

Reviewer A Comments

For author and editor

Dear Koehler et al. and Seismica Editors,

I enjoyed reviewing the manuscript and you will find my reviewer summary and detailed comments for consideration in the attached word document and annotated PDF. Overall the manuscript reads very nicely and makes a valuable contribution. I find that it should be published after minor considerations.

Sincerely,

Nathan Toke

May 2025

Dear Editor Alex Hatem,

Thank you for the opportunity to participate as a reviewer for ***Seismica***. The following letter summarizes my review of **Koehler et al.** titled: **Surface rupture and associated ground disturbances of the 09 December 2024 Mw5.7 Parker Butte Earthquake near Yerington, Nevada, central Walker Lane.**

Overall, I enjoyed reading about this event and find the paper makes a nice contribution and is suitable for publication with only minor revisions and considerations. My review consists of two parts:

A) Summary addressing the contributions of the paper followed by

B) A list of the issues and/or questions that I noted and should either be addressed or considered prior to proceeding to publication.

I have also included an annotated pdf of the author's manuscript where I highlight specific items (most of which are covered in B) and some of which are minor and not directly highlighted in B above.

Sincerely,

Nathan A. Toke

Associate Professor, Department of Earth Science, Utah Valley University.

Nathan.toke@uvu.edu

A) Summary of contributions made by this paper:

Koehler et al., contributes valuable documentation of an example of a moderate magnitude earthquake that has a curious case of short and minor surface rupture on a

conjugate structure within the Walker Lane area of the western US. The paper documents secondary shaking effects and translates that into local shaking estimates. They also observe and propose that ice cracking patterns in earthquakes that occur at high latitudes, or the correct season may be utilized to infer information about seismic patterns of shaking. They also demonstrate that the inferred main fault trace did not have surface rupture, and they document that this fault has not ruptured in larger earthquakes since at least the last Pluvial late maxima. All these things make the paper valuable and worthy of publication. Overall, the paper is well written as is, but I do point out several minor points of clarification in the attached and annotated PDF of the manuscript.

B) Specific (small) issues to consider and possibly address:

Title – Add the word conjugate in here, to show that the fault producing the shaking was not necessarily the one that ruptured the ground surface. Here is a possibility: **The 09 December 2024 Mw 5.7 Parker Butte Earthquake, conjugate surface rupture and associated ground disturbances near Yerington, Nevada, central Walker Lane.**

Abstract –

Line 36 – it's still unmapped, I suggest saying **on an unmapped ENE-striking fault aligned with...**

Lines 38-39 – Consider leading with the fact that the inferred mainshock did not produce surface rupture and then bring up the rupture of the conjugate structure.

Lines 40-42- I suggest adding (here in the abstract) in the estimated ground shaking parameters your study produced from all your hard work documenting the details of the local effects. I also suggest a comment about the impact (or lack thereof) to infrastructure that you also document in the paper.

Introduction

Line 68 and elsewhere PRESENT VS PAST TENSE – be consistent, I'd recommend past tense since the features are fragile and likely not still there: Several places in the manuscript the language of is present tense and then switches to past tense (aftershocks are vs were e.g., line 68) OR (sandblows are vs were sometimes found in clusters Line 356).

Lines 71-73 here and elsewhere in the regional context section, lineaments are sometimes used synonymously with active fault. This is somewhat new to me and perhaps a curiosity of the region and how it's been mapped and named in the past and with so many small faults all over the place, but I think the authors could stand to explain the nomenclature up front in the paper (probably in the regional context section) so that readers don't get

confused. Normally, I think of lineament as an alignment of linear features that might suggest a fault, but very tentatively.

Line 90 – reference the supplemental materials.

Line 104 – why not reference the actual page (it is referenced elsewhere I see).

Regional Context...

Line 139 – first two sentences somewhere should say that these normal faults dip to the east.

Line 151-152 – See my comment above lineaments (lines 71-73 above).

Line 162-164 – Seems like this could be made more direct by getting into the details of the geodetic vs geologic rate budgets (numbers).

