

Tutorial 9 – Spatial Interpolation

This tutorial is designed to introduce you to a basic set of interpolation techniques and surface comparisons including:

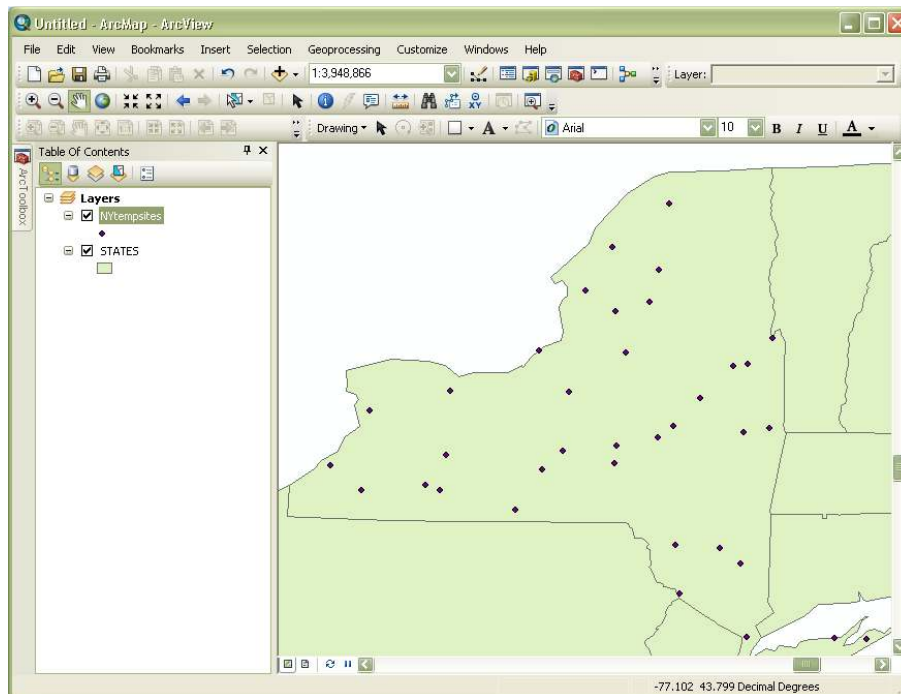
- Inverse Distance Weighting
- Splines
- Kriging
- Setting the extent of an interpolated surface to a shapefile (a.k.a. visual clipping)
- Using the raster calculator to perform mathematical functions between/among whole raster grids (example - subtracting grids).

Before beginning the tutorial, please copy the Lab09 archive to your server folder and unpack it. You should also think about creating a default file geodatabase for you work.

New York Winter Temperature

The data for this tutorial are average winter temperatures for a series of weather stations in New York State. These data are contained in a shapefile called NYtempsites.

Launch ArcMap and open the NYtempsites shapefile. You might also want to underlay a map of NY State for visual reference and change the projection to something more appropriate (see below). The attribute table for NYtempsites contains a variable called AveWinT which contains the average winter temperature values (as can be seen in the attribute table).

