Introducing Modelbuilder as an Automated Local Accounting System

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ABSTRACT: In the world of computer industry, previously developed programs are being improved, and in our country, along with the developed countries of the world, there is a gradual transition to work on the basis of modern programs.ArcGIS software products based on the latest computer technologies meet all open standards, which allows them to be used in many practical areas and at different levels of work organization (individual, server and mobile).

KEYWORDS: Modelbuilder, ArcGIS software, Data base

I. INTRODUCTION

ArcGIS software has a clear model of working with data, especially spatial data, and this model is called a geodata. The geodatabase serves as the basis for storing all types of data used in the process of working with ArcGIS applications, i.e. the geospatial acts as a warehouse for storing various data. Using a geodata helps not only to effectively manage data stored locally or on a server, but also to create complex models when working with different industries and projects.

II. ACTUALITY OF THE TOPIC

Today, when working with a geodatabase, users will be able to work with two different models at the same time. These are physical and logical models. This not only ensures that the objects are geometrically related,but also allows them to be linked at the object level.

1.picture. **Geo – data base models**

Phisic model		Logical model

III. OBJECT AND METHODS OF RESEARCH

In a geodata, data can be stored locally, i.e. on users 'PCs or on a server. The following geospatial storage options are available:

- file geodatabase - file folders on disk;
- personal geodata - a database in a Microsoft Access (.mdb) file;
- MBBS (Database Management System - Oracle, SQL Server, Informix, DB2 or PostgreSQL).

When modeling a geodatabase, users can introduce some rules to be able to avoid mistakes and inaccuracies that may occur in the future. It is also possible to correct deficiencies in data entry using special verification tools.

In a geodatabase, users can not only work with simple dots, lines, and polygons whose data is stored in tables, but also rely on real-world objects. For example, they have the ability to work with transformers instead of points, and with pipes instead of lines.

Although there are many different scripting languages in the GAT software market, we can distinguish three programs that are recognized by many: VBScript, JScript, and Python. VBScript and JScript are considered by many programmers to be simple programming languages. These programs are also designed to run in a Windows environment, such as the C programming language. Python programming language is an easy to learn language similar to C programming language. In addition, Python can run on UNIX, Linux, Windows, and more, regardless of the operating system.

Python is a standalone open platform programming language. It is widely used because it is a fast, powerful and easy to learn programming language.

Python has been used in script writing for geoprocessing since ArcGIS version 10.0. Each edition of Python is expanding its capabilities and making it easier to use.

Python programming language is introduced into the whole ArcGIS system, it is a language for automation of analysis, data modification, cartographic work processes, which increases the productivity of work.

Geoprocessing using the Python programming language is done with the ArcPy site-package mechanism in ArcGIS software. ArcPy provides access to additional features, classes, and modules that allow you to quickly organize simple and complex workflows in geoprocessing tools as well.

It is possible to store large amounts of data in a geodata. For example, sheets of topographic maps can be stored as a common thematic layer of multiple sheets, rather than as a whole. In doing so, most operators can refer to layers of such themed cards and edit them at the same time. ArcGIS also has the ability to create additional modules using the visual programming language ModelBuilder or by writing a script in a text programming language. Scripting in ArcGIS is an effective method that can be used to perform large and complex processes, from simple processes. It is also notable for allowing scripts to be reused.

Everyone who uses ArcGIS is required to write their own scripts to automate the workflow. Even someone unfamiliar with the programming language or its terminology should be able to visually create a model of personal tools using the ModelBuilder model.

ModelBuilder is a sequence of algorithms used to create, edit, and manage models. The models are linked to each other in a sequence of geoprocess tools. In his research, the author used ModelBuilder as a visual programming language to create workflows.

In this model, a number of process algorithms were performed using the Study area polygon, such as soil analysis, new field addition, layer shearing, calculation of new area value, and geostatistical analysis.

