UCLouvain
CRED Centre for Research on the Epidemiology of Disasters

# Earthquakes in Türkiye
## A Review from 1900 to Today

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**Türkiye, situated on the highly active Mediterranean-Alpine-Himalayan seismic belt (Box 1), is susceptible to frequent powerful earthquakes. This newsletter presents an overview of earthquake data and their impact on the country over the last century.**

Earthquakes can have devastating consequences worldwide, as reported by EM-DAT.[1,2] Since 1900, the five most destructive earthquakes have resulted in the loss of approx. one million lives (see Table 1).

**Table 1. The Deadliest Earthquakes Worldwide (1900-2022)**

| Date | Country | Magnitude* | N° of Deaths |
|---|---|---|---|
| 28 Jul 1976 | China | 7.8 | 242,000 |
| 12 Jan 2010 | Haiti | 7.0 | 222,570 |
| 16 Dec 1920 | China | 8.3 | 180,000 |
| 26 Dec 2004 | Indonesia** | 9.1 | 165,708 |
| 01 Sep 1923 | Japan | 7.9 | 143,000 |

* Moment Magnitude scale (Mw)
** Indian Ocean tsunami affecting 12 countries with a total of 226,408 deaths
Source: EM-DAT, CRED / UCLouvain, Brussels, Belgium – www.emdat.be

Certain countries are particularly susceptible to earthquakes, especially if they are located on active fault lines. From 1900 to 2020, Türkiye experienced 1,796 potentially damaging earthquakes, i.e., quakes of a magnitude five or higher, indicating the region's active seismicity. In Türkiye, earthquakes are among the most devastating disasters, accounting for over 60% of all disaster-related fatalities.

A recent tragedy that began on February 6, 2023 with two powerful earthquakes measuring 7.8 and 7.5 on the moment magnitude scale (Mw, Box 1), resulted in the loss of 50,783 lives (Box 2, Fig. 1, Table 2).

These quakes affected 11 provinces and impacted approximately 14 million people, which represents 16.4% of the total population.[3,4,5] Aftershocks are ongoing and will likely continue to occur for months if not years.

### Box 1: Vocabulary

**Seismic belts**: Seismic belts, also known as seismic zones or regions, are geographical areas characterized by a higher frequency of earthquakes due to active tectonic plate boundaries and faults.

**Moment Magnitude Scale (Mw):** The Moment Magnitude Scale is a logarithmic measure used by seismologists to evaluate earthquake energy release and size. It considers factors such as fault area, slip, and rock rigidity. Today, the Mw scale has largely replaced the historical Richter scale.[8]

### Box 2: Earthquakes in Türkiye in 2023

On 06.02.2023, two powerful earthquakes of a magnitude Mw 7.8 and Mw 7.5 struck Pazarcık (Kahramanmaraş) and Elbistan (Kahramanmaraş), respectively. These earthquakes were strongly felt in several provinces, causing extensive damage and loss of life. An area of 108,812 km$^2$ spanning 11 provinces in the Eastern and Southeastern Anatolia Region was affected, compelling three million individuals to evacuate their homes (see Fig. 2). Informal settlements now house around 1.6 million people. Moreover, approximately 800,000 people were residing in officially structured temporary sites as of June 2023.[7]

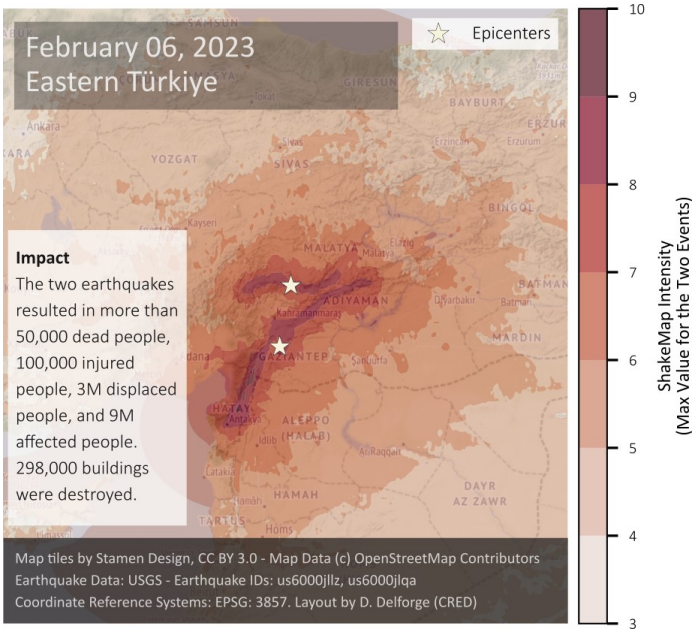


**Fig. 1. Two Powerful Earthquakes of Magnitude Mw 7.8 and Mw 7.5 Struck Kahramanmaraş on 06.02.2023**

**Table 2. The Deadliest Earthquakes in Türkiye (1900 - August 2023)**

| Date | Province | Magnitude* | N° of Deaths |
|---|---|---|---|
| 06 Feb 2023 | Kahramanmaraş | 7.8 & 7.5 | 50,783 |
| 26 Dec 1939 | Erzincan | 7.8 | 32,700 |
| 17 Aug 1999 | Kocaeli | 7.6 | 17,118 |
| 24 Nov 1976 | Van | 7.0 | 5,000 |
| 26 Nov 1943 | Samsun | 7.5 | 4,020 |

