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Decorrelation and Deformation: Sentinel-1 InSAR Analysis of the March 2025 Earthquake in Central Myanmar and along the Sagaing Fault

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Abstract: A moment magnitude (M_w) 7.7 earthquake, as reported by the U.S. Geological Survey (USGS), struck central Myanmar on 28 March 2025. Its epicenter was situated near the Sagaing Fault, a major right-lateral strike-slip fault system that accommodates the relative motion between the Indian and Sunda plates. As one of Southeast Asia's most active tectonic structures, the Sagaing Fault has a history of producing destructive earthquakes, and this event caused significant ground displacement and surface rupture particularly across the Mandalay and Sagaing regions, which lie directly along its central segment. Using Sentinel-1 satellite imagery and advanced Interferometric Synthetic Aperture Radar (InSAR) techniques, the co-seismic deformation was mapped and quantified with high precision, revealing clear patterns of displacement. Interferometric phase analysis indicated a reported maximum line-of-sight (LOS) pixel displacement of 52.0 cm, which requires coherence and phase-unwrapping validation before it can be interpreted as ground displacement

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concentrated near the fault trace while coherence analysis showed localized areas of signal decorrelation corresponding to intense ground disturbance. To refine rupture mapping, the Normalized Coherence Change Index (NCCI) was applied for the identification of severely damaged zones. Spatial analysis further indicates that as the distance from the epicenter increases, the deformation amplitude gradually decreases, which is consistent with the typical elastic strain release of strike-slip faults. Quantitative assessments were conducted by dividing the affected area into multiple zones for the evaluation of displacement gradients and rupture extent. The results provide new insights into the mechanics of active fault systems in central Myanmar and reveal the spatial patterns of ground movement associated with large-magnitude seismic events. These findings identify regions of high seismic vulnerability and highlight the importance of remote sensing combined with ground-based observations for hazard assessment, infrastructure resilience planning and earthquake preparedness.

Keywords: co-seismic deformation; Sentinel-1 SAR interferometry; Sagaing Fault; line-of-sight displacement; zonal displacement analysis

1. Introduction

Myanmar is located in a highly active tectonic zone at the convergence of the Indian Plate and the Sunda microplate, which accommodates substantial strain via many fault systems [1]. The Sagaing Fault is the most conspicuous and seismically active fault in Myanmar. It is a right-lateral strike-slip fault that spans 1400 km from the Andaman Sea in the south to the Eastern Himalayan syntaxis in the north serving as the primary tectonic boundary between the two plates [2]. One of the most hazardous faults in Southeast Asia is the Sagaing Fault Line (SFL), which sustains a significant amount of regional plate motion and has slip rates between 15 and 25 mm/year [3,4]. This fault has previously produced a number of powerful earthquakes that seriously endanger heavily populated places like Mandalay and Sagaing. Buildings and vital infrastructure in the area were not constructed to resist earthquakes making it particularly seismically vulnerable. On 28 March 2025, an Mw 7.7 earthquake, according to the USGS, struck the central segment of the Sagaing Fault near the Mandalay–Sagaing district boundary at a shallow depth of around 10 km, followed by a powerful aftershock of approximately Mw 6.4. This is one of the most important earthquake events to strike the area in recent decades, inflicting extensive destruction. Understanding fault mechanics, slip distribution, and the updating of seismic hazard models all depend on the monitoring and measurement of co-seismic surface deformation. The geographic coverage of traditional ground-based measurements is often limited particularly in remote regions. InSAR has become a powerful tool for detecting ground deformation over wide regions with centimeter-scale accuracy [5,6]. This study generates the high-resolution LOS displacement maps and provides insights into deformation patterns for

seismic hazard assessment and post-event disaster management using InSAR techniques. These findings contribute to regional disaster resilience strategies and enhance our understanding of active fault behavior in Myanmar.

Although traditional seismological and geodetic observations are of great value, they are often constrained by limited spatial coverage, particularly in remote or inaccessible regions of central Myanmar. To overcome these limitations, InSAR has proven to be a transformative technique capable of mapping co-seismic deformation with cm-level precision over large areas [7]. Globally, InSAR has been successfully applied to major earthquakes such as the 1999 İzmit event in Turkey, the 2008 Wenchuan earthquake in China, and the 2015 Gorkha earthquake in Nepal, offering critical insights into rupture geometry, slip distribution, and fault mechanics [8]. Its ability to provide rapid, consistent, and wide-area observations makes InSAR especially valuable for Myanmar, where sparse ground-based networks hinder detailed monitoring. Among the strongest earthquakes in recent decades, this event offers an important opportunity to investigate rupture processes, validate tectonic models, and refine regional risk assessments. This study utilizes Sentinel-1 SAR data to characterize co-seismic deformation associated with the event. By generating high-resolution LOS displacement fields, assessing coherence loss through NCCI, and conducting zonal statistical analyses, the work not only documents the rupture characteristics of this significant earthquake but also demonstrates the role of InSAR in strengthening earthquake science and informing disaster risk reduction strategies in Southeast Asia.

2. Study Area

This study focuses on the Mandalay and Sagaing regions of central Myanmar along the central segment of the Sagaing Fault Zone, a major right-lateral strike-slip fault that marks the active boundary between the Indian Plate and the Burma microplate of the Sunda Plate system [1,3] (Figure 1). The Sagaing Fault is among the most seismically active fault systems in Southeast Asia with a horizontal slip rate of roughly 15 to 25 mm per year as determined by Global Positioning System (GPS) observations. The fault has caused multiple major earthquakes throughout historical and instrumental records. The study area focuses on the region affected by the earthquake. The epicenter is located approximately 16 to 17 km west of Mandalay, near the Sagaing–Mandalay border, close to the surface trace of the Sagaing Fault. This area has about 1.5 million residents. Mandalay, the second-largest city in Myanmar, is situated on the eastern bank of the Irrawaddy River, which faces prominent seismic hazards due to its close proximity to the Sagaing Fault, which is a major tectonic boundary. This vulnerability is compounded by the prevalence of non-reinforced masonry buildings and the presence of soft alluvial soils in the river's floodplain, which amplify ground shaking during earthquakes [4,9]. The event occurred at a depth of around 10 km along the Sagaing Fault indicating a strike-slip mechanism. A significant aftershock measuring

approximately Mw 6.4 occurred approximately 11 minutes later, further intensifying the destruction across the affected regions [10].

