Technical Manual

HOW TO CREATE AN INTERPOLATION MAP IN ARCMAP USING KRIGING

A step-by-step guide to Geostatistical Analyst tool

Version 1.2

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THESSALONIKI, GREECE

How to create an interpolation map in ArcMap using Kriging

A step-by-step guide to Geostatistical Analyst tool

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Aim: Create an interpolation map in ArcMap (Geostatistical Analyst tool) using Kriging as interpolation method to estimate values over the selected area of interest.

Case study and data: soil data from the valley of Thessaloniki, Greece.

An introduction to the ArcGIS Geostatistical Analyst Tutorial can be found here.

Contents

1. Input data

We will use as data the following: (a) Samples500.shx (soil data) and (b) Samples500_BorderC.shp (border of the region). Right click on "layers" and then select "Add data …" (Figure 1). The result is shown in Figure 2.

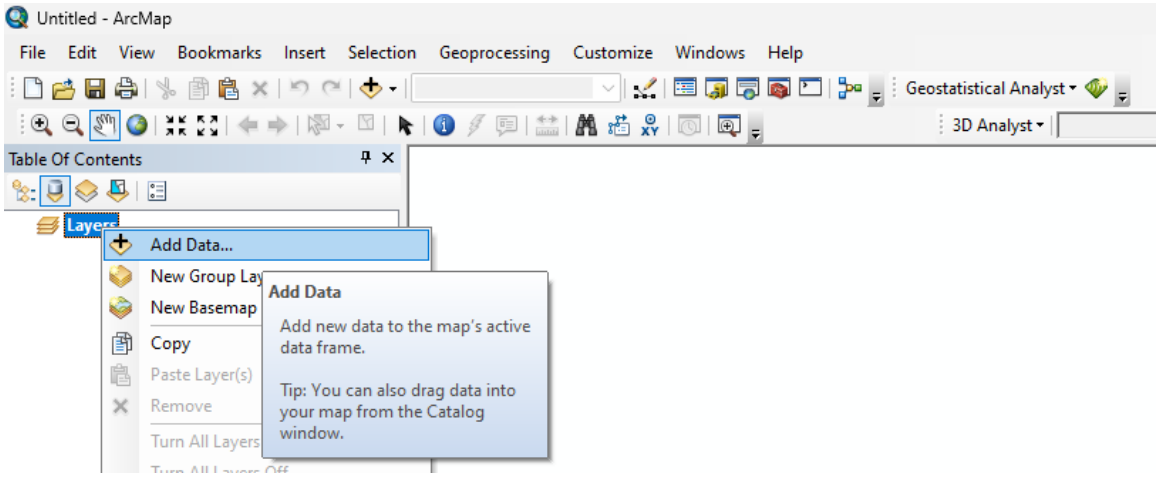


Figure 1. Add data to ArcMap project.

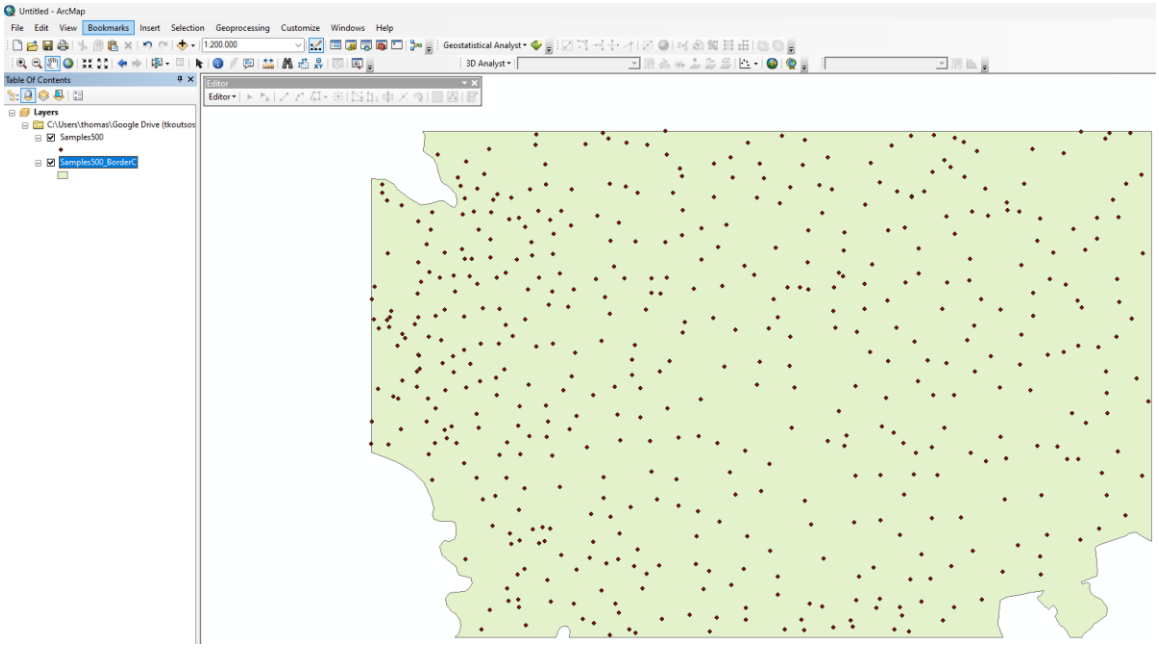


Figure 2. ArcMap project after soil data (samples500) and border (samples500_BorderC) added.

