

PRELIMINARY REPORT

July 21th 2017
Bodrum Offshore Earthquake
(Muğla-Turkey)
Mw=6.5

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21.07.2017 Bodrum Offshore Earthquake (Mw=6.5)

An earthquake with magnitude Mw=6.5 occurred at local time 01:31 on July, 21, 2017. Epicentral coordinates of the earthquake was determined as 36.9198 N - 27.4435 E. and 19.44 km depth. Total 225 weak motion stations record were used for determination of this earthquake parameters. After this earthquake, 1369 aftershocks were recorded with magnitude range 1.0- 5.0 in the first five days (21-26 July 2017) (www.deprem.gov.tr) (Fig.1, Graph 1).

This earthquake was strongly felt in large area. Muğla City and Districts center, whole Aegean Region and Kos Island in Greece. It caused major damage in some structures in Kos Island and 70 injured in Bodrum, 20 incured in Datça and 2 dead were reported by press in Kos Island.

Focal Mechanism Solutions performed by considering first motion direction of P wave and moment tensor method of Mw=6.5 earthquake is emerged from normal faulting (E-W direction) (Fig.2). Improvement of earthquake locations were performed via HypoDD method and It is given in figure 3 and 4 as comparatively. Total 1051 event were used (M \geq 1.0) as input data. HypoDD results indicate E-W linearity in aftershock activities. According to coulomb stress change that is performed with source fault parameter of Mw=6.5 earthquake, it is observed that west and east part of the fault are loaded with additional stress of approximately 0.8-1 bar and stress is decreasing in North-South direction. (Fig.5).

In the last century, earthquakes that occurred in the region are given as; 1926 Datça offshore Ms=7.7, 1933 Aegean Sea Ms=6.4, 1941 Muğla Ms=6.0, 1941 Muğla offshore Ms=6.0, 1943 Aegean Sea Ms=5.8, 1944 Aegean Sea Ms=5.6, 1989 Gökova Gulf Mw=5.5 (Fig.6).

Bodrum offshore earthquake has been recorded by 209 accelerometer stations, which belong to AFAD National Strong Motion Network (TR-NSMN). Epicentral distances (Repi) range from 12 to 628km. PGA values are uncorrected data and given in the table. The largest peak ground acceleration (PGA) has been recorded at Muğla-Bodrum Station called 4809 (158.76gal at NS component). According to 4809 record, SM durations have been calculated as follows; Significant Duration 5.2sec (estimated between 5% and 95% of the IA) as seen in the figure 7, Effective Duration 5.2sec, Bracketed Duration 19.9sec. In addition to this, Acceleration, Velocity Waveforms and Fourier and Response spectrum graphs of 4809 station are given below (Table 1 and Figure 7-10)



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Generated by AFAD-RED (Rapid Damage and Loss Estimation System), intensity Map is given in the figure 11. According to AFAD-RED, earthquake intensity has been designated as VII (very strong shaking). Also, acquired from measured accelerations, AFAD-ShakeMap of offshore of Bodrum Earthquake has been created by using AFAD Epicenter parameters as seen in the Figure 12.

Earthquake activity of this region (and all of Turkey) has been observed in Disaster and Emergency Management Presidency, Earthquake Department Data Center Ankara 7 days/24 hours with 255 weak motion and 660 accelerometer total 915 seismic station. Obtained results are shared with public, press and relevant authorized.

For your information.



