

Exercise 13

Single Map Vector Interpolation

About this exercise and the data set

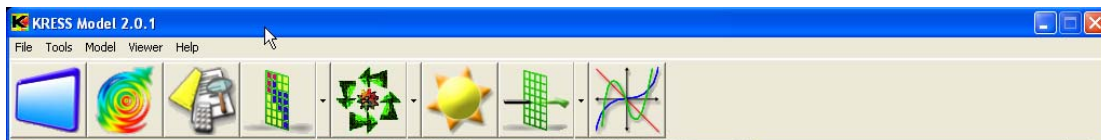
The data used in this exercise was collected from the east pasture at McDougal Ranch in California using thermistors. Thermistors were laid out in a grid sampling at this California foothill pasture. Temperature data was collected every 15 minute interval during the month of June 2004. The objective of the analysis is to map temperature variability in space (across the landscape) at noon on the 18th of June 2004.

Step 1: Start KRESS program

To start running the Model, double-click on the KRESS application icon.



This will automatically load the KRESS Model program.

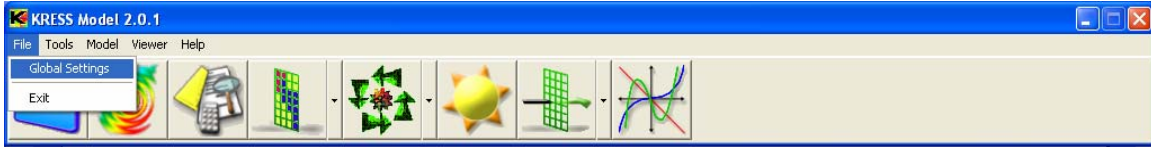


Step 2: Setting the working Directory

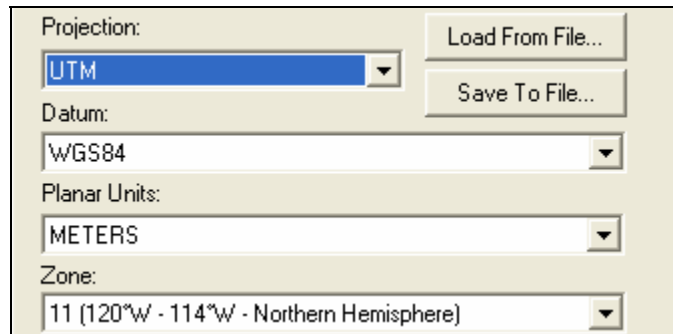
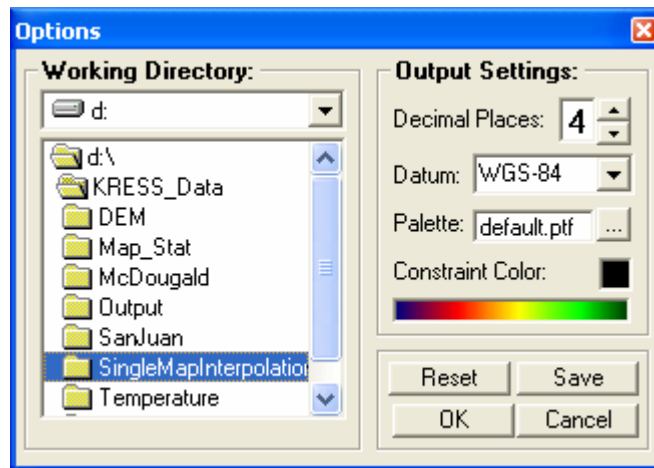
A project is a compilation of data files. Therefore, it is necessary to create a Working Directory. This is the most fundamental element in organizing data files, both the input files to be used and the output files subsequently created by you, as well as your written analysis results. Creating a Working Directory activates the Project Environment module, allowing you to set the data paths of your file folders. In order to access the working directory, go to the drop-down menu

labeled "Model" and click on the selection "Options". This will open a new window, as pictured below.

