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OCSEAP Research Unit 716

April 1990

Contract #50ABNC-9-00045

By

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Research Report

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I.Activities for January 1 thru March 31,1989

A. Data Acquisition. For the first three months of 1989, data acquisition was accomplished under an extension of contract #ABNC-600041. The following Landsat data were acquired and archived; sixty-eight photographic prints at the scale of 1:1,000,000 with selected portions enlarged to 1:500,000 and 1:250,000 for features of interest. The following AVHRR data were acquired and archived on 8mm tape; 566 facsimile images, twenty three 8-bit images and nine 10-bit images.

The 8 mm tapes are an inexpensive mass storage media that have a much greater storage capacity than conventional digital tapes. Typically AVHRR data stored on approximately sixty of the 1600 bpi tapes can be stored on one 8 mm tape and hence much more data can be stored in a small space. The major disadvantage of the 8 mm medium is that the scenes must be transferred to 1600 or 6250 bpi format to be loaded on the image analysis system. All the digital data in the Gee-Data Center have been transferred to 8 mm tapes which have become our standard digital format for archive purposes after June 1989

IL Activities for 1 April 1989-16 April 1990

A. Data Acquisition. During this 12-month period RU 716 acquired and archived 322 Landsat scenes at 1:1,000,000 scale with selected portions enlarged to 1:500,000 and 1:250,000 scale for features of interest AVHRR imagery have also been archived including: 993 facsimile images, 453 8-bit digital tapes of images and 33 10-bit digital tapes of images. Appendix I lists the digital AVHRR data acquired and stored on 8 mm tapes from

February 1989 to March 1990. Appendix II lists the Landsat images received and archived from 9 April 1989 to 9 March 1990.

A procedure has been developed to acquire a single-band subsection of an AVHRR image, digitally enhance the data and generate a black and white laser print in near-real time. The resulting image has been sent to investigators in the field for operational use. This procedure involves down-loading the AVHRR data from the University of Miami over computer networks. The University of Miami receives the data through Domsat transmission from the Gilmore Creek CDA Station, Alaska. It may be possible to have the University of Miami record full AVHRR data swaths on 8 mm tapes to be archived at the Gee-Data Center.

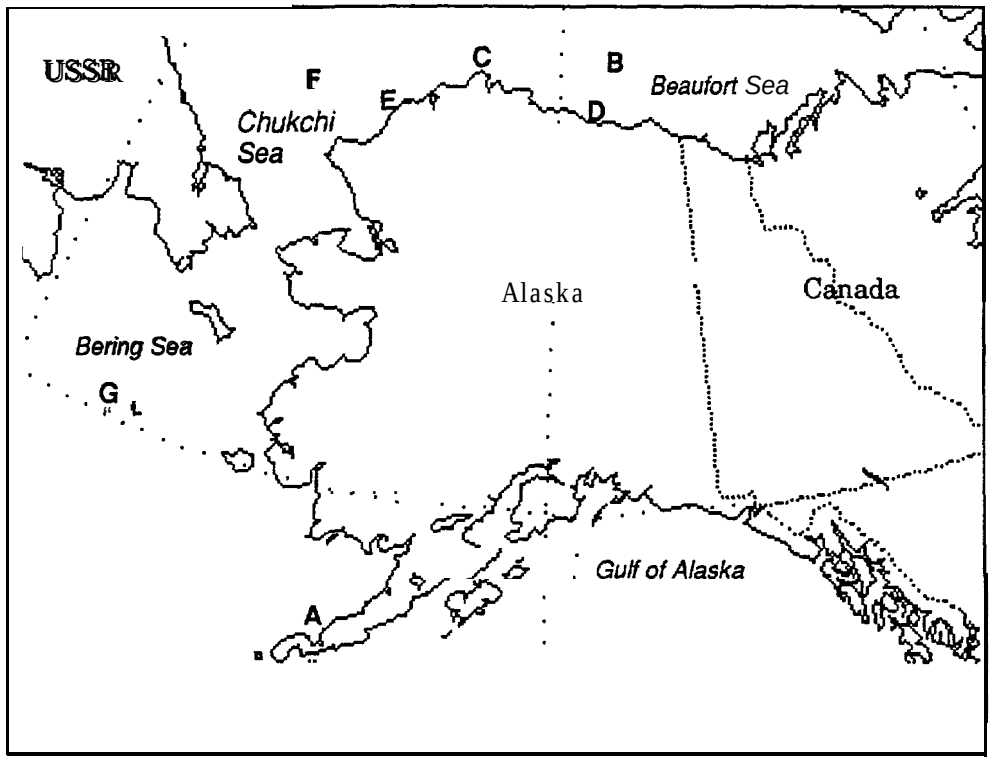
III. Data Requests and Analysis. Data analysis was performed for six OCSEAP investigators using the University's image analysis systems. These studies were conducted at a variety of locations around the state (Fig. 1).

A) Physical Oceanographic Study of Port Moller (RU 705).

AVHRR data were acquired to support the study of marine circulation in Port Moller and Herendeen Bays by Dr. Cheryl Greengrove of EG&G, Inc.. Knowledge of this circulation is important for an understanding of how it effects biological communities. Port Moller Bay has eel grass beds at its southern end and is a spawning ground for herring. Herendeen Bay is nearly 100 meters deep at its southern end and is a breeding ground for blue king crab.

Current meters were placed at strategic points in the bay system to measure and monitor currents from early May to the end of October. Satellite images were acquired during this time interval to monitor and map both sea surface temperature (SST) patterns and suspended sediment plumes.

Analysis of satellite images consisted of examining facsimile replications of images from the National Weather Service office in Fairbanks to select potential candidates for digital processing.



A - Physical Oceanography Study of Port Moller(RU 705).

B - Bowhead Whale Migration in the Beaufort Sea

C - Effects of Oil Production Activities on Arctic Whales.

D - Beaufort Coastal Water Fisheries Study (RU 712)

E - Sediment Analysis in Kasegaluk Lagoon (RU 707)

F. Bowhead Whale Migration in the Chukchi Sea

Figure 1, Map of Alaska showing the location of OCSEAP invsetigations.

This examination yielded 108 potentially cloud-free scenes for which 8-bit digital tapes were obtained from the NOAA/NESDIS CDA Station at Glimore Creek, Alaska. Three criteria existed for selection of digital data: I) low cloud cover conditions, 2) concurrence with field operations, and 3) acquisition of data at periodic intervals other than concentrated during periods of exceptionally good visibility. Criteria 2 often made it necessary to examine multiple sets of images each day during field operations to obtain as much data as possible. Criteria 3 resulted in acquisition of some images that were of marginal use due to cloud cover.

Twenty-six scenes were selected to be analyzed on the university's image analysis systems to enhance sea surface temperature patterns. The

distribution and concentration of suspended sediments were analyzed on 19 images recorded during daylight hours. Color photographic prints and slides were generated from the enhanced imagery and sent to investigators. Tables were provided relating temperatures to digital numbers shown as shades of gray or color tones on the photographic products. To assist in interpretation of suspended sediment data, tables were provided relating image gray level or color to the range of digital numbers represented.

Dr. Greengrove visited our facility September 11-13 to become familiar with the image analysis system and to assist in the development of the enhanced images. Preliminary results of this work suggests that cool water in southern and eastern Herendeen Bay appears to be related to deeper channels and pools in those locations. The analysis also revealed some well-defined temperature bands at the entrance to Port Moller (Fig. 2) whose origin was not clear at this time. Detailed results should be available following her comparison of these images with field data.

The preliminary analysis suggested that higher resolution data would provide additional information. A search for available high resolution Landsat Thematic Mapper (TM) data for the field season May thru October 12, 1989 revealed that no low cloud cover images were available. However, a TM image recorded during July 1988 was found that maybe used in subsequent analyses. An attempt was made to acquire Landsat Multispectral scanner (MSS) imagery though the Quick Look facility at the University of Alaska Fairbanks but the target area was obscured by clouds.

At Dr. Greengrove's request, twelve of the twenty-six scenes that were originally analyzed were registered to a digitized coastline provided by the Alaska Branch of the USGS EROS Data Center in Anchorage. Sea surface temperatures were obtained for all twelve registered images at two sites that correspond to the position of current meters and for two sites to measure the temperature gradient between Bristol Bay and the entrance to Port Moller Bay. Linear plots of SST were made for each registered scene to display this temperature gradient.

Four of the twelve registered scenes were provided to Dr. Greengrove as **35 mm** slides for her presentation to the American Association for the Advancement of Science (AAAS) Conference in New Orleans, La. Several color enhancements for the sea surface temperature analyses were also provided.

B Bowhead Whale Migration in the Beaufort Sea-Fall Season

Ice limit maps and satellite images were analyzed for Mr. S. Treaty of the Minerals Management Service (MMS), Anchorage. The data were used to monitor the fall bowhead whale migration in the Beaufort Sea in the fall of 1988 and 1989.

Eight maps showing sea ice concentration were prepared for September and mid-October 1988 by digitizing Southern Ice Limit sheets, a product of the Joint Ice Center of the Naval Polar Oceanography Center. These were provided as computer-generated hard copy outputs to the investigator.

Fifteen maps were compiled showing four levels of ice concentration (same as in 1988) between 30 August to 20 October 1989. Nine maps were prepared by digitizing the Southern Ice Limit sheets, a product of the Joint Ice Center of the Naval Polar Oceanography Center. Six maps were generated by digitizing Sea Ice Analysis sheets prepared by the National Weather Service(NWS), Anchorage. These were also provided as computer-generated hard copy outputs to the investigator.

The Joint Ice Center maps were preferred by Mr. Treaty over the NWS maps because they are routine, weekly products that are consistent with his previous investigations. The mapping procedures used by both agencies were investigated and compared. Both the Joint Ice Center (Petty Officer Gibbs) and the NWS (C. Bower) thought that the NWS map was probably more accurate due to the large amount of local input,

The fall ice edge location was also monitored during the 30 August to 20 October 1989 period using NOAAAVHRR images. Three images with low cloud cover along the coast or the ice edge were identified. Analysis of these images showed that the ice edge remained a considerable distance from the coast for this field season.

The September 7 visible band image (N-n, Orbit 04914) was digitally analyzed to show ice floes and sea surface temperature patterns along the coast. A map was compiled from this data showing suspected ice floes offshore from the Canning and Sagavanirktok River deltas. The ice edge was obscured by clouds. The map was transmitted to investigators in Prudhoe Bay a few hours after the satellite recorded the image.

The October 6 image set (N-1O, Orbit 15856) showed the ice edge to be approximately 100 km off shore from Cape Bathurst, Canada and approximately 250 km off of the Alaskan coast to its east (Fig. 3). A 35 mm slide was provided of the digitally enhanced near-infrared (band 2) image. Digital analysis was not performed on the 7 September (N-10, Orbit 15443) image.

C. Effects of Oil Production Activities on Arctic Whales.

AVHRR images were examined to support a study of the effects of oil production on whales off Point Barrow for Dr. Gary Miller of LGL, Limited in King City, Ontario, Canada, MMS Contract 14-12-0001-30412. May is typically a cloudy month, and only three images were identified as partially cloud-free in the region of interest. Visible band images were examined to study a large lead that developed off Barrow around May 20. Images recorded immediately before and after the opening of the lead, as well as, an additional scene recorded around the end of the month were examined. These were recorded on 15 May (N-1O, Orbit 13807),27 May (N-11, Orbit 03457) and 28 May (N-11, Orbit 03471). The 28 May image had the lowest cloud cover of the three dates and was thus selected for further digital analysis.

The 28 May image was analyzed on the university's image analysis system to optimize the detection of the lead and to characterize its morphology. This resulted in three enhancements: 1) a color composite formed from the visible, near infrared and thermal infrared bands with the contrast optimized in each band, 2) a near infrared band image with the contrast optimized, and 3) a visible band image with the contrast optimized (Fig. *4).* The lead was most clearly evident in the visible and near-infrared bands. Slides (35 mm) of the three enhancements were sent to Dr. Miller.