* Moment Magnitude scale (Mw, Box 1)
Source: NCEI/WDS Global Significant Earthquake Database, Anadolu Agency, a state-run news agency, news dated 22.04.2023 (accessed on 24.07.2023)

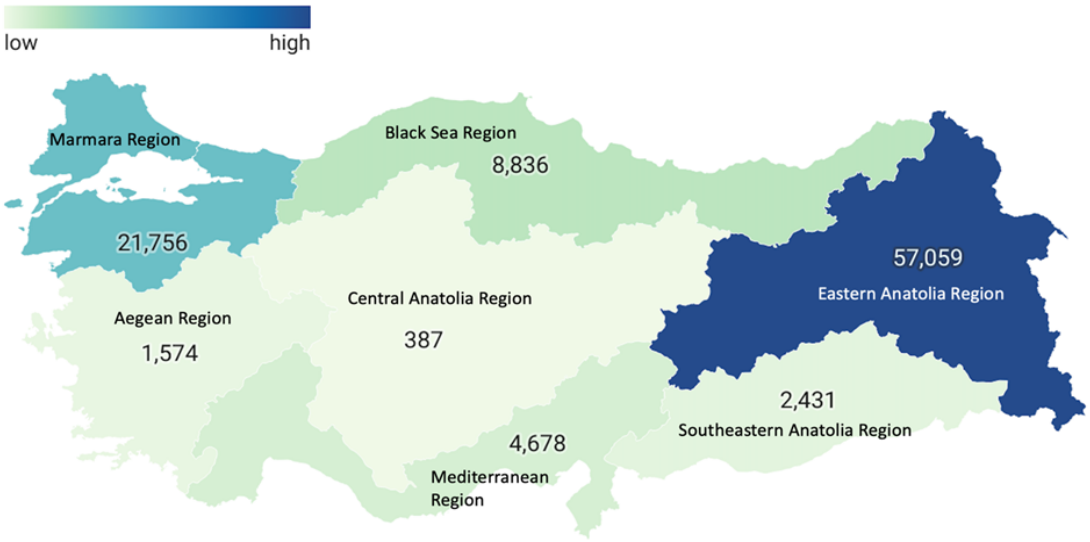


**Fig. 2. Total Number of Deaths Due to Earthquakes, Classified According to EM-DAT Criteria As Disasters, by Regions in Türkiye Between 1900 and 2022**

## Reviewed Sources

We collated data from multiple sources, including the NCEI/WDS Global Significant Earthquake Database, covering earthquake activity from 2150 BC to now. We also consulted Bogazici University's Kandilli Observatory and the Earthquake Research Institute database, focusing on major earthquakes in the region. Additionally, data provided by The Republic of Türkiye's Ministry of Interior through their Disaster and Emergency Management Presidency were incorporated, specifically concerning earthquakes causing casualties and property damage.[3]

## Results

Between 1900 and 2022, Türkiye experienced a total of 90 earthquakes classified as disasters according to the inclusion criteria used in EM-DAT.[6] These earthquakes led to 96,721 fatalities (see Fig. 2 and Table 2). Notable seismic events during this period include the Burdur earthquake in 1914, the Erzincan earthquake in 1939, and the Kocaeli earthquake in 1999, each causing significant loss of life. The Eastern Anatolia Region faced the highest number of deaths during this period, accounting for about 60% of total fatalities.[3]

## Conclusions

Türkiye's geographical location in a seismically active region poses a considerable risk to its population. Due to its proximity to the Eastern Anatolian and Northern Anatolian Fault Lines, the Eastern Anatolia Region is especially vulnerable. The recent devastating earthquakes in February 2023 have been among the deadliest earthquakes in Türkiye's history.

## References


1. CRED Crunch n°51 - Earthquakes in Europe, 2018, https://cred.be/sites/default/files/CredCrunch51.pdf
2. CRED Crunch n°39 - Focus on Nepal earthquake and earthquakes in Southern Asia, 2015, https://www.cred.be/sites/default/files/CredCrunch39.pdf
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6. EM-DAT: The OFDA/CRED International Disaster Database, CRED / UCLouvain, Brussels, Belgium – www.emdat.be
7. Kahramanmaraş Earthquakes – Türkiye and Syria, 31 May 2023, Public Health Situation Analysis World Health Organization
8. USGS. Earthquake magnitude, energy release, and shaking intensity. Retrieved from https://www.usgs.gov/programs/earthquake-hazards/earthquake-magnitude-energy-release-and-shaking-intensity


## CRED Updates and Recent Publications

- M. Tonnelier (CRED) has been accepted by the 'Fonds Spéciaux de Recherche (FSR)' for her PhD project: Disability-Adjusted Life Years due to disasters: the Health Burden of Disasters, a composite indicator for measuring post-disaster mortality and morbidity.
- New CRED publication: Walika, M., Almeida, M. M. D., Delgado, R. C., and González, P. A.: Outbreaks Following Natural Disasters: A Review of the Literature, Disaster Medicine and Public Health Preparedness, 17, e444, https://doi.org/10.1017/dmp.2023.96, 2023.
- UCLouvain received the Africa-Europe CoRE award, a partnership between ARUA and The Guild of European Universities. The "Africa-Europe Cluster for Pandemics and Shocks" will be led by Rhoda Wanyenze from Makerere University and Niko Speybroeck from UCLouvain.
- The EM-DAT Public Data Portal received an update on September 26, 2023, which includes a new documentation website.


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EM-DAT: The BHA/CRED International Disaster Database. Data are subject to change, for enquires: contact@emdat.be
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