INTERNATIONAL
EARTHQUAKE SYMPOSIUM KOCAELI 2007
22 - 26 OCTOBER 2007

A PRESENT DAY EVIDENCE FOR THE ACTIVE TECTONICS IN THE INNER PART OF ISPARTA ANGLE IN SW TURKEY

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Keywords: Isparta Angle, Moment Tensor Inversion, Egirdir Lake, Extensional tectonics

ABSTRACT *The Isparta Angle is a prominent tectonic feature in Eastern Mediterranean region lying to the north of Africa-Anatolia collision zone and to the east of Aegean extensional zone. The distinct morphological trace of the eastern and western flanks namely the NW trending Aksehir fault zone and NE trending Fethiye-Burdur fault zone, respectively, marks the outer boundaries of the angle. The low seismic activity during the last century left the Isparta Angle as a feature with little-known seismotectonics that gave rise to long lasting debates. Several researches identified the western flank as a prominent left-lateral shear zone but the normal faulting associated with the M7 1914 and M6 1971 Burdur contradicted them. Similarly, the recent M6 2000 and 2002 Sultandag earthquakes showing predominantly normal faulting mechanisms took place on the "well-known Sultandag thrust fault" occurring along the eastern flank.*

Thus, the focal mechanisms of the large events on the eastern and western flanks of the Isparta Angle clearly depicts present day extensional tectonics in the outer part of Isparta Angle rather than strike-slip or reverse faulting. The March 30, 2007 (M_L=4.7) and April 04, 2007 (M_L=4.9) earthquakes in Egirdir (Isparta) are the two most recently events that shed light on the tectonics acting in the inner part of Isparta angle. These two events were accompanied with more than 100 smaller earthquakes that can be classified as aftershocks or foreshocks of each other. The NNW-SSE lineament of this seismic activity is in accordance with the N-S and NNW-SSW trending tectonic features such as Kovada graben and several other normal faults occurring further south extending toward Mediterranean seaside.

We conduct moment tensor inversion for these recent earthqukes using the digital local sismograms recorded by the broandband sismograph stations of the national seismic network operated by Kandilli Observatory and Earthquake Research Institute. The reliability of the locations is quite good owing to the newly deployed broand-band stations in the region. The accuracy of the seismicity maps based on data acquired from these stations and the results of source mechanisms solution is satisfactorily good.

INTRODUCTION

The study area, where the seismic activity related with the present study took place covers the southern offshore and onshore Egirdir Lake, is located in the inner part of the Isparta angle (Figure 1). The Isparta Angel is formed along to boundary of the African and Eurasian plates by NE- and NW- striking faults north of the Antalya Gulf in SW Turkey. The Isparta Angle is the link between: (a) the extensional province of western Turkey bounded to the south by the actively subducting Hellenic arc and (b) the uplifted Anatolian plateau bounded to the south by the Cyprus subduction zone (Glover and Robertson, 1998). The March 30, 2007 (M_L=4.7) and April 04, 2007 (M_L=4.9)

earthquakes in Egirdir (Isparta) are the two most recently moderate sized events that took place on relatively lower seismically active regions in the inner part of Isparta angle.

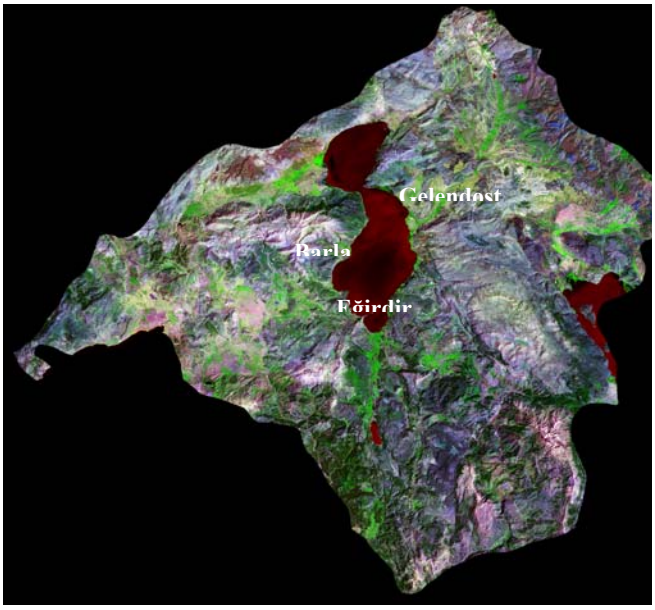

Figure-1. Satellite image (Landsat ETM+) of Egirdir Lake

At the beginning of 1990's there were only two broandband stations operating in Turkey. The installation of the nowadays satellite based data transmission system commenced in 2004 and the number of the broadband stations reached up to 67; thus, allowing Centroid Moment Tensor (CMT) retrieval of events Mw<4.0 all over the country.

