THE USE OF GIS TECHNOLOGY IN HIDROGRAPHIC MANAGEMENT

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Abstract. *The work represents the delimitation of a river basin from the NE side of Timis county using GIS tehnology. GIS (Geographic Information System) is a system that allows the collection, storage, management, analysis and processing of spatially distributed data through a computerized process, having it's roots in the science of geography. A GIS has the ability to store data that has a geographic reference and can store topographic details of the terrain and their attributes. Before taking the necessary steps for the hydrographic analaysis, the DEM model was corrected, by filling in some existing gaps in the model, gaps that represent certain errors that appeared in the model creation. The hydrographic analaysis of the area was done using ArcGIS software. ArcGIS Desktop let you analayze data and generate geographic knowledge, to examine relationships, to test predictions and ultimately to make better decisions. ArcGIS Desktop includes ArcGIS Pro, ArcCatalog and ArcMap. In this work paper we used ArcMap. ArcMap is the main component of ESRI's ArcGIS suite of geospatial processing programs an dis used primarly to view, edit, create and analyze geospatial data. ArMap allows the user to explore data within a data set, symbolize features accordingly and create maps. This is done through two distinct sections of the program, the table of contents and the data frame. It presents graphical information that indicates the spatial distribution of the studied elements as well as infromation in database form to store the attributes associated with these elements. By using Esri solutions we have estabilshed the direction of the water flow in the area. We have also identified areas where the wave can accumulate using the „flow accumulation" command. Data is the mos important but also the mos expensive component of geographical information systems. The geographic data and the associated table data can come from the internal sources of an organization or can be obtained from specialized distributors.*

Key words: Hidrography, GIS, Models

INTRODUCTION

In this paper we used the GIS technology (BEGOV ET AL., 2016) to perform the hydrography analysis of a river basin from the NE side of Timis.

A geographic information system (GIS) is a system for collection, management, integration, manipulation, analysis and the display (presentation) of information (HERBEI ET AL., 2015, HERBEI AND SALA, 2015) and the care of information are attributed to the earth's surface (geographic data / information) with the help of automatic calculation tools (computer) (HERBEI AND SALA, 2014).

A GIS system can be conceived as having 4 main functions (HERBEI, 2015):

1. data entry (FILIP ET AL., 2015);
2. storage and access to the database (MANOLE ET AL., 2015);
3. data manipulation, processing and analysis (DRAGOMIR ET AL., 2016);
4. output of data and results.

GIS can refer to a number of different technologies (HERBEI, 2013), processes (BADULESCU, 2016), techniques and methods (SMULEAC ET AL., 2014). It is attached to many operations and has many applications related to engineering (NISTOR, 2011), planning, management, transport/logistics, insurance, telecommunications and business (HERBEI O . AND HERBEI M., 2010).

MATERIAL AND METHOD

The hydrographic analysis of the area was done using ArcGIS software by ESRI (HERBEI AND NEMES, 2012). ArcGIS Desktop is a collection of software products for building complete geographic information systems (ONCIA ET AL., 2013). ArcGIS Desktop provides an integrated GIS, combining object-oriented and traditional file-based data models with a set of tools to create and work with geographic data (IENCIU ET AL., 2013). The following three applications comprise the ArcGIS Desktop software suite: ArcMap, ArcCatalog and ArcGIS Pro.

In this work paper we used ArcMap. ArcMap is the main component of ESRI's ArcGIS suite of geospatial processing programs and is used primarily to view, edit, create and analyse geospatial data.

It is most widely used for map creation, but also has broad capabilities for editing and analysis. The "Toolbox" available in ArcMap provides an encyclopaedic array of GIS data manipulation and analysis functions for almost any application.

RESULTS AND DISCUSSIONS

Before taking the necessary steps for the hydrographic analysis, the DEM model was corrected by filling in some existing gaps in the model, gaps which represent certain errors that appeared in the model creation (POPESCU ET AL., 2016).

