Сегодня уже очевидно, что природные ресурсы небезграничны, что плодородие земли не бесконечно. Без естественных почв людям не обойтись, поэтому человеку нужно пересмотреть своё отношение к почвам, заботясь об их сохранении и умножении.

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FLOW DIRECTION AND LENGTH DETERMINED BY ARCGIS SPATIAL ANALYST AND TERRAIN ELEVATION DATA SETS

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Abstract. *Current work presents results of the terrain data processing for hydrological analysis using two GIS software: ArcGIS and Idrisi GIS. The aim of the research is to analyze the situation of the river basin in the selected study area (Gallocanta, Spain), to assess possible risks for floods and landslides. The study aims to understand the processes and spatial and temporal patterns of surface-climate interaction in a watershed to assess the impacts of the local climate change on the hydrological conditions of the lake's surroundings and to develop geomorphic analysis using SRTM input data, for effective environmental management.*

Key words*: Elevation, Hydrology, Modeling, Climate Change*

1. Introduction. There are various existing geospatial data formats for digital elevation models (further, DEMs). In this research the geotiffs were taken as initial raw data (Fig.1), because they are high quality free datasets available at the website of NASA's Shuttle Radar Topography Mission (STRM) and cover much of the globe.

The study area is located in the north-east Spain, surroundings of the Gallocanta lake (Laguna de Gallocanta), notable for sensitive and rapidly changing environment and changed drastically as a sequence of wet and dry phases during the past 60 years [4].

The aim of the study is to developed a spatially distributed dynamic runoff model using SRTM DEM data. The purpose if to assess influence of the climate change on the spatio-temporal patterns of the hydrological processes in the Gallocanta basin. Lake level and salinity are subject of periodic changes of rainfall in course of XX century. Thus, since 1980s, the level of Laguna de Gallocanta has distinct changes (high water level or dry period), each lasting up to ten years [2], [3]. For the past eight years, lake levels dropped several times which resulted in complete disappearance of water. In course of the 20th century the fluctuations in the lake level were also significant including seven completely dry periods since the middle of the XX century [1]. Thus, the hydrology of lake is strongly affected by the external climate and environmental changes.

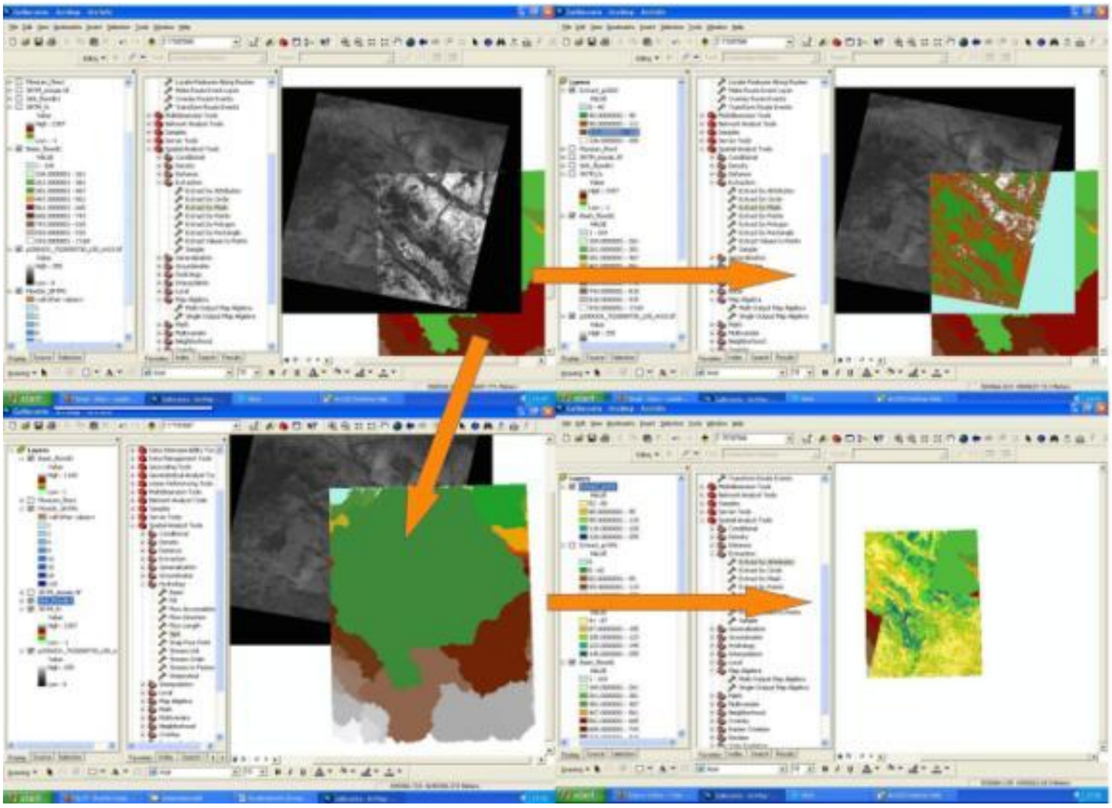


Fig.1. Study area: location (upper left), DEM model (upper right), Histogram of the elevation values (below left), location of four image parts (below right).

