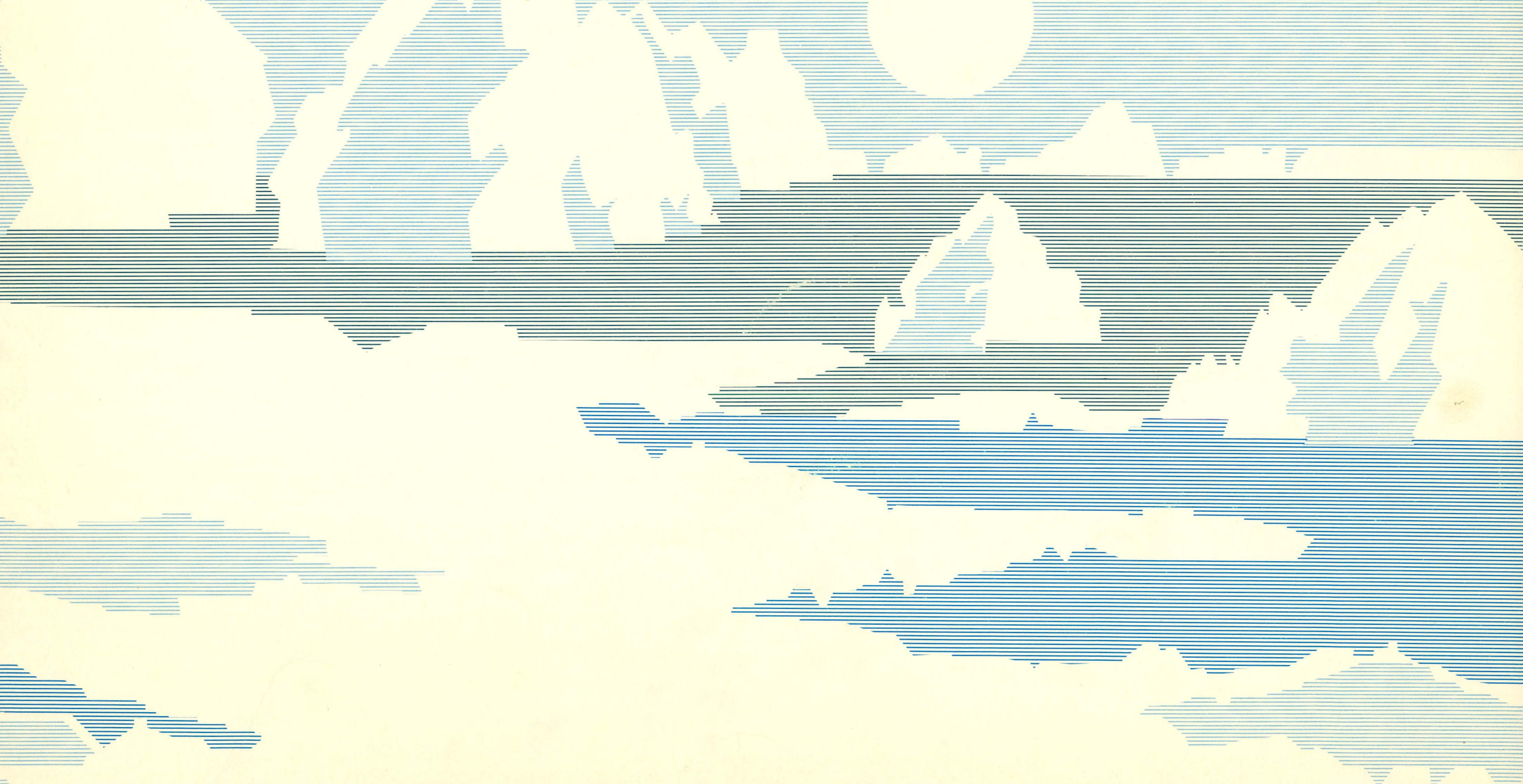
Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Sea Ice Atlas of Arctic Canada 1975-1978

by
D.G. Lindsay



1981

Available by mail from

Printing and Publishing
Supply and Services Canada
Ottawa, Canada K1A 0S9

or through your bookseller.

Catalogue No. M78-4/1978E — Canada: $30.00
ISBN 0-660-11024-5 — Other Countries: $36.00

Price subject to change without notice.

SEA-ICE ATLAS OF ARCTIC CANADA 1975-1978

D. G. LINDSAY

Prepared in Ottawa for the Department of Energy, Mines and Resources. Contracts OSQ4-0147, OSQ5-0122, OSQ77-00006 and OSQ78-00062 provided the guidelines for the work.

The maps were prepared by the Polar Continental Shelf Project and produced by the Map Reproduction Centre, Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa, 1980.

Published under the authority of the Honourable Marc Lalonde, Minister of Energy, Mines and Resources, Government of Canada.

PREFACE

The results of aerial sea-ice observations made by the Polar Continental Shelf Project, Department of Energy, Mines and Resources along with pertinent information from other agencies, both government and private, for various intervals between April and November, from 1975 through 1978, are shown in this atlas. The observations were made in the Queen Elizabeth Islands and adjacent areas including the Arctic Ocean, Beaufort Sea, and Parry Channel and the channels connecting them as well as Nares Strait. Two previous atlases, published in 1976 and 1977, describe the sea-ice conditions from 1961 through 1968 and from 1969 through 1974 respectively.

This atlas, like its predecessors, shows the geographical distribution and extent of the various types of sea ice, and their characteristic features at various times throughout the years. The observations recorded on each map were made over as short a time as operationally feasible—usually three to eight days—in order to give a more or less simultaneous overall view of the state and extent of sea ice in the Canadian Arctic at selected intervals. Thus this atlas is an historical record of the sea ice; it also provides sequential observations on the dynamic and constantly changing phenomena which dominate the marine areas of arctic Canada.

The purpose of the atlas is to make available, in comprehensive cartographic form, the reliable information available about sea ice in the areas covered, for the periods indicated. The information on the maps is supplemented by written descriptions which emphasize special features of the sea-ice cover at the times portrayed and describe the geographical and chronological changes throughout each season: the progression of break-up, the process of ablation, the pattern of movement and the sequence of freeze-up. It is hoped that these descriptions will increase the usefulness of the information shown on the maps and add to the significance of changes or similarities between successive maps or between different years. This atlas includes maps which show the routes taken and the visibilities encountered during each track, so that the reliability and extensiveness of the observations can be assessed if necessary and information from other sources can be compared or amalgamated with that given here. One black and white satellite photo, 15.8 x 15.8 cm with a scale of 1:1,000,000, has been selected to accompany each sea-ice map to show the actual ice conditions in a specific area and to help the user visualize conditions in other areas represented by a combination of colours, line patterns, symbols and numerical expressions.

The maps comprising the atlas have been arranged in sequence from 1975 to 1978. A seasonal summary introduces each year; and the written description, track routes, and map and satellite photographs are on the page facing the map to which they refer. This atlas is the last in the series. The sea-ice reconnaissance project was terminated in December, 1978.

CANADA THEN AND NOW

Maps of the Nations Growth
1867 - 1982.

This folder contains three new maps produced by Energy, Mines and Resources Canada. They portray the early geography of Canada and the progressive evolution of provincial and territorial boundaries, culminating with Canada as it is today.

CANADA - CONFEDERATION
Scale 1:7 500 000

The beginnings of Canada in 1867 are shown on this map. Names of cities, towns and villages, and the populations of the time are depicted, along with development of rail and road networks and important trails leading West. Major trading posts are also highlighted.

CANADA - TERRITORIAL EVOLUTION
Scale 1:7 500 000

Witness the country's evolution and important boundary changes through a colourful scheme showing the progressive growth and development of Canada. A useful chronological table outlines the dates and events connected with this growth.

CANADA
Scale 1:7 500 000

This map showing Canada in 1982 is the most modern small-scale map of the nation in recent years; it is a must for amyone who wants a good general-purpose map. The relief of the land, principal topography and information on the depths of the seas around Canada are shown. You will appreciate the fine delineation of the most important place names, transporation routes, major national parks, lakes, rivers and glaciers.

(over)

LE CANADA D'HIER À AUJOURD'HUI

Les cartes de l'histoire d'un pays
1867 - 1982.

Les trois nouvelles cartes dans cette pochette, qui ont été produites par Énergie, Mines et Ressources Canada, illustrent l'évolution de la nation canadienne: le Canada de la Confédération, la croissance des provinces et des territoires et le Canada d'aujourd'hui.

CANADA - CONFÉDÉRATION
Échelle: 1:7 500 000

Cette première carte dépeint le Canada en 1867, au moment de la Confédération. Les villes et les villages de l'époque, avec leur population, y apparaissent. La carte illustre de plus le développement des routes et des voies ferrées, et les pistes menant vers l'Ouest. Les principaux postes de traite y sont aussi indiqués.

CANADA - ÉVOLUTION TERRITORIALE
Échelle 1:7 500 000

C'est à travers un habile jeu de couleurs qu'on voit le Canada prendre de l'expansion etles provinces et territoires émerger tour à tour, sur cette deuxième carte. Un tableau qui accompagne la carte indique par ordre chronologique les événements qui ont marquécette croissance et l'établissement des provinces et territoires.

CANADA
Échelle 1:7 500 000

Cette carte à petite échelle du Canada de 1982 est la plus moderne à ce jour. Même s'il s'agit d'une carte générale, elle contient une foule de renseignements, allant du relief du pays à la profondeur de la mer, au large des côtes, en passant par la topographie générale du Canada. Une attention particulière a été accordée à la présentation graphique des centres importants, du réseau de transport et des principaux parcs nationaux, lacs, rivières et glaciers.

(voir verso)

These beautiful maps measuring 90 X 80 centimetres are available in separate English and French versions; convenient for table-top reference but also very suitable for wall display and framing.

Available through map dealers or the Canada Map Office.

Ces magnifiques cartes mesurant 90 cm sur 80 cm sont disponibles en anglais et en français. En plus de constituer une excellente source de renseignements, elles se prêtent merveilleusement à l'encadrement et sauront agrémenter un mur de toute pièce.

En vente par l'entremise des vendeurs de cartes ou du Bureau des cartes du Canada.

Price / Prix

Canada $ 5.95 Canada

Other Countries $ 7.15 à l'étranger

Flat copies of these maps avaible @ $3.50 per copy.

Provincial Sales Tax for the provinces listed must be included:

- *Quebec* 9%
- *Ontario* 7%
- *British Columbia* 6%

Les exemplaires en feuilles sont disponibles au prix de $3.50 chaque.

La taxe provinciale de vente s'appliquant aux provinces énumérées ci-dessous doit être ajoutée

- *Québec* 9%
- *Ontario* 7%
- *Colombie-Britannique* 6%

CONTENTS

ABSTRACT

Systematic aerial surveys of sea ice in the Canadian Arctic Archipelago and adjacent waters were started by the Polar Continental Shelf Project in 1961 and were concluded at the end of 1978. During these years, at various intervals between March and November, successive sets of observations have been made of distributions of sea-ice types and features, progression of break-up, advance of ablation, patterns of movement and the sequence of freeze-up. These observations, for 1974 to 1978, are presented on 64 coloured maps, 28 x 38 cm, accompanied by written descriptions, selected satellite imagery and seasonal summaries.

This atlas is the last of a set of three. The first, entitled ***Sea Ice Atlas of Arctic Canada 1961-1968*** was published in 1976. The second volume ***Sea Ice Atlas of Arctic Canada 1969-1974*** was published in 1977.

INTRODUCTION

The Polar Continental Shelf Project, Department of Energy, Mines and Resources, has carried out investigations of the sea ice of Arctic Canada since 1958. The first formal field program of sea-ice observations was started in 1961 and continued each year until the conclusion in the fall of 1978. The main aims of the program were to observe and map the types, nature, distribution, break-up, ablation, movement and freeze-up of sea ice found throughout the Canadian Arctic Archipelago. Other objectives were to determine and describe typical patterns that recurred and to provide information to the Atmospheric Environment Service (AES), the Ministry of Transport (MOT) and other agencies who require and request this type of information.

The results of the early years are included in a report entitled ***Sea Ice Atlas of Arctic Canada 1961-1968*** published in 1976. The second volume ***Sea Ice Atlas of Arctic Canada 1969-1974***, published in 1977, differs in two main ways from its predecessor. First, the area regularly surveyed is larger, the map scale is larger and two maps, one for the eastern region and one for the western region, are used to show the information for each flight. Secondly, the terminology used to present the information on the maps was changed to correspond with World Meteorological Organization (WMO) conventions. This, the third and final atlas in the series, closely follows the format of volume two. The report is divided into sections, one for each calendar year. Each section shows the results of a series of flights. A flight consists of a number of reconnaissance surveys or tracks and may include data collected from between two and eleven tracks. The number of tracks per flight varies depending on weather, available flying time, and the schedule of flying required to observe as much as possible of the entire area without duplicating similar surveys conducted by other government agencies.

A seasonal summary outlining the general ice regime for each year is presented at the beginning of each section. Every sea-ice map is accompanied on the facing page by a written description, a figure showing the track routes and a photograph from a satellite. The description outlines progressive changes in ice conditions and a paragraph entitled "Unobserved Areas" indicates the ice conditions inferred or known to exist in nearby regions which were not observed directly. The last paragraph in the description for each map includes the author's comments about features that are not immediately evident on the map. The figure showing the track routes indicates the direction and path followed during each track. The dates, times, and points of departure and arrival are listed for each track. Visibilities encountered during the survey are shown beside the track route to enable the reader to appreciate the weather conditions as the observer recorded data along each track. The black and white satellite photograph shows, in some detail, the ice conditions for a small part of the area shown on the main map. The location of the photograph is shown on the track routes map and on the main sea-ice map and is included to help the user visualize the numerical codes, symbols, colours and line patterns shown on the main map.

Two reference maps, one for the eastern area and one for the western area showing the names of places, islands and water bodies, are included at the beginning and end of the atlas. A legend of symbols and terminology is included with each main map to assist the user.

PROGRAM

Between 1975 and 1978 all of the in-flight, sea-ice data collected by the Polar Continental Shelf Project were recorded on maps with a scale of 1:1,000,000 especially prepared for sea-ice information. Under normal observing conditions, one complete set of observations including the numerical figures representing ice types, concentrations and surface features were recorded on these maps in the form of fractions at five-minute intervals. Pertinent boundaries separating unique types of ice and distinguishable zones between concentrations were also noted. These fractions and boundaries were recorded and drawn continuously whenever visibility permitted. This information was subsequently concentrated, reduced and transferred by the observer to a map at a scale of 1:2,622,000. Normally three or four field observations were combined to form one of the fractions shown on the drafted or main sea-ice map. After these maps were drafted they were photographically reduced to a scale of approximately 1:5,317,000, the scale of the maps in this atlas.

In the field the observer planned the route for each separate survey, referred to as a track, on the basis of the need to know and according to the existing and forecast weather in order to maximize the amount of data to be collected. Efforts were made to determine the activities of the AES ice reconnaissance flights in order to avoid duplicating observations and to provide complimentary data. The results of the care and planning of the observers are evident in the following maps.

Two types of aircraft were used to transport the observer: a Beechcraft 18 for the first series of flights and a Twin Otter for the flights carried out in the latter part of the season. The author, under contract with the Department of Energy, Mines and Resources, and under the direction of the Director of the Polar Continental Shelf Project, was required to plan and direct the field programs and to analyse and prepare the results of the field surveys for publication in their present form.

As the information in the following table suggests, only relatively minor changes took place in the program between 1975 and 1978. Most of these were related to poor weather or the logistics of maintaining an aircraft in the Arctic. This table does not include the hours flown when the observers joined other flights carried out by the Polar Continental Shelf Project as supply missions for other projects because these flights were not charged against the bank of hours reserved for sea-ice reconnaissance.

TABLE 1
Summary of Reconnaissance
1975-1978

YEAR	PERIOD OF OBSERVATION	NO. OF MAPS	NO. OF TRACKS	HOURS FLOWN
1975	April 1-October 18	16	90	440
1976	April 5-October 17	16	81	453
1977	April 15-October 18	16	81	466
1978	April 1-October 20	16	98	435

All of the work for this atlas, 1975 through 1978, was completed under the guidance of the Director of the Polar Continental Shelf Project, G.D. Hobson. Observations for the first flight of 1975 were made by B. Alt. The next 23 flights, seven in 1975, eight in 1976, eight in 1977, and the last three in 1978, were completed by K. Peister. The first five flights in 1978 were carried out by J. Carmichael.

ACKNOWLEDGMENTS

I wish to express my special thanks and gratitude jointly to Ken Peister for his superior skills as an ice observer during the many years we have worked together and to the dedication, dependability, and competence of Peter Hermann, who co-ordinated and/or completed all drafting and associated tasks for this volume as well as the two previous ones. I have been very fortunate to have had the help, understanding, and encouragement during all of the various phases of the work from George D. Hobson, the Director of the Project. The ice observing work carried out by B. Alt and J. Carmichael is very much appreciated.

Many other people were involved in the preparation of this atlas. When the observers were in the field, their ability to collect the amount, type and quality of data required was

only made possible by the efforts of the Polar Continental Shelf Project team who organized and provided all field support and logistics. The skill, co-operation and continuous efforts of the pilots and their engineers and the facilities rented to us at Arctic weather stations by the AES (Atmospheric Environment Service) were very useful. Similarly I would like to acknowledge the valuable suggestions and fine craftsmanship provided by the various photo-mechanical specialists of the Map Production Division of the Surveys and Mapping Branch.

TERMINOLOGY AND REPORTING SYSTEM

The terminology used in this atlas is the same as that described in the WMO (World Meteorological Organization) publication entitled *WMO Sea-Ice Nomenclature*, designated as WMO-No. 259,TP, 145. The first edition of this report was published in 1970 by the Secretariat of the WMO in Geneva, Switzerland. Since that time, various supplements have been issued to keep it up to date. These have been adapted where pertinent.

Terminology

The basic explanation of all terminology and symbols used in this atlas is given below. For a full and illustrated glossary see the WMO publication mentioned above.

Ice Types:

New ice—A general term used for recently formed ice composed of ice crystals which are only weakly, if at all, frozen together.
Nilas—A thin elastic crust of ice which is readily bent rather than fractured by waves, swell or pressure. Nilas ranges up to 10 cm in thickness.
Young ice—Ice in the transition stage between nilas and first-year ice, 10 to 30 cm in thickness. It can be subdivided into grey ice and grey-white ice.
Grey ice—Young ice 10-15 cm in thickness. Less elastic than nilas and breaks on swell. Usually rafts under pressure.
Grey-white ice—Young ice 15-30 cm in thickness. Under pressure more likely to ridge than to raft.
First-year ice—Sea ice of not more than one winter's growth, developing from young ice with a thickness greater than 30 cm.
Second-year ice—Ice which has survived one summer's melt.
Multi-year ice—Ice which has survived two or more summer's melt.
Open water—A large area of water in which sea ice is present in concentrations less than one-tenth of the total area.

Ice Forms:

Rafting—The overriding of one piece of ice upon another; the result of such action.
Ridging—The pressure process by which ice is forced into ridges. A ridge is a wall of broken ice as a result of ridging.
Hummocking—A hump of ice formed by: a) ablation of an ice sheet through more than one year, b) ablation of rafted ice, c) ablation of ridges.
Puddling—An accumulation of water on the ice.
Thaw holes—Vertical holes through an ice cover formed when surface puddles melt through to the underlying water.
Frozen puddles—The result when ice forms across a puddle.
Iceberg—A piece of ice either afloat or aground rising more than 5 m above sea level which has broken away from a glacier and is generally larger than a house.
Ice Island—A form of tabular iceberg. A large flat piece of floating or grounded fresh-water ice generally extending about 3 m above sea level which has broken away from an arctic ice shelf. Characterized by a regularly undulating surface which gives it a ribbed appearance from the air.
Strip—A long narrow distinct string of small ice fragments.

Floe Size:

Brash ice—Accumulations of floating ice made up of fragments not more than 2 m across.
Small floe—A piece of floating sea ice from 2 to 100 m across.
Medium floe—A piece of floating sea ice from 100 to 500 m across.
Big floe—A piece of floating sea ice from 500 to 2000 m across.

Conventions and Symbols used on the maps

Each of the maps in this atlas has a legend which gives a brief explanation of the system used to show the observed conditions. A more detailed description of the various components of the system is presented in the following paragraphs.

The first of the three types of boundary used to indicate limits or divisions is the Observed boundary. On the map this is the thin solid black line which shows the limits of two different dominant types of ice or the limits for specific concentrations of the same type of ice. An Assumed boundary is a thin broken black line used on the map when the junction between ice types or concentrations was not directly observed or readily determined. The third type, Limit of visibility, is shown by the edge of a graphic pattern and colour that is not bounded by a line on the map. In most cases this unbounded limit suggests that similar ice types and concentrations extend for some distance beyond it.

The concentration or coverage and the types or ages of sea ice are represented on the maps by a combination of four colours and four line patterns in addition to the numerical expression given in the form of a fraction. The line patterns and colours have been included to assist the user to see the general types, patterns and colours at first glance without reference to the details provided by the fractions and symbols.

Ice concentrations have been grouped into four categories. Each category corresponds roughly to the ease of navigation through the ice. These categories of concentrations are shown on the maps by directional patterns of lines. Most ice-going vessels can move through concentrations from one- to four-tenths regardless of the type or age of ice which predominates. Ice in this range is shown on the maps by broken diagonal lines. Passage through ice of the next range, from four- to seven-tenths, shown by vertical lines, can be accomplished with some difficulty. The category including concentrations from seven- to ten-tenths, shown on the map by solid diagonal lines, requires an icebreaker. The final concentration pattern, crossed lines, represents a ten-tenths ice cover (no water) and indicates that the entire area is completely solid or consolidated. An additional category which ranges from less than one-tenth to no ice at all is classed as open water and the letters OW are put on the map along with the characteristic colour to show these areas.

There are a variety of different types of sea ice. Usually an ice field is made up of varying concentrations of each type although occasionally one type will exist as a distinct and separate entity over a large area. To help the user interpret the map, the various ice types have been put into three groups based on the age of the ice. The system used to determine the predominant type of ice and the colour shown on the map is based on the oldest type for which the concentration is three-tenths or more. Where this convention cannot be applied, the colour shows the ice which appears to dominate.

In addition to the patterns and colours, the ice types and their concentrations are shown on the map by expressions similar to fractions which give the specific detail observed for that locality. The numbers in the numerator indicate the tenths of ice of each type present and the denominator shows the tenths of the ice floes of each type that are medium or larger in size. The numbers in the numerator of the fraction which indicate the ice types are always recorded in the same sequence. The example in the legend of each map shows this sequence. Another part of the fraction expression shows the presence and abundance of sea-ice types and features. The numerator symbols indicate the type or feature and the demominator shows its occurrence in tenths of the total ice cover in the vicinity.

Terms

The following selected list gives definitions for terms commonly used in the written descriptions which accompany each map:
Calving—The breaking away of a mass of ice from a glacier, ice shelf, iceberg or ice island.
Concentration—The ratio in tenths of the sea surface actually covered by ice to the total area of the sea surface, both ice-covered and ice-free, at a specific location or over a defined area.
Fast-ice—Sea ice which forms and remains fast along the coast where it is attached.

Floe—Any piece of sea ice 20 m or more across.
Ice cover—The ratio of an area of ice of any type or concentration to the total area of sea surface within some large geographic area.
Ice edge—The demarcation between the open sea and sea ice.
Pack ice—A term used in a wide sense to include any area of sea ice, other than fast ice, no matter what form it takes or how it is disposed.
Polynya—Any nonlinear-shaped opening of water enclosed by a solid ice cover.
Rotten ice—Sea ice which has become honeycombed and which is in an advanced state of disintegration.
Sea ice—Any type of ice formed at sea which has originated from the freezing of seawater.

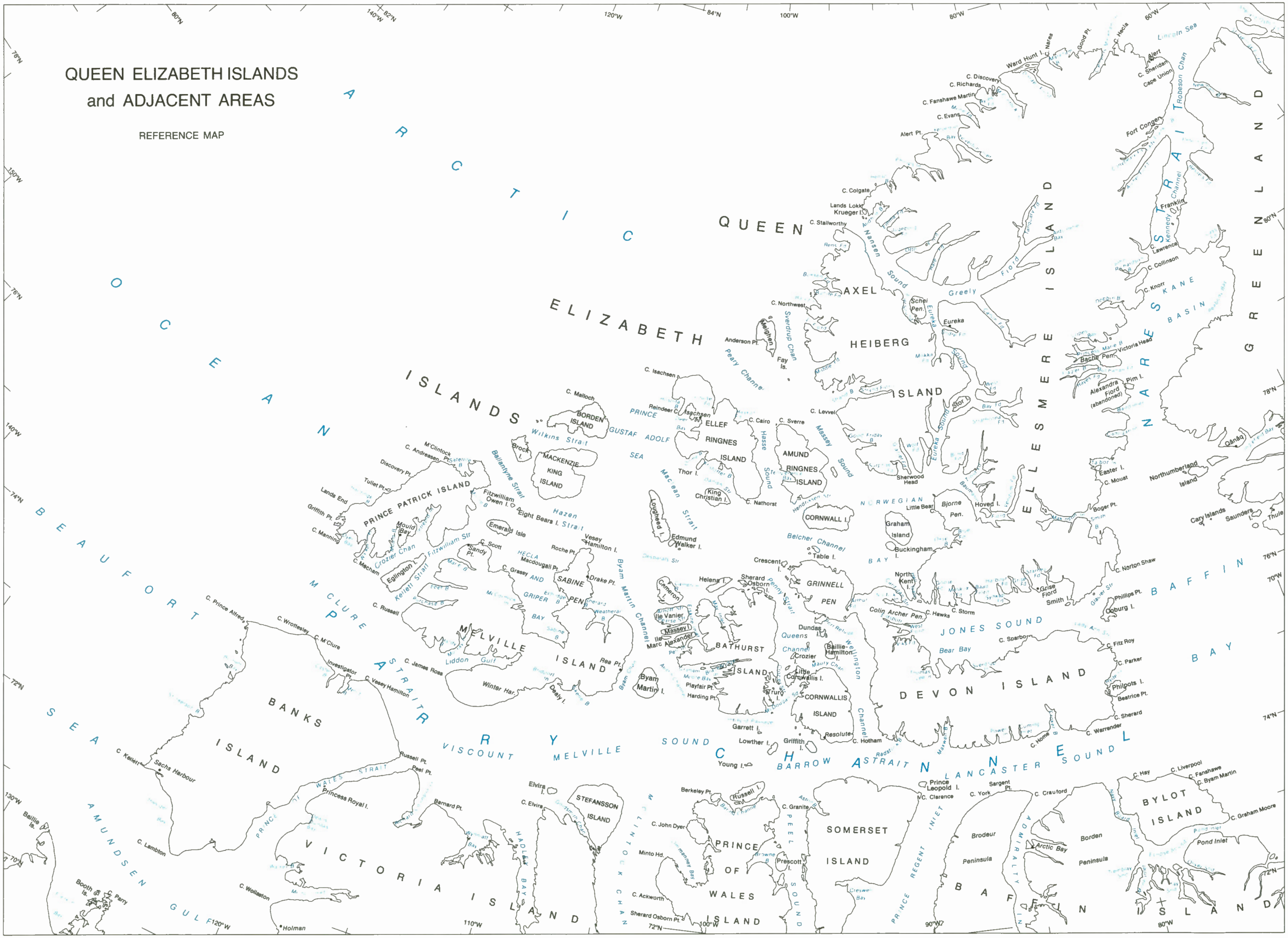
Satellite photographs

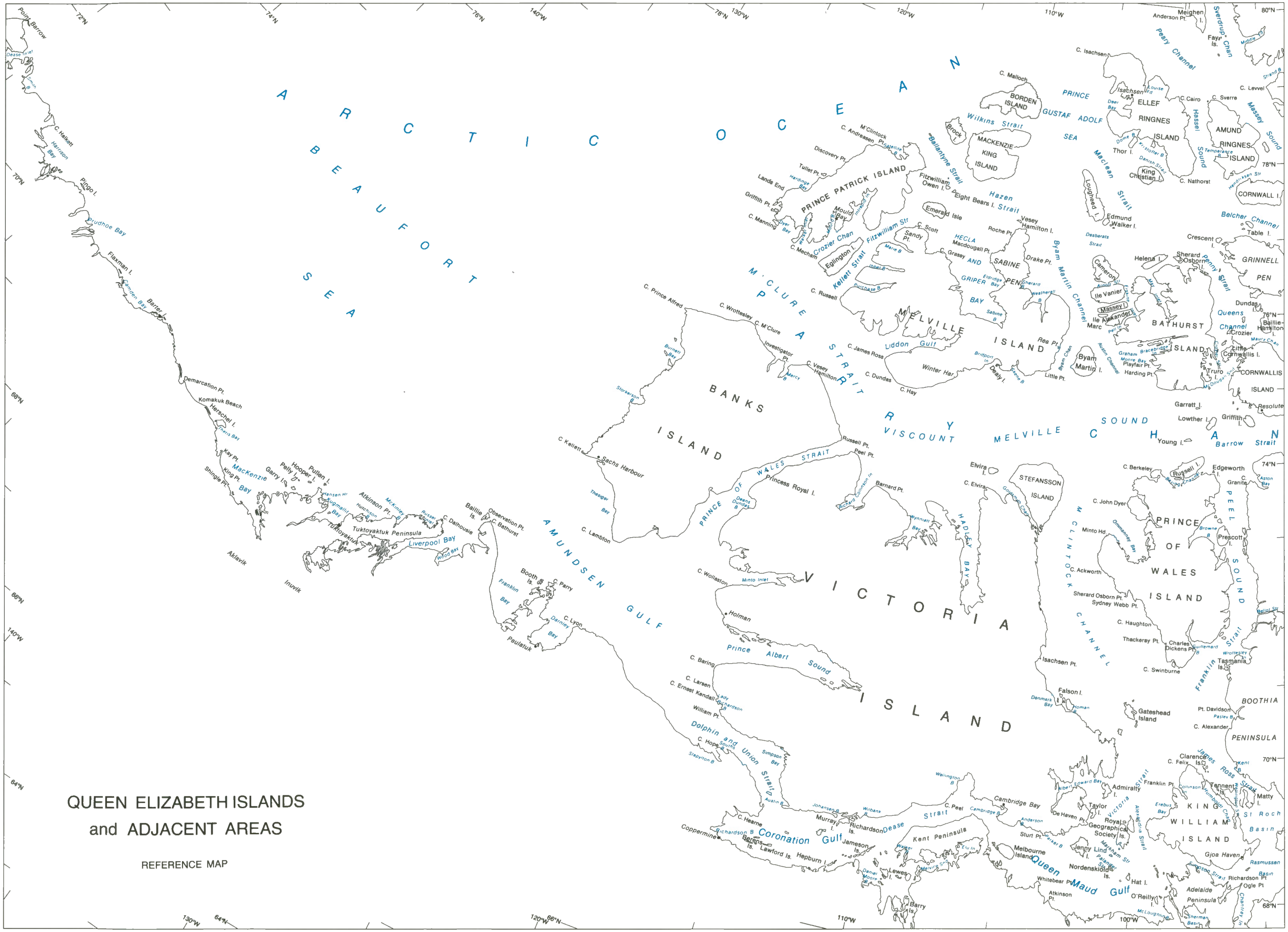
A black and white satellite photograph showing detailed information for a small area accompanies each map. These images were prepared from the multispectral scanner system waveband 5 from LANDSAT 1 and LANDSAT 2. Each photograph shown in this atlas covers an area 160 km by 160 km with a resolution of 79 m and a scale of 1:1,000,000. The caption under each photograph identifies its location, date, track (orbit or path) number and the frame (or image) number.

LIST OF MAPS

LIST OF SATELLITE PHOTOGRAPHS

DESCRIPTIONS


QUEEN ELIZABETH ISLANDS
and ADJACENT AREAS
REFERENCE MAP
ARCTIC OCEAN
QUEEN ELIZABETH ISLANDS
BEAUFORT SEA
AMUNDSEN GULF
BANKS ISLAND
VICTORIA ISLAND
M'CLURE STRAIT
PARRY CHANNEL
VISCOUNT MELVILLE SOUND
BARROW STRAIT
LANCASTER SOUND
PRINCE PATRICK ISLAND
MELVILLE ISLAND
BORDEN ISLAND
MACKENZIE KING ISLAND
ELLEF RINGNES ISLAND
AMUND RINGNES ISLAND
AXEL HEIBERG ISLAND
ELLESMERE ISLAND
CORNWALL I.
GRINNELL PEN
BATHURST ISLAND
CORNWALLIS ISLAND
DEVON ISLAND
SOMERSET ISLAND
PRINCE OF WALES ISLAND
STEFANSSON ISLAND
BYLOT ISLAND
BAFFIN ISLAND
BAFFIN BAY
GREENLAND
NARES STRAIT
KANE BASIN
JONES SOUND
NORWEGIAN BAY
GUSTAF ADOLF SEA
Lincoln Sea
Robeson Chan
Kennedy Channel
Hazen Strait
Wilkins Strait
Prince Gustaf Adolf Sea
Peary Channel
Sverdrup Chan
Nansen Sound
Eureka Sound
Greely Fiord
Massey Sound
Hassel Sound
Maclean Strait
Belcher Channel
Penny Strait
Queens Channel
Wellington Channel
Byam Martin Channel
Kellett Strait
Crozier Chan
Fitzwilliam Str
Ballantyne Strait
Liddon Gulf
Winter Har.
Sachs Harbour
Prince of Wales Strait
Princess Royal I.
Hadley Bay
M'Clintock Channel
Peel Sound
Prince Regent Inlet
Admiralty Inlet
Arctic Bay
Pond Inlet
Brodeur Peninsula
Borden Peninsula
Prince Leopold I.
Resolute
Eureka
Alert
Thule
Holman
Cary Islands
Northumberland Island
Coburg I.
Bear Bay
Colin Archer Pen
Sabine Pen
Hecla and Griper Bay
Eight Bears I.
Emerald Isle
Lougheed I.
Edmund Walker I.
King Christian I.
Meighen I.
Graham Island
Buckingham I.
Fort Conger
Alexandra Fiord (abandoned)
Bache Pen
Pim I.
Grise Fiord
Smith Sound
C. Columbia
C. Stallworthy
C. Isachsen
C. Manning
C. Prince Alfred
C. Kellett
C. Lambton
C. Sherard
C. Warrender
C. Hotham
C. Clarence
C. Crauford
C. Graham Moore
120°W
100°W
80°W
60°W
110°W
90°W
80°N
78°N
76°N
74°N
72°N
70°N



QUEEN ELIZABETH ISLANDS
and ADJACENT AREAS

REFERENCE MAP

SEASONAL SUMMARY 1975

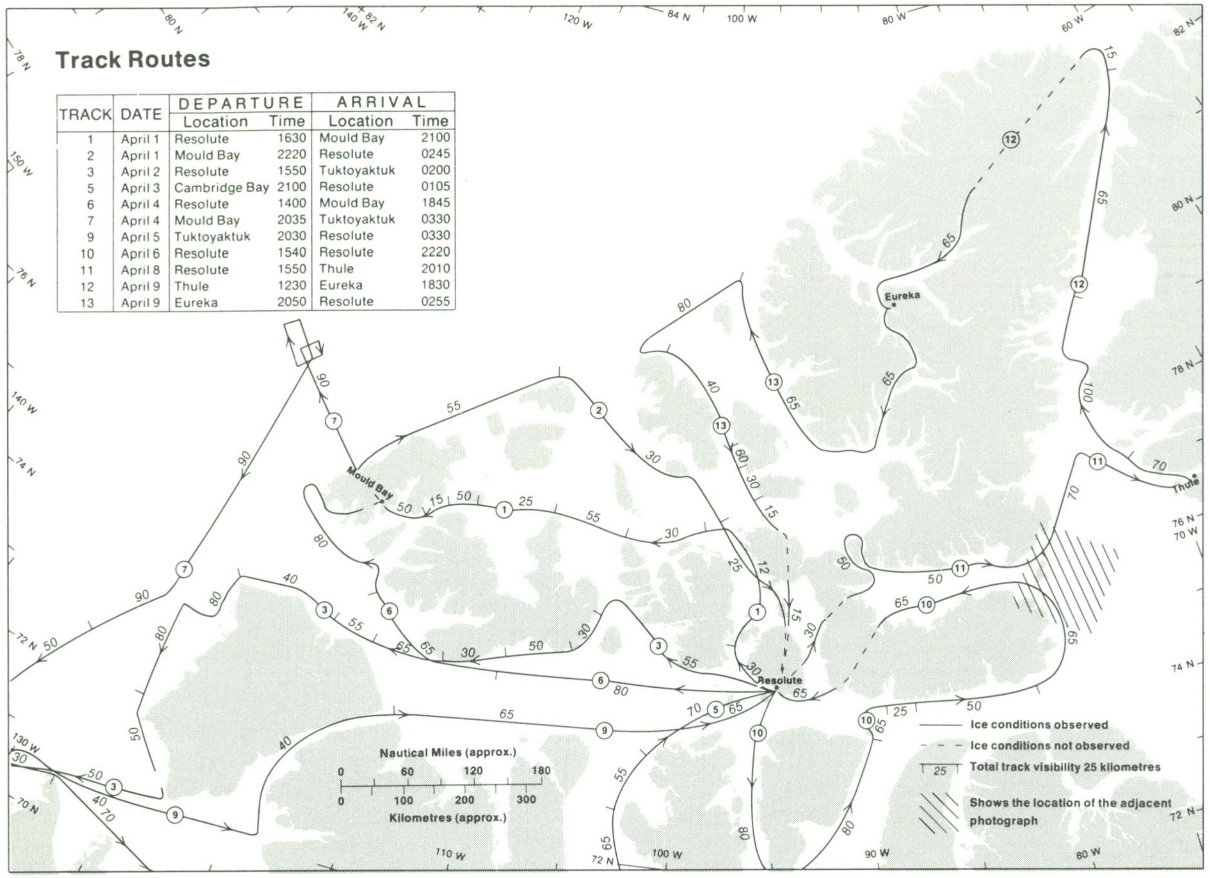
During the 1975 season more sea ice in the Canadian Arctic Archipelago broke up, moved and melted than in a typical year. In general, break-up started earlier but so did freeze-up. Compared with other years the ice conditions in the eastern part of the region were better than usual for navigation while in the western part of the region unusually concentrated conditions created problems for navigation.

The greatest deviation from the norm in the 1975 season was the lack of movement in most parts of the region especially in the Beaufort Sea and M'Clintock Channel. At the end of July a large portion of the Beaufort Sea was ice-free, but by mid-August persistent northwesterly winds had driven multi-year ice into this area and held it there for the remainder of the season. In M'Clintock Channel break-up and clearing was much ahead of normal by the end of July, but then the rate of ablation declined dramatically and few further changes developed. Similar conditions developed in M'Clure Strait, Viscount Melville Sound and Peel Sound. All of these areas, like M'Clintock Channel, experienced an earlier-than-normal break-up but this initial head start was not followed up by large amounts of clearing in the latter half of the ablation season. North-south movements in the eastern half of the region, during the 1975 season from April to October, were notable because of their very limited extent. Only small quantities of ice were exported to the south in any of the eastern channels although the opportunity for large scale drift existed if the winds were favourable. The main movements in the eastern area were easterly through Barrow Strait. In the western area the massive southerly invasion across the Beaufort Sea was the major movement although some easterly drift took place in M'Clure Strait and Viscount Melville Sound.

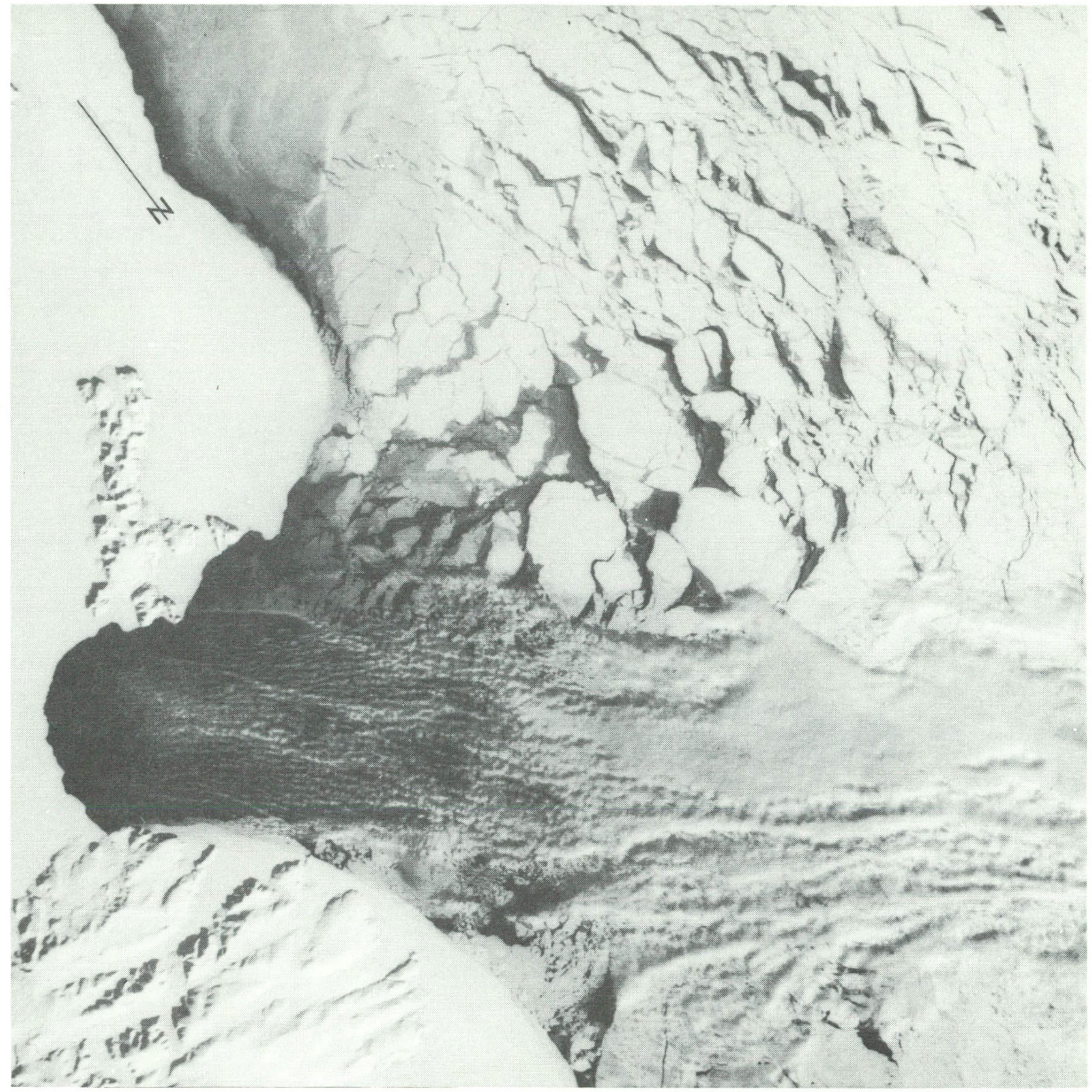
Although the extent of break-up was greater than normal, the pattern of advancement was similar to previous years. No obvious departures from the usual trends of freeze-up were noted.

The weather seemed to be better than usual as far as ice observing conditions were concerned and consequently the flights were much more effective than usual.

The two special aspects of the 1975 season that make it distinctive were the warm spring which indicated a favourable season, and the cooler temperatures after July which arrested the development of the ice-free conditions expected and indicated in the spring.



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	April 1	Resolute	1630	Mould Bay	2100
2	April 1	Mould Bay	2220	Resolute	0245
3	April 2	Resolute	1550	Tuktoyaktuk	0200
5	April 3	Cambridge Bay	2100	Resolute	0105
6	April 4	Resolute	1400	Mould Bay	1845
7	April 4	Mould Bay	2035	Tuktoyaktuk	0330
9	April 5	Tuktoyaktuk	2030	Resolute	0330
10	April 6	Resolute	1540	Resolute	2220
11	April 8	Resolute	1550	Thule	2010
12	April 9	Thule	1230	Eureka	1830
13	April 9	Eureka	2050	Resolute	0255



Lady Ann Strait, April 4, 1975, T39 F6

MAP 1-1975 East

April 1-9

Flight Effectiveness

The weather for this series of surveys was generally favourable for ice reconnaissance. Observing altitudes were lower than 1800 m because of the ice haze resulting from ice crystals and ice fog. Only two of the seven tracks carried out over the eastern part of the region were less than 75 per cent successful. Overall the flight was judged to be 80 per cent effective because parts of almost all the channels in the area were observed.

Ice Conditions

The conditions observed in the northern channels, Prince Gustaf Adolf Sea, Peary Channel, Sverdrup Channel and Nansen Sound, in April were similar to those noted in October, 1974. No movement had taken place in these areas during the winter. The solid arch across the northern part of Byam Martin Channel also held fast and no multi-year ice was able to enter Parry Channel. Quite likely, as is usual, there was considerable movement in the eastern channels into the new year and the sequence of consolidation probably started with Wellington Channel, followed by Jones Sound and Barrow Strait. The ice cover on Prince Regent Inlet was temporarily solid while the ice in Lancaster Sound remained in motion throughout the winter. The distribution and concentration of multi-year ice in Norwegian Bay reflected the conditions that existed the previous fall.

The ice edge for North Water appeared in its usual place for this time of year. The open areas in Hell Gate developed in their usual positions and so did the polynyas near Dundas Island and Baillie-Hamilton Island; however, the ice cover in each of these three areas seemed to be greater than usual. While these areas were more congested than usual, four small ice-free polynyas were observed in the northeast part of Penny Strait. These polynyas had never been noted before. It is likely they do develop regularly but have not been noted due to their small size. Like other polynyas they may freeze over in the latter part of April.

The ridging patterns were similar to previous years and the ice on Prince Regent Inlet, Western Barrow Strait and the Arctic Ocean adjacent to the archipelago continued to maintain its level of roughness.

In some areas, north of Melville Island and west of Lougheed Island, the ice was wind blown clear of snow in places while in other areas such as in Massey Sound the snow cover seemed greater than usual and much of the surface roughness normally expected was hidden.

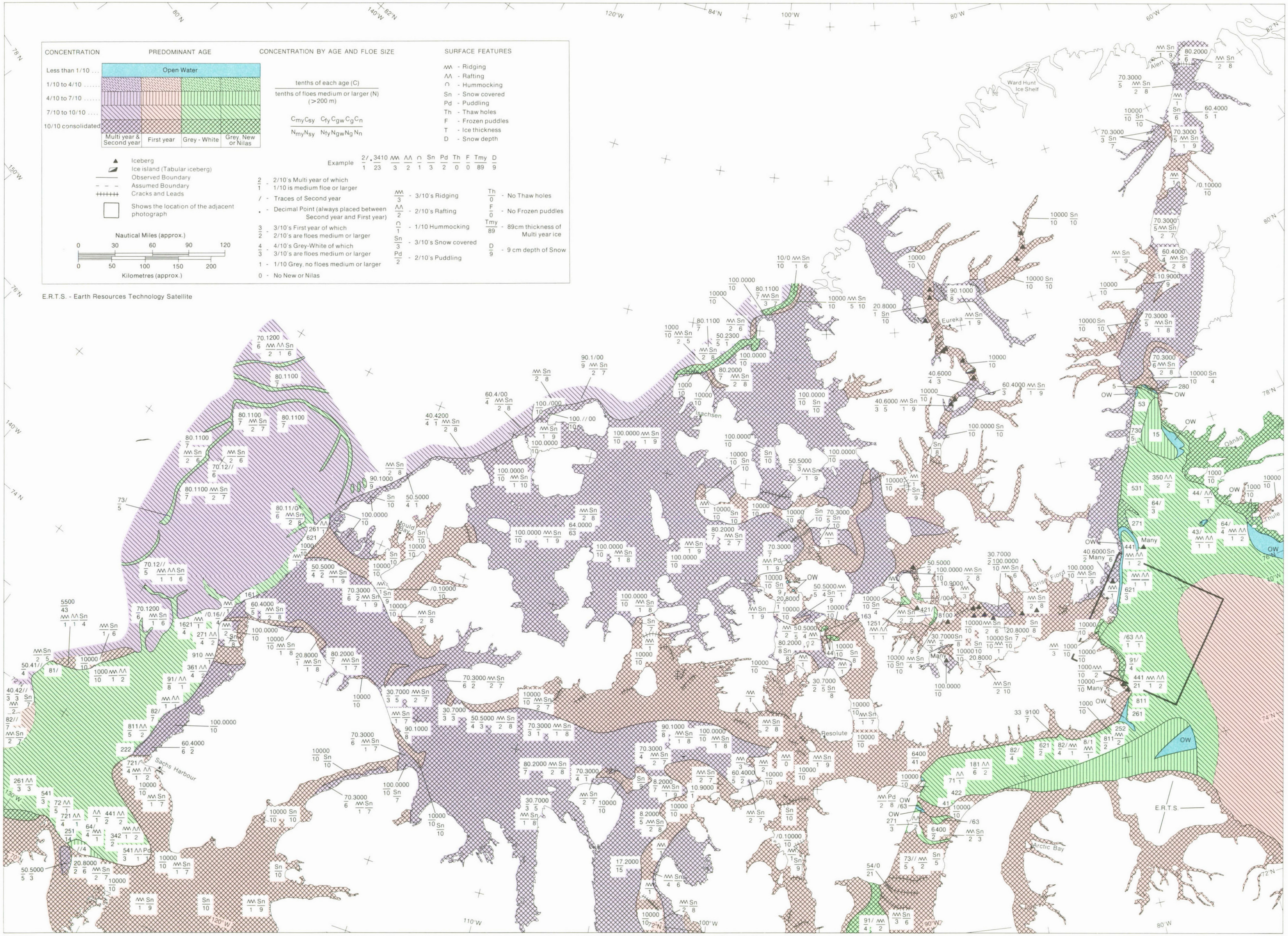
Unobserved Areas

Satellite photographs were used to determine the ice conditions in the unobserved parts around Bylot Island. The conditions in other areas not observed were based on observations made in subsequent flights. Reports from other aircraft flying over the ice along the northern coast of Ellesmere Island indicate there was no departure from the normal situation where the moving pack ice of the Arctic Ocean forces itself against the solid landfast zone which extends a few km seaward from the headlands.

Comments

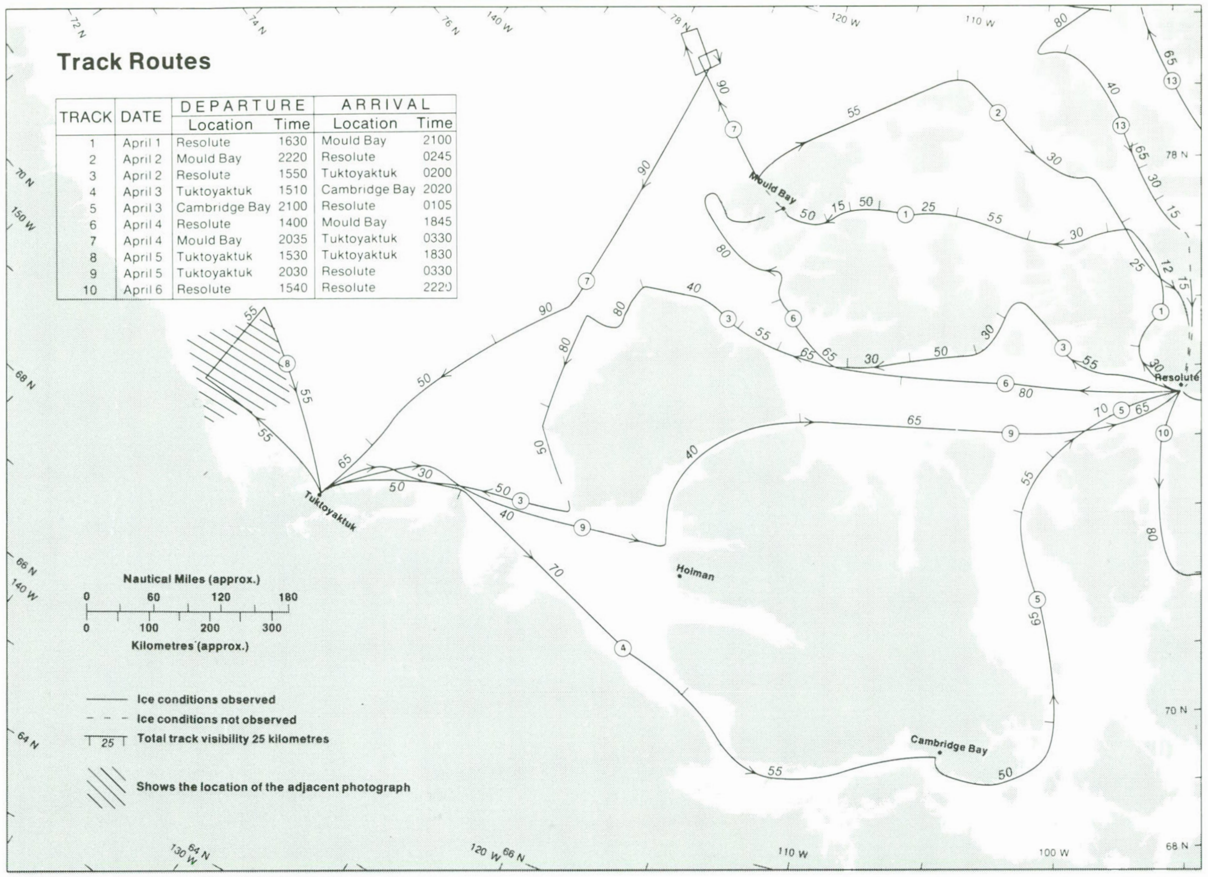
A search for an ice island believed to be about 200 km west of Mould Bay was not successful.

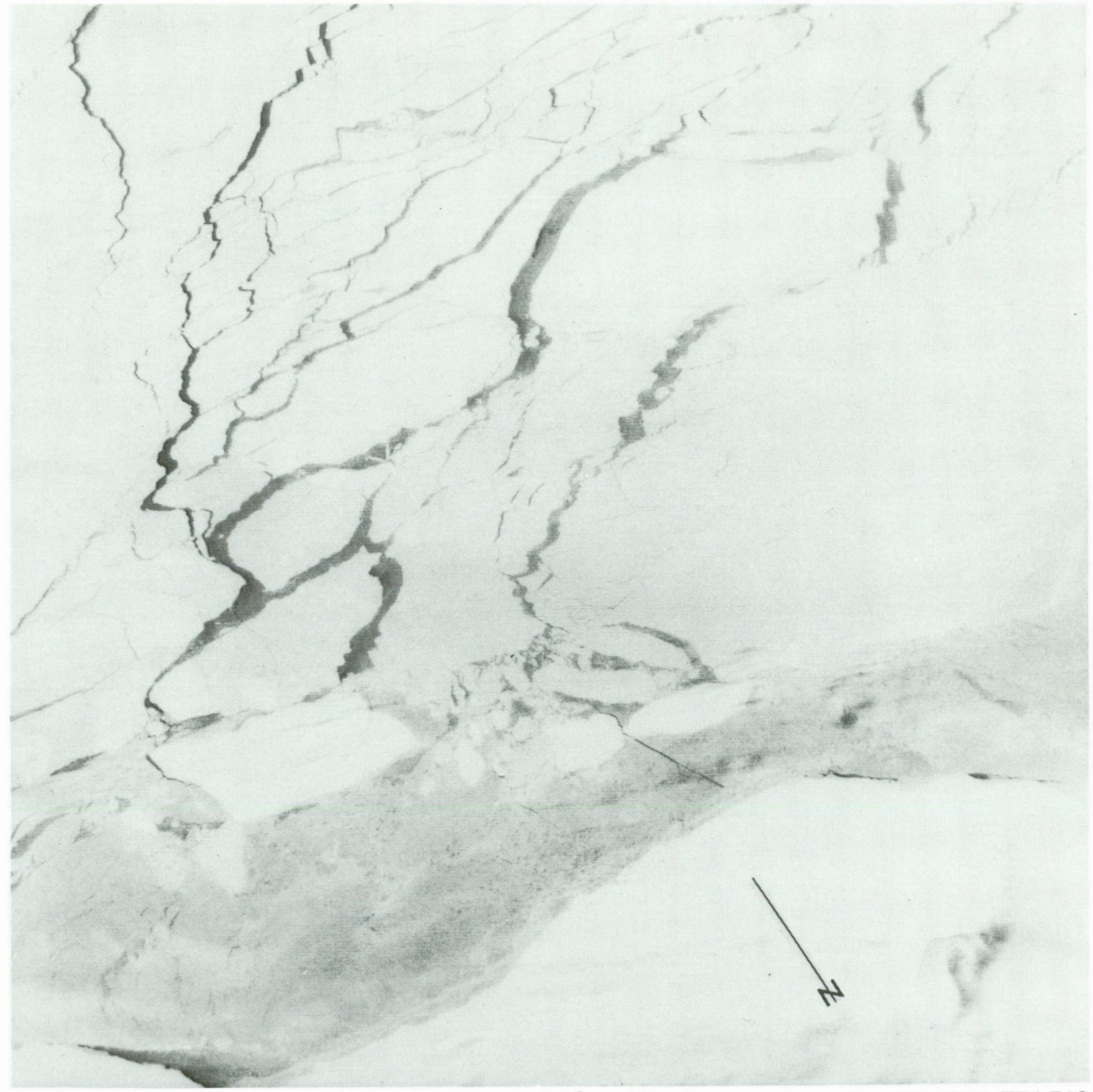
The satellite photo, a few days prior to the tracks in the area, shows a little more open water than the map and pilot reports indicate that there was an even greater ice-free expanse in this area a few days before the photograph was taken.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
E.R.T.S. - Earth Resources Technology Satellite
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Mould Bay
Sachs Harbour
Resolute
Grise Fiord
Arctic Bay
Thule
Qânâq
E.R.T.S.

Track Routes

TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	April 1	Resolute	1630	Mould Bay	2100
2	April 2	Mould Bay	2220	Resolute	0245
3	April 2	Resolute	1550	Tuktoyaktuk	0200
4	April 3	Tuktoyaktuk	1510	Cambridge Bay	2020
5	April 3	Cambridge Bay	2100	Resolute	0105
6	April 4	Resolute	1400	Mould Bay	1845
7	April 4	Mould Bay	2035	Tuktoyaktuk	0330
8	April 5	Tuktoyaktuk	1530	Tuktoyaktuk	1830
9	April 5	Tuktoyaktuk	2030	Resolute	0330
10	April 6	Resolute	1540	Resolute	2220





Southern Beaufort Sea, April 3, 1975, T74 F10

MAP 1-1975 West

April 1-9

Flight Effectiveness

The visibility during the seven tracks carried out over the western part of the archipelago was very good. The flight was 90 per cent effective.

Ice Conditions

Ice conditions in the southern channels were typical and except for some easterly movement in Viscount Melville Sound and southern M'Clintock Channel were almost identical to those reported the previous October. The main departure from the norm was the large expanse of new ice in the form of grey and grey-white ice found in the southern half of the Beaufort Sea.

The amount and distribution of surface roughness (i.e. ridging and hummocking) was normal. However, the reduced snow cover, seven-tenths or less, in some areas was not expected.

The solid ice cover over the region was interrupted only by the polynya in Bellot Strait. The Bathurst polynya in Amundsen Gulf north of Cape Bathurst was well developed.

