

Research Paper

Post-seismic Coulomb stress simulation and seismic hazard analysis of the 2025 Myanmar $M_W7.7$ earthquake

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ARTICLE INFO

Article history:

Received 30 April 2025

Received in revised form

25 July 2025

Accepted 2 September 2025

Available online 31 October 2025

Keywords:

Myanmar earthquake

Coulomb failure stress change

The Sagaing fault

Southwest Yunnan

ABSTRACT

On March 28, 2025, an $M_W7.7$ earthquake struck Myanmar, with the epicenter located in the central segment of the Qinghai–Xizang–Yunnan–Myanmar–Indonesia η -type structure. This region hosts a series of active faults, including the right-lateral Sagaing Fault and the Red River Fault in southwestern Yunnan. Based on the fault geometry model published by Zhang et al. and the Crust1.0 layered medium model, this study simulates the co-seismic and post-seismic Coulomb stress changes at depths of 5, 10, and 15 km on the main fault zones within the study area. The results indicate that the earthquake was dominated by Coulomb stress unloading, with localized loading observed at the northern and southern ends of the rupture. On the Sagaing Fault, Coulomb stress changes were dominated by unloading: average decreases ranged from -2.4 to -4.7 bar across all depths and timescales, indicating a low likelihood of large-scale rupture on that fault. However, in the northern segment of the rupture, localized stress loading exceeded the critical threshold of 0.1 bar, suggesting a possible enhancement of local seismic hazard. In southwestern Yunnan, co-seismic Coulomb stress loading at all depths ranged from -0.37×10^{-2} to 1.8×10^{-2} bar. Post-seismic stress changes were minor, with a maximum of 3.2×10^{-3} bar. These results imply that the $M_W7.7$ event induced only subtle adjustments to the long-term tectonic stress field in southwestern Yunnan; nevertheless, the presence of stress-loading regions within seismic gaps warrants continued attention to potential hazard.

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1. Introduction

According to the observations of the USGS, an $M_W7.7$ earthquake occurred in Myanmar (22.00°N , 95.93°E) at 14:20:52 on March 28, 2025. Twelve minutes later, an $M_W6.7$ aftershock occurred, and the focal depths of both were 10 km. According to statistics, the death toll of this earthquake reached 1700 on March 30, 3400 were injured, and about 300 were missing [1].

Myanmar lies in the central segment of the Qinghai–Xizang–Yunnan–Myanmar–Indonesia η -type structure [2,3], at

the junction of the Indian, Eurasian, and other plates. The Indian Plate on the left compresses the northern Qinghai–Xizang Plateau at 35–45 mm/yr. The complex geological processes have created multiple active fault zones [4]. Among them, the Sagaing Fault that extends in the north–south direction is the most geologically active. According to GNSS measurements, the fault zone slips at a rate of about 20–24 mm/yr [5]. This right-lateral strike-slip fault system runs through the entire territory of Myanmar and extends to the Andaman Sea, constituting the core geological structure system of the region. According to the USGS earthquake catalog, large earthquakes frequently occur in this fault zone. Since the 1930s, 6 strong earthquake events with $M_W7.0$ or above have been recorded. In 1946, a double earthquake sequence of the same magnitude occurred, with a large-scale energy release occurring approximately every 16 years, fully revealing the continuous crustal stress adjustment process at the plate boundary.

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Peer review under the responsibility of Editorial office of Geodesy and Geodynamics.

The Sagaing Fault passes through or is adjacent to many densely populated areas in Myanmar, such as Mandalay, Nay Pyi Daw, and Shwebo. Mandalay, the second-largest city in Myanmar, is also the city closest to the epicenter of this earthquake (21.97°N, 96.08°E), with a population of approximately 1.72 million. Xiong et al. [6] simulated the Coulomb failure stress change (ΔCFS) accumulated in the Sagaing Fault by 10 earthquakes with $M_w 6.7$ or above in the past 110 years, revealing the spatio-temporal evolution pattern of the ΔCFS accumulation in the Sagaing Fault on a century-scale and identifying the seismogenic gap with significant stress accumulation characteristics. It is worth noting that this earthquake is located in the delineated Mandalay - Nay Pyi Taw section. Therefore, through co-seismic and post-seismic analysis, it is of great value for improving the probabilistic prediction model of earthquake hazard in Myanmar. In addition, the earthquake in Myanmar is relatively close to the border of Yunnan, China. As shown in Fig. 1, there are obvious seismic gaps in the convergence area of the Nantinghe Fault, the Lancangjiang Fault, and the Red River Fault. It is worthy of attention whether this earthquake will affect the movement of the fault zones in Yunnan and endanger the safety of the people.

Fault dislocation will cause changes in the stress of the medium inside the Earth. Calculating the ΔCFS can effectively estimate the earthquake hazard [7–15]. Quantitative analysis of the stress loading and unloading process of the $M_w 7.7$ earthquake in Myanmar has important scientific value for in-depth evaluation of its disaster effects. Based on the elastic dislocation theory and the lithosphere stratification model, this paper calculates the ΔCFS caused by this earthquake, calculates the ΔCFS disturbance induced by the Sagaing, Nantinghe, and Lancangjiang Faults, and

simulates the stress evolution trend on a ten-year and century-scale. Analyzing the loading and unloading effects of the tectonic stress field provides a reference basis for delineating earthquake hazard areas and earthquake research in this region in the future.

