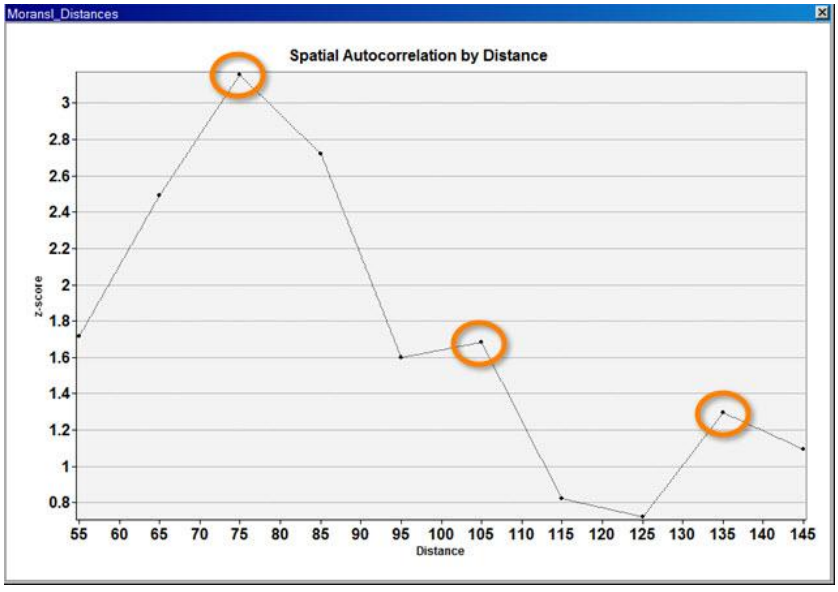
How Incremental Spatial Autocorrelation Works

With much of the spatial data analysis you do, the scale of your analysis will be important. The default Conceptualization of Spatial Relationships for the Hot Spot Analysis, for example, is Fixed Distance and requires you to specify a distance value. For many density tools you will be asked to provide a radius. The distance you select should relate to the scale of the question you are trying to answer or to the scale of remediation you are considering. Suppose, for example, you want to understand childhood obesity. What is your scale of analysis? Is it at the individual household or neighborhood level? If so, the distance you use to define your scale of analysis will be small, encompassing the homes within a block or two of each other. Alternatively, what will be the scale of remediation? Perhaps your question involves where to increase afterschool fitness programs as a way to potentially reduce childhood obesity. In that case, your distance will likely be reflective of school zones. Sometimes it's fairly easy to determine an appropriate scale of analysis; if you are analyzing commuting patterns and know that the average journey to work is 12 miles, for example, then 12 miles would be an appropriate distance to use for your analysis. Other times it is more difficult to justify *any* particular analysis distance. This is when the Incremental Spatial Autocorrelation tool is most helpful.

Whenever you see spatial clustering in the landscape, you are seeing evidence of underlying spatial processes at work. Knowing something about the spatial scale at which those underlying processes operate can help you select an appropriate analysis distance. The Incremental Spatial Autocorrelation tool runs the Spatial Autocorrelation (Global Moran's I) tool for a series of increasing distances, measuring the intensity of spatial clustering for each distance. The intensity of clustering is determined by the z-score returned. Typically as the distance increases, so does the z-score, indicating intensification of clustering. At some particular distance, however, the z-score generally peaks. Sometimes you will see multiple peaks.



Peaks reflect distances where the spatial processes promoting clustering are most pronounced. One strategy for identifying an appropriate scale of analysis is to select the distance associated with the peak that best reflects the scale of your question. Often this is the first peak.

How do I select the Beginning Distance and Distance Increment values?

For many analyses you will want to select a beginning distance that ensures all features have at least one neighbor. You can use the Calculate Distance Band from Neighbor Count tool to find this distance (it is the Maximum Distance Reported). One strategy for selecting a Distance Increment is to use the average distance returned by the Average Nearest Neighbor tool. A tutorial, which includes instructions for using the Incremental Spatial Autocorrelation tool, walks you through the steps of finding these values.

What if the graph never peaks?

In some cases, you will use the Incremental Spatial Autocorrelation tool and get a graph with a z-score that just continues to rise with increasing distances; there is no peak. This most often happens in cases where data has been aggregated and the scale of the processes impacting your Input Field variable is smaller than the aggregation scheme. You can certainly try making your Distance Increment smaller to see if this captures more subtle peaks. If this doesn't work, however, and you still aren't getting peaks, you will likely need to justify the analysis distance you choose using some other criteria.

Additional Resources

- Videos outlining some best practices for performing a hot spot analysis:
  - Hot Spot Analysis Part 1
  - Hot Spot Analysis Part 2
  - Hot Spot Analysis Part 3

- Tutorial and video walking through an analysis that of Dengue Fever data that uses the Incremental Spatial Autocorrelation tool:
  - Spatial Pattern Analysis – A Tutorial
  - Spatial Pattern Analysis of Dengue Fever – A Video

- See "Selecting a Fixed Distance Band" in the Modeling Spatial Relationships online documentation

- How Hot Spot Analysis Works includes a discussion about finding an appropriate scale of analysis.

- Keep checking back at http://bit.ly/spatialstats for upcoming videos, tutorials and more.