Line 167-169 – This seems like a conclusion (out of place summary). Move this to the abstract and to the discussion?

Observations

Line 192 - Surface rupture heading – suggestion to change to: Surface Rupture Reconnaissance and Observations.

Lines 210-212 – reference Figure 2d here and label where Campbell Valley is located on the figure.

Line 218 – Put lat long tick marks on Figure 3 for consistence and reproducibility.

Lines 219 – 224 – Great descriptions of the conjugate rupture pattern. I think it could be worth contextualizing these results by referring to other rupture patterns of moderate magnitude SS events. For example, the Parkfield earthquake or creeping fractures on the SAF have been shown to have similar patterns Toke et al, 2006; Rymer et al. 2006, Scott et al., 2020. Also, might be nice to comment here that the rupture could be due to seismic slip or triggered creep given that both types of slip can produce similar patterns on the ground, especially when the surface soils are either super dry (scott et al., 2020 OR if the ground is frozen --- then creeping fractures can look very much like moderate magnitude rupture).

Line 275 – I suggest separating the location reference from the figure reference so that people clearly know that the figure refers to all observations discussed in this section and that the location reference is for a particular one.

Line 299 – replace incised with cut.

Line 302 – consider defining the term frazil (not probably commonly known by seismology types)

Line 346 – Strike vs Trend? I think trend is more appropriate here.

Lines 369-373 – Feel like you should provide a reference for the 1933 event.

Older Faulting

Line 389-391 – I'd add a few clarifying words in here to be more precise. I gave suggestions in the PDF annotations.

Line 393 – add significant local to emphasize significance.

Discussion and conclusion

Line 494 – please explain or reference the Ridgecrest analogy for those that are not aware of the details of that event.

Line 526 – here and in the abstract, I felt that you could specifically call out all the sub disciplines to emphasize their value even more Geodetic Remote Sensing, Seismology, Field Geology, etc.

Figure 1 – Looks Good.

Figure 2 – Looks nice.

Figure 3 – Could use lat/long tick marks

Figure 4 - Looks good.

Figure 5 – Nice.

Figure 6 – Good.

Supplemental Material – Could reformat the tables so they don't look like a pure copy paste out of excel and would be easier to use by someone mining data (just text format with tab spacing for instance).

In summary the most important of the issues listed above for me would be:

1. Adding in a bit more of your overall results (shaking estimates, summary of geotechnical impacts) to the abstract.
2. Explaining why lineaments are conflated with active faults regionally.
3. Contextualizing the rupture patterns observed by referencing mapping of other moderate Magnitude surface ruptures and cases where creep has ruptured the

ground (I mostly referred to my own associated work in the PDF comments, but there are likely other cases).

4. Finally, I am not sure how to go about it, but it feels like you could have some more discussion about the various mechanisms that could explain the surface rupture of the conjugate fault in your discussion section. Do you favor triggered slip near the surface due to shaking, propagating aseismic slip, or something else? Seems like it would be hard to propagate seismic slip given the lowish magnitude and depth of the event. Perhaps just a paragraph discussing possible mechanisms would do.

Reviewer B Comments

For author and editor

This manuscript presents a fascinating and unique dataset from a <M 6 surface-deforming earthquake in the central Walker Lane of northern Nevada, and does so in a way that is detailed and largely well-organized. Based on the unique nature of the data alone, this work is worthy of publication. The authors do a good job of putting the event and scientific response into geologic context, and bring up some fascinating implications that I hope spur some fascinating discussions about earthquake geology and scientific response, in addition to furthering our understanding of strain accommodation and the geologic record of seismicity in the Walker Lane. I believe this manuscript is in a good place for publication with only minor changes, and my suggestions below are intended to help accentuate the significance of the work presented by the authors.

