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Effects of Soil Surface Roughness on Particle Size Distribution in Sediment Under a Laboratory Simulated Rainfall

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Particle size distribution in sediment can reflect the interactions between soil surface roughness and soil erosion. A better understanding of sediment size distribution will provide insight on the mechanism of roughness effects on sediment detachment and transport. Although most studies on roughness focus on its quantitative description and on its impact on soil and runoff loss, almost no studies on the roughness impact on particle size distribution during a rainfall event. Rainfall simulation experiments were conducted to investigate the dynamic changes in particle size distribution of exported sediment from rough slope under a simulated rainfall at an intensity of 50, 75, 100 mm/h for 1 h. The surface treatments comprise Mounds (MT), Depressions (DT), which are the subcomponents of roughness, and a smooth surface as a control group. These results show that the proportion of clay ($< 2\mu$m) from three treated slopes has no significant difference. The sediment form MT was coarse with lower proportion in silt (2 -50μm) and higher proportion in sand (50 -2000μm) than that exported from CK. However, the sediment from DT contained higher silt (2 -50μm) and lower sand (50 -2000μm) than CK. From the dynamic changes in sediment particle size in a rainfall event, the clay ($< 2\mu$m) and silt (2 -50μm) in MT shows a decreased trend and sand (50 -2000μm) was increased owing to raindrop splashing impact on mound and provide sand source of sediment. In DT, the dynamic changes in clay ($< 2\mu$m), silt (2 -50μm) and sand (50 -2000μm) was showed little fluctuations under slight rainfall intensity, due to the depressions, which may contribute to the coarse particles deposition. However, the sand (50 -2000μm) proportion was improved along with the erosion process under higher rainfall intensity when the depressions were full. These results provide evidence of the dynamic process of sediment transport and deposition from rough surface slope.