Click of File and then select Global Settings

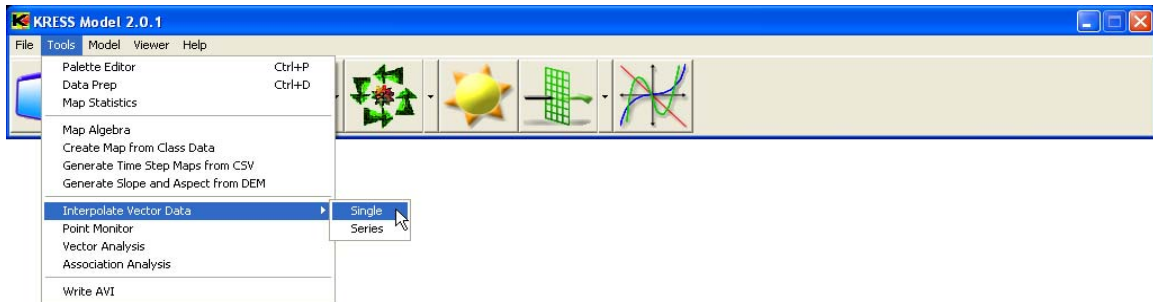


Set your working directory to where you have saved your data.

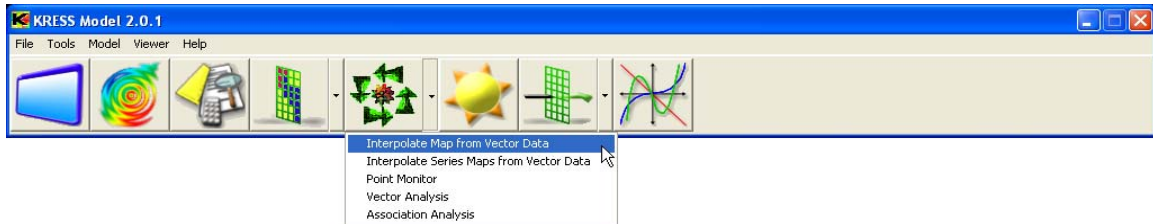


Step 3: Open the Interpolate Vector Data window

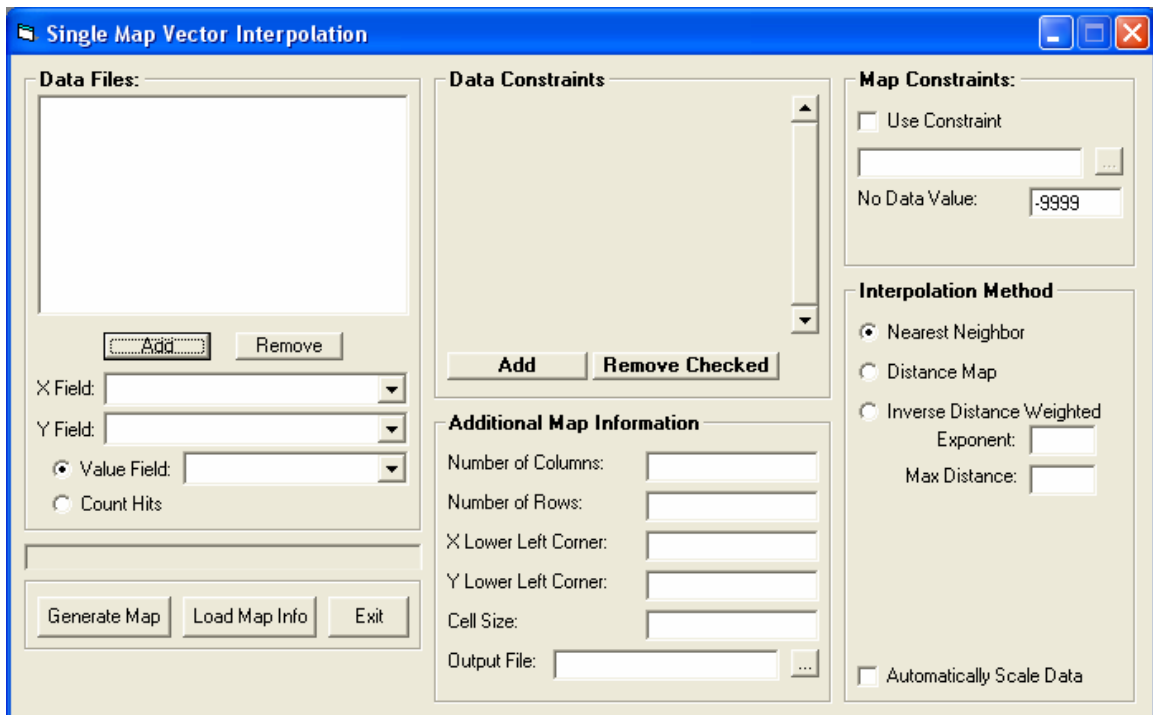
From the drop down menu select Interpolate Vector Data and then Series.



