

## Mw 5.4 Karaköprü (Şanlıurfa) Earthquake of September 24, 2026

*T Rupt Modeling and Data Analytics Department (with contributions from Prof. Dr. Erhan Altunel)*

### 1. Introduction and Earthquake Summary

A moderate-sized earthquake occurred at 10:40:56 a.m. (UTC+3) on September 24, 2026, in a rural area of Karaköprü District, Şanlıurfa Province, near the boundary with Hilvan District. According to AFAD, the nearest settlements to the epicenter are the villages of Yedikuyu and Cemal (about 2.5 km away, in Hilvan) and Başören, Gölgen, and Şeyhzeliha (about 4 km away, in Karaköprü). The earthquake occurred in the shallow crust; hypocentral depths reported by the different seismic agencies range from 5 to 10 km (Table 1). The source parameters reported by the different seismic agencies are listed in Table 1. AFAD's focal mechanism solution is presented in Table 2 and indicates strike-slip faulting (Section 2).

*Table 1. Source parameters reported by different seismic agencies for the September 24, 2026 Karaköprü (Şanlıurfa) earthquake*

| Source* | Magnitude**     | Depth (km) | Latitude (°N) | Longitude (°E) |
|---------|-----------------|------------|---------------|----------------|
| AFAD    | Mw 5.4          | 7.0        | 37.4205       | 38.8678        |
| KOERI   | ML 5.5 / Mw 5.3 | 5.1        | 37.3630       | 38.8185        |
| USGS    | Mw 5.3          | 10.0       | 37.4736       | 38.8612        |

*\* AFAD: Disaster and Emergency Management Authority, Ministry of Interior, Republic of Türkiye; KOERI: Kandilli Observatory and Earthquake Research Institute, Boğaziçi University; USGS: United States Geological Survey. \*\* ML: local magnitude; Mw: moment magnitude.*

This report summarizes the earthquake source parameters, faulting mechanism, and seismotectonic setting. It also summarizes the limited aftershock activity and provides a high-level assessment of the areas affected by the earthquake and the expected building damage based on the modeled regional ground-motion distribution. The report provides a preliminary evaluation of the earthquake based on data available during the first few hours after the event.

### 2. Seismotectonic Assessment

Crustal deformation in the region is governed by the relative motions of the Anatolian Block and the African and Arabian plates. Interactions among these plates and blocks are accommodated by the North Anatolian Fault Zone (NAFZ), East Anatolian Fault Zone (EAFZ), Dead Sea Fault Zone (DSFZ), and the Hellenic-Cyprus subduction system in the Mediterranean. In addition to these major plate boundaries, secondary tectonic structures with different orientations and styles of faulting (normal, reverse/thrust, and strike-slip) have developed across Türkiye in response to the regional stress field. The secondary and internal deformation structures outside these major systems may become inactive or vary over time in response to local changes in the regional stress field or the evolution of the tectonic regime.

Because of its tectonic setting, Türkiye experiences many earthquakes of varying magnitude every year. Some can be directly associated with active faults that have known surface traces,

whereas the faults responsible for others cannot be clearly identified or remain subject to seismotectonic debate. The main reasons for such uncertainty include blind faults with no surface expression, faults concealed beneath alluvial deposits, earthquakes that are too deep or too small to produce surface rupture, and secondary faults not yet mapped at the scale of existing active-fault maps. Another reason for the lack of surface expression is the reactivation of paleotectonic structures that form crustal zones of weakness under the current neotectonic stress field. These reactivated paleotectonic structures produce present-day seismicity but do not fully exhibit the morphometric signatures of the neotectonic period, resulting in a complex pattern of deformation.

The Mw 5.4 Karaköprü earthquake, which occurred approximately 25 km north of Şanlıurfa on September 24, 2026, was not located on any active fault shown on the Active Fault Map of Türkiye (Figure 1). However, it occurred approximately 30 km east of the Bozova Fault (Duman et al., 2012), which the Active Fault Map classifies as a Quaternary fault that produced surface faulting during the Pleistocene (within the past 2.6 million years), although its Holocene activity is uncertain (Figure 1).

