REPUBLIC OF TURKEY
Prime Ministry
Disaster And Emergency Management Presidency,
Earthquake Department, Ankara - TURKEY

PRELIMINARY REPORT ON ERZİNCAN-KEMAH EARTHQUAKE (EASTERN TURKEY) MI=5.4

An earthquake with magnitude Ml= 5.4 occurred at local time 06.22 on September, 22, 2011. Epicenteral coordinates of the earthquake is determined as 39.6635 N – 38.6842 E with focal depth 8.49 km. After this earthquake, 25 aftershocks were determined with magnitude range 1.7 – 3.4 in the one hour (Fig 1). Earthquake did not cause any damage or loss of life. Number of earthquakes-magnitude and time-magnitude graphs are given in Graph 1,2.

Focal mechanism solution performed by considering first motion direction of P wave of ML= 5.4 earthquake is emerged from strikeslip fault (Fig 2).

According to focal mechanism solutions these earthquakes result from Ovacık Fault Zone (NE-SW) which located in the South of Erzincan

This region is a very active in terms of seismicity. Distribution of the earthquakes that occurred in Erzincan Region from 1900 to present are given Fig 3 (M>4). Erzincan has been exposed to destructive earthquakes during the historical times. This city has been completely destroyed 11 times in the last millennium. The earthquake that occurred in 1939 (M=7.9) is the most destructive earthquake in Erzincan-Turkey. Historical time earthquakes are given Table 1.

Destructive earthquakes that occurred in the last century; 1909 M=5.1 Kığı, 1930 M=6.1 Kemah, 1939 M=5.9 Tercan, 1939 M=7.9 Erzincan, 1941 M=5.9 Erzincan and 1992 M=6.8 Erzincan earthquake.

September 22, 2011 Erzincan Earthquake was recorded by accelerometers at 6 different locations within National Strong Ground Motion Observation Network operated by Earthquake Department at Disaster and Emergency Management Presidency of Turkey. Peak ground acceleration values recorded at Erzincan Refahiye station which is located at nearest distance (about 28 km) to epicenter of this earthquake are 15.56 cm/sec2 in NS direction, 14.44 cm/sec2 in EW direction and 6.75 cm/sec2 in up-down direction (Table 2, Fig. 4).

Peak ground acceleration and seismic intensity values that can be created by 22 September 2011 Erzincan Kemah Earthquake in the earthquake-hit area and its vicinity are estimated and the maps showing the spatial distribution of these values are prepared (Fig 5,6)

Earthqauke activity of this region (and all of Turkey) has been observed in Disaster and Emergency Management Presidency, Earthqauke Department Data Center Ankara 7 days/24 hours with 200 Seismic station and 315 accelerometer. Obtained results are shared with public, press and relevant authorized.

For your information.

