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Information Content of Data from the Landsat-4 Thematic Mapper (TM) and Multispectral Scanner (MSS)

John C. Price
USDA Hydrology Laboratory
Beltsville Agricultural Research Center, West
Beltsville, Maryland 20705
(301) (FTS) 344-2498

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Accomplishments:

During this quarter the computations were completed for the investigation, and the major portion of a report for journal submission has been completed. The follwing page has been submitted for the December 6-7 investigators meeting at Goddard.

In one month to six weeks the final report will be submitted, consisting of the journal submission plus various summary tables and explanatory material as are too detailed or inconsequential for formal publication.

Problems and Recommendations:

It is incredible that a project costing hundreds of millions of dollars does not have documentation with a table of contents and numbered pages some 16 months after launch of the satellite.

Funding for the project is now completely expended.

Executive Summary

Comparison of the Information Content of Data from the Landsat 4 Thematic Mapper and the Multispectral Scanner

John C. Price
USDA Hydrology Laboratory
Beltsville Agricultural Research Center, West
Beltsville, Maryland 20705

Keywords: Landsat 4, Thematic Mapper, Multispectral Scanner, Information Theory, Thermal Infrared, Agriculture

Simultaneous data acquisition by the Landsat 4 Thematic Mapper (TM) and the Multispectral Scanner (MSS) permits the comparison of the two types of image data with respect to engineering performance and data applications. In this paper the 'information' contained in five matching scenes in agricultural areas is evaluated for the visible and near-IR channels, leading to the conclusion that the TM provides a significant advance in information gathering capability as expressed in terms of either bits per pixel or bits per unit area.

Because the MSS lacks a thermal IR channel the 10-12 micrometer data of the TM at 120 m resolution are analyzed theoretically using methods developed for the Heat Capacity Mapping Mission, which produced data at 481 meter resolution, but with a more favorable orbital acquisition strategy. It appears that the TM thermal IR data are of interest mainly for mapping water bodies, which do not change temperature during the day, and for monitoring thermal features associated with human activity. Interpretation for surface moistness is also possible, but use of thermal data for agricultural purposes would require a broader swath width to increase coverage frequency, and possibly a paired 'night' satellite in order to assure day-night coverage, which is needed for accurate quantitative analysis of the thermal IR data.

For large scale agricultural assessment both the cost and frequency of data acquisition are very important. Despite the excellent quality of the TM data, a pair of lower cost (MSS) satellites must be considered as a viable option for applications such as for national or international production forecasting. For studies of localized areas the superior TM spatial and spectral resolution is clearly an overwhelming advantage.