Solid Earth Discussions

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Reply on RC1

Abeer Al-Ashkar et al.

Author comment on "Tectonic Geomorphology and Paleoseismology of the Sharkhai fault: a new source of seismic hazard for Ulaanbaatar (Mongolia)" by Abeer Al-Ashkar et al., Solid Earth Discuss., https://doi.org/10.5194/se-2021-91-AC1, 2022

Dear Daniela Pantosti,

We start with our best wishes for 2022 and good health.

All the co-authors thanks you very much for your detailed review of our submitted paper about Sharkhai fault, the propositions of correction and the comments that allowed us to clarify, correct and improve our first submission.

All the correction you proposed in the PDF have been included in the new version. Thank you for this detailed review.

Here under, you will find our answers to each of your general comment and to two specific comments in the PDF. There is no opposition and we agree with them.

Answers to general comments.

- Comment D. Pantosti: English language needs some improvements.

Answer: all the suggestions have been included. A complete review on the English language has been done as well.

- Comment D. Pantosti: At the beginning of 2021 a paper from Suzuki et al was published on SRL and shows the presence of a fault located very close to the capital city named Ulaanbaatar fault. On the basis of tectonic geomorphology and trenching the authors show that this is an active fault threatening this part of Mongolia. The Ulaanbaatar fault is not discussed in your paper nor reported in your maps. However, I strongly recommend to integrate the Suzuki et al data and discuss convergences or divergences between the results and interpretation to provide a more complete view of the hazard for the capital city and surroundings.

Answer: We include in the corrected version of our paper the recent work of Suzuki et al. 2020. This "Ulaanbaatar fault" is discussed in the "introduction and context" part with

other known faults. We also added it to the new Figure 2 (results of the merging of initial figure 2 and 3 as proposed by D. Pantosti)

- Comment D. Pantosti: Since a few years the scientific community as adopted the use of Common Era – CE/BCE to replace AD and BC. Please change accordingly.

Answer: All the dates have been changed to the common Era- CE/BCE.

- Comment D. Pantosti : I cannot reproduce the interevent interval 2080+-470 from the ages of MRE and PE. Maybe I have lost something. MRE can have occurred anytime between 775CE and today, or better the year in the Mongolian history from which an earthquake along this fault would have been reported in the historical documentation. In Europe this can be 1600-1700 CE. What about Mongolia? Can 1800 be the oldest age for an earthquake to be recorded in historical documentation in Ulaanbataar? It is true that the town was established there in 1778? Can we assume that any earthquake after that date should appear in some historical documentation? If this is correct the MRE can have occurred anytime between 775 CE and 1778 CE. Thus, this is the range to be used for interevent calculation along with 1605-835BCE for the PE. On this basis the interevent can be as long as 3383 and as short as 1610 years. Your interval appears much smaller: 1610-2550 yr All the calculation derived from the interevent estimate should be refreshed.

Answer: The comment is right. We checked the oldest age for an earthquake to be recorded in historical documentation. We can consider 1778 CE as the oldest age for an earthquake in the region of Ulaanbaator. The calculations of interval time are corrected, the minimum is 1610 yr. and the maximum is 3383 yr., thus yields an average interval time of 2496 ± 887 years. The induced values of slip rate estimates are also corrected (paragraphe 4.2 Magnitude, co-seismic displacement and slip rates).

- Comment D. Pantosti: The morphologic evidence of the fault sections should be better explained, what are the geomorphic elements that support the reconstruction of the fault trace? These should be discussed and also highlighted in figures (as for example in fig 11).

Answer: Drainage offsets are the main geomorphological features observed along the Sharkhai fault, in addition to small scarps of about 50 cm height along the northern section (trench site Figure 14). Between them, we can follow more or less the fault traces in the HR images and on the field a "lineament" at surface, related to the eroded fault trace, locally associated to smoothed scarp or a change in the slope (see new figure 4). Outside HR images or field observations, the fault is very difficult to follow or even detect. (see complements in text).

- Comment D. Pantosti: Figures are too small and resolution increased.

Answer: The figures in PDF have a reduced resolution. All the figures will be provided with the highest resolution for the final version.

- Comment D. Pantosti: Figures 2 and 3 should converge in one single figure with geology draping the topography

Answer: We merged initial figures 2 and 3 (the topography and the geological context of The Ulaanbaatar region and the active faults) in the new Figure 2. All the other figure numbers have been corrected

- Comment D. Pantosti: Figure 4 should show the fault without covering it with a black line. I would recommend to remove the line and use arrows to point to the fault. As it is

now it is impossible to recognize the fault geomorphic expression. A better version of the fault trace is presented in figure 13. I would suggest that these two figures are merged to make a single one composed of two panels: 1) a good DEM highlighting the geomorphic elements used to recognize the fault trace (using arrows and symbols not covering the fault) and 2) the fault trace with all possible details always on the DEM. Consider that this figure should be at the beginning (eg fig 4) because it is critical to the description of the fault sections.

Answer: The figure 4 is modified as requested, the new one (called now figure 3) is composed of two panels: one with a good DEM without fault trace and the second with the details.

- Comment D. Pantosti: Figures 5-10+12 are nice reconstructions of offset streams to measure offset. I think that part of these should go as supplementary material to leave space to field photos showing the fault, its geomorphic evidence and setting. I would also recommend to extend the summary table 1 including site name and coordinates, measured offset and type/age of sediments recording the offset. Moreover, the estimate of uncertainties appear well too small. You should consider first the resolution of the images, then max and min measure of offset with their own uncertainty (that should be calculated by correlating stream axis with different trends especially when streams are not perpendicular to the fault and have a windy geometry). Therefore, all these uncertainties sum up in the cumulative offset evaluation.

Answer: Some figures are displaced in supplementary material. The table 1 has been extended with the information requested except for the type/age of sediments recording the offset that has not been studied in this work. The uncertainties are re-estimated considering the resolution of the images (see details in text and legend of figures).

- Comment D. Pantosti: Figure 14 contains some details on the complexity of the fault trace I was asking to show in the chapters describing the fault. However, the scale is still not adequate for these fine complexities (ex.: I cannot see the changes in strike), some field remote sensing evidence should be shown as in fig 11.

Answer: These details in the mapping have been removed from figure 14 as they are very local complexity of fault traces (at metric scale) and they do not bring fundamental information for our results and the mapping of the fault.

- Comment D. Pantosti: Figure 15 g. Add units names in the log

Answer: The unit names have been added.

Answers to specific comments included in the PDF version of the reviewed paper.

- Comment D. Pantosti line 12: Part of it was already reported in Suzuki et al as Saharai fault? Is correct? see fig 1

Answer: The Sharkhai fault reported by Suzuki et al. (fig 1 of their paper) at very small scale is based directly on our work and preliminary results (Al-Ashkar et al., 2013 and Schlupp et al., 2013) on Avdar and Sharkhai faults. Our work is not cited in the legend of their figure 1 but well cited in their text.

- Comment D. Pantosti line 256: this age is meaningless, any age younger than the age of the industrial time cannot be considered. Just for your information the living roots

are removed in the lab by acids during the preparation of the sample. Just do not consider this measure as reliable and use sample

Answer: It seems it was a confusion. The age was BP and not AD, therefore it was not associated with industrial time but to 45 ± 80 CE. We clarified in the text the part related to the roots which was not the idea understood.

Thank you again for the review.

With kind regards,

The co-authors