RAINFALL-RUNOFF MODELLING ON SMALL PLOTS UNDER DIFFERENT LAND USES WITH A UNIT HYDROGRAPH APPROACH.

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Modelling the rainfall-runoff transformation on small plots with fully mechanistic models remains challenging, because of the difficulty on obtaining the necessary data. We propose to use a statistical approach based on the Unit Hydrograph (UH) model to quantity the effects of different forms of land use on the quantity of water in excess of infiltration that constitutes runoff, and subsequently as a function of time and plot properties, results in aggregate runoff term. This model has previously been used for watershed hydrology. It allows the simultaneous identification of the production function (PF) (excess precipitation per event) and the transfer function (TF=UH in this case). Four sloping plots (length: 10 m , width: 2 m) treated in four ways were studied: bare soil (P1), unplanted soil covered with 1.5 t/ha maize residues (P2), direct sown maize crop on soil covered with 1.5 t/ha maize residues (P3) and 4.5 t/ha maize residues (P4). Runoff was collected at the outlet of each plot in two successive drums. The water level in each drum was recorded with a pressure transducer at a dynamic time step ranging from 20 s during rainfall to 1 h. The first derivative of the signal was then calculated and smoothed to determine the runoff fluxes at the outlet of each plot. A specific treatment related TF was identified for each plot. The TF of P1 was very sharp and narrow and responded within the first time step upon onset of rain, whereas the TF of P3 and P4 were smoother, broader and delayed. These results were in agreement with *in situ* measurements of flow pathways tortuosity, flow velocity and kinetics of runoff response. Different PF were also identified on each plot and were related to *in situ* measurements of infiltration rate, soil moisture and soil surface properties. These results can now be incorporated in distributed hydrological models and applied to watersheds.