ModelBuilder is very useful in creating simple and complex workflows and implementing automated systems, providing with additional methods for ArcGIS functionality, which allows to create and share specific models as a tool.

ModelBuilder provides great convenience in creating and executing less complex workflows, as well as providing additional methods for the functionality of ArcGIS, which allows to create and share specific models as a panel. In addition, ModelBuilder allows ArcGIS to be integrated with other applications (Figures 2, 3, and 4).

In the ArcMap application, algorithmic work is carried out using the ModelBuilder panel for quality management of agricultural lands and modulation of the automated system. When performing algorithmic work, the sequence of commands is determined by the rules of the program and modulated based on the use of thematic layers and tools in the ArcToolbox panel.

In order to implement the modulation, it is first necessary to automate the field research system. Electronic digital maps created in ArcGIS software, which belongs to the family of geographic information systems, serve as a basis for automating field research.
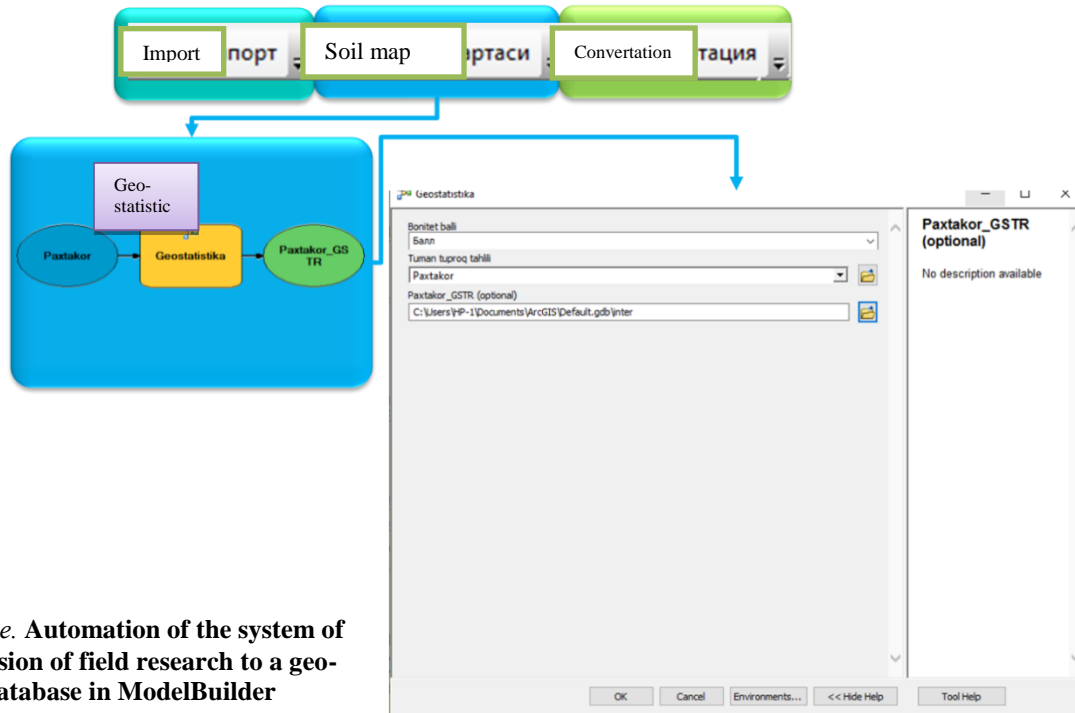
2-picture. **Automation of the system of conversion of field research to a geo-database in ModelBuilder**
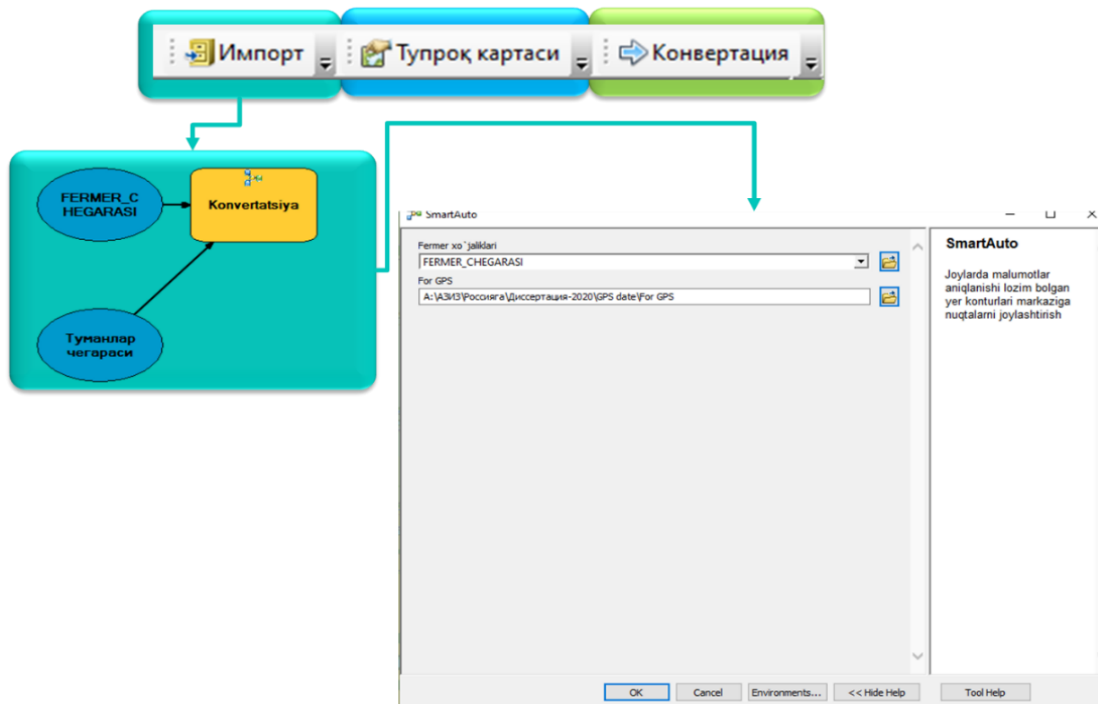
3-picture. **Automation of the system of conversion of field research to a geo-database in ModelBuilder visualization**
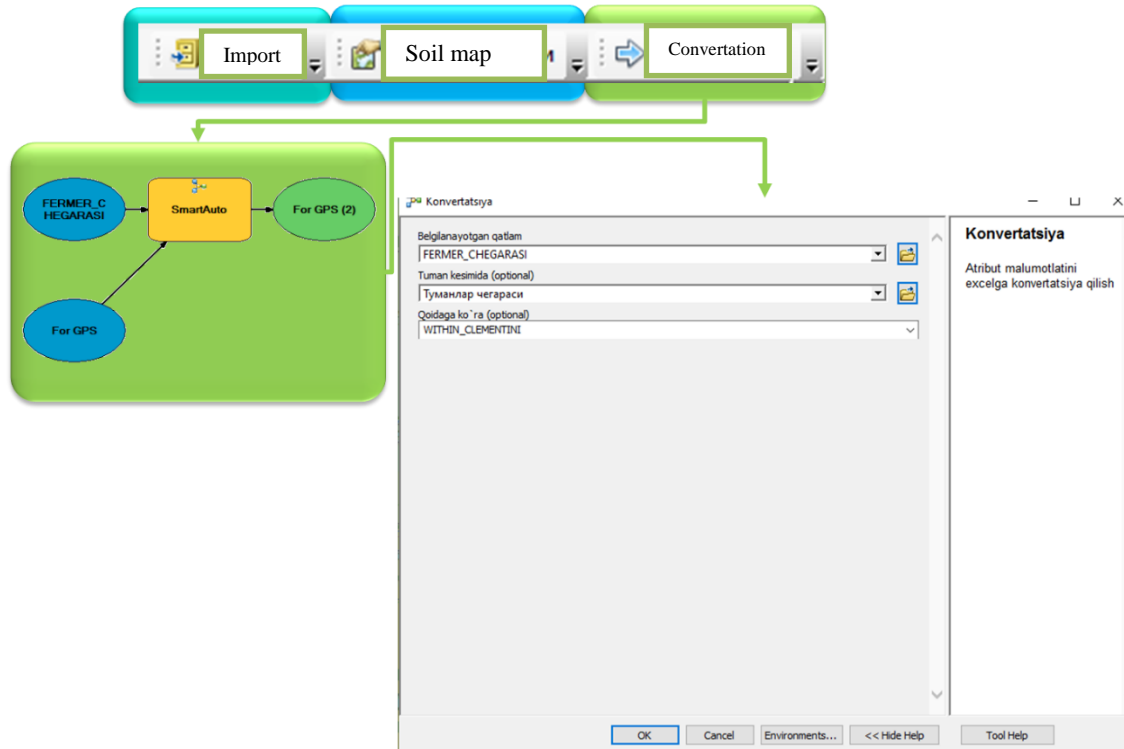
4-picture. **Automated Algorithm for Exporting Analyzed Data to a Table View in ModelBuilder**

