

Solid Earth Discuss., referee comment RC1
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Comment on se-2021-91

Daniela Pantosti (Referee)

Referee 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-RC1>, 2021

The paper by **Al-Ashkar et al.** entitled Tectonic Geomorphology and Paleoseismology of the Sharkhai fault: a new source of seismic hazard for Ulaanbaatar (Mongolia), describes and characterizes, from a seismogenic point of view, an active fault located south Ulaanbaatar, the capital city of Mongolia. Large earthquakes are well known in the western part of Mongolia but recent papers have shown that, even if of smaller Magnitude, earthquakes may hit the capital area and be deadly.

Therefore any contribution to the understanding of the seismic potential of this part of Mongolia where more than half of the country population is concentrated, represents a valuable information. The knowledge of faults that may generate an earthquake is a critical ingredient to estimate the seismic hazard of a region and to prepare scenarios of occurrence to direct prevention and preparedness actions. So this paper is a scientific contribution to science and society. The paper is based on tectonic geomorphology and paleoseismology approaches including up to date techniques. The presentation, both text and figures can be improved to make it more immediate and friendly for the reader. The calculation of the interevent time needs some revision and all the other calculations/estimates (e.g., slip rate, coseismic slip) needs full explanation of the data used.

I have annotated the MS and summarize below the general comments.

- English language needs some improvements.
- 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.

- Since a few years the scientific community has adopted the use of Common Era – CE/BCE to replace AD and BC. Please change accordingly.
- 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.
- 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).
- Figures are too small and resolution increased
- Figures 2 and 3 should converge in one single figure with geology draping the topography
- 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.
- 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.
- 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.
- Figure 15 g. Add units names in the log

Please also note the supplement to this comment:

<https://se.copernicus.org/preprints/se-2021-91/se-2021-91-RC1-supplement.pdf>