Exercise 1: Creating a surface using default parameters

ArcMap 10.4
|
Other versions

- 10.4
- 10.3

Complexity:
Beginner
Data Requirement:
ArcGIS Tutorial Data for Desktop
Data Path:
C:\ArcGIS\ArcTutor\Geostatistical Analyst
Goal:
The goal of this exercise is to introduce you to the process of creating surfaces from sample data.

This exercise introduces you to the Geostatistical Analyst extension. It takes you through the process of creating a model using default parameter values to generate a surface of ozone concentration.

Start ArcMap and enable Geostatistical Analyst

To begin, start ArcMap and enable the Geostatistical Analyst extension.

1. Start ArcMap.
2. Click Cancel on the ArcMap - Getting Started dialog box.

   This dialog box may not open if you've previously opted not to show it.

3. On the main menu, click Customize > Extensions.
4. Check the Geostatistical Analyst check box.
5. Click Close.

Add the Geostatistical Analyst toolbar

1. On the main menu, click Customize > Toolbars > Geostatistical Analyst.

   The Geostatistical Analyst toolbar is added to your ArcMap session.

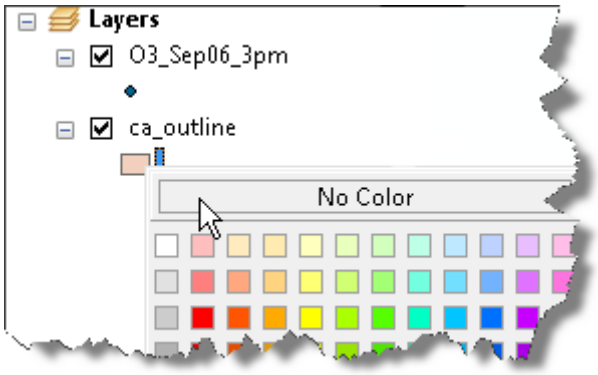
   The extension and toolbar only need to be enabled and added once; they will be active and present the next time you open ArcMap.

Add data to your ArcMap session

You will add your data to ArcMap and alter its symbology.

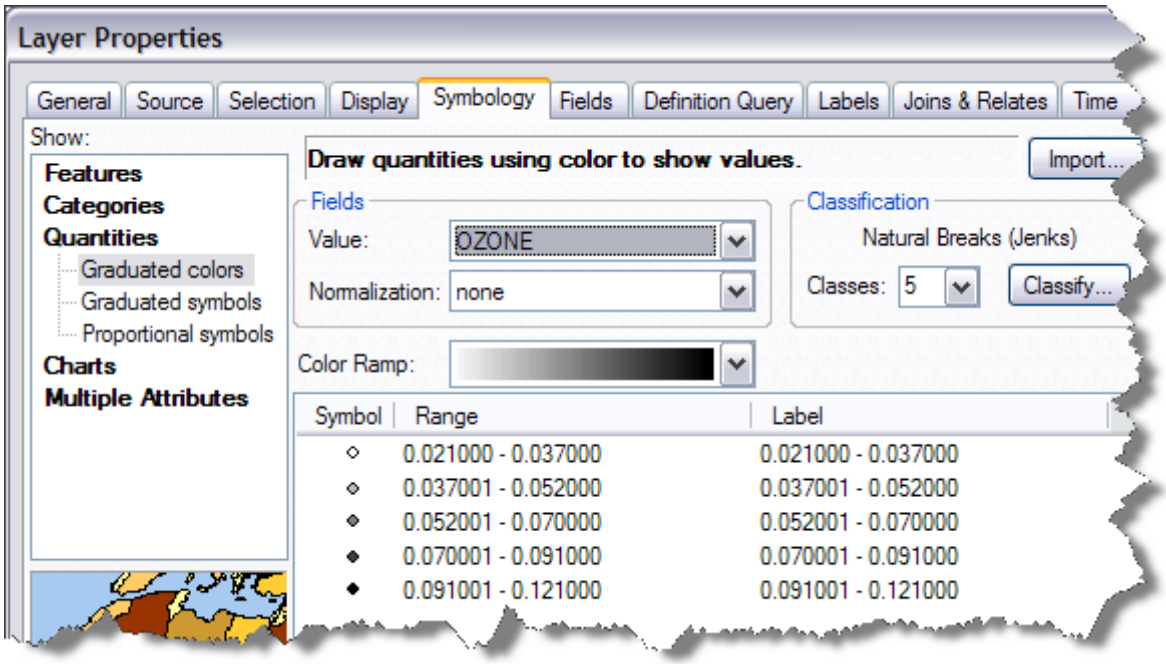
1. Click the Add Data button on the Standard toolbar.
2. Navigate to the folder where you installed the tutorial data (the default installation path is C:\ArcGIS\ArcTutor\Geostatistical Analyst).
3. Double-click the ca_ozone.gdb geodatabase to see its contents.
4. Press the Ctrl key and choose the O3_Sep06_3pm and ca_outline datasets.
5. Click Add.

6. Right-click the ca_outline layer legend (the box below the layer's name) in the table of contents and click No Color, as shown in the following figure:



   Only the outline of California is displayed. This allows you to see the layers that you will create in this tutorial underneath this layer.

7. Double-click the O3_Sep06_3pm layer's name in the table of contents.
8. In the Layer Properties dialog, click the Symbology tab.
9. In the Show box, click Quantities and click Graduated colors.
10. In the Fields box, set the Value to OZONE.
11. Choose the White to Black color ramp so that the points will stand out against the color surfaces you will create in this tutorial. The symbology dialog box should look like this:



12. Click OK.

Note that the highest ozone values occurred in California's Central Valley, while the lowest values occurred along the coast. Mapping the data is the first step in exploring it and understanding more about the phenomenon you want to model.

Save your map document

It is recommended that you save your map throughout each exercise and at the end of each exercise.

1. On the main menu, click File > Save.
2. Browse to your working folder (for example, you could create the following folder to store your work: C:\Geostatistical Analyst Tutorial).

