Global M5+ Earthquake Catalogue Analytics, 1970-2026: Spatial, Intensity, and June 2026 Context

Prepared from the supplied M5+ catalogue and generated analytics suite

28 June 2026

Abstract

This article summarizes a global catalogue of 89,487 earthquakes of magnitude 5 and larger from 1970-01-01 to 2026-06-28 07:05 UTC. The analysis treats seismicity through three complementary quantities: event frequency, magnitude-depth structure, and cumulative seismic moment. A special contextual section examines June 2026, including the week from 22-28 June 2026, against the full 1970-2026 baseline. June 2026 contains 162 M5+ events, 19 M6+ events, 3 M7+ events, and a maximum magnitude of Mw 7.8. Its cumulative seismic moment is 1.051e+21 N m, placing the month at approximately the 92.0th percentile of all monthly windows in the catalogue. The week of 22-28 June 2026 contains only 32 M5+ events, but 2 M7+ events and 3.450e+20 N m of cumulative seismic moment, placing it near the 95.0th percentile by weekly moment and the 99.3th percentile by weekly M7+ count. The result is therefore not an exceptional global event-count anomaly, but it is a high-energy, large-event-rich interval.

1 Introduction

Earthquake catalogues mix several different notions of intensity. Event counts describe frequency, magnitude describes logarithmic source size, depth describes tectonic regime, and seismic moment gives an additive measure of source release. For a global M5+ catalogue, the most robust interpretive strategy is to report all of these quantities side by side rather than treating event count alone as a proxy for activity. A month with many M5.0 events may be dynamically less important than a month with fewer earthquakes but several Mw 7+ events.

The supplied catalogue spans 56.49 years and contains 89,487 M5+ events. The workflow generated global maps, gridded event and moment density products, magnitude-frequency distributions, depth-class summaries, regional profiles, cross-sections, optional spatial DBSCAN clustering, and a conservative Gardner-Knopoff-like declustering layer. This article concentrates on the scientific interpretation of those products and places June 2026 in historical context.

2 Data and methods

2.1 Catalogue preparation

The input data contain origin time, latitude, longitude, depth, magnitude, magnitude type, network/source fields, review status, and location descriptors. Longitudes were normalized to the interval $[-180, 180]$, event times were parsed as Unix milliseconds, non-earthquake records were excluded, and duplicate identifiers were removed. Derived fields include decimal year, decade, depth class, magnitude class, seismic moment, and approximate radiated energy.

2.2 Moment and intensity metrics

Magnitude is logarithmic and cannot be summed directly. The analysis therefore uses seismic moment as the additive high-energy metric:

$$M_0 = 10^{1.5M_w+9.1}, \tag{1}$$

where M_0 is in N m. Approximate radiated energy was also computed as

$$\log_{10} E \simeq 1.5 M_w + 4.8, \tag{2}$$

with E in joules. Because the catalogue is dominated energetically by the largest events, figures and tables distinguish event count from cumulative moment.

2.3 Spatial and temporal products

Spatial context was produced using event maps, one-degree grid summaries, maximum magnitude per cell, median depth per cell, cumulative moment per cell, and b-value estimates for cells with at least 50 events. Temporal context was produced using annual, monthly, weekly, and daily summaries. The June 2026 monthly window is compared with all monthly windows in the catalogue (675 windows), while the 22-28 June 2026 week is compared with Monday-Sunday weekly windows (2933 windows).

2.4 Declustering caveat

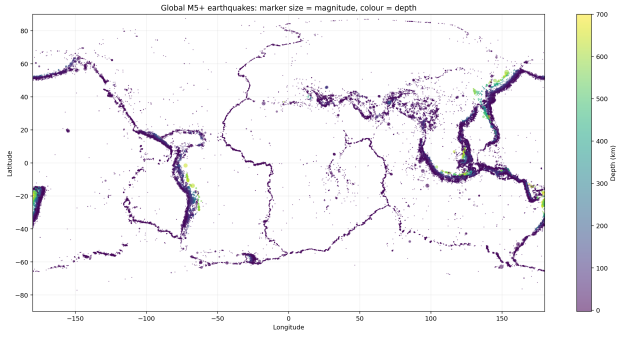
The optional declustering product is a conservative Gardner-Knopoff-like filter. It is useful for contrasting raw and retained-background maps, but it should not be interpreted as a formal ETAS, Reasenberg, or nearest-neighbour declustering model. In particular, the largest events in close space-time proximity may remain independent mainshocks or doublets depending on fault geometry; the GK-like flags are therefore a diagnostic layer, not a definitive causality assignment.

