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№ 4578

ANAGLYPHS DERIVED FROM TOPOGRAPHIC DATA AND REMOTELY SENSED IMAGERY FOR THE ANALYSIS OF GEOMORPHIC FEATURES AND PROCESSES

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Synthetic stereoscopic views generated from digital elevation models (DEM) provide an ideal method of visualizing geomorphic manifestations of geologic features and processes. Such views can be generated solely from the DEM or can be enhanced via the incorporation of remotely sensed imagery and/or geophysical data. Full color stereo pairs are most useful, but achromatic anaglyphs provide exceptional visualization capabilities.

The following steps are used to produce an anaglyph: (1) register a digital image to a DEM (the image can be remotely sensed data or a shaded-relief depiction of the DEM itself), (2) for each eye, distort the image as a positive linear function of elevation (shift pixels left for the right-eye image and shift pixels right for the left-eye image), and (3) merge the two images into a color composite that displays the left-eye image in red and the right-eye image in both green and blue. The composite image is then viewed with anaglyph ("3-D") glasses that have red and blue-green film over the left and right eyes, respectively. In calculating the image distortion, view angles 20 degrees off nadir work well. Optimal vertical exaggerations (1x to 4x) are inversely related to terrain ruggedness. Essentially every characteristic and detail of a DEM can be viewed in an anaglyph.

A simple method to produce a shaded-relief image is to filter the DEM using a 3x3 kernal that is negatively weighted on the top row, oppositely positively weighted on the bottom row, and zero-weighted on the middle row, with the result offset (typically by 128) so as to be centered in the quantization range (typically 0-255). Geophysical graphics can be used as the image but typically will need to be merged with remotely sensed data or topographic shading in order to have sufficient detail to reveal the topographic form.

In developing applications, iterative generation of anaglyphs using altered DEMs can facilitate three-dimensional palinspastic reconstructions of tectonically deformed landforms, and the merger of geophysical data as layers or points floating above or below the topographic surface can produce effective synergistic interpretation tools.

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anaglyph, stereoscopic, topography, geomorphology, visualization

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