Ice conditions were also analyzed on two images recorded on 8 May, prior to the formation of the lead. The first image was recorded at 1100 ADT {(N -10, Orbit 13708) and the second was recorded at 2100 ADT (N- 10, Orbit 137 14). Few clouds were evident on the images and the sea ice cover extended to shore. Various enhancement techniques were applied to the data but no ice-related features of interest could be detected. Thirty-five mm

slides of the visible, near infrared and thermal infrared bands were generated of these images.

D. Beaufort Coastal Water Fisheries Study (RU 712)

Dr. Lyman Thorsteinson of the NOAA Ocean Assessments Division Alaska Office, Anchorage, conducted a fisheries study of the influence of water temperature in the Beaufort Coastal waters on the movements of Arctic Char in the summer of 1988 on digitally analyzed AVHRR satellite images. Although no field work was done during the summer of 1989, and no digital analysis was requested, monitoring of SST patterns observed on satellite imagery of the Beaufort Coast was considered useful. With a small additional effort, the AVHRR imagery acquired for the Port Moller study was examined for cloud free coastal conditions in the Beaufort Sea area. A digital tape of low cloud cover data was archived approximately every two weeks. These scenes are available for future ice edge location, thermal infrared analysis, sediment analysis, etc.

E. Sediment Analysis in Kasegaluk Lagoon

Kasegaluk Lagoon has become an area of interest to several OCSEAP investigators: Dr. K. Frost and Dr. L. Lowery, Ak. Dept. of Fish and Game; and, Dr. Alan Springer of Biosystems Analysis, Fairbanks, Alaska (RU 707). The lagoon is a very important habitat for spotted seals, which maybe added to the endangered species list in the near future, as well as whales and birds. The largest spotted seal haulout in Alaska occurs along its shores. Beluga whales often "reside" on the seaward side of the barrier islands and occasionally enter the lagoon. The lagoon is relatively shallow and the water level is highly variable depending upon wind magnitude and direction. This influences the amount of exposed beach and the morphology of the coastline, and hence seal haulouts. The lagoon also has plankton blooms and is often turbid. There has been an observed decrease in the population of marine mammals in the area.

Satellite imagery, meteorological data and conventional field observations from other research units will be combined to analyze the influence of wind on water level, distribution of suspended sediments and

other coastal environment factors of Kasegaluk Lagoon. A data search revealed low cloud cover Landsat images recorded on 17 August 1983 (31991-22051), 14 September 1983 (40425-22070), 1 September 1984 (50184-22015), and 3 September 1988 (51647-22082 and 51647-22084) that coincide with available field data. Photographic transparencies were ordered from the EROS Data Center for Bands 2 and 3 of the September 14, 1983 and September 1, 1984 scenes.

Readily available Landsat MSS image transparencies recorded on 14 September 1983 and 1 September 1884 were scanned and digitally processed to investigate the feasibility of utilizing digital data for further satellite based analyses (Fig. 5). These enhancements revealed sediment distribution patterns that appear to be related to circulation and possibly bathymetry or plankton blooms in the lagoon. Images recorded in visible red (Band 2) and near-infrared (Band 3) were preferred over the visible green (Band 1) wavelengths for detection of these sediments. The promising results from the initial analysis resulted in a order for digital tapes where improved spectral and spatial resolution can be achieved. Color photographic prints and slides of the preliminary analysis were supplied to Dr. Springer. A search of retrospective data for useful SPOT and Landsat Thematic Mapper images was conducted but none were found. Landsat and SPOT will be scheduled to acquire coverage of the Lagoon for the upcoming field season.

F) Whale Migration in the Chukchi Sea

The migratory routes of Bowhead whales will be analyzed using AVHRR satellite data in conjunction with bathymetry and aerial sightings for Ms. S. Moore SEACO/SAIC. The migration routes maybe related to bathymetry and the movement of surface water as seen on satellite images of sea surface temperature and/or turbidity patterns

Whale sightings will be merged with satellite images recorded in the general time frame of sightings as will as bathymetric data in the Chukchi and Northern Bering Sea. The specific area of interest is north of St. Lawrence I. to somewhat beyond the ice edge, and from Pt. Barrow to Wrangel I. (This broad extent into Soviet waters will permit us to include Soviet sightings.) Low cloud covered AVHRR imagery recorded September

thru October 1989-1982 and digital elevation data (ETOPO - 5) will be used in the analysis.

G) Monitoring of the Position of the Ice Edge, St. Matthew Island.

The position of the ice edge was monitored in the St. Matthew Island area using AVHRR satellite images for the U. S. Coast Guard as requested by Dr. Hameedi of the NOAA Ocean Assessments Division Alaska Office, Anchorage. In mid-November diesel oil and 130,000 gallons of fuel oil were spilled east of St. Matthew Island. The movement of ice against the St. Matthew Island coast and the freezing of sea water in the area was monitored to help access any environmental impact that may be related to the spill.

Beginning on 27 December facsimile prints of thermal infrared (band 4) images were examined to determine the location of the ice edge. Appendix III shows a list of potentiallyuseful imagery and an assessment of the location of the ice edge. Images recorded on 6 January (Orbit 17157) and 8 January 1990 (Orbit 06650) were analyzed on our image analysis system.

Analyses indicates that there was a significant accumulation of fast ice on the north shore of St. Matthew Island by 6 January. At that time the sea surface temperature for the water surrounding the island was -1.40 C. No visible band data were available. The 8 January image revealed that the ice edge was approximately 70 km north of St. Matthew Island. By 18 January the ice edge reached the north coast of the island. . At the end of January the ice edge was far enough south that a well defined polynya developed south of St. Matthew Island.

H. Sea Surface Temperature Analysis for Field Station AVHRR CCTs.

Instructions were prepared describing the computation required to derive temperature values from NOAA/NESDIS CDA Station 8 bit digital data using HRPT Calibration Period Summary sheets. This was considered necessary to facilitate wider use of the 8-bit CDA field station CCTS (Computer Compatible Tape) obtained from the Gilmore Creek

tracking station whose data is archived by our research unit at the Geo-Data Center.

I) Arctic Storm Tracks

At the suggestion of the Contracting Officer's Technical Representative, we have begun an investigation relating arctic storm tracks to ice motions as seen on satellite images and as monitored by the arctic position buoys. The thrust of the investigation is to use the buoy tracks to provide continuity between satellite images which only provide "snapshots" of the ice before and after major ice-moving events. To date, the major effort has gone into a literature search and an examination of the satellite and buoy data bases for identification of useful study periods. Following this, we will perform a pilot study (a one or two case study) to determine the feasibility of the approach and to make corrections in the study plan. If all goes well, this will become a Master's thesis study.

J) Analysis of Polynyas

The time series study of polynyas based on digitally enhanced AVHRR images of the Chukchi and Bering Seas is being re-analyzed using our improved method of temperature calibration for eight and ten bit digital data. The new analysis will be presented at the Firs Circumpolar Symposium on Remote Sensing of Arctic Environments, May 1-3, 1990, Yellowknife, N. W. T., Canada. The finalized cataloging and description of the polynyas will be published and presented at the International Conference on the Role of Polar Regions in Global Change, June 11-15, 1990, University of Alaska Fairbanks. Fairbanks, Alaska.

III. ACTIVITIES NEXT SIX MONTHS

1. **Data Collection.** We will continue to collect and archive Landsat and AVHRR imagery, with a special emphasis on AVHRR data in digital tape format. Near-real time data acquisition through the University of Miami will be refined and the possibility of receiving full swaths of AVHRR data for archival purposes will be further evaluated.

2. **Analysis.** We will complete the analysis on the Port Moller Project and the Kaselgaluk Lagoon Project in cooperation with the OCSEAP investigators involved in these studies. The Chukchi Whale Migration project will begin in cooperation with OCSEAP investigators. The thermal infrared AVHRR images of polyni will be re-analyzed using the new temperature calibrations. The finalized cataloging and description of polynyi of the Chukchi and Bering Seas will be published.

IV Acknowledgements

These studies were funded by the Minerals Management Service, U. S. Department of the Interior, through an interagency agreement with the National Oceanic and Atmospheric Administration, U. S. Department of the Outer Continental Shelf Environment Assessment Program.

Appendix L List of AVHRR Digital Data Acquired from February 1989 to M-arch 1990.

Date: mo/da/yr	Equator x-ing	orbit rev #	8MM cassette	File #	Bands	Comments (Projects, etc.)
5/23/85	135W	2293	5	44	1,2,4	
4/25/86	140W	7033	5	47	1,2,4	
2/2/89	140W	1855	2	5	1,2,4	
4/3/89	121W	6736	5	35	1,2,4	
5/1/89	024E	13608	5	15	1,2,4	oil spill - subscene ADVAL
5/9/89	013E	13708	2	3	1,2,4	oil spill - subscene ADVAL
5/16/89	128W	3307	2	4	1,2,4	oil spill
6/23/89	105W	3842	1	7	1,2,4	
6/25/89	029E	14390	1	20	1,2,4	oil spill
6/26189	097W	3884	1	4	1,2,4	
6/27/89	146W	3900	1	9	1,2,4	oil spill
6/27189	015E	14419	1	27	1,2,4	oil spill
6/28/89	118W	3913	1	8	1,2,4	
6/28/89	143W	3914	1	18	1,2,4	oil spill
6/29/89	130W	14439	1	19	1,2,4	oil spill
6/30/89	112W	3941	1	22	1,2,4	
6/30/89	138W	3942	1	17	1,2,4	oil spill
7/1 /89	144W	14468	1	25	1,2,4	oil spill
7/2/89	017E	3950	1	1	1,2,4	oil spill
7/2/89	135W	3956	1	28	1,2,4	
7/2/89	020E	3964	1	29	1,2,4	
7/2/89	013E	14476	1	23	1,2,4	oil spill
7/2/89	138W	14482	1	30	1,2,4	
7/2/89	018E	14490	1	24	1,2,4	
7/3/89	133W	14496	1	10	1,2,4	
7/3/89	024E	14504	1	2	1,2,4	oil spill
7/6/89	097W	4025	1	5	1,2,4	
7/7/89	154W	4060	5	46	1,2,4	
7/8/89	149W	4074	5	45	1,2,4	
7/9/89	124W	14581	1	6	1,2,4	
7/10189	137W	4083	1	15	1,2,4	oil spill
7/11/89	018E	4091	1	3	1,2,4	
7/14/89	101W	4138	1	11	1,2,4	
7/16/89	021 E	14689	1	21	1,2,4	oil spill
7/17/89	144W	4182	1	16	1,2,4	oil spill
7/17/89	027E	14703	1	12	1,2,4	
7/17/89	027E	14703	2	35	1,2,4	
7/18/89	124W	14709	2	40	1,2,4	
7/18/89	?	14716	1	26	1,2,4	
7/1 8/89	032E	14717	2	36	1,2,4	
7/18/89	007E	14718	2	34	1,2,4	
7119189	144W	14724	2	37	1,2,4	
7/19/89	144W	14724	2	41	1,2,4	
7/20/89	018E	14746	1	13	1,2,4	
7/22/89	004E	14775	3	29	1,2,4	
7/23/89	103W	4265	1	14	1,2,4	
7/23/89	121W	14780	3	30	1,2,4	

