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Determining erosion relevant soil characteristics with a small-scale rainfall simulator

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The use of soil erosion models is of great importance in soil and water conservation. Routine application of these models on the regional scale is not at least limited by the high parameter demands.
Although the EROSION 3D simulation model is operating with a comparable low number of parameters, some of the model input variables could only be determined by rainfall simulation experiments.
The existing data base of EROSION 3D was created in the mid 90s based on large-scale rainfall simulation experiments on 22x2m sized experimental plots. Up to now this data base does not cover all soil and field conditions adequately. Therefore a new campaign of experiments would be essential to produce additional information especially with respect to the effects of new soil management practices (e.g. long time conservation tillage, non tillage).
The rainfall simulator used in the actual campaign consists of 30 identic modules, which are equipped with oscillating rainfall nozzles. Veejet 80/100 (Spraying Systems Co., Wheaton, IL) are used in order to ensure best possible comparability to natural rainfalls with respect to raindrop size distribution and momentum transfer.
Central objectives of the small-scale rainfall simulator are
- effectively application
- provision of comparable results to large-scale rainfall simulation experiments.
A crucial problem in using the small scale simulator is the restriction on rather small volume rates of surface runoff. Under this conditions soil detachment is governed by raindrop impact. Thus impact of surface runoff on particle detachment cannot be reproduced adequately by a small-scale rainfall simulator
With this problem in mind this paper presents an enhanced small-scale simulator which allows a virtual multiplication of the plot length by feeding additional sediment loaded water to the plot from upstream. Thus is possible to overcome the plot length limited to 3m while reproducing nearly similar flow conditions as in rainfall experiments on standard plots.
The simulator is extensively applied to plots of different soil types, crop types and management systems. The comparison with existing data sets obtained by large-scale rainfall simulations show that results can adequately be reproduced by the applied combination of small-scale rainfall simulator and sediment loaded water influx.