

The Van, Turkey Earthquake of October 2011: Seismicity, Mechanism and its Aftershocks

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On 23 October 2011, a strong earthquake ($M_w=7.1$) occurred east of Van Lake. The earthquake destroyed damage along the Van Fault Zone. Generally, it is caused significant damage in the city of Van with Ercis town, as well as in many villages. The epicenter of the main shock was located in Tabanlı Village between Van city and Ercis town. Shortly afterwards the November 9, 2011 earthquake ($M_w=5.6$) occurred southeastern part of Van Lake, Edremit town area. The main shock and second shocks caused significant damage and deaths of 644 people.

After the main shock 11 important earthquakes ($5.0 \leq M \leq 6.0$) were occurred in the region which has hypo-central distances of 8-38 km. from the main shock location. The main shock triggered mass movement, spreading, and local liquefaction. The important earthquakes and the aftershocks distribution showed that the E-W and NE-SW oriented fault segments caused the earthquake activities. The distribution of the aftershocks supported the presence a rupture of approximately 70 ± 10 km. Aftershocks occurred within an area of approximately 2300 km².

Fault mechanism solution has supported 23 October 2011 Van Earthquake was a reverse fault with a northward dipping fault plane. The fault plane solutions of about 225 important earthquakes ($M \geq 4.0$) were calculated using MT inversion solution technique by this study.

In addition, the stress tensor analysis was completed using the focal mechanism solutions. The stress tensor values of the region were calculated using the azimuth and plunge pairs of P and T axes for 225 earthquakes. The maximum principal stress (P-compressional) of the main shock is aligned in an N-S (NNW/SSE) direction and the tensional axis (T-dilatation) is aligned in an E-W (ENE-WSW) direction. The results of the focal mechanism and stress analysis solutions show that earthquakes have occurred on the reverse faulting and the seismic activity has been continuing under the compressional regime in the region. The Van earthquake activity initiated and caused an increase in seismic activity of the region. This may be explained by the triggering of small faults by the Van Earthquake. The Van earthquake is a good example of compressional deformation and the activity of blind reverse faulting.

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