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# CREATING A 3D MODEL OF THE RELIEF OF THE PLACE USING GIS PROGRAMS BASED ON THE HEIGHT DATA OF THE AREA

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## ANNOTATION

In this article, create a 3D terrain model using GIS software based on area elevation data, Google Earth, Google Earth interface, Create a raster elevation model from points, The process of creating a raster terrain model, Upgrading raster and vector terrain models to three dimensions, Adding data to ArcScene information has been provided.

**Keywords:** Google Earth, GIS, ArcScene, ArcMap, model, 3D, GPS, ArcToolbox.

## INTRODUCTION

Geographic information systems (GIS) are systems designed for the collection, storage, analysis and graphical representation of spatial data and related information. In other words, these are tools that allow users to search, analyze and edit digital maps, as well as provide additional information about objects.

GIS includes the capabilities of raster and vector graphics editors and analytical tools, and is used in the fields of cartography, geology, meteorology, land planning, ecology, urban management, transportation, economics, and defense.

Implementation of geoinformation projects (GIS project), creation of GIS in the broadest sense of the word includes the following stages: pre-project studies (feasibility study), including the study of user requirements (user requirements) and functional GIS software tools feasibility, feasibility study, assessment of "cost/benefit" ratios (costs/benefits); GIS system design (GIS design), including pilot project stage (pilot-project), GIS (GIS development); small regional part or test area (test area), prototyping or creation of an experimental sample or prototype (prototype); introduction of GIS implementation; use and use.

The purpose of the research is to import the data obtained from the geodetic measuring instruments into the ArcGIS program and to create a plan of the place according to the given outline. Also, create a map of the location in ArcMap based on the elevation data of the area's point layer obtained from Google Earth Pro [1,2,3].

Methods for solving the problem: obtaining data using electronic measuring devices used in geodesy (tacheometer, GPS receiver), creating a 3D model of the place using the Google Earth Pro program based on the elevation data of the points and horizontal lines.

## RESULT AND DISCUSSION

What is Google Earth?

Google Earth is a world map on steroids. Zoom in on satellite photos of the world and walk slowly. Use Google Earth to find driving directions, find nearby restaurants, measure the distance between two places, do serious research, or take a virtual vacation. Use Google Earth Pro to print high-quality photos and create images.

Google Earth can be downloaded for free from earth.google.com.

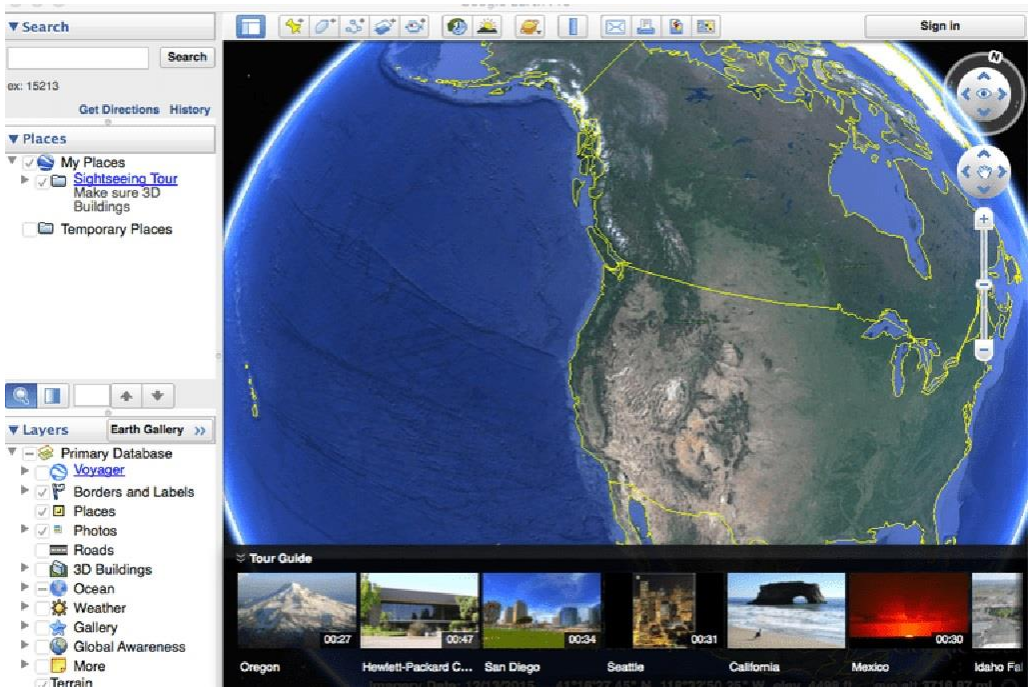


**Figure 1. Google Earth program interface**

Many Google Earth features are already available in Google Maps. Google Maps has added features from Google Earth over the years, and Google Earth will eventually disappear as a separate product [4,5,6].