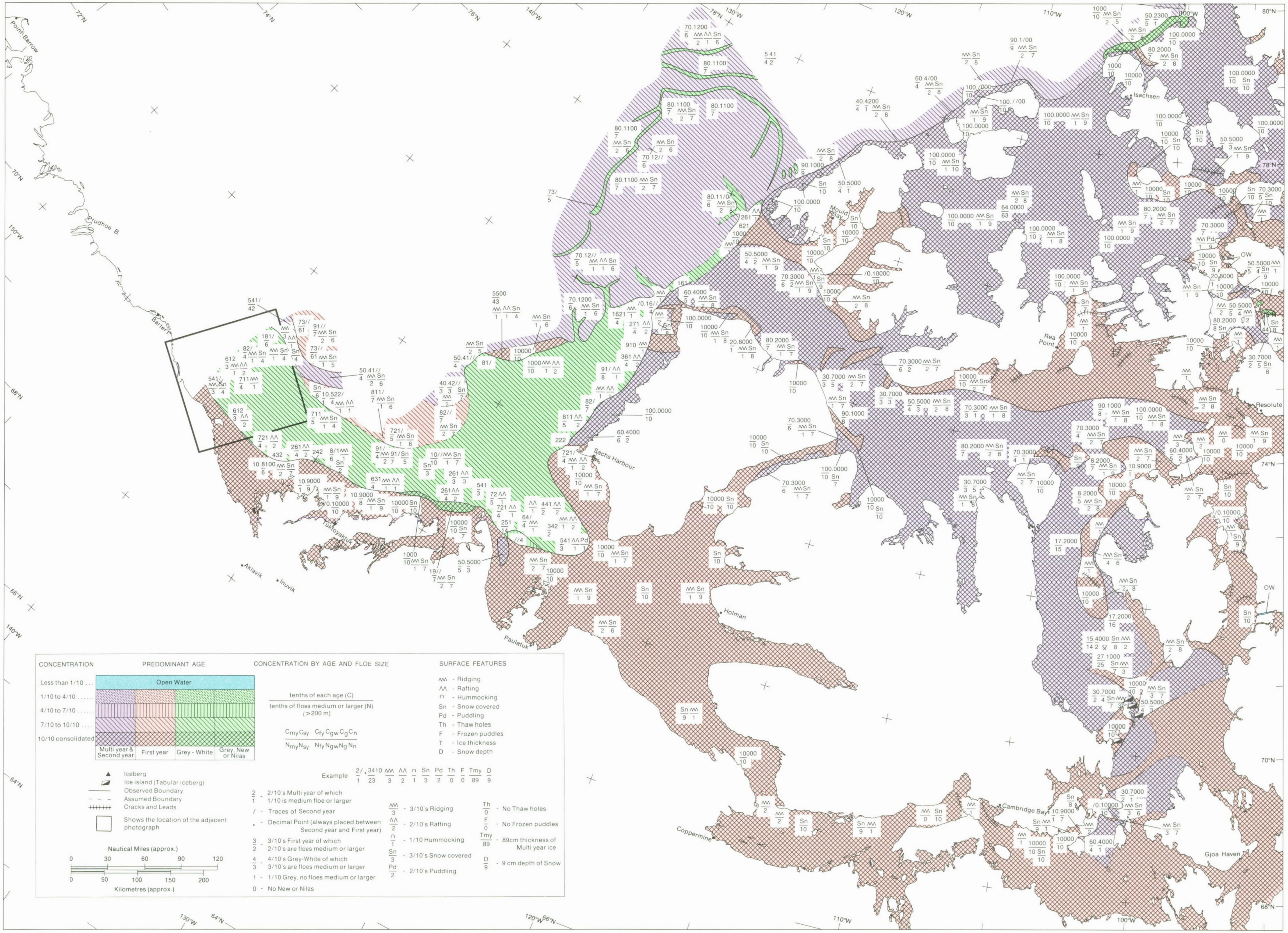
Unobserved Areas

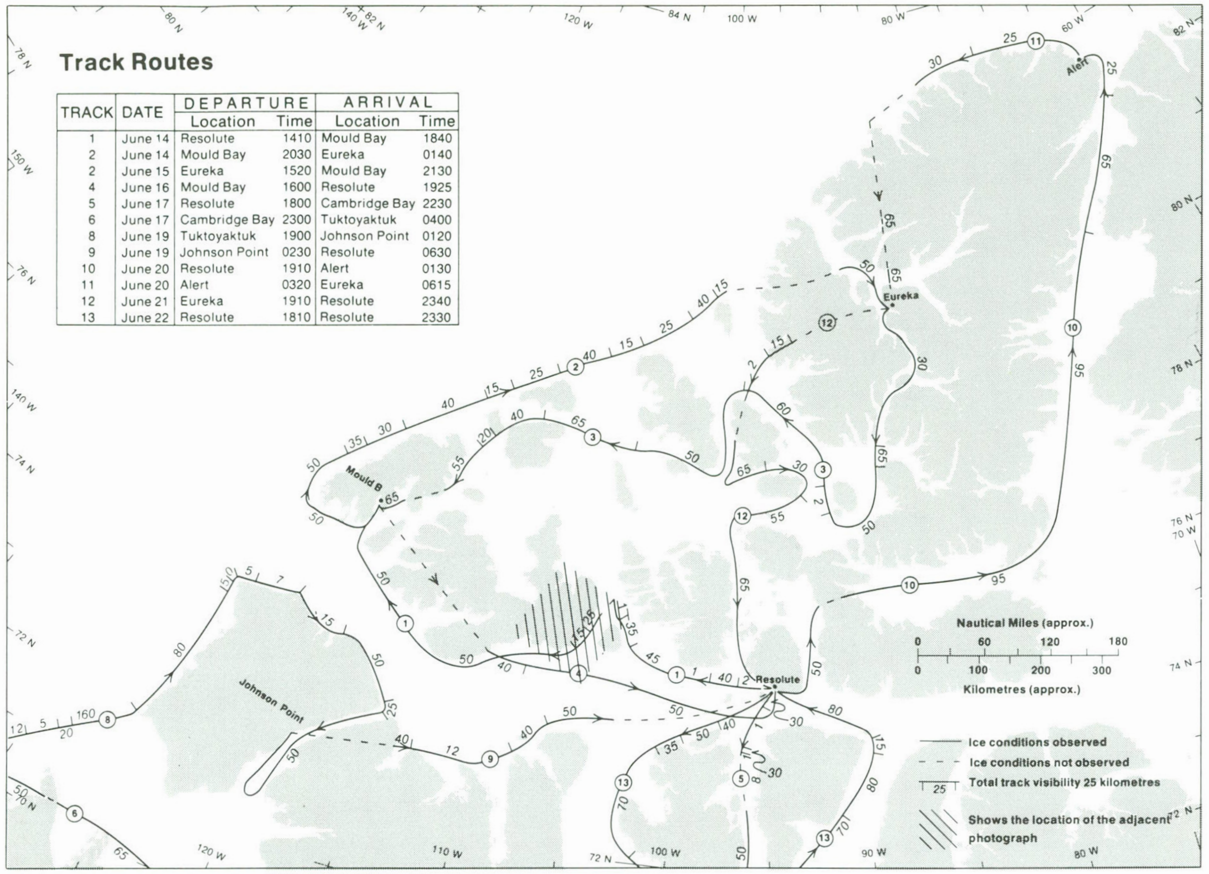
The ice cover in the northwestern part of the Beaufort Sea probably changed gradually from first-year to multi-year ice in the vicinity of 72°N.

Comments

Winds are the main cause of various anomalies noted during this series of tracks. During track 9 unexpectedly strong westerly winds at 900 m were encountered. The lack of snow cover in some of the channels particularly southern Amundsen Gulf and Victoria Strait, where four-tenths of the ice surface was bare, was due primarily to the effects of the wind. The most obvious and most important effect of winds is evident in the Beaufort Sea where the older form of ice had been driven to the north allowing the new ice types to form in the south next to the landfast ice along the coastline. To permit such an extent of new ice to form the winds must have prevailed from a southeasterly quadrant from about the third week in March.

The satellite photograph illustrates the extent of the new ice formation. It also provides the reader with some idea of the problems an observer faces when trying to map the ice conditions. The boundary between first-year ice and nilas and the grey ice is fairly obvious from the photograph but for an observer in a low-flying aircraft it is difficult to plot this boundary on a map because of the masking effect of snow cover and a low-relief, featureless shoreline where rough ice melds with the land. Ice haze and ice crystals are other factors which can complicate the problem. In this photograph the north coast of Herschel Island appears beside the N in the north arrow. This provides the key to locating the ice edge.


Point Barrow
Prudhoe B.
Barter I.
Aklavik
Inuvik
Tuktoyaktuk
Paulatuk
Sachs Harbour
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Mould Bay
Isachsen
CONCENTRATION
Less than 1/10 ...
1/10 to 4/10 ......
4/10 to 7/10 ......
7/10 to 10/10 ....
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/1 - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	June 14	Resolute	1410	Mould Bay	1840
2	June 14	Mould Bay	2030	Eureka	0140
2	June 15	Eureka	1520	Mould Bay	2130
4	June 16	Mould Bay	1600	Resolute	1925
5	June 17	Resolute	1800	Cambridge Bay	2230
6	June 17	Cambridge Bay	2300	Tuktoyaktuk	0400
8	June 19	Tuktoyaktuk	1900	Johnson Point	0120
9	June 19	Johnson Point	0230	Resolute	0630
10	June 20	Resolute	1910	Alert	0130
11	June 20	Alert	0320	Eureka	0615
12	June 21	Eureka	1910	Resolute	2340
13	June 22	Resolute	1810	Resolute	2330


Byam Channel, June 17, 1975, T59 F6

MAP 2-1975 East

June 14-22

Flight Effectiveness

The weather was generally favourable but the aircraft was not available for surveys at all times throughout the period. Unfortunately, previous commitments and maintenance put the sea-ice reconnaissance missions out of step with the weather systems and some areas such as Hecla and Griper Bay and the north coast of the archipelago were not observed. The flight was 75 per cent effective.

Ice Conditions

No unexpected changes had taken place since Flight 1 was completed on April 9. The clearing in Lancaster Sound and Baffin Bay and the expansion of the polynyas in Hell Gate, Belcher Channel, Penny Strait and Queens Channel are usual. The small open areas in Belcher Channel covered by the fractions on the map were observed in their usual positions.

The ice edge at the western end of Lancaster Sound had remained stationary until June 6. Shortly thereafter it retreated into Barrow Strait to the position shown for June 22.

The ice in Prince Regent Inlet, observed on June 22 from 900 m in cloudless skies, appeared to be rougher than first-year. As a result it was designated as second-year. Subsequent observations returned it to its original and quite likely correct classification as first-year ice.

In mid-June there was a considerable variation in the surface conditions. In the sheltered bays of Somerset Island thaw holes were appearing near Bathurst Island, puddles were expanding to five-tenths, and some areas were completely flooded. However, nearby in Byam Martin Channel the puddles were frozen, the ice near Mould Bay was still ten-tenths snow covered and a fresh thick layer of snow covered the area around Ward Hunt Island.

Unobserved Areas

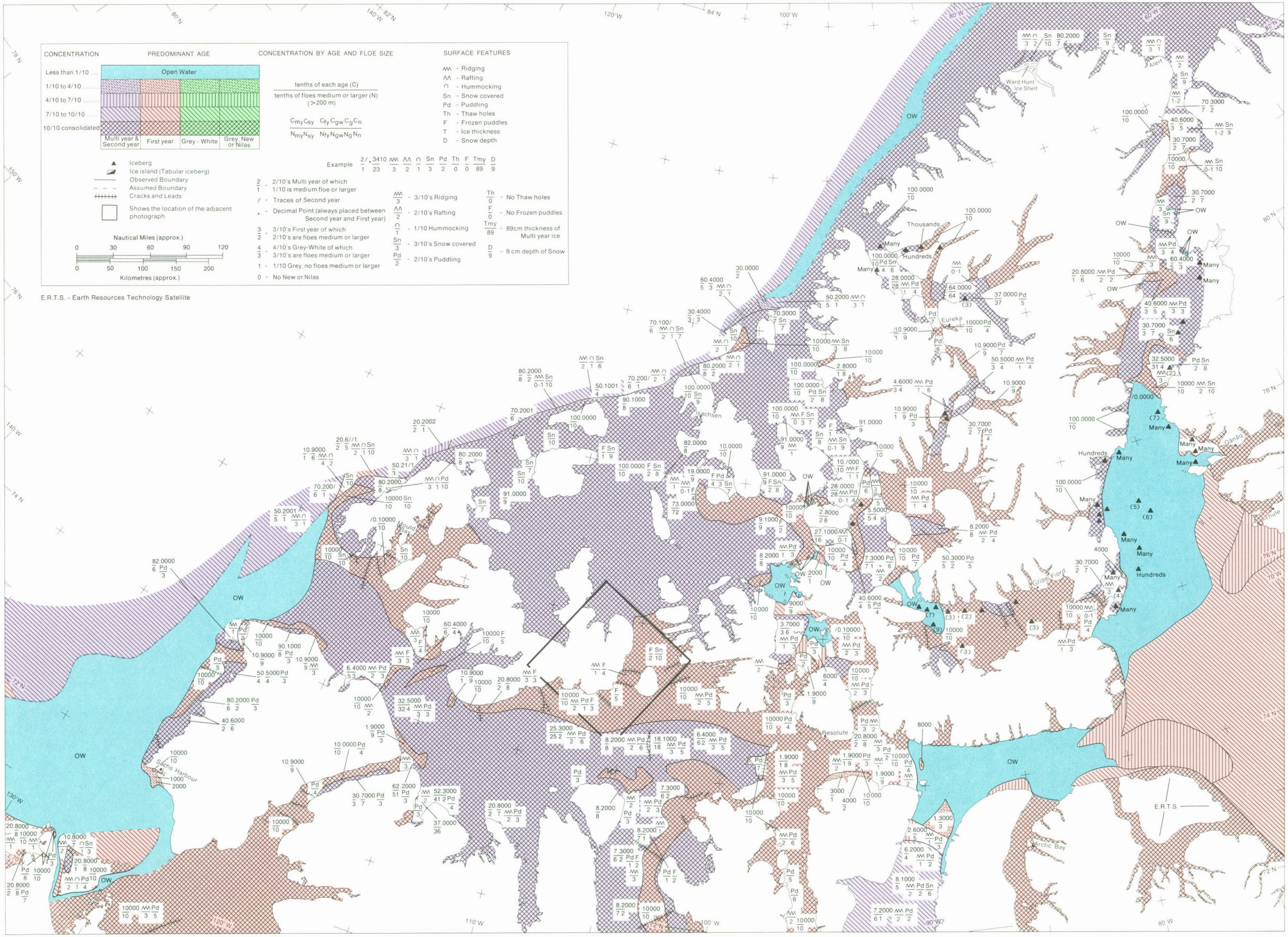
Reports from other aircraft in the area were the basis for showing the ice conditions in the Arctic Ocean northwest of Ellesmere Island. The ice cover shown for Hecla and Griper Bay is based on satellite photographs and subsequent information.

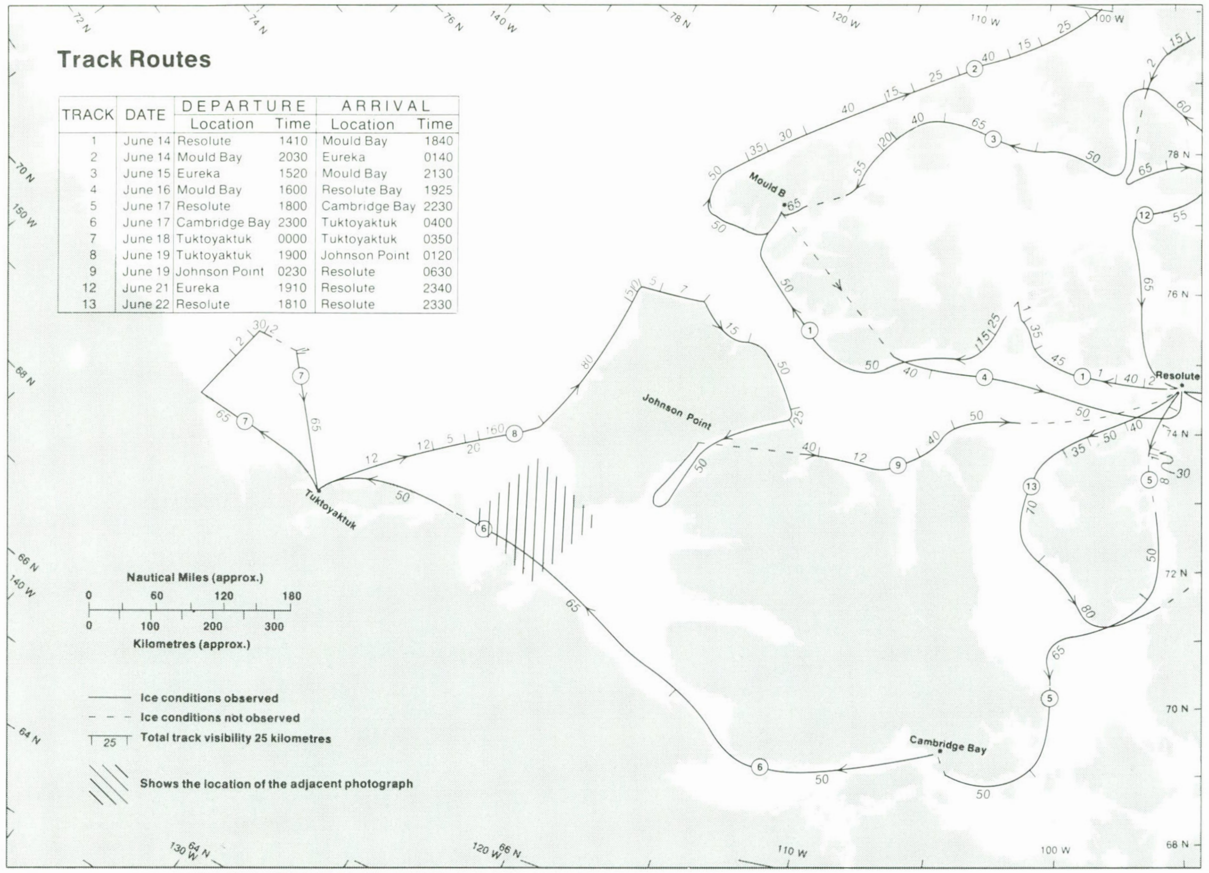
Comments

Ablation was advancing well in some areas while others like Mould Bay were still snow-covered. The rain in the latter area on June 14 was not a normal event but it would speed up the appearance of puddles.

The ice edge in North Water as observed on June 20 did not seem to be arched as much as usual toward the north.

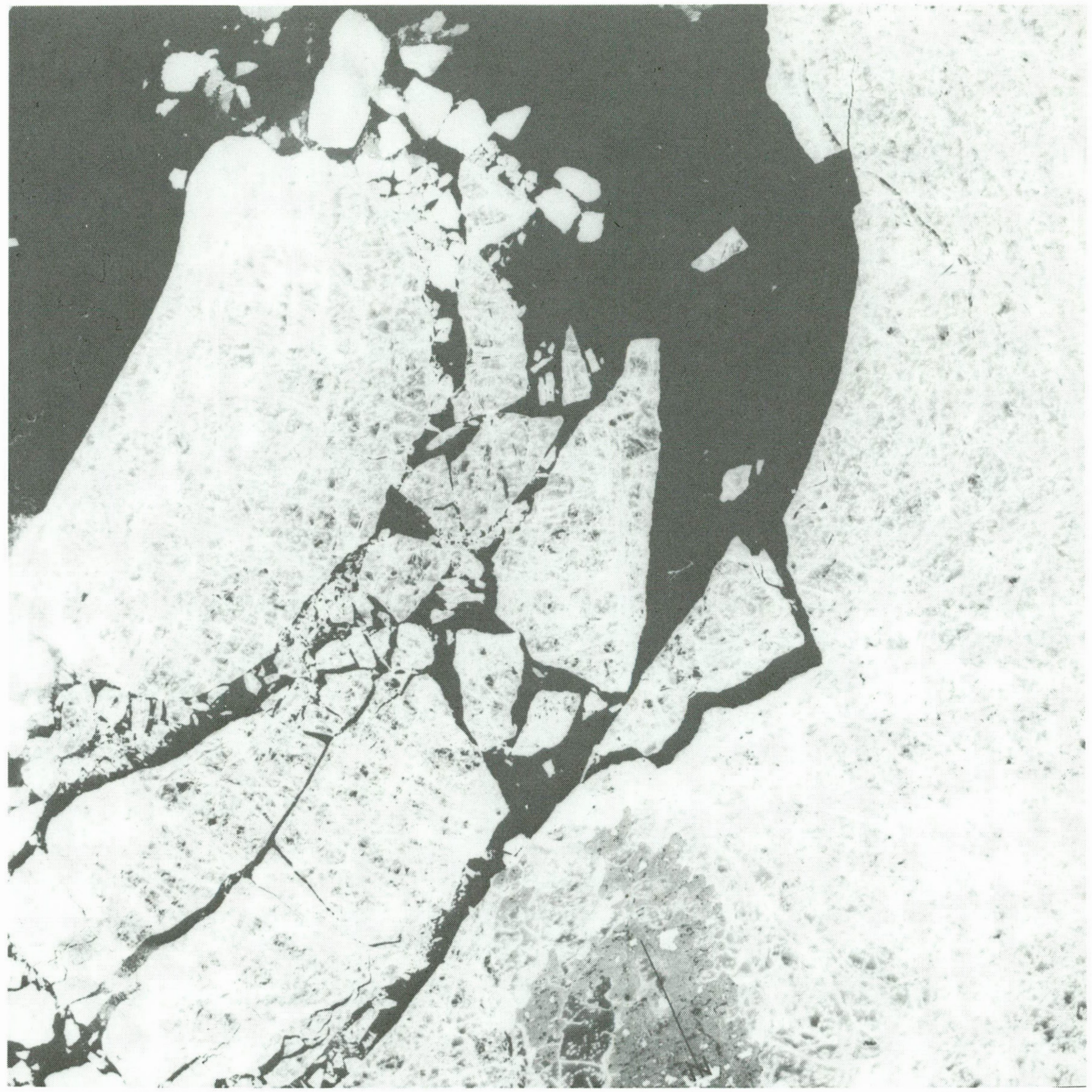
The satellite photograph gives a very good view of the areas to the north, west and south of Byam Martin Island. The photograph was taken on June 17 and these areas were observed on June 14 and 16. The boundary between multi-year and first-year ice arching from Melville Island across Byam Martin Channel stands out even though clouds obscure the details characteristic of multi-year ice. The sequence of freeze-up in Byam Channel during the fall of 1974 is evident. However, the photograph does not show the puddling, up to six-tenths of the surface, observed on June 16 when track 4 crossed the southern part. It would be interesting to determine the cause of this difference.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)
E.R.T.S. - Earth Resources Technology Satellite
Alert
Ward Hunt Ice Shelf
Eureka
Resolute
Sachs Harbour
Arctic Bay
Grise Fiord
Thule
Qânâq
OW
E.R.T.S.



Track Routes

TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	June 14	Resolute	1410	Mould Bay	1840
2	June 14	Mould Bay	2030	Eureka	0140
3	June 15	Eureka	1520	Mould Bay	2130
4	June 16	Mould Bay	1600	Resolute Bay	1925
5	June 17	Resolute	1800	Cambridge Bay	2230
6	June 17	Cambridge Bay	2300	Tuktoyaktuk	0400
7	June 18	Tuktoyaktuk	0000	Tuktoyaktuk	0350
8	June 19	Tuktoyaktuk	1900	Johnson Point	0120
9	June 19	Johnson Point	0230	Resolute	0630
12	June 21	Eureka	1910	Resolute	2340
13	June 22	Resolute	1810	Resolute	2330



Amundsen Gulf, June 22, 1975, T64 F10

MAP 2-1975 West

June 14-22

Flight Effectiveness

In spite of the rain encountered during portions of tracks 6, 7 and 8, the observing conditions during the western surveys of Flight 2 were good and the results were about 80 per cent effective.

Ice Conditions

The most obvious change between the end of Flight 1 on April 9 and Flight 2 on June 22 was the melting of the new ice in the southwestern part of the Beaufort Sea to create the large ice-free expanse shown on Map 2–1975 WEST. The southwesterly winds continued to keep the older ice types in the Beaufort Sea away from the coast of Banks Island and that part of the mainland between Tuktoyaktuk and Cape Bathurst. In fact, the open area north of the latter area was slightly larger than the April conditions indicated.

Less evident changes between the two flights took place in M'Clure Strait where the ice edge retreated to its usual position for this time of year. Similarly the portion and extent of the polynya in Dolphin and Union Strait was usual. Another polynya, never before observed on these flights, was noted at the extreme southeast part of Franklin Strait.

The ice-free area in Bellot Strait did not change. The snow cover was melting very rapidly and puddling was approaching its maximum in the southern channels. In general the season was advancing in a normal fashion. The rather atypically early advance of break-up into Amundsen Gulf is a result of ice-free conditions nearby and cannot be used as an indicator for an earlier season.

Unobserved Areas

The boundaries in the central part of the Beaufort Sea were established by interpreting satellite photographs.

Comments

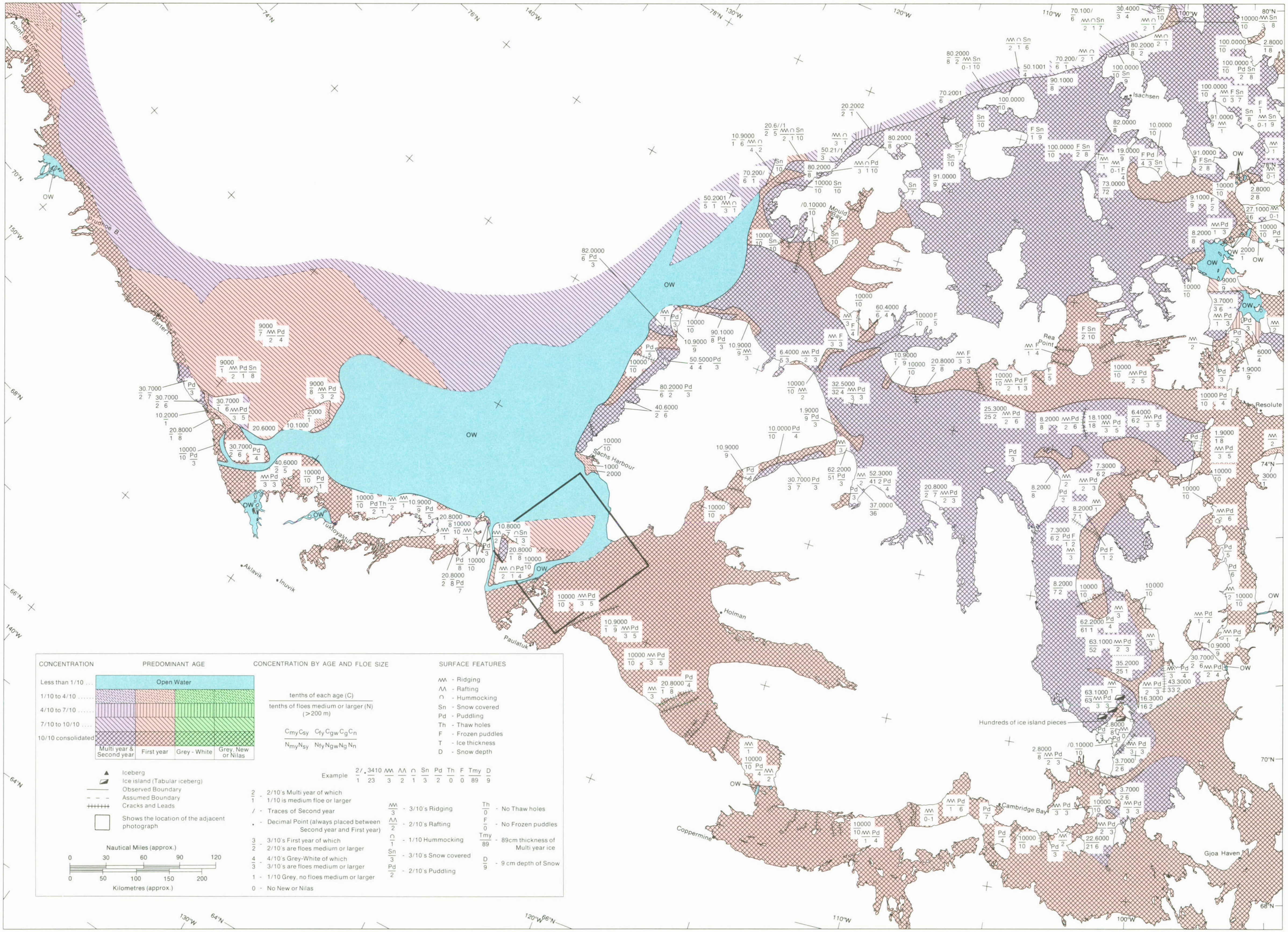
The season appeared to be advancing in a normal fashion and at a normal rate. The ice-free area in the Beaufort Sea was similar in size to that observed at the same time for five of the six previous years. Also typical were the crack patterns. Most of those shown on the map can be relied on to appear in the same place and at the same time year after year.

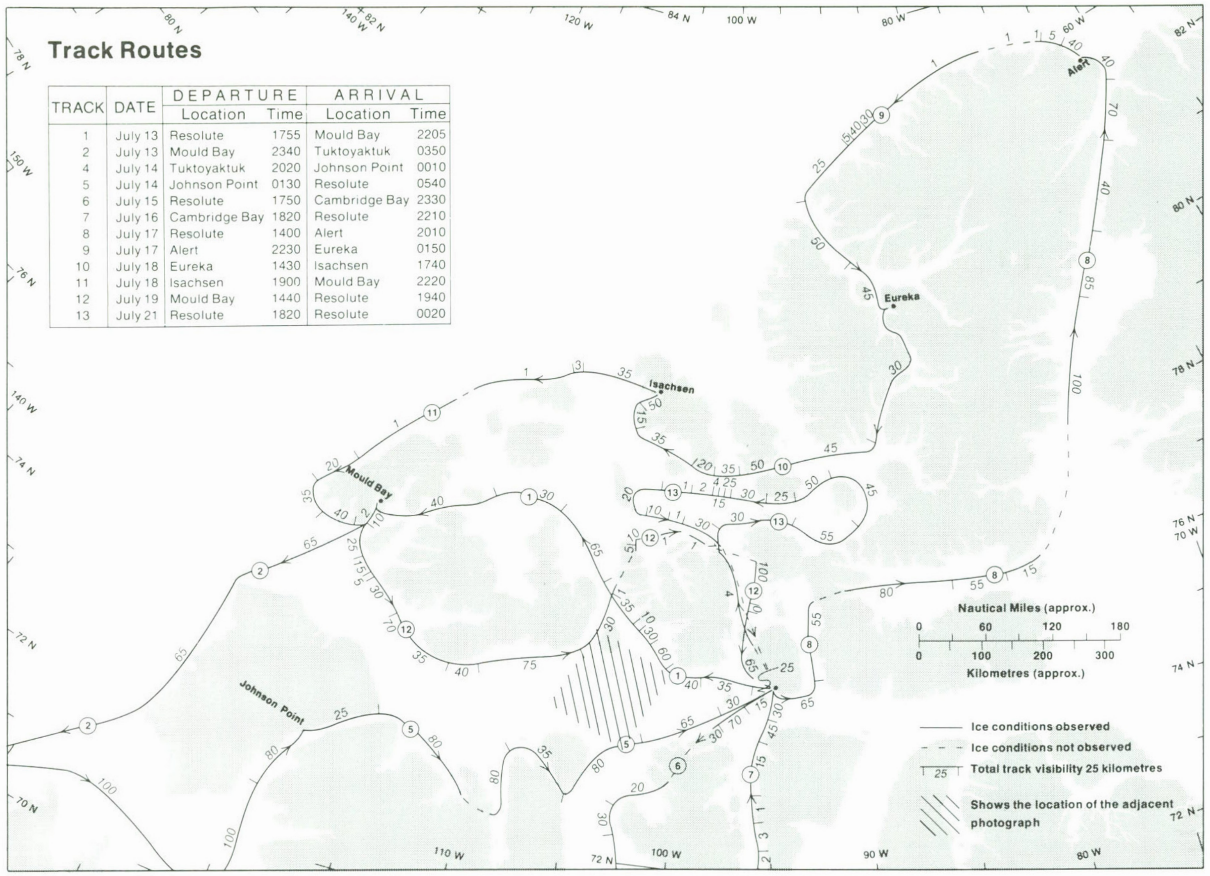
In addition to the hundreds of small ice island fragments held in the ice north of Gateshead Island, there were still three large pieces remaining from the break-up of T-1.

The large extent of first-year ice north of Herschel Island did not start to form in the fall of 1974. The black colour, rather than the bluish colour usually expected, indicated that the ice had formed after the new year.

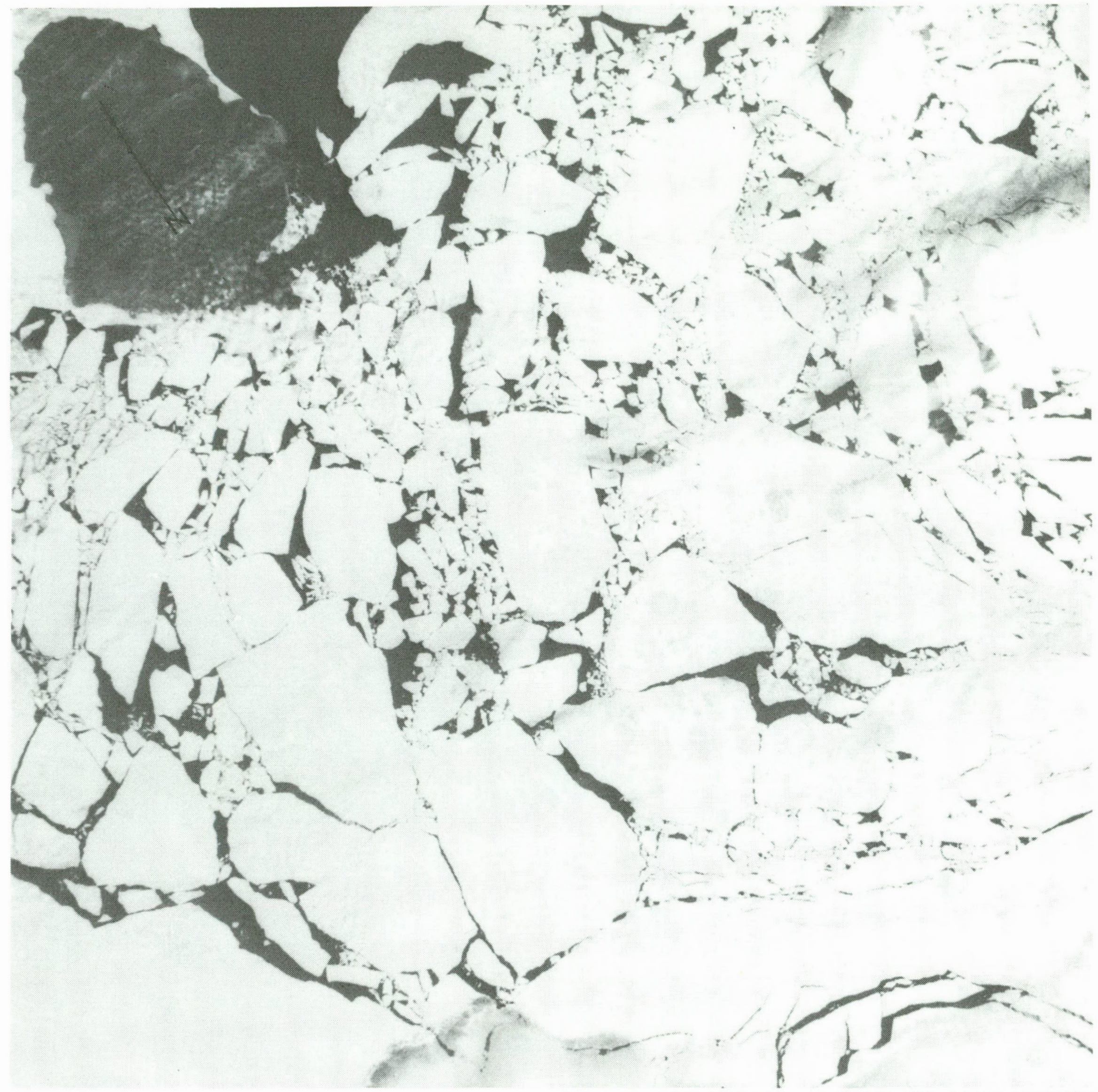
The solid ice arch across Mackenzie Bay separating the ice-free areas of the Beaufort Sea and Shallow Bay of the Mackenzie River usually occurs at this time· and place each year.

The satellite photograph was made June 22. The observations shown on the map were made on the 17th. During the interval some more ice had moved out of Amundsen Gulf. In the photograph, puddling on the ice was between four- and five-tenths.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
Open Water
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Point Barrow
Prudhoe B.
Barter I.
Aklavik
Inuvik
Tuktoyaktuk
Sachs Harbour
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Isachsen
Mould Bay
Rea Point
Hundreds of ice island pieces
OW



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	July 13	Resolute	1755	Mould Bay	2205
2	July 13	Mould Bay	2340	Tuktoyaktuk	0350
4	July 14	Tuktoyaktuk	2020	Johnson Point	0010
5	July 14	Johnson Point	0130	Resolute	0540
6	July 15	Resolute	1750	Cambridge Bay	2330
7	July 16	Cambridge Bay	1820	Resolute	2210
8	July 17	Resolute	1400	Alert	2010
9	July 17	Alert	2230	Eureka	0150
10	July 18	Eureka	1430	Isachsen	1740
11	July 18	Isachsen	1900	Mould Bay	2220
12	July 19	Mould Bay	1440	Resolute	1940
13	July 21	Resolute	1820	Resolute	0020



Viscount Melville Sound, July 19, 1975, T55 F7

MAP 3-1975 East

July 13-21

Flight Effectiveness

Low cloud or fog or rain reduced the visibility during some part of all the tracks except the first one. Aircraft icing reduced the area covered during track 13. The flight was 70 per cent successful.

Ice Conditions

The changes that took place in the four week interval separating the ends of flights 2 and 3 were impressive and in some cases unexpected. The clearing in Baffin Bay and the break-up of the ice cover in Nares Strait is usual. The break-up of Wellington Channel and Western Barrow Strait was unusually early. The disintegration and partial clearing in Jones Sound and in the area between Hassel Sound and Penny Strait was unusual that early in the season. The fracturing of the ice cover in west Barrow Strait and northeastern Viscount Melville Sound was completely unexpected at this time of the year.

In the southern channels puddling had reached its maximum and had declined to a stable three-tenths while in the central regions it was still increasing. North of Ellesmere Island the puddling had just started and the snow cover was still quite heavy. Frozen puddles in Barrow Strait, Wellington Channel and Jones Sound were a temporary feature and did not indicate an early freeze-up.

Break-up was advancing very quickly and the season was ahead of normal.

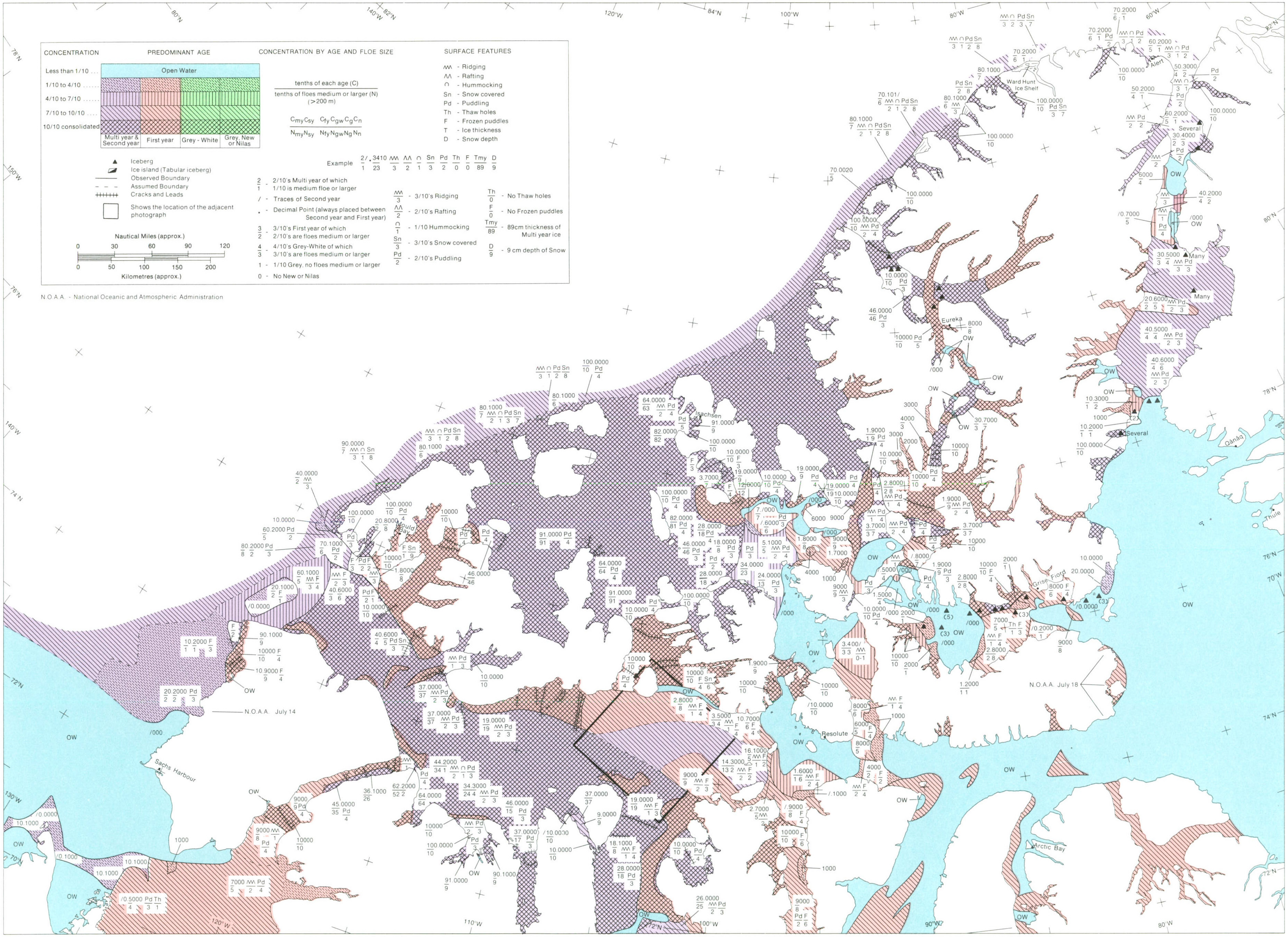
Unobserved Areas

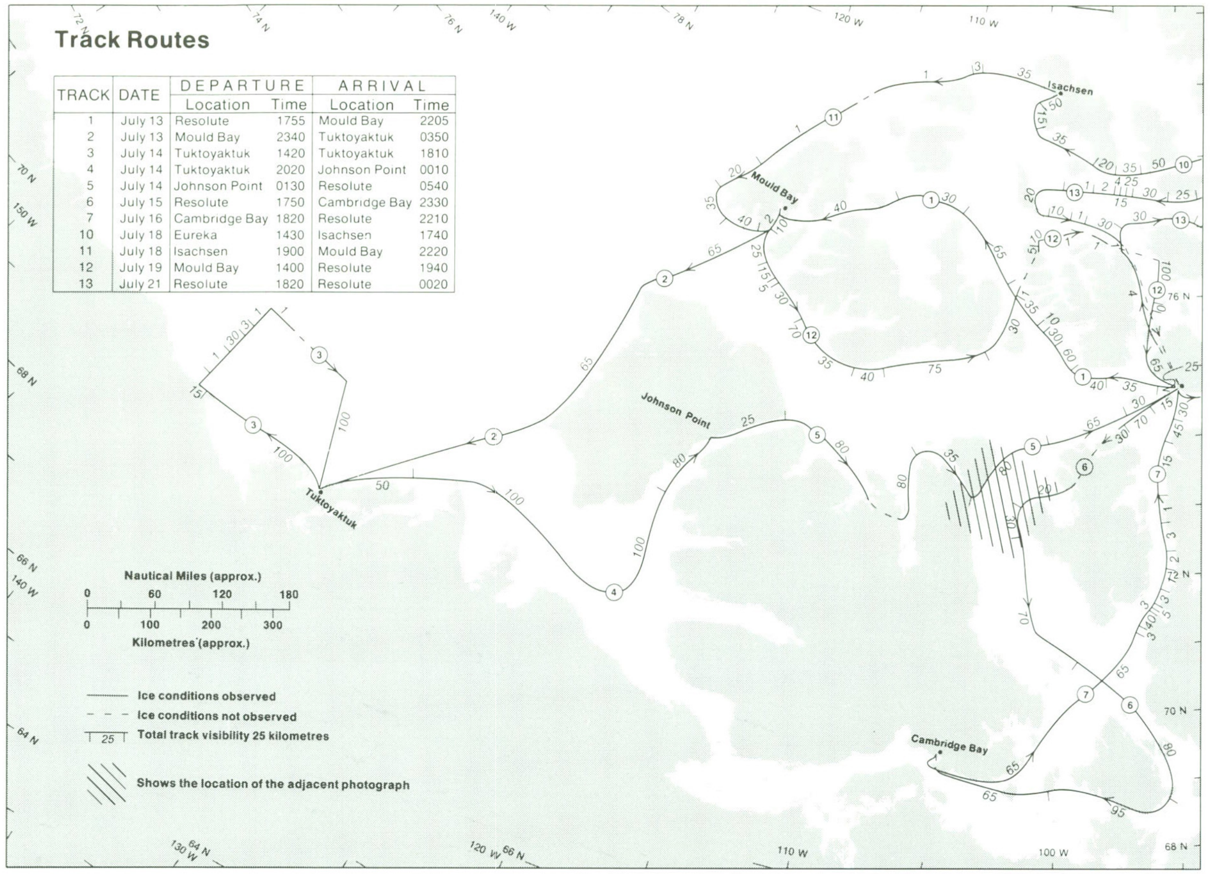
Satellite photography provided the information for the conditions shown for the southeastern part of the region. The conditions shown around Meighen Island are based on adjacent observations and previous experience. North of Ellesmere Island the ocean was probably nine-tenths covered while landfast ice filled the bays and formed a thin strip between the land and the moving ice of the Arctic Ocean.

Comments

The ice conditions that developed during the summer of 1972 (see ***Sea Ice Atlas of Arctic Canada, 1969-1974***) were characteristic of a normal, typical or average season. It was obvious from Flight 3 that the sea-ice regime in the summer of 1975 was going to be exceptionally advanced. The ice conditions noted in Peel Sound and Viscount Melville Sound in mid-July 1975 usually appear about five weeks later near the end of August. The break-up in Jones Sound, Wellington Channel and the area north of Penny Strait was at least four weeks earlier than usual.

The satellite photograph, July 19, and the observations made on July 13 during track 1 through Austin Channel show that the ice edge continued to migrate north through the channel. On the 19th it probably arched from Byam Martin Island to Schomberg Point and then across Graham Moore Bay to Harding Point. It is interesting to note that the observations made southwest of Byam Martin Island on July 19 duplicate those in the photograph.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
N.O.A.A. - National Oceanic and Atmospheric Administration
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Resolute
Grise Fiord
Arctic Bay
Sachs Harbour
Thule
Qânâq
N.O.A.A. July 14
N.O.A.A. July 18
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	July 13	Resolute	1755	Mould Bay	2205
2	July 13	Mould Bay	2340	Tuktoyaktuk	0350
3	July 14	Tuktoyaktuk	1420	Tuktoyaktuk	1810
4	July 14	Tuktoyaktuk	2020	Johnson Point	0010
5	July 14	Johnson Point	0130	Resolute	0540
6	July 15	Resolute	1750	Cambridge Bay	2330
7	July 16	Cambridge Bay	1820	Resolute	2210
10	July 18	Eureka	1430	Isachsen	1740
11	July 18	Isachsen	1900	Mould Bay	2220
12	July 19	Mould Bay	1400	Resolute	1940
13	July 21	Resolute	1820	Resolute	0020


Northern M' Clintock Channel, July 17, 1975, T53 F8

MAP 3-1975 West

July 13-21

Flight Effectiveness

Fog, rain and low clouds interrupted observations briefly during tracks 3 and 7. Observing conditions during the remaining four tracks were very good and the flight was 90 per cent successful.

Ice Conditions

Many changes took place during the four week interval between June 22, the finish of Flight 2, and July 21, the end of Flight 3. The solid band of landfast ice in the southern Beaufort Sea had disappeared. The ice cover in Amundsen Gulf had broken and was decaying very rapidly. The channels south of Victoria Island and King William Island, previously solid, were now mostly ice-free. The break-up in M'Clintock Channel and Peel Sound was exceptionally early.

Unobserved Areas

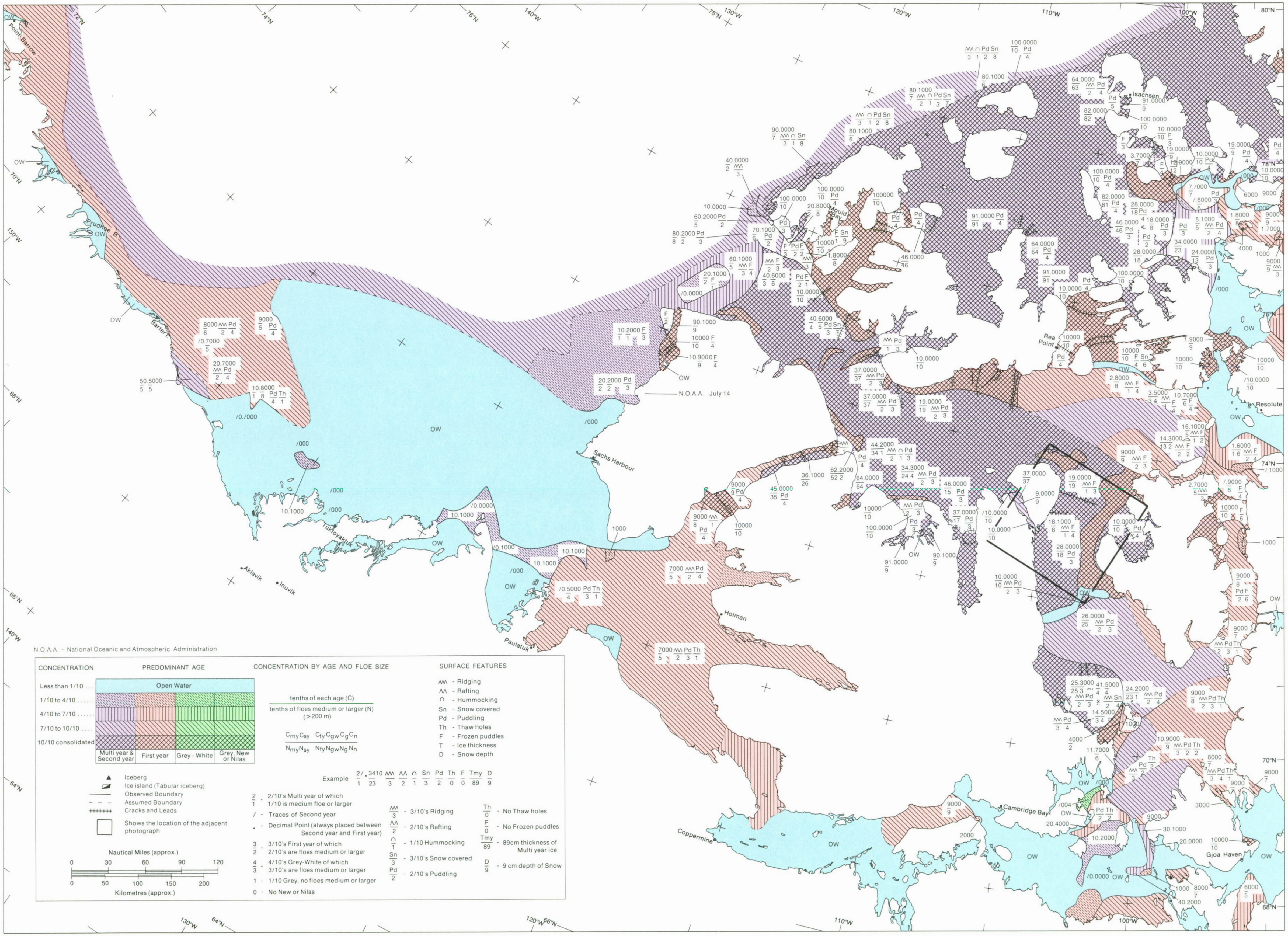
Pilot reports and the interpretation of satellite photographs provided the information used to show the conditions in Dease Strait, Coronation Gulf and the eastern part of Dolphin and Union Strait.

Comments

The season was advancing very rapidly. The break-up and clearing in all the channels south of Victoria Island from Dolphin and Union Strait to Victoria Strait was at least two weeks ahead of the normal timing. The break-up in Peel Sound and M'Clintock Channel was exceptionally early. Usually these areas, if they break up at all, do so in the first part of September. This year they broke up at least six weeks ahead of normal.

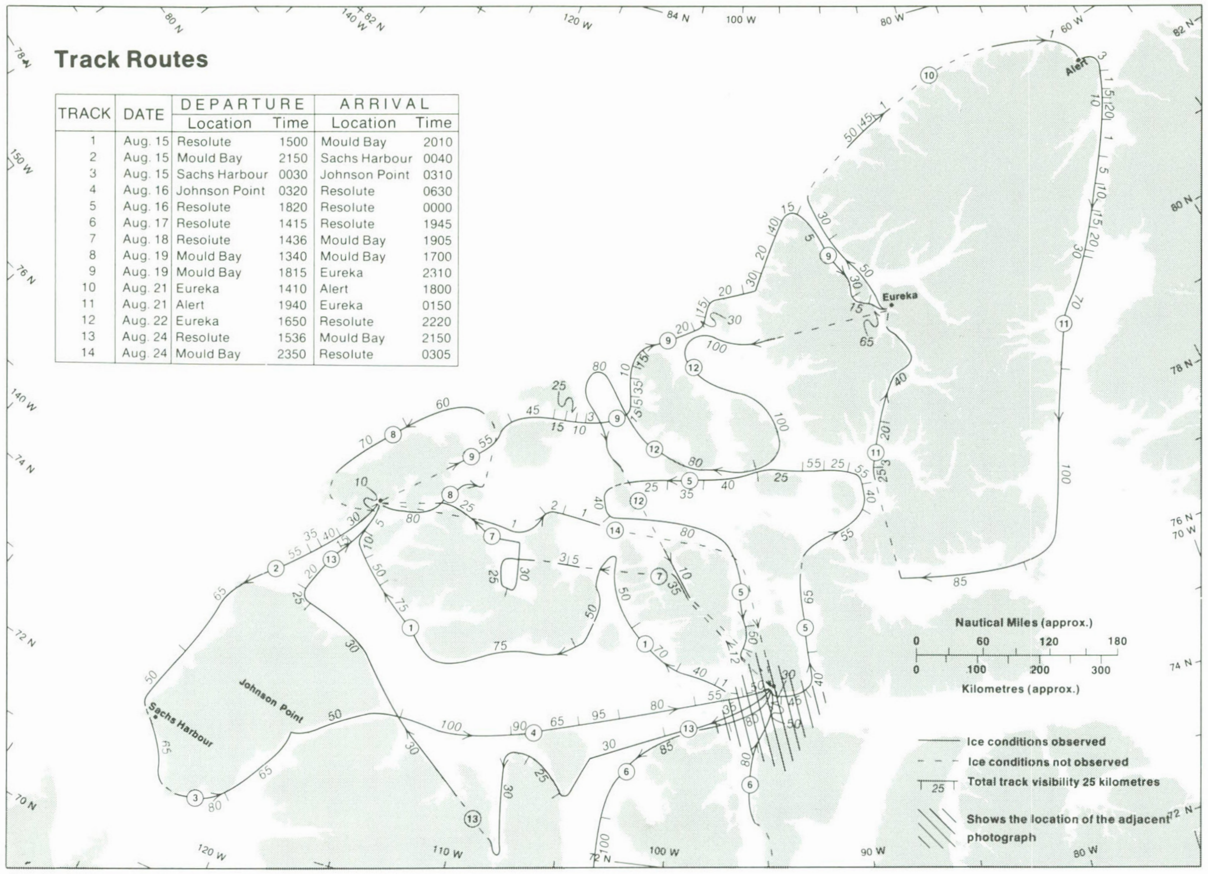
The patterns of break-up in these areas were typical. However, in M'Clure Strait and Prince of Wales Strait the pattern was different. Usually in M'Clure Strait the ice edge retreats in concentric bands into the strait from the west. The advance of break-up south of Prince Patrick Island was an exception to this typical pattern. The solid plug of ice at the southern end of Prince of Wales Strait would soon disappear as many cracks crossed it. A solid pattern is shown because no significant movement had taken place although break-up was imminent. A similar condition existed in the nothern half of Prince of Wales Strait.

The northern part of M'Clintock Channel was observed on July 14, track 5, and on July 15 during track 6. In both cases the weather permitted the observer to establish the ice conditions and the boundaries without doubt. The satellite photograph shows the same area on July 17. During the two days that elapsed between the two observations more than 170 km of ice broke up as the ice edge extended into Viscount Melville Sound. Judging by the rate of break-up and the southerly movement of the floes in M'Clintock Channel strong northerly winds must have prevailed.

