Geophysical Research Abstracts
Vol. 13, EGU2011-7541, 2011
EGU General Assembly 2011

Parameterization of the process-based soil erosion model LISEM by means of experimental measurements

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The process-based, spatially distributed hydrological and soil erosion model LISEM (Roo et al., 1996) has originally been developed for small catchments in the Province of Limburg in the Netherlands. LISEM mainly covers the processes interception, infiltration, overland flow, channel flow, splash detachment as well as detachment and transport by overland flow. The splash detachment depends on aggregate stability, kinetic energy of rainfall and the depth of the water film at the soil surface, whereas flow detachment is influenced by the transport capacity of the flowing water, the sediment concentration in the flow and the settling velocity of transported particles, as well as from flow width and flow length (Jetten, 2002). According to the high complexity of the model, the data requirements are quite demanding.
In this study the described model is parameterized for the Arnas catchment, a small watershed in the Central Spanish Pyrenees, using detailed soil and vegetation data with a high spatial resolution as well as climate data. The climate in the studied region is characterised by a strong seasonality of hydrological processes particularly for wetland areas that regularly dry out in summer. In order to cover the seasonal variation in runoff generation, rainfall-runoff events with different antecedent soil moisture conditions are used for parameterization. The spatial and temporal pattern of overland-flow generation and erosion processes and their intensity are assessed by means of small plot-scale rainfall experiments in the field at different soil moisture states. The results of the rainfall simulations are used for the parameterization of infiltration and runoff generation as well as for the parameterization of erosion susceptibility parameters (e.g. aggregate stability, cohesion).
Furthermore, the spatial discretization in LISEM is realized using a raster-grid, so the spatial pattern of simulated soil erosion processes can be analysed and compared to field mappings. For validation of the simulated results, a detailed mapping of geomorpho-dynamics as well as gauge data on runoff and suspended sediment load are used.

Jetten, V. (2002), LISEM User manual, version 2.x., Utrecht University, The Netherlands.

Roo, A. P. J. D., C. G. Wesseling, and C. J. Ritsema (1996), LISEM: A single-event physically-based hydrological and soil erosion model for drainage basins. I: Theory, input and output, Hydrological Processes, 10(8), 1107-1117, doi:10.1002/(SICI)1099-1085(199608)10:8<1107::AID-HYP415>3.0.CO;2-4.