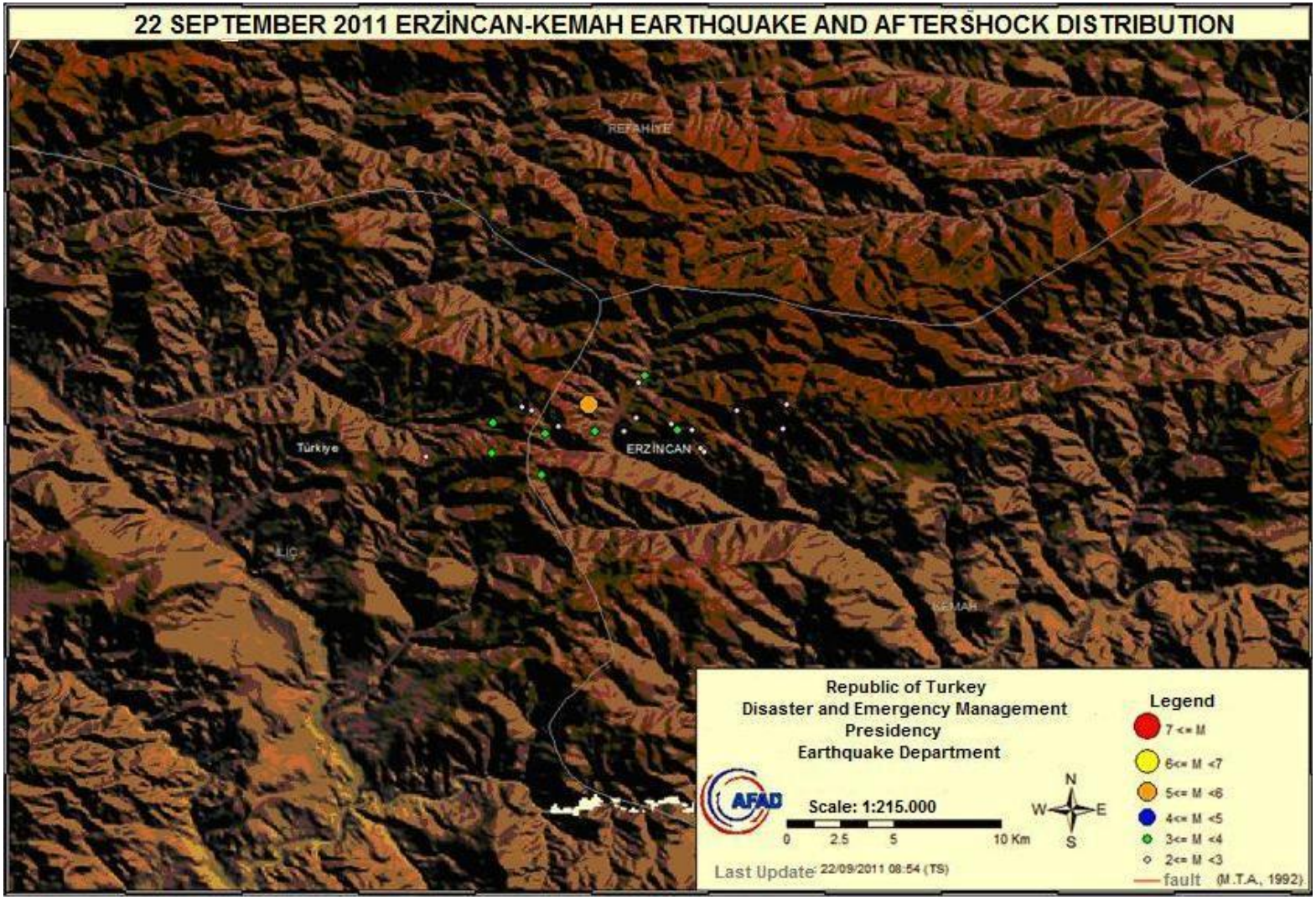
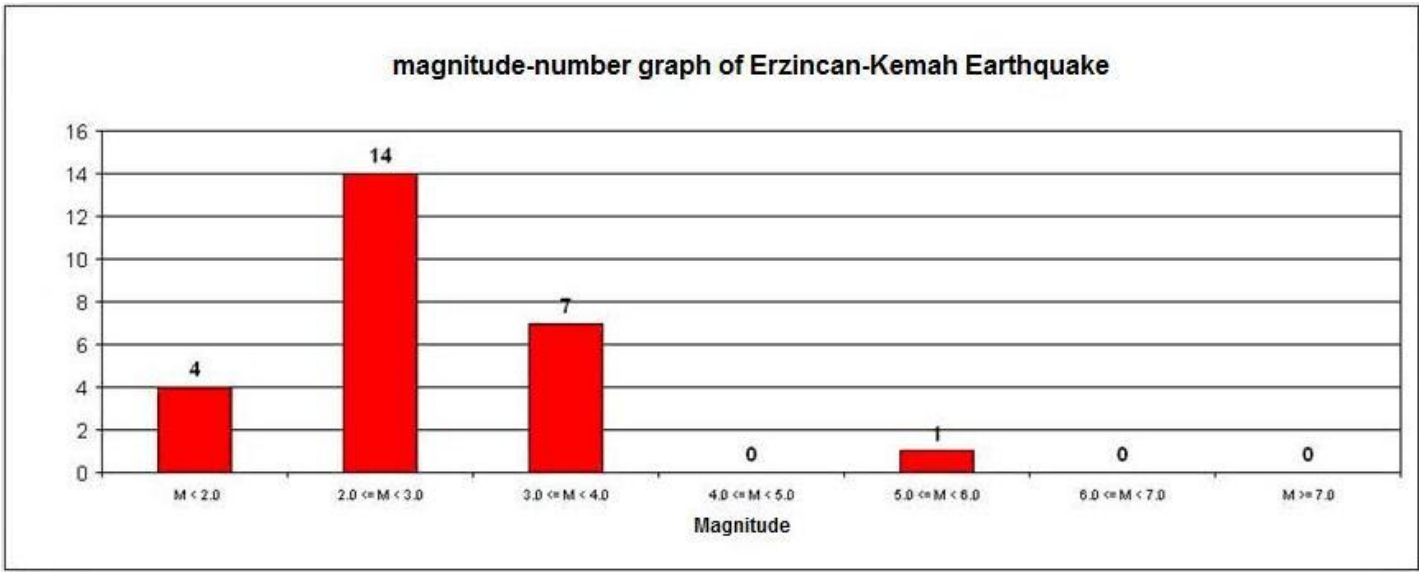
