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Hanover, New Hampshire 03755

ERTS-1 Project No. MMC-298

ARCTIC AND SUBARCTIC ENVIRONMENTAL
ANALYSES UTILIZING ERTS-1 IMAGERY

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Seventh Bimonthly Progress Report

23 October 1973 - 23 December 1973

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Objectives: (Reference NASA Contract S-70253-AG dated 14 June 1972):

- * Analyze and map the sediment deposition in harbors, inlets and docking facilities in the Cook Inlet.
- * Map the permafrost areas of Alaska as inferred by vegetative patterns. Compare major tonal and textural permafrost patterns with Mariner imagery.
- * Correlate the snow pack cover of Caribou-Poker Creek with stream runoff.
- * Map and inventory the icing of the Chena River.
- * Items 2 and 4 above are to be correlated with the University of Alaska studies in the same area.

Change in Data Analysis Schedule:

A proposed change (reference letter dated 12 September 1973) in the reporting requirements has been approved. This Type I Bimonthly report is being substituted for a Type II Semi-Annual Report. The requirements for the Type III Final Report remain unchanged.

Accomplishments:

A photomosaic of the Yakutian region of Siberia has been prepared with 12 MSS band 7 images. Interpretations have been made of the surficial geology and geomorphology of the area topography in this region. This topography is being analyzed as an analog to Martian terrain.

Four cycles (Nos. 26-29) were completed over Cook Inlet during this reporting period. Image 1464-20554, acquired on 30 October, is the only scene from these four cycles received to date. The image shows the littoral transport of coastal sediment in the lower southwestern portion

of the inlet. During ebb flow, sediment laden water moves along the west shore through Kamishak Bay past Cape Douglas into the Shelikof Straits.

Several useable images* acquired during the previous reporting period were received. The sediment distribution, circulation patterns and relationship between oceanic and inlet water masses, as previously interpreted, were verified on these images.

A letter (dated 4 December 1973) was submitted requesting that satellite imagery be acquired during the winter cycles over Cook Inlet. Circulation patterns could be observed by monitoring sea ice movement within the inlet. These winter patterns may differ from the circulation patterns in summer when fresh water runoff is significantly greater.

A preliminary review of imagery from the northern Alaska coast indicated that ERTS-1 provides, for the first time, multispectral imagery of sufficiently high resolution to perform detailed ice studies. Imagery of a portion of the Beaufort Sea was analyzed as a test. It has been possible to determine sequential positions of grid points (fiducial marks) on the ice pack. The data collected for analysis represent a four-day deformation sequence across the shear zone northeast of Point Barrow, Alaska for the period 19-22 March 1973. The results have relevance to the boundary conditions used for drift calculations**. Analysis suggests that the pack is behaving as a relatively cohesive mass (i.e. highly viscous) with slippage over a narrow region (-50 km) at the

* Image identifiers: 1410-20563, 1428-20554, 1428-20560, 1428-20563,
1426-20441, 1426-20444, 1446-20553

** Results presented at the Symposium on Advanced Concepts and Techniques in the Study of Snow and Ice Resources, December 2-8, 1973.

boundaries. This indicates that the assumption of no slip at the boundary coupled with a single viscosity model is probably not tenable for the arctic ice pack.

This study, recognized certain limitations, in the utilization of ERTS imagery to assess regional deformation and drift of arctic pack ice. The most serious limitation is the difficulty of obtaining sequential, cloud-free imagery coincident with the occurrence of significant deformation.

Mapping of permafrost related features was continued along a large portion of the Alaskan Coast where permafrost continues below the continental shelf. Shore fast ice was mapped along the west coast of Alaska to relate its occurrence to the distribution of offshore permafrost. Also, shore fast ice accumulation and ablation was mapped for the spring and early summer seasons. Analysis is not yet complete, but it is clear that the formation and persistence of shore-fast ice is easily monitored with ERTS sequential imagery. When compiled in an atlas of shore-fast ice distribution as a function of season, such data will be valuable in guiding the planning and construction of navigational and shore facilities.

Development of the North Slope oil reserves together with offshore docking facilities and northern sea transportation routes has generated a need for a rapid method of assessing sea ice deformation and drift. Measurements like those described above are needed in the formulation of realistic prediction models. Three particular types of data are especially in demand: 1) data on ice deformation across the shear zone region where

the moving pack impacts and grinds against stationary shore fast ice,
2) the formation, distribution and persistence of the shore-fast ice,
and 3) sequential deformation measurements on a variety of spatial
scales at representative locations to determine the regional character-
istics of the ice velocity field.

Work to be accomplished next reporting period:

The preliminary draft of the Type III Final Report will be submitted
on 26 February 1974.

Articles, papers, preprints, abstracts:

Crowder, W.K., McKim, H.L., Ackley, S.F., Hibler, W.D. and D.M.
Anderson, 1973, Mesoscale deformation of sea ice from satellite
imagery presented at the Symposium on Advanced Concepts and Tech-
niques in the Study of Snow and Ice Resources, December 2-8, 1973.

Presentation entitled, "The Use of ERTS-Imagery in Arctic Research,"
given at the meeting of the Committee on Polar Research, National
Academy of Sciences at the National Center for Atmospheric Research
(NCAR), Boulder, Colorado on 26 October 1973.

Project status review of the ERTS-1 investigation, "Arctic and
Subarctic Environmental Analyses Utilizing ERTS-1 Imagery," given
for the Environmental Research Panel convened by NASA at Goddard
Space Flight Center on 30 October 1973.

ERTS-1 Investigation Review selected for presentation at the 3rd
ERTS-1 Principal Investigator's Symposium sponsored by the Goddard
Space Flight Center, 10-13 December 1973.

Recommendations:

None

Changes in Standing Order Forms:

None submitted

ERTS Image Descriptor Forms:

None submitted

Data Request Forms Submitted:

15 November 1973 - Bulk color prints and transparencies, 9.5 in.,
Cook Inlet - Pending.

19 November 1973 - Bulk B/W prints and transparencies, 9.5 in.,
North slope of Alaska - Pending.

Data Query Forms Submitted:

15 November 1973 - print out received