Adjacency Matrix (Aaron Marks)

To get things started we went ahead and made an adjacency matrix for our data set by state. We were going to use county level data by joining our data points with a county shapefile but that was a ton of data to work with, not to mention the matrix would be huge. We made this by hand using excel and the continuity method used didn't matter or wasn't a factor due to all of the states sharing a at least an edge. None of the states only had corners sharing a boundary. Had there been the option between which method to choose we would have gone with queen adjacency because the boundaries of states don't affect weather patterns and in some cases a storm could have crossed one of these corner connections as opposed to a defined edge with length.

An adjacency matrix is the basis for many analysis methods, including Moran's I and other spatial autocorrelation methods. This is, as we know, due to spatial autocorrelation measuring the influence neighboring areas have on each other. They can be useful for both human calculations but are really easy for a computer to work with, speeding up complicated formula calculations.

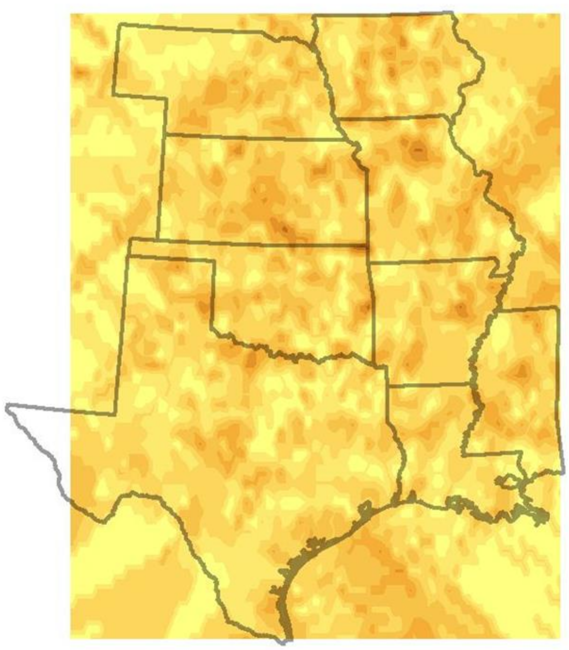
We didn't actually compute or work on the data by hand at all as there were too many entries to attempt an analysis by hand. Perhaps a local analysis would have been possible but we never got around to trying it during our work sessions. The key point with providing a matrix though is to show that we understand how they are made, using both methods, and what their purpose is.

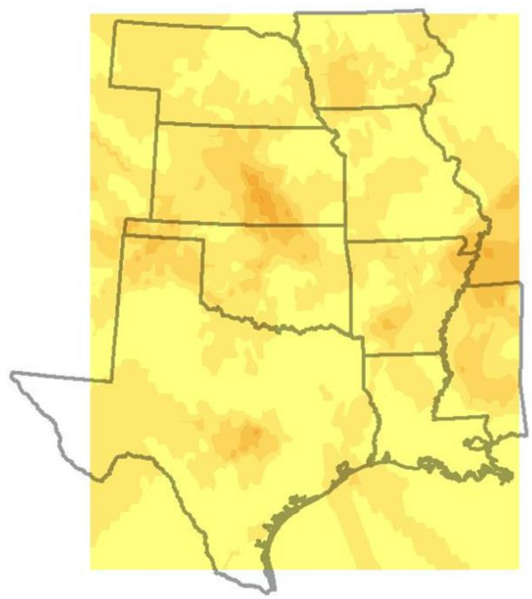
Kriging (Aaron Marks)

Kriging is a statistical based spatial estimation, or interpolation, method used for predicting unknown values at unobserved locations. Kriging is a bit different than other interpolation methods, like IDW and Trend surface, in that it uses three different variables to determine the outcome. It looks at the 'direction', or spatial trend, between points, such as the tornado intensity or air temperature decreasing from north to south as an example. The second component deals with local spatial autocorrelation amongst observed data points. The observed change in the autocorrelation with respect to distance helps generate the predicted values. These two components are then combined with stochastic variation in the estimation formula allowing measured data to estimate values across our study area. Kriging also uses estimated weights for each data point based on these three components in comparison to IDW weighting scheme. While Kriging's original use was for locating ore based on known locations it can be used for many other areas of interest as well. Due to the in depth mathematics out of our scope it is best left to the computer with human defined variables, such as in our case, to handle the process.

We didn't focus on Kriging all the much in class, perhaps due to it's complexity but it was fun to mess around with and explore these other methods available in ArcGIS. As previously mentioned, Kriging can be used for multiple areas of interest. It can be used for generating something as simple as an elevation model based on known elevation values and locations but this method really excels in more costly situations with its more precise weighting method involving the lowest variance value, as opposed to the entire variance between each point. A great example is that of its original use, mining, where expenses quickly add up with less precise interpolation.

In our case, with tornados, there really isn't much benefit over other methods other than producing different visuals. Tornado touchdown points are different from temperature and elevation in that they don't occur over the entire area of study. So what we decided to do was think of it as a hazard zone or a hotspot map. Areas surrounding the tornado may have received damaged related to the actual touchdown point and therefore would be represented with interpolation. Another way to look at it is that if something has happened in the past it is more than likely to occur in that same spot than say a place that has never seen a tornado in the past 50 years. There is always a chance for anything to happen though and we also didn't consider limiting or promoting factors such as the landscape. A flat open area is more prone to a larger tornado, if any, that compared to a mountain region. Once again it was of more importance experimenting with the method than seeing what our outcome was for the data used. Different data would produce different results and meanings but the method remains the same. With that in mind our results are presented in the power point and below are a few as well.





Above: (left) shows our Kriging Interpolation based on F-scale for our data from 1950-2009 and (right) shows 1990-1999 data that highlights the more intense areas that cover Kansas and Oklahoma. The area with the most estimation falls north of Mississippi due to an edge effect of higher values. Based on what we know, and what we have to work with, this estimation is entirely plausible, unlike estimations of the Gulf of Mexico. (Again, landscape was not factored in.)