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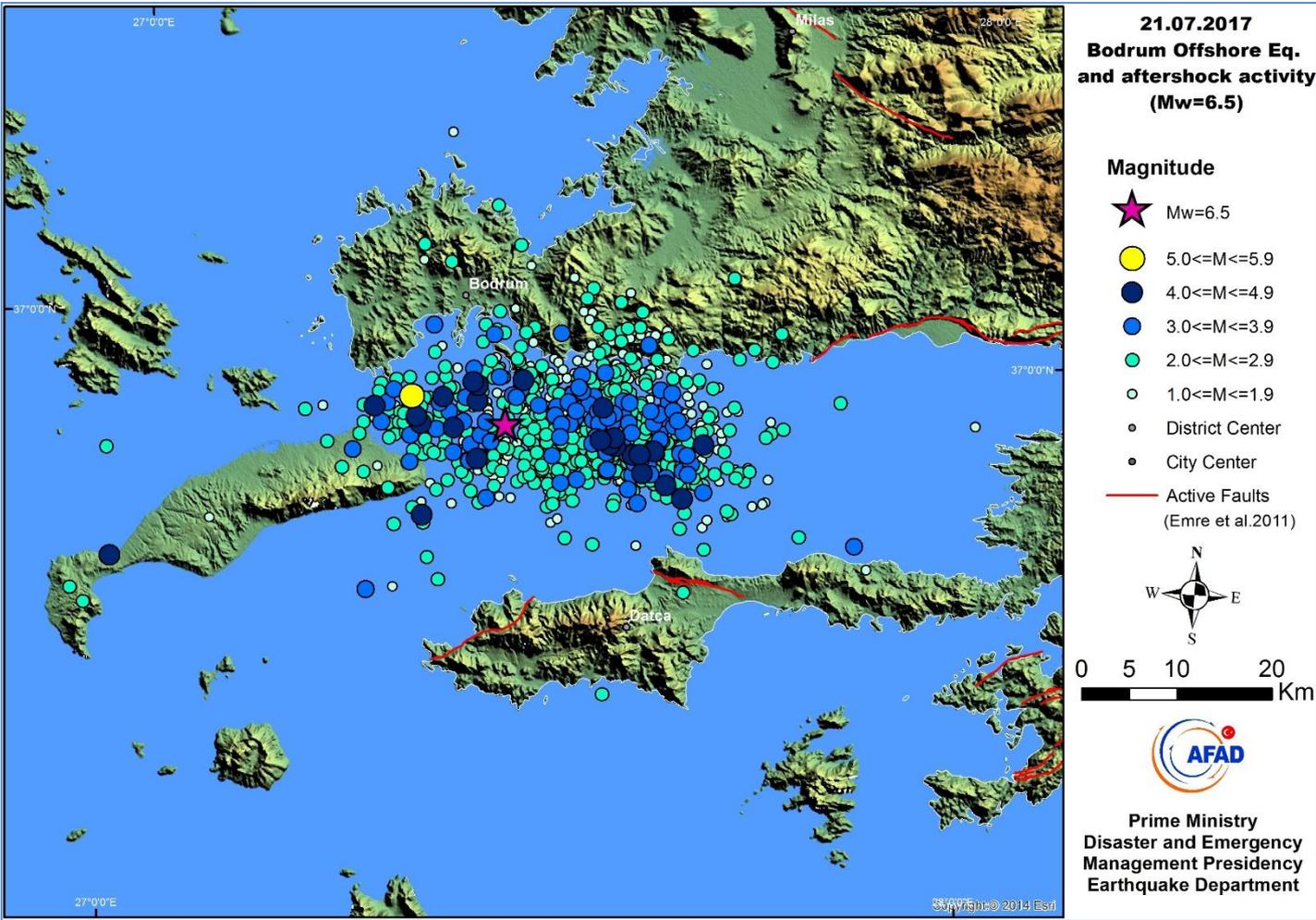
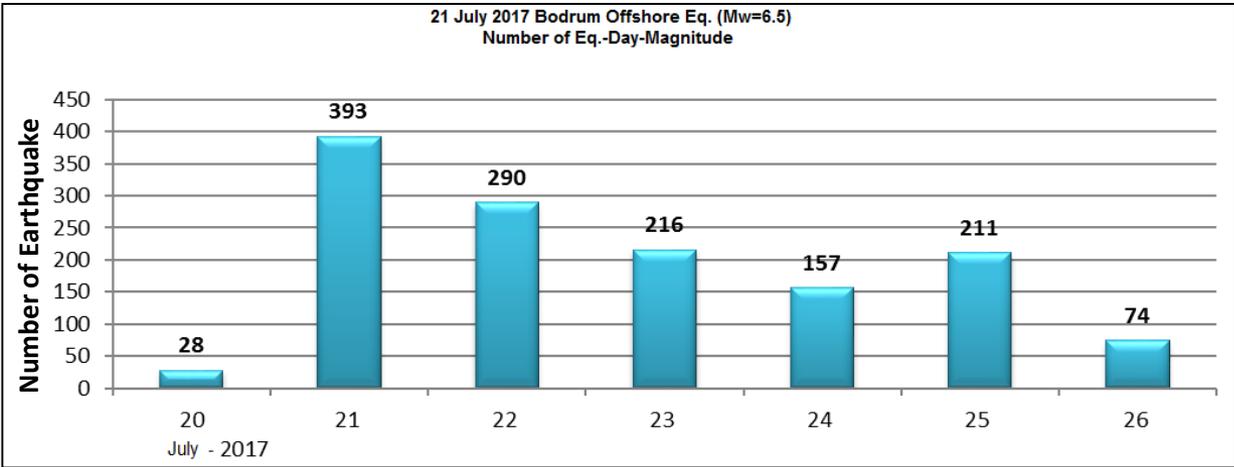
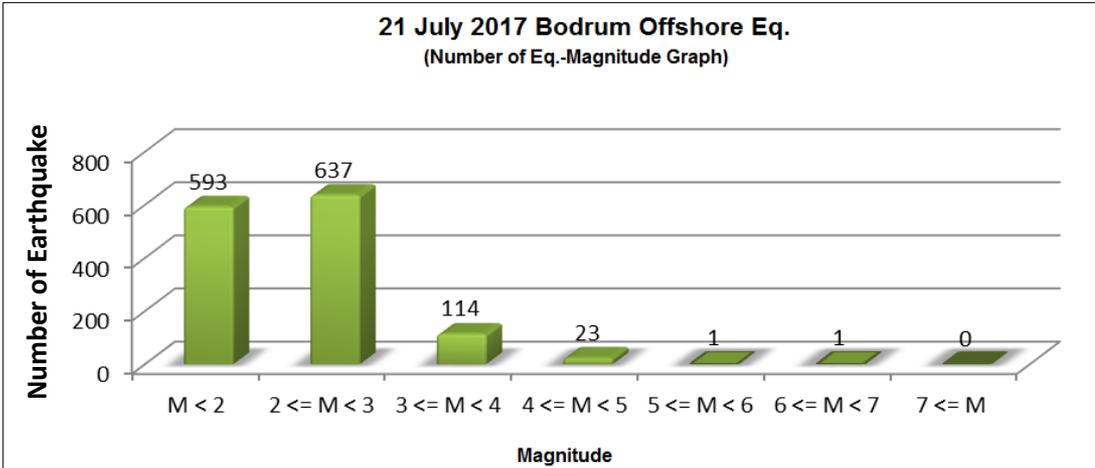


Fig. 1. 21.07.2017 Bodrum Offshore earthquake (Mw=6.5) and aftershock distribution (between 21-26 July 2017)

21.07.2017 Bodrum Offshore Earthquake (Mw=6.5)



Graph 1. Distribution of aftershocks in the first five days (21-26 July 2017)



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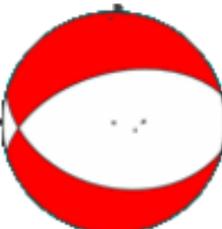
	Strike1	Dip1	Rake1	Strike2	Dip2	Rake2	FType
	286.00	38.00	-80.00	82.00	53.00	-98.00	MT
	105.00	41.00	-66.00	255.00	53.00	-109.00	FP

Fig. 2. Focal Mechanism Solutions of Bodrum Offshore Eq. Mw=6.5 (red one indicate p wave first motion, black one indicate moment tensor solution)