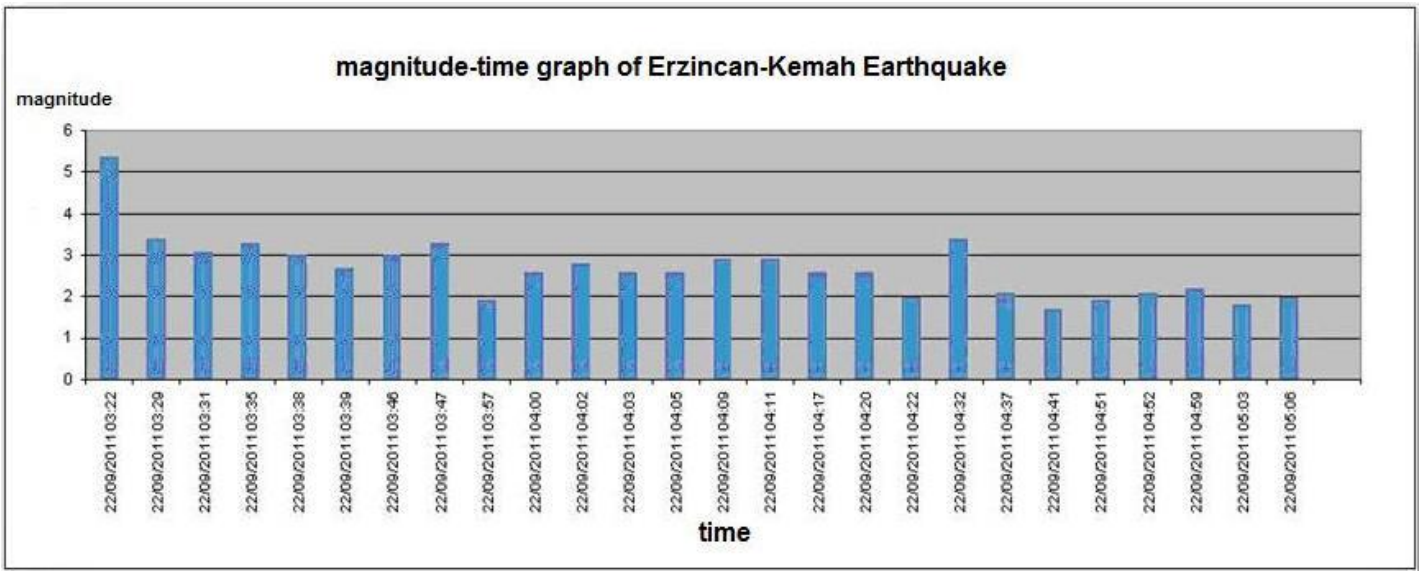