History

Google Earth was originally called Keyhole Earth Viewer. Keyhole, Inc. was founded in 2001 and was acquired by Google in 2004. Co-founders Brian McClendon and John Hanke were with Google until 2015. McClendon went to Uber and Hanke ran Niantic Labs, which was spun off from Google in 2015.

Platforms

Google Earth is available for download as desktop software for Mac or Windows. Use on the web with a compatible browser plug-in. Google Earth is also available as a standalone mobile app for Android or iOS.

Google Earth interface

Google Earth opens the world to space. Clicking on the planet and walking will rotate the globe. Medium scroll wheel or right-click zooms in and out for close-up shots. In some places, it has enough information to evacuate cars and even people. If you move past the top-right corner of the globe, the small compass becomes a large naviGISion control. Press and hold the circle button to open the map. A north compass moves accordingly. Press the arrows to move right or

use the star as a joystick to move in any direction. The dial on the right controls the zoom level [7,8,9].

You can get a perspective view of the world and move the horizon line up or down. This makes you look like you're above your loved ones rather than looking directly at them. Also very comfortable with 3-D buildings. This view is better with the Terrain layer turned on.

Google Earth can provide a lot of information about a place, and if you start looking at it all at once, it would just be more confusing. To fix this, information is stored in layers, which can be turned on or off. Layers include roads, boundary markers, parks, food, gas, and housing. The layer area is located at the bottom left of Google Earth. Enable layers by clicking the checkbox next to the layer name. Disable the layers in the same way. Some layers are grouped into folders. Click the check box next to a folder to open all items in the group. Open a folder by pressing the triangle next to the folder. You can use the advanced view to select or deselect individual layers [10,11].

Earth and 3D buildings

The two layers are also useful for creating a three-dimensional globe. Simulates terrain elevation, so you can see mountains and other terrain while locking your perspective. A 3D building layer allows you to zoom in on cities like San Francisco and fly between buildings. Buildings are available for a limited number of cities and are only available in gray, random shapes (although additional textual building information is downloadable).

Search from Google Earth

The top right corner allows you to search for any address. Most addresses require a state or country, but some major US cities require only the name. Typing in the full address will get you to that address, or at least close to it. Most of the addresses I live in have at least two houses closed [12,13].

When making a map, first of all, we open the Google Earth program. From the program interface “Добавыт путь” the elevation points of a place are determined through the command. In the marking process, it is better to take places with a more obvious relief. In this case, the right mouse button is pressed and the points are selected.

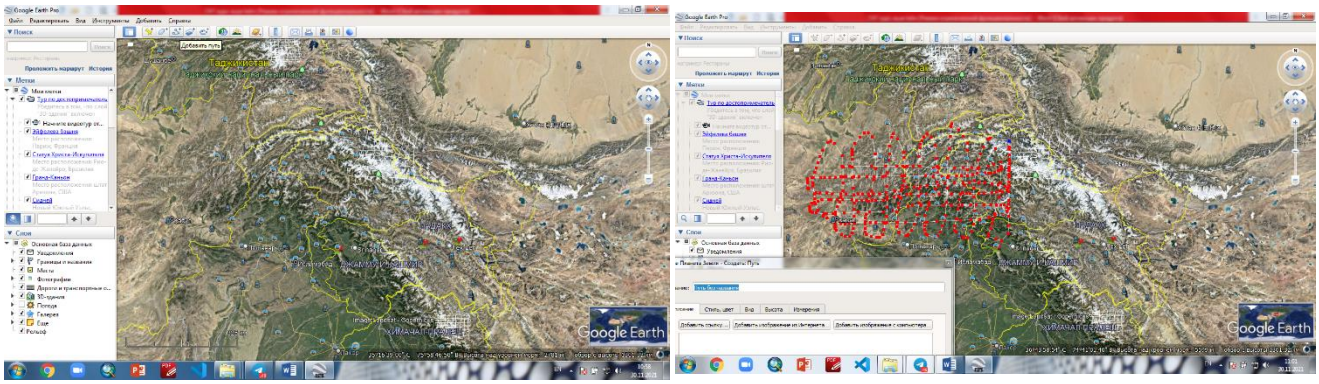

**Figure 2. The process of marking points in Google Earth**

We save the obtained points in the label column with the name "height data name". Then, to save our obtained points again, we right-click on it and save it in "KML" format, specifying the storage location.
Before saving, it is better to open a folder with the name of the drawing and save it in it.
Now we need to convert our saved data into a format that ArcGIS can read. Internet helps us in this. For this, we go to the "GPS visualizer" site and convert our data to GPX format [14,15].

