

Co-seismic and Post-seismic Seismic Velocity Changes Along the Sagaing Fault Following the 28 March 2025 Mw 7.7 Myanmar Earthquake: Insights from Ambient Noise Interferometry and Volumetric Strain Modelling

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Abstract

The Sagaing Fault, a major right-lateral strike-slip structure accommodating relative motion between the Indian and Sunda plates, ruptured over ~480 km on 28 March 2025 in a shallow Mw 7.7 earthquake near Mandalay, central Myanmar. Despite the region's high seismicity, upper-crustal velocity changes associated with large earthquakes here remain poorly documented. We applied ambient noise-based seismic interferometry to continuous records from four broadband stations (NPW, NGU, TGI, and MHIT) to resolve co- and post-seismic relative velocity changes (dv/v) between March and April 2025. All stations show a co-seismic dv/v decline coincident with the mainshock, with the largest reduction (~1.9%) at NPW, the station closest to the fault, decreasing systematically to ~0.6%, ~0.5%, and ~0.05% at NGU, TGI, and MHIT, respectively. A gradual post-seismic recovery follows at all sites, interrupted by minor fluctuations tied to aftershock activity, though velocities remain below pre-earthquake levels through the end of the observation window, indicating only partial healing. Comparison with modelled co-seismic static volumetric strain shows that NPW alone lies within a zone of positive volumetric strain (dilation), consistent with its pronounced velocity drop, while the more distant stations fall within weak compressional zones that appear to partly offset dynamically induced damage. Together, these results indicate that transient dynamic shaking is the primary source of pervasive microcracking across the region, while the static volumetric strain field exerts first-order control on its spatial distribution — producing amplified, slowly healing damage near the fault and comparatively muted, more rapidly recovering perturbations farther away.

Key Points

- Ambient noise interferometry at four stations reveals a co-seismic dv/v drop of up to ~ 1.9% (NPW) that decays systematically with distance from the Sagaing Fault, followed by only partial post-seismic recovery.
- The spatial pattern of velocity reduction closely tracks the modelled co-seismic static volumetric strain: the near-fault station lies in a dilational zone, while farther stations fall in weak compressional zones.
- Dynamic shaking drives widespread microcracking, but static volumetric strain governs its spatial distribution, and dv/v recovery correlates with declining aftershock activity rather than rainfall or pressure variations.

1. Introduction

On 28 March 2025, at 06:20:54 UTC, a 7.7-magnitude earthquake occurred in central Myanmar, causing widespread damage in major cities including Mandalay, Nay Pyi Taw, and Bangkok, Thailand. Seismic and geodetic studies indicate that the event ruptured the Sagaing Fault (SF), with a maximum slip of approximately 6 m and a total rupture length of 450–510 km (Antoine et al., 2025; Melgar et al., 2025; Ye et al., 2025; Peng et al., 2025; Xu et al., 2025). Rupture propagation occurred in two stages: an initial bilateral phase at approximately 3 km/s, followed by a southward-propagating supershear phase

exceeding 5 km/s, sustained over a distance of at least 200 km (Ye et al., 2025; Wei et al., 2025). The event has been identified as one of the deadliest earthquakes worldwide since the 2023 Türkiye–Syria earthquake, with at least 5,352 fatalities, 7,108 injuries, and 538 people reported missing in Myanmar to date (Wei et al., 2025).

The SF, a right-lateral strike-slip fault, is one of the most active geological structures in both Myanmar and Southeast Asia. The prevalent understanding of this phenomenon is that it is the result of oblique convergence between the Indian and Sunda plates (Pivnik et al., 1998). The fault exhibits a slip rate of 20 ± 4 mm/yr (Tin et al., 2022; Mallick et al., 2019), accounting for more than half of the relative motion between the Indian and Sunda plates (Tun & Watkinson, 2017). This oblique convergence is accommodated through strain partitioning, with thrusting along the northern Sunda trench and right-lateral strike-slip motion along the SF, which extends approximately 1,400 km from northern Myanmar to the ridge-transform system of the Andaman Sea (Fig. 1a; Xiong et al., 2017; Mon et al., 2020; Lindsey et al., 2023). The contemporary relative motion between India and Eurasia, estimated to be between 33–39 mm/yr, is primarily attributable to two distinct components: the dextral SF, which contributes up to 23–24 mm/yr (Tin et al., 2022), and the Indo-Myanmar Ranges accretionary wedge.

A comprehensive analysis of geomorphological and seismotectonic studies has led to the delineation of the SF into six distinct segments, as depicted in Fig. 1b. This segmentation is based on meticulous analysis of structural geometry, fault kinematics, and rupture history, encompassing the Northern Sagaing, Sagaing, Mandalay, Meiktila, NayPyiTaw, Pyu, and Bago segments. Each segment of the fault is approximately 70–200 km in length and has the capacity to generate large-scale seismic events with magnitudes ranging from 7 to 8 (e.g., Ye et al., 2025). Of particular significance is the Mandalay segment, which constitutes a critical transitional zone between the northern and central SF, thus rendering it of paramount importance in the context of comprehending crustal deformation processes along the fault. The SF has a long history of destructive seismicity, including the 1839 Amarapura (Mw ~ 7), 1930 Pyu and Pegu (Mw 7.4–7.5), 1931 (Mw 7.6), 1946 (Mw 7.3–7.7), 1956 (Mw 7.0–7.1), 1990–1991 (Mw 6.9–7.0), 2012 Thabeikkyin (Mw 6.8), and, most recently, the 28 March 2025 Mandalay earthquake (Thingbaijam et al., 2025; Melgar et al., 2025). The Mw 7.7 earthquake in 2025 occurred in the vicinity of Mandalay at 06:20:54 UTC (12:54 p.m. local time), causing significant damage to the SF, with a rupture extending approximately 450–500 km and a coseismic slip of 3–5 m. A Mw 6.4 aftershock occurred 12 minutes later, at 06:32 UTC, with a faulting geometry that was almost identical to that of the mainshock.

Despite the fact that the structure and kinematics of the SF have been the subject of numerous geological and seismotectonic studies (Tun & Watkinson, 2017), the majority of this work has focused on fault geometry, slip rates, and long-term tectonic deformation. Conversely, the short-term temporal evolution of crustal properties associated with major earthquakes remains poorly understood in this region. This is a significant gap in the current understanding of the subject: variations in seismic velocity can reveal coseismic damage, stress redistribution, and fluid-pressure changes in the crust following major earthquakes, yet such temporal monitoring has rarely been applied along the SF.

In this study, we utilised continuous data from four broadband stations (NPW, NGU, TGI, and MHIT) to monitor relative seismic velocity changes (dv/v) prior to and following Myanmar's 28 March 2025 Mw 7.7 earthquake. This ambient-noise-based approach has the capacity to detect changes in crustal velocity that are subtle and time-dependent, and it does so without reliance on active seismic sources. The present study will examine dv/v variations from March to April 2025 in order to quantify coseismic and post-seismic velocity changes and their spatial variability. The subsequent analysis will involve the interpretation of these results in the context of crustal damage and recovery. The findings of this study offer novel insights into the short-term elastic response of the SF zone and its role in accommodating large-magnitude deformation in central Myanmar.

2. Data and Methodology

2.1 Dataset

Continuous three-component seismic waveforms were retrieved for stations NPW, NGU, TGI, and MHIT (Fig. 1b), which are part of the GE, MM, and TM networks, from the IRIS Data Management Center (DMC). The epicentral distances of these stations from the 28 March 2025 Mw 7.7 Mandalay earthquake are as follows: 249 km (NPW), 137 km (NGU), 179 km (TGI), and 367 km (MHIT). The continuous records from each station were analysed for the period 1 March–23 April 2025, with the vertical-component (HHZ) channel retrieved in MiniSEED format. All four stations are equipped with broadband seismometers sampling at 100 Hz across three components. The quality of the data is generally satisfactory, with only minor temporal discrepancies at TGI and NGU that do not significantly disrupt the continuity of the ambient noise wavefield (see supplementary figure S1). Continuous datasets of this kind are essential for resolving the small, time-dependent variations in near-surface seismic velocity that this study targets (e.g., Bilek et al., 2023; Kim & Lekic, 2019).

2.2 Methodology

Single-station autocorrelation analysis is a well-established technique for measuring earthquake-induced temporal fluctuations in seismic velocity (e.g., Caudron et al., 2021; Çubuk-Sabuncuet al., 2024; De Plaen et al., 2016, 2019; Wegler & Sens-Schönfelder, 2007). In accordance with the aforementioned methodology, ambient noise autocorrelations were computed from the vertical component of the seismic records, employing the SeisMIC open-source Python toolkit (Makus & Sens-Schönfelder, 2024). The workflow comprised five steps: The following steps were taken in order to complete the task:

1. (a) Continuous seismic data was downloaded,
2. (b) Spectrograms were computed in order to characterise temporal energy fluctuations,
3. (c) Autocorrelation functions (ACFs) were computed in order to derive empirical Green's functions,
4. (d) Waveform coherence and stability were evaluated, and
5. (e) dv/v was estimated using the stretching method.

Prior to the analysis of temporal dv/v variation, the downloaded daily continuous waveform data underwent a series of preprocessing steps. Initially, detrending is employed to eliminate linear trends from the signal, thus eradicating low-frequency drift and instrumental offsets that have the potential to contaminate the power spectrum. Secondly, the process of demeaning was applied by subtracting the mean value of the signal, thereby ensuring that the data would have a zero-mean. This involved the centering of the signal around zero and the removal of any constant offset. Subsequently, the data underwent band-pass filtering, with corner frequencies ranging from 0.01 to 12 Hz. This was followed by down-sampling to a 25 Hz sampling rate. This process was undertaken to enhance the desired frequency range signal and to remove low and high frequency noise. The filtered signals were subsequently utilised to compute spectrograms, which provide a time-frequency depiction of seismic energy distribution (Barbé et al., 2009; Makus & Sens-Schönfelder, 2024). The generation of spectrograms was achieved through the utilisation of the Welch method, as incorporated within the SeisMic toolbox. This method involves the calculation of the power spectral density through the partitioning of the signal into overlapping segments, the application of a tapering window, and the subsequent averaging of the resultant Fourier spectra, employing a Hann/Hamming window (e.g., Barbé et al., 2009; Seats et al., 2012; Chen et al., 2020; Bilek et al., 2023). A significant change in energy levels is evident in the energy spectrogram on 28 March 2025, coinciding with the occurrence of seismic activity at all stations (Fig. 2). Prior to this date, energy levels were generally low at all stations, with the exception of NGU, which displayed comparatively higher energy. At the time of the earthquake, a sudden increase in energy was evident across all stations. Subsequent to the primary seismic event, the NPW station demonstrated sustained elevated energy levels throughout the observation period, a consequence of the numerous aftershocks that occurred. Conversely, the energy patterns at the TGI and MHIT stations gradually returned to their pre-mainshock behaviour. In the meantime, the NGU station exhibited a consistent high energy level, with only a slight increase observed during the seismic event.

