Geophysical Research Abstracts
Vol. 14, EGU2012-664, 2012
EGU General Assembly 2012

Statistical approach to a better prediction of surface runoff

K. Auerswald (1), F. Winter (2), and M. Disse (2)

(1) TU München, Lehrstuhl für Grünlandlehre, 85350 Freising-Weihenstephan, Germany (auerswald@wzw.tum.de), (2) Universität der Bundeswehr München, Institut für Wasserwesen, 85579 Neubiberg, Germany

Runoff generation is highly variable in time and space, especially on arable fields. Currently it is either predicted by lumped models like the SCS curve numbers (CN) or by more physically based infiltration models like Horton, Green-Ampt, Philip or Richards. The CN approach only allows a rough consideration of soils and land uses with strong inherent inconsistencies like the fact that the same CN is applied for all crop stages. The physically based approaches suffer from the fact that each model represents a certain process like sealing or wetting front propagation that may not be governing runoff generation in the prediction case. The linkage between different runoff generation processes remains difficult, mainly because of the uncertainty of model parameters. Hence, a holistic consideration of the interactions of rain, soil and landuse for the prediction of spatial and temporal variable runoff is still missing.

We followed a different, purely statistical approach that does not depend on any a priori selection of a model and thus can account for various influences. To this end we parameterized 24384 runoff measurements from 726 hydrographs obtained by various researchers under various environmental and landuse settings and correlated these with 20 time-invariant soil properties (e.g. texture), three variable soil properties (e.g. moisture content), four rain properties (e.g. specific kinetic energy) and three landuse properties (e.g. plant coverage). Despite the large variation in the dataset, the runoff hydrographs could be predicted surprisingly well with an interaction of simple rain, soil and landuse parameters, namely rain depth and intensity, organic carbon content and time since tillage. The RMSE of the hydrographs was about 5 mm and cannot be lowered markedly by any better model because such differences already existed in the measured data of replicated plots. They must be caused by properties that were not measured and that also would not be available for predictions (e.g. antecedent sealing, moisture conditions or macropore continuity).

Neither the information used for lumped modelling nor that for the physically based models was satisfying in the prediction of runoff from rainfall simulation studies. Our approach to predict runoff from widely available information including rain, soil and land use aspects is a step towards an improved applicability without depending on a specific deterministic model. The improved applicability also results from the fact that the difficulties of parameter classification (e.g. how to classify hydrological soil groups or seed bed conditions; sudden changes between classes) are avoided.