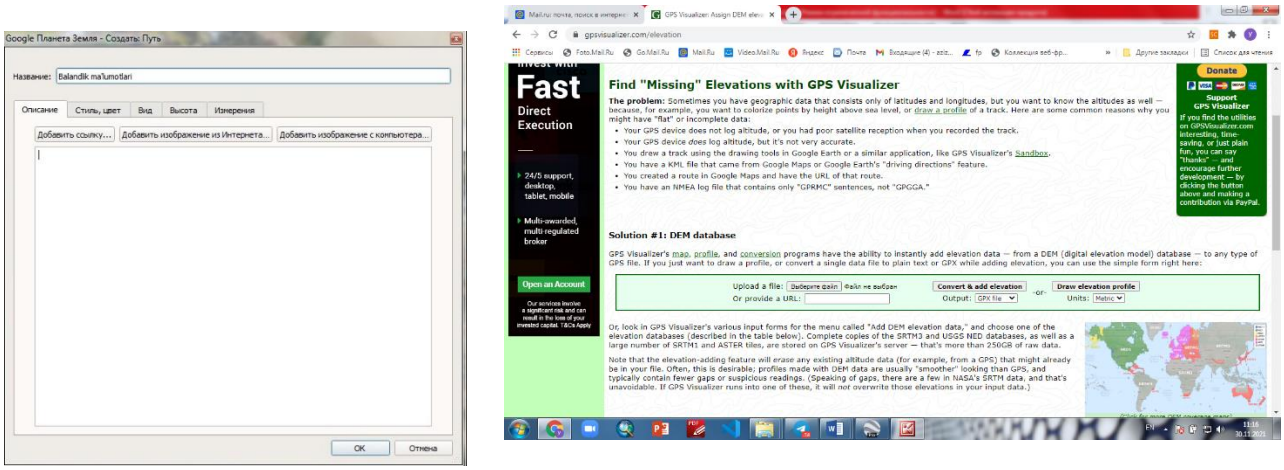


Figure 3. The interface of the "GPS visualizer" site

Open ArcMap and enter Arctoolbox. There, select from GPS and GPX to features command from Conversion Tool.