Following the computation of the spectrograms, an autocorrelation analysis was conducted using empirical Green's functions (EGFs) derived from ambient noise. The continuous daily time series was divided into hourly segments with a view to enhancing stationarity of the noise field and improving temporal resolution (Fig. 3). The resulting EGFs were dominated by Rayleigh waves, consistent with the well-documented predominance of surface-wave energy in the ambient noise field (Campillo & Paul, 2003; James et al., 2014). Following the computation of the autocorrelation functions (ACFs) for each hourly segment, the individual ACFs were stacked, with 12 ACFs making up each stack, thus corresponding to a 12-hour window, with a view to improving the signal-to-noise ratio. Coherent signals that persist across hours add constructively, while random noise, which varies unpredictably, tends to cancel out. The resultant data set comprised a single stacked ACF for each 12-hour (half day) interval. From the complete set of stacked ACFs, a reference ACF was constructed, representing the time-averaged subsurface response over the entire analysis period.

Utilising the reference ACF and the individual 12-hour stacked ACFs, a coherence analysis was conducted to quantify the degree to which each stacked ACF aligns with the reference, as a function of frequency and lag time. The latter is defined as the mean zero-lag cross-correlation between the

reference ACF and the ACF at a specific time t (Makus & Sens-Schönfelder, 2024). A coherence value above 0.5 is generally indicative of stable noise sources and, by implication, reliable dv/v estimates. Conversely, lower coherence values are typically associated with fluctuating source distributions or other ambient influences (Clarke et al., 2011; Hadziioannou et al., 2009). As demonstrated in Fig. 2, coherence values remained consistently above 0.5 within the 2–4 Hz band at all stations, thereby confirming this frequency range as reliable for dv/v analysis. The lag-time window was further restricted to intervals with coherence above 0.5, ensuring that dv/v estimates were derived only from stable, physically meaningful segments of the coda wavefield.

The dv/v was estimated using the stretching method, which involves the comparison of current and reference correlation functions through the non-linear stretching or compression of the time axis (Kim & Lekic, 2019; Larose et al., 2015; Makus et al., 2023; Sens-Schönfelder & Wegler, 2008). This approach involves the identification of the stretching coefficient that optimises the correlation between the reference and current ACFs within the lag-time and frequency windows that have been delineated through coherence analysis. A stretching range of $\pm 3\%$ was tested in 1001 increments. That is to say, 1001 candidate dv/v values were evaluated in order to determine the optimal match between the reference ACF and the ACF at each time t . This approach enables the detection of small velocity perturbations linked to changes in the elastic properties of the shallow crust due to coseismic damage, aftershock activity, or post-seismic recovery. Following the establishment of the highest correlation coefficients and coherence levels consistently above 0.5, the 2–4 Hz frequency band and 2–6 s lag-time window were selected as the optimal parameters for monitoring near-surface temporal velocity variations (Fig. 4).

3. Results

Figure 4 exhibits the temporal evolution of dv/v and the corresponding correlation coefficients for all seismic stations between 1 March and 23 April 2025. A gradual increase in dv/v is evident from 1 March to 27 March, with a slight short-term decrease that is likely associated with foreshock activity preceding the mainshock. A significant decline in dv/v was observed on 28 March, coinciding with the occurrence of the mainshock. Subsequent to the occurrence of the aforementioned event, from 29 March to 23 April, dv/v demonstrated a progressive recovery and subsequent stabilization, albeit with intermittent interruptions from minor decreases that may be indicative of the influence of aftershock activity.

The amplitude of the co-seismic dv/v variation is found to differ among the seismic stations. The NPW station, situated along the SF, demonstrates the most substantial dv/v variation, with values ranging from -0.4% to 1.5% , corresponding to a total variation of approximately 1.9% . The TGI station has been observed to record intermediate variations ranging from 0.8% to 0.3% , with a total variation of approximately 0.5% . In a similar manner, the NGU station displays dv/v values ranging from -0.3% to 0.3% , corresponding to a total variation of approximately 0.6% . In contrast, the MHIT station exhibits only minor fluctuations, with dv/v varying from 0.19% to 0.14% , yielding a total variation of approximately 0.05% .

The correlation coefficients also vary among the stations, generally ranging from 0.5 to 1.0. It is evident that correlation coefficient values exceeding 0.6 signify relatively stable ambient noise sources, thereby ensuring confidence in the reliability of the estimated seismic velocity changes.

To further examine the relationship between dv/v variations and spatial proximity to the rupture, we analysed the dv/v data in the context of co-seismic volumetric strain at each station location (Brenguier et al., 2008). Using a three-segment slip model of the Sagaing Fault (Ding et al., 2008) and Coulomb 3.4 (Toda et al., 2011) to model strain variations at three representative crustal depths (2, 5, and 10 km), we computed the static co-seismic volumetric strain. The resulting spatial distribution of volumetric strain is shown in Fig. 5.

As illustrated in Fig. 5, only station NPW, which is the closest to the rupture zone, experiences positive volumetric strain at all evaluated depths. By contrast, the more distant stations (NGU, TGI, and MHIT) fall within zones of weak negative volumetric strain, indicating compression. To quantify this relationship, we extracted the static volumetric strain values at each station's coordinates and compared them with the maximum co-seismic dv/v reduction. Figure 6 presents a dual-axis plot of the percentage drop in dv/v and volumetric strain as a function of epicentral distance. The modelled strain values across all three depth profiles closely track the trend of the dv/v drop observed at the surface (Donaldson et al., 2019).

4. Discussion

4.1 Post-seismic Velocity Reduction and Crustal Damage

A significant decrease in dv/v was observed immediately following the 28 March 2025 Myanmar earthquake, with a subsequent gradual recovery that was punctuated by minor fluctuations during the aftershock sequence. The dv/v reduction reached approximately 1.9% at the NPW station, which is situated along the SF, whereas variations at the NGU, TGI, and MHIT stations ranged between 0.6% and 0.05%. The spatial and temporal characteristics of these dv/v changes suggest that mechanical damage to the shallow crust, coupled with stress redistribution induced by strong ground motion, constitutes the primary drivers of these velocity perturbations. Although alterations in groundwater levels and pore pressure cannot be entirely discounted, it is likely that their contribution is subordinate to direct seismic damage (Brenguier et al., 2008; Lecocq et al., 2017; Clements & Denolle, 2018).

Co-seismic Crustal Damage

The Mw 7.7 earthquake on 28 March 2025 resulted in substantial structural and geological damage across the study region. According to reports from the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) and the World Health Organization (WHO), the Sagaing and Mandalay regions sustained the most severe impacts, with over 10,000 buildings either completely destroyed or critically damaged by early April 2025. Satellite imagery acquired by the Indian Space Research Organization (ISRO) corroborated extensive infrastructure damage in Mandalay and Sagaing, including

the collapse of major public edifices and bridges, such as the historic Ava Bridge over the Irrawaddy River, alongside liquefaction-induced ground fissures in floodplain areas.

The significant decrease in dv/v observed shortly after the mainshock can be attributed to the widespread physical damage. The collapse of structures, fracturing of fault-zone materials, and co-seismic surface deformation collectively contribute to the drop in seismic velocity. During an earthquake, co-seismic fracturing of the surrounding rock mass generates additional microcracks, which weaken the rock framework, thereby reducing its elastic stiffness and seismic velocity in proximity to the fault (Brenguier et al., 2008; Rubinstein et al., 2007; Mitchell & Faulkner, 2009; Shelef & Oskin, 2010). It has been demonstrated that, over time, these cracks progressively close through a process of self-healing, leading to a gradual increase in seismic velocity (Sens-Schönfelder & Wegler, 2006; Hobiger et al., 2016). The Mandalay-Sagaing corridor experienced the most intense shaking; accordingly, stations located within or adjacent to these heavily impacted zones should exhibit the most pronounced dv/v anomalies. As the distance from the fault increases, the density of induced microcracks decreases, indicating that the majority of physical damage is concentrated near the fault core. The station NPW, located in close proximity to the central segment of the SF, exhibited the most significant dv/v reduction ($\sim 1.9\%$), while stations NGU, TGI, and MHIT, situated at greater distances from the fault, demonstrated comparatively lower reductions (ranging from $\sim 0.6\%$ to $\sim 0.05\%$). Documented reductions in post-seismic velocity have been observed following a number of moderate- to large-scale seismic events around the world (e.g., Sens-Schönfelder & Wegler, 2006; Brenguier et al., 2008; Wu et al., 2016). Wegler et al. (2009) reported that the 2004 Mw 6.6 Mid-Niigata earthquake in Japan resulted in a $\sim 0.5\%$ decrease in seismic velocity at a depth of 5 km. This was attributed to crustal stress changes and fault-zone damage (Wegler et al., 2009). In a similar fashion, Boschelli et al. (2021) found that during the 2019 Mw 7.1 Ridgecrest earthquake, the magnitude of the velocity reduction exhibited a clear dependence on distance from the fault zone.

Hydrological Effects

In order to understand whether the observed temporal dv/v variations were influenced by surface hydrological parameters, a comparison was made between the time series of dv/v and rainfall and surface pressure data for the period spanning from March to April 2025 (see supplementary material, Figure S2). The findings indicate an absence of a statistically significant correlation between dv/v and meteorological variables, thereby suggesting that local fluctuations in precipitation or atmospheric pressure are unlikely to be the primary drivers of the observed changes in seismic velocity. In contrast, the temporal evolution of dv/v appears to be predominantly reflective of subsurface processes as opposed to surface hydrological forcing.

