

FRINGE 96
Topographic Signatures in Geology

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Abstract

Topographic information is required for many Earth Science investigations. For example, topography is an important element in regional and global geomorphic studies because it reflects the interplay between the climate-driven processes of erosion and the tectonic processes of uplift. A number of techniques have been developed to analyze digital topographic data, including Fourier texture analysis. A Fourier transform of the topography of an area allows the spatial frequency content of the topography to be analyzed. Band-pass filtering of the transform produces images representing the amplitude of different spatial wavelengths. These are then used in a multi-band classification to map units based on their spatial frequency content. Results using a radar image instead of digital topography showed good correspondence to a geologic map, however brightness variations in the image unrelated to topography caused errors. An additional benefit to the use of Fourier band-pass images for the classification is that the textural signatures of the units are quantitative measures of the spatial characteristics of the units that may be used to map similar units in similar environments. * Work performed under contract to NASA.

Keywords: Topography, Geology, Texture, Fourier analysis