



## **Climatic conditions for the formation of the glacial debris flows under the global warming**

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Glacial debris flow is one of the typical mountain hazards in the Qinghai Tibet Plateau and its surrounding alpine mountains, and it is also one of the most active hazards in the southeast of Tibet. Different from the formation mechanism of debris flow in the low altitude mountain area, the glacier debris flow is caused by the coupling of avalanches, glacier movement, snow melting, and extreme precipitation. Based on the glacial debris flows events we collected in the Tibetan Plateau since 1970s, the impacts of global warming on glacial debris flow in alpine area were analyzed. Under the background of global warming, the continuous warming and increasing precipitate on make the glacial debris flows tend to be more active. Moreover, the disasters usually occur in chains and are amplified by cascaded processes, involving a variety of types of disasters in a long period and over a wide range of space. The results show that the cumulative precipitation and daily average temperature before the formation of hazards are simultaneously satisfied with the formula  $y = 29329x - 2.199$  ( $y$  represents the cumulative precipitation and  $x$  is average temperature), and when the average temperature is greater than 10 [U+2103] for 30 consecutive days in the glacier tongue, which is easy to trigger a mega glacial debris flow. It is estimated that temperature will get a rise of 3.2 [U+2103]–3.5 [U+2103] by 2050 and 3.9 [U+2103]–6.9 [U+2103] by 2100 compared with the reference period (1961–1990), accompanied by rainfall rise of 10.4%–11.0% and 14.2%–21.4%. Rise in temperature and rainfall will increase the risk of glacial debris flow. The climatic condition for the formation of glacial debris flow is of great significance for the further study on the formation mechanism and prediction analysis of the glacial debris flow.