7124189	126W	4280	1	41	1,2,4
7/ 24/89	041 E	14802	1	42	1,2,4
7/25/89	021 E	14817	1	32	1 ,2,4
7/25/89	021 E	14817	1	36	1,2,4
7/26/89	032E	4302	2	39	1,2,4
7/26/89	006E	4303	2	38	1,2,4
7/27/89	032E	14845	1	44	1,2,4
7/27189	007E	14846	1	38	1,2,4
7/28/89	012E	4331	1	37	1,2,4
7/28/89	115W	4336	1	40	1,2,4
7/29/89	006W	14875	1	46	1,2,4
7130/89	042E	4358	1	47	1,2,4
7/30/89	11OW	4364	1	48	1,2,4
7130189	107W	14879	3	42	1,2,4
7/3 1 /89	107W	4378	1	35	1,2,4
7/31/89	030E	14902	1	50	1,2,4
8/3/89	099W	4420	1	33	1,2,4
8/4/89	148W	4436	1	39	1,2,4
8/4/89	007E	4444	3	43	1,2,4
8/4/89	145W	4450	3	44	1,2,4
8/4/89	155W	14952	1	51	1,2,4
8/6/89	O1OE	4458	1	34	1,2,4
8/6/89	142W	4464	1	49	1,2,4
8/6/89	013E	14988	1	52	1,2,4
8/8/89	024E	15016	1	45	1,2,4
8/9/89	101W	15021	1	31	1,2,4
8/1 0/89	O1OE	15045	1	43	1,2,4
8/1 1/89	048 E	4527	3	35	1,2,4
8/1 2/89	129W	4534	3	45	1,2,4
8/12/89	026E	4542	3	32	1,2,4
8/12/89	127W	4548	3	33	1,2,4
8/1 3/89	003E	4557	3	46	1,2,4
8/13/89	021 E	4562	3	34	1,2,4
8/1 3189	021 E	15073	3	31	1,2,4
8/1 3/89	027E	15087	3	36	1,2,4
8/14/89	031E	4570	3	48	1,2,4
8/14/89	121W	4576	3	37	1,2,4
8/1 4/89	002E	15088	3	47	1,2,4
8/14/89	124W	15093	3	39	1,2,4
8114189	007E	15102	2	42	1,2,4
8/15/89	147W	4577	3	38	1,2,4
8/15/89	008E	4585	3	40	1,2,4
8/16/89	019E	15130	3	49	1,2,4
8/18/89	016E	4627	3	50	1,2,4
8/18/89	005E	15159	3	41	1,2,4
8/20/89	022E	15201	3	51	1,2,4
8121/89	128W	4675	2	1	1,2,4
8/22/89	129W	15207	2	2	1,2,4
8/24/89	013E	15244	2	43	1,2,4
8/24/89	O l l w	15245	2	44	1,2,4
8124189	011W	15245	2	28	1,2,4
8/25189	143W	4732	2	45	1,2,4
8126/89	012E	4740	3	3	1,2,4
8/26/89	141W	4746	3	4	1,2,4

8/26189	132W	15264	3	2	1,2,4
8/26/89	050E	15271	3	5	1,2,4
8/26/89	025E	15272	3	6	1,2,4
8127189	I12W	4759	3	7	1,2,4
8127/89	138W	4760	3	8	1,2,4
8/29/89	O05W	4783	3	9	1,2,4
8/29/89	005W	4783	3	10	1,2,4
8/30/89	022E	4796	3	11	1,2,4
8/30/89	130W	4802	3	12	1,2,4
8/31/89	Ooow	4811	3	15	1,2,4
8/31 /89	Ooow	4811	3	16	1,3,5
8/31/89	002E	15344	3	13	1,2,4
8131 /89	002E	15344	3	14	1,3,5
9/1/89	153W	4817	3	17	1,2,4
9/1/89	153W	4817	3	18	1,3,5
9/2/89	150W	4831	2	6	1,2,4
9/2/89	150W	4831	2	7	1,3,5
9/2/89	118W	15363	3	19	1,2,4
9/2189	Ollw	15373	3	20	1,2,4
9/4/89	142W	4873	3	21	1,2,4
9/5/89	151W	15407	2	8	1,2,4
9/5/89	151W	15407	2	9	1,3,5
9/5/89	005E	15415	3	22	1,2,4
9/6/89	165W	4888	2	10	1,2,4
9/6/89	165W	4888	2	11	1,3,5
9/6/89	137W	4901	3	23	1,2,4
9/7/89	018E	4909	3	25	1,2,4
9/7/89	109W	4914	3	26	1,2,4
9/7/89	140W	15435	3	24	1,2,4
9/7/89	016E	15443	3	27	1,2,4
9/7/89	016E	15443	4	3	1,2,4
9/7/89	008W	15444	2	12	1,2,4
9/8/89	021 E	4923	2	13	1,2,4
9/8/89	134W	15449	2	14	1,2,4
9/8/89	047E	15456	2	18	1,2,4
9/9/89	023E	4937	2	20	1,2,4
9/9/89	103W	4942	2	19	1,2,4
9/9/89	129W	15463	2	15	1,2,4
9/9/89	154W	15464	2	16	1,2,4
9/10/89	000E	4952	2	21	1,2,4
9/10/89	000E	4952	2	22	1,3,5
9/11/89	152W	4958	4	21	1,2,4
9/11/89	152W	4958	4	22	1,2,4
9/1 1/89	003E	4966	4	23	1,2,4
9/1 1/89	003E	4966	4	24	1,3,5
9112189	149W	4972	2	17	1,2,4
9/1 2/89	006E	4980	4	25	1,2,4
9/1 2/89	006E	4980	4	26	1,3,5
9/1 2/89	162W	15507	4	27	1,2,4
9/1 2189	162W	15507	4	28	1,3,5
9/1 3/89	025E	15528	2	46	1,2,4
9/1 4/89	141W	5014	2	48	1,2,4
9/15/89	014E	5022	2	49	1,2,4
9/15/89	145W	15549	2	47	1,2,4

9/1 6/89	008W	5037	4	50	1,2,4
9116189	008W	5037	4	23	1,3,5
9/1 6/89	008W	15572	4	24	1,2,4
9/1 6/89	008W	15572	4	25	1,3,5
9/1 7/89	006W	5051	4	26	1,2,4
9/1 7/89	006W	5051	4	27	1,3,5
9/1 7/89	133W	5056	4	33	1,2,4
9/18/89	022E	5064	4	32	1,2,4
9/1 8/89	003W	5065	4	31	1,2,4
9/1 8/89	131W	5070	4	30	1,2,4
9118/89	154W	15592	4	28	1,2,4
9/20/89	027E	5092	4	40	1,2,4
9/20/89	027E	5092	4	41	1,3,5
9121189	004E	5107	4	42	1,2,4
9/21/89	004E	5107	4	43	1,3,5
9/21/89	137W	15634	2	29	1,2,4
9/22/89	007E	5121	4	4	1,2,4
9/24189	145W	15677	4	5	1,2,4
9/24/89	011E	15685	4	2	1,2,4
9125189	015E	5163	4	9	1,2,4
9/25/89	138W	5169	4	14	1,2,4
9/25/89	140W	15691	4	7	1,2,4
9/25/89	017E	15699	4	6	1,2,4
9/25/89	007W	15700	4	44	1,2,4
9125/89	007W	15700	4	45	1,3,5
9/26189	163W	5170	4	46	1,2,4
9/26189	163W	5170	4	47	1,3,5
9127189	020E	5191	4	10	1,2,4
9127/89	132W	5197	4	8	1,2,4
9/27/89	028E	15727	4	11	1,2,4
9/27/89	003E	15728	4	12	1,2,4
9/28/89	023E	5205	4	34	1,2,4
9/28/89	002W	5206	4	48	1,2,4
9/28/89	002W	5206	4	49	1,3,5
9/28/89	148W	15734	4	13	1,2,4
9128189	034E	15741	4	29	1,2,4
9/28/89	034E	15741	4	30	1,3,5
9128189	009E	15742	4	15	1,2,4
9/28/89	009E	15742	4	16	1,3,5
9/28/89	016W	15743	4	50	1,2,4
9128189	016W	15743	4	51	1,3,5
9/29189	127W	5225	4	39	1,2,4
9129189	014E	15756	4	19	1,2,4
9/30/89	124W	5239	4	17	1,2,4
9/30/89	004W	15771	5	28	1,2,4
9/30189	004W	15771	5	29	1,3,5
10/1 /89	150W	5240	4	33	1,2,4
10/1/89	005E	5248	4	37	1,2,4
10/1 /89	019W	5249	4	38	1,2,4
10/1/89	106W	15775	4	36	1,2,4
10/1 /89	131W	15776	4	35	1,2,4
10/1/89	000E	15785	4	20	1,2,4
10/3/89	142W	5282	4	18	1,2,4
10/3/89	012E	15813	4	31	1,2,4

10/5/89	016E	5304	5	18	1,2,4	
10/5/89	135W	15833	4	32	1,2,4	
10/6/89	019E	5318	5	19	1,2,4	
10/6/89	154E	15848	5	20	1,2,4	
10/6/89	003E	15856	5	21	1,2,4	
10/7/89	022E	5332	5	22	1,2,4	
10/7/89	131W	5338	5	23	1,2,4	
1017/89	009E	15870	5	24	1,2,4	
10/9/89	026E	5360	5	2	1,2,4	
10/9/89	136W	15890	5	3	1,2,4	
10/9/89	020E	15898	5	5	1,2,4	
10/1 2189	009E	5403	5	6	1,2,4	
10/1 2/89	143W	5409	5	7	1,2,4	
1 0/12J89	145W	15933	5	4	1,2,4	
10/1 2189	012E	15941	5	8	1,2,4	
10/1 3/89	012E	5417	5	10	1,2,4	
10/1 3/89	139W	15947	5	9	1,2,4	
10/1 3/89	004E	15984	5	11	1,2,4	
10/18/89	021E	16026	5	12	1,2,4	
10/21 /89	013E	16069	5	13	1,2,4	
10/22/89	113W	16074	5	14	1,2,4	
10/23/89	038E	5557	5	16	1,2,4	
10/25/89	018E	5586	5	27	1,2,4	
10/25/89	134W	5592	5	26	1,2,4	
10/25/89	O1OE	16126	5	25	1,2,4	
11/5/89	022E	16282	5	30	1,2,4	
11/7/89	002E	5770	5	36	1,2,4	
1117f89	124W	16302	5	37	1,2,4	
11/7/89	008E	16311	5	33	1,2,4	
11/1 0/89	132W	16345	5	34	1,2,4	
11/11/89	126W	16359	5	31	1,2,4	
11/11/89	151W	16360	5	32	1,2,4	
11/13/89	134W	5860	5	38	1,2,4	
11/14/89	106W	5873	5	39	1,2,4	
11116/89	014E	16453	5	40	1,2,4	
11/19/89	025E	16481	5	41	1,2,4	
11/20/89	011E	5953	5	42	1,2,4	
11/20/89	129W	16487	5	43	1,2,4	
12/2/89	134W	6128	5	48	1,2,4	
1216189	11OW	16714	5	49	1,2,4	
12/1 4/89	016E	16837	5	51	1,3,5	Redoubt Volcano
12/1 4/89	016E	16837	5	50	1,2,4	Redoubt Volcano
12/1 4/89	009W	16838	6	2	1,2,4	
12/14/89	009W	16838	6	3	1,3,5	
12/1 5/89	028E	6305	6	4	1,2,4	Redoubt Volcano
12/15/89	028E	6305	6	5	1,3,5	Redoubt Volcano
12/15189	002E	6306	6	6	1,3,5	Redoubt Volcano
12/1 5/89	002E	6306	6	7	1,2,4	Redoubt Volcano
12/1 5/89	135W	16843	6	8	1,2,4	
12/1 5/89	135W	16843	6	9	1,3,5	
12/16/89	031E	6319	6	10	1,3,5	Redoubt Volcano
12/16/89	031 E	6319	6	13	1,2,4	Redoubt Volcano
12/1 6/89	027E	16865	6	12	1,3,5	Redoubt Volcano
12/16/89	027E	16865	6	11	1,2,4	Redoubt Volcano