2. Method

Based on the Coulomb failure criterion, the ΔCFS is shown in Eq. (1), where $\Delta \tau_s$ represents the shear stress change, μ' denotes the effective friction coefficient, which includes the influence of pore fluids and the medium properties in the fault zone, and $\Delta \sigma_n$ is the normal stress change. The ΔCFS greater than 0 indicates stress loading and an increase in fault instability, while a value less than 0 indicates stress unloading and an increase in stability. The general range of the effective friction coefficient is 0.2–0.8, and an empirical value of 0.4 is taken [16]. This paper also simulates the influence of other friction coefficients on the calculation results. This study uses PSGRN/PSCMP [17] to calculate the ΔCFS caused by the Myanmar earthquake.

$$\Delta CFS = \Delta \tau_s + \mu' \Delta \sigma_n \quad (1)$$

3. Medium model and fault model

For the post-earthquake stress evolution, we adopted the Maxwell viscoelastic relaxation model to calculate the viscoelastic effect in this study. Based on the Crust1.0 model, the study area was discretized into five layers: sedimentary layer, upper crust,

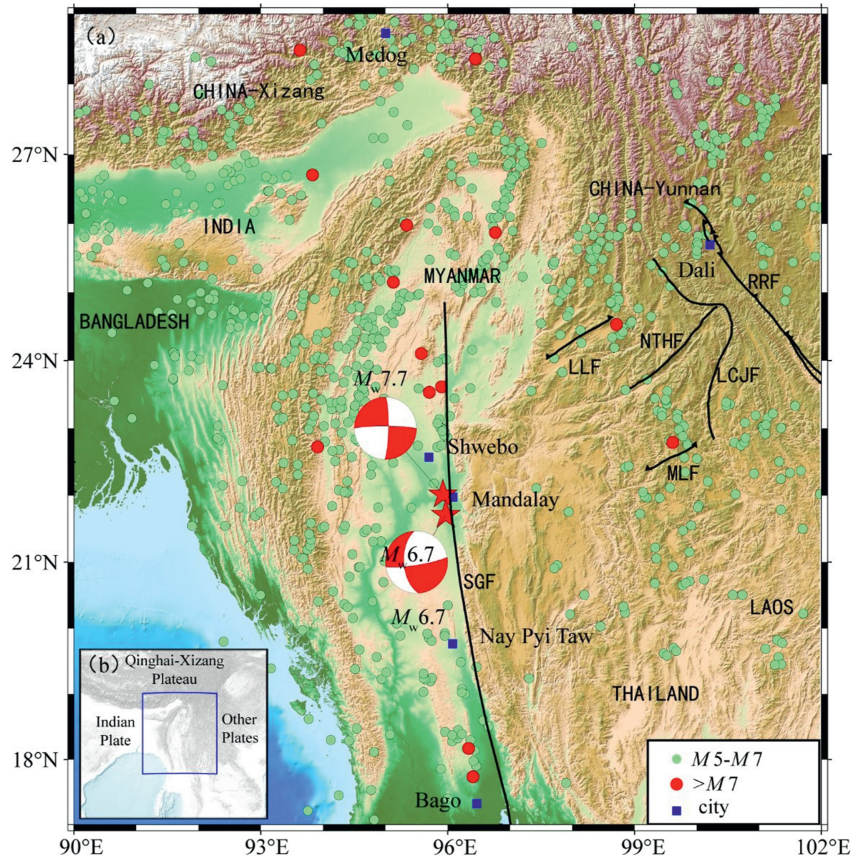


Fig. 1. (a) The tectonic background and historical earthquake distribution of the $M_w 7.7$ earthquake in Myanmar in 2025 (SGF, NTHF, LCJF, RRF, LLF, and MLF represent the Sagaing Fault, the Nantinghe Fault, the Lancangjiang fault and the Red River Fault, the Longling-Ruili Fault, the Menglian-Lancang Fault, respectively). (b) The location of the study area.

middle crust, lower crust, and upper mantle. The elastic domain extends to a depth of 14 km (covering the sedimentary layer and upper crust), and the viscoelastic domain spans from 14 km depth to the upper mantle. The transient (η_1) and steady-state (η_2) viscosity coefficients are shown in Table 1, and the parameters refer to Xiong et al. [6] and Li et al. [18]. The time windows are set to 10 a and 100 a for comparative analysis. The fault model published by Zhang Yong's research group is used as the seismogenic fault (see Fig. 2). The basic information of the fault model is the epicenter (22.01°N, 95.92°E), and the depth is 10 km. Table 2 shows the focal mechanism of the double earthquakes in Myanmar released by the USGS. The strike of the receiving fault of the Sagaing Fault is selected to be the same as that of the main shock. The parameters of each receiving fault of NTHF, LCJF, and RRF are shown in Table 3 [6,19,20], in which the LCJF is divided into three sections for calculation.

4. The ΔCFS induced by the $M_w 7.7$ Myanmar earthquake

4.1. Co-seismic and post-seismic ΔCFS

The study area spans 90°E–102°E and 17°N–29°N, discretized into an 80×80 grid. To analyze future seismic hazards, the ΔCFS at each grid point and the stress perturbations on major faults near the epicenter were calculated.

The mainshock occurred at a depth of 10 km. Accordingly, we computed the co-seismic and post-seismic ΔCFS at depths of 5, 10, and 15 km, as shown in Fig. 3 and Table 4. The co-seismic simulations indicate that overall stress release is concentrated around the epicenter and extends north–south, with stronger unloading to the south than to the north, and decaying rapidly with distance. Co-seismic stress-loading patches align north–south, consistent with a strike-slip rupture. Vertically,

Table 1
Rheological parameters of the layered Earth model.

Layer	Depth (km)	V_p (km/s)	V_s (km/s)	ρ (kg/m ³)	η_1 (Pa·s)	η_2 (Pa·s)
Sed	4	4	2.13	2370	1.00E+23	1.00E+23
UC	14	6	3.5	2710	1.00E+23	1.00E+23
MC	24	6.3	3.62	2740	1.50E+19	2.00E+20
LC	34	6.95	3.93	2930	2.00E+19	3.00E+20
UM	64	8.03	4.46	3310	2.00E+19	5.00E+21

Note: Among them, Sed represents sedimentary layer, UC represents the upper crust, MC represents the middle crust, LC represents the lower crust, and UM represents the upper mantle.

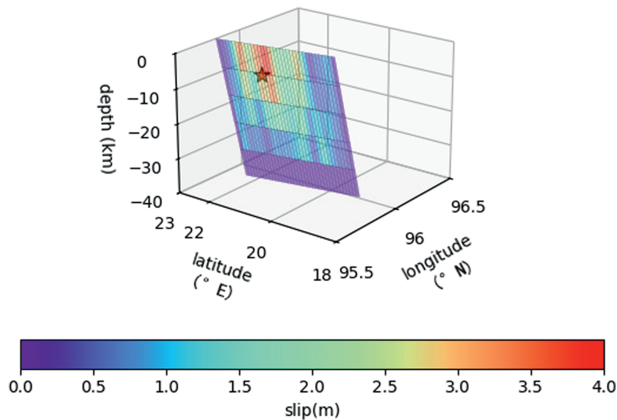


Fig. 2. Zhang Yong-Slip model.