3 Global catalogue overview

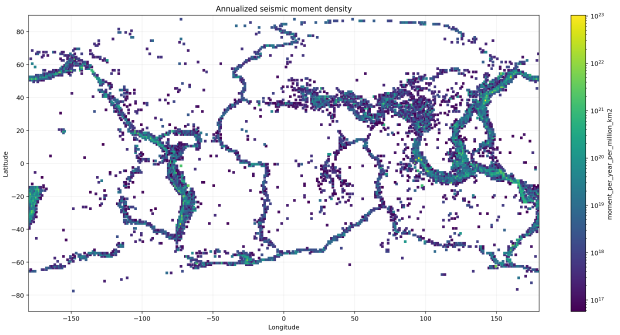
Table 1: Core catalogue and June 2026 summary. Percentiles are computed relative to monthly windows for June 2026 and weekly windows for 22-28 June 2026.

Period	Events M5+	M6+	M7+	M8+	Max Mw	Median depth km	Moment N m	Moment percentile	M7 percentile
Full catalogue	89487	7679	766	44	9.1	33.0	4.249e+23	–	–
June 2026	162	19	3	0	7.8	35.0	1.051e+21	92.0	96.1
Week 2026-06-22 to 2026-06-28	32	5	2	0	7.5	30.6	3.450e+20	95.0	99.3

Figure 1 summarizes the spatial structure of the catalogue. As expected for a global M5+ threshold, the densest and most energetic zones are plate-margin systems, especially subduction zones. The gridded moment map is more selective than the event-count map because great earthquakes dominate moment release. This distinction is central to the June 2026 interpretation: the week of 22-28 June has a modest raw M5+ count, but an elevated moment total due to multiple large events.

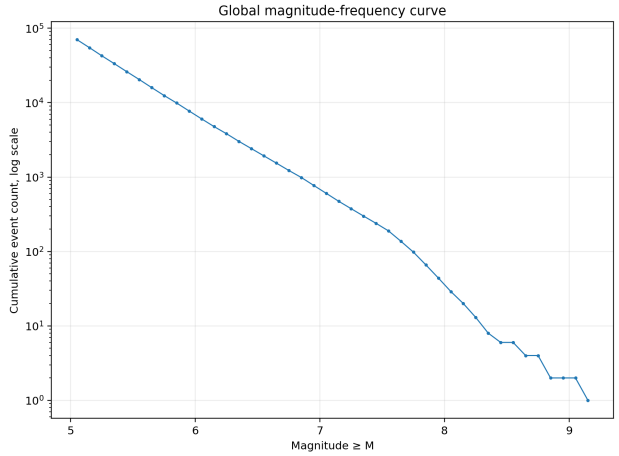


(a) Global M5+ event distribution, marker size by magnitude and colour by depth.

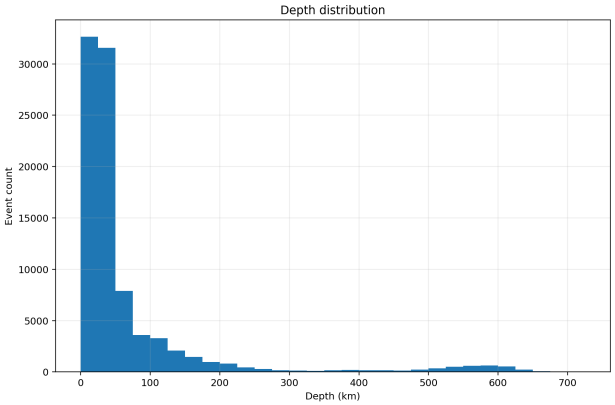


(b) Annualized gridded moment density.

Figure 1: Spatial context for the full 1970-2026 catalogue.