Although the direct impact of groundwater dynamics on seismic velocities is negligible, changes in pore pressure and rock saturation can exert a measurable influence on seismic wave propagation. The USGS documented rapid fluctuations in groundwater levels in several nearby wells in the immediate aftermath of the 28 March 2025 Myanmar earthquake. Such hydrologic responses have been documented on

numerous occasions and are interpreted as reflecting the opening or closure of microcracks induced by stress redistribution and ground shaking (Brandsdóttir et al., 2010; Chaves & Schwartz, 2016). The process of stress release has been demonstrated to promote crack opening, leading to a decrease in seismic velocity. Conversely, compression has been shown to seal cracks or expel fluids from pore spaces, resulting in increased velocity (Christensen & Wang, 1985; Lecocq et al., 2017; Clements & Denolle, 2018). These mechanisms are responsible for two phenomena: firstly, the transient drop in dv/v following the mainshock; and secondly, the subsequent post-seismic stabilisation. Analogous hydrologic responses to seismic events have been observed in other locations; for instance, the 2012 Mw 7.6 Nicoya earthquake in Costa Rica produced a $\sim 0.6\%$ reduction in dv/v at depths exceeding 5 km, attributed to increased pore-fluid pressure rather than near-surface damage (Chaves & Schwartz, 2016). In a similar manner, the 2000 Mw 6.5 earthquake in Iceland induced groundwater level shifts of up to 10 m, as evidenced by well observations (Jónsson et al., 2003). These findings provide further evidence to support the hypothesis that large-magnitude earthquakes have the capacity to disrupt groundwater systems, which may consequently lead to a transient effect on seismic velocities.

4.2. Spatial Dependency of dv/v Variations

The spatial distribution of dv/v following the Mw 7.7 Myanmar earthquake on 28 March 2025 exhibits a clear correlation with station distance from the fault. The station NPW, located in the closest proximity to the fault, recorded the largest immediate post-mainshock dv/v reduction ($\sim 1.9\%$), indicative of substantial co-seismic effects in the adjacent crust. Station NGU, located at a greater distance from the fault on the western side, exhibited a moderate dv/v reduction of approximately 0.6%. In contrast, stations TGI and MHIT, positioned at greater distances from the rupture zone on the eastern flank, exhibited moderate to minimal dv/v variations (ranging from $\sim 0.5\%$ to 0.05%). This spatial pattern underscores the strong influence of both the distance from the fault and the local intensity of ground shaking on the magnitude of dv/v reduction. In the vicinity of the fault, intense seismic activity can induce the formation of microcracks and fractures, thereby reducing the elastic stiffness of the rock and consequently decreasing seismic velocities. As the distance from the fault increases, both the shaking intensity and the density of the newly formed microcracks decrease, resulting in progressively smaller dv/v perturbations (Fig. 7). These observations are consistent with those of previous studies on earthquake-induced seismic velocity variations, which indicate that co-seismic microcracking and structural damage are primarily concentrated within a few km of the fault core (Li et al., 1998; Peng & Ben-Zion, 2006). Brenguier et al. (2008) and Rivet et al. (2011) found that dv/v reductions are most pronounced within a few km of active faults and decay rapidly with distance, based on data from California and Japan, respectively. The findings support the interpretation that the dv/v reductions observed at the NPW station were predominantly governed by localized fault-zone damage and stress perturbations, whereas the smaller changes at the MHIT may also reflect minor contributions from regional elastic deformation or hydrological effects (Rubinstein et al., 2007; Hobiger et al., 2016; Takagi & Okada, 2012).

4.3. Post-seismic Recovery of dv/v

In the post-seismic recovery phase, the progressive closure of microcracks enables the gradual healing of damaged rocks, thereby restoring seismic velocities to pre-event levels (Li et al., 1998; Brenguier et al., 2008). The analysis of the Mw 7.7 Myanmar earthquake, which occurred on 28 March 2025, revealed distinct post-seismic dv/v recovery patterns across the four stations. It is of particular note that the station located in the closest proximity to the fault exhibited the most substantial initial reduction in dv/v . Despite the initial signs of recovery in seismic velocities, it was observed that these velocities did not return to pre-earthquake levels during the observation period, suggesting that the recovery was only partial. This incomplete healing is likely attributable to intense local shaking, chronic damage in the shallow crust, non-linear elastic effects, and ongoing post-seismic fluid redistribution (Christensen & Wang, 1985; Hobiger et al., 2016; Lecocq et al., 2017). NGU, located approximately 137 km from the epicentre, recorded a clear co-seismic dv/v decline, while TGI (~ 175 km from the epicentre) exhibited a comparable drop. MHIT, located approximately 367 km from the epicentre, exhibited the most negligible initial dv/v decline and demonstrated a rapid recovery following the earthquake, a likely consequence of the minimal co-seismic effects observed at this distance. The 2019 Mw 7.1 Ridgecrest earthquake in California also produced co-seismic velocity reductions in shallow layers, with stations in closer proximity to the rupture requiring longer recovery times (Boschelli et al., 2021). Furthermore, smaller Mw 5 earthquakes in Japan have demonstrated variable recovery durations, influenced by factors such as local shaking intensity and near-surface geology (Takagi & Okada, 2012).

4.4. Sensitivity of dv/v to Aftershocks

Within the first few days following the 28 March 2025 Mw 7.7 Myanmar earthquake, the SF produced over 25 aftershocks of magnitude ≥ 4.5 , with the vast majority occurring during this early post-seismic window (USGS, 2025). A significant portion of these events took place at depths ranging from 8 to 12 km, suggesting the ongoing release of stress and the persistence of deformation within the fault zone. In the hours following the primary seismic event, a series of moderate aftershocks (Mw 4.5–6.7) occurred along the fault, indicative of substantial post-seismic deformation and stress redistribution within the crust. As has been documented in previous studies, there is a tendency for intense aftershock sequences to be concentrated in a specific area following major seismic events (e.g., Brandsdóttir et al., 2010; Hardebeck, 2021). The observations indicate a close correlation between the temporal evolution of dv/v and the pattern of aftershock activity. The immediate decreases in dv/v across all stations following the mainshock suggest that co-seismic damage occurred within the crustal medium through the combined effects of fracturing and stress perturbations (Wegler & Sens-Schönfelder, 2007; Rubinstein et al., 2007). As aftershock frequency underwent a gradual decline over the course of subsequent days, dv/v demonstrated a corresponding recovery. This progressive increase in dv/v suggests that microcracks are either undergoing partial healing or re-compaction, while crustal stresses are progressively relaxing (Brenguier et al., 2008; Hobiger et al., 2016). As illustrated in Fig. 1, the stations located in closer proximity to the fault zone (e.g., NPW) exhibited a more pronounced decrease in dv/v and a slower recovery. This observation is consistent with the higher density of aftershocks and the stronger ground shaking observed in this region. In contrast, stations located farther from the fault,

such as MHIT, exhibited comparatively minor dv/v variations due to their limited exposure to aftershock-induced strain changes.

4.5 Relation of dv/v to Volumetric Strain

The correlation between modelled volumetric strain and observed dv/v variations provides an understanding of the rock physics mechanisms that drive subsurface velocity anomalies. The most compelling result is the strong morphological agreement between the co-seismic drop in dv/v and the static volumetric strain as a function of epicentral distance (see Fig. 6). The spatial trend of maximum velocity reduction closely tracks the modelled strain gradients across all evaluated depths, possibly indicating a fundamental poroelastic coupling. Figures 5 and 6 show that station NPW is uniquely situated within a zone of positive volumetric strain (dilation). This dilatational strain mechanically opens up pre-existing fractures and promotes the formation of new microcracks (Brantut and Petit, 2023). The increase in fracture density and crack volume that results allows fluids to infiltrate the newly opened pore space. This lowers the bulk elastic modulus of the rock mass and facilitates the substantial ($\sim 1.9\%$) dv/v reduction observed at this location (O'Connell and Budiansky, 1974).

In contrast, stations NGU, TGI, and MHIT are located in the far field, within zones of negative volumetric strain (i.e. co-seismic compression). However, the magnitude of this static compression is small (ranging between 0 and -0.5×10^{-6}), relative to the static dilation at NPW (20×10^{-6}). As compressive stress is expected to stiffen the rock matrix by closing microcracks, producing a velocity increase rather than a decrease, the reductions in dv/v observed at these stations suggest that static strain is not the primary mechanism causing damage there. Instead, it is likely that widespread transient microcracking, triggered by strong dynamic ground motion from the Mw 7.7 mainshock, is the dominant factor behind the velocity drops at these more distant stations. The static compressive strain appears to counteract this dynamic damage to some extent, or 'mute' it, by stabilising microfractures. This is consistent with the comparatively smaller dv/v reductions observed there.

The near-uniform volumetric strain gradients and magnitudes across the 2 km, 5 km, and 10 km depth profiles (see Fig. 5) reflect the near-vertical geometry and right-lateral strike-slip kinematics of the Sagaing Fault. Since co-seismic slip is predominantly horizontal and relatively uniform through the upper 10 km, the resulting static strain field essentially behaves as a two-dimensional projection, showing minimal vertical attenuation or distortion through the shallow-to-mid crust. Together with the spatial gradients shown in Fig. 5, the close correspondence between the drop in velocity (dv/v) and volumetric strain across all three depths indicates that the velocity perturbations are not confined to the shallow subsurface, but rather reflect a response consistent with poroelastic behavior distributed throughout the crust (Denolle & Clements, 2022).

Overall, these results suggest that, although dynamic shaking (transient stress) triggers widespread microcracking, permanent static stress changes (volumetric strain) primarily control the magnitude and spatial distribution of the co-seismic velocity drop (Hobiger, 2012). Regions subject to static dilation experience amplified damage and pronounced velocity reductions, whereas regions undergoing weak

static compression exhibit muted velocity drops, which is consistent with the partial closure of microfractures.

