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COMPARATIVE ASSESSMENT OF LANDSAT-4 MSS AND TM DATA QUALITY FOR MAPPING APPLICATIONS IN THE SOUTHEAST

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Efforts to-date have centered on obtaining Landsat-4 MSS and TM data of the Georgia study area. Despite an acquisition window which has extended from August 1 to December 31, 1982, only two MSS scenes of suitable quality of the study area have been acquired. Of these, the first scene was recorded on October 29 (path 19, row 36). It was ordered from the EROS Data Center (EDC) in late November and a computer compatible tape (CCT-P) was received on December 9. Film images and prints arrived on December 21. In late December, a second MSS scene (path 18, row 36) acquired on December 9 was ordered from EDC. We expect to receive the CCT-P in mid-January.

The initial objectives of analyses of the MSS data are two-fold: 1) to evaluate the geodetic accuracy of CCT-P data of the test sites; and 2) to improve the geodetic accuracy by additional processing if the original data either do not meet pre-launch specifications or our mapping requirements. The location of 46 ground control points (GCP) digitized from 35 U.S. Geological Survey 1:24,000 scale quadrangles (UTM coordinates) have been identified in terms of pixel and scan line values with the aid of our ERDAS 2400 interactive image processing system and color CRT display. These 46 points will be used to establish UTM position error vector distributions in the scene. The Digital Image Rectification System (DIRS) programs developed at Goddard Space Flight Center have been modified for use on University of Georgia IBM 370/158 computer

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system and will be employed for affine and higher order polynomial rectifications of the MSS data.

As an initial check on the geometric reliability of the EDC MSS data, 28 well-distributed GCPs were input to a program which compares the scaled image distances between all possible point pairs with the corresponding map distances and computes the distance differences; that is, the relative positional errors. The relative errors obtained from initial computations averaged about ±200 m. This figure does not meet the geodetic accuracy specifications of 0.5 pixel (41.5 m) 90 percent of the time. However, it is not a true measure of geodetic position. Errors in geodetic position will be determined by converting the image scan line and pixel values for the GCPs to UTM coordinates and plotting the residual vectors in the UTM system. This task is currently underway.

The relative errors discussed above could result from a number of sources, including misidentification of GCP locations, UTM coordinate errors in the GSFC introduced by the map digitizing process or errors resulting from data acquisition and geometric processing. An effort is being made to eliminate the first two sources in order to isolate those errors caused by the data acquisition and processing systems.

In order to meet our mapping objectives, we hope to achieve RMSE values of less than ±30 m over areas of 1024 X 1024 pixels or smaller. A combination of techniques will be employed involving both our minicomputer-based interactive image processing system and the modified DIRS batch programs. Full rectification of quarter-scene and 7 1/2 minute quadrangle size test areas have been performed and are in the process of being evaluated. It is anticipated that the effects of relief, subscene size, and the numbers and spacing of GCP's on rectification accuracies can be assessed for the Georgia test sites during the next month.

In addition, to work with the MSS data, some preliminary examinations have been made of the quality of the Detroit and Arkansas TM scenes, and efforts are underway to develop a methodology to derive modulation transfer functions (MTF's) for the TM system. Two TM scenes have been recorded of the Georgia study sites, but have not yet been released by Goddard. It is anticipated that at least one of these scenes will be made available by late January.

In summary, Landsat-4 MSS data of the Georgia study sites were not received until mid-December, and TM data are not anticipated until late January (1983). However, despite these problems, efforts are now underway to evaluate the geodetic rectification accuracies of Landsat-4 MSS data. It is anticipated that the results of comprehensive analyses of two or more MSS scenes will be completed by mid-February, and that some early evaluations of TM data quality will also be available by that date.