



## Mapping erosion-accumulation forms using electromagnetic conductivity

Aleš Létal (1), Libor Burian (2), and Anna Smetanová (3)

(2) Comenius University, Faculty of natural science, Physical geography and geoecology, Bratislava, Slovakia (liborburian@gmail.com), (1) Palackého University, Faculty of natural science, Geography, Olomouc, Czech Republik (ales.letal@upol.cz), (3) Comenius University, Faculty of natural science, Physical geography and geoecology, Bratislava, Slovakia (anna.smetanova@gmail.com)

The erosion-accumulation processes have become significant at times when most of usable landscape is influenced by human activities. In the 20th century conventional methods for analysing this phenomenon were discovered. It was found that common geophysical methods are able to analyse erosion-accumulation forms in landscape as a consequence of rainfall-runoff processes. Quantification of cubature of erosion and accumulation forms using geophysical approach, mainly electromagnetic conductivity is the main subject of the study. Huge amount of geophysical approaches are used for such an analysis, but conductivity meter was recognised by us as an appropriate method. However, the interpretation of geophysical measurement outputs is disputable (based on proper operation of instrument). The previous approach was based on the qualitative interpretation of the entities and discontinuities in electromagnetic record. This method varies on operator abilities and experiences because it depends only on abilities of operator. Traditional pedological-geomorphological research and utilization geophysical methods are interconnected in our new approach. Thickness of accumulation forms is calculated from their electromagnetic records. For this purpose a specific equation for each measurement has to be derived. Data gained from boreholes or excavations is compared with geophysical measurement using statistical methods. There is no universal form defined for this equation, only general formula:

$$r < M : h = f(E) \vee r \geq M : h \neq f(E)$$

Where  $r$  is a coefficient of correlation ranging from 0 to 1, 0 represents weak correlation,  $M$  is maximum permitted coefficient of correlation,  $h$  is thickness of selected soil horizon or thickness of accumulation form and  $E$  is a value of electromagnetic conductivity or resistivity. This approach was tested in two study areas. The first represents buried gully, at the outlet of small 1<sup>st</sup> order catchment, near village Voderady, Slovakia. Thickness and physical attributes of buried gully infill was analyzed from the 15 boreholes and from an excavation trench. The electromagnetic conductivity and susceptibility was measured. A coefficient of correlation was close to 0,8, which means strong correlation, thus cubature of refilled gully could be calculated from derived equation. Furthermore two paleomeanders were identified from the electromagnetic conductivity records. Deep accumulation has been found in the second study area at the outlet of a steep Y-shaped valley system near the village Kostolné, Slovakia, the second study area. An estimated hypothetical border between erosion dominating zone and accumulation dominating zone was the point where valleys are connected to the major valley. One excavation and 8 boreholes were made on the cross-section in the main valley. Analyses of micromorphologic attributes were used for determining of soil horizons. The value of a correlation coefficient was calculated to be near 0,5, meaning low correlation. Based on electromagnetic image, some representative areas with constant value of electromagnetic conductivity were chosen for further drilling and cores analysis. Depth of accumulation was described from boreholes and extrapolated to the study areas. Database for geomorphologic information system (GmIS) in a large scale was constructed. Cubature of accumulation form was analysed as an output of GmIS. Geophysical approach as a tool for quantification of accumulation forms is suggested to become a common method in pedological-geomorphologic and agricultural studies.