Remote Sensing Brief

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Stereoscopic Viewing of Landsat Imagery

Stereo viewing aided geologic interpretation.

Between successive orbits Landsat imagery has marginal sidelap except in the polar regions (where the sidelap becomes greater) and the interpretation of the imagery is carried out essentially by monocular observation of individual frames. Monocular observation considerably reduces the interpretability of the imagery where correct identification and precise delineation of terrain relief features are necessary.

A pair of frames of repetitive imagery of Landsat-1 covering a part of the Godavari Valley of central India was studied by the authors by employing a conventional mirror stereoscope for geological interpretation. The two frames of repetitive imagery have an incidental sidelap of 94 percent which brings in parallax sufficient to cause a perceptible three-dimensional model of the terrain. The model reveals clearly identifiable and precisely delineable stratigraphic, structural, and geomorphic units. By employing a pair of Band-5 images in conjunction with a pair of Band-7 images, substantial improvement in quality and content of interpretation could be achieved over what was possible under monoscopic observation of a single frame. Fusion of a pair of different spectral bands, however, results in a model lacking in clarity and causes strain on the eyes of the interpreter due to dissimilar reflectivity of various terrain features in different bands.

A pair of Band-7 images, which emphasizes the drainage network and relief features, provides a clear three-dimensional perception of the terrain. The pair is ideally suited for precise demarcation of drainage features because of the combined effect of emphasis of water bodies in this band and the perception of valleys under stereoscopic observation. Regional structural trends expressed as relief variations of the terrain are also brought out clearly in this band under stereo viewing.

A stereo model obtained with a pair of Band-5 images, on the other hand, helped in a quicker identification and delineation of different stratigraphic units, particularly of horizontally disposed strata, because their boundaries follow different topographic levels. The contrast of lineaments, which are faint on a single frame in this band, become enhanced under the stereoscopic observation of a pair. Quaternary deposits, such as alluvium laid along the present and palaeo river channels, could be delineated with greater ease and precision on the stereo model obtained in this band because of a clearer perception of the valley floors.

Cloud cover imposes a major limitation in the application of this method. The time lag between the scanning of individual frames of a pair of repetitive images often brings in a change in the spatial distribution of the cloud cover in different frames of the pair. This considerably reduces the effective area that can be studied by employing stereo viewing. The change in the spatial distribution of cloud cover, however, permits monocular observation of the cloud covered areas. Interpretation could be extended into these areas with relative ease by drawing guidance from the stereo model of the contiguous terrain. The availability of a number of frames of repetitive Landsat-1 and Landsat-2 images should, in any case, give the interpreter enough scope to select a pair with suitable sidelap and minimum cloud cover.

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