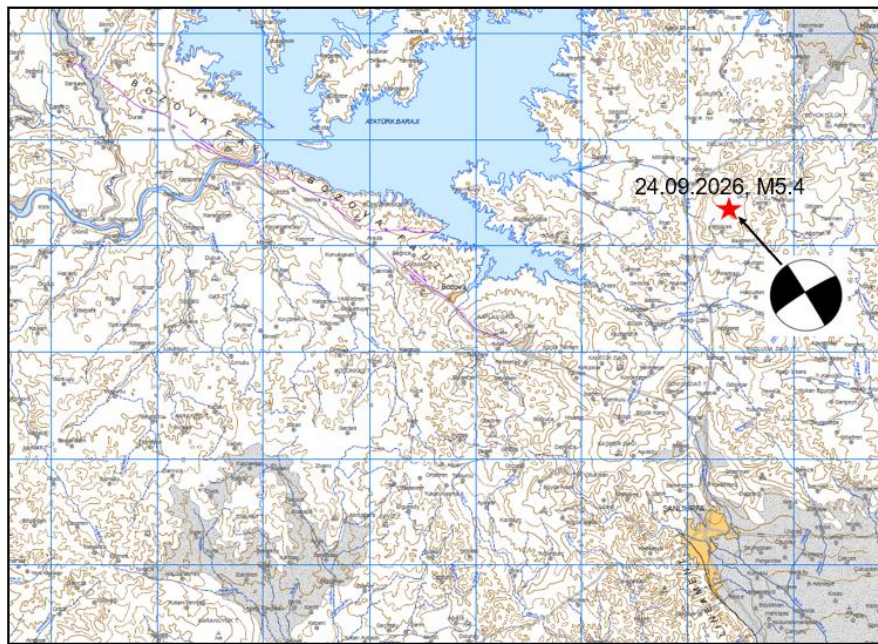


Figure 1. Location of the September 24, 2026 Mw 5.4 earthquake on the Active Fault Map of Türkiye (Duman et al., 2012). The focal mechanism solution is from AFAD.

The focal mechanism solution for the September 24, 2026, Karaköprü earthquake indicates strike-slip faulting (Figure 1). Surface rupture is not expected from an earthquake of this magnitude (Mw 5.4) in Türkiye, and no morphological lineament or cumulative surface deformation associated with the causative structure has been observed in the epicentral area. The available evidence therefore does not establish which of the two orthogonal nodal planes (NW-SE or NE-SW) represents the actual fault plane.

Considering the region's morphotectonic structure and the orientation and character of the Bozova Fault, rupture on the NW-SE-striking plane appears more likely. The available data suggests the reactivation of an NW-SE-striking paleotectonic plane of weakness under the current neotectonic stress regime. Decaying aftershocks are expected; however, given the limited dimensions of the inferred fault segment and the regional tectonic setting, a larger earthquake is not expected in the area.

Figure 2 shows the epicenter, active faults in the region, and instrumental seismicity within 150 km. Table 2 gives the focal mechanism parameters published by AFAD. The NW-SE-trending nodal plane (strike  $328^\circ$ , dip  $88^\circ$ ) was used as the basis for the T Rupt ground-motion modeling.