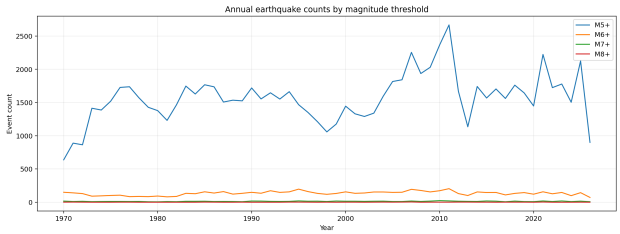
(a) Magnitude-frequency curve.



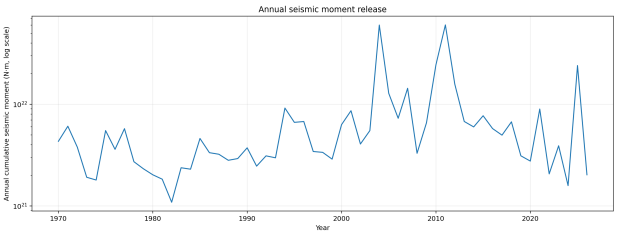
(b) Depth distribution.

Figure 2: Magnitude and depth structure of the global catalogue.

4 Historical temporal context

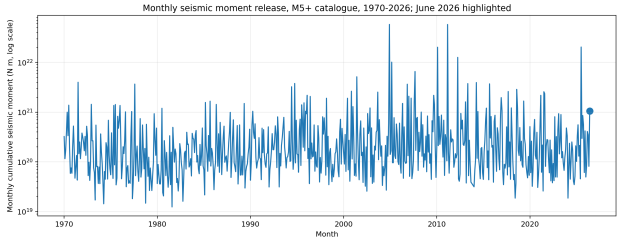


(a) Annual event counts by magnitude threshold.

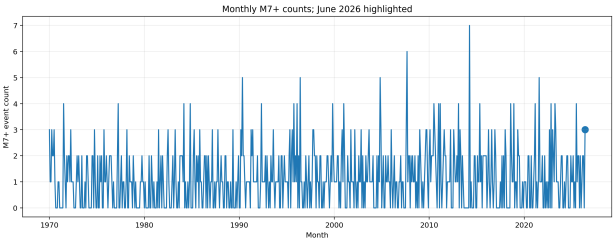


(b) Annual moment release.

Figure 3: Annual count and moment context. Count and moment do not measure the same thing; a year can have ordinary counts but large moment release if it includes one or more great earthquakes.



(a) Monthly moment release, with June 2026 highlighted.

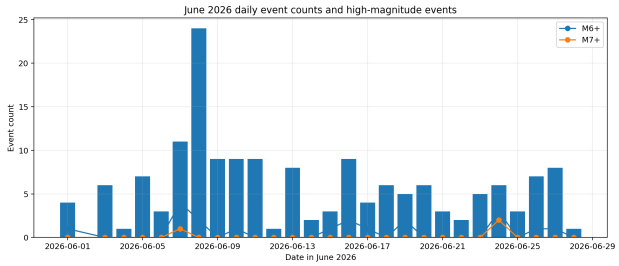


(b) Monthly M7+ counts, with June 2026 highlighted.

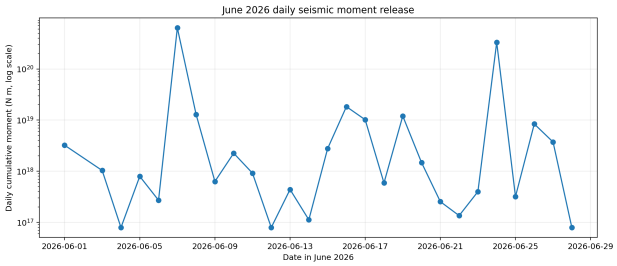
Figure 4: Monthly context for June 2026. June 2026 ranks 55 of 675 monthly windows by cumulative moment and 27 of 675 by M7+ count.

5 June 2026 analysis

June 2026 contains 162 M5+ events through 28 June, including 19 M6+ events and 3 M7+ events. The largest event is the Mw 7.8 Philippines earthquake on 7 June 2026. The month is not dominated by event count: its M5+ count lies at about the 84th percentile of monthly windows. It is more anomalous by high-magnitude content and moment release, ranking 27 of 675 monthly windows by M7+ count and 55 of 675 by cumulative seismic moment.

