Establishing a mountain flash flood forecasting/warning strategy through case studies in different climatic regions in China

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Flash flood is one of the most common natural hazards in China, particularly in mountainous areas, causing heavy damages and casualties. However, mountain flash flood forecast remains challenging due to its short response time and the limited monitoring capacity over ungauged regions. This paper aims at assessing the predictability of flash flood in mountainous watersheds in humid, semi-humid and semi-arid regions of China. To access the applicability of flood forecast based on the rain-gauge network, we implement a distributed hydrological model (GBHM) over several mountainous catchments in China with drainage area of 5 to 2882 km2. The response time of flood is first derived using typical rainstorm, and the low limit of catchment area for flash flood forecast based on the rain-gauge network is determined through the intercomparison over different spatial scales. For those catchments smaller than the lowest limit, people can only escape from the flash floods by warning rather than by forecast due to the short response time. Hence the flash flood warning (FFN) method is introduced. Implement of the FFN needs to determine the rainfall threshold that may be different due to the antecedent soil moisture status. Based on the GBHM simulation using the historical rainfall data, we introduced an appropriate method to determine the FFN rainfall threshold in different climatic regions in China. The results show that the rainfall threshold decreases significantly with the antecedent soil moisture in the humid regions, while it keeps constant approximately in different soil wet conditions in the semi-arid regions.