Interpolating Climate Data

Introduction: This guide outlines the procedure for downloading climate data from the Environment Canada website and using these data to create an interpolated surface map in ArcMap.

Requirements:
- ArcMap 10.x
- Web browser

Part 1: Data Acquisition
1. Open a web browser and navigate to the Environment Canada – Climate Data website. For the purposes of this guide the monthly climate summaries data will be used.

2. Link to the Monthly Climate Summaries website.

3. Select the appropriate year and the month for your analysis, as well as the province or territory of interest.

4. Select CSV as the download format option. Click 'Download Data'.

5. Run Excel and open the downloaded file. The table that has been downloaded is already in a suitable format for analysis in ArcMap, but it was found that the best functionality is achieved by saving the table in the .xls format.

6. For ease of use once the table is brought into ArcMap, you will want to identify the range of cells in Excel you wish to utilize for your analysis. For further instructions on this process, see Appendix.

7. Once you have saved your named range, close Excel before moving onto **Part 2**.

Part 2: Interpolating Climate Variable in ArcMap 10.x

1. Run ArcMap 10.x.

2. Add the named range from **Part 1** into ArcMap.

3. Set the projection (Right click 'Layers' in the Table of Contents > Properties… > Coordinate System tab) to a coordinate system that is appropriate for your study area.

4. Right click the table and select 'Display XY Data…'. This displays the locations of the weather stations that you specified in your named range.

5. Once the points have been displayed you will save them as a shapefile (right click the point layer then select Data> Export Data…). Remove the Events layer from the contents.

6. From these points you can interpolate a continuous surface using a climate variable of your choosing, which can be found in the table downloaded from Environment Canada. For the purposes of this tutorial the two variables that will be utilized are temperature (Tm) and precipitation (P).

7. To interpolate a surface the 'Kriging' tool is used. Open the search tab and type in 'Kriging', select the 'Kriging (Spatial Analyst)' tool.

8. Select the shapefile that you created under 'Input point features' drop down menu. From the drop down menu under 'Z value field' select the variable of interest, in this case Tm, and accept all other defaults. You can only interpolate for one variable at a time.

9. After the tool has been carried out your interpolated surface will appear, this can then be clipped to a boundary file using the 'Extract by Mask (Spatial Analyst)' tool.

10. The symbology of the interpolated surface can be formatted (Properties… > Symbology tab) to change the colour and how the surface is displayed (i.e. classified or stretched). The example below utilizes two different colour ramps, and both data are displayed as 'Classified' as opposed to 'Stretched'.

11. Repeat the process using different variables for a region, or a time series for one variable from different years. The map below is an example of two variables from the same month and year displayed on one map.
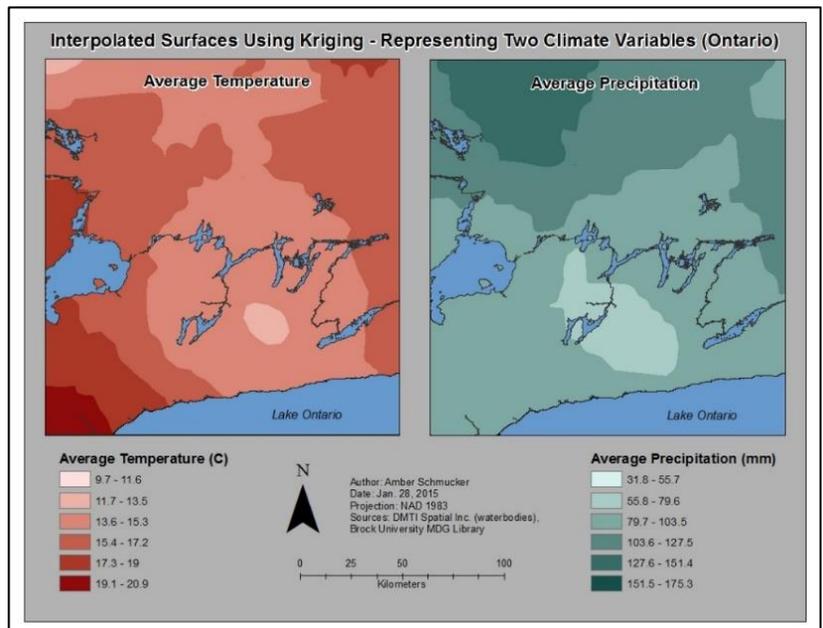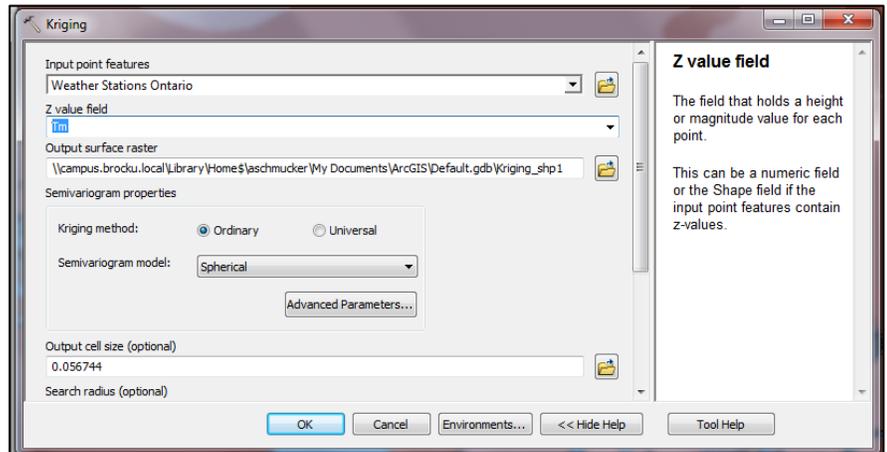
APPENDIX: Identifying a range of cells in Excel

1. Click the top-leftmost cell to be included in the range (header of the first column of data).
2. Hit **F8** to begin the selection.
3. On the keyboard hold down **CTRL** and hit **END** to stretch the range to the lowest rightmost cell of data.
4. From the Excel ribbon, select **FORMULAS** and click **NAME MANAGER**. This tool allows us to assign a name to the selection of cells we are going to import to ArcGIS.
5. Click **NEW** and provide a descriptive name for the range of cells (i.e. Data_import). DO NOT INCLUDE SPACES OR SPECIAL CHARACTERS.
6. Click OK and close the Name Manager.
7. Select **File > Save as…** and save the file as an *Excel Workbook 97-2003* (i.e. census_data.xls). DO NOT INCLUDE SPACES OR SPECIAL CHARACTERS.

February 2015