In this study, we analyze the broadband waveforms of the 2007 Egirdir earthquakes where the Regional Moment Tensor inversion method has been used to determine the source parameters of the small and moderate size earthquakes (3.5≤M≤4.9) recorded at local and regional distances by the broandband sismograph stations of the national seismic network operated by Kandilli Observatory and Earthquake Research Institute.

METHODOLOGY

We use the moment tensor inversion method of Dreger (2002) to infer the source parameters of the earthquakes. The method makes use of the full waveform from a single or preferably many broand band stations recorded at regional and near regional distances. The earthquake fault plane solutions (strike, dip, rake) and the seismic moment follow directly from the moment tensor description. Inversion for the seismic moment tensor was done with the least squares approach that has been demonstrated as being reliable for events with local magnitudes as low as 3.5 in the study region. The preparation of the data for the moment tensor inversion involved first of all a quality check of the three component waveforms. Low signal-to-noise ratio, low sensitivity of some stations, or occasional recording gaps were the reasons for absence of data. All waveforms are band pass filtered between 50 to 12 s according to the data characteristic quality and the sizes of events. The source depth of the events are determined iteratively by performing inversions with Green's functions computed for a suite of source depths. The best fitting source depth may be determined from the variance reduction. Only up to

three stations are used for each moment tensor estimation. All available station combinations are then examined by testing all possible origin time offsets and source depths.

Here we processed 20 earthquakes given in the following table.

Table-1. The list of the Eğirdir earthquakes (M>3.5) occurred between 31.03-11.04.2007.

Tarih	Oluş zamanı	Enlem	Boylam	Ml	Md	H(km)
30.03.2007	16:56:52	38.002	30.929	4.7		6
30.03.2007	17:29:51	37.993	30.942	3.8		7
30.03.2007	19:23:56	37.993	30.914	4.7		6
30.03.2007	20:10:42	38.002	30.928	4.0		7
30.03.2007	20:49:25	37.993	30.923	3.9		7
30.03.2007	22:05:24	38.036	30.91		3.5	5
30.03.2007	23:43:37	38.009	30.916	3.8		4
31.03.2007	01:21:00	38.174	30.971	4.1		10
01.04.2007	07:38:37	38.010	30.907	3.6		9
10.04.2007	21:34:56	38.032	30.981	3.7		9
10.04.2007	21:39:18	38.014	30.95	4.6		7
10.04.2007	21:51:17	38.031	30.933	3.7		9
10.04.2007	22:00:34	38.003	30.93	4.9		8
11.04.2007	00:23:22	37.991	30.908	3.7		9
11.04.2007	00:35:08	38.008	30.94	3.7		6
11.04.2007	01:06:30	37.958	30.899	3.7		8
11.04.2007	08:59:14	38.025	30.912	4.3		23
11.04.2007	09:57:58	38.051	30.921	4.2		4
11.04.2007	10:06:38	38.039	30.914	4.3		5
11.04.2007	19:17:46	37.966	30.927	3.7		10

