Geophysical Research Abstracts
Vol. 12, EGU2010-3897-1, 2010
EGU General Assembly 2010

Rill erosion dynamics investigated by rill experiments in different rills in Andalusia

Stefan Wirtz (1), Manuel Seeger (2), Alexander Remke (1), René Wengel (1), and Johannes B. Ries (1)

(1) Dep. of Physical Geography, Trier University, Trier, Germany , (2) Dep. of Land Degradation and Development, Wageningen University, Wageningen, Netherlands

Most experimental work about rill erosion that has been carried out in laboratory or under field conditions has used soil with different texture and natural or simulated rainfall. The aim was mainly to observe rill network formation, to define the initial conditions for rilling, to study the development of rill head morphology, to estimate the main hydraulic variables like cross-section area, wetted perimeter, hydraulic radius, mean velocity and shear stress or to propose mathematical models for estimating soil loss due to rill erosion. But there is a lack of research about the behaviour of existing rills, natural or developed anthropogenically , under field conditions. For closing this gap, we developed a standardized, reproducible experimental set-up and applied it to different rills in eastern Andalusia to address the following questions:
1) What is the rill's contribution to soil erosion?
2) How effective are rills for routing water and sediments through their environment?
With a motor driven pump, a constant discharge up to 330 l min-1 is maintained. Water quantity reaches 1000 l. The flow velocity within the rill is characterized in three steps: the travel time of the waterfront and of two colour tracers (introduced after one minute of experiment the second follows after two minutes) is measured for every meter using a chronograph. At the end of the rill, the runoff is continuously measured by a pressure transducer, rill's morphology is characterized by measuring its slope with a spring bow of 1 m range and a digital air lever and rill cross sections are measured with a simple laser telemeter and water levels with a ultrasonic sensor. For gathering intermediate data on suspended sediment transport, three adequate measuring points are selected. Here, four water samples are taken: the first directly when the waterfront has reached the sampling point, the second after 30 seconds, the third after 1:30 and the fourth 2:30 after the arrival of the water. The maximum sediment concentrations are between 35 and 422 g l-1. Using the measured values and soil parameters, different hydraulic and transport parameters used in different soil erosion models (shear stress, unit length shear force, stream power, transport and detachment rates, transport and detachment capacities, critical shear stress for example) can be calculated. The measured transport rates reach maximum values of up to 2.05 kg s-1. Regarding the duration of the experiment (3-4 min), material loss of up to 80 kg in 3:30 minutes is possible. In most cases, the transport rate is higher than the calculated transport capacity.
This suggests that rill erosion and transport equations do not take into account the complex process interaction of the transport of loose material, the retreat at knickpoints and headcuts and bank failures.