2. Activate the Geostatistical Analyst tool

If the "Geostatistical Analyst" tool is not already available, then just right click on an empty space on the menu bar and then check/select it. Several options for analyzing spatial data are available after activating the Geostatistical Analyst tool (Figure 3).

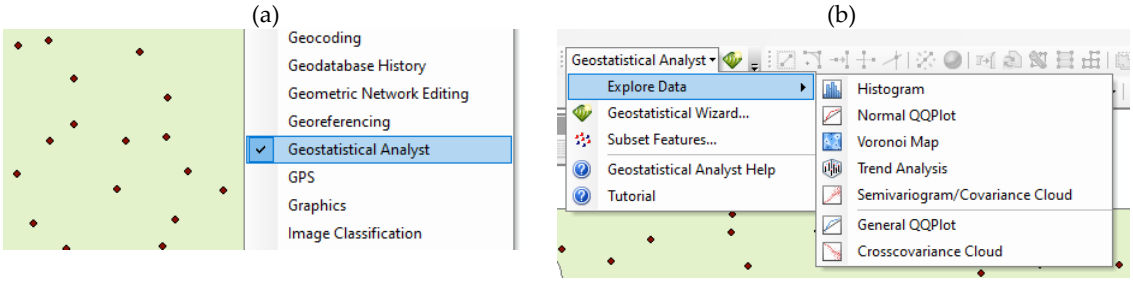


Figure 3. Geostatistical Analyst tool: (a) activate the Geostatistical Analyst tool from the menu; (b) options after activating the Geostatistical Analyst tool.

3. Check the data that will be used for the interpolation

It is always good practice to check the data that will be used for the interpolation. For this reason, right click on the layer containing the data (soil data samples) and then select the option "Open Attribute Table" (Figure 4). A new window-table will be appeared with all the records of this layer (Figure 5).

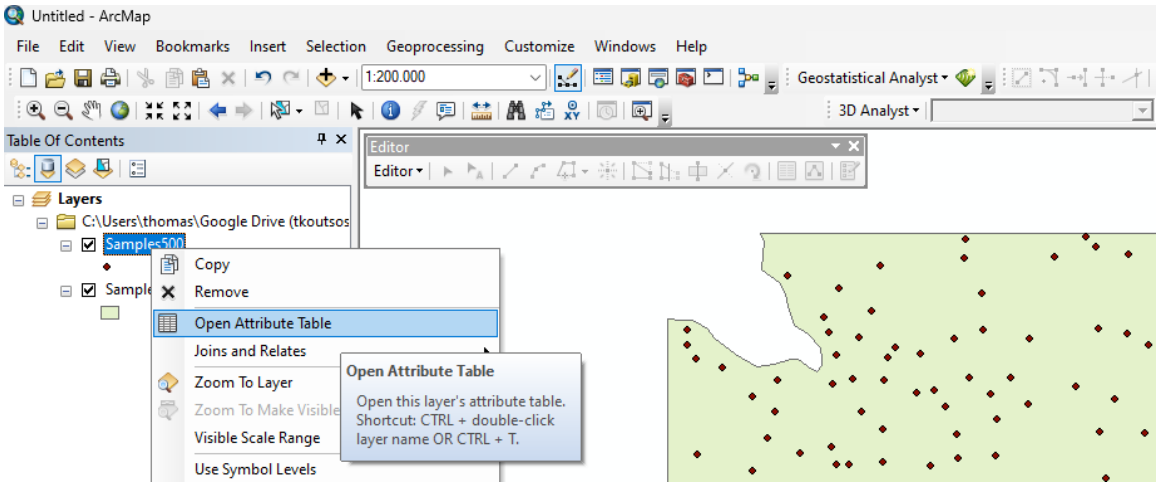


Figure 4. Check the data that will be used; open the attribute table for the data by right click on the corresponding layer and then select "Open Attribute Table".

