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INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY

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HCM 036

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1. INTRODUCTION

1.1 Objectives of Investigation

The objectives of the investigation of the application of HCMM thermal data to snow hydrology (HCMM Investigation No. 036) are as follows:

(1) Determine practical utility of HCMM thermal IR data to establish distribution of snow cover and determine accuracy of temperature measurements.

   a. Determine accuracy of surface temperatures acquired through use of HCMM thermal IR measurements.

   b. Determine relative resolution utility between VHRR and HCMM for thermal IR measurements.

   c. Specifically delineate and quantify the problems involved with measuring snow temperature from space and relate them to present and planned earth observing satellite systems. This objective will take into consideration and utilize the capability of HCMM for day and night thermal measurements over appropriate sites and the satellite's eight-day repeat cycle.

(2) Determine if and how HCMM measurements can be factored in with Landsat data into an overall snow hydrology program related directly to snowmelt runoff prediction.

(3) Develop an approach to automated data processing of combined visible and thermal infrared satellite acquired data to provide information of interest and use to the snow hydrologist.

1.2 Anticipated Results

The primary anticipated result of the proposed investigation is the development of improved techniques for the mapping and analysis of snowcover using spacecraft-acquired data. The results will provide an evaluation of the usefulness of high resolution thermal infrared data for snow mapping and for input to snowmelt prediction programs; and will provide a better understanding of the relationships between the measured temperature values and such factors as type of snow, snow depth, type of

terrain, and vegetation. The mapping and analysis techniques can then be applied to the automatic processing of data from future spacecraft systems, and will eventually enable snow survey, which is a vital part of water resources management, to be accomplished on a more cost-effective basis.

2. ACCOMPLISHMENTS DURING REPORTING PERIOD

This is the initial quarterly progress report of the subject investigation. The start date of the contract for HCMM Investigation No. 036 was 1 October 1977; the end date will be 31 August 1979.

During this period, analysis has been undertaken of Heat Capacity Mapper (HCM) data collected on a U-2 flight last spring (23 March 1977). The flight was a daytime flight over the central Arizona test site (Salt-Verde Watershed). The processing of a portion of the computer compatible tape has been completed, and the accompanying imagery (polaroid prints) has been examined.

Some difficulties have been encountered with regard to the utility of this initial aircraft HCM data. Nevertheless, the availability of these data has enabled an assessment to be made of the overall usefulness of the aircraft data as part of the HCMM program and has provided an opportunity to become familiar with the HCM data formats. The preliminary assessment has indicated that further aircraft flights will provide useful data for this HCMM experiment; flights during this winter/spring season will be particularly useful since snow cover in some of the test site areas may be marginal by the time of the satellite launch in late spring.

The difficulties with the data from the initial flight are as follows:

(1) The measurements taken were on a daytime flight only, so it was not possible to compare sequential daytime/nighttime data.

(2) The test site area (Arizona) had very little snow cover at the date of the flight (23 March) as a result of the 1977 drought in the West. Furthermore, at the time of the flight, a considerable amount of cumulus cloud existed in the mountain areas which did have snow cover.

(3) Some calibration problems were apparently experienced with this particular flight; these problems have been discussed with personnel at the data processing facility at GSFC.

(4) The polaroid images have been found to be useful only for a rough assessment of the data because of their small scale. Larger scale images in the negative transparency format have been requested, so that further analysis can be undertaken.

3. PROBLEMS

No significant problems are anticipated at this time. Of course, because the objectives of the investigation are related to snow hydrology, a delay in the launch date of the satellite may reduce the amount of useful data that can be collected this spring. If the satellite is not launched until early May, it is unlikely that sufficient snowpack will remain in the Arizona test site area. However, it still should be possible to collect data over the other test site areas, including the Sierra Nevada in California. If the launch date slips beyond early May, it may be necessary to wait until the next winter season to collect useful snow data.

4. PLANS FOR THE NEXT REPORTING PERIOD

During the next reporting period, the analysis of the U-2 HCM data collected last spring will be continued. Additional U-2 flights are scheduled for the California and Arizona test site areas in late January or early February. We will coordinate with the U-2 flight office at NASA/Ames and with personnel of the USGS Water Resources Division in Phoenix in order to schedule a USGS snow survey flight over the Arizona test site as nearly concurrent as possible with the U-2 flight. At this date, snow conditions are marginal in Arizona; adequate snowpack exists in California.

Early in the next reporting period, the Principal Investigator will attend the next HCMM Experimenters Team meeting, scheduled to be held in Phoenix, 25-26 January. Planned activities for the investigation will

be discussed at the meeting. Also, following the meeting the Principal Investigator plans to meet with USGS personnel to discuss the data from the U-2 flight of last March and to coordinate future underflights concurrent with U-2 flights.

5. TRAVEL

No travel occurred during the past reporting period.

6. PUBLICATIONS

No publications have resulted from this investigation.

7. SIGNIFICANT RESULTS

No significant results have been obtained in the first three months of the investigation.

8. FUNDS EXPENDED

Approximately 5 per cent of the available funds have been expended to date. It is anticipated that the remaining funds will be adequate to complete the project.