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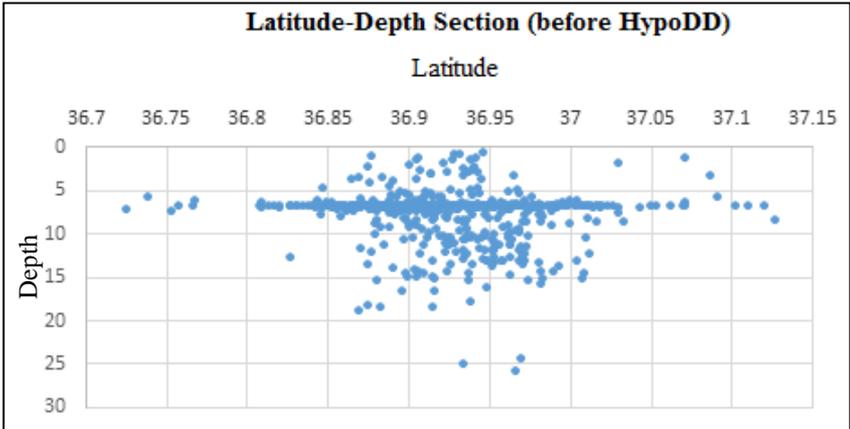
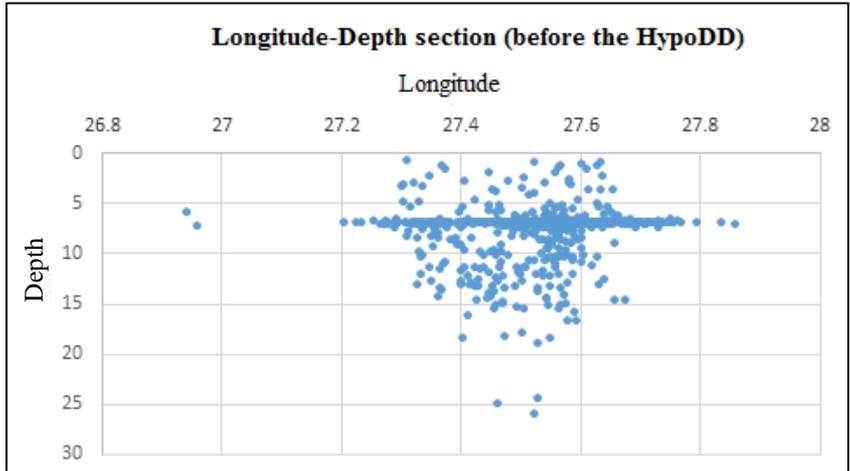
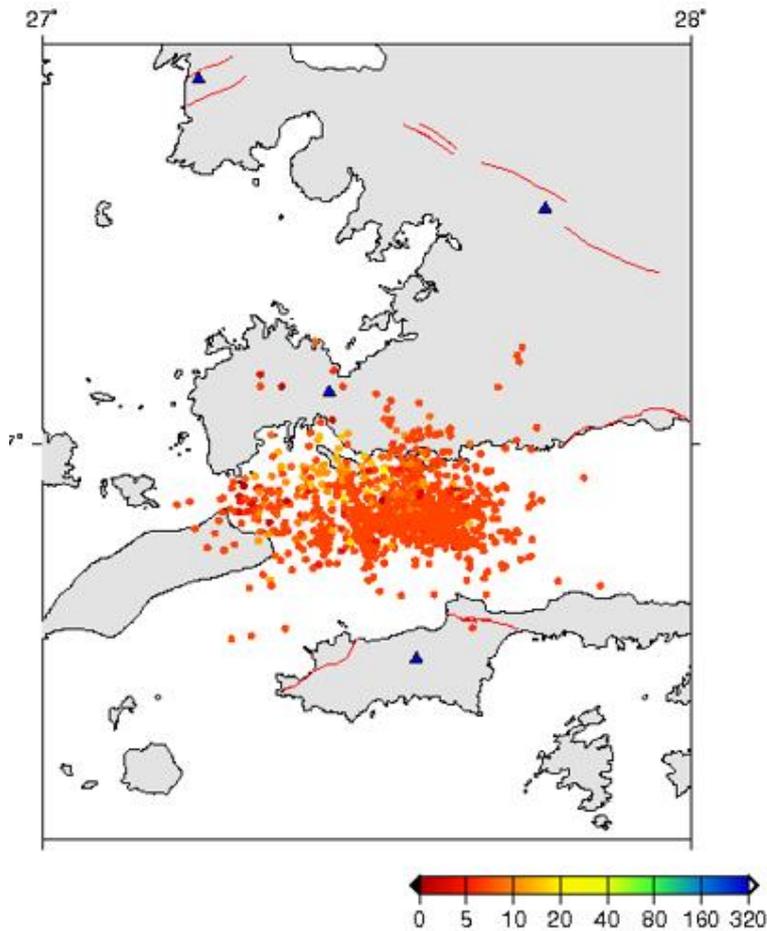


Fig. 3. Improvment earthquake locations via HypoDD Method (before HypoDD) (Waldhauser, F. and Ellsworth, W.L. 2000)



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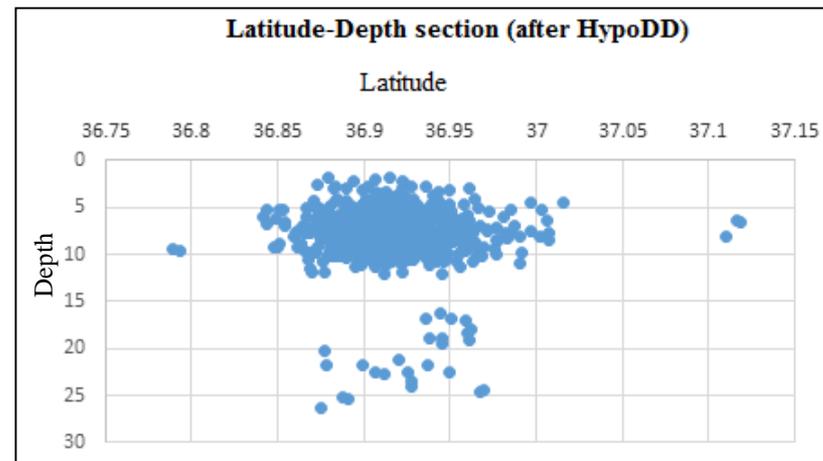
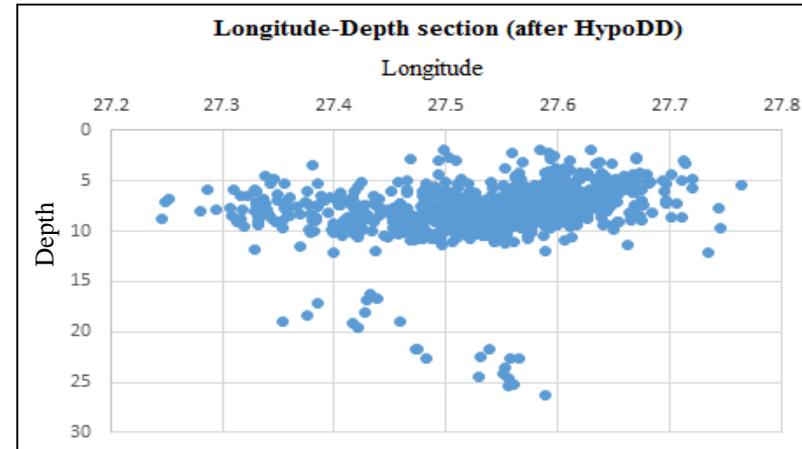
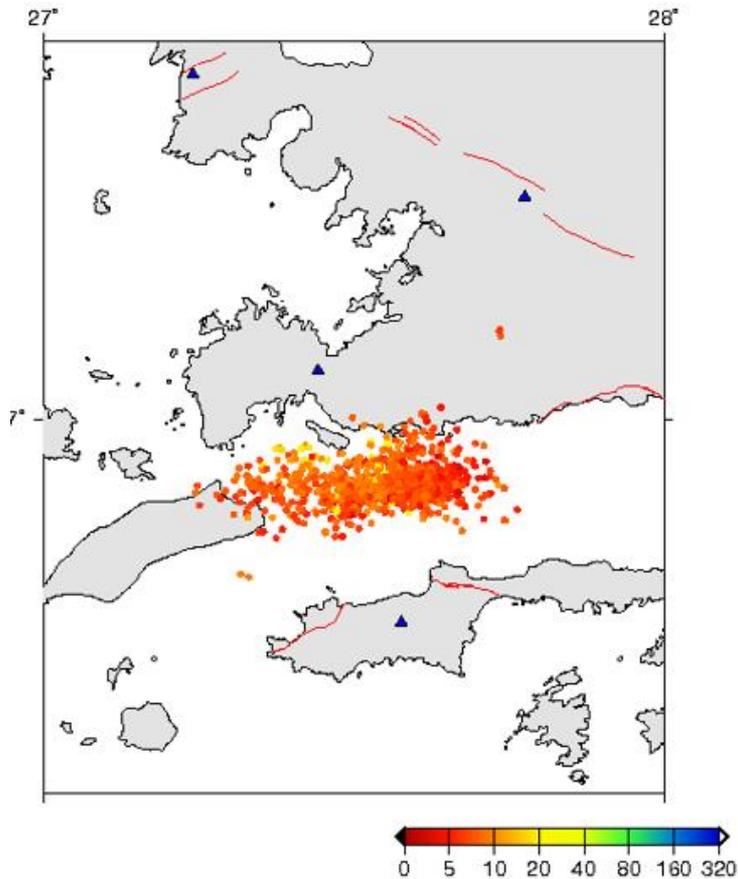