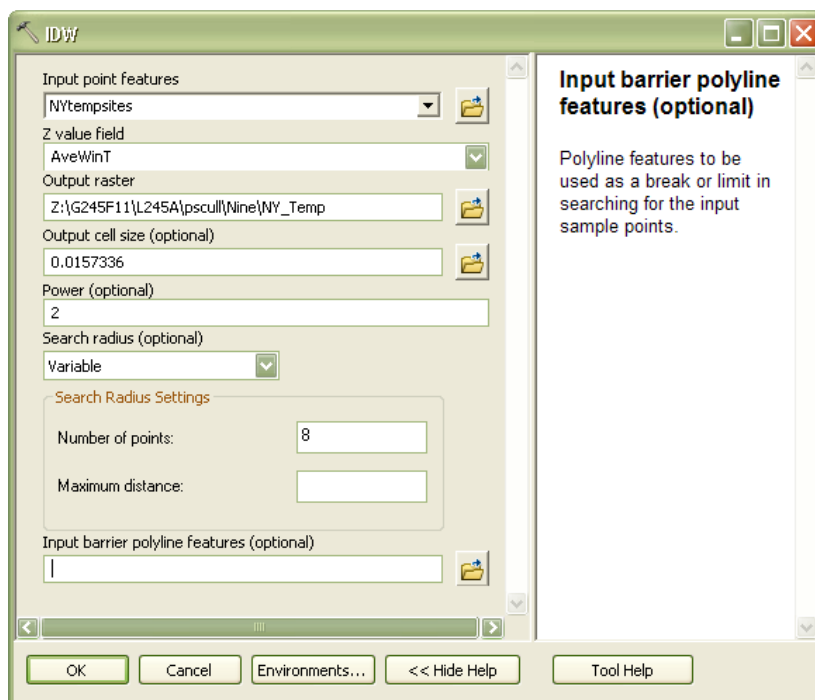


1. Inverse Distance Weighting

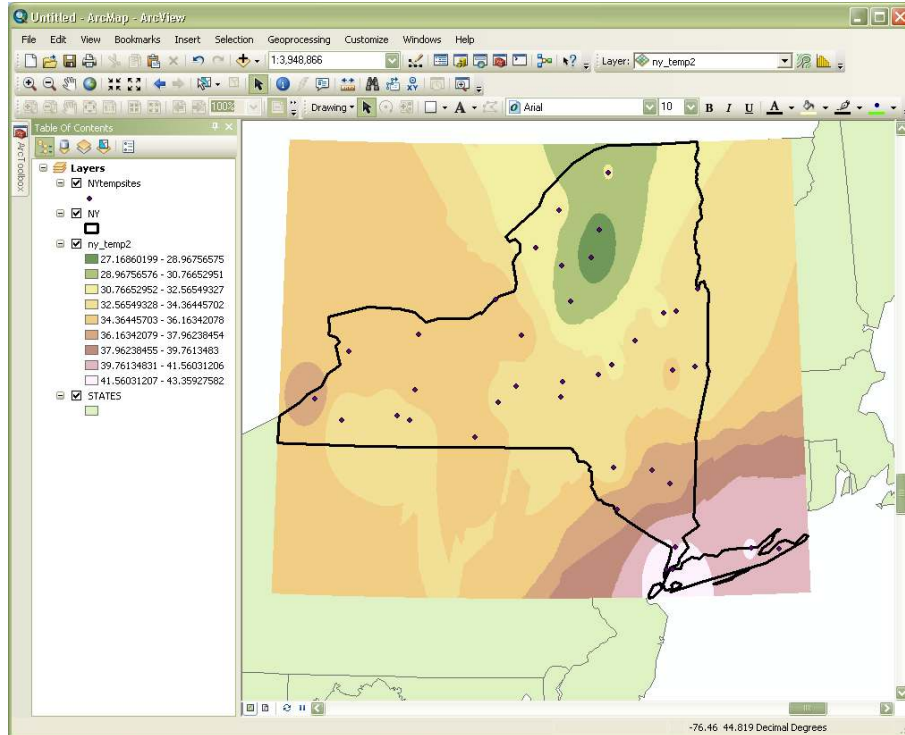
Although there are a number of places in ArcMap where interpolation and geostatistical tools are found, we will be relying primarily on the Spatial Analyst suite of tools (in ArcToolbox). Before starting, make sure you adjust your environmental settings as appropriate. Otherwise, the resulting grids you create will only cover as far east/west/north/south as the weather data points. To limit the extent to only NY State, you must first create a new shapefile of just New York State (you should know how to do this).

Initiate the IDW interpolator (Spatial Analyst Tools → Interpolation → IDW). The window that appears gives you options for selecting the input point features (NYtempsites), the Z value or the variable to interpolate (AveWinT), the output raster, the output cell size, the power of the distance weighting, and the search parameters (IDW's can be local or global).

In my example, I used distance squared with the 8 nearest points. I also retained the default grid size. Keep in mind that if you plan to keep the resulting grid you should save it somewhere other than in the temporary space.



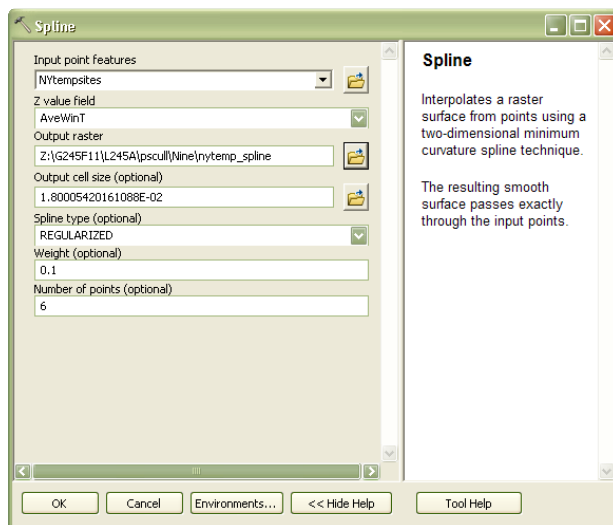
The resulting grid is shown below.