3. In the File name text box, type Ozone Prediction Map.mxd.
4. Click Save.

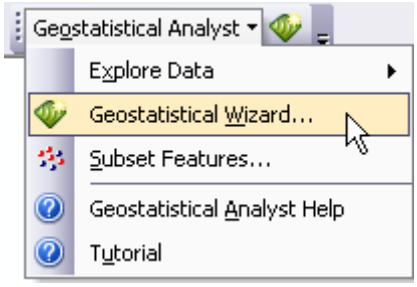
   You needed to provide a name for the map because this is the first time you have saved it. To save the ArcMap document in the future, simply click Save.

Create a surface using the default options

Next, you will create (interpolate) a surface of ozone concentration using the default Geostatistical Analyst settings. You will use the ozone point dataset (O3_Sep06_3pm) as the input dataset and use ordinary kriging to interpolate the ozone values at the locations where values are not known. You will click Next on many of the dialog boxes to accept the defaults.

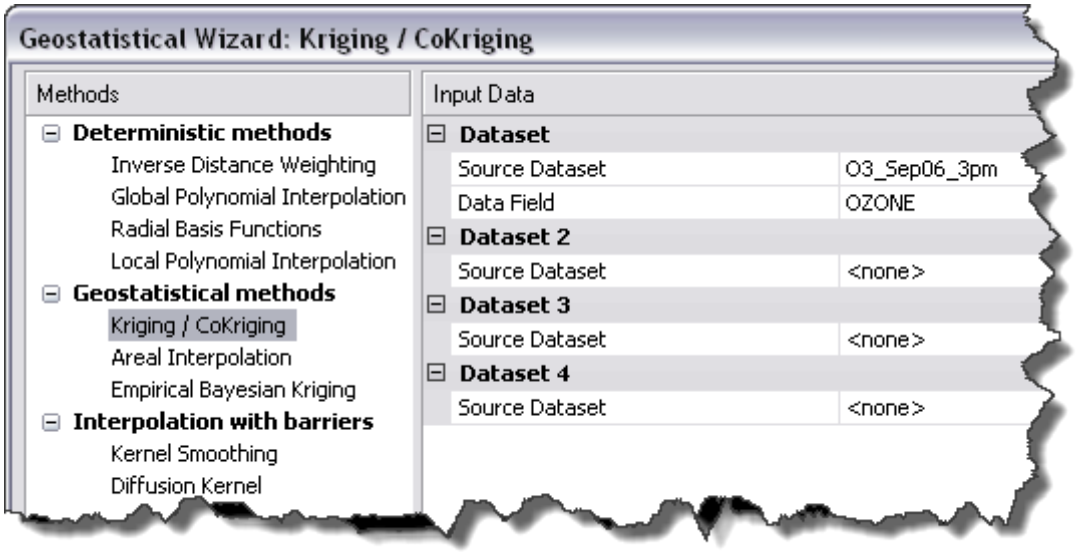
You do not need to concentrate on the details of the dialog boxes in this exercise because in later exercises each dialog box will be revisited. The intent of this exercise is to introduce you to Geostatistical Wizard.

1. Click the Geostatistical Analyst arrow on the Geostatistical Analyst toolbar and click Geostatistical Wizard.



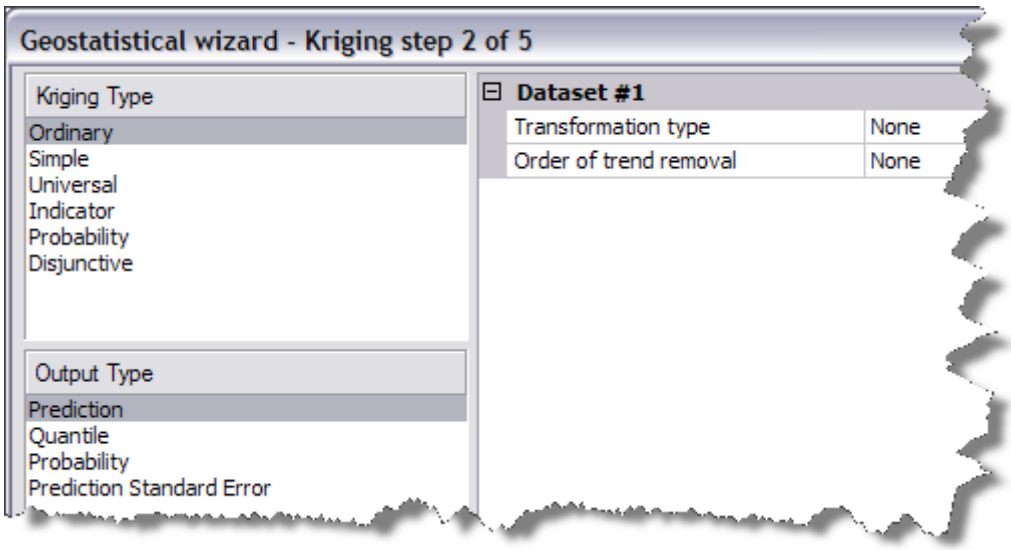
   The Geostatistical Wizard dialog box appears.

2. Click Kriging/CoKriging in the Methods list box.
3. Click the Source Dataset arrow and click O3_Sep06_3pm.
4. Click the Data Field arrow and click the OZONE attribute.

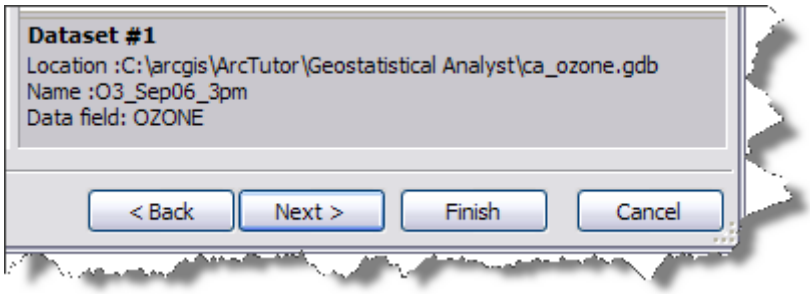


5. Click Next.
6. Click Ordinary Kriging; notice that Prediction Map is selected as the output type.

   Since the method to map the ozone surface is selected, you could click Finish to create a surface using the default parameters. However, steps 7 to 11 will expose you to other dialog boxes. In each step of the wizard, the interior panels (windows) can be resized by dragging the dividers between them.

