E. and Zahradnik, J, 2008 . ISOLA A Fortran code and a Matlab GUI to perform multiple-point source inversion of seismic data. Computers and Geosciences, 34, 967-977.

Zahradnik, J., F. Gallovic, E. Sokos, A. Serpetsidaki and G-A. Tselentis: Quick Fault-Plane Identification by a Geometrical Method: Application to the Mw 6.2 Leonidio Earthquake, 6 January 2008, Greece. Seismological Research Letters Volume 79, Number 5, September/October 2008, 653-662.