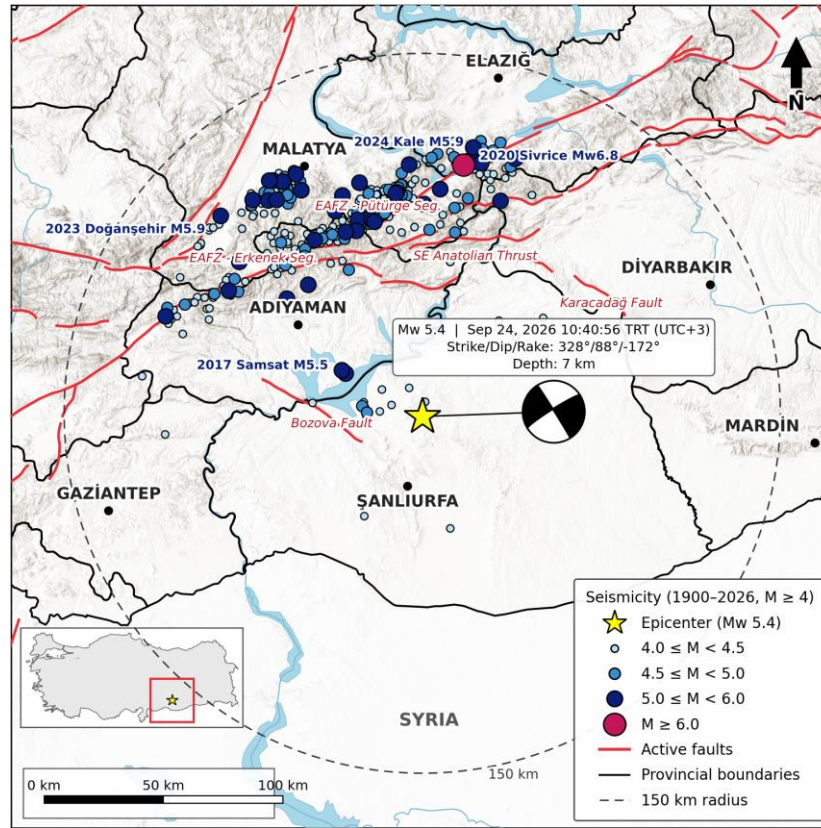


Figure 2. Epicenter (yellow star) of the September 24, 2026 Mw 5.4 Karaköprü (Şanlıurfa) earthquake, AFAD focal mechanism solution, active faults (red lines), and instrumental seismicity within 150 km (AFAD, 1900-2026,  $M \geq 4$ ). Black lines indicate provincial boundaries.

Table 2. AFAD focal mechanism solution for the September 24, 2026 Karaköprü (Şanlıurfa) earthquake (T Rupt modeling used nodal plane 2)

| Source / Plane         | Mw  | Depth (km) | Strike ( $^\circ$ ) | Dip ( $^\circ$ ) | Rake ( $^\circ$ ) |
|------------------------|-----|------------|---------------------|------------------|-------------------|
| AFAD - Plane 1 (NE-SW) | 5.4 | 7          | 238                 | 82               | -2                |
| AFAD - Plane 2 (NW-SE) | 5.4 | 7          | 328                 | 88               | -172              |

### 3. Aftershock Assessment

Aftershock data were compiled from the AFAD earthquake catalog as of 4:28 p.m. on September 24, 2026, approximately 5 hours and 45 minutes after the mainshock. During this period, two aftershocks were recorded within 50 km of the epicenter: ML 2.4 at 10:59 a.m. at a depth of 11.3 km and ML 2.3 at 2:16 p.m. at a depth of 7.0 km. Both aftershocks occurred west-northwest of the epicenter within a radius of approximately 5 km. Their depths are consistent with the mainshock's depth and indicate that activity remained within the shallow crust (Figure 3). The early aftershock distribution did not provide sufficient resolution to distinguish the rupture plane when this report was prepared.