Notice what happens to the interpolated surface as you move outside of the control points.

2. Splines

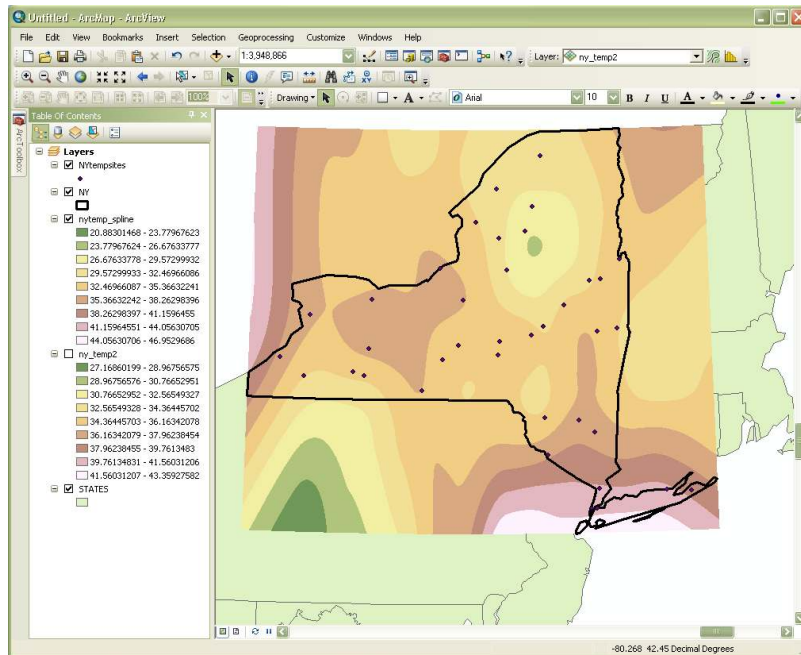
Selecting the spline interpolation option produces a window like the one below. Again, you must identify the variable to be interpolated. You must also select the spline type (regularized or tension), the weight, and the number of points. The results for my example are shown below.



Why is this the size of the cell?

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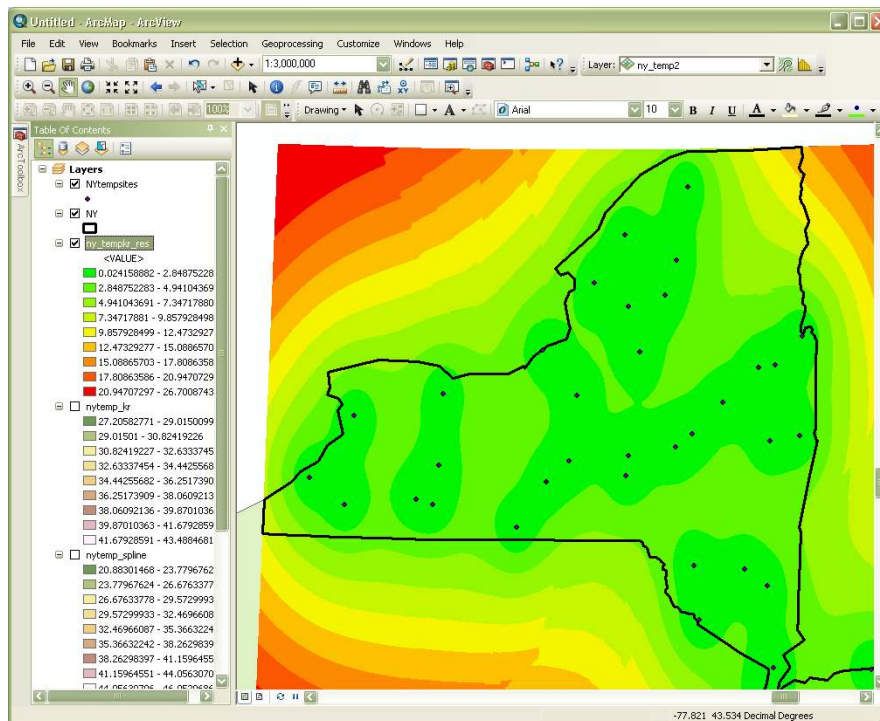
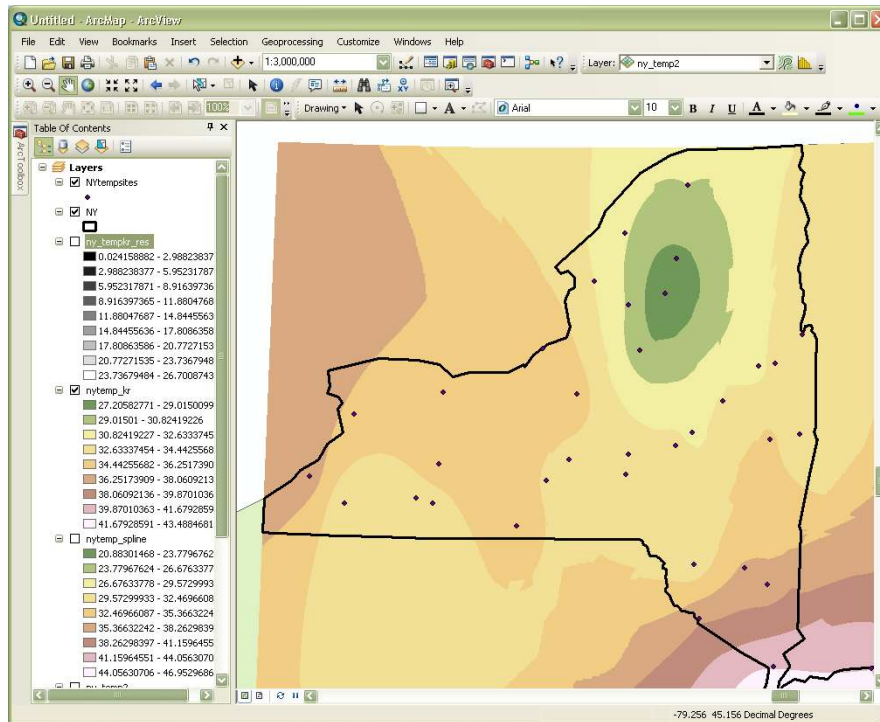