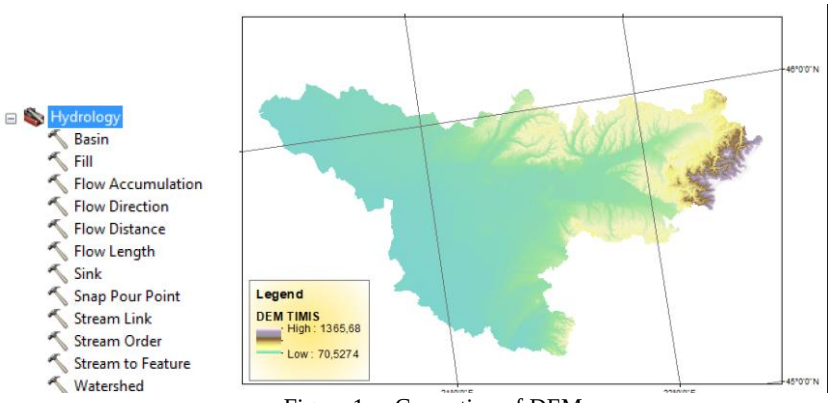
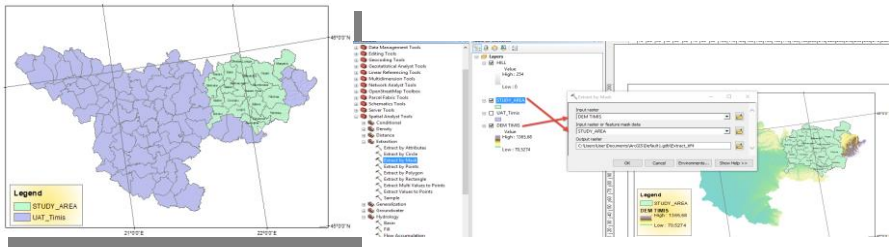


Figure 1. Correction of DEM

From the DEM (HERBEI ET AL., 2016) fill model of Timiş county, only one area of Timiş county was selected for analysis using the Extract by Mask command and thus a part of the model was cut after a series of omissions (study_area).



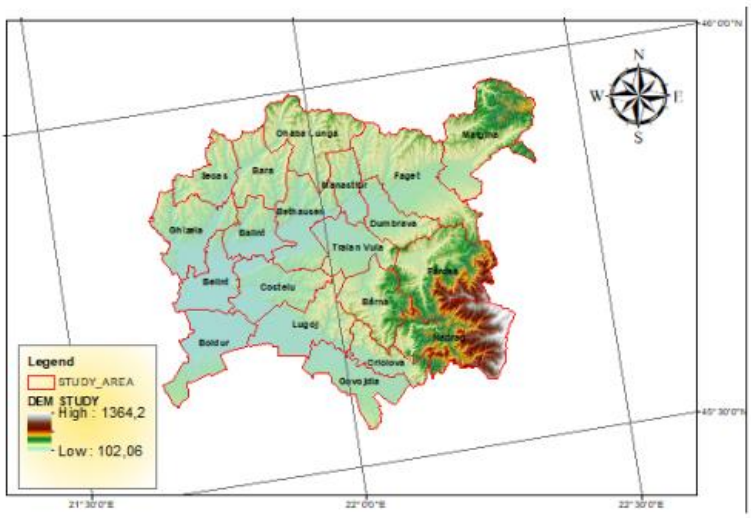


Figure 2. Cutting part of DEM

Flow Direction Determination: Flow Direction - The flow direction must be known for each cell in the model, this flow direction determines the final destination of the water flowing on the earth's surface.

The direction of flow is determined by finding the largest slope of each cell.

