Review Report

Shnizai and Walker, Detailed Mapping of the Spin Ghar Active Fault System in Eastern Afghanistan Based on Satellite Image Interpretation. TEKTONIKA, 2024.

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1st Round of Revisions

Decision Letter

(14 Aug. 2023)

Dear Zakeria Shnizai and Richard Walker,

First of all, we would like to thank you for your submission to Tektonika. It is fundamental that our community participate to the effort of launching this new journal and we really appreciate your contribution.

The manuscript entitled “Detailed active fault map of the Spin Ghar fault system and related seismicity in eastern Afghanistan” which you submitted to the Tektonika, has now been reviewed. The manuscript fits the scheme of the journal, presents new data and shows interesting observations that help our understanding of the neotectonics of the eastern Afghanistan, a place which is hard to access. However, both reviewers are quite critical and agree that your manuscript needs important revision before we can proceed with it. A reorganization and refocusing is strongly recommended so that the results and discussion can be developed in accordance to a well-developed question in introduction. To make sure your contribution is easy to follow by its audience, you need to show more detailed description of faults and scarps. In addition, some more work needs to be done in the text and figures to make sure that all the details are carefully checked and accurately presented. Detailed comments of the peer reviewers are included at the bottom of this letter. Reviewer 2 has also commented on your manuscript file (you may access their file while connecting to your Tektonika web space) Please consider and take into account all comments and reviewers' suggestions.

Submit your revised manuscript via the TEKTONIKA web site: under your manuscript's record you'll find a box named "revisions" with a way to upload your new files. Please also submit a detailed rebuttal letter explaining how you took into account reviewer's and editorial recommendations, and an additional manuscript version with the changes outlined.

Based on the scope of work suggested by the reviewers, we would hope that the revisions could be completed in approximately two months. If you have any concerns about this proposed timeline, or any other questions about how to proceed, you are most welcome to contact Executive Editor Robin Lacassin and Associate Editor Hongdan Deng.

Once again, thank you for submitting your manuscript to the Tektonika and we look forward to receiving your revision.

Sincerely yours,

Hongdan Deng, Associate Editor

Robin Lacassin, Executive Editor

14 August 2023

Comments by Reviewer 1
(Marie-Luce Chevalier)

Section A: Overview of manuscript

A1) Overall evaluation, general comments & summary

A1.1) Reviewer's comments

A1.1.1) General evaluation and publication suggestion – Required:
This paper investigates an area of E Afghanistan, the Jalalabad basin and Spin Ghar mountains, using remote sensing techniques that highlight the lithology/geology and tectonic structure. The authors show that the basin and mountain front are cut by numerous active oblique (strike-slip/thrust) faults, visible as scarps and deflections, hence the region can experience earthquakes. They conclude by saying that more wok is needed in this remote region, to determine the absolute age of the offset surfaces.

A1.1.2) What does the submission need to be publishable? (select as needed; comment for all cases)

- ☐ No changes required
- ■ Rewriting
- Reorganising
- ☐ More data/figures
- ☐ Condensing
- ☐ Reinterpretation
- ☐ Other

Comments:

In general, I find that too many places mentioned in the text do not appear in any figure. Please make sure you do as it is very hard to follow the description if you are not familiar with the area. I found myself searching for the names mentioned and failing to find it anywhere in the figures. You may either add more figures for each zone you describe, or either find a way to show every name mentioned in the text in at least one figure (and cite this figure when mentioning it in the text).
While the authors are probably familiar with place names, others may not be, and it makes it really hard to follow when you keep looking for places in the figures. Also, the names are written across the figure without an exact location, especially for cities (ok for mountains and rivers). Add a square or something at the exact location in the figures.

Also, please cite figures more often in the text, especially when you describe something. Figure citations in the text are also incorrect at many places. For example, how can one see a NW contraction in Fig. 4? Too many times, the information cited in the text with cited figure is not visible in that particular figure.

Figures are poorly drafted with for example, faults in A and B being different. Boxes within a figure are also inaccurate and not identical to panels. Arrows pointing to features also lack accuracy and do not necessarily point at what the authors want to show.
Too many local names appear vaguely on the figures. Please only keep place names that you mention and remove the un-necessary ones for clarity.

There are numerous typos, grammar, and spelling mistakes throughout the text. Please double check everything.

Why isn't there any field photograph? If you did field work there, it is essential to show photos, not

just satellite images.

Some key references are missing (e.g., Tapponnier et al., 1981, EPSL). In general, I find the number of references insufficient, although I recognize that this is a poorly studied region.

Overall, the paper is too sloppy, with too many inaccuracies and vague statements which makes the paper really hard to follow.
While the authors present image-based evidence of activity along the Spin Ghar fault and the Jalalabad basin, I think a lot more work needs to be done in the text and figures to make the study used by others. Therefore, I have to reject it at this point but believe it will be a good contribution once all details are carefully checked and accurately corrected.

A1.1.3) Can the submission be improved by reducing/adding any of the following? (select as needed; comment for all cases)

- ☐ Text
- ☐ Table
- ■ Figures
- ☐ Supplementary material

Comments:

Many places in the text do not appear in the figures, so maybe adding more figures or better drafting the current ones would help.

A1.1.4) Please complete the following section if you recommend that the submission is NOT appropriate for publication (select as needed; comment if a box is selected)

- ■ Quality is poor
- ☐ Research is not reproducible
- ☐ Other

Comments:

A1.2) Author(s) Responses:

A2) Summary of main merits and main points of improvement

A2.1) Reviewer's comments

The main merits I have found are...

The authors study a region that is hard to access (hence I imagine the lack of field photos, and the entirely image-based research? Please explain) and must be commanded for it. They found numerous active fault traces using remote-sensing anayses, which is a first step towards more accurate field mapping and earthquake hazard assessment. I believe the authors may be able to continue this work in the field in the future and I am looking forward to seeing more photos and detailed measurements (offsets and ages).

The main points of improvement I have found are...

Please see my detailed comments above, which I hope will help the authors improve the clarity and presentation.

A2.2) Author's responses:

Section B: Detailed evaluation of manuscript

B1) Title and abstract

B1.1) Reviewer's comments

The *Title* describes the main topic of the manuscript **accurately** — [NO]

The title mentions seismicity while it only appears in one sentence and one figure of the paper. I would not write that in the title, since the paper mostly focuses on mapping.

The *Title* describes the main topic of the manuscript **succinctly** —[NO]

The *Title* includes **appropriate key terms** — [YES]

The *Abstract* includes a **clear aim and rationale** — [YES] / [NO]

It somewhat does. I would try to rewrite the absract for clarity. Some statements are not the most important.

The *Abstract* supports the rationale with **sufficient background information** — [YES] / [NO]

Can also be improved.

The *Abstract* includes a **well-balanced description of the methods** — [YES]

The *Abstract* describes the **main results sufficiently and adequately** — [YES] / [NO]

Can also be improved.

The *Abstract* clearly describes the **importance/impact of the study** — [YES]

The *Abstract* clearly states the **conclusions of the study** — [YES]

The *Abstract* is **clear** and **well structured** — [NO]

Comments:

B1.2) Author's responses

B2) Introduction

B2.1) Reviewer's comments

The *Introduction* provides **sufficient background and context** for the study — [NO]

The *Introduction* describes the **aim/hypothesis/rationale** clearly, providing **sufficient context** — [NO]

The *objective/hypothesis/rationale* **flows logically from the background** information — [YES]

The *Introduction* describes the study's **objective and approach** (last paragraph) — [YES]

The *Introduction* contains **relevant, suitable citations** — [NO]

The *Introduction* is **organized effectively** — [NO]

Comments:

B2.2) Author's responses

B3) Data and methods

B3.1) Reviewer's comments

The *Methods* are described **concisely and with enough detail** for reproducibility — [NO]

Necessary information about **data sources/acquisition/processing** is included — [NO]

Data used are accessible via either supplementary files or links in the data availability statement — [NO]

The *Dataset and/or Methods* are **organized effectively** — [NO]

Comments:

B3.2) Author's responses

B4) Results

B4.1) Reviewer's comments

The *Results* findings are **supported by data** — [YES]

The *Results* findings are presented **clearly and succinctly** — [NO]

The text in the *Result* section **cites tables and figures appropriately** — [NO]

The *Results* directly **relate to the study objectives** — [YES]

The *Results* present **data for all the approaches** described in the *Methods* section — [YES]

The *Results* **text belongs to the Results section**, not to *Introduction*, *Methods*, or *Discussion.* — [YES]

The *Results* section is **organised effectively** — [YES]

Comments:

B4.2) Author's responses

B5) Discussion and conclusions

B5.1) Reviewer's comments

The *Discussion* is **focused on the objectives** of the study — [YES]

The *Discussion* **addresses all major results** of this study, which are shown in *Results* — [NO]

The *Discussion* section makes **comparisons with other studies** that are relevant and informative — [NO]

The *Discussion* section properly identifies all **speculative statements** — [YES]

The *Discussion* section presents the **implications of the study** persuasively — [YES]

The *Discussion* section **highlights novel contributions** appropriately — [YES]

The *Discussion* section **addresses the limitations** of the study appropriately — [YES]

The *Discussion* section is **organised effectively** — [NO]

More discussion about the seismic risk should be presented.

The *Conclusions* are **consistent** with and **summarise** the rest of the manuscript — [YES]

The *Conclusions* are **supported by the data** in *Results* and **follow logically** from the *Discussion* — [YES]

The *Conclusions* are **clear and concise** — [YES]

Comments:

B5.2) Author's responses

B6) Figures, tables and citations

B6.1) Reviewer's comments

Tables and *Figures* are **ordered logically** and **numbered sequentially** — [NO]

Tables and *Figures* have **captions that explain** all their major features — [NO]

Tables and *Figures* have **captions that complement** the information in the main text — [YES]

Tables and *Figures* present data that **relate** to the study objective — [YES]

Tables and *Figures* present data that are **consistent** with and support the description of results — [NO]

Tables and *Figures* have **succinct and informative titles** — [YES]

Figures are **accessible** (elements are clearly labelled, accessible colour palettes, colour contrasts, font size legible, etc.…) — [NO]

Figures with **maps or cross-sections** contain all **elements to be understood** (north arrow orientation, scale, visible coordinates, sufficient coordinate grid intercepts) — [YES]

Figures with **maps** have **sufficient location information** (in the map or caption) — **[NO]**

Cross-sections have clear labels for **scale and coordinates** at ends and within-section kinks — [YES]

All georeferenced elements are provided in common format (.shp, .geotiff, .kml) [in an open-access repository] — [YES] / [NO] not applicable

Citations throughout are relevant, suitable, and comprehensive — [NO]

Comments:

B6.2) Author's responses

Section C: Additional comments

C1) Minor/line-numbered comments

C1.1) Reviewer's comments

Below are the detailed line by line comments. I hope the authors will find this useful in order to

correct the text and figures.
L21: west-west?

L66-67: “approximately 65 million years ago to present (Late Palaeogene to Holocene) (Quittmeyer and Jacob, 1979; Ruleman et al., 2007)”
This is an interesting choice of references...as it is generally accepted that the collision occurred ~55 Ma ago, not 65 Ma. Please cite more adequate references.