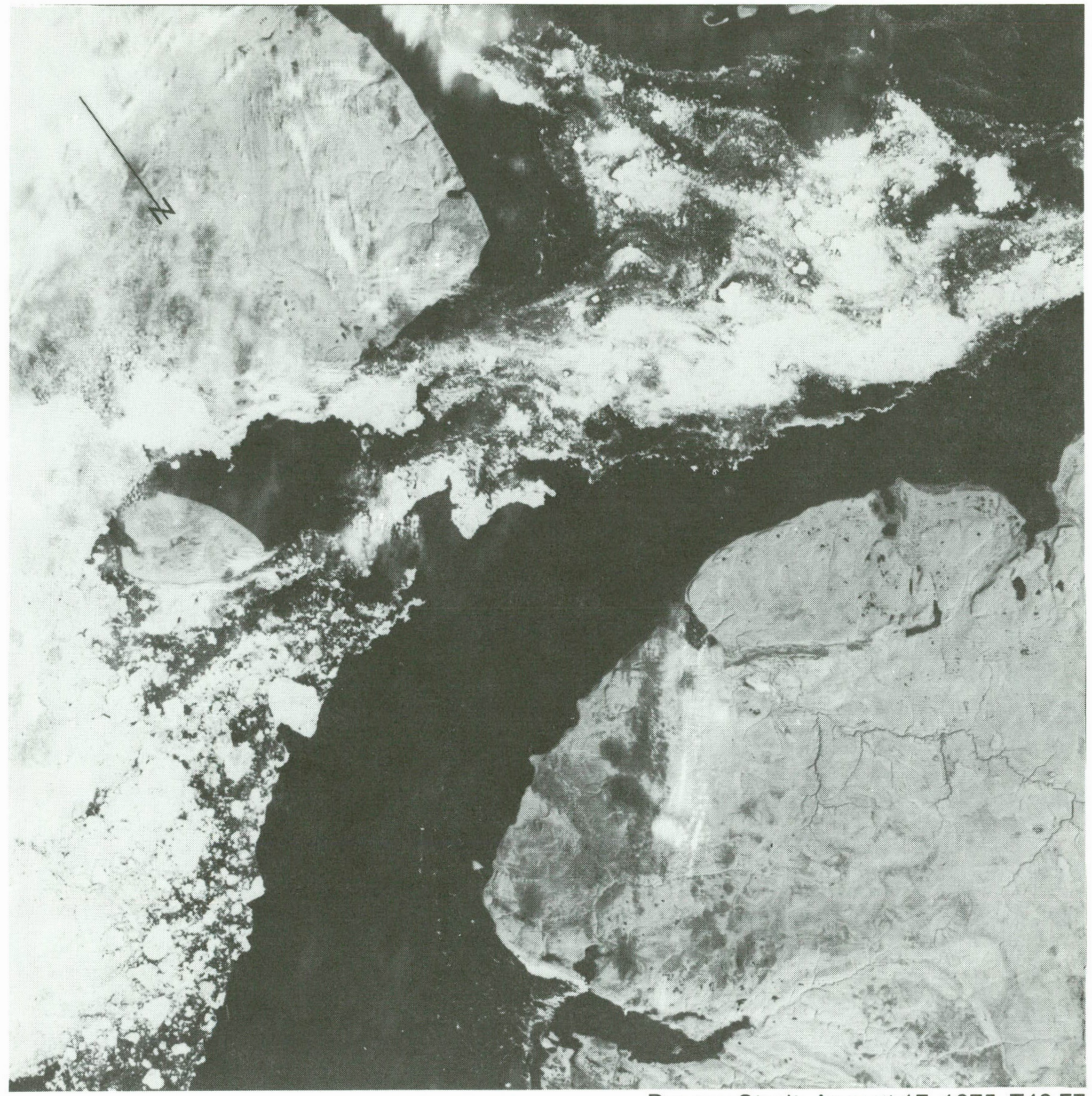


MAP 3 - 1975 WEST

July 13-21, 1975



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 15	Resolute	1500	Mould Bay	2010
2	Aug. 15	Mould Bay	2150	Sachs Harbour	0040
3	Aug. 15	Sachs Harbour	0030	Johnson Point	0310
4	Aug. 16	Johnson Point	0320	Resolute	0630
5	Aug. 16	Resolute	1820	Resolute	0000
6	Aug. 17	Resolute	1415	Resolute	1945
7	Aug. 18	Resolute	1436	Mould Bay	1905
8	Aug. 19	Mould Bay	1340	Mould Bay	1700
9	Aug. 19	Mould Bay	1815	Eureka	2310
10	Aug. 21	Eureka	1410	Alert	1800
11	Aug. 21	Alert	1940	Eureka	0150
12	Aug. 22	Eureka	1650	Resolute	2220
13	Aug. 24	Resolute	1536	Mould Bay	2150
14	Aug. 24	Mould Bay	2350	Resolute	0305



Barrow Strait, August 17, 1975, T48 F7

MAP 4-1975 East

August 15-24

Flight Effectiveness

The observer judiciously selected the tracks to cover the areas where the break-up was advancing and tried to time these missions to coincide with favourable weather. The result was excellent coverage of the key areas and although many tracks were hindered by fog, low cloud and in the case of track 14 freezing drizzle the flight was 70 per cent effective.

Ice Conditions

The most obvious change between flights 3 and 4 was the ablation and subsequent disappearance of most of the first-year ice in the region. The result was ice-free conditions in the eastern part of the area. The clearing in Greely Fiord was dramatic; from a solid ice cover in late July to an ice-free state by the third week in August. Typical changes included the break-up in northern Norwegian Bay, Massey Sound, Hassel Sound and the remainder of the unnamed sea east of Lougheed Island as well as Maclean Strait. The fracture of the ice cover in Viscount Melville Sound and M'Clure Strait was completed and the channels on either side of Eglinton Island broke up to the southern entrance of Fitzwilliam Strait.

Although the advance of break-up was very rapid in the early part of the season subsequent clearing did not keep pace, with the result that at the end of August the season was about three weeks ahead of what might be expected in a normal season.

The pattern of break-up in the northern channels differed from the usual case as Peary Channel broke before Prince Gustaf Adolf Sea. The solid ice plugs that remained in Nansen Sound and Sverdrup Channel were typical.

Freezing conditions were returning with the appearance of frozen puddles in Viscount Melville Sound, Hecla and Griper Bay, new ice on Otto Fiord and other areas and a snow storm at Resolute on August 24.

Unobserved Areas

No observations were made in Lancaster Sound and adjoining channels or northern Baffin Bay because once these areas become ice-free in July they remain so until the new ice types begin to appear in mid-September. Also satellite photographs are very effective, especially for open water conditions.

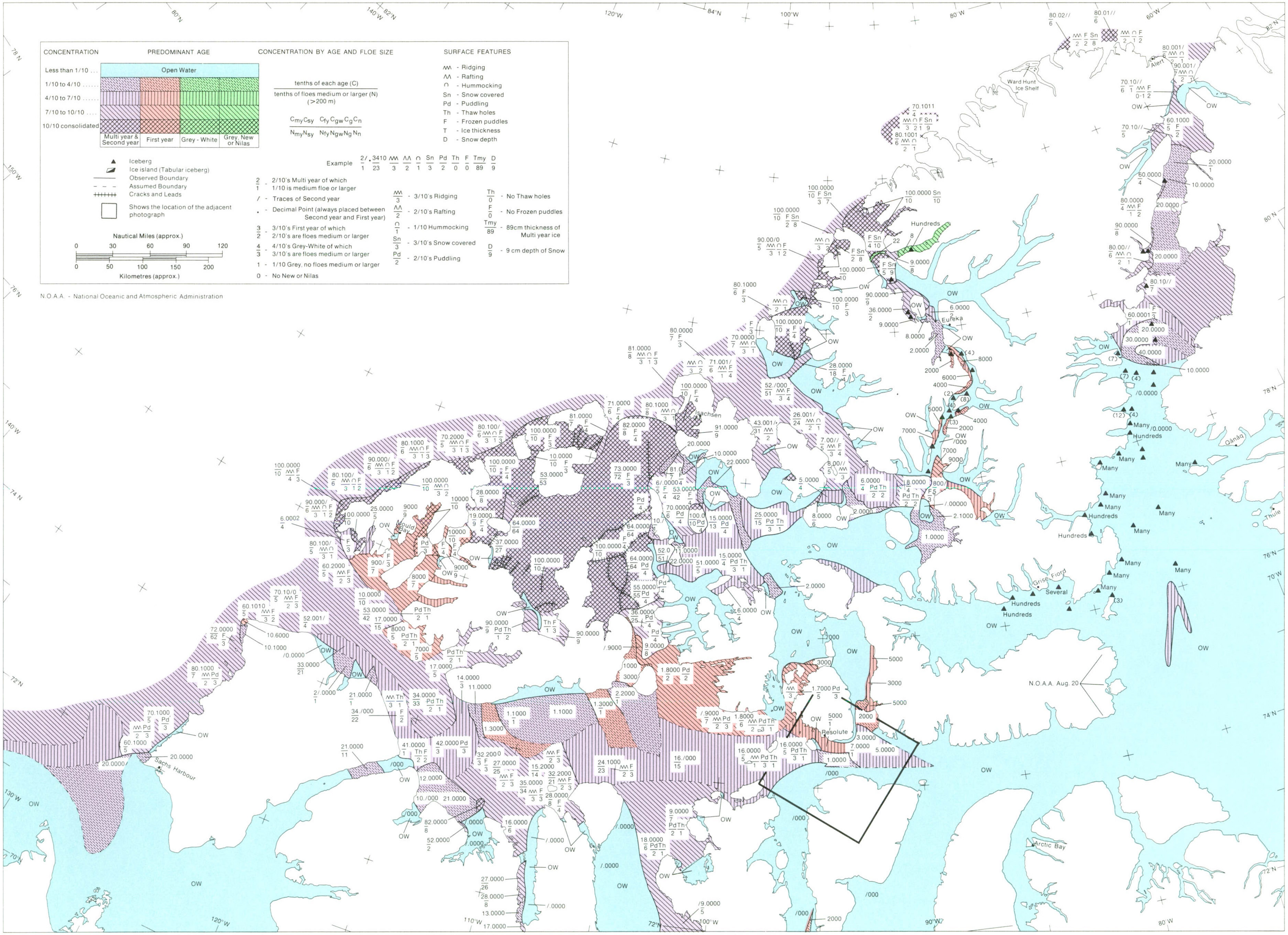
Comments

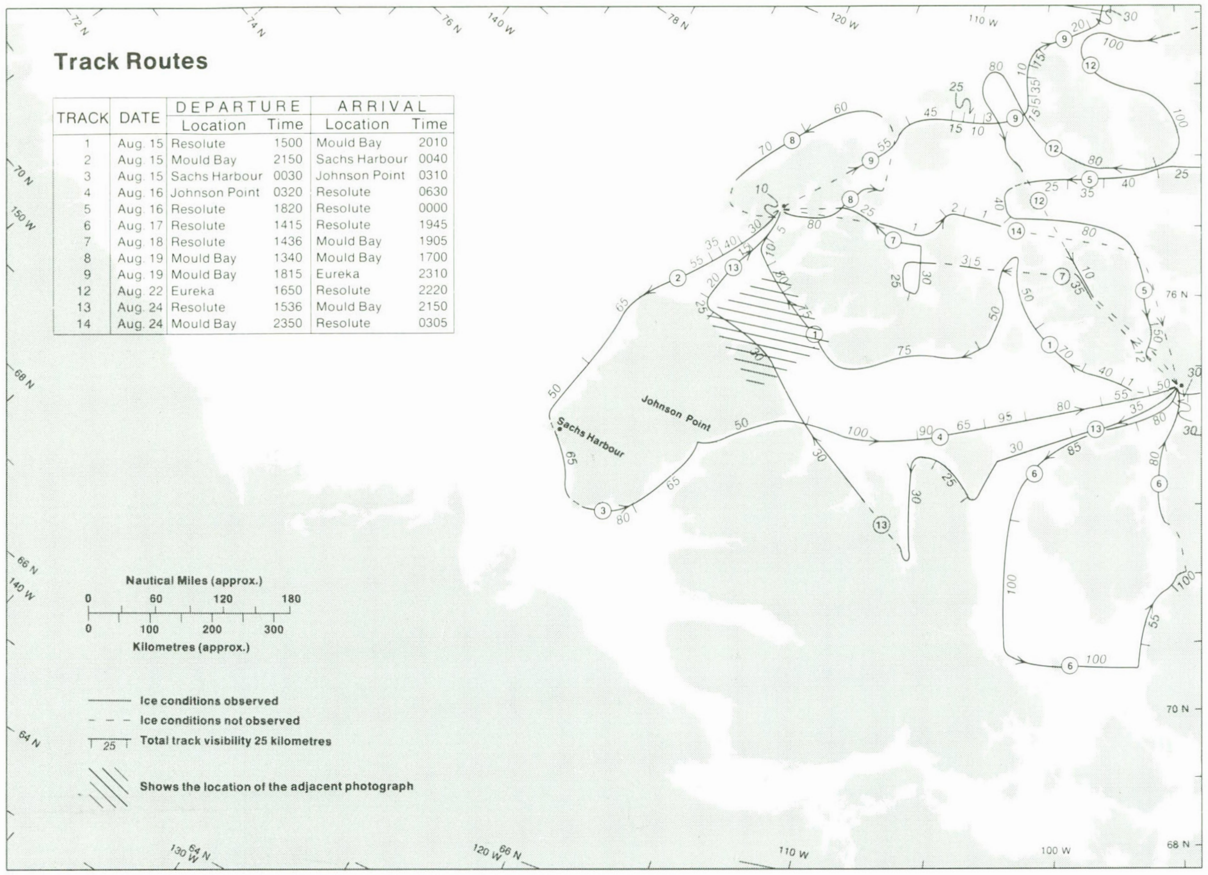
The broken ice cover north of Emerald Isle and southern Hecla and Griper Bay combined with the many cracks, especially north of Byam Martin Channel, indicated that the ice cover in the entire area north of Melville Island and through Hazen Strait and Prince Gustaf Adolf Sea would soon break up.

The iceberg population in the northern part of Jones Sound had risen dramatically as they swarmed in from Baffin Bay through Glacier Strait.

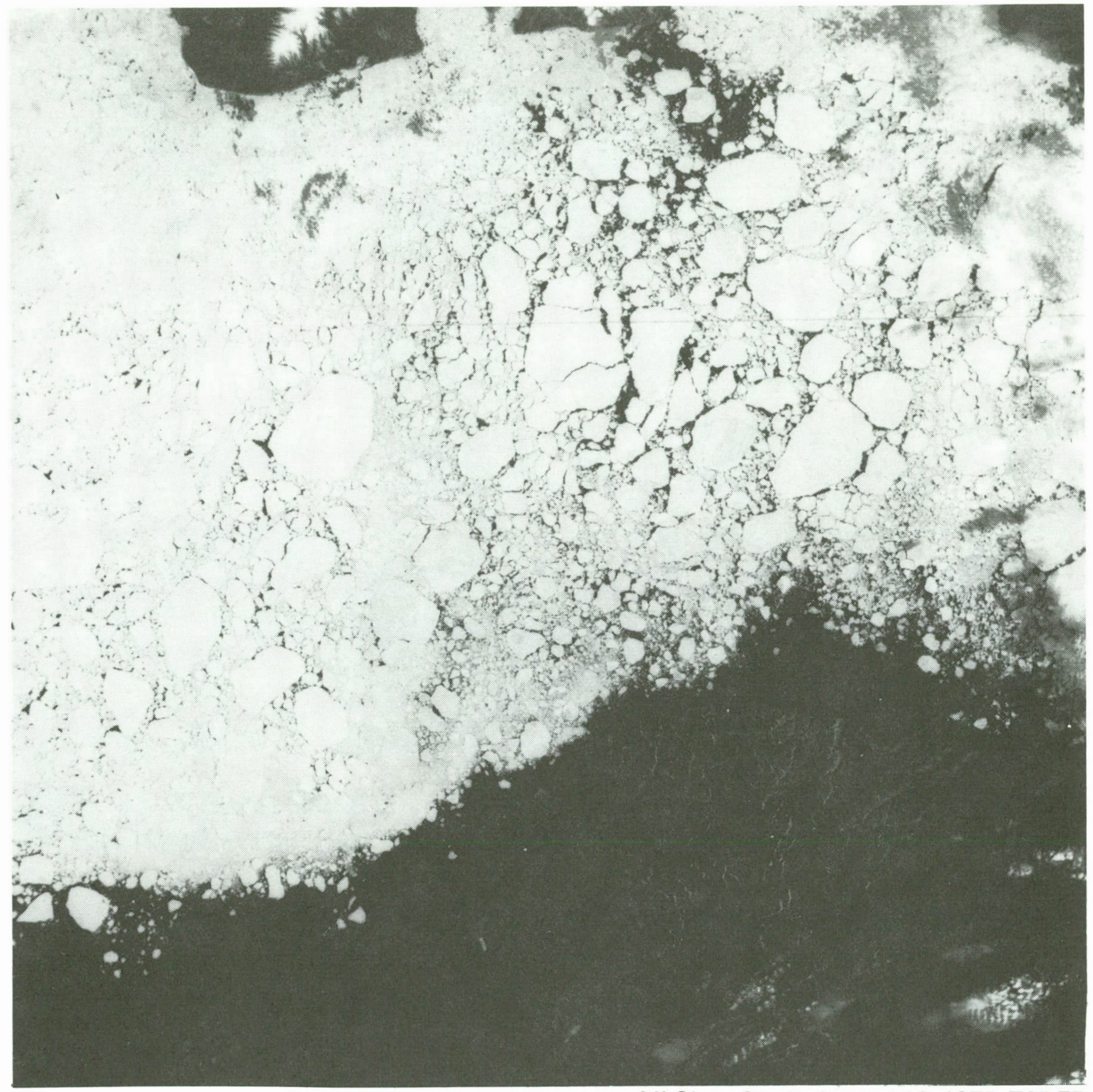
A large, previously untracked ice island, about 3 km × 2 km, was sighted on August 15, 3 km off the southwest tip of Cameron Island. An ice island more than ten times its size moved through Byam Martin Channel about the same time in 1962.

The area south of Resolute was observed during track 13 on August 24. The satellite photo shows the area on the 17th. Aside from a small advance to the east of Russell Island the ice conditions remained remarkably similar during the seven-day interval.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
- Traces of Second year
- Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
N.O.A.A. - National Oceanic and Atmospheric Administration
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Thule
Grise Fiord
Resolute
Sachs Harbour
Arctic Bay
N.O.A.A. Aug. 20



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 15	Resolute	1500	Mould Bay	2010
2	Aug. 15	Mould Bay	2150	Sachs Harbour	0040
3	Aug. 15	Sachs Harbour	0030	Johnson Point	0310
4	Aug. 16	Johnson Point	0320	Resolute	0630
5	Aug. 16	Resolute	1820	Resolute	0000
6	Aug. 17	Resolute	1415	Resolute	1945
7	Aug. 18	Resolute	1436	Mould Bay	1905
8	Aug. 19	Mould Bay	1340	Mould Bay	1700
9	Aug. 19	Mould Bay	1815	Eureka	2310
12	Aug. 22	Eureka	1650	Resolute	2220
13	Aug. 24	Resolute	1536	Mould Bay	2150
14	Aug. 24	Mould Bay	2350	Resolute	0305



M' Clure Strait, August 16, 1975, T65 F7

MAP 4-1975 West

August 15-24

Flight Effectiveness

Five tracks were completed over the western part of the region during Flight 4. Low cloud and rain were encountered as track 1 came into Mould Bay and as track 2 left Mould Bay. Apart from this brief smear on the record the weather conditions for ice observing were excellent and the flight was 100 per cent effective.

Ice Conditions

Changes from the previous flight were considerable. The most ominous, as far as navigation was concerned, was the 200 km southward invasion of the multi-year ice cover across the Beaufort Sea to within 100 km of the coast. During a four-week period the area of open water in the Beaufort Sea had been reduced to one third of its original size as the winds that created the open area and held the ice back in July were not present in the middle part of August. Considerable ablation in all the remaining channels of the area left Amundsen Gulf and Prince of Wales Strait and the channels south of Victoria Strait and Prince of Wales Island ice-free. The clearing in M'Clintock Channel was well advanced.

At first glance it appears as if very little change had taken place in Viscount Melville Sound. However, concentrations had declined dramatically from a solid cover to an average of about five-tenths of the surface only four weeks later. The change in M'Clure Strait was not as great. Concentrations in this channel were about eight-tenths.

Unobserved Areas

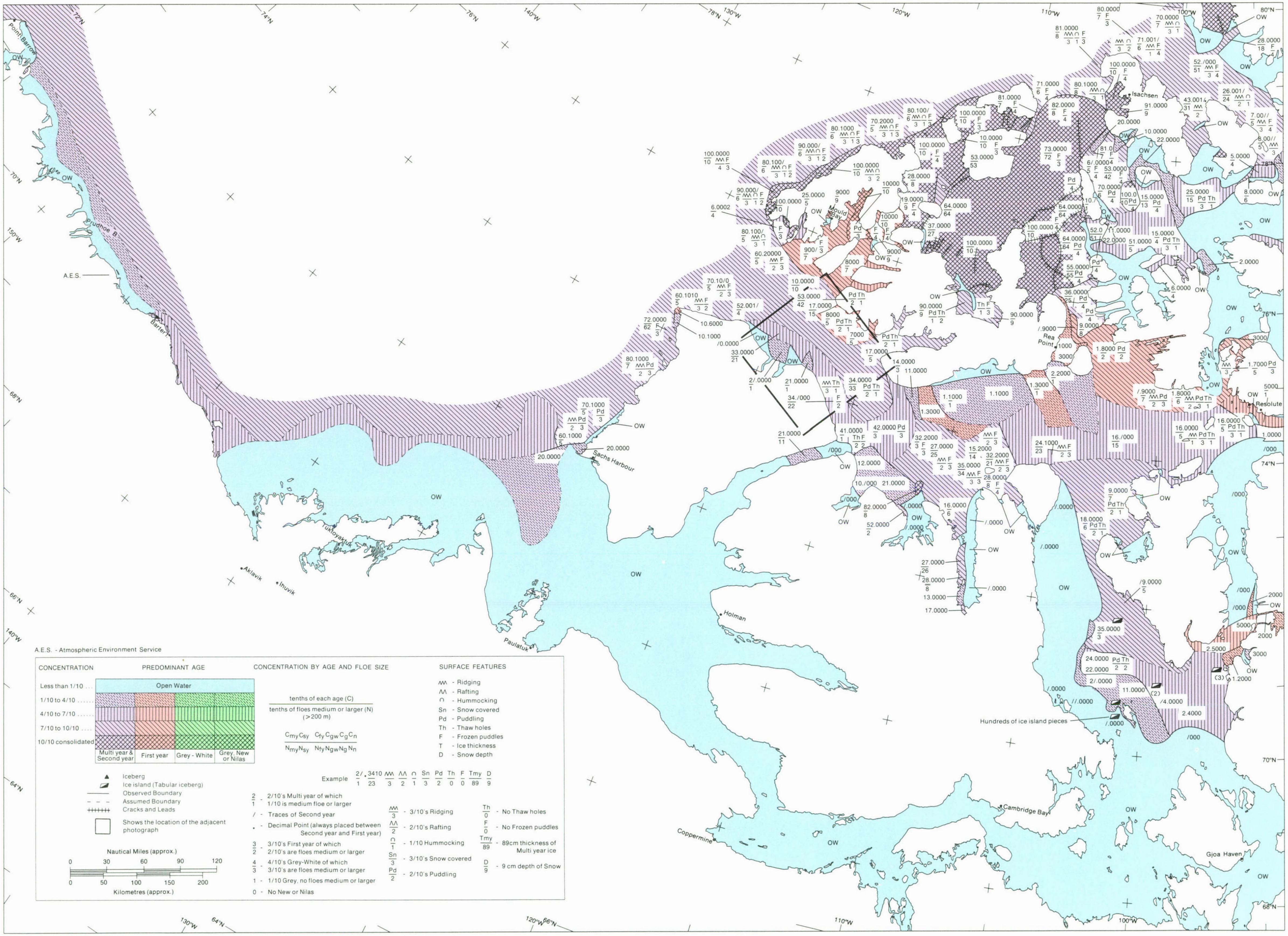
Observations at both ends of the channels between Victoria Island and the mainland showed all the ice had melted. This means that a similar situation will exist along the length of the channels and no survey was required. No surveys were carried out in the Beaufort Sea since the fine weather would give the AES sea-ice reconnaissance group, who were active in the area, an opportunity to obtain good coverage.

Comments

The ice island T-1 broke up in the southern part of M'Clintock Channel. Most of the pieces were trapped in the shallows around Gateshead Island where they were gradually melting. Others were drifting back and forth across the channel as the winds directed.

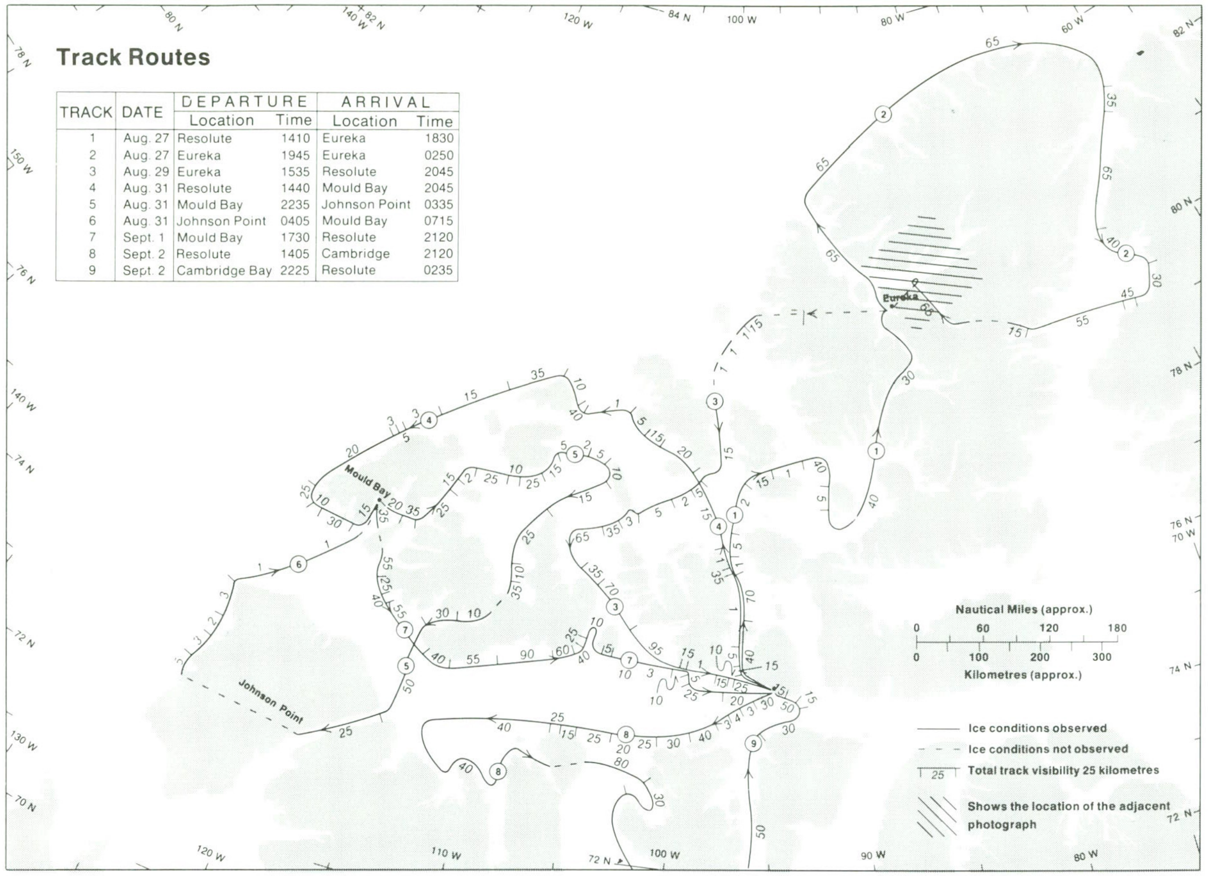
The satellite photograph is excellent although it is difficult to separate the dark open water areas from the land mass of northern Banks Island.

The observing conditions during track 6 over M'Clintock Channel on August 17 were excellent. The ceiling and visibility were unlimited and observations were made from 900 m. In mid-channel at 71°40'N and 103°W, visibility was reduced for a few kilometres by a bluish haze. The people on board said they could smell smoke. Is it possible the smoke from forest fires further south could be transported this far north?



MAP 4 - 1975 WEST

August 15-24, 1975



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 27	Resolute	1410	Eureka	1830
2	Aug. 27	Eureka	1945	Eureka	0250
3	Aug. 29	Eureka	1535	Resolute	2045
4	Aug. 31	Resolute	1440	Mould Bay	2045
5	Aug. 31	Mould Bay	2235	Johnson Point	0335
6	Aug. 31	Johnson Point	0405	Mould Bay	0715
7	Sept. 1	Mould Bay	1730	Resolute	2120
8	Sept. 2	Resolute	1405	Cambridge	2120
9	Sept. 2	Cambridge Bay	2225	Resolute	0235

Greely Fiord, September 1, 1975, T63 F1

MAP 5-1975 East

August 27-September 2

Flight Effectiveness

Flying conditions and ice reconnaissance are severely hampered at this time every year as the temperatures fluctuate between freezing and thawing. Flying conditions are poor due to freezing rain and aircraft icing. Observing conditions are poor as a result of low cloud and shorter days. Flight 5, 1975 was no exception as low strato-cumulus cloud, snow showers and freezing rain reduced the effectiveness during a part of every track. The flight was 75 per cent successful.

Ice Conditions

The major change was the break-up of the ice cover in Prince Gustaf Adolf Sea, Byam Martin Channel and Hazen Strait and adjoining areas. The break-up took place between August 24 and 31. Typical of the time of year was the absence of puddles, the presence of frozen puddles and the southerly advance of the snow cover. The new ice that was appearing would gradually develop into first-year ice.

The multi-year ice in the northern channels was slowly moving south and spreading out into the previously open water areas of the southern channels. Norwegian Bay is an example of a southern channel.

The ice edge in Kane Basin had moved slightly further south in the interval between flights 4 and 5, but no sea ice was being exported into Baffin Bay. Sea ice was definitely moving east into central Barrow Strait where concentrations increased between flights 4 and 5.

Unobserved Areas

The conditions shown for Northern Baffin Bay, Jones Sound and Lancaster Sound and its connecting channels were determined from satellite photographs. The regime around northern Ellef Ringnes Island was established from adjacent observations and previous experience.

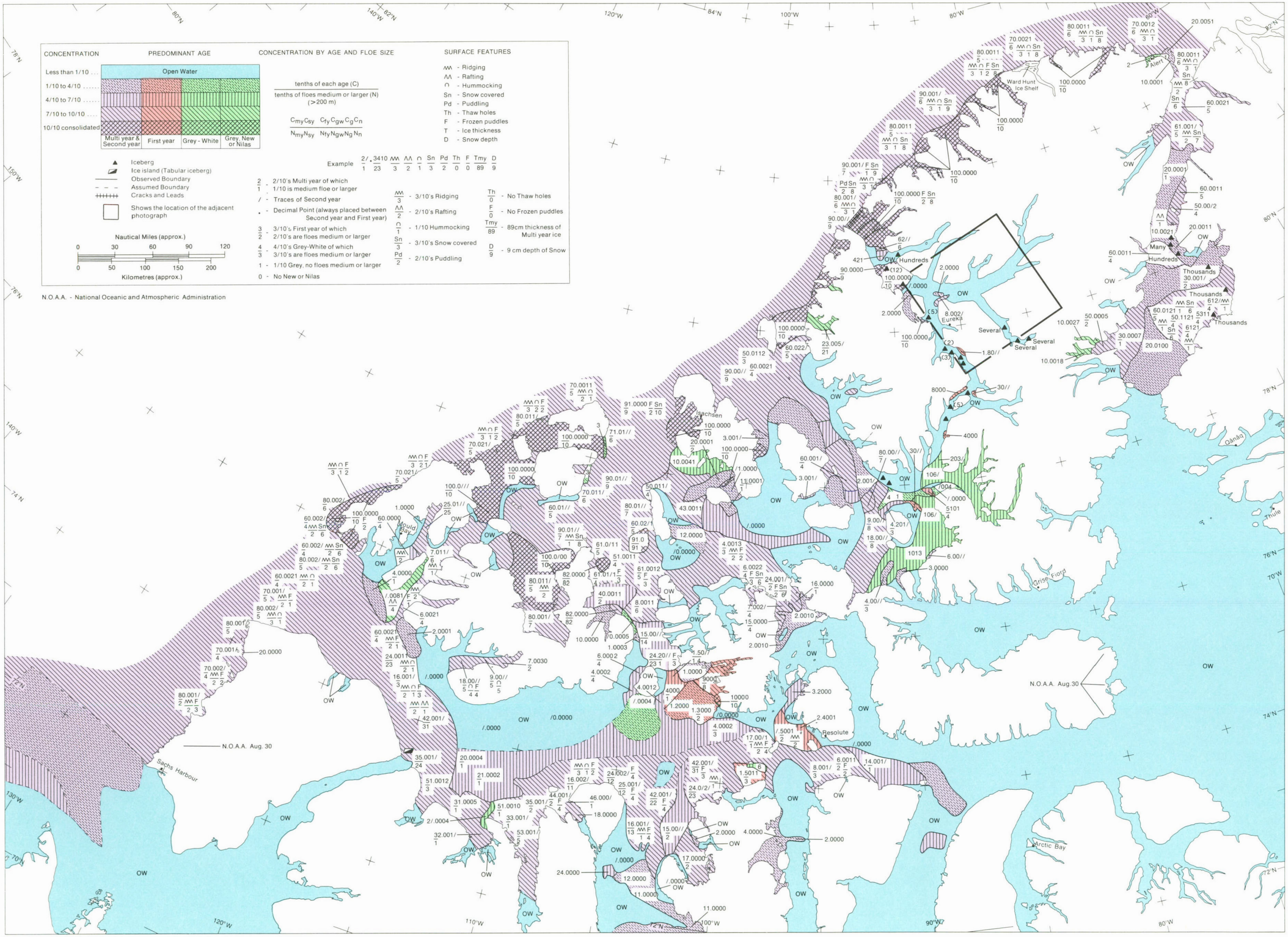
Comments

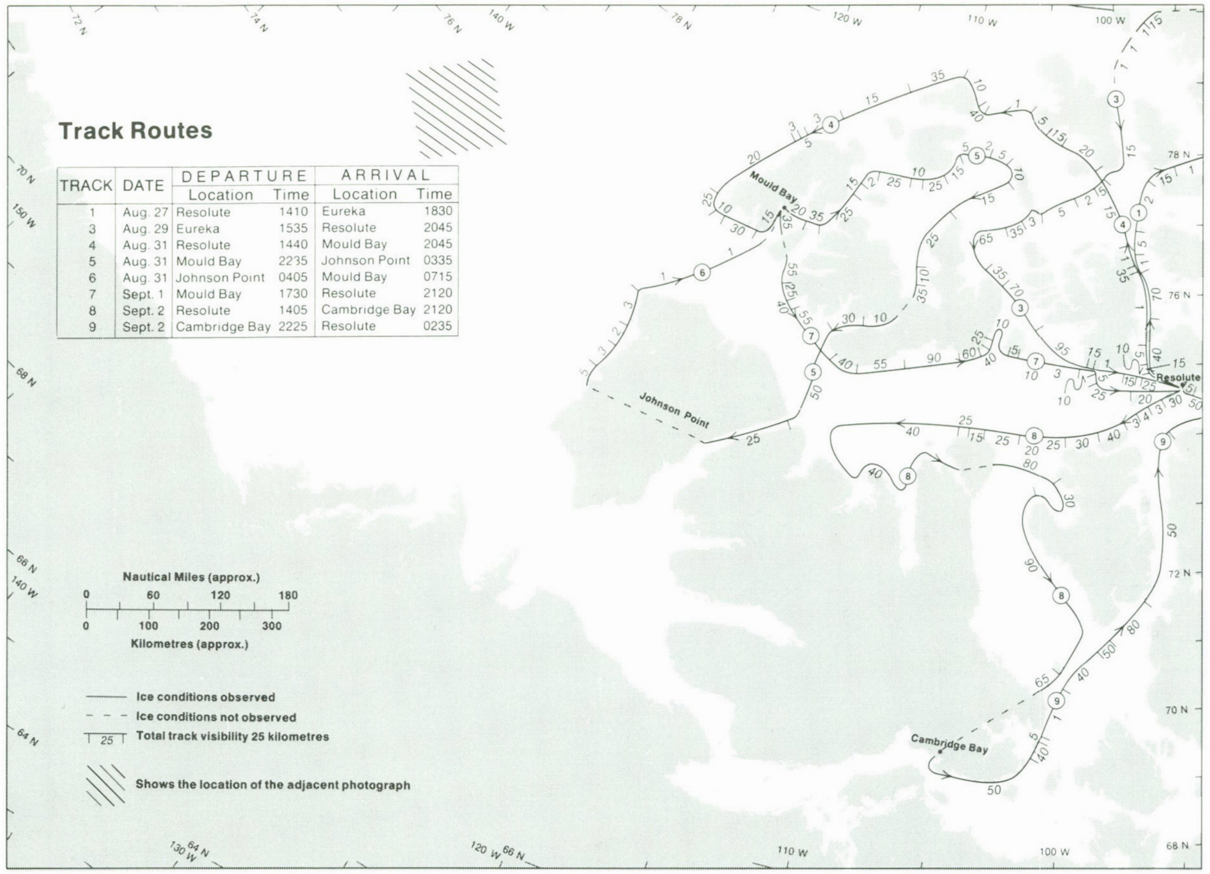
The weather finally permitted the ice conditions along northern Ellesmere Island to be mapped. The types, distributions and concentrations were probably very similar to the conditions that prevailed during the previous two months when efforts to observe the area were thwarted by the weather.

Thousands of relatively flat-topped icebergs were seen in Peabody Bay close to their origin, the Humboldt Glacier. These ice masses were free to move with the winds and currents in Kane Basin and, when conditions were favourable, would start moving south along the western part of Baffin Bay. Other icebergs like the hundreds of small ones in Otto Fiord could not go anywhere until the solid barrier of ice south of them in Nansen Sound broke and permitted a southerly drift.

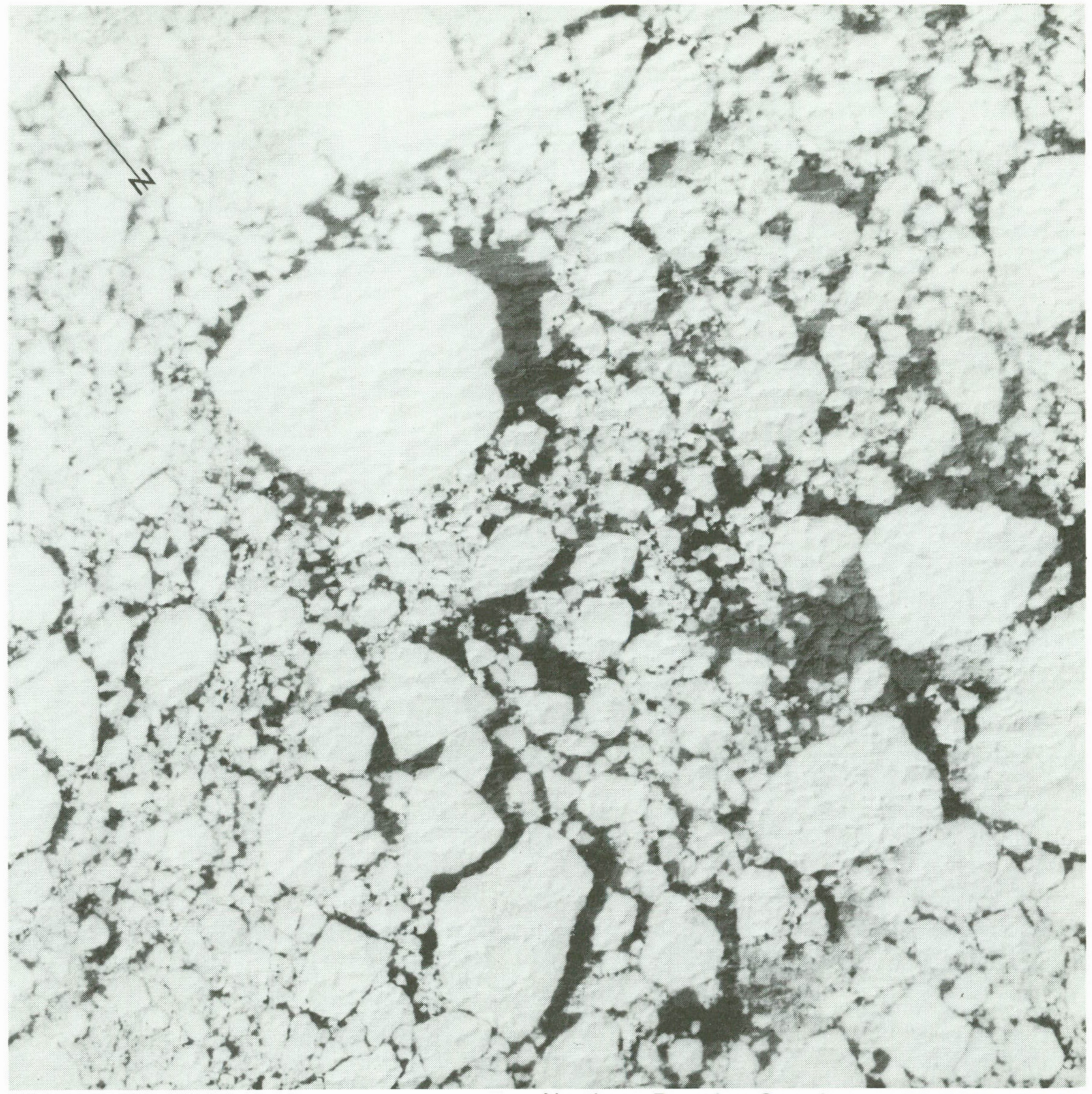
The solid ice cover in Ballantyne Strait, Wilkins Strait, Sverdrup Channel and Nansen Sound still prohibited ice from the Arctic Ocean from gaining access to the channels of the archipelago.

The satellite photo indicates the extent of the fresh snow and the ice-free conditions the icebreaker John A. Macdonald had to contend with during the resupply mission to Eureka on August 29.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
N.O.A.A. - National Oceanic and Atmospheric Administration
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Resolute
Grise Fiord
Thule
Qânâq
Arctic Bay
Sachs Harbour
N.O.A.A. Aug. 30
N.O.A.A. Aug.30
Hundreds
Thousands
Several
Many



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 27	Resolute	1410	Eureka	1830
3	Aug. 29	Eureka	1535	Resolute	2045
4	Aug. 31	Resolute	1440	Mould Bay	2045
5	Aug. 31	Mould Bay	2235	Johnson Point	0335
6	Aug. 31	Johnson Point	0405	Mould Bay	0715
7	Sept. 1	Mould Bay	1730	Resolute	2120
8	Sept. 2	Resolute	1405	Cambridge Bay	2120
9	Sept. 2	Cambridge Bay	2225	Resolute	0235



Northern Beaufort Sea, August 30, 1975, T79 F7

MAP 5-1975 West

August 27-September 2

Flight Effectiveness

The season was changing from summer to winter and as the air temperatures hovered around freezing flying and observing conditions were difficult. Generally every track was hampered by low stratocumulus clouds with a base at 150 m, or snow showers, or rain showers, or freezing rain or shorter daylight hours. The flight was about 75 per cent effective.

Ice Conditions

From first glance it would appear that the main change between flights 4 and 5 was the clearing in Viscount Melville Sound which resulted in the development of the large area of open water to the south of Melville Island. Although some melting and ablation did take place the main reason was northerly winds which concentrated the ice in the southern half of the sound. Melting was the main cause of the reduction of the ice cover in the southern part of M'Clintock Channel. In M'Clure Strait the concentrations appeared to have increased as the winds moved ice into the area and concentrated it in the southern part of the strait.

In the Beaufort Sea, north of Tuktoyaktuk, the pack ice had moved about 25 km closer to the coast. It is interesting to note that the two fingers of ice reaching for Tuktoyaktuk and Cape Parry stayed in the same place.

Unobserved Areas

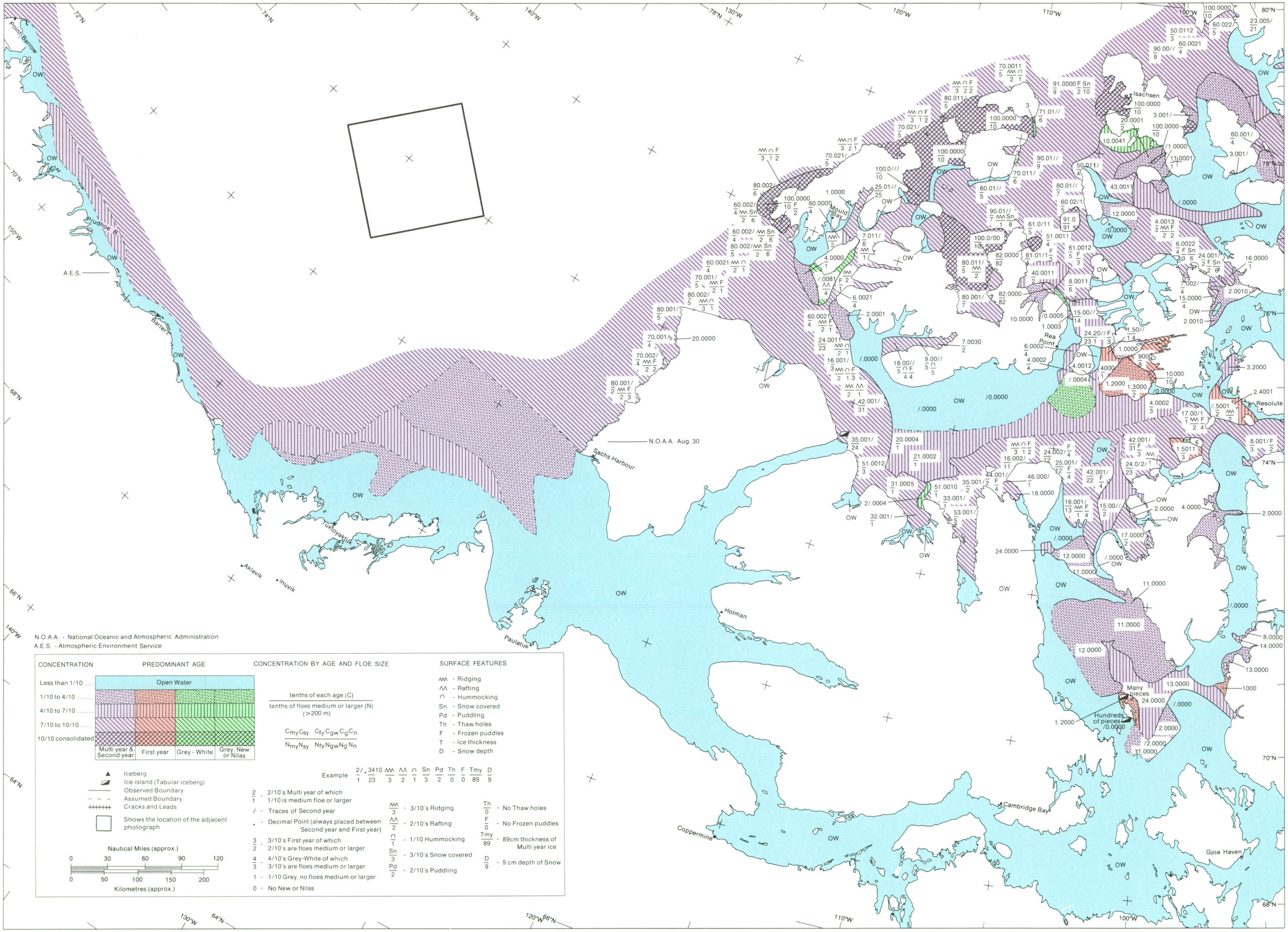
Satellite information combined with AES ice reconnaissance data provided the means to show the conditions in the southern part of the Beaufort Sea as well as Amundsen Gulf and the adjacent channels. Judging from the adjacent satellite photo the northern part of the Beaufort Sea supported a similar ice cover.

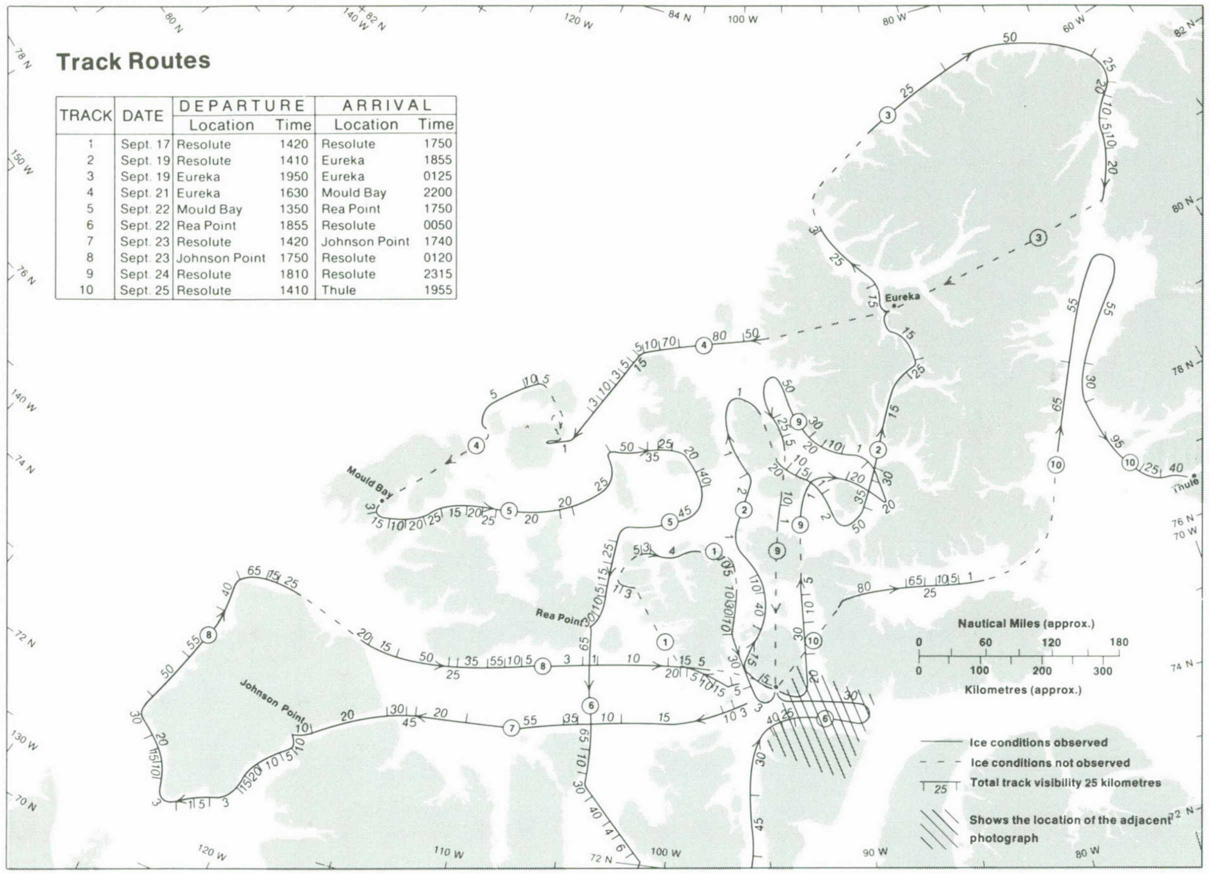
Comments

An almost square ice island, about 4 km per side, was located on August 31 at the northern entrance to Prince of Wales Strait. Likely it moved into this area along with the influx of multi-year ice that came through M'Clure Strait into Viscount Melville Sound during the previous fall. The ice island fragments around Gateshead Island had continued to melt and many were reduced to odd-shaped, small-sized floes that hardly resembled an ice island at all. A few pieces had finally reached the northern entrance to Victoria Strait where they were undergoing their final melt.

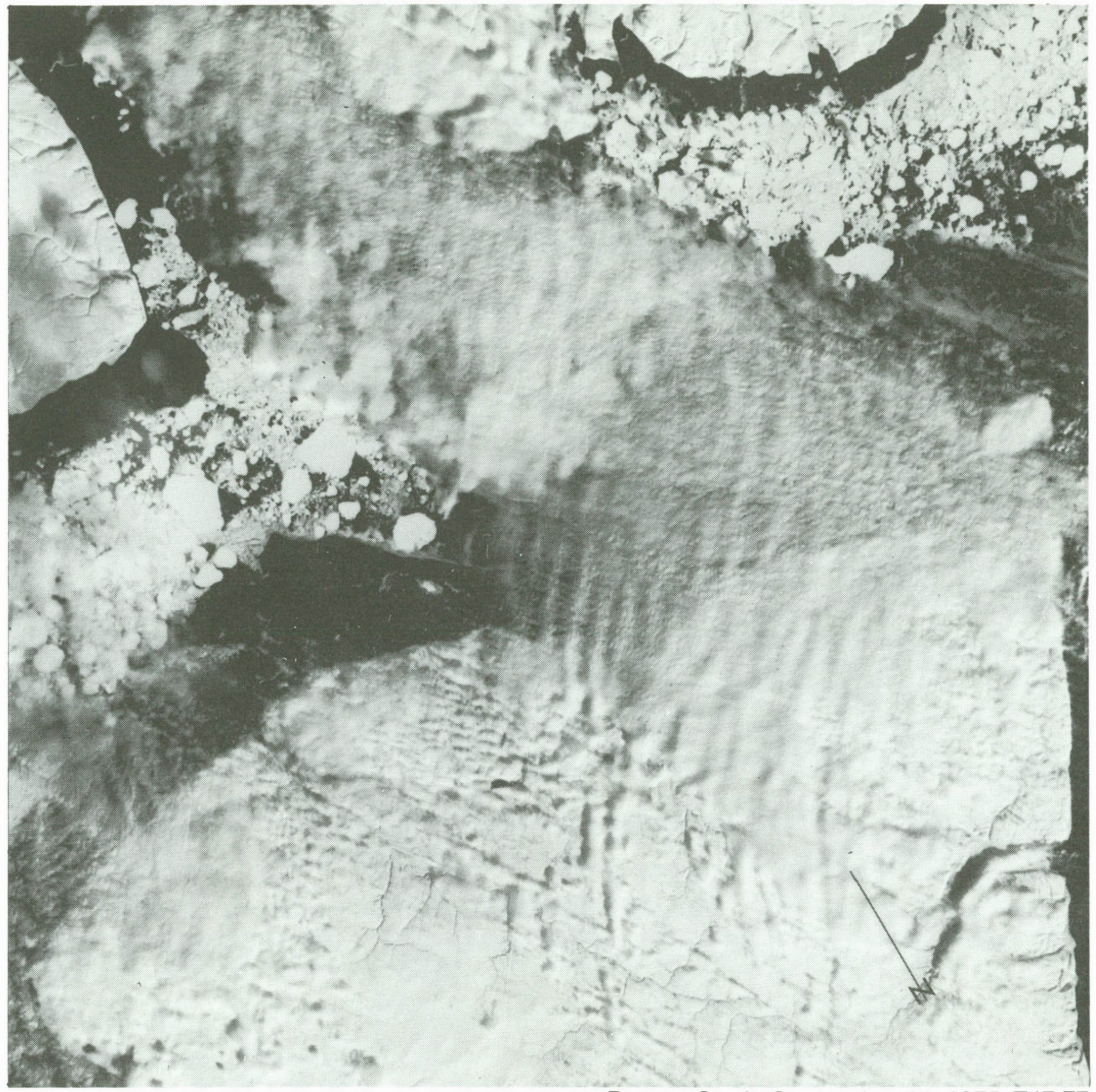
On August 17 during track 6 of Flight 4 Browne Bay, the northeast side of Prince of Wales Island was observed to be ice-free. On September 2 the bay was up to four-tenths covered with multi-year ice. In both cases Peel Sound in the vicinity of Browne Bay was ice-free. The multi-year ice must have moved south from Barrow Strait.

The satellite photograph looks mottled because of the cloud cover. The cloud also obscures the water and makes it look like new ice is present. The clouds cannot obscure the fact that the floes are snow-covered, ranging up to 40 km across and displaying the characteristics of multi-year floes.


N.O.A.A. - National Oceanic and Atmospheric Administration
A.E.S. - Atmospheric Environment Service
CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Point Barrow
Prudhoe B.
A.E.S.
Barter I.
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Sachs Harbour
N.O.A.A. Aug. 30
Holman
Mould Bay
Isachsen
Rea Point
Resolute
Cambridge Bay
Coppermine
Gjoa Haven
Many pieces
Hundreds of pieces
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Sept. 17	Resolute	1420	Resolute	1750
2	Sept. 19	Resolute	1410	Eureka	1855
3	Sept. 19	Eureka	1950	Eureka	0125
4	Sept. 21	Eureka	1630	Mould Bay	2200
5	Sept. 22	Mould Bay	1350	Rea Point	1750
6	Sept. 22	Rea Point	1855	Resolute	0050
7	Sept. 23	Resolute	1420	Johnson Point	1740
8	Sept. 23	Johnson Point	1750	Resolute	0120
9	Sept. 24	Resolute	1810	Resolute	2315
10	Sept. 25	Resolute	1410	Thule	1955



Barrow Strait, September 21, 1975, T47 F7

MAP 6-1975 East

September 17-25

Flight Effectiveness

Out of seven tracks made over the eastern part of the region only one, track 5, was able to maintain observations throughout the track. Some part of each of the others was disrupted by low stratus cloud, fog, snow showers, or blowing snow. In addition, unexpectedly strong surface winds in some areas and a malfunctioning radar made navigation even more difficult than it usually is at this time of year when the snow cover masks the ground details. The flight was 60 per cent successful.

Ice Conditions

Immediately evident are the changes from open water to the various forms of new ice in the fifteen-day period that separated the end of Flight 5 and the start of Flight 6. All of the places in the central part of the area previously ice-free were now nine-tenths covered with the new ice types. Peel Sound, Lancaster Sound and adjoining channels to the south as well as Baffin Bay remained ice-free.

The solid ice cover in Ballantyne Strait and Sverdrup Channel had broken and ice from the Arctic Ocean could move into the archipelago through these and the other channels when the winds dictated. Nansen Sound remained solid.

With the exception of more snow the conditions along the northern coast of Ellesmere Island remained unchanged between the two flights. The multi-year ice in Kennedy Channel had either melted or drifted to the south and the older ice in Kane Basin was concentrated in the southern part. Here concentrations of multi-year ice had almost doubled.

While Penny Strait was becoming free of multi-year ice, the neighbouring channels of Bathurst Island, May Inlet and Erskine Inlet were inundated with multi-year ice which was consolidated by the formation of new ice.

Unobserved Areas

Satellite photography and previous and subsequent observations helped establish the ice conditions in Baffin Bay and the Lancaster Sound area. Conditions north of Axel Heiberg Island were based on adjacent observations and past years' experience.