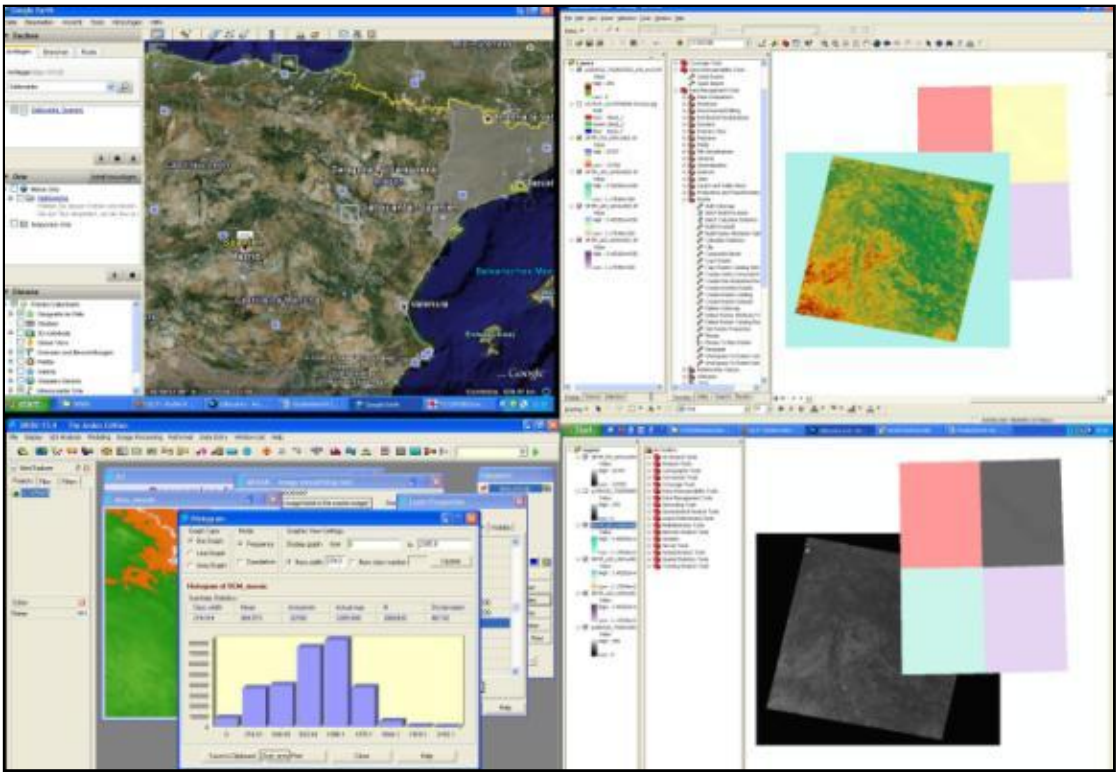


Fig.2. Mosaic of image covering study area.