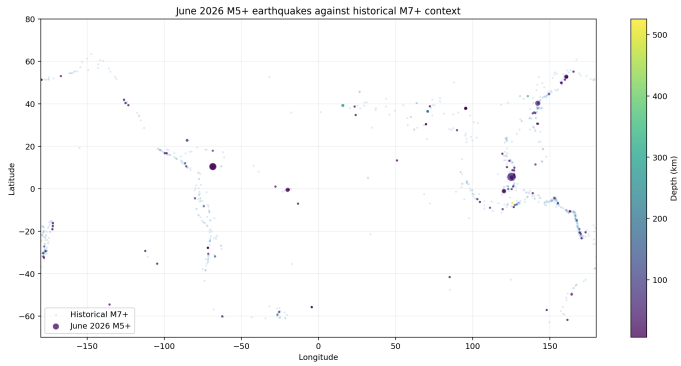


(a) Daily M5+, M6+, and M7+ counts in June 2026.

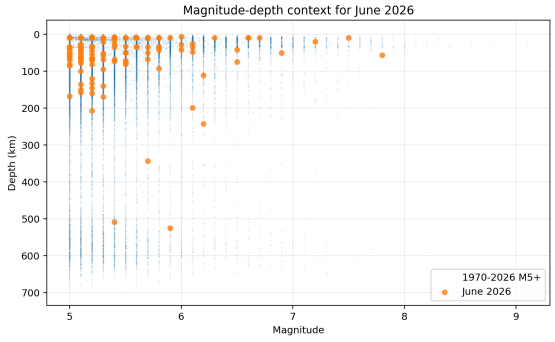


(b) Daily cumulative moment release in June 2026.

Figure 5: Daily structure of the June 2026 activity. The strongest daily moment pulse occurs on 24 June, when the Venezuela doublet and Japan event fall within a short interval.



(a) June 2026 M5+ events relative to historical M7+ events.



(b) Magnitude-depth distribution with June 2026 highlighted.

Figure 6: Spatial and depth context for June 2026. The month samples several active tectonic belts rather than one isolated global source region.

Table 2: Largest June 2026 events by magnitude.

UTC time	Mw	Depth km	Region	M0 N m
2026-06-07 23:37	7.8	57.2	24 km SW of Kablalan, Philippines	6.310e+20
2026-06-24 22:05	7.5	10.0	28 km SE of Yumare, Venezuela	2.239e+20
2026-06-24 22:04	7.2	20.3	23 km SE of Yumare, Venezuela	7.943e+19
2026-06-24 22:30	6.9	50.9	30 km ENE of Kuji, Japan	2.818e+19
2026-06-16 03:27	6.7	10.0	43 km ESE of Palu, Indonesia	1.413e+19
2026-06-17 18:56	6.6	10.0	central Mid-Atlantic Ridge	1.000e+19
2026-06-19 06:52	6.6	10.0	133 km ESE of Petropavlovsk-Kamchatsky, Russia	1.000e+19
2026-06-26 11:34	6.5	42.0	34 km WSW of Sarangani, Philippines	7.079e+18
2026-06-08 00:55	6.5	75.1	18 km SW of Balangonan, Philippines	7.079e+18
2026-06-16 09:06	6.3	10.0	260 km SSE of Dunhuang, China	3.548e+18

The moment budget is strongly concentrated. The Mw 7.8 Philippines event alone contributes 60.0% of the June 2026 cumulative seismic moment. The two largest events contribute 81.3%, and the four largest events contribute 91.6%. This is typical of earthquake moment accounting: one large event can outweigh many moderate events.