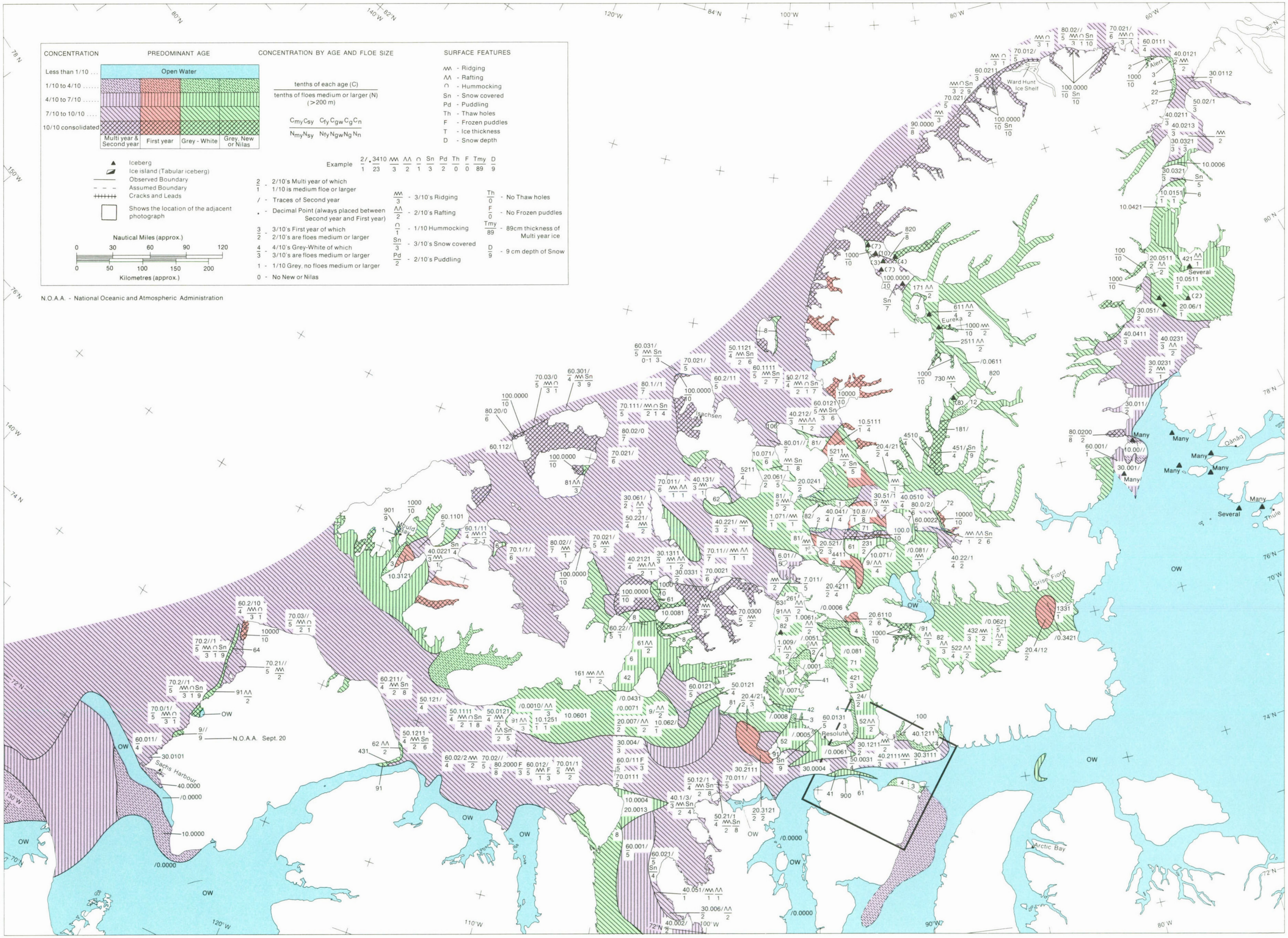
The conditions west of Prince Patrick Island probably resembled those shown on Maps 5 and 7 - 1975 EAST.

Comments

The multi-year ice was moving east in Parry Channel and some had rounded Somerset Island and moved south into Prince Regent Inlet which was previously ice-free. An opposite trend briefly appeared in Eureka Sound near Slidre Fiord. The map shows the nine-tenths cover observed on September 19 whereas when track 4 crossed the area two days later the area was ice-free. This short-lived reprieve from ice was likely a combined effect of winds and currents.

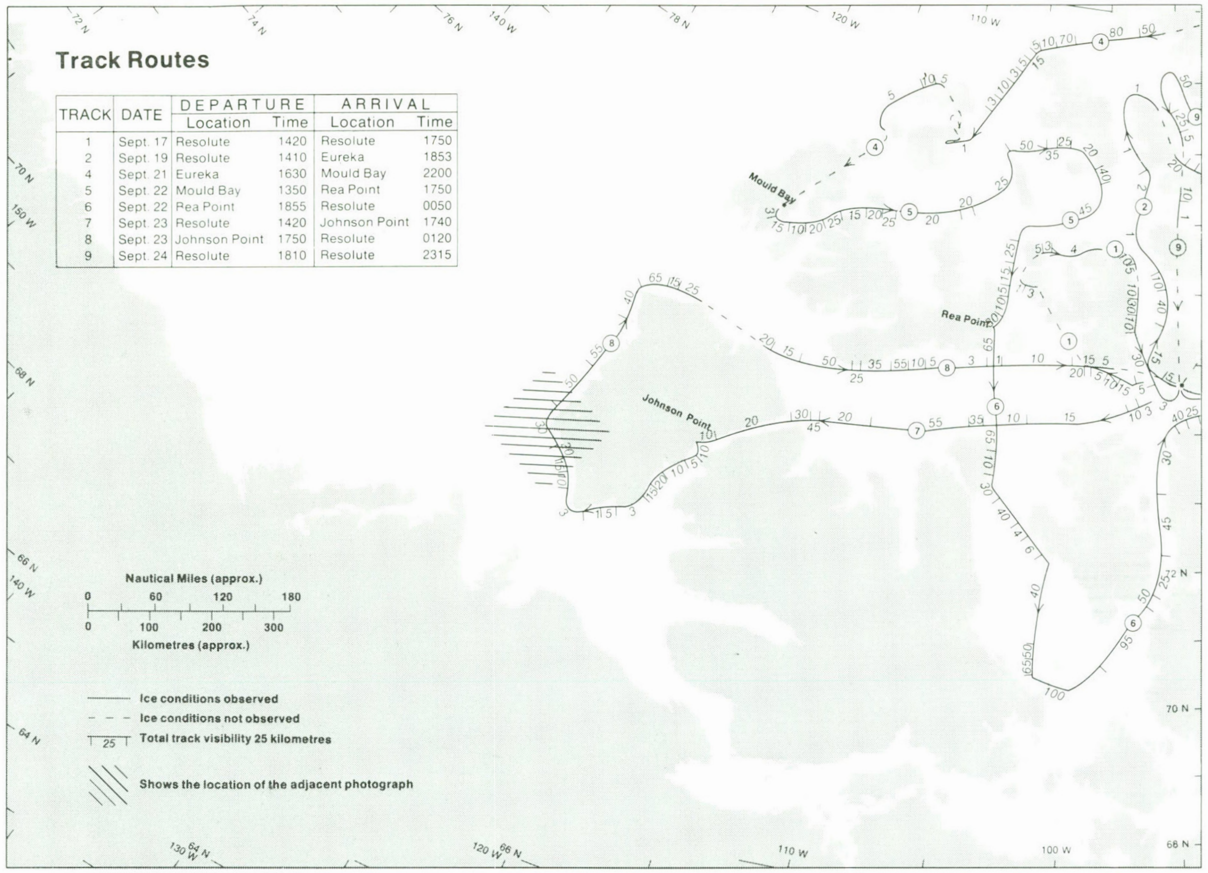
Kane Basin was beginning to export ice into northern Baffin Bay. The hook-shaped area of ice east of Talbot Inlet is an interesting feature. Similarly shaped concentrations have been observed there regularly in previous seasons.

The ice conditions for eastern Barrow Strait were mapped on September 22. The satellite photograph from September 21 shows little change.

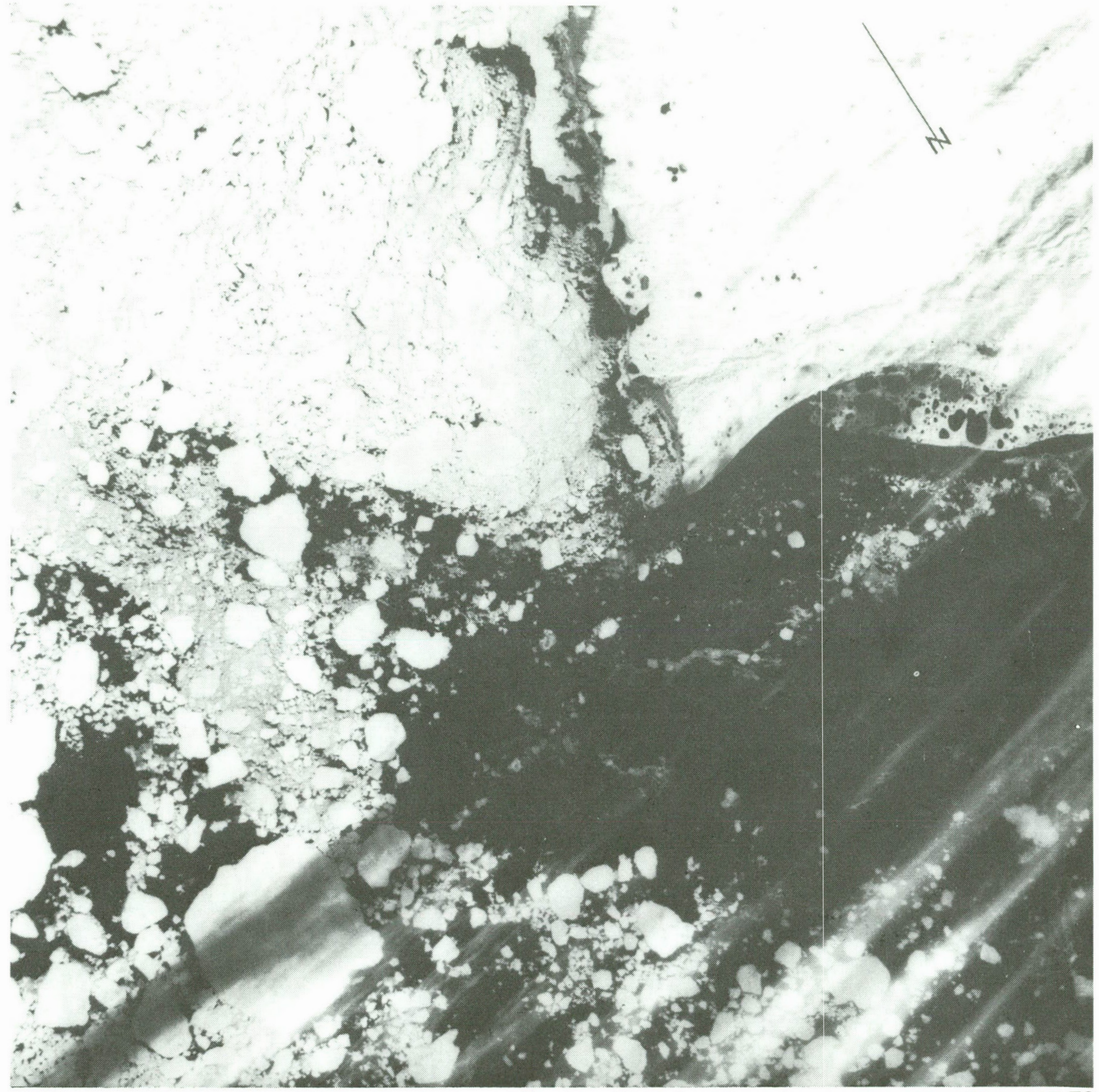


MAP 6 - 1975 EAST

September 17-25, 1975



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Sept. 17	Resolute	1420	Resolute	1750
2	Sept. 19	Resolute	1410	Eureka	1853
4	Sept. 21	Eureka	1630	Mould Bay	2200
5	Sept. 22	Mould Bay	1350	Rea Point	1750
6	Sept. 22	Rea Point	1855	Resolute	0050
7	Sept. 23	Resolute	1420	Johnson Point	1740
8	Sept. 23	Johnson Point	1750	Resolute	0120
9	Sept. 24	Resolute	1810	Resolute	2315



Eastern Beaufort Sea, September 23, 1975, T67 F9

MAP 6-1975 West

September 17-25

Flight Effectiveness

Low cloud ceilings were the major limiting factor to observations. Snow showers, freezing rain and the shortening daylight hours also hindered the surveys. In spite of it all, the observer collected information over most of the area and the flight was 80 per cent effective.

Ice Conditions

New ice had formed in all open areas in Parry Channel and central and northern M'Clintock Channel. Two more subtle changes had taken place in the fifteen-day interval between the two flights. First, the relentless movement of the pack ice in the Beaufort Sea towards the mainland coast continued and the ice edge moved about 30 km south or about 2 km per day until only 40 km of open water separated the ice from the coast. Secondly, the concentrations of multi-year ice in M'Clure Strait and Viscount Melville Sound seemed to have increased. This increase was probably a result of ice moving in from the west and southerly winds concentrating existing multi-year ice. A similar condition developed in M'Clintock Channel where the concentrations of multi-year ice seemed to increase. In this case the increase was likely due to wind action although some southerly movement from Viscount Melville Sound was possible.

The multi-year ice in the channels around Byam Martin Island had drifted south leaving the nothern reaches with a new ice cover. At first this seems odd since the multi-year ice to the north was broken and free to drift south. The reason for this situation was the huge ice floe that plugged Byam Martin Channel and stopped the older ice from moving south.

Unobserved Areas

The ice conditions shown along the mainland coast from Point Barrow to Herschel Island are based on observations made by the AES ice reconnaissance unit. Satellite photographs were used to determine the situation for the remainder of the Beaufort Sea and northern M'Clure Strait. The conditions in the channels south of Victoria Island connecting Amundsen Gulf with M'Clintock Channel were established in a similar fashion.

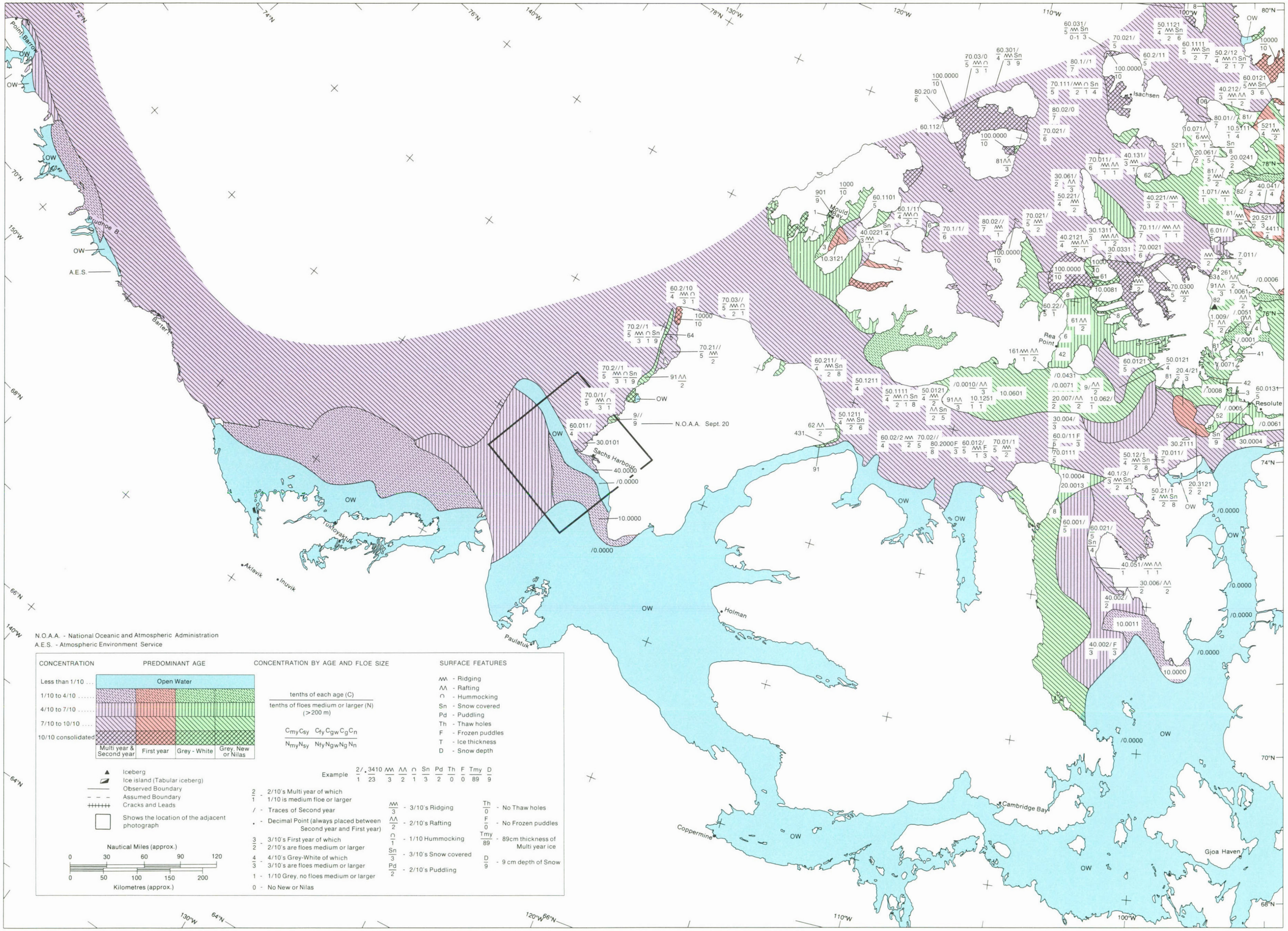
Comments

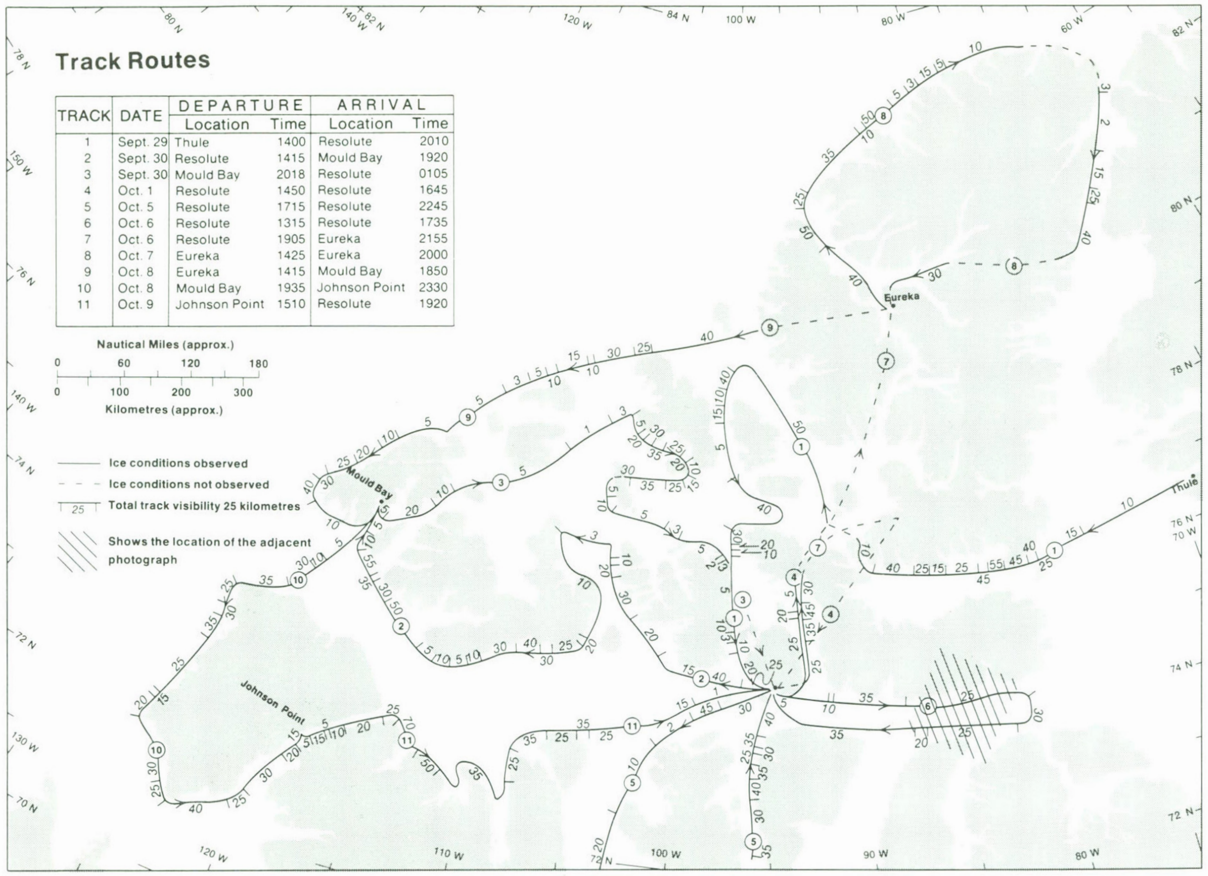
The ice island fragments were still in the vicinity of Gateshead Island and some were grounded on the adjacent coast of Victoria Island.

The satellite photograph and the observations were made on the same day.

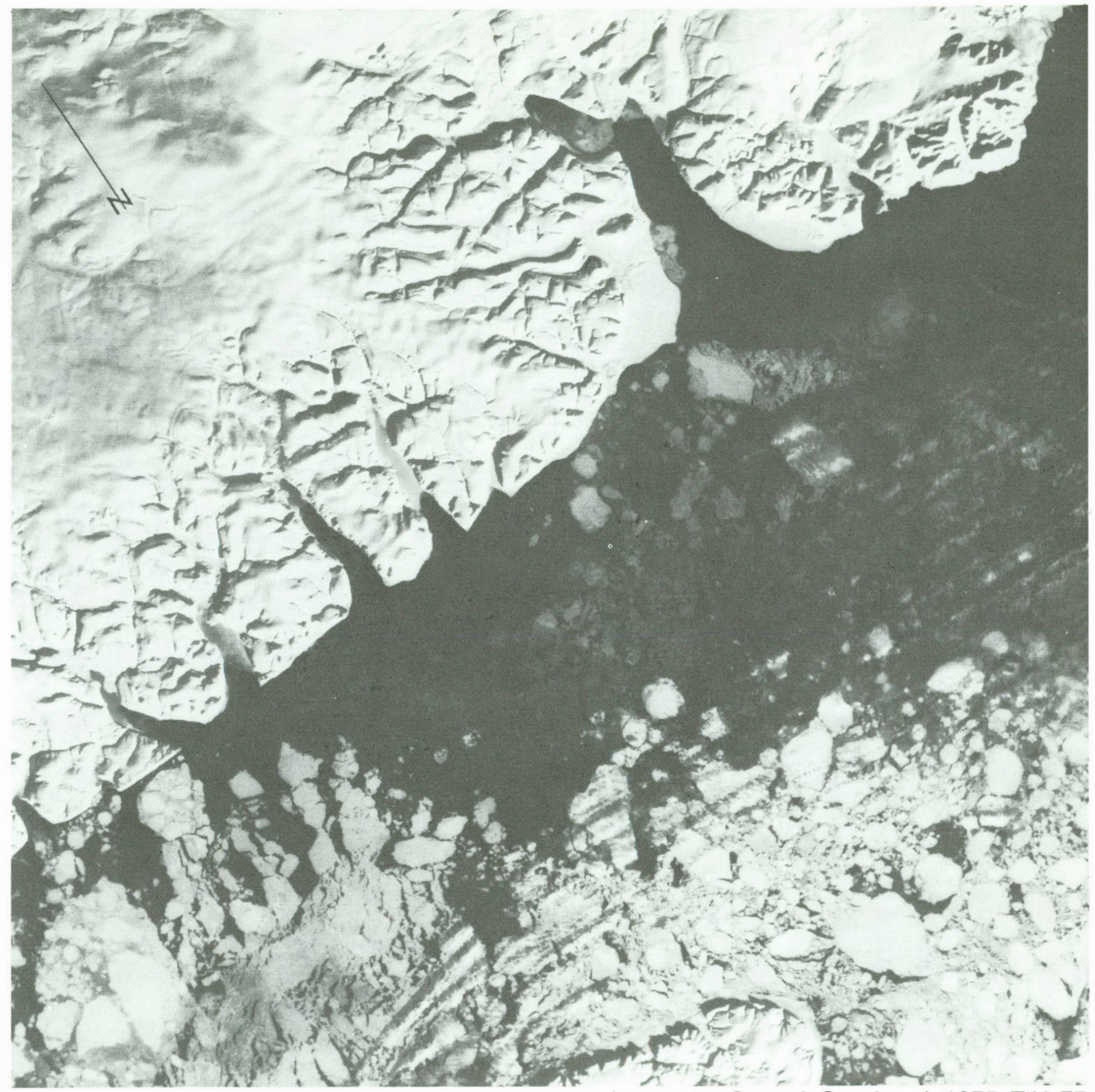
Previously we described the mysterious appearance of multi-year ice in Browne Bay, see Map 5 - 1975 WEST. The bay was ice-free when it was observed on September 23, or 21 days after the ice was sighted. It is hard to conceive ice melting in the Arctic in September but that is what must have happened.

Who knows how the history of the Canadian Arctic might have changed if Sir John Franklin and his ships had met ice conditions like these instead of those that trapped him west of King William Island and led to the loss of the entire expedition?


Point Barrow
Prudhoe B.
A.E.S.
Barter I.
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Sachs Harbour
N.O.A.A. Sept. 20
Holman
Mould Bay
Isachsen
Rea Point
Resolute
Cambridge Bay
Coppermine
Gjoa Haven
OW
N.O.A.A. - National Oceanic and Atmospheric Administration
A.E.S. - Atmospheric Environment Service
CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Sept. 29	Thule	1400	Resolute	2010
2	Sept. 30	Resolute	1415	Mould Bay	1920
3	Sept. 30	Mould Bay	2018	Resolute	0105
4	Oct. 1	Resolute	1450	Resolute	1645
5	Oct. 5	Resolute	1715	Resolute	2245
6	Oct. 6	Resolute	1315	Resolute	1735
7	Oct. 6	Resolute	1905	Eureka	2155
8	Oct. 7	Eureka	1425	Eureka	2000
9	Oct. 8	Eureka	1415	Mould Bay	1850
10	Oct. 8	Mould Bay	1935	Johnson Point	2330
11	Oct. 9	Johnson Point	1510	Resolute	1920



Lancaster Sound, October 4, 1975, T42 F7

MAP 7-1975 East

September 29-October 9

Flight Effectiveness

Many dichotomies accompanied the eight tracks carried out over the eastern part of the region during Flight 7. For the time of year the weather was excellent, the best for a number of years. On the other hand, cloud, snow showers, shortening length of daylight and long shadows from the low sun angle resulted in tracks such as number 7 being less than 20 per cent effective. Aircraft instrument problems, malfunction of radar, radar altimeter and precessing gyros during track 4 resulted in an unexpected rough landing on an ice cap at 1500 m in whiteout conditions. Fortunately no serious injuries resulted. Overall the flight was judged to be 70 per cent effective.

Ice Conditions

With the exception of Baffin Bay, new ice types had formed in all areas of the eastern part of the region that were ice-free during Flight 6. These ice types were beginning to form solid ice covers in protected bays and fiords. In some areas thin first-year ice was beginning to appear.

The break-up and movement in Hagen Strait and Hecla and Griper Bay lasted for about three weeks before new ice cemented the floes together into a solid cover once again.

The amount of ice movement between the two flights was limited. A thin tongue of multi-year ice had drifted south through Smith Sound from Kane Basin into Baffin Bay. A similar invasion was taking place in northern Penny Strait where the older floes were moving in from the unnamed sea north of Bathurst Island. Although the ice was free to move south through Prince Gustaf Adolf Sea and Peary Channel the winds to cause the drift did not develop. A similar situation existed in Byam Martin Channel. Sverdrup Channel supported a solid ice cover once again and the northern part of Nansen Sound remained unbroken while consolidation was taking place in the southern half. The multi-year ice was broken and ready to move south into Viscount Melville Sound through the channels on either side of Byam Martin Island but no movement occurred.

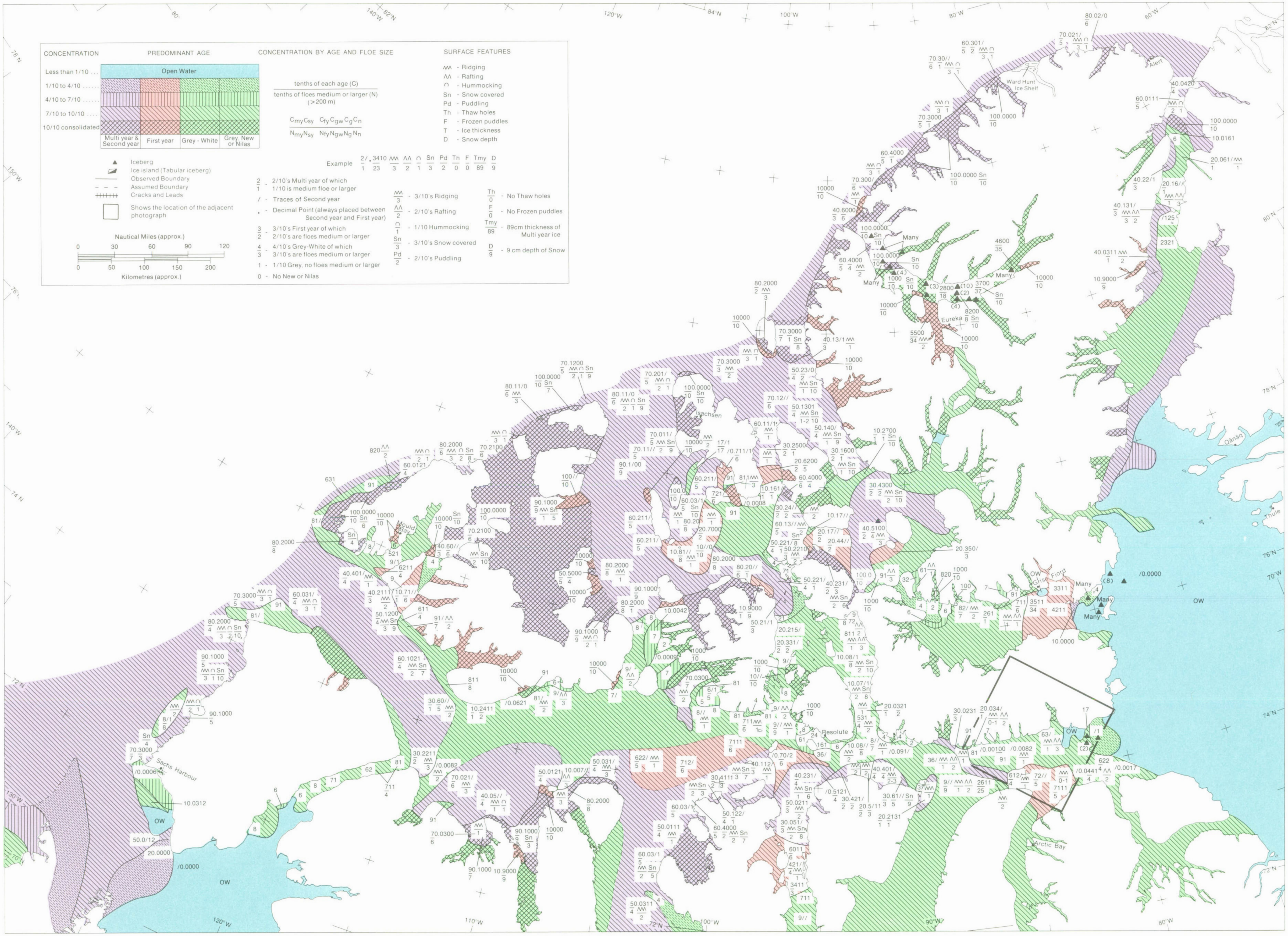
Unobserved Areas

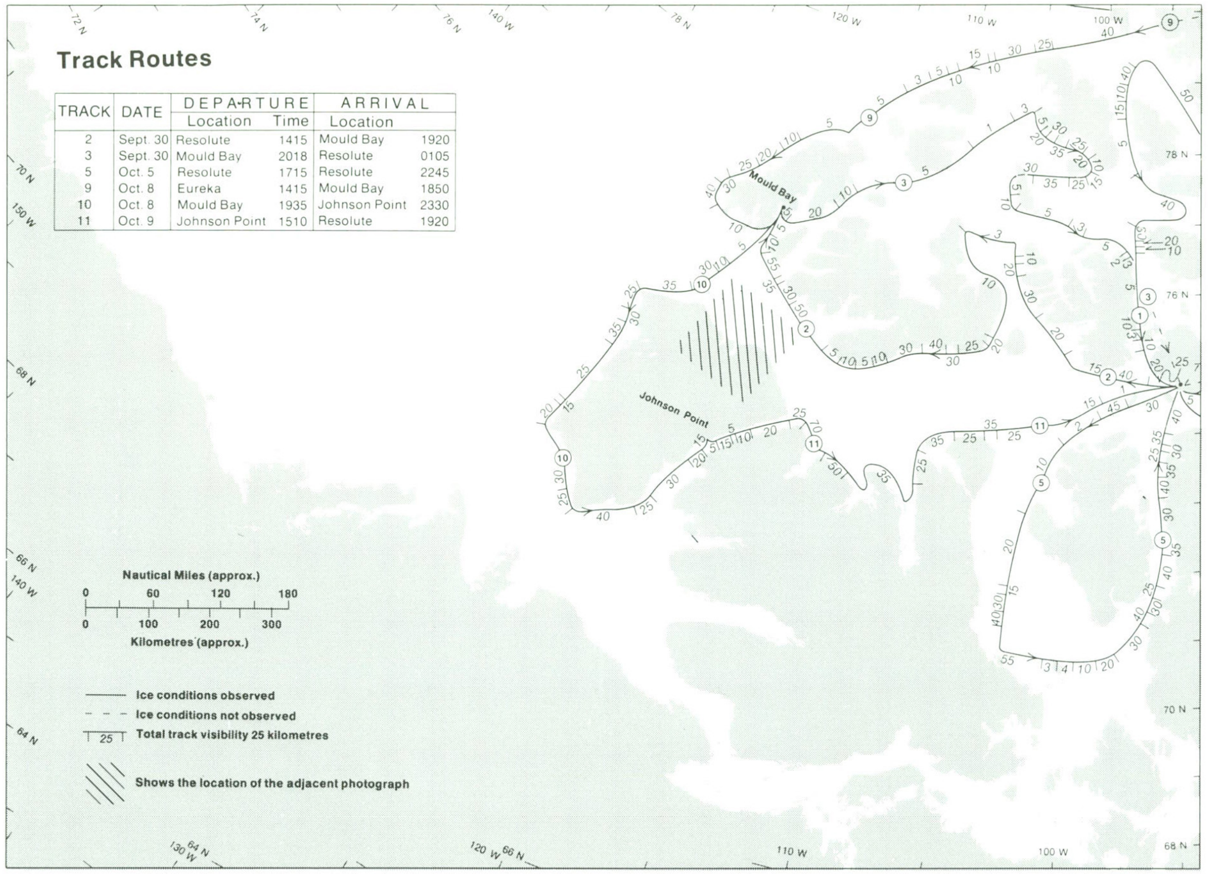
The conditions along the north coast of Axel Heiberg Island are shown to be the same as observed before based on previous experience. In southern Nares Strait and the unobserved part of Baffin Bay, pilot reports, interpretation of satellite photos and previous experience were the basis used to prepare the map.

Comments

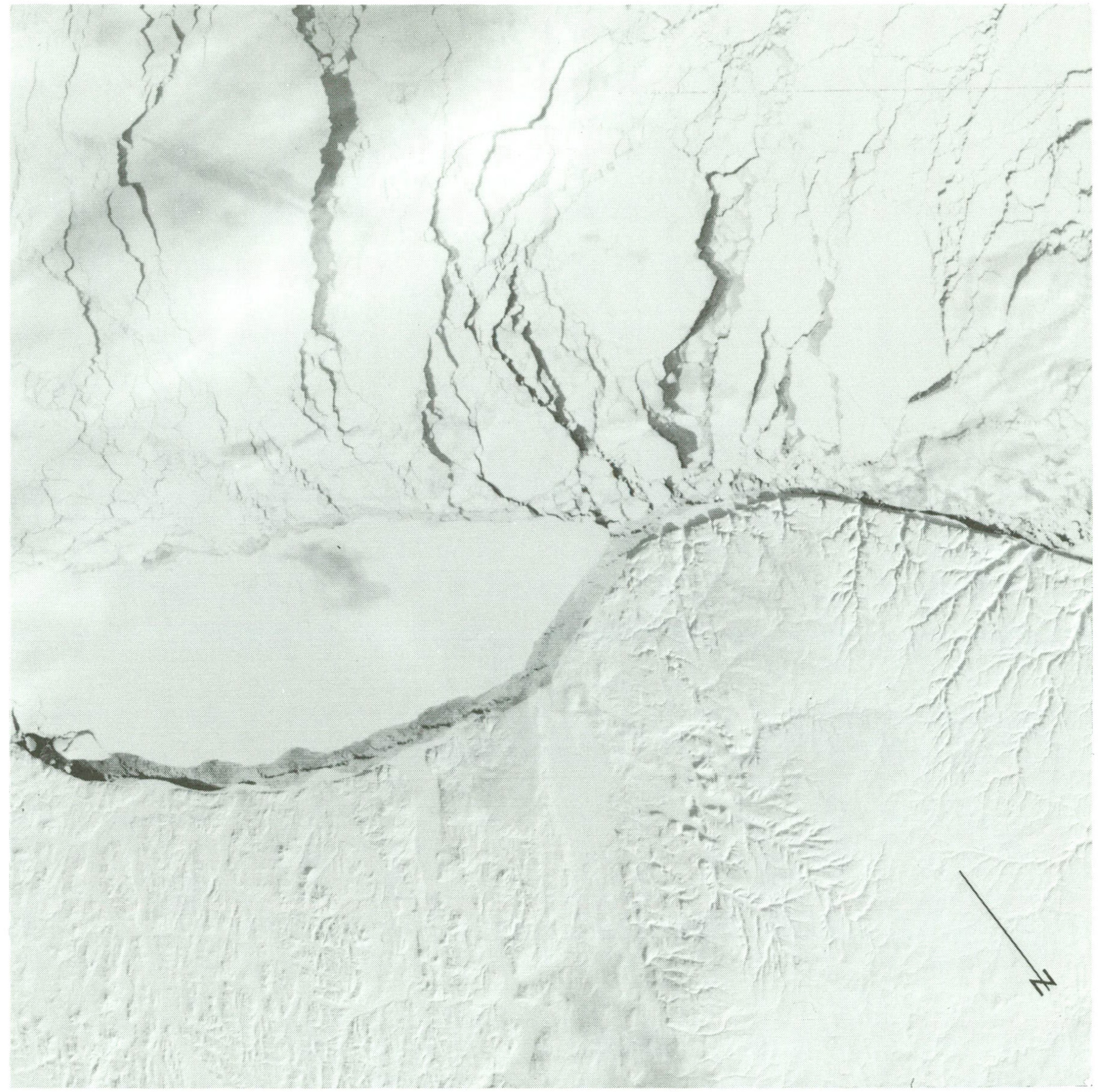
The lack of persistent northerly winds meant that very little ice had moved to the south. However, in Parry Channel westerly winds and currents had moved multi-year ice from Viscount Melville Sound to the vicinity of Bylot Island at the eastern end of Lancaster Sound.

The satellite photograph, October 4, was taken two days before the area was observed under similar cloud-free conditions. Little change had taken place during the interval.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Resolute
Sachs Harbour
Arctic Bay
Thule
Qânâq
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	
2	Sept. 30	Resolute	1415	Mould Bay	1920
3	Sept. 30	Mould Bay	2018	Resolute	0105
5	Oct. 5	Resolute	1715	Resolute	2245
9	Oct. 8	Eureka	1415	Mould Bay	1850
10	Oct. 8	Mould Bay	1935	Johnson Point	2330
11	Oct. 9	Johnson Point	1510	Resolute	1920



Eastern M' Clure Strait, October 10, 1975, T65 F7

MAP 7-1975 West

September 29-October 9

Flight Effectiveness

Although poor ice observing conditions are usually expected at this time of year the weather was excellent and the flight was 85 per cent effective.

Ice Conditions

In the southern part of the Beaufort Sea, north of Tuktoyaktuk, the southern boundary of the multi-year ice of the pack remained in almost the same position as previously shown on Map 6–1975 WEST. However, the formation of new ice considerably reduced the area of open water. The pack ice had invaded Amundsen Gulf a distance of about 100 km in the fifteen days that separated track 8 on September 23 from track 10 on October 8. This was a slow but persistent southeasterly movement. A similar drift took place in M'Clintock Channel. From its observed location on September 22 during track 6 the ice edge had moved southeasterly a distance of over 100 km to where it was observed thirteen days later during track 5 on October 5. Multi-year ice moved south slightly more than 100 km from Barrow Strait into Peel Sound during the same time interval.

In addition to drifting south, the concentration of multi-year ice in M'Clintock Channel increased and the older ice moved from the east to the central part of the channel. While these drifts were taking place new ice was forming, existing ice was getting thicker and consolidation of the ice cover was taking place in the sheltered bays such as Ommanney Bay and those north of Victoria Island. Browne Bay made a rapid change from ice-free conditions to a first-year ice cover. Undoubtedly, this would be very thin first-year ice.

Unobserved Areas

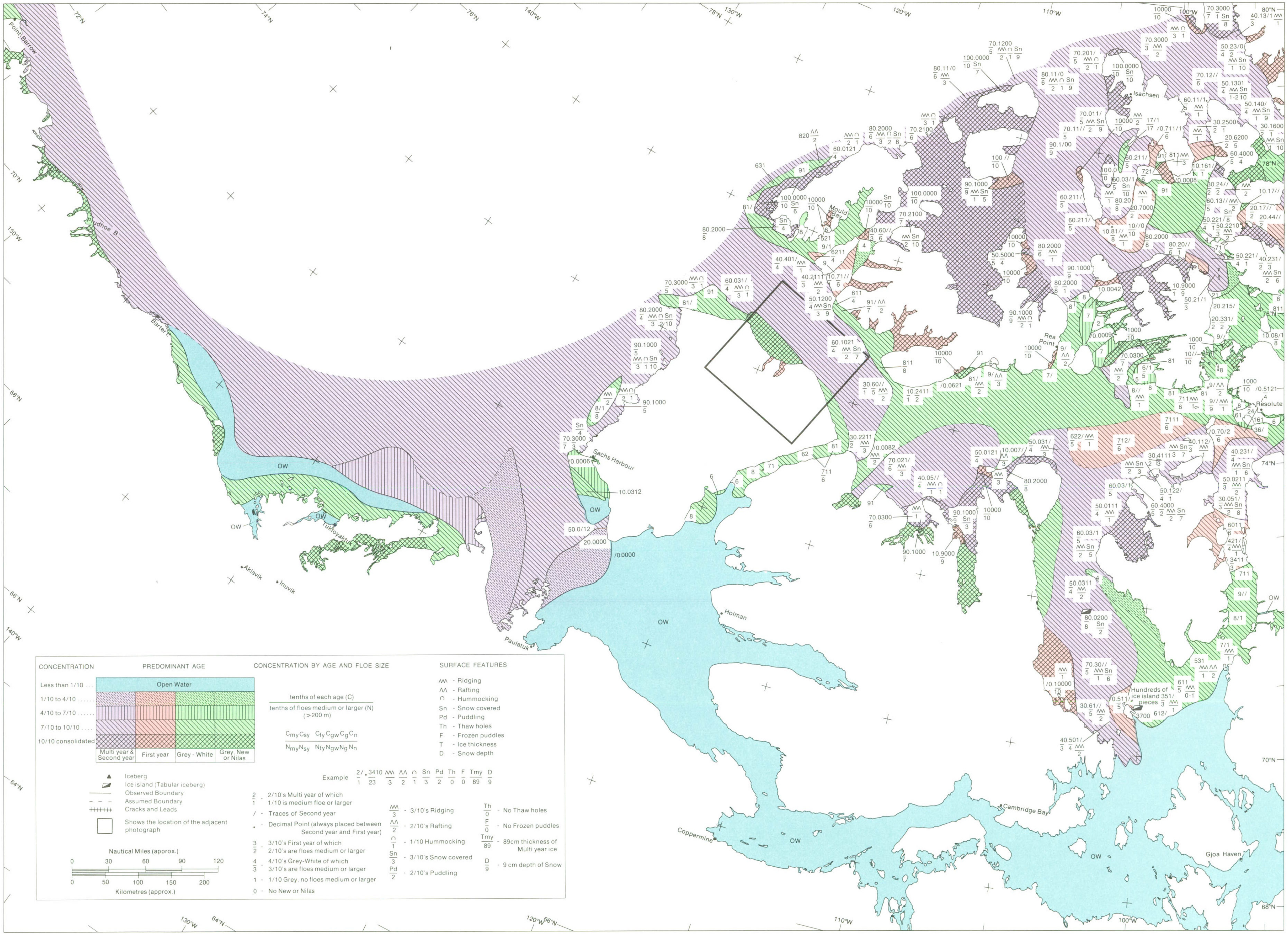
The ice conditions shown from Point Barrow to Cape Parry are based on the interpretation of satellite photographs, AES reports and pilot reports. The ice-free conditions from Amundsen Gulf through Victoria Strait and in the channels around King William Island are shown from satellite information and because previous experience has indicated that if both ends of the waterway are ice-free the central part is also open water. Also observations during Flight 8 were helpful.

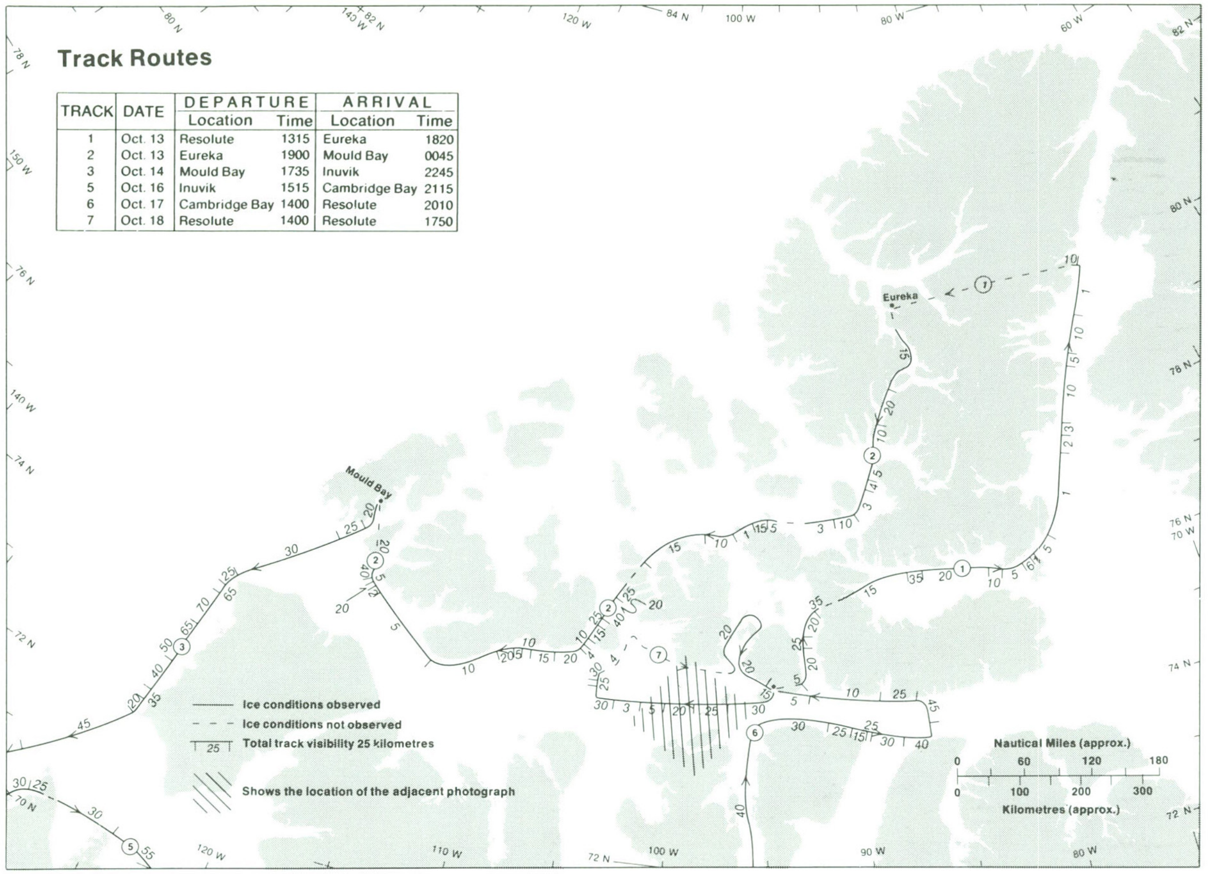
Comments

Three areas, western Amundsen Gulf, southern M'Clintock Channel and northern Peel Sound experienced an invasion of multi-year ice. In each case the distance covered and the time required were very similar. Winds were probably responsible for this movement.

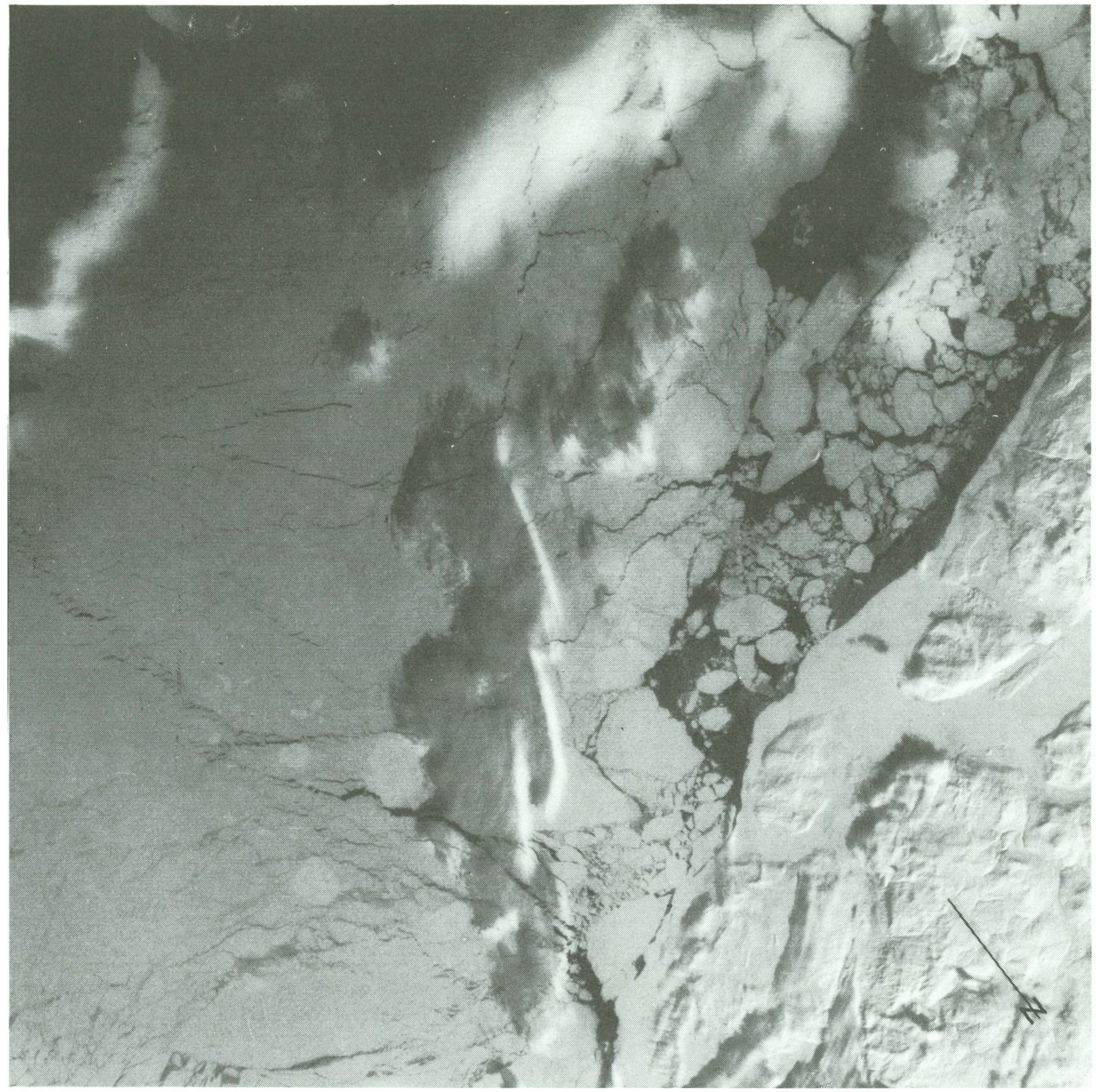
Concentrations of multi-year ice throughout Viscount Melville Sound dropped between the two flights. Some of this ice moved into Barrow Strait and on to Lancaster Sound or Peel Sound and some of it moved south into M'Clintock Channel. There was a considerable increase in the concentration of multi-year ice in the southern half of this channel. This ice must have moved from the northern part and the northern ice was replaced by an influx from Viscount Melville Sound. In spite of all this southerly movement, Victoria Strait still remained ice-free.

The crack patterns shown on the satellite photograph are long, linear and relatively parallel. This indicates that the new ice has cemented existing multi-year floes together and masks their existence. See the photographs on the Beaufort Sea, September 23, 25 and August 30, 1975 for typical multi-year patterns. The solid area of new ice north of Mercy Bay was moving away from the coast and would soon break up.


CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Point Barrow
Prudhoe B
Barter I
Aklavik
Inuvik
Tuktoyaktuk
Paulatuk
Sachs Harbour
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Isachsen
Mould Bay
Rea Point
Hundreds of ice island pieces
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Oct. 13	Resolute	1315	Eureka	1820
2	Oct. 13	Eureka	1900	Mould Bay	0045
3	Oct. 14	Mould Bay	1735	Inuvik	2245
5	Oct. 16	Inuvik	1515	Cambridge Bay	2115
6	Oct. 17	Cambridge Bay	1400	Resolute	2010
7	Oct. 18	Resolute	1400	Resolute	1750



Barrow Strait, October 15, 1975, T53 F7

MAP 8-1975 East

October 13-18

Flight Effectiveness

Much of the eastern region remained unobserved after the three tracks of Flight 8, 1975 were completed and it might be expected that its effectiveness would be very low. Key areas were observed during track 2 and they indicated what was happening further north. These indicators combined with the low sun angle and brief period of daylight made it prudent to spend precious observing time in other areas. The flight was almost 70 per cent effective.

Ice Conditions

Baffin Bay ice conditions changed dramatically between September 29 and October 13. They showed similar ice types to those in Lancaster Sound and northwestern Baffin Bay. However, it is still difficult to believe that in two weeks sufficient ice could form and reach the 30 cm (one foot) thickness required by first-year ice concentrations. Undoubtedly it was thin first-year ice that made this rapid appearance in the bay. The presence of first-year ice in Prince Regent Inlet is reasonable considering that it was previously covered with mainly grey-white ice. If Prince Regent Inlet was mainly first-year ice, logic dictates that Admiralty Inlet and the channels around Bylot Island should be similarly covered. The satellite photo indicates tones similar to new ice and this is shown on the map.

Another rather different, but not unique, change took place during the two tracks. This was the sudden appearance of multi-year ice in Wellington Channel; the multi-year ice that replaced it in Barrow Strait mainly came from Peel Sound.

Unobserved Areas

The ice conditions shown on Map 8 – 1975 EAST for Baffin Bay are based on the interpretation of satellite photographs. The determination of the ice types in this area was possible as a result of observations made during tracks 1 and 6. The same imagery was used to establish the conditions in Prince Regent Inlet, Admiralty Inlet and the channels on either side of Bylot Island.

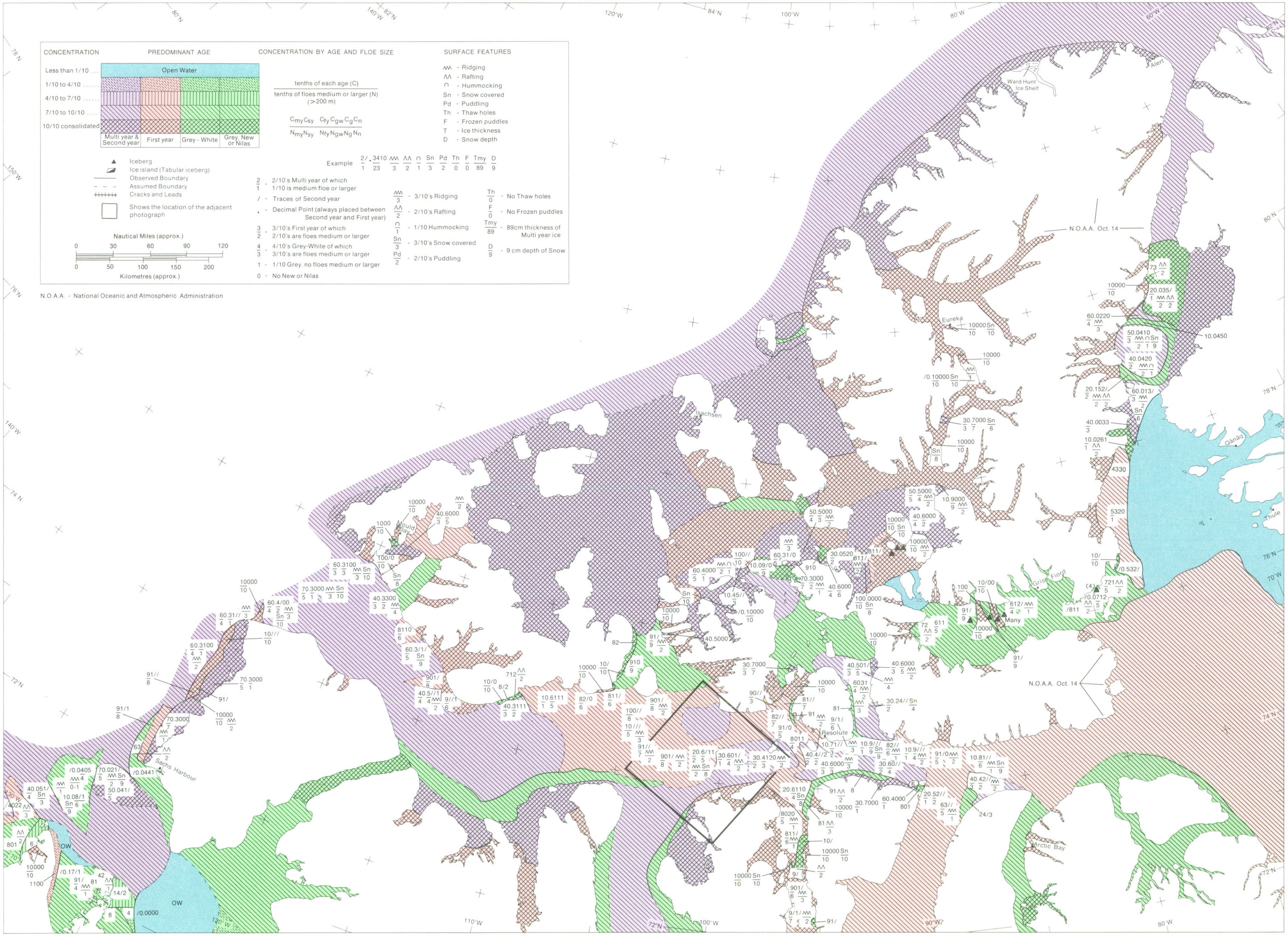
The ice cover in the northern part of the region is based on the results of track 2, satellite photographs and events in previous years. Little movement was evident during track 2. This means that further north the movement was less. Final proof for the patterns shown in the northern channels was provided during the first flight of 1976.