Figure 1: Erzincan-Kemah Earthquake (Ml=5.4) and aftershocks



Graph 1: magnitude-number of earthquakes graph of Erzincan Kemah Earthquake



Graph 2: magnitude-time graph of Erzincan Kemah Earthquake

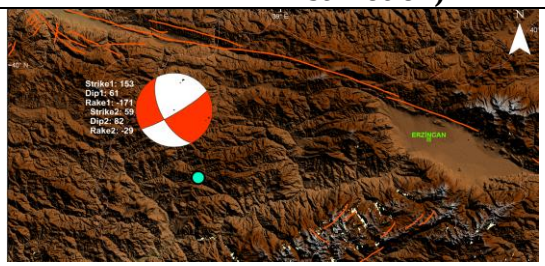
Date	Time	Ml	Focal Mechanism Solution (according to P wave first motion)
22.09.2011	06:22	5.4	

Figure 2: Focal Mechanism Solution of Erzincan-Kemah Earthquake (Ml=5.4)

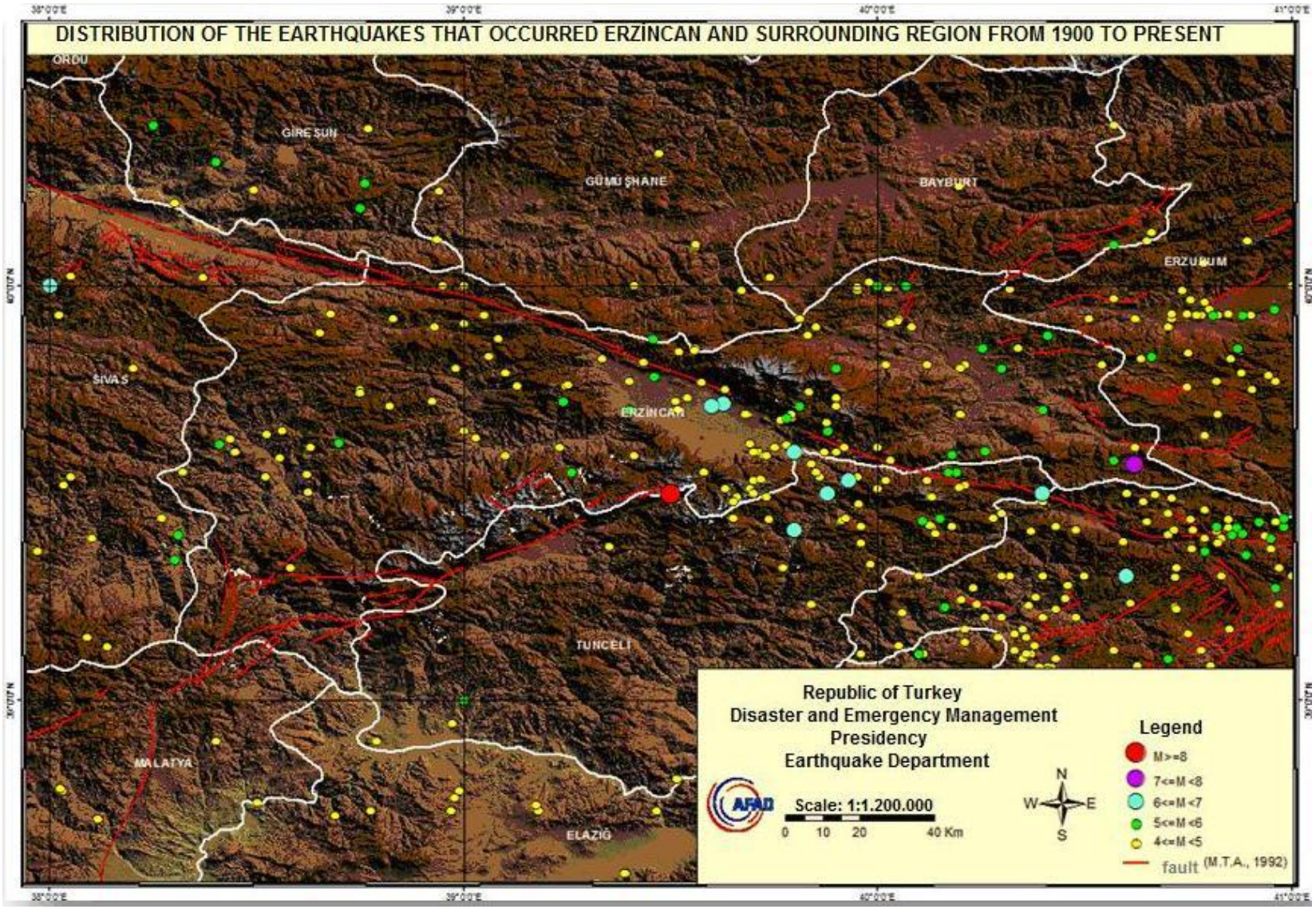


Fig 3. Distribution of the earthquakes that occurred in Erzincan Region from 1900 to present (M>4)

Historical Seismicity

Begining	Year	Latitude	Longitude	Location	Intensity	Ref.	References
M.S	1888	40	40	Erzincan	7	B1	13,18,8
M.S	1787	40	40	Erzincan	8	A2	13,18
M.S	1784	40	40	Erzincan,Pülümür,Erzurum	8	A1	2,18,19,8,1
M.S	1667	40	40	Erzincan	8	B1	18,2,13,8
M.S	1584	40	40	Erzincan,Erzurum	9	A1	2,16,8,13
M.S	1583	40	40	Erzincan	0	C2	18
M.S	1579	40	40	Erzincan	8	C1	15
M.S	1576	40	40	Erzincan	7	A2	2,16,8
M.S	1543	40	40	Erzincan	7	C1	8
M.S	1458	40	40	Erzincan,Erzurum	10	A1	8,2,16,13,18,21
M.S	1456	40	40	Erzincan	8	B1	13,18,2
M.S	1433	40	40	Erzincan	6	B3	8,2
M.S	1422	40	40	Erzincan	8	B1	8,2
M.S	1374	40	40	Erzincan	8	A2	16,8,2
M.S	1366	40	40	Erzincan	6	C1	8
M.S	1356	40	40	Erzincan	6	C1	2
M.S	1345	40	40	Erzincan	6	C1	16
M.S	1308	40	40	Erzincan	7	B1	8,2
M.S	1290	40	40	Erzincan	6	B3	2,11,16
M.S	1289	40	40	Erzincan	7	B3	2,16
M.S	1287	40	40	Erzincan	8	A1	8,2,13,16
M.S	1281	40	40	Erzincan	6	B1	16,2,11
M.S	1268	40	40	Erzincan,Erzurum	9	A1	8,2,13,16,1
M.S	1254	40	39	Refahiye-Erzincan,Sivas	8	A1	16,6,2,19,8
M.S	1236	40	40	Erzincan	7	B2	2,8
M.S	1168	40	40	Erzincan	8	A1	16,8,2,13,1
M.S	1161	40	40	Erzincan	7	B1	2,16,8
M.S	1068	40	40	Erzincan	7	C1	13
M.S	1047	40	40	Erzincan	0	C1	13
M.S	1045	40	40	Erzincan	9	A1	8,2,16,13
M.S	1011	40	40	Erzincan	8	A2	8,2,16

Table 1: Historical time earthquakes of Erzincan and Surrounding Region

Acceleration Records

No	Station		Equpment Type	Accelaration Records			Distance from station to epicenter (km)
	City	Town		KG (gal)	DB (gal)	UD (gal)	
1	ERZİNCAN	REFAHİYE	CMG-5TD	**15.56**	14.44	6.75	28
2	ERZİNCAN	MERKEZ	CMG-5TD	2.93	**3.03**	1.73	72
3	SİVAS	SUŞEHRİ	CMG-5TD	1.92	**2.14**	1.38	75
4	GÜMÜŞHANE	KELKİT	CMG-5TD	1.27	**1.55**	0.88	83
5	ELAZIĞ	PALU	CMG-5TD	0.93	**1.07**	0.66	152
6	ELAZIĞ	KOVANCILAR	CMG-5TD	0.85	**1.06**	0.45	147

Table 2: Acceleration records of Erzincan-Kemah Earthquake (Ml=5.4)