Myanmar's Mandalay and Sagaing regions are particularly vulnerable to seismic hazard due to their high population density, significant essential infrastructure, and proximity to an active seismic fault. Assessing earthquake-induced ground deformation is critical, and SAR interferometry provides the optimal methodology for this purpose. The goals of this work are to accurately measure co-seismic ground displacements and comprehensively analyze the resulting deformation field. The data gathered from this research will then be critical in improving the seismic hazard assessments and increasing disaster risk reduction initiatives throughout central Myanmar.

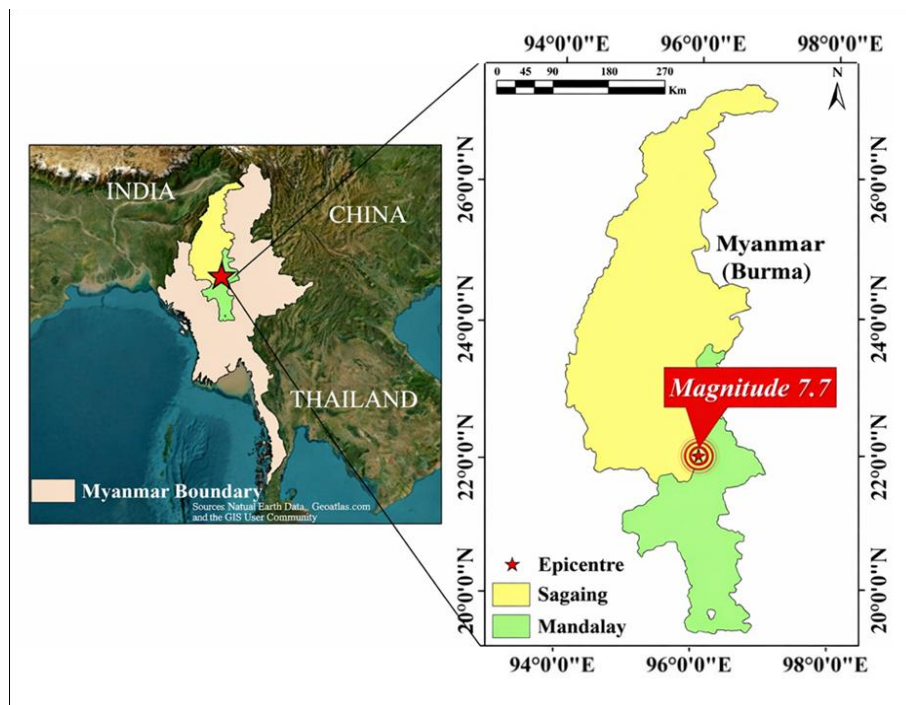


Figure 1. Location of the study area covering the Mandalay and Sagaing regions in central Myanmar, showing the surface trace of the Sagaing Fault Zone and the epicenter of the March 2025 event.

3. Data Used

This study utilized Sentinel-1 SAR data accessed from the Alaska Satellite Facility (ASF) Vertex portal under the European Space Agency (ESA) Copernicus program. The Sentinel-1 mission operating in the C-band (5.405 GHz) provides dual-polarized SAR data (VV+VH or HH+HV); however, only the VV polarization was used in this study due to its higher coherence, which is optimal for interferometric analysis [6,11]. The SAR data were acquired in Interferometric Wide (IW) swath mode with a spatial resolution of

approximately 10 meters and a swath width of 250 km that is suitable for large area deformation monitoring. Only ascending orbit data were employed as the descending orbit data did not provide full coverage of the Region of Interest (ROI), which includes the Mandalay and Sagaing districts. The ascending LOS geometry is effective for capturing deformation along the right-lateral strike-slip Sagaing Fault where horizontal displacement is dominant [5,6]. To correct for topographic phase contributions, the study used the Copernicus DEM at 30-meter spatial resolution offering global coverage with consistent elevation accuracy. All SAR data were acquired in Single Look Complex (SLC) format preserving phase and amplitude information necessary for interferometric processing. The details of the SAR scenes and ancillary data are summarized in Table 1.

Table 1. Summary of Sentinel-1 SAR SLC Dataset Used.

