THE VALUATION OF MAXIMUM RUN OFF ON INTERBASINAL AREAS, ASSISTED BY GIS

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ABSTRACT
The major floods are those resulted from pouring rain, and they exceed through their volume the floods resulted from the melting snow and even those resulted from pouring rains and melted snow combined. According to hydrological specialized literature, it is emphasized the fact that the summer pouring rains generate floods which get over those already existent, regrdless of their genesis. The determination of maximum run off is usually realized on small basin areas, without taking into consideration the interbasinal areas. The interbasinal areas are characterized by great water contribution coming from pouring rains. The determination of this kind of areas represent the object of the study below.

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The determination of the maximum run off on interbasinal areas assisted by SIG needs to go through some mandatory stages. The logical sequence of these stages is: finding the interbasinal areas; choosing the points, as evaluation sections on the main river flow on which cascading interbasinal areas can be determined; getting the forecast on the maximum intensities; the determination of the maximum discharge. All these stages will be realized by geoinformatical softwares and their specific extensions, except the determination and the rainfall forecasts.

1. THE DETERMINATION OF THE CASCADING INTERBASINAL AREAS

1.1. The determination of the interbasinal areas

In order to make our point, we decided to analize Somesul Mic superior hydrographic basin. The determination of interbasinal areas starts with the removal of the small, 2nd range Horton – Strahler interbasinal areas. All these areas were automatically acquired using specific functions and extensions of the ArcInfo software.

The interbasinal areas are automatically realized having the DEM of the hidrographical basin area as an initial data base. The DEM is a polygon type shapefile that contains the second range basinal areas and uses the extension *Grid Tools* of ArcView 3.2 software.

Grid Tools

Some procedures can be realized through extensions: analyzing, editing, visualising, cutting or combining the grids. (Fig. 1).

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The *clip grid* procedure gives the user the possibility to cut off a grid in many ways: cutting the grid using a polygon type theme or cutting the grid that is displayed. The grid can also be cut off inside or outside the polygon or the object.(Fig. 2)

Considering the fact that the graphical database where we determined the interbasinal areas is grid type and the hydrographical basins are polygonal type, the clip grid procedure will be used in the delimitation process.

Fig. 1. *Grid Tools extension menu*

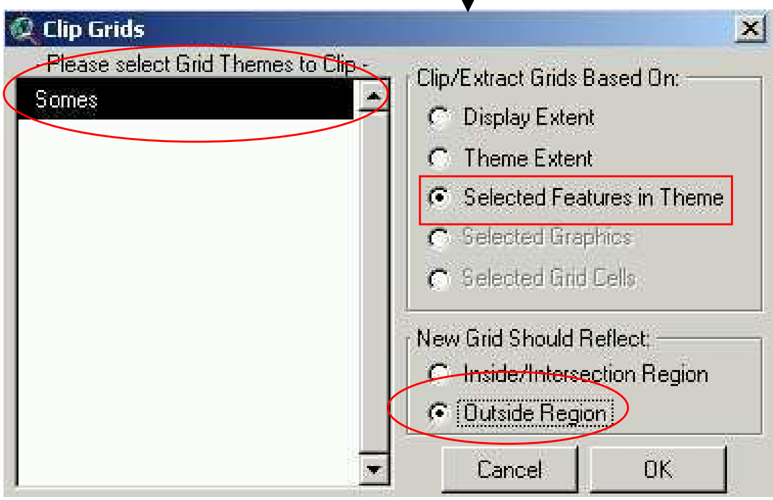

Fig. 2. *Cutting off the DEM*

Another grid appeared after cutting off the initial one. It resulted as a database having the features of the initial grid excluding the surfaces that have been erased.

The structure of the newly formed database will represent all the interbasinal areas adherent to the analized hidrographical basins.