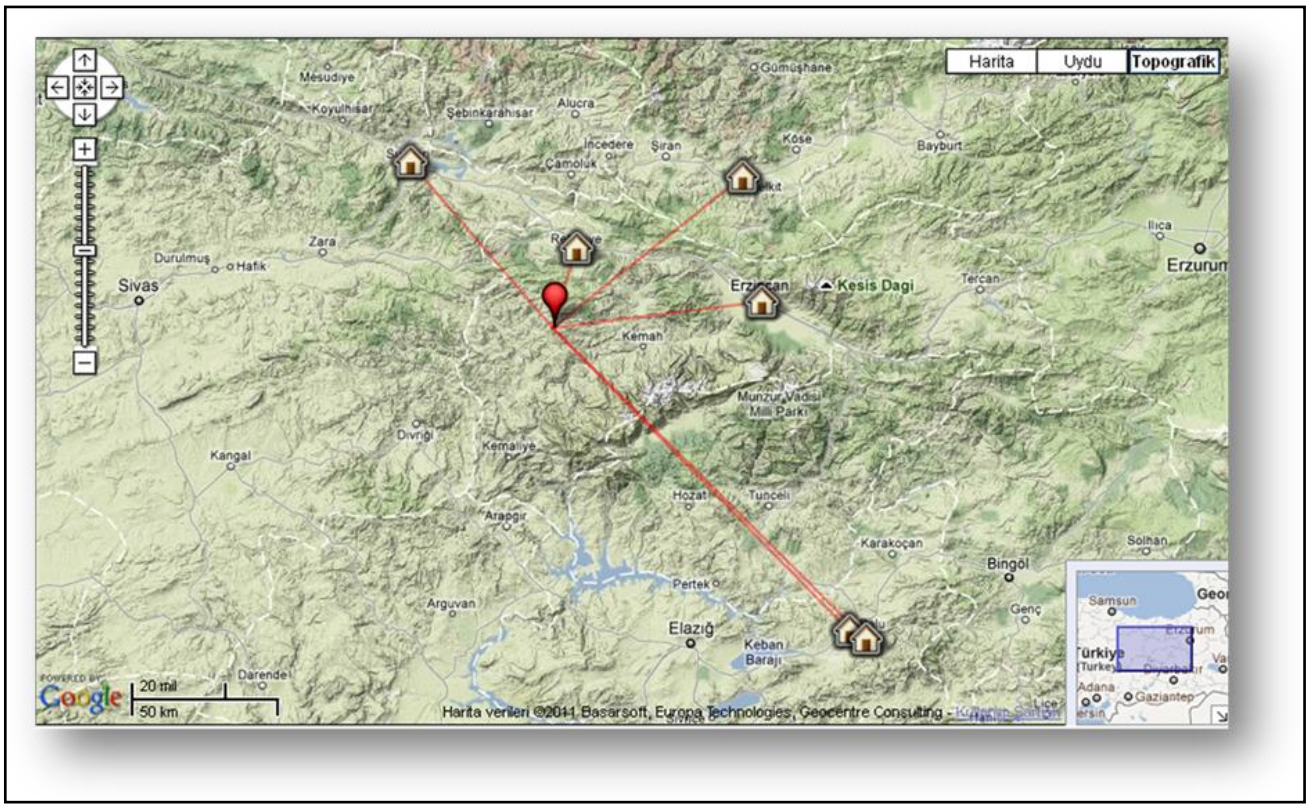


Fig 4. Acceleration records of Erzincan-Kemah Earthquake (Ml=5.4)