What are some of the differences between the two surfaces?

3. Kriging

The kriging option within spatial analyst provides basic kriging functions. Select the appropriate variable to interpolate, the semivariogram model (I suggest spherical for beginners), and search radius settings. See my example below.

Notice that I have saved the variance associated with the prediction. This interpolator produces two grids, one is the prediction and the other is the residuals (both shown below).



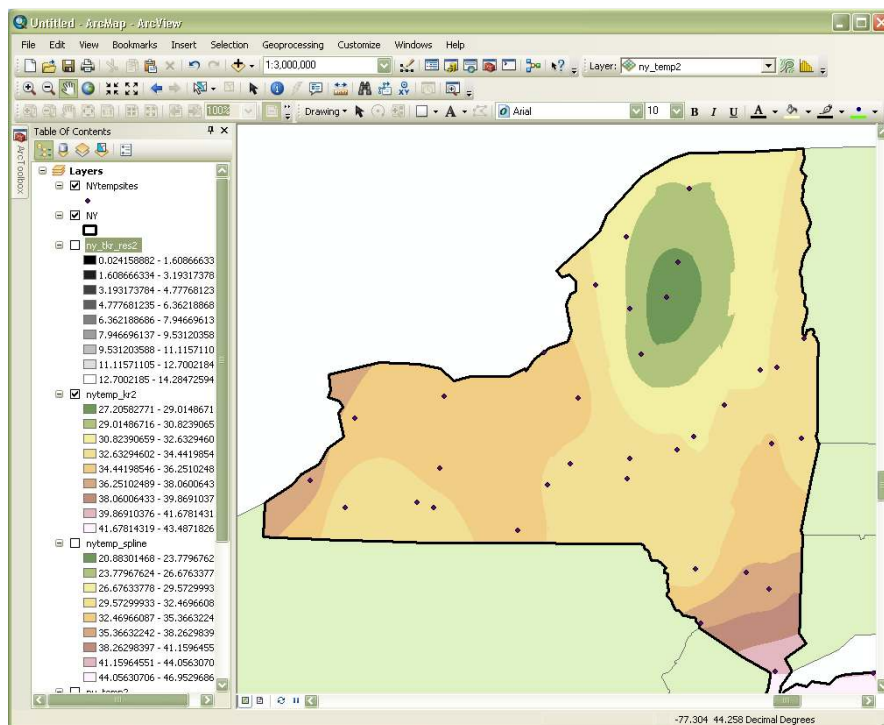
Which area of the state has the least accurate interpolated values? Why is this the case?