Table 2

The focal mechanism parameters of the 2025 Myanmar earthquake.

Longitude (°E)	Latitude (°N)	Depth (km)	Plane	Strike (°)	Dip (°)	Rake (°)	M_w	Organization
95.93	22.00	10	I	1	82	−174	7.7	USGS
			II	270	84	−8		
95.97	21.71	10	I	81	82	−34	6.7	
			II	177	56	−170		

Table 3

Parameters of reception faults.

Strike (°)	Dip (°)	Rake (°)	Fault
1	80	180	SGF
228	75	−17	NTHF
315	70	174	LCJF-S1
270	70	174	LCJF-S2
193	70	174	LCJF-S3
320	70	−180	RRF

Note: SGF, NTHF, LCJF, RRF represent the Sagaing Fault, the Nantinghe Fault, the Lancangjiang fault and the Red River Fault, respectively.

shallow layers exhibit markedly greater unloading than deeper layers, and the southern unloading slightly exceeds that in the north. It is noteworthy that the mainshock generated a pronounced stress-loading zone south of the epicenter at depths below 10 km, reaching a peak amplitude of 38.1 bar. Twelve minutes later, an $M_w 6.7$ aftershock occurred near this loading zone.

The Sagaing Fault, as the core strike-slip structure in Myanmar, was greatly affected by this earthquake. This fault passes through the stress unloading area, and the maximum stress unloading at different depths exceeds 11 bar, as shown in Table 5. The impact on China can be divided into three parts. In the north, the southern part of Xizang is a loading area with a magnitude range of $0\text{--}2 \times 10^{-3}$ bar. The northwest Yunnan region is a stress-weakening area with a magnitude generally lower than 2×10^{-2} bar. The southwest Yunnan region is a stress-loading area with a magnitude also generally lower than 2×10^{-2} bar. In addition, two densely populated cities in Myanmar, Nay Pyi Taw and Bago, are in the stress-loading area and are relatively close to the Sagaing Fault. At a depth of 10 km, the stress loading in Nay Pyi Taw is 0.4 bar, which is significantly greater than the trigger threshold of 0.1 bar, and the seismic hazard in this area needs to be noted. In contrast, the stress loading in Bago is 6.4×10^{-3} bar, with a relatively small impact. Using Motuo County in southern Xizang and Dali City in Yunnan as case studies, the ΔCFS at various depths in Motuo County is approximately 1.2×10^{-3} bar, whereas Dali City is about -2×10^{-3} bar. Owing to the greater distance, the effect there is comparatively smaller. The simulation results of post-seismic ΔCFS over 10 and 100 years are illustrated in Fig. 3. At depths of 5 km and 10 km, which are considered elastic regions, the maximum and average post-seismic Coulomb stress values over a 10-year period show minimal differences compared to the co-seismic values. However, at a depth of 15 km, representing a viscoelastic region, the ΔCFS loading and unloading are more pronounced, with the 10-year post-seismic ΔCFS generally exhibiting a decreasing trend. The 100-year post-seismic simulation at 15 km depth indicates that the minimum co-seismic ΔCFS can reach up to 842.7 bar. This significant stress unloading in the deeper layers is attributed to viscoelastic relaxation, suggesting that these regions may remain stress-unloading for an extended period, as detailed in Table 4.