Event	Pair	Master / Slave	Scene ID	Acquisition Date
Pre-event	1	Master	S1A IW SLC 1SDV 20250310T113844 20250310T113911 058242 07329D 3561	10.03.2025
	1	Master	S1A IW SLC 1SDV 20250310T113908 20250310T113936 058242 07329D 7A06	10.03.2025
	1	Master	S1A IW SLC 1SDV 20250310T113934 20250310T114001 058242 07329D 35D1	10.03.2025
	1	Master	S1A IW SLC 1SDV 20250310T113959 20250310T114026 058242 07329D 3752	10.03.2025
	1	Master	S1A IW SLC 1SDV 20250310T114024 20250310T114051 058242 07329D 93C9	10.03.2025
	1	Master	S1A IW SLC 1SDV 20250310T114049 20250310T114116 058242 07329D 241B	10.03.2025
	1	Slave	S1A IW SLC 1SDV 20250322T113935 20250322T114002 058417 073988 9F68	22.03.2025
	1	Slave	S1A IW SLC 1SDV 20250322T113959 20250322T114026 058417 073988 68F9	22.03.2025
	1	Slave	S1A IW SLC 1SDV 20250322T114024 20250322T114051 058417 073988 7344	22.03.2025
	1	Slave	S1A IW SLC 1SDV 20250322T114049 20250322T114116 058417 073988 FDC	22.03.2025
	2	Master	S1A IW SLC 1SDV 20250315T114746 20250315T114813 058315 073579 B6C8	15.03.2025
	2	Master	S1A IW SLC 1SDV 20250315T114811 20250315T114838 058315 073579 D17E	15.03.2025
	2	Master	S1A IW SLC 1SDV 20250315T114836 20250315T114903 058315 073579 C8DD	15.03.2025
	2	Master	S1A IW SLC 1SDV 20250315T114901 20250315T114928 058315 073579 0A16	15.03.2025
	2	Slave	S1A IW SLC 1SDV 20250327T114721 20250327T114748 058490 073C5E B388	27.03.2025
	2	Slave	S1A IW SLC 1SDV 20250327T114746 20250327T114813 058490 073C5E FF9E	27.03.2025
	2	Slave	S1A IW SLC 1SDV 20250327T114811 20250327T114838 058490 073C5E 17C9	27.03.2025
	2	Slave	S1A IW SLC 1SDV 20250327T114836 20250327T114904 058490 073C5E 9EC2	27.03.2025
	2	Slave	S1A IW SLC 1SDV 20250327T114901 20250327T114928 058490 073C5E 787A	27.03.2025

Post-event	1	Master	S1A IW SLC 1SDV 20250322T113935 20250322T114002 058417 073988 9F68	22.03.2025
	1	Master	S1A IW SLC 1SDV 20250322T113959 20250322T114026 058417 073988 68F9	22.03.2025
	1	Master	S1A IW SLC 1SDV 20250322T114024 20250322T114051 058417 073988 7344	22.03.2025
	1	Master	S1A IW SLC 1SDV 20250322T114049 20250322T114116 058417 073988 FDC	22.03.2025
	1	Slave	S1A IW SLC 1SDV 20250403T113935 20250403T114002 058592 074094 0591	03.04.2025
	1	Slave	S1A IW SLC 1SDV 20250403T114000 20250403T114027 058592 074094 D60B	03.04.2025
	1	Slave	S1A IW SLC 1SDV 20250403T114025 20250403T114051 058592 074094 F43B	03.04.2025
	1	Slave	S1A IW SLC 1SDV 20250403T114049 20250403T114116 058592 074094 B49B	03.04.2025
	2	Master	S1A IW SLC 1SDV 20250327T114721 20250327T114748 058490 073C5E B388	27.03.2025
	2	Master	S1A IW SLC 1SDV 20250327T114746 20250327T114813 058490 073C5E FF9E	27.03.2025
	2	Master	S1A IW SLC 1SDV 20250327T114811 20250327T114838 058490 073C5E 17C9	27.03.2025
	2	Master	S1A IW SLC 1SDV 20250327T114836 20250327T114904 058490 073C5E 9EC2	27.03.2025
	2	Slave	S1A IW SLC 1SDV 20250408T114657 20250408T114724 058665 07438A 2508	08.04.2025
	2	Slave	S1A IW SLC 1SDV 20250408T114722 20250408T114748 058665 07438A 9C91	08.04.2025
	2	Slave	S1A IW SLC 1SDV 20250408T114746 20250408T114813 058665 07438A 16C7	08.04.2025
	2	Slave	S1A IW SLC 1SDV 20250408T114811 20250408T114838 058665 07438A F00A	08.04.2025
	2	Slave	S1A IW SLC 1SDV 20250408T114836 20250408T114904 058665 07438A 3F0D	08.04.2025

4. Methodology

The co-seismic ground deformation was examined using InSAR methods. These methods were applied to Sentinel-1 ascending track SAR data. The processing sequence was carried out using the ESA Sentinel Application Platform (SNAP) toolbox and its steps are outlined in Figure 2. The sequence started by applying precise orbit files to adjust for errors in the path of the satellite and to guarantee accurate baseline calculation [6]. Following this, pre-event (master) and post-event (slave) SLC images were co-registered. This co-registration process aligned radar pixels with the same ground locations with sub-pixel precision [5].

An interferogram was then produced by determining the phase difference between the aligned images. The interferometric phase, influenced by multiple contributing factors, is represented by Equation (1).

$$\Phi = \Phi_{\text{flat}} + \Phi_{\text{topo}} + \Phi_{\text{disp}} + \Phi_{\text{atm}} + \Phi_{\text{noise}} \quad (1)$$

where: Φ_{flat} = flat-earth phase, Φ_{topo} = topographic phase, Φ_{disp} = deformation-related phase, Φ_{atm} = atmospheric delay, Φ_{noise} = noise [12]. The flat-earth phase was removed based on orbital geometry. To reduce phase noise while keeping the deformation fringes clear, the interferogram was processed with the Goldstein filter [13].

A coherence map in SAR interferometry is used to evaluate the reliability of phase data by measuring phase consistency between image pairs. Pixels with a coherence value higher than 0.9 were retained to ensure that subsequent analysis focuses on areas with minimal decorrelation. This means that the phase information is stable and reliable for deformation measurement. This high cutoff helps in concentrating on regions with consistent phase signals, which is critical for accurate displacement and deformation mapping using InSAR techniques [14,15].

