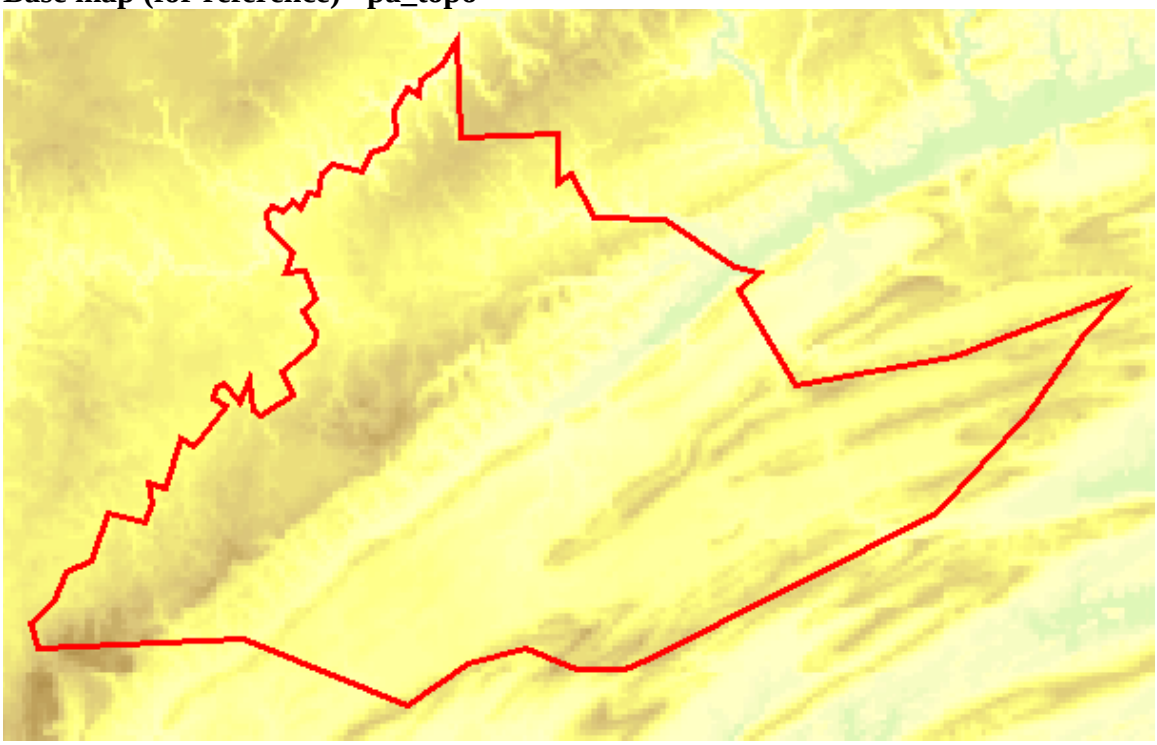
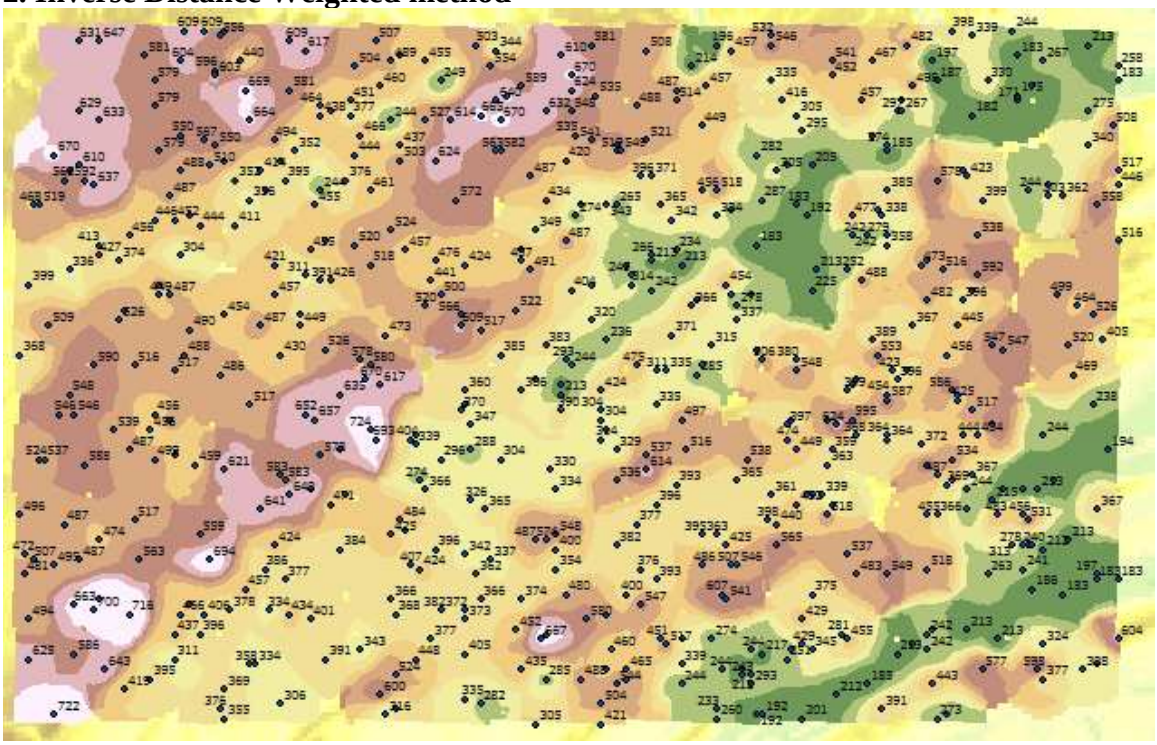
Geography 586 / Project 5 - Interpolation / Bruce Kinner