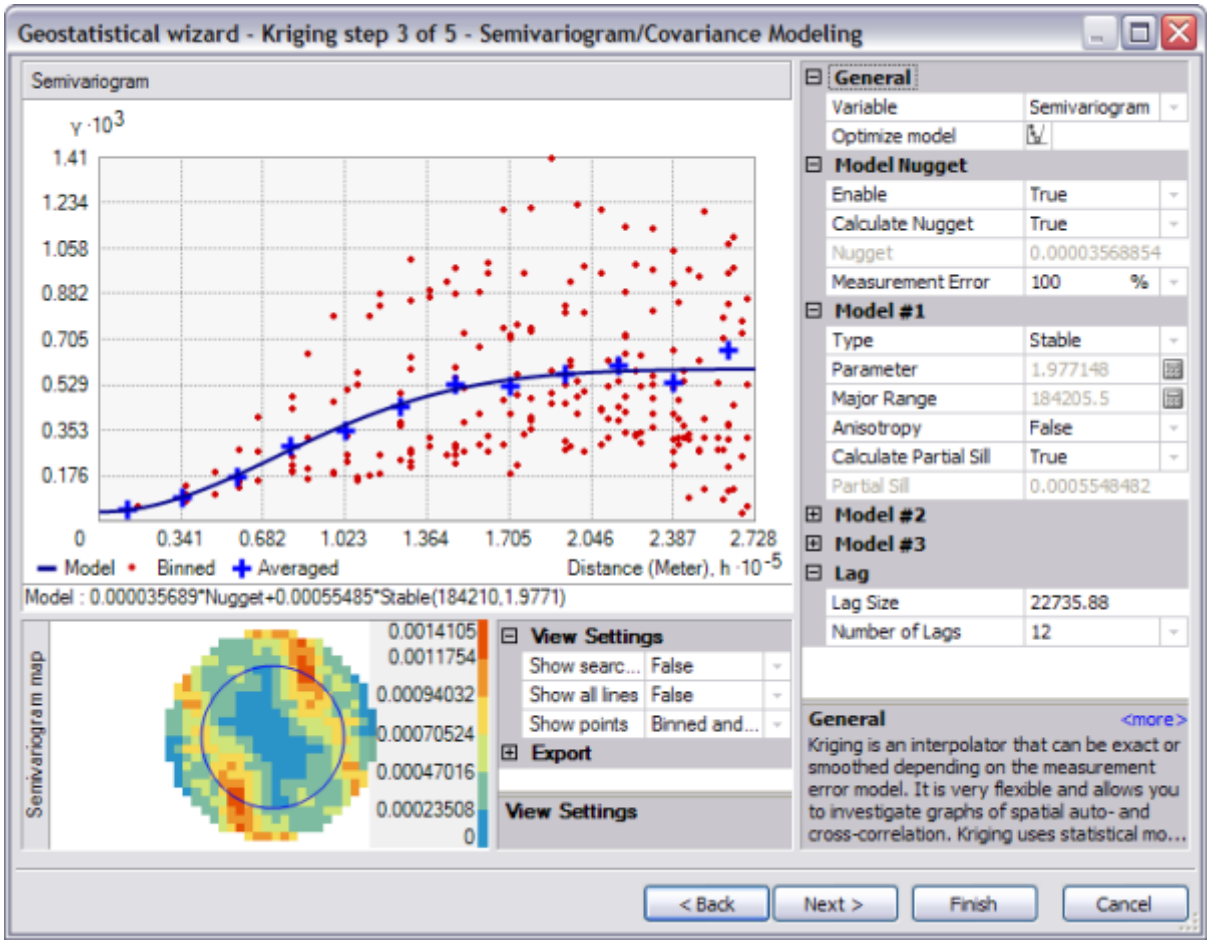


Note that there is a box on the bottom-right of the Geostatistical Wizard that shows a brief description of the highlighted method or parameter. At this stage, the box shows the dataset and field that will be used to create the surface.



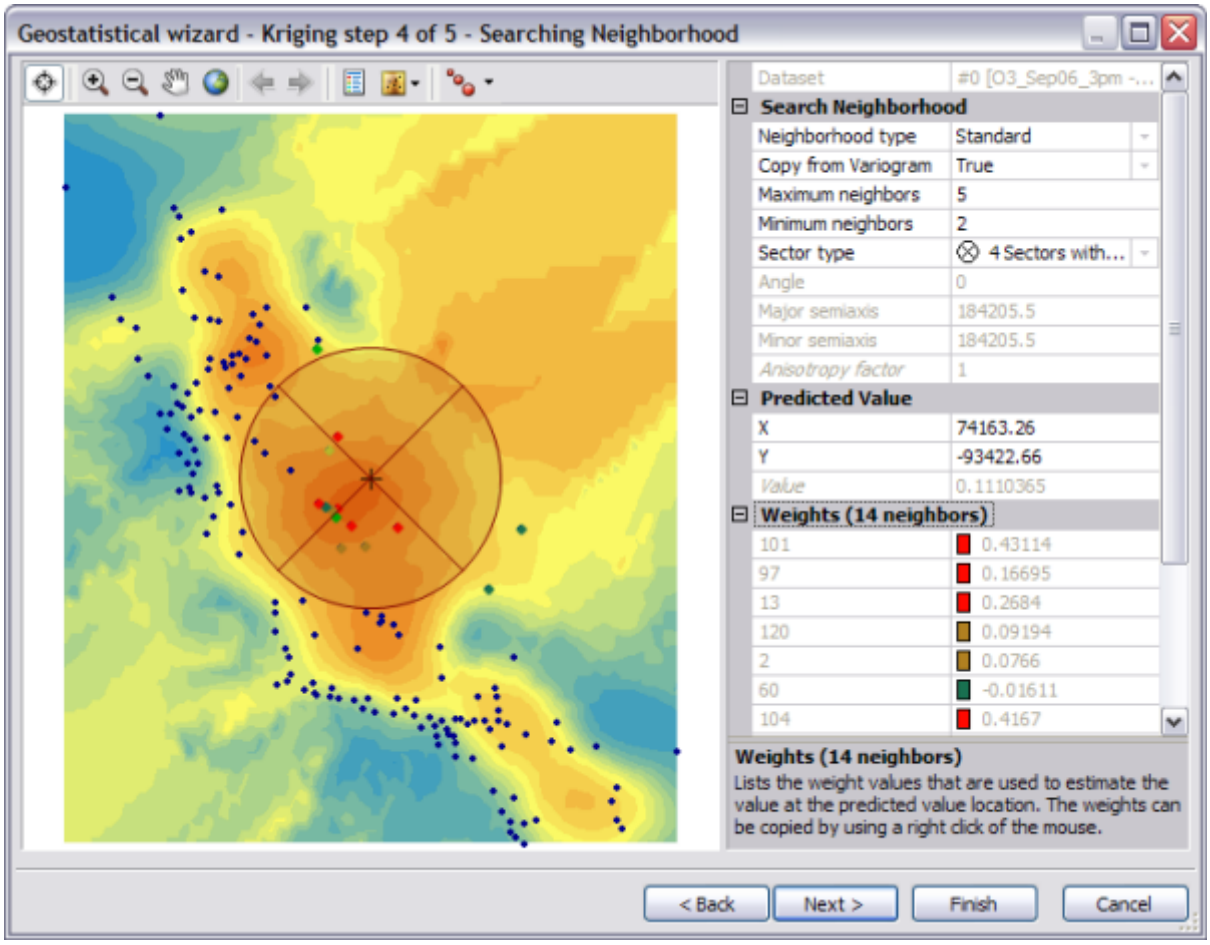
7. Click Next.

