The 2025, M7.7 Myanmar earthquake

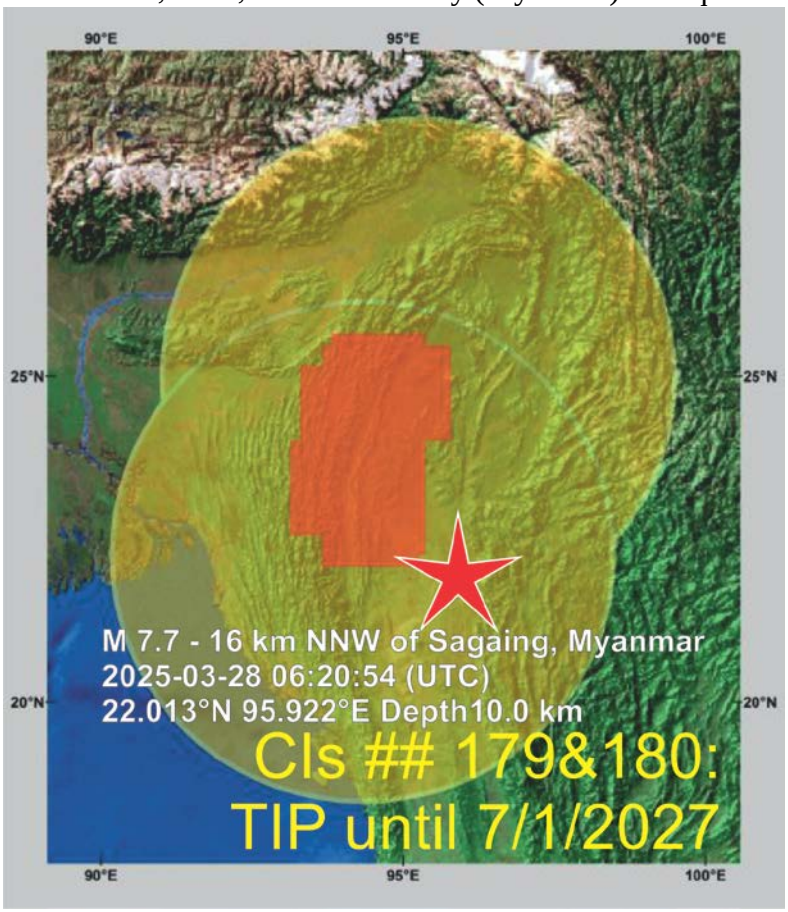
The M 7.7 earthquake in Mandalay (Myanmar) occurred on 2025-03-28 06:20:54 (UTC), i.e., 12:50:54 local time, with the epicenter coordinates 22.013°N 95.922°E at a depth of 10 km. The size of the focal zone is about 200 km along the meridional strike of the 1400-km transform Sagaing Fault. More than 7.5 million people were exposed to extreme, violent, and severe ground shaking of intensity X, IX, and VIII on MMI scale. As of April 06, according to Democratic Voice of Burma the number of confirmed victims in Myanmar has raised to 4,316 fatalities, 6,588 injured, and 448 missing (Mizzima News reported 5,330 fatalities, 7,108 injuries, and 538 missing persons, while the Information Team of Myanmar's State Administration Council reported 3,564 dead, 5,012 injured, and 210 missing). This tragedy joins the list of the Deadliest earthquakes of the 21st century (Table 1) and proves once again that, same as GSHAP, the GEM product's "inconsistency is inadmissible for any type of responsible evaluation of seismic risk and making decisions concerning earthquake disaster prevention" (Kossobokov and Nekrasova, 2012). Moreover, in comparison to GSHAP Final Map GEM has reduced by 20% the expected PGA at the site of the deadly earthquake.

TABLE 1. Top deadliest earthquakes since 2000. Notes: at least 1,000+ fatalities including victims of tsunami and other associated effects. The ratio $R_{PGA} = mPGA_{GEM}/mPGA_{GSHAP}$ (* from GEM interactive map); increments $\Delta I_0 = I_{0\,EVENT} - I_{0\,GSHAP}$ and $\Delta I_0' = I_{0\,EVENT} - I_{0\,GEM}$ are computed as in (Kossobokov and Nekrasova, 2011; 2012) rounded to the closest integer.