5. Conclusions

This study demonstrates that continuous ambient noise monitoring is an effective way of quantifying co-seismic damage and tracking post-seismic crustal recovery. It offers a robust framework for understanding the coupled mechanical and hydrological processes that govern post-seismic evolution in tectonically active regions. The main findings are summarised below:

- Ambient seismic noise recorded following the 28 March 2025 Mw 7.7 Myanmar earthquake reveals significant co-seismic and post-seismic velocity perturbations across the Sagaing Fault region. The maximum reduction in dv/v of $\sim 1.9\%$, observed near the fault, is consistent with transient crustal weakening driven by co-seismic fracturing and stress-induced changes in the upper crust. This initial decline is followed by the partial recovery of dv/v at most stations, which reflects the progressive closure of cracks and the elastic healing of the damaged medium.
- The spatial distribution of dv/v with pronounced reductions near the fault, diminishing progressively with distance suggests that the associated deformation and mechanical damage were largely confined to the fault zone.
- The observed variations in dv/v are due to physical processes, such as stress redistribution, rock damage, and partial healing, rather than artefacts caused by transient anthropogenic or environmental noise sources.
- The spatial distribution and magnitude of the reduction in velocity (dv/v) correlate strongly with co-seismic static volumetric strain. Although pervasive microcracking from transient dynamic shaking is the main cause of velocity reduction across the region, the static strain field exerts critical spatial control. Station NPW, which recorded the most severe velocity drop, lies within a zone of positive volumetric strain (dilation), which appears to amplify co-seismic damage by mechanically opening microcracks and altering the distribution of pore fluids. Conversely, stations located farther from the rupture zone (NGU, TGI, and MHIT) are located within zones of negative volumetric strain (compression). This local compressive regime appears to offset the velocity reductions induced by dynamic shaking to some extent by clamping rock masses and restricting pre-existing cracks. This is consistent with the smaller perturbations observed at these more distant stations.
- A clear temporal correlation exists between aftershock activity and dv/v evolution, supporting the interpretation that post-seismic velocity changes are linked to ongoing crustal damage and the recovery processes that accompany it.

Declarations

Competing Interests:

The authors declare that they have no competing interests.

Author Contribution

All authors contributed to the study conception and design. Akshita, A.K.T. and U.A.D have performed the formal analysis, data curation, visualization as well as writing the first draft of the manuscript. A.K.T and T.E reviewed the manuscript.

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Data Availability

The waveform data used in this study can be downloaded from the NSF SAGE Facility by EarthScope (formerly IRIS-DMC). The relevant DOIs for the data are as follows: 10.7914/SN/MM for the MM Network, 10.14470/TR560404 for the GE Network, and 10.1186/s40562-023-00278-7 for the TM Network.

References

1. Antoine, S. L., Shrestha, R., Milliner, C., Im, K., Rollins, C., Wang, K., ... Avouac, J. P. (2025). The 2025 Mw7. 7 Mandalay, Myanmar, earthquake reveals a complex earthquake cycle with clustering and variable segmentation on the Sagaing Fault. *Proceedings of the National Academy of Sciences*, 122(33), e2514378122. <https://doi.org/10.1073/pnas.251437812>
2. Barbé, K., Pintelon, R., & Schoukens, J. (2009). Welch method revisited: nonparametric power spectrum estimation via circular overlap. *IEEE Transactions on signal processing*, 58(2), 553–565. <https://doi.org/10.1109/TSP.2009.2031724>
3. Bilek, S. L., Luhmann, A. J., Grapenthin, R., Woo, H. B., & Gochenour, J. A. (2023). Capturing seismic signals from karst aquifer injection experiments and a natural recharge event. *Journal of Geophysical Research: Solid Earth*, 128(4), e2022JB025635. <https://doi.org/10.1029/2022JB025635>
4. Boschelli, J., Moschetti, M. P., & Sens-Schönfelder, C. (2021). Temporal seismic velocity variations: Recovery following from the 2019 Mw 7.1 Ridgecrest, California earthquake. *Journal of Geophysical*

- Research: Solid Earth*, 126(4), e2020JB021465. <https://doi.org/10.1029/2020JB021465>
5. Brandsdóttir, B., Parsons, M., White, R. S., Guðmundsson, O., Drew, J., & Thorbjarnadóttir, B. (2010). The May 29 2008 earthquake aftershock sequence within the South Iceland Seismic Zone: Fault locations and source parameters of aftershocks. *Jokull: journal of the glaciological and geological societies of Iceland*, 60, 23–46. <https://doi.org/10.33799/jokull2010.60.023>
 6. Brantut, N., & Petit, L. (2023). Micromechanics of rock damage and its recovery in cyclic loading conditions. *Geophysical Journal International*, 233(1), 145–161. <https://doi.org/10.1093/gji/ggac447>
 7. Brenguier, F., Campillo, M., Hadziioannou, C., Shapiro, N. M., Nadeau, R. M., & Larose, É. (2008). Postseismic relaxation along the San Andreas fault at Parkfield from continuous seismological observations. *Science*, 321(5895), 1478–1481. <https://doi.org/10.1126/science.1160943>
 8. Campillo, M., & Paul, A. (2003). Long-range correlations in the diffuse seismic coda. *Science*, 299, 547–549. <https://doi.org/10.1126/science.1078551>
 9. Caudron, C., Girona, T., Jolly, A., Christenson, B., Savage, M. K., Carniel, R., ... Mazot, A. (2021). A quest for unrest in multiparameter observations at Whakaari/White Island volcano, New Zealand 2007–2018. *Earth, Planets and Space*, 73(1), 1–21. <https://doi.org/10.1186/s40623-021-01506-0>
 10. Chaves, E. J., & Schwartz, S. Y. (2016). Monitoring transient changes within overpressured regions of subduction zones using ambient seismic noise. *Science Advances*, 2(1), e1501289. <https://doi.org/10.1126/sciadv.1501289>
 11. Chen, H. J., Ye, Z. K., Chiu, C. Y., Telesca, L., Chen, C. C., & Chang, W. L. (2020). Self-potential ambient noise and spectral relationship with urbanization, seismicity, and strain rate revealed via the Taiwan Geoelectric Monitoring Network. *Journal of Geophysical Research: Solid Earth*, 125(1), e2019JB018196. <https://doi.org/10.1029/2019JB018196>
 12. Christensen, N. I., & Wang, H. F. (1985). The influence of pore pressure and confining pressure on dynamic elastic properties of Berea sandstone. *Geophysics*, 50(2), 207–213. <https://doi.org/10.1190/1.1441910>
 13. Clarke, D., Zaccarelli, L., Shapiro, N. M., & Brenguier, F. (2011). Assessment of resolution and accuracy of the Moving Window Cross Spectral technique for monitoring crustal temporal variations using ambient seismic noise. *Geophysical Journal International*, 186(2), 867–882. <https://doi.org/10.1111/j.1365-246X.2011.05074.x>
 14. Clements, T., & Denolle, M. A. (2018). Tracking groundwater levels using the ambient seismic field. *Geophysical Research Letters*, 45(13), 6459–6465. <https://doi.org/10.1029/2018GL077706>
 15. Clements, T., & Denolle, M. A. (2023). The seismic signature of California's earthquakes, droughts, and floods. *Journal of Geophysical Research: Solid Earth*, 128(1), e2022JB025553. <https://doi.org/10.1029/2022JB025553>
 16. Çubuk-Sabuncu, Y., Jónsdóttir, K., Árnadóttir, T., Mordret, A., Caudron, C., Lecocq, T., & De Plaen, R. (2024). Temporal seismic velocity changes associated with the mw 6.1, May 2008 Ölfus doublet, South Iceland: a joint interpretation from dv/v and gps. *Journal of Geophysical Research: Solid Earth*, 129(4), e2023JB027064. <https://doi.org/10.5281/zenodo.10450793>

17. De Plaen, R. S., Cannata, A., Cannavo', F., Caudron, C., Lecocq, T., & Francis, O. (2019). Temporal changes of seismic velocity caused by volcanic activity at Mt. Etna revealed by the autocorrelation of ambient seismic noise. *Frontiers in Earth Science*, 6, 251. <https://doi.org/10.3389/feart.2018.00251>
18. De Plaen, R. S., Lecocq, T., Caudron, C., Ferrazzini, V., & Francis, O. (2016). Single-station monitoring of volcanoes using seismic ambient noise. *Geophysical Research Letters*, 43(16), 8511–8518. <https://doi.org/10.1002/2016GL070078>
19. Ding, Z., Wang, X., Wang, S., Xu, C., & Wang, L. (2026). The 28 March 2025 MW7.7 Myanmar earthquake revealed by InSAR and POT observations: A supershear event with no shallow slip deficit. *Geodesy and Geodynamics*, 17(3), 295–307. <https://doi.org/10.1016/j.geog.2025.09.008>
20. Donaldson, C., Winder, T., Caudron, C., & White, R. S. (2019). Crustal seismic velocity responds to a magmatic intrusion and seasonal loading in Iceland's Northern Volcanic Zone. *Science Advances*, 5(11), eaax6642. <https://doi.org/10.1126/sciadv.aax6642>
21. Hadziioannou, C., Larose, E., Coutant, O., Roux, P., & Campillo, M. (2009). Stability of monitoring weak changes in multiply scattering media with ambient noise correlation: Laboratory experiments. *The Journal of the Acoustical Society of America*, 125(6), 3688–3695. <https://doi.org/10.1121/1.3125345>
22. Hardebeck, J. L. (2021). Spatial clustering of aftershocks impacts the performance of physics-based earthquake forecasting models. *Journal of Geophysical Research: Solid Earth*, 126(2), e2020JB020824. <https://doi.org/10.1029/2020JB020824>
23. Hobiger, M., Wegler, U., Shiomi, K., & Nakahara, H. (2012). Coseismic and postseismic elastic wave velocity variations caused by the 2008 Iwate-Miyagi Nairiku earthquake, Japan. *Journal of Geophysical Research: Solid Earth*, 117(B9). <https://doi.org/10.1029/2012JB009402>
24. Hobiger, M., Wegler, U., Shiomi, K., & Nakahara, H. (2016). Coseismic and post-seismic velocity changes detected by passive image interferometry: comparison of one great and five strong earthquakes in Japan. *Geophysical Journal International*, 205(2), 1053–1073. <https://doi.org/10.1093/gji/ggw066>
25. James, E. K., Dalton, C. A., & Gaherty, J. B. (2014). Rayleigh wave phase velocities in the Atlantic upper mantle. *Geochemistry, Geophysics, Geosystems*, 15(11), 4305–4324. <https://doi.org/10.1002/2014GC005518>
26. Jónsson, S., Segall, P., Pedersen, R., & Björnsson, G. (2003). Post-earthquake ground movements correlated to pore-pressure transients. *Nature*, 424(6945), 179–183. <https://doi.org/10.1038/nature01776>
27. Kim, D., & Lekic, V. (2019). Groundwater variations from autocorrelation and receiver functions. *Geophysical Research Letters*, 46(23), 13722–13729. <https://doi.org/10.1029/2019GL084719>
28. Larose, E., Carrière, S., Voisin, C., Bottelin, P., Baillet, L., Guéguen, P., ... Massey, C. (2015). Environmental seismology: What can we learn on earth surface processes with ambient noise?. *Journal of Applied Geophysics*, 116, 62–74. <https://doi.org/10.1016/j.jappgeo.2015.02.001>