Stages of automation:
1. Export of electronic digital data with geographical location;
2. Integration of geodata database of field research results through GSM network;
3. Carry out geostatistical analysis based on the results of field research.

The thematic layers of electronic digital cards created in the ArcMap application of ArcGIS are the object of modulation.

Uploading the results of field research using a GPS device to the ArcGIS formula and performing geostatistical analysis is carried out in the following order (Figure 5):

- Mobile Mapper Office software is installed on the computer;
- administrative-territorial boundaries of the selected territory are downloaded;
- the Open line is activated via the file menu;
- the generated Open window displays the address of the results of field research on the GPS device;
- * .MMJ format unit GPS device files are selected and the Open button is pressed;
- Open data a window will appear under the name GIS and the coordinate system and attribute columns will be viewed;
- When the open button is pressed, the data of the vector layer in the form of a dot of the GPS device is visualized on the desktop;
- exported to * .Shape ArcGIS format unit via file menu;
- Vector layers in * .Shape format are imported into the ArcMap application of ArcGIS;
- the geographical location of vector layers in the form of points is considered;
- Qualitative analysis of the results of field research through the geostatistical analysis panel;
- the appropriate information column is selected for the analysis of the vector layer in the form of a dot;
- the process of sectoring is carried out using the method of quality colors;
- according to the results of the analysis, the errors are equalized;
- Colors describing the quality of lands are standardized at the stage of classification;
- in the standardization of classifications are brought into a single unit with non-natural numbers;
- Possibilities of color visualization of soil color are considered;
- the classification is memorized and combined with an electronic digital card using RGB spectral colors;
- Land users and land contours are activated and the information of the attribute data columns is visualized.
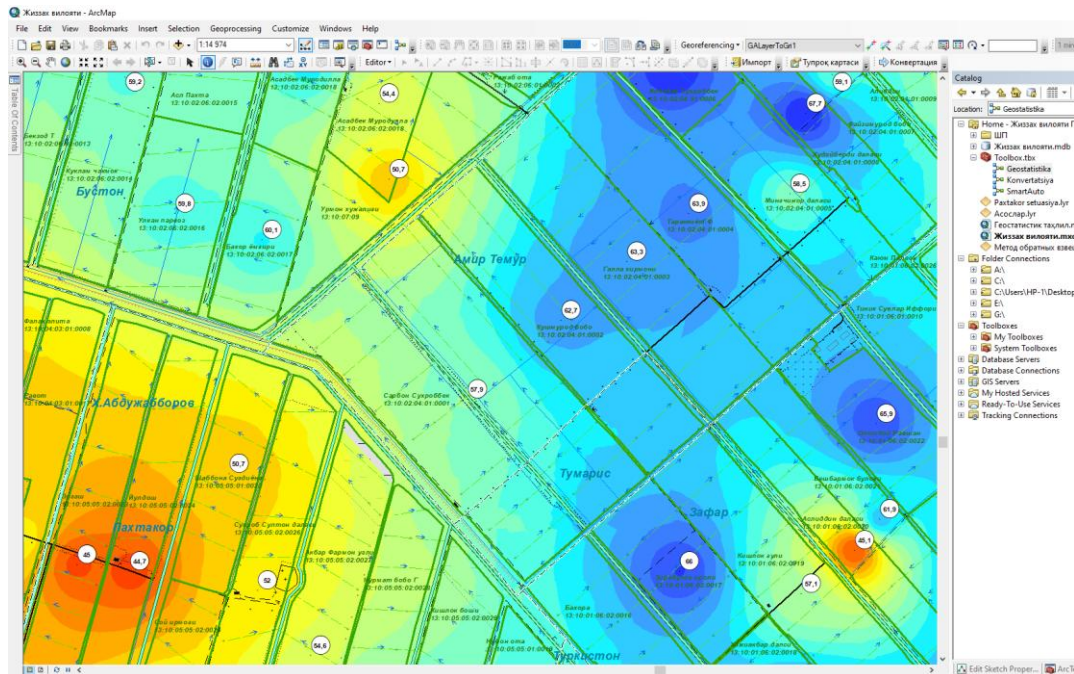
5-picture. **ArcGIS program interface that visualizes land users, land contours and soil quality points.**