My primary suggestion is a reworking and/or reorganization of the Discussion and Conclusions section to emphasize the points the authors make within it. The authors bring up a lot of relevant and interesting points — how this type of rupture might be representative of Walker Lane strain release; the potential reasons there is no obvious preserved record of previous events (or a previously mapped fault trace); the role/significance of surface rupture observations from this size of earthquake in the global catalog of surface rupture observations — but as written currently it reads a bit stream-of-consciousness, and would be more impactful with clear emphasis of the takeaway points. I think this is primarily a structural/organizational point, and leading paragraphs with the takeaway points, rather than those points falling in the middle or end of paragraphs, might be sufficient. A bit of a reorganization might be needed to highlight the significant discussion points.

On a related note, I would like to see a bit more depth to the discussion as it ties this event (and the resulting field campaign) to similar events and similar rapid scientific responses to events. The analogue to Monte Cristo is an intriguing and obvious one, given the apparent similarity in rupture style and similarity in data-guided response (insar in particular). This seems to me to merit at least a few sentences in the discussion rather than the current inclusion only in a list of historic Walker Lane events. I would also be interested in more discussion of what we might take away for future event responses, particularly to events like this one where the magnitude is small enough that we would not particularly expect surface rupture. Should we be mobilizing a rapid field campaign for every Walker Lane

event greater than M 5? Do our modern datasets allow us to find this kind of minute, ephemeral surface deformation associated with M 5 earthquakes outside of the Walker Lane, when we might have missed it before? etc.

I include a short list of line-numbered comments below, all of which are fairly minor.

Thank you for the opportunity to review this manuscript.

Line number comments:

66. Seems a bit strange to dedicate a sentence to this, especially here when you already described the event location in the previous paragraph and have shown it on a figure.

71. Would be helpful to provide a citation for the Wabuska Lineament, and/or more of a description of what it is and what data are used to define it.

77. The tone of the first few sentences here seems a bit odd, more like a newspaper story and less like a journal article. But that may be personal preference.

93. Include figure citation for location of seismic station?

98. Consider paragraph break for where you switch from seismic network to geodetic network?

100. Define acronyms (MAGNET, GAGE) or provide citations

Consider moving lines 92-106 (discussion of network datasets) to results section, as the details of these networks are not really 'Introduction' to the study. I suggest a new subheading in the observations section, after the regional context is provided, or alternatively you might include them under a subheading within the regional context section (though this would isolate the portions of these paragraphs that pertain specifically to this event).

118. Fig.2 extent rectangle on Fig. 1 appears to refer to 2b-2d, rather than 2a? Please clarify.

171. You have already presented some event details above, which felt a bit like 'Observations' to me, albeit not your own field observations. Perhaps the relocation of network description paragraphs described above might help with this... but it also might help to include more subheadings might help to clarify what is where and guide the reader through the manuscript. In this case, maybe add an 'Event Details' section or something along those lines?

180. Consider showing fig 2b-2d extent on fig 2a to minimize confusion, since the footprints of all four panels are not the same.

240. "Aerial" or "areal"? The latter may be technically correct but it seems like you mean the former. Even if you intentionally used the latter, the former seems more appropriate here.

244. Not observable in the DSM, or in the orthophoto?

270. I suggest restructuring the opening sentence of this paragraph to say "We observed bank failures, lateral spread, etc..... which appear to have occurred coseismically and which we interpret as secondary effects of shaking for reasons x, y, and z" or something along those lines.

375. [Evidence of?] “Older faulting” seems like it should be a category of its own, rather than a subheading within “Secondary effects of earthquake shaking.” Or perhaps I am confused about whether I am looking at headings or subheadings. Some clarification is needed on that front in any case.

August 13, 2025

Re: Review rebuttal letter for Seismica manuscript “**The 09 December 2024 Mw5.7 Parker Butte Earthquake: Orthogonal surface fracturing and associated ground disturbances near Yerington, Nevada, central Walker Lane**”

Dear Editor Alex Hatem,

We are pleased to submit our revised manuscript to Seismica and appreciate the thoughtful comments from the reviewers. Please find below detailed responses to reviewer comments from Dr. Nathan Toke (Reviewer A). In addition to the general and line comments in his review, we also adhered to his grammatical and word suggestions in the annotated manuscript. Following the responses to Dr. Toke’s review we provide detailed responses to the review comments from the anonymous reviewer (Reviewer B). We also adhered to all of Reviewer B’s line item suggestions. Our responses are in blue font.