L78: mention what kind of fault is the Chaman fault, whether a recent large EQ occurred, i.e., how active it is, what its slip rate is etc. Just give a bit more details here since it is the most prominent fault of your study region.

L84: “…separates the Konar fault block from the Spin Ghar block (Fig. 1b).”
Indicate the Konar fault block in Figure 1

L107: briefly explain “anaglyph image” for the unfamiliar reader (like me). How it works and what is its advantage.

L147: replace “dormant” by “abandoned”

L178: “light-deep pink and crimson colours”
What is light-deep pink” and what is “crimson color”?

L228: so it is a right-lateral fault?

L233: you probably mean EW, not NS trending

L244: are the thrusts SE-verging or SW-dipping?

L249: Please show the Safed Koh fault and Parachinar syntaxis in Fig 1A.

L258: “rapidly eroding terrain”
What evidence do you have that the region is eroding rapidly? Add erosion rate data and references? Add precipitation values etc. Isn’t that region particularly dry? Hence scarp preservation in bedrock may not necessarily represent recent activity.

L260: replace SW by SE?
Also please double check all the direction/orientation mentioned in the text as I noticed several mistakes.

L265: “the blind thrust faults have at least twice as much horizontal shortening than the mapped faults at the surface”
Please rephrase.

L268: “The active faults are densely distributed on and near the Main Boundary Thrust, and mostly have east-west trending dips”
Please rephrase.

L270: show “Main Boundary Thrust” in figures

L271-275: here you discuss the eastern side of the Sulaiman range but then you conclude on something EW trending and south of Peshawar which is way east. Please rephrase. Also names

mentioned are missing in figures.

L286: Figure 7a only shows a tiny portion of the Spin Ghar fault. What about the rest? Is the remaining part of the fault also clearly expressed in the geomorphology? Do you have any similar figure as 7a to prove it?

L291: cite the appropriate figure here.

L300: “The height of the scarp ranges from <1 m to tens of meters along the basin.”
Please show field photos.

L310: what is the uncertainty on the 600 m offset?

L311: how do you know the age of the fan? Add references.

L314-321: show images or photos of these “cliff-like scarps” and other “clear geomorphic evidence” of the restraining bends

L339: why do you talk about extension if you only have thrusts? You need normal fault for extension

L351: Fig. 9BD does not show fault 3 at all

L356: you mean 9C?

L357: you mean 9C?

L358: N to S in the figure…

L359: please replace “eastwards” by either right-laterally or left-laterally. And also show this in figure.

L364: “The faults have right-laterally displaced alluvial fans by tens to hundreds meters (Fig. 9f-g)”
Please indicate the piercing points in figure + the offset value and uncertainty

L366: “We measured the fault scarp height at ~50 m using the 1-arcsecond SRTM DEM (Figs, 9f-g).”
Show an elevation profile from the DEM that shows this value + its location on the DEM

L376: “Along the fault, we identified scarps no more than a few meters high on alluvial lowlands. This represents freshly broken, back-tilted and warped depositional surfaces.”
Please show in Fig.

L390: “Thus, it is assumed that these scarps are formed through recent faulting events in the study area”
These scarps may be very old if the climate is relatively dry. It could be >10 ka

L391: “deflection to the NE”
Write right- or left-letral

L441: add “green circles”?

L456: “Although the total displacement on these faults is large, but rate of active slip is unknown,

and must be calculated from the division of the accumulated offset (alluvial fan, gullies, etc.) by dating age of the corresponding geological unit in the field."
-I would not consider 900 m as large.
-you could estimate already matching the offsets of assumed Holocene surfaces to estimate a rate.

Figure 1:
-How do you define the "Himalayan Realm" in green?
-Indicate Jalalabad basin
-show international borders
-show Kabul river and river valley
-show Suleiman-Kirthar Folded Region and Hinduraj-Hazar folded region
-show Katwaz trough

Figure 2:
I find it hard to distinguish what the various lithologies are. I find it unclear, too small. Can you maybe draw contours for the different units mentioned? Draw the fault instead of mentioning "fault" with an arrow?
-for "marble and gneiss", I would have mapped many more areas if these are shown by the purple color?
-lava? Do you mean basalt?
-how can conglomerate and sandstone be at the same location as the Q sediments?
-are volcanic rocks the same thing as "lava"?
-the red lines that limit the various regions marked by yellow name are too small. Make thicker.

Figure 3:
Indication in Figs 2 and 3 are not identical…please mark the same things in both figures, point to young alluvial fans etc
-granite is not a volcanic rock
-the fault trace is clear in A and B, more than in C

Figure 4:
-Add names of rivers, cities
-Add main ages of geologic timescale

Figure 5:
-please correct all the typos in the legend
-Why did you choose such extent of your study area (in yellow)?
-Add sense of main faults

Figure 7:
-rectangle in C different from 8D

Figure 8:
-rectangle in A is different from B
-scale missing in B
-600 m offset in B should be taken along the fault, i.e., along a straight line.
-Indicate fault trace better (too transparent) in B and D
-C: keep the N pointing down as in B
-very unclear what C represents
-fault traces in D different from those in Fig 7C (rectangle also different)
-hard to see the correlation between E and F
-where is 8G? show in other map.

-write “pressure ridges” that are described in the text
-in caption, 600, not 6 m

Figure 9:
-in C better point at the offset or beheaded channels as it is not clear what you want to show
-N pointing to wrong orientation in D
-show location of E in other figure
-check frames in A, some are incorrect
-what is the black line in C?

Figure 10:
-Box in A should be BC not AB
-better show the offsets + indicate the values and uncertainties

Figure 11:
- show before/after image
-highlight what you realign exactly with this reconstruction
-A and B are unrelated. I suggest to separate in Fig. 11 and 12
-900±140 m in figure but 1000±100 m in caption…which one is it?

Figure 12:
-circle sizes for earthquakes should be different, according to their magnitude
-indicate fault names and main cities or mountains
-L690: 2017?

Comments by Reviewer 2

(Jérome Van Der Woerd)

(reviewer has also commented directly on the manuscript)

Review of “Detailed active fault map of the Spin Ghar fault system and related seismicity in eastern Afghanistan” by Z. Schnizai and R. Walker.

The study is focused on fault strands cutting through the Jalalabad basin in northeastern Afghanistan, a basin located within the northwestern corner of the India-Asia collision zone. Based on detailed analysis of satellite images, the study results in a map of active faults across the Jalalabad basin, which are then described and tentatively interpreted at regional scale.

The manuscript contains 12 figures of good quality and is easy to read. However, it is not well organized and confused about the real focus of the study. I made comments in the manuscript (using the word editing tool) and have additional comments below. I recommend major revision.

In general, the manuscript gathers and presents an interesting piece of work, namely the resulting geomorphic and active fault map of the Jallabad basin. From this map, it is possible to build an interesting discussion and suggest some major conclusions. Indeed, the position of the Jalalabad basin within a key area of the India-Asia collision zone make it an interesting target to understand how the India convergence is accommodated in northeastern Afghanistan, a place of major faults and plate boundary junction.

The authors need to decide what is the real focus and result of the study. Is it the active fault map? Or is it the development of techniques of Landsat image analysis? What is the area targeted: is it the Jalalabad basin (or the northern piedmont of the Spin Ghar range) or is it all the faults around the Spin Ghar mountain? What is the link between the Safed Koh fault and the faults in the Jalalabad basin? What is the major conclusion: is it the structural sketch of figure 11a (it has been already proposed in other already published papers a long time ago, see for instance Tapponnier et al., EPS, 1981)? Or is the goal to better constrain seismic hazard?

All these goals seem to be addressed in various ways across the manuscript and it is difficult to follow the authors in their reasoning. Some clarifications are needed from the introduction to the conclusion.

My review remains at this stage limited with respect to the core results as the manuscript first deserves some clarification.

The Method section needs to be enhanced. Has been fieldwork performed? If it is the case, then it should be described in the method section. This section also needs a detailed description of how the fault mapping has been performed and what the authors understand with fault, fault system, section, segment, scarp, strand, traces… Throughout the manuscript there is confusion between the fault “system” or a fault in particular. This needs to be clarified.

Section 4.1 is mixing methodology and results, very confusing. Separate all methodology relative to the data processing (band rationing, PCA, etc) and displace it to the method section. Keep only the results relevant to the Jalalabad basin.

Numbering of sections is odd, maybe a result of submission.

Safed Koh fault:

This fault is not located in the Jalalabad basin. This is confusing. Why is this fault studied? All the satellite data analysis is concentrated in the Jalalabad basin, on the northern side of the Spin Ghar

mountains. It is necessary to better introduce the study area and target and explain why the satellite data analysis has not been extended over the Safed Koh fault area.

Discussion.

Authors need to explain why the surface fault mapping implies the suggested geometry at depth, as proposed in figure 11 (see also remarks below).

Figures.

figure 1: plate boundary: what is exactly mapped as the “plate boundary”?

figure 5: fault strands are just red or black lines, with no hierarchy within faults. Which one is a major fault? Which ones are minor? Is it possible to specify which ones are strike-slip, reverse, normal?

Figure 8: try to keep north towards top of figures whenever possible. Same with figure 9.

Figure 11: a) very sketchy section. I guess Indian plate thickness is not a scale, thus make drawing different. Better to draw section at scale with addition of topographic profile above with vertical exaggeration. What is the Konar Fault Block? Is it a fault? Not very clear. Jalalabad basin extension seems to include part of the Spin Ghar mountain, is that so? b) unclear where Neogene fan limits and offsets are restored, add interpretation.

The association of these two sub-figures in figure 11 is odd, I suggest to make 2 different figures.

Figure 12: catalog or catalogue, make a choice. What is the yellow dotted line?

Dear Editors Hongdan Deng and Robin Lacassin,

We are very grateful to you and the two anonymous reviewers for the very thoughtful critique of our manuscript titled "Detailed mapping of the Spin Ghar active fault system in eastern Afghanistan based on satellite images interpretation". We are pleased to say that we have addressed all the concerns raised. The results remain qualitatively the same as our initial findings. We appreciate the time and effort you and the reviewers have spent on providing feedback on our manuscript. We have taken into account all of the suggestions made by the reviewers and incorporated them into the manuscript. Please find the highlighted changes in the attached document along with a point-by-point response to the reviewers' comments and concerns, which have been written in blue colour. In keeping with their suggestion, we have added several statements to the limitations of our study. Please note that the line numbers noted are not the same as were written in the first version of the manuscript. Finally, we are pleased that answer reviewers' questions as below, which are written in blue colour.

Thank you again for your consideration.

Best regards

Zakeria Shnizia and Richard Walker

Authors' responses to review comments of reviewer 1:

We express our sincere gratitude for your invaluable comments and guidance on our manuscript. Your expertise and thoughtful feedback have significantly contributed to enhancing the quality and depth of the manuscript. Your suggestions and criticisms have been valuable in improving the content, structure, and coherence of the manuscript. Your dedication to upholding scholarly standards is evident in the time and effort you put into providing detailed feedback.

