

**Referee Report** on "*Modeling Seismic Hazard and Landslide Potentials in Northwestern Yunnan, China: Exploring Complex Fault Systems with Multi-segment Rupturing in a Block Rotational Tectonic Zone*"

**Summary:**

The paper entitled "*Modeling Seismic Hazard and Landslide Potentials in Northwestern Yunnan, China: Exploring Complex Fault Systems with Multi-segment Rupturing in a Block Rotational Tectonic Zone*" is authored by Jia Cheng, Chong Xu, Xiwei Xu, Shimin Zhang, and Pengyu Zhu. The affiliations are the School of Earth Science and Resources, China University of Geosciences (Beijing), and the National Institute of Natural Hazards, Ministry of Emergency Management of China, both located in Beijing, China. The corresponding author is Jia Cheng.

**Strengths and Novelties:**

The study addresses a significant gap in understanding the seismic hazards in the Northwestern Yunnan Region (NWYR) by focusing on the complex fault systems and their potential for multi-segment rupturing. The integration of fault slip parameters and the assessment of multi-segment rupturing risks using four potential models is particularly innovative. The analysis identifies Model 1, which focuses on multi-segment rupture combinations on single faults, especially the Zhongdian fault, as the most suitable for the NWYR. This model is validated by the alignment of modelled seismicity rates with fault slip rates. The use of peak ground-motion acceleration values, calculated with a 475-year return period, and their correlation with fault distribution provides a detailed understanding of the seismic hazard landscape. Furthermore, the study's simulation of landslide occurrence probabilities, using peak ground-motion acceleration distribution maps, highlights the intricate interplay between multi-segment rupturing hazards and regional geological dynamics. This integration of seismic hazard modelling with landslide probabilities is a notable strength of the paper.

**Weaknesses and Areas for Improvement:**

While the study is comprehensive, there are several areas that require improvement to enhance the manuscript's quality. Firstly, the introduction could benefit from a more detailed literature review to contextualise the current study within the broader field of

seismic hazard analysis. Secondly, the methodology section, although detailed, could be more clearly structured to ensure readers can easily follow the complex modelling processes. Additionally, while the study highlights the importance of fault segmentation and multi-segment rupturing, it would benefit from a more explicit discussion of the limitations of the models used and the assumptions made during the simulations.

### **Constructive Criticism and Suggestions for Improvement:**

To improve the manuscript, the authors should consider incorporating the following suggestions:

1. Expand the literature review to include more recent studies on seismic hazard analysis and multi-segment rupturing to provide a comprehensive background for the research.
2. Clarify the methodology section by breaking down the modelling process into more distinct sub-sections, each with clear headings and explanations.
3. Discuss the limitations of the study in greater detail, particularly the assumptions made during the modelling and their potential impact on the results.
4. Include a section on future research directions, highlighting how the current study could be expanded or refined with additional data or more advanced modelling techniques.

### **Research Gaps:**

The paper identifies the lack of comprehensive seismic hazard models that integrate fault geometry and segmentation with historical seismicity rates as a significant research gap. While the study makes a substantial contribution towards filling this gap, further research is needed to validate the models used and to explore the potential for other fault systems to exhibit similar multi-segment rupturing behaviour. Additionally, the impact of climate change on landslide probabilities and seismic hazards in the region could be an important area for future investigation.

### **Missing References:**

Several relevant references are missing from the current manuscript. These include recent studies on seismic hazard analysis, fault segmentation, and multi-segment rupturing. Incorporating these references would provide a more comprehensive context for the research and strengthen the validity of the study's findings.

Furthermore, I would like to kindly suggest that the authors incorporate references to a few previous studies that seem to have been overlooked. For instance, the phenomenon of multiple ruptures has been applied to the problem of tsunami generation, as demonstrated in the following article: Dutykh, D., Mitsotakis, D., Gardeil, X., & Dias, F. (2013). On the use of the finite fault solution for tsunami generation problems. *Theoretical and Computational Fluid Dynamics*, 27(1–2), 177–199. <https://doi.org/10.1007/s00162-011-0252-8>. Additionally, probabilistic methods have been applied to tsunami hazard assessment, as illustrated in the manuscript: Rashidi, A., Shomali, Z. H., Dutykh, D., & Keshavarz Farajkhah, N. (2020). Tsunami hazard assessment in the Makran subduction zone. *Natural Hazards*, 100(2), 861–875. <https://doi.org/10.1007/s11069-019-03848-1>. It would be beneficial for the authors to examine the approaches utilised in the tsunami wave community and compare them with the methodologies applied in their study of landslide hazards. Incorporating these references will not only strengthen the context of the research but also provide a broader perspective on multi-segment rupture phenomena and probabilistic hazard assessment.

### **Language and Grammar Corrections:**

The manuscript contains several language and grammar errors that need correction. Here are some identified issues:

1. Page 3, Line 45: "the Eurasia Platea" should be "the Eurasian Plate."
2. Page 3, Line 46: "Plateau world highest" should be "Plateau, the world's highest."
3. Page 5, Line 80: "diverse rupture behaviors contributes" should be "diverse rupture behaviors contribute."
4. Page 6, Line 108: "resulting in notable errors" should be "resulting in significant errors."
5. Page 8, Line 160: "increased precision and reliability" should be "increasing precision and reliability."

**Conclusion:**

In conclusion, the paper presents a valuable contribution to the understanding of seismic hazards and landslide potentials in the Northwestern Yunnan Region. However, several areas need improvement, particularly in terms of literature review, methodology clarity, and addressing limitations. By incorporating the suggested revisions and adding the missing references, the authors can significantly enhance the manuscript's quality. I recommend a revision of the paper to address these points.

This report is intended to provide constructive feedback to the authors to help them improve their work and to ensure that the manuscript meets the high standards required for publication in the Natural Hazards and Earth System Sciences (NHESS) Journal.