12/18/89	O1OE	6348	6	14	1,2,4	Redoubt Volcano
12/18/89	116W	6353	6	19	1,2,4	Redoubt Volcano
12/18/89	013E	16894	6	15	1,2,4	Redoubt Volcano
12/18/89	013E	16894	6	34	1,3,5	Redoubt Volcano
12/22/89	011E	16951	5	20	1,2,4	Redoubt Volcano
12/25/89	123W	6452	6	21	1,2,4	Redoubt Volcano
12/26/89	032E	6460	6	22	1,2,4	Redoubt Volcano
12/26/89	120W	6466	6	23	1,2,4	Redoubt Volcano
12/26/89	123W	16999	6	24	1,2,4	Redoubt Volcano
12/26/89	034E	17007	6	25	1,2,4	Redoubt Volcano
12/27/89	143W	17014	6	26	1,2,4	Redoubt Volcano
12/29/89	138W	6509	6	27	1,2,4	Redoubt Volcano
12/29/89	026E	17050	6	28	1,2,4	Redoubt Volcano
12/29/89	001 E	17051	6	29	1,2,4	
12/29/89	126W	17056	6	30	1,2,4	Redoubt Volcano
12/29/89	151W	17057	6	31	1,2,4	
12/31/89	020E	6531	6	33	1,2,4	Redoubt Volcano
113190	028E	6573	6	18	1,2,4	Redoubt Volcano
1/3/90	128W	17113	6	16	1,2,4	Redoubt Volcano
1 /3)90	128W	17113	6	17	1,3,5	Redoubt Volcano
1/5/90	144W	6608	6	35	1,2,4	Redoubt Volcano
1/5/90	144W	6608	6	36	1,3,5	Redoubt Volcano
1/6/90	142W	6622	6	38	1,2,4	Redoubt Volcano
1/6/90	161W	17157	6	39	1,2,4	
1/7/90	014E	6630	6	40	1,2,4	Redoubt Volcano
1/7/90	139W	6636	6	41	1,2,4	Redoubt Volcano
1/7/90	156W	17171	6	43	1,2,4	
1/7/90	027E	17178	6	44	1,2,4	Redoubt Volcano
1/8/90	006E	17193	6	32	1,2,4	Redoubt Volcano
1/8/90	006E	17193	6	37	1,3,5	Redoubt Volcano
1/8/90	136W	6650	6	45	1,2,4	
1/12/90	004E	17250	6	46	1,2,4	
1/16/90	004E	17307	6	47	1,2,4	
1/1 6/90	140W	6763	6	48	1,2,4	Redoubt Volcano
1/17/90	015E	6771	6	49	1,2,4	Redoubt Volcano
1/18/90	013E	17335	7	4	1,2,4	Redoubt Volcano
1/18/90	Ollw	17336	7	5	1,2,4	
1/24/90	118W	6875	7	6	1,2,4	
1/24/90		17421	7	7	1,2,4	
1/25/90	140W	6890	7	8	1,2,4	Redoubt Volcano
1/25/90	002E	17435	7	9	1,2,4	
1/26/90	Olow	6899	7	10	1,2,4	
1 /30/90	126W	17497	7	11	1,2,4	Redoubt Volcano
2/6/90	021 E	17605	7	12	1,2,4	
2/7/90	130W	17611	7	13	1,2,4	
2/9/90	012E	17648	7	14	1,2,4	
211 1/90	119W	7129	7	19	1,2,4	Redoubt Volcano
2/12/90	035 E	7137	7	20	1,2,4	
2/15/90	018E	7180	7	2	1,2,4	Redoubt Volcano
2/15/90	018E	7180	7	3	1,3,5	Redoubt Volcano
2/20/90	Ooow	17805	7	21	1,2,4	
2/21/90	146W	7257	7	22	1,2,4	
2/21/90	034E	7264	7	15	1,2,4	Redoubt Volcano
2/21/90	034E	7264	7	17	1,3,5	Redoubt Volcano

2/21/90	009E	7265	7	16	1,2,4	
2/21/90	009E	7265	7	18	1,3,5	
2/21 /90	005E	17819	7	23	1,2,4	
2/27/90	142W	17896	7	24	1,2,4	
3/4/90	014E	7420	7	27	1,2,4	
3/4/90	113W	7425	7	28	1,2,4	
3/7/90	147W	18010	7	29	1,2,4	
3/9/90	125W	7496	7	25	1,2,4	
3/9/90	125W	7496	7	26	1,3,5	
3/10/90	030E	7504	7	30	1,2,4	
3/14/90	Ooow	18118	7	31	1,2,4	
3/1 4/90	Ooow	18118	7	32	1,3,5	
3/1 6/90	121W	18137	7	33	1,2,4	
3/1 8/90	022E	18174	7	35	1,2,4	
3/20/90	120W	7651	7	36	1,2,4	
3/22/90	037E	7673	7	37	1,2,4	
3/22190	012E	7674	7	38	1,2,4	
3/23/90	015E	7688	7	41	1,2,4	Redoubt Volcano
3/23/90	025E	18245	7	42	1,2,4	Redoubt Volcano
3/29/90	009E	18331	7	39	1,2,4	
3129190	009E	18331	7	40	1,3,5	

Appendix II

(List of Landsat MSS Data Acquired in the 1989-1990 Period)

Landsat Scenes of Alaska, Sorted by Grid, Path, and Row

Sat Grid	Path	Row	Scene ID	Date	% Cloud Cover	Quick Look	Color Uniq	Tape	Bands	Center Lat	Center Long	Remarks
4	57	18	51864-19290	09-apr-1989	0	Q			4	60 4.2'N	132 35.4'W	
		18	51944-19274	28-jun-1989	25	Q			4	60 5.4'N	132 36.6'W	
		19	51864-19293	09-apr-1989	0	Q			4	58 40.8'N	133 28.8'W	
		19	51944-19281	28-jun-1989	0	Q			4	58 42.0'N	133 30.0'W	
		20	51864-19295	09-apr-1989	0	Q			4	57 17.4'N	134 18.6'W	
		20	51944-19283	28-jun-1989	25	Q			4	57 18.6'N	134 19.8'W	
		21	51864-19302	09-apr-1989	60	Q			4	55 53.4'N	135 4.8'W	Clouds mainly over water
	58	19	51871-19354	16-apr-1989	50	Q			4	58 41.4'N	135 4.2'W	
	59	18	52118-19354	19-dec-1989	10	Q	U		4	60 6.0'N	135 43.8'W	
	60	18	51885-19472	30-apr-1989	0	Q			4	60 5.4*N	137 15.6'W	
	61	16	51988-19504	11-aug-1989	2	Q			4	62 50.4'N	136 49.2'W	
		17	51988-19511	11-aug-1989	2	Q			4	61 28.2'N	137 51.6'W	
		18	51988-19513	11-aug-1989	10	Q			4	60 4.8'N	138 48.6'W	
		18	52196-19453	07-mar-1990	0	Q			4	60 5.4'N	138 53.4'W	
	62	18	52155-19530	25-jan-1990	10	Q		*	2	60 7.2'N	140 21.6'W	
	63	11	52082-19583	13-nov-1989	10	Q			2	69 36.6'N	132 59.4'W	
		12	52082-19590	13-nov-1989	0	Q			2	68 16.8'N	134 40.2'W	
		13	52082-19592	13-nov-1989	0	Q			2	66 56.4'N	136 10.8'W	
		14	52082-19594	13-nov-1989	0	Q			2	65 34.8'N	137 31.8'W	
		15	52082-20001	13-nov-1989	0	Q			2	64 13.2'N	138 46.2'W	
		16	52162-19581	01-feb-1990	0	Q			2	62 52.8'N	139 56.4'W	
		17	52162-19584	01-feb-1990	0	Q			2	61 30.0'N	140 58.8'W	
	64	14	52160-20095	30-jan-1990	5	Q			2	65 36.6'N	140 40.2'W	
		15	52160-20101	30-jan-1990	0	Q			2	64 15.0'N	141 54.6'W	
	65	16	52160-20104	30-jan-1990	0	Q			2	62 52.8'N	143 1.8'W	
		17	52160-20110	30-jan-1990	20	Q			2	61 30.0'N	144 4.2'W	
	66	12	52183-20143	22-feb-1990	0	Q			4	68 17.4'N	139 25.2'W	
		13	52183-20150	22-feb-1990	0	Q			4	66 57.0'N	140 55.2'W	
		14	52183-20152	22-feb-1990	0	Q			4	65 36.0'N	142 16.2'W	
		15	52183-20154	22-feb-1990	0	Q			4	66 13.8'N	143 30.0'W	
		16	51959-20221	13-jul-1989	20	Q			4	62 51.0'N	144 31.2'W	
		17	51959-20223	13-jul-1989	30	Q			4	61 28.2'N	145 33.6'W	
		17	52135-20175	05-jan-1990	50	Q	v		4	61 29.4'N	145 33.0'W	
		17	52183-20163	22-feb-1990	7	Q			4	61 28.8'N	145 39.6'W	

Sat Grid	Path Row	Scene ID	Date	% Cloud cover	Quick Look	Color Uniq	Tape	Bands	Center Lat	Center Long	Remarks
	18	52135-20181	05-jan-1990	25	Q	u		4	60 6.6'N	146 30.0'W	
	18	52183-20170	22-feb-1990	2	Q			4	60 6.0'N	146 37.2'W	
67	11	52190-20200	03-jan-1990	0	Q			4	69 37.2'N	139 16.2'W	
	12	52190-20202	03-jan-1990	25	Q			4	68 17.4'N	140 30.0'W	
	13	51871-20290	15-apr-1989	0	Q			4	66 55.8'N	142 22.2'W	
	13	52142-20221	12-jan-1990	30	Q			2	66 57.6*N	142 21.6'W	
	14	51871-20292	15-apr-1989	0	Q			4	65 34.8*M	143 44.4*W	
	14	52142-20224	12-jan-1990	0	Q			2	65 36.6'N	143 42.6'w	
	15	51871-20294	15-apr-1989	0	Q			4	64 12.6'N	144 57.6'W	
	16	51871-20301	15-apr-1989	0	Q			4	62 50.4'N	146 5.4'W	
	17	42457-20343	07-apr-1989	10			T		61 16.8'N	147 0.0'W	TM
	17	51871-20303	15-apr-1989	30	Q			4	61 27.6'N	147 7.8'W	
	18	42457-20355	07-apr-1989	10			T		60 3.6'N	147 34.2'W	TM
	18	51871-20310	15-apr-1989	60	Q			4	60 4.8*N	148 4.8'W	
68	11	51878-20340	22-apr-1989	50	Q			4	69 36.0'N	140 40.2'W	Clouds over water
	11	51910-20333	24-may-1989	5	Q			4	69 37.2'N	140 42.0'W	excellent image of overflow
	11	52182-20263	20-feb-1990	45	Q			4	69 37.2'N	140 49.2'W	
	11	52197-20260	08-mar-1990	0	Q			4	69 37.2'N	140 50.4'W	
	12	51910-20340	24-may-1989	0	Q			4	68 17.4'N	142 22.8'W	
	12	52182-20270	20-feb-1990	5	Q			4	68 18.0'N	142 29.4'W	
	12	52197-20262	08-mar-1990	0	Q			4	68 17.4'N	142 30.6'W	
	13	52133-20284	03-jan-1990	0	Q	u		2	66 57.6'N	143 54.0'W	
	13	52182-20272	20-feb-1990	0	Q			4	66 57.0'N	144 0.0'W	
	13	52197-20265	08-mar-1990	0	Q			4	66 57.0'N	144 0.6'W	
	14	51878-20351	22-apr-1989	35	Q			4	65 34.8'N	145 12.6'W	
	14	52133-20290	03-jan-1990	0	Q	u		2	65 36.0'N	145 15.6'W	
	14	52197-20271	08-mar-1990	0	Q			4	65 35.4'N	145 22.2'W	
	15	51878-20353	22-apr-1989	30	Q			4	64 13.2'N	146 27.0'W	
	15	52133-20293	03-jan-1990	30	Q	u		2	64 14.4'N	146 29.4'W	
	16	52197-20284	08-mar-1990	0	Q			4	62 51.0'N	147 43.2'W	
	17	51862-20364	06-apr-1989	0	Q			4	61 27.6'N	148 36.6'w	
	17	52197-20282	08-mar-1990	2	Q			4	61 28.2'N	148 45.6'W	
	18	51862-20370	06-apr-1989	0	Q			4	60 4.2'N	149 34.2'W	
	18	52133-20304	03-jan-1990	99	Q			2	60 6.6'N	149 36.0'W	
	19	51862-20372	06-apr-1989	0	Q			4	58 40.8'N	150 27.6'W	
	20	51878-20375	06-apr-1989	20	Q			4	57 17.4'N	151 17.4'W	clouds over land
69	8	52045-20354	06-oct-1989	20	Q			4	73 29.4'N	135 49.8'W	
	9	52045-20361	06-oct-1989	0	Q			4	72 13.8'N	138 16.2'W	
	10	52157-20330	26-jan-1990	10	Q			2	70 57.0'N	140 24.0'W	
	11	52045-20370	06-oct-1989	2	Q			4	69 37.8'N	142 18.0'W	
	12	52141-20342	10-jan-1990	0	Q			2	68 0.0'N	143 56.4'W	
	12	52157-20335	26-jan-1990	0	Q			2	68 18.6'N	143 58.2'W	
	13	52141-20344	10-jan-1990	0	Q			2	66 57.6'N	145 27.0'W	
	13	52157-20341	26-jan-1990	0	Q			2	66 58.2'N	145 28.2'W	
	13	52173-20335	11-feb-1990	0	Q			4	66 57.6'N	145 30.6'W	