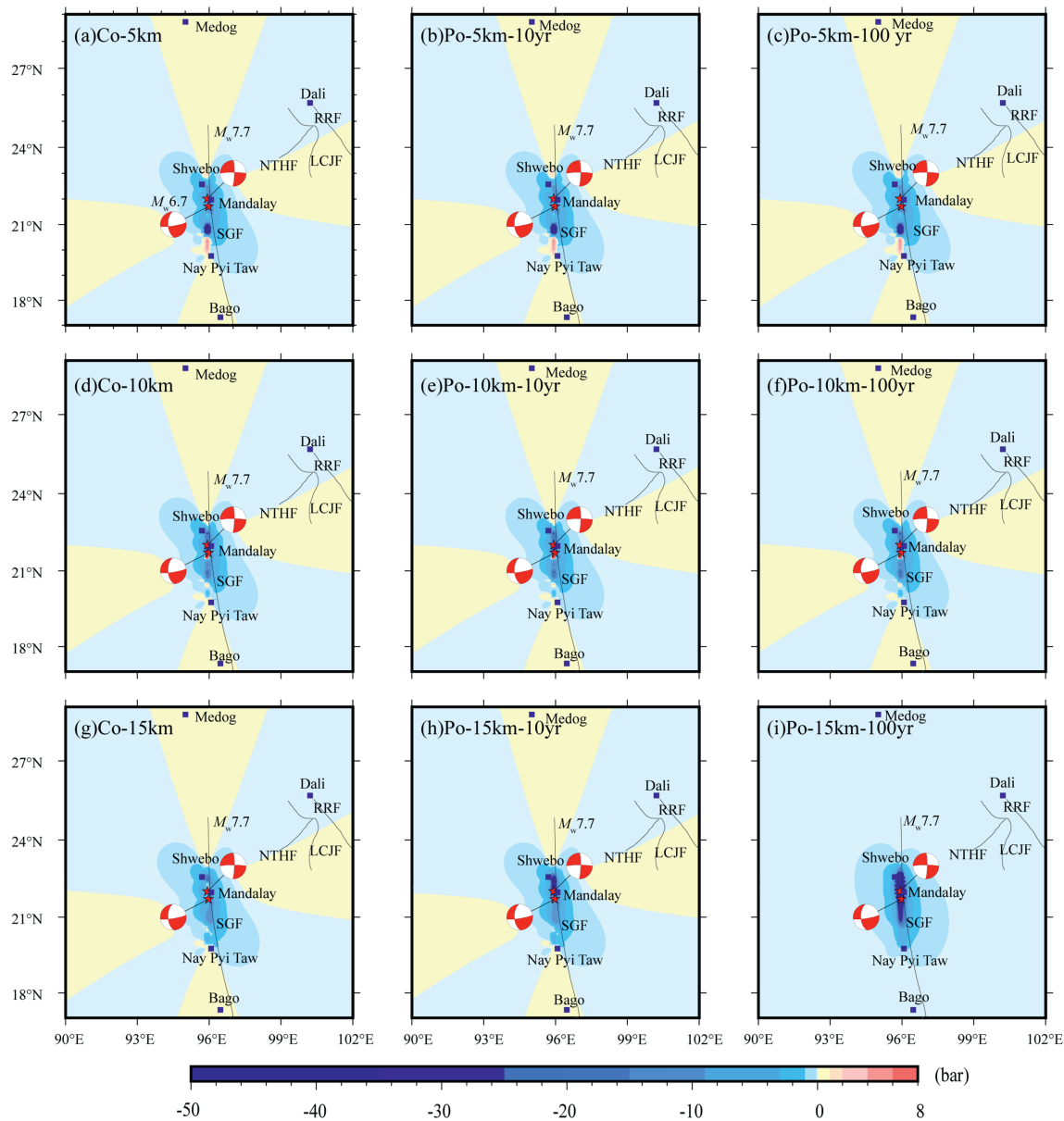


Fig. 3. ΔCFS distribution of co-seismic (Co) and post-seismic (Po) at different depths (ZY-slip model).

Table 4
The co-seismic ΔCFS loading and unloading situation of $M_W7.7$.

Depth	Co-seismic			Po-seismic-10yr			Po-seismic-100yr		
	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)
5	7.0	−205.6	-1.4×10^{-1}	7.0	−205.7	-1.4×10^{-1}	6.8	−207.3	-1.5×10^{-1}
10	38.2	−43.5	-1.3×10^{-1}	38.1	−43.6	-1.3×10^{-1}	36.1	−45.1	-1.3×10^{-1}
15	6.3	−28.7	-1.2×10^{-1}	3.0	−73.7	-1.6×10^{-1}	-2.2×10^{-4}	−842.7	-7.9×10^{-1}

Table 5
ΔCFS loading and unloading situation on the Sagaing Fault caused by the $M_W7.7$ earthquake.

Depth (km)	Co-seismic			Po-seismic-10yr			Po-seismic-100yr		
	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)
5	0.6	−11.8	−2.4	0.6	−11.8	−2.4	0.5	−11.6	−2.4
10	1.3	−14.1	−2.7	1.3	−14.1	−2.7	1.2	−13.9	−2.7
15	1.4	−16.5	−3.1	1.3	−17.0	−3.2	0.4	−24.7	−4.7

4.2. Co-seismic and post-seismic Δ CFS in the Sagaing Fault

The epicenter of this earthquake is located in the Sagaing Fault, a right-lateral strike-slip fault that runs through the entire territory of Myanmar and is the core geological structure system in this region. The simulation of Δ CFS at multiple depths in the Sagaing Fault is shown in Fig. 4 and Table 5. The results show that the elastic co-seismic and 10-year post-earthquake Δ CFS changes are very small. As the depth increases, both stress loading and unloading increase. At a depth of 10 km, the maximum stress unloading changes by 2.3 bar compared to the 5 km depth, and the maximum stress loading changes by 0.7 bar. According to statistics, the co-seismic and 10-year post-seismic simulations show that more than 28% of the fault zone is stress loading, located in the AB and CD sections, with the maximum value falling in the AB section. In the viscoelastic region, the unloading effect continues to enhance with the increase of time. The 100-year simulation results show that about 10% of the area of the Sagaing Fault Zone is under stress loading. Overall, at different depths, the Coulomb stress unloading is far greater than the stress loading, indicating that the main feature of this earthquake in the Sagaing Fault is stress unloading. The risk of large-scale rupture of this fault zone is relatively low. However, there are areas in the AB segment where the stress loading exceeds 0.1 bar, reaching the critical triggering conditions for typical fault rupture. Therefore, the dynamic evolution of the AB segment area needs to be continuously monitored.

4.3. Δ CFS in the main fault zones in Southwest Yunnan

The southwestern Yunnan region, adjacent to Myanmar, occupies a critical segment within the Qinghai–Xizang–Yunnan–Myanmar–Indonesia η -type structure. This region exhibits intense neotectonic activity and frequent seismicity, driven by ongoing Indo-Eurasian plate convergence. Multiple active fault zones traverse the area, including the Red River Fault (RRF), Nantinghe Fault (NTHF), and Lancangjiang Fault (LCJF). Studies demonstrate that seismicity in southwestern Yunnan is significantly influenced by stress perturbations from major Myanmar earthquakes, with clustered events showing strong seismotectonic linkages to regional stress transfer processes [3]. Since earthquakes in this area mostly occur at depths of about 10 km and 15 km [19–22], this paper calculates the Δ CFS caused by this strong earthquake at depths of 10 km and 15 km on the Nantinghe Fault, the Lancangjiang Fault, and the Red River Fault, which are closer to the strong

earthquake in Myanmar, as shown in Fig. 5. The results show that the occurrence of the strong earthquake in Myanmar has exerted a certain degree of stress perturbation on the three fault zones in Southwest Yunnan. At a depth of 10 km, the maximum co-seismic Δ CFS loading of the Nantinghe Fault is 1.6×10^{-2} bar, the maximum loading of the Lancangjiang Fault is 1.0×10^{-2} bar, and the maximum loading of the Red River Fault is 5.8×10^{-3} bar. At a depth of 15 km, the co-seismic Δ CFS of each fault zone has increased to a certain extent compared with that at a depth of 10 km, with the maximum being 1.8×10^{-2} bar for the Nantinghe Fault. Affected by the viscoelastic coefficient of the medium, the Δ CFS after the earthquake at a depth of 10 km is small. The 100-year simulation at a depth of 15 km shows that the stress of each fault has decreased significantly, among which the Nantinghe Fault has a large change, changing from Δ CFS loading to stress unloading, with an average value of -2.2×10^{-4} bar. The southern section of the Lancangjiang Fault shows the same trend. The above results indicate that the $M_W 7.7$ earthquake in Myanmar has a small stress perturbation on the main fault zones in Southwest Yunnan and has not reached a significant triggering level. The dynamic impact is mainly reflected in the slight adjustment of the long-term tectonic stress.

