Inference of sediment transport pathways in a gully system using the morphological method

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Gully erosion seriously threatens farmland and causes soil loss. Inferring sediment transport paths in a gully system is important for understanding the mechanisms of gully erosion. The morphological method successfully applied in estimating bed-material transport in both one dimension and two-dimensions in rivers, for some decades, has yet to be applied to gully erosion. Here, we infer sediment transport paths in a gully system using the morphological method. Two catchments in the Loess Plateau of China were selected as study areas. Multi-temporal high-resolution Digital Elevation Models (DEMs) were acquired using structure-from-motion multiview-stereo (SfM-MVS) photogrammetry for determining morphological changes. Then, both 1D sediment transport and 2D sediment transport paths were calculated based on morphological changes and topographic attributes. The results showed that the use of 1D treatment leads to substantial local errors in transport rate estimates, to a degree related to the number of branch gullies. The 2D application showed that a large proportion of the total transport was actually concentrated into one main channel in steep areas, the proportion of transport in branches is substantial in lower relief areas.