The most important changes address comments by both reviewers in regards to the discussion section. All discussion paragraphs were modified to emphasize the main point in the topic sentence (as suggested by reviewer B). As suggested by Reviewer A, a few sentences were added to explain the Ridgecrest analogy including the occurrence of a left-lateral earthquake prior to a right-lateral earthquake and the static stress changes that led to cross-fault rupture. We added a new paragraph in the discussion to contextualize the observed fracture pattern by comparison to similar patterns generated in other moderate magnitude events. Additionally, we discuss the various other mechanisms that can generate similar patterns of rupture/fracturing including afterslip and/or creep. Finally, we expanded our discussion of multidisciplinary response by adding details on the use of InSAR in the Parker Butte earthquake and the Monte Cristo earthquake responses and the relative merits of field and remote data, reinforcing the need for multidisciplinary responses in the future.

The subheadings in the ‘Observations’ section were simplified (Reviewer B) and now reflect the main elements of the reconnaissance in a more logical order.

Another change that was not pointed out by the reviewers was the modification of ‘surface rupture’ to ‘surface fractures’ throughout the manuscript. We feel this is an important update of the nomenclature used to describe the observed fractures because recent geodetic inversions and Coulomb stress change modeling suggest that the main shock promoted ‘aseismic slip’ on the orthogonal fault plane. This suggests that the observed fractures are NOT coseismic and thus the term ‘surface rupture’ is not appropriate. We feel that ‘left-stepping en echelon fractures’ is better terminology.

If the paper is accepted, we will provide a final version in .tex format in the Seismica template for the Copyediting and Standards team with the final file uploads.

We hope you find our revised manuscript in accordance with the reviews and welcome any further comments.

Sincerely,
Rich Koehler

Responses to Dr. Nathan Toke's review (Reviewer A):

A) Summary of contributions made by this paper:

Koehler et al., contributes valuable documentation of an example of a moderate magnitude earthquake that has a curious case of short and minor surface rupture on a conjugate structure within the Walker Lane area of the western US. The paper documents secondary shaking effects and translates that into local shaking estimates. They also observe and propose that ice cracking patterns in earthquakes that occur at high latitudes, or the correct season may be utilized to infer information about seismic patterns of shaking. They also demonstrate that the inferred main fault trace did not have surface rupture, and they document that this fault has not ruptured in larger earthquakes since at least the last Pluvial late maxima. All these things make the paper valuable and worthy of publication. Overall, the paper is well written as is, but I do point out several minor points of clarification in the attached and annotated PDF of the manuscript.

Thanks for the nice summary review.

B) Specific (small) issues to consider and possibly address:

Title – Add the word conjugate in here, to show that the fault producing the shaking was not necessarily the one that ruptured the ground surface. Here is a possibility: **The 09 December 2024 Mw 5.7 Parker Butte Earthquake, conjugate surface rupture and associated ground disturbances near Yerington, Nevada, central Walker Lane.**

We modified the title as suggested with the exception of the word “conjugate”. The two faults intersect at an angle too high to be defined as a conjugate set based on Andersonian mechanics. In the discussion, we describe how conjugate and orthogonal have been used interchangeably in the literature, and explain that we prefer orthogonal or high angle to describe the interaction of the two planes involved in the Parker Butte earthquake.

Abstract –

Line 36 – it's still unmapped, I suggest saying **on an unmapped ENE-striking fault aligned with...**

Suggestion incorporated. Now says “on an unmapped ENE-striking fault”. We did not incorporate the last part of the comment “aligned with” in the abstract because that is addressed later in the paper. The fault is subparallel to the Wabuska Lineament (6 km north) but not co-linear (does not project directly toward it along the fault trace trend). Thus, we feel that indicating it occurred in the central Walker Lane earlier in the sentence is sufficient to introduce the fault in the abstract.

Lines 38-39 – Consider leading with the fact that the inferred mainshock did not produce surface rupture and then bring up the rupture of the conjugate structure.