The phase component caused by topography (Φ_{topo}) given in Equation (2) was subtracted using the Copernicus 30-meter DEM, leaving only the residual phase related to ground deformation.

$$\Phi_{\text{residual}} = \Phi - \Phi_{\text{flat}} - \Phi_{\text{topo}} \quad (2)$$

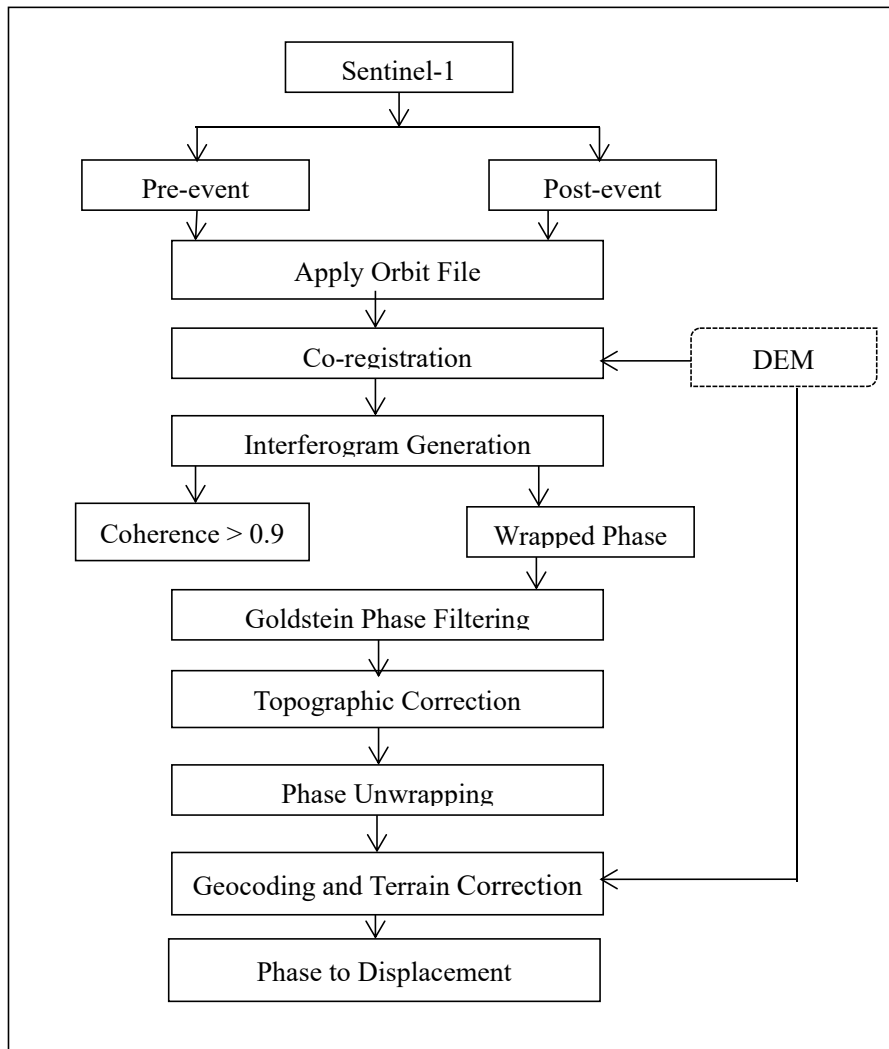
The residual wrapped phase was then unwrapped using the SNAPHU algorithm, which reconstructs continuous phase values from modulo 2π wrapped phases [16]. The unwrapped phase was converted into LOS displacement using the relation given in Equation (3).

$$d_{\text{LOS}} = -\frac{\lambda}{4\pi} * \Phi_{\text{unwrapped}} \quad (3)$$

where $\lambda = 5.6$ cm is the radar wavelength for Sentinel-1 C-band. LOS displacement was geocoded using terrain correction based on the DEM to transform the radar image coordinates into a standard geographic map

projection [6]. The complete InSAR processing workflow is illustrated in Figure 2.

Figure 2. Schematic of the InSAR processing workflow used in this study.



5. Results

5.1 Interferometric Phase and Coherence Analysis

The Sentinel-1A interferograms were generated from the acquisition pairs listed in Table 1. The 27 March–8 April 2025 pair brackets the 28 March 2025 earthquake and captures the co-seismic phase changes. A wrapped interferogram (Figure 3) reveals a concentrated pattern of long, narrow bands aligned along a straight path that corresponds to the documented position of the Sagaing Fault [17,18]. These fringes form two main sections, on each side of the fault, which is a typical sign of ground deformation caused by a major

fault rupture [5]. These bands are most densely packed near the fault, suggesting the greatest ground movement occurred there.