The semivariogram/covariance model is displayed, allowing you to examine spatial relationships between measured points. You can assume that things that are closer together are more alike than things that are farther apart. The semivariogram allows you to explore this assumption. The process of fitting a semivariogram model to capture the spatial relationships in the data is known as variography.



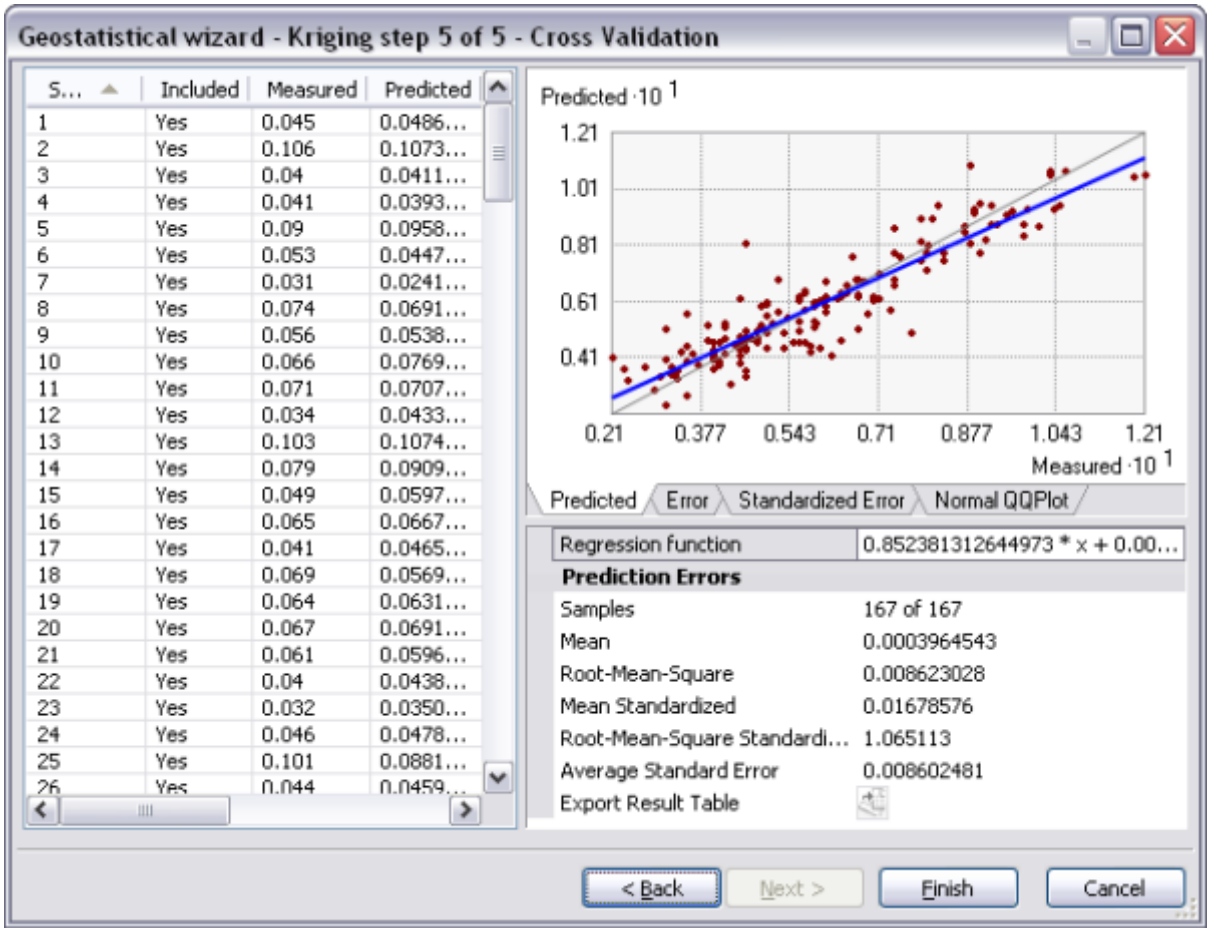
8. Click Next.

   The crosshairs show a location that has no measured value. To predict a value at the crosshairs, you can use the values at the measured locations. You know that the values of the closest measured locations are most alike to the value of the unmeasured location that you are trying to predict. The red points in the image below are going to be weighted (or influence the unknown value) more than the green points since they are closer to the location you are predicting. Using the surrounding points and the semivariogram/covariance model fitted previously, you can predict values for the unmeasured location.