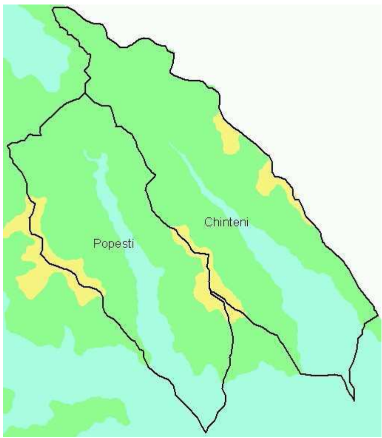

Fig.3. ***Basinal areas***

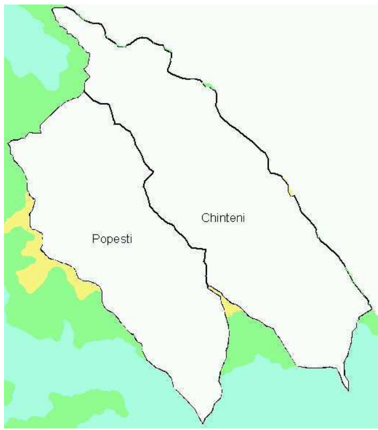

Fig. 4. ***Interbasinal areas***

1.2. Chosing the points on the main river flow, as determination sections, where cascading intrbasinal areas can be determined.

Once all the interbasinals areas were determined one can identify their points and determine the sections of the maximum debits. Three points were identified on the main river flow for calculus. Hidrographical basins tributary to these points are automatically realized using the function *Bach Watershed Deliniation* of the extension Arc Hydro for the Arc Gis software. (Fig. 5,6,7).

