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Experiments for comparison of small scale rainfall simulators

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Small scale portable rainfall simulators are an essential tool in research of recent process dynamics of soil erosion. Such rainfall simulators differ in design, rainfall intensities, rain spectra etc., impeding comparison of the results. Due to different research questions a standardisation of rainfall simulation is not in sight. Nevertheless, the data become progressively important for soil erosion modelling and therefore the basis for decision-makers in application-oriented erosion protection.

The project aims at providing a criteria catalogue for estimation of the different simulators as well as the comparability of the results and a uniform calibration procedure for generated rainfall.
Within the project "Comparability of simulation results of different rainfall simulators as input data for soil erosion modelling (Deutsche Forschungsgemeinschaft – DFG, Project No. Ri 835/6-1)" many rainfall simulators used by European research groups were compared.

The artificially generated rainfall of the rainfall simulators at the Universities Basel, La Rioja, Malaga, Trier, Tübingen, Valencia, Wageningen, Zaragoza and at different Spanish CSIC-institutes (Almeria, Cordoba, Granada, Murcia, Zaragoza) were measured with the same methods (Laser Precipitation Monitor for drop spectra and rain collectors for spatial distribution). The data are very beneficial for improvements of simulators and comparison of simulators and results. Furthermore, they can be used for comparative studies with natural rainfall spectra. A broad range of rainfall data was measured (e.g. intensity: 30 – 149 mmh-1, Christiansen Coefficient for spatial rainfall distribution 61 – 98 %, mean drop diameter 0.375 – 5.0 mm, mean kinetic energy expenditure 25 – 1322 J m-2 h-1, mean kinetic energy per unit area and unit depth of rainfall 4 – 14 J m-2 mm-1). Similarities among the simulators could be found e.g. concerning drop size distributions (maximum drop numbers are reached within the two smallest drop classes < 1 mm) and low fall velocities of bigger drops due to a general physical restriction. The comparison provides a good data base for improvements and a consistent picture of the parameters of the simulators.

To assess the influence of rainfall simulator type and plot dimensions on runoff and erosion, rainfall simulators from Freiberg, Tübingen, Trier, Valencia, Zaragoza, Basel and Wageningen were compared on a prepared bare fallow field during the Rainfall Simulator Workshop in Trier (Germany). The results show a clear and consistent relationship in runoff, erosion and infiltration behaviour of the different used rainfall simulators. With all the devices total soil loss was measurable, but different plot sizes, intensities and kinetic energies of the simulated rainfall caused differences in soil loss and runoff quantities per unit of area. Regarding course characteristics over runs, similarities could be observed especially in runoff behaviour.