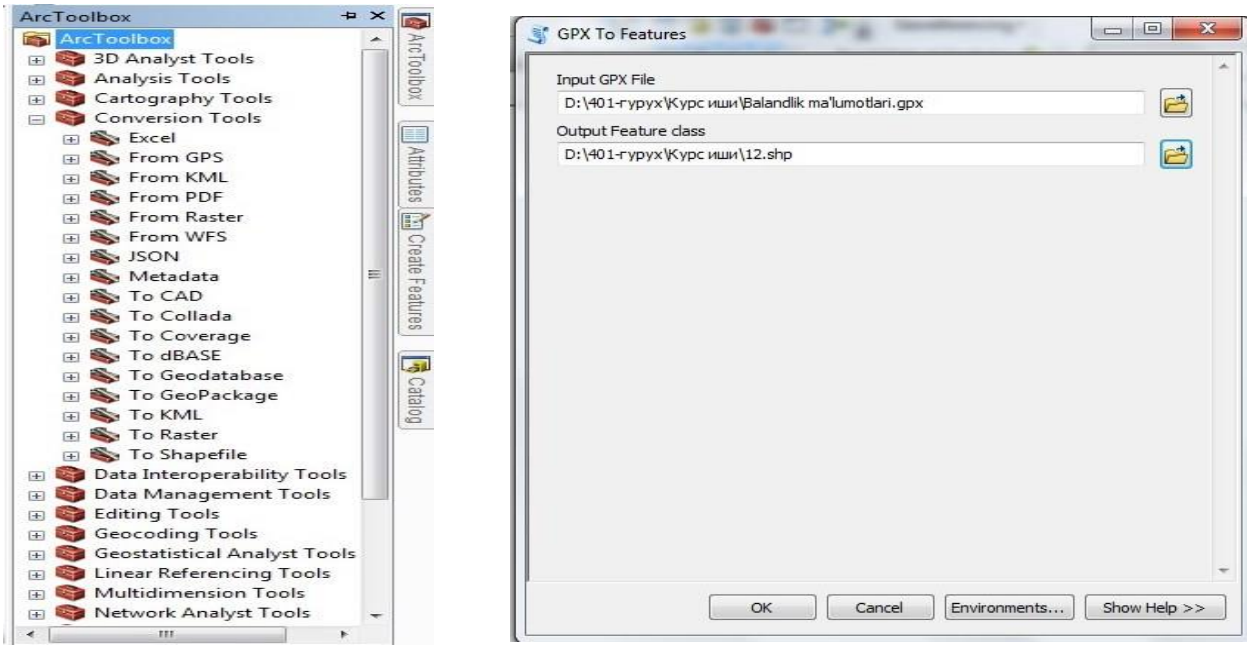


Figure 4. GPX file conversion window in Arctoolbox

In the process of conversion, the storage location of the points is indicated and the "Ok" button is clicked. This will display the points in the ArcMap window [16,17].

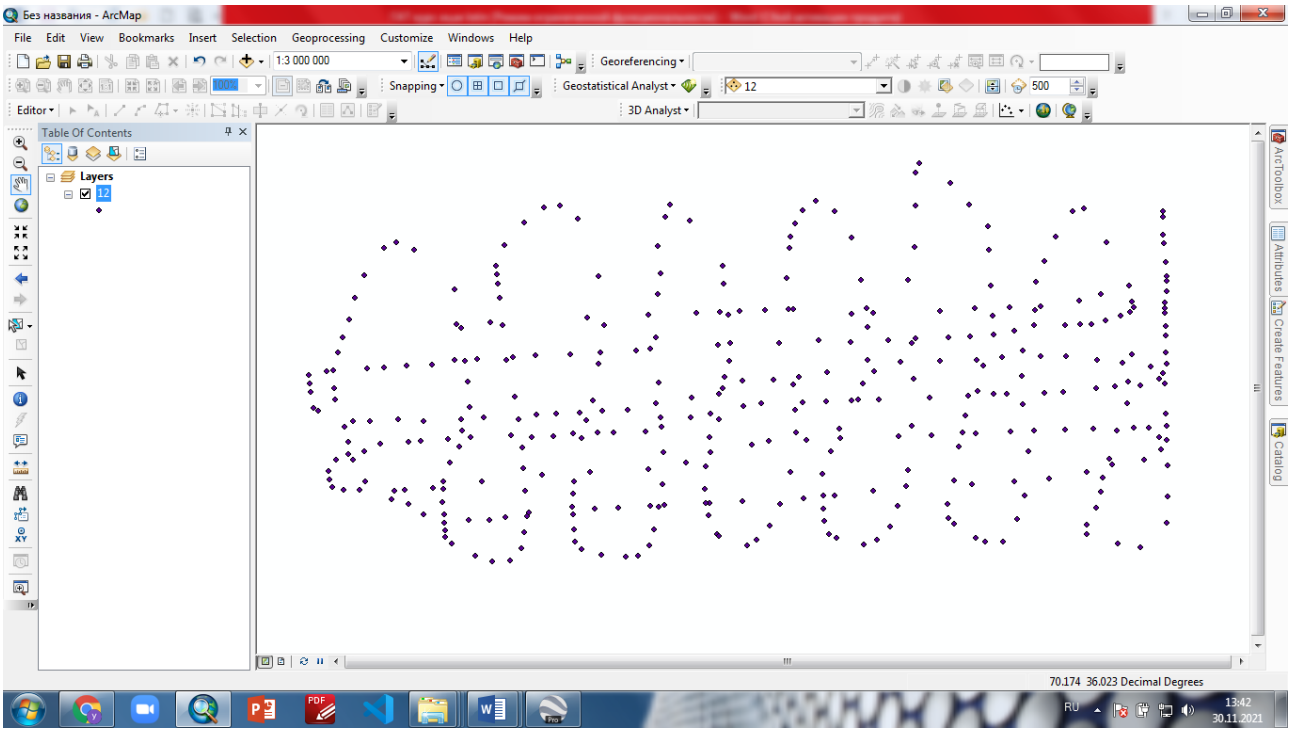


**Figure 5. The resulting points**

Create a raster elevation model from points

Through our resulting point layers, an elevation model of the location is created based on its elevation information. To do this, select Spatial analyst Tools in ArcToolbox and select IDW from it. Then the following window will open to us.

