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A rapid method to identify the potential of debris flow development induced by rainfall in catchments of the Wenchuan earthquake area

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Abstract: In many mountainous areas, the limited space in the valley floors has created a need to construct the temporary settlements in zones potentially exposed to debris flow hazards after a strong earthquake. In these zones, a rapid identification of catchments with a high hazard level for debris flows is then necessary, to provide information for future risk management. This paper presents an empirical model to identify debris flow prone catchments at a regional scale. Sixty-nine debris flow catchments in the Wenchuan earthquake area were selected and investigated using high-resolution aerial photography to estimate the area of loose materials in the debris-flow catchments The statistical results show that debris flow prone catchments, have areas lower than 5 km^2, and channel gradients which vary between 364 and 1192‰ and an internal relief lower than 2 km. But the level of debris flow hazard in these catchments is more closely related to the area of loose materials than basin relief and channel gradient. So basin area and area of loose materials were selected as the key factor to establish an applicable identification model. A mathematical model was constructed to estimate the thresholds of areas of loose materials for debris-flow prone catchments. The validation showed that the established model was suitable and met the requirements for identification of potential debris flows in the Wenchuan earthquake area. The results of the study will help the local government to select safe sites for rehabilitation and relocation in the future and can also be used as an important basis for debris-flow risk management. The approach may be applied to other earthquake areas, when adapting the threshold parameters according to new local conditions.

Key words: Wenchuan earthquake; statistical model; debris flow thresholds