Cover Sheet to Accompany the GIS Spatial Analysis Exercise:

# *Spatial Analysis -An Antarctic Example*

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In this activity, students use 1:5,000,000 scale continent-wide Antarctic data sets of surface elevation, ice thickness, bedrock topography, rock outcroppings, and coast lines to examine the effects of ice removal and sea level rise on the physiography of the continent. Datasets come from the Scientific Committee on Antarctic Research (SCAR) and the BEDMAP project.

The emphasis of the exercise is on the nuts and bolts of some of the tools in the ArcGIS Spatial Analyst extension for analysis and display of raster data, with considerably less emphasis on higher order thinking skills. Quoting from the introduction "What does Antarctica look like beneath the ice? A continent of mountain ranges, deep valleys, plains, inland seas, offshore islands and the like exists there, for the most part invisible but for a few features that protrude above the ice. Wouldn't it be nice to have a topographic map in shaded relief of Antarctica without the ice and with oceans filling areas that are below sea level? Wouldn't it be even nicer to have such a map that accounted for the isostatic rise of the land surface that would occur after the weight of the ice was removed? What would the continent look like if sea level rose by an amount equal to the volume of the water locked up as ice? How much ice is there? Digital data are available to make such maps and answers these questions, as is software to do so. Let's have a crack at it!"

The exercise was originally written for ArcGIS 9.0 ArcInfo with Spatial Analyst and 3D Analyst extensions. It is entirely compatible with ArcGIS 9.3 ArcInfo with Spatial Analyst and 3D Analyst extensions. 3D Analyst is used to calculate ice area/volume (a minor component of the exercise) but is otherwise not required.

The activity assumes some familiarity with:

- Basic ArcMap tools and functions - stardard toolbar, Layer Properties, Table of Contents, Layout and Data views, labeling; layer files;
- Vector and raster data formats and differences;
- Concept of projected coordinate systems.

A cookbook approach provides instructions and practice with:

1) Creating a custom projection by modifying an existing one;
2) Use of an available layer file to symbolize vector data;
3) How to use stretched and classified symbology for raster data;
4) Use of an Analysis Mask;
5) Clipping raster data to an Analysis Mask;
6) Producing a Hillshade;
7) Query of raster data;
8) Creating binary rasters with the Raster Calculator;
9) Use of a conditional statement in the Raster Calculator;
10) Addition and multiplication with the Raster Calculator;
11) Creating contour lines from a raster;
12) Using the Area and Volume Statistics in the 3D Analyst extension.
13) How to examine and use raster data set properties - e.g. resolution, bit depth, file size, file format.

Data for the exercise are contained within a zipped file ("Antarctic_Data") that can be downloaded from **https://utexas.box.com/s/0wz54dpnq33i3xacnm2s** . Data credits and file details are contained within hyperlinks in the exercise, and within xml metadata files that can viewed in ArcCatalog.

Students are evaluated on the basis of answers to 12 questions throughout the exercise and a finished map showing a derived digital elevation model of Antarctica after isostatic rebound from ice removal and a sea level rise of 80.5 meters. Questions from the exercise are collated in a single MS Word file for student use. A PowerPoint containing examples of maps produced by the procedures in this exercise is included.