You can also access the interpolate map from vector data from the button menu.



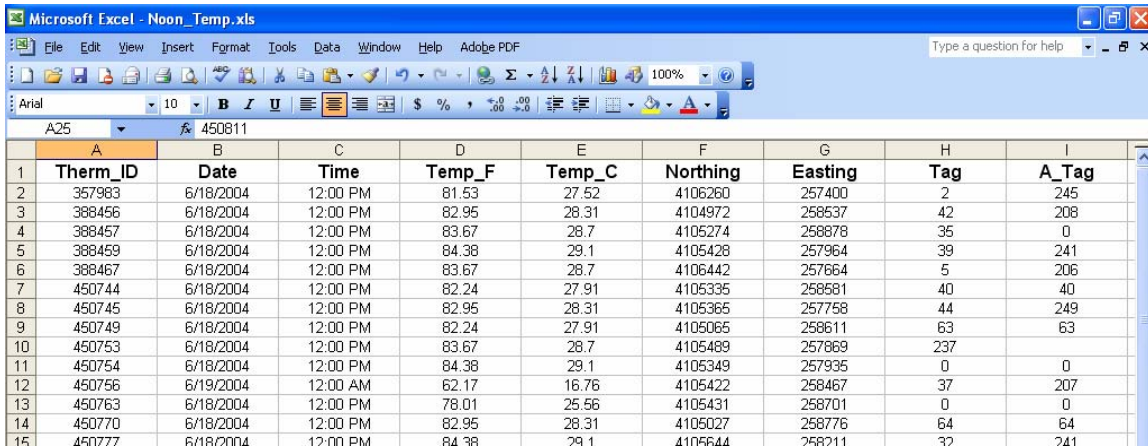
This will open a new window.



In the next steps we will fill in the necessary information in the above window.

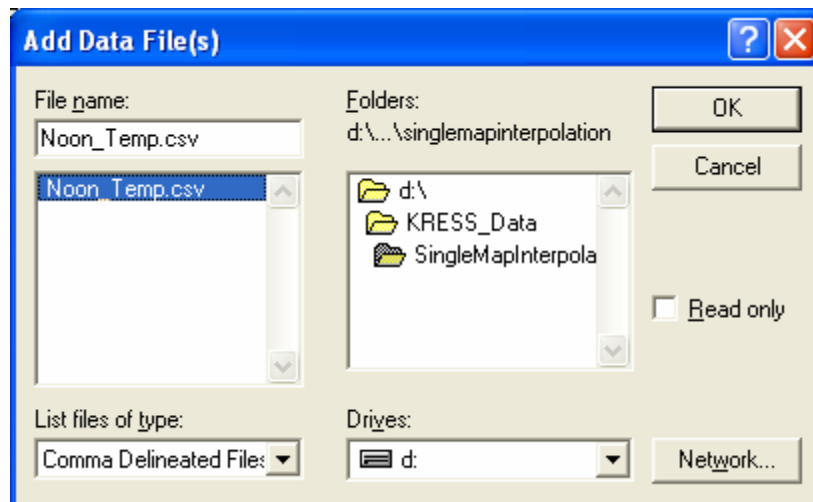
Step 4: Input Data Files

The input data file requires a comma delimited text file "CSV". To see the content of this type of file, open a CSV file using Microsoft excel. The file contains thermistors ID, Date, Time, Temperature at noon in Degree Celsius and Fahrenheit, and Northing and Easting.