1. DEM spikes (posted to discussion board)

Base map (for reference) - pa_topo



2. Inverse Distance Weighted method



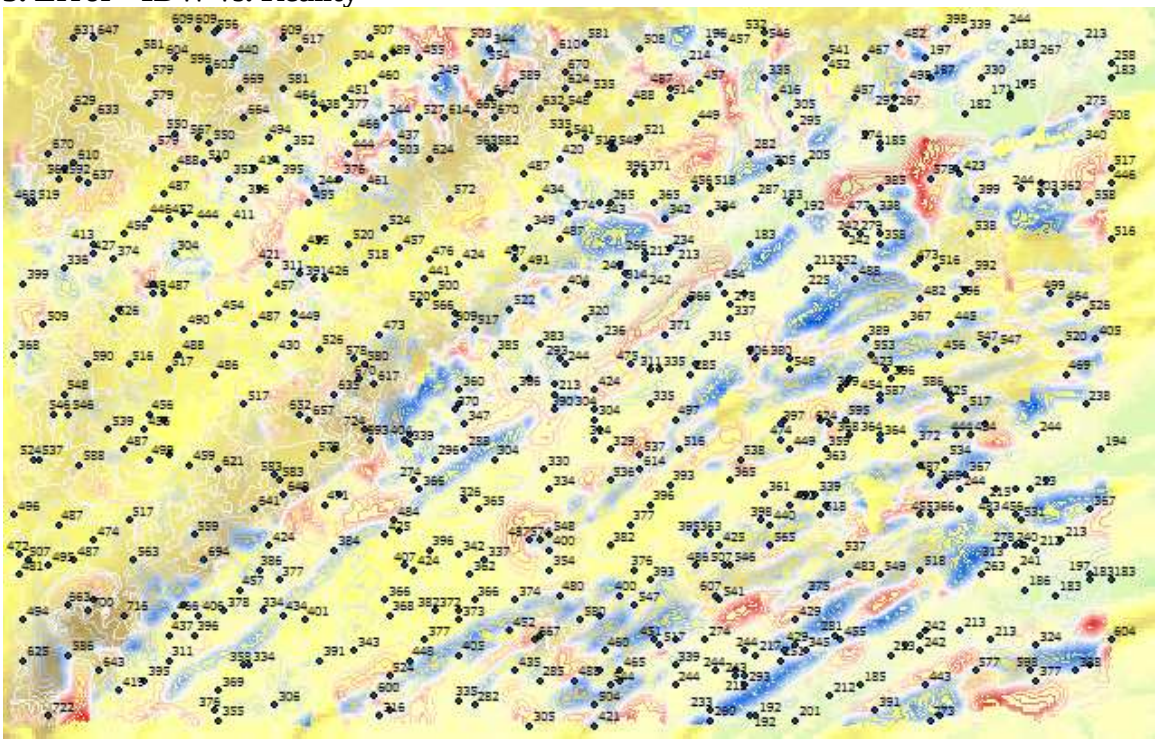
My goal with this project was to focus on the valley in the NE quadrant of the map (see pa_topo). I would work to preserve the appearance of the valley on the output obtained from the different techniques applied during the project.