Sat Path Grid	Row	Scene ID	Date	% Cloud Cover	Quick Look	Color Uniq	Tape	Bands	Center Lat	Center Long	Remarks
	14	51869-20414	13-apr-1989	0	Q			4	65 34.8*N	146 47.4'W	
	14	51965-20395	18-jul-1989	20	Q			4	65 34.8'N	146 48.0'W	
	14	52141-20350	10-jan-1990	0	Q			2	65 36.6'N	146 48.0'W	
	14	52157-20344	26-jan-1990	0	Q			2	65 36.6'N	146 49.8'W	
	14	52173-20341	11-feb-1990	0	Q			4	65 36.6'N	146 52.2'W	
	15	51965-20401	18-jul-1989	1	Q			4	64 13.2'N	148 2.4'W	
	15	52157-20350	26-jan-1990	0	Q			2	64 15.0'N	148 3.6'w	
	15	52173-20343	11-feb-1990	0	Q			4	64 14.4'N	148 6.0'W	
	16	51965-20404	18-jul-1989	1	Q			4	62 50.4'N	149 10.2'W	1.s. anomaly
	16	52061-20381	22-oct-1989	0	Q			4	68 17.4'N	164 0.0'W	
	16	52157-20353	26-jan-1990	2	Q			2	62 52.8'N	149 10.8'w	
	16	52173-20350	11-feb-1990	0	Q			4	62 52.2'N	149 13.8'W	
	17	51869-20425	13-apr-1989	0	Q			4	61 27.6'N	150 11.4'W	
	17	51965-20410	18-jul-1989	L	Q			4	61 27.6'N	150 12.0'W	
	17	52061-20384	22-oct-1989	0	Q			2	62 51.6'N	149 7.8'W	
	17	52157-20355	26-jan-1990	2	Q			2	61 30.0'N	150 13.2'W	
	17	52173-20352	11-feb-1990	0	Q			4	61 29.4'N	150 15.6'W	
	18	51869-20431	13-apr-1989	5	Q			4	60 4.8'N	151 9.0'W	
	18	51965-20413	18-jul-1989	2	Q			4	60 4.8'N	151 9.6'W	
	18	52061-20390	22-oct-1989	20	Q			2	61 28.8'N	150 10.2'w	
	18	52157-20361	26-jan-1990	20	Q			2	60 7.2'N	151 10.2'w	
	18	52173-20355	11-feb-1990	0	Q			4	60 6.6'N	151 12.6'W	
	19	42551-20480	10-jul-1989	20			T		58 25.2'N	151 34.2*W	TM - CCT
	19	51965-20415	18-jul-1989	1	Q			4	58 41.4'N	152 3.0'W	
70	10	52164-20390	02-feb-1990	0	Q			2	70 56.4'N	141 58.8'W	
	11	52148-20400	17-jan-1990	10	Q			2	69 37.8'N	143 51.0'W	
	11	52164-20393	02-feb-1990	30	Q			2	69 37.8'N	143 51.6'W	
	12	52148-20402	17-jan-1990	2	Q			2	68 18.0'N	145 31.8'W	
	12	52164-20395	02-feb-1990	0	Q			2	68 18.6'N	145 32.4'W	
	13	51956-20454	09-jul-1989	30	Q			4	66 56.4'N	146 57.6'W	
	13	52132-20412	01-jan-1990	2	Q			2	66 57.0'N	147 1.8*W	
	13	52148-20405	17-jan-1990	20	Q			2	66 57.6'N	147 1.8'W	
	13	52164-20401	02-feb-1990	0	Q			2	66 57.6'N	147 2.4'W	
	14	51956-20461	09-jul-1989	30	Q			4	65 35.4'N	148 19.2'W	
	14	52132-20414	01-jan-1990	0	Q			2	65 36.0'N	148 22.8'W	
	14	52148-20411	17-jan-1990	75	Q			2	65 36.6'N	148 23.4'W	
	14	52164-20404	02-feb-1990	2	Q			2	65 36.6'N	148 24.0'W	s. half hazy
	15	52132-20421	01-jan-1990	10	Q			2	64 14.4'N	149 37.2'W	
	15	52164-20410	02-feb-1990	2	Q			2	64 15.0'N	149 37.8'W	image is hazy
	16	52164-20413	02-feb-1990	20	Q			2	62 52.8'N	150 45.6'W	image is hazy
	17	52132-20425	01-jan-1990	0	Q			2	61 29.4'N	151 46.8*W	
	17	52164-20415	02-feb-1990	0	Q			2	61 30.0'N	151 47.4'W	
	18	51956-20474	09-jul-1989	30	Q			4	60 5.4'N	152 40.2'W	
	18	52164-20421	02-feb-1990	0	Q			2	60 6.6'N	152 45.0'W	
	18	52180-20415	18-feb-1990	0	Q			4	60 6.0'N	152 46.8'W	
	19	42606-20541	03-sep-1989	20			T		58 25.2'N	153 18.0'W	TM
	19	51956-20481	09-jul-1989	70	Q			4	58 42.0'N	153 33.6'W	Augustine visible

Sat Grid	Path	Row	Scene ID	Date	% cloud Cover	Quick Look	color Uniq	Tape	Bands	Center Lat	Center Long	Remarks
		19	52164-20424	02-feb-1990	0	Q			2	58 43.2'N	153 37.8'W	
		20	42606-20543	03-sep-1989	30			T		57 10.8'N	154 11.4'W	TM
	71	8	52075-20471	05-nov-1989	0	Q			2	73 29.4'N	138 55.8'W	
		9	52075-20474	05-nov-1989	2	Q			2	72 13.2'N	141 22.2'W	
		10	52075-20480	05-nov-1989	80	Q			2	70 55.2'N	143 30.6'W	
		11	52075-20482	05-nov-1989	10	Q			2	69 36.6*N	145 24.0'W	
		12	52155-20462	24-jan-1990	30	Q			2	68 18.6'N	147 3.6'W	
		13	52155-20464	24-jan-1990	2	Q			2	66 58.2'N	148 33.6'w	
		14	51947-20523	30-jun-1989	30	Q			4	65 35.4'N	149 52.8'W	
		14	52139-20473	08-jan-1990	50	Q	v		2	65 36.6'N	149 53.4'W	
		15	51947-20530	30-jun-1989	30	Q			4	64 13.8'N	151 6.6'W	
		15	52139-20475	08-jan-1990	10	Q	u		2	64 14.4'N	151 12.6'W	
		16	51947-20532	30-jun-1989	15	Q			4	62 51.6'N	152 14.4'W	
		16	52075-20502	05-nov-1989	50	Q			2	62 51.0'N	152 18.0'W	
		16	52139-20482	08-jan-1990	10	Q	u		2	62 52.2'N	152 14.4'W	
		17	51947-20535	30-jun-1989	2	Q			4	61 28.8'N	153 16.8'W	
		17	52139-20484	08-jan-1990	10	Q	u		2	61 30.0'N	153 16.8'W	
		17	52155-20482	24-jan-1990	30	Q			2	61 30.0'N	153 18.6'W	
		17	52171-2047S	09-feb-1990	5	Q			4	61 29.4'N	153 21.0'W	
		18	52075-20511	05-nov-1989	40	Q			2	60 5.4'N	154 17.4'W	
		18	52123-20494	23-dec-1989	50	Q	u		4	60 6.0'N	154 15.6'W	
		18	52139-20490	08-jan-1990	0	Q	u		3	60 6.6'N	154 13.8'W	
		18	52155-20484	24-jan-1990	70	Q			2	60 7.2'N	154 16.2'W	
		18	52171-20481	09-feb-1990	0	Q			4	60 6.6'N	154 18.0'W	
		19	52123-20500	23-dec-1989	50	Q			4	58 42.6'N	155 9.0'W	
		19	52171-20484	09-feb-1990	20	Q			4	58 43.2'N	155 11.4'W	
		20	52123-20503	23-dec-1989	30	Q			4	57 18.6'N	155 58.8'W	
	72	9	52162-20510	31-jan-1990	0	Q			2	72 14.4'N	142 55.2'W	
		10	52050-20545	11-oct-1989	30	Q			4	70 56.4'N	145 0.6'W	
		10	52162-20513	31-jan-1990	30	Q			2	70 57.0'N	145 3.6'W	
		11	52050-20551	11-oct-1989	80	Q			4	69 37.8'N	146 54.0'W	
		14	51906-20593	20-may-1989	20	Q			4	65 36.0'N	151 24.6'W	
		14	52050-20563	11-oct-1989	2	Q			4	65 36.0'N	151 26.4'W	
		15	51906-20595	20-may-1989	0	Q			4	64 13.8'N	152 39.0'W	
		16	51906-21002	20-may-1989	20	Q			4	62 51.6'N	153 46.8'W	clouded areas- thin clods
		17	52050-20574	11-oct-1989	20	Q			4	61 29.4'N	154 50.4'W	
		18	52050-20580	11-oct-1989	2	Q			4	60 6.6'N	155 48.0'W	
		19	52050-20583	11-oct-1989	1	Q			4	58 43.2'N	156 41.4'W	
	73	10	51913-21040	27-may-1989	20	Q			4	70 55.8'N	146 33.0'W	
		10	51945-21032	28-jun-1989	0	Q			4	70 55.8'N	146 32.4'W	
		10	51977-21025	30-jul-1989	20	Q			4	70 54.6'N	146 34.2'W	
		11	51913-21043	27-may-1989	20	Q			4	69 37.2'N	148 26.4-W	
		11	51945-21035	28-jun-1989	2	Q			4	69 36.6'N	148 25.8'W	
		11	51977-21031	30-jul-1989	2	Q			4	69 36.0'N	148 27.0'W	
		12	51913-21045	27-may-1989	40	Q			4	68 17.4'N	150 7.2'W	

