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USE OF ERTS DATA FOR MAPPING SNOW COVER IN THE WESTERN UNITED STATES

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ABSTRACT

The purpose of this investigation is to evaluate the application of ERTS data for mapping snow cover, primarily in the mountainous areas of the western United States. The specific objectives are to determine the spectral interval most suitable for snow detection, to determine the accuracy with which snow lines can be mapped in comparison with the accuracies attainable from other types of measurements, and to develop techniques to differentiate reliably between snow and clouds and to understand the effects of terrain and forest cover on snow detection. Snow cover is a water resource for which spacecraft observation holds great promise. The results of this study will provide the hydrologist with interpretive techniques that will enable data from future operational satellite systems to be used to map snow on a more cost effective basis.

Preliminary results of the analysis of ERTS-1 data indicate that snow cover can be detected in the MSS-4 (0.5 to 0.6 μm) bands by its high reflectance compared to that of the surrounding snow-free terrain. Snow can generally be distinguished from clouds because of well-defined boundaries as compared with the less-distinct cloud edges, the lack of shadows characteristic of clouds and pattern configurations that fit closely with higher elevations and terrain features. At higher latitudes where repetitive ERTS coverage occurs, snow can also be identified by the day-to-day continuity of the patterns. In the longer wavelengths, particularly the MSS-7 (0.8 to 1.1 μm) band, the contrast between snow and snow-free terrain is much lower, and, thus, snow is more difficult to detect.

In several mountain areas, including the Southern Sierra Nevada, the White Mountains, the Olympic Mountains, the Mt. Rainier area, and the central Arizona Mountains, snow lines have been mapped from ERTS pictures from the fall and early winter. Changes in snow line elevation are clearly evident in data collected on different dates. In ERTS data from the Arctic, considerable detail is evident in glaciers located along the east and west coasts of Greenland. Detectable features include imbedded sediment trails (medial moraines) and crevassed areas. Significant differences are also apparent in the various spectral bands. Several glaciers exhibit a uniform reflectance in the MSS-4 band, whereas in the MSS-7 band, the lower elevation portions appear much darker than the upper portions. This difference in reflectance is believed to be due to the existence of meltwater on the surface of the glacier at lower elevations in contrast to snow cover at the higher elevations.