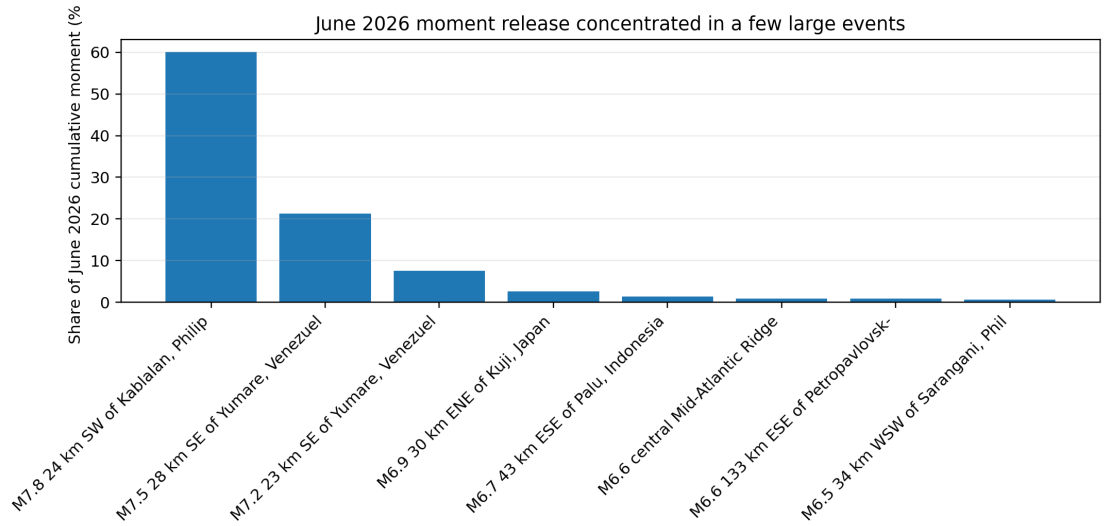


Figure 7: Pareto structure of June 2026 moment release. Moment is concentrated in a small number of high-magnitude earthquakes.

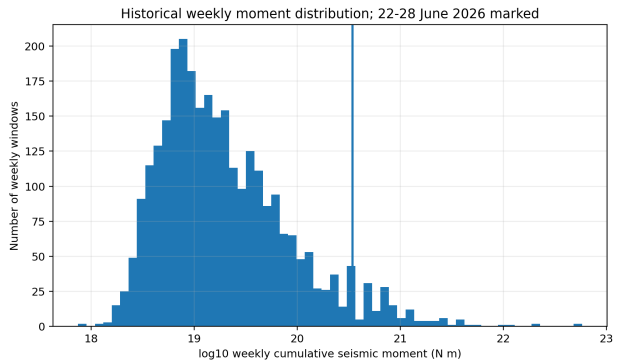
Table 3: Largest contributors to June 2026 cumulative seismic moment.

UTC time	Mw	Region	Share of June moment pct
2026-06-07 23:37	7.8	24 km SW of Kablalan, Philippines	60.0
2026-06-24 22:05	7.5	28 km SE of Yumare, Venezuela	21.3
2026-06-24 22:04	7.2	23 km SE of Yumare, Venezuela	7.6
2026-06-24 22:30	6.9	30 km ENE of Kuji, Japan	2.7
2026-06-16 03:27	6.7	43 km ESE of Palu, Indonesia	1.3
2026-06-17 18:56	6.6	central Mid-Atlantic Ridge	1.0

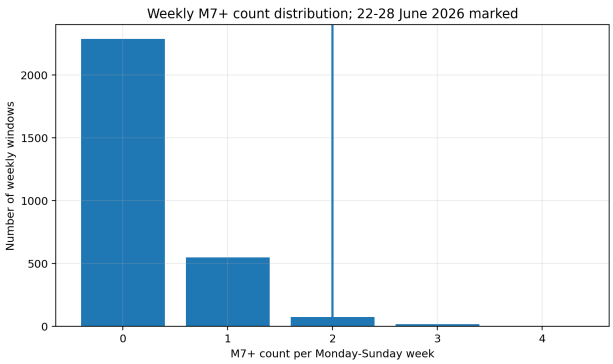
6 The 22-28 June 2026 high-energy week

The week from 22-28 June 2026 contains 32 M5+ events, 5 M6+ events, and 2 M7+ events. Its raw event count is not extreme, ranking only around the 67.7th percentile of weekly windows. However, the week is unusual by large-event content and moment release: it is at approximately the 99.3th percentile by M7+ count and 95.0th percentile by cumulative weekly moment.

The key concentration occurs on 24 June 2026. The catalogue records a Mw 7.2 Venezuela event at 22:04:33 UTC, a Mw 7.5 Venezuela event at 22:05:11 UTC, and a Mw 6.9 Japan event at 22:30:14 UTC. These events dominate the weekly moment budget. The Philippines Mw 6.5 event on 26 June and Afghanistan Mw 6.1 event on 27 June add to the high-energy character of the week, but the week is principally a large-event cluster rather than a broad increase in global M5+ frequency.



