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GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA

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16 Abstract

During the January - March quarter of the JPL/HCMM Investigation, a detailed field measurement program was carried out at the Death Valley, California test site during the week of February 12, 1979, to coincide with the HCMM satellite overpass. A simulated HCMM satellite image of the Pisgah Crater, California test site created from aircraft data and an actual satellite image of the same area were compared and found to be very similar. The development and construction of a device to measure thermal inertia in situ was begun.

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Introduction

The JPL/HCMM Investigation is a study of the feasibility of using thermal inertia, inferred from remotely sensed temperature data, to complement Landsat reflectivity data for reconnaissance geologic mapping and mineral exploration. During the January - March 1979 quarter of this investigation a detailed field measurement program was carried out at the Death Valley, California test site. Simulated and actual HCMM satellite data of the Pisgah Crater, California test site were compared and found to be similar. The development and construction of a device to measure thermal inertia *in situ* was begun in this quarter.

Problems

To date, only one set of satellite daytime data tapes has been received. This lack of HCMM satellite data remains the major obstacle at this point in the investigation. Until satellite data coincident with our field measurement programs are made available, no significant conclusions concerning the HCMM satellite data are possible.

Accomplishments

The investigation at Death Valley, California is designed to develop a better understanding of the physics of the spatial and diurnal temperature variations of this region and determine if these temperature patterns are related to the hydrogeology of the region. A four-man field team began a measurement program the week of February 12 - 16, 1979, to coincide with the February 15, 1979, HCMM overpass. Micro-meteorological measurements taken at six sites in the Valley included. soil heatflux; net radiation flux, net long-wave radiation flux, incident short-wave radiation flux; and windspeed, temperature, and humidity at seven levels over an 8 m height interval. In addition, surface radiation temperatures and subsurface probe temperatures were measured at three sites. Soil moisture samples were collected at the

subsurface probe levels at each site and at various depths along a prominent alluvial valley.

It is assumed the HCMM satellite data coincident with this measurement program was successfully acquired. Mechanical breakdown prohibited acquisition of Daedalus (U-2) thermal data.

A simulated HCMM satellite image of the Pisgah Crater test site had previously been created from aircraft data obtained in March, 1975. This image (figure 1) has been compared with an image created from a satellite daytime data tape (figure 2) obtained during the May 31, 1978, HCMM overpass of this same area. Each image appears to accurately portray the size and shape of the Sunshine and Pisgah basalt flows and the playa, Lavic Lake. The satellite data looks very similar to what was predicted by the aircraft simulated data.

The development and construction of a field thermal inertia measuring device was begun in this quarter. The device employs two standards of known thermal inertia which will be simultaneoiusly and equally heated along with the ground surface by quartz heating lamps. The ratio of the heating history of either of the standards to the heating history of the ground surface can be directly related to the ratio of the thermal inertia of the standards to calculate the thermal inertia of the ground surface. After construction is completed and laboratory testing defines the capabilities of the system, field work with the device will be initiated.

Significant Results

Comparison of a simulated HCMM image of the Pisgah Crater, California test site obtained from aircraft data with an image generated from the preliminary satellite data tape of the area indicates that the HCMM satellite data appears much as predicted by the simulation.

Presentations

None

Program for next reporting interval

Analysis of previously obtained aircraft and ground-truth data will continue. Analysis of satellite data will commence upon receipt of HCMM data tapes. Laboratory testing of the thermal inertia measuring device will be carried out and a detailed field sampling program will be initiated at the Goldfield, Death Valley, and Pisgah Crater test sites.

Recommendations

It is recommended that the HCMM CCTs be disseminated to the investigators in some reasonable length of time after acquisition to allow them to proceed with their studies.