9. Click Next.

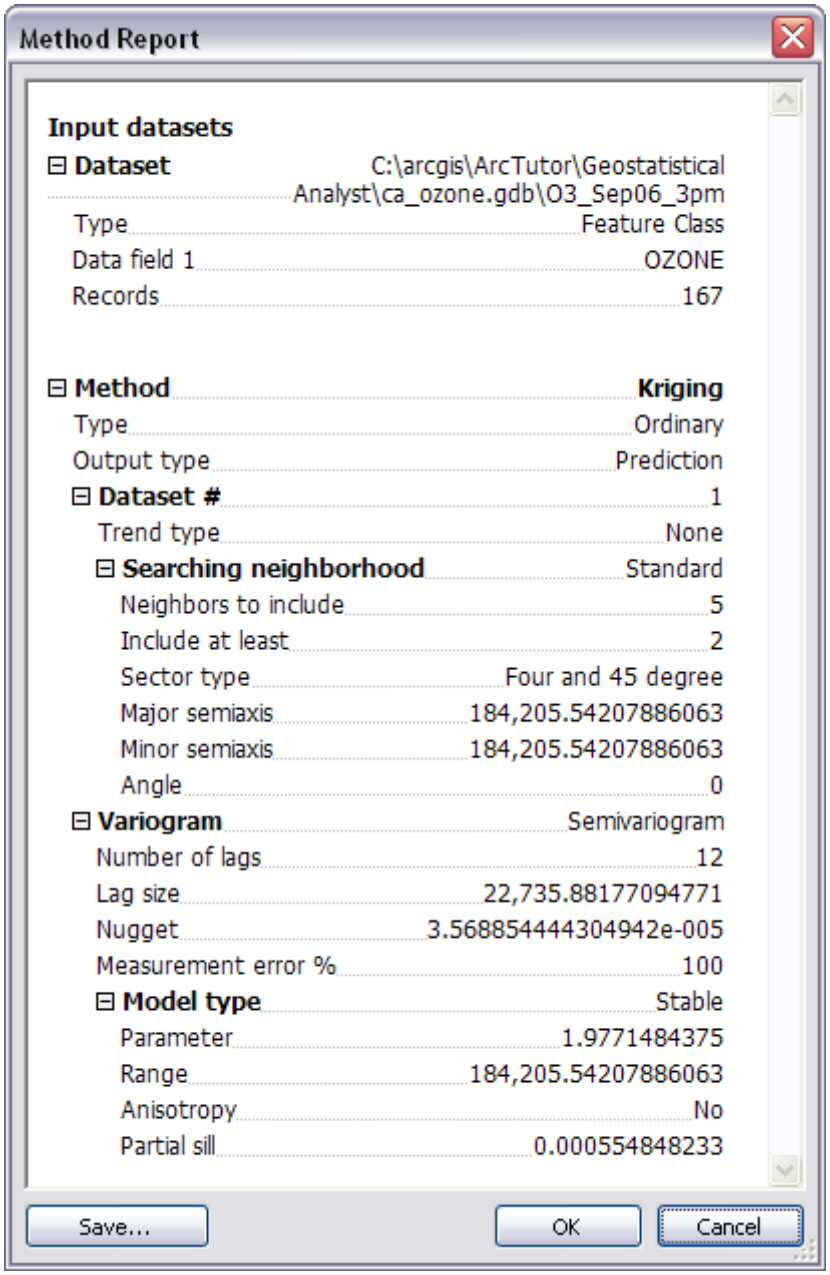
The cross-validation diagram gives you an idea of how well the model predicts the values at the unknown locations.



You will learn how to use the graph and understand the statistics in exercise 4.

10. Click Finish.

    The Method Report dialog box summarizes information on the method (and its associated parameters) that will be used to create the output surface.