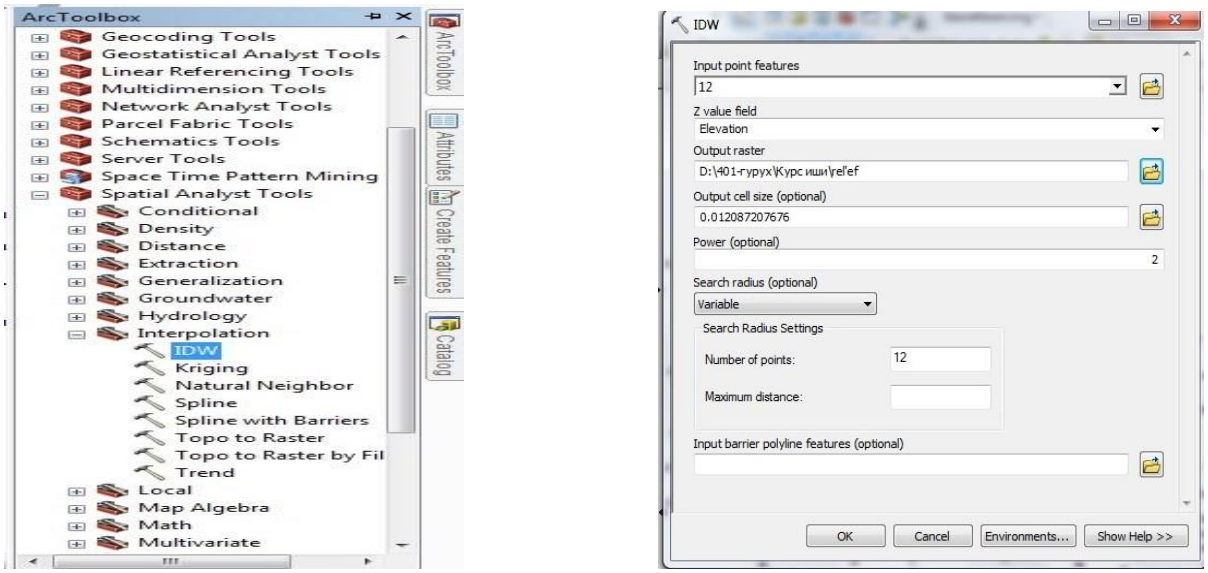


**Figure 6. The process of creating a raster model of the terrain**

The points obtained there are marked as sources. Because the program creates relief based on its data. The storage location must also be specified and the "Ok" button will be clicked at the end. In this way, the raster model of the relief is created in the classes of cross sections of heights [18,19].

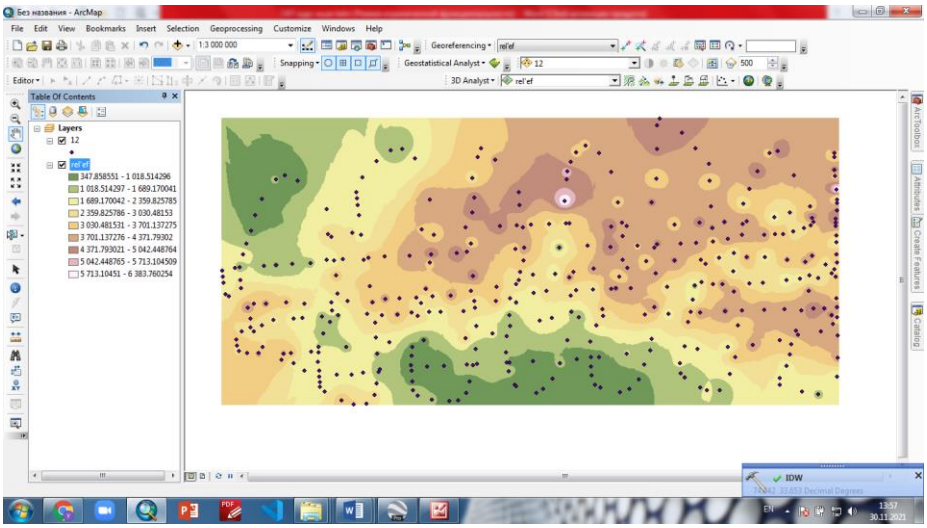

Figure 7. Raster model of terrain

The next process is to create a vector model of the place through horizontal lines based on the raster model. For this, in ArcToolbox, click on Spatial analyst Tools and select Surface from it. Click on Contour and the following window will open.