We've gone through the manuscript and made corrections to typos, grammar, and spelling mistakes. Additionally, we've expanded the list of references including the Tapponnier et al, 1981. Based on reviewer feedback, we've included extra text, figures, and topographic profiles. Any missed citations for figures have been added, and we've labelled all figures with names on top. Finally, we've removed a confusing section to ensure consistency throughout the text.

Once again, thank you for your valuable contributions. We have incorporated your suggestions and revising the manuscript accordingly. We are excited to submit the revised version, with the goal of producing a polished and impactful piece of research. We provide below the point-by-point responses. Please note that the line numbers noted are not the same as were written in the first version of the manuscript. Finally, we are pleased that answer your questions as below, which are written in blue colour.

L21: west-west?

Authors' Response: Thank you for your comment. We have changed the "west" to "east".

L66-67: "approximately 65 million years ago to present (Late Palaeogene to Holocene) (Quittmeyer and Jacob, 1979; Ruleman et al., 2007a)"

This is an interesting choice of references...as it is generally accepted that the collision occurred ~55 Ma ago, not 65 Ma. Please cite more adequate references.

Authors' Response: Thank you for your valuable feedback. We agree with the reviewer and have brought necessary changes to the manuscript. We also added two other references (Aitchison et al., 2007; Treloar and Izatt, 1993) to the manuscript.

L78: mention what kind of fault is the Chaman fault, whether a recent large EQ occurred, i.e., how active it is, what its slip rate is etc. Just give a bit more details here since it is the most prominent fault of your study region.

Authors' Response: Thanks for reviewing our work. We have added some information about the Chaman fault, including its slip-rate and history of large earthquakes. Here are the details:

"This fault is a significant geological feature located in Afghanistan and Pakistan, which has led to tectonic activity and creation of various geologic structures in the region. The fault is a left-lateral strike-slip fault accommodating tectonic stress generated by the plate collision between Indian and Eurasian plates. Several studies have estimated the left-lateral slip rate of the Chaman fault to range from 5-35 mm/yr (e.g., Crupa et al., 2017; Dalaison et al., 2021; Lawrence et al., 1992; Shnizai, 2020b; Shnizai et al., 2020; Ul-Hadi et al., 2013). Based on the displacement of four geologic features with age from 25-20 Ma, Lawrence et al. (1992) estimated a slip rate of 19-24 mm/yr along the Chaman fault. According to Mohadjer et al. (2010) measurements based on GPS over a period of 7 years showed a slip rate of 18 ± 1 mm/yr. According to studies by Crupa et al. (2017), the fault located at latitude 31.0° N and 31.96° N has a slip rate of 8 mm/yr based on InSAR data. Dalaison et al. (2021) stated that a seismic slip along the Chaman fault is
12 mm/yr with three large distinct aseismic section. Based on beryllium-10 cosmogenic dating of alluvial fans offset by the northern Chaman fault, Shnizai et al. (2020) found that the Chaman fault accommodates at 3.5-4.5 mm/yr of left-lateral strike-slip near Kabul, while south of Afghanistan the slip rate is 33 mm/yr that was estimated by Ul-Hadi et al. (2013). Throughout history, movement of the Chaman fault has caused moderate to large magnitude earthquakes in the region. On July 5 or 6, 1505 a significant earthquake occurred in Kabul causing widespread damage of infrastructures and casualties in Kabul and the surrounding regions. That earthquake had a magnitude of 7.2 and was felt as far as Delhi, India (Quittmeyer and Jacob, 1979). The

Chaman fault has been the site of several other notable earthquakes, including a magnitude 6.5 earthquake near Chaman in 1892, a 6.7 magnitude earthquake in 1975, a 6.1 magnitude earthquake in Nushki 1978, a 7.7 magnitude earthquake in Balochistan in 2013, and a magnitude 6.4 earthquake in Ziarat district of Balochistan (Bilham and Ambraseys, 2016; Quittmeyer and Jacob, 1979; Wheeler and Rukstales, 2005; Yeats et al., 1979) (Fig. 1a)."

L84: "…separates the Konar fault block from the Spin Ghar block (Fig.1b)."

Indicate the Konar fault block in Figure 1

Authors' Response: Thanks form the reviewer. In Fig. 1b, we've marked the Konar Block, Sping Ghar Block, and other blocks with abbreviations that are explained in the caption below.

L107: briefly explain "anaglyph image" for the unfamiliar reader (like me). How it works and what is its advantage.

Authors' Response: We really appreciate the reviewer feedback. We have added information regarding the anaglyph images as below:
"The anaglyph image of the area creates a 3D simulation using both the shaded relief and the DEM data that we were able to visualize in 3D and observe the expression of geomorphology. These glasses have a red lens for the left eye and a cyan lens for the right eye. When the glasses are wear, the red channel (band) of the image will be filtered to only be visible to the left eye, and the blue channel will be filtered to only be visible to the right eye. By using this process, your brain is able to combine two images, which results in a perception of depth.
This allows for the identification of tectonic geomorphic features with great detail."

L147: replace "dormant" by "abandoned"

Authors' Response: Changed it as requested.

L178: "light-deep pink and crimson colours" What is light-deep pink" and what is "crimson color"?

Authors' Response: Thanks for your comment! We've made some edits to the text. The main pink color can range from very light pink to deep pink, depending on the area. We've also corrected the use of "crimson" to refer to a deep red color in the text.

L228: so it is a right-lateral fault?

Authors' Response: Thank you. It is a right lateral dip-slip fault that has both strike-slip and dip-slip motion in the area. The strike-slip motion is the right-lateral and the dip-slip motion is up that is typically smaller than the strike-slip motion.

L233: you probably mean EW, not NS trending

Authors' Response: We appreciate the reviewer feedback. We agree with the reviewer and have changed the NS to EW.

L244: are the thrusts SE-verging or SW-dipping?

Authors' Response: We appreciate the reviewer feedback. We agree with the reviewer and have changed the southeast-verging to southwest-dipping.

L249: Please show the Safed Koh fault and Parachinar syntaxis in Fig 1A.

Authors' Response: We have added the Safed Koh fault and Parachinar syntaxis to the Figs. 1a, b. However, we have removed that section (1.3.1. Safed Koh Fault) based on the reviewer 2 suggestions to ensure consistency in the text and avoid any confusion.

L258: "rapidly eroding terrain"

What evidence do you have that the region is eroding rapidly? Add erosion rate data and references? Add precipitation values etc. Isn't that region particularly dry? Hence scarp preservation in bedrock may not necessarily represent recent activity.

Authors' Response: We have removed that section (1.3.1. Safed Koh Fault) to ensure consistency in the text and avoid any confusion with Spin Ghar fault. Explaining the fault was beyond the scope of our explanation. We're so thankful for the reviewer's feedback.

L260: replace SW by SE?

Also please double check all the direction/orientation mentioned in the text as I noticed several mistakes.

Authors' Response: We have removed the section (1.3.1. Safed Koh Fault), but we have also checked all the direction/orientation mentioned in the manuscript. We appreciated the reviewer suggestion.

L265: "the blind thrust faults have at least twice as much horizontal shortening than the mapped faults at the surface" Please rephrase.

Authors' Response: We appreciate the reviewer feedback. We have removed that section (1.3.1. Safed Koh Fault), but added this sentence to discussion. The edited version is as below:

"In this area, the thrust faults have twice the amount of horizontal shortening compared to the faults that are mapped on the surface."

L268: "The active faults are densely distributed on and near the Main Boundary Thrust, and mostly have east-west trending dips" Please rephrase.

Authors' Response: We have removed that section (1.3.1. Safed Koh Fault).

L270: show “Main Boundary Thrust” in figures

Authors’ Response: The main Boundary Thrust is shown in Fig. 1a.

L271-275: here you discuss the eastern side of the Sulaiman range but then you conclude on something EW trending and south of Peshawar which is way east. Please rephrase. Also names mentioned are missing in figures.

Authors’ Response: We have removed that section (1.3.1. Safed Koh Fault).

L286: Figure 7a only shows a tiny portion of the Spin Ghar fault. What about the rest? Is the remaining part of the fault also clearly expressed in the geomorphology? Do you have any similar figure as 7a to prove it?

Authors’ Response: Thank you for your kind suggestion. We have also shown the Spin Ghar fault other portion in Figs. 6,-9.

L291: cite the appropriate figure here.

Authors’ Response: Thank you for your kind suggestion. We have cited Fig. 7c in the text.

L300: “The height of the scarp ranges from <1 m to tens of meters along the basin.”

Please show field photos.

Authors’ Response: Thank you for your kind suggestion. Sadly, we have not done fieldwork to show here. All the description is based on satellite images interpretation. We have edited the sentence. However, we have also added several topographic profile to the figure 7.

L310: what is the uncertainty on the 600 m offset?

Authors’ Response: The uncertainty is ± 70 and we have added to the text.

L311: how do you know the age of the fan? Add references.

Authors’ Response: We appreciate the reviewer feedback. The age is based on the geological map of the country. Therefore, we have added two references to the sentence.

L314-321: show images or photos of these “cliff-like scarps” and other “clear geomorphic evidence” of the restraining bends

Authors’ Response: We have added a topographic profile (Fig. 7c) for showing cliff-like scarp and Figs. 6c, 8d for exhibiting the restraining bend.

L339: why do you talk about extension if you only have thrusts? You need normal fault for extension

Authors' Response: We have edited the word. We apologize for any confusion this may have caused. Before, we aimed stretch of specific geological deposits throughout time, but we used the word incorrectly.

L351: Fig. 9BD does not show fault 3 at all

Authors' Response: We agree with the reviewer. We have edited citing the figure correctly. We have cited Figs. 9d (Before edited it was Fig. 9e).

L356: you mean 9C?

Authors' Response: Thanks form the reviewer comment. We have removed based your comment in figure. Here, we have cited Fig. 9e.

L357: you mean 9C?

Authors' Response: We have removed the Fig. 9c, but added Figs. 6b, 7d.

L358: N to S in the figure…

Authors' Response: The Rivers flow from south to north. We have edited the text and cited the figure 9a.

L359: please replace "eastwards" by either right-laterally or left-laterally. And also show this in figure.

Authors' Response: We agree with the reviewer. We have edited the sentence and replaced the "eastwards" by right-laterally. We have cited figs 5 and 8e.

L364: "The faults have right-laterally displaced alluvial fans by tens to hundreds meters (Fig. 9f)" Please indicate the piercing points in figure + the offset value and uncertainty

Authors' Response: We appreciate the reviewer feedback. We have shown the offset with uncertainty in the Fig. 9g.

L366: "We measured the fault scarp height at ~50 m using the 1-arcsecond SRTM DEM (Figs, 9f-g)." Show an elevation profile from the DEM that shows this value + its location on the DEM

Authors' Response: Thanks form the reviewer comment. We have added elevation profiles for the fault scarps shown in Fig. 7.

L376: "Along the fault, we identified scarps no more than a few meters high on alluvial lowlands. This represents freshly broken, back-tilted and warped depositional surfaces." Please show in Fig.