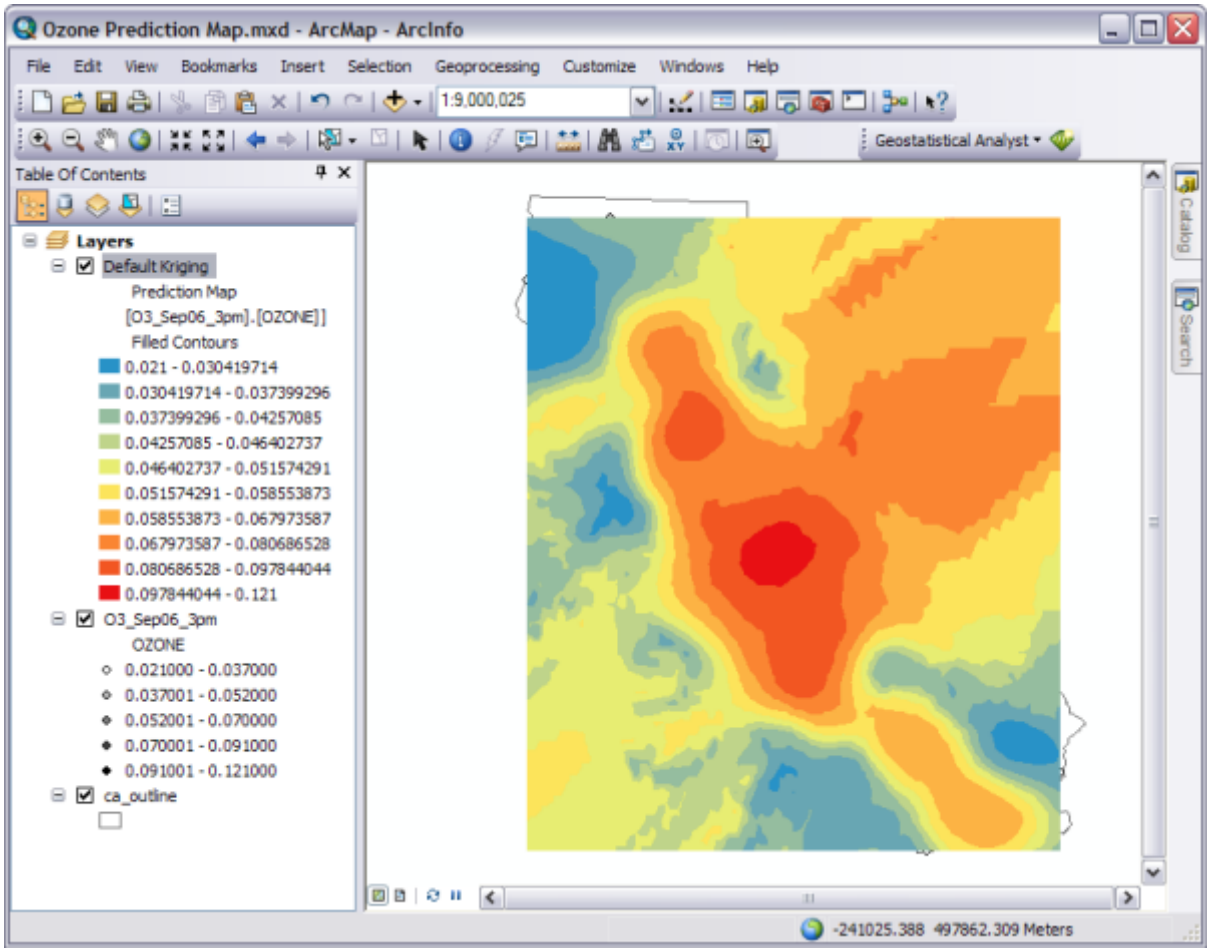


11. Click OK.

    The predicted ozone map is added as the top layer in the table of contents.

12. Double-click the layer in the table of contents to open the Layer Properties dialog box.
13. Click the General tab and change the layer's name to Default Kriging and click OK.

    Changing the layer's name will help you distinguish this layer from the one you will create in exercise 4.

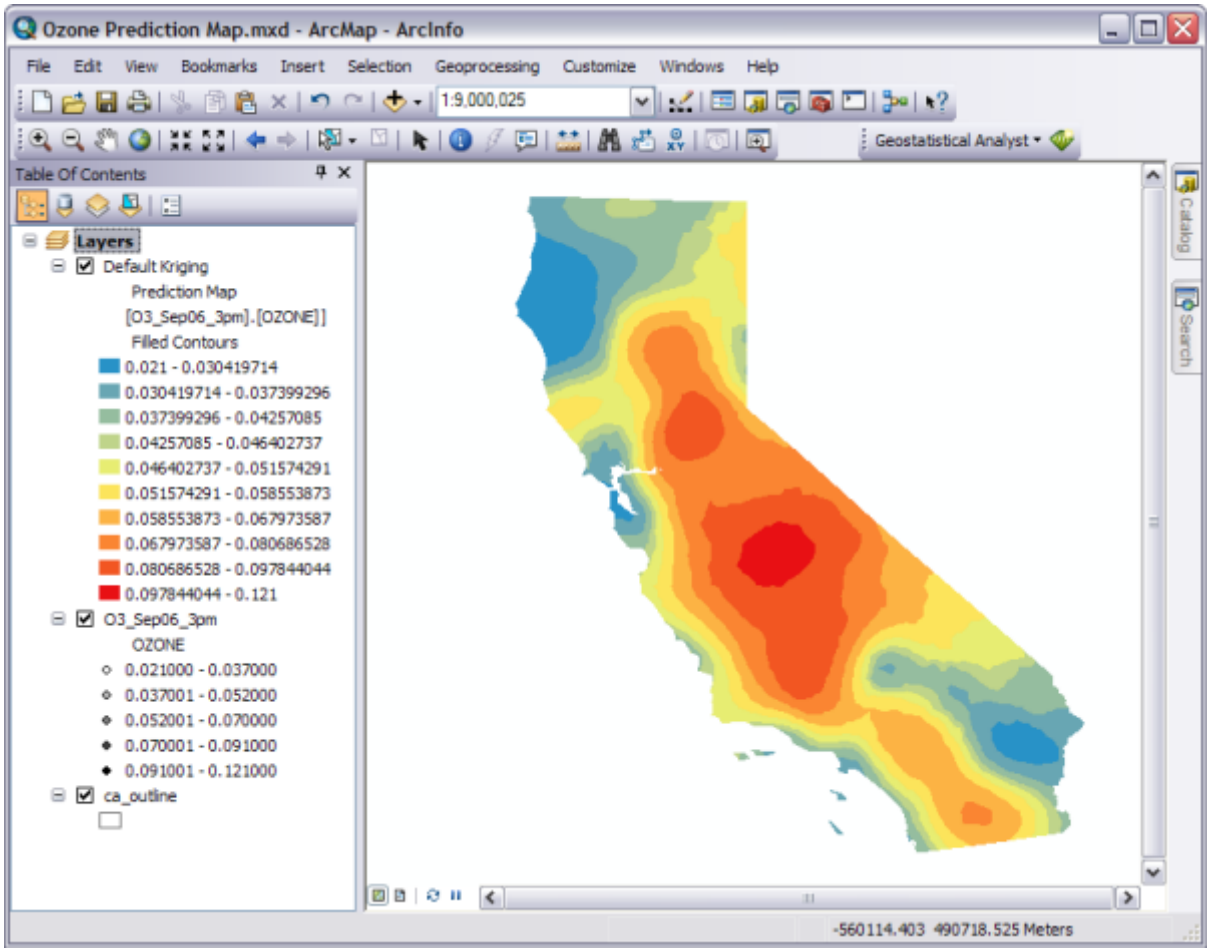


14. Click the Save button on the Standard toolbar to save your work.
    Notice that the interpolation continues into the ocean because the extent of the layer is the same as the extent of the input data (O3_Sep06_3pm).
15. To restrict the prediction surface to within California, right-click the Default Kriging layer and click Properties.
16. Click the Extent tab.
17. Click the Set the extent to arrow, click the rectangular extent of ca_outline, then click OK.

    The interpolated area extends so that it covers all of California.

18. Right-click the Layers data frame in the table of contents, click Properties, then click the Data Frame tab.
19. Click the Clip Options arrow, choose Clip to shape, then click the Specify Shape button.
20. On the Data Frame Clipping dialog box, click the Outline of Features button, click the Layer arrow, then click ca_outline.
21. Click OK, then click OK again.