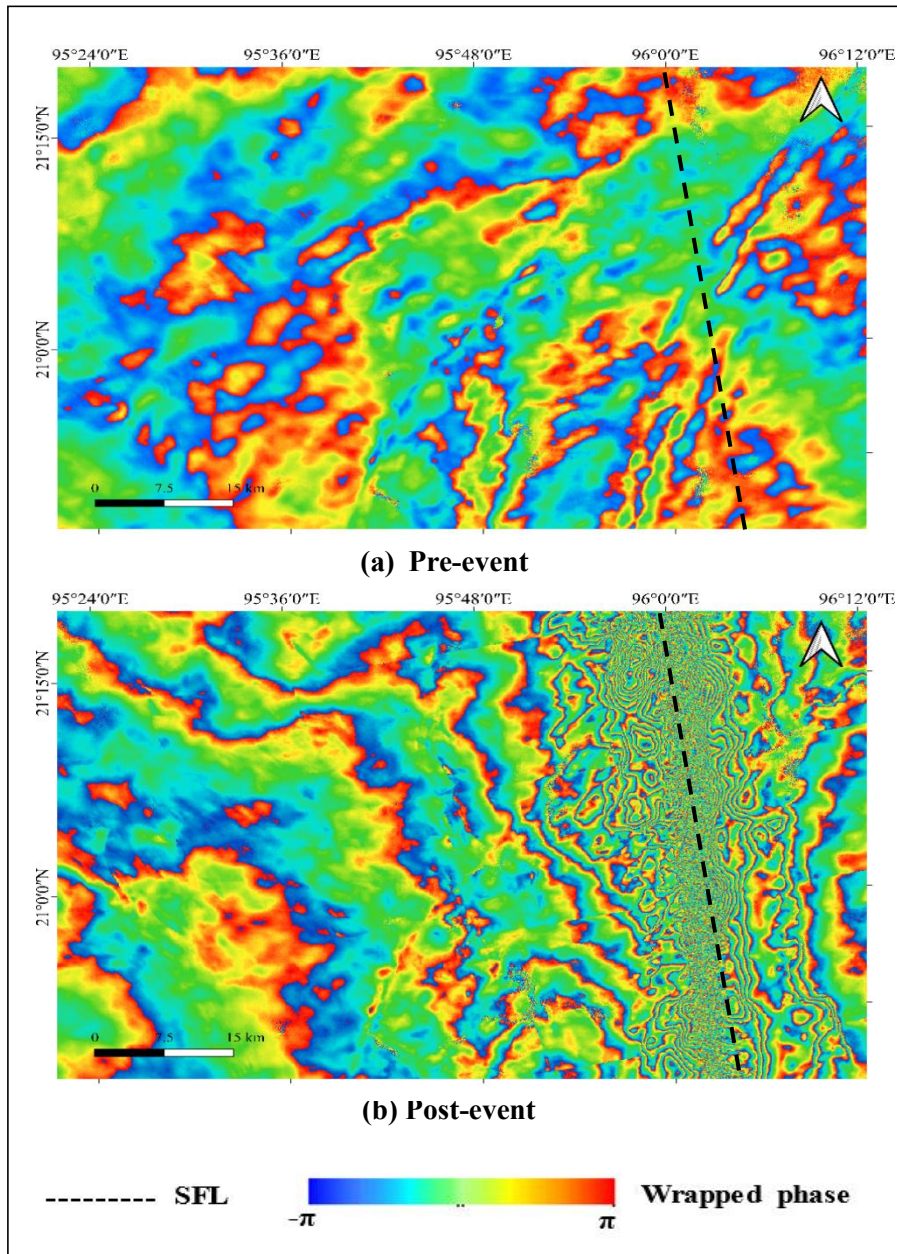


Figure 3. (a) Pre-event wrapped phase interferogram from Sentinel-1 SAR data, showing surface conditions before the earthquake. (b) Post-event wrapped phase interferogram highlighting dense irregular fringe patterns near the SFL, indicating significant co-seismic surface rupture.

5.2 Coherence Mapping and Analysis

Coherence analysis was carried out to assess the quality of the interferometric data and to pinpoint areas where the ground surface had undergone changes. The pre-event coherence map, generated from images taken on 15 March and 27 March 2025 (Figure 4a), reveals that most of the region exhibited very high coherence, with average values exceeding 0.95. This suggests that the ground remained stable before the earthquake, with low coherence mainly restricted to the Irrawaddy River and other water bodies [15].

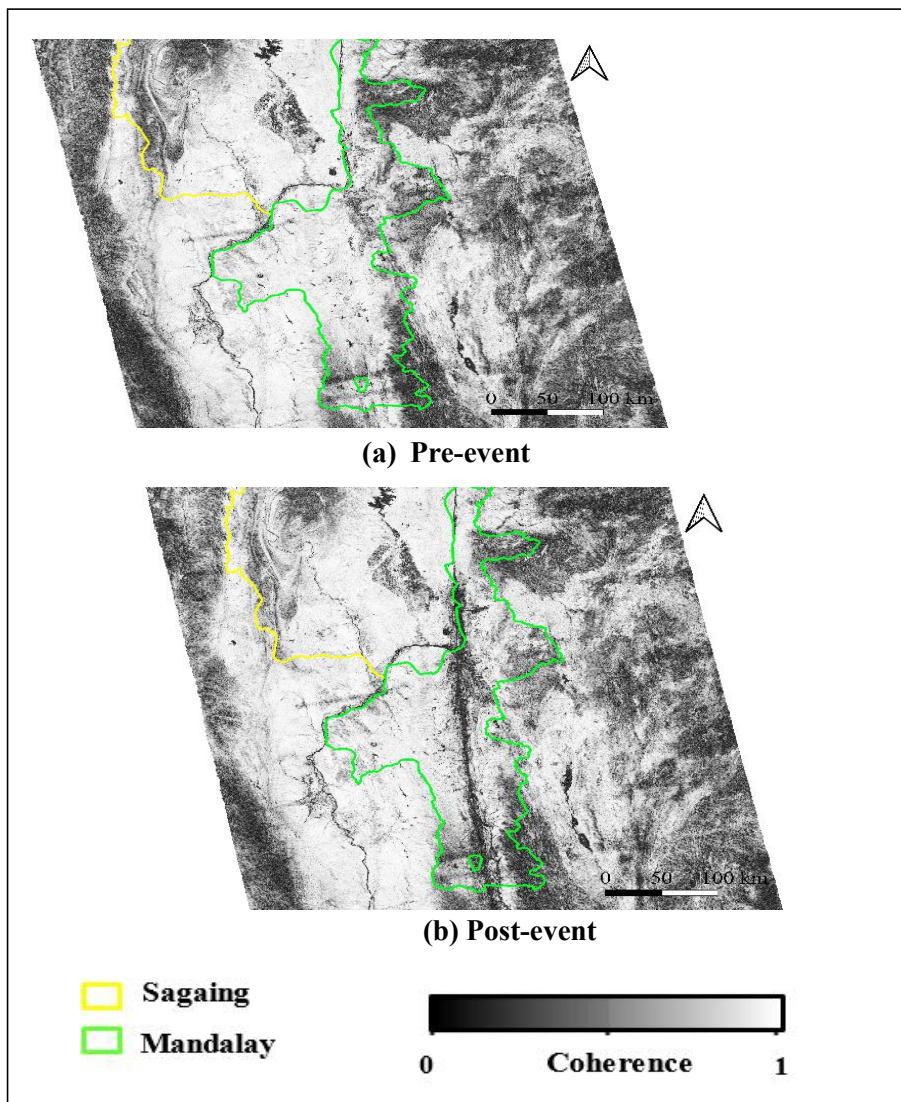


Figure 4. (a) Pre-event coherence map derived from Sentinel-1 SAR data, indicating surface stability prior to the earthquake. (b) Post-event coherence

map highlighting spatial changes in radar signal correlation due to co-seismic surface disturbance.

