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How to accomplish high precision rainfall experiments on raindrop impacted thin water flows

Wolfgang Fister (1), Peter I.A. Kinnell (2), Philip Greenwood (1), and Nikolaus J. Kuhn (1)

(1) University of Basel, Physical Geography and Environmental Change, Environmental Sciences, Basel, Switzerland (wolfgang.fister@unibas.ch), (2) University of Canberra, Institute for Applied Ecology, Canberra, Australia

In order to be able to investigate important erosion processes and mechanisms in surface flows associated with sheet and interrill erosion, it is essential to reproduce spatially homogeneous rainfall and flow conditions, which are constant throughout the whole experiment. There are many different obstacles to this goal. For example, variations in the plot surface microtopography between experiments can cause flow depths to vary between "replicated" experiments, or change flow depth during the experiment, particularly in experiments with rainfall fed surface runoff on sloping surfaces. Another essential task necessary to produce valuable data is to measure the key parameters directly with highest possible accuracy and not just to infer them roughly from other, easier to measure parameters. Something that is often done is the backcalculation of flow depth by known water discharge and the dimension of the flow crossection, instead of specifically measuring the water depth in the experiment. With the help of more than 300 rainfall experiments and varying technical designs, an experimental setup and measurement protocol was designed over the last few years which allows precise control and measurement of the key parameters in small scale erosion experiments. In this study, the control and measurement setup and the protocol are presented, as well as problems and possible solutions to them are beeing discussed, based on data from the accomplished experiments. It seems obvious that experiments on such a small scale are not able to reproduce erosion processes as they occur under natural conditions, nevertheless, their high level of control and reproducibility of experiments makes them a valuable tool that can be used in many different ways to improve our knowledge on the mechanics of soil erosion.