    The predicted surface is clipped so it does not display data beyond the borders of the state but covers all areas within the state, as shown below.

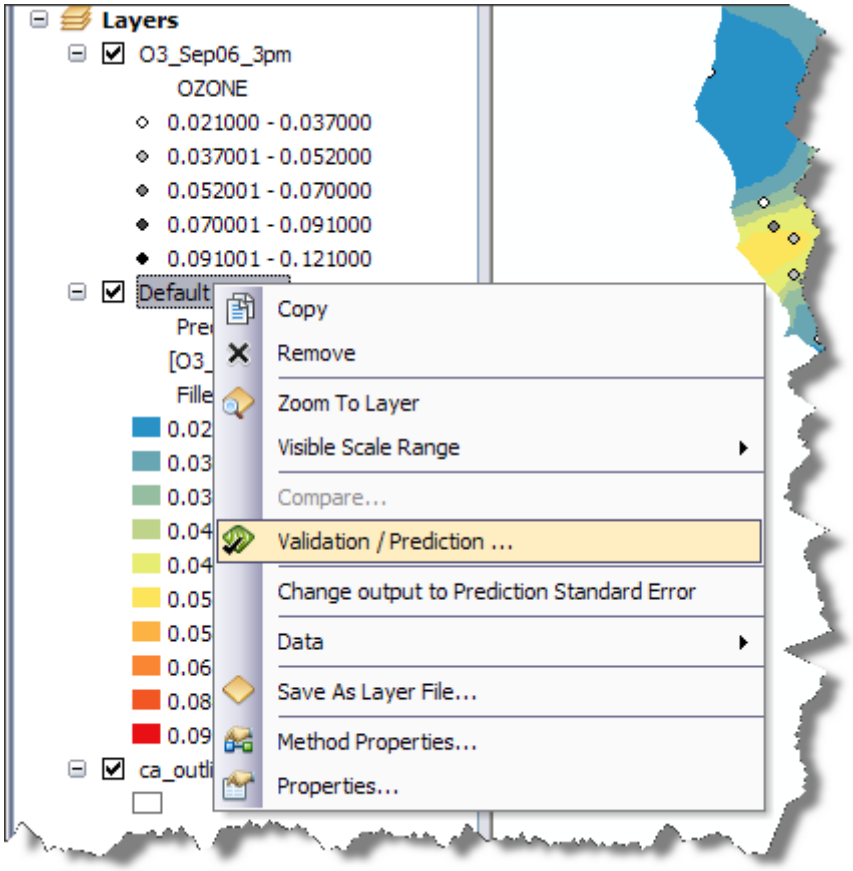


22. Drag the O3_Sep06_3pm layer to the top of the table of contents.

    Visually judge how well the Default Kriging layer represents the measured ozone values. In general, do high ozone predictions occur in the same areas where high ozone concentrations were measured? In exercises 3 and 4, you will learn how to quantitatively judge how well a model performs and how to compare two models.

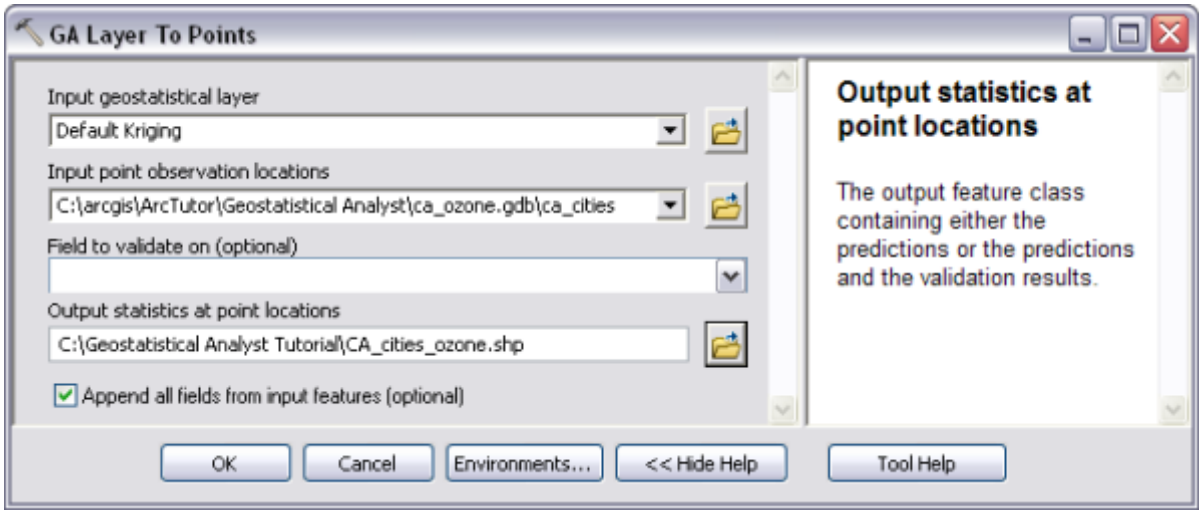
23. Right-click the Default Kriging layer in the table of contents and click Validation/Prediction.

    This opens the GA Layer To Points geoprocessing tool with the Default Kriging layer specified as the input geostatistical layer.



24. Input geostatistical layer should be automatically set to Default Kriging. For Point observation locations, navigate to the geodatabase that contains the data for this tutorial, and click the ca_cities dataset. Leave the Field to validate on empty as we just want to generate ozone predictions for the major cities, not validate the predicted values against measured values. For Output statistics at point locations, navigate to the folder you created for the output, and name the output file CA_cities_ozone.shp. Leave the Append all fields from input features checked as we want to be able to see the names of the cities in the output feature class.

