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STUDY OF TIME LAPSE DATA PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS

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TYPE I PROGRESS REPORT

a) Title: STUDY OF TIME-LAPSE DATA PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS

ERTS-A Proposal 342-B

b) GSFC ID PR 154

c) Problems Impeding Progress — Time Required for Data Extraction and Analysis

The principal problem to date has been the time required to extract and study data from the imagery of the several investigators having markedly different interests has been greater than had been anticipated. Many of those functions for which the Console was initially designed to handle in quantity (i.e., scaled linear measurements from time-lapse sequences) thus far have been employed relatively little. On the other hand, functions requiring appreciably more care in quality control of individual images (i.e., photographs from multiple superpositions, display and photography in color, careful measurements of area, multiband manipulation for feature enhancement) have been the ones for which the demand has been greatest. Solutions for most of the problems are apparent, but their implementation is time-consuming. The great versatility of the Electronic Satellite Image Analysis Console (ESIAC) tempts one to test many of the procedures in the interest both of extracting more information and of speeding up the process.

d) Accomplishments

(1) During Reporting Period

(a) Equipment

A high-quality color TV monitor (Tektronix Model 650-1) has been procured and mated with the Console so that either two-primary or three-primary additive color displays are possible. In the most usual arrangement one channel of the disc memory is displayed in red and the other channel is displayed in cyan (blue plus green). Two-band analysis is then performed by loading imagery from the longer wavelength band onto the red channel and imagery from the shorter wavelength band onto the cyan channel. Since the disc channels can be stepped in synchronism, time-lapse display of the color composite is then possible. At the same time it is possible to operate on the two video signals individually or jointly, using amplitude thresholding circuitry and to superimpose the resulting data (binary masks) onto the display.

The density slicing capability of the original equipment has been improved by the addition of two more level-decision circuits (one bit A/D converters), together with high-speed logic for combining their outputs. Also, the vidicon camera has been reworked and fitted with dynamic shading correction circuitry to improve the uniformity of response over the raster area.

(b) Measurements

Figures 1-4 illustrates electronically displays resulting from some of our data handling procedures required to obtain measurements of snow cover for Dr. Mark Meier. In these measurements thus far the emphasis has been on achieving repeatability and apparent credibility of results rather than speed and volume. Figure 1 is a polaroid photograph of the T.V. Display of the ERTS-A MSS6 image on September 2, 1972 (1041-18253-6) for a drainage basin identified as 1755. This drainage basin is in the North Cascades National Park in Northern Washington. The image is entered on a scale such that the picture height covers 28.75 km. The outline of the boundary of this particular drainage basin has been electronically superimposed over the ERTS Image which shows the distribution of terrain and snow cover. Figure 2 is an electronically created thematic representation (mask) of the snow cover in Fig. 1. The areal extent of this snow cover is obtained quite simply from automatic digital display (not shown) of the number of pixels that represent the threshold level set for snow. Figure 3 shows the ERTS MSS6 image on October 8, 1972 (1072-18254-6) showing the same area and for the same expended scale. Figure 4 is a similar thematic mask of snow cover for this data in which the snow cover in the basin is approximately 60% less than that on September 2nd.

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FIGURE 1 MSS BAND 6 ERTS IMAGE OF BASIN 1755 IN NORTH CASCADE RANGE 2 SEPTEMBER 1972

