



Magnitude and frequency relations of debris flows affected by narrow sections in Guxiang gully, Palongcangbu, Tibet

Liquan Lyu, Mengzhen Xu, and Zhaoyin Wang

Tsinghua university, Institute of River and Ocean research, State Key Laboratory of Hydrosience and Engineering,
China [U+FF08]lvliqunqinghua@126.com [U+FF09]

Debris flows occurred very often in Guxiang gully, one tributary of Palongcangbu since 1950s. Debris flows were investigated and the volume of debris flows have been calculated since 1953. This paper collected 60-years data of accumulation rates of loose sediment in the upstream of the narrow sections of the gully with relationships of debris flows magnitude. Sediments changes in the upstream of the narrow gully section are compared with channel incision, debris flow activity and motions. The data of the sediment accumulations and its debris flow events provide insights into narrow gully section controls and debris flow dynamics. Acceleration in debris flow events was recorded between the 1950s and 1980s, compared with a decrease in debris flow events since the 2000s. The narrow gully section has always formed as a dam for sediment accumulation. The loose material accumulations rates have remained quite small and sediment is not enough to support the frequent debris flows since 2000. On the contrary, sediments accumulated in the upstream of the narrow section due to large earthquake in 1950 were the sources of debris flows. There was not a clear coupling between accumulation rates of sediment and the frequency-magnitude debris flows in the 1950s and 1980s. On the contrary, a clear link between accumulation rates of sediment and the frequency-magnitude debris flows exists since 2000. In the debris flow events since 2000, debris flows in the gully are both controlled by the rainfall and narrow section of the gully. In this paper we have considered the dynamics of many debris flow events in the upstream and downstream of the narrow gully section. The sediments accumulation in the upstream of the narrow section of the gully created as a dam, which was depending on the accumulated sediment volume and the width of the narrow section. The accumulation of sediment in the upstream of the narrow section could affect its longitudinal morphology and add the longitudinal gradient, which caused a perturbation of debris flow dynamic in the gully.

Key Word: debris flow; narrow section; consolidation; intermittent motion; additional gradient