Due to the topology of the subject area, often only the closest control points will be very relevant. Therefore, with Inverse Distance Weighting it is necessary to use a larger power number than might otherwise be the case. A power of three returned the best results. It gives a much greater weight to closer control points while still allowing farther away points to matter especially if they are the only data available. Using this method even two control points were sufficient for a nice result. Using the variable search radius, additional points beyond three only smoothed the data.

Before applying a fixed search radius, I measured the width of valley at a narrow point and used that value (1374m) as an increment for the fixed radius. I found that in order to cover the subject area with values it was necessary to use three increments (4122m), although complete coverage could actually be achieved with a slightly smaller number. However, my settings of 'threes' (power, number of points, and incremental multipliers on the 'feature' I wanted to preserve) did result in the best representation of the valley (shown above) I was able to obtain through trial and error.

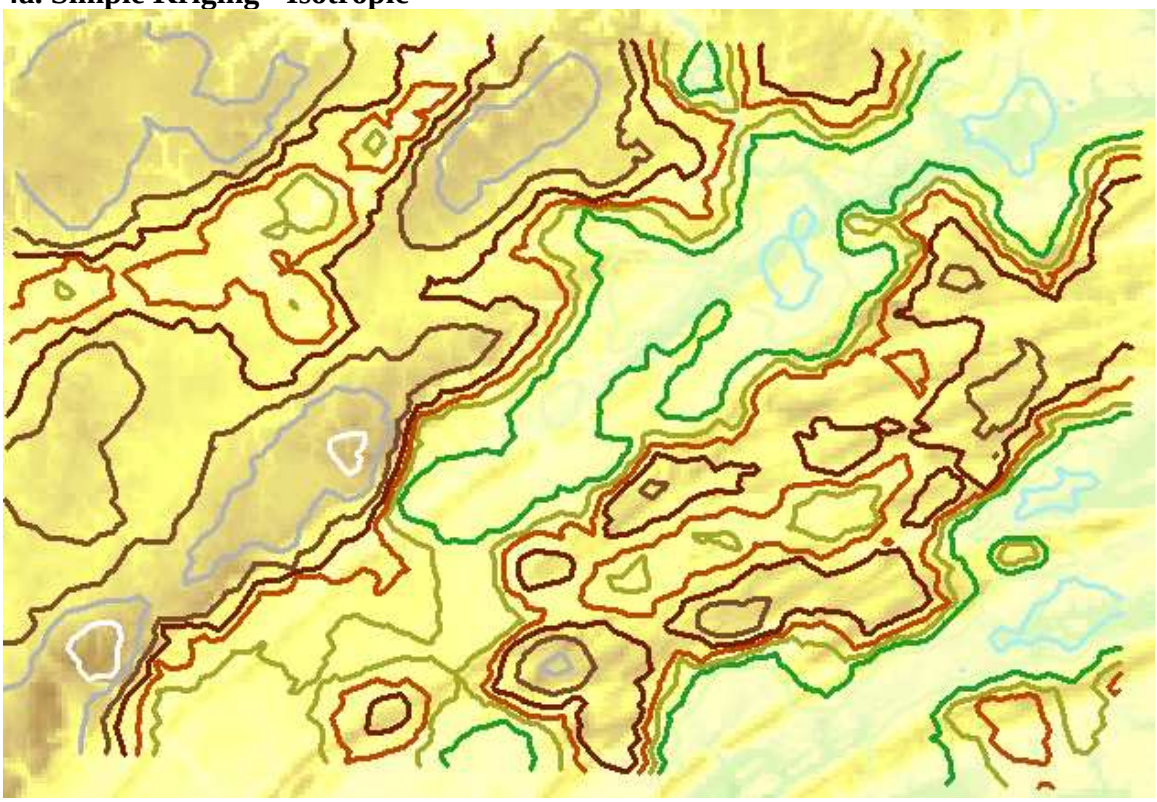
Overall, I was satisfied with the result. The IDW tool was easy to use and also somewhat intuitive as it usually predictable what the result would look like from the settings chosen.