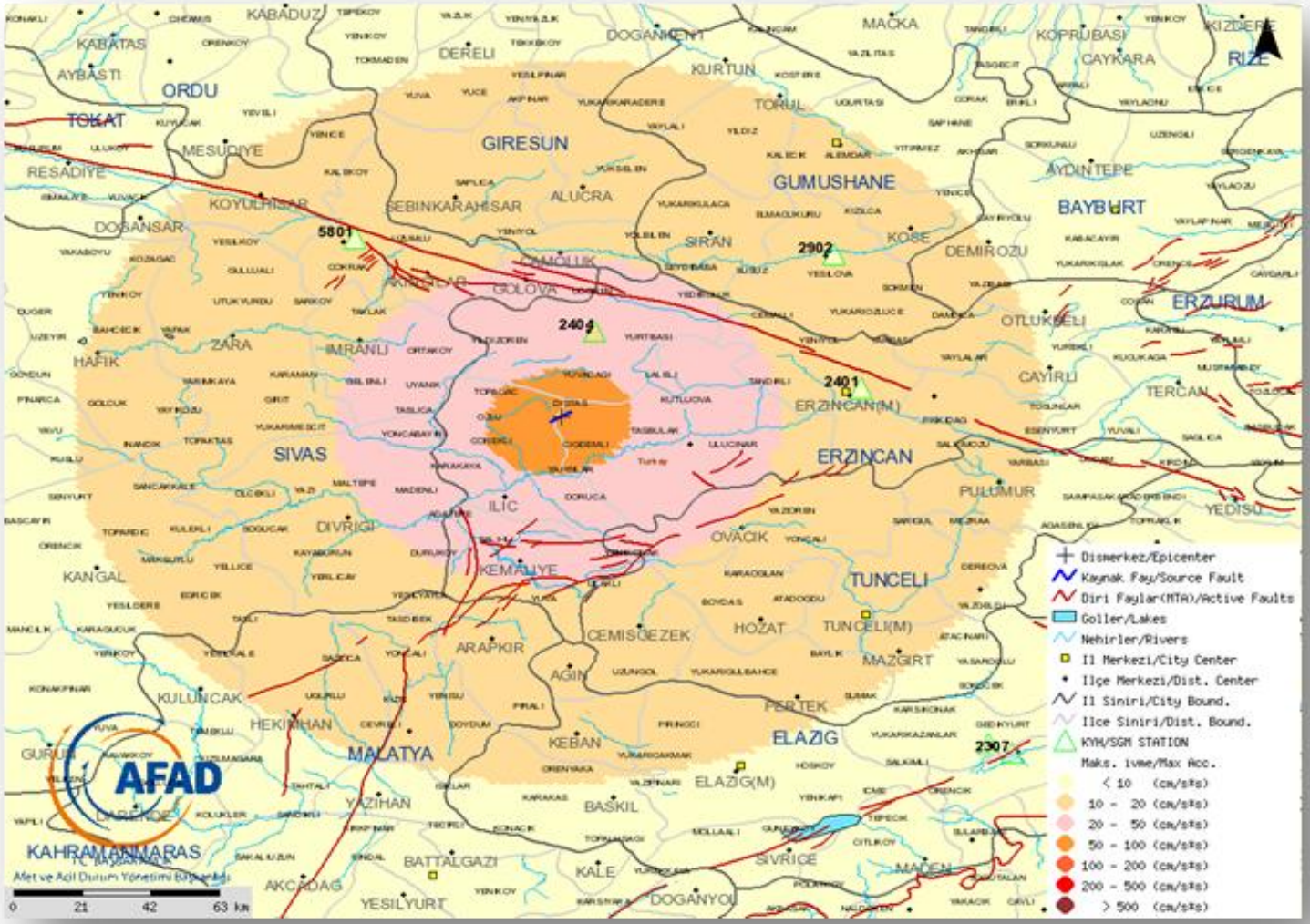


Fig.5: Peak Ground Accelaration Distribution of Erzincan-Kemah Earthquake (Ml=5.4)(Çeken et al.2008)