- Automation and modulation of quality management of agricultural lands is carried out in the following order (picture 6):
- - A new ArcToolbox toolbar will be created in the ArcCatalog window of the ArcMap application;
- - A module is created through a new line from the ArcToolbox toolbar;
- - the resulting module window is schematized by the algorithmic sequence;
- - the required tools are downloaded from the ArcToolbox toolbar;
- - schematic algorithms are interconnected;
- - Several Toolbox tools can be interconnected in the development of algorithms;
- - it is possible to ensure the participation of the required vector layers in the loading and algorithmic process by the add command;
- - In the algorithm it is possible to make corrections to instruments;
- - or amendments may be made;
- - enters the toolbox to provide rules and explanations to the interfaces in modulation;
- - The completed module is started and checked. Successfully completed module schemes are automatically visualized with unique colors;
- - module interfaces can be checked and modified;
- - Algorithm of the module created for automatic implementation of geostatistical analysis;
- - Algorithm of the module for identifying land users in the relevant area and exporting attribute data to an Excel spreadsheet;
- - Algorithm of the export module to create a vector layer in the form of a dot from the ground users to the center of the land area and upload it to the GPS device.
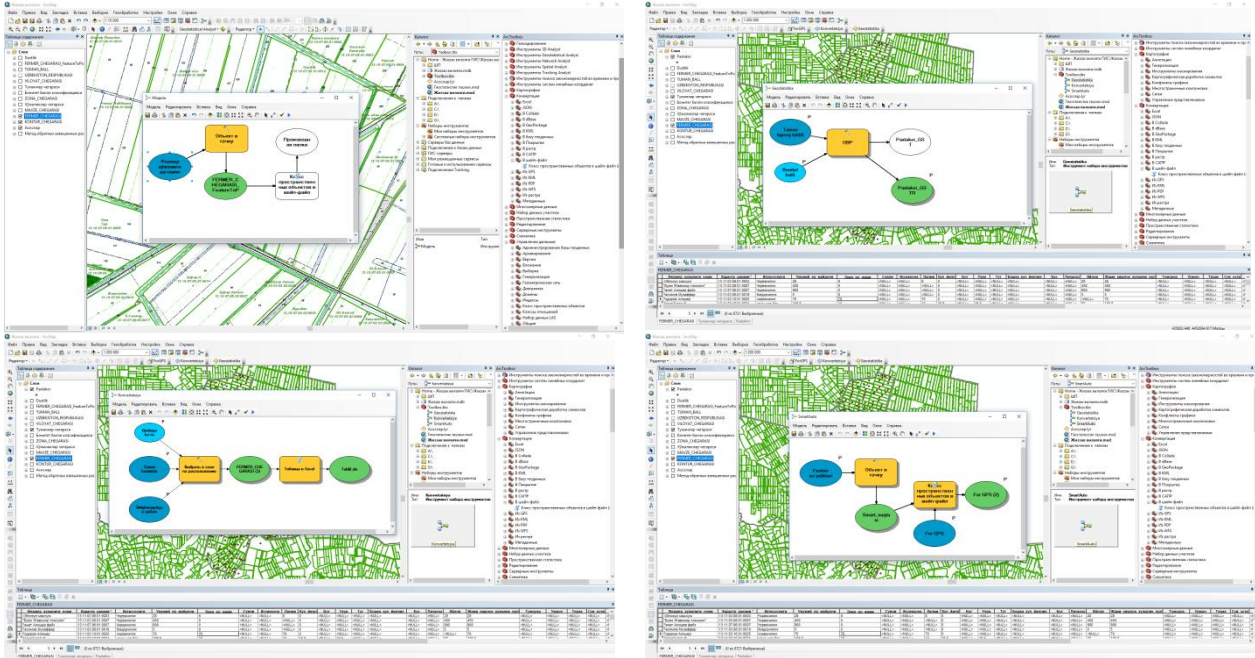
6-picture. **Automation and modulation of quality management of agricultural lands.**