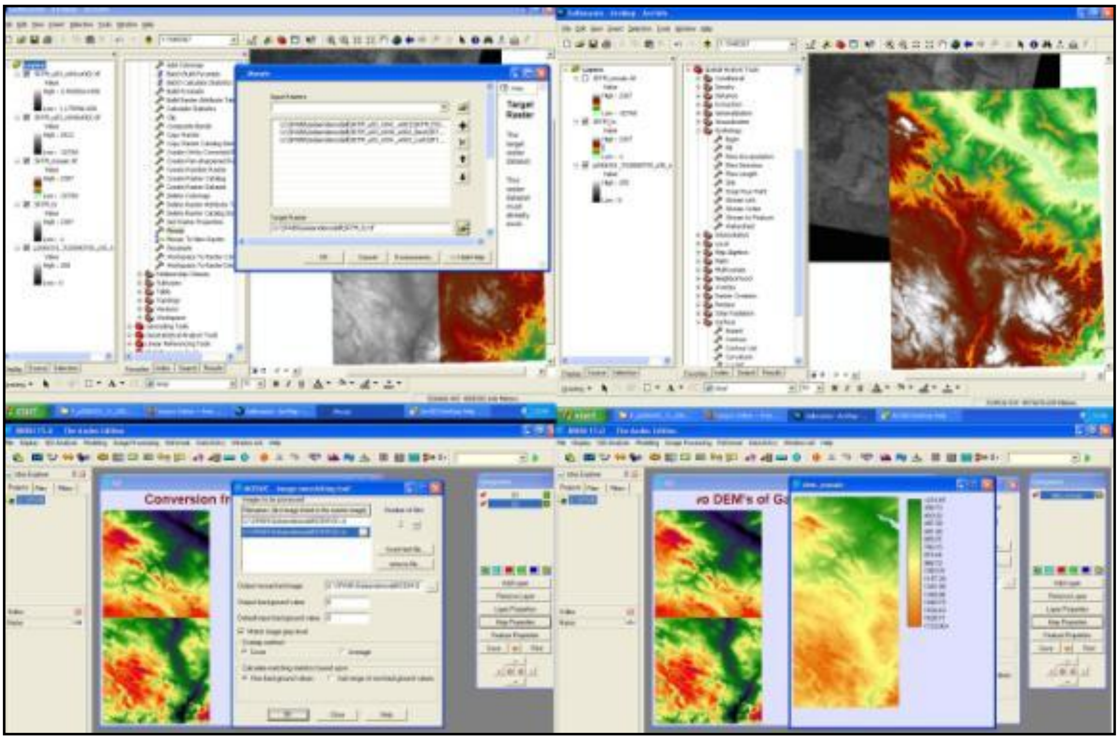
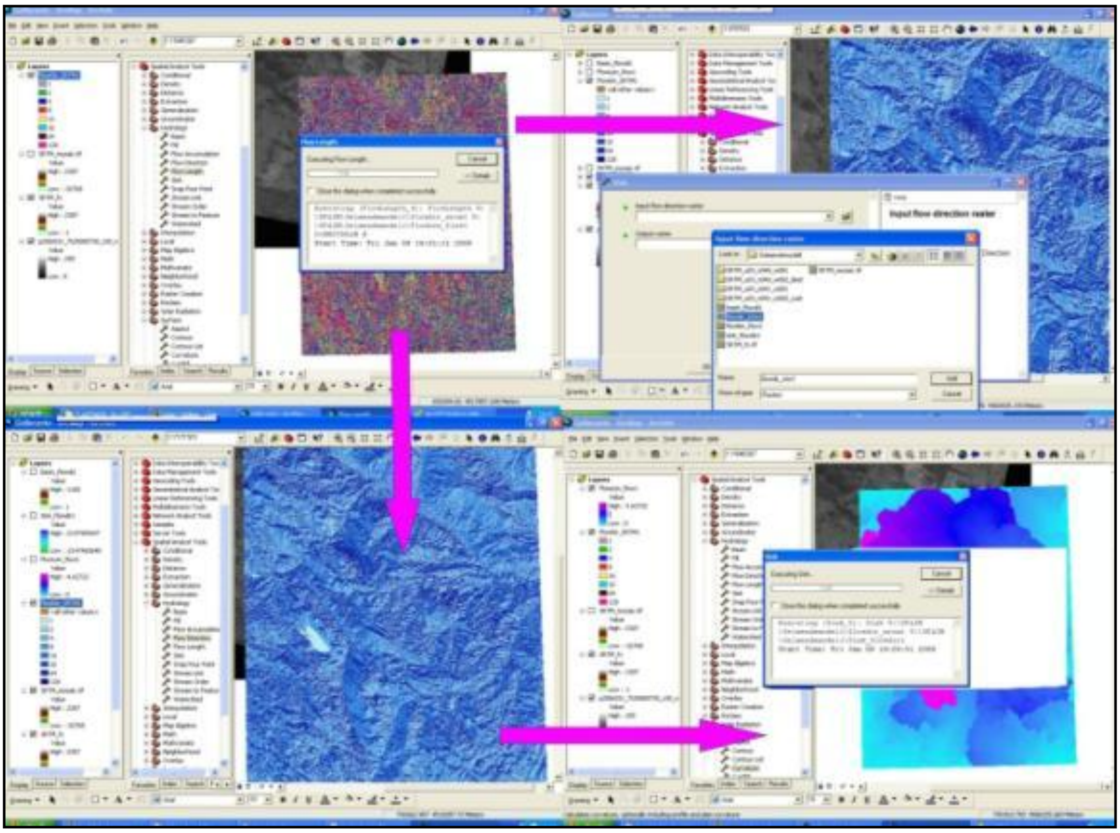