4. Comparing interpolated surfaces

Often times it is useful to compare the output of different interpolated results. To do this we will subtract one of our interpolated surfaces from one another. This will highlight the differences between the two interpolations.

Before we complete this task, let's make another version of our kriging and IDW surfaces. This time change your environment settings to mask the area outside of NY (do you remember how to do this? Hint: it's under the geoprocessing pull down menu on the main GUI). If we don't do this the highlighted differences will more than likely be outside the state.

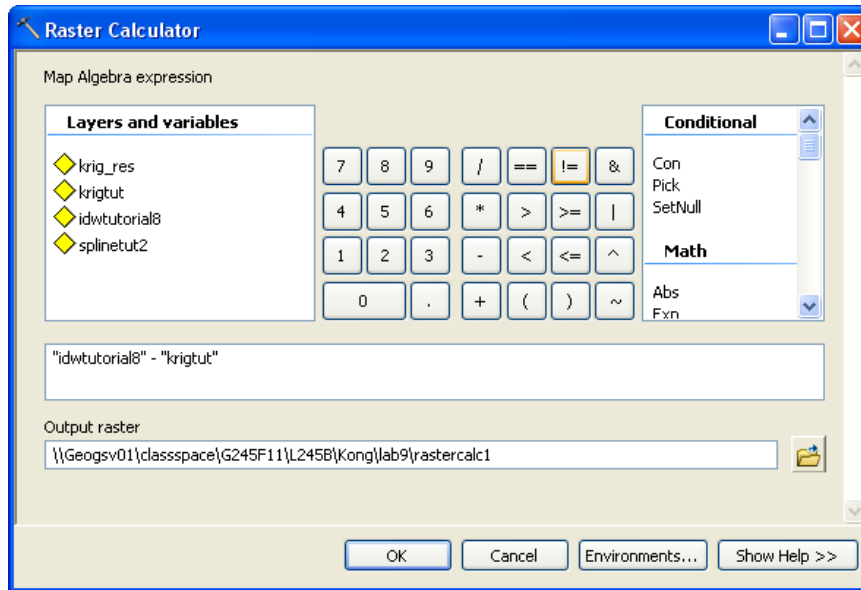
Now, create an ordinary kriging and an IDW surface similar to the one you created above. Your kriging surface should look similar to the one below. Not that unlike the IDW surface the green values do not extent to the Canadian border.



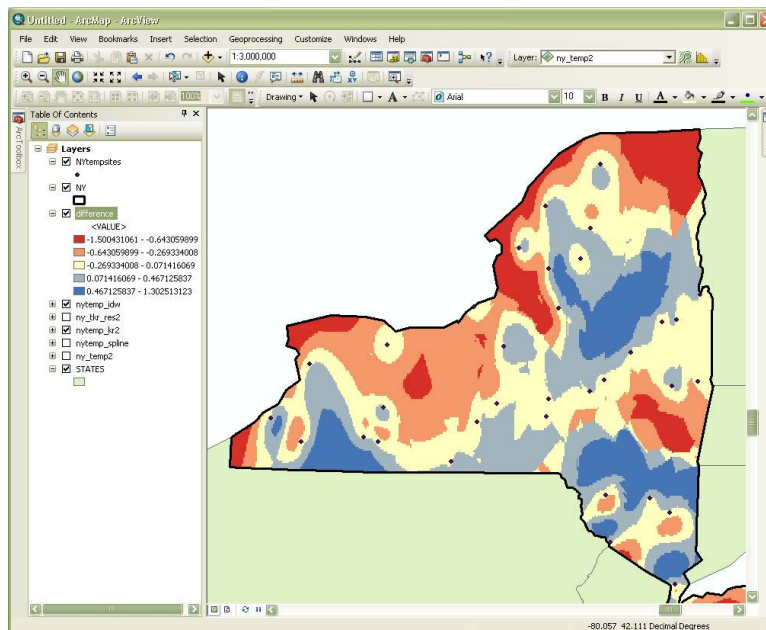
We can further compare these surfaces by subtracting one from the other. If we subtract the kriged surface from the IDW surface the positive values will be locations where the IDW provided a greater estimate than kriging and vice-versa.

Open the raster calculator to perform the subtraction. Your expression should look like the one below. Your names could very well be different.

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Once you click 'ok the output should be added to your map (as shown below).



By default, the white areas are high values (IDW > Kriging) and the black areas are negative values (IDW < Kriging). To best illustrate you could change the symbology to display the negatives and positive values in different hues, similar to tutorial three (as I've done above).