By comparison, the post-event coherence map (Figure 4b) displays a distinct, linear zone marked by a significant drop in coherence. This narrow strip, roughly 500 km long, shows very low coherence values around 0.2–0.3 and aligns closely with the Sagaing Fault and the area where phase fringes are densest. This notable decrease in coherence provides compelling evidence of significant disruption to the Earth's surface and irregular ground movement resulting from the fault rupture [19].

5.2.1 Normalized Coherence Change Index (NCCI)

To further isolate the changes caused by the earthquake from pre-existing low-coherence areas, an NCCI was calculated [20]. The NCCI map (Figure 5) effectively highlights the rupture trace as a sharp, continuous line of strong positive values. The NCCI measures the difference between a set of coherence data from before the event and after the event [21]. The index is calculated by Equation (4):

$$\text{NCCI} = \frac{\gamma_{\text{pre}} - \gamma_{\text{post}}}{\gamma_{\text{pre}} + \gamma_{\text{post}}} \quad (4)$$

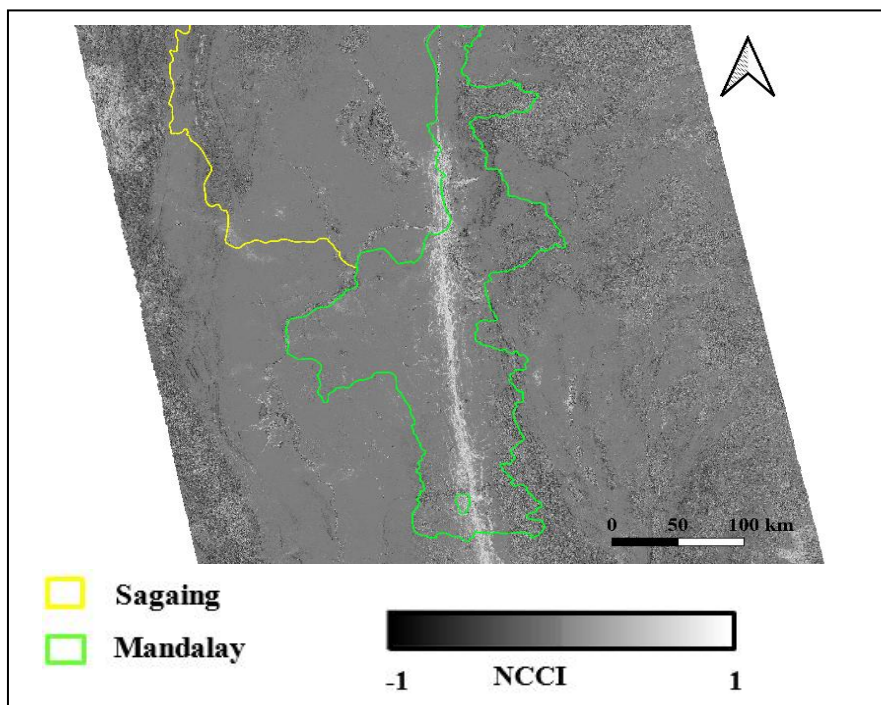


Figure 5. NCCI map showing areas of significant coherence loss, with high values indicating potential rupture or surface disruption zones.

5.3 Line-of-Sight Displacement Field

The Sentinel-1 interferogram analysis reveals ground movement associated with the earthquake. The LOS displacement map generated using established methods for Sentinel-1 Terrain Observation by Progressive Scans (TOPS) data [22] shows a distinct asymmetric deformation pattern along the Sagaing Fault with the largest displacements near the epicenter. The most negative displacement values are located west of the fault, while the eastern block is characterized by primarily positive values. The spatial distribution shows a LOS deformation pattern consistent with motion across a strike-slip fault. Because only ascending-orbit observations were used, the horizontal and vertical components cannot be separated. The Sagaing Fault clearly separates the deformation pattern, creating an antisymmetric displacement signature that lessens further away from the rupture zone. This pattern is typical of large strike-slip earthquakes and demonstrates the release of elastic strain along the fault plane [23,24]. The most significant ground shifts represented by LOS displacements occurred nearest to the fault. The data consistently indicate that the rupture initiated near the central segment of the Sagaing Fault. Table 2 summarizes the LOS values mapped for the pre-event and earthquake-spanning periods. The pre-event maximum of 28.8 cm cannot represent displacement caused by the 28 March earthquake. Therefore, the difference between this value and the post-event maximum of 52.0 cm is not used to quantify earthquake-induced displacement. Both maxima are reported as pixel statistics and require assessment of coherence and phase-unwrapping reliability before being interpreted as ground motion.

Table 2. LOS displacement statistics for the pre-event and post-event periods, showing the minimum, maximum, and mean displacement and the standard deviation, in centimeters.

Event	LOS _{Min} (cm)	LOS _{Max} (cm)	LOS _{Mean} (cm)	Standard Deviation (cm)
Pre-event	0	28.8	3.2	4.8
Post-event	0	52.0	3.9	6.2

Note: The minimum and maximum values are pixel extrema from the mapped LOS fields; their reliability has not been independently verified, and they should not, on their own, be interpreted as validated ground displacement.