Sat Grid	Path	Row	Scene ID	Date	% Cloud Cover	Quick Look	color Uniq	Tape	Bands	Center Lat	Center Long	Remarks
		12	52025-21022	16-sep-1989	0	Q			4	68 17.4'N	150 4.2'W	
		12	52121-20594	21-dec-1989	0	Q	u		4	68 17.4'N	150 9.6'W	
		13	52025-21024	16-sep-1989	0	Q			4	66 57.0'N	151 34.8'W	
		13	52121-21001	21-dec-1989	0	Q	u		4	66 57.0'N	151 39.6'W	
		14	52025-21030	16-sep-1989	0	Q			4	65 36.0'N	152 55.8'W	
		14	52121-21003	21-dec-1989	0	Q	v		4	65 35.4'N	153 1.2'W	
		15	52025-21033	16-sep-1989	20	Q			4	64 14.4'N	154 10.2'W	
		15	52121-21010	21-dec-1989	10	Q	u		4	64 13.8'N	154 15.0'W	
		17	51945-21061	28-jun-1989	20	Q			4	61 28.8'N	156 22.8'W	
		18	51945-21063	28-jun-1989	2	Q			4	60 6.0'N	157 19.8'W	
		19	51945-21070	28-jun-1989	1	Q			4	58 42.0'N	158 13.2'W	
	74	10	52160-21035	29-jan-1990	2	Q			2	70 56.4'N	148 9.6'W	hazy image
		11	52160-21042	29-jan-1990	0	Q			2	69 37.8'N	150 3.0'W	hazy image
		12	52160-21044	29-jan-1990	0	Q			2	68 18.6'N	151 43.8'W	hazy image
		13	52160-21051	29-jan-1990	0	Q			2	66 57.6'N	153 13.8'W	
		14	52160-21053	29-jan-1990	0	Q			2	65 36.6'N	154 35.4'W	
		15	52160-21055	29-jan-1990	0	Q			2	64 15.0'N	155 49.2'W	
		16	52160-21062	29-jan-1990	1	Q			2	62 52.8'N	156 56.4'w	
		17	52160-21064	29-jan-1990	5	Q			2	61 30.0'N	157 58.8'W	lots of reflection
		18	52128-21080	28-dec-1989	40	Q			2	60 6.0'N	158 54.0'W	
	75	8	52071-21120	01-nov-1989	0	Q			2	73 29.4'N	145 4.8'W	
		9	52071-21122	01-nov-1989	0	Q			2	72 13.2'N	147 31.8'W	
		10	51895-21164	09-may-1989	2	Q			4	70 55.2'N	149 38.4'W	
		10	51975-21151	28-jul-1989	0	Q			4	70 54.6'N	149 39.6'W	
		10	52071-21125	01-nov-1989	60	Q			2	70 55.8'N	149 39.6'w	
		11	51895-21171	09-may-1989	5	Q			4	69 36.6'N	151 31.8'W	
		11	51975-21153	28-jul-1989	0	Q			4	69 36.0'N	151 33.0'W	
		11	52071-21131	01-nov-1989	10	Q			2	69 36.6'N	151 33.0'W	
		12	51895-21173	09-may-1989	2	Q			4	68 16.8'N	153 12.6'W	
		12	52071-21133	01-nov-1989	40	Q			2	68 16.8'N	153 13.8'W	
		12	52183-21101	21-feb-1990	30	Q			4	68 17.4'N	153 19.2'W	
		13	51895-21180	09-may-1989	0	Q			4	66 56.4'N	154 43.2'W	
		13	52135-21115	04-jan-1990	2	Q	u		2	66 57.6'N	154 42.6'W	
		13	52183-21103	21-feb-1990	0	Q			4	66 57.0'N	154 49.2'W	
		14	51895-21182	09-may-1989	5	Q			4	65 35.4'N	156 4.8'W	
		14	52135-21122	04-jan-1990	0	Q	u		2	65 36.6'N	156 4.2'W	
		14	52183-21110	21-feb-1990	0	Q			4	65 36.0'N	156 10.2'w	
		15	51895-21184	09-may-1989	0	Q			4	64 13.8'N	157 18.6'W	
		15	52119-21132	19-dec-1989	0	Q	u		4	64 13.8'N	154 15.0'W	
		15	52135-21124	04-jan-1990	0	Q	u		2	64 14.4'N	157 18.0'W	
		15	52167-21115	05-feb-1990	0	Q			4	64 15.0'N	157 21.0'W	
		15	52183-21112	21-feb-1990	0	Q			4	64 13.8'N	157 24.0'W	
		16	51895-21191	09-may-1989	0	Q			4	62 51.6'N	158 26.4'W	
		16	52135-21131	04-jan-1990	2	Q	u		2	62 52.2'N	158 25.2'W	
		16	52183-21115	21-feb-1990	0	Q			4	62 51.6'N	158 31.8'W	
		17	51895-21193	09-may-1989	0	Q			4	61 28.8'N	159 28.8'W	

Sat Grid	Path	Row	Scene ID	Date	% Cloud Cover	Quick Look	Color Uniq	Tape	Bands	Center Lat	Center Long	Remarks
		17	52135-21133	04-jan-1990	0	Q	u		2	61 29.4'N	159 27.6'W	
		17	52183-21121	21-feb-1990	0	Q			4	61 28.8'N	159 33.6'W	
		18	51895-21195	09-may-1989	0	Q			4	60 5.4'N	160 25.8'W	
		18	52135-21135	04-jan-1990	20	Q	u		2	60 6.6'N	160 24.6'w	
		18	52167-21130	05-feb-1990	10	Q			4	60 6.6'N	160 28.2'W	
		18	52183-21123	21-feb-1990	0	Q			4	60 6.0'N	160 31.2'W	
		19	51895-21202	09-may-1989	3	Q			4	58 42.0'N	161 19.2'W	
		19	52183-21130	21-feb-1990	0	Q			4	58 42.6'N	161 24.0'W	
		19	52199-21122	09-mar-1990	0	Q			4	58 41.4'N	161 25.2'W	
	77	8	52069-21242	30-oct-1989	0	Q			2	73 29.4'N	148 10.2'w	
		9	52069-21245	30-oct-1989	0	Q			2	72 13.2'N	150 36.6'W	
		10	52037-21261	28-sep-1989	10	Q			4	70 56.4'N	152 45.0'W	
		10	52069-21251	30-oct-1989	10	Q			2	70 55.8'N	152 45.0'W	
		10	52197-21211	07-mar-1990	0	Q			4	70 55.8'N	152 51.6'W	
		11	52037-21263	28-sep-1989	40	Q			4	69 37.2'N	154 38.4'W	
		11	52069-21253	30-oct-1989	50	Q			2	69 36.6'N	154 38.4'W	
		11	52197-21214	07-mar-1990	0	Q			4	69 37.2'N	154 45.0'W	
		12	52069-21260	30-oct-1989	0	Q			2	68 16.8'N	156 19.2'W	
		12	52149-21234	18-jan-1990	20	Q			2	68 18.6'N	156 21.0'W	
		12	52197-21220	07-mar-1990	0	Q			4	68 17.4'N	156 25.2'W	
		13	52069-21262	30-oct-1989	0	Q			2	66 56.4*N	157 49.2'W	
		13	52149-21240	18-jan-1990	1	Q			2	66 57.6'N	157 51.0'W	
		13	52197-21222	07-mar-1990	0	Q			4	66 57.6'N	157 55.2'W	
		14	52133-21244	02-jan-1990	0	Q			2	65 36.0'N	159 10.2'W	
		14	52149-21242	18-jan-1990	0	Q			2	65 36.6'N	159 12.6'W	
		14	52197-21225	07-mar-1990	0	Q			4	65 35.4'N	159 16.8*W	
		15	52133-21251	02-jan-1990	0	Q			2	64 14.4'N	160 24.0'W	
		15	52149-21245	18-jan-1990	1	Q			2	64 15.0'N	160 26.4'W	
		15	52197-21231	07-mar-1990	0	Q			4	64 13.8'N	160 30.6'W	
		16	52133-21253	02-jan-1990	60	Q			2	62 52.2'N	161 31.8'W	
		16	52149-21251	18-jan-1990	0	Q			2	62 52.8'N	161 34.2'W	
		16	52197-21234	07-mar-1990	0	Q			4	62 51.0'N	161 37.8'W	
		17	52149-21254	18-jan-1990	30	Q			2	61 30.0'N	162 36.0'W	
		17	52197-21240	07-mar-1990	30	Q			4	61 28.2'N	162 39.6'W	
	78	12	52156-21293	25-jan-1990	0	Q			2	68 18.6'N	157 52.8'W	
		13	51916-21360	30-may-1989	35	Q			4	66 57.0'N	159 20.4'W	
		13	52140-21302	09-jan-1990	0	Q			2	66 57.6'N	159 20.4'W	
		14	51916-21363	30-may-1989	20	Q			4	65 36.0'N	160 42.0'W	
		14	52140-21304	09-jan-1990	2	Q			2	65 36.6'N	160 42.0'W	
		15	51916-21365	30-may-1989	15	Q			4	64 14.4'N	161 55.8'W	
		15	52140-21311	09-jan-1990	0	Q			2	64 15.0'N	161 55.8'W	
		15	52156-21304	25-jan-1990	50	Q			2	64 15.0'N	161 58.2'W	
		16	51916-21371	30-may-1989	40	Q			4	62 52.2'N	163 3.6'W	
		16	52140-21313	09-jan-1990	0	Q			2	62 52.2'N	163 3.6'w	
		16	52156-21311	25-jan-1990	30	Q			2	62 52.8'N	163 5.4'W	
		16	52188-21301	26-feb-1990	4	Q			4	62 51.6'N	163 10.2'E	

Sat Grid	Path Row	Scene ID	Date	% Cloud Cover	Quick Look	color Uniq	Tape	Bands	Center Lat	Center Long	Remarks
	17	52140-21315	09-jan-1990	40	Q			2	61 30.0'N	164 5.4'W	
	17	52156-21313	25-jan-1990	20	Q			2	61 30.0'N	164 7.8'W	
	17	52188-21303	26-feb-1990	0	Q			4	61 28.8'N	164 12.0'W	
	18	52156-21315	25-jan-1990	10	Q			2	60 7.2'N	165 4.8'w	
	18	52188-21310	26-feb-1990	0	Q			4	60 6.0'N	165 9.6'W	
79	16	52147-21373	16-jan-1990	30	Q			2	62 52.8'N	164 37.2'W	
	18	52147-21382	16-jan-1990	30	Q			2	60 7.2'N	166 36.6'w	
80	8	52074-21425	04-nov-1989	10	Q			2	73 28.8'N	152 49.8'W	
	9	52074-21431	04-nov-1989	20	Q			2	72 13.2'N	155 16.8'W	
	10	52074-21434	04-nov-1989	20	Q			2	70 55.2'N	157 24.6'W	
	10	52154-21411	23-jan-1990	30	Q			2	70 57.0'N	157 24.0'W	
	10	52170-21401	08-feb-1990	0	Q			4	70 56.4'N	157 25.8'W	
	12	52074-21443	04-nov-1989	0	Q			2	68 16.8'N	160 58.8'W	
	12	52154-21420	23-jan-1990	0	Q			2	68 18.6'N	160 58.2'w	
	13	52074-21445	04-nov-1989	0	Q			2	66 56.4'N	162 28.8'W	
	13	52122-21432	22-dec-1989	0	Q	U		4	66 57.0'N	162 28.2'W	
	13	52154-21422	23-jan-1990	40	Q			2	66 58.2'N	162 28.2'W	
	14	52074-21451	04-nov-1989	20	Q			2	65 35.4*N	163 50.4'W	
	14	52122-21434	22-dec-1989	20	Q	u		4	65 35.4'N	163 49.8'W	
	15	52122-21441	22-dec-1989	20	Q	u		4	64 13.8'N	165 3.6'w	
	16	52122-21443	22-dec-1989	40	Q	u		4	62 51.6'N	166 11.4'W	
	17	52122-21450	22-dec-1989	30	Q	u		4	61 28.8'N	167 13.2'W	
81	9	52065-21493	26-oct-1989	80	Q			2	72 13.2'N	156 44.4'w	
	10	52065-21495	26-oct-1989	20	Q			2	70 55.8*N	158 52.8'W	
	11	52065-21501	26-oct-1989	0	Q			2	69 37.2'N	160 46.2'W	
	12	52065-21504	26-oct-1989	0	Q			2	68 17.4'N	162 27.0'W	
	13	52065-21510	26-oct-1989	15	Q			2	66 57.0'N	163 57.0'W	
	13	52129-21492	29-dec-1989	0	Q			2	66 57.0'N	164 0.0'W	
	14	52065-21513	26-oct-1989	2	Q			2	65 35.4*N	165 18.6'W	
	15	52129-21500	29-dec-1989	10	Q			2	64 14.4'N	1.66 35.4'W	
82	10	52168-21530	06-feb-1990	5	Q			4	70 56.4'N	160 31.2'W	
	11	52168-21533	06-feb-1990	0	Q			4	69 37.8'N	162 24.0'W	hazy image
	12	52056-21571	17-oct-1989	10	Q			2	70 55.8'N	158 52.8'W	
	12	52120-21552	20-dec-1989	0	Q	u		2	68 17.4'N	164 3.6'W	
	12	52168-21535	06-feb-1990	0	Q			2	68 18.0'N	164 4.8'W	hazy image
	12	52184-21533	22-feb-1990	0	Q			4	68 17.4'N	164 8.4'W	
	13	52120-21555	20-dec-1989	0	Q	u		2	66 57.0'N	165 33.6'W	
	13	52184-21535	22-feb-1990	0	Q			4	66 57.0'N	165 38.4'w	
	14	52120-21561	20-dec-1989	0	Q	u		2	65 35.4'N	166 55.2'W	
	14	52184-21541	22-feb-1990	0	Q			4	65 36.0'N	166 59.4'W	
	15	52120-21563	20-dec-1989	0	Q	u		2	64 13.8*N	168 9.0'W	
	15	52184-21544	22-feb-1990	0	Q			4	64 13.8'N	168 13.8'W	
	16	52184-21550	22-feb-1990	0	Q			4	62 51.6'N	169 21.0'W	
	17	52184-21553	22-feb-1990	0	Q			4	61 28.8'N	170 22.8'W	