The distance is calculated as the distance between the centers of the cells. The direction of flow can be achieved in eight characteristic directions: up, up-right, right, down-right, down, down-left, left, up – left

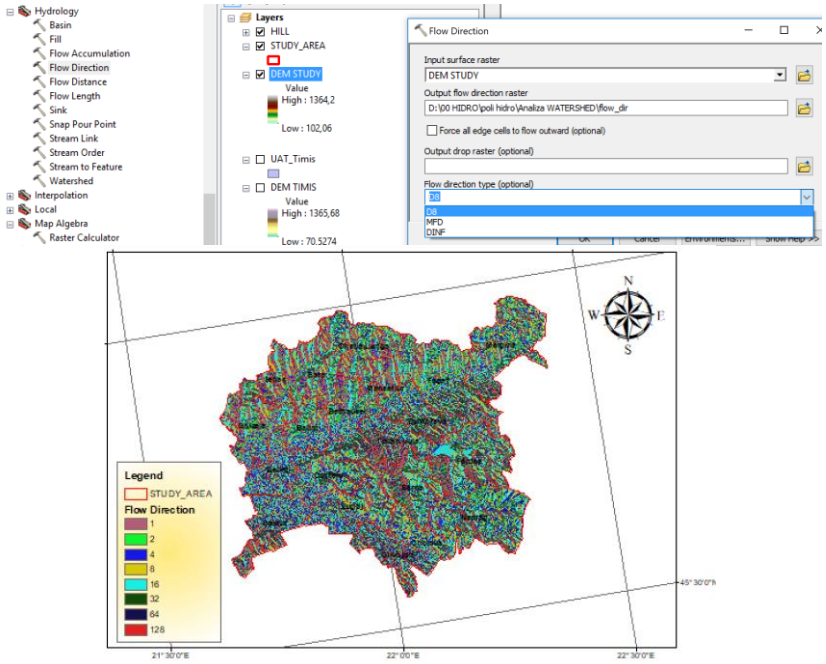


Figure 3. Flow directioin

The complex hydrological models, designed to warn and prevent the effects of slope floods, have, among the main aims and that of identifying the areas, the territories where the wave can accumulate

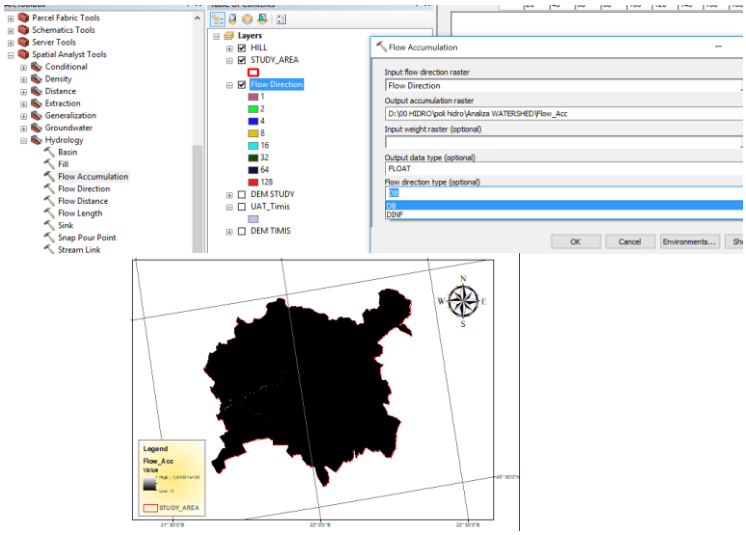


Figure 4. Calculation of possible accumulations

The range of values for flow_accumulation is very large, so this range can be resized by applying the logarithmic function to the flow_acc raster.