Fig. 4. Improvement earthquake locations via HypoDD Method (after HypoDD)



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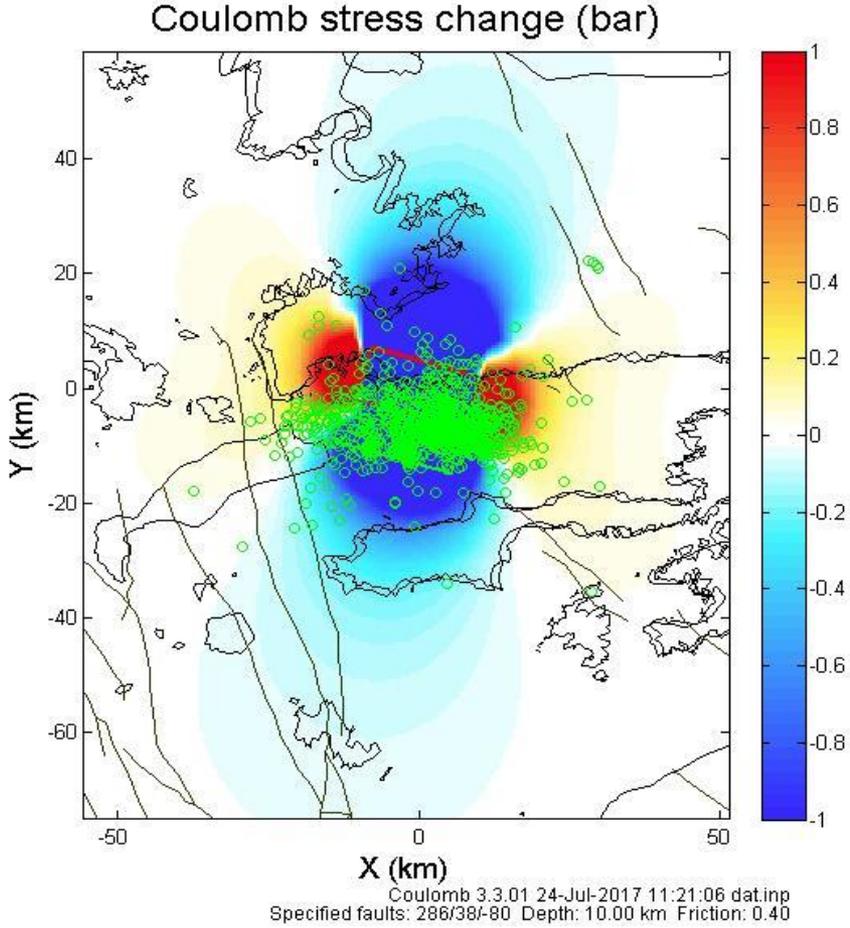