5.3.1 Quantitative Zonal Displacement Analysis

For spatial analysis of ground deformation, five concentric zones (Zone 1–Zone 5) were categorized based on the distance from the earthquake epicenter. These zones focused on the rupture point have varying widths to allow detailed observation of displacement patterns notably in severely impacted regions like Mandalay. For ease of deformation analysis, zones were

used to represent strong ground movement near the epicenter and weaker movement farther away. This zoning facilitates uniform statistical examination of displacement information across differing distances from the source. Displacement features within each zone are summarized in Table 3 as absolute LOS displacement for analysis purposes irrespective of direction, including maximum displacement, average displacement, and standard deviation for both pre- and post-event. The spatial distribution of LOS displacement for the post-event period is illustrated in Figure 6, clearly showing the concentric buffer zones used for zonal statistics, with the highest deformation concentrated near the epicenter and progressively reduced displacement in the outer zones.

Table 3. Zone-wise statistics of absolute LOS displacement based on distance from the earthquake epicenter.

Buffer Zone	Distance (km)	Pre-event Max (cm)	Pre-event Mean (cm)	Pre-event SD (cm)	Post-event Max (cm)	Post-event Mean (cm)	Post-event SD (cm)
Zone 1	0–100	26.7	4.1	5.8	52.0	7.2	8.4
Zone 2	100–250	18.7	1.3	3.2	51.4	1.8	4.5
Zone 3	250–350	20.2	0.2	1.4	28.7	0.4	2.3
Zone 4	350–500	28.8	0.2	1.4	11.9	0.0	0.3
Zone 5	500–550	12.3	0.0	0.3	4.9	0.0	0.1

Note: The minimum and maximum values are pixel extrema from the mapped LOS fields; their reliability has not been independently verified, and they should not, on their own, be interpreted as validated ground displacement.

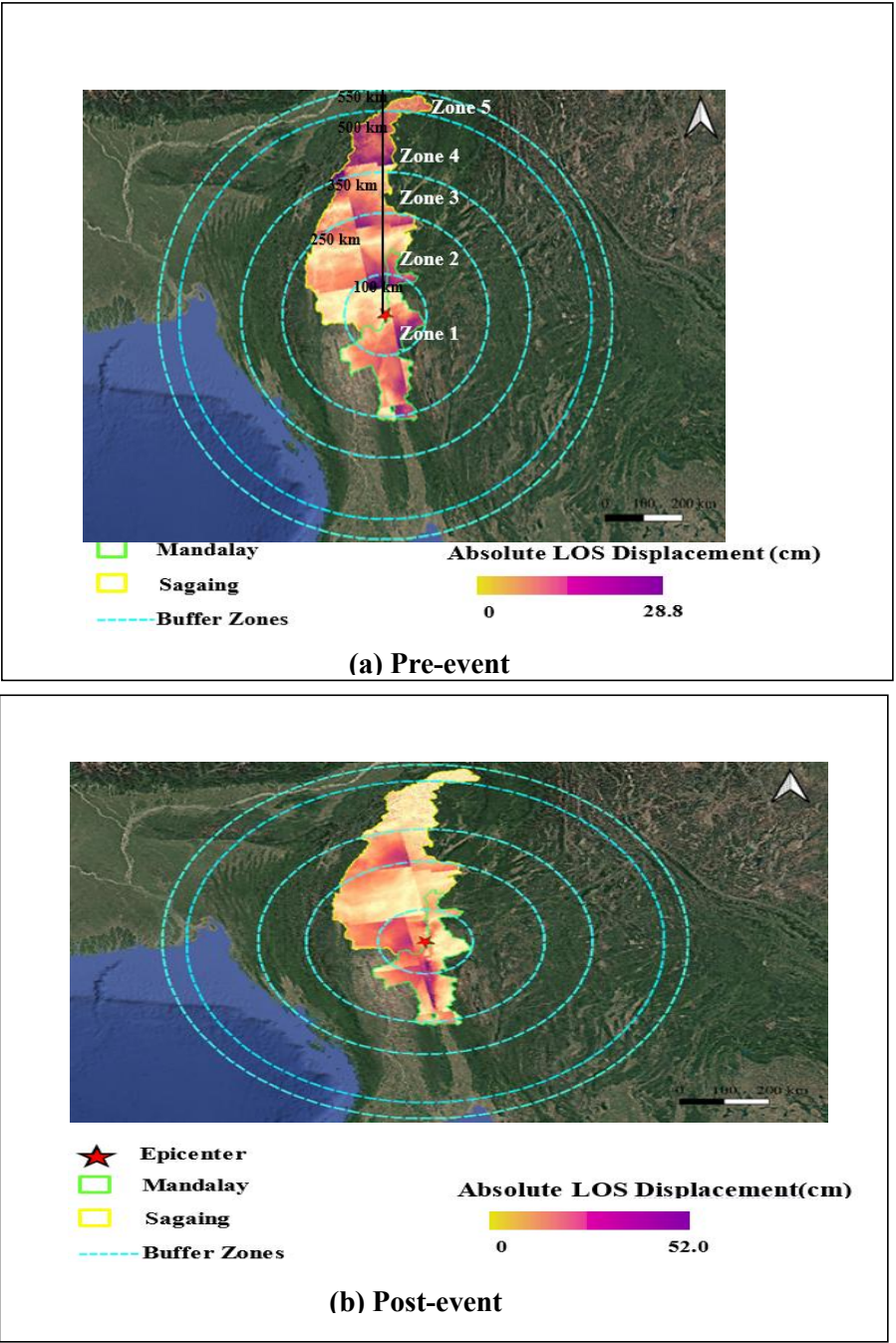


Figure 6. LOS displacement maps derived from pre- and post-event Sentinel-1 SAR data. (a) Pre-event absolute LOS displacement map showing the concentric buffer zones (0–550 km) used for zonal analysis. (b) Post-event LOS displacement in centimeters, showing direction and magnitude of ground motion.

