Creating advanced shaded-relief maps and layer blending with Global Mapper software

J. Buck Ehler

GIS Analyst/Cartographer

Utah Geological Survey

buckehler@utah.gov

(801) 537-3343

SLUG Meeting

August 11, 2010

I would like to welcome everyone to the Department of Natural Resources (DNR)

As one of Utah's largest state agencies, the DNR helps ensure Utah's quality of life by managing, researching, and protecting our state's natural resources.

The DNR is composed of seven divisions:

1. Geological Survey
2. Water Resources
3. Water Rights
4. Wildlife Resources
5. State Parks and Recreation
6. Forestry, Fire, and State Lands
7. Oil, Gas, and Mining

http://dnr.utah.gov/

Shaded-Relief modeling
### aka; hill-shading, relief-shading, sun-shading…

Shaded-relief modeling simulates the shadows that would be cast over the terrain based on the position of the sun over the terrain. In GIS the terrain is typically modeled using a Digital Elevation Model (DEM) or Triangulated Irregular Network (TIN) of the terrain. The primary parameters for calculating a shaded relief are sun-angle and sun-azimuth.

Sun-angle or altitude represents the angle of the sun above the horizon usually expressed in degrees from the horizon.

Sun-azimuth represents the position of the sun in the sky, usually based on azimuthal rotation. Most shaded relief models use top-left lighting, placing the sun at a north-west azimuth. Although this is unnatural in the Northern-Hemisphere it is often preferred because it mimics the left-to-right reading pattern that westerners are accustomed to. The default settings in ArcGIS are 315° azimuth (NW) and 45° sun-angle.

Shaded-Relief modeling

Using the tools provided in the "traditional" GIS software package shaded-relief modeling is limited to 4 parameters
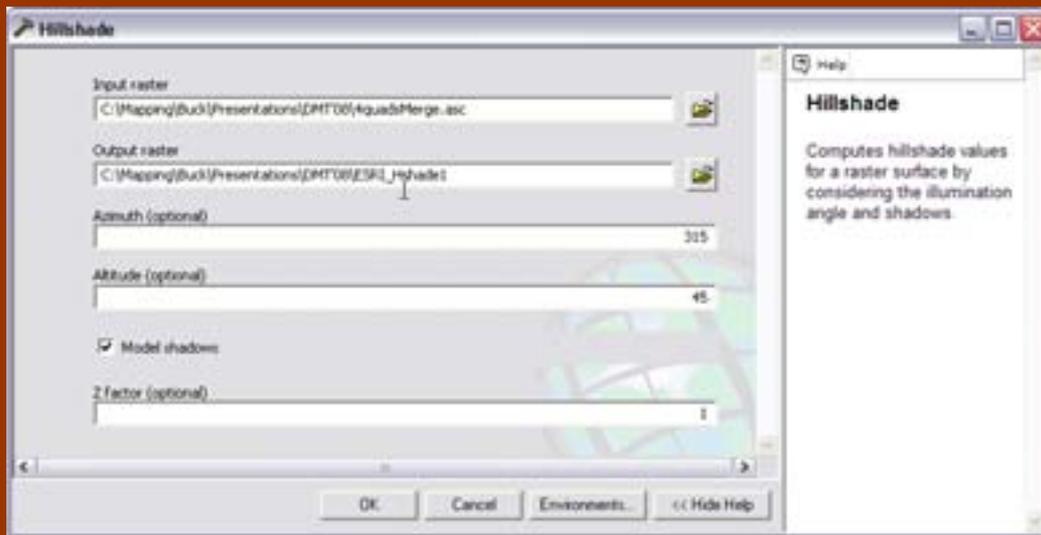

Other limitations are that the rendering of the shaded-relief is not shown until the calculation is complete and changes to settings require creation of a new shaded relief.

…enter Global Mapper

- Global Mapper is a very useful and powerful GIS application that I use frequently. It includes powerful data manipulation and translation tools along with a very reasonable price.
    - A single license is $349 but volume discounts and Government pricing are available
    - It can do many things that the "traditional" GIS software package cannot
        - advanced hill-shading
        - layer blending
        - on-the-fly rendering
        - and more…
    - It is often referred to as the "Swiss Army Knife of GIS"
    - Global Mapper is a good and cost effective alternative to Spatial or 3D Analyst extensions
    - Visit http://www.globalmapper.com/ for more information.
        - A free, limited-use, trial is available
    - Warning: Sensible discretion is advised. Any resemblance to a Global Mapper shill is purely coincidental!
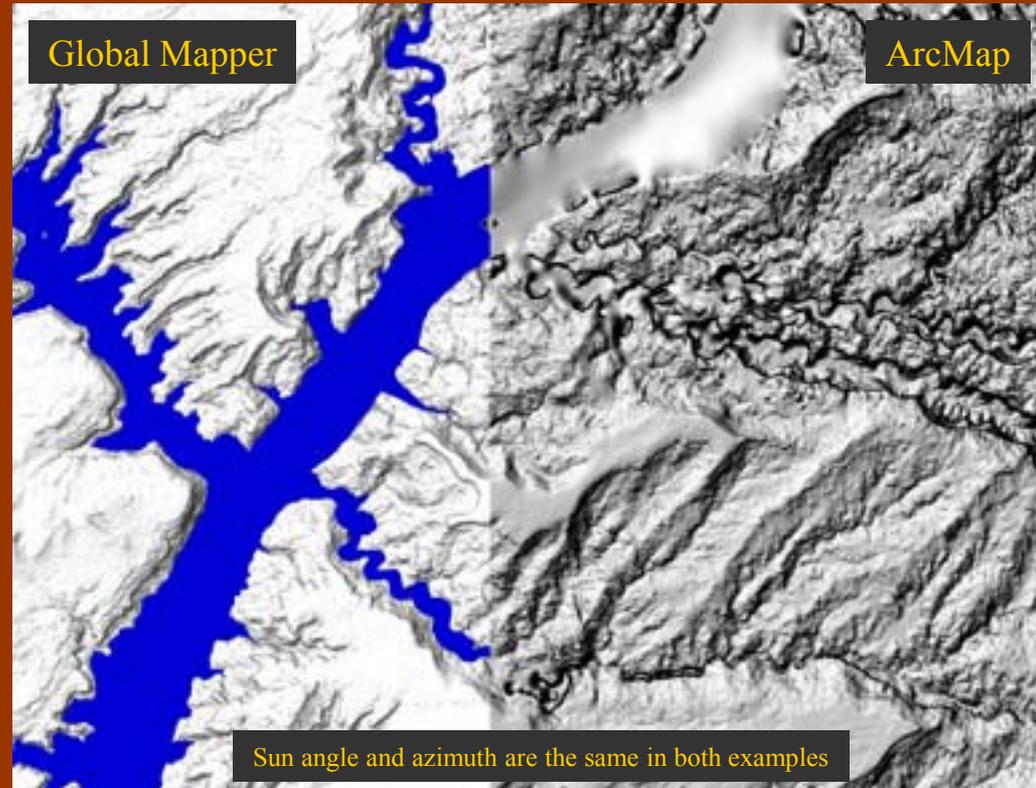
Shaded-Relief modeling with Global Mapper