Region	Date	M	Fatalities	ΔI_0	$\Delta I_0'$	R_{PGA}
Sumatra-Andaman Islands (Indonesia, India)	26 Dec 2004	9.0	227,898	4	4	1.20*
Port-au-Prince (Haiti)	12 Jan 2010	7.3	222,570	2	1	3.10
Wenchuan (Sichuan, China)	12 May 2008	8.1	87,587	3	3	1.60
Kashmir (northern border India-Pakistan region)	8 Oct 2005	7.7	87,351	2	2	2.06
Nurdağı (Turkey)	**6 Feb 2023**	**7.8(8.0)**	**59,359+**	**1(2)**	**2**	**1.08**
Ekinözü (Turkey)		**7.5(7.7)**		**1(2)**	**2**	**1.11**
Bam (Iran)	26 Dec 2003	6.6	26,271	0	1	0.86
Bhuj (Gujarat, India)	26 Jan 2001	8.0	20,085	3	2	2.30
Off the Pacific coast of Tōhoku (Japan)	11Mar 2011	9.0	19,759+	3	3	1.22*
Bharatpur (Nepal)	25 Apr 2015	7.8	8,964	2	2	1.01
Yogyakarta (Java, Indonesia)	26 May 2006	6.3	5,782	0	0	1.57
Sulawesi Island (Indonesia)	28 Sep 2018	7.5	4,340	2	2	1.62
Mandalay (Myanmar)	**28 Mar 2025**	**7.7**	**4,316+**	**1**	**1**	**0.80**
Southern Qinghai (China)	13 Apr 2010	7.0	2,968	2	1	1.68
Oukaïmedene (Morocco)	**8 Sep 2023**	**6.8**	**2,946+**	**3**	**2**	**2.09**
Boumerdes (Algeria)	21 May 2003	6.8	2,266	2	0	3.75
Nippes (Haiti)	14 Aug 2021	7.2	2,248	2	1	3.39
Zindah Jān, Herāt (Afghanistan)	**7 Oct 2023**	**6.3, 6.3**	**2,445? 1,482+**	**0**	**0**	**1.22**
Nias Island (Indonesia)	28 Mar 2005	8.6	1,313	3	3	2.22
Padang (Southern Sumatra, Indonesia)	30 Sep 2009	7.5	1,117	1	1	1.38
Hindu Kush (Afghanistan)	25 Mar 2002	6.1	1,000+	−1	−1	0.74

According to the Global Test of predictions by the M8 and M8-MSc algorithms (Figure 1), conducted in real time since 1992, the epicenter of the earthquake is in the area (highlighted yellow) where an earthquake in magnitude range M7.5+ was expected from January 2021. During the next semiannual updates the alert was confirmed, last time in January 2025, tentatively until mid-2027. The refinement of the alerted area by the MSc algorithm (highlighted red), which outlined the 390-km long area of Myamar Central Basin, misses the epicenter of the M 7.7w main shock (star) by about 70 km. Note that a few seismological agencies reported the magnitude of the March 28th main shock in range from Mw 7.7 to 8.0 and the epicenter within 85 km distance from the US GS determination (https://www.emsc-csem.org/Special_reports/?id=352). The earthquake parameters may be refined in the future; however, it is evident that the event adds a "success" of M8 and a "failure" of M8-MSc to the statistics of reliable intermediate-term forecasts of these algorithms (Ismail-Zadeh and Kossobokov, 2021).

FIGURE 1. Global testing of the M8-MSc predictions in advance of March 28, 2025, M 7.7 Mandalay (Myanmar) earthquake



Unlike the misleading expectations from GSHAP and GEM probabilistic seismic hazard maps, a map of the maximum observed magnitude (Figure 2, Table 2) is not surprised by the 2025 Myanmar earthquake, which epicenter is in less than 150 km distance from the epicenter of May 23, 1912, M 7.9 earthquake 32 km NW of Taunggyi (Myanmar); note that the location contributed by ISC-GEM is at 70 km from the Sagaing Fault ruptured on March 28, 2025.