(a) Weekly moment distribution; 22-28 June 2026 marked.



(b) Weekly M7+ count distribution; 22-28 June 2026 marked.

Figure 8: The 22-28 June 2026 week is much more anomalous by moment and M7+ incidence than by raw M5+ event count.

7 Raw versus declustered interpretation

The GK-like retained-background layer reduces the June 2026 event count from 162 to 82 events, and the week from 32 to 25 events. However, it preserves most of the June and weekly moment, because the retained events include the dominant large shocks. This confirms that many smaller June events are sequence-related, but the high-energy interpretation does not disappear after declustering.

Table 4: Raw and GK-like retained summaries for June 2026 and 22-28 June 2026.

Period	Events	M6+	M7+	Moment N m
June 2026 raw	162	19	3	1.051e+21
June 2026 GK-like retained	82	10	3	9.809e+20
Week raw	32	5	2	3.450e+20
Week GK-like retained	25	3	2	3.088e+20

8 Rank and percentile diagnostics

Table 5: Rank context for June 2026 and the 22-28 June 2026 week. Rank 1 is the highest value in the corresponding historical window set.

Scale	Metric	Value	Rank desc.	Windows	Percentile ¡= value
monthly	event_count	162	108	675	84.1
monthly	M6_plus	19	42	675	93.9
monthly	M7_plus	3	27	675	96.1
monthly	M8_plus	0	42	675	93.9
monthly	max_mag	7.8	60	675	91.3
monthly	moment	1.051e+21	55	675	92.0
weekly	event_count	32	949	2933	67.7
weekly	M6_plus	5	240	2933	91.9
weekly	M7_plus	2	22	2933	99.3
weekly	M8_plus	0	43	2933	98.6
weekly	max_mag	7.5	176	2933	94.0
weekly	moment	3.450e+20	149	2933	95.0

The ranking diagnostics support a precise interpretation. June 2026 is an upper-tail month by M6+, M7+, maximum magnitude, and moment, but it is not one of the catalogue's great-earthquake months because it contains no M8+ event. The week of 22-28 June is even more selective: its M5+ count is ordinary-to-moderately elevated, but its two M7+ events place it in the extreme upper tail of weekly large-event counts. This is exactly the kind of interval that would be muted by count-only analytics and highlighted by moment-weighted analytics.

9 Conclusions

The June 2026 activity is best described as a high-energy, high-magnitude interval rather than a globally exceptional burst of total M5+ earthquake frequency. The month through 28 June contains 162 M5+ events and 1.051e+21 N m of cumulative seismic moment, placing it near the upper decile of monthly windows by moment. The week from 22-28 June contains 32 M5+ events, but its 2 M7+ events place it in the upper one percent of weekly M7+ incidence in this catalogue. The apparent spate is therefore real in terms of high-energy event concentration, especially on 24 June, but it is not primarily a broad global increase in earthquake frequency.

For subsequent work, the most valuable extensions would be: formal nearest-neighbour or ETAS declustering; plate-boundary distance and tectonic-class attribution; moment tensors/focal mechanisms for the June large events; and exposure-oriented shaking metrics if the goal shifts from source intensity to human or infrastructure impact.

References

[1] Gutenberg, B. and Richter, C. F. (1944). Frequency of earthquakes in California. *Bulletin of the Seismological Society of America*, 34, 185-188.

[2] Hanks, T. C. and Kanamori, H. (1979). A moment magnitude scale. *Journal of Geophysical Research*, 84(B5), 2348-2350.

[3] Gardner, J. K. and Knopoff, L. (1974). Is the sequence of earthquakes in Southern California, with aftershocks removed, Poissonian? *Bulletin of the Seismological Society of America*, 64(5), 1363-1367.

[4] Reasenberg, P. (1985). Second-order moment of central California seismicity, 1969-1982. *Journal of Geophysical Research*, 90(B7), 5479-5495.

[5] Zaliapin, I. and Ben-Zion, Y. (2020). Earthquake declustering using the nearest-neighbor approach in space-time-magnitude domain. *Journal of Geophysical Research: Solid Earth*, 125.