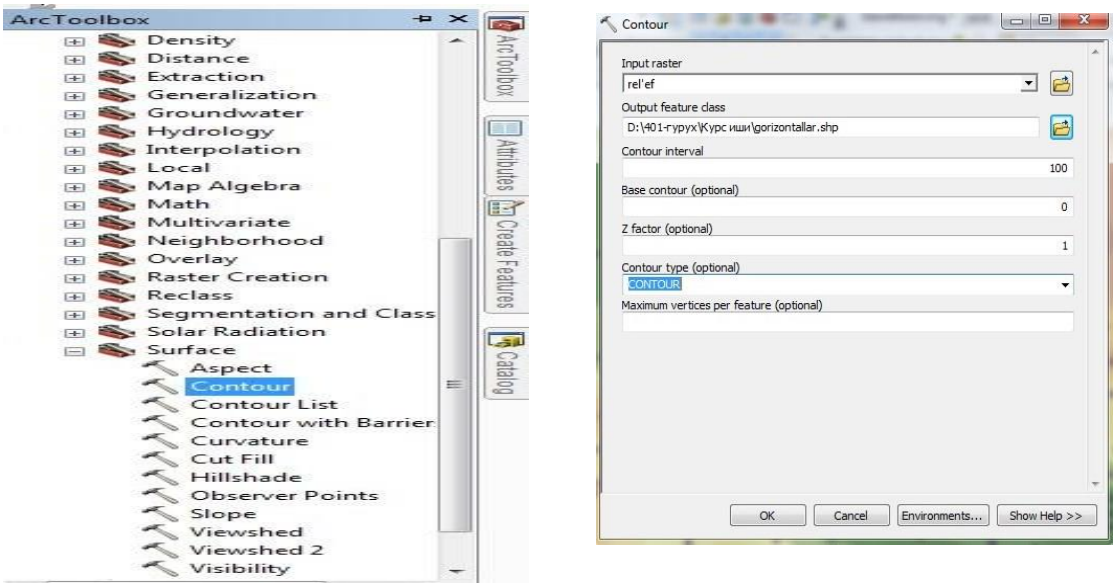


**Figure 8. Command windows used to create horizontals**

Then click the «Ok» button. Then the program will build a vector model of the place using horizontal lines [20-24].