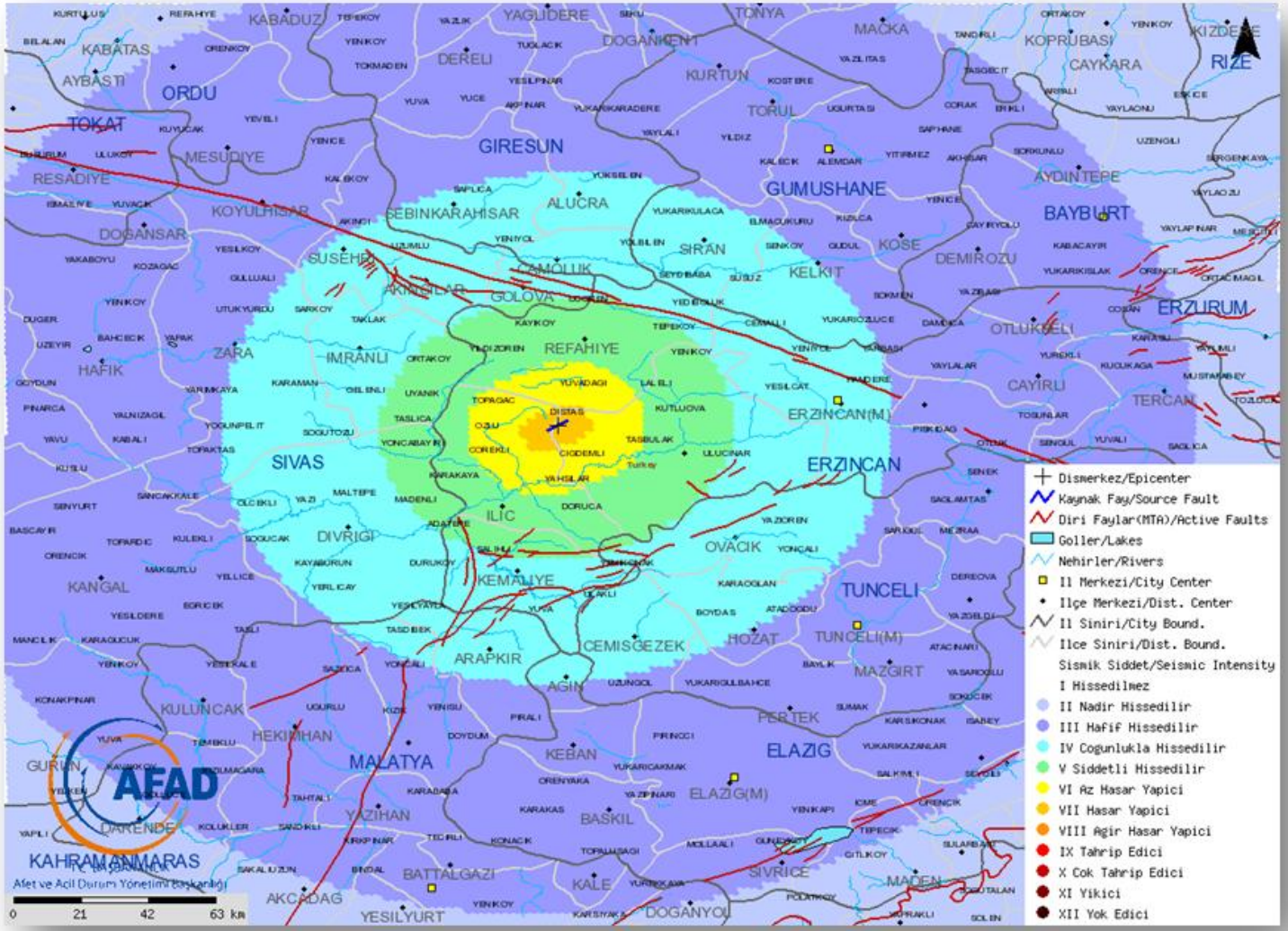


Fig.6: Seismic Intensity Map of Erzincan-Kemah Earthquake (Ml=5.4) (Arıoğlu et.al. 2001)

Refernces

- Arıoğlu E., Arıoğlu B. M., Girgin C. (2001). Doğu Marmara Depreminin Yer İvme Değerleri Açısından Değerlendirilmesi, Beton Prefabrikasyon, 57-58, 5-15.
- Çeken U., Beyhan G. ve Gülkan P. (2008). Kuzeybatı Anadolu Depremleri için Kuvvetli Yer Hareketi Azalım İlişkisi, 18. Uluslararası Jeofizik Kongre ve Sergisi, Vol:3B14, ss:1-4, Maden Tetkik ve Arama Genel Müdürlüğü, Kültür Sitesi, Ankara, 14-17 Ekim.
- Şaroğlu F., Emre Ö. ve Kuşçu İ. (1992). Türkiye Diri Fay Haritası, 1:1,000,000 ölçekli,

  Maden Tetkik ve Arama Genel Müdürlüğü, Ankara.
- TC. Başbakanlık AFAD Deprem Dairesi Başkanlığı (DDA). http://www.deprem.gov.tr/

References of historical earthquakes;

Code	References
1	Shblin,N.V., Karnik,V.,Hardzievski,D.(1974) Caalogue of Earthquakes UNESC,Skopje,Yugoslavia
10	Maravelakis,M.J.(1941)Beitrage zur Kentnis der Erdbbengeschicte von Griechenland und den Nachbarlandernauf Grund der Erinnerungen.Veröffentlichungen der Reichsanstalt für Erdbebenforschung in jena
11	Pınar,N.,Lahn,E.(1952)Türkiye Depremleri İzahlı Kataloğu.T.C.Bayındırlık Bak.Yapı ve İmar İş.Reis.Y.Seri 6,Sayı 36
12	İncicyan,P.G.(1976)Onsekizinci sırda İstanbul.İst.Fetih Cemiyeti Ens.Yayın No.43,Baha Matbaası,İstanbul
13	Arıncı,R.(1945)Arzda ve Yurdumuzda Zelzele Bölgeleri.Çoruml Mecmuası,Çorum Halkevi Yayını,Yıl 4,Sayı 29,Çorum
4	Yücel.E.(1971)İstanbul Depremleri HayatTarih Mecmuası,Sayı 6,Temmuz 1971,Cilt 2,S.58-63
15	Muralt Cronologie Byzantine.Prof.Dr.H.Soysal Arşivi,İstanbul
16	Andreasyan,H.(1970)Ermeni Kaynaklarından Derlenmiş Deprem Listesi.Yayımlanmamış, Prof.Dr.H.Soysal Arşivi,İstanbul.
1	Naima Tarihi Cilt 4,S.17-289,Cilt5, S.145-267
18	Akyol ,İ.H.(1938)Erzincan Zelzelesi ve Son Feyezanlar.Ülkü Halkevleri Dergisi,Cilt 11,Sayı64,Haziran 1938
19	Ambraseys,N.N.(1975) Studies in Historical Seismicity and Tectonics.Geodynamics Today,Chap.2,Te Royal Soc.,London.
2	Calvi,V.S.(1941)Erdbebenkatalog der Turkei und Einiger Benaehbarter Gebiete.Yayımlanmamış,Rapor No.276,MTA Enstitüsü,1941,Ankara
20	Öcal,N.(1968) Türkiyenin Sismisitesi ve Zelzele Coğrafyası , 1850-1960 Yılları İçin Zelzele Katoloğu Kandilli Rasathanesi Yayınları No:8, İstanbul
21	Andreasyan, H. (1973) xıv VE xv. Yüzyil Türk Tarihine ait Ufak Kronolojıler, Kolofanlar . İst. Üni. Ede. Fak. Tarih Ens. Dergisi, Sayı 3, İstanbul
22	Topkapı Sarayı Kütüphanesi Revan Kitapları No:1101 , Varak 105/b , 72/b , İstanbul
23	Cezar, M. (1963) Türk Sanat Tarihi Araştırmaları ve İncelemeleri I. Güzel Sanatlar Akademisi, Türk Sanatı Tarihi Enstitü Yayınları No:1, S:327-414
24	Kömürcüyan,E:Ç: (19529 XVII. Asırda İstanbul Tarihi İstanbul Üni. Edebiyat Fak. Yayınları , No:506, İstanbul
25	Coşar, Ö.S. (1979) Fransanın İzmir Dosyası 19 Aralık 1979 tarihli Yeni Asır Gazetesi , İzmir
26	H. Saadettin Tarihi Cilt II El Yazması , İstanbul Üni. Kütüphanesi, İstanbul
27	Reşit Tarihi Cilt II s.122-213 El Yazması , İstanbul Üni. Kütüphanesi, İstanbul
28	İstanbul İl Yıllığı (1973) S. 6-230 , İstanbul Üni. Kütüphanesi, İstanbul

