



## **Rainfall-runoff-sediment discharge investigation in a small river catchment in Central Poland**

K. Banasik, L. Hejduk, M. Barszcz  
Warsaw Agricultural University, Poland

Measurements of rainfall-runoff and suspended sediment discharge have been carried out in a small river catchment in central Poland to establish lag times for runoff and sediment discharge. Lag time, LAG is one of the characteristic values in rainfall-runoff modelling, representing the retention of the system, which is defined as the time elapsed between the centroids of effective rainfall and the direct runoff hydrograph. An important characteristic in the process of predicting the time distribution of suspended sediment rate (sedimentgraph) is lag time for sediment yield, LAG<sub>s</sub>, which is defined as time elapsed between centroids of sediment production graph (similar to effective rainfall hyetograph) and sedimentgraph.

Data of 15 events from the 23.4 km<sup>2</sup> lowland catchment of the upper part of Zagożdżonka river at the Czarna gauging station (100 km south of Warsaw), collected by Department of Water Engineering and Environmental Recultivation, Warsaw Agricultural University in the period of 1999-2003 have been used in the investigation. Long term mean annual precipitation is 610 mm and runoff 109 mm in this area. Land use in the watershed upstream of the Czarna gauge is dominated by arable land and sandy soils are the dominant type in the area. The absolute relief of the watershed to Czarna gauging station is 26,5 m and the mean slopes of the main channels are in the range of 2.0-3.5%<sub>o</sub>. The gauging station at Czarna is equipped with automatic and electronics devices, for measuring intensity of rainfall (using rainfall tipping bucket gauge), water level (water levels sensor) and turbidity (continuous recording turbidity infrared sensor). Estimation of suspended sediment concentration was based on relationship between turbidity at the measurement point and suspended sediment concentration in the river cross-section. The relationship was established by field calibration. The measured data have been recorded on data logger in time interval of 10 minutes.

The rainfall depth  $P$  associated with the 15 events, measured at the gauging station of Czarna, varied from 3.0 mm to 60.9 mm, with the average value of 18.6 mm, and effective rainfall depth  $H$  varied from 0.20 mm to 5.16 mm, with the average value 1.20 mm. The peak discharges  $Q_{max}$  have a range from  $0.22 \text{ m}^3 \text{ s}^{-1}$  to  $2.08 \text{ m}^3 \text{ s}^{-1}$ , with the average value of  $0.69 \text{ m}^3 \text{ s}^{-1}$ .

The analysis shows that (i) a significant linear relationship exists between the lag time for hydrographs  $LAG$  and lag time of the sedimentgraphs  $LAG_s$ , (ii) the values of  $LAG_s/LAG$  are for most cases smaller than 1 and decrease with the rainfall depth increase.