Fig.3. Computing Flow Direction and Flow Length by Hydrology Modeling Tools



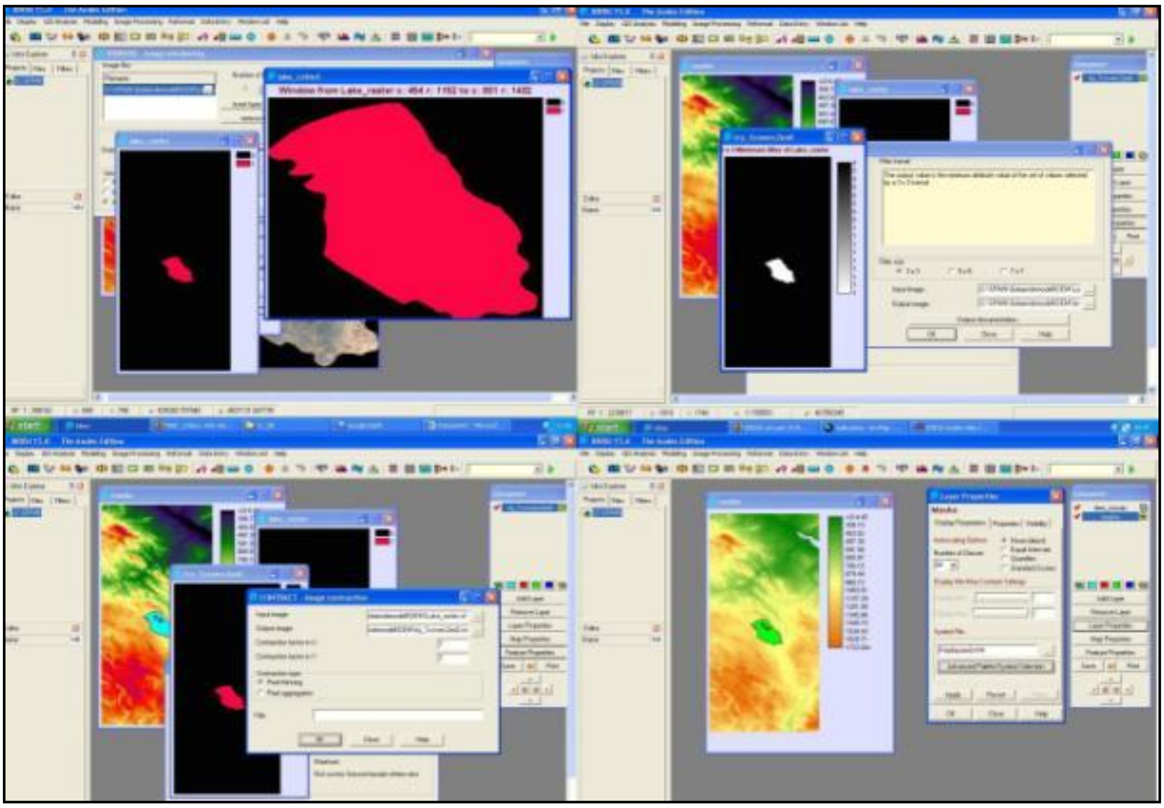
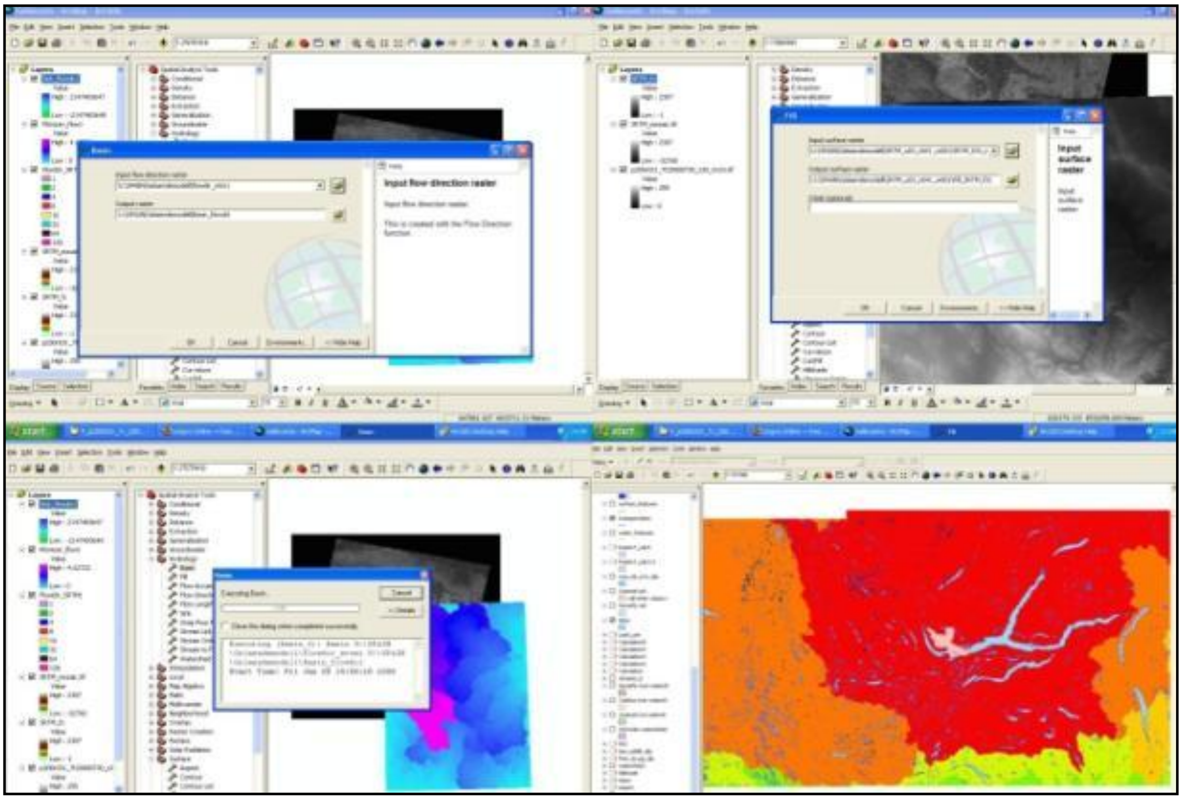


