Response to the Associate Editor

We thank the reviewers and the AE for useful and critical comments. As requested, we provide the marked up and clean versions of the manuscript, as well as detailed reviewer responses in blue below.

We have made no significant modifications to pour findings. The biggest change is to move several of the figures, as per discussion with the editorial team to the supplement, we also included new reconnaissance photos of the fault scarp int eh vicinity of the trench site collected by colleagues in Myanmar. We have updated the Zenodo repository accordingly to reflect this.

We hope you will find our responses adequate and sufficient.

Regards on behalf of the team,

Diego Melgar

Reviewer A:

The submitted manuscript is reporting the source process analysis of the 2025 Myanmar earthquake. The authors jointly use the strong motion records and the pixel offsets from the InSAR data to carry out kinematic inversion. The authors also reconstruct the paleo-seismic displacements at the trench site near the epicenter of the 2025 earthquake, relying on mapping of faults and 14C dating. The authors find the ~450-km-length rupture along the Sagaing Fault, favored by the model with allowed maximum rupture speed at 4.8 km/s. The reconstructed paleo-seismic displacements show consistency between the 2025 co-seismic slip displacement inferred from the kinematic inversion and the averaged slip displacement at the trench site. I would like to confirm that the authors' finding is fundamental for a fast response to the devastating 2025 event, providing critical insights into the hazard assessment around the Sagaing Fault. Here I only have the minor points, which I hope might be useful for improving the manuscript.

L117: Hurukawa et al. -> Hurukawa and Maung

Modified as requested

L176: Figure 2 -> Figure 1?

Modified as requested

L185 and L187 look duplicated? (e.g., "is only 2.5 km from the surface rupture" and "is only 2.7 km from the surface rupture")

Deleted duplicate

L193: eight events, we estimated -> eight events. We estimated?

Modified as requested

L232: [Rosen et al., 2012] -> (Rosen et al., 2012)

Modified as requested

L272: faulting, we -> faulting. We

Modified as requested

L290: 4 s rise time re allowed for each -> 4 s rise time allowed for each

Modified as requested

L331–332: Is this 40 cm thickness calculated by considering a total of 4 events (E2–E5), by neglecting the youngest (shallowest) event (E1)? I think this statement can be made after describing the trench sections and the possible signatures of fault boundaries.

Yes, we note that due to cultural modification for agriculture, the youngest event is too modified to measure accurately. Added the following text:

"We note that this calculation neglects the youngest event which is heavily modified by agriculture"

L336: Perhaps I am missing the context, but could the authors show how we could rely on this "20%" ratio. It seems this number (20%) is critical when inferring the horizontal displacement (4 m in this case), so I would appreciate it if the authors could clarify the context or evidence.

The section of the fault including the trenches in the original Figure 6 has a more westerly trend forming a slight left step in the purely right-lateral portions to the north and south; we simply calculate the fraction of compression from geometry; if the fault trace is NS it's pure strike slip and if EW pure reverse; the orientation at the trench site suggests ~20% compression expressed as the reverse component of slip on the fault plane.

L354: we cand conclude -> we can conclude

Modified as requested

L355: super-she ar -> super-shear

Modified as requested

L357: The dashed lines on that figure -> The dashed lines on Figure 2?

Modified as requested

L403: "That time is far shorter than the inter-event time we report here"

I am a bit confused about this sentence. Could the authors please clarify "the inter-event time we report here"? The Inter-event time is from 1839 to 2025 (186 years) and the geologically inferred interval is 200–250 years ("That time" in the corresponding sentence)? If so, it seems that the sentence of "That time is far shorter than the inter-event time" may not be easily followed.

We clarified further, see modified text as:

"*This last point is notable—at the location of our trenches (Figures 5,6) several ruptures overlap. For an average slip rate of 20 mm/yr, the 4-5 m of coseismic slip on this segment of the fault inferred from paleoseismology and observed in 2025 requires 200-250 yrs to accumulate. That time is shorter than the inter-event time we report here, as seen at the trenches, and suggests that ruptures on this "overlap region" of the Sagaing fault cluster closely in time and further, seem to nucleate close to or on it."*

L409: purple layers

Are the ones labeled as 31–35000 yrs in Figure 8B?

Yes, and note updated figure legend to 31,000 to 35,000

L417: are centered -> is centered?

Modified as requested

L419–420: "the boundary between the Sagaing and Meiktila segments of the fault (Figure 6A) is rather diffuse" and L422: "This suggests that the boundary is not a strict barrier"

> I would feel that these statements can be evaluated by the authors' own kinematic inversion as well.
>
> A possible along-strike heterogeneity or segmentation can be a key feature of the 2025 Maynamer earthquake (or Sagaing Fault itself) to better understand the rupture dynamics, including the supershear rupture. Presumably "the boundary" is considered at ~21.5°N in this context. I see in Figure A6 (2025 co-seismic depth-averaged displacement "Fault displacement (m)") that the displacement decreased at around 21.5°, which seems consistent with the hypothesized along-strike segmentation (e.g., Sagaing and Meiktila segments).