Funds Expended

Expenditures for January - March, 1979: $18,065.00

Conclusions

None

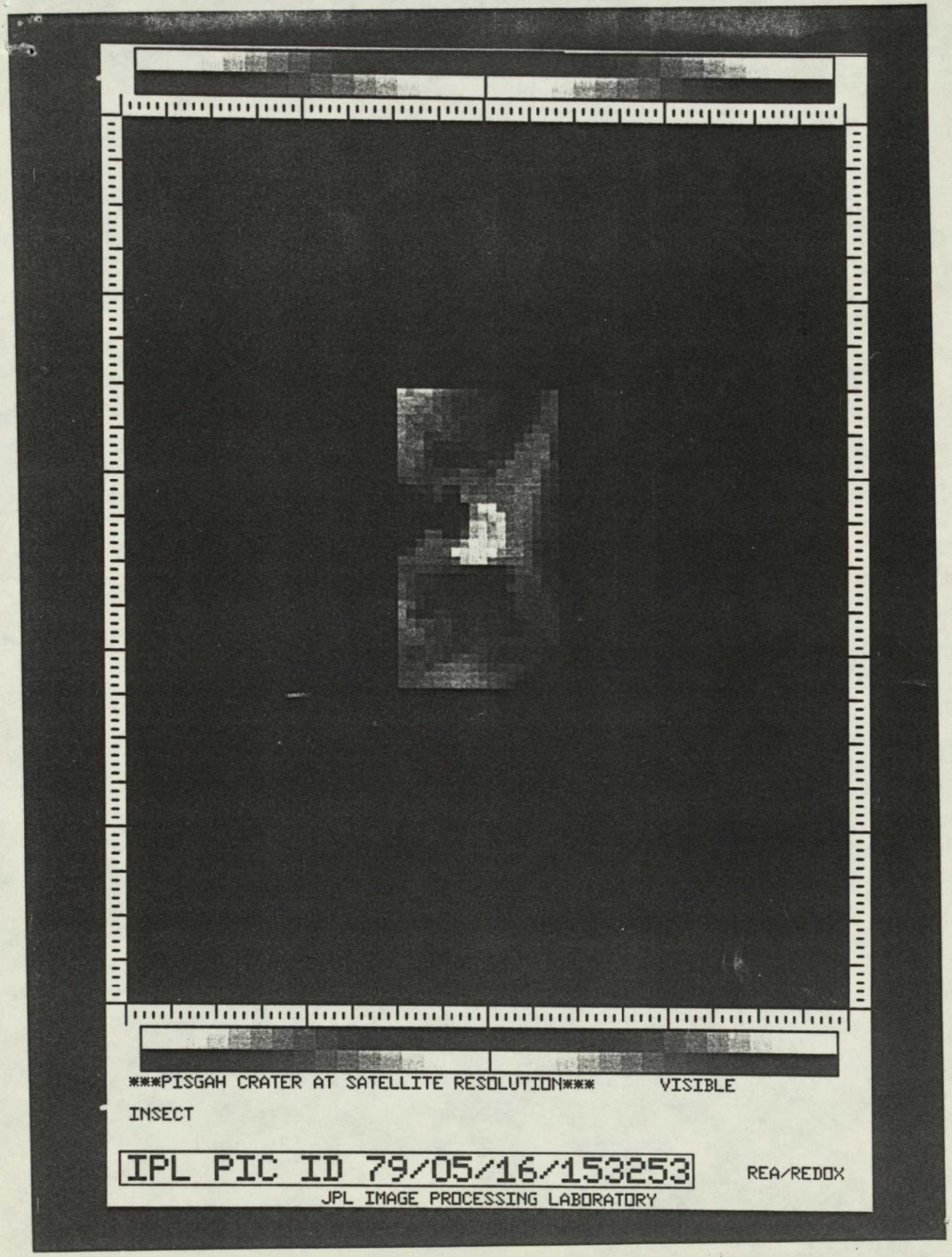

Figure 1. A simulated HCMM satellite day visible image of the Pisgah Crater, California test site created from aircraft data obtained in March 1975. North is to the left.