However, for the triggering threshold of 0.1 bar, some scholars believe that a smaller stress perturbation may also trigger an earthquake under a certain time scale, and this tiny stress loading may become the “last straw” [23]. Therefore, although this earthquake had a relatively limited impact on the faults in southwestern Yunnan, a seismic gap suggests that the potential for triggering subsequent earthquakes persists.

5. Discussion and conclusions

5.1. Uncertainty analysis

5.1.1. Effective friction coefficients

Multiple parameters influence the co-seismic and post-seismic modeling results, including viscoelastic relaxation and the fault friction coefficient. During the post-seismic phase, the mantle and lower crust respond to the co-seismic stress perturbation through viscous flow, a process that typically requires many years to produce significant effects. As shown in Fig. 5, at viscoelastic-dominated depths, post-seismic Coulomb stress changes remain minor over a 10-year timescale but become substantial over a 100-year timescale.

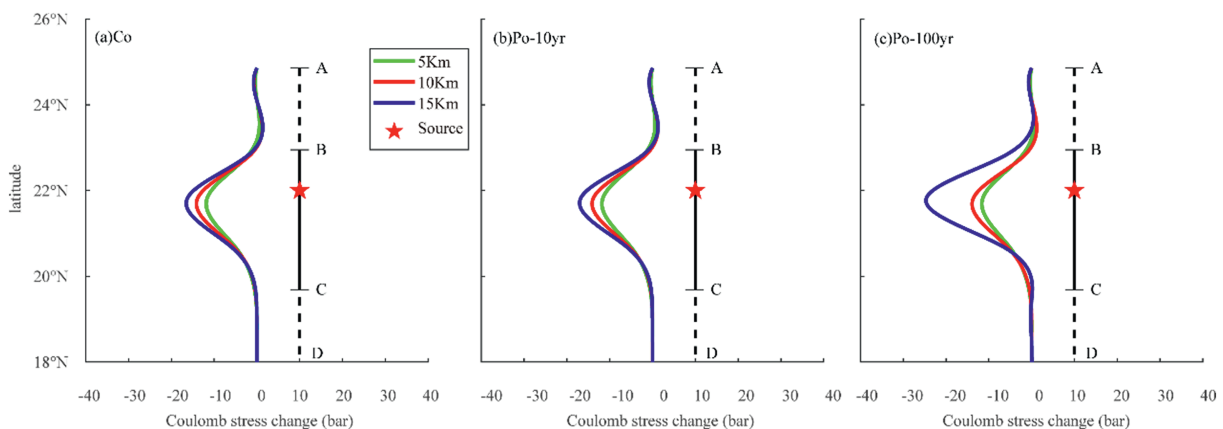


Fig. 4. Δ CFS at different depths along the Sagaing Fault induced by the $M_W 7.7$ earthquake in Myanmar (ZY-slip model): 5 km (green), 10 km (red), 15 km (blue). The Sagaing Fault can be divided into three sections: AB, BC, and CD, among which the BC section is the rupture section.