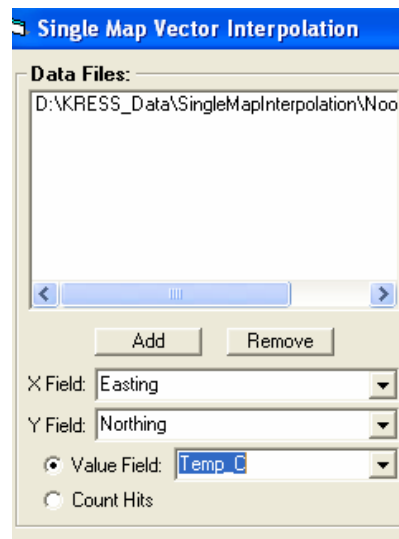
	A	B	C	D	E	F	G	H	I
1	Therm_ID	Date	Time	Temp_F	Temp_C	Northing	Easting	Tag	A_Tag
2	357983	6/18/2004	12:00 PM	81.53	27.52	4106260	257400	2	245
3	388456	6/18/2004	12:00 PM	82.95	28.31	4104972	258537	42	208
4	388457	6/18/2004	12:00 PM	83.67	28.7	4105274	258878	35	0
5	388459	6/18/2004	12:00 PM	84.38	29.1	4105428	257964	39	241
6	388467	6/18/2004	12:00 PM	83.67	28.7	4106442	257664	5	206
7	450744	6/18/2004	12:00 PM	82.24	27.91	4105335	258581	40	40
8	450745	6/18/2004	12:00 PM	82.95	28.31	4105365	257758	44	249
9	450749	6/18/2004	12:00 PM	82.24	27.91	4105065	258611	63	63
10	450753	6/18/2004	12:00 PM	83.67	28.7	4105489	257869	237	
11	450754	6/18/2004	12:00 PM	84.38	29.1	4105349	257935	0	0
12	450756	6/19/2004	12:00 AM	62.17	16.76	4105422	258467	37	207
13	450763	6/18/2004	12:00 PM	78.01	25.56	4105431	258701	0	0
14	450770	6/18/2004	12:00 PM	82.95	28.31	4105027	258776	64	64
15	450777	6/18/2004	12:00 PM	84.38	29.1	4105644	258211	37	241

Click on Add to insert all CSV files. To select all files, click on the first file then hold the shift key and scroll all the way down.



Step 5: Value Specification

We need to indicate where in the landscape our thermistors are located. For this step we recorded the exact location ($\pm 1-2\text{m}$) of every thermistor with a Trimble XRS Pro GPS unit. For the X Y fields select the easting and northing. Next, for the value field choice select Temp (C). We would like to use Celsius value for our maps.

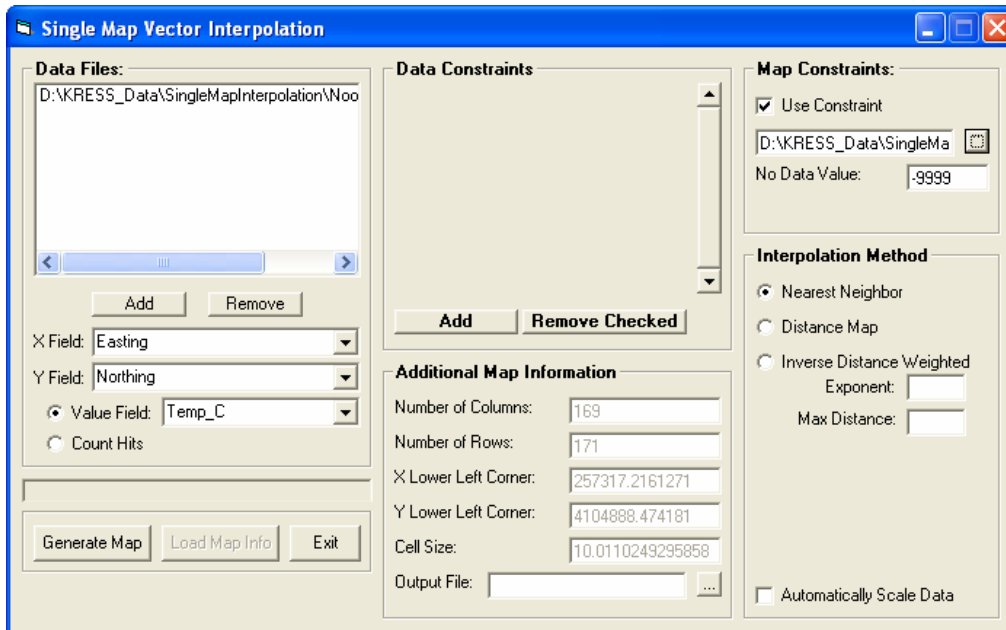


Step 6: Output Map Specifications

In this step we would like to specify the spatial parameters of the image to be created. You may choose one of the following three options:

1. Copy spatial parameters from an existing image. To do this you need to click on the Load Map Info button.
2. Use a constraint file.
3. Define spatial parameters individually. If you choose this option you need to enter the number of columns and rows of the output image, the minimum and maximum coordinates in the X and Y dimensions, and specify the cell size.