Fig. 5. Coulomb stress change

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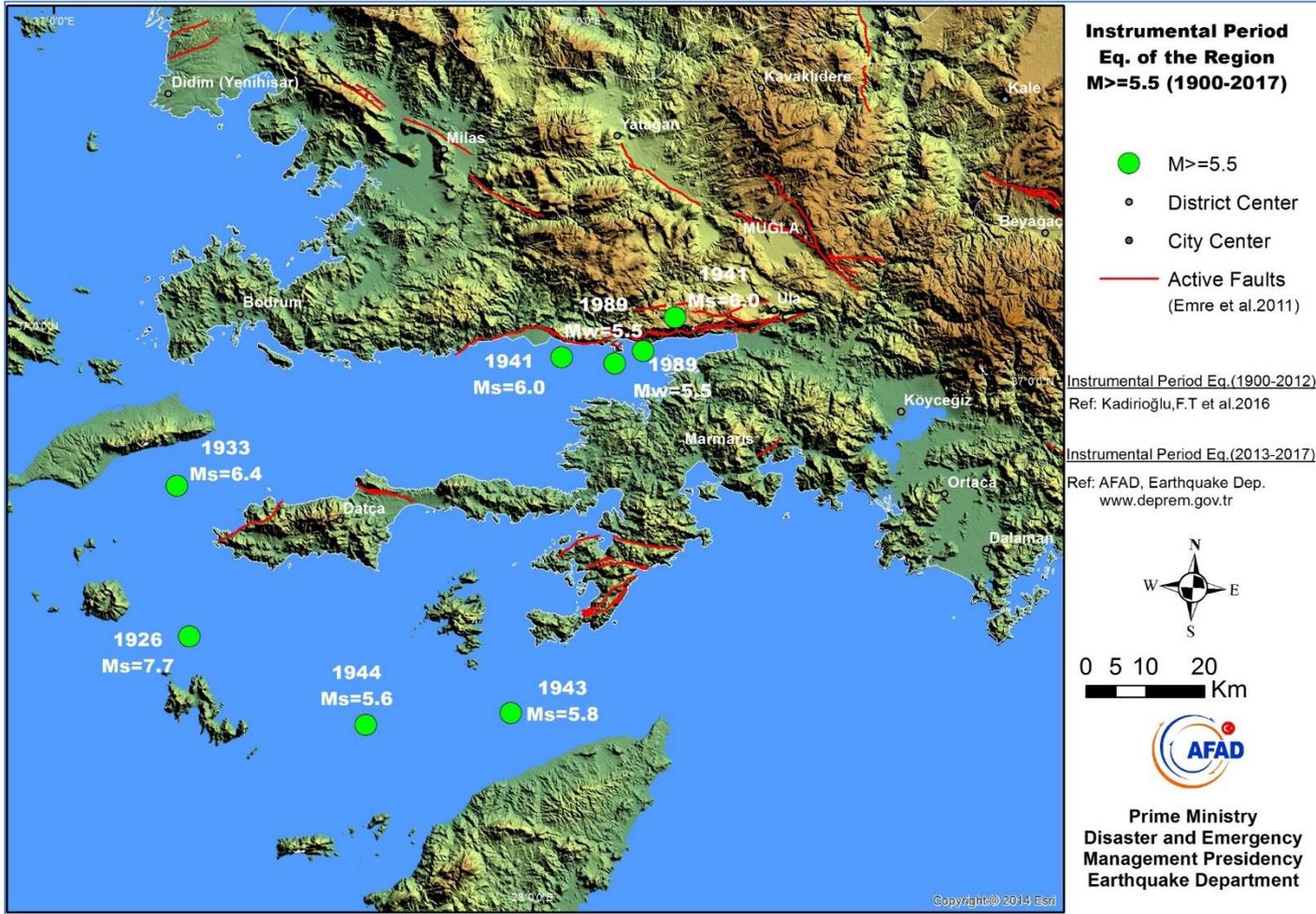


Fig.6. Instrumental period earthquake activity in the region

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N	STATION							PGA (cm/sn ²)			Epicentral Distance (R _{epi}) (km)	Shear Wave Velocity VS30 (m/sn)
	PROVINCE	Country/Town	CODE	Latitude	Longitude	Elevation (m)	Type of Instruments	NS	EW	UD		
1	Muğla	BODRUM	4809	37.03304	27.43997	25	Guralp cmg5td	158.76	102	88.04	12	747
2	Muğla	DATCA	4812	36.71225	27.68801	25	GeoSig gmsplus	37.85	39.77	32.13	32	
3	Muğla	GULLUK	4817	37.2401	27.6031	10	GeoSig gmsplus	79.04	57.98	31.73	37	
4	Muğla	OREN	4819	37.0313	27.9712	10	GeoSig gmsplus	78.72	87.94	45.11	48	
5	Muğla	MILAS	4806	37.30253	27.78054	52	GeoSig gmsplus	58.54	59.99	25.54	51	323
6	Aydın	DIDİM	918	37.3697	27.2643	47	GeoSig gmsplus	30.64	23.28	14.47	52	
7	Muğla	SELİMİYE	4814	37.3991	27.6567	63	GeoSig gmsplus	21.63	24.43	14.07	55	
8	Muğla	BOZBURUN	4815	36.6886	28.046	10	GeoSig gmsplus	33.61	35.89	24.44	60	
9	Muğla	MILAS_2	4822	37.4417	27.646	128	GeoSig gmsplus	76.66	76.91	61.35	60	
10	Muğla	MILAS_3	4823	37.4418	27.64403	129	GeoSig gmsplus	44.9	48.94	34.37	60	

Table 1. Acceleration values of Bodrum Offshore Earthquake (according to epicentral distance, first 10 records) detailed information can be reached from "<http://kyhdata.deprem.gov.tr>"



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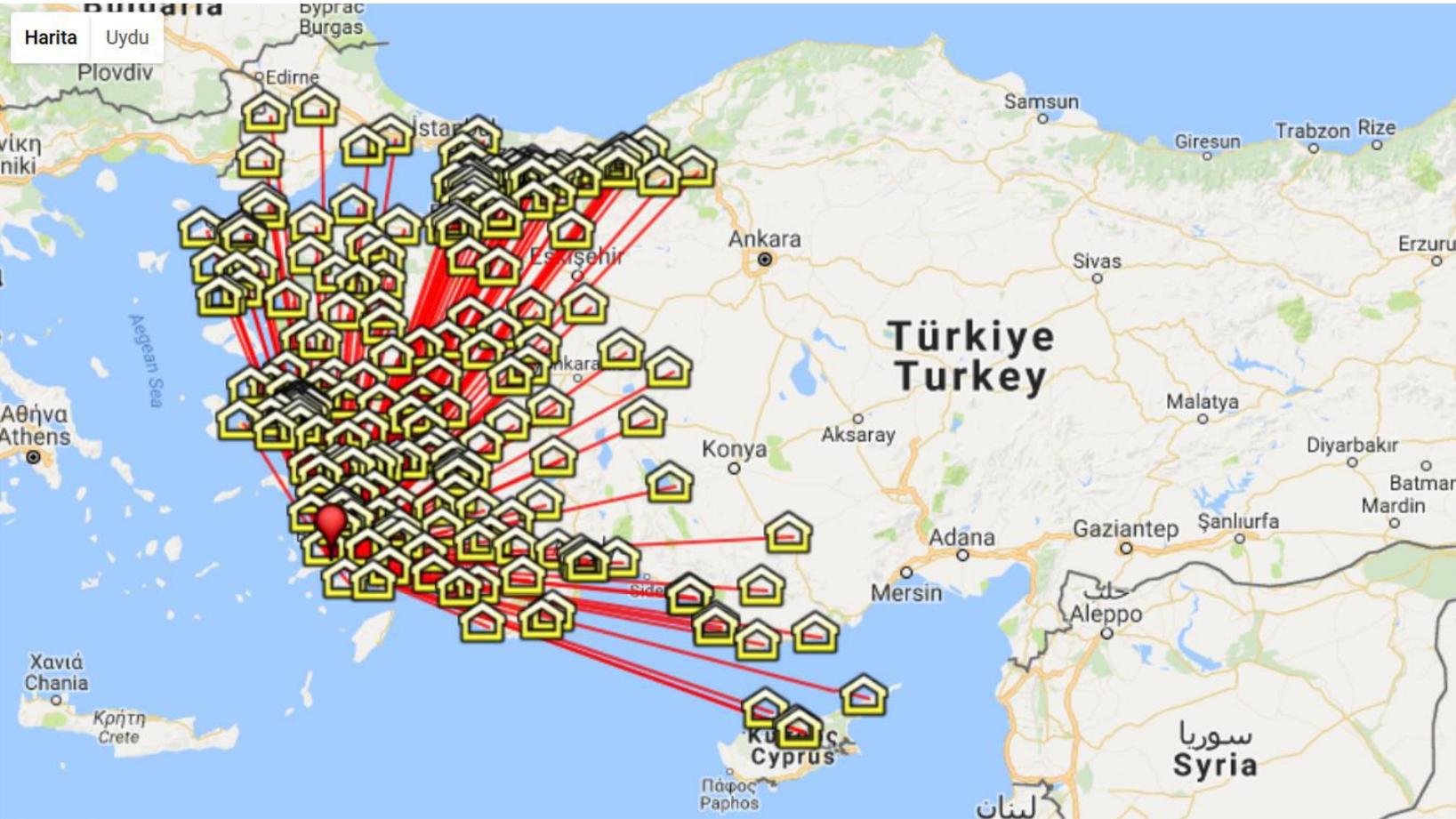


