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Experiments for understanding soil erosion processes

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Soil erosion processes are usually quantified by observation and measurement of their related forms. Rill, and gullies, moulds or sediment sinks are often used to estimate the soil loss. These forms are generally related directly to different types of processes, thus are also used to identify the dominant processes on a certain type of land-use.
Nevertheless, the direct observation of erosion processes is constrained by their temporal and spatial erratic occurrence. As a consequence, the process understanding is generally deduced by analogies.
Another possibility is to reproduce processes in experiments in both, the lab and in the field. Laboratory experiments are implemented when we want to have full control over all parameters we think are relevant for the process in our focus. So are very useful for identification of parameters influencing processes and their intensities, but also as physical models of the processes and process interactions in our focus. Therefore, we can use them to verify our concepts, and to define relevant parameters.
Field experiments generally only simulate with controlled driving forces, this is the rain or the runoff, but dealing with the uncertainty of our study object, the soil. This enables two things: 1) similar as with lab experiments, we are able to identify processes and process interactions and so, to get a deeper understanding of soil erosion; 2) experiments are suitable for providing data about singular processes in the field and thus, to provide data suitable for model parametrisation and calibration. These may be quantitative data about erodibility or soil resistance, sediment detachment or transport.
The Physical Geography Group at Trier University has a long lasting experience in the application of experiments in soil erosion research in the field, and has become lead in the further development conception and of devices and procedures to investigate splash detachment and initial transport of soil particles by wind and water, rill erosion and the transport of fine and coarse sediments.
Herein, rainfall simulations are one of our principal methods, as they can be used easily to study splash processes and to get data about soil erodibility. But therefore, measurements need to be comparable and the methodology very well established and documented. The incorporation of wind into rainfall events, as they usually appear in nature, is a challenge in field experimentation, which has been tackled in cooperation with colleagues from Basel (Switzerland). So, we are one of the few groups in the world able to use a low cost, but efficient rainfall-wind simulator in the field.
In addition, to cover erosion processes by concentrated flow, a methodology has been developed for field measurement of erosion processes. In this context, we are focusing now also on the development of sensors to understand the movement of coarse particles (as pebbles) in concentrated flow and to investigate their influence on soil erosion.
With this contribution, I would like to promote the use of experiments for soil erosion research, and to provide information and expertise on the design and application of lab and field experiments on all partial processes of soil erosion.