Since we have a mask we would choose option number 2. Check the box next to use a constraint. Browse to the directory and select windowed_east_pasturetrim the spatial parameters from the mask file will be copied.



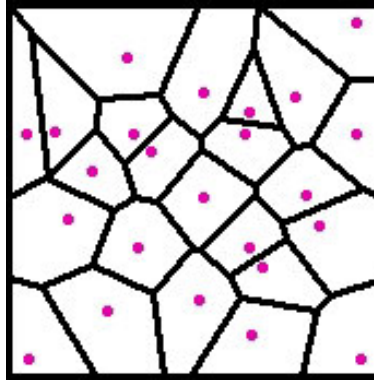
Step 7: Interpolation Method

Interpolation is a mathematical process of estimating the value of a surface in locations where the values are unknown, based on the known values of nearby "control" points. Interpolation is commonly used to identify and map spatial patterns across a landscape.

The KRESS modeler can interpolate point data using one of two techniques:

1. Nearest Neighbor

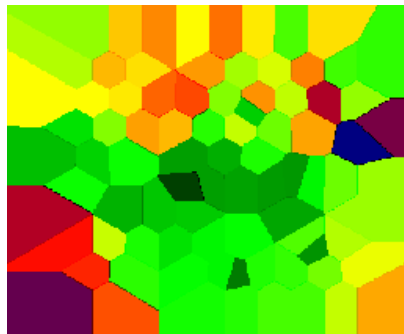
If you take a set of points and connect each point to its nearest neighbour, you have what's called a triangulated irregular network (TIN). If you bisect each connecting line segment perpendicularly and create closed polygons with the perpendicular bisectors, the result will be a set of Thiessen polygons. The area contained in each polygon is closer to the point on which the polygon is based than to any other point in the dataset.



Thus, the nearest neighbor interpolation technique defines the area of influence around a point that polygon boundaries are equidistant from neighboring points in the following manner:

- Join points to nearest neighbor in a triangular tessellation
- Compute perpendicular bisector
- Remove triangles

We should note that the size and shape of area depends on point distribution.



2. Inverse Distance Weighted

The Inverse Distance Weighted (IDW) is a quick deterministic interpolator. Which mean it is directly based on the surrounding measured values or on specified mathematical formulas that determine the smoothness of the resulting surface. The IDW interpolator assumes that each input point has a local influence that diminishes with distance. It weights the points closer to the processing cell greater than those farther away. It assumes variable decreases in influence with distance from sampled location. In another word, observations located close together tend to be more alike than observations far apart.

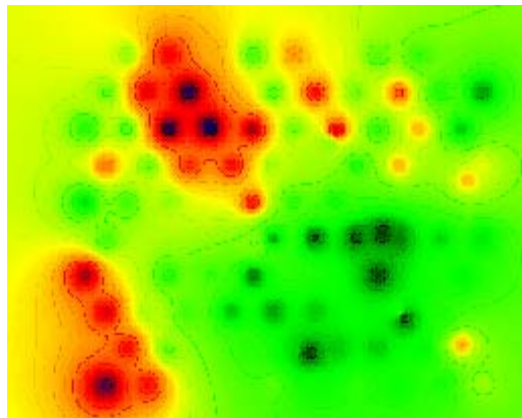
$$Z_0 = \frac{\sum_{i=1}^n w_i z_i}{\sum_{i=1}^n w_i}$$