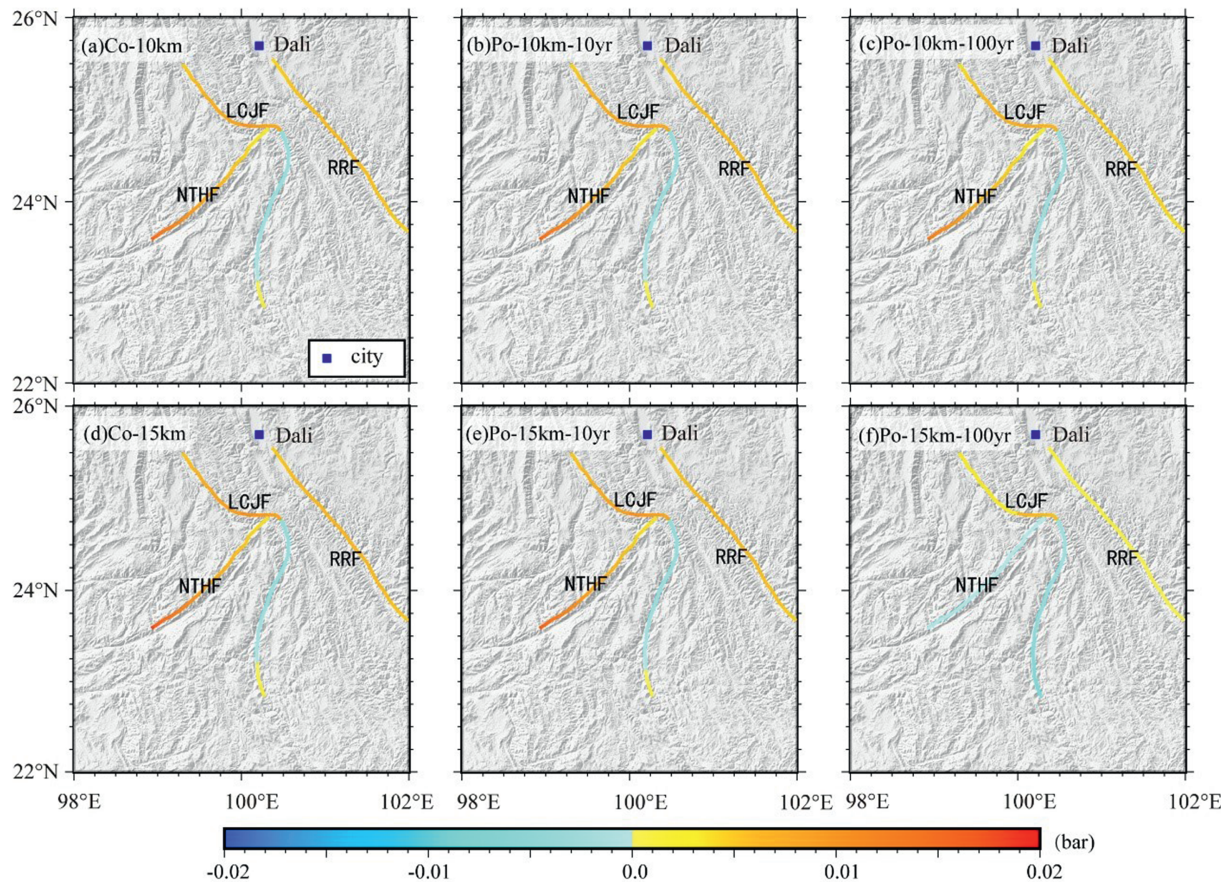


Fig. 5. ΔCFS of the Yunnan fault zone induced by the $M_w7.7$ Myanmar earthquake (ZY-slip model).

Given that stress changes within the elastic depth range are relatively small for the Myanmar earthquake, this section analyzes the effects at a 15 km viscoelastic depth. Based on the Zhang Yong (ZY) model, we evaluate how varying the friction coefficient ($\mu = 0.2, 0.4, 0.6$, and 0.8) influences Coulomb stress changes across the region $94^\circ\text{E}–102^\circ\text{E}$ and $18^\circ\text{N}–26^\circ\text{N}$. The results are summarized in Table 6, where ρ represents the proportion of the area experiencing Coulomb stress changes greater than 0.1 bar. Although varying μ' slightly alters both the mean ΔCFS and ρ , the changes remain small. Hence, within the scope of our study, the choice of friction coefficient has a negligible effect on the overall results.

5.1.2. Model comparison

Additionally, differences in slip models may lead to significant variations in results. Based on the slip model released by the USGS, we recalculated the co-seismic and post-seismic ΔCFS for the Myanmar and southwestern Yunnan regions, as shown in Fig. 6. Both the USGS slip model (Fig. 6) and the ZY model show that

this earthquake exhibited bilateral rupture. In comparison, the rupture extent is larger in the USGS model, with the main rupture zone concentrated at a depth of 10 km, as depicted in Fig. 6. The co-seismic and post-seismic results for this earthquake are shown in Fig. 7 and Table 7. Overall, the stress distribution is similar to that of the ZY model, but there are differences in the regions of stress loading. For instance, in the ZY model, a stress loading zone near the $M_w6.7$ aftershock at a depth of 10 km, whereas in the USGS model, stress loading zones appear at depths of 5 km and 15 km, and are farther from the $M_w6.7$ aftershock. The effects on the Sagaing Fault (Fig. 8) indicate that the stress loading and unloading are more pronounced, although the overall spatial pattern of ΔCFS remains similar. Stress unloading is concentrated near the hypocenter, with the largest unloading region located south of the source, while stress-loading areas exceeding 0.1 bar occur along the northern and southern segments of the fault zone. In the southwestern Yunnan region, the distribution of Coulomb stress change (Fig. 9) on the principal fault zones closely

Table 6
The influence of different effective friction coefficients.

μ'	Co-seismic		Po-seismic-10yr		Po-seismic-100yr	
	σ_{ave} (bar)	ρ (%)	σ_{ave} (bar)	ρ (%)	σ_{ave} (bar)	ρ (%)
0.2	-2.8×10^{-1}	1.3	-3.5×10^{-1}	1.1	-1.3	0
0.4	-3.0×10^{-1}	1.4	-3.7×10^{-1}	1.2	-1.4	0
0.6	-3.2×10^{-1}	2.0	-4.0×10^{-1}	1.8	-1.4	0
0.8	-3.4×10^{-1}	3.2	-4.2×10^{-1}	2.7	-1.4	0

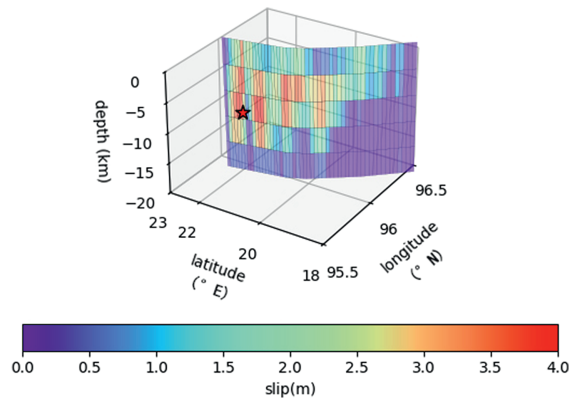


Fig. 6. USGS-slip model

follows that of the ZY model; however, owing to factors such as fault dip, the computed ΔCFS is generally lower than the ZY model predictions.

5.1.3. Impact of the aftershock

At present, there is no rupture model available for aftershock. Therefore, we estimated its Coulomb stress change based on the empirical rupture scaling law proposed by Wells and Coppersmith [24], together with the source parameters provided by the USGS (receiver fault set to $177^\circ/56^\circ/-170^\circ$, as shown in Table 2). Subsequently, we superimposed the aftershock-induced stress changes onto the Coulomb stress results of both the ZY model and the USGS model. The combined results show no significant changes in the overall stress pattern.