29. Lecocq, T., Longuevergne, L., Pedersen, H. A., Brenguier, F., & Stammer, K. (2017). Monitoring ground water storage at mesoscale using seismic noise: 30 years of continuous observation and thermo-elastic and hydrological modeling. *Scientific reports*, 7(1), 14241. <https://doi.org/10.1038/s41598-017-14468-9>
30. Li, Y. G., Vidale, J. E., Aki, K., Xu, F., & Burdette, T. (1998). Evidence of shallow fault zone strengthening after the 1992 M 7.5 Landers, California, earthquake. *Science*, 279(5348), 217–219. <https://doi.org/10.1126/science.279.5348.217>
31. Lindsey, E. O., Wang, Y., Aung, L. T., Chong, J. H., Qiu, Q., Mallick, R., ... Hill, E. M. (2023). Active subduction and strain partitioning in western Myanmar revealed by a dense survey GNSS network. *Earth and Planetary Science Letters*, 622, 118384. <https://doi.org/10.1016/j.epsl.2023.118384>
32. Makus, P., & Sens-Schönfelder, C. (2024). Seismic-an open-source python toolset to compute velocity changes from ambient seismic noise. *Seismica*, 3(1). <https://doi.org/10.26443/seismica.v3i1.1099>
33. Makus, P., Sens-Schönfelder, C., Illien, L., Walter, T. R., Yates, A., & Tilmann, F. (2023). Deciphering the whisper of volcanoes: Monitoring velocity changes at Kamchatka's Klyuchevskoy group with fluctuating noise fields. *Journal of Geophysical Research: Solid Earth*, 128(4), e2022JB025738. <https://doi.org/10.1029/2022JB025738>
34. Mallick, R., Lindsey, E. O., Feng, L., Hubbard, J., Banerjee, P., & Hill, E. M. (2019). Active convergence of the India-Burma-Sunda plates revealed by a new continuous GPS network. *Journal of Geophysical Research: Solid Earth*, 124(3), 3155–3171. <https://doi.org/10.1029/2018JB016480>
35. Melgar, D., Weldon, R., Wang, Y., Bato, M. G., Aung, L. T., Shi, X., ... Dawson, T. (2025). Supershear source model of the 2025 M7. 8 Myanmar earthquake and paleoseismology of the Sagaing Fault: regions of significant overlap with past earthquakes. *Seismica*, 4(2). <https://doi.org/10.26443/seismica.v4i2.1771>
36. Mitchell, T. M., & Faulkner, D. R. (2009). The nature and origin of off-fault damage surrounding strike-slip fault zones with a wide range of displacements: A field study from the Atacama fault system, northern Chile. *Journal of Structural Geology*, 31(8), 802–816. <https://doi.org/10.1016/j.jsg.2009.05.002>
37. Mon, C. T., Gong, X., Wen, Y., Jiang, M., Chen, Q. F., Zhang, M., ... He, Y. (2020). Insight into major active faults in central Myanmar and the related geodynamic sources. *Geophysical Research Letters*, 47(8), e2019GL086236. <https://doi.org/10.1029/2019GL086236>
38. O'Connell, R. J., & Budiansky, B. (1974). Seismic velocities in dry and saturated cracked solids. *Journal of Geophysical Research*, 79(35), 5412–5426. <https://doi.org/10.1029/JB079i035p05412>
39. Peng, Z., & Ben-Zion, Y. (2006). Temporal changes of shallow seismic velocity around the Karadere-Düzce branch of the north Anatolian fault and strong ground motion. *Pure and Applied Geophysics*, 163(2), 567–600. <https://doi.org/10.1007/s00024-005-0034-6>
40. Peng, Z., Lei, X., Wang, D., Si, X., Mach, P., Zhong, Q., ... Miao, S. (2025). Mainshock rupture properties, aftershock activities and remotely triggered seismicity associated with the 2025 Mw7. 7 Sagaing

- fault earthquake in Myanmar. *Earthquake Research Advances*, 100413.
<https://doi.org/10.1016/j.eqrea.2025.100413>
41. Pivnik, D. A., Nahm, J., Tucker, R. S., Smith, G. O., Nyein, K., Nyunt, M., & Maung, P. H. (1998). Polyphase deformation in a fore-arc/back-arc basin, Salin subbasin, Myanmar (Burma). *AAPG bulletin*, 82(10), 1837–1856. <https://doi.org/10.1306/1D9BD15F-172D-11D7-8645000102C1865D>
 42. Rivet, D., Campillo, M., Shapiro, N. M., Cruz-Atienza, V., Radiguet, M., Cotte, N., & Kostoglodov, V. (2011). Seismic evidence of nonlinear crustal deformation during a large slow slip event in Mexico. *Geophysical Research Letters*, 38(8). <https://doi.org/10.1029/2011GL047151>
 43. Rubinstein, J. L., Uchida, N., & Beroza, G. C. (2007). Seismic velocity reductions caused by the 2003 Tokachi-Oki earthquake. *Journal of Geophysical Research: Solid Earth*, 112(B5).
<https://doi.org/10.1029/2006JB004440>
 44. Seats, K. J., Lawrence, J. F., & Prieto, G. A. (2012). Improved ambient noise correlation functions using Welch's method. *Geophysical Journal International*, 188(2), 513–523.
<https://doi.org/10.1111/j.1365-246X.2011.05263.x>
 45. Sens-Schönfelder, C., & Wegler, U. (2006). Radiative transfer theory for estimation of the seismic moment. *Geophysical Journal International*, 167(3), 1363–1372. <https://doi.org/10.1111/j.1365-246X.2006.03139.x>
 46. Sens-Schönfelder, C., & Wegler, U. (2008). Passive image interferometry and seasonal variations of seismic velocities at Merapi Volcano, Indonesia. *Geophysical Research Letters*, 33, L21302.
<https://doi.org/10.1029/2006GL027797>
 47. Shelef, E., & Oskin, M. (2010). Deformation processes adjacent to active faults: Examples from eastern California. *Journal of Geophysical Research: Solid Earth*, 115(B5).
<https://doi.org/10.1029/2009JB006289>
 48. Toda, S., Stein, R. S., Sevilgen, V., & Lin, J. (2011). Coulomb 3.3 Graphic-rich deformation and stress-change software for earthquake, tectonic, and volcano research and teaching—user guide. *US Geological Survey open-file report*, 1060(2011), 63. <https://pubs.usgs.gov/of/2011/1060/>
 49. Takagi, R., & Okada, T. (2012). Temporal change in shear velocity and polarization anisotropy related to the 2011 M9.0 Tohoku-Oki earthquake examined using KiK-net vertical array data. *Geophysical Research Letters*, 39(9). <https://doi.org/10.1029/2012GL051342>
 50. Thingbaijam, K. K. S., Okuwaki, R., & Hobbs, T. E. (2025). Fast Reports of the 2025 Mw 7.8 Mandalay, Myanmar Earthquake: unraveling the rupture characteristics. *Seismica*, 4(2).
<https://doi.org/10.26443/seismica.v4i2.1914>
 51. Tin, T. Z. H., Nishimura, T., Hashimoto, M., Lindsey, E. O., Aung, L. T., Min, S. M., & Thant, M. (2022). Present-day crustal deformation and slip rate along the southern Sagaing fault in Myanmar by GNSS observation. *Journal of Asian Earth Sciences*, 228, 105125.
<https://doi.org/10.1016/j.jseaes.2022.105125>
 52. Tun, S. T., & Watkinson, I. M. (2017). The sagaing fault, Myanmar. <https://doi.org/10.1144/M48.19>

53. Wegler, U., & Sens-Schönfelder, C. (2007). Fault zone monitoring with passive image interferometry. *Geophysical Journal International*, 168(3), 1029–1033. <https://doi.org/10.1111/j.1365-246X.2006.03284.x>
54. Wegler, U., Nakahara, H., Sens-Schönfelder, C., Korn, M., & Shiomi, K. (2009). Sudden drop of seismic velocity after the 2004 Mw 6.6 mid-Niigata earthquake, Japan, observed with Passive Image Interferometry. *Journal of Geophysical Research: Solid Earth*, 114(B6). <https://doi.org/10.1029/2008JB005869>
55. Wei, S., Wang, X., Li, C., Zeng, H., Ma, Z., Shi, Q., ... Chen, L. (2025). Supershear rupture sustained through a thick fault zone in the 2025 Mw 7.8 Mandalay earthquake. *Science*, 390(6772), 468–475. <https://doi.org/10.1126/science.adz2101>
56. Wu, C., Delorey, A., Brenguier, F., Hadziioannou, C., Daub, E. G., & Johnson, P. (2016). Constraining depth range of S wave velocity decrease after large earthquakes near Parkfield, California. *Geophysical Research Letters*, 43(12), 6129–6136. <https://doi.org/10.1002/2016GL069145>
57. Xiong, X., Shan, B., Zhou, Y. M., Wei, S. J., Li, Y. D., Wang, R. J., & Zheng, Y. (2017). Coulomb stress transfer and accumulation on the Sagaing Fault, Myanmar, over the past 110 years and its implications for seismic hazard. *Geophysical Research Letters*, 44(10), 4781–4789. <https://doi.org/10.1002/2017GL072770>
58. Xu, X., Kang, W., Wang, T., Zhang, X., Liu, Y., Zhang, Y., ... Ren, J. (2025). The Mw7.7 Myanmar earthquake: a continental longest surface-rupturing supershear cascading event. *npj Natural Hazards*, 2(1), 73. <https://doi.org/10.1038/s44304-025-00125-z>
59. Ye, L., Lay, T., & Kanamori, H. (2025). The 28 March 2025 M w 7.8 Myanmar earthquake: preliminary analysis of an~ 480 km long intermittent supershear rupture. *The Seismic Record*, 5(3), 260–269. <https://doi.org/10.1785/0320250021>