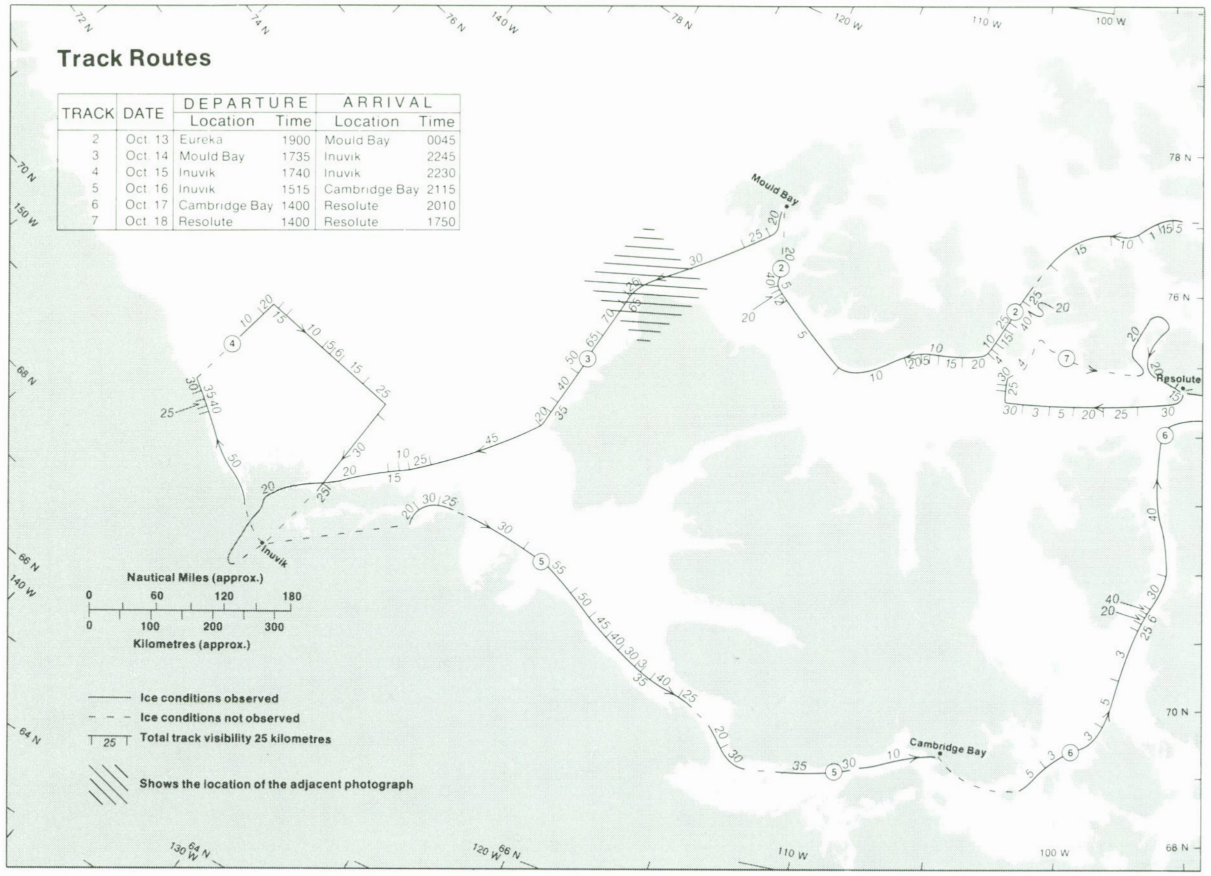
Comments

The USS "Advance" and "Rescue" commanded by Captain De Haven were caught in the new ice near the southeastern tip of Cornwallis Island in September, 1850. By the end of the month the wind had driven both vessels to the northern part of Wellington Channel. Likely similar conditions resulted in multi-year ice moving from Barrow Strait into Wellington Channel. The fact that no ice moved south in any channel including Nares Strait further proves the northerly drift. Movement would soon cease in Norwegian Bay and in the area south of Ellef Ringnes Island. The ice in Lancaster Sound and the eastern half of Barrow Strait remained in motion throughout the winter.

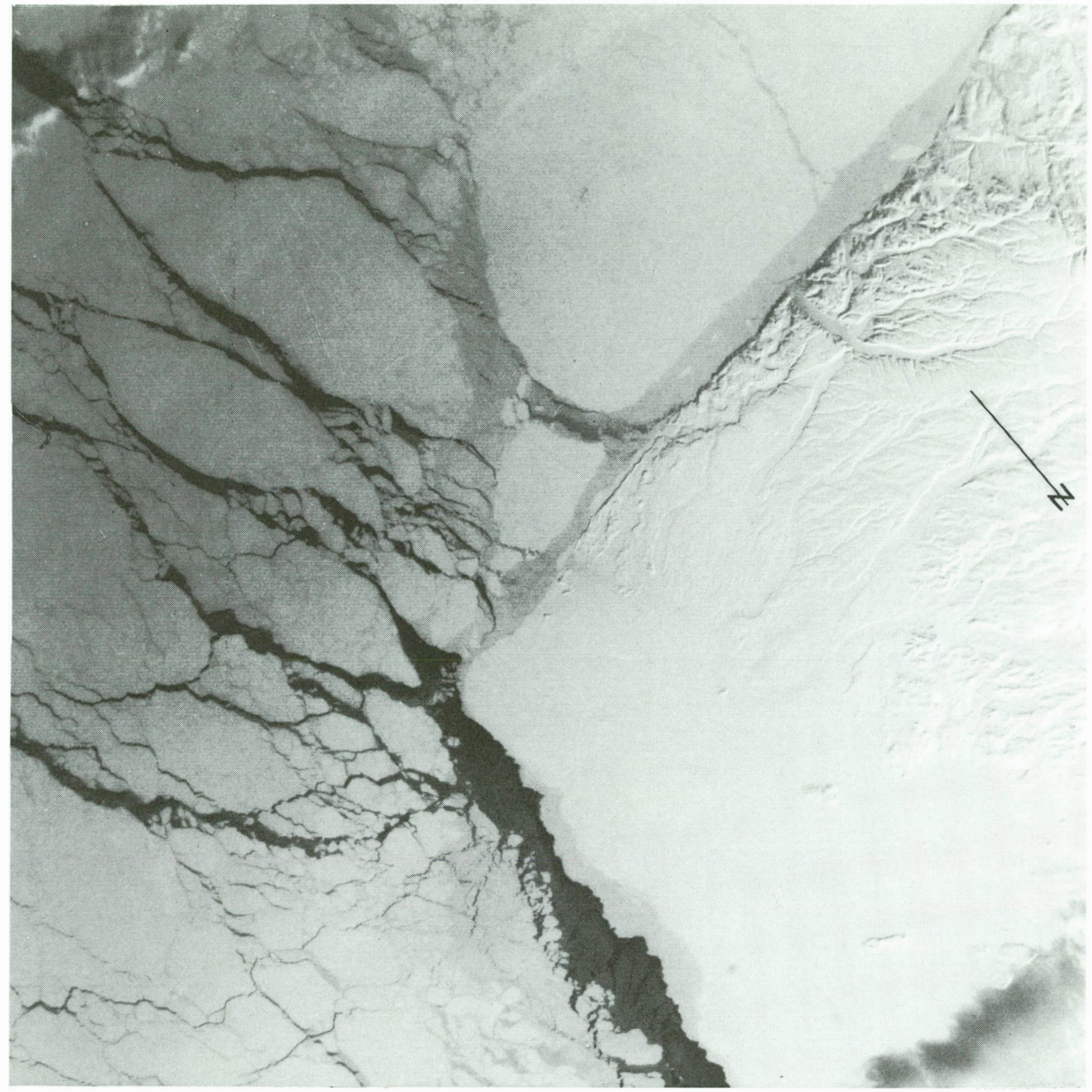
Two small ice islands were observed near Nelson Griffiths Point at the southeast tip of Melville Island. A lone musk-ox was observed near the edge of the consolidated ice cover in northern McDougall Sound about 8 km west of Cornwallis Island.

The consolidation effects of new ice and a snow cover along with low light levels mask the ice types on the satellite photograph. Ice reconnaissance in the area three days later provided the necessary ground truth.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
N.O.A.A. - National Oceanic and Atmospheric Administration
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Qanaq
Thule
Grise Fiord
Resolute
Sachs Harbour
Arctic Bay
Mould Bay
N.O.A.A. Oct. 14
OW
Many



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
2	Oct. 13	Eureka	1900	Mould Bay	0045
3	Oct. 14	Mould Bay	1735	Inuvik	2245
4	Oct. 15	Inuvik	1740	Inuvik	2230
5	Oct. 16	Inuvik	1515	Cambridge Bay	2115
6	Oct. 17	Cambridge Bay	1400	Resolute	2010
7	Oct. 18	Resolute	1400	Resolute	1750


Southwestern M' Clure Strait, October 14, 1975, T70 F7

MAP 8-1975 West

October 13-18

Flight Effectiveness

The weather was very good for ice reconnaissance considering the time of year. The flight was 80 per cent effective and this would have increased if there had been enough flying hours left to permit one additional survey over the channels to the east, north and west of Victoria Island.

Ice Conditions

Obvious changes were the new ice types that appeared in Queen Maud Gulf, the channels surrounding King William Island and Amundsen Gulf. In many areas, north of Tuktoyaktuk, in Peel Sound and eastern Viscount Melville Sound, thin first-year ice was developing.

The major movement occurred in Peel Sound where the area of multi-year ice that was observed in the northern entrance on October 5 had moved out by October 17. There may have been some small influx of multi-year ice from eastern M'Clure Strait into western Viscount Melville Sound.

Unobserved Areas

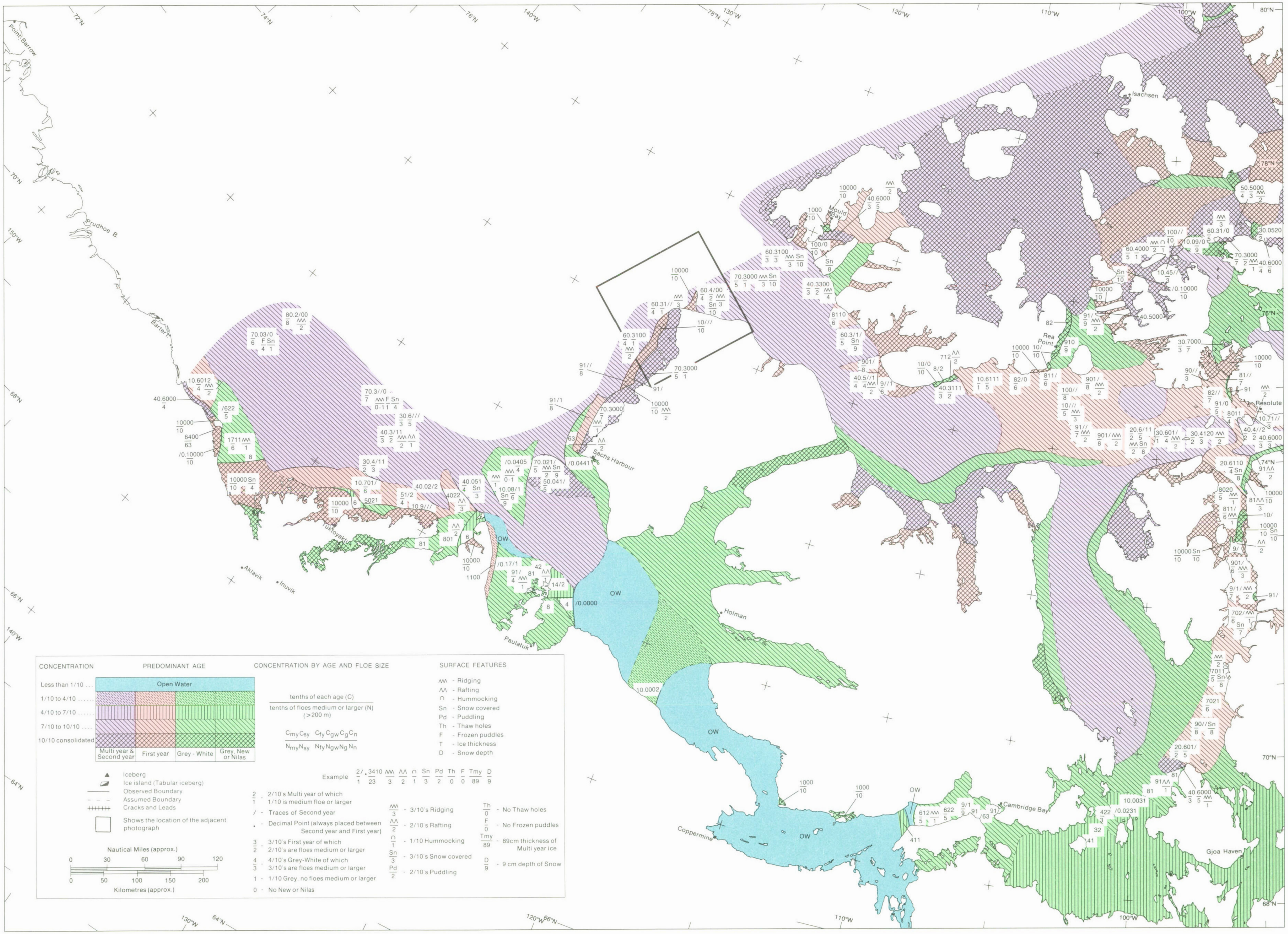
The southern parts of M'Clure Strait, Viscount Melville Sound as well as M'Clintock Channel, Prince of Wales Strait and northern Amundsen Gulf were not observed. The ice conditions shown for these areas on Map 8–1975 WEST are based on observations made during Flight 7 and data collected during the first flights of 1976.

Comments

Many small fragments of ice island T-1 were seen in Erebus Bay, along the west coast of King William Island.

Final freeze-up and consolidation of the ice cover in the channels between the mainland and Banks and Victoria Island was probably complete by early November. Movement in M'Clintock Channel likely ceased in mid-November while some shifting would still be possible in M'Clure Strait and Viscount Melville Sound into December.

Both the satellite photograph and track 3 were made on October 14. At first comparison of map and photograph, it appears that the map may be wrong because we assume that photographs are exact. In this case the photograph may mislead the interpreter. Note that what seems to be land on the west coast of Banks Island is really an ice cover. In addition, on the photograph this ice cover looks smooth and most would erroneously assume that it was new ice. The photographs are very useful, but in this area at this time of year they must be interpreted with care or erroneous ideas will result. Fortunately in this instance ground truth was available to help interpret the imagery.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Point Barrow
Prudhoe B
Barter I
Aklavik
Inuvik
Tuktoyaktuk
Paulatuk
Sachs Harbour
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Mould Bay
Isachsen
OW

SEASONAL SUMMARY 1976

The season was better than normal meaning that more ice broke up earlier, melted and created more open water, and consolidated later than usual. Although this was the general trend it did not take place in all areas in the same sequence and indeed some areas were slightly behind the typical state at the end of the season. The season in the southern part of the Beaufort Sea had an ominous beginning because when first observed a solid ice cover spread across the area. Even the Bathurst polynya was absent. Both situations were unusual. The ice remained unusually close to the coast until mid-August when the winds moved it to its usual position off the coast. Meanwhile break-up and clearing in the channels from Amundsen Gulf to King William Island was normal. The break-up in M'Clintock Channel and Peel Sound was early and subsequent melting created more open water than usual. A similar trend took place in M'Clure Strait and Viscount Melville Sound and by mid-August the season was ahead of normal in all areas.

Break-up in the eastern part began early because the ice in eastern Barrow Strait had remained in motion throughout the winter. This did not really affect succeeding events. The season in the eastern region seemed to be slower in the Hecla and Griper Bay area and faster than usual in the Jones Sound area. Break-up and clearing in the central part of the Queen Elizabeth Islands was more extensive than usual. All of this resulted in a season slightly better than average.

There are departures from the usual pattern and timing of break-up and clearing even in typical years. In 1976 there were four areas where the ice conditions developed in a different fashion from their normal advance. The solid ice cover on the Beaufort Sea along the absent Bathurst polynya and the late (mid-August) clearing from the coast were unusual. Break-up and partial clearing in M'Clintock Channel and Peel Sound was much earlier than normal. The ice in central and eastern Barrow Strait remained in motion thoughout the winter, an observation which has been made previously but infrequently. The advance of break-up through Maclean Strait and Prince Gustaf Adolf Sea without the break-up west of Lougheed Island had not been noted in previous seasons. Typically the Prince Gustaf Adolf Sea does not break before the southern areas north of Byam Martin Channel and west of Loughheed Island break and start to move.

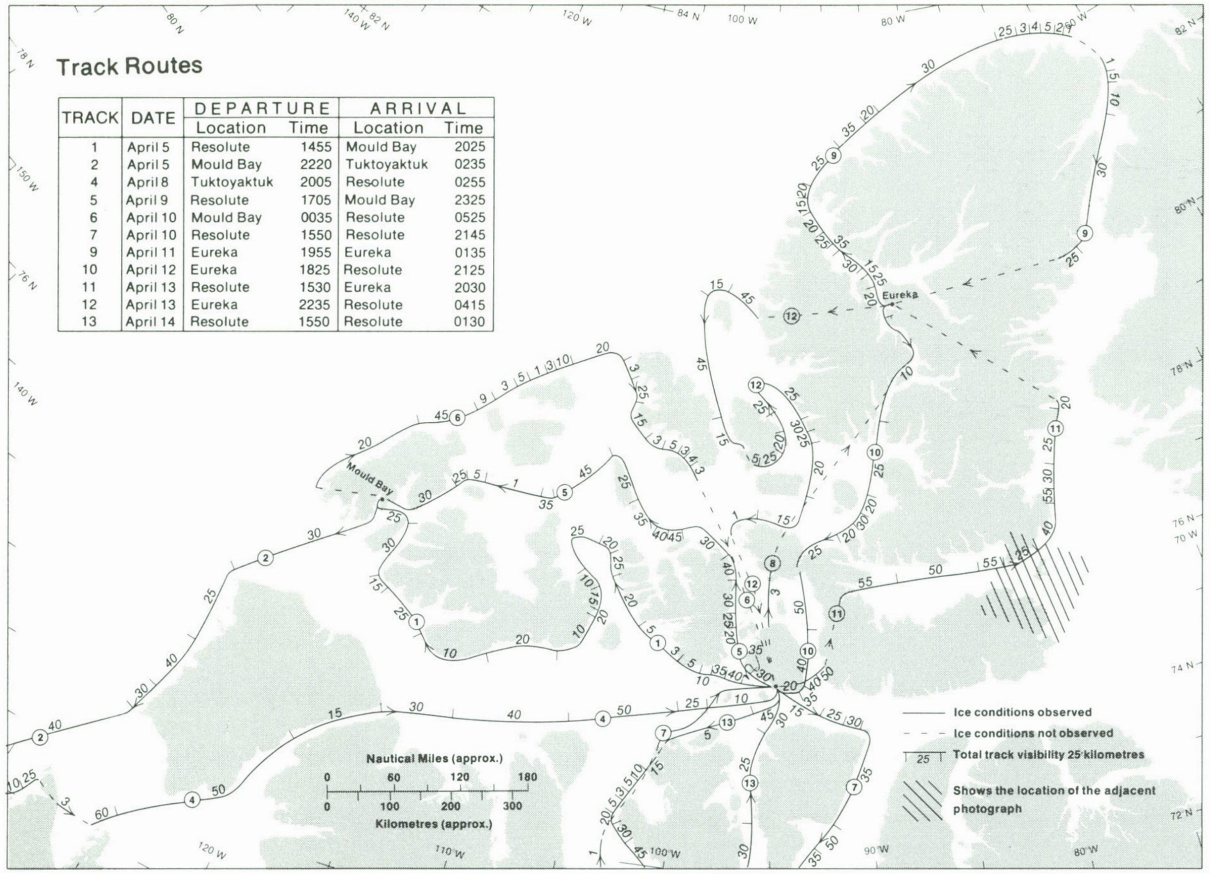
Weather and consequent flying and observing conditions were generally above average throughout the season. Especially favourable weather prevailed during the last three flights in the fall from mid-September to mid-October. Usually only half as much area, or less, is observed during the tracks of these flights.

The early spring observations in Barrow Strait indicated that strong winds had developed periodically to keep the area broken and to keep the ice moving east through Lancaster Sound. In the Beaufort Sea and part of the Arctic Ocean the consolidated condition in April indicated that light westerly winds had existed for some time to allow the pack to consolidate briefly before continuing its clockwise drift through the area.

It is not possible to say whether or not the typical patterns of break-up were followed in Peel Sound, M'Clintock Channel, Viscount Melville Sound and M'Clure Strait because the solid ice cover in all of these areas broke up between flights 3 and 4. However, subsequent movements and clearing in these areas was typical. The regular pattern and sequence of break-up and clearing was followed in all areas that broke up. Patterns of freeze-up followed the usual routine.

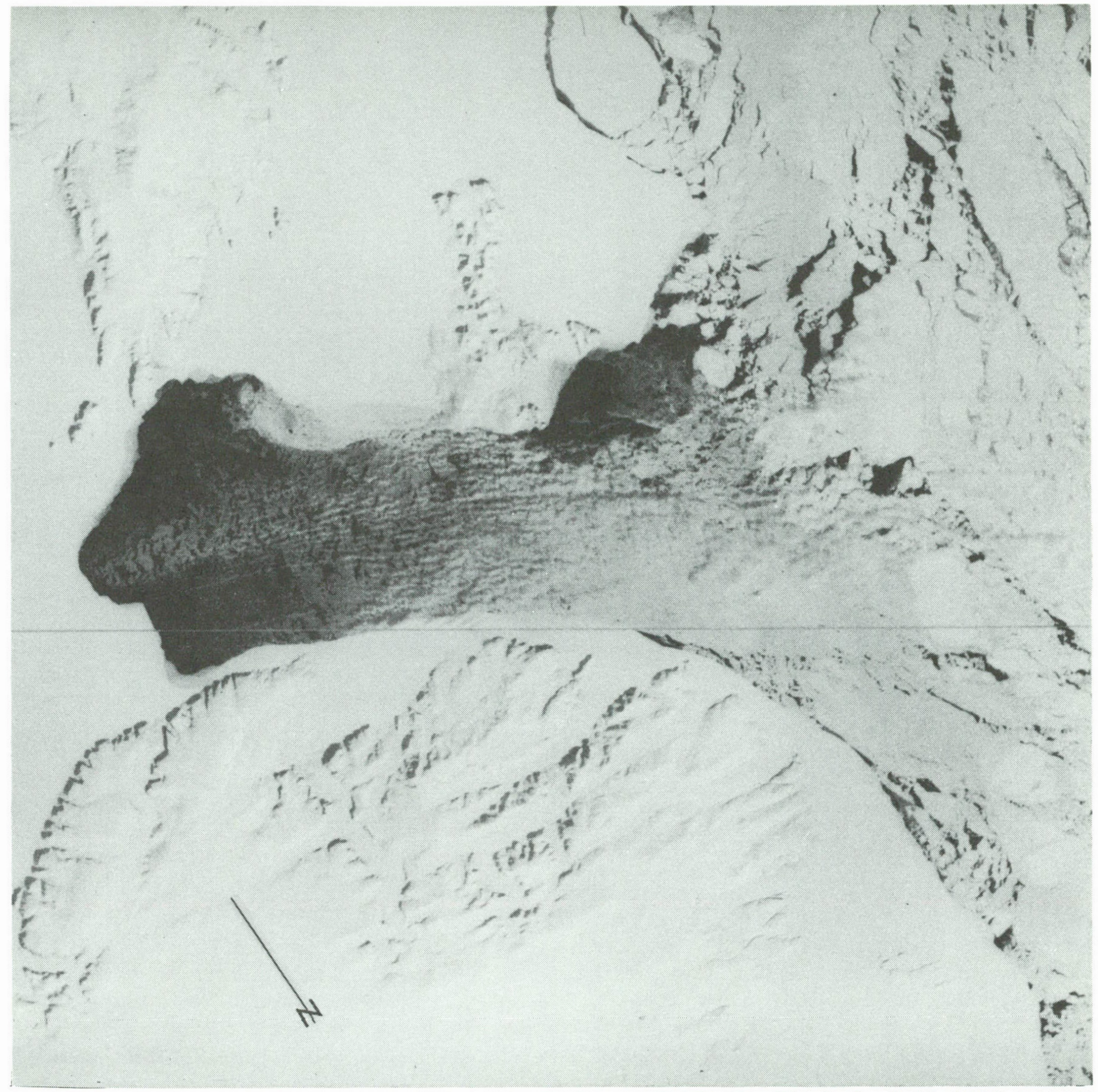
The trend, noted during the last few seasons, for M'Clintock Channel and Peel Sound to break up and partially clear before they usually broke up, continued. The trend to collect more information, more accurately over a wider area continued and the fine imagery from satellites helped immensely.

No special features, apart from the two small ice islands sighted west of Prince Patrick Island on September 16, were noted. The operations for the season reflected the ice conditions; both were better than normal.



Track Routes

TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	April 5	Resolute	1455	Mould Bay	2025
2	April 5	Mould Bay	2220	Tuktoyaktuk	0235
4	April 8	Tuktoyaktuk	2005	Resolute	0255
5	April 9	Resolute	1705	Mould Bay	2325
6	April 10	Mould Bay	0035	Resolute	0525
7	April 10	Resolute	1550	Resolute	2145
9	April 11	Eureka	1955	Eureka	0135
10	April 12	Eureka	1825	Resolute	2125
11	April 13	Resolute	1530	Eureka	2030
12	April 13	Eureka	2235	Resolute	0415
13	April 14	Resolute	1550	Resolute	0130



Lady Ann Strait, April 18, 1976, T41 F6

MAP 1-1976 East

April 5-14

Flight Effectiveness

Low temperatures, poor weather, equipment delays, heater malfunctions, frozen oil breathers, oil leaks, demands on the aircraft for other projects and darkness combined to reduce the effectiveness of some part of each of the tracks carried out for the flight. Throughout the flight, no matter how plans were made, it seemed that each track was out of step with the weather. The observer noted that this was the worst first flight of any in the previous eight years. It was 60 per cent successful.

Ice Conditions

Some changes in distribution had taken place since the fall of 1975. The seemingly solid ice covers on Massey Sound and Hassel Sound broke in October and allowed some older ice to move further south. A similar southerly drift took place in the second half of October as multi-year ice moved into Penny Strait. Ice also moved south out of Wellington Channel.

There were a few areas that displayed ice conditions slightly different from those normally expected at this time of year. The fact that these anomalies occurred did not mean that the ensuing season would be more or less ice-free than usual. The solid ice cover in the Arctic Ocean is a rare sight. Usually this area is crisscrossed with cracks and leads. The only sign of movement was in a narrow band made up of many leads in the transition zone between the solid ice cover of the archipelago and the temporarily solid ice cover on the Arctic Ocean. The ice in the eastern half of Barrow Strait had remained in motion throughout the winter. Probably a similar situation recurs every six or seven years. The polynyas between Queens Channel and Wellington Channel were not as large as usual. Similarly the area of ice-free water in Hell Gate seemed to be smaller than normal. A somewhat greater than average depth of snow covered all of the area and specific areas like Maclean Strait, east of Lougheed Island, had a heavy snow cover. The amounts of multi-year ice in Hall Basin, Kennedy Channel and Kane Basin were less than usual.

The first-year ice in the southern half of Byam Martin Channel was very smooth indicating a quiet freeze-up while the roughness noted in western Barrow Strait and southern Viscount Melville Sound indicated considerable motion during the freeze-up period.

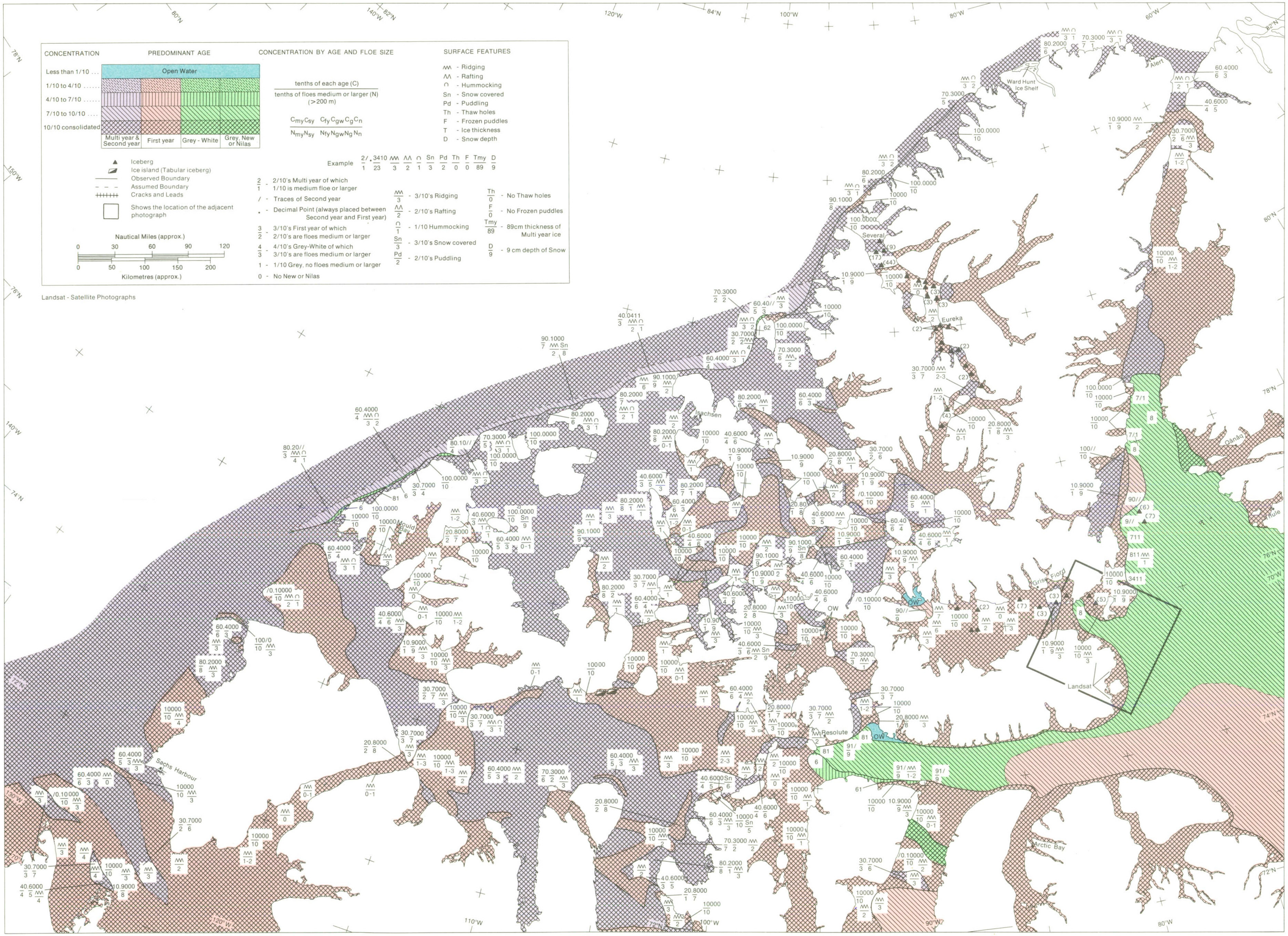
Unobserved Areas

The ice conditions shown on the map for Baffin Bay and eastern Lancaster Sound were interpreted from satellite photographs. The conditions north of Axel Heiberg Island are based on past experience, adjacent conditions and later observations.

Comments

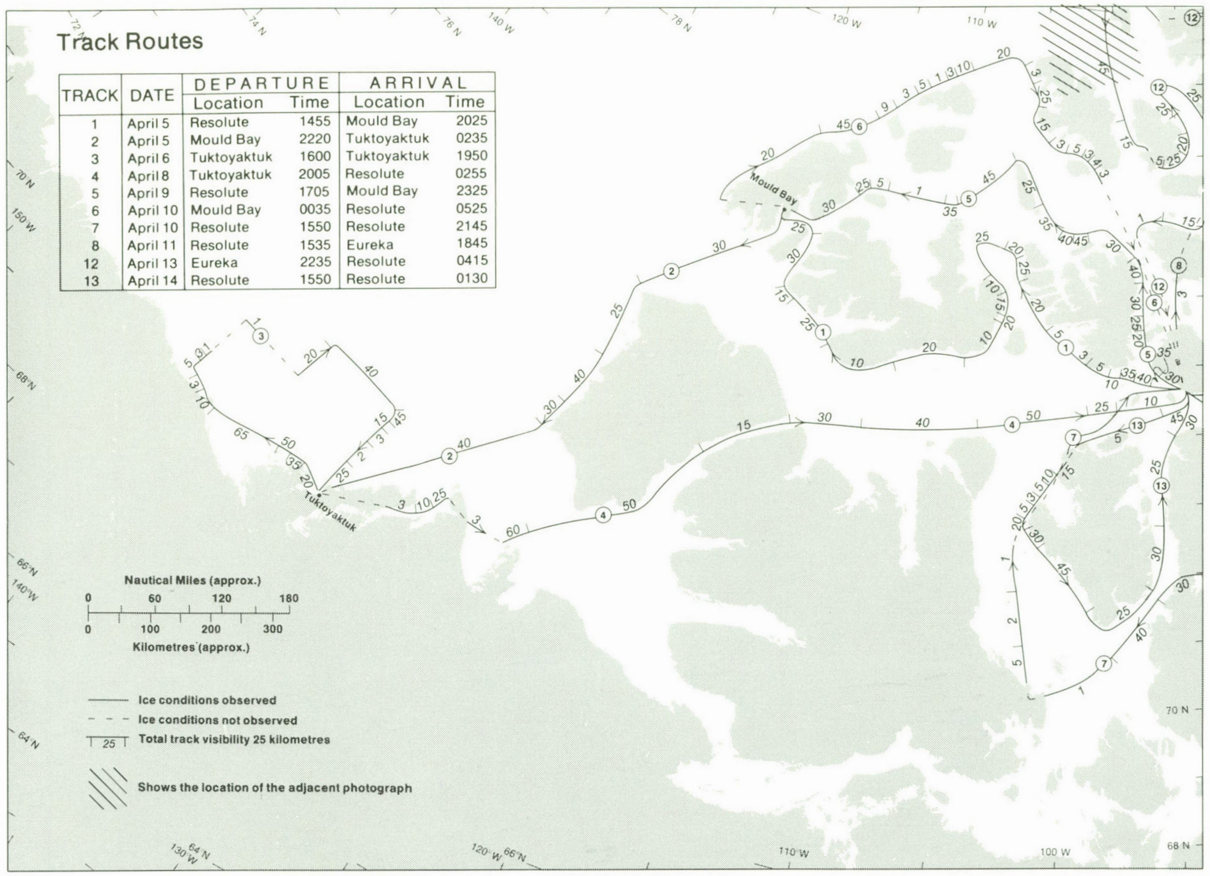
A heavier than usual snow cover existed and masked the surface roughness making it difficult to identify the multi-year ice types. The solid ice cover on the Arctic Ocean was unusual. Soon it would be broken again. Six ice island fragments were seen off the southeast tip of Melville Island. Two were seen in the same vicinity the previous October.

Some changes took place in Lady Ann Strait during the five days that separated track 11 from the satellite photography.



MAP 1 - 1976 EAST

April 5 - 14, 1976



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	April 5	Resolute	1455	Mould Bay	2025
2	April 5	Mould Bay	2220	Tuktoyaktuk	0235
3	April 6	Tuktoyaktuk	1600	Tuktoyaktuk	1950
4	April 8	Tuktoyaktuk	2005	Resolute	0255
5	April 9	Resolute	1705	Mould Bay	2325
6	April 10	Mould Bay	0035	Resolute	0525
7	April 10	Resolute	1550	Resolute	2145
8	April 11	Resolute	1535	Eureka	1845
12	April 13	Eureka	2235	Resolute	0415
13	April 14	Resolute	1550	Resolute	0130

Peary Channel, April 2, 1976, T70 F2

MAP 1-1976 West

April 5-14

Flight Effectiveness

As in the eastern sector the weather was not as good as expected; ice fog, ice haze and some airframe icing combined to reduce the effectiveness of the five tracks over the western half of the region to about 30 per cent.

Ice Conditions

Ice conditions in the western half of Parry Channel changed considerably from those observed the previous October indicating that final freeze-up probably came to these areas through November and part of December. Only limited quantities, if any, of multi-year ice moved into the western part of M'Clure Strait while ice from the eastern part of the strait was exported to Viscount Melville Sound. The result was a slight decline in the amount of multi-year ice in M'Clure Strait. The amount of multi-year ice in Viscount Melville Sound increased during the late fall of 1975 for the previous season even though some of the older ice was exported from the sound into M'Clintock Channel and Barrow Strait. In M'Clintock Channel movements probably persisted until mid-November. During this time some multi-year ice moved south from Viscount Melville Sound. Also the movements caused the distribution pattern to change.

The rather odd-shaped distribution shown in Amundsen Gulf on Map 1–1976 WEST was probably developed in the fall when the multi-year ice consolidated and then split along east-west lines and moved north and then south leaving alternate bands of first-year and multi-year ice across the gulf.

Snow covered the ice throughout the area, except north of Prince of Wales Island, and seems particularly deep along the west coast of Banks Island between Cape Prince Alfred and the central part of Amundsen Gulf. Generally the snowfall appeared heavier than normal.

Unobserved Areas

The ice conditions shown throughout the channels from Amundsen Gulf east to and surrounding King William Island are based on subsequent observations and the situation usually seen at this time of year. The conditions west from Herschel Island to Point Barrow are generalized on the basis of satellite data and adjacent conditions.

Comments

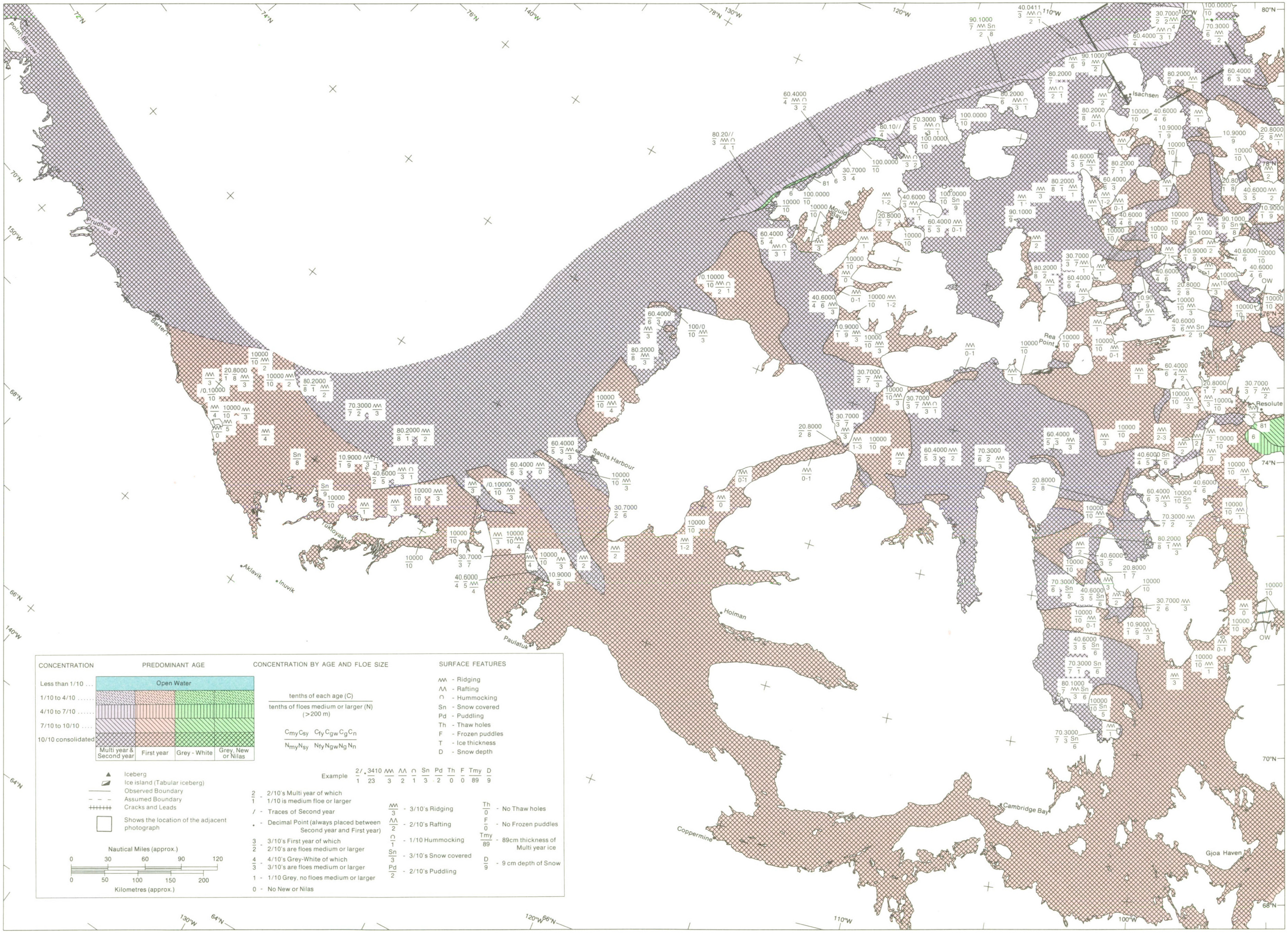
The Bathurst polynya was not evident yet but it would soon develop in its usual position in Amundsen Gulf to the north of Cape Bathurst.

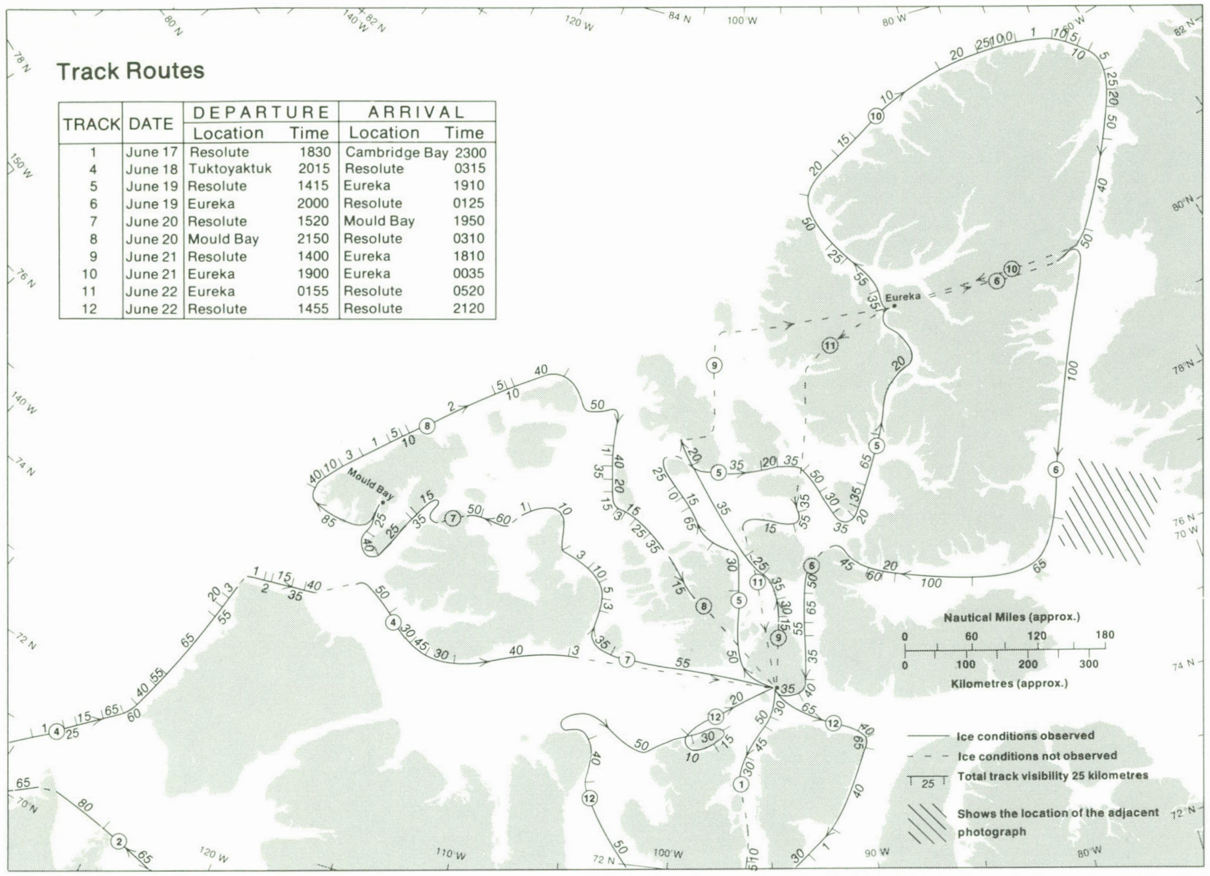
The ridging west of Banks Island was particularly heavy this year. This indicated that considerable pressure came from the west on the landfast ice along the coast.

It is unusual to see a solid ice cover on the Beaufort Sea and even more unusual to see the same condition on the Arctic Ocean. This situation was temporary.

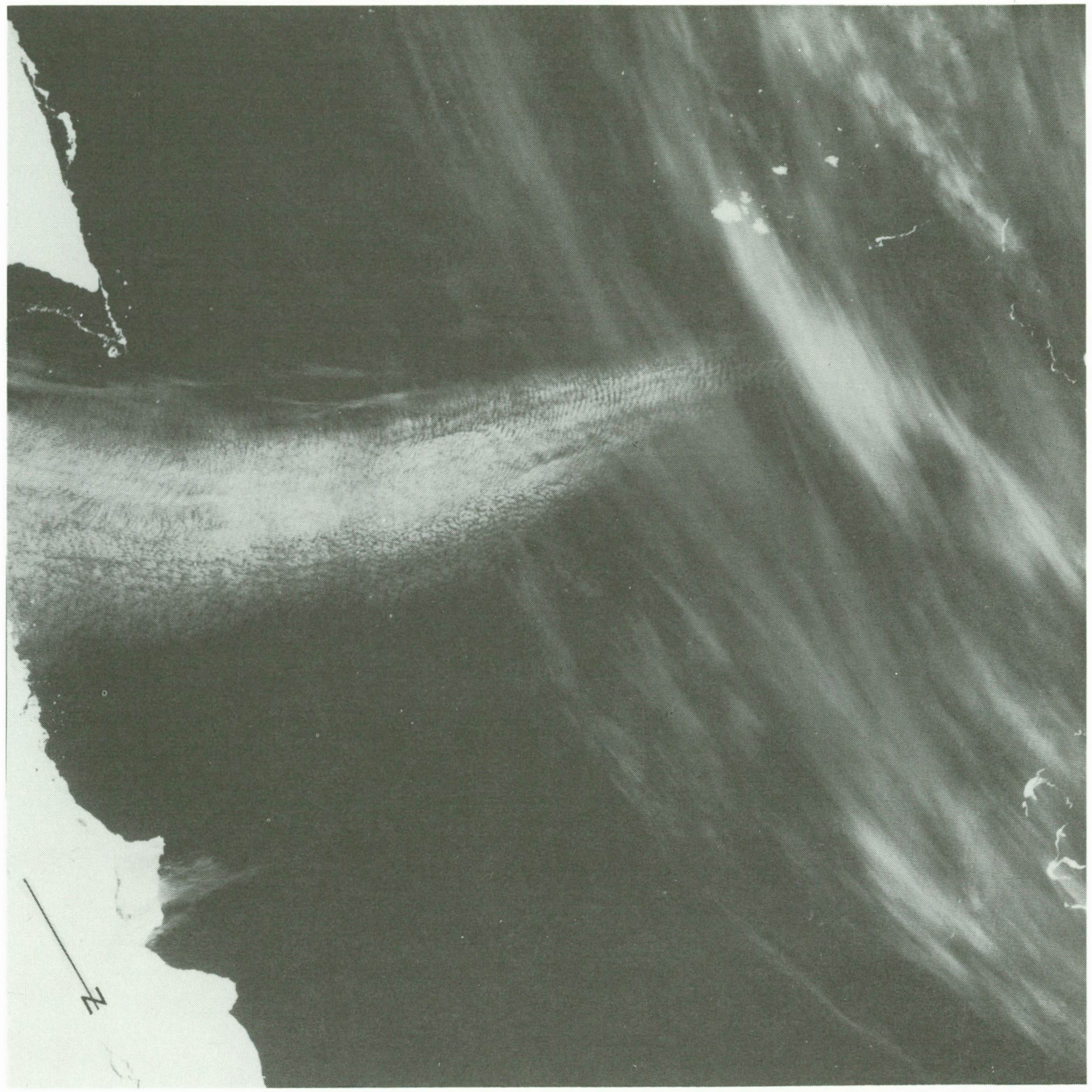
The ice conditions in the southern Beaufort Sea appeared to be very similar to those noted the previous fall. However, except for the brief period of consolidation shown on Map 1–1976 WEST the multi-year ice in the Beaufort Sea would move in a clockwise fashion throughout the winter.

The satellite photo might mislead one to believe that the ice in the area was smooth. Closer observations during track 12 indicated three- to four-tenth ridging in the central part of the photograph.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10 ...
Open Water
1/10 to 4/10 ......
4/10 to 7/10 ......
7/10 to 10/10 ....
10/10 consolidated
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)
Point Barrow
Prudhoe B.
Barter I.
Aklavik
Inuvik
Tuktoyaktuk
Paulatuk
Sachs Harbour
Holman
Mould Bay
Isachsen
Rea Point
Resolute
Cambridge Bay
Coppermine
Gjoa Haven
80°N
74°N
70°N
68°N
72°N
70°N
68°N
66°N
64°N
74°N
76°N
78°N
150°W
140°W
130°W
120°W
110°W
100°W



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	June 17	Resolute	1830	Cambridge Bay	2300
4	June 18	Tuktoyaktuk	2015	Resolute	0315
5	June 19	Resolute	1415	Eureka	1910
6	June 19	Eureka	2000	Resolute	0125
7	June 20	Resolute	1520	Mould Bay	1950
8	June 20	Mould Bay	2150	Resolute	0310
9	June 21	Resolute	1400	Eureka	1810
10	June 21	Eureka	1900	Eureka	0035
11	June 22	Eureka	0155	Resolute	0520
12	June 22	Resolute	1455	Resolute	2120



Northern Baffin Bay, June 19, 1976, T40 F5

MAP 2-1976 East

June 17-22

Flight Effectiveness

The effectiveness of the seven tracks carried out over the eastern part of the region during Flight 2 ranged from 40 to almost 100 per cent. The factors responsible were fog and low stratus cloud which caused sections of tracks to be flown at a height of 30 m in order to maintain visual contact with the ice surface. Overall the flight was 75 per cent successful.

Ice Conditions

At this time of year, before break-up is really underway, the changes from the previous flight are usually limited. In spite of this the developments are important because they can give an indication of the type of season to follow. The obvious change was the expected break-up in the Arctic Ocean and the disappearance, probably by melting, of all new ice types in Lancaster Sound and Baffin Bay. The interesting developments, as far as forecasting succeeding events is concerned, were the polynyas that either expanded or appeared by the third week in June. The main polynyas, Queens Channel, Penny Strait, Belcher Channel and Hell Gate are obvious as they appear every year at this time. Smaller open areas like those near the southeast tip of Bathurst Island, near Little Cornwallis Island in Hendriksen Strait and central Belcher Channel may be overlooked. In spite of their small size the fact that they appear in their usual spot at a particular time is important for forecasting. The polynya south of Bache Peninsula and west of North Water regularly appears and is important but so are the ice-free areas that develop each year early in the season in Kennedy Channel and at the northern end of Kane Basin. Two other very small polynyas, not shown on the map, were in their usual place along the northwest coast of Kennedy Channel.

Like the development of polynyas the amount, distribution and rate of advance of puddling can be used as an indicator when compared with other years. Puddling was just starting in the eastern region.

The break-up of the ice in eastern Barrow Strait was early but the types and distributions in the other parts of the area were normal.

Unobserved Areas

Observations in adjacent areas, subsequent observations and the patterns that usually develop were used to show the ice conditions in northern Prince Gustaf Adolf Sea, Peary Channel, Sverdrup Channel and the northern coast of Axel Heiberg Island.

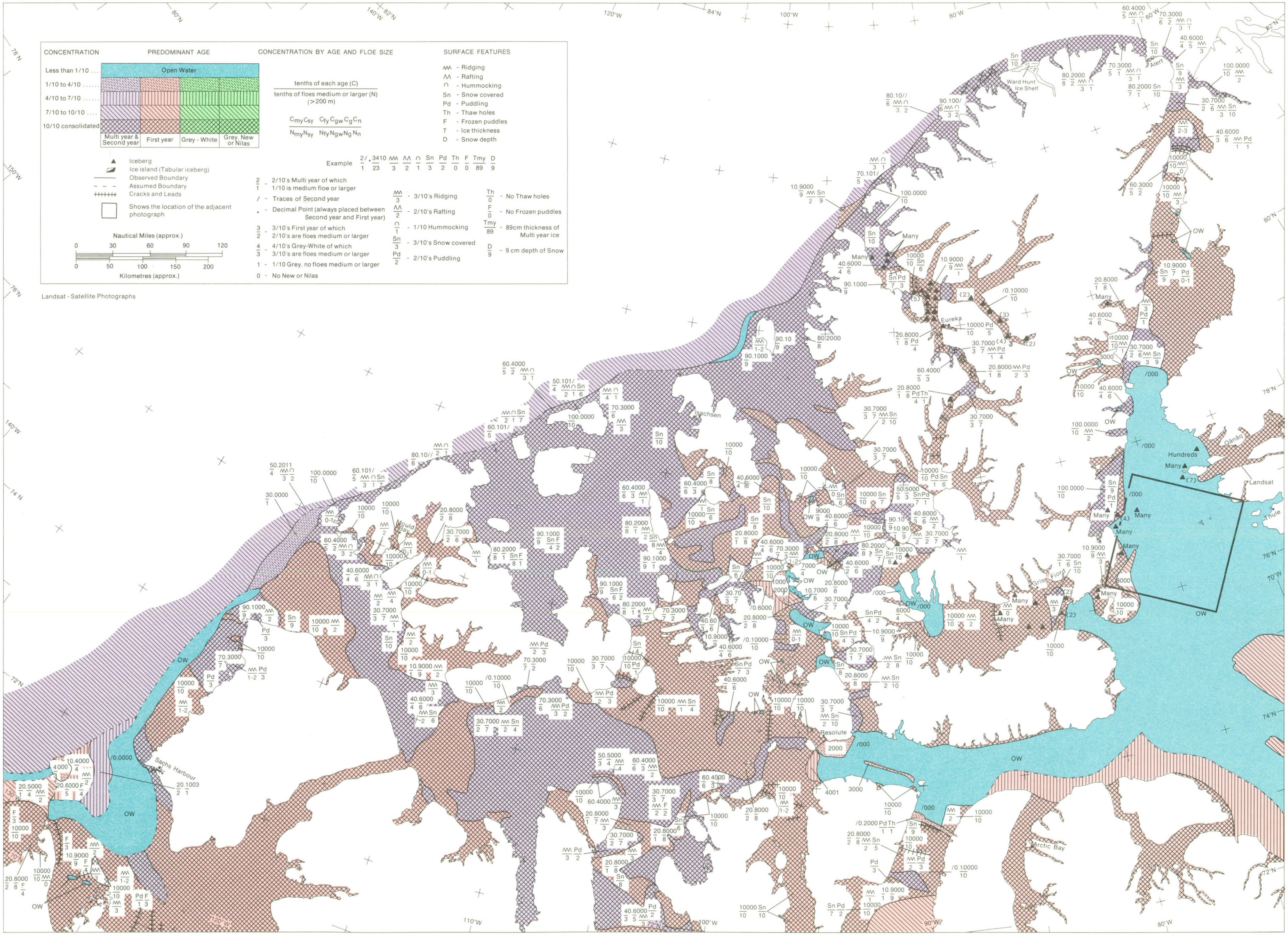
Satellite photographs established the conditions in Baffin Bay, Lancaster Sound and its adjoining channels to the south.

Comments

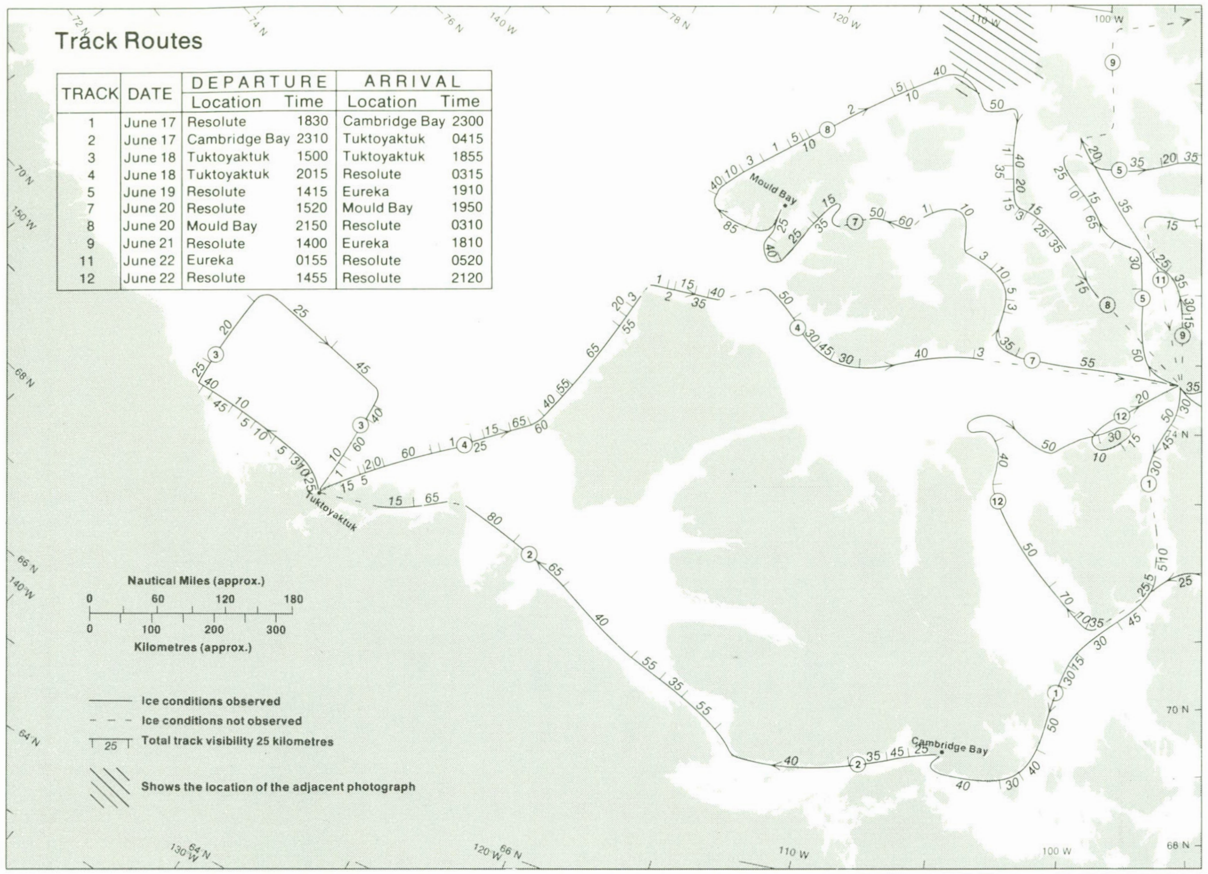
The season was slightly advanced if one assumes that 1972 was a normal, typical year.

Many factors, such as winter temperatures, snow cover, ice growth, ice thickness, amounts and distribution of ice types, as well as the advance of puddling and the appearance and size of polynyas, can be considered when an assessment of the type of year is made. A simple, but reliable way is to note when polynyas appear and how they develop. The same technique is employed for puddling except that distribution is important.

A few small ice island fragments were observed east of Drake Point. The icebergs in Eureka Sound were plentiful and many more were ready to move south from Otto Fiord in Nansen Sound.