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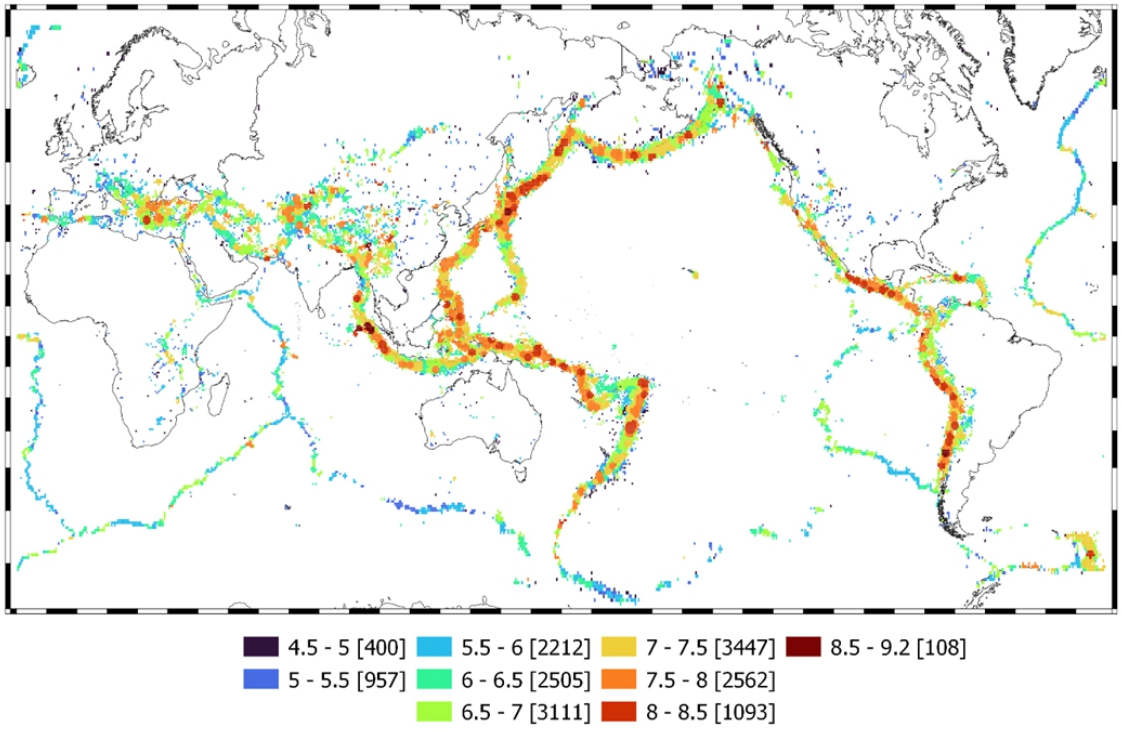

FIGURE 2. Global map of the largest earthquake magnitude observed in overlapping circles of 150 km radius. Notes: All 311,846 earthquakes of magnitude 4.5 or above at depth less than 100 km in 1900-June 2023 from NEIC/USGS Global Hypocenter Data Base updated with the ANSS Comprehensive Catalog were used to determine the maximum magnitude, M^*_{max} in a circle cantered at a regular 0.5°×0.5° grid. For each color-coded 0.5 magnitude interval the number of circles is given in brackets. (Nekrasova et al., 2025)

TABLE 2. Strong (M ≥ 6.0) earthquakes nearest to the 2025, M7.7 Mandalay epicenter.

Note: USGS ANSS ComCat search https://earthquake.usgs.gov/earthquakes/search/, April 07, 2025, 6:43:13 PM

Time	Latitude, °N	Longitude, °E	Depth, km	M	M type	Distance, km
2025/03/28 06:20:52.7	**21.996**	**95.926**	**10**	**7.7**	**mww**	**0**
1956/07/16 15:07:12.3	22.178	95.781	34	6.8	mw	25
2025/03/28 06:32:04.7	21.707	95.969	10	6.7	mww	32
2012/11/11 01:12:38.9	23.005	95.885	14	6.8	mww	112
1975/07/08 12:04:42.4	21.485	94.700	157	6.5	mb	139
1912/05/23 02:24:04.0	**21.031**	**96.859**	**15**	**7.9**	**mw**	**144**
2016/04/13 13:55:17.8	23.094	94.865	136	6.9	mww	164
1964/02/27 15:10:50.1	21.546	94.347	101	6.1	mw	171
1946/09/12 15:20:25.7	23.532	95.705	15	7.6	mw	172
1969/10/17 01:25:14.2	23.041	94.636	135	6.3	mw	176
1991/01/05 14:57:11.6	23.613	95.901	20	7.0	mw	180
1936/02/21 06:20:43.8	23.594	96.364	15	6.1	mw	183

Kossobokov V, April 9, 2025

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