Suggestion incorporated. Sentence was rearranged to begin with the secondary effects and lack of surface rupture on the mainshock trace, followed by mention of the minor surface fractures on the orthogonal trace.

Lines 40-42- I suggest adding (here in the abstract) in the estimated ground shaking parameters your study produced from all your hard work documenting the details of the local effects. I also suggest a comment about the impact (or lack thereof) to infrastructure that you also document in the paper.

Sentences were added to the abstract to report the estimated ground motions and infrastructure impacts. Also a slight rewrite of the sentence on line 42 was incorporated as suggested on the annotated pdf.

Introduction

Line 68 and elsewhere PRESENT VS PAST TENSE – be consistent, I'd recommend past tense since the features are fragile and likely not still there: Several places in the manuscript the language of is present tense and then switches to past tense (aftershocks are vs were e.g., line 68) OR (sandblows are vs were sometimes found in clusters Line 356).

Manuscript was updated to reflect past tense and corrected where appropriate.

Lines 71-73 here and elsewhere in the regional context section, lineaments are sometimes used synonymously with active fault. This is somewhat new to me and perhaps a curiosity of the region and how it's been mapped and named in the past and with so many small faults all over the place, but I think the authors could stand to explain the nomenclature up front in the paper (probably in the regional context section) so that readers don't get confused. Normally, I think of lineament as an alignment of linear features that might suggest a fault, but very tentatively.

The Wabuska Lineament is actually the name of a Quaternary active fault in the literature. Thus, the reference that shows its mapped trace and describes its activity was added (as was suggested on the annotated manuscript comments). We clarified the historical use of "lineament" in this case and interpret the "Wabuska Lineament" as a recently active fault. We added a sentence in the regional context section to clarify that the lineaments are actually faults in this area to avoid confusion. Also added the original reference that named the structure (Wabuska Lineament). See statement that was added in comment for lines 151-152.

Line 90 – reference the supplemental materials.

Supplemental Section S1 was referenced here. Also as suggested in annotated manuscript, digital surface model and hillshade was added to the sentence.

Line 104 – why not reference the actual page (it is referenced elsewhere I see).

The link was updated to the actual Parker Butte event page on the Nevada earthquake clearinghouse web site. Previously the link went to the Clearinghouse site but not the event page. Now states “The NBMG launched an event page on the Nevada Earthquake Clearinghouse (<https://nevada-earthquake-clearinghouse-nbmh.hub.arcgis.com/pages/parker-butte-earthquake>) to support field operations.....”

Regional Context...

Line 139 – first two sentences somewhere should say that these normal faults dip to the east.

“east-dipping” was added to the second sentence.

Line 151-152 – See my comment above lineaments (lines 71-73 above).

To clarify the confusion indicated by the reviewer on the difference between “lineaments” and “faults” we added the statement “*These structures have been referred to as lineaments in the Walker Lane literature for decades (Stewart, 1988), however they are clearly faults with evidence for Quaternary deformation (Li et al., 2017).*”

Line 162-164 – Seems like this could be made more direct by getting into the details of the geodetic vs geologic rate budgets (numbers).

Agreed. Added the slip rate numbers to the sentence. We summed the available geologic slip rates across the latitude of the Parker Butte earthquake to estimate 5.4 mm/yr, about 68% of the available geodetic strain accumulation rate. Also added the references from which the rates come from.

Line 167-169 – This seems like a conclusion (out of place summary). Move this to the abstract and to the discussion?

Agreed. This statement was removed. Parts of it were incorporated into the abstract and discussion.

Observations

Line 192 - Surface rupture heading – suggestion to change to: Surface Rupture Reconnaissance and Observations.

Based on reorganization comments from reviewer B, the subheadings were adjusted. We left the sub heading “surface rupture”, but placed it underneath a new subheading (Field Reconnaissance observations). We feel that this captures Reviewer A’s comment here and honors reviewer B’s reorganization suggestion.

Lines 210-212 – reference Figure 2d here and label where Campbell Valley is located on the figure.

Figure 2d is now referenced in text. Campbell Valley was added to figure 2d.