June 17 - 22, 1976



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	June 17	Resolute	1830	Cambridge Bay	2300
2	June 17	Cambridge Bay	2310	Tuktoyaktuk	0415
3	June 18	Tuktoyaktuk	1500	Tuktoyaktuk	1855
4	June 18	Tuktoyaktuk	2015	Resolute	0315
5	June 19	Resolute	1415	Eureka	1910
7	June 20	Resolute	1520	Mould Bay	1950
8	June 20	Mould Bay	2150	Resolute	0310
9	June 21	Resolute	1400	Eureka	1810
11	June 22	Eureka	0155	Resolute	0520
12	June 22	Resolute	1455	Resolute	2120

MAP 2-1976 West

June 17-22

Flight Effectiveness

Five tracks were flown over the western region and the key areas were covered. Some aircraft icing, fog and low stratus cloud interrupted observations occasionally but the flight was at least 80 per cent effective.

Ice Conditions

As expected, the main change between the first two flights was the break-up of the solid ice cover in the Beaufort Sea and Arctic Ocean. The Bathurst polynya had appeared recently and was catching up to its usual development by a rapid expansion into Amundsen Gulf. The Mackenzie River entrances were ice-free and the solid ice bridge separating this open area from the lead in the Beaufort Sea appeared in its usual place. Similarly the polynyas in Dolphin and Union Strait were in their accustomed place and were slightly larger than usual. Puddling was advancing throughout the area. In the Beaufort Sea area and western part of Amundsen Gulf they were temporarily frozen.

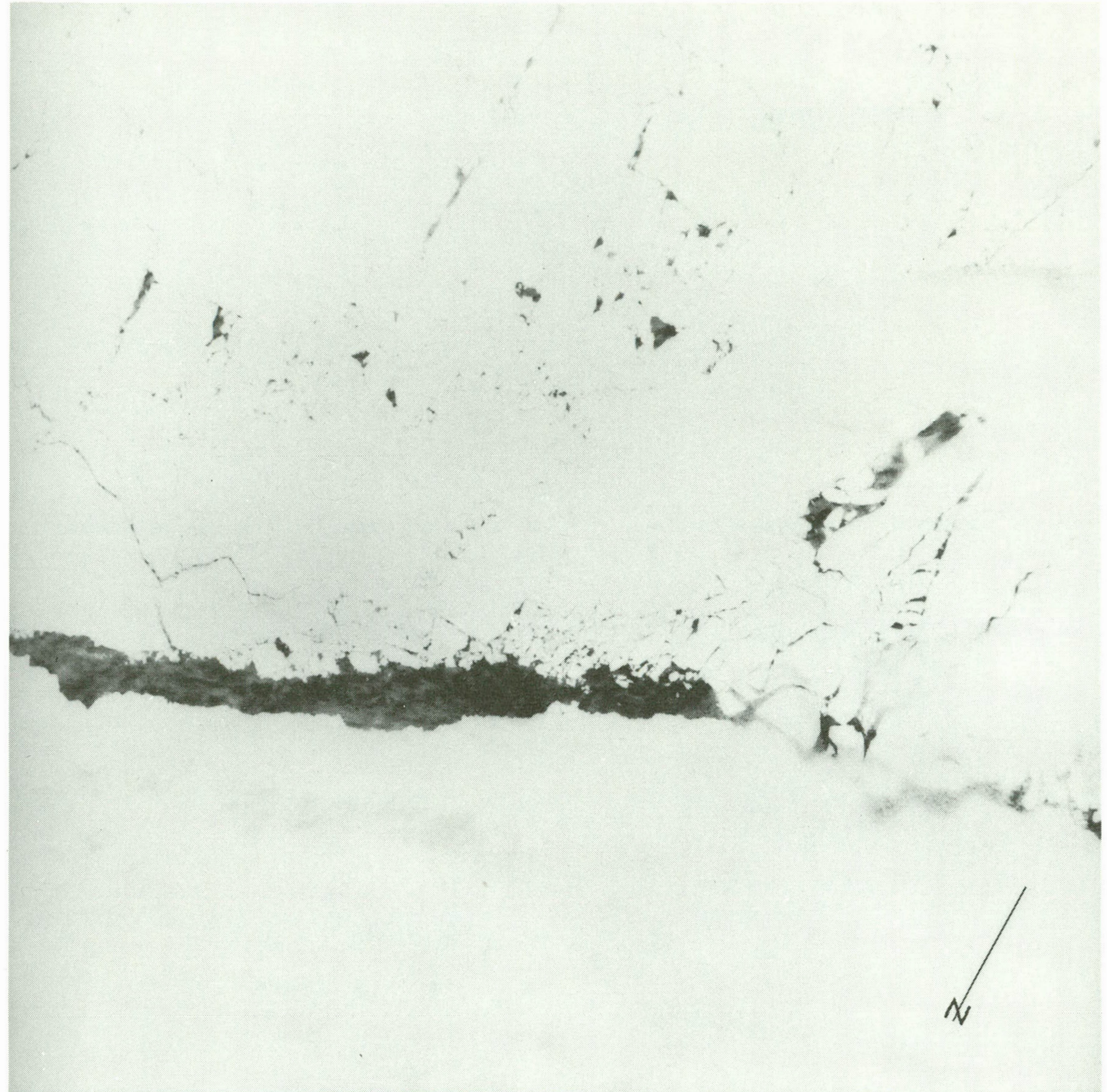
The two small areas of open water that appeared in the solid ice cover in Franklin Bay, south of the Bathurst polynya, had not been observed in previous years. The crack pattern in Dolphin and Union Strait and in the southern part of Amundsen Gulf is a normal development and a herald of things to come.

Unobserved Areas

The ice conditions in Prince of Wales Strait, northern Amundsen Gulf, southern Viscount Melville Sound and in the channels around King William Island were determined on the basis of observations made in adjacent channels and data collected during Flight 3. The patterns shown along the north coast of Alaska are based on interpretations of satellite photographs.

Comments

The rate of melting and the advance of ablation in the western region were slightly behind what is usually expected at this time of year.

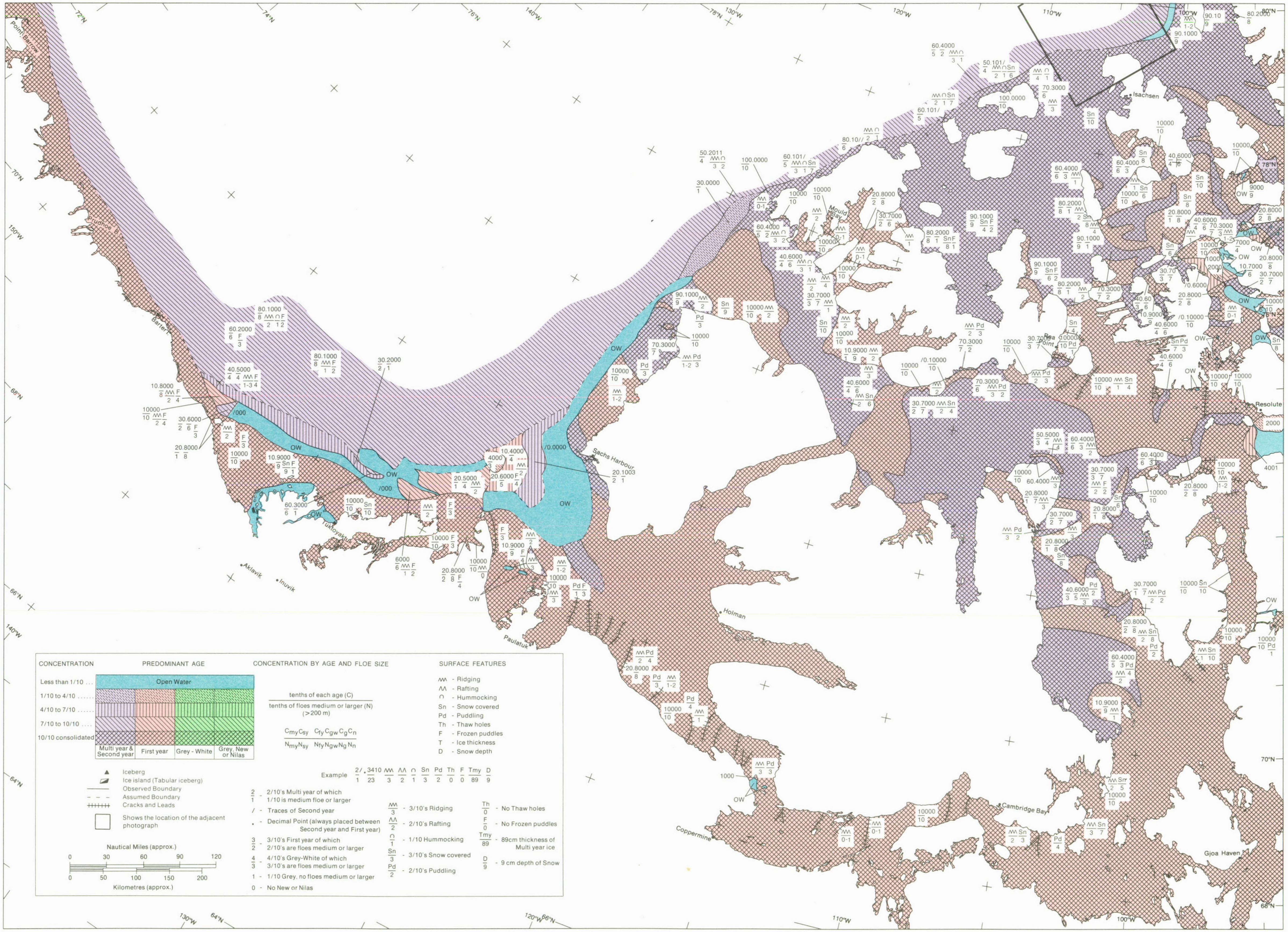


Prince Gustaf Adolf Sea, June 17, 1976, T74 F2

Six small pieces of ice island were sighted frozen into the landfast ice north of Komakuk Beach.

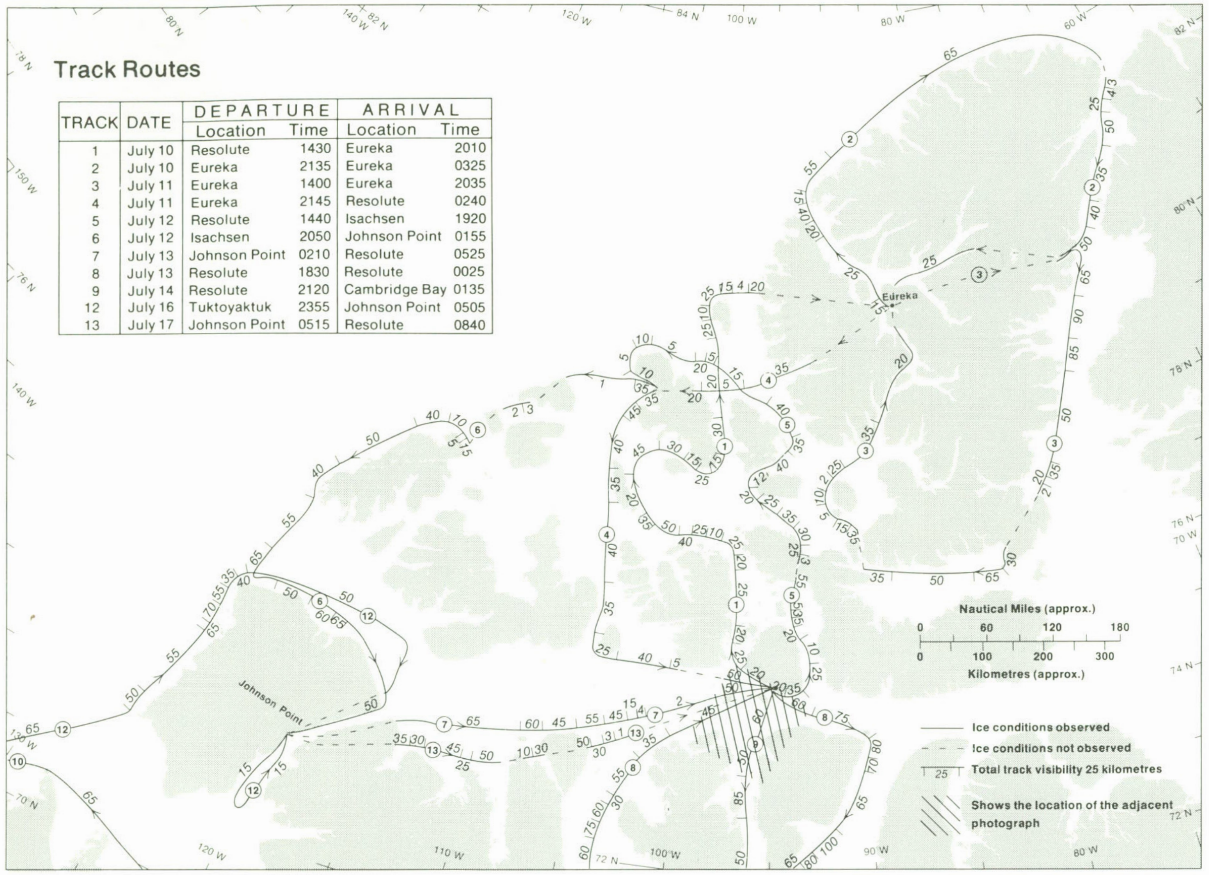
Break-up had taken place very recently and rapidly in Amundsen Gulf. By June 25 the boundary or ice edge between solid, unmoving ice and mainly open water in the eastern part of the gulf had receded 75 km further east than the position shown on Map 2–1976 WEST where it was observed eight days earlier on June 17.

The lead that the satellite photograph, June 17, shows along the ice edge in northern Prince Gustaf Adolf Sea had closed when track 8, June 20, was conducted in the area. This opening and closing is a frequent and normal occurrence in the area. Cloud and fog are usual in this area and obscure features in the photographs.



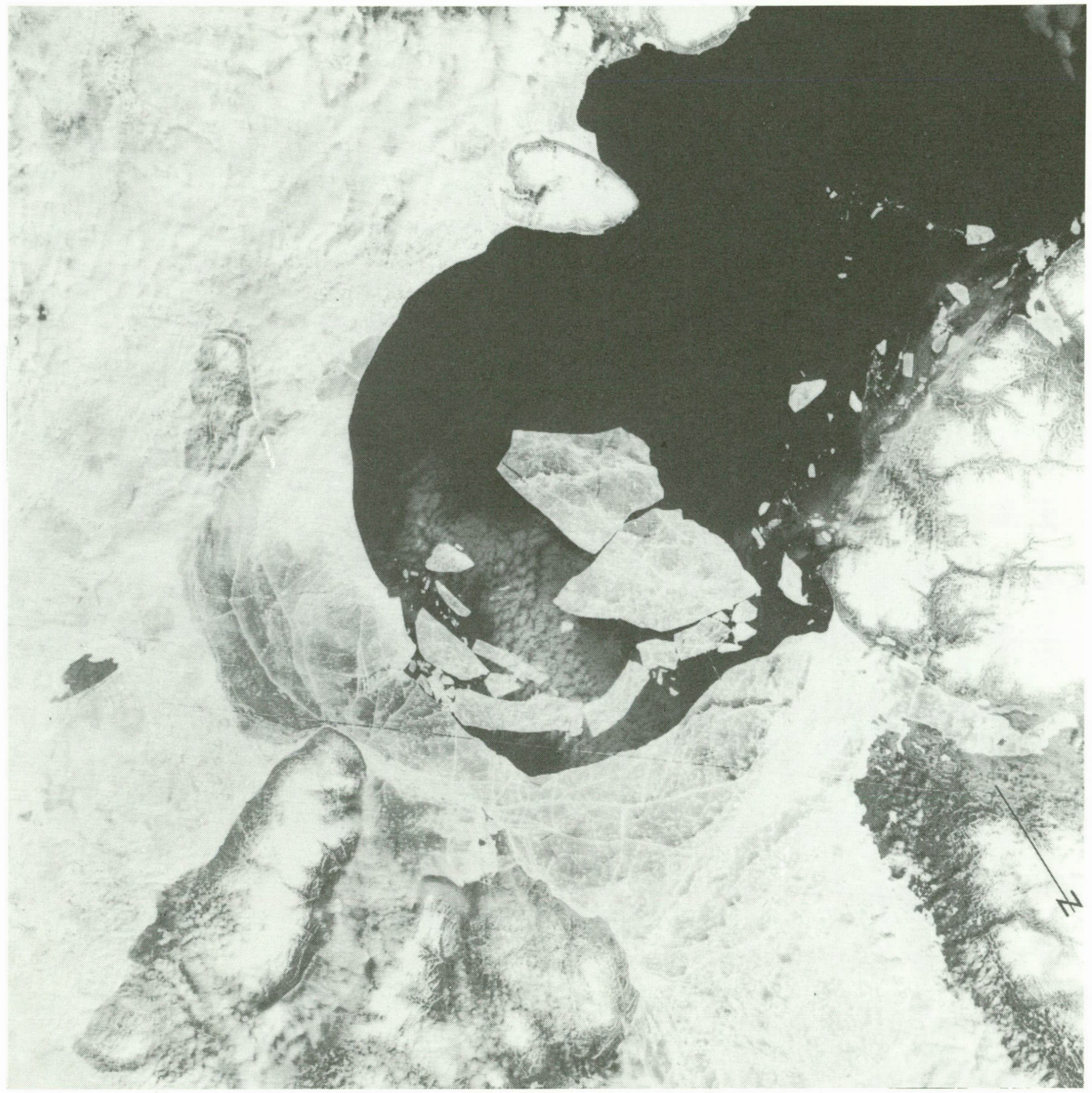
MAP 2 - 1976 WEST

June 17 - 22, 1976



Track Routes

TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	July 10	Resolute	1430	Eureka	2010
2	July 10	Eureka	2135	Eureka	0325
3	July 11	Eureka	1400	Eureka	2035
4	July 11	Eureka	2145	Resolute	0240
5	July 12	Resolute	1440	Isachsen	1920
6	July 12	Isachsen	2050	Johnson Point	0155
7	July 13	Johnson Point	0210	Resolute	0525
8	July 13	Resolute	1830	Resolute	0025
9	July 14	Resolute	2120	Cambridge Bay	0135
12	July 16	Tuktoyaktuk	2355	Johnson Point	0505
13	July 17	Johnson Point	0515	Resolute	0840



Barrow Strait, July 17, 1976, T50 F7

MAP 3-1976 East

July 10-17

Flight Effectiveness

Some areas of low stratus cloud during a few tracks and rain during parts of tracks 3 and 6 reduced the overall effectiveness. Generally observations were made in the right place and time as far as weather systems were concerned and the flight was 80 per cent successful.

Ice Conditions

Puddling had spread over the ice in the eastern region. Most of these puddles were frozen over in mid-July. Snow from the winter months covered the ice and land in many areas that are usually bare at this time and fresh snow was appearing in areas where melting had taken place. These conditions along with average temperatures hovering around the mean minimums made it look like the season would be late.

In spite of low temperatures and fresh snow, signs of a continuing break-up were evident. The ice in Prince Regent Inlet had broken and much of the ice had disappeared. Lancaster Sound became ice-free between the two flights. The ice edge in Barrow Strait had advanced about 30 km further west from its position in Flight 1 and a similar expansion to the north had taken place in the southern part of Wellington Channel. Other changes and signs that the season was advancing were the increase in size of the open water areas in Penny Strait, Queens Channel, Belcher Channel, Hendriksen Strait and Hell Gate. An additional area of open water developed in Pell Inlet between Bathurst Island and Alexander Island. The ice in Kennedy Channel and northern Kane Basin had broken.

Break-up and clearing was taking place in a typical fashion.

Unobserved Areas

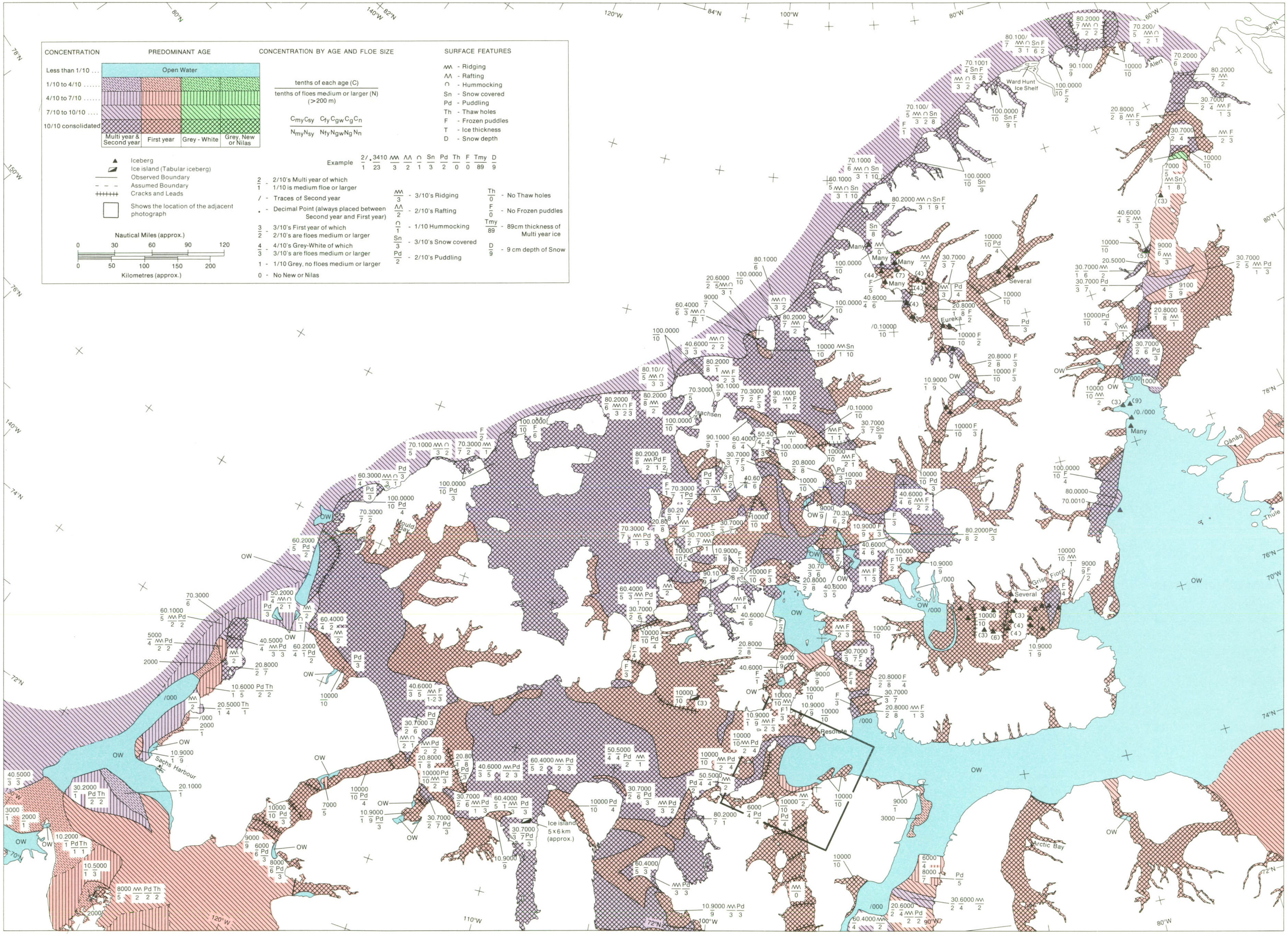
Satellite photographs were interpreted to establish the ice conditions in Baffin Bay, Lancaster Sound, Admiralty Inlet and the straits separating Bylot Island from Baffin Island. The distributions and ice types shown for northern M'Clure Strait, Hecla and Griper Bay and Hazen Strait are based on conditions noted during subsequent tracks over these areas.

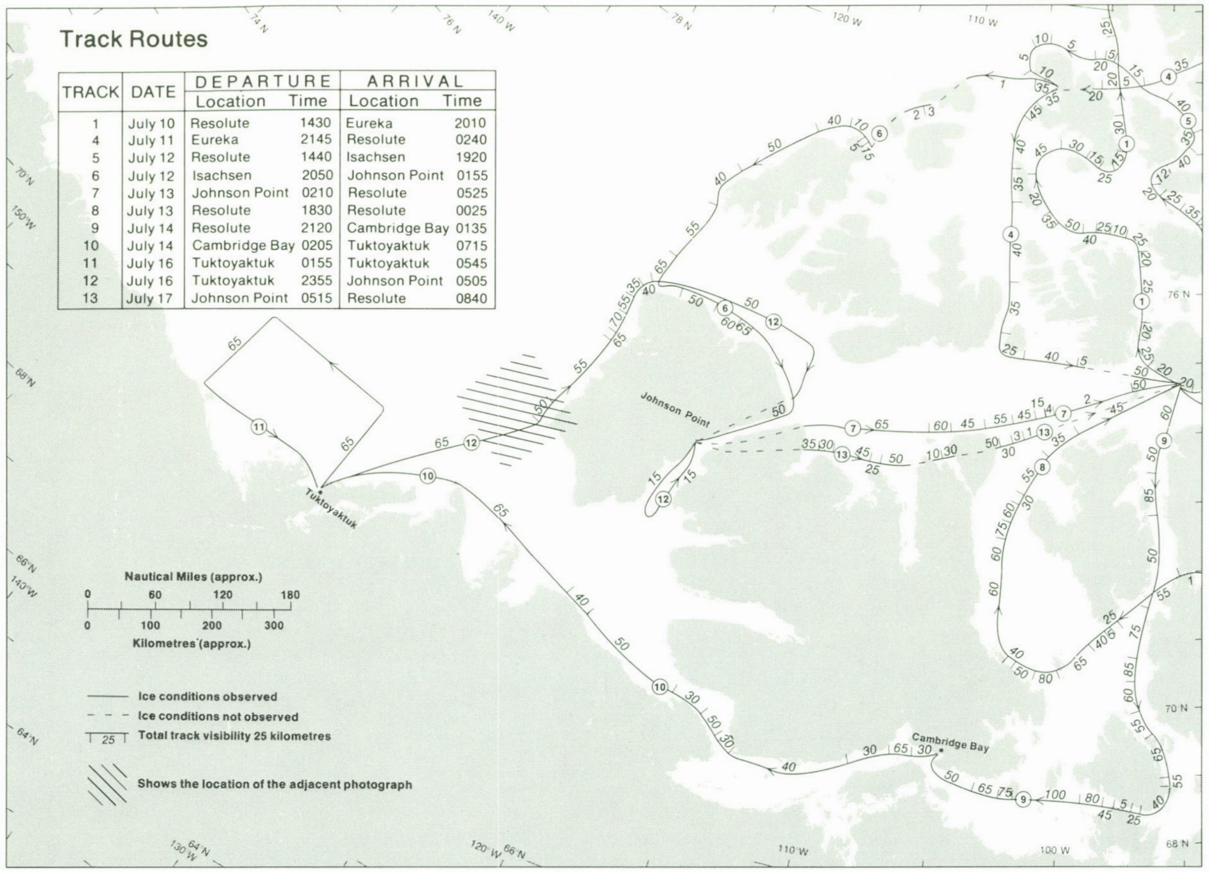
Comments

New ice in Kennedy Channel, unmelted snow in some areas, new snow in others and frozen puddles throughout the eastern region indicated an early winter. However, expansion of the open areas indicated that the season was still advancing in spite of this gloomy outlook.

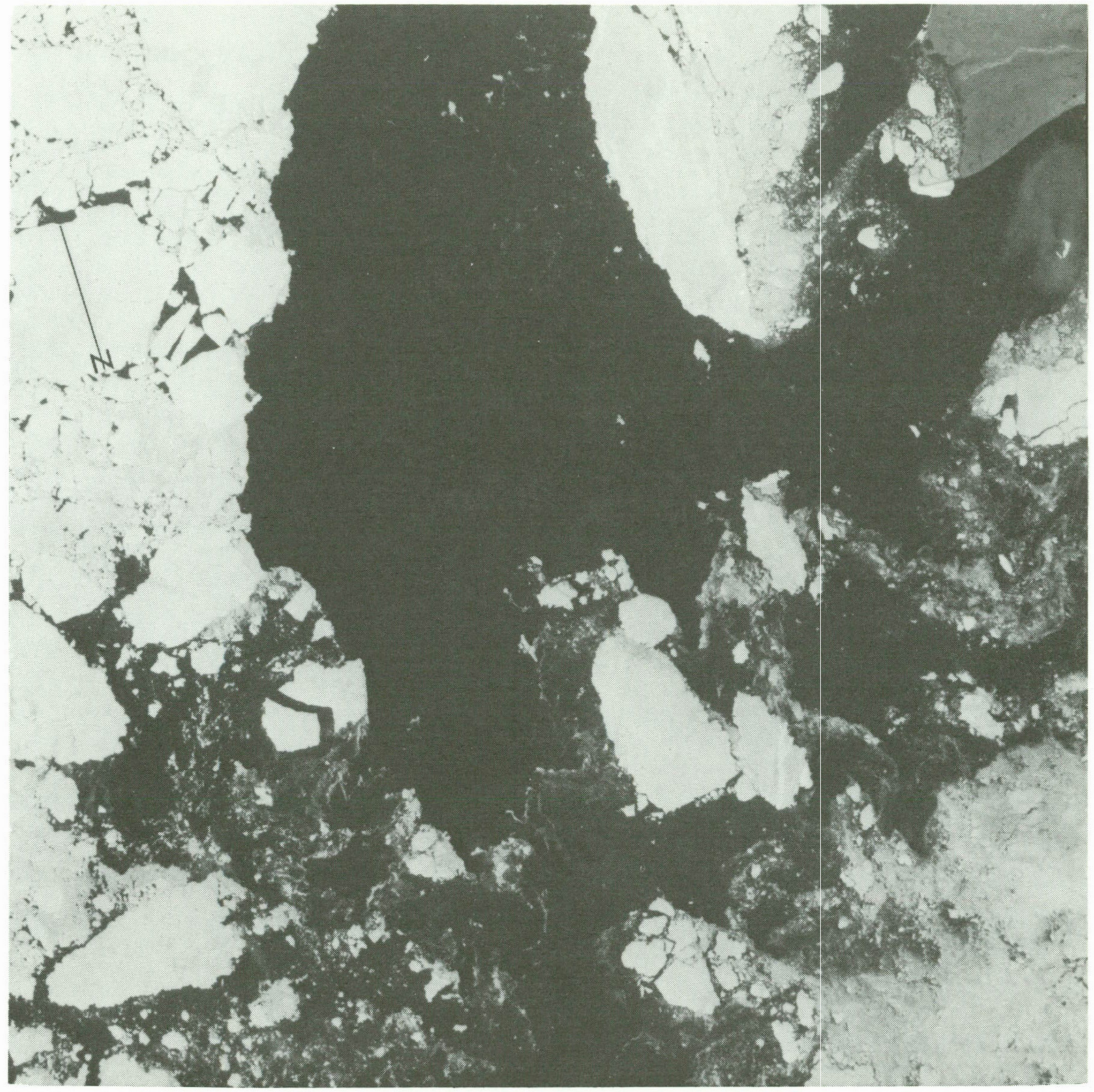
The rate of advance was a little slower than usual. For example, in Nares Strait the ice throughout the area had broken by mid-July, whereas in 1976, the break-up was expanding but would not extend from north to south until July 20.

The ice edge in central Barrow Strait shown on Map 3–1976 EAST was established from observations made during tracks 7, 8 and 9 conducted on July 13 and 14. The satellite photo shows the conditions on July 17. The ice edge had remained stationary while the large floes were moving toward the east. The crack patterns paralleling the ice edge indicate the sequence of break-up to follow.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Sachs Harbour
Mould Bay
Isachsen
Eureka
Alert
Ward Hunt Ice Shelf
Resolute
Grise Fiord
Arctic Bay
Thule
Qânâq
Ice island 5 x 6 km (approx.)
Many
Several
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	July 10	Resolute	1430	Eureka	2010
4	July 11	Eureka	2145	Resolute	0240
5	July 12	Resolute	1440	Isachsen	1920
6	July 12	Isachsen	2050	Johnson Point	0155
7	July 13	Johnson Point	0210	Resolute	0525
8	July 13	Resolute	1830	Resolute	0025
9	July 14	Resolute	2120	Cambridge Bay	0135
10	July 14	Cambridge Bay	0205	Tuktoyaktuk	0715
11	July 16	Tuktoyaktuk	0155	Tuktoyaktuk	0545
12	July 16	Tuktoyaktuk	2355	Johnson Point	0505
13	July 17	Johnson Point	0515	Resolute	0840



Southeastern Beaufort Sea, July 17, 1976, T68 F9

MAP 3-1976 West

July 10-17

Flight Effectiveness

Excellent weather and good distribution of tracks permitted almost all of the western part of the region to be surveyed during Flight 3. The flight was almost 90 per cent effective.

Ice Conditions

The main changes between flights 2 and 3 were in Amundsen Gulf where the entire ice cover broke up and started to move and in the southern part of the Beaufort Sea along the coast where the previously solid band of ice along the coast had broken and melted to a three-tenths concentration. Less obvious were the advances break-up made along the west coast of Banks Island and into M'Clure Strait. The development of the polynya in Dolphin and Union Strait continued and open areas appeared in Prince of Wales Strait, along the southern coast of Victoria Island and in the narrows south and east of King William Island. The small open area in Franklin Strait near Boothia Peninsula appeared in the same place about three weeks later than it did the previous season. Puddles were developing in M'Clure Strait, thaw holes were appearing in Amundsen Gulf and the puddles in Queen Maud Gulf were either frozen or drained.

The patterns of break-up and ablation were following the usual sequence. The amount of break-up was typical for this time of year but the extent of puddling was less than normally expected. The season was slightly later than usual.

Unobserved Areas

The ice conditions along the north coast of Alaska are based on AES information. Those in northern Amundsen Gulf are the result of satellite interpretation while in Victoria Strait observations made during flights 2 and 4 were used to establish the regime.

Comments

In general the rate at which break-up and ablation were advancing was slightly slower than normal. However, because the winds had not developed to move the ice in the southern part of the Beaufort Sea away from the coast, some people expressed the idea that the season was very late.

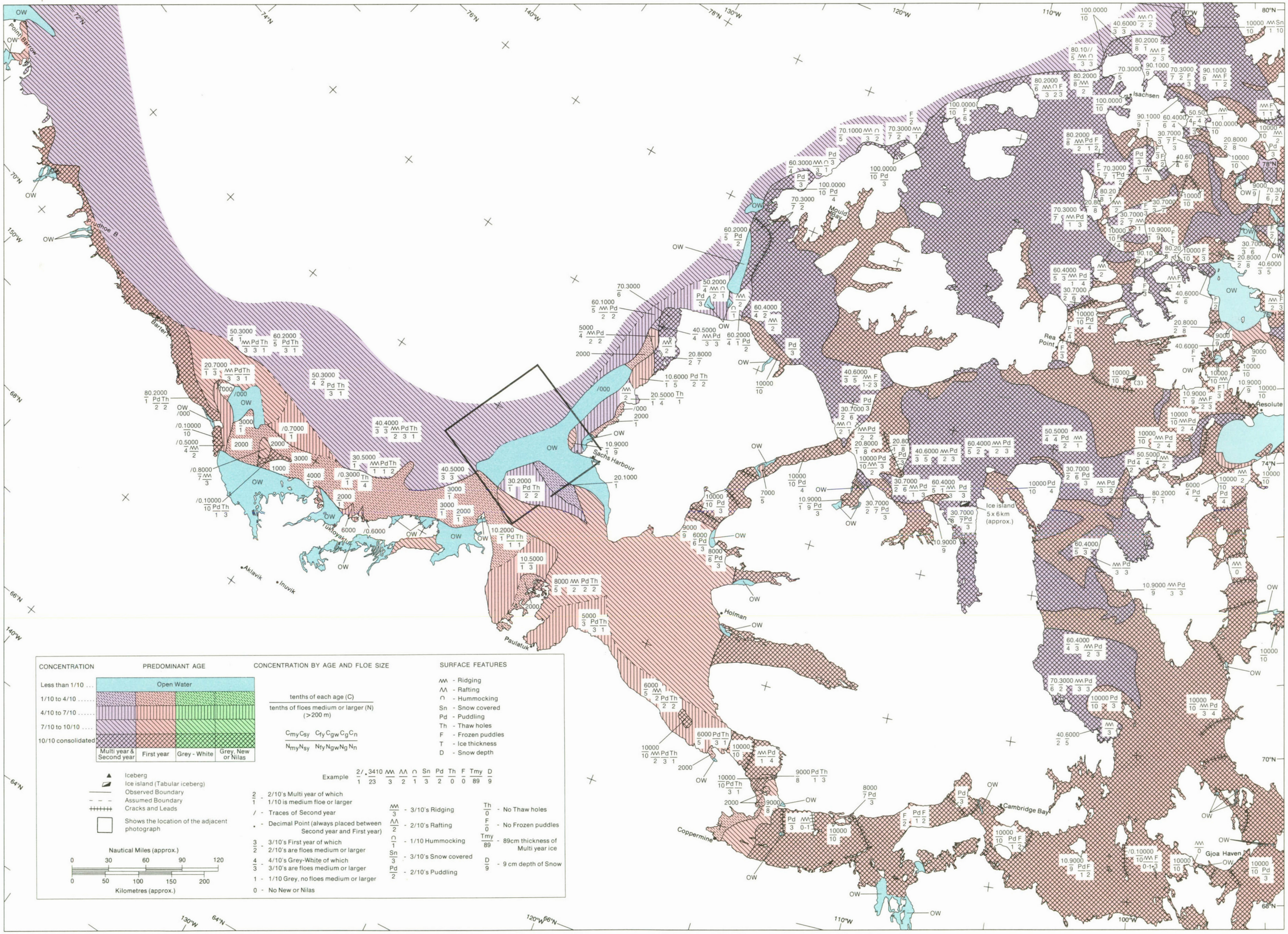
The cracks shown across Peel Sound are only a fraction of the number that actually were observed during track 9 on July 14.

No ice island fragments from T-1 were seen in the vicinity of Gateshead Island. They had finally melted or drifted south into the northeastern part of Victoria Strait. The fair-sized ice island seen in southern Viscount Melville Sound at the northern entrance to Hadley Bay might be the same one located north of Prince of Wales Strait on August 31 some 200 km further west.

On July 12 the ice edge across M'Clure Strait touched Banks Island at Ballast Beach. On July 16 it had moved 35 km further east. The solid ice cover in the northern half of Amundsen Gulf had broken up since July 8.

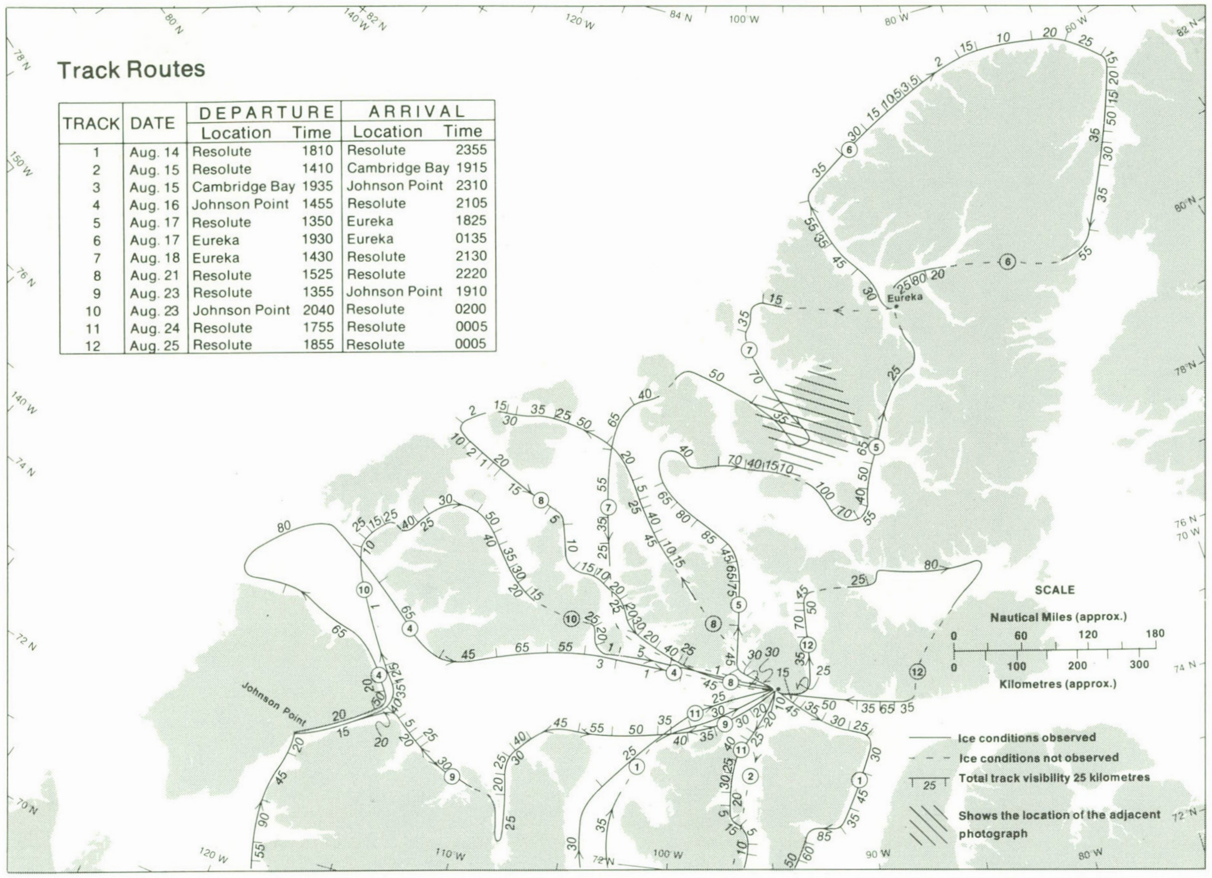
The limited extent of open water in the southern part of the Beaufort Sea was very unusual. Typically, in other years, southerly winds have created an ice-free area 100 km wide at this time.

The distributions observed on July 16 and those shown on the satellite photograph of July 17 near the southwest tip of Banks Island reflect the limited movements in the area.

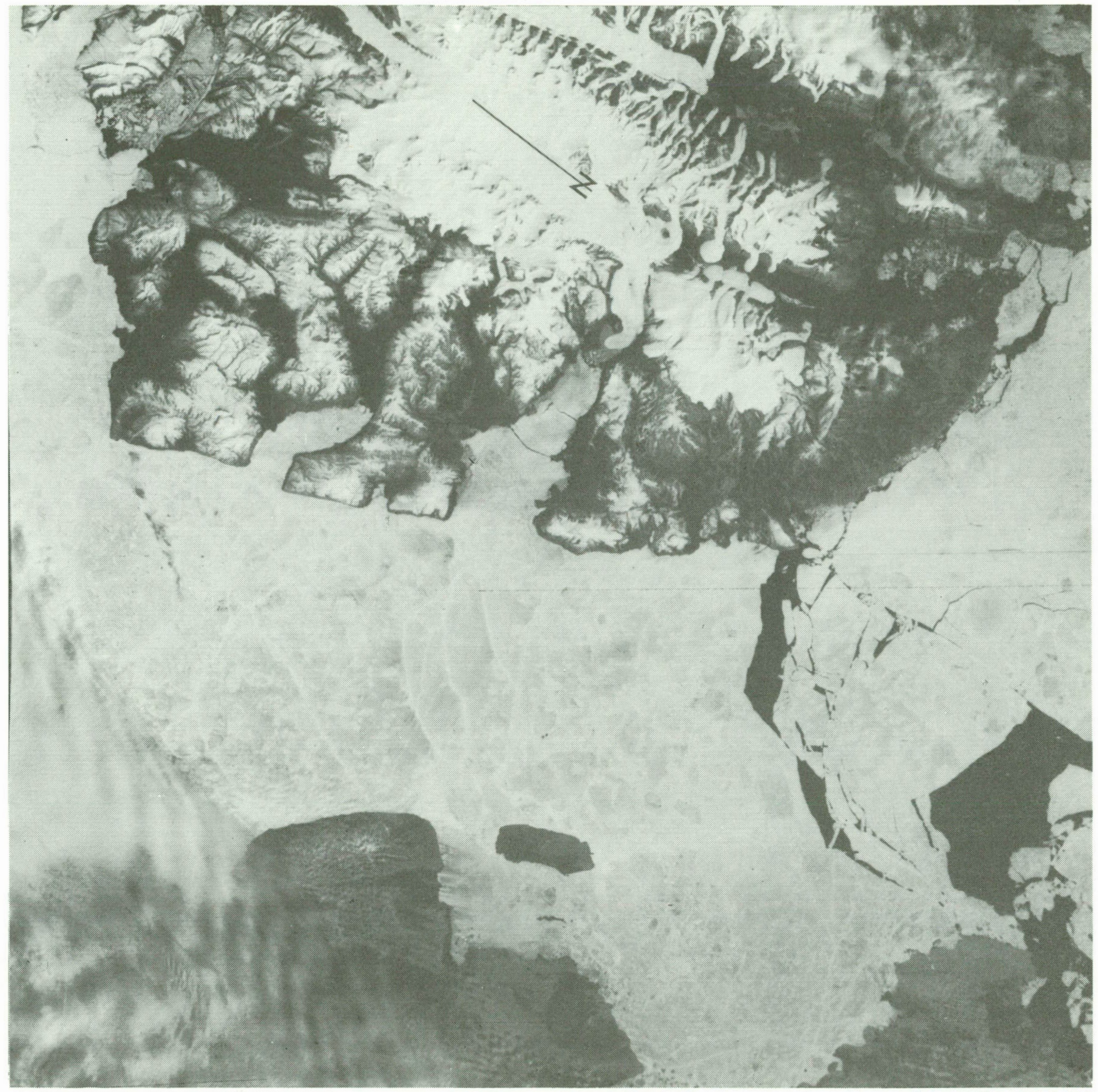


MAP 3 - 1976 WEST

July 10 - 17, 1976



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 14	Resolute	1810	Resolute	2355
2	Aug. 15	Resolute	1410	Cambridge Bay	1915
3	Aug. 15	Cambridge Bay	1935	Johnson Point	2310
4	Aug. 16	Johnson Point	1455	Resolute	2105
5	Aug. 17	Resolute	1350	Eureka	1825
6	Aug. 17	Eureka	1930	Eureka	0135
7	Aug. 18	Eureka	1430	Resolute	2130
8	Aug. 21	Resolute	1525	Resolute	2220
9	Aug. 23	Resolute	1355	Johnson Point	1910
10	Aug. 23	Johnson Point	2040	Resolute	0200
11	Aug. 24	Resolute	1755	Resolute	0005
12	Aug. 25	Resolute	1855	Resolute	0005



Massey Sound, August 14, 1976, T60 F3

MAP 4-1976 East

August 14-25

Flight Effectiveness

Observing conditions fluctuated drastically during Flight 4. Clear skies and unlimited visibility were followed by low stratus clouds and fog making observations impossible. New snow, 5 cm, at Resolute on August 20 signified the end of summer and the beginning of winter. Generally the weather was poor and resembled that usually encountered in October. The observing altitude averaged about 150 m. Flexibility in planning tracks to cover areas where favourable weather prevailed and the ability to modify the track while airborne to avoid weather was very important as it made the flight more than 80 per cent effective.

Ice Conditions

Considerable changes had taken place since the last flight ended on July 17. In Nares Strait break-up was completed in the latter part of July and the first-year ice left the area to be replaced by multi-year ice from the Arctic Ocean. The multi-year ice had drifted throughout the length of the strait and was spilling into Baffin Bay. In mid-July Jones Sound was mainly solid, first-year ice. By late August it was mainly ice-free. Some of this ice had melted in situ and the remainder seemed to drift east and south around Devon Island. In Norwegian Bay the solid ice cover gave way to a moving ice cover with a concentration of eight-tenths. The ice in Eureka Sound had broken but concentrations in the southern half were still near nine-tenths. The solid ice cover in Wellington Channel and McDougall Sound had given way and these areas were mainly ice-free. The break-up in the unnamed sea north of Penny Strait was extensive and considerable areas of open water developed south of Ellef Ringnes Island. The ice in Maclean Strait broke and huge masses of ice moved south leaving the northern portion ice-free. The solid first-year ice cover on the channels around Byam Martin Island had broken; Byam Channel was ice-free and Austin Channel would soon be as well. The solid ice barring the northern entrance to these channels stopped older ice types from moving south.

The patterns of break-up were progressing normally. The season, break-up and clearing, was ahead of the usual conditions expected at this time of year.

Unobserved Areas

Landsat satellite photographs, along with adjacent observations to determine ice types, were used to determine the ice conditions in Kane Basin, northern Baffin Bay, Lancaster Sound and the channels extending south from it. Along the north coast from M'Clure Strait to Nansen Sound the conditions shown are based on observations in nearby areas, data from other flights and usual conditions.

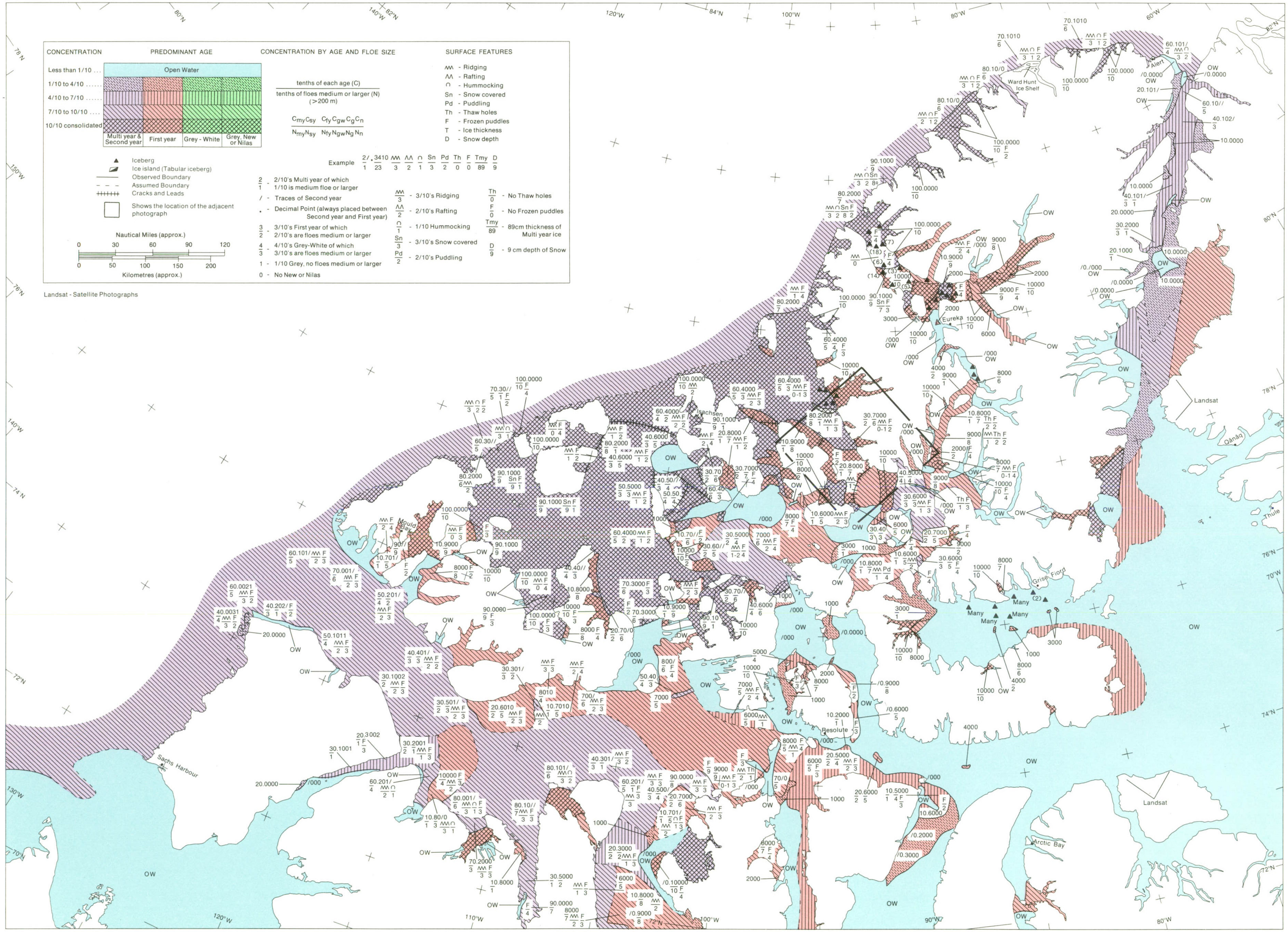
Comments

From being slightly behind in mid-July the ice conditions changed considerably to slightly ahead of what is expected by August 25.

The ice around southern Byam Martin Island started to break about August 11 and reached the ice edge shown on the map by August 15. The solid arch between Little Cornwallis Island and Cornwallis Island broke up on August 25. A lead crossed Prince Gustaf Adolf Sea and then joined Borden and Mackenzie King Island.

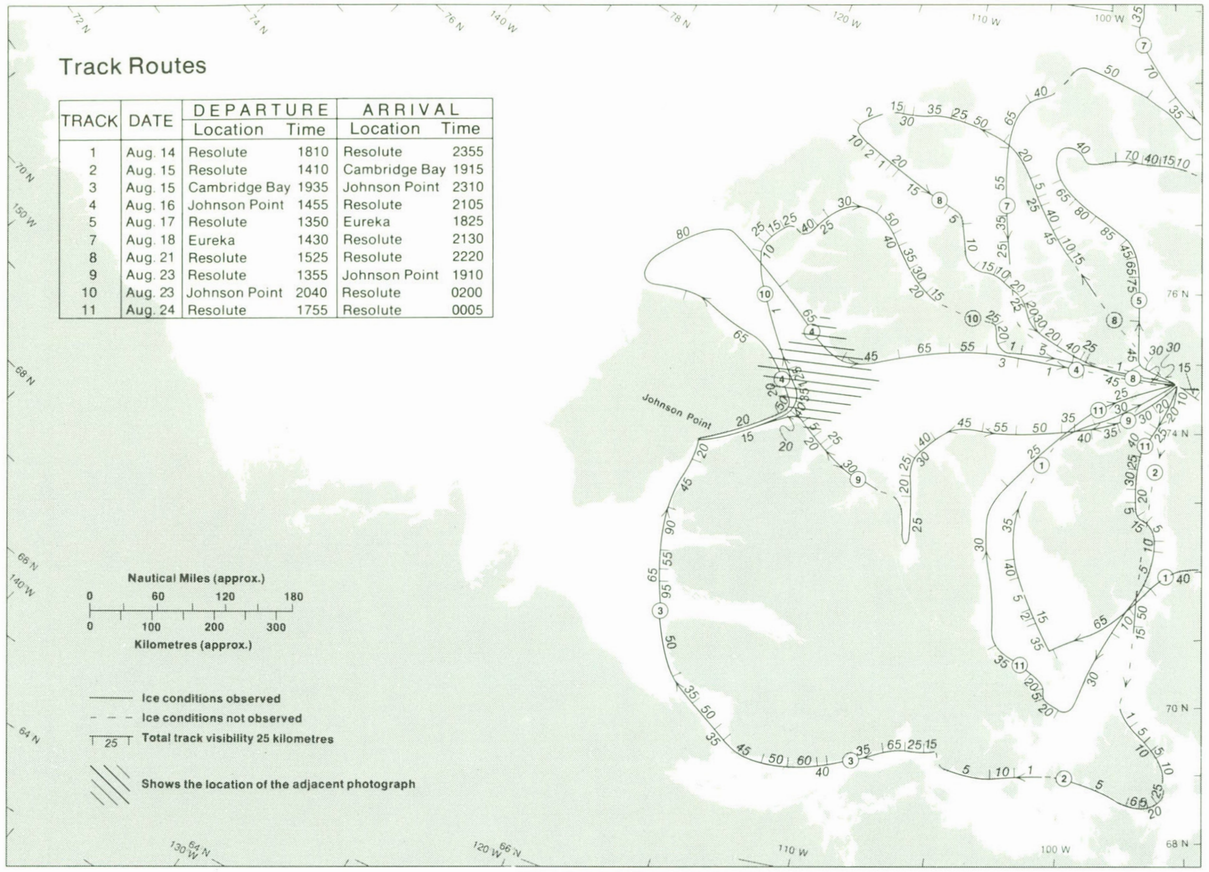
Rain and temperatures of +4°C were encountered on August 17 along the north coast of Ellesmere Island.

The satellite photograph of August 14 shows the early stages of break-up into Massey Sound and the map gives the extent on August 18.

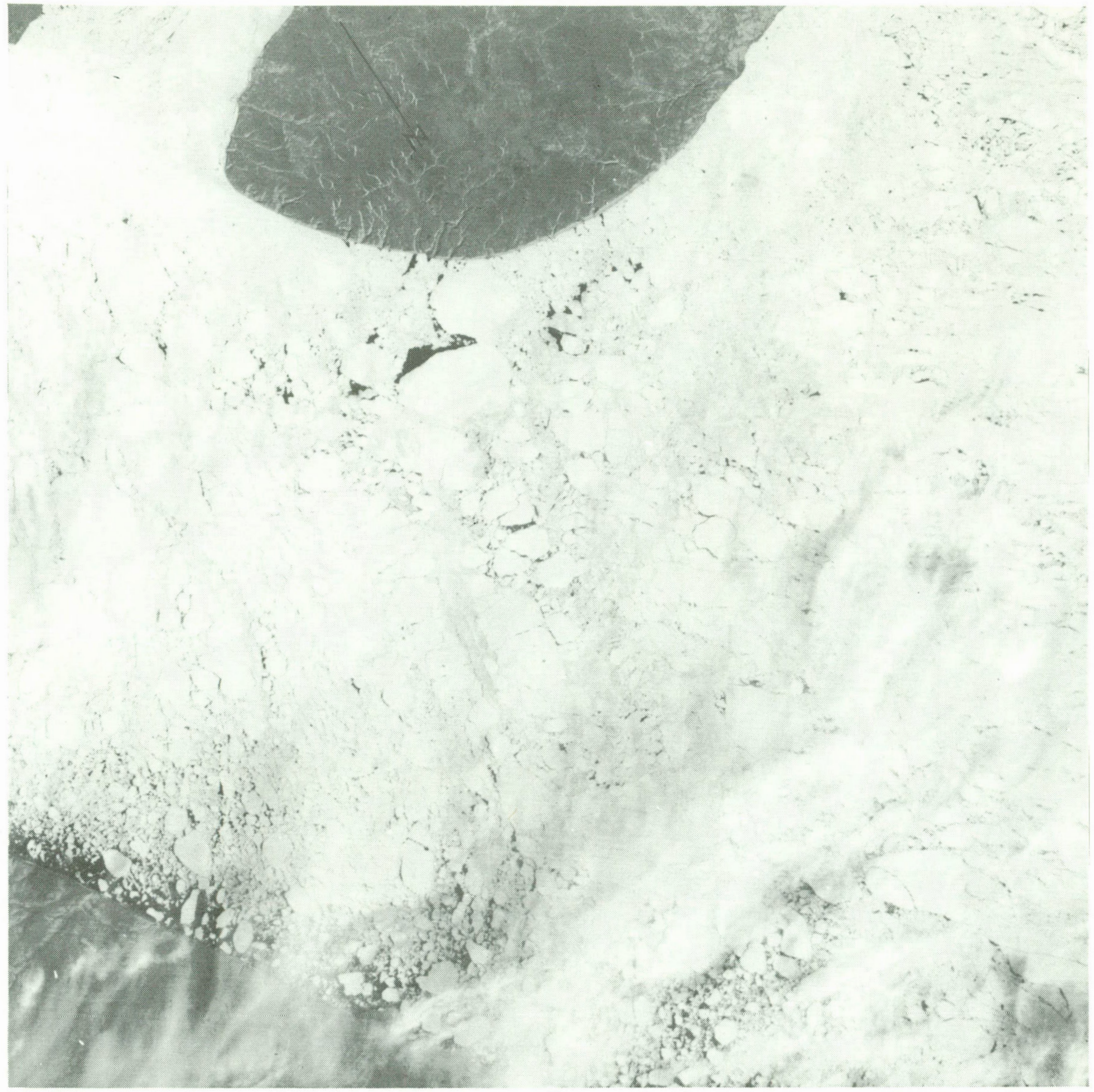


MAP 4 - 1976 EAST

August 14 - 25, 1976



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 14	Resolute	1810	Resolute	2355
2	Aug. 15	Resolute	1410	Cambridge Bay	1915
3	Aug. 15	Cambridge Bay	1935	Johnson Point	2310
4	Aug. 16	Johnson Point	1455	Resolute	2105
5	Aug. 17	Resolute	1350	Eureka	1825
7	Aug. 18	Eureka	1430	Resolute	2130
8	Aug. 21	Resolute	1525	Resolute	2220
9	Aug. 23	Resolute	1355	Johnson Point	1910
10	Aug. 23	Johnson Point	2040	Resolute	0200
11	Aug. 24	Resolute	1755	Resolute	0005



Eastern M' Clure Strait, August 16, 1976, T62 F7

MAP 4-1976 West

August 14-25

Flight Effectiveness

The weather for track 3 was excellent. For the other six tracks low stratus clouds, fog and rain interrupted observations. No observations were made in the Beaufort Sea area. Overall the flight was 75 per cent effective.