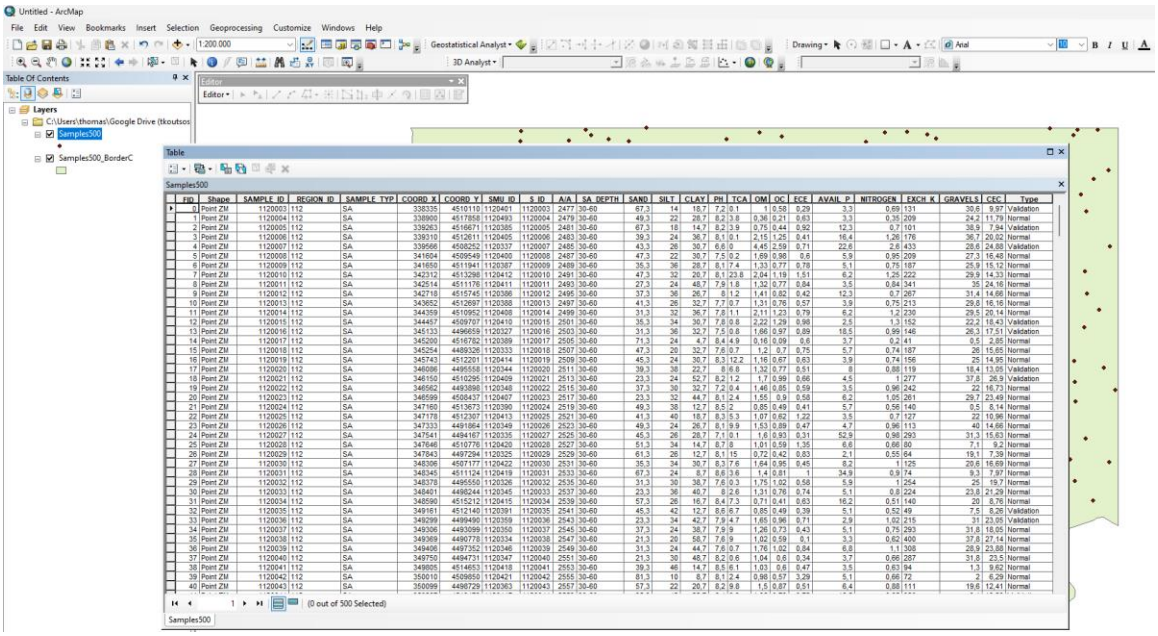


Figure 5. Attribute Table with all the data records from the layer Samples500 that will be used for the interpolation process.

4. Interpolation process

ArcMap provides a useful tool called “Geostatistical Wizard” to facilitate the process of selecting the parameters needed for the interpolation process. To open the Geostatistical Wizard, we only must left click on the Geostatistical Analyst and then select the option “Geostatistical Wizard” from the menu (Figure 6).

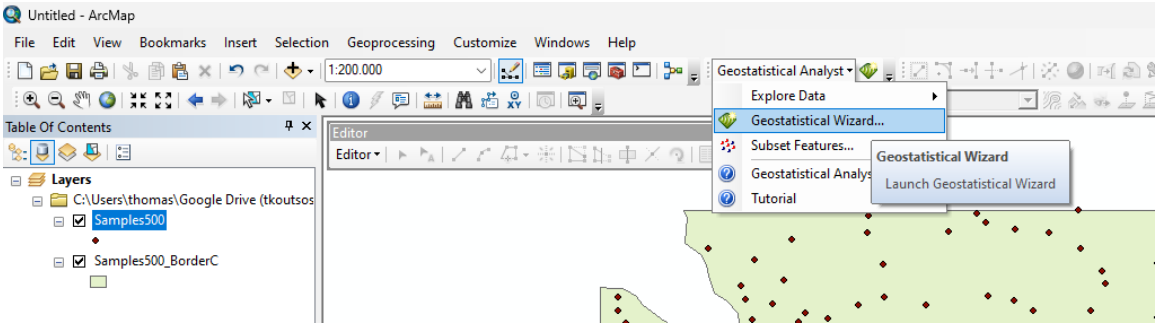


Figure 6. Open the Geostatistical Wizard to proceed with the interpolation process.

We must make sure that "Kriging/Cokriging" is selected as the interpolation method that will be used and that the correct layer of data (Samples500) is selected in the Source Dataset along with the correct data field (PH) that will be used for the interpolation (Figure 7).

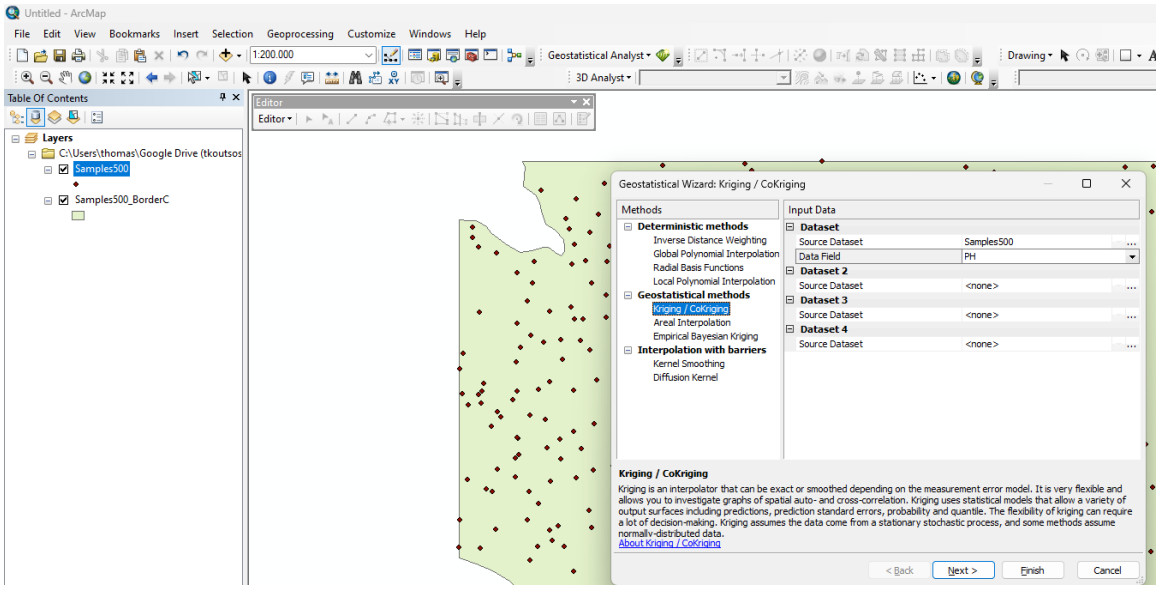


Figure 7. Selecting the parameters for the interpolation with Kriging/Cokriging method; selecting the data (PH) that will be used for the "Kriging/Cokriging" interpolation method.