Line 218 – Put lat long tick marks on Figure 3 for consistence and reproducibility.

Lat long ticks were added to Figure 3. For clarity, the GPS coordinates for the endpoints of the observed rupture were also annotated on the figure. The location of Figure 3 is also shown on Figure 2c which is noted in the caption.

Lines 219 – 224 – Great descriptions of the conjugate rupture pattern. I think it could be worth contextualizing these results by referring to other rupture patterns of moderate magnitude SS events. For example, the Parkfield earthquake or creeping fractures on the SAF have been shown to have similar patterns Toke et al, 2006; Rymer et al. 2006, Scott et al., 2020. Also, might be nice to comment here that the rupture could be due to seismic slip or triggered creep given that both types of slip can produce similar patterns on the ground, especially when the surface soils are either super dry (scott et al., 2020 OR if the ground is frozen --- then creeping fractures can look very much like moderate magnitude rupture).

We agree that it is important to contextualize the rupture pattern result. However, this is the results section and not the appropriate location to discuss comparison details (better suited for the Discussion section). We added a brief statement here to indicate that the pattern has been observed in other moderate magnitude events and has been related to coseismic slip and triggered creep. We added a new paragraph in the discussion to further contextualize this result.

Line 275 – I suggest separating the location reference from the figure reference so that people clearly know that the figure refers to all observations discussed in this section and that the location reference is for a particular one.

Suggestion adopted. As suggested on the annotated pdf, Fig 2c is now referenced at the end of the first sentence of the paragraph. The reference with the coordinates of the specific feature (untopped boulders on the playa) mentioned in the text was retained.

Line 299 – replace incised with cut.

Suggestion adopted.

Line 302 – consider defining the term frazil (not probably commonly known by seismology types)

A brief definition was added in parentheses.

Line 346 – Strike vs Trend? I think trend is more appropriate here.

Yes thanks. Trend is more appropriate. Change made.

Lines 369-373 – Feel like you should provide a reference for the 1933 event.

Reference for 1933 event was added.

Older Faulting

Line 389-391 – I'd add a few clarifying words in here to be more precise. I gave suggestions in the PDF annotations.

Thanks. The suggestion on the annotated pdf were adopted.

Line 393 – add significant local to emphasize significance.

Agreed. Now states "...significant local seismic shaking"

Discussion and conclusion

Line 494 – please explain or reference the Ridgecrest analogy for those that are not aware of the details of that event.

A sentence was added to explain the Ridgecrest analogy including the occurrence of a left-lateral earthquake prior to a right-lateral earthquake. A sentence was also added describing the static stress changes in the Ridgecrest sequence that led to the cross-fault rupture. References were also added.

Line 526 – here and in the abstract, I felt that you could specifically call out all the sub disciplines to emphasize their value even more Geodetic Remote Sensing, Seismology, Field Geology, etc.

Agreed. The multiple subdisciplines are now spelled out. Here and in the abstract as suggested.

Figure 1 – Looks Good.

Figure 2 – Looks nice.

Figure 3 – Could use lat/long tick marks

Thanks. Lat/long ticks were added for reference.

Figure 4 - Looks good.

Figure 5 – Nice.

Figure 6 – Good.

Supplemental Material – Could reformat the tables so they don't look like a pure copy paste out of excel and would be easier to use by someone mining data (just text format with tab spacing for instance).

Tables S2-1 and S2-2 were reformatted as tab delimited text as suggested.

In summary the most important of the issues listed above for me would be:

1. Adding in a bit more of your overall results (shaking estimates, summary of geotechnical impacts) to the abstract.

Done.

2. Explaining why lineaments are conflated with active faults regionally.

This issue is somewhat unique to the Walker Lane where the original names have propagated through the literature. We retain the name 'lineament' to honor the original literature. Comment was addressed by adding the original references that named the faults "lineaments" and the references that showed they exhibit Quaternary activity. A statement was also added to clarify: "These structures have been referred to as lineaments in the Walker Lane literature for decades (Stewart, 1988), however they are clearly faults with evidence for Quaternary deformation (Li et al., 2017)."