Sat Grid	Path Row	Scene ID	Date	% Cloud Cover	Quick Look	Color Uniq	Color Tape	Bands	Center Lat	Center Long	Remarks
	18	52184-21555	22-feb-1990	0	Q			4	60 6.0'N	171 20.4'W	
83	9	52063-22015	24-oct-1989	25	Q			2	71 13.2'N	159 50.4'W	
	9	52191-21580	01-mar-1990	0	Q			4	12 13.8'N	159 58.8'W	
	10	51903-22060	17-may-1989	60	Q			4	70 55.8'N	161 58.8'W	ice edge visible
	10	52191-21583	01-mar-1990	0	Q			4	70 56.4'N	162 6.6'W	
	11	51903-22062	17-rosy-1989	5	Q			4	69 37.2'N	163 52.2'W	
	11	52191-21585	01-mar-1990	0	Q			4	69 37.2'N	164 0.0'W	
	12	52191-21592	01-roar-1990	0	Q			4	68 17.4'N	165 40.2'W	
	13	52127-22014	27-dec-1989	1	Q			2	66 57.0'N	167 6.6'W	
	14	52127-22021	27-dec-1989	2	Q			2	65 36.0'N	168 27.6'W	
84	9	52198-22040	08-mar-1990	5	Q			4	72 13.2'N	161 32.4'W	
	10	52198-22043	08-mar-1990	5	Q			4	70 55.8'N	163 40.8'W	
	11	52182-22053	20-feb-1990	0	Q			4	69 37.2'N	165 32.4'W	
	11	52198-22045	08-mar-1990	5	Q			4	69 37.2*N	165 33.6'W	
	12	52118-22075	18-dec-1989	0	Q	u		2	68 17.4'N	167 9.6'W	
	12	52182-22055	20-feb-1990	0	Q			4	68 18.0'N	167 13.2'W	
	12	52198-22051	08-mar-1990	5	Q			4	68 17.4'N	167 14.4'W	
	13	52118-22081	18-dec-1989	0	Q	u		2	66 56.4'N	168 40.2'W	
	13	52182-22061	20-feb-1990	5	Q			4	66 57.0'N	168 43.2'w	
	13	52198-22054	08-mar-1990	5	Q			4	66 56.4'N	168 44.4'W	
	14	52118-22084	18-dec-1989	2	Q	u		2	65 35.4'N	170 1.2'W	
	14	52182-22064	20-feb-1990	0	Q			4	65 36.0'N	170 4.2'W	
	14	52198-22060	08-mar-1990	0	Q			4	65 35.4'N	170 5.4'W	
	15	52118-22090	18-dec-1989	20	Q	u		2	64 13.8'N	171 15.0'W	
	15	52182-22070	20-feb-1990	0	Q			4	64 14.4'N	171 18.0'W	
	15	52198-22063	08-mar-1990	0	Q			4	64 13.2'N	171 19.2'W	
	16	52182-22072	20-feb-1990	4	Q			4	62 51.6'N	172 25.8'W	
	16	52198-22065	08-mar-1990	10	Q			4	62 51.0'N	172 27.0'W	
	17	52182-22075	20-feb-1990	0	Q			4	61 29.4'N	173 27.6'W	
	18	52182-22081	20-feb-1990	0	Q			4	60 6.0'N	174 25.2*w	
85	11	51901-22185	15-may-1989	20	Q			4	69 36.6'N	166 57.6'W	
	12	51901-22191	15-may-1989	30	Q			4	68 17.4'N	168 38.4'W	
	13	51901-22193	15-may-1989	2	Q			4	66 57.0'N	170 9.0'W	
	14	51901-22200	15-may-1989	2	Q			4	65 35.4*N	171 30.6'W	clouds over water only
	15	51901-22202	15-may-1989	60	Q			4	64 13.8'N	172 45.0'W	Chaplin (USSR) clear
86	9	51956-22230	09-jul-1989	30	Q			4	72 12.6'N	164 27.6'w	
	10	51956-22232	09-jul-1989	20	Q			4	70 55.2'N	166 36.0'W	
	11	51956-22235	09-jul-1989	40	Q			4	69 36.6'N	168 29.4'W	
88	14	52162-22315	31-jan-1990	2	Q			2	65 36.6'N	176 12.0'W	
	15	52162-22322	30-jan-1990	30	Q			2	64 15.0'N	177 26.4'W	
90	12	52160-22434	29-jan-1990	2	Q			2	68 18.6'N	176 27.0'W	
	13	52160-22440	29-jan-1990	0	Q			2	66 58.2'N	177 57.0'W	

Sat Grid	Path	Row	Scene ID	Date	% Cloud Cover	Quick Look	Color Uniq	Color Tape	Bands	Center Lat	Center Long	Remarks
		14	52160-22442	29-jan-1990	50	Q			2	65 36.6'N	179 18.6*W	
	91	10	52199-22474	09-mar-1990	0	Q			4	70 55.8'N	174 30.6'W	
		11	52199-22481	09-mar-1990	0	Q			4	69 36.6'N	176 23.4'W	
		12	52199-22483	09-mar-1990	0	Q			4	68 16.8'N	178 4.2'W	
		13	52183-22493	21-feb-1990	0	Q			4	66 57.0'N	179 32.4'W	
		13	52199-22485	09-mar-1990	0	Q			4	66 56.4'N	179 34.2'w	
		14	52183-22495	21-feb-1990	0	Q			4	65 36.0'N	179 6.6'E	
		15	52183-22502	21-feb-1990	0	Q			4	64 13.8'N	177 52.2*E	
		16	52183-22504	21-feb-1990	0	Q			4	62 51.6'N	176 45.0'E	
		17	52183-22510	21-feb-1990	0	Q			4	61 28.8'N	175 43.2'E	
	92	12	52030-22594	21-sep-1989	60	Q			4	68 18.0'N	179 27.0'W	
		13	52030-23000	21-sep-1989	30	Q			4	66 57.6'N	179 2.4'W	
		14	52030-23003	21-sep-1989	1	Q			4	65 36.0'N	177 40.8'E	
		15	52030-23005	21-sep-1989	30	Q			4	64 14.4'N	176 27.0'E	
		16	52030-23011	21-sep-1989	25	Q			4	62 52.2'N	175 19.2'E	
		17	52030-23014	21-sep-1989	20	Q			4	61 29.4'N	174 17.4'E	
	94	9	52076-23094	06-nov-1989	2	Q			2	72 13.2'N	176 54.0'W	
		10	52076-23100	06-nov-1989	2	Q			2	70 55.2'N	179 1.8'W	
		11	52076-23103	06-nov-1989	20	Q			2	69 36.6'N	179 4.8*E	
		12	52076-23105	06-nov-1989	20	Q			2	6a 16.8'N	177 24.0'E	
		13	52076-23112	06-nov-1989	0	Q			2	66 56.4'N	175 54.0'E	
		13	52188-23075	26-feb-1990	0	Q			4	66 57.0'N	175 49.2'E	
		14	52076-23114	06-nov-1989	0	Q			2	65 35.4'N	174 32.4'E	
		14	52188-23081	26-feb-1990	0	Q			4	65 36.0'N	174 27.6'E	
		15	52076-23120	06-nov-1989	0	Q			2	64 13.2'N	173 18.6'E	
		15	52188-23084	26-feb-1990	0	Q			4	64 13.8'N	173 13.8'E	
		16	52076-23123	06-nov-1989	0	Q			2	62 51.0'N	172 10.8'E	
		16	52188-23090	26-feb-1990	0	Q			4	62 51.6'N	172 6.6'E	
		17	52076-23125	06-nov-1989	0	Q			2	61 28.2'N	171 9.0'E	
		17	52188-23092	26-feb-1990	0	Q			4	61 28.8'N	171 4.8'E	
		18	52076-23131	06-nov-1989	30	Q			2	60 4.8'N	170 11.4'E	
		18	52188-23095	26-feb-1990	45	Q			4	60 5.4'N	170 7.2'E	

Sat Grid	Path Row	Scene ID	Date	% Cloud Cover	Quick Look Uniq	Color Tape	Bands	Center Lat	Center Long	Remarks
Summary of Entire Report:										
Number of Scenes:		381								
Average:				11						
Min:	57 8		**06-apr-1989**	0				55.89	-179.57	
Max	**94 21**		09-mar-1990			99			**73.49**	179.11

Where Clause (up to 255 characters of it) used to select this data:

sdate>='4/1/89' and **sdate<='3/31/90'** and **grid='4'**

(Please note that the user may have manually reduced the selected data further.)

Appendix III. List of AVHRR satellite imagery showing the position of the ice edge in the vicinity of St Matthew Island.