Where: Z_0 = value of estimation point

Z_i = value of neighboring point

w_i = weighting factor; e.g. = $1/(\text{distance from neighbor})^2$

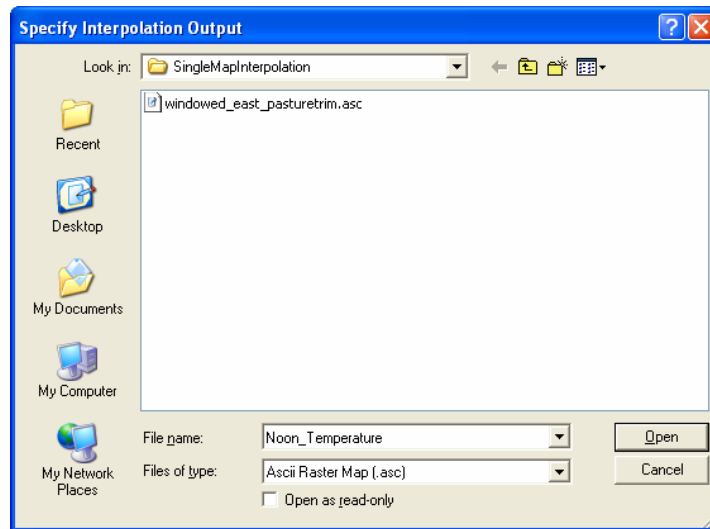
However, using IDW there is no assessment of prediction errors, and IDW can produce “bulls eyes” around data locations.



The exponent parameter influences the weighting of the measured location's value on the prediction location's value. In another word, as the distance increases between the thermistor locations (known temperature) and the prediction location, the weight (or influence) that the measured temperature point will have on the prediction will decrease exponentially.