EXAMPLES

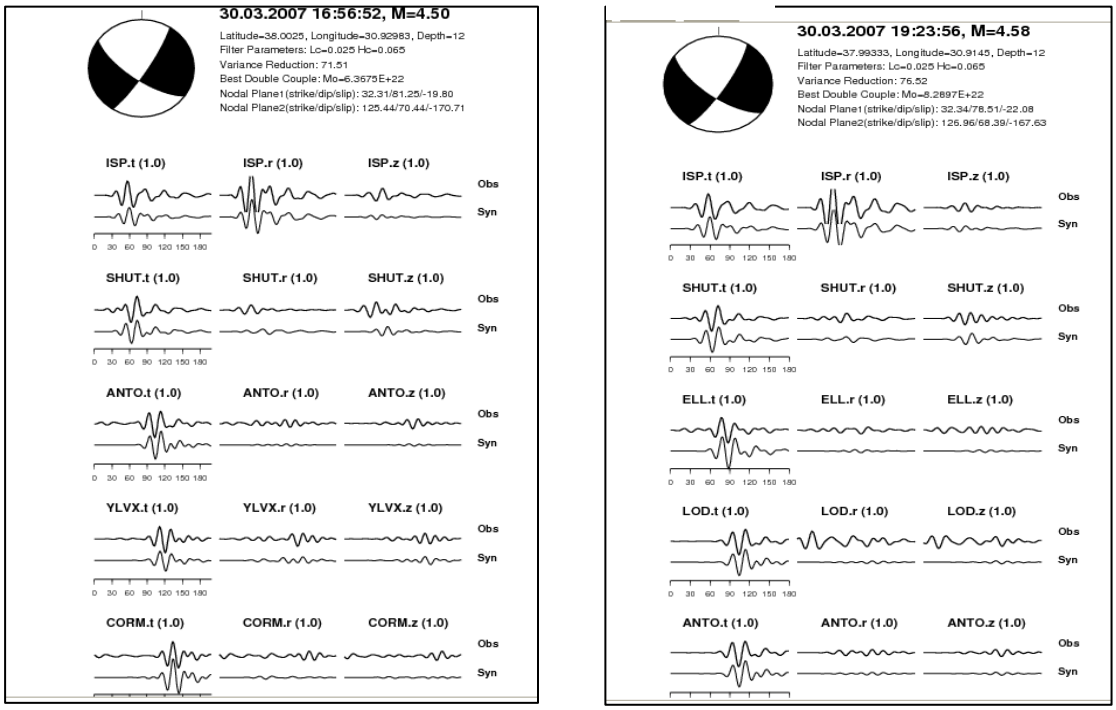

Figure-2. The Moment Tensor Inversion solutions for the April30, 2007 (GMT 16:56) Egirdir Lake (left) and the April 30, 2007 (GMT 19:23) (right) events. Comparision between observed (seismogram at the top) and synthetic (seismogram at the bottom).

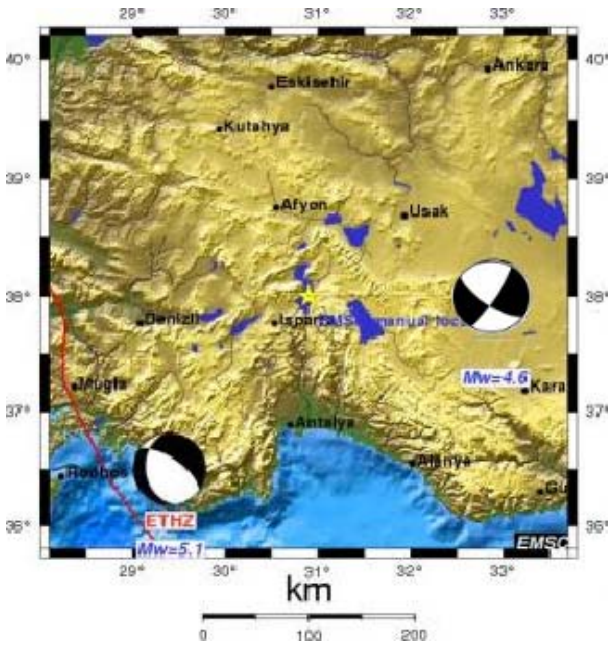

Figure-3. Comparision of the Moment Tensor Inversion solutions obtained by ETHZ and KAN for the April 30, 2007 (GMT 16:56) Egirdir Earhquake.

RESULTS

The preliminary CMT solutions of the recent two events (April,30,2007, 16:56 and the April 30,2007 19:23) illustrated in Fig 2 indicates that the fault plane solution is predominantly strike-slip with small normal component. As shown in Fig. 3 our Moment Tensor Inversion results are quite different from the result of ETHZ. Here, a reliable aftershocks distribution of the Egirdir earthqukes can help to distinguish which of the two nodal planes is the fault plane.

REFERENCES

Dreger,D.S., 2002, Time-Domain Moment Tensor Inverse Code (TDMT_INVC) Release 1.1, **www.seismo.berkeley.edu/~dreger**

Glover, C., Robertson, A., 1998, Neotectonic intersection of the Aegean and Cyprus tectonic arcs: extensional and strike-slip faulting in the Isparta Angle, SW Turkey, **Tectonophysics**, 298, 103-132.

Örgülü, G., 2001, Analysis Regional Moment Tensor Inversion Method and Its Applications To the Izmit, Duzce Earthquake Sequneces And Eastern Anatolian Earthquakes, **Doktora Tezi**, Boğaziçi Üniversitesi.

Yağmurlu, F., Savaşcın, Y., Ergün M., 1997, Relation of Alkaline Volcanism and Active Tectonism within the Evolution of the Isparta Angle, SW Turkey, **Journal of Geology**,105, 717-728.

Yılmazer, M., 2003, Deprem Kaynak Parametrelerinin On-Line Belirlenmesi, **Yüksek Lisans Tezi,** İstanbul Üniversitesi.