Figures

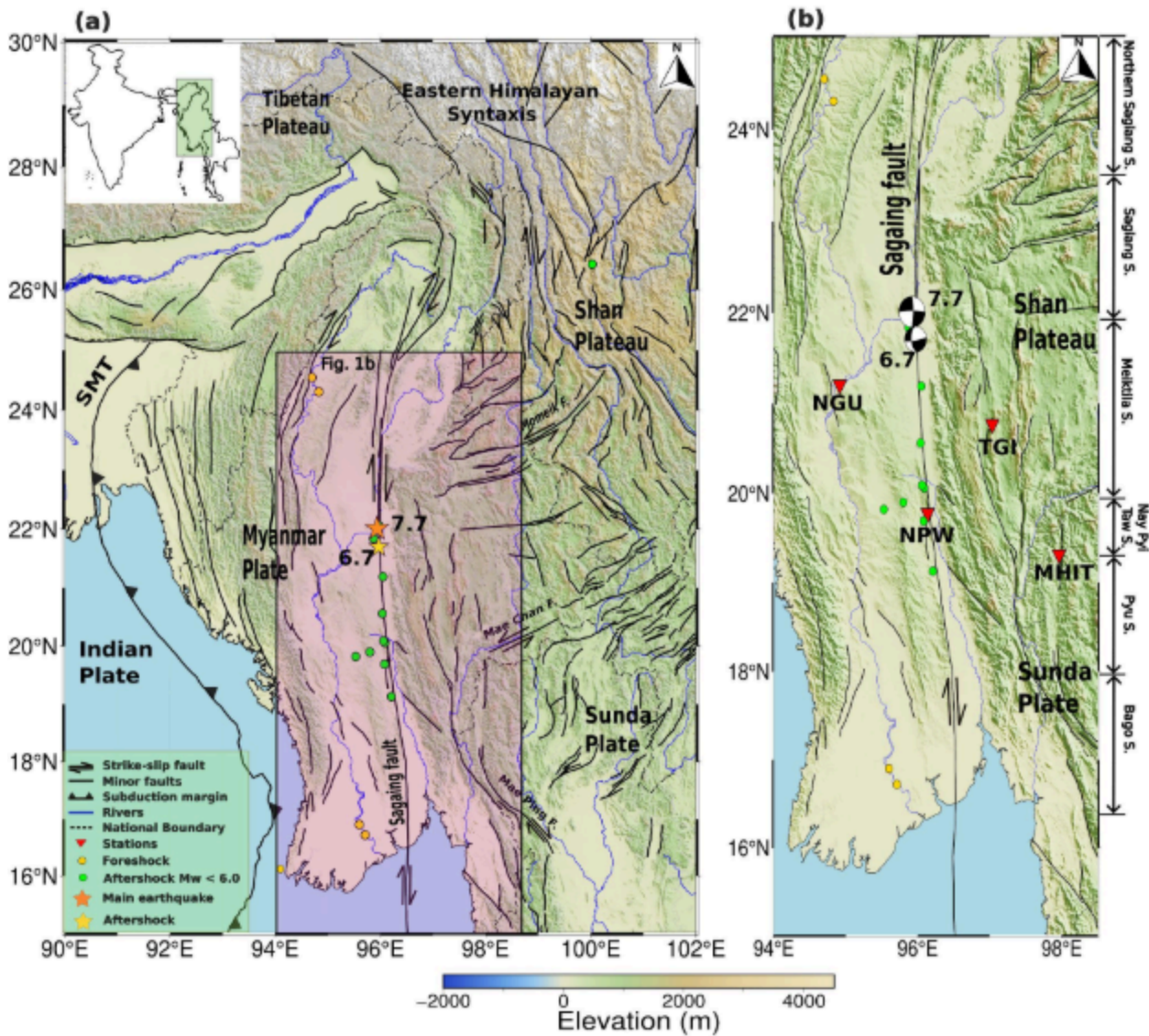


Figure 1

Regional map (a) showing the topography and major tectonic structures of the Indian Plate, Sunda Plate, and Myanmar Plate regions. The purple box outlines the area that is enlarged in panel (b), which emphasizes the right-lateral SF along the boundary between the Myanmar and Sunda Plates. The orange star marks the epicenter of the 2025 Mw 7.7 Myanmar earthquake, as reported by the U.S. Geological Survey National Earthquake Information Center (USGS-NEIC). The yellow star marks the epicenter of the Mw 6.7 aftershock that occurred approximately 12 minutes after the mainshock. Green circles represent aftershocks with magnitudes greater than Mw 4.6, while smaller yellow circles denote foreshocks exceeding Mw 4.6 that were recorded between March 1 and April 30, 2025. The focal mechanisms for the 2025 Mw 7.7 mainshock and Mw 6.7 aftershock are sourced from the Global Centroid Moment Tensor (Global CMT) catalog. The red inverted triangle demonstrates the location of seismic stations.

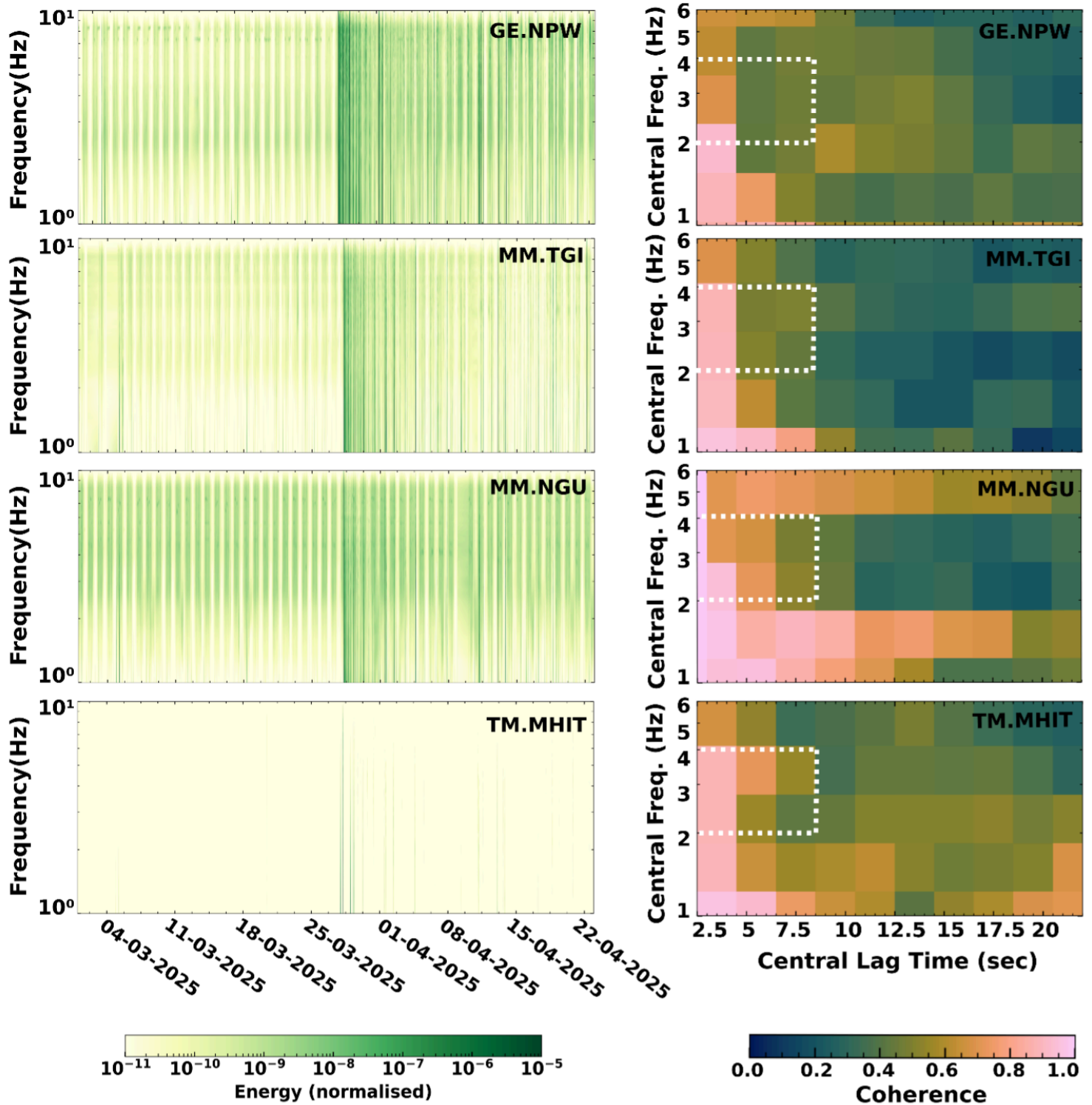


Figure 2

The figure presents the temporal stability analysis of ambient seismic noise recorded at four stations (GE.NPW, MM.TGI, TM.MHIT, and MM.NGU) between March 01 and April 23, 2025. The left panel displays daily energy spectrograms (1–10 Hz), illustrating variations in normalized spectral amplitude over time. The right panel shows waveform coherence as a function of central frequency (1–6 Hz) and central lag time (up to 22 s). Dotted boxes indicate the selected optimal frequency band (2–4 Hz) and lag window used for dv/v estimation. The consistently good coherence within this frequency band

confirms the temporal stability and the suitability of the selected parameters for analyzing seismic velocity changes.