Authors' Response: We have also added a figure (Fig.10a) and showing the offset

stream channels.

L390: “Thus, it is assumed that these scarps are formed through recent faulting events in the study area” These scarps may be very old if the climate is relatively dry. It could be >10 ka

Authors’ Response: We totally agree and appreciate the reviewer feedback. The assumption here is that the scarp in the study area is the result of relatively recent faulting that vary depending on the geological context and the specific region being studied from. We have edited and added some more information based on the reviewer comment.

“It is assumed that these scarps are formed through recent faulting events in the study area. The study area has a semi-arid climate, which means there is also a possibility that the fault scarps could be quite old without significant modification. To verify this, it's important to use a combination of methods, including field observation and dating techniques.”

L391: “deflection to the NE” Write right- or left-lateral

Authors’ Response: Authors’ Response: Thanks form the reviewer. We have edited the sentence and added right-lateral as well.

L441: add “green circles”?

Authors’ Response: We have highlighted the green circles in text as well as in Fig 13a.

L456: “Although the total displacement on these faults is large, but rate of active slip is unknown, and must be calculated from the division of the accumulated offset (alluvial fan, gullies, etc.) by dating age of the corresponding geological unit in the field.”

-I would not consider 900 m as large.
-you could estimate already matching the offsets of assumed Holocene surfaces to estimate a rate.

Authors’ Response: We agree with the reviewer and have added the below description to the text. We've calculated the slip rate for the 600 m offset surface, which only belongs to the Middle Pleistocene based on the geological mapping (e.g., Abdullah and Chmyriov, 1977; Doebrich et al., 2006). The 900 m displacement, based on geological mapping, belongs to both the Neogene and Middle Pleistocene. We, therefore, have broadly estimated the slip rate for the 600 m offset surface as below:

“Although the total displacement on these faults is large, but rate of active slip is unknown, and must be calculated from the division of the accumulated offset (alluvial fan, gullies, etc.) by dating age of the corresponding geological unit in the field. However, we have broadly estimated the slip rate by estimating the age of the offset depositions, which we believe to be from the Middle Pleistocene era. During the Middle Pleistocene, the Spin Ghar fault in Sherzad District

(34°14'1.89"N, 69°58'31.11"E) displaced alluvial fan by 600 ± 70 m. Meanwhile, the Chaman fault displaced an alluvial fan in Sayed Abad District of Wardak Province (33°48'48.49"N,68°36'13.32"E) with estimated age 172.0 ± 16.4 to 218.7 ± 21.1 ka based on Beryllium-10 cosmogenic dating (Shnizai et al., 2020). These two alluvial fans are approximately 135 km apart and have the same climate, with less than one degree (25.2') difference in latitude. Based on the age of the offset alluvial fan along the Spin Ghar fault, which is imagined to be between 172-218 ka, we can infer that the slip rate of the sinistral movement is between 2-3.5 mm/yr. Ruleman et al. (2007) estimated that the slip rate for the Spin Ghar fault ranges from 1-10 mm/yr based on the geological displacement of specific landforms in the Quaternary period. This provides general information about the continuity and expression of the fault (e.g., Abdullah et al., 2008; Doebrich et al., 2006). Without knowing the absolute age of the offset alluvial fan, it's impossible to determine the fault slip rates."

Figure 1:

-How do you define the "Himalayan Realm" in green?

-Indicate Jalalabad basin

-show international borders

-show Kabul river and river valley

-show Suleiman-Kirthar Folded Region and Hinduraj-Hazar folded region

-show Katwaz trough

Authors' Response: Thanks form the reviewer. We have edited the figure as well as the figure captions as below:

- We have edited the figure legend and added the below text to the figure caption regarding the Himalayan Realm "Geological history of Afghanistan were defined into the orogenic periods of Variscan, Cimmerian and Himalayan (Siehl, 2017). The Himalayan Mountains were formed when the Indian Plate collided with the Eurasian Plate and caused a shift in the geodynamic setting of south-eastern Afghanistan including the Sulaiman Mountains and Kohistan Arc."
- We have shown the Jalalabad Basin in Fig. 2b.
- We have shown the international borders with orange colour between Afghanistan and the surrounding countries
- We have also shown the Kabul River in Fig. 2b, and edited the "river valley" word in the text. Because the Kabul River and the Kabul River Valley shows the same region, and we therefore edited in text.
- We have shown the Sulaiman-Kirthar Folded Region in Fig. 1a, and the Hinduraj-Hazard Folded Region in Fig. 1b.
- The Katawaz Basin (previously referred to as the trough) are shown in Fig. 1b. We realized that using the term "trough" was causing confusion, so we decided to simplify the text by using "basin" instead.

Figure 2:

I find it hard to distinguish what the various lithologies are. I find it unclear, too small. Can you maybe draw contours for the different units mentioned? Draw the fault instead of mentioning “fault” with an arrow?

-for “marble and gneiss”, I would have mapped many more areas if these are shown by the purple color?

-lava? Do you mean basalt?

-how can conglomerate and sandstone be at the same location as the Q sediments?

-are volcanic rocks the same thing as “lava”?

-the red lines that limit the various regions marked by yellow name are too small. Make thicker.

Authors’ Response: Thanks form the reviewer. We have edited the figure as well as the manuscript as below:

- We've added contour lines to show the different geologic units on top of the figures, and we'vealso drawn some lines instead of arrows to indicate the fault trace.
- So, we just shared an example using Landsat 8 band compositions images. But we agree with the reviewer that marble and gneiss together with other minerals can be mapped in different

  places. The general lithology of the mapped units are marble and gneisses, but it may have many more minerals like biotite, schist, quartzite and others. These deposits are mostly found northern front of the Spin Ghar and eastern front of the Tor Ghar mountains, and we can see them on the geological map (fig. 4). Once we had mapped out our units, we took a look at the geological map of the country and make any necessary adjustments to ensure that the relative ages and compositions of the geological units are accurate.
- From lava we mean volcanic rocks. Based on some geological reports, these are the igneous rocks that have been metamorphosed. Thus, the Metavolcanic rock could be a suitable name for these type of rocks. The specific synonym depends on the exact composition of the rocks and the degree of metamorphism that has undergone.
- Generally, the coexistence of conglomerate and sandstone with Quaternary sediments in the same location is not uncommon in geological terms. It reflects the complex history of sediment deposition, erosion, tectonic activity, and environmental changes that have occurred in a particular area over geological time. In overall, the sediment in the Q1-3 consists of conglomerate, sandstone, gravel, sand, silt, and clay. However, the Q34 and Q4 (Holocene) are made up of loess, fine-grained sediment, and fan alluvium and colluvium. Although we have not conducted fieldwork, I, as the an author of this manuscript, have visited the region several times and have a good understanding of the general lithology of the Jalalabad Basin.
- We've made some edits. These metavolcanic lavas refer to volcanic rocks that have undergone metamorphism.
- We've made some edits to the red lines and updated the names. Additionally, we've added masks

to the names to make them easier to read.

Figure 3:

Indication in Figs 2 and 3 are not identical…please mark the same things in both figures, point to young alluvial fans etc

-granite is not a volcanic rock

-the fault trace is clear in A and B, more than in C

Authors' Response: Thanks form the reviewer. We have edited the figure as well as the manuscript as explained above.

- We totally agree with the reviewer and have edited the things in both figures.
- We also agree with the reviewer and the granite is a type of igneous rock. We have edited thetext.
- Yes, the fault trace is clear in Figs. 3a, b. But the geologic units are much easier to distinguish in Fig. 3C compared to Figs. 3a and 3b. One of out aim is also to prepare a geological map and that is why we used different bands combinations, bands ratio, PCA including this figure instead.

Figure 4:

-Add names of rivers, cities

-Add main ages of geologic timescale

Authors' Response: We appreciate the reviewer feedback. We have added names of rivers and cities to the map. We have also added ages of geologic timescale to the map legends.

Figure 5:

-please correct all the typos in the legend

-Why did you choose such extent of your study area (in yellow)?

-Add sense of main faults

Authors' Response: We greatly appreciate the reviewer's comments.

- We have corrected all the typos in the legend.
- The Spin Ghar fault is a geological feature located in eastern Afghanistan's Nangarhar Province, specifically in the Jalalabad Basin that extends into Pakistan's border region. This fault inside the extent area has played a vital role in the tectonic history of the region, shaping its landscape and geology. It has also contributed significantly to the formation and uplifted of the mountain ranges, including the Spin Ghar and Torghar and inside the Jalalabad Basin (yellow extent). To better simplify the extent of our study area, we have added a yellow extent to the map. Geographically, this area also belongs to a province called Nangrahar, and it fits perfectly within the fault extent.
- We have added sense of main fault on the map.

Figure 7: -rectangle in C different from 8D

Authors' Response: We appreciate your attention in detail. We have edited the rectangle in Fig. 7c (now Fig. 6c) and 8d.

Figure 8:
-rectangle in A is different from B
-scale missing in B
-600 m offset in B should be taken along the fault, i.e., along a straight line.
-Indicate fault trace better (too transparent) in B and D
-C: keep the N pointing down as in B
-very unclear what C represents
-fault traces in D different from those in Fig 7C (rectangle also different)
-hard to see the correlation between E and F
-where is 8G? show in other map.
-write “pressure ridges” that are described in the text
-in caption, 600, not 6 m

Authors’ Response: We really appreciated the reviewer feedback. We have edited the figure as below:

- We have edited location of the rectangle in Fig. 8a and Fig. 8b. The Fig. 8b is from 3D mode, so it seems a bit distorted because different scale at different location of the figure.
- We have added scale to the figure 8b. We used Google Earth 3D images that uses a 3D globe projection, while the 2D image projection is Mercator. The 3D globe projection is more accurate, but it can also make it appear as if the scale is different in different parts of the region. If we zoom in on a place/city in Google Earth 2D, we will see the buildings or other things in great detail. If we zoom in on the same place/city in Google Earth 3D, we will see the buildings and other things in less detail, but we will also be able to see the surrounding terrain and the city from a different perspective. This is because Google Earth 3D is using a different projection and a different levels of detail than Google Earth 2D. Thus, the offset in Fig. 8b looks greater, but in reality it is not.
- We have shown the 600 m offset along a straight line in Fig. 8a.
- We have edited the fault traces in Figs. 8b, d and removed the transparency.
- We have pointed down the north arrow in Fig. 8c.
- Fig. 8c is a SRTM DEM to analyse the offset alluvial surface and fault trace while assessing elevation differences, which provides valuable insights into fault-related processes and landscape evolution.
- We agree with the reviewer and have edited the fault traces in Fig. 8d as well as rectangle Fig. 6c (Before 7c).
- We agree with the reviewer's comments on Fig. 8e and 8f, which are 3D views from Google Earth. As we explained before that it is because Google Earth 3D is using a different projection and a different levels of detail than Google Earth 2D. Fig. 8b is from ESRI 3D uses a different projection and level of detail than 2D, which makes it difficult to correlate E and F. However, in reality, image F is located inside Fig. 8e.
- We have shown the Fig. 8g location on Fig. 5.