3. Contextualizing the rupture patterns observed by referencing mapping of other moderate Magnitude surface ruptures and cases where creep has ruptured the ground (I mostly referred to my own associated work in the PDF comments, but there are likely other cases).

Also see response to comment for Lines 219 – 224. We added a new paragraph in the discussion to further contextualize this result.

4. Finally, I am not sure how to go about it, but it feels like you could have some more discussion about the various mechanisms that could explain the surface rupture of the conjugate fault in your discussion section. Do you favor triggered slip near the surface due to shaking, propagating aseismic slip, or something else? Seems like it would be hard to propagate seismic slip given the lowish magnitude and depth of the event. Perhaps just a paragraph discussing possible mechanisms would do.

A paragraph on the various mechanisms that can produce left-stepping fracture patterns similar to what we observed in the Parker Butte earthquake was added including afterslip and creep. Specific examples of each with associated references were described.

Responses to anonymous comments from Reviewer B:

Reviewer B:

This manuscript presents a fascinating and unique dataset from a <M 6 surface-deforming earthquake in the central Walker Lane of northern Nevada, and does so in a way that is detailed and largely well-organized. Based on the unique nature of the data alone, this work is worthy of publication. The authors do a good job of putting the event and scientific response into geologic context, and bring up some fascinating implications that I hope spur some fascinating discussions about earthquake geology and scientific response, in addition to furthering our understanding of strain accommodation and the geologic record of seismicity in the Walker Lane. I believe this manuscript is in a good place for publication with only minor changes, and my suggestions below are intended to help accentuate the significance of the work presented by the authors.

Thanks for the nice comments.

My primary suggestion is a reworking and/or reorganization of the Discussion and Conclusions section to emphasize the points the authors make within it. The authors bring up a lot of relevant and interesting points — how this type of rupture might be representative of Walker Lane strain release; the potential reasons there is no obvious preserved record of previous events (or a previously mapped fault trace); the role/significance of surface rupture observations from this size of earthquake in the global catalog of surface rupture observations — but as written currently it reads a bit stream-of-consciousness, and would be more impactful with clear emphasis of the takeaway points. I think this is primarily a structural/organizational point, and leading paragraphs with the takeaway points, rather than those points falling in the middle or end of paragraphs, might be sufficient. A bit of a reorganization might be needed to highlight the significant discussion points.

This is a good point and we have reorganized and modified the discussion paragraphs to emphasize the main take away points at the beginning of each paragraph. This is in addition to adding a new paragraph to the discussion in response to reviewer A related to the pattern of deformation and the various mechanisms responsible for it.

On a related note, I would like to see a bit more depth to the discussion as it ties this event (and the resulting field campaign) to similar events and similar rapid scientific responses to events. The analogue to Monte Cristo is an intriguing and obvious one, given the apparent similarity in rupture style and similarity in data-guided response (insar in particular). This seems to me to merit at least a few sentences in the discussion rather than the current inclusion only in a list of historic Walker Lane events.

Several more sentences were added to the discussion describing the field mapping response in the Monte Cristo earthquake and the relative contributions of the on-the-fly InSAR analyses in helping find surface rupture. This was also related to the current study of the Parker Butte earthquake emphasizing the need for both field and remote sensing assessments to capture the most accurate depiction of the deformation.

I would also be interested in more discussion of what we might take away for future event responses, particularly to events like this one where the magnitude is small enough that we would not particularly expect surface rupture. Should we be mobilizing a rapid field campaign for every Walker Lane event greater than M 5? Do our modern datasets allow us to find this kind of minute, ephemeral surface deformation associated with M 5 earthquakes outside of the Walker Lane, when we might have missed it before? etc.

More details were added related to how InSAR helped in the Monte Cristo response. We emphasized that not all InSAR lineaments had deformation recognizable in the field, and the more prominent scarps were not shown on the InSAR presumably due the wide zone of deformation. This reinforces the need for both InSAR and field study of moderate earthquakes. Additional text was added reinforcing the need for multidisciplinary responses in the future.