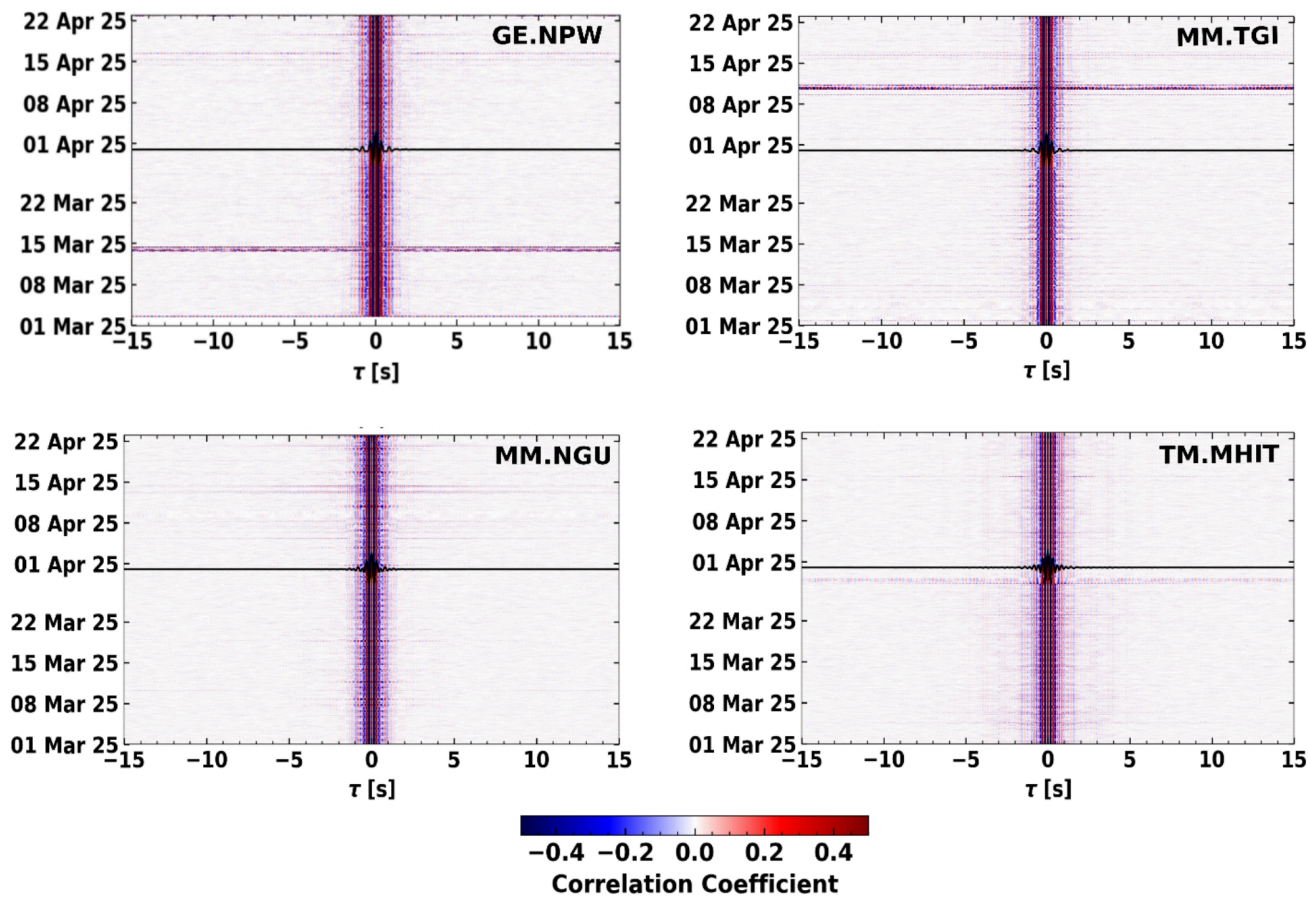


Figure 3

Daily autocorrelation functions (ACFs) for the stations GE.NPW, MM.TGI, MM.NGU, and TM.MHIT, plotted as lag time (τ) vs date. The color scale represents the correlation coefficient. A stable and symmetric waveform centered around zero lag is observed for most days, indicating consistent ambient noise conditions.

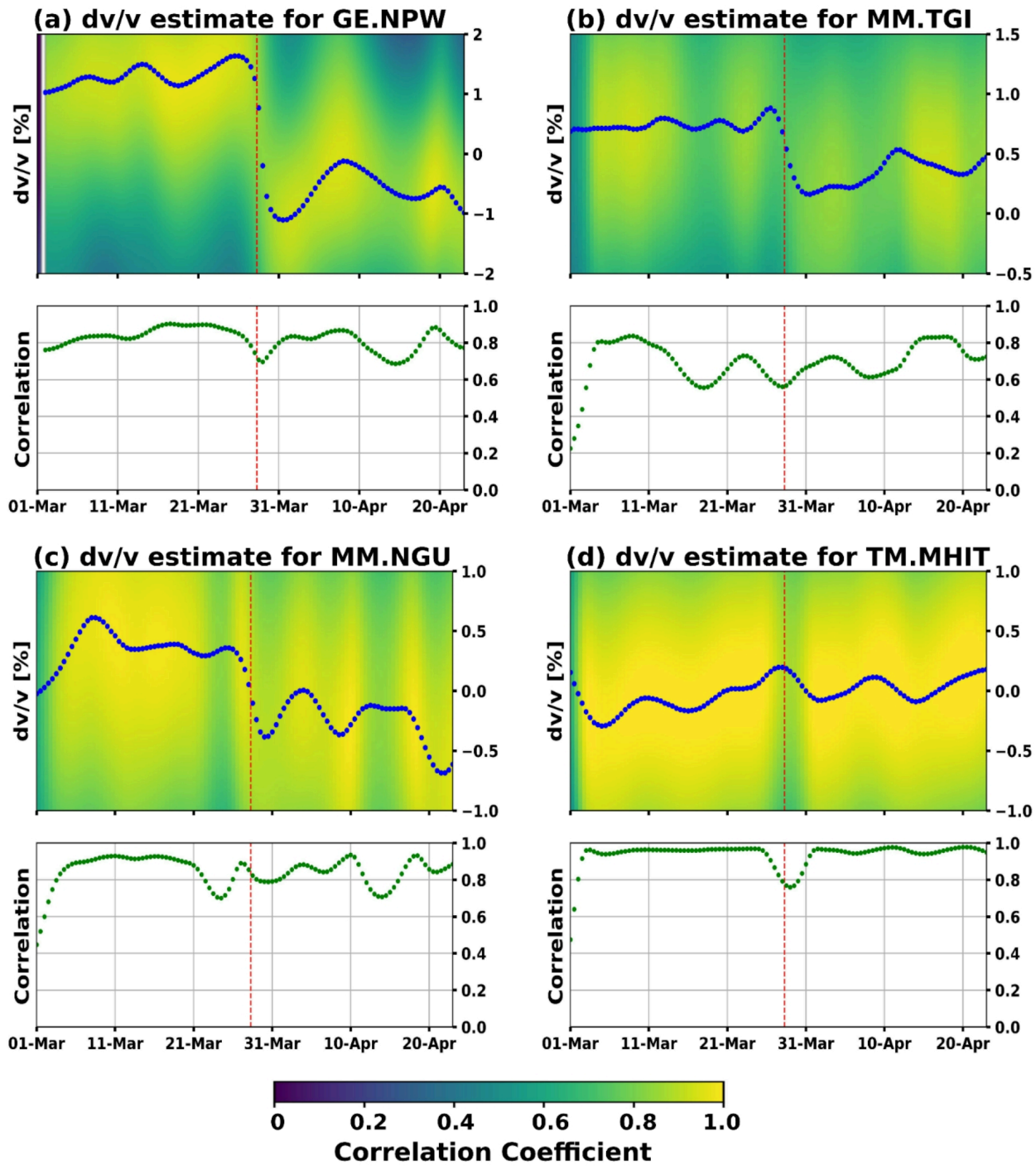


Figure 4

Temporal variations in dv/v and their corresponding autocorrelation coefficients for the following seismic stations: (a) MM_NPW, (b) MM_TGI, (c) TM_MHIT, and (d) MM_NGU. The analysis is presented for the 2-4 Hz frequency band and 2-6 sec lag time window. In each dv/v subplot, the background shading represents the correlation function surrounding the optimal dv/v estimates across the spectrum of stretching values. Blue dots indicate the optimal dv/v estimate at each time step. The color intensity

varies from dark blue (low correlation) to yellow (high correlation), reflects the strength of the correlation.