- We have also written “pressure ridges” on top of the image
- We have changed the 6 to the 600 m.

Figure 9:

-in C better point at the offset or beheaded channels as it is not clear what you want to show

-N pointing to wrong orientation in D

-show location of E in other figure

-check frames in A, some are incorrect

-what is the black line in C?

Authors’ Response: Thank you for your comments. We have edited the figure as below:

- We agree with the reviewer and have deleted the Fig. 8c (before).
- We have added the North arrow in Fig. 9d.
- We have shown the location of Fig. 9e on top of Fig. 9a.
- We have edited location (frame) for the Fig. 9d (before 9e) on top of Fig. 9a.
- We have removed the fig 9c. In Figure b, the black line represents the presumed active faults. We've provided an explanation in the figure caption and in the legends of Figure 5.

Figure 10:

-Box in A should be BC not AB

-better show the offsets + indicate the values and uncertainties

Authors’ Response: We agree with the reviewer’s suggestion that the box in Fig. 10a is BC (and now Figs. 10d-e).

We have shown the offsets + uncertainties on top of the

figures. Figure 11:

- show before/after image

-A and B are unrelated. I suggest to separate in Fig. 11 and 12

-900±140 m in figure but 1000±100 m in caption…which one is it?

Authors’ Response: We appreciated the reviewer feedback.

- We have shown the image before and after in Fig 12a, b (now).
- We have shown the area that has been displaced by the fault in the Basin.
- We have also separate the Fig 11a (now Fig. 11) from Fig. 11b (now Fig. 11a, b).
- The 900±140 m offset is right and we have edited in manuscript as well.

Figure 12:

-circle sizes for earthquakes should be different, according to their magnitude

-indicate fault names and main cities or mountains

-L690: 2017?

Authors' Response: We appreciated the reviewer feedback. We have made some edits to figure 12, and it is now referred to as Fig. 13.

- That is true and we have edited the figure and added circle sizes based on their magnitude.
- We have added fault names and city names to the figure.
- We agree with the reviewer and this one is 2017.

Authors' responses to review comments of Reviewer 2:

We appreciate the reviewer's insightful feedback, as it has greatly aided in enhancing the quality and comprehensiveness of our manuscript. We are confident that the revisions made have effectively addressed the raised concerns and have strengthened the overall contribution of our work to the scholarly discourse. Your thoughtful comments and suggestions have played a pivotal role in enhancing the quality and clarity of our work. We believe that your contributions have significantly strengthened the overall impact of our work.

The following text has been edited/added the changes that were highlighted in email and inside the manuscript as a track changes. Thank you once again for your invaluable input. Please note that the line numbers noted are not the same as were written in the first version of the manuscript. Finally, we are pleased that answer your questions as below, which are written in blue colour.

Our main focus is on the Spin Ghar active fault system and its mapping that covers the Jalaabad Basin and the northern front of the Spin Ghar Range. "The study focuses to understand the active tectonics of the eastern Afghanistan by interpreting the tectonic geomorphology of the Jalalabad Basin and northern front Spin the Ghar Mountains."

We've provided detailed explanations of the fault strands in the area, and have excluded the Safed Koh fault as it was out of our study range. Figure 11a (now Fig. 12) gives a general structural sketch and constraints of seismic hazards in the Jalalabad Basin. While we cited Tapponnier et al. (1981) in our manuscript, but sadly could not find the exact kind of sketch. Tapponnier et al. (1981) proposed a possible origin of the Pamir-Hindu Kush intermediate earthquakes including the Konar fault. Our schematic section consists of a topographic profile, geological units, faults, and structural based on our mapping.

The Method section needs to be enhanced. Has been fieldwork performed? If it is the case, then it should be described in the method section. This section also needs a detailed description of how the fault mapping has been performed and what the authors understand with fault, fault system, section, segment, scarp, strand, traces… Throughout the manuscript there is confusion between the fault "system" or a fault in particular. This needs to be clarified.

Authors' Response: Thanks for reviewing our work. We haven't done fieldwork, this observation is only based on satellite images interpretation. We have also added information about anaglyph images and other images as below:

"SRTM 1-arcsecond DEM images with 30 m resolution were processed using SimpleDEMViewer software available at http://www.jizoh.jp to create three-dimension anaglyph images, which were interpreted and viewed through red and cyan glasses. The anaglyph image of the area creates a 3D simulation using both the shaded relief and the DEM data that we were able to visualize in 3D and observe the expression of geomorphology. The red and cyan glasses have a red lens for the left eye and a cyan lens for the right eye. When the glasses are wear, the red channel (band) of the image will be filtered to only be visible to the left eye, and the blue channel will be filtered to only be visible to the right eye. By using this process, our brain is able to combine two images, which results in a perception of depth. This allows for the identification of tectonic geomorphic features with great detail. Furthermore, we used shaded-relief, slope, and topographic maps to analyze the landscape and determine if there are any active faults. We also made use of high-resolution optical satellite imagery within the ESRI and Google Earth base maps (https://earth.google.com). Based on this analysis, we created a map of the active and presumed active faults using ArcMap software."

Section 4.1 is mixing methodology and results, very confusing. Separate all methodology relative to the data processing (band rationing, PCA, etc) and displace it to the method section. Keep only the results relevant to the Jalalabad basin.
Numbering of sections is odd, maybe a result of submission.

Authors' Response: We appreciate the reviewer feedback. We have separated the Landsat 8 processing such as band combination, rationing and PCA from result section. We have kept results relevant to the study area geology.

The section numbering would be due to the submission, if no we numbered each section consistently.

Safed Koh fault:
This fault is not located in the Jalalabad basin. This is confusing. Why is this fault studied? All the satellite data analysis is concentrated in the Jalalabad basin, on the northern side of the Spin Ghar mountains. It is necessary to better introduce the study area and target and explain why the satellite data analysis has not been extended over the Safed Koh fault area.

Authors' Response: We totally agree and appreciate the reviewer's observation. We deleted this section (1.3.1. Safed Koh Fault) to ensure consistency in the text and avoid any confusion with Spin Ghar fault. Explaining the fault was beyond the scope of our explanation. Again, we're so thankful for the reviewer's feedback.

Discussion.
Authors need to explain why the surface fault mapping implies the suggested geometry at depth, as proposed in figure 11 (see also remarks below).

Authors' Response: By systematically analysing the information gathered through surface fault mapping and considering it in the broader geological context, we have made inferences about the

suggested geometry of the fault at depth.

Across the Jalalabad Basin, we have created a schematic cross-section that includes a topographic profile, geological units, faults, and structures based on our mapping. We assumed the geometry of the faults at depth based on the fault strike, the presence of offset geomorphic features, and seismicity. The Spin Ghar fault system is made up of a series of parallel reverse and right-lateral fault strands that offset the earth's crust in a step-like pattern, which rotates clockwise due to tectonic plate movement. In the basin, we have also observed several anticlinal structures that have an east-west direction. Therefore, the Spin Ghar oblique fault strands suggest that they are part of a zone of a bookshelf.

Figures.
figure 1: plate boundary: what is exactly mapped as the “plate boundary”?

Authors’ Response: We appreciate the reviewer feedback. This mapped “plate boundary” shows the area where the Indian and Eurasian tectonic plates come together and interact. It shows the main thrust faults and fold belts as we have shown in Fig. 1b.

figure 5: fault strands are just red or black lines, with no hierarchy within faults. Which one is a major fault? Which ones are minor? Is it possible to specify which ones are strike-slip, reverse, normal?

Authors’ Response: We sincerely thank to the reviewer. We have added some text regarding fault classification. Fault classification is based on the present of offset young geomorphic surfaces.

“The faults marked by thick red color are the major faults that has evidence of movement in recent geological time. We observed that the major faults cut all materials. Those faults marked by black color are minor faults that show no clear evidence of recent movement.”

We have also added motion of the fault to the figure 6 (now).

Figure 8: try to keep north towards top of figures whenever possible. Same with figure 9.

Authors’ Response: We absolutely agree with the reviewer, but it's important to note that Google Earth uses a 3D globe projection for its images, while the 2D projection is Mercator. This means that if we change the north towards the top of the figure, the view and scale of the offset geomorphic surface would be difficult to see. We, therefore, use the north toward the bottom that we can easily see the displaced landform without any difficulty in scale and perspective or angle of view.

Figure 11: a) very sketchy section. I guess Indian plate thickness is not a scale, thus make drawing different. Better to draw section at scale with addition of topographic profile above with vertical exaggeration. What is the Konar Fault Block? Is it a fault? Not very clear. Jalalabad basin extension seems to include part of the Spin Ghar mountain, is that so?

Authors' Response: We agree with the reviewer. The figure depicting the earth's crust, including the Indian plate, has no scale and the thickness is based on an assumption. The numbers on top of the schematic section (Fig. 12) indicate elevation above sea level, and thus we only have a horizontal scale. It would have been great if we could also draw the section with a vertical scale, but unfortunately, we don't have enough data to estimate the crust thickness.

The Konar Block is the area between the Spin Ghar and Konar faults, as shown in Fig. 1b. In this case, the Spin Ghar fault strands belong to the Konar fault. The extension of the Jalalabad Basin is mostly related to the Spin Ghar Mountains.

The association of these two sub-figures in figure 11 is odd, I suggest to make 2 different figures.

Authors' Response: We have separated the two figures.

Figure 12: catalog or catalogue, make a choice. What is the yellow dotted line?

Authors' Response: We have changed the "catalog" to "catalogue". The yellow dotted line shows boundary between Afghanistan and Pakistan. We have added the names to the figure.

Authors responses to review comments of Reviewer 2 on the manuscript (as a track changes)

The line numbers correspond to the manuscript after it has been reviewed.

Line 43: This is not what is shown in figure 5: faults are all over the basin and not restricted to the margins.

Authors' Response: Thank you for your valuable feedback. We agree with the reviewer and have edited the sentence. We have changed the "margin" to the "eastern front of the Spin Ghar Mountains".

Line 52: What are fault blocks? Fault system may be more accurate.

Authors' Response: We agree with the reviewer and have changed the text.

Line 69-74: Crust has not only thickened but was also shifted away thanks to strike-slip faulting. Refer to Tapponnier et al., EPSL, 1981.

Authors' Response: We sincerely thank to the reviewer. We have edited the text as below:

"Due to the collision and strike-slip faults, the continental crust in eastern Afghanistan has thickened and shifted, and the surface uplift has led to development of a regional highland, inverting the prior tectonic relief (Shnizai et al., 2022; Tapponnier et al., 1981). Shortening between India and Eurasia continues on structures such as the thrust faults within Sulaiman and salt ranges (Shnizai et al., 2022), which also contain several shear zones and faults trending north-northeast causing horizontal movements along strike-slip faults (Tapponnier et al., 1981)."

Line 80-84: Indicate that the Chaman fault is a srike-slip fault, left-lateral. It does not only separate regions, it accommodates relative block displacements at quite a large rate (references?).

Authors' Response: Thanks from the reviewer. We have described the Chaman fault slip-rate. Based on the first reviewer suggestion, we have also explain the fault structure and large earthquakes that occurred along the fault.