After clicking on next, we move on to the selection of the proper Kriging type for the interpolation (Figure 8).

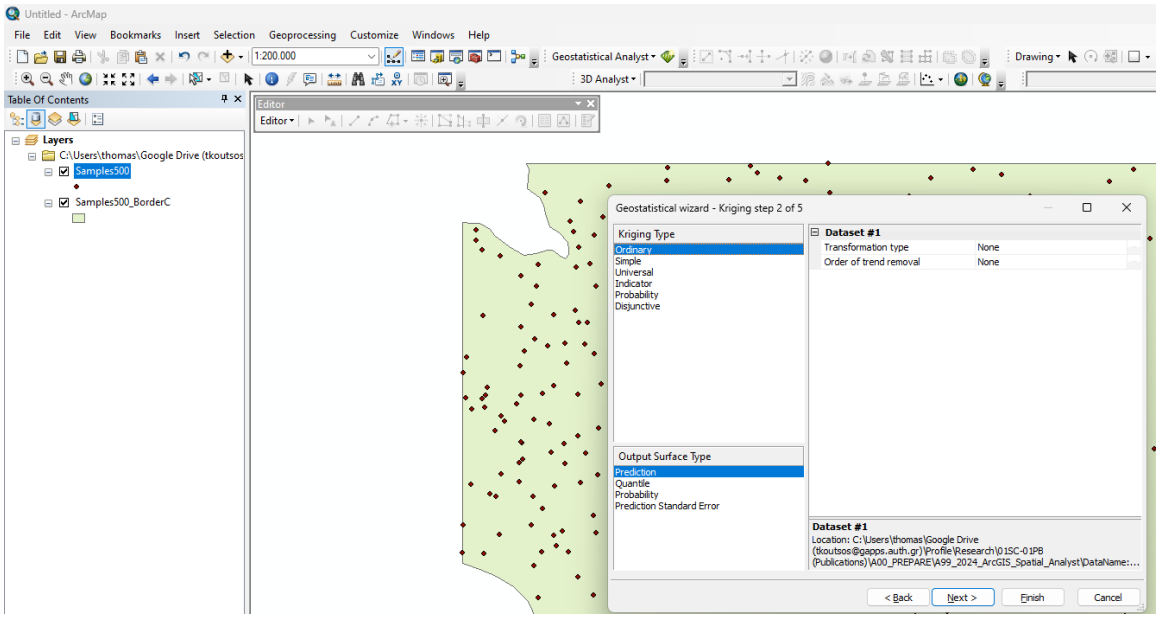


Figure 8. Selection of the Kriging type that will be applied for the interpolation.

For more information on how Kriging works and on the different types available please check the following link:

https://pro.arcgis.com/en/pro-app/3.1/tool-reference/3d-analyst/how-kriging-works.htm

Click on next we move on to a new window that provides all the information about the interpolation (Figure 9). We can right click on Semivariogram plot and then select "copy" to copy and paste the graph in a text. In tab "General" at the right side of the window "Optimized model" is selected by default, so we do not have to make changes.