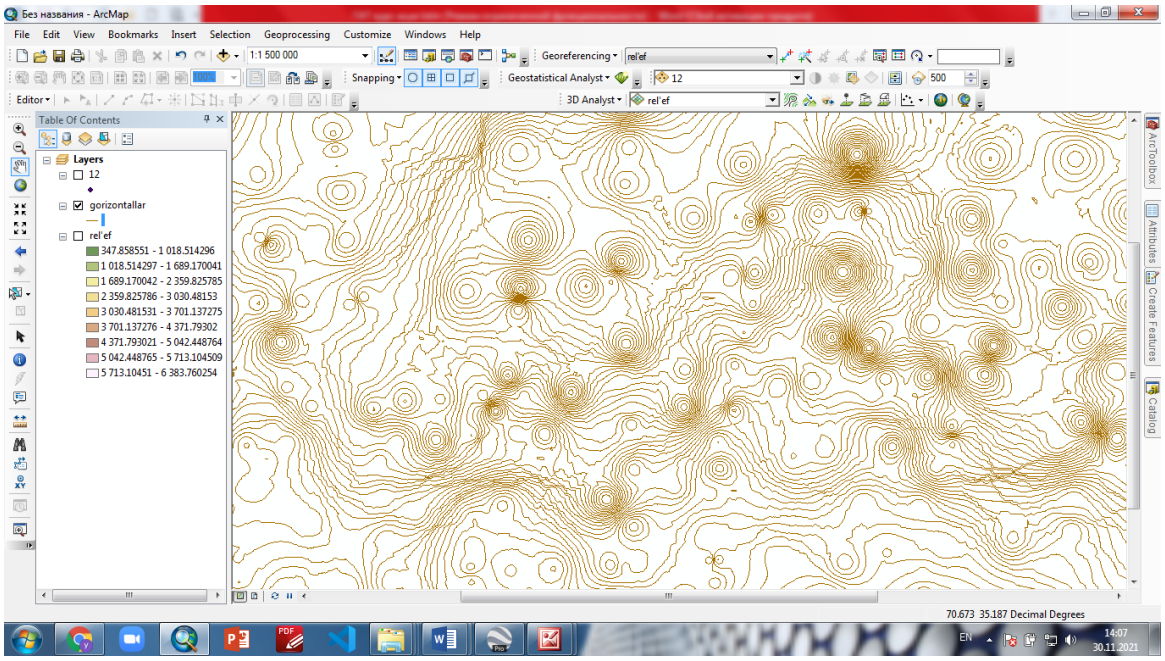


**Figure 9. Vector model of space in horizontal lines**

Upscaling raster and vector models of space to three dimensions

ArcGIS has an ArcScene platform for working with 3D models. This is used to scale and manipulate 2D models to 3D. To do this, we can open it by clicking the left mouse button on its icon [25-29].

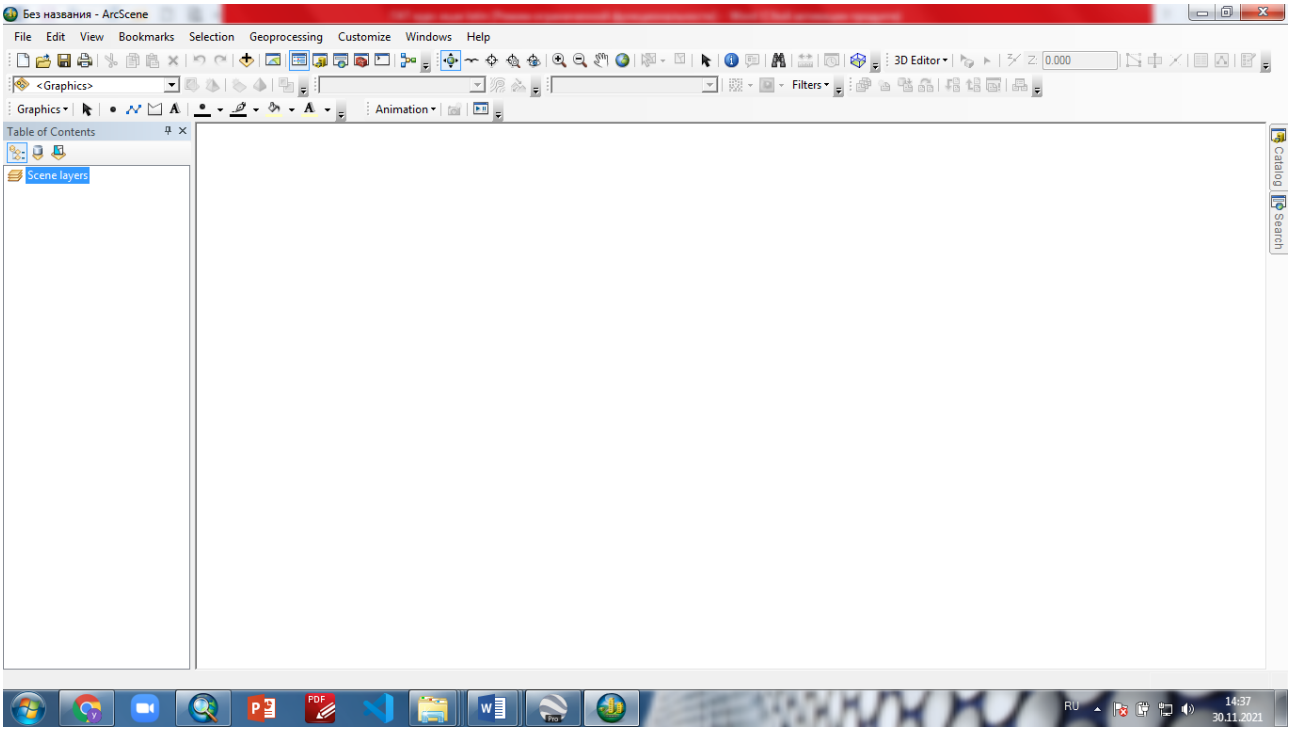


Figure 10. ArcScene's interface

To make a 3D model, we will take the rast and vector models created in the previous exercise from our storage and drop them into ArcScene. To do this, click on the Add data button and add our data to the layers.