I include a short list of line-numbered comments below, all of which are fairly minor. Thank you for the opportunity to review this manuscript.

Line number comments:

66. Seems a bit strange to dedicate a sentence to this, especially here when you already described the event location in the previous paragraph and have shown it on a figure.

Agree that this sentence is not needed here. Sentence was deleted. Coordinates of the epicenter were added to the caption for Figure 1.

71. Would be helpful to provide a citation for the Wabuska Lineament, and/or more of a description of what it is and what data are used to define it.

This comment was also brought up by reviewer A. As suggested the citation for the naming and characterization of the Wabuska Lineament was added here. Additionally, more details of what the lineament is, how it was named (Stewart, 1988), and the evidence for Quaternary activity (Li et al., 2017) was added to the regional context section.

77. The tone of the first few sentences here seems a bit odd, more like a newspaper story and less like a journal article. But that may be personal preference.

The first few sentences were combined and shortened a bit to modify the tone of the paragraph.

93. Include figure citation for location of seismic station?

Thanks for pointing out this omission. Figure citation was added (Fig 2a). Also the seismic station and label was added to Figure 2a.

98. Consider paragraph break for where you switch from seismic network to geodetic network?

Agreed. Paragraph break was added to separate seismic network and geodetic network descriptions.

100. Define acronyms (MAGNET, GAGE) or provide citations.

The acronyms are now defined in the text. MAGNET (Mobile Array of GPS for Nevada Transtension) and GAGE (Geodetic Facility for the Advancement of Geoscience).

92-106. Consider moving lines 92-106 (discussion of network datasets) to results section, as the details of these networks are not really 'Introduction' to the study. I suggest a new subheading in the observations section, after the regional context is provided, or alternatively you might include them under a subheading within the regional context section (though this would isolate the portions of these paragraphs that pertain specifically to this event).

The discussion of the network datasets was removed from the introduction and moved to a new sub section in the Observations section (Event details from seismic and geodetic networks) that follows the regional context section as recommended.

118. Fig.2 extent rectangle on Fig. 1 appears to refer to 2b-2d, rather than 2a? Please clarify.

Thanks for noting this discrepancy. The rectangle on figure 1 was adjusted to show the extent of Fig 2a. Also, the extent of figs 2b-d was added to fig 2a.

171. You have already presented some event details above, which felt a bit like 'Observations' to me, albeit not your own field observations. Perhaps the relocation of network description paragraphs described above might help with this... but it also might help to include more subheadings might help to clarify what is where and guide the reader through the manuscript. In this case, maybe add an 'Event Details' section or something along those lines?

Similar to comment for line 92-96. The network observations were removed from the Intro and added to the observations section. The subheadings were also updated to reflect each part of the field reconnaissance.

180. Consider showing fig 2b-2d extent on fig 2a to minimize confusion, since the footprints of all four panels are not the same.

Similar to comment for line 118. The extent of figs 2b-d are now shown on fig 2a.

240. "Aerial" or "areal"? The latter may be technically correct but it seems like you mean the former. Even if you intentionally used the latter, the former seems more appropriate here.

Ah yes. Aerial is what was intended. Change made.

244. Not observable in the DSM, or in the orthophoto?

Fractures were not observable under sage brush in both the DSM and orthophoto. Thus statement was changed to “not observable *on the DSM and the orthophoto mosaic*”.

270. I suggest restructuring the opening sentence of this paragraph to say “We observed bank failures, lateral spread, etc..... which appear to have occurred coseismically and which we interpret as secondary effects of shaking for reasons x, y, and z” or something along those lines. Suggested sentence restructuring was incorporated.

375. [Evidence of?] “Older faulting” seems like it should be a category of its own, rather than a subheading within “Secondary effects of earthquake shaking.” Or perhaps I am confused about whether I am looking at headings or subheadings. Some clarification is needed on that front in any case.

Agreed. Heading changed to “Evidence of older faulting”. Headings and subheadings were restructured throughout the Observations section to clarify and improve organization. Now “Evidence of older faulting” is a subheading below “Field reconnaissance observations”.