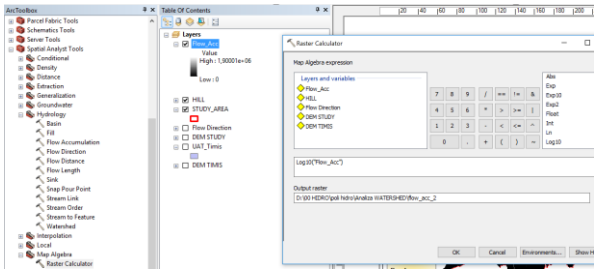


Figure 5. Resizing the range of values for flow accumulation

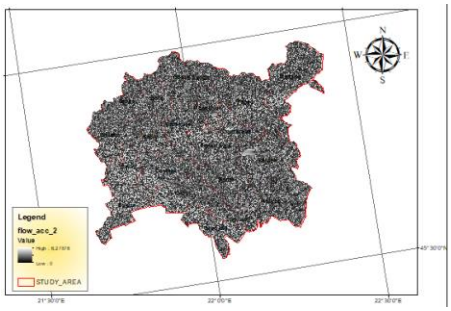
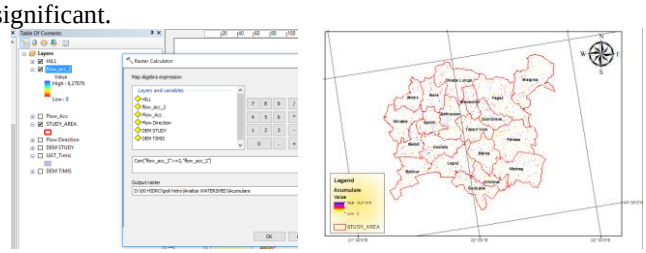


Figure 6. After Resizing the range of values for flow accumulation

Not all accumulations are significant, some of them can be eliminated. The range of values of this raster is 0 - 6.2. Subsequently, the values in the range 0-2 were eliminated because they are not significant.



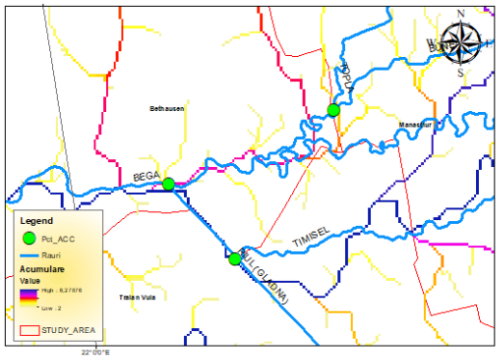


Figure 7. Elimination of errors

The accumulation point must be on a cell where the accumulation is large, within a user-defined radius.

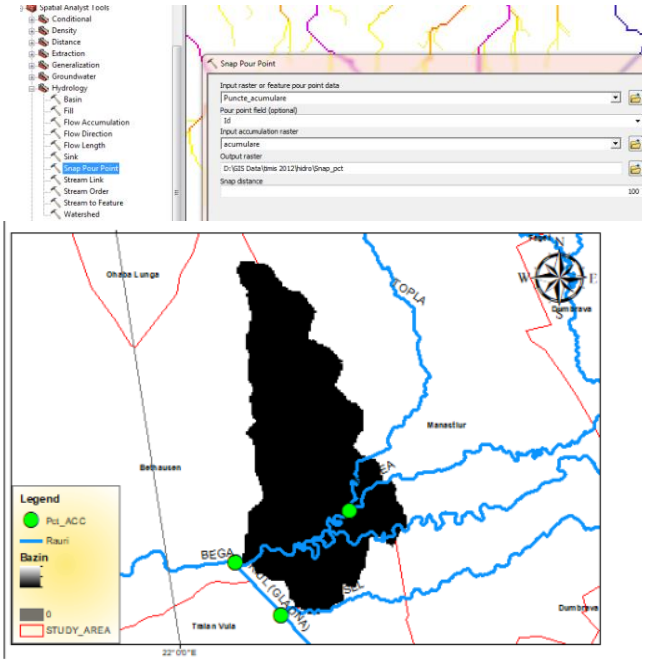


Figure 6. Creation and adjustment of accumulation points

CONCLUSIONS

GIS is one of the informational technologies that has radically transformed the way geographers conduct their research for the benefit of society. The same major impact had on him to the ordinary users by the fact that it has made their daily life easier to see.

Advantages of using a GIS:

• The data is better organized;
• Eliminates redundancy in data storage;
• Ease of updates;
• Analyzes, statistics and new searches much easier;
• Users are more productive.

By using Esri solutions we have estabilshed the direction of the water flow in the area. We have also identified areas where the wave can accumulate using the „flow accumulation" command. Data is the most important but also the most expensive component of geographical information systems.