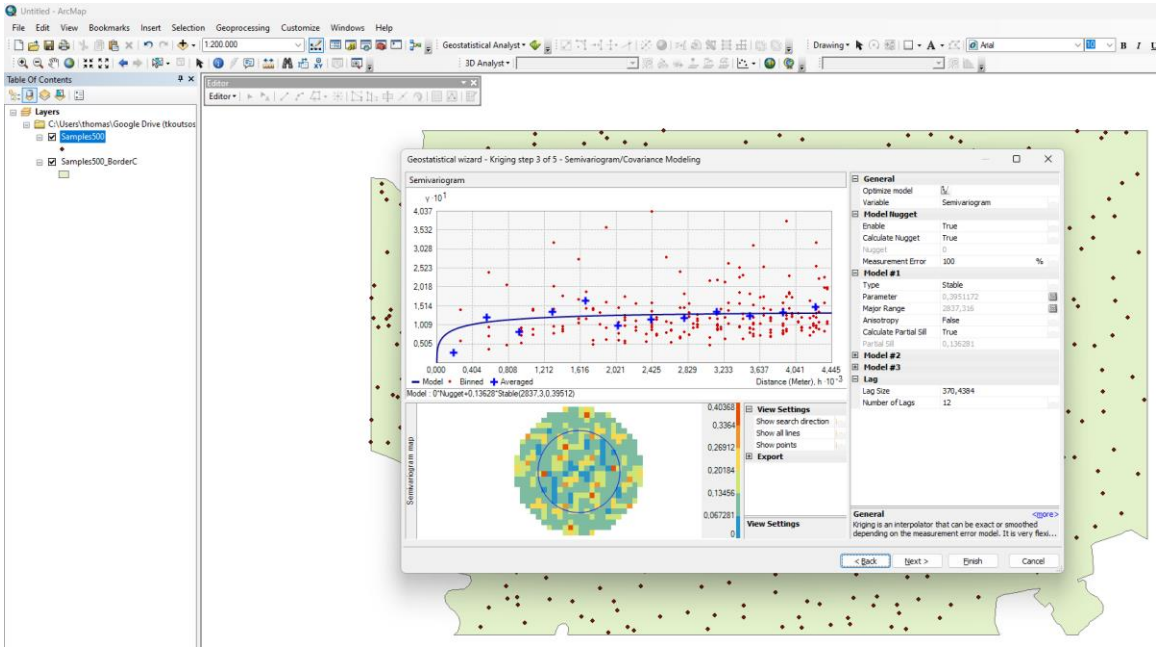


Figure 9. Semivariogram/Covariance Modeling with Kriging

Clicking on next we get a preview of the interpolation results. We can change the “Sector Type” to the left side of the window to “8 Sectors” instead of “4 sectors with 45º offset”, which is the default option (**Figure 10**), to take into consideration more neighboring data values (**Figure 11**). To check the weights that are being calculated we can expand the “Weights (16 neighbors) to examine the weights that have been assigned to each of the neighboring data measurement.

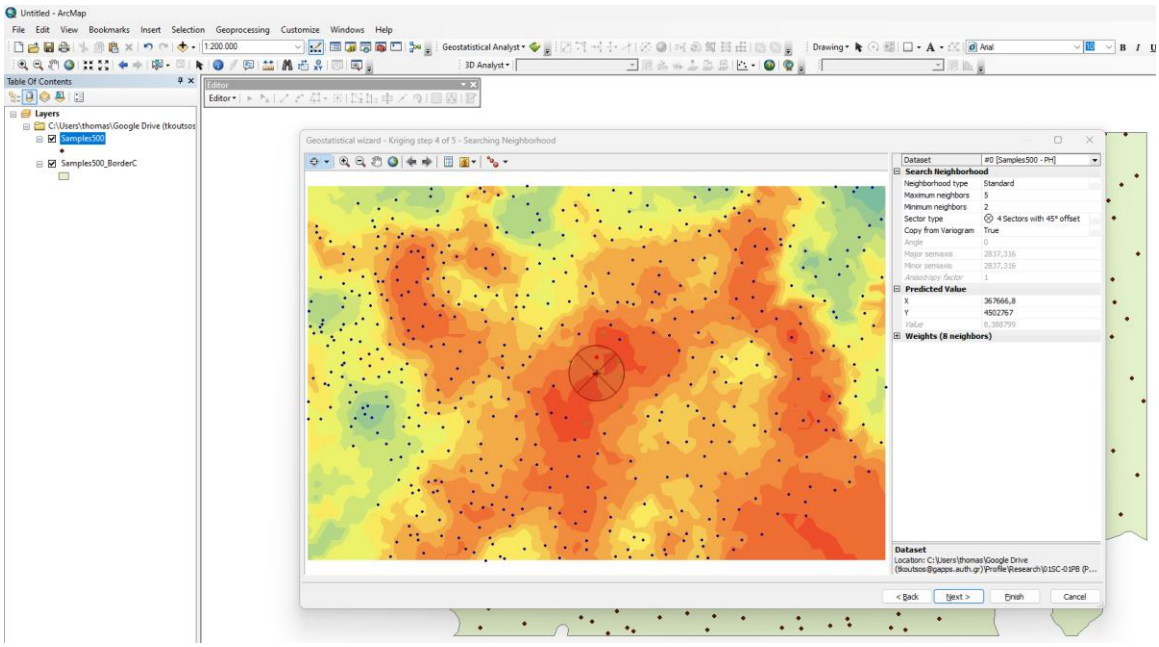


Figure 10. Searching Neighborhood in Kriging; default option the "4 sectors with 45o offset (8 neighbors)"