Fig.4. Masking study area and converting in Idrisi GIS Andes.

The data include terrain digital elevation models taken at SRTM website. The methodological tools included GIS software: ArcGIS and Idrisi GIS. The workflow consisted in processing data using ArcToolbox by means of embedded mathematical modeling instruments for visualizing hydrological settings of the study area. The first step included downloading data and reading them into the GIS project. To analyze the terrain properties, a histogram of the raster data was visualized (Fig.1). Second step consisted in creating a mosaic using two neighboring images covering parts of the study area, respectively. The details of the workflow are depicted on four slides of the image: 1) choosing SRTM data to generate tiff; 2) creating mosaic; 3) setting up scale parameters (zero pint of elevation) to smooth two images and adjust to one scale; 4) visualizing created image; (Fig.2). The next step included data overlay (Fig.1) and computing hydrological settings (Fig.3). Calculating flow directions is possible using embedded functions and modeling in ArcToolbox, ArcGIS. Executing Flow Length and Flow Direction has been done using Spatial Analyst Tool, Hydrology. Flow Direction is visualized in blue colors on Fig. 4. as well as the process workflow.

The Flow Direction created a new grid (shown in blue colors, Fig.4) that demonstrated the direction that each of the cells in the grid flows into using shadows of color (the “relief” effect, Fig.4). After the Flow Direction was created, the next step was creating a Flow Length grid which is received from the Flow Direction grid (while Flow Direction was created directly from the DEM). The Flow Length was calculated to select the length of the longest flow path within a basin of the Gallocanta lake and to create distance-area diagrams of rainfall and runoff events using the weight raster. To determine distance and travel time the weights was used. In theory, the travel time varies depending final discharge point of water: if it runs in a channel or downslope. In this case, is a simple version of a runoff model was used, determining water running downslope. The area has been masked using lake contour of the study area overlapping the raster image. The output terrain has elevation values from 214,7 m to 1723 m a.s.l. The masking has been performed using Idrisi GIS and converted then to the ArcGIS.

Finally, the Basin tool of ArcGIS was using to model watershed of the study area. The Basin tool is based on the ridges within the raster dividing the entire image into different basins. It automatically selected the pour points (points where water flows out of an area, the outlet of the Gallocanta lake) located on the ridges of the highest elevations. Using this data, the basin for the whole area was modeled (Fig.5). The drainage basin was delineated within the analysis window by identifying ridge lines between sub-basins within study area of laguna de Gallocanta. The input flow direction raster has been analyzed to find all sets of connected cells that belong to the same drainage basin. Thus, the drainage basin is created by locating the pour points at the edges of the study area, as well as sinks, resulting in a visualized raster of the drainage basins within the study



area of laguna de Gallocanta (Fig.5).

Fig.5. Processing Basin Hydrology modeling tools, ArcGIS, fragment.

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