"The Chaman fault is a significant geological feature located in Afghanistan and Pakistan, which has led to tectonic activity and creation of various geologic structures in the region. The fault is a left-lateral strike-slip fault accommodating tectonic stress generated by the plate collision between Indian and Eurasian plates. Several studies have estimated the left-lateral slip rate of the Chaman fault to range from 5-35 mm/yr. (Crupa et al., 2017; Dalaison et al., 2021; Furuya and Satyabala, 2008; Lawrence et al., 1992; Shnizai, 2020; Shnizai et al., 2020; Ul-Hadi et al., 2013). Based on the displacement of four geologic features at 25-20 Ma, Lawrence et al. (1992) estimated a slip rate of 19-24 mm/yr along the fault. According to Mohadjer et al. (2010) measurements based on GPS over a period of 7 years showed a slip rate of 18 ± 1 mm/yr. According to studies by Crupa et al. (2017) and Furuya and Satyabala (2008), the fault located at latitude 31.0° N and 31.96° N has a slip rate of 8 mm/yr based on InSAR data. Dalaison et al. (2021) found that a seismic slip along the Chaman fault is 12 mm/yr with three large distinct aseismic section. Based on beryllium-10 cosmogenic dating of alluvial fans offset by the northern Chaman fault, Shnizai et al. (2020) found that the Chaman fault accommodates at 3.5-4.5 mm/yr of left-lateral strike-slip near Kabul, while south of Afghanistan the slip rate is 33 mm/yr that was estimated by Ul-Hadi et al. (2013). Throughout history, movement of the Chaman fault has caused moderate to large magnitude earthquakes in the region. On July 5 or 6, 1505 a significant earthquake occurred in Kabul causing widespread damage of infrastructures and casualties in Kabul and the surrounding regions. That earthquake had a magnitude of 7.2 and was felt as far as Delhi, India (Quittmeyer and Jacob, 1979). The Chaman fault has been the site of several other notable earthquakes, including a magnitude 6.5 earthquake near Chaman in 1892, a 6.7 magnitude earthquake in 1975, a 6.1 magnitude earthquake in Nushki in 1978, a 7.7 magnitude earthquake in Balochistan in 2013, and a magnitude 6.4 earthquake in Ziarat district of Balochistan (Bilham and Ambraseys, 2016; Quittmeyer and Jacob, 1979; Wheeler and Rukstales, 2005; Yeats et al., 1979)"

Line 85: Which fault is the Spin Ghar fault whihin the "system"?

Authors' Response: Thanks from your feedback. We have highlighted the Spin Ghar fault on top of Fig. 1b.

Line 86: Where is the Konar block: not located in figure 1b. Be more precise, there is confusion between faults, fault systems, and blocks; these are structurally different things.

Authors' Response: Thanks form the reviewer. We have shown the Konar Block on top of Fig.

1b with abbreviation KoB. We have edited the manuscript and have tried to make the text consistent.

Line 91-92: Is the Jallabab basin part of the Spin Ghar block?

Authors' Response: The Jalalabad Basin is mostly part of the Konar Block, and little Spin Ghar Block. We have highlighted it in Fig. 1b and also have changed the text.

Line 95: Which fault system? Does it have a name? Very confusing.

Authors' Response: We really appreciate the reviewer feedback. We missed the fault name. The Spin Ghar Block is bounded in south by the Safed Koh fault. We have edited the text.

Line122: Why is Japan a reference for this area of central Asia? I would have thought of other "commonly used criteria" or studies from Pamir, Tibet or Tian Shan, for instance.

Authors' Response: We totally agree and really appreciate the reviewer feedback. This was only fault classification, and we have edited the text. The classifications are used to assess the likelihood of a fault activity and to prioritize monitoring and research efforts.

Line 200-210: This section is more general context than original results from this study.

Authors' Response: We appreciate the reviewer comment. We agree with the reviewer and have simplified the text. The first paragraph of this section is mostly related to geomorphology of the area, and therefore it is a bit general.

Line 207: Which strike is that?

Authors' Response: Thanks form the reviewer feedback. It is actually mountains orientation or trend. We have edited the text.

Line 211: How is this determined? From the satellite image analysis or from field observations? Nowhere is fieldwork acknowledged.

Authors' Response: That is true that we haven't done any fieldwork yet. We apologize for not citing the references. We've added Abdullah et al. (2008) and Doebrich et al. (2006) as references for the information we used. We appreciate your help!

Line 222: Where is this? Is it the Spin Ghar range to the south?

Authors' Response: Thank you for pointing out this. Yes, it is the Spin Ghar Mountains. We have edited the sentence.

Line 238: What is the Spin Ghar "Ridge"? Is it the mountain to the south of the Jalalabad basin? Figures 1a and 1b do not mention "ridge", but Spin Ghar fault or Spin Ghar fault block.

Authors' Response: Yes, the Spin Ghar Ridge refers to the Spin Ghar Mountain. We have edited the text as well as adding names on Figure 1a, b. Spin Ghar Block is different from Spin Ghar fault. We have also edited this throughout the manuscript. Really appreciate for letting us know about it

Line 239: I thought east-west trending

Authors' Response: We agree and appreciate with the reviewer's observation. Definitely, it

is east-west trending. We have edited the sentence.

Line 246: Arcuate how?

Authors' Response: Thank you for the observation. An arcuate fault scarp that has a curved or arcuate shape that is typically formed by a combination of faulting and erosion. As these both components are dominant in the area, we therefore use arcuate expression. The faulting causes the ground surface to be offset, and the erosion then causes the scarp to become curved.

Line 253: This fault is not located in the Jalalabad basin. This is confusing. Why is this fault studied? All the satellite data analysis is concentrated in the Jalalabad basin, on the northern side of the Spin Ghar Mountains.

Authors' Response: We agree and appreciate with the reviewer's observation. We deleted this section (1.3.1. Safed Koh Fault) to ensure consistency in the text and avoid any confusion with Spin Ghar fault. Explaining the fault was beyond the scope of our explanation. We're so thankful for the reviewer's feedback.

Line 257: This is a confusing description of the Safed Koh fault, which appears to be an ensemble of various fault strands of different nature. More detailed description and precisions are necessary.

Authors' Response: We have removed the section (1.3.1. Safed Koh Fault) to ensure consistency in the text and avoid any confusion. Explaining the fault was beyond the scope of our explanation. We're so thankful for the reviewer's feedback.

Line 260: There are 2 strands of the Gardez fault in figure 5, which one is the right one?

Authors' Response: We agree with the reviewer's observation. We have removed that section (1.3.1. Safed Koh Fault).

Line 271: Now, other faults are added to an already complicated multi-stranded fault zone: what is described? What is the zone of interest?

Authors' Response: This section have been deleted.

Line 274-276: This has nothing to do with the description of the Safed Koh fault: keep these elements for the discussion, if needed.

Authors' Response: We have removed that section (1.3.1. Safed Koh Fault).

Line 276-282: Is this related to the east-west trending Safed Koh fault along the southern slope of Spin Ghar mountain? How can an east-west trending fault have dips to the east or west? I am lost…

Authors' Response: This section have been deleted. We appreciate the reviewer observation.

Line 286: Be precise: is it one fault strand or a fault system? Or a fault zone (with multiple strands)? The reader needs to know what is the target of the section and description.

Authors' Response: We agree with the reviewer suggestion. We have edited the text throughout the manuscript. The Spin Ghar fault is a fault system composed of many different types of faults including strike-slip and reverse faults.

Line 306: One single scarp or several?

Authors' Response: We appreciate the reviewer feedback. It refers to several fault scarps because of different types of strands faulting in the area.

Line 307: One single scarp?

Authors' Response: We have edited the text. It refers to several fault scarps because the Spin Ghar fault consists of multiple strands.

Line 311: Now the fault is a "fault system"…

Authors' Response: Yes, it is "fault system" and there was a mistake in the text. We have edited it throughout the entire manuscript. We apologize for any confusion this may have caused.

Line 314: Now we have a segment? Clarify: strand, system, section, segment, scarp, trces: use the method section to clarify how the mapping and fault classification and interpretation is processed.

Authors' Response: Instead of segment it is a section. We apologize for any confusion this may have caused.

Line 320: One fault strand?

Authors' Response: We appreciate the Reviewer feedback. Yes, it is a fault strand and we have edited the sentence.

Line332: And it is active?

Authors' Response: It could be active because of it has continues lineaments in bedrock as well as close location to the main frontal thrust fault, which are shown in Fig. 1b. The presence of continuous lineaments in the bedrock should indicate ongoing geological activity, such as fault movement. Additionally, the proximity to a main frontal thrust fault suggests that the feature may be influenced by the tectonic forces associated with the fault, further supporting the idea that it could be active. Furthermore, the occurrence of earthquakes in the region can provide additional evidence of ongoing tectonic activity.

Line 340: How is the age determined?

Authors' Response: We appreciate the reviewer feedback. The age is based on the Geological map of the country. We have added two references to the sentence.

Line 396: English.

Authors' Response: We have edited the sentence as below:
"The fault lines are located 4 km east of Tor Ghar Mountain and are marked by the number 7. These lines run parallel to the steep slope of Spin Ghar Mountains"

Line 413: Is this relevant to the present study? Why?

Authors' Response: We appreciate the reviewer feedback. We have edit the paragraph and have added/removed some information from it. We desicribed geology and have also used Landsat 8 data for studying geology and geomorphology. We therefore added some information about the Geology and Geomorphology of the study area. Anyhow, there isn't any research on

active fault and seismicity in Eastern Afghanistan, especially regarding the Spin Ghar fault. The deformation in the study area is due to the movement of the Indian and Eurasian tectonic plates as well as active faults that have caused the compressional and shear deformation in the study area. The deformation have significant impact on the landscape as well as rocks or crust. We, therefore, firstly explain the general deformation in eastern Afghanistan and then came to the Jalalabad Basin where the Spin Ghar fault is located. The basin as well as the Spin Ghar Mountains have experienced more ground uplift and subsidence. We also explained the faults that are located in vicinity of the Jalalabad Basin, to understand the geological context that can act as boundaries or barriers affecting the movement of sediments and even tectonic forces within the area.

Line 414: Which fault strand?

Authors' Response: Thanks form the reviewer. Here we mean all the Spin Ghar fault system and we have edited the sentence.

Line 435: No, 11b is a suggestion, not a demonstration.

Authors' Response: We agree with the reviewer and have edited the sentence.

Line 445: Unclear. Authors need to explain why the surface fault mapping implies the suggested geometry at depth.

Authors' Response: We appreciate the reviewer feedback. We have edited the text and added some extra text for explaining the surface faulting. We cited the reference for the text. By systematically analyzing the information gathered through surface fault mapping and considering it in the broader geological context, we have made inferences about the suggested geometry of the fault at depth. Additional studies using higher-resolution imagery and field investigations are needed to more accurately characterize these faults.

