

# Spatial scale dependency of erosive runoff and sediment flow behavior on loessial slopes: an energy perspective

Qingyuan Wang<sup>1</sup>, Zhang Letao<sup>1</sup>, Yiyuan Wei<sup>1</sup>, Mengzhen He<sup>1</sup>, and Zehao Zheng<sup>1</sup>

<sup>1</sup>Henan University College of Geography and Environmental Science

May 15, 2023

## Abstract

Runoff erosion response associated with sediment transport as influenced by erosive energy variability is a highly scale-dependent process. It is of great significance to effectively identify the spatial scale effect on erosive runoff energy for understanding the spatial pattern of sediment flow behavior across various sites. To address this issue, thresholds for erosive runoff were established based on frequency analysis and four selected threshold parameters including runoff duration ( $T$ ), stream power ( $\omega$ ), stream energy factor ( $SE$ ) and area-specific sediment yield ( $SSY$ ). Based on these thresholds, 77 erosive events were identified and separated from non-erosive events for further analysis. The threshold for  $T$  was roughly constant at hillslope but rapidly increased at entire slope. Thresholds for  $\omega$  and  $SE$  was linearly and positively related to the plot area. A general increasing trend was observed in the threshold for  $SSY$  from the upper hillslope to the entire slope. The sediment delivery capacity of erosive runoff varied from 0.075 to 0.115  $\text{kg}\cdot\text{m}\cdot\text{J}^{-1}$ , while the sediment increments capacity of erosive runoff ranged from 0.43 to 4.47  $\text{kg}\cdot\text{m}^{-2}\cdot\text{W}^{-1}$ . The sediment reduction benefit by regulation unit stream energy factor varied from 5% to 65%. Overall, erosive runoff events were characterized by longer runoff duration and larger erosive energy, as well as greater sediment delivery capacity compared to non-erosive events. Therefore, the runoff regulation on slopes should be mainly orientated at the erosive energy control and the conversion of slope runoff from erosivity to non-erosivity.

## Hosted file

Manuscript\_LDD.docx available at <https://authorea.com/users/618319/articles/643404-spatial-scale-dependency-of-erosive-runoff-and-sediment-flow-behavior-on-loessial-slopes-an-energy-perspective>







