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MapCalc Learner: Quick-take Review
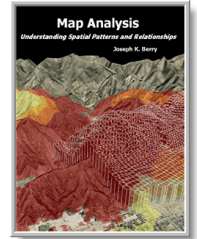
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Mapcalc Learner: *Quick-take Review*

by W. Fredrick Limp

Price: Single user-$21.95, academic lab license-$495.

Requirements: Microsoft Windows.

Company: Red Hen Systems Inc., 2310 E. Prospect Road, Suite A, Fort Collins, CO 80525 [800-237-4182, fax: 970-493-3938, e-mail: info@redhensystems.com, Web: http://www.redhensystems.com].

Introduction

MapCalc Learner is the latest and most accessible incarnation in a lineage of groundbreaking raster software packages. MapCalc Learner originated in the late 1970s with the creation of raster extensions to the famous SYMAP program. In time, SYMAP led to MAP, which led to pMAP, which led to aMAP, which led to MapCalc (for more information, see "The MapCalc Legacy," below). Throughout all these developments, Joe Berry, author of GeoWorld's "Beyond Mapping" columns, was present.

MapCalc represents the latest version of raster software specifically designed to help students learn the rich range of analysis options available in the raster domain. In addition to the software itself, MapCalc Learner comes with myriad case studies, examples, graphics and workflows written by Berry.

Anyone familiar with the "Beyond Mapping" columns knows their clarity and range, but, if you've tried to duplicate Berry's operations in your own raster GIS, you'll frequently find that operations Berry discusses aren't in your package. With MapCalc Learner, all those "gee I wish my software did that" operations are accessible.

Analytical Operations

MapCalc Learner has an excellent range of standard raster operators, but also includes several powerful advanced operations. "Clump," for example, identifies contiguous areas; "Configure" allows a wide range of shape and structural analyses such as the number of exterior cells and holes; "Size" computes the areas for each analysis; "Span" calculates the minimum width of each contiguous area from edge to edge; and "Spread" is a module that creates "traditional buffers," but it also allows spreading over an elevation data surface or through a friction surface. Users can specify that movement is only uphill or downhill and that movement is restricted or permitted over flat areas.

The "Composite" module allows users to compute values from one map within categories in another map. For example, users can compute the average slope in each farm field. Composite operations include average, median, standard deviation, majority, minority, coefficient of variation, diversity, etc. The "Scan" operation applies similar operations, but to a predefined neighborhood around each cell. Comprehensive map computations (e.g., Map 1 plus Map 2) are possible with many operators available.

The "Analyze" function allows users to compute a range of statistics for each cell across multiple maps. "Crosstab" generates a table of cross occurrence of values in two maps, while "Intersect" creates a map with a different map category reflecting various combinations in two input maps. For example, forest and steep could be one category while forest and flat could be another. There are several operations that use an elevation (or "elevation-like") dataset. "Drain" operations create maps showing all steepest descent paths from each location to adjacent ones, while "Stream" follows an individual descent path (such as what water would follow).

In addition, "Radiate" computes viewsheds, allowing users to enter "through" and "onto" maps. The "through" map layer would have heights of features such as trees that can block a view, while "onto" represents heights of features that can be illuminated. The module can compute the number of starting cells that can "see" each cell in the map. Other parameters allow users to assign weights to the starting cells that would be applied to each viewed cell. A cell viewed from cells with high weights would have larger values than a cell viewed from lower-weighted locations. An interesting option computes a "maximum prominence angle" for each seen location. A somewhat related operation called "Profile" calculates the height relationship for each cell and its neighbors.

Statistical Operations

MapCalc Learner has a wide range of standard statistical operations, but it also provides a series of innovative functions. The "Cluster" operation performs a classification process, identifying cells based on their similarities across multiple maps. The "Correlate" operation creates a correlation matrix for multiple maps, and "Compare" prepares a table of statistics comparing two maps. "Regress" performs a linear regression on values in each cell in multiple independent maps, outputting a map with the estimated value for the dependant map's cell. The "Relate" operator determines the degree of similarity of a second (or multiple) map to an evaluation map.

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There are several operations that allow point data to be converted to a cell structure using a variety of interpolation methods, including kriging. All of the MapCalc operations have many additional parameters that allow great flexibility.
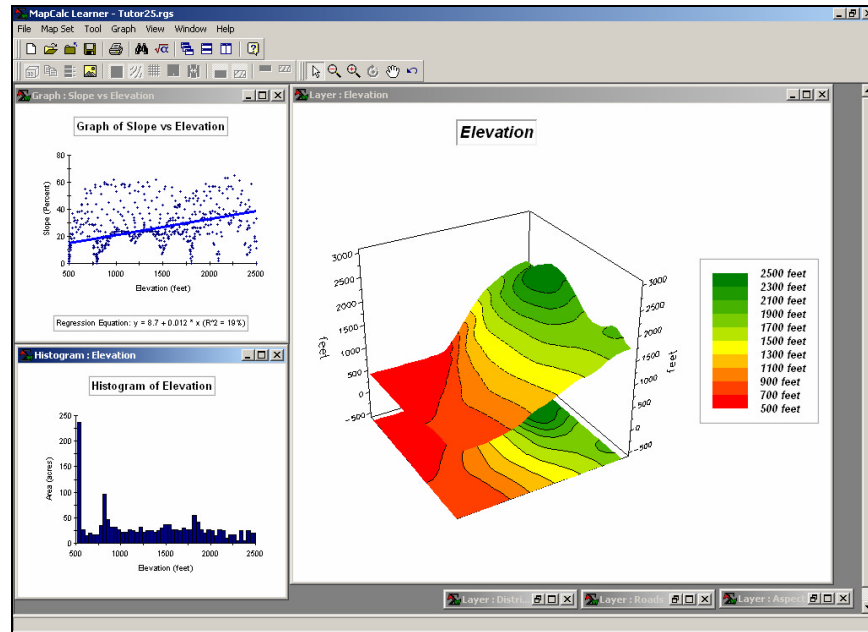

Figure 1. MapCalc learner provides an extraordinary combination of economy and power.