How can we evaluate this diffusivity of the boundary from the authors' kinematic inversion? For example, the authors testified a number of scenarios of the allowed maximum rupture speed (e.g., Figure 5C), but do the authors find that the decreasing displacement is robustly seen at ~21.5° even when changing the maximum rupture speed or perhaps is sensitive or not consistently resolved against the model assumption of maximum rupture speed?

Thanks for the above comments—this is more of a discussion item rather than a strict finding. But what we are intending to say is that the fact that historic ruptures so frequently overlap at the trench *seems* to suggest that what we would consider the boundary is not a strict cutoff past which ruptures can't propagate but rather a zone that can sometimes participate in northern ruptures, sometimes in southern ruptures and other times, like 2025 allows through-going ruptures. To clarify this we added:

"*…beyond which only ruptures to the north or to the south exclusively occur. Rather, the ruptures that overlap at this trench can be north propagating, south propagating, and throughgoing (as in 2025).*"

L438: calculations for the Sagaing -> calculations for the Sagaing Fault?

Modified as requested

Figure 1A:

Explanation of triangle markers: seismic stations used for inversion?

Blue line?

Star: USGS?

Added explanatory text

Figure 1B (and L272–273): Is the star the USGS' epicenter?

Added explanatory text

Figure 2

fault parallel: which strike angle (azimuth) is used for rotating the horizontal records?

Added explanatory text

Figure 4

"Shown as well are east-west and north-south pixel offsets from optical Sentinel 2 observations."

It seems that the Sentinel 2 images are not shown?

https://d1z62tir4fw0q0.cloudfront.net/20250328_Myanmar_EQ/Displacements/Sentinel-2/S2-COSEIS_OPT-20250228-20250401/S2-COSEIS_OPT-20250228-20250401-NS.png

Yes, they are not shown here, we removed this text

Figure 6

Note Figure 6 is now re-labeled as Figure 5.

Explanation of beachball seems missing.

Added explanatory text

Plotting the epicenter of the 2025 event should be helpful when evaluating the sentences at L414–418 (discussion related to the short fault segment). Oy, maybe the location of the red beachball ("2025 Mw 7.7") represents the epicenter?

Yes the red beachball represent the epicenter, added text to clarify

"southern half of the paleoseismic study site" reads ambiguous to me. Could it be possible to indicate the specific extents (lat/lon) of the site in the caption?

Added coordinates to figure caption

Please follow the guideline of Google Earth (e.g., "Required attribution") and add the image acquisition date in the caption if possible.

https://about.google/brand-resource-center/products-and-services/geo-guidelines/#required-attribution

Added date

Figure 8

As well as the annotated images of trench, I would be expecting that the authors could show raw images without plotting the lines of possible boundaries, so that the readers could evaluate the data. The annotated Figure 8 is indeed helpful, but I would be keen to see the raw images somewhere in the supplement.

We have added an example of a abre trench log to the supplelentary figures

Figure 8B: (legend)

Likely 3–5000 yrs -> 3000–5000 yrs?

Modified as requested

31–35000 yrs -> 31000–35000 yrs?

Modified as requested

Figure 8C

Presumably the "Detail Trench2-2018" should be a close-up view, but I would appreciate it if the authors could clarify which section of the Trench2-2018 (Figure 8A) is picked up for Figure 8C (is it beneath the red-shaded area of "Sagaing Fault"?).

Yes, the red shading in the map (A) is the main fault zone shown in the details (C&D). Figure 8C. Added clarifying text to caption.

Could it be possible to add a scale of the photo?

Added

Figure 8D

I guess the label "C" is accidentally shown in the right-bottom corner of the photo.

Removed the errant label

Figure 11

the residuals between the observed and modeled offsets can be shown.

Modified as requested

Displayed items:

I find every displayed item is informative and necessary to support the authors' statement. However, in the light of the scope of Fast Reports, I might be expecting the following figure layout if feasible.

(main text)

Figures 1 and 2 can be merged into one figure

Figures 5 and 10 can be merged into one figure

Figure 11 (+ residuals if available)

Figure 6

Figure 8

(Supplementary material)

Figures 3, 4, 7 and 9

Please see the changes to the figures after discussion with handling editor , we moved several to the supplement

Recommendation: Revisions Required

Reviewer Kiran Kumar Thingbaijam:

Overall, the manuscript is an excellent Fast Reports article. The analysis and findings presented contributed to scientific information of this significant event. I find that there are only a few minor concerns as listed below.

Abstract: "segmentation" - how about "rupture segmentation"?

Modified as requested

Abstract: "exceptional exposure" .. perhaps, "exceptional exposure to the hazard"

Modified as requested

Line 270: Would this be "Section 2.2" instead of "Section 2.1"?