Fig. 7. Distribution of accelerometers recorded during the Bodrum Offshore Eq. (Mw=6.5)



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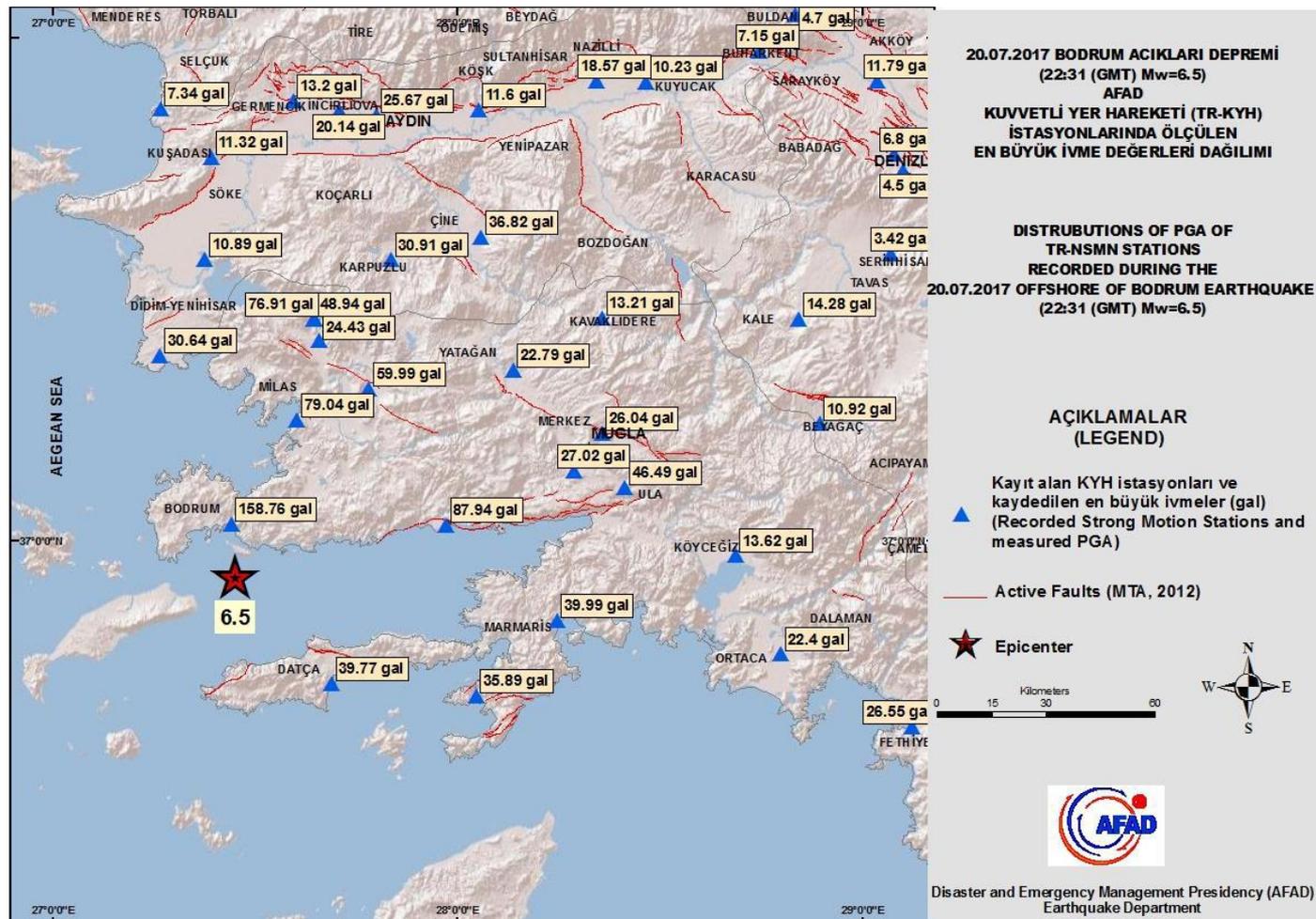


Fig.8. Distribution of accelerometer stations and PGA values measured during the Bodrum Offshore Eq. (Mw= 6.5).