Date	Orbit	GMT	COMMENTS
12/27/89	OB17014	361:05:14	Island cloudy but visible; ice edge north
	OB17022	361:18:57	Ice edge visible and north of Island; Island cloud covered.
12/28/89	OB06495	362:23:30	Ice edge visible and north of Island; Island cloud covered.
12129189	OB06503	363:13:20	Ice edge visible and north of Island; Island cloud covered.
	OB06509	363:23:19	Ice edge visible and north of Island; Island cloud covered.
	OB17051	363:19:52	Ice edge visible and north of Island; Island cloud covered.
12/30/89	OB06518	364:14:51	Ice edge visible and really clear.
	OB06523	3642309	Ice edge visible and north of Island; Island cloud covered.
	OB17057	364:05:47	Very nice one with both island and ice edge visible.
12131/89	OB17071	365:05:24	Ice edge visible and north of Island; Island cloud covered.
1.11.190	OB 06546	001:14:29	Ice edge visible and north of Island; Island cloud covered.
1/3/90	OB06566	003:00:18	Ice edge visible and north of Island; Island cloud covered.
	OB06574	003:14:08	Ice edge visible and north of Island; Island cloud covered.
	OB17114	003:05:56	Ice edge visible and north of Island; Island cloud covered.
1/4/90	OB17136	004:19:16	Ice edge visible and north of Island; Island cloud covered.
I/5/90	OB06608	005:23:46	Ice edge visible and north of Island; Island cloud covered.
1/6/90	OB06616	006:13:36	Ice edge might just be touching St. Matthew
	OB17156	006:04:39	Ice edge against Island ?; only l/2 of island; BEST image
	OB17157	006:06:00	No FAX
	OB17165	006:20:11	Ice edge visible and north of Island; Island cloud covered.
1/8/90	OB06645	008:14:56	Ice edge looks close
	OB17193	008:19:26	Ice edge looks close
	OB06650	008:23:43	Digitally processed, ice edge NOT at St. Matthew I.
I/9/90	OB06651	009:00:57	Ice edge looks close
1/10/90	OB17222	010:20:21	Ice edge looks close
I/11/90	OB17236	011:19:58	Ice edge looks close
1/12/90	OB06693	012:00:27	Difficult to interpret
	OB06701	012:14:12	Very nice, no visible bands; should digitally process
	OB17250	012:19:35	Digitally processed; unsuitable; no visible bands
1/14/90	OB06729	014:13:51	Looks nice and clear
1/15/90	OB17293	015:20:08	Looks nice and clear
	0B06749	015:23:39	Difficult to interpret
I/16/90	OB17299	016:06:03	Looks nice and clear
	OB17307	016:19:45	Very nice, except no visible bands; should look at
	OB06763	016:23:58	Ice edge looks close
I/17/90	OB06764	017:01:12	Ice edge looks close
	OB17313	017:05:40	Very nice, except no visible bands; should look at
1/18/90	OB06786	018:14:49	Ice edge at Island
	OB17335	018:19:00	Ice edge at Island
	OB17336	018:20:40	Ice edge at Island
#19/90	OB06792	019:00:50	Ice edge at Island
	OB17341	019:04:54	Ice edge at Island

Date	Orbit	GMT	COMMENTS
	OB17342	019:06:36	Ice edge at Island
l/20/90	OB17356	020:06:13	Ice edge around Island, Island cloudy
1/23/90	OB06862	023:23:55	Ice edge at Island
	OB17407	023:20:27	Ice edge around Island, Island cloudy
1/24/90	OB06870	024:13:45	Ice edge around Island, Island cloudy
	OB06876	024:23:44	Ice edge around Island, Island cloudy
	OB17421	024:20:04	Polynya forming; good image
1.125/90	OB06884	025:13:34	North coast frozen into the ice edge
	OB06890	025:23:33	Polynya formed; good image
	OB17427	025:06:00	Polynya formed; good image
	OB17435	025:19:41	Polynya formed; good image
1/26/90	OB06898	026:13:23	Polynya formed; good image
	OB06899	026:15:04	Polynya formed; good image
	OB17441	026:05:36	Polynya formed; good image
	OB17449	026:19:18	Polynya formed; good image
1/27/90	OB06913	027:14:53	Polynya formed; cloudy
	OB17455	027:05:13	Polynya formed; good image
l/28190	OB06919	028:00:54	Large polynya formed; good image
	OB17469	028:04:50	Polynya formed; good image

Figure 2. Thermal infrared (band 4) AVHRR satellite image of Port Moller, 8 May 1989. Colors were assigned to specific ranges of digital numbers to delineate sea surface temperature (SST) patterns. The patterns are shown as gray tones on this black and white print of the original color image. Radiant temperature values range from 5.8° C in southern Port Moller Bay (A) and Herendeen Bay (B) to 0.20 C in Bristol Bay (C). The image has been registered to a topographic data base for geographic reference.

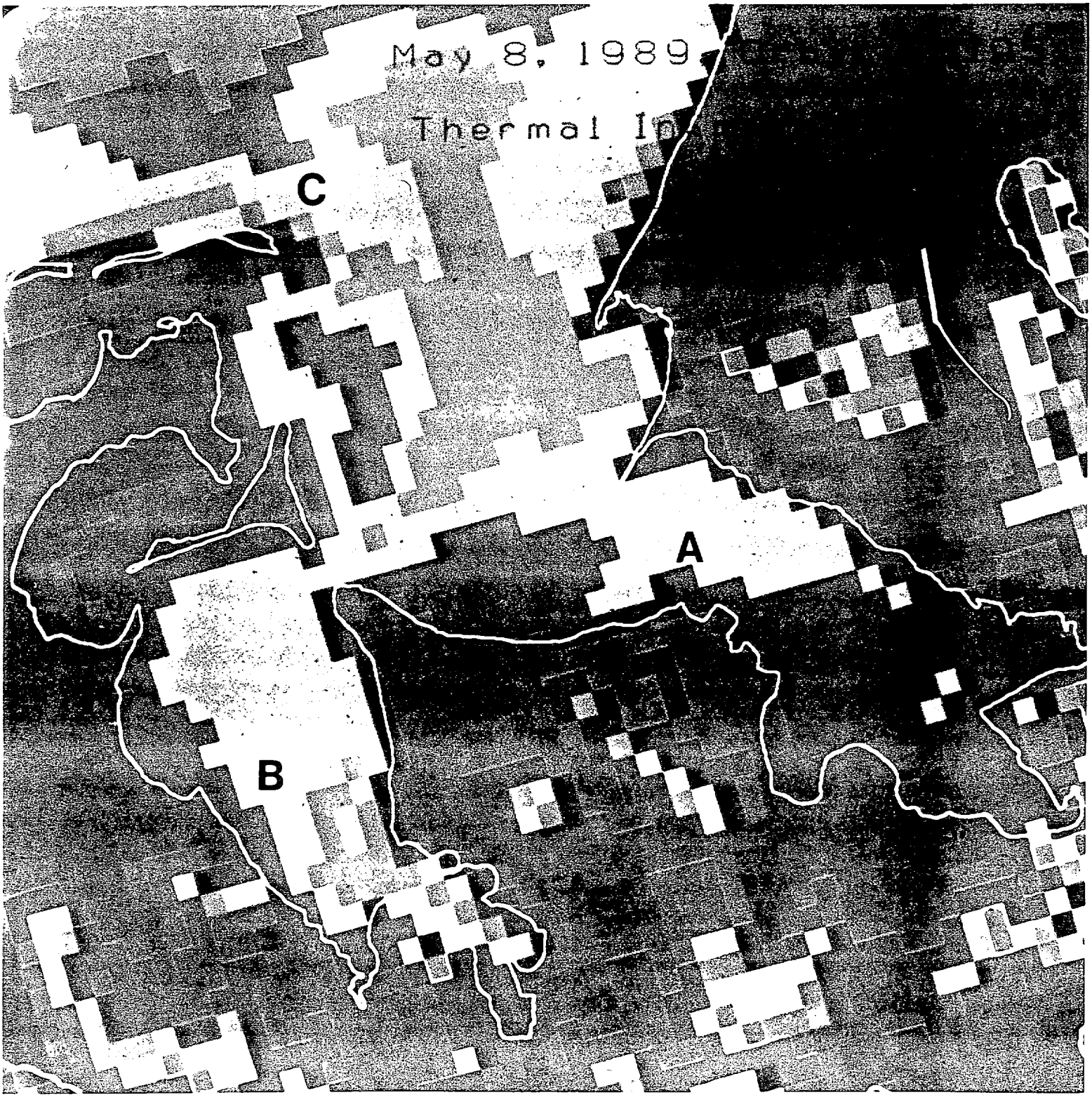

May 8, 1989
Thermal In
C
A
B

Figure 3. Near-infrared AVHRR satellite image of the ice edge in the Beaufort Sea, 6 October 1989. The ice edge (A) is approximately 100 km off shore from Cape Bathurst (B), Canada and approximately 250 km offshore from Herschel Island (C). Most of the coast along the bottom of the image is obscured by clouds as is sea ice to the upper left. This print was produced from a color image and thus the contrast is significantly degraded.

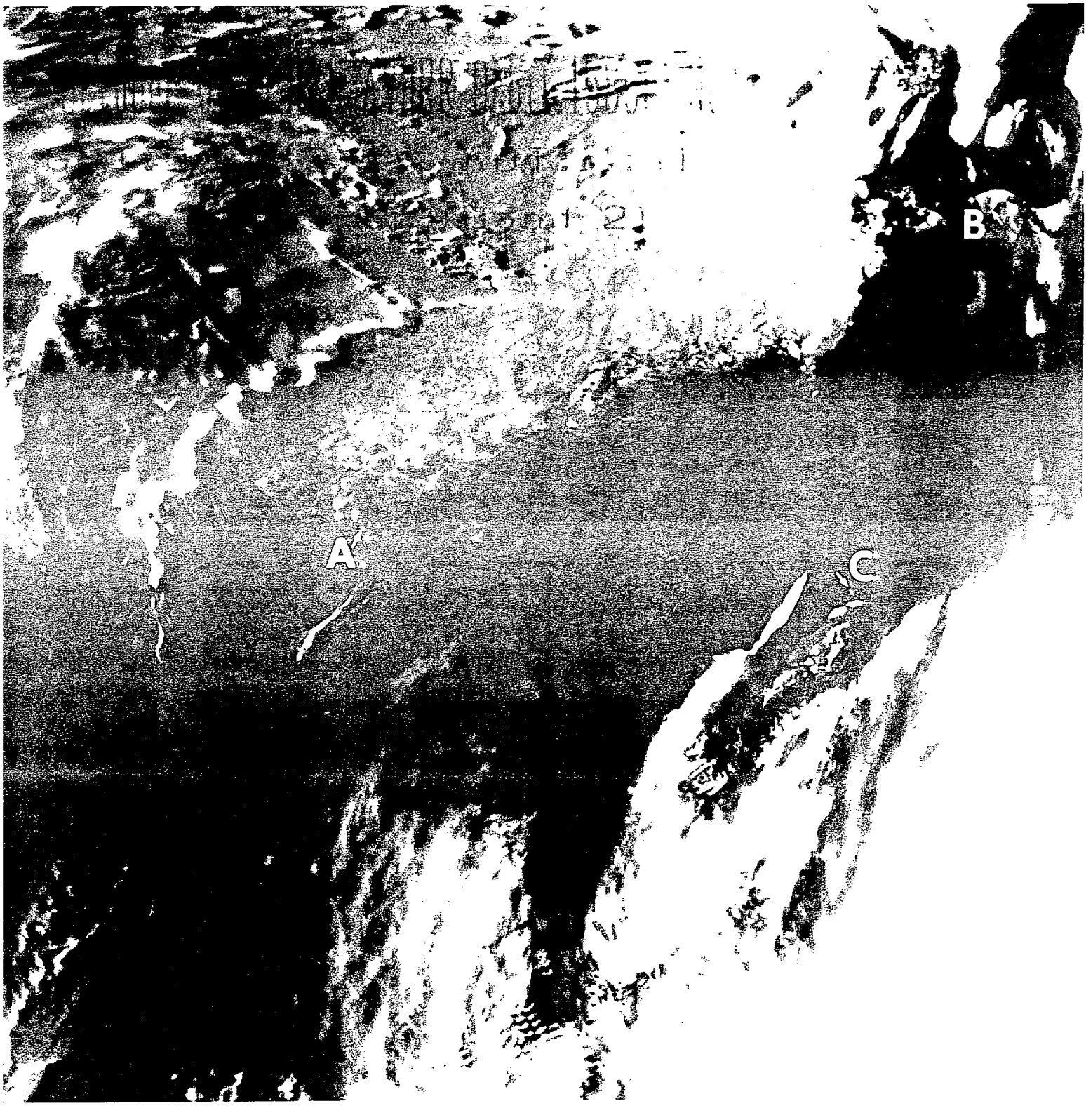

B
A
C

Figure 4. Visible-band AVHRR satellite image of a lead in the Beaufort Sea ice, 28 May 1989. This image was recorded eight days after this large lead developed off shore from Point Barrow. Images such as this one were recorded before and after the opening of the lead.

GMT:148:13:57--ADT:05:57
Visible (Band 1)
Pt. Barrow
May 28, 1989, OB03471, NOAA-11

Figure 5. Landsat MSS satellite image of Kasegaluk Lagoon (A), 1 September 1984.. This visible-red band image was enhanced to show spectral difference in the water within the lagoon. The digital data was derived by scanning photographic prints of the image.

SEPT, 01
A
A