Modified as requested

Figure 5. Root Mean Square (RMS). I suppose that that is averaged over all the stations, in case of the seismic recordings.

Yes, added to figure caption to clarify

Line 290: How much time is overlapped?

50%, added to text to clarify

Section 2.3. How are the Green's functions generated? Which of the three velocity models was finally used?

The regional Litho 1.0 model, added to text to clarify:

"For each geometry elastostatic and elastodynamic Green's functions are generated using the frequency-wavenumber approach of Zhu & Rivera (2002) and the regional LITHO1.0 model discussed in Section 2.1"

Section 2.4. "In the context of a field-training school funded by the Earth Observatory of Singapore and including students from Myanmar, five other SE Asian countries, China, and USA from 2016 to 2018, …." Not clear how this is relevant. Is that the field data was collected during the field-training school?

Yes, the field data was collected then. Modified for ckarity to:

"*Paleoseismic results reported here are **preliminary** and from work carried out in the context of…"*

Figure 6. “Added the “8 are located in the center where 2016 and 2018 trenches are clustered and have the best evidence for the timing and displacement of recent earthquakes.” This sentence would need rewriting. Perhaps, the images and the analysis in Figures 7, 8 are located .....”

Agreed, phrasing was dissonant, modified to:

“The images and analysis in Figures 7,8 are located at the location labeled “main trench site” and have the best evidence for the timing and displacement of recent earthquakes.”

Section 2.24. Would it be useful to indicate somewhere in this section that the paleoseismology results are preliminary?

See modified text, add the “preliminary” qualifier.

Section 2.4. Line 340. Would this paragraph be better placed in the Conclusion? It is already there (Line 412).

This result is important so we prefer to reiterate it here and in the conclusions.

Line 350: “This means the long rupture length is somewhat anomalous compared to the mean expected length of 186 km for this magnitude from the probabilistic scaling laws of Blaser et al. (2010), placing it at the 98th percentile of expected rupture lengths.”

I wish to share an additional assessment of the rupture length. If we know the rupture width (constrained by seismogenic depth), it is preferable to estimate the rupture length L from the scaling relation between magnitude Mw and rupture area A such that L = A / W (Thingbaijam *et al*. 2017). Applying this approach, the strike-slip scaling relations of Thingbaijam et al. (2017) gives mean estimates of L = 450 km (for effective W = 13 km), L = 390 km (for effective W = 15 km), L = 325 km (for effective W = 18 km), and L = 293 km (for effective W = 20 km).

Thingbaijam, K.K.S., Mai, P.M. and Goda, K., 2017. New empirical earthquake source-scaling laws. *Bulletin of the Seismological Society of America*, *107*(5), pp.2225-2246.

Added:

“Similarly, considering the scaling relationships for source area of strike-slip events from Thingbaijam et al. (2017) and the assumed seismogenic depth of 20 km we would expect a rupture length of ~300km for this magnitude. By all these metrics, the event is remarkably long.”

Figure 8: “cow+“ Is it just “cow”?

Modified as requested

Line 354: Typos.

Corrected

Line 358: "… that figure show …", perhaps, .. Figure 2 show…"

Modified in response to previous reviewer

Reference List:

A consistent format would be helpful. I might have missed the citations found missing, and request the authors to cross-check the reference list and citations.

"Bondar" in text but it is "Bondár" in the list

Modified as requested

Deng et al. (200) is not cited.

Added to text

"Department of Meteorology and Hydrology - National Earthquake Data Center. (2016)" in the list, but we have "Myanmar Department of Meteorology and Hydrology (2016)" in the text.

Modified as requested

"Ekström" in the list, but "Ekstrom" in the text.

Modified as requested

"GEOFON Data Centre" in the list is only "GEOFON" in the text

Modified as requested

Is it Guy(1990) in the list or Guy (1989) in the text?

Modified as requested

Hlaing et al. (2019) is missing in the text.

Modified as requested

Should be Kennett & Engdahl (1991) in the text (Line 202)

Modified as requested

Lindsey, E.O., et al.(2023).. Perhaps, include the first three authors.

Modified as requested

Melgar, D., & Hayes, G. P. (2017) Not cited.

Modified as requested

National Research Council (2007) Not cited

Modified as requested

Tsutsumi, H., & Sato, T. (2009)?? It is “Tsutumi & Sato, 2009” in Line 449.

Modified as requested

U.S. Geological Survey (USGS) Earthquake Hazards Program (2017).. Not cited

U.S. Geological Survey (2025) Not cited

We have USGS, 2017 and USGS, 2025 in the text

Wang et al. 2017 not found

Modified as requested

Weldon, R., K. Scharer, T. Fumal, G. Biasi (2004). Not cited

Removed

Recommendation: Revisions Required

Reviewer B:

I was asked to review the Chinese abstract. It looks good to me. The Chinese is consistent with the English version.

Handling Editor's Note: The abstracts in other langauges have not been reviewed. However, I believe that they would be also consistent with the English Version.

No actions taken