"Across the Jalalabad Basin, we have created a schematic cross-section that includes a topographic profile, geological units, faults, and structures based on our mapping. We assumed the geometry of the faults at depth based on the fault strike, the presence of offset geomorphic features, and seismicity. The Spin Ghar fault system is made up of a series of parallel reverse and right-lateral fault strands that offset the earth's crust in a step-like pattern, which rotates clockwise due to tectonic plate movement. In the basin, we have also observed several anticlinal structures that have an east-west direction. Therefore, the Spin Ghar oblique fault strands suggest that they are part of a zone of a bookshelf."

Line 469: How is this known? What kind of work has been performed in the field to be able to state that?

Authors' Response: We sincerely thank the reviewer. We have not done fieldwork, but this description are based on the geological mapping and reports that have been referenced.

Line 471: But it seems some of the ages are inferred: authors could suggest a rate, even if it is badly constrained from the poor age determination of offset landforms.

Authors' Response: We agree with the reviewer and have added the below description to the

text.

"Although the total displacement on these faults is large, but rate of active slip is unknown, and must be calculated from the division of the accumulated offset (alluvial fan, gullies, etc.) by dating age of the corresponding geological unit in the field. However, we have broadly estimated the slip rate by estimating the age of the offset depositions, which we believe to be from the Middle Pleistocene era. During the Middle Pleistocene, the Spin Ghar fault in Sherzad District (34°14'1.89"N, 69°58'31.11"E) displaced alluvial fan by 600 ± 70 m. Meanwhile, the Chaman fault displaced an alluvial fan in Sayed Abad District of Wardak Province (33°48'48.49"N,68°36'13.32"E) with estimated age 172.0 ± 16.4 to 218.7 ± 21.1 ka based on Beryllium-10 cosmogenic dating (Shnizai et al., 2020). These two alluvial fans are approximately 135 km apart and have the same climate, with less than one degree (25.2') difference in latitude. Based on the age of the offset alluvial fan along the Spin Ghar fault, which is imagined to be between 172-218 ka, we can infer that the slip rate of the sinistral movement is between 2-3.5 mm/yr. Ruleman et al. (2007) estimated that the slip rate for the Spin Ghar fault ranges from 1-10 mm/yr based on the geological displacement of specific landforms in the Quaternary period. This provides general information about the continuity and expression of the fault (e.g., Abdullah et al., 2008; Doebrich et al., 2006). Without knowing the absolute age of the offset alluvial fan, it's impossible to determine the fault slip rates."

Line 474: What about the Safed Koh fault? It is not part of the conclusion?

Authors' Response: Thanks from the reviewer. We simplified the text by removing section 1.3.1, which was about the Safed Koh Fault. However, it's worth noting that the Safed Koh Fault is responsible for bounding the southern boundary of the Spin Ghar Block. Therefore, we have also added some additional information about the Safed Koh fault to the discussion part.

Line 479-480: Still in conclusion? I though the aim of this study is to bring some understanding of the tectonic activity of the faults across the Jalalabad basin.

Authors' Response: We appreciate the reviewer feedback and have edited the text.

Line 630: Not mapped?

Authors' Response: Thanks from the reviewer. We have mapped the Spin Ghar fault strands that was marked by number 1 and 2 in Fig. 6c.

Line 657: What is meant here?

Authors' Response: Thanks for the reviewer feedback!

We've made some edits to the text. When we said "uplifted area," we were referring to hills that were formed when an old alluvial fan was dissected and then uplifted. We've since removed that part from the text.

Line 664: Would be better with North towards top of figure

Authors' Response: We agree with the reviewer, but it's important to note that Google Earth uses a 3D globe projection for its images, while the 2D projection is Mercator. This means that if we

were to change the north towards the top of the figure, the view of the offset surface would be difficult to see. However, if we zoom in on Google Earth 3D, we can get a different perspective on the surrounding terrain, and the current view we used was great.

Line 678: Where is figure 9e?

Authors' Response: We apologize for not displaying the location of Fig. 9e previously and now 9d. However, we have now added its location on top of Fig. 9a for your convenience.

Line 700: Or 900±140 m?

Authors' Response: We're really sorry for wrongly mentioning the offset earlier. We completely agree with the reviewer that the offset is 900 m, which is also indicated in the figure.

Line 715-716: Keep for text or discussion, speculative.

Authors' Response: Thanks for the reviewer feedback!

We've made some changes to the text, discussion, and figure citation.

2nd Round of Revisions

Decision Letter
(1 Feb. 2024)

Dear Zakeria Shnizai and Richard Walker,

The revised version of your manuscript on the Spin Ghar fault system has now been evaluated by one reviewer and our associate editor Hongdan Deng. They both found that your manuscript has been greatly improved. However, before being able to accept your manuscript for publication, we will ask for a final round of minor corrections, mostly to improve the readability of the text and figures. Pay in particular attention to the reviewer's remarks concerning the figures. You'll find below the associate editor's recommendation as well as the reviewer's comments. We would like to receive your revision, together with an answer to the reviewer's comments, within less than a month, thus before March 1st.

Best regards

Robin Lacassin, Executive editor Tektonika
Hongdan Deng, Associate editor Tektonika

---- Associate editor recommendation :

Dear Zakeria Shnizai and Richard Walker,

Your revised manuscript submitted to the Tektonika has been reviewed by Dr. Marie-Luce Chevalier and the Associate Editor. We are mostly satisfied with the authors answers to the comments raised by two reviewers on the previous version. We believe that this paper will make a good contribution to our journal and will definitely help future research in E and NE Afghanistan. However, we still find that the writing and the illustrations need further improvement to increase the readability and consistency. In particular, we suggest the second author, Professor Richard Walker to carefully check the grammar and spelling, which can greatly help to improve the quality of the manuscript. Therefore, before we proceeding for MS acceptance, minor corrections is recommended.

Thank you for submitting your manuscript to the Tektonika and I look forward to receiving your revision ASAP.

Sincerely yours,

Hongdan Deng, Associate Editor

Comments by Reviewer 1
(Marie-Luce Chevalier)

Dear Editor and authors,

I am mostly satisfied with the author answers to my comments and those of the other reviewer.

This paper is in a much better shape than before. The authors have improved the figures and have checked that the names in the text and figures are consistent.

However, many inconsistencies still need to be addressed. Please check again that names are spelled identically throughout the text and figures, that all names are located in at least one figure (+ cite it), and that box extents in figures are correct. As it is, numerous boxes and/or their names are still incorrect.

The authors added figures for clarity, as suggested, which helps understand this poorly known, remote region. I find that some figures can still be improved, and I recommend the authors to really try to simplify them while keeping all the necessary information in it. For example, Figure 1 is even more crowded than before.

Finally, I would highly recommend the second author to carefully check the grammar and spelling, which can greatly be improved.

I therefore recommend minor revisions and I believe this paper will make a good contribution to this journal, and will help future investigations in NE Afghanistan.

Below, I hope that my non-exhaustive detailed comments will help you improve the text and figures.

L43: should be “along the northern front”, not eastern

L113: which date for the M6.4 earthquake?

L126: locate Katawaz basin

L137: define OLI. Or does it mean Thermal Infrared Sensor?

L256: locate highest peaks in Fig 2

L295: SE-dipping thrusts and L300: SW-dipping thrusts. Which one is it?

L310: spelling different from Fig 2

L333: give exact value (22 m?) rather than “tens of meters” which could mean 70 m

L381: names spelling and location

L425: you probably mean parallel to the Tor Ghar Mt no?

L468: indicate that that offset is late Quaternary, not to be confused with geologic offsets

L476: fig 12 not 14a

L487: Fig 14c?

L535: which crust and mantle? Indian? Please add

L540: 900 m is not large at all…

L548: indicate the offset value of the alluvial fans along the Chaman fault for comparison

L552: Note that such age is glacial (MIS-6), hence hard to emplace alluvial deposits. You should discuss this issue. Also why do you only use the 600 m offset and not the 900 m one? You could also suggest a slip rate based on that offset.

Figure 1:
A: I find that figure messier than before
-hard to see the country boundaries
-why is the colored DEM only to the west and not the entire country?
-typos in legend
-hard to see the “Himalayan realm”
-caption: L715-718 do not belong in a caption

Figure 2:
-indicate faults’ sense of motion
-show rivers flowing directions
-no need to detail the elevations like this. A general color scale bar is enough

Figure 6:
-fig 6c should be 7c
-check all other fig numbers indicated here
-check boxes, many are incorrect. For ex 14c

Figure 8:
-typo in elevAtion
-fault scarp is measured vertically, not along the scarp slope
-locate BB’ in Fig 9 rather than Fig 7
-location of CC’ different from that in Fig 9

Figure 9:
-box for 9f in E looks different from F
-G also looks different from that in Fig 6
-CC’ in D is different from that in Fig 8

Figure 10:
-box in A different from B
-clearly indicate where Jalalabad city is

Figure 11:
-B: indicate offsets better by adding arrows at each piercing point
-add uncertainties in C
-caption is incorrect please check
-D: try to increase the contrast and you may find that D and E are very similar

Authors' Response to Comments

Dear Robin Lacassin, Executive editor Tektonika and Hongdan Deng, Associate editor Tektonika

We would like to express our gratitude to you and the reviewer for the encouraging appraisal and valuable feedback that helped us improve our work. We also appreciate the thoughtful critique from you, Associate Editor to Tektonika and anonymous reviewers on our manuscript. We are happy to report that we have addressed all the concerns raised and the results remain qualitatively the same as our initial findings.

We have provided point-by-point responses to each reviewer's comments, which are highlighted in blue. The manuscript has been updated with important information and we have improved the quality of sentences, words and figures that were difficult to understand. In response to the reviewers' suggestion, we have removed and/or added several words and statements to the limitations of our study.

Please note that the line numbers mentioned are not the same as those in the first version of the manuscript "Mapping of the Spin Ghar active fault system in eastern Afghanistan based on satellite image interpretation". The references list includes all the sources cited in the text and is arranged alphabetically by the last name of the first author.

Zakeria Shnizai

---- Associate editor recommendation:

Dear Zakeria Shnizai and Richard Walker,

Your revised manuscript submitted to the Tektonika has been reviewed by Dr. Marie-Luce Chevalier and the Associate Editor. We are mostly satisfied with the authors answers to the comments raised by two reviewers on the previous version. We believe that this paper will make a good contribution to our journal and will definitely help future research in E and NE Afghanistan. However, we still find that the writing and the illustrations need further improvement to increase the readability and consistency. In particular, we suggest the second author, Professor Richard Walker to carefully check the grammar and spelling, which can greatly help to improve the quality of the manuscript. Therefore, before we proceeding for MS acceptance, minor corrections is recommended.

Thank you for submitting your manuscript to the Tektonika and I look forward to receiving your revision ASAP.

Sincerely yours,

Hongdan Deng, Associate Editor

Authors' Response:

Dear Associate Editor Hongdan Deng,

We really appreciate your positive feedback and helpful suggestions, they've definitely improved our work. We really take your constructive criticism and Dr. Marie-Luce Chevalier's feedback to heart. We're happy to report that we've addressed all the concerns raised and our results still support our initial findings.

