EGU21-13776
https://doi.org/10.5194/egusphere-egu21-13776
EGU General Assembly 2021

Dynamic process and failure mechanism of rammed building structure subject to debris flow

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The failure mechanism of building structure is important for quantitatively assessing vulnerability of elements at risk, which is a critical step in risk assessment of debris flow. Scholars have recently made great processes in the researches on debris flow hazard effects and vulnerability of elements at risk. Statistical analysis methods have widely used to analyze field survey data and build vulnerability functions. Based on numerical simulation and model experiment, structural dynamic response process was analyzed to evaluate structure vulnerability. However, due to the lack of quantitative relationship between the debris flow hazard-forming mechanism and the dynamic response of building structure, it is essential to analyze the dynamic response characteristics and process of building structure subject to debris flow, which would play an important guiding role in disaster prevention and disaster mitigation.

Through hazard field investigation, the failure modes of rammed earth building caused by debris flow were summarized as burying, scouring and impact. Figure 1 shows the debris flow hazard in Jiende Gully, Liangshan. In addition, by using the finite element analysis method, the structure model of rammed earth building was established to simulate to the impact process of debris flow on the structure. During the dynamic failure process of rammed earth building shown in Figure 2, the failure types of building wall impacted by the debris flow mainly presented at crushed failure of the impact point, tensile failure of the inside wall and shear failure of the corner. Then debris flow destroyed the gable wall, rushed into the room, and broke the doorway, which resulted in damage of the longitudinal wall. Moreover, the response characteristics and failure mechanism of rammed earth buildings under the impact of debris flow further show that the integrity of rammed earth building is poor and the development of cracks cuts off the propagation path of stress, which effectively protects other walls. The transform-shape locations of the rammed earth building including were initially destroyed at the points of the wall foundation, corners of wall and the points impacted by big rocks of debris flow. Therefore, the reinforced measures on the locations where stress suddenly changes, such as wall foundations and wall corners should be paid more attention to protect rammed structure of buildings.

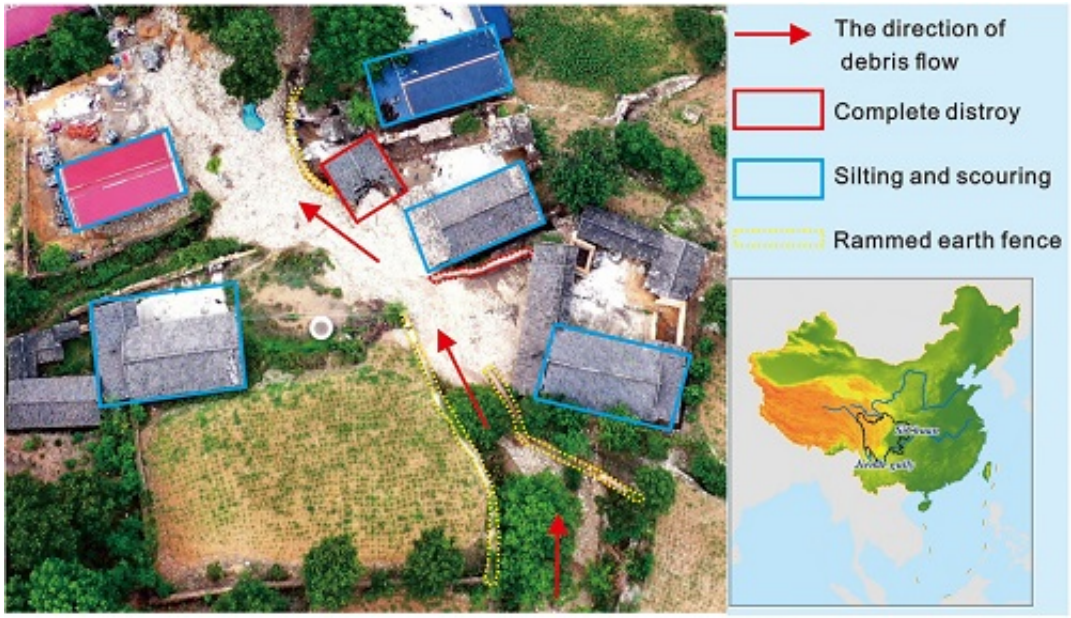

Figure 1 Buildings in alluvial area of Jiende Valley