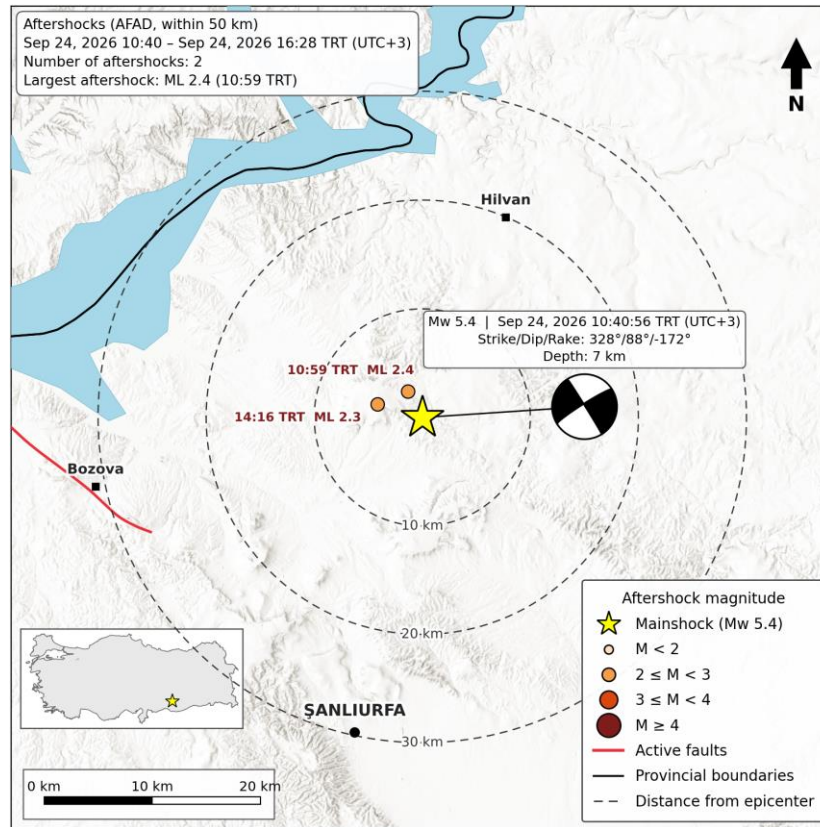


Figure 3. Aftershock distribution for the September 24, 2026 Karaköprü (Şanlıurfa) earthquake (AFAD; within 50 km of the epicenter, as of 4:28 p.m. on September 24, 2026). The yellow star marks the mainshock epicenter, orange circles mark the aftershocks, and dashed circles show distances of 10, 20, and 30 km from the epicenter. The red line represents the active fault in the region.

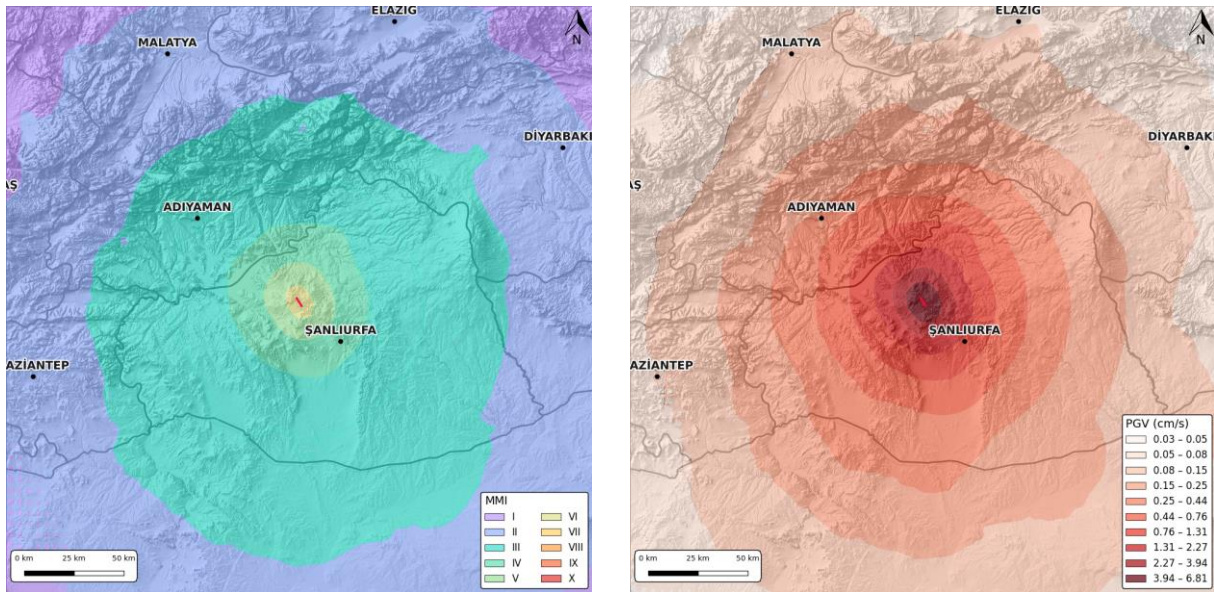
### 4. Expected Ground Motion and Affected Areas

The macroseismic intensity (MMI) map in Figure 4 and peak ground velocity (PGV) map in Figure 5 were generated using the AFAD source parameters in Tables 1 and 2 and the T Rupt regional ground-motion prediction model. Regional variations in site conditions were considered in the ground-motion calculations. Because AFAD strong-motion records were not yet available when

this report was prepared, the ground-motion distributions were not conditioned on observed ground-motion values.

