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A coupled hydrological and hydrodynamic modeling approach for estimating rainfall thresholds of debris-flow occurrence

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Supplement

We conducted a statistical analysis of the rainfall characteristics in the study area. Historical rainfall records were obtained from the nearby Xixia weather station, which is approximately 1.2 km away from the study site. Fig. S1 compares the rainfall intensity records obtained at the study site and the Xixia station, clearly indicating that the spatial variability of rainfall between the two sites is not significant. This finding is further supported quantitatively by calculating the Nash-Sutcliffe coefficient (EI) for the two datasets, which yielded a value of 0.82. This indicates that the rainfall characteristics observed at the Xixia station are similar and relevant to those at the study site.

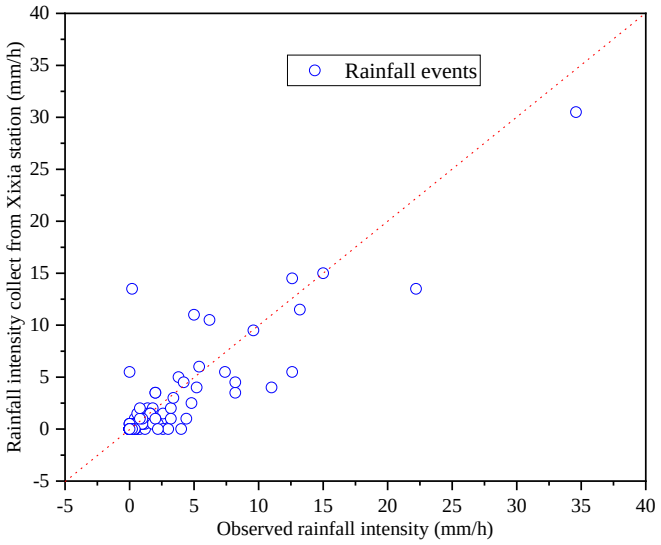

Fig.S1 Comparisions between observed rainfall intensity and rainfall intensity from Xixia station

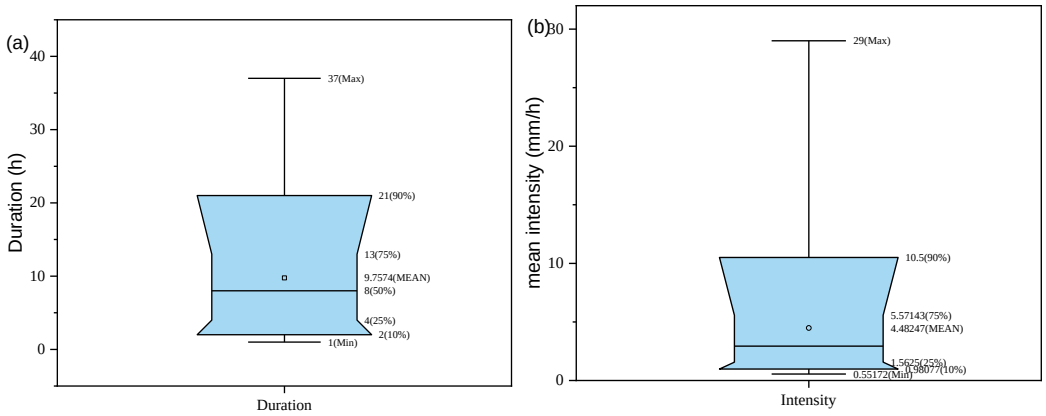

Fig.S2 Statistical analysis of the rainfall features: (a) rainfall duration (b) rainfall intensity

Then, further analysis was conducted on the 4 years of rainfall records between September 2014 and March 2018, based on the data recorded at the Xixia station. A total of 167 rainfall events were identified, and the distributions of duration and mean intensity for these 167 events are shown in Fig. S2. The results reveal that the mean duration of these events is 9.7 hours, and the mean intensity is 5.5 mm/h. This indicates that the occurrence frequency of short-duration and high-intensity events is rare in the study area. Most of the rainfall events in the study area fall under the moderate to long-duration category. Therefore, the authors believe that the two groups of calibration parameters, namely short-intense and others, are sufficient to cover all types of rainfall events in the study area.