Ice Conditions

The major change came to the southern channels from the Beaufort Sea through Coronation Gulf to St. Roch Basin to the east of King William Island. These channels, mainly solid in mid-July, were ice-free by mid-August. The ice cover in Peel Sound had broken; half of the area was ice-free. The solid ice cover in M'Clintock Channel, Viscount Melville Sound and M'Clure Strait had broken but concentrations remained near nine-tenths.

The patterns of break-up were not observed but the results indicate that the progression was normal. No unusual distributions or concentrations were observed.

Frozen puddles were noted throughout the region. This condition would likely predominate until new snow covered the ice again.

Unobserved Areas

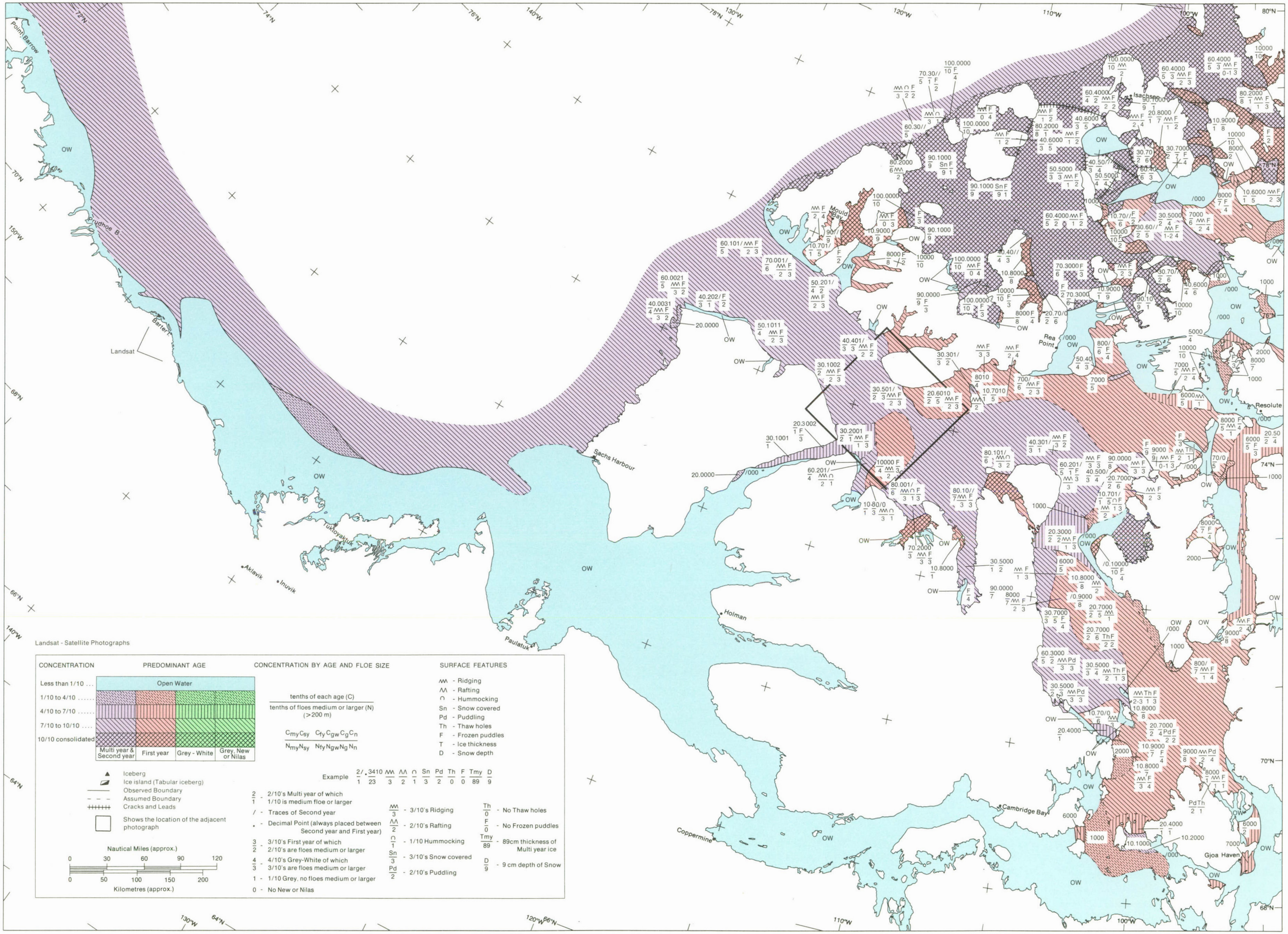
Satellite photographs were used to determine the ice conditions along the coast of Alaska, in the Beaufort Sea and Amundsen Gulf. The ice types shown in the central part of Victoria Strait were determined on the basis of the conditions observed at both ends.

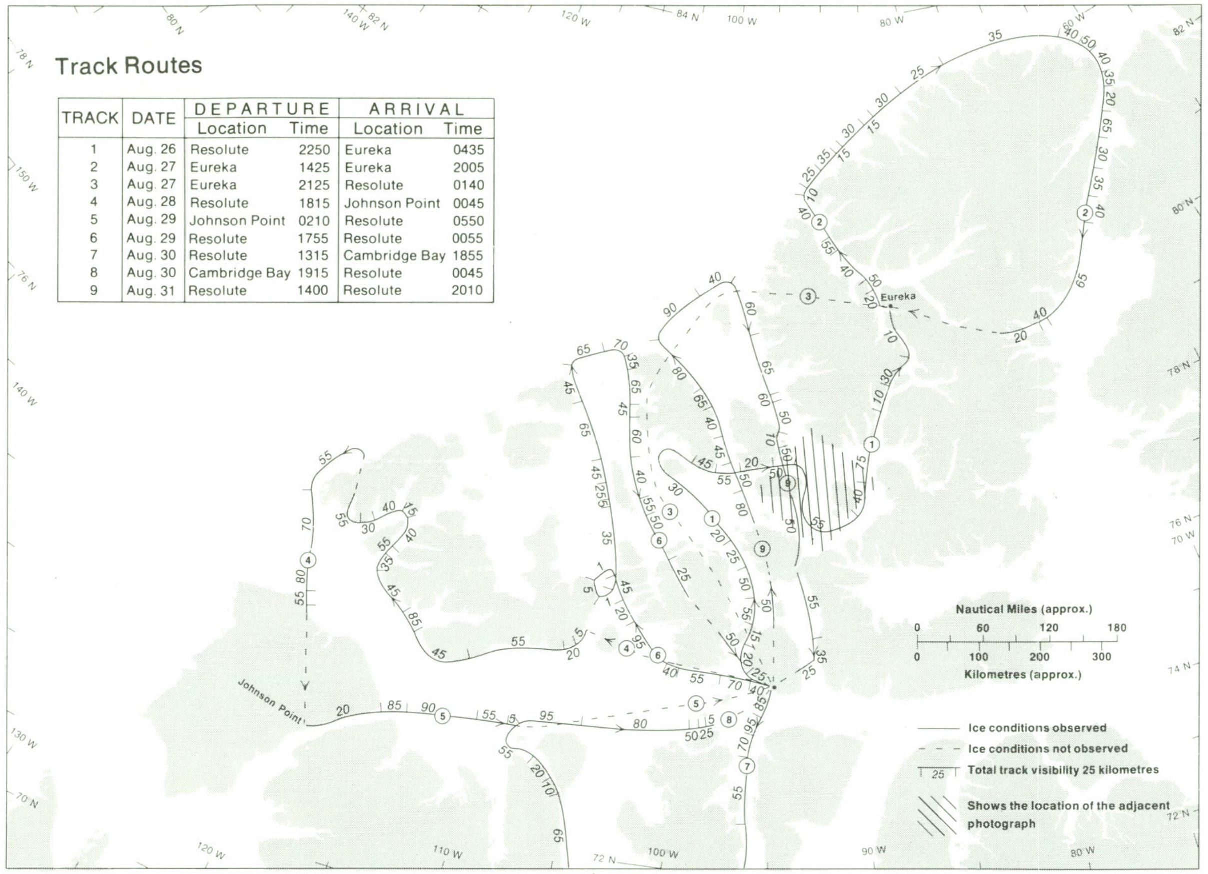
Comments

Multi-year ice in the Beaufort Sea was closer to the coast than it normally is at this time of year. Based on this and its effect on navigation in the area, the year was described by many as being worse than usual. However, all of the first-year ice in the Beaufort had melted and break-up and clearing in all of the other channels in the western region were ahead of the typical situation. Overall the season was more advanced than usual. Unfortunately, the winds to hold the multi-year ice off the coast in the Beaufort Sea had not developed.

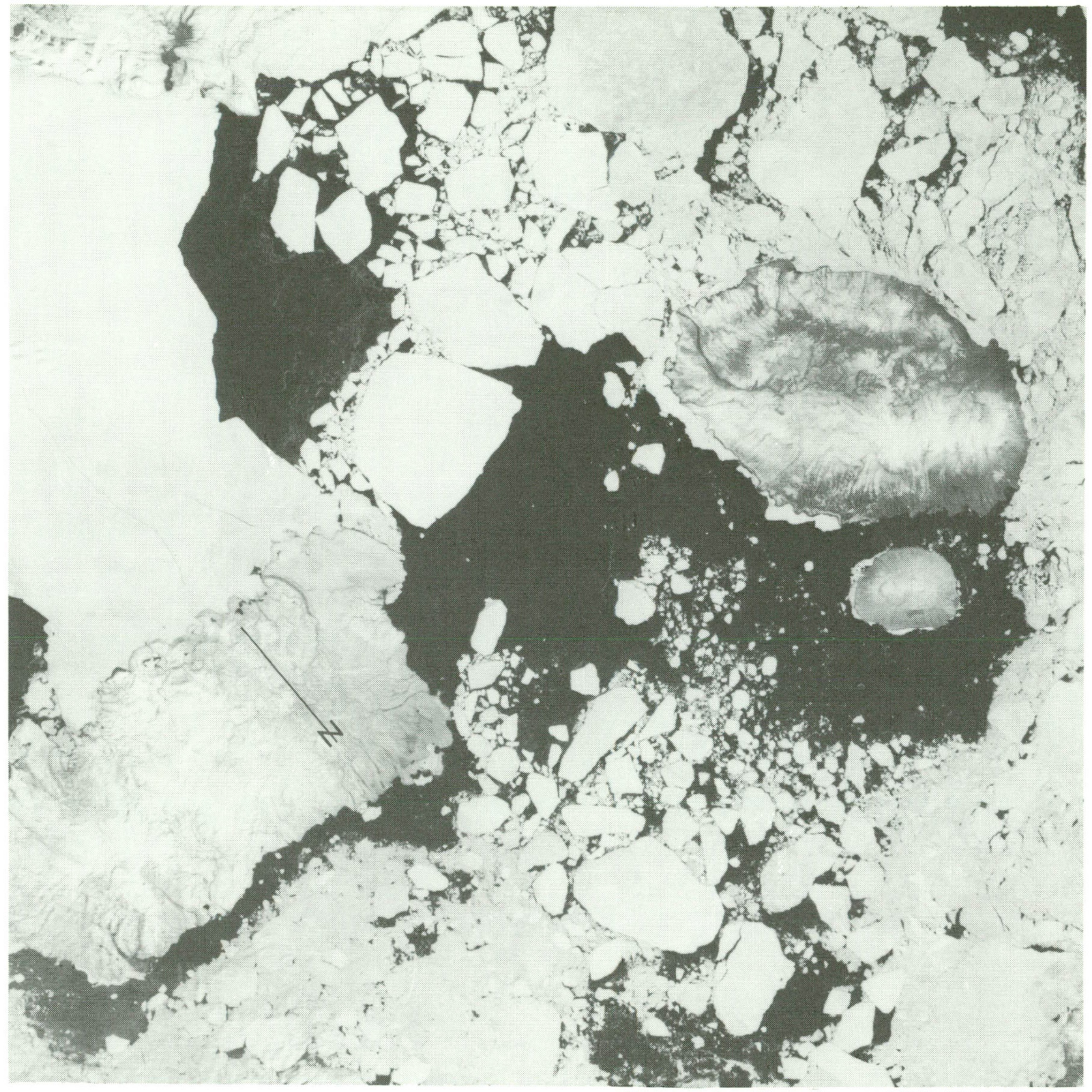
Probably the ice cover in Viscount Melville Sound and M'Clure Strait was broken and in motion by August 11. The small floe sizes noted during the tracks in these areas and on the satellite photograph indicate that considerable movement, shifting back and forth, had taken place to grind and crash the floes together to reduce their area. No predominant pattern of movement was obvious in Viscount Melville Sound. In M'Clure Strait the multi-year ice was moving from west to east. Some of this older ice had invaded the northern part of Prince of Wales Strait.

During track 11 on August 24 a drill ship and its icebeaker escort, Louis St. Laurent, had reached the southern part of Peel Channel and were preparing to test their strength against the ice in Larsen Sound and Victoria Strait that separated them from the ice-free passage to Tuktoyaktuk.


Point Barrow
Prudhoe B.
Barter I.
Landsat
Sachs Harbour
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Isachsen
Mould Bay
OW
Landsat - Satellite Photographs
CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 26	Resolute	2250	Eureka	0435
2	Aug. 27	Eureka	1425	Eureka	2005
3	Aug. 27	Eureka	2125	Resolute	0140
4	Aug. 28	Resolute	1815	Johnson Point	0045
5	Aug. 29	Johnson Point	0210	Resolute	0550
6	Aug. 29	Resolute	1755	Resolute	0055
7	Aug. 30	Resolute	1315	Cambridge Bay	1855
8	Aug. 30	Cambridge Bay	1915	Resolute	0045
9	Aug. 31	Resolute	1400	Resolute	2010



Norwegian Bay, August 27, 1976, T55 F4

MAP 5-1976 East

August 26-31

Flight Effectiveness

Observing and flying conditions for Flight 5 - 1976 were exceptionally good. Usually it requires at least ten days to get enough good weather to carry out surveys. This year the permitted flying time was used up in half that time. The ice conditions in all of the key areas were mapped with fine visibility. It seemed that if poor weather limited observations in an area one day, the next day it would be excellent and very good coverage would result. Surveys in Jones Sound, Lancaster Sound and northern Baffin Bay were deliberately omitted because changes in these areas at this time can be monitored by conditions in adjacent areas and by satellite photography. The flight was more than 90 per cent effective.

Ice Conditions

Only a few days separated flights 4 and 5 with the result that no major changes developed. In Nares Strait the amount of multi-year ice was about half as much as previously noted; it was concentrated along the east coast of Ellesmere Island and new ice types had formed in the open areas that were created by the westward drift. Clearing continued in Eureka Sound and concentrations had dropped considerably. The ice in Greely Fiord had broken up.

Clearing was progressing in other areas as well. This was aided by the fact that many ice edges remained stationary which meant that no new floes were generated or were permitted to move into an adjacent area. These temporarily stationary ice edges were located in Byam Martin Channel, Prince Gustaf Adolf Sea, Hassel Sound, Massey Sound and Nansen Sound.

Frozen puddles and snow were observed throughout the region and the formation of new ice types in the open areas was starting.

The state of the advance of break-up and clearing was slightly ahead of the conditions usually expected particularly in the northern part of Norwegian Bay which is often solid and in Jones Sound where concentrations greater than five-tenths are usual at this time.

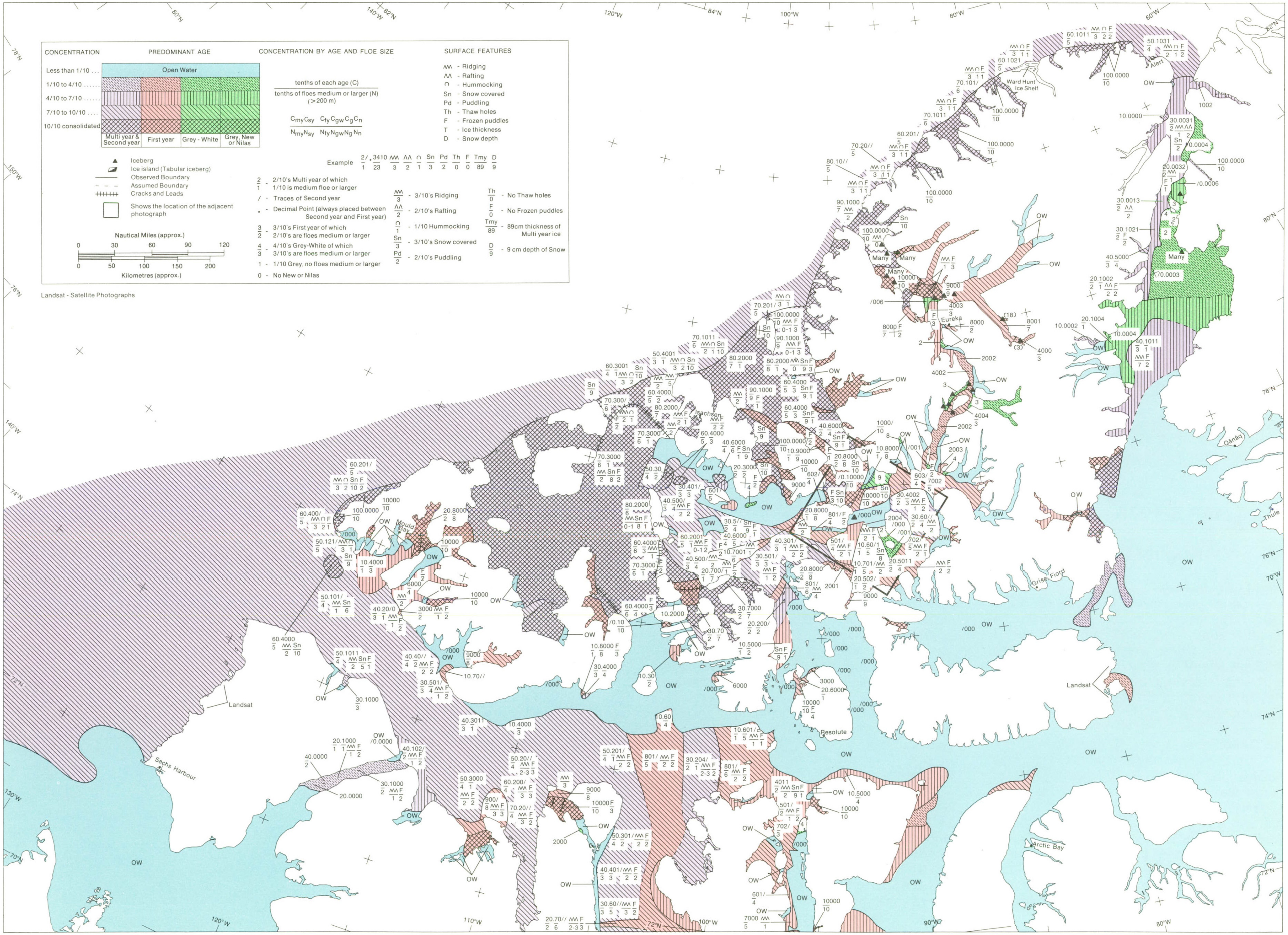
Unobserved Areas

The lack of surveys in Lancaster Sound, Jones Sound and Baffin Bay was deliberately planned. Once these areas become ice-free they will remain so unless ice moves in from other areas. If these areas are monitored then tracks can be completed if ice moves into them. Satellite photography used to determine the conditions in the southeastern part of the area confirmed this hypothesis. Because all the entrances to the Hecla and Griper Bay area were solid no surveys were necessary; the main area would reflect the conditions around its perimeter.

Comments

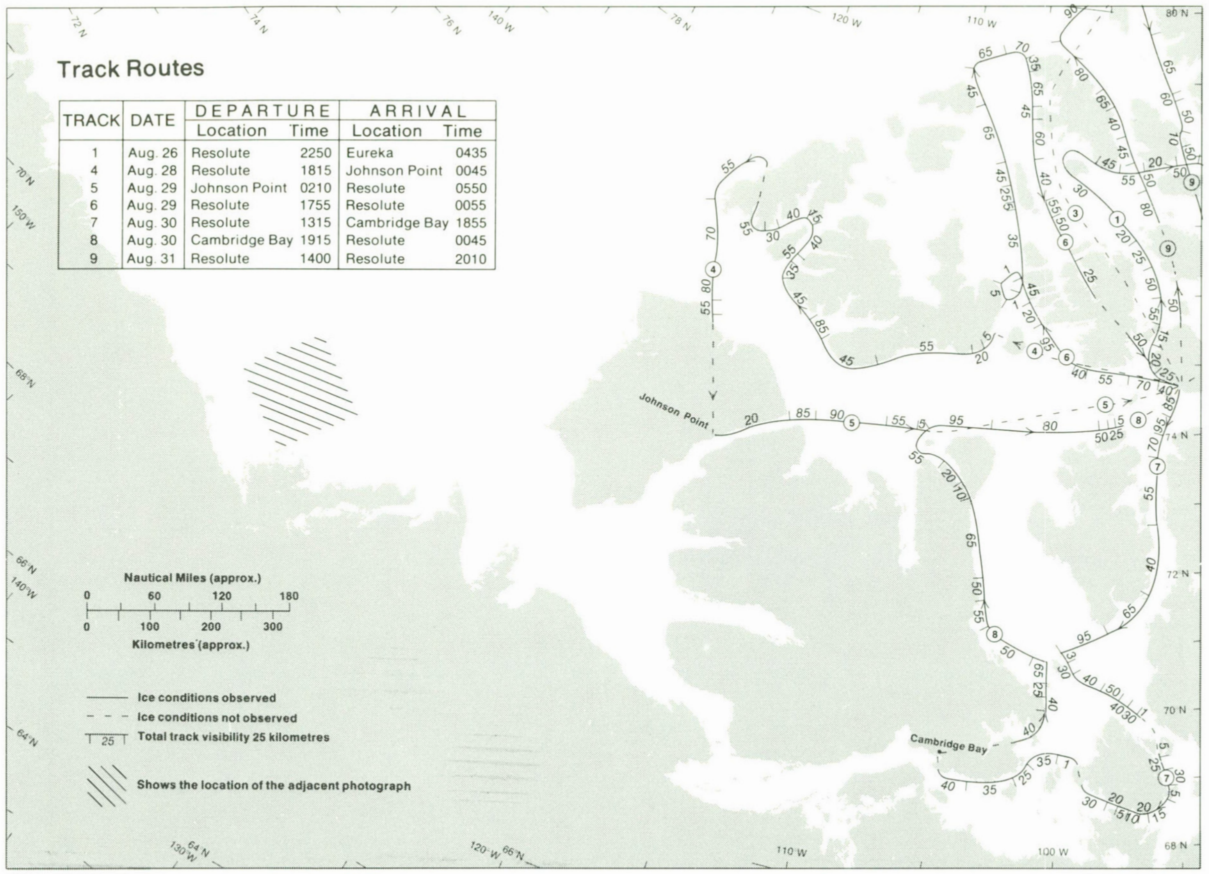
Break-up and movement were continuing. Southern Massey Sound was gradually breaking up. The map shows Desbarats Strait as it was mapped on August 29. By the 31st it had broken as far west as the crack across it south from Lougheed Island. Ice in Austin Channel moved 130 km south during the week that separated observations in the area.

The satellite photograph of Norwegian Bay is excellent and typifies the weather that accompanied this flight.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Mould Bay
Sachs Harbour
Resolute
Grise Fiord
Arctic Bay
Thule
Qânâq
Landsat
OW

Track Routes

TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	Aug. 26	Resolute	2250	Eureka	0435
4	Aug. 28	Resolute	1815	Johnson Point	0045
5	Aug. 29	Johnson Point	0210	Resolute	0550
6	Aug. 29	Resolute	1755	Resolute	0055
7	Aug. 30	Resolute	1315	Cambridge Bay	1855
8	Aug. 30	Cambridge Bay	1915	Resolute	0045
9	Aug. 31	Resolute	1400	Resolute	2010



Southern Beaufort Sea, August 26, 1976, T72 F10

MAP 5-1976 West

August 26-31

Flight Effectiveness

The ice conditions in all of the key areas were observed or surmised. Surveys in the Beaufort Sea were not conducted for a number of reasons: satellite photographs are available; the AES ice reconnaissance unit was in the area; and there was no fuel at Mould Bay (the aircraft alternate). The flight was 85 per cent effective.

Ice Conditions

Many changes had and were taking place between flights 4 and 5. The most obvious of these was the development of the large expanse of open water in the Parry strip in the northern part of Viscount Melville Sound. The winds responsible for creating this open water concentrated the ice into the southern part of the sound and into the northern part of M'Clintock Channel. In the southern part of the Beaufort Sea the multi-year ice moved farther away from the coast.

All of these changes were typical and no irregular events or patterns were noted.

Unobserved Areas

Satellite photographs were used to establish the conditions in the Beaufort Sea. Since both ends of the waterway from Amundsen Gulf to Queen Maud Gulf were ice-free, the central area would be ice-free and need not be surveyed unless ice is moving into the area through Prince of Wales Strait. Conditions in central Victoria Strait and eastern M'Clintock Channel were based on adjacent observations and the patterns in the bays north of Victoria Island were established from satellite photographs.

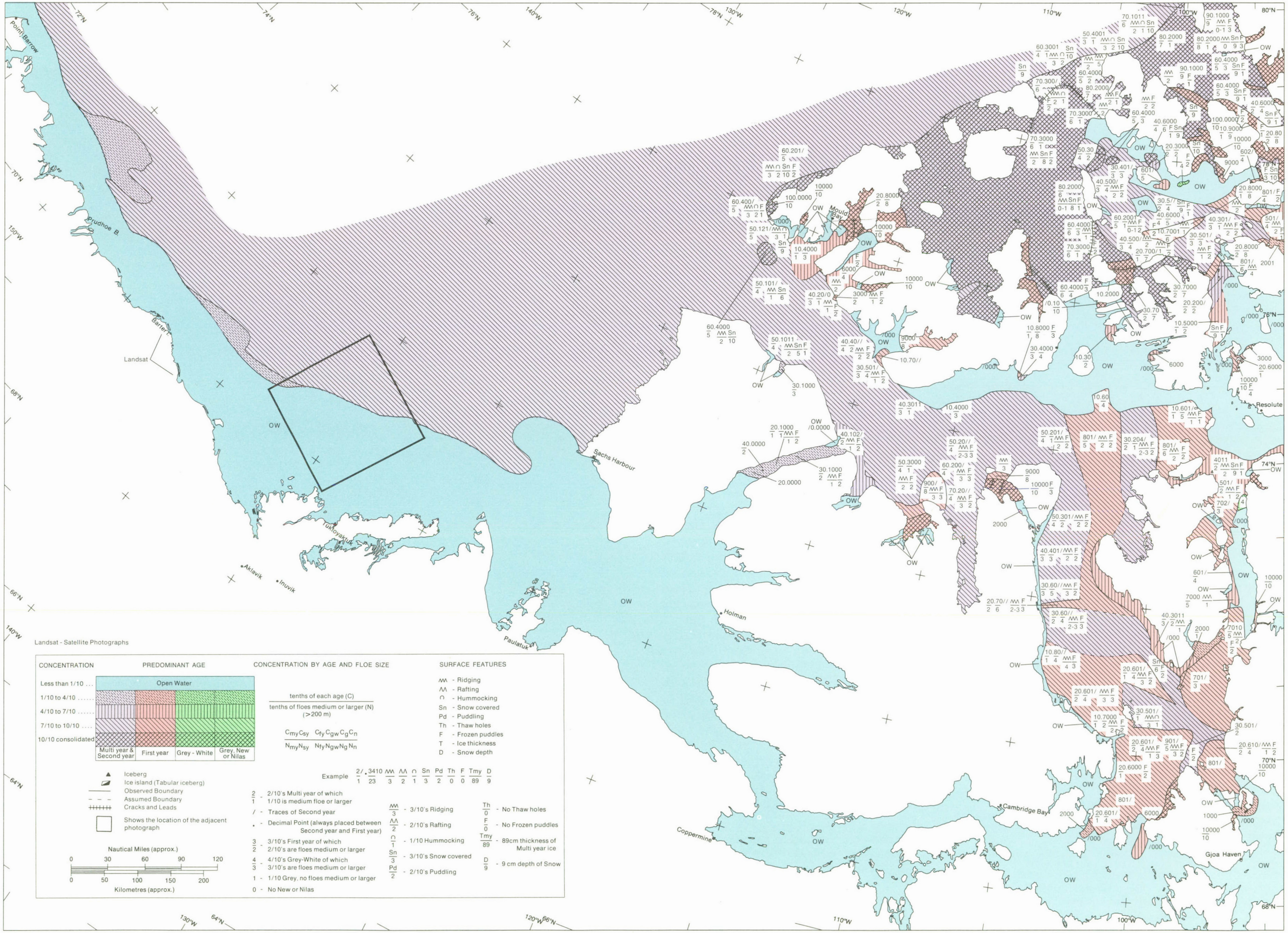
Comments

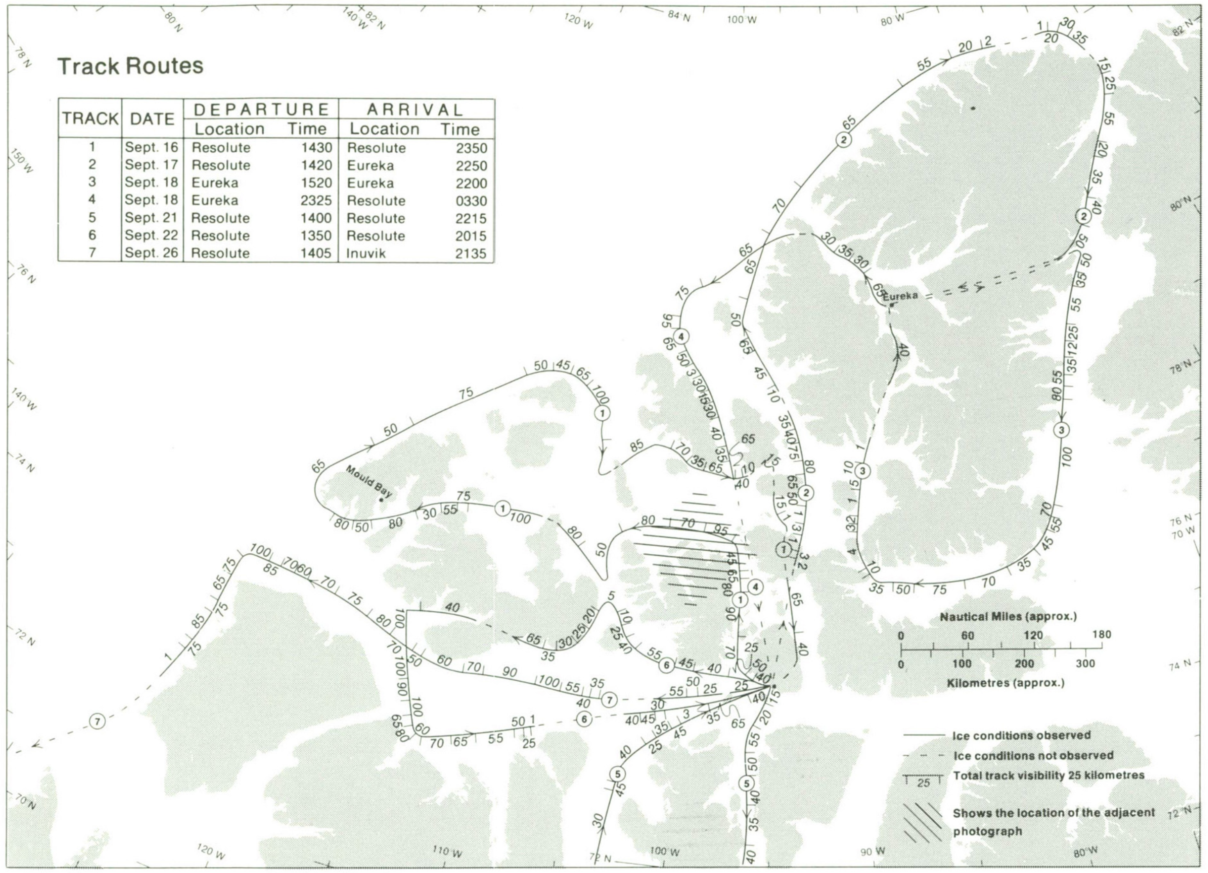
The puddles were freezing but clearing was still possible and mass movements were just starting. At this point the season was farther advanced than usual. Typically at this time the ice cover on Peel Sound is unbroken and a similar state exists in M'Clintock Channel while Viscount Melville Sound is nine-tenths covered having just recently broken up. Unfortunately, the whole western area seems to have been judged on the basis of the ice conditions along the coast of the Beaufort Sea and up to this point navigation conditions in this area had not been favourable.

Movements in the area, aside from the 40 km plus southerly shift in Viscount Melville Sound, were not obvious but they were taking place. Multi-year ice was moving east into and through M'Clure Strait into Viscount Melville Sound. Ice from around Byam Martin Island had moved south into the sound and northern M'Clintock Channel had received first-year ice and some multi-year ice from the same area. Smaller amounts had moved into western Barrow Strait and then south into Peel Sound. The observer had an opportunity to spend some time on the shore of Prince of Wales Strait at Johnson Point and noted that although there were no winds the multi-year ice was steadily and remarkably rapidly rustling and tinkling its way toward the south.

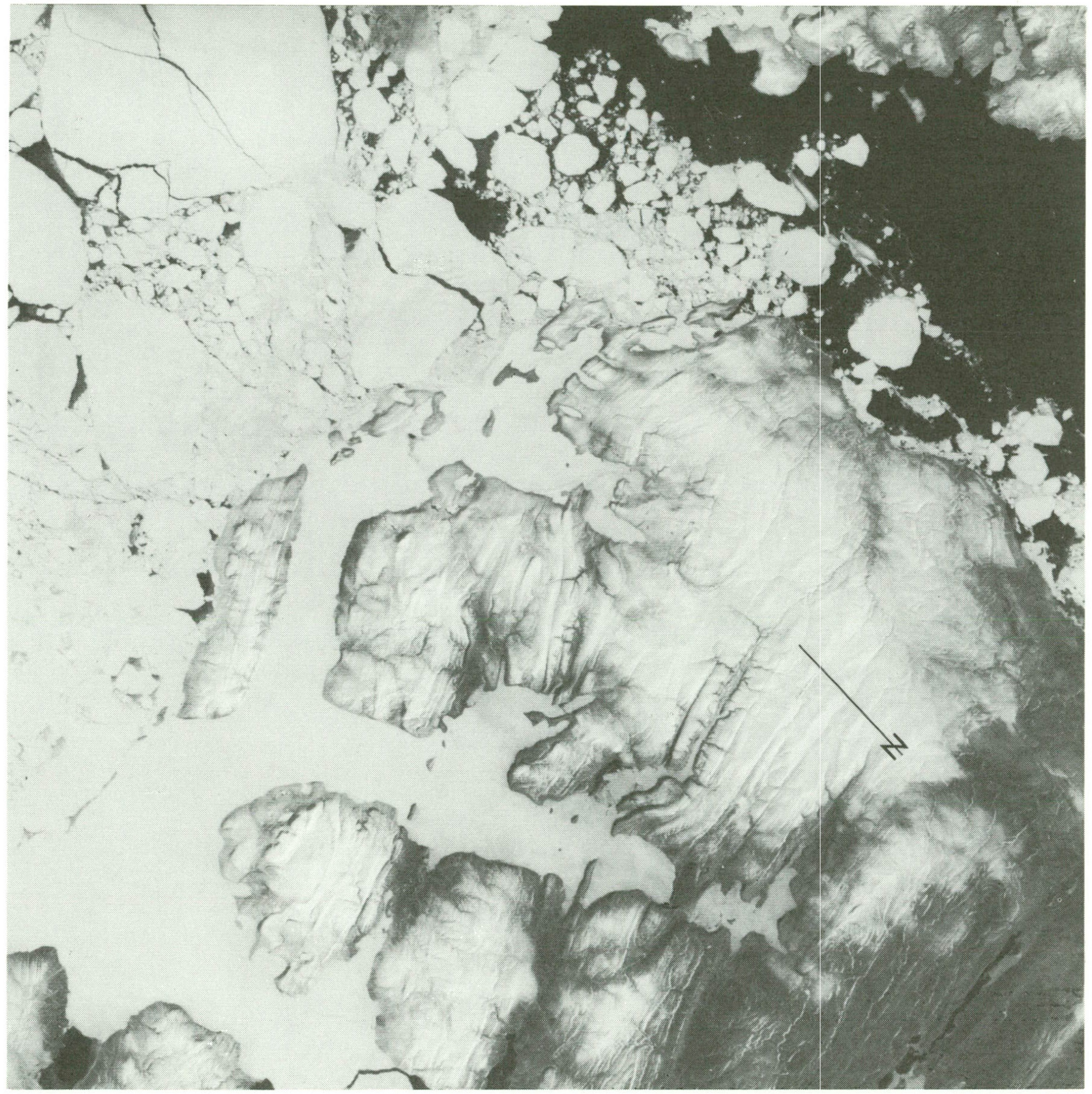
As this flight finished, the winds were switching the ice back across Viscount Melville Sound.

The uniform size of the very small floes shown by the satellite photograph are typical of the conditions expected near an ice/water boundary that has existed for some time.


Point Barrow
Prudhoe B.
Barter I.
Landsat
OW
Sachs Harbour
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Mould Bay
Landsat - Satellite Photographs
CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/1 - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	Sept. 16	Resolute	1430	Resolute	2350
2	Sept. 17	Resolute	1420	Eureka	2250
3	Sept. 18	Eureka	1520	Eureka	2200
4	Sept. 18	Eureka	2325	Resolute	0330
5	Sept. 21	Resolute	1400	Resolute	2215
6	Sept. 22	Resolute	1350	Resolute	2015
7	Sept. 26	Resolute	1405	Inuvik	2135



North of Bathurst Island, September 16, 1976, T57 F5

MAP 6-1976 East

September 16-26

Flight Effectiveness

The weather in the eastern part of the region continued to be especially favourable for airborne sea-ice reconnaissance surveys. Another plus was the regular fall change of aircraft from the Beechcraft to a Twin Otter. Among the Twin Otter's many features was the Global 500 navigation system where you press a button to find the latitude and longitude. The combination of fine weather and an aircraft with superior capabilities resulted in a flight effectiveness of 85 per cent. Most of the observations during the flight were made from between 1500 and 1800 m in clear skies. The decrease, from ten to four, in the number of tracks to cover the area was due to the longer range of the aircraft.

Ice Conditions

Many small but no major changes took place during the two weeks that separated flights 5 and 6. Freeze-up was underway and new snow and new ice types were appearing. All of the new ice types were very thin. The ice conditions in Nares Strait were very similar to those observed the previous flight and very little southerly drift had taken place during the interval. The first-year ice in Eureka Sound had disappeared and was replaced by new ice and, although the ice in the southern part of Nansen Sound broke up, a solid cover remained in the northern part. Some ice had moved from southern Norwegian Bay into Hell Gate but the overall concentrations and distributions in Norwegian Bay remained similar to those noted previously. The ice edge in the southern part of Massey Sound remained stationary. Also there was no change in the position of the ice edge in southern Hassel Sound. It may seem strange that first-year ice should suddenly appear in the southwestern part of the unnamed sea north of Bathurst Island. This ice type was always present. The concentrations of multi-year ice had reduced to the point where convention requires the first-year colour to appear. The ice edge in Desbarats Strait remained in the same position but the boundary between moving ice and a solid ice cover in Prince Gustaf Adolf Sea moved another 50 km north towards the Arctic Ocean. No changes were noted in Fitzwilliam Strait.

Unobserved Areas

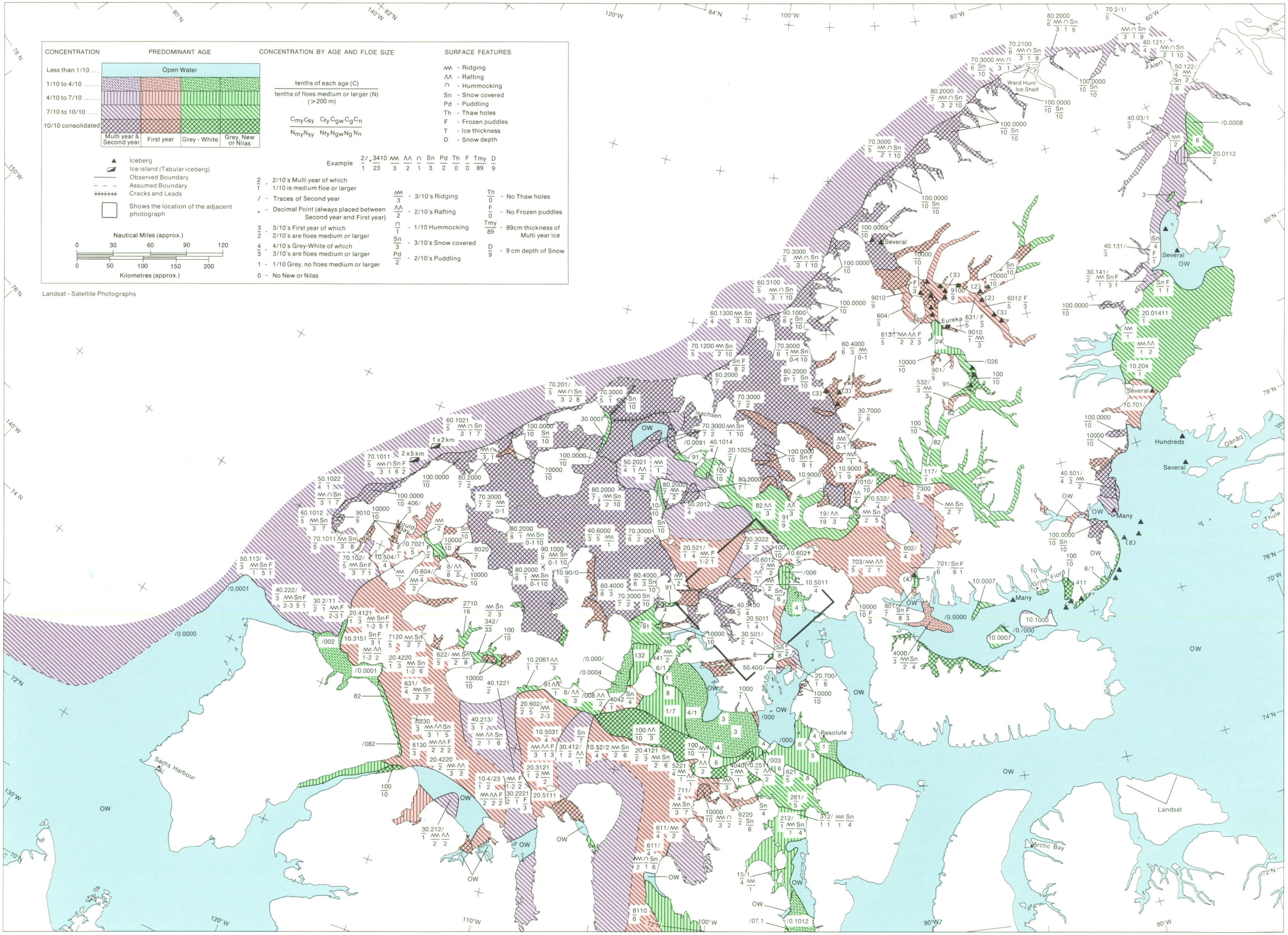
Satellite photographs provided the information required to map the conditions in Prince Regent Inlet, Lancaster Sound and the channel extending south from it and northern Baffin Bay. The northern part of Prince Gustaf Adolf Sea is shown on the basis of adjacent observations, usual pattern and subsequent observations.

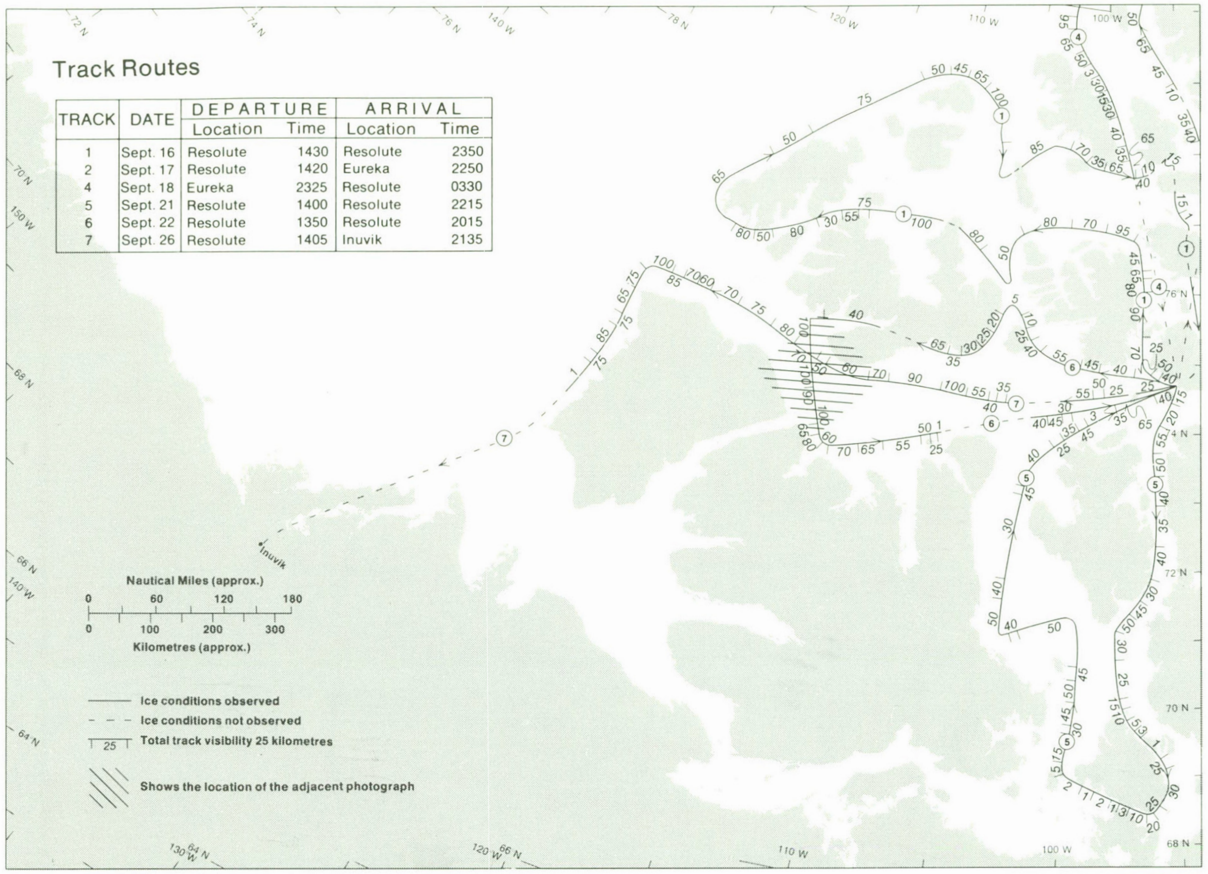
Comments

The season was still slightly ahead of usual. Two ice islands were sighted west of Prince Patrick Island and another small one, 1.5×3 km, not shown on the map, was located near Nansen Sound at 81°49′N, 95°40′W.

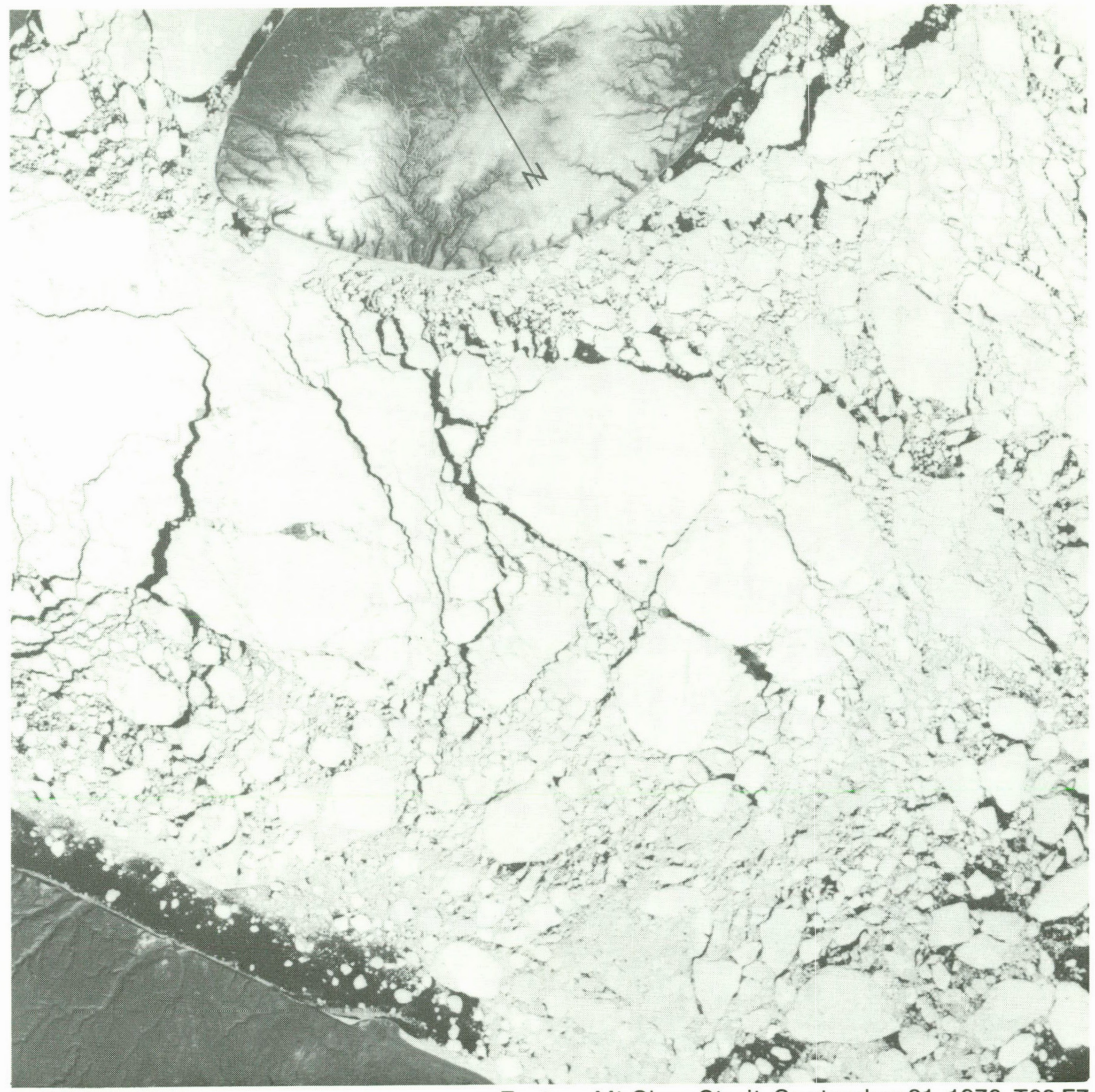
Very little ice was moving through Nares Channel this year. On September 20 pilot reports indicated a solid new ice cover over Austin Channel; persistent winds had changed this considerably when it was observed only two days later.

The masking effect of new snow combined with the formation of new ice types is evident from the satellite photograph.


CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Resolute
Grise Fiord
Thule
Qânâq
Sachs Harbour
Arctic Bay
Landsat
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Sept. 16	Resolute	1430	Resolute	2350
2	Sept. 17	Resolute	1420	Eureka	2250
4	Sept. 18	Eureka	2325	Resolute	0330
5	Sept. 21	Resolute	1400	Resolute	2215
6	Sept. 22	Resolute	1350	Resolute	2015
7	Sept. 26	Resolute	1405	Inuvik	2135



Eastern M' Clure Strait, September 21, 1976, T62 F7

MAP 6-1976 West

September 16-26

Flight Effectiveness

Snow and fog briefly interrupted observations during parts of tracks 5 and 6. No observations were possible during the last part of track 7 over the Beaufort Sea due to heavy rain, some snow and a very dense, continuous cloud cover extending to the surface of the ocean. The flight was about 80 per cent effective.

Ice Conditions

Changes took place in a number of areas between the two flights. In Peel Sound the remnants of first-year ice had disappeared and new ice was distributed throughout the sound. The ice in Larsen Sound and southern M'Clintock Channel had moved further west. The concentrations of the older ice types in southeastern Viscount Melville Sound were reduced and replaced by new ice types. A similar change took place in Prince of Wales' Strait. The ice in the eastern part of M'Clure Strait appeared to be multi-year. When this area was observed, twice during Flight 6, from higher altitudes (1800 m) and clear skies, the ice with its topography and colour masked by new snow, and floe sizes and shapes changed by new ice, it looked like mainly first-year ice, and it is shown as such. Large areas of open water appeared in the Beaufort Sea as the ice edge moved about 100 km further north from the mainland coast and a similar distance to the west off the coast of Banks Island.

Break-up throughout the western region was almost complete. Only a few small sheltered areas north of Victoria Island continued to support an unbroken cover.

Unobserved Areas

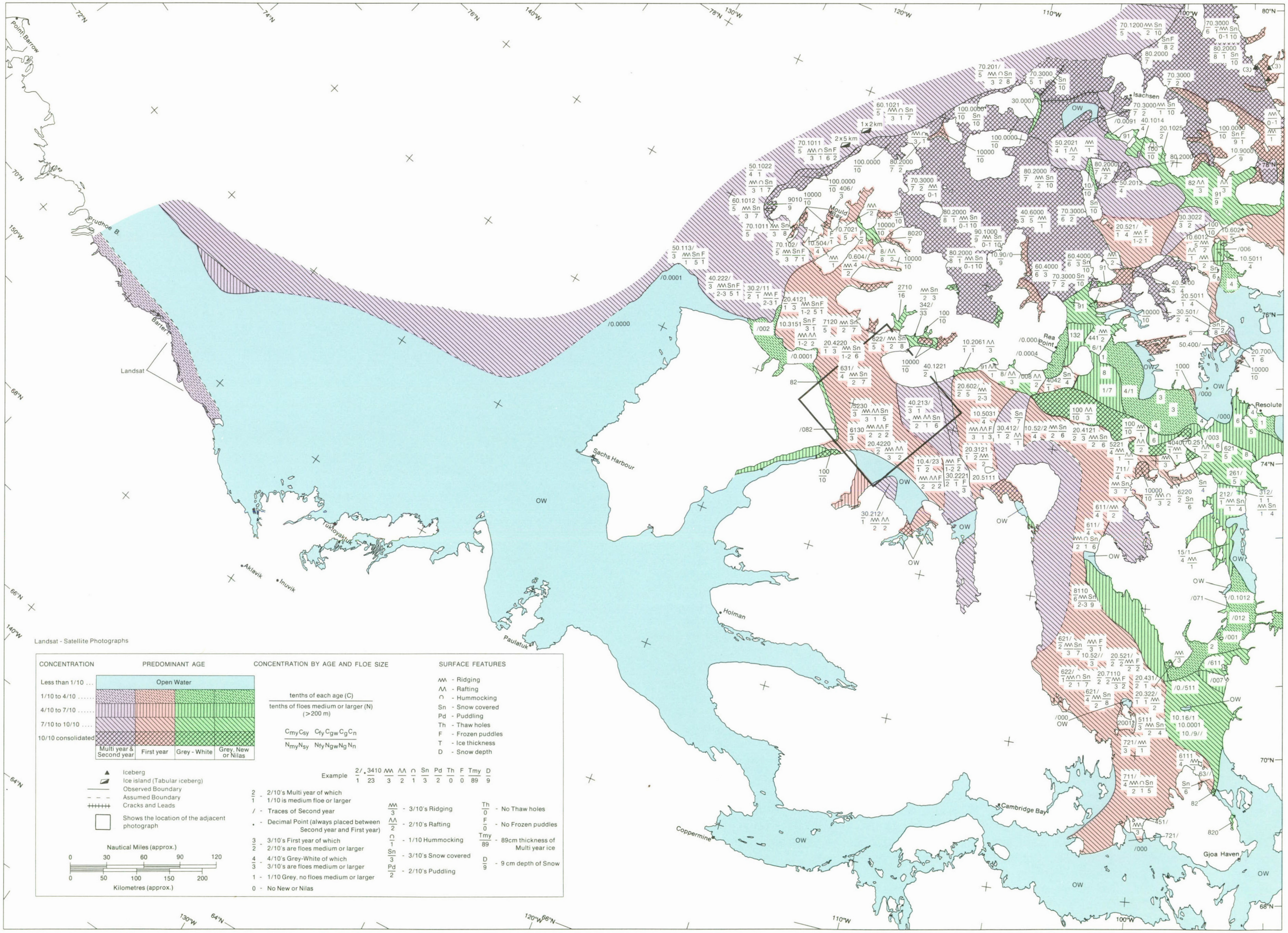
No surveys were planned for the waterway between Tuktoyaktuk and Queen Maud Gulf because these channels were ice-free and once they are in this state they remain so until October. Usually a survey is conducted over the eastern part of the Beaufort Sea and in the central area northwest of Tuktoyaktuk. However, cloud and rain precluded observations on September 26 and the same system produced fog and rain the following day and stopped the survey planned northeast of Tuktoyaktuk. The ice conditions in the area are based on interpretations of satellite photographs.

Comments

With the movement of the ice away from the coast in the Beaufort Sea, the ice conditions in the area were the same if not slightly better than those expected at this time in a normal year.