5.2. Seismic hazard assessment

As a fundamental component of seismic hazard assessment, ΔCFS analysis provides critical insights into fault interaction mechanisms [7–15]. The above research results show that:

- (1) The $M_w 7.7$ Myanmar earthquake was characterized predominantly by co-seismic Coulomb stress unloading, distributed mainly along the north-south direction, consistent with the typical rupture behavior of a strike-slip

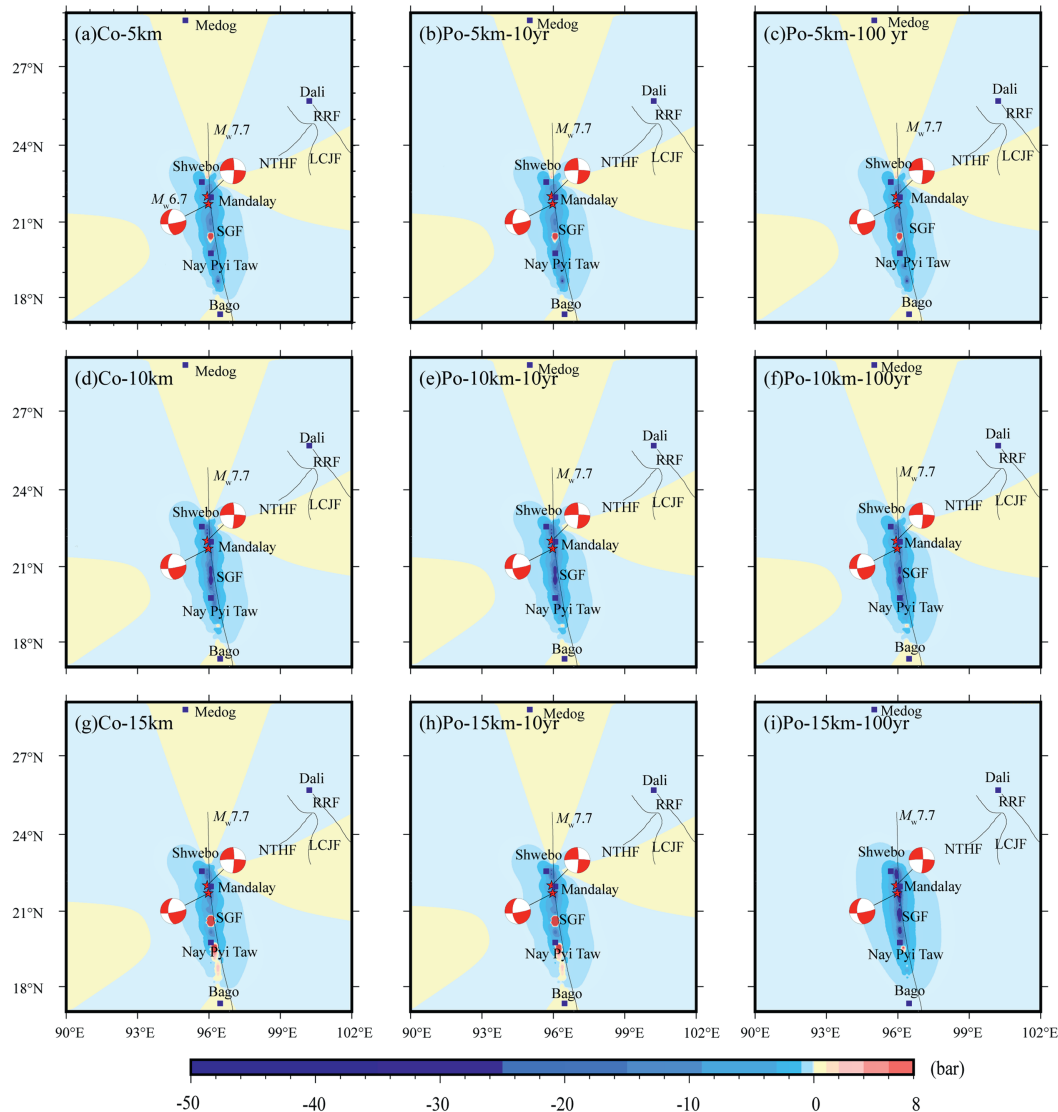


Fig. 7. ΔCFS distribution of co-seismic (Co) and post-seismic (Po) at different depths (USGS-slip model).

Table 7
ΔUSGS model-ΔCFS loading and unloading situation on the Sagaing Fault caused by the $M_W7.7$ earthquake.

Depth (km)	Co-seismic			Po-seismic-10yr			Po-seismic-100yr		
	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)	$\sigma_{\max}$ (bar)	$\sigma_{\min}$ (bar)	σ_{ave} (bar)
5	5.2	−13.8	−2.7	5.2	−13.7	−2.7	5.2	−12.0	−2.4
10	8.5	−32.3	−4.7	8.5	−32.2	−4.7	8.3	−29.9	−4.4
15	11.0	−40.3	−4.8	11.2	−43.5	−5.4	15.2	−88.2	−12.0

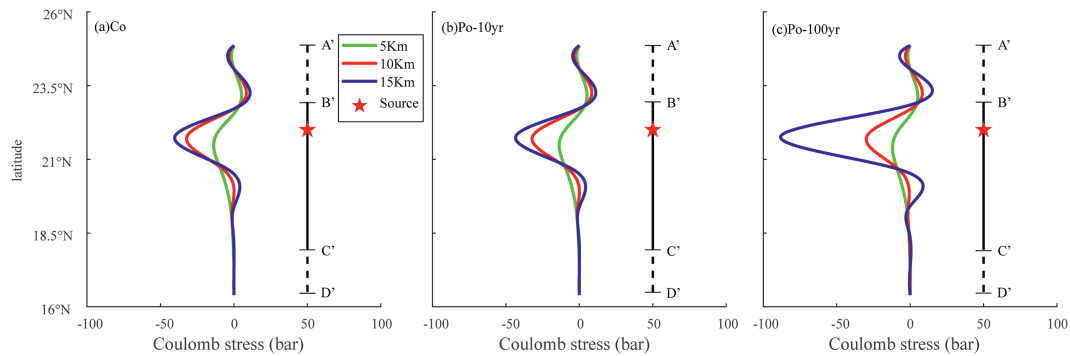


Fig. 8. ΔCFS at different depths along the Sagaing Fault induced by the $M_W7.7$ earthquake in Myanmar (USGS-slip model).