BIBLIOGRAPHY

BADULESCU, C., MARCHIS, D. M., & NISTOR, M. C. 2016. Benefits of using fgd gypsum in Agriculture. Research Journal Of Agricultural Science, 48(4), 247-253.

BEGOV UNGUR A., SĂLĂGEAN T., FERENCZ Z. 2016. Example of a GIS Application afferent to the introduction of real estate cadastre in Cluj Napoca city, using AutoCAD Map 3D, 16-th International Multidisciplinarry Scientific Geoconference SGEM 2016, Conference Proceedings, Volume III, Book 2, Informatics, Geoinformatics and Remote Sensing, pag. 207-214.

DRAGOMIR, L., HERBEI, M., BERTICI, R., & POPESCU, G. 2016. Reducing surface soil erosion through different crop types. International Multidisciplinary Scientific GeoConference: SGEM: Surveying Geology & mining Ecology Management, 1, 561-568.

FILIP L., VEREŞ I., DIMA N. 2015. Setting up of underground topography supports two fixed points, SGEM2015 Conference Proceedings, Book2 Vol. 2, 439-446 pp.

HERBEI M. V., HERBEI R. C., POPESCU C. A., BERTICI R. 2015. Domogled – Valea Cernei National Park monitoring using satellite technology, Ecoterra 12(3):73-78.

HERBEI M., SALA F. 2015. Use Landsat Image to evaluate vegetation stage in sunflower crops, USAMV Bucuresti, AgroLife Scientific Journal - Volume 4, Number 1, pp. 79-86.

HERBEI, M. 2013. Sisteme informatice geografice, aplicaţii. Universitas, Petroşani

HERBEI, M. 2015. GIS si Modelare cartografica. Universitas, Petroasni

HERBEI, M. V., & SALA, F. 2014. Using GIS technology in processing and analyzing satellite images–case study Cheile Nerei Beusnița National Park, Romania. JOURNAL of Horticulture, Forestry and Biotechnology, 18(4), 113-119.

HERBEI, M., & NEMES, I. 2012. Using GIS analysis in transportation network, 12th International Multidisciplinary Scientific GeoConference.

HERBEI, M. V., POPESCU, C. A., BERTICI, R., SMULEAC, A., & POPESCU, G. 2016. Processing and Use of Satellite Images in Order to Extract Useful Information in Precision Agriculture. Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Agriculture, 73(2), 238-246.

HERBEI, O., HERBEI, M. V. 2010. Sisteme informatice geografice: fundamente teoretice şi aplicaţii. Universitas, Petrosani

IENCIU, I., VOROVENCII, I., OPREA, L., POPESCU, C. 2013. The urban development of mountain areas with the aim of developing local tourism. Journal of Environmental Protection and Ecology, Vol. 14, No. 3, p. 980–985

MANOLE, M., NISTOR, M., & MARCHIS, D. 2015. Using Modern Software in Surveying, Gis and Agricultural Road Design. Research Journal of Agricultural Science, 47(4), 104-114.

NISTOR, C. 2011. Theoretical and experimental researches on geomechanical characteristics of rocks used in road infrastructure.

ONCIA, S., HERBEI, M., POPESCU, C. 2013 Sustainable development of the Petrosani city, the Hunedoara county, based on GIS analysis. Journal of Environmental Protection and Ecology, 14(1), 232-239.

POPESCU, G., POPESCU, C. A., HERBEI, M., & SMULEAC, A. 2016. Measuring the parameters that influence the phenomenon of displacement and deformation of the ground at Mina Livezeni. Research Journal of Agricultural Science, 48(1).

SMULEAC A, POPESCU. C., HERBEI M., BARLIBA L., SMULEAC L. 2014. Topographic surveys and compensations with Toposys applied at the B.U.A.S.V.M. Timisoara, Romania, 14th SGEM GeoConference on Informatics, Geoinformatics and Remote Sensing, Vol. 2, No. SGEM2014 Conference Proceedings, ISBN 978-619-7105-11-7 / ISSN 1314-2704, June 19-25, Vol. 2., pp. 615-622.

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