Abstract

The assessment of physicochemical water quality is very important worldwide and is currently a priority in the European Union. Studies on the intensity of water erosion and surface runoff measured on the basis of the denudation intensity, as a loss of clastic soil material, are a very important part of agro-environmental-climate programs in Poland. The rationale for starting the research was that the hydrochemical evaluation of surface water alone is not sufficient to determine water quality. Heavy rains dampen the substrate and increase its susceptibility to water-surface erosion. Determination of variability of the main sources of transported eluvia, and the concentration of the total suspended solids (TSS) activated during surface runoff and its supply during heavy rainfall is important in the assessment of soil water erosion. Empirical equations and theoretical methods are used most often for determining the size of flowing river material These events are usually characterised by high dynamics, rapidity and short duration. Their often local character makes it difficult to register with the existing network of meteorological and hydrological posts. Therefore, they do not easily undergo scientific research, and their random occurrence in practice makes it impossible to predict them.

Water samples were sampled in hydrometric cross-sections, and during small floods in the cross section of the Smugawka stream bed, located in the Beskidy Zachodnie (Western Carpathians). In the doctoral thesis, attention was drawn to the possibility of accumulation of surface runoff (rainwash) on the slope and the susceptibility of the soil to water erosion. Erosion processes affect the leaching of substances from the catchment, hence the physicochemical composition of surface water was analysed, and one of the points discussed in the paper was to determine the relationship between heavy metals and nutrients that could potentially be washed out of the catchment, depending on the type of use. The assessment of water erosion took into account physicochemical properties of surface water and the source of supply of material from subsequent homogeneous hydrological periods. The influence of land use on leaching of weathered products in the form of total suspended solids into the bed of the flysch stream as a result of water erosion was evaluated. The paper also contains a quantitative comparison of physicochemical indices in subsequent measurement periods on the scale of individual observations. Relationships between physicochemical parameters were verified by multivariate exploratory statistical analysis. A close relationship between selected

04.06.2020

Haledki

physicochemical and chemical indices of surface water quality from the individual parts of the catchment was determined by means of a spatial autoregression equation.

An innovative solution proposed in the doctoral thesis is a combination of methods of multivariate statistical data exploration and a spatial autoregression model, used to verify the analysed data in a spatial system. The original contribution of the research analysis is related to the application of the pedotranfer function and the compilation of some hydraulic properies of soil at various land use variants. However, forecasting the intensity of erosion processes, water quality and determining the relationship between clay-rubble sediments and biogen concentration, requires establishing determinant indices, further developed by spatial analysis techniques. The method for calculating the amount of supply of material dissolved with surface-runoff must be calibrated. In the doctoral thesis, a spatial model was proposed that can be useful to show the relationship between land use and physicochemical indices in surface water. Results have shown that nitrite nitrogen and total suspended solids are connected with each other, which means that arable land had an impact on the quality of surface water.

Spatial autoregression allowed including spatial analysis to extrapolate data on mountain area cover as a basis for constructing a dependency model in multiple measurement series in a system of dependent factors. The analysis of spatial autoregression largely revealed spatiotemporal relationships in various measurement points in determining the intensity of surface runoff. Another value of the results is the demonstration that the studied variables and spatial data in the analyzed period are to the highest degree suitable for showing the water erosion of mountainous soils in the mountainous area. The inclusion of spatial analysis to determine the many contaminants entering the surface water will gain significance in solving technical problems with the correct use of arable land. Physicochemical indices in surface water have shown more intense relationships with one another in relation to arable land than for mountain meadows or forests, and should be taken into account in some protection and monitoring programs for the study of the threats to mountain watercourses.

Keywords: flysch catchment, geoinformatics technique, multivariate analysis, physicochemical surface water quality, soil erosion by water