The highest modeled values are concentrated near the epicenter. The area affected by MMI VI is limited to a radius of approximately 8 km, and the area affected by MMI V is limited to a radius of approximately 20 km. The MMI IV boundary extends to 35-40 km. Median PGV values are 2.3-6.8 cm/s within approximately 10 km of the epicenter, 1.3-2.3 cm/s at distances of 10-30 km, and generally below 0.44 cm/s beyond 60 km.

The rural settlements closest to the epicenter (Yedikuyu, Cemal, Başören, Gölgen, and Şeyhzeliha) are within the MMI VI area. Hilvan district center (19 km) lies in the MMI IV-V transition zone. Karaköprü (27 km), Haliliye (32 km), and Eyyübiye (35 km), which make up the Şanlıurfa urban center, as well as Bozova (28 km), are in the MMI IV zone, where modeled PGV values range from 1.3 to 2.3 cm/s. Samsat (32 km) lies in the MMI III-IV transition zone; Kâhta (40 km), Siverek (55 km), Adıyaman (58 km), and Suruç (64 km) are at MMI III. The MMI III zone extends approximately 100-130 km from the epicenter. The more distant provincial centers of Malatya, Diyarbakır, and Gaziantep (110-140 km away) remain within the MMI II zone, with calculated PGV values below 0.15 cm/s.



Figures 4 (left) and 5 (right). Ground-motion distributions for the September 24, 2026 Karaköprü (Şanlıurfa) earthquake: macroseismic intensity (MMI) in the left panel (Figure 4) and peak ground velocity (PGV, cm/s) in the right panel (Figure 5). The red line shows the surface projection of the modeled rupture plane. Calculations were performed using the T Rupt ground-motion model, AFAD source parameters, and data available as of September 24, 2026.

The maps in Figures 4 and 5 are not based on recorded ground motions. They present model-based ground-motion estimates for use in this preliminary post-earthquake assessment.

## 5. Regional Damage Assessment

The MMI VI zone is confined to an area within approximately 8 km of the epicenter and includes rural settlements in Karaköprü and Hilvan districts. At this intensity, light nonstructural damage (plaster cracks, partition wall cracks, and chimney damage) is expected to be common. More severe damage may occur in isolated rural masonry buildings that were not designed in accordance with seismic codes.

The earthquake was clearly felt in the MMI IV-V zone, which includes the Şanlıurfa urban center (Karaköprü, Haliliye, and Eyyübiye) and the district centers of Hilvan and Bozova. However, modeled PGV levels (approximately 1-2 cm/s) are below structural damage thresholds. Calculated ground-motion levels in more distant districts and provincial centers are not expected to cause building damage.

Overall, widespread earthquake damage is not expected given the earthquake's magnitude and the confinement of the MMI VI area to rural locations. Damage reports are expected to be limited in number and concentrated in older masonry buildings in rural areas of Karaköprü and Hilvan near the epicenter. However, because Şanlıurfa's urban center has high building and population densities, reports of nonstructural damage may outnumber those from rural areas even if damage rates are low. This assessment is qualitative and should be revisited when field observations and strong-motion records become available.

## 6. Conclusion

At 10:40 a.m. on September 24, 2026, a shallow Mw 5.4 earthquake occurred in Karaköprü District, Şanlıurfa Province, with reported hypocentral depths ranging from 5 to 10 km. The focal mechanism solution published by AFAD indicates strike-slip faulting. According to the seismotectonic assessment in Section 2, the earthquake resulted from reactivation of an NW-SE-striking paleotectonic structure under the current neotectonic stress regime, and a larger earthquake is not expected in the region.

According to T Rupt ground-motion modeling, macroseismic intensity is limited to MMI VI in rural areas within approximately 8 km of the epicenter, while the Şanlıurfa urban center is in the MMI IV zone. The earthquake is not expected to cause widespread building damage; a limited number of reports, primarily involving nonstructural damage, are anticipated.

This report presents a preliminary assessment based on the initial data available after the event. It should be updated after AFAD strong-motion records are published, the aftershocks are relocated, and field observations are completed.

## References

Duman, T. Y., Emre, Ö., Özalp, S., Olgun, Ş., and Elmacı, H. (2012). 1:250,000-Scale Active Fault Map Series of Türkiye, Şanlıurfa (NJ37-10) and Suruç (NJ37-14) Sheets, Serial No. 43. General Directorate of Mineral Research and Exploration, Ankara, Türkiye.