Surfer and Documentation Included

In addition to the base software, a demo version of the popular Surfer version 7 system from Golden Software is included. The demo version is fully functional, but the output capabilities are disabled. In addition to the normal documentation expected, MapCalc Learner includes all the "Beyond Mapping" columns Berry has written from 1996-2000 as well as the Precision Farming Primer, which is a compilation of columns on the subject from @gInnovator from 1993-2000. It also should be noted that Berry authorizes anyone to reuse the images, examples, etc., in teaching and presentations as long as proper credit is given.

Versions and Formats

An instructor's version of MapCalc Learner is planned with a projected price of $495, which will include multiple lab seats and a large suite of instructor-oriented overheads and materials. A professional version also is planned for release later in 2001. All the current MapCalc Learner analysis operations will be present as well as additional capabilities. Of course, the 100 by 100 limit on map size will be removed.

Vector import formats supported are .shp and .tab, and raster input formats include ASCII matrix, ESRI grid and Surfer grid. Image formats that can be used are BMP, JPG,

TARGA, Photoshop, Windows metafile, Zsoft (pex), PNG, Sun raster and Mac PICT. Vector data can be exported to ASCII, ESRI or Surfer grids or latitude/ longitude values.

Some Limitations

MapCalc Learner's data files are limited to a maximum of 100 rows by 100 columns, and all data must be in WGS84 datum. Also, MapCalc Learner doesn't have a re-project capability. Although complex cartographic modeling is possible, hard-copy cartographic composition is limited to a basic structure. There are no scale bars and north arrows, and legends and other text and images aren't moveable. Legends can be located at the top, sides or bottom, but they can't be repositioned using the mouse.

However, MapCalc has a solid range of map display capabilities, including a quick 3-D view. Color control is extensive, and there are several methods to group continuous data. In addition to raster mapping, there are several charting and graphing options. There's no vector interaction capability, such as overlaying a vector on a raster or summarizing a raster map within vector polygons. But users can convert any vector to a raster and accomplish an equivalent operation in the raster domain.

If you're serious about learning the full range of "map-ematical" opportunities possible in raster GIS, MapCalc Learner provides an extraordinary combination of economy and power. The documentation alone is worth the price of admission.

MapCalc Learner

Strengths: Features an extensive suite of "map-ematical" and spatial operations; large amounts of high-quality documentation, examples and workflows; and a fantastic price.

Weaknesses: Has poor cartographic output and no projection support (all data must be in WGS84).

The MapCalc Legacy

MapCalc has one of the longest and most distinguished histories of any spatial analysis software product. Its origins are directly connected to one of the key pioneering projects in raster GIS, dating back to a dissertation at Yale University from 1977-1982.

Doctoral student C. Dana Tomlin worked with professors Joseph K. Berry (major advisor) and Kenneth L. Reed to extend the grid analysis module in Harvard University's SYMAP program. Additional analytic operations and an interactive user interface were added to SYMAP and made generally available by Yale University in the public domain as the Map Analysis Package (MAP), which was coded in unstructured FORTRAN IV for the IBM 360 mainframe environment and distributed on nine-track tape. Numerous universities, public agencies and private companies (domestic and foreign) obtained the code and modified it for use in their computer environments.

In 1982, the MAP source code was obtained by HDR, a Santa Barbara, Calif.-based consulting firm. At first, it was envisioned that the code would be translated from FORTRAN to the Pascal language needed in the project, but the unstructured code required complete re-coding. Reed and Berry again were actively involved in the code development. In this capacity, they introduced several new algorithms and modified many others.

In 1986, Reed and Berry formed Spatial Information Systems (SIS) Inc., and used the basic framework of the software's Pascal version to develop a commercial version for DOS-based PC environments. This version underwent several important modifications from 1990-1996 and was distributed and sold under the name pMAP version 3.1. More than 200 universities and thousands of individuals acquired special educational licenses for classroom use, Academic MAP (aMAP), and self-instruction, Tutorial MAP (tMAP).

In fall of 1997, Red Hen Systems Inc. began developing a product called SoilRx, which it released in late 1998. The software accepts yield and sample data and then spatially interpolates these values into continuous maps of crop productivity and soil nutrient, properties, conductivity and other distributions for a field. The advanced 2-D and 3-D graphics, charting functions and grid math capabilities enable farmers to visualize and interact the spatial relationships within and among precision agriculture data. The software is primarily used to help identify management zones of similar data characteristics and develop prescription maps that use variable-rate technology to adjust the amount of chemicals applied throughout a field.

In spring 1998, Red Hen Systems began purchasing deployments of the pMAP modules to enhance the spatial analysis capabilities of SoilRx. In April 2000, Red Hen Systems acquired SIS and all rights to the pMAP code. MapCalc Learner and Academic packages are the educational versions of the software based on the integration of SoilRx and pMAP technologies. A commercial version of MapCalc is under development, and a developer's version based on the MapCalc library of Active X controls is under consideration.

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