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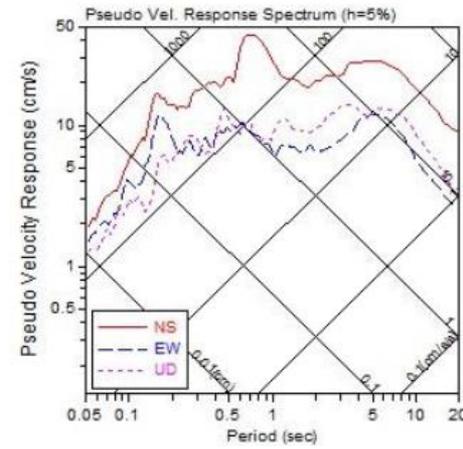
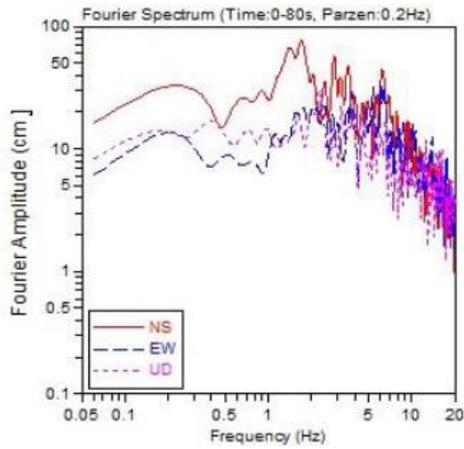
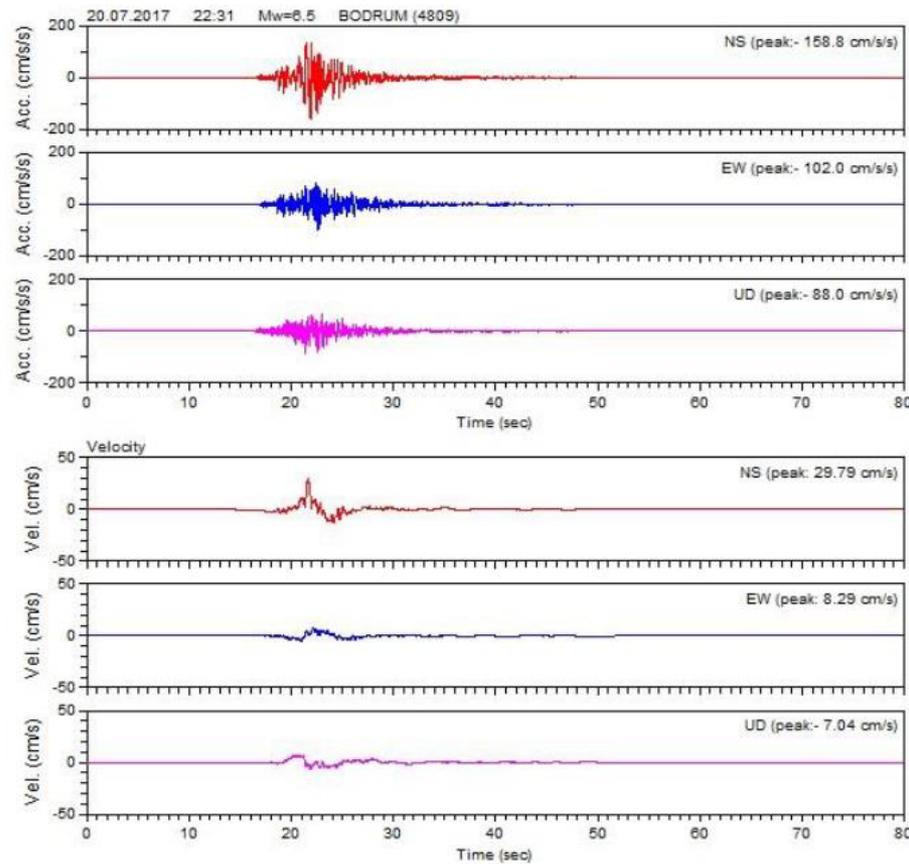


Fig.9. Acc, Velocity, Fourier and Response spectrum graphs of Bodrum Offshore Eq. (Mw=6.5). (Bodrum Station)



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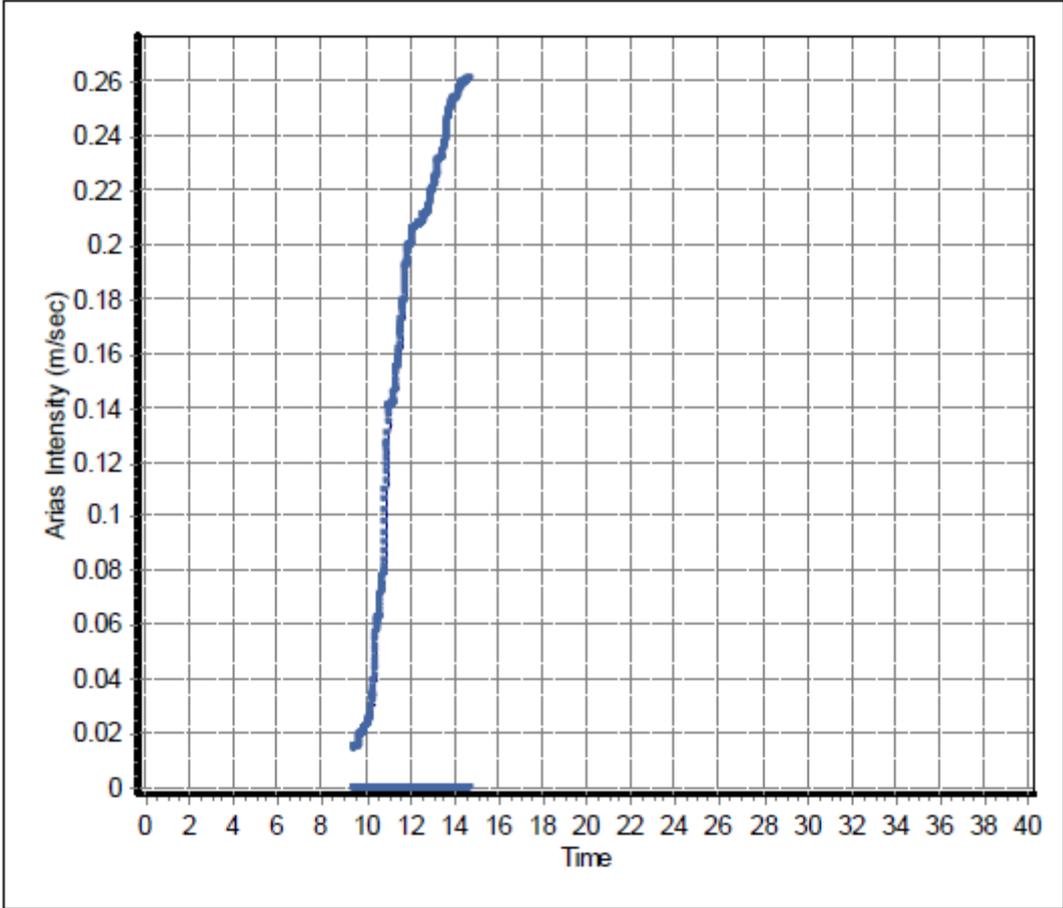


Fig.10. Arias Intensity (IA) Graph of Bodrum Eq. (Mw=6.5) calculated from Bodrum station.



