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Changes in rainfall thresholds for debris flow initiation and run-out on a local and regional scale in the Wenchuan earthquake area, SW China.

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For the development of early warning systems for the initiation and run-out distances of debris flows, to avoid or mitigate intolerable risks, it is necessary to assess rainfall thresholds. However one must be aware that these thresholds can change. These changes can be ascribed to environmental and climate change as well as socio-economical changes. In the Wenchuan area in the Sichuan Province, SW China, changes in thresholds are related to a depletion of source materials for these debris flows.
The intensive Earthquake of 2008 in the Wenchuan area generated many co-seismic landslides, which delivered a lot of loose source material. It caused a dramatic increase in debris flow occurrences in the subsequent years. A preliminary model was designed, with entrainment processes driven by run-off water as the main triggering mechanism, to describe the relationship between rain input and debris flow run-out with the intention to assess rainfall thresholds for the start of debris flows and critical run out distances. The model was calibrated on the depositional volumes of debris flow events which occurred in individual catchments in August 2011. The calibrated model was used to construct rainfall intensity –duration threshold curves. These curves describe the thresholds for a critical run-out distance, determined by the outlet of the catchment, which was considered as the limit beyond which elements at risk situated in the main river plain are threatened. The research is focused on the change in these thresholds curves after a range of consecutive debris flow triggering rain events. It appeared that for individual catchments the rate of change of these thresholds can vary dramatically which is related to the location of available loose erodible material in the catchment.
The model is also applied on a regional scale in the Jingxiu area. A method was proposed to made a general estimate of the time duration to arrive at a debris flow frequency level before the earthquake, which depends on the diminution rate of the loose co-seismic source materials for these debris flows.