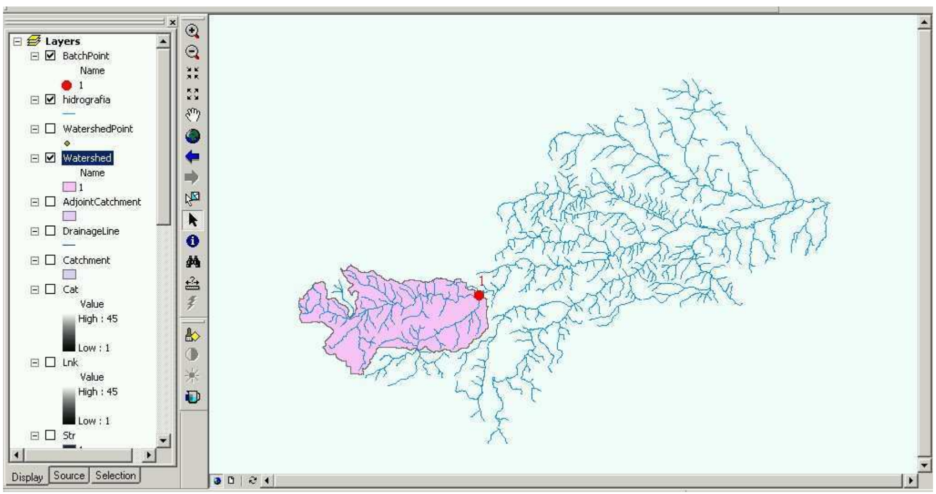

Fig. 5. ***The first point and interbasinal area***

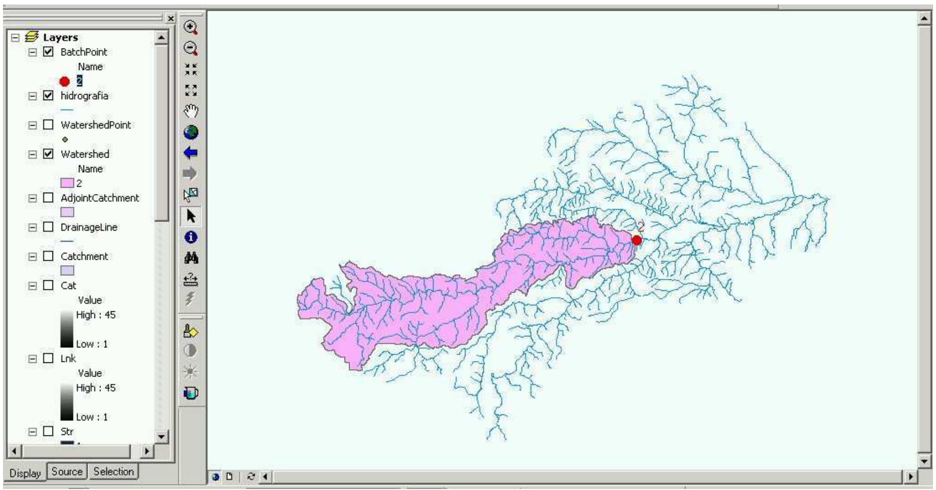

Fig. 6. ***The second point and interbasinal area***

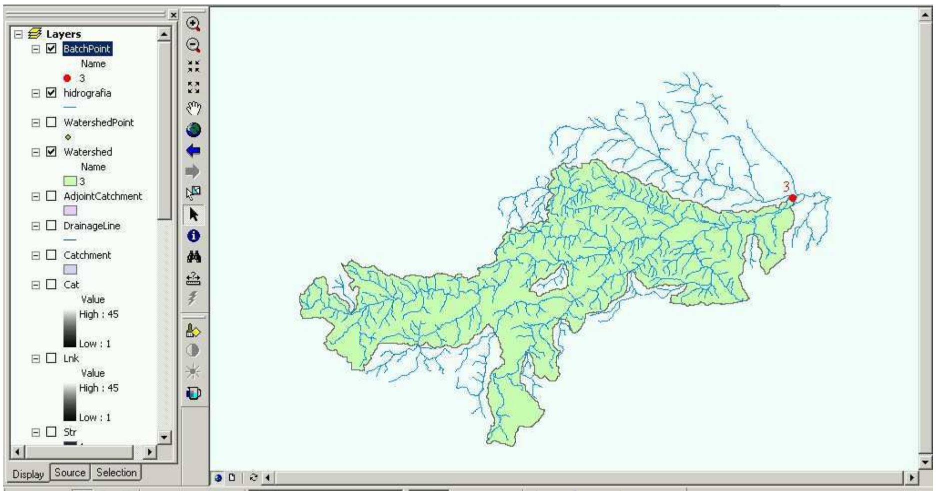

Fig. 7. ***The third point and interbasinal area***

As you can see from the figures above, the hidrographical basins, tributary to each of the 3 points, expand only on interbasinal areas. The surfaces consisting of a hidrographical basin were removed. This can be easily observed in figure Nr. 7 , where the second range hidrographical basin called Lesu was rejected from the hidrographical basin of point no. 3.

2. THE DETERMINATION OF THE MAXIMUM DEBIT AFTER POURING RAINS

In order to determinate the maximum discharge it is necessary to know the physico – geographical and geomorphological conditions of the hidrographical basins and also the rainfalls of maximum intensities from the hidrographical basin.

2.1 Rainfall forecast

The high technology meteorological stations can forecast the pouring rains. One of the ultimate technologies analyses RADAR echoes in order to find the rainfall centre and the places where the rain can create a maximum intensity rainfall situation.

The forecast should contain: the amount of precipitation in mm/min, the duration of precipitation per second or minute and the medium intensity of the rain. For this determination , a 20l/sqm controlled rain has been used during a time span of 5 minutes.

2.2 The determination of maximum disccharge

The determination of maximum discharge resulted from pouring rains, that generates the maximum flow, was first used to determine the necessary discharge for dimmensioning the evacuation of water gathered on railroads and railway working sites.

There is more than one way to determine the maximum discharge , the most frequently used being the Kestlin's formula, published in the „Austrian Engineer and Architects Society" magazine in 1868:

$$Q = K * i * \alpha * F \quad m^3 / s \tag{1}$$

where:

Q – maximum discharge în m^3/s
K – shifting factor in metric system16,67
i – rainfall intensity în mm/min
F- hidrographical basin surface in km^2
α – adimensional factor

$$\alpha = \alpha_1 * \alpha_2 \tag{2}$$

where:

α_1 – flow factor of 0,50, recommended 0,57 for rocky fields

α_2 – unconformity factor of concentrating and spreading the water in its bed. The factor varies according to the water bed's lenght and can vary from 1 to 1/8 .

All the ways in which a discharge is determined must take into consideration some mandatory elements: the medium intensity of the precipitation, the amount of precipitation, time time and the surface of the hidrographical basin

Utilizând formula 1 şi datele referitoare la bazinele hidrografice, extrase automat, odată cu realizarea cumpenelor de apă specifice suprafeţelor interbazinale, respectuv punclelor reprezentând secţiunile de calcul, s-au obţinut următoarele valori ale debitelor maxime la ploi torenţiale (Tabelul 1):

Using the 1st formula and the data reffering to the hidrographical basins, automatically extracted with the identification of the basin watersheds specific for interbasinal areas, namely the points for the sections we obtained the following estimates of the maximum discharge caused by pouring rain.

Maximum discharge determination results on interbasinal areas

Tabel 1

Calculus area	**Surface Km2**	**Q (m^3/s)**	**Q ($l/s/km^2$)**
Interbasinal area Nr. 1	237,62	14,85	62,51
Interbasinal area Nr. 2	402,03	25,13	62,51
Interbasinal area Nr. 3	948,44	59,28	62,51

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