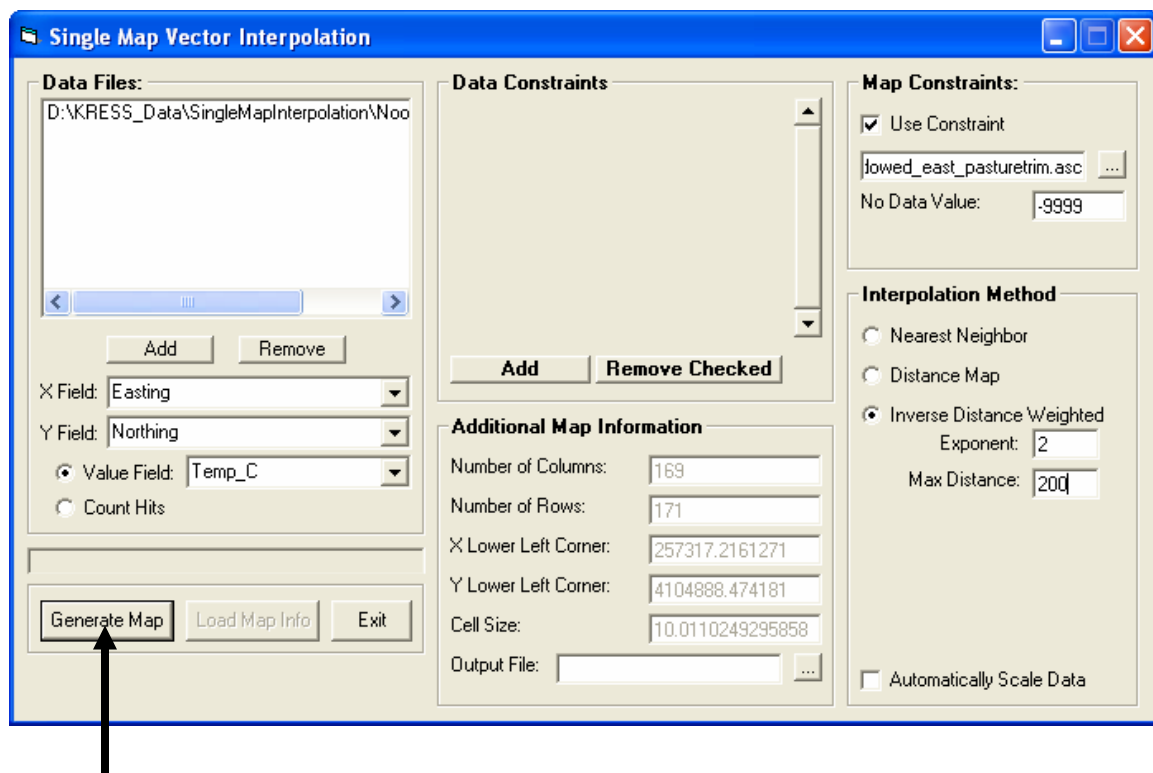
Step 8: Name Output File Name

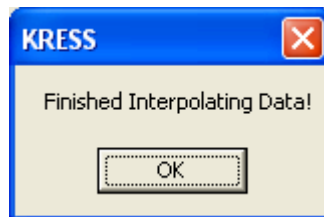
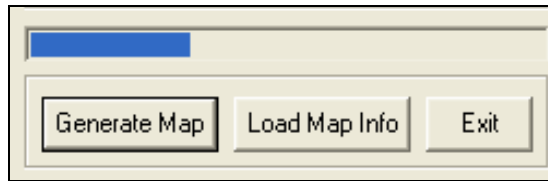
Name your output Noon_temperature.



Step 9: Run the Interpolation Technique

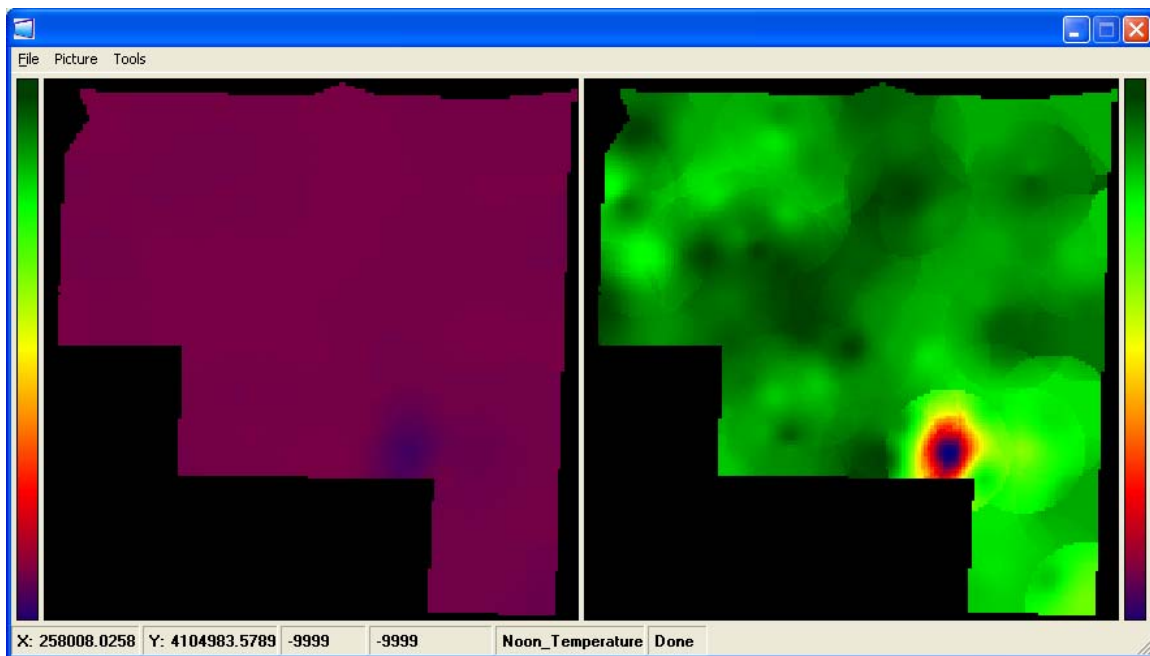
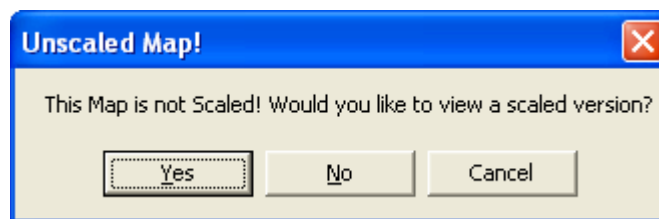
After you have decided what interpolation methods you would like to run, now you are ready to run the analysis by clicking on the Begin button.





Step 10: View your output map

Use the viewer to display side by side an image before and after it was scaled.



Move your cursor to check the value.