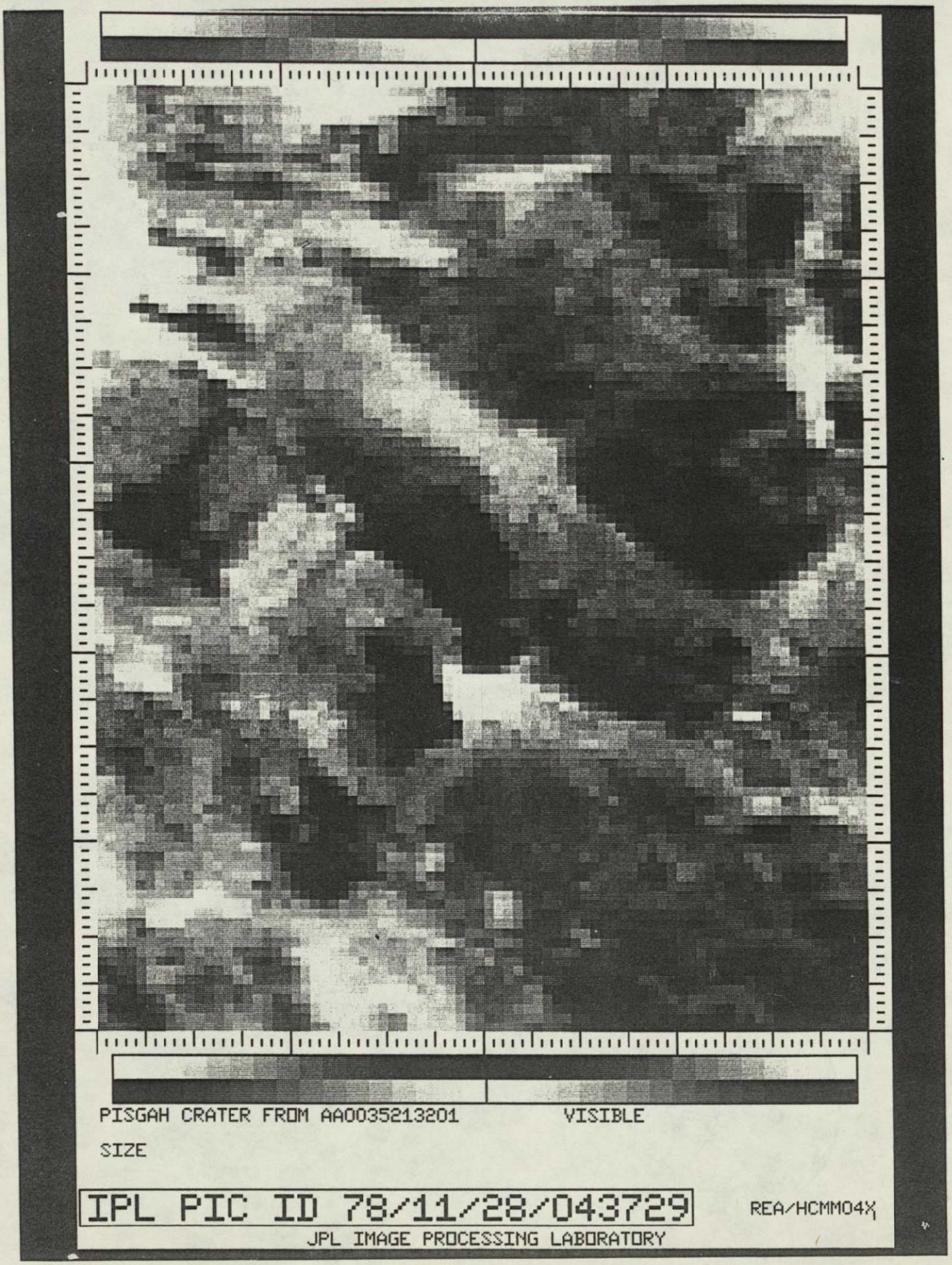

Figure 2. Day visible image of the Pisgah Crater, California test site obtained during the May 31, 1978, HCMM overpass. North is to the top.


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