The maximum pre-event values of ~27 cm in Zone 1 and 28.8 cm in Zone 4 are not interpreted as true ground deformation. These pixel extrema are reported without assigning an unverified cause and require coherence and phase-unwrapping assessment before interpretation [15]. This approach gives a more complete picture of ground movement throughout the whole area. The post-event data shows a strong and spatially consistent signal related to the earthquake. The region closest to the earthquake (Zone 1: 0–100 km) has a robust mean LOS displacement of 7.2 cm, along with a maximum of 52.0 cm and a high standard deviation of 8.4 cm, indicating significant and complex deformation in the near-field, which is typical [25]. The displacement magnitude decreases non-linearly with distance, a trend shown in the comparative plot in Figure 7. The average LOS displacement decreases rapidly to 1.8 cm in Zone 2 (100–250 km) and becomes insignificant beyond 350 km. Ground movement decreased with increasing distance from the epicenter [26]. The spatial extent of the earthquake's impact is revealed in Table 3, exhibiting a clear trend: displacement decreases as distance from the epicenter increases. The zonal analysis also helps separate real ground warping from possible data irregularities. Figure 7 reinforces this, illustrating how LOS displacement changes relative to distance from the epicenter.

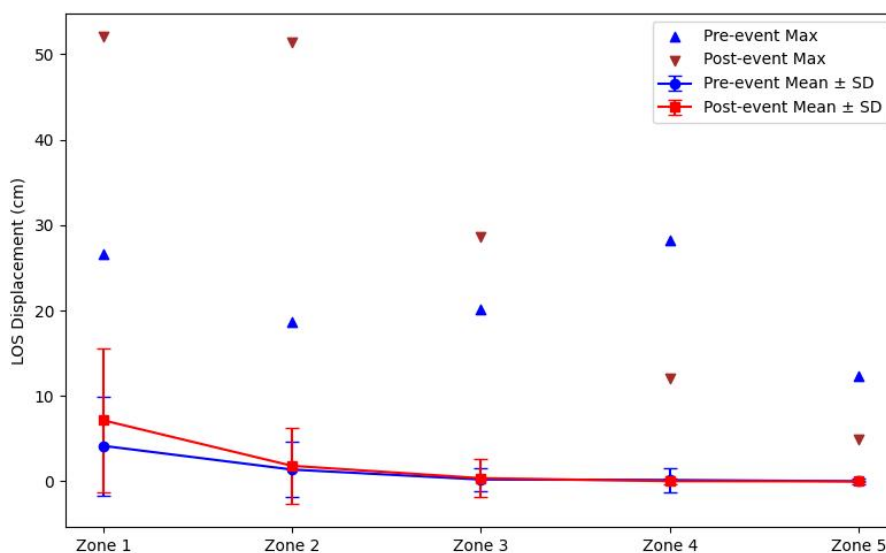


Figure 7. Zone-wise absolute LOS displacement patterns showing the maximum and minimum LOS displacements during the pre- and post-event periods, with the highest values near the epicenter progressively decreasing with distance from it.

The plot shows the mean absolute LOS displacement across five buffer zones (0–550 km) centered on the epicenter. A clear decay trend is observed, with maximum displacement occurring in Zone 1 (0–100 km) and rapidly diminishing beyond 250 km. The pattern illustrates the spatial extent of co-seismic deformation and reflects the attenuation of ground motion with

distance, consistent with strike-slip rupture behavior and empirical ground motion models.

5.4 Limitations

The InSAR method used in this study has certain inherent limitations that must be taken into account. Primarily, InSAR is only capable of measuring ground displacement in the direction of the satellite's LOS, which combines both vertical and horizontal movement components. Consequently, a single viewing angle is unable to fully characterize the three-dimensional complexity of ground deformation [5].

Secondly, while the Sentinel-1 sensor, which operates in the C-band frequency, generally offers adequate spatial resolution and sensitivity for detecting surface deformation, regions characterized by dense vegetation cover, particularly within the rural portions of the Sagaing and Mandalay districts may have been subject to temporal decorrelation. This phenomenon can result in localized data gaps or less dependable displacement estimates [15].

Even after applying correction methods, some residual atmospheric disturbances may persist. These are largely attributable to spatial and temporal fluctuations in tropospheric water vapor and they can introduce broad-scale errors within the displacement field. Although pre-event interferograms confirmed that these effects did not introduce any systematic bias, they do contribute to the overall background noise and uncertainty associated with the measurements [19].

6. Conclusion

This study demonstrated that satellite radar is extremely effective in imaging and quantifying ground movement following the massive Mw 7.7 earthquake on Myanmar's Sagaing Fault. This form of satellite radar is ideal for precisely measuring even minor changes on the ground especially in remote places. The study assessed the effects of the earthquake by integrating multiple InSAR-derived products, including interferometric phase, coherence, NCCI, and LOS displacement fields; the coherence and the NCCI helped pinpoint where the surface ruptured. The wrapped interferogram also clearly highlighted the pronounced phase variations over the fault zone. As a result, it is possible to identify the locations that have undergone significant changes, and the stress distribution caused by the earthquake is also demonstrated. The post-event LOS field contains a reported maximum pixel value of 52.0 cm near the epicentral region. This extreme value requires verification against phase coherence and phase-unwrapping quality before it can be interpreted as a reliable displacement magnitude. The utilization of continuous spatial data from SAR interferometry has provided critical insights into how the fault moved and how the rupture occurred. Mean LOS displacement decreases by nearly 75% from the near-field (0–100 km) to the 100–250 km zone, demonstrating rapid decay of earthquake-induced deformation with distance. This approach yields the continuous and detailed spatial information that

SAR interferometry can uniquely provide. The study demonstrates the value of spatial analysis in understanding fault dynamics and rupture development by detecting even subtle variations in land movement across the region. The results demonstrate the value of SAR interferometry for mapping spatial patterns of surface displacement after an earthquake, subject to the coherence, phase-unwrapping, and single-viewing-geometry limitations described above.

Supplementary Materials: Not applicable.

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