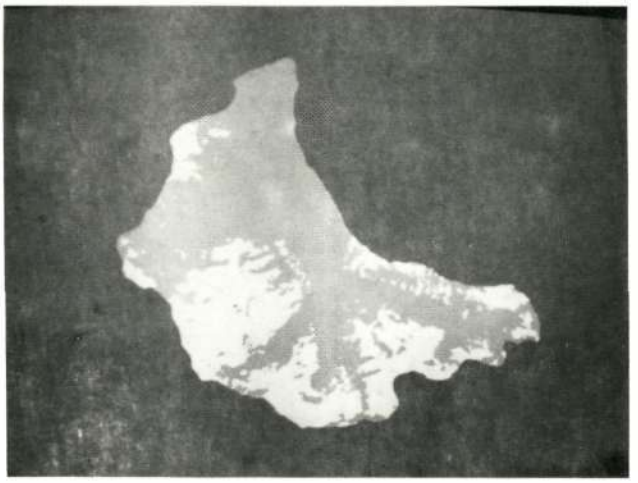

FIGURE 2 THEMATIC MASK OF SNOW COVER IN FIG. 1

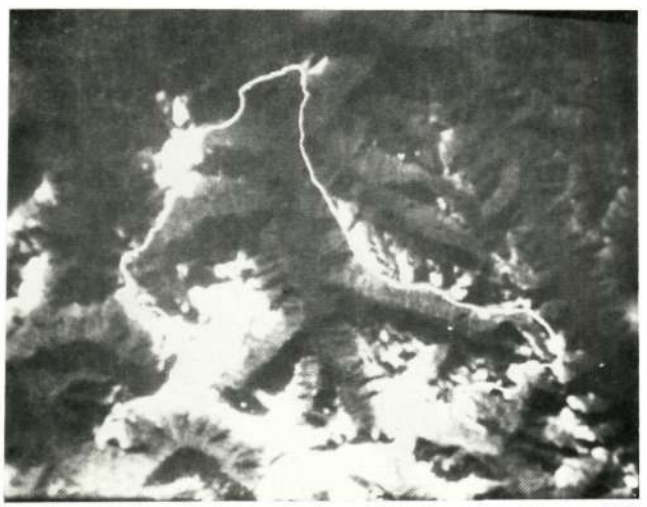

FIGURE 3 MSS BAND 6 ERTS IMAGE OF BASIN 1755 IN NORTH CASCADE RANGE 8 OCTOBER 1972

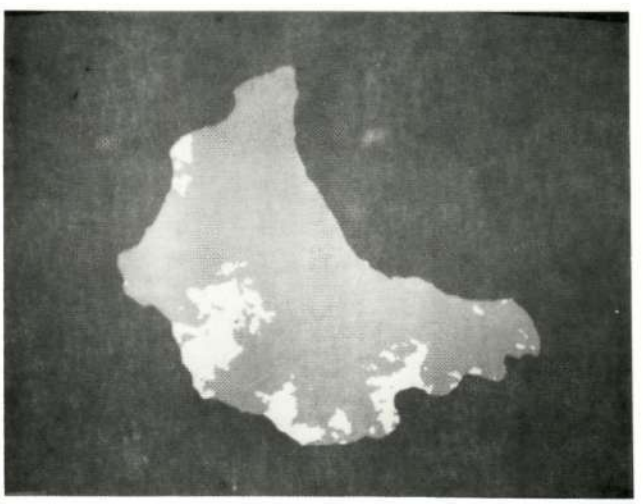

FIGURE 4 THEMATIC MASK OF SNOW COVER IN FIG. 3

Also during this reporting period Dr. Raymond M. Turner Participating Investigator (342-8) from U.S.G.S. Tucson, Arizona spent November 29th and 30th working on the Console with images of Grasslands and Phreatophyte Growth in Central Arizona. A technique and program for future processing of his imagery by SRI and personnel were agreed upon.

(2) Planned for Next Reporting Period

(a) Equipment

The major equipment activities planned during the next period will be concerned with routine maintenance with gradual clean-up of those breadboard circuit additions which appear most useful during actual image processing, and with the construction of jigs, grids, registration masks, and similar fixtures with which to improve the ease and speed of processing. The major remaining equipment addition currently envisioned for the Console is a "scratchpad" memory for storing and editing binary thematic image masks. As mentioned in the last report this functional feature currently exists, but to use it ties up one of the disc memory channels which is often needed for raw image storage. It now appears that semiconductor memory will provide the most satisfactory solution, and detailed design of this addition should be done in the next period.

(b) Measurements

1) For Dr. Meier (IN 045)

We will continue with experiments for measuring snow in a number of specified areas.

2) For Dr. Turner (IN 411)

Make measurements and provide densitometry traces for the Avra Valley Transect, the Old Baldy Transect and the Mine Transect.

Further we will make time lapse studies of both the Benson and Sabino Canyon Phreatophyte areas.

3) For Dr. Reeves (UN 168)

For his area of interest determine numerically a) how many lake basins contain water and b) area of the water surface. Also for the Double Lakes and T-Bar Playa determine the area of these playas that are covered by water.

4) For Dr. Ruggles (IN 395)

Measure Plume development at the mouth of the Connecticut River in Long Island Sound.

Items e through k N/A