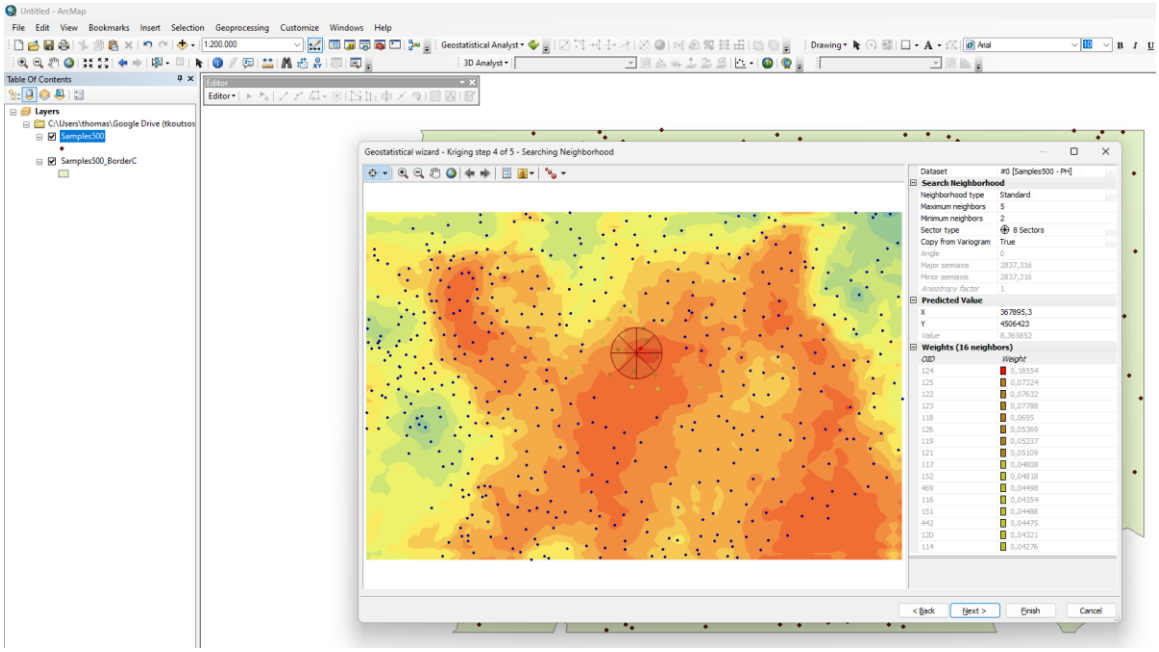


Figure 11. Searching Neighborhood in Kriging; selecting 8 sectors (16 neighbors)

We can also have the option to define the neighbor type of the search in searching neighbors in each neighborhood of the data that can be either “normal” or “smooth”. We usually select “normal”.

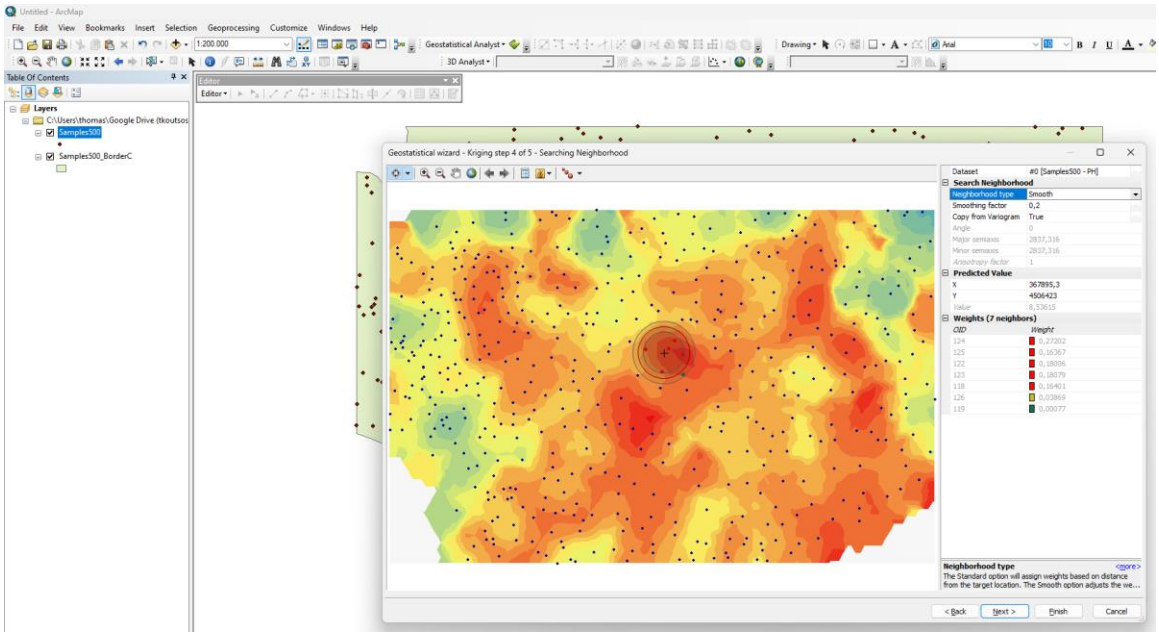


Figure 12. Selecting the type of neighbor type in searching neighbors: normal (default) or smooth.

Moving to the next step, we finally get a window with cross validation results (Figure 13) presenting the predicted values. Plots are available for (a) Predicted vs measured; (b) Error; (c) Standardized Error, and (d) Normal QQ-Plot for normality check.

The plots can be copied and pasted into a new document by right clicking on them and selecting "copy". At the down right side of the window the primary interpolation metrics are available and can be exported to file. These are the main statistical metrics that must be reported for each interpolation.

By clicking on "Finish" a small window appears presenting all the corresponding interpolation information and it can also be exported in a xml file.

