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SEVENTH BI-MONTHLY PROGRESS REPORT
UNIVERSITY OF ALASKA
ERTS PROJECT 110-13
September 30, 1973

A. TITLE OF INVESTIGATION: Glaciological and Volcanological Studies in the Wrangell Mountains, Alaska

B. PRINCIPAL INVESTIGATOR/GSFC ID: Carl S. Benson/UN594

C. PROBLEMS IMPEDING INVESTIGATION: None

D. PROGRESS REPORT:

Accomplishments during the reporting period

From 24-30 August 1973 Drs. Carl Benson and Gunter Weller made a field trip to the summit of Mt. Wrangell (4317 meters) to obtain ground truth data for use with the ERTS images. The funds for this field trip (approximately $2000) were provided by the State of Alaska and personally by Benson and Weller. There was no charge made against the inadequate ERTS 110-13 budget.

The summit area was photographed from the air and from the ground. The north crater was examined in greatest detail. We walked over the western half of the crater and photographed it from three control points which were established in our previous field work during 1961 and 1965. Weather, and logistical difficulty limited our stay on the summit itself to 28 through 30 August. Surveying was done with a Wild, T-16 direct reading Theodolite from two primary survey control points. A total of 12 points were measured from each end of the base line. These points were on the snow cover in the western third of the north crater as well as along the western and southern rims.

The work confirmed our conclusions, reached by study of aerial photographs and ERTS images, that:

1. The center of greatest activity is moving from the active crater to the north crater.
2. The area of exposed rock surrounding the north crater has increased significantly since our last field work on the summit in 1966.
3. The elevation of the snow surface in the north crater has decreased by about 20m over the relatively undisturbed western half of the crater. It has gone down by about 30m in the northeastern 1/3 of the crater and by about 100m in 1/5th of the crater.

4. A first approximation indicates that $13 \times 10^9$ Kg of ice has melted because of volcanic heating in the north crater since 1965. This is equivalent to $1.4 \times 10^{12}$ K cal over an area of $5 \times 10^5$ $m^2$ in 8 years which yields a heat flux of 1150 $\mu$cal $cm^{-2}$ $sec^{-1}$. This is approximately the same as heat flux values calculated from direct measurements on exposed rock surfaces in 1961. However, it is significant that this heat flux is applied to the entire north crater and indicates non-equilibrium heating.

As noted in our last report, photographic imagery of the summit was acquired by the U.S. Navy on July 24, 1973. First look analysis of these images has been completed, and comparison of these along with similar imagery acquired by NASA in July 1972, indicates that noticeable changes in snow cover have taken place during the year that this project has been active. In addition, we have just received digital tapes of ERTS scenes acquired during July 1973 which complements similar data from August 1972, and the photographic and ground truth data described above. Thus, the data set which we had indicated in previous reports to be necessary for completion of the project has now been acquired.

Plans for next reporting period

During the next reporting period we plan to complete the comparative study of the snow cover at the summit from the aircraft data. Then, a similar study will be made using the print-outs of the ERTS data in digital form. The results will then be utilized to define the accuracy with which changes in the snow cover at the summit can be mapped from the ERTS imagery.

E. SIGNIFICANT RESULTS: Attached

F. PUBLICATIONS:

Benson, C.S. 1973, Snow Cover Surveys in Alaska from ERTS-1 Data. Procedings, ERTS-1 Symposium on Significant Results from ERTS-1, NASA/GSFC, 5-9 March 1973, Vol. 1 Tech. Presentations, Section B, P. 1593-1596.

G. RECOMMENDATIONS: None

H. REVISED STANDING ORDERS: None

I. ERTS IMAGE DESCRIPTOR FORMS: None

J: DATA REQUEST FORMS:
Ordered Digital Tapes on August 28, 1973 Tapes Received

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PRINCIPAL INVESTIGATOR: Carl S. Benson/UN594

DISCIPLINE: Mineral Resources, Geological Structure and Land Form Surveys/Water Resources

SUBDISCIPLINE: Volcano Surveys/Glacier Surveys

SUMMARY OF SIGNIFICANT RESULTS:

A field trip was made to the summit of Mt. Wrangell to verify conclusions reached by study of ERTS imagery and aerial photographs. Twelve points were surveyed on the snow surface of the north crater from two primary control points established in 1961-1965 on the rim.

The snow surface has dropped by about 20m in the western half of the crater since 1965. In the eastern half the settling is much greater. The total amount of ice which has melted by volcanic heat appears close to $18 \times 10^9$ Kg. The heat flux calculated from this estimate over the $5 \times 10^5$ $m^2$ area of the crater is slightly more than 1000 $\mu$cal $cm^{-2}$ $sec^{-1}$. It is now clear that the increase in rock area observed on ERTS images is due entirely to volcanic heat.