POTENTIAL OF MULTISENSOR DATA AND STRATEGIES FOR DATA AQUISITION AND ANALYSIS

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BACKGROUND

Registration and simultaneous analysis of multisensor images have been found useful because the multiple data sets can be compressed through various image processing techniques to facilitate interpretation. This also allows integration of other spatial data sets, such as geophysical data, in a geographical management approach.

Multisensor image sets have been used for discrimination and, to some extent, characterization of geologic units. In the San Rafael Swell, Utah study area, coregistered Landsat and Seasat images provided better discrimination of geologic units than Landsat or Seasat data alone, due to the complementary effects of the compositional inferences possible from the multispectral data, and the textural and roughness data from the radar (Blom, et al., 1981). In other studies, coregistered Landsat and radar images of Death Valley resulted in less ambiguous discrimination of alluvial units based on albedo variations in Landsat images and roughness variations in the radar images (e.g. Daily, et al., 1978).

New techniques are being developed to analyze multisensor images that involve comparison of image data with a library of attributes based on the physical properties measured by each sensor. This results in the ability to characterize geologic units based upon their similarity to the library attributes, as well as discriminate among them. Refinement of the attributes-library concept may also make it possible to extract intrinsic physical properties from the images, such as dielectric constant and surface roughness in radar images. Once the physical properties can be extracted from the images, other applications for the multisensor images become possible, for example, 1) to use radar images to correct visible and near IR and thermal IR images for effects of surface roughness, and 2) to use near IR images to estimate vegetation cover in order to isolate the effects of partial vegetation cover from intrinsic surface properties in other images.

DETERMINATION OF DATA REQUIREMENTS

There are several studies that will provide information on ways to optimize multisensor remote sensing. Continuation of analyses of the Death Valley and San Rafael Swell image data sets will provide some insight into tradeoffs in spectral and spatial resolutions of the various sensors. The San Rafael Swell data set consists of coregistered Landsat, Seasat and HCMM images. The southern portion of the swell was also covered by the Shuttle Imaging Radar (SIR-A). Part of the SIR-A image has been digitized and registered to the coregistered Landsat/Seasat/HCMM images. SIR-A images provide more information about small scale surface roughness properties of the units than Seasat because of the larger incidence angle (50 degrees compared to 23 degrees for Seasat). Thus, the SIR-A image provides complementary tonal information to the Landsat/Seasat combination described in Blom, et al. (1981). However, the resolution of SIR-A was lower than Seasat (40 meters compared to 25 meters for Seasat), and the effect of this lower resolution on texture analysis will have to be assessed.

The Death Valley coregistered data set consists of Seasat and Landsat images, as well as aircraft L-band and X-band radar images, and 11 channel VIS-NIR and thermal inertia images. This represents a wide range in both spatial and spectral resolution that can be analyzed. However, these data were obtained at different times, which could introduce some ambiguous results.

It will be very valuable for future multisensor experiments to acquire calibrated images with near-coincident coverage and comparable pixel sizes. It will then be possible to reduce the number of variables, and determine optimized resolution for a combination of sensors. The results might indicate that if one sensor has an optimal resolution for discriminating a given rock type, it may be possible to relax the resolution constraints on the other sensors.

REFERENCES

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