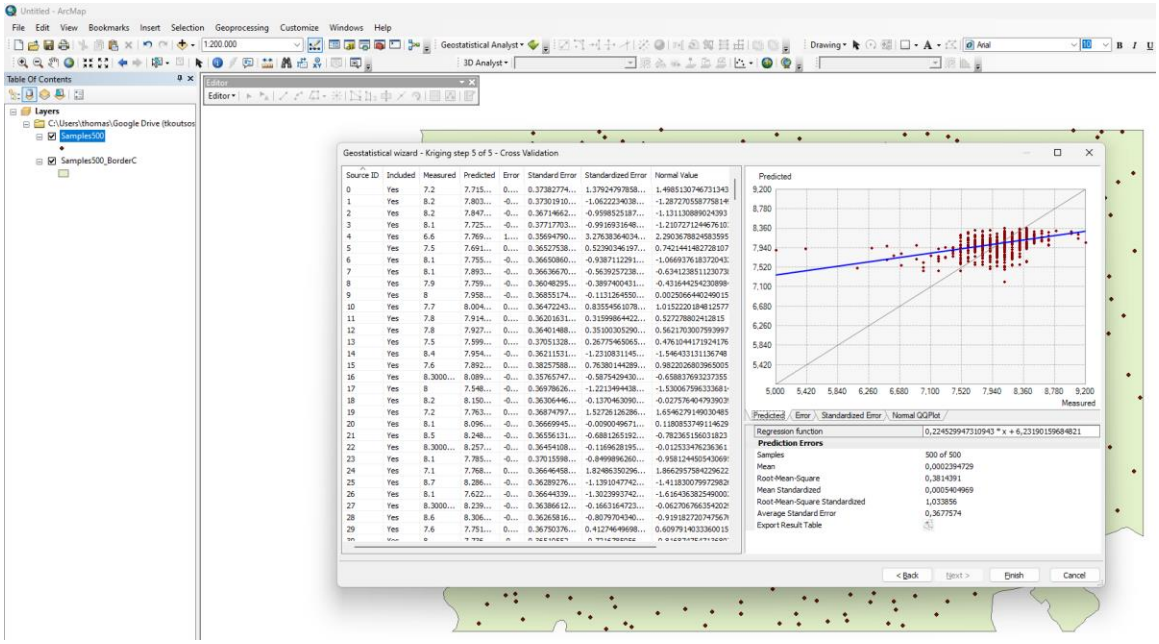


Figure 13. Cross validation results for the interpolation and corresponding plots.

The final interpolation product is an interpolation map that provides estimates for the given parameter (pH) over the study area (Figure 14).

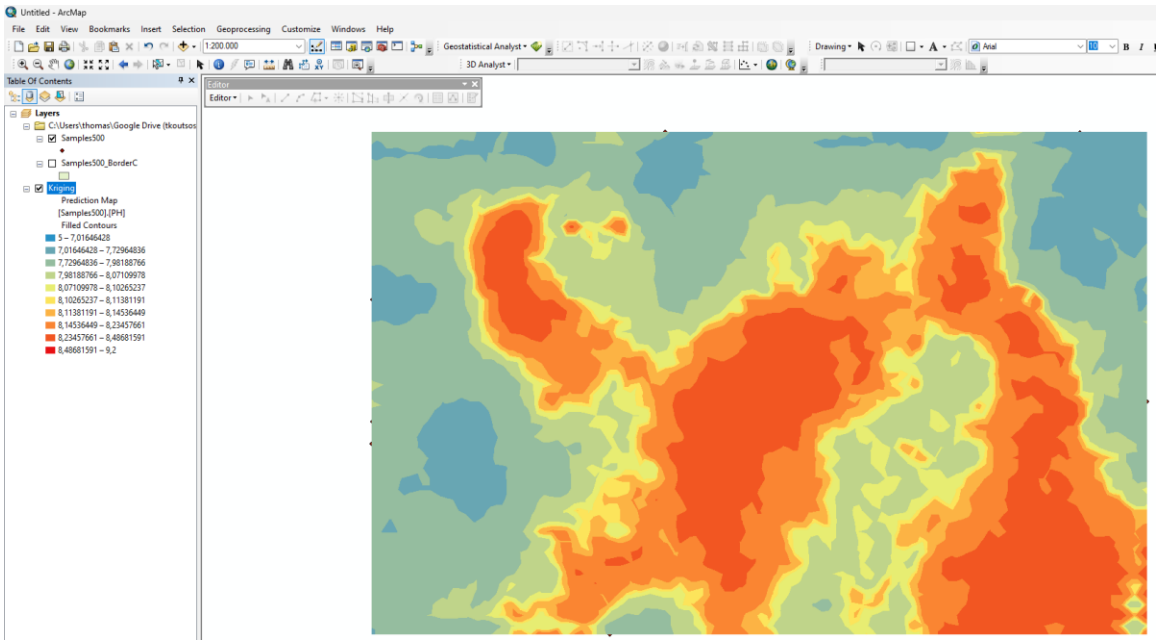


Figure 14. Interpolation map as the result of the interpolation process using Kriging and the Geostatistical Analyst tool of ArcMap.

In case we want to crop this final interpolation map to the extent of the border then we export the “Kriging” layer to raster and then we search for the tool “Extract by mask” (Figure 15).

