Investigation of detachment rate and transport distance of sediment under controlled conditions in raindrop impacted thin surface flows

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The connectivity of sediment transport through the landscape is controlled by many different factors. Beside environmental factors such as soil surface properties, land management and vegetation cover, the dominant ones are rainfall and surface flow characteristics and interactions. To improve our understanding of the basic processes and to be able to improve sediment transport models, the behaviour (stability, disintegration during transport) and transport distance of sediment needs to be better understood. In order to be able to investigate the change of sediment properties over transport distance and time, it is, therefore, necessary to understand the basic interactions between rainfall kinetic energy and amount, particle size and density as well as flow depth and velocity. So far, the mechanistic understanding of these principal physical interactions is mostly of empirical nature, obtained either under natural, highly complex and uncontrollable conditions, or with rainfall experiments that weren’t able to control the conditions with high enough precision. With the presented setup and experimental approach it is possible to precisely control these parameters. By conducting rainfall experiments on different sand mixtures and thereafter on soil substrates, this study aims on filling this gap of knowledge. The results from experiments on stable sand particles show specific relations between sand-sizes, drop kinetic energy, force of flow, and resulting erosion rates. Although these preliminary results are very promising and further experiments could lead to a better understanding of the erosion processes in the future, they clearly show that already straightforward sand mixtures behave in a complex way. Further experiments with grain mixtures are, therefore, needed before experiments on more complex, instable sediments can be used to further advance our knowledge about the influence of sediment characteristics on transport connectivity.