The role of integration is important in the management of agricultural land accounting and the modulation of automated systems. An electronic digital map created in ArcGIS software to perform field research results on a GPS device is loaded with vector data in the form of dots placed in the centers of the field according to land users and their geographical location. Based on the loaded vector data, the GPS device examines the total land area of land users, crop types, irrigation networks, and similar objects.

To investigate soil quality and classifications, point-view vector layers mounted on the center of common land areas of land users are loaded into a GPS device. Soil analyzes are taken from the points along the defined threshold according to the loaded layers. The soil obtained under field conditions is analyzed and the results are sent to the geodata database via the GSM network. The results are imported into the ArcGIS program and analyzed by the geostatistics module. The analysis results in the automatic creation of RGB spectrum classifications and visualization of soil differences using the quality color method according to the value of soil score quality. These studies show that to date, soil separation is carried out mechanically by the Center for Soil Composition and Repository, Quality Analysis. Drawing of land allotments in mechanical works is time-consuming and poses considerable problems for regional land surveyors in deriving normative value estimates to land users. In particular, we can cite the fall of several soil separations in a single land contour. In the automated system recommended by the author, the software module performs the drawing of soil separations automatically. Provides the ability to determine the normative value estimates on the land contour at the general regional, district or provincial level using algorithm codes.

IV. RESEARCH RESULTS AND DISCUSSIONS

As a result of scientific research, the means of spatial analysis of data and their geographical processing have been expanded. Algorithms in Model Builder for export of attribute data, creation of vector-shaped layers in the center of land plots and geostatistical analysis of spatial data, creation of statistically accurate surfaces and automatic visualization of soil separations for land users to conduct qualitative field research developed.

V. CONCLUSIONS, SUGGESTIONS AND RECOMMENDATIONS

The analysis of the development of algorithms for modulation and data integration in the automated system of quality indicators of land accounting was analyzed and the following conclusions were drawn.

Field research results ESRI individual products belonging to the ArcGIS family have been integrated into common architecture and interface basic applications such as ArcMap, ArcCatalog and ArcToolbox, and their functions, geographic processing and spatial analysis tools have increased.

Currently, the above work is being continued and it is planned to implement it in other regions of the country in 2020-2025.

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