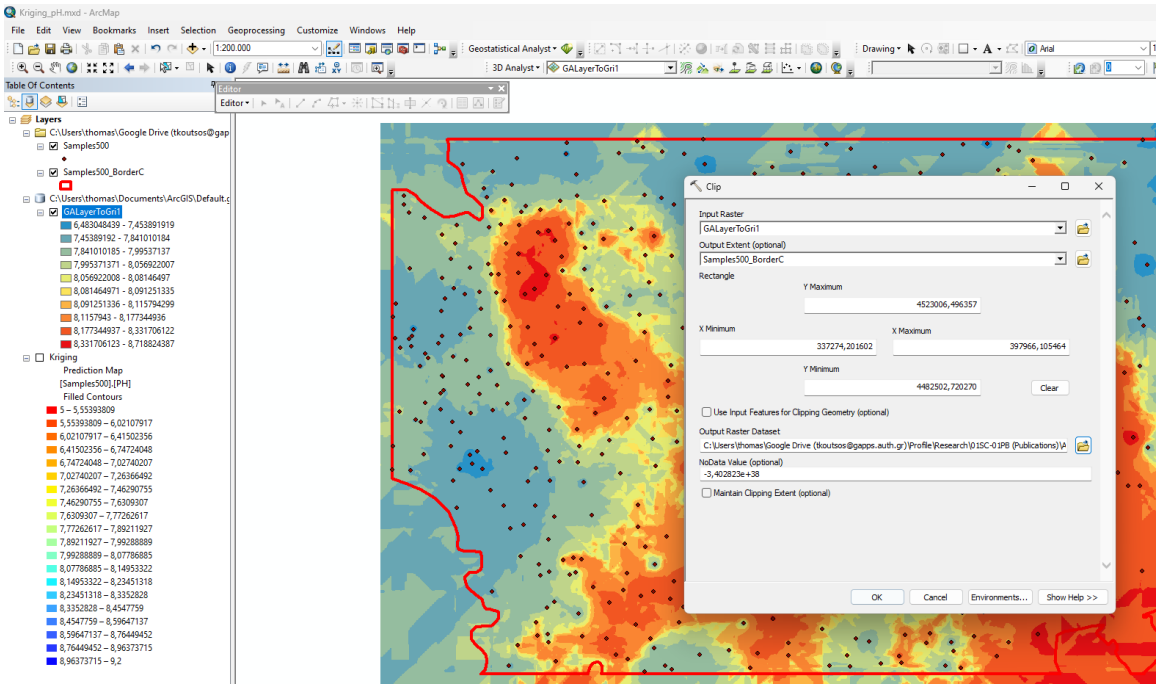
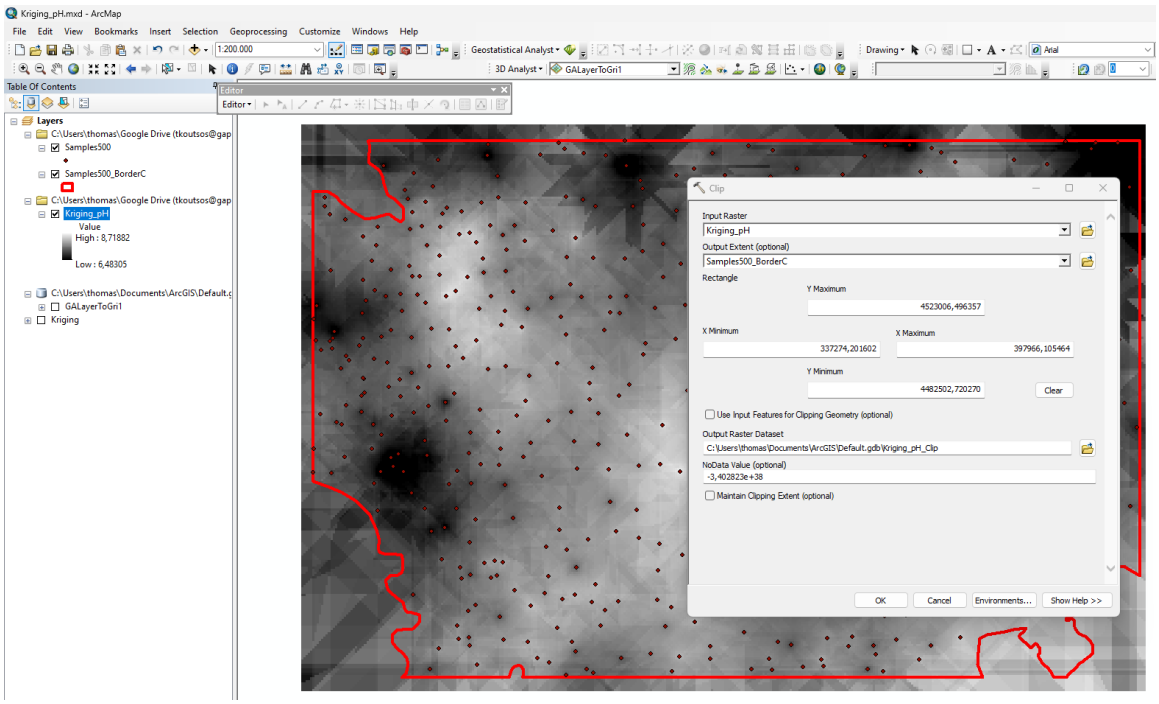


Figure 15. Cropping the interpolation map to the extent of the border layer.



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