July 21th 2017
Bodrum Offshore Earthquake
(Muğla-Turkey)
Mw=6.5
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 incurred 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>=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.
Fig. 1. 21.07.2017 Bodrum Offshore earthquake (Mw=6.5) and aftershock distribution (between 21-26 July 2017)
Graph 1. Distribution of aftershocks in the first five days (21-26 July 2017)
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**Fig. 2. Focal Mechanism Solutions of Bodrum Offshore Eq. Mw=6.5**

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<th>Dip1</th>
<th>Rake1</th>
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(red one indicate p wave first motion, black one indicate moment tensor solution)
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Fig. 3. Improvement 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)
Fig. 5. Coulomb stress change

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Fig. 6. Instrumental period earthquake activity in the region

21.07.2017 Bodrum Offshore Earthquake (Mw=6.5)
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<th>N</th>
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<th>CODE</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Elevation (m)</th>
<th>Type of Instruments</th>
<th>PGA (cm/s²)</th>
<th>Epicentral Distance (R_e) (km)</th>
<th>Shear Wave Velocity V_S30 (m/s)</th>
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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”
Fig. 7. Distribution of accelerometers recorded during the Bodrum Offshore Eq. (Mw=6.5)
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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Fig. 12. AFAD-ShakeMap generated by using measured accelerations and AFAD Epicenter parameters.
REFERENCES


- Kadıroğlu, FT., Kartal, RF., Kılıç, T., Kalafat, D., Duman, TY., Eroğlu Azak, T., Özalp, S., Emre, Ö. (2016). An Improved Earthquake Catalogue (M ≥ 4.0) for Turkey and Its Near Vicinity (1900-2012). Bulletin of Earthquake Engineering, Published online. DOI 10.1007/s10518-016-0064-8