    The GA Layer To Points geoprocessing tool dialog box should look like this:



25. Click OK to run the tool.

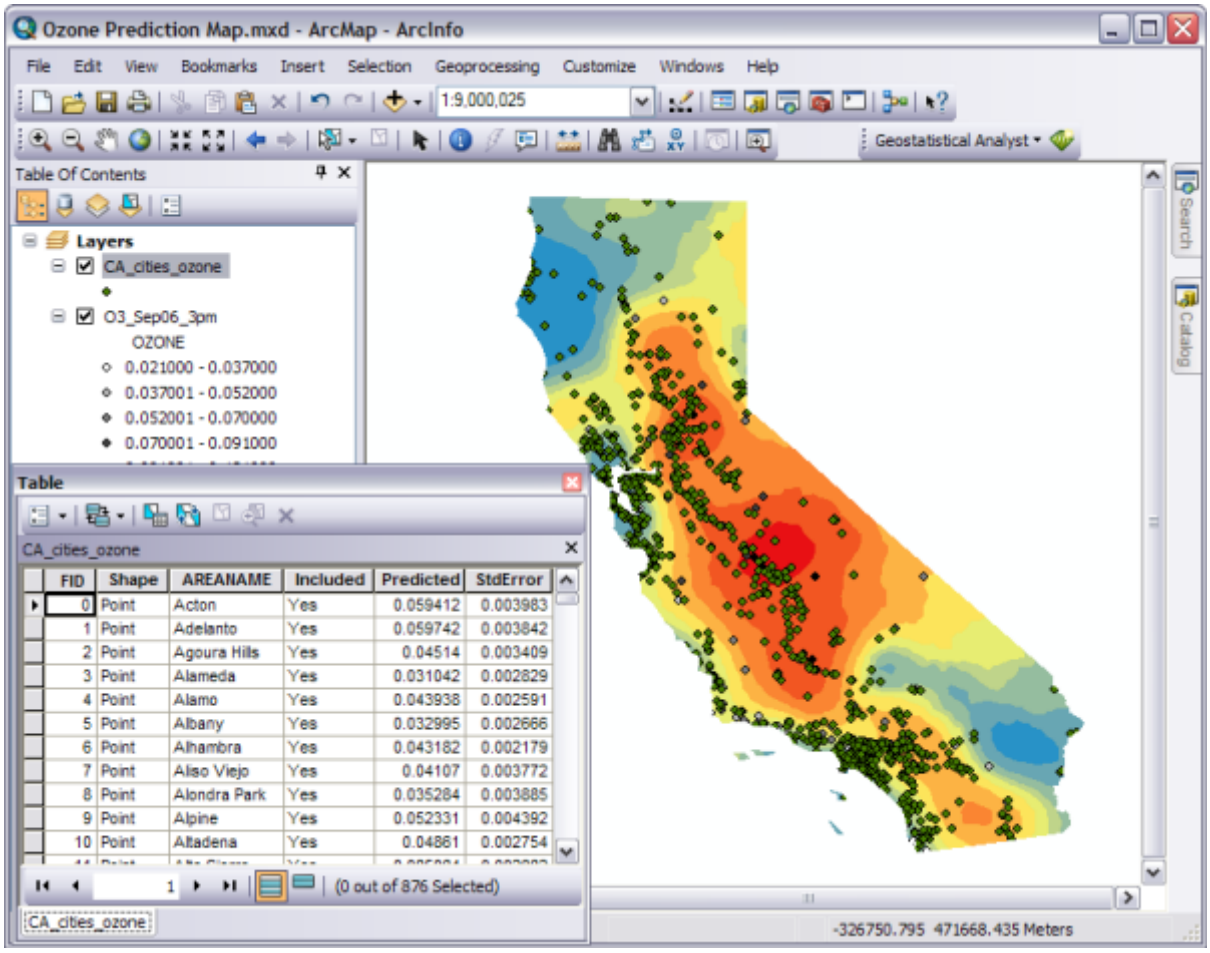
    Background geoprocessing is enabled by default, so all you will see as the tool runs is its progress on the ArcMap status bar (at the bottom of the ArcMap window).

26. Once the tool has run, click the Add Data button on the Standard toolbar.
27. Navigate to the data, click CA_ozone_cities.shp, then click Add.

The point observations layer is added to your map.

28. Right-click the CA_cities_ozone layer and click Open Attribute Table.

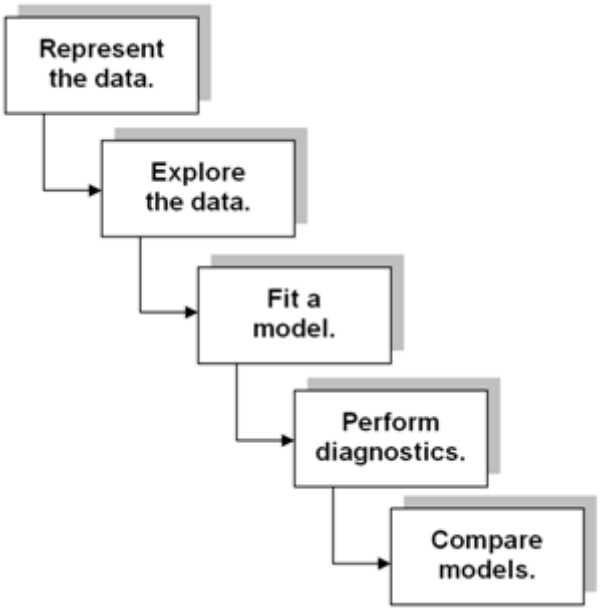
    Note that each city now has a predicted ozone value, as well as a standard error value (which indicates the level of uncertainty associated with the ozone prediction for each city).



29. Close the Table window.
30. Right-click the CA_cities_ozone layer and click Remove to remove the layer from the project.
31. Save the ArcMap document.

Surface-fitting methodology

You have now created a map of ozone concentration and completed exercise 1. While it is a simple task to create a surface map using the default options that the Geostatistical Wizard provides, it is important to follow a structured process such as the one shown below:



You will practice this structured process in the following exercises of the tutorial. In addition, in exercise 5, you will create a surface showing the probability that ozone concentrations exceed a specified threshold. Note that you have already performed the first step of this process, representing the data, in exercise 1. In exercise 2, you will explore the data.

In this exercise, you were introduced to the Geostatistical Wizard and to the process of creating an interpolation model. The following exercises will refine this process by extracting as much pertinent information as possible from the data to create a better model.

Related Topics

- Introduction to the ArcGIS Geostatistical Analyst Tutorial