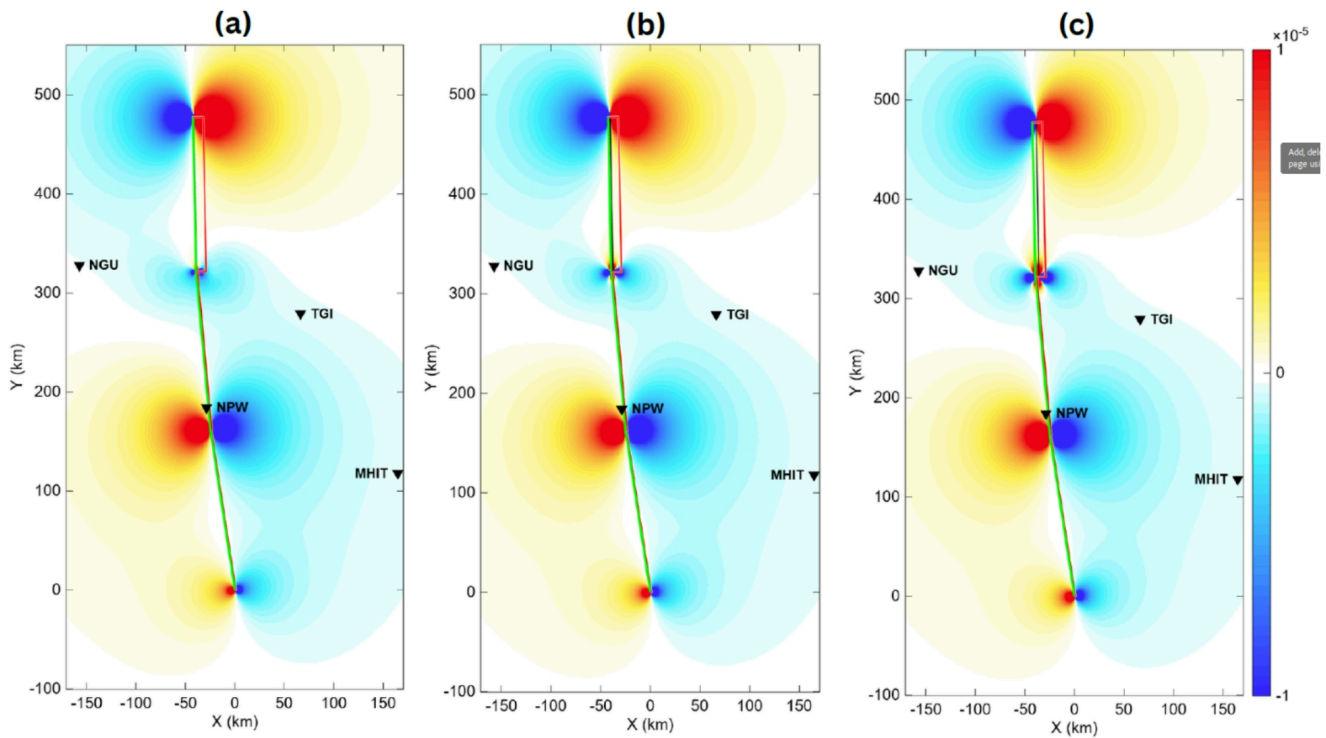


Figure 5

Spatial distribution of co-seismic static volumetric strain at depths of: (a) 2 km, (b) 5 km, and (c) 10 km. The X and Y axes denote Cartesian distance (km) from the southernmost tip of the Sagaing fault rupture. Warm colours (red) indicate positive volumetric strain (dilation), while cool colours (blue) indicate negative volumetric strain (compression). Inverted black triangles mark the locations of seismic stations.

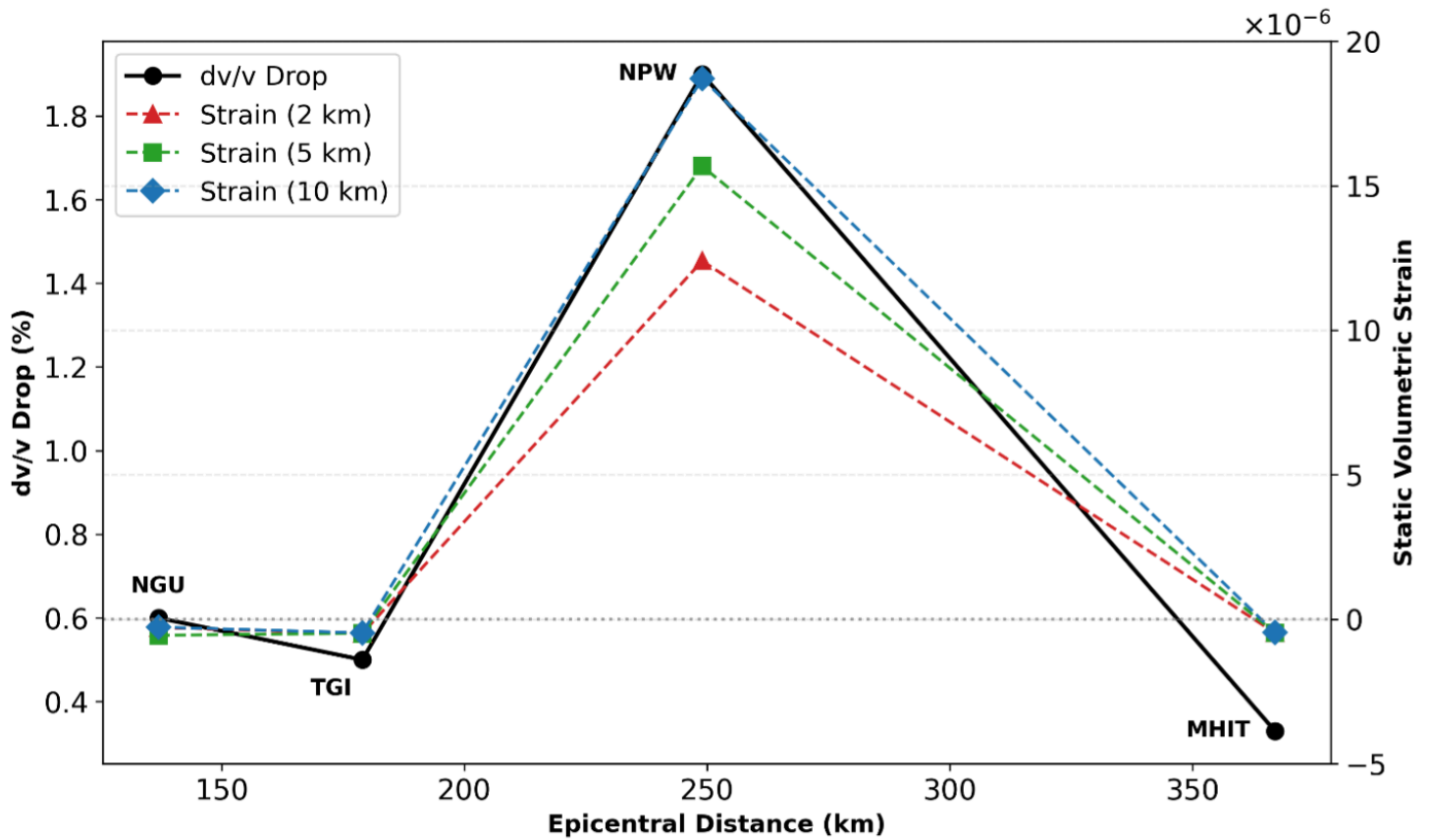


Figure 6

Comparison of maximum co-seismic dv/v reduction and static volumetric strain as a function of epicentral distance. The solid black curve on the left-hand y-axis shows the co-seismic dv/v drop (%), while the dashed red, green, and blue curves on the right-hand y-axis show the modelled static volumetric strain at depths of 2 km, 5 km, and 10 km, respectively.

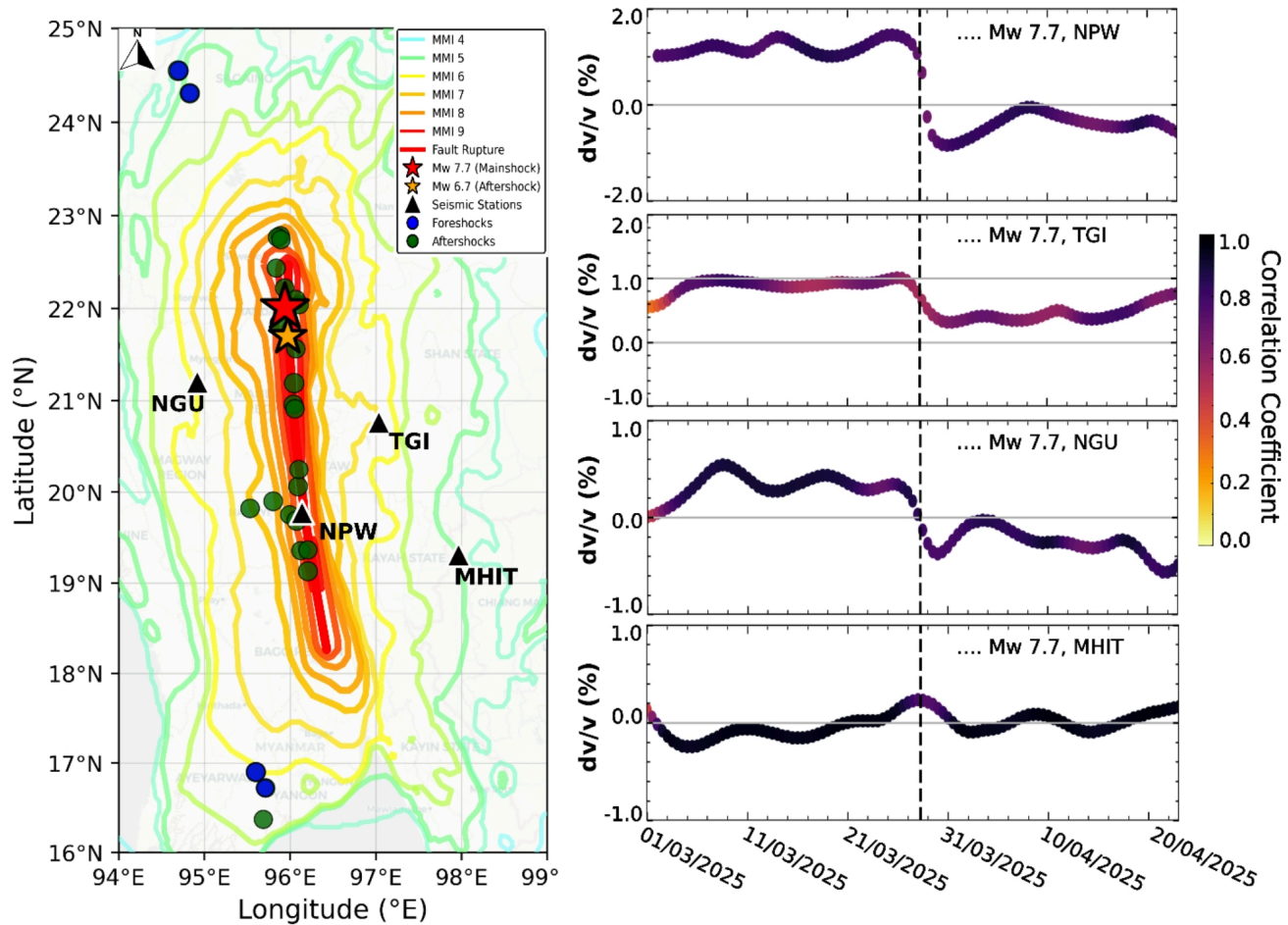


Figure 7

The left panel displays the spatial distribution of modified Mercalli intensity (MMI) based on the U.S. Geological Survey (USGS) (USGS, 2025) map of the study area, highlighting station locations (NPW, TGI, NGU, MHIT) relative to the SF and the earthquake epicenter (Mw 7.7). The right panels show the temporal variation in dv/v (%) at each seismic station. A dashed vertical line marks the time of the earthquake occurrence.

Supplementary Files

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