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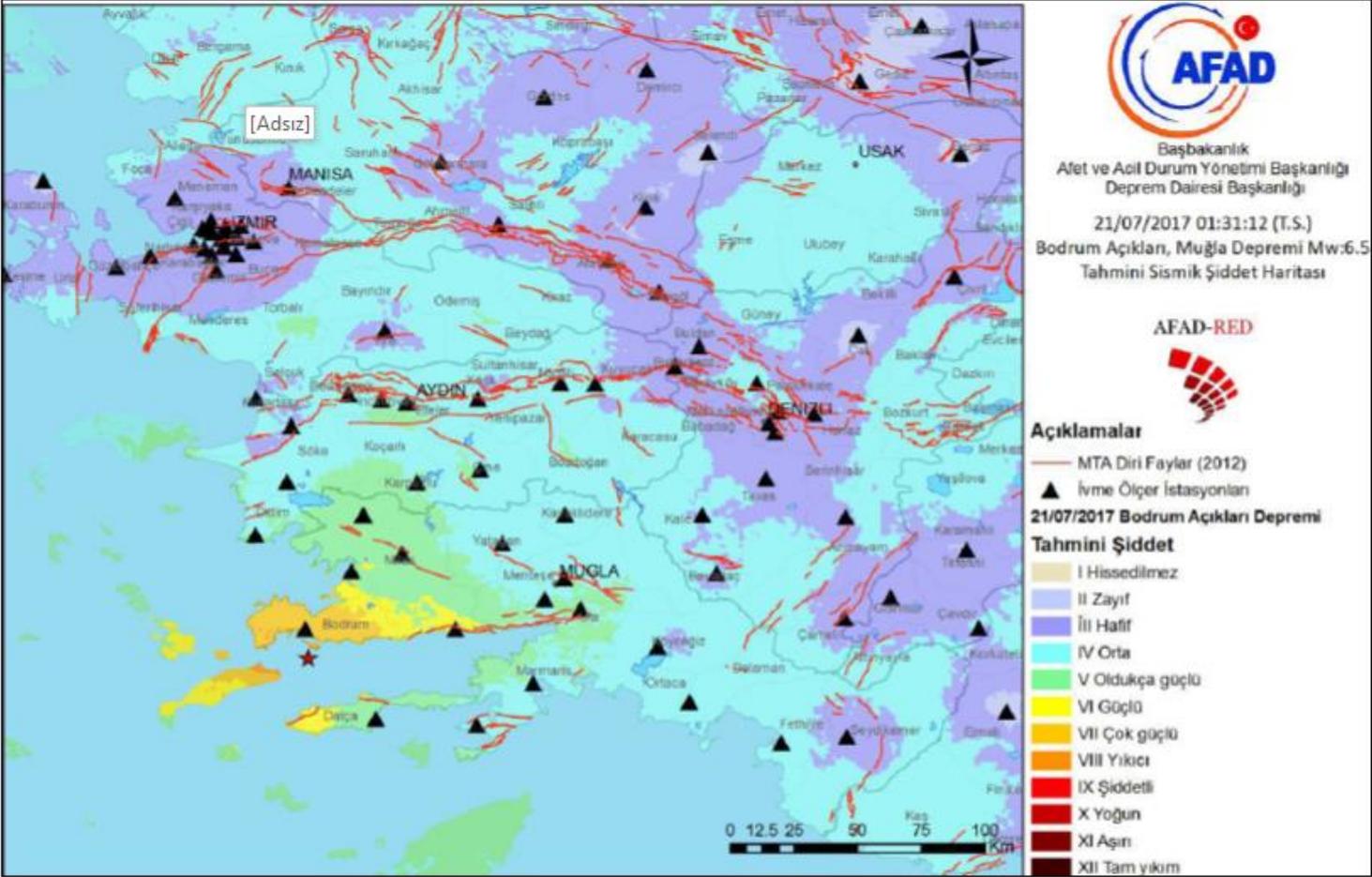
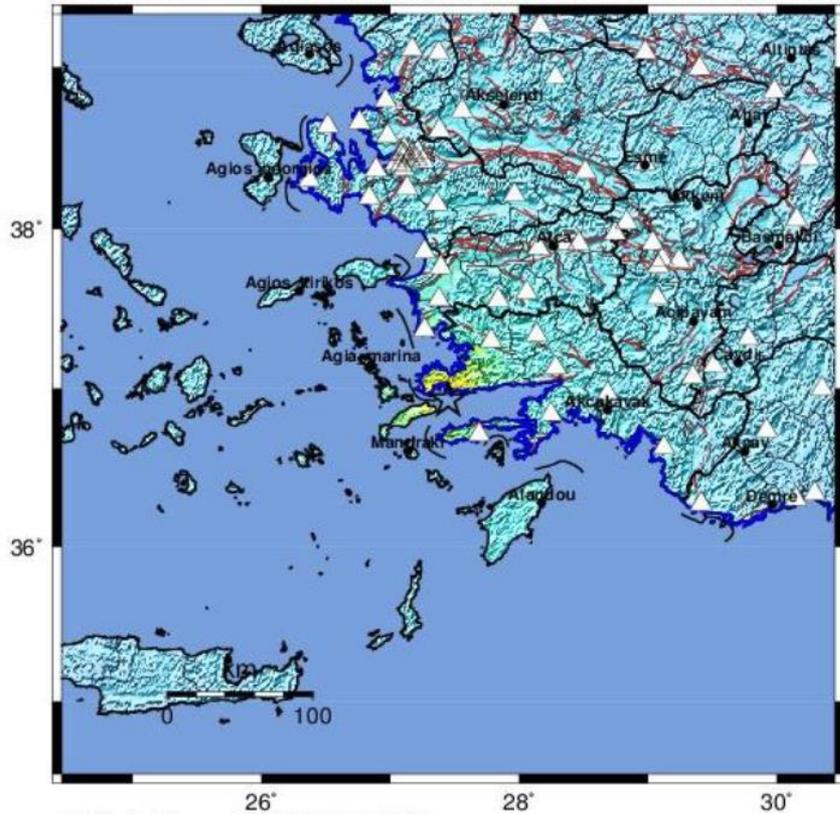


Fig.11. AFAD-RED Estimated Intensity Map generated together with measured accelerations coming from TR-NSMN

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AFAD ShakeMap : dda2017odde / 36.9283 / 27.4493

Jul 20, 2017 22:31:10 UTC M 6.5 N36.93 E27.45 Depth: 18.7km ID:20170720223111



Map Version 4 Processed 2017-07-21 11:47:18 UTC

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	<0.02	0.1	1.4	4.7	9.6	20	41	86	>178
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Fig.12. AFAD-ShakeMap generated by using measured accelerations and AFAD Epicenter parameters.



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