29 İstanbul İl Yıllığı (1973) S. 167-270 , İstanbul Üni. Kütüphanesi, İstanbul

3 Ambraseys,N.N.(1965)The Seismic History of Cyprus.Revue de I'Union Inter.de Secours No.3,35-48,Geneva

30 Mambury,E(1925)İstanbul Rehber-i Seyyahin.Tercüman Gazetesi Arşivi,İstanbul.

31 Zincirkıran,N.ve diğerleri(1968)Hürriyet Cep Ansiklopedisi.Hürriyet Gazetesi Yayınları,İstanbul.

32 Şemdanı Zade(1976)Fındıklı Süleyman Efendi Tarihiİst.Üni.Ede.Fak.Yayını No.2088,Cilt1,S.176

33 Verrolot,M.P.(1856)Compt-rondu.Tableau des tremblements de terre qui ont eulieu dans I'Empire Ottoman en 1855.Ac de Sei.Paris,Tome 42,p.93-293

34 Gökmenzade Hacı Çelebi(Sayyid Hüseyin Rıfat)İşaretnuma(El Yazması),Cebeci Semt Kütüph.No.1314,Ankara

35 Slaars M.B.F.(1932),Çev.Arapzade Cevdet İzmir Hakkında Tetkikat.İzmir ve Havalisi Asarı Atika Muhipleri Yayını ,Sayı6,Marifet Matbaası,İzmir.

36 Deprem Dosyası Cumhuriyet Gazetesi Arşivi, İstanbul.

37 İslam Ansiklopedisi(1966)No.53B,İstanbul Maddesi,S.1214-1239

38 Swiss Reinsurance Company(1978)Atlas on Seismicity and Volcanism.Swiss Reinsurance Company,October 1977,Switzerland.

39 Ambraseys,N.N.,Zatobek,A.,Taşdemiroğlu,M.,Aytun,A.(1968)The Mudurnu Valley Eathquake of 22 July 1967.Serial No.622/BMS. RD/AVS,Paris,June 1968,UNESCO.

4 Plassard-Kogoş(1968)Catalogue des Seismes Re cents a Liban.Ann.Memoires de I'Observ.de Xsara.TomeIV,Cahier 1

40 Karnik,V.(1971) Seismicity of the Eurpean Area 2.D.Rediel Publishing Company /Dortrecht,Holland

5 Kondorskaya,N.V.,Shebalin,N.V.(1977)New Catalogue of strong Earthquakes on the Territory of USSR from theAncientest times to 1975.Moscow

6 Collection Academique Tome VI de la Partie Etrangere et Premier Tome de la Physique Experimantale Separee.

7 Broghton,T:R:S:(1938) An Economic survey of Ancient Roma.Vol.IV,The Johns Hopkins Press,Baltimore

8 Ergin,K.,Güçlü,U.,Uz,Z.(1967)Türkiye ve civarının Deprem Katoloğu.İ:T:Ü: Maden Fak.Arz Fiziği Ens.Yayın No.24,İstanbul

9 Francis,I.(1947)Bizans Kaynaklarına göre Orta Şark'ta Vukubulan Zelzeleler İ.Ü.Ed.Fak.Coğ.Bl.Doktora Tezi İ.Ü.Kitaplığı No.1420

A1 Kaynak sayısı üç'den fazla bilgi ve belge düzeyi yüksek

A2 Kaynak sayısı üç'den az bilgi ve belge düzeyi yüksek

A3 Kaynak sayısı üç'den fazla bilgi ve belgeleri geliştirilmeye gereksinim gösteriyor.

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B2 Kaynak sayısı üç veya daha az,bilgi ve belgeleri geliştirilmeye gereksinim gösteriyor düzeyi orta

B3 Kaynak sayısı üç veya daha az,bilgi ve belgeleri yetersiz.

C1 Kaynak sayısı yetersiz.

C2 Bilgi ve belgeleri yetersiz.

C3 Hem kaynak sayısı ,hemde bilgi ve belgeleri yetersiz.