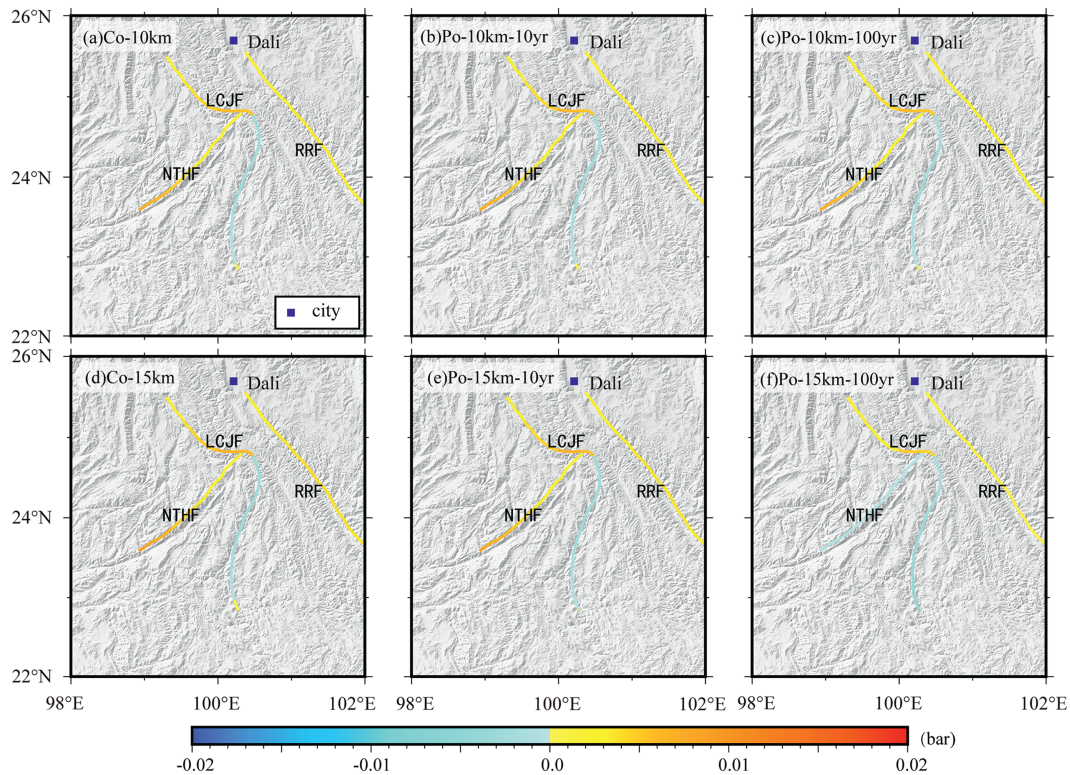


Fig. 9. ΔCFS of the Yunnan fault zone induced by the $M_W7.7$ Myanmar earthquake (USGS-slip model).

earthquake. Notably, localized stress increase zones were identified in both the northern and southern segments of the rupture area, with Coulomb stress changes exceeding 0.1 bar at certain depths, such as in the vicinity of Inner Nay Pyi Taw. Moreover, the co-seismic stress perturbations induced by this event in adjacent regions, including Xizang and southwestern Yunnan, were relatively minor and limited in extent.

(2) The Sagaing Fault Zone primarily experienced stress unloading. However, both the co-seismic and 10-year post-seismic results show localized stress-loading areas along the northern and southern segments of the fault, with stress increases exceeding the critical threshold of 0.1 bar in parts of the northern segment. Therefore, we infer that the risk of large-scale rupture along the Sagaing Fault induced by this event is relatively low, but the seismic hazard associated with the northern segment remains a concern.

- (3) Given the considerable distance between Southwest Yunnan and the earthquake source area, the co-seismic simulation results show that the maximum Coulomb stress increase on major faults within Southwest Yunnan at various depths was 1.8×10^{-2} bar, while the maximum stress decrease was -3.7×10^{-3} bar. Post-seismic modeling results indicate that the maximum increase in Coulomb stress on these faults was about 1.2×10^{-3} bar, with the maximum decrease reaching 3.2×10^{-3} bar. Overall, we conclude that the $M_W 7.7$ Myanmar earthquake had a limited impact on the major faults in Southwest Yunnan. Nevertheless, the regional seismic hazard still warrants attention, given the observed stress loading near faults adjacent to the seismic gap, the regional seismic hazard still warrants attention.

6. Conclusions

Based on the finite fault models published by Zhang Yong's research group and the USGS, integrated with the Crust1.0 layered viscoelastic medium model, this study quantifies both co-seismic and post-seismic Coulomb stress changes (ΔCFS) induced by the $M_W 7.7$ Myanmar earthquake on the Sagaing Fault Zone and major active faults in southwestern Yunnan Province. The conclusions are as follows:

- (1) The Sagaing Fault is mainly characterized by stress unloading, and the possibility of large-scale rupture is relatively low. However, it should be noted that the northern section of the $M_W 7.7$ earthquake rupture is close to the stress loading area near the earthquake triggering threshold.
- (2) The $M_W 7.7$ earthquake in Myanmar has a relatively small ΔCFS disturbance on the faults in southern Xizang and southwestern Yunnan. The ΔCFS in southern Xizang ranges from 0 to 0.2×10^{-2} bar, and in southwestern Yunnan, it is generally less than 2×10^{-2} bar. It is worth noting that the fault near the seismic gap in southwestern Yunnan is subject to stress loading. The 100-year post-seismic simulation shows that the shallow stress accumulation effect is more obvious, which may potentially impact the activity of shallow faults. It is recommended that the shallow stress disturbance in southwestern Yunnan be focused on to assess the regional seismic hazard.

CRedit authorship contribution statement

Sheng Liu: Writing – review & editing, Writing – original draft, Formal analysis. **Hongbo Tan:** Writing – review & editing, Supervision, Funding acquisition. **Guangliang Yang:** Writing – review & editing, Supervision. **Haitao Qin:** Supervision. **Hengzhou Meng:** Supervision. **Tianxiang Zhou:** Supervision. **Ziheng Chen:** Supervision.

Declaration of competing interest

The authors declare that there is no conflicts of interest.

Acknowledgments

This work was supported by Science for Earthquake Resilience (XH23014YC); National Natural Science Foundation of China (42174104); Hubei Province Natural Science Foundation (2022CFB350); the Key Project of the National Natural Science Foundation of China (U1939204); the Special Project for Basic Resources Survey of the Ministry of Science and Technology (2023FY10150502).

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