



Formation of asymmetrical loess gullies in the northeastern Loess Plateau

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Abstract: Gully is the most common geomorphological form in nature. Therefore, the study of the evolution mechanism and influencing factors of the gully has become one of the most important topics in geomorphology. Under ideal conditions, the gullies on both sides should develop in a symmetrical form if the external forces on both sides of the drainage divide are exactly the same. However, gullies in nature are often in a disequilibrium state whether in terms of spatial form, such as river-network shape, or characteristic elements like gully density characteristics. These factors result in so-called asymmetric gullies. Thus, a definition can be given as follows, the gully asymmetrical characteristic refers to the disequilibrium morphological structure formed on both sides of the drainage divide after the long-term topographic evolution process. This feature is also one of the basic characteristics of complex terrain, which can intuitively reflect the unbalance in gully development area under the influence of different force. This study takes the Loess Plateau region of China as an example to study the asymmetrical gullies. Using DEM data and geological map data and proposing a series of scientific indicators to quantify the asymmetric characteristics, the differences on both sides of the gully can be evaluated, and we can analyze the factors that contribute to this asymmetry. By systematically evaluating the asymmetry of the gullies, it can be found that the underlying bedrock structure and loess accumulation are the primary causes of the asymmetrical characteristics of the gullies in this region, and the interaction force between adjacent basins also has a certain impact on the development of the gullies, but the influence of hydrothermal conditions and vegetation cover on the asymmetrical characteristics of gullies is not as obvious as the assumption. I believe that this experiment is instructive for studying the evolution of the gullies in other complex topographical structure areas.

Key words: Loess Plateau ; Geomorphological evolution ; Gully ; Asymmetry ; DEM