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INVESTIGATION OF THE APPLICATION OF
HCMM THERMAL DATA TO SNOW HYDROLOGY

James C. Barnes, Principal Investigator

ERT Document No. P-2061-6
HCMM Investigation No. 036

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Type II Report for Period
January through March 1979

Prepared for

National Aeronautics & Space Administratio
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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, and
 - 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; and
- (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 snow cover 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

During this reporting period our progress has been hampered by a lack of HCMM data. We have received six HCMM images; however, no new digital data have been made available to us. Therefore, no significant accomplishments have occurred during this reporting period.

3. PROBLEMS

At the HCMM Experimenters Team (HET) meeting held in December, the impact on the investigations of the delay in processing HCMM data was discussed by the HET members. In particular, it was pointed out that the delays in data delivery would make it difficult for the investigations to be completed within the contractual time limits. At the request of the HCMM Project Scientist, we have submitted a letter providing information about the requirements for an extension in time and additional funding for our investigation.

As stated in the letter, since HCMM was not launched until the end of April, fewer useful data than had been anticipated were collected during the 1978 snowmelt season. For example, it was too late to obtain any data over our Arizona test site. We expect, therefore, that a considerable amount of data for use in the study will be collected during the current (1978-79) snow season.

We had anticipated that our preliminary analysis would have been completed by this time, using the data collected last spring. However, because of the delay in the HCMM data processing, we have, of course, not been able to complete the analysis of that data. Furthermore, because of the backlog in data processing, it will likely take longer for us to acquire any data collected during the 1978-79 season. According to the existing schedule of our contract, the draft final report is

due by 23 June 1979. We believe that an extension in time until October 1979 is needed in order to complete a thorough evaluation of the HCMM data.

4. PLANS FOR THE NEXT REPORTING PERIOD

Our objective for the next reporting period is a continuing analysis of HCMM digital data. We assume that with standard data production in progress, additional CCT's will be received in the near future. In an effort to expedite the processing of data for our experiment, a priority standing order request for data for the Arizona and Sierras test sites was submitted on 2 March to the HCMM Investigations Manager. The data requested are for HCMM passes with the most favorable cloud conditions, determined from examination of synoptic weather charts.

Having only worked with the daytime IR tape so far, we hope to analyze both daytime and nighttime IR data to determine the diurnal variations in snowpack temperature and investigate the relationship between the observed variations and snowmelt conditions.

5. TRAVEL

No travel occurred during this reporting period.

6. PUBLICATIONS

No publications have resulted from this investigation.

7. SIGNIFICANT RESULTS

No significant results have been obtained through the sixth reporting period of the investigation.

8. FUNDS EXPENDED

Approximately 55 per cent of the available funds have been expended to date. As stated in the letter submitted on 3 January to the HCMM Project Scientist, we believe that an extension in time until October 1979 is needed in order to complete a thorough evaluation of the HCMM data. Also, because of the delays in data processing, we have spent a greater effort working with preliminary data that turned out not to be useful (such as U-2 data that were collected when the system was having problems). Therefore, additional funding will also be needed to carry our investigation until October 1979.