PREDICTING SOIL ERODIBILITY FOR A RESEARCH MODEL

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The classic USLE concept of soil erodibility (K factor) expresses the empirical soil resistance against combined splash and sheet erosion. The underlying assumption is that erodibility does not change between erosion events thus its value is relatively stable over time. This is basically true if we retain the essential component of the original concept that K factor should be established from multiple year observations as a yearly average. On the contrary, even USLE literature point out that short-term values of the K factor may vary as large as by seven times within a particular year due to the freeze-thaw cycles, changing water content etc. USLE based models do not but physically based erosion models do assess infiltration during rainfall events. Our hypothesis is that the large within year variability of the USLE K factor must be sufficiently explained by the variability of infiltration thus its long term average could be used to derive erodibility for physically based models.

Rainfall simulation experiments were carried out in the watershed of Lake Balaton at four sites between 2000 and 2005 during summertime on soils with texture classes between slightly silty sand and sandy clay loam on slopes between 6 and 19 %. The methodology of the experiments has been developed in an EU FP5 project. The soils were prepared to seedbed condition, the experiments were repeated on 3-4 plots (2 m by 5 m) and 3-4 consecutive simulations were applied to each plot at 60 $mm.h^{-1}$ intensity. Runoff and soil loss were usually measured in 1 minute intervals. The experiment was started on pre-wetted soils nearly at field capacity.

A physically based plot scale research model was developed to assess runoff and erosion. The model predicts infiltration by a negative exponential equation the predictors being initial infiltration, equilibrium infiltration and water storage of the active layer. Erosion is estimated as product of soil erodibility and kinetic energy of the water flowing on the surface. The novelty of the model has been the fine scale representation of the random surface roughness hence the prediction of the non-uniform runoff and erosion patterns and rill initiation.

Measured equilibrium infiltration rates in the consecutive experiments corresponded with the infiltration data given in the Bodenkundliche Kartieranleitung (German Guide for Mapping Soils) for the particular soil texture classes at different bulk densities.

After calibrating the model with the experimental data, physically based soil erodibility values have shown good correlation with the products of USLE K factors and soil slaking grades published in the same guide.

Our conclusion is that the vast amount of information accumulated in the USLE type erosion experiments could be used to parameterize physically based erosion models if relationships would be discovered by purposefully designed experiments.