3. Error - IDW vs. Reality

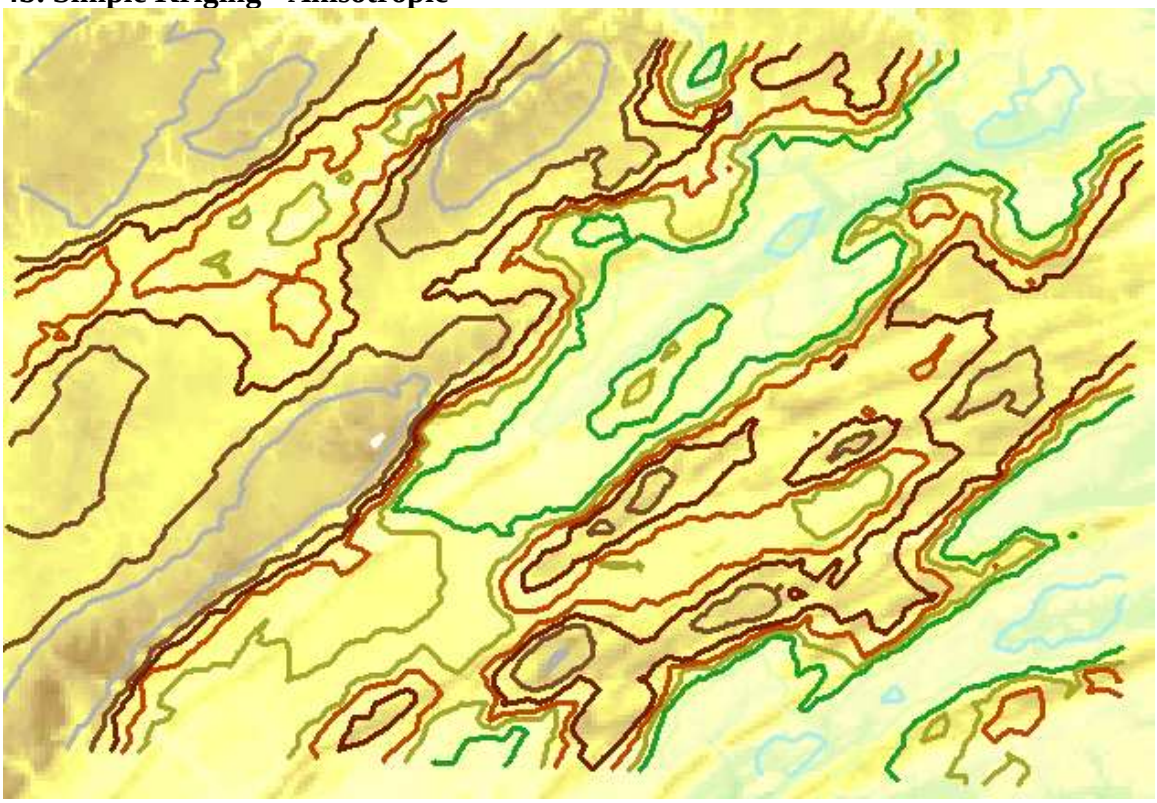


Contours at 30m are shown over the base map. The contours represent the amount of error in the IDW with red meaning the calculation was too high (valleys) and the blue showing the IDW predict a value too low (peaks). Areas of concentrated red or blue are where the amount of error changes rapidly. The white contours are low amounts of error. The errors are largest in areas of extreme elevation change even if a control point is very close but at a much different elevation. It is these extremes of the peaks and valleys where the IDW does not do well.

4a. Simple Kriging - Isotropic



4b. Simple Kriging - Anisotropic



I tried many settings with the kriging tool but in the end I mostly used the default settings. I chose a spherical model and the circular sector option where only a limited number of close points are chosen. This seemed appropriate due to the nature of the project area with the potential for extreme changes in elevation over short distances. Since my goal for the different methods used in the project was to preserve the structure of the valley in the NE quadrant of the map, the output was acceptable. Due to the way ArcMap created the output, it was difficult to match the colors and ranges between the IDW and the kriging maps to determine which one was actually better. However, the kriging values have a more narrow range (210-660m) than the IDW (171-724m). This means the kriging map would show more extreme errors but it isn't clear if there would be more or less error overall.

The basic kriging output does indicate the existence of the valley although the IDW map seems to show it better defined. The anisotropic output does do a nice job of indicating the angle of the valley walls as shown on pa_topo. I also tried the universal kriging but the output created was too smooth. With multiple valleys in the subject area, a method where all the points should be expected to have an effect on each other is not desirable.

Overall, while other methods may be superior in various mathematical or statistical ways, I thought the output from the IDW was the best for creating an appropriate surface and specifically for meeting my goal of preserving the valley structure. It was also clear more control points would have helped all the methods (of course more data is always better!) Additionally, since the mathematics involved are more intuitive and easier to visualize (and have less options in the software), the user can more easily achieve an acceptable and understandable result. With the kriging method, I felt if I tried a few thousand more different settings that somewhere in the tool the perfect result was just waiting to happen!