- Multiple parameters let you "fine-tune" your shaded relief
- On-the-fly shaded relief rendering lets you get a feel for the best settings for your area of interest
- ability to model water elevations can be useful for "what-if" scenarios and inundation maps
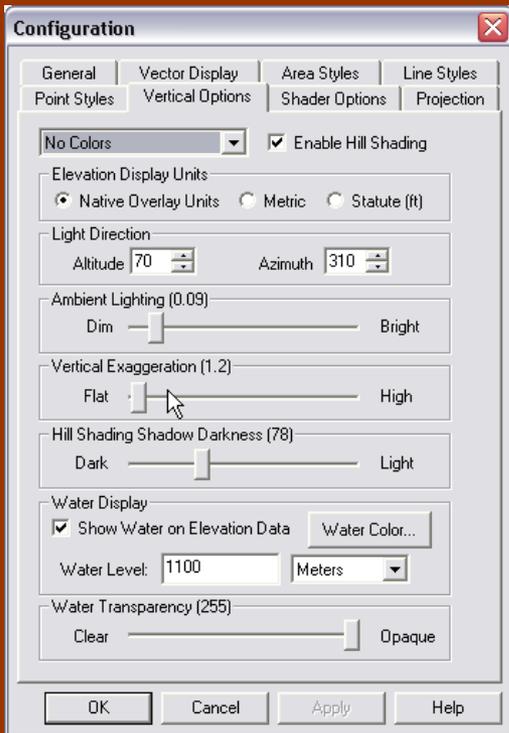
Shaded-relief settings:

- sun angle
- azimuth
- ambient lighting
- vertical exaggeration
- hill shading shadow darkness
- water display at a specific elevation
- water transparency
- color intensity
- transparency

Global Mapper

ArcMap

Sun angle and azimuth are the same in both examples

Shaded-Relief modeling with Global Mapper

Live demonstration of shaded-relief creation in Global Mapper…….

But what if my shaded-relief could use a little more detail, a little more "pop"?

Slopes and hillsides facing the sun are washed out and lack important detail.

By blending a slope shade with the shaded relief we can get a "**Slope enhanced shaded-relief**" model that gives some depiction to all areas with a slope greater than X.

Google Maps uses slope enhanced shaded relief models

www.geology.utah.gov

How to create a slope-shade and what is "layer blending"?

- Global Mapper can be used to create a slope-shade based on the best range of slope angles for a given area of interest.
  - Low relief areas will typically use lower slope angles in the model while high relief areas are best suited for higher slope angles.
  - A demonstration will follow.
- "Layer blending" is a technique used to blend two or more different images into one image.
  - This method is better than using transparencies because neither layer is degraded by a transparency.
  - Different methods include: normal, multiple (my favorite), screen, overlay, hard light, color burn, color dodge, apply color, apply color reverse, darken, lighten, difference, exclusion, keep red, keep green, keep blue, SPOT natural color (SPOT to natural), pseudo natural color (CIR to Natural)
  - Global Mapper, Photoshop, Illustrator, and the GIMP all have blending capabilities.
    - Global Mapper works the best with spatial data, especially when you have layers with different cell sizes and extents

Slope-enhanced shaded-relief modeling and layer blending with Global Mapper

The science behind layer blending is complex and quite variable depending on the different blend modes, so I prefer to just call it magic…….and do another live demo to show how it works.

For more information on slope enhanced shaded-relief modeling, layer blending, or Global Mapper

- Cartographic Relief Presentation, Eduard Imhof, 2007 ESRI Press. http://esripress.esri.com/display/index.cfm?fuseaction=display&websiteID=118&moduleID=0

- http://www.globalmapper.com/ Global Mapper website

- http://en.wikipedia.org/wiki/Blend_modes Wikipedia article on image blending

- http://en.wikipedia.org/wiki/Shaded_relief Wikipedia article on shaded relief

- http://www.shadedrelief.com/

- http://www.reliefshading.com/

Thanks!!!

J. Buck Ehler

GIS Analyst/Cartographer

Utah Geological Survey

buckehler@utah.gov

(801) 537-3343