We've provided detailed responses to each of the comments, which are highlighted in blue. The manuscript has been updated with important information, and we've made improvements to sentences, words, and figures to make them clearer. In response to the reviewers' suggestions, we've adjusted the limitations of our study by removing or adding several words and statements. The second author carefully reviewed the manuscript and made significant improvements to the sections highlighted in blue in the manuscript named "Colour changes-SpingGharFault-revised manuscript.doc". While the changes made by both reviewers to the manuscript are highlighted in red.

Detailed responses to the Associate Editor comments

Line 30: Repetition of the previous sentence?

Authors' Response: We appreciate the feedback and agree with the comment. We have removed that sentence and added the below sentence.

"The Indian and Eurasian plate movements have caused the rock sequences to get folded, faulted, and uplifted, creating the highest mountain ranges (Dhakal, 2015; Shnizai et al., 2023) (Fig. 1). It has resulted in differences in crustal ages and deformation throughout the region"
Line 44-46. Please rewrite the sentence, it is unclear.

Authors' Response: We sincerely thanks to the reviewer. We have edited the sentence as below:

"The Jalalabad Basin is a large basin that is structurally controlled and drained, with a semi-arid subtropical steppe climate (Fig. 1b)."
Line 66. Either tectonic setting or regional geology is ok

Authors' Response: We have edited the title from "Regional tectonic setting" to "Tectonic setting" as requested.
Line 74. Redundancy between Quaternary and Holocene.

Authors' Response: We really appreciate the reviewer feedback. We have changed the word of "shifted" to "uplifted".
Line 127-128. Please rewrite

Authors' Response: We have edited the sentence as below:

"The Katawaz Basin and the Sarobi right-lateral strike-slip fault border the Spin Ghar Block's western side."

Line 251-252. The expression is award, please write

Authors' Response: Thank you for the comment. We have edited the sentence as below:

"From south to north, the region can be divided into two main geomorphological zones: the highland folded Spin Ghar Mountains Range and the Jalalabad Basin"

Line 561. Please reorganise the conclusions and highlight the key conclusions in bullet points, such as (1),(2), (3)...

Authors' Response: We appreciate the reviewer. We have reorganized the conclusion and highlighted the key conclusions in bullet points.

Reviewer #1Comments

For author and editor

Dear Editor and authors,

I am mostly satisfied with the author answers to my comments and those of the other reviewer.

This paper is in a much better shape than before. The authors have improved the figures and have checked that the names in the text and figures are consistent.

However, many inconsistencies still need to be addressed. Please check again that names are spelled identically throughout the text and figures, that all names are located in at least one figure (+ cite it), and that box extents in figures are correct. As it is, numerous boxes and/or their names are still incorrect.

The authors added figures for clarity, as suggested, which helps understand this poorly known, remote region. I find that some figures can still be improved, and I recommend the authors to really try to simplify them while keeping all the necessary information in it. For example, Figure 1 is even more crowded than before.

Finally, I would highly recommend the second author to carefully check the grammar and spelling, which can greatly be improved.

I therefore recommend minor revisions and I believe this paper will make a good contribution to this journal, and will help future investigations in NE Afghanistan.

Below, I hope that my non-exhaustive detailed comments will help you improve the text and figures.

Authors' Response:

We sincerely thank the reviewer for his encouraging appraisal and for the valuable feedback, which has helped us improve our work. We revised the manuscript and agree with the reviewer's assessment of the analysis. We have taken the comment and edited and added/removed text as suggested. We cited figures where were necessary and corrected the

boxes on figures for their location. The second author carefully reviewed the manuscript, significantly enhancing the sections highlighted in blue. While the changes made by you and associated editor to the manuscript are highlighted in red.

L43: should be “along the northern front”, not eastern

Authors’ Response: The reviewer is correct, and we have edited the sentence as below:

“The Spin Ghar fault stretches east-west along the border of the Jalalabad Basin and the Spin Ghar Mountains”

L113: which date for the M6.4 earthquake?

Authors’ Response: Thank you for pointing out this. The date for the magnitude 6.4 earthquake is 2008 and we have added it to the manuscript and the Fig. 1a.

L126: locate Katawaz basin

Authors’ Response: We appreciate the reviver feedback. We have edited the sentence as below:

“The Katawaz Basin and the Sarobi right-lateral strike-slip fault border the Spin Ghar Block's western side.”

L137: define OLI. Or does it mean Thermal Infrared Sensor?

Authors’ Response: Thank you very much for pointing out this. We have define OLI that stands for “Operational Land Imager”.

L256: locate highest peaks in Fig 2

Authors’ Response: We have shown the highest pic in Fig. 2.

L295: SE-dipping thrusts and L300: SW-dipping thrusts. Which one is it?

Authors’ Response: Thank you for pointing this out. It is southeast-dipping thrusts. We have edited the sentences.

L310: spelling different from Fig 2

Authors’ Response: We really appreciate the reviewer feedback. We have edited the text and "Khyber-Pakhtunkhwa" is the correct form of it.

L333: give exact value (22 m?) rather than “tens of meters” which could mean 70 m

Authors’ Response: We have added exact value (80 m) to the text.

L381: names spelling and location

Authors’ Response: Thank you very much pointing this out. We have edited the names as well as the location.

L425: you probably mean parallel to the Tor Ghar Mt no?

Authors’ Response: We agree with the reviewer’s assessment. We have edited the sentence.

L468: indicate that that offset is late Quaternary, not to be confused with geologic offsets

Authors' Response: Thank you very much. We've made the requested sentence edits.

L476: fig 12 not 14a

Authors' Response: We have added Fig. 12 instead of Fig. 14.

L487: Fig 14c?

Authors' Response: We have removed citation of the Fig.14c form the sentence.

L535: which crust and mantle? Indian? Please add

Authors' Response: Thank you very much for the suggestion. It is Indian plate, and we have added to the manuscript.

L540: 900 m is not large at all…

Authors' Response: We agree with the reviewer, but what we have measured is relatively larger compared to other offsets that we have measured in this manuscript.

L548: indicate the offset value of the alluvial fans along the Chaman fault for comparison.

Authors' Response: Thank you. We have added the 800 ± 70 m offset value of the offset alluvial fan along the Chaman fault.

L552: Note that such age is glacial (MIS-6), hence hard to emplace alluvial deposits. You should discuss this issue. Also why do you only use the 600 m offset and not the 900 m one? You could also suggest a slip rate based on that offset.

Authors' Response: We appreciate the reviewer feedback and totally agree. We have added the following sentence to the manuscript based on the geological observations that have been done there.

"According to Abdullah et al. (2008), the Jalalabad Basin is filled with red to variegated continental deposits from the Neogene-Quaternary period, along with fine and coarse terrigenous materials. It also contains a small amount of lacustrine limestones and marls."

However, the alluvial fan complexes in the Jalalabad Basin are among the best preserved in the area and were offset by the fault. To determine if they are glacial (MIS-6), we need a comprehensive investigation combining field observations, sediment analysis, and geological context.

Regarding the 900 m offset, which based on the geologic map belongs to the Pliocene epoch, there is no absolute dating for Pliocene deposits in nearby regions to suggest slip rate for this offset. We believe it's pretty tough and not very reliable to suggest a slip rate for the offset without knowing its age.

L552: Note that such age is glacial (MIS-6), hence hard to emplace alluvial deposits. You should discuss this issue. Also why do you only use the 600 m offset and not the 900 m one? You could also suggest a slip rate based on that offset.

Authors' Response: We think, this is a repeated comment that has been responded before.

Figure 1:

A: I find that figure messier than before

-hard to see the country boundaries

-why is the colored DEM only to the west and not the entire country?

-typos in legend

-hard to see the "Himalayan realm"

-caption: L715-718 do not belong in a caption

Authors' Response: We have simplified the figure and bring necessary changes to it.

-The DEM is for the entire country, but before the transparency was high so it was hard to read it. We have edited the DEM color as well as the transparency.

- We also edited the Himalayan realm transparency to be seen clearly

- We have edited the caption from line 715-718.

Figure 2:

-indicate faults' sense of motion

-show rivers flowing directions

-no need to detail the elevations like this. A general color scale bar is enough

Authors' Response: Thank you for pointing out this.

-We have added the sense of motion to faults.

- We have shown river flowing direction

- While we agree with the reviewer, we have already explained the elevation using numbers in the manuscript. If we remove the elevation, it would be difficult to determine the specific areas and their elevations above sea level.

Figure 6:

-fig 6c should be 7c

-check all other fig numbers indicated here

-check boxes, many are incorrect. For ex 14c

Authors' Response: We really appreciate the reviewer feedback.

-We are extremely sorry for such mistake. We have changed Fig. 6c to Fig. 7c.

- We have checked all the figures indicated in Fig. 6.

- We have also edited the boxes and there location including the Figure 4c, which is now fig. 15.

Figure 8:

-typo in elevAtion

-fault scarp is measured vertically, not along the scarp slope

-locate BB' in Fig 9 rather than Fig 7

-location of CC' different from that in Fig 9

Authors' Response: We are grateful from the reviewer feedback.

-We have corrected the typo and changed the "elevetion" to "elevation".

- We have located the BB' from Fig.7 to Fig. 9d.

- We extremely sorry for wrong writing this the CC' locatetion. The right location is shown in Fig. 7.

Figure 9:

-box for 9f in E looks different from F

-G also looks different from that in Fig 6

-CC' in D is different from that in Fig 8

Authors' Response: We are grateful from the reviewer feedback.

-We have edited location of the figure 9f. We now shown on figure 7c. This is the 3D image, and difficult to show exact location of the figure.

- The location of the Fig. 9G was also edited in Fig.6

- We edited the location of the CC', which is now shown on Fig. 7c.

Figure 10:

-box in A different from B

-clearly indicate where Jalalabad city is

Authors' Response: We sincerely thank the reviewer comment.

-We have edited the box location. Now the box location is shown on Fig. 6.

- We have shown Jalalabad City on top of the Fig. 10a.

Figure 11:

-B: indicate offsets better by adding arrows at each piercing point

-add uncertainties in C

-caption is incorrect please check

-D: try to increase the contrast and you may find that D and E are very similar

Authors' Response: We sincerely thank the reviewer comment.

-We have indicated offsets by adding arrows at each piercing point.

- W have added uncertainties to Fig. 11c.

- We have checked the caption and corrected it.

-The contrast has been increased between Fig. 11d and Fig.11e.

Final decision
(5 March 2024)

Dear Zakeria Shnizai, Richard Walker:

We have reached a decision regarding your submission to тєкtоnіka, "Detailed active fault map of the Spin Ghar fault system and related seismicity in eastern Afghanistan". Our decision is to:
Accept Submission

In your manuscript, I noted few remaining typos and minor English wording or syntax issues. Not enough to ask for another round of revision though, but I recommend a very careful copy-editing process as well as serious proof reading by you BOTH authors. You will also need to add "author's contribution" and "data availability" sections at the copy-editing stage. To help for production, be also ready to provide a .bib file with all references (extracted from your reference manager).

Thanks for submitting to Tektonika
Best Regards

Robin Lacassin EE Tektonika
Hongdan Deng AE Tektonika