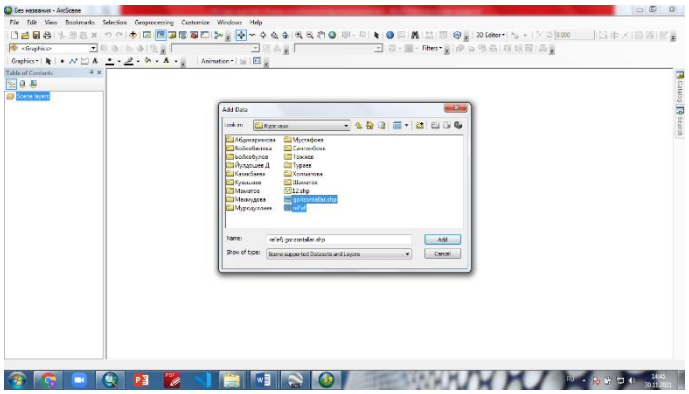

Figure 11. The process of adding data to ArcScene

When added, their appearance will initially be flat. A three-dimensional model of each model is generated only when the base heights of each model are given through its properties [30-34].

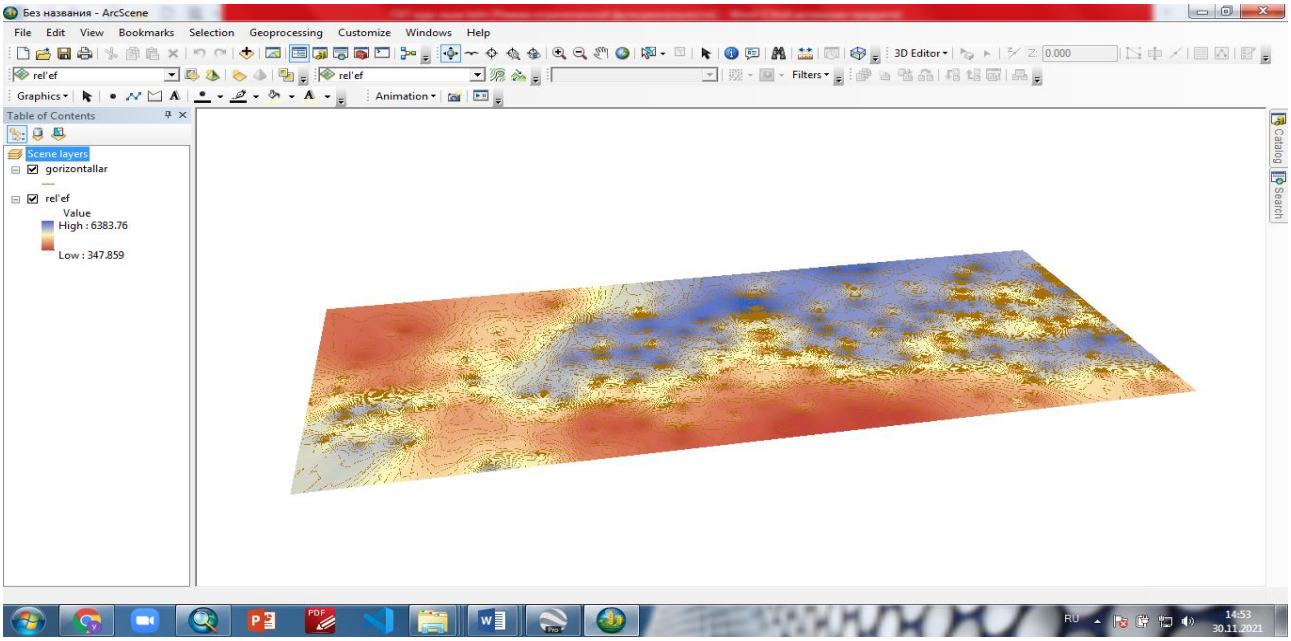


Figure 12. A preview of our textures in ArcScene

To do this, first click on the horizontal layer with the right mouse button and go to its properties. From there, select the base height column and enter the required value. Then our layer will change to three-dimensional view.

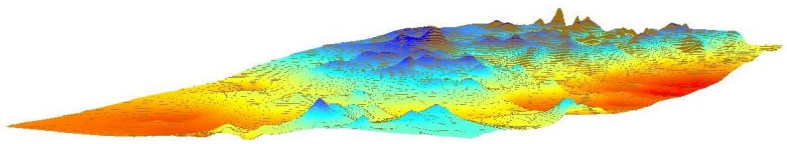

Figure 13. A three-dimensional model of the area

## CONCLUSION

In conclusion, it can be said that not only two-dimensional but also three-dimensional models of the place are important in researching the features of the place. This is important in studying it in all aspects. In addition, modern methods of geodetic measuring instruments have increased the possibility of digitalization of data and digital drawing of map plan materialsh.

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