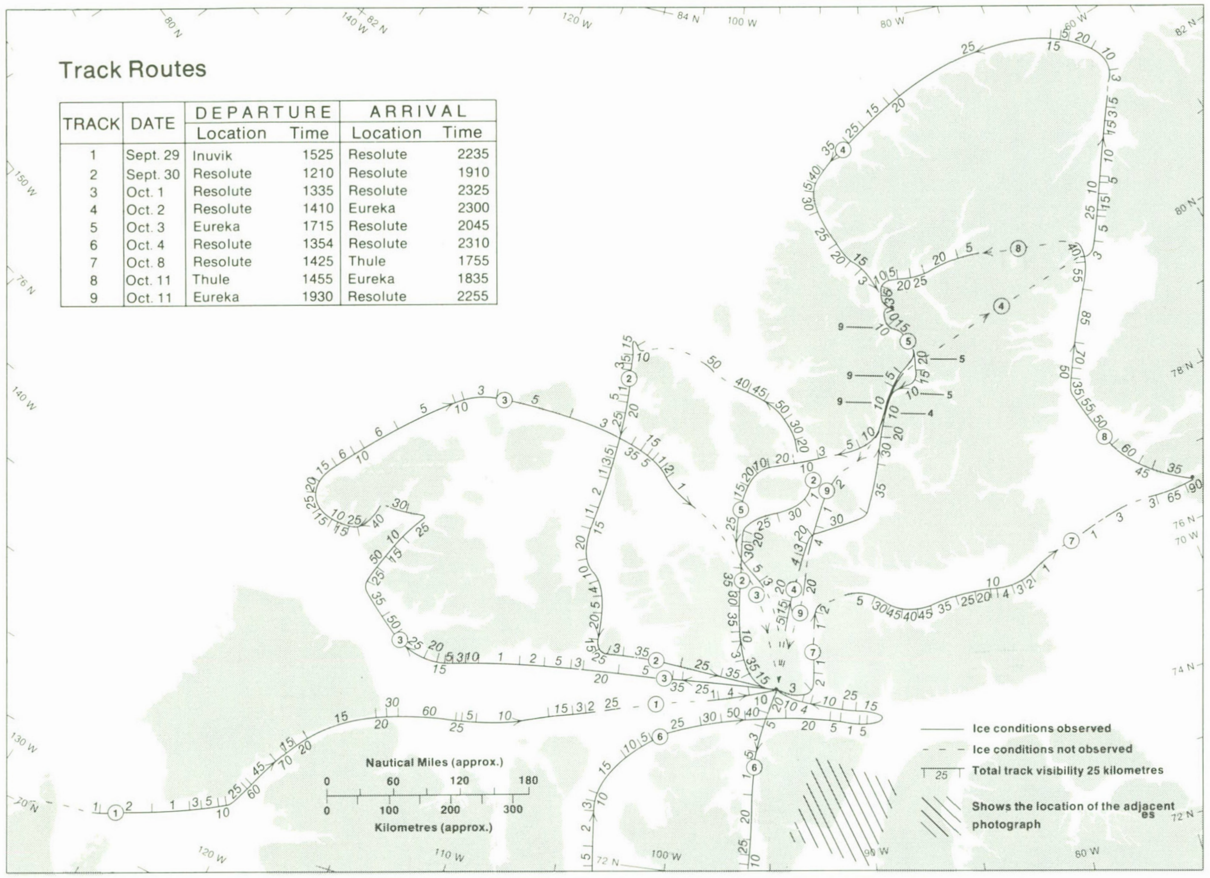
Two icebreakers and a seismic vessel were working through the ice in the northern part of Peel Sound.

The satellite photograph was taken in excellent weather. It does not help to determine the ice types in M'Clure Strait but it does indicate the effects fresh snow and new ice have on an existing ice cover.



MAP 6 - 1976 WEST

September 16 - 26, 1976



Track Routes

TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	Sept. 29	Inuvik	1525	Resolute	2235
2	Sept. 30	Resolute	1210	Resolute	1910
3	Oct. 1	Resolute	1335	Resolute	2325
4	Oct. 2	Resolute	1410	Eureka	2300
5	Oct. 3	Eureka	1715	Resolute	2045
6	Oct. 4	Resolute	1354	Resolute	2310
7	Oct. 8	Resolute	1425	Thule	1755
8	Oct. 11	Thule	1455	Eureka	1835
9	Oct. 11	Eureka	1930	Resolute	2255

MAP 7-1976 East

September 29-October 11

Flight Effectiveness

The weather was not as unseasonably favourable as on the previous flight. Typical fall observing conditions, low stratus cloud, snow showers, ice crystals, fog and low levels and shorter hours of daylight reduced the flight effectiveness to 75 per cent.

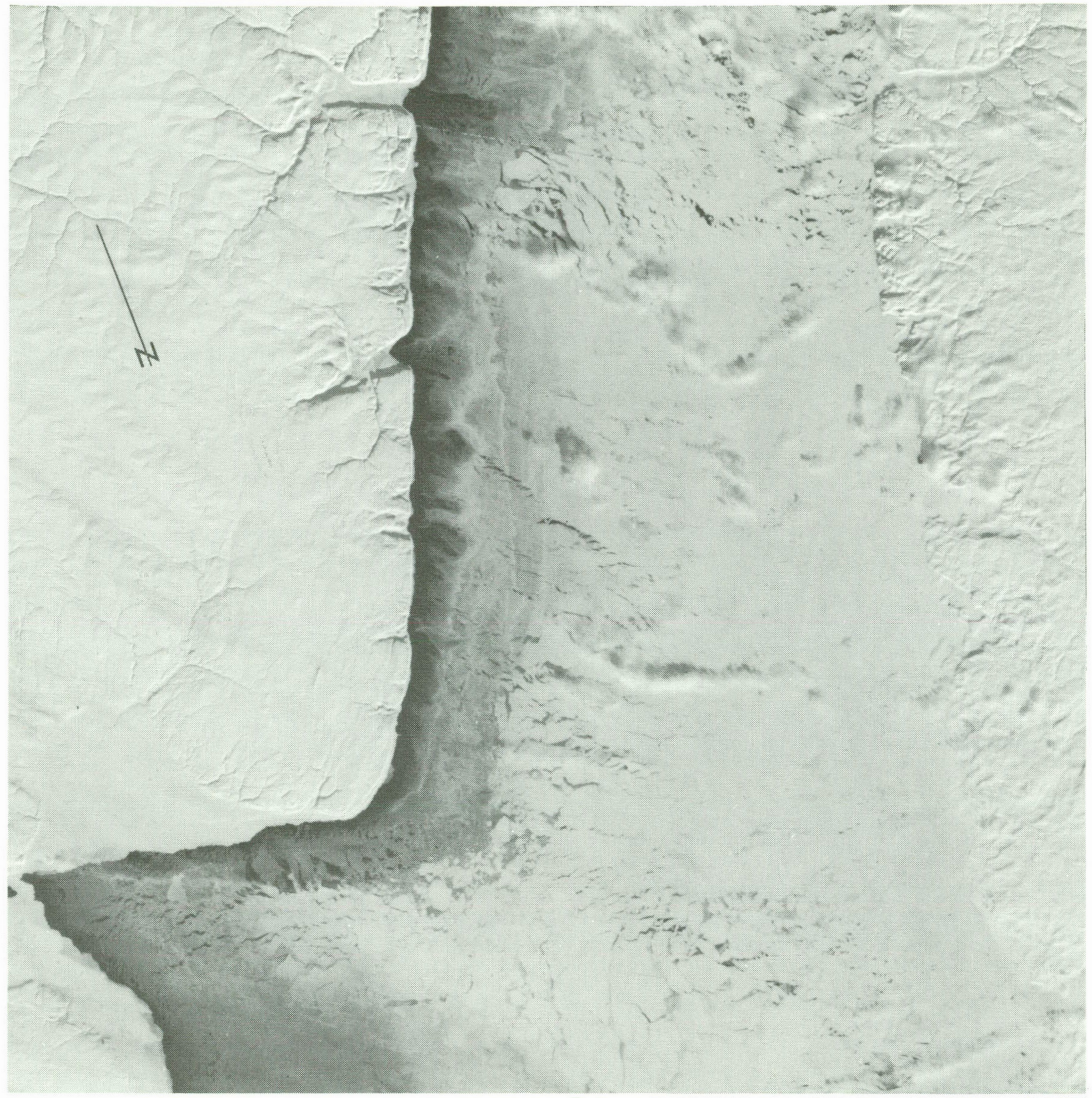
Ice Conditions

Two main changes developed between flights 6 and 7. The first was the annual birthday for the ice types when all existing first-year ice becomes second-year and all second-year becomes multi-year. The second, and very obvious change, was the expansion of the new ice types throughout the region. Some movement was still possible in the southern part of Eureka Sound on October 4. Two days later the new ice cover was complete and the ice in the sound would remain almost stationary until the following summer. The same state had spread throughout Greely Fiord where a heavy fall of fresh snow covered the ice. While most areas were freezing up some areas were undergoing the final break-up. In Prince Gustaf Adolf Sea the ice in the northern part broke up between September 28 and 30. The appearance and expansion of the new ice types seemed to be particularly rapid between October 8 and 10. Very thin first-year ice was starting to develop.

The progression of break-up into Prince Gustaf Adolf Sea did not follow the typical pattern. Usually the ice cover north of Byam Martin Channel and west of Lougheed Island breaks before Prince Gustaf Adolf Sea. With the exception of the break-up of northern Prince Gustaf Adolf Sea the ice edges in Byam Martin Channel, Desbarats Strait, Hassel Sound, and Massey Sound remained stationary and in their typical position.

Unobserved Areas

As planned, the ice conditions in key areas were observed and thus the ice conditions in adjacent areas could be determined without a survey. The patterns and distributions along the north coast of Axel Heiberg Island, Sverdrup Channel, Hassel Sound and northern Peary Channel were mapped on the basis of their typical regime and the situation in adjacent areas. Since the ice around the perimeter of the large area north of Melville Island was solid the entire area would be solid.

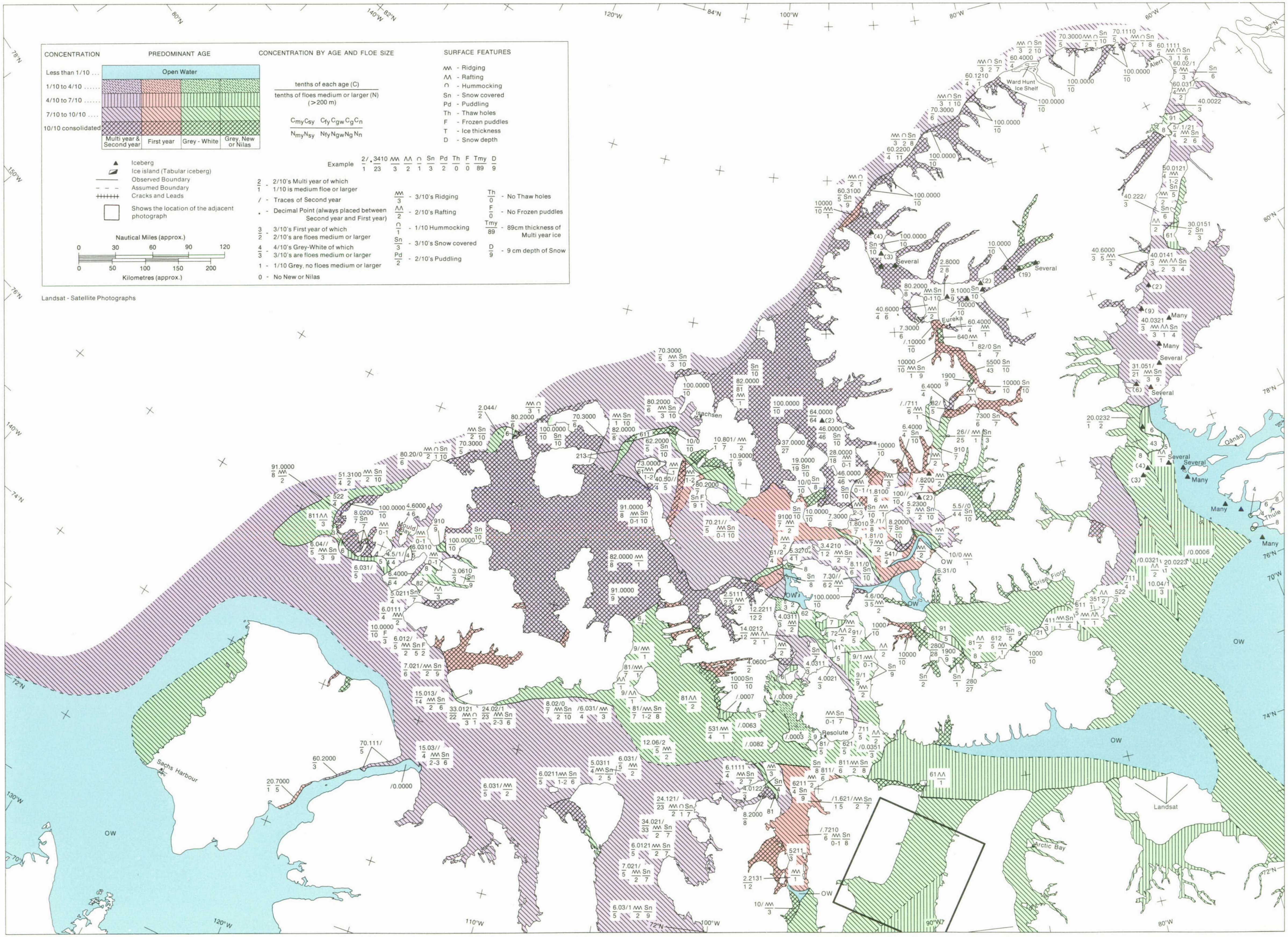


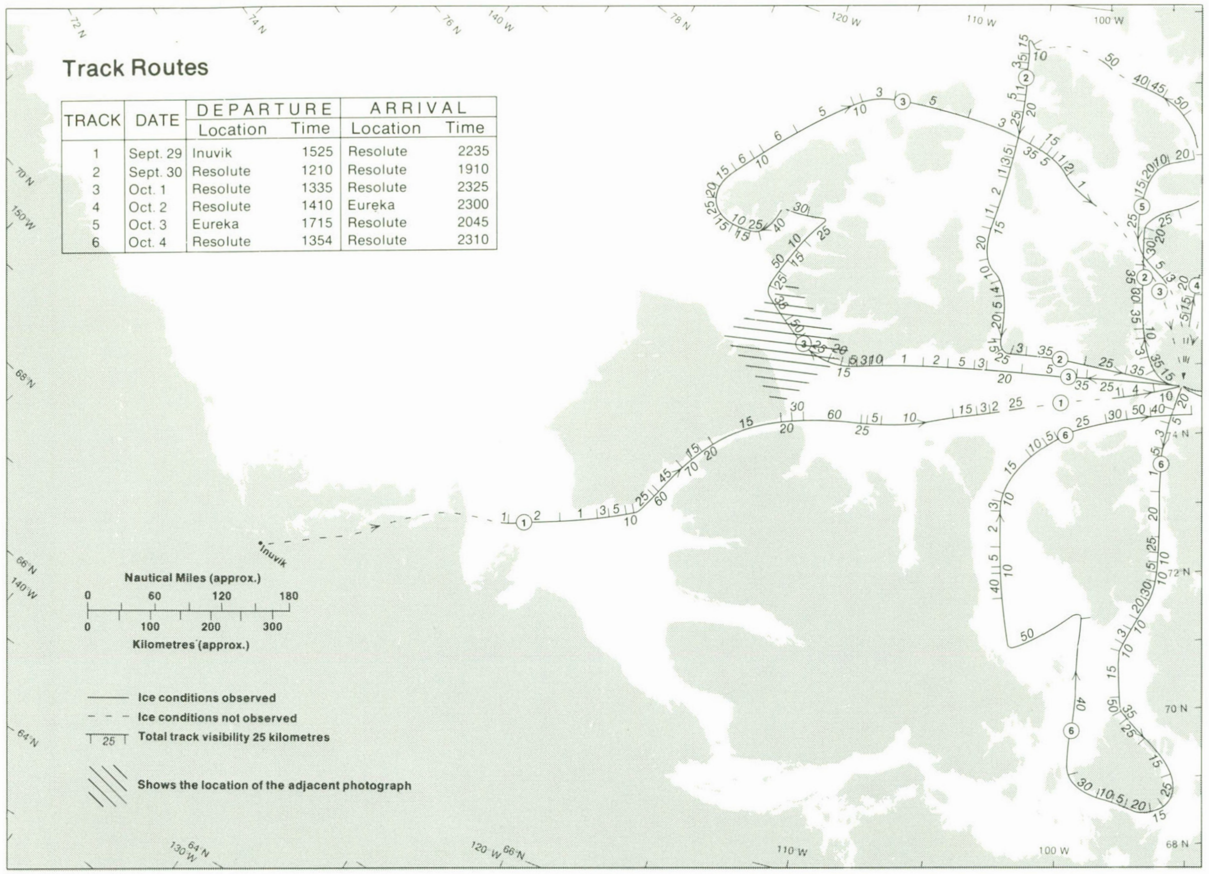
Prince Regent Inlet, October 10, 1976, T44 F8

Comments

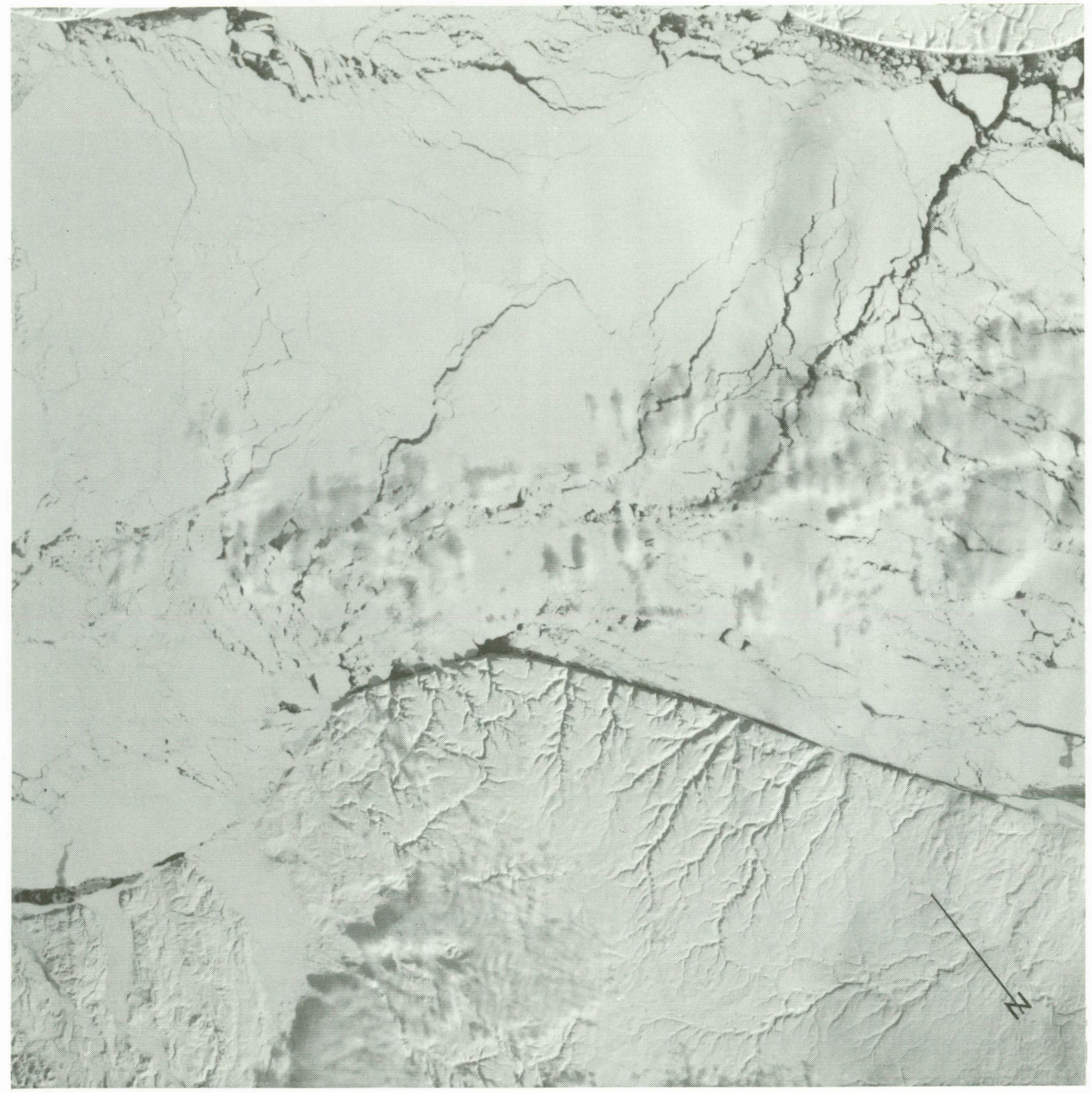
The year was ahead of a normal one. Typically Prince Gustaf Adolf Sea and Maclean Strait do not break up.

Movements in the Queen Elizabeth Islands between the two eastern flights and throughout the season were very limited. In Nares Strait the first major drift was noted. From its position on September 17 the multi-year ice drifted south across Kane Basin and into Smith Sound. This movement of about 250 km was completed in fifteen days. Similar rates regularly take place in most years. The range of the aircraft reduced time lost in refueling stops and increased effective use of reduced daylight. The Global navigation system was excellent, especially at this time of year when flying and observing conditions are nearing their poorest. The satellite photograph is an excellent aid. The unsuspecting might assume that a new ice cover with snow on it exists in a bay north of Creswell Bay. In fact this smooth snow-covered, bay-like feature is land, part of Somerset Island. Fortunately the relief of the coast of Brodeur Peninsula helps to distinguish ice from land in the eastern part of the inlet. Although the satellite photograph shows the distribution very well the ice types are not immediately evident.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Resolute
Sachs Harbour
Grise Fiord
Arctic Bay
Qânâq
Thule
Landsat
OW
Several
Many



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Sept. 29	Inuvik	1525	Resolute	2235
2	Sept. 30	Resolute	1210	Resolute	1910
3	Oct. 1	Resolute	1335	Resolute	2325
4	Oct. 2	Resolute	1410	Eureka	2300
5	Oct. 3	Eureka	1715	Resolute	2045
6	Oct. 4	Resolute	1354	Resolute	2310


M' Clure Strait, October 10, 1976, T64 F7

MAP 7-1976 West

September 29-October 11

Flight Effectiveness

Typical fall weather prevailed during the tracks over the western part of the region. Low stratus clouds with ceilings from 30 to 450 m were usual. Occasionally the clouds extended to the ice surface stopping all observations. Ice crystals and freezing drizzle also limited observations in certain areas. In addition the low sun angle and the relentless shortening of the daylight hours and the lack of observations in the Beaufort Sea reduced the flight effectiveness to about 70 per cent.

Ice Conditions

Initially, a comparison of Maps 6 and 7 WEST would indicate that large quantities of first-year ice melted or disappeared in M'Clure Strait and Viscount Melville Sound after the surveys for Map 6 had been completed. In fact the ice was the same but its designation changed due to the convention of aging the existing ice by one year at the end of September. At that time all existing first-year ice becomes second-year and all second-year and older ice originating in the sea is designated as multi-year. New ice had formed in the channels around King William Island and Queen Maud Gulf and Dease Strait. Thin first-year ice developed in northern Peel Sound.

Generally the patterns, concentrations, distributions and types of ice shown on the adjacent map are typical. The season was slightly more advanced than a normal year. Occasionally, break-up in Peel Sound and M'Clintock Channel does not take place.

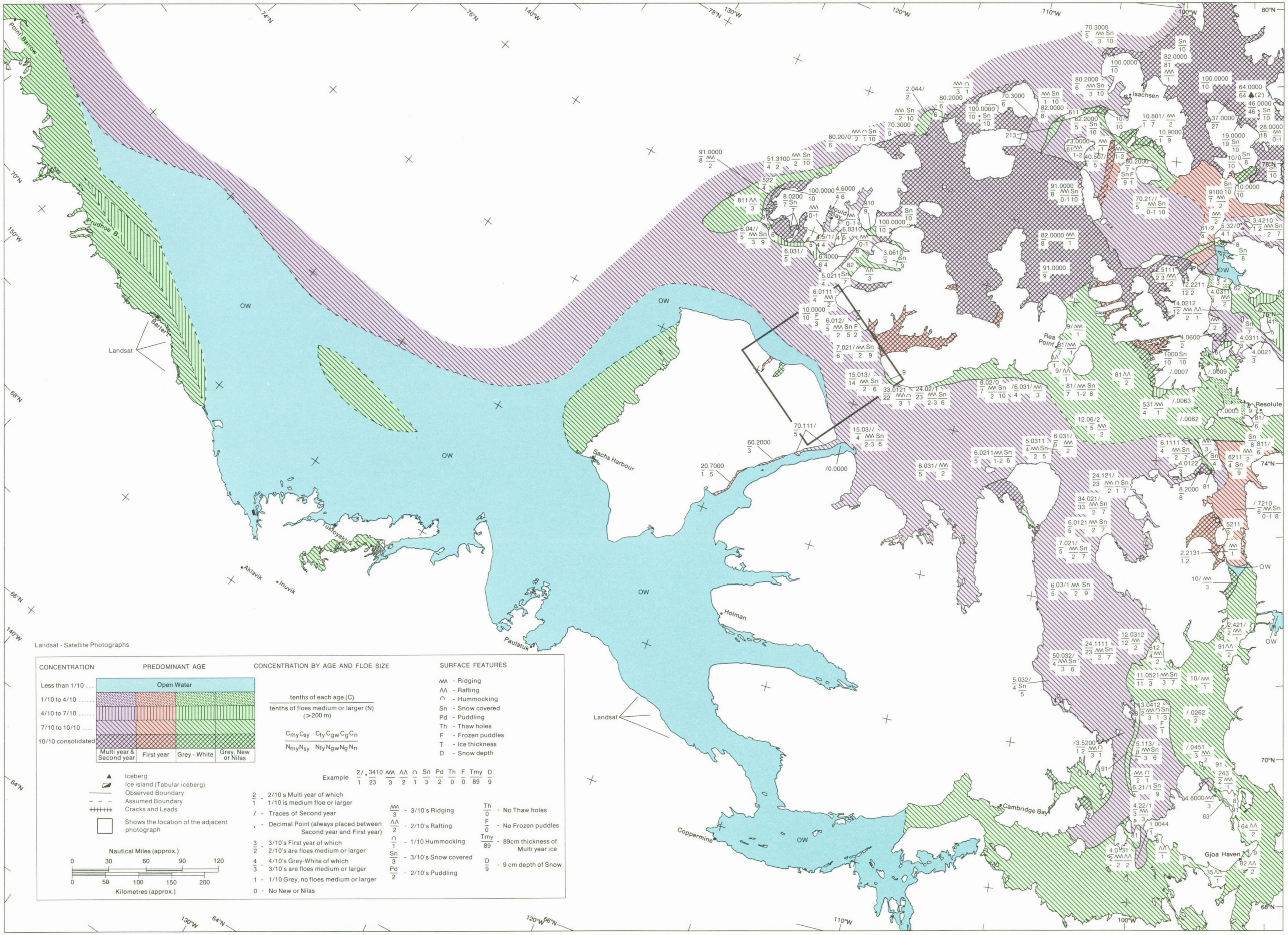
Unobserved Areas

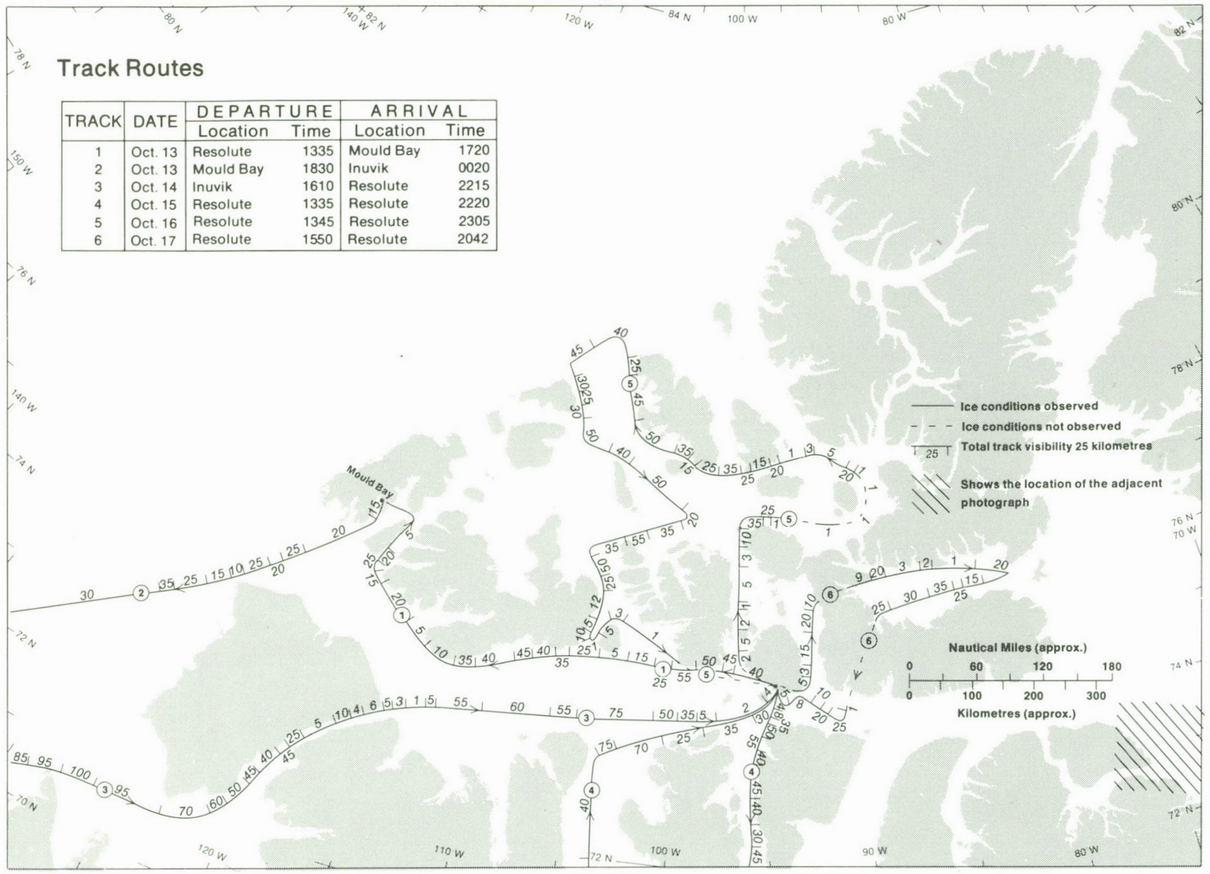
Fortunately satellite photographs were available and sufficiently free of cloud to establish general trends in the Beaufort Sea. This plus information gathered by the AES ice reconnaissance team that established the ice edge about 240 km north of the mainland on September 28 were used to prepare the map. Satellite imagery was used to establish the conditions in Amundsen Gulf, Dolphin and Union Strait and Coronation Gulf.

Comments

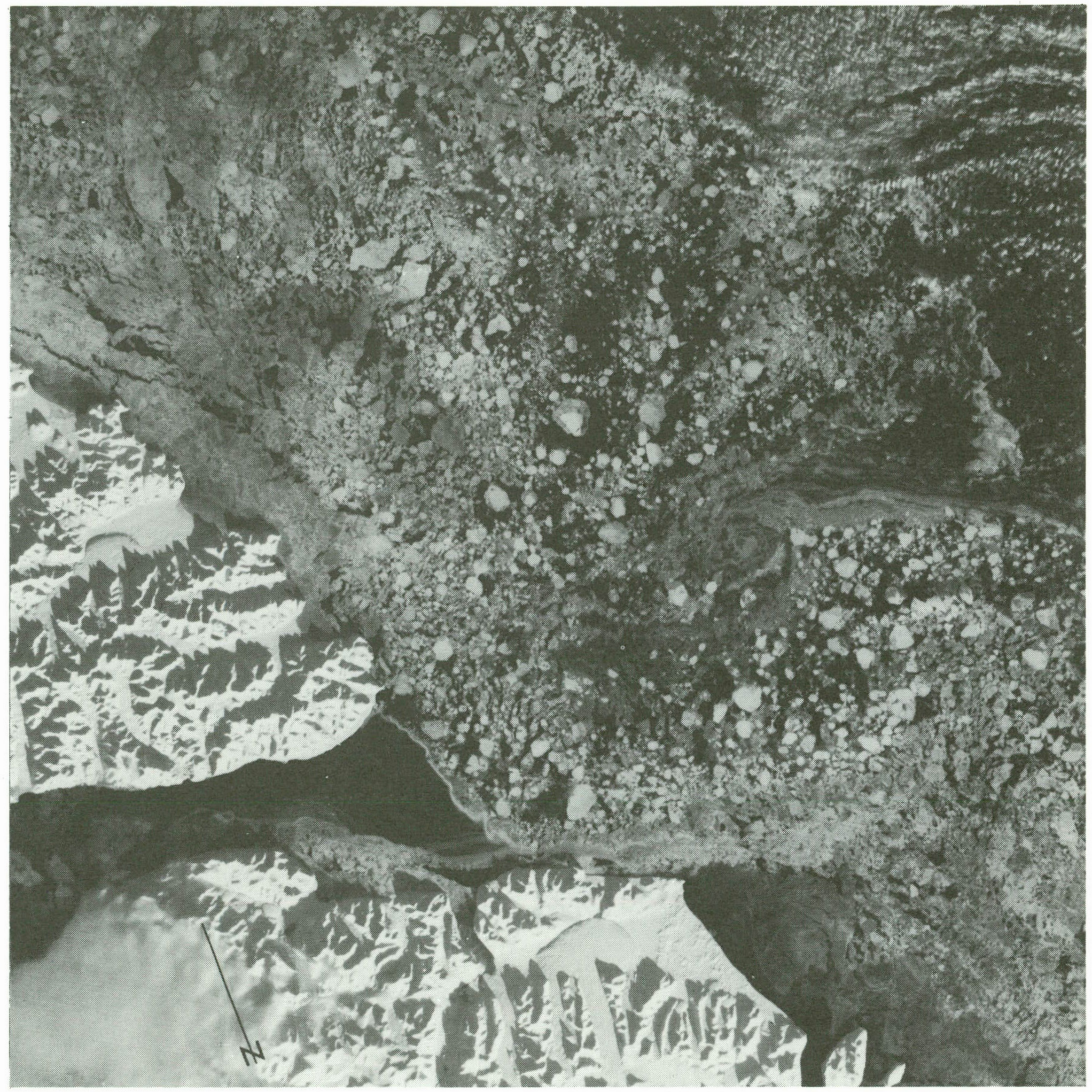
Very few major changes such as movement or melting took place between the start of Flight 6 on September 16 and the finish of Flight 7 on October 11. The year was still ahead of what is usually expected at this time of the season.

The satellite photograph provides a fine view of the ice conditions at the junction of M'Clure Strait and Viscount Melville Sound. Aside from the concentrations and crack patterns, very little additional information can be gleaned from the picture because the resolution of the camera is restricted to objects about 80 m across and because of the mask the new snow has put over the area.


Point Barrow
Prudhoe B.
Barter I.
Landsat
OW
Sachs Harbour
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Isachsen
Mould Bay
Landsat - Satellite Photographs
CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
$C_{my}C_{sy}$ $C_{fy}C_{gw}C_gC_n$
$N_{my}N_{sy}$ $N_{fy}N_{gw}N_gN_n$
SURFACE FEATURES
- Ridging
- Rafting
∩ - Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/1 - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)
72°N
74°N
76°N
78°N
80°N
70°N
68°N
66°N
64°N
150°W
140°W
130°W
120°W
110°W
100°W



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Oct. 13	Resolute	1335	Mould Bay	1720
2	Oct. 13	Mould Bay	1830	Inuvik	0020
3	Oct. 14	Inuvik	1610	Resolute	2215
4	Oct. 15	Resolute	1335	Resolute	2220
5	Oct. 16	Resolute	1345	Resolute	2305
6	Oct. 17	Resolute	1550	Resolute	2042



East of Bylot Island, October 16, 1976, T33 F7

MAP 8-1976 East

October 13-17

Flight Effectiveness

The key channels in the eastern part of the region were surveyed during Flight 8. Only two tracks were carried out because that was all that remained in the bank of flying hours allocated to the sea-ice reconnaissance program. These tracks were about 75 per cent effective. Low cloud, snow showers, low sun angle and the decline of daylight hours were the main reasons the effectiveness was reduced. Generally these weather conditions were much better than usually expected at this time of year.

Ice Conditions

Flight 8 started the day after the previous flight was completed. As a result tracks made in similar areas are about two weeks apart. The changes in ice conditions during this interval are those usually expected. Multi-year ice finally moved south and extended throughout the length of Nares Strait. Some had drifted further south through Smith Sound and into the northwest part of Baffin Bay and was concentrated in its usual position along the eastern coast of Ellesmere Island. The appearance of first-year ice in Jones Sound was a result of grey-white ice increasing in thickness to 30 cm rather than from drifting in to the area. Some movement had taken place in Norwegian Bay with the result that distributions changed.

No changes took place in the areas of Nansen Sound, in Massey Sound and north to the Arctic Ocean, in Hassel Sound and north through Peary Channel or Byam Martin Channel or the Hecla and Griper Bay–Hazen Strait areas. In all of these cases, as well as Desbarats Strait and Fitzwilliam Strait, the ice edge at the southern entrance remained solid and so did the ice cover as far north as the Arctic Ocean. Some southeasterly movement had occurred from Prince Gustaf Adolf Sea into Maclean Strait, across the unnamed sea and into Penny Strait. The multi-year ice that had drifted through Penny Strait and was observed strung out in the western part of Wellington Channel during Flight 7 was gone. Likely it had drifted south into Barrow Strait where it may have drifted further west to the area south of Griffith Island.

Unobserved Areas

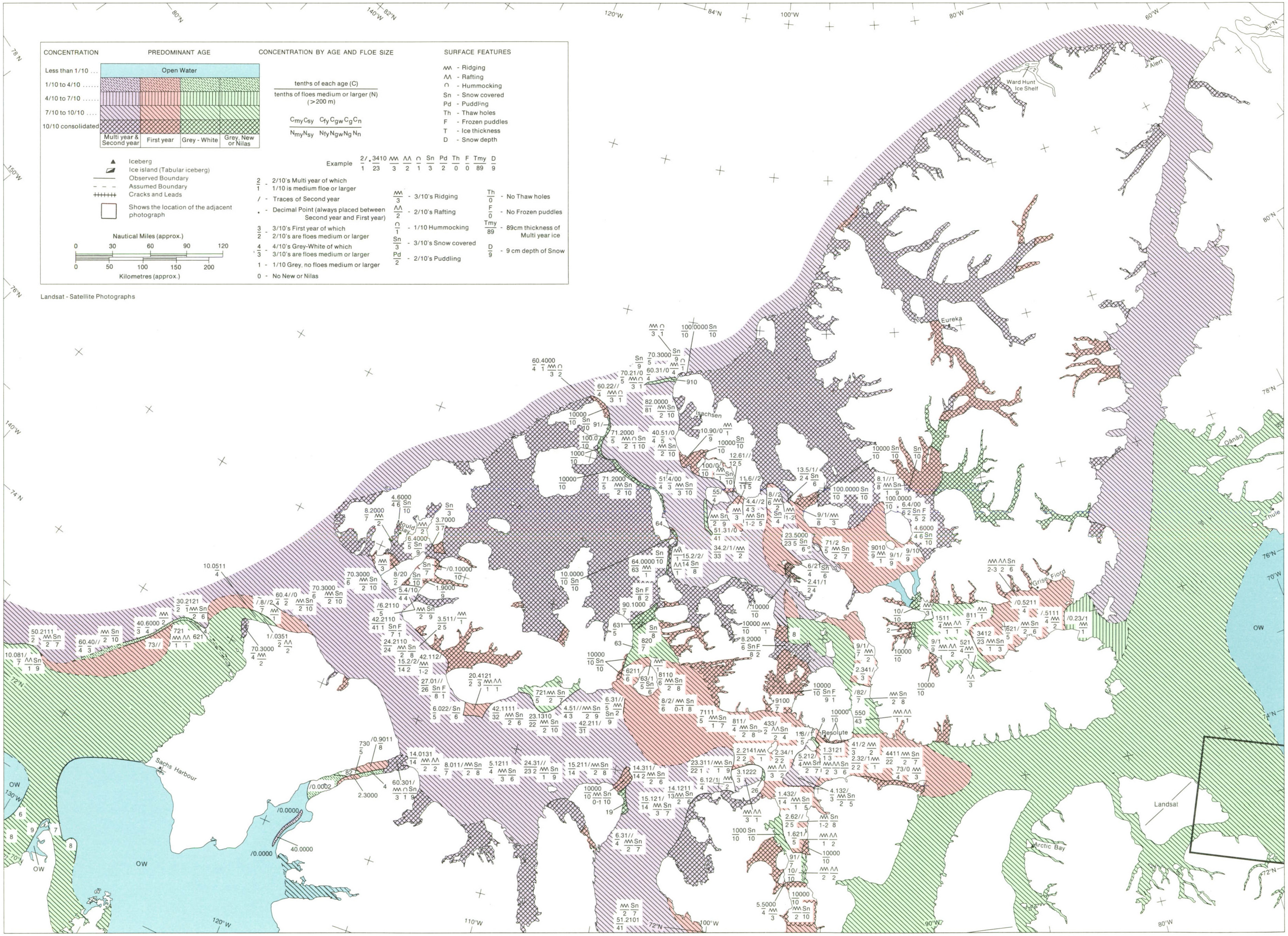
The key areas were surveyed during the tracks of Flight 8. These areas are the places in which break-up was active. For example, if the southern part of Massey Sound, Hassel Sound, Desbarats Strait and Byam Martin Channel had remained solid and unmoving, then all areas to the north would be similar. Prince Gustaf Adolf Sea was not acting in a typical fashion so it was surveyed to confirm that adjacent areas were solid.

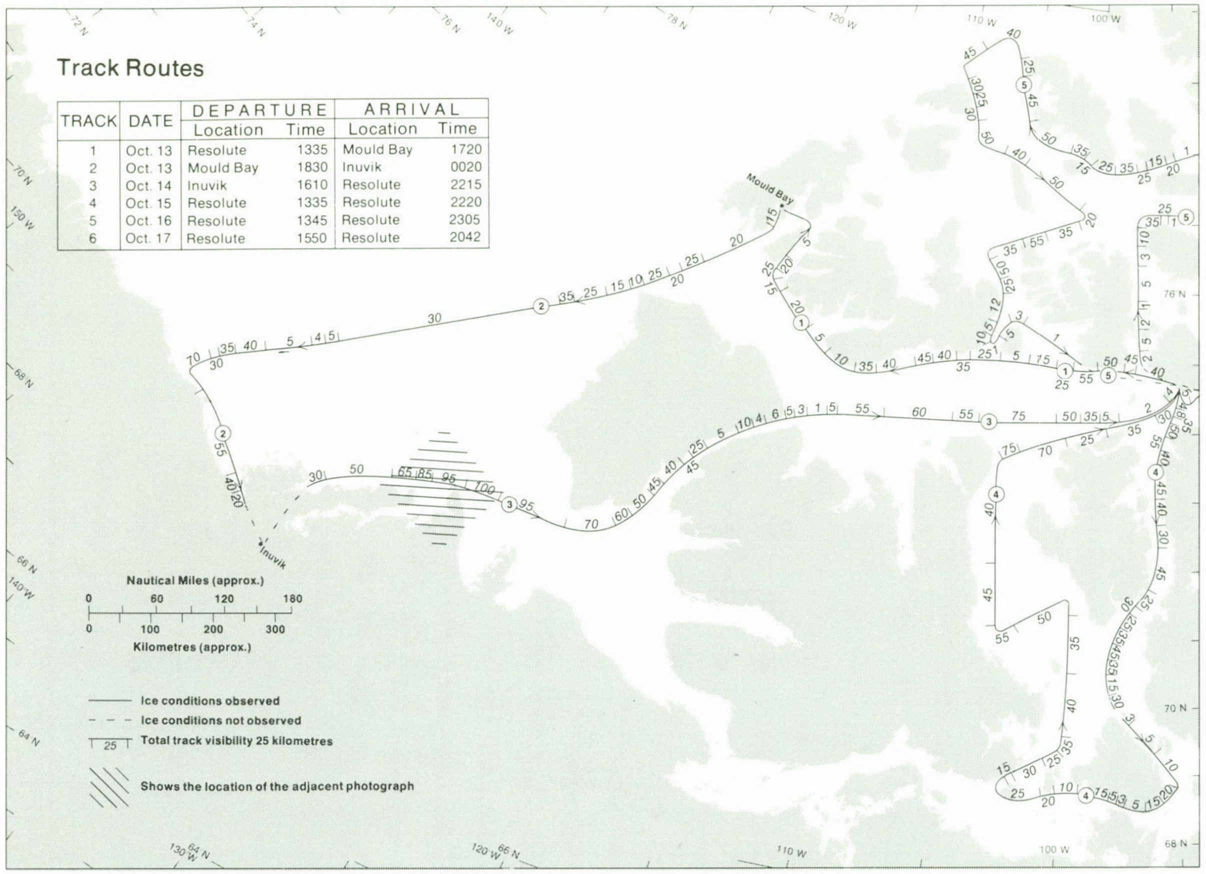
The ice conditions along the north coast from Prince Patrick Island to Ellesmere Island and in Eureka Sound are based on adjacent observations and the usual patterns that develop. Nares Strait, Baffin Bay, Lancaster Sound and adjacent channels to the south were mapped by interpreting satellite photographs and previous information.

Comments

Freeze-up was advancing at a normal rate and in a typical fashion. Little ice would move south through Prince Gustaf Adolf Sea in the few days that remained before final freeze-up in the central areas. Although some movement was possible in Hall Basin and Kennedy Channel into the new year only small quantities of ice passed south through Nares Strait and Smith Sound. The latter area consolidated in early December.

The satellite photograph is excellent and provides good examples of all types of ice including thin first-year ice.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
$\frac{C_{my} C_{sy} \quad C_{fy} C_{gw} C_g C_n}{N_{my} N_{sy} \quad N_{fy} N_{gw} N_g N_n}$
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/1 - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
Sn/3 - 3/10's Snow covered
Pd/2 - 2/10's Puddling
Th/0 - No Thaw holes
F/0 - No Frozen puddles
Tmy/89 - 89cm thickness of Multi year ice
D/9 - 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Grise Fiord
Thule
Resolute
Sachs Harbour
Arctic Bay
Landsat
OW



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	Oct. 13	Resolute	1335	Mould Bay	1720
2	Oct. 13	Mould Bay	1830	Inuvik	0020
3	Oct. 14	Inuvik	1610	Resolute	2215
4	Oct. 15	Resolute	1335	Resolute	2220
5	Oct. 16	Resolute	1345	Resolute	2305
6	Oct. 17	Resolute	1550	Resolute	2042

MAP 8-1976 West

October 13-17

Flight Effectiveness

Considering the time of year and the observing conditions normally encountered the weather for flying an ice reconnaissance in the western part of the region during the four tracks of Flight 8, 1976 was very good. The flight was 90 per cent effective although some low level cloud, snow and ice crystals were encountered. Shorter daylight hours and low light levels were not a serious factor because the fine weather permitted optimum choice of track routes and timing.

Ice Conditions

The obvious changes were the reduction of the open water area in the Beaufort Sea as the new ice forms appeared and grew. The appearance and development of first-year ice in Peel Sound, Larsen Sound and in the channels on either side of King William Island was another development.

In general about two weeks separated the observations in individual channels. With the exception of the development of new ice the amount of movement was unusually limited.

Unobserved Areas

Landsat satellite photographs helped to establish the general trends along the north coast of Alaska. The eastern part of the Beaufort Sea shows the distributions assumed to exist based on adjacent observations and usual patterns. Satellite photographs were interpreted to map the developments in the southern channels from Amundsen Gulf to Queen Maud Gulf.

Comments

The ice conditions in mid-October continued to be more favourable than in typical years. The break-up was greater than usual in M'Clintock Channel and much earlier than normal in Peel Sound.

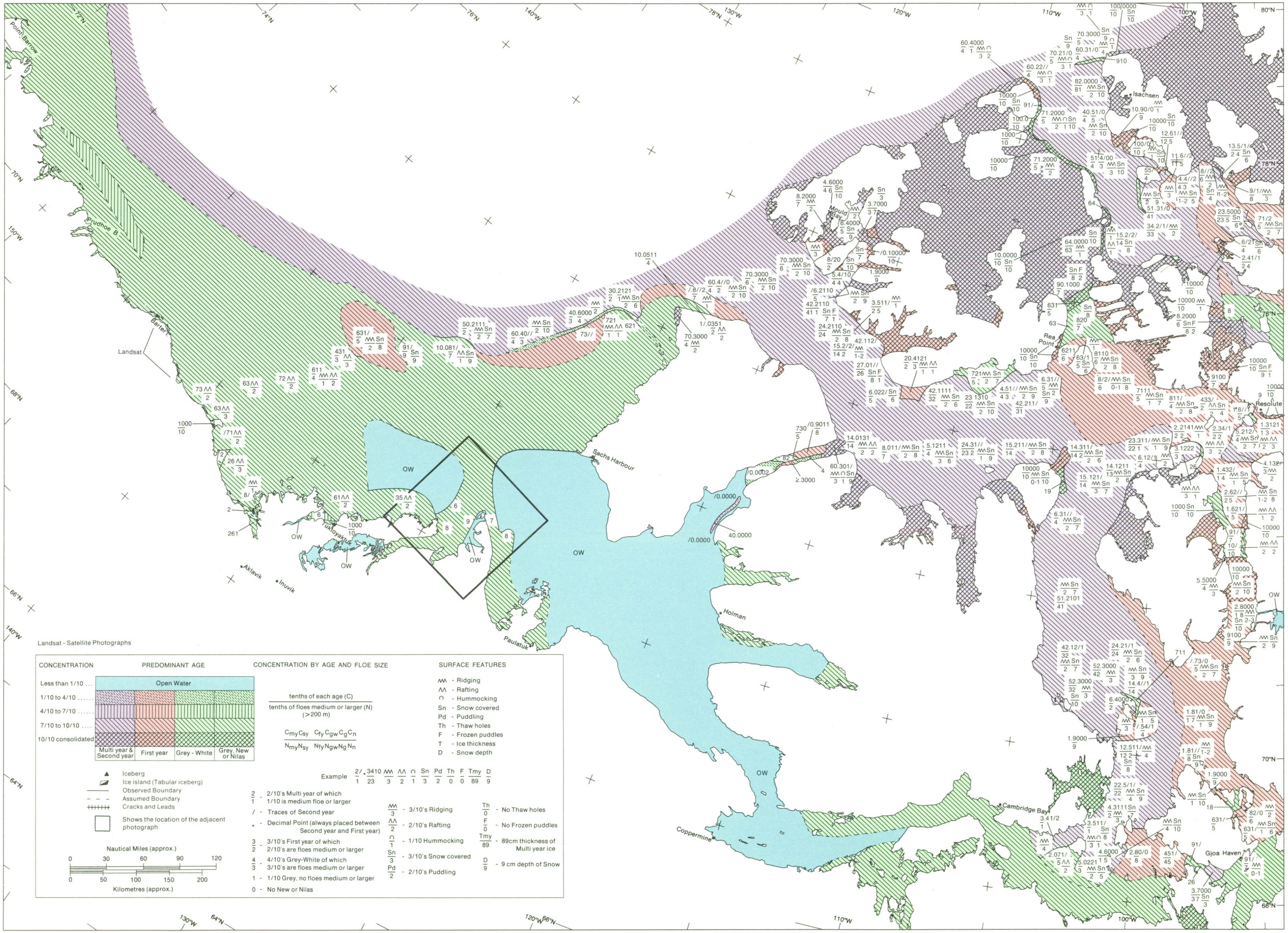
Movement of ice was limited in the channels of the western part of the region during the 1976 season. By the last flight some multi-year ice had moved south through Prince of Wales Strait and into northern Amundsen Gulf. A similarly small amount of multi-year ice squeezed through Victoria Strait and into Queen Maud Gulf.

Clearing in this area starts around the Bathurst polynya of Amundsen Gulf and gradually expands to the east, west and north. Freeze-up follows the reverse order with the extremities freezing first followed by the middle regions until all that remains ice-free is the western part of Amundsen Gulf, which stopped moving in mid-March of 1977. The pattern of freeze-up in 1976 seemed to be following the usual sequence.

The ice conditions in the northern part of the Mackenzie River between Mackenzie Bay and Inuvik were noted on October 13 at the end of track 2. The main channel was ice-free with some ice forming on the inside of the corners. The lakes in the delta area had frozen over.

Like its companion, for Map 8–1976 EAST, taken two days later, the satellite photograph showing the Cape Bathurst area is very clear and shows the early stages in the development of sea ice. In this case only the very young forms like nilas and grey ice are present in large amounts.

Liverpool Bay, October 14, 1976, T67 F10


Point Barrow
Prudhoe B.
Barter I.
Landsat
Aklavik
Inuvik
Tuktoyaktuk
Paulatuk
Sachs Harbour
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Isachsen
Mould Bay
Rea Point
OW
Landsat - Satellite Photographs
CONCENTRATION
PREDOMINANT AGE
Less than 1/10
Open Water
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)

SEASONAL SUMMARY 1977

The season was very favourable. Large areas became ice-free and remained so until a later-than-usual freeze-up started to consolidate the ice cover once again. Other years, such as 1962 and 1972, were exceptionally ice-free. The melting and developments in 1977 were similar to those earlier years.

In spite of the fact that 1977 was a very good year for ice disintegration and disappearance in all parts of the region, the sequence followed by the break-up, clearing and subsequent freeze-up was the typical pattern. No obvious departures from the normal were noted.

The overall observing conditions were much better than usual. The weather for the surveys to the end of August was much better than usual. In September and October the conditions for flying and mapping the ice were typical.

In April the distribution and amounts of multi-year ice and first-year ice were typical in the eastern part of the region. In the western area there was more first-year ice in Larsen Sound and in the Beaufort Sea than is usually encountered. The Bathurst polynya did not exist because light winds had allowed a solid unmoving ice cover to extend across much of the Beaufort Sea and into Amundsen Gulf.

Throughout May and June there must have been more sunlight and higher temperatures than usual, especially in the eastern part of the Queen Elizabeth Islands and the southwestern part around Banks Island because puddling was very early and polynyas were expanding faster than usual. In the central part, including M'Clintock Channel, Peel Sound and the channels north of Melville Island, there were no signs of an early advance.

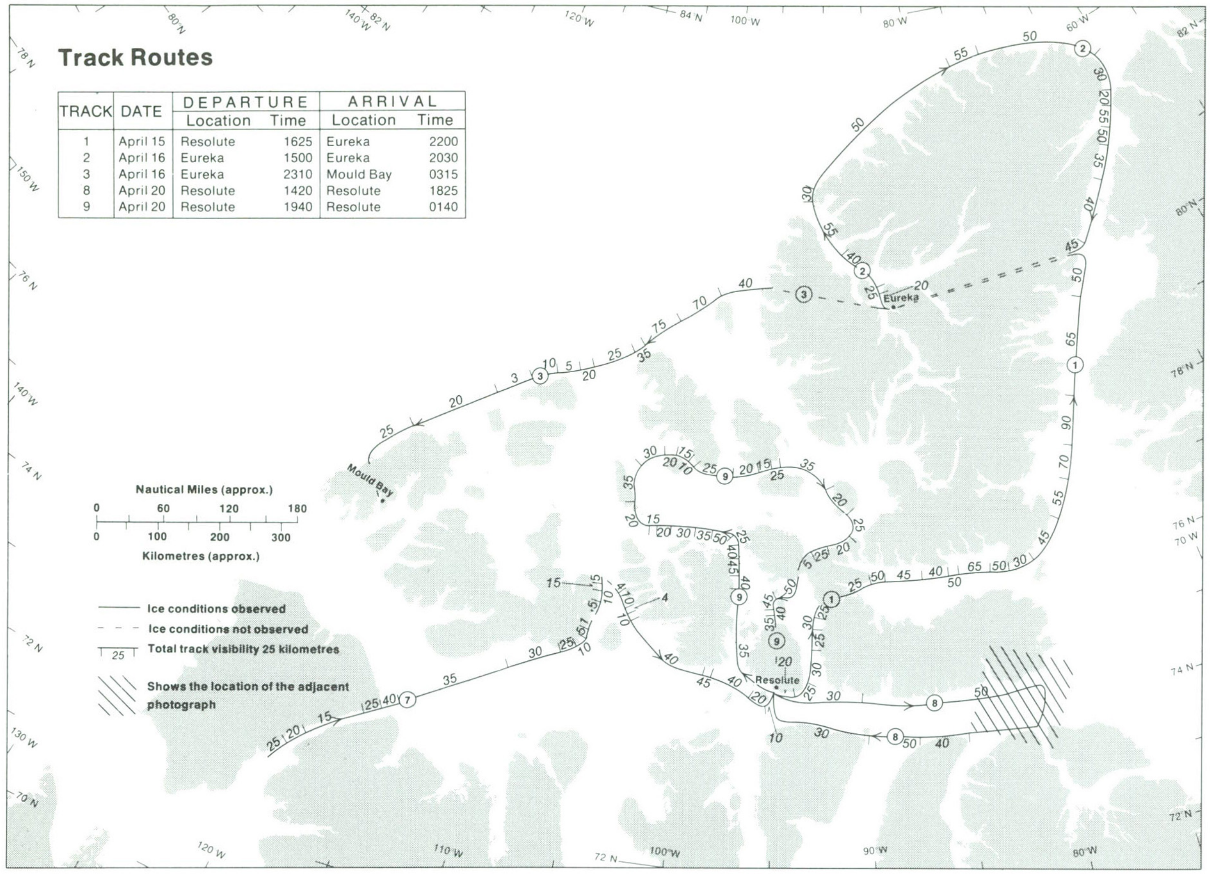
Rapid melting and clearing left much of the southwestern area ice-free by the end of July and a similar, but more impressive, clearing had developed in the eastern part of the archipelago by the end of August. Break-up in M'Clintock Channel and Peel Sound was earlier than usual but the amount of clearing had not advanced nearly as rapidly as in the areas to the northeast and southwest. The ice in the western part of Parry Channel had broken and was moving and melting faster than usual. Conditions in the area north of Melville Sound were slightly more advanced than usual.

In the fall the season was usual but the open areas were already developed. Freeze-up was slower than usual in all areas.

No new trends were observed but, in addition to being an extremely favourable season for ice disintegration, the year should also be noted for the lack of ice movement. Of course the ice in all areas, except in northern Nansen Sound and in the sheltered bays in the north where no break-up took place, was shifted by the winds.

Generally these winds were light and variable because the ice shifted to and fro with the result that net movements were less than usual. Typically noticeable drifts take place through the northern channels in September after they have broken. No appreciable movement was noted in these areas nor their southern counterparts in 1977. Even in Nares Strait the export was sporadic and lighter than usual. The relative absence of movements, especially the southerly drifts in the fall, resulted in greater than usual amounts of first-year ice at the beginning of the next ablation season.

Seasons as favourable as 1977 seem to develop about every six years. Undoubtedly the weather, temperatures and cloud cover in May and June are critical. The 1977 season had very limited movements. It would be interesting to compare surface wind information with other years to see if the winds from April to October in 1977 were lighter and more variable than normal.



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	April 15	Resolute	1625	Eureka	2200
2	April 16	Eureka	1500	Eureka	2030
3	April 16	Eureka	2310	Mould Bay	0315
8	April 20	Resolute	1420	Resolute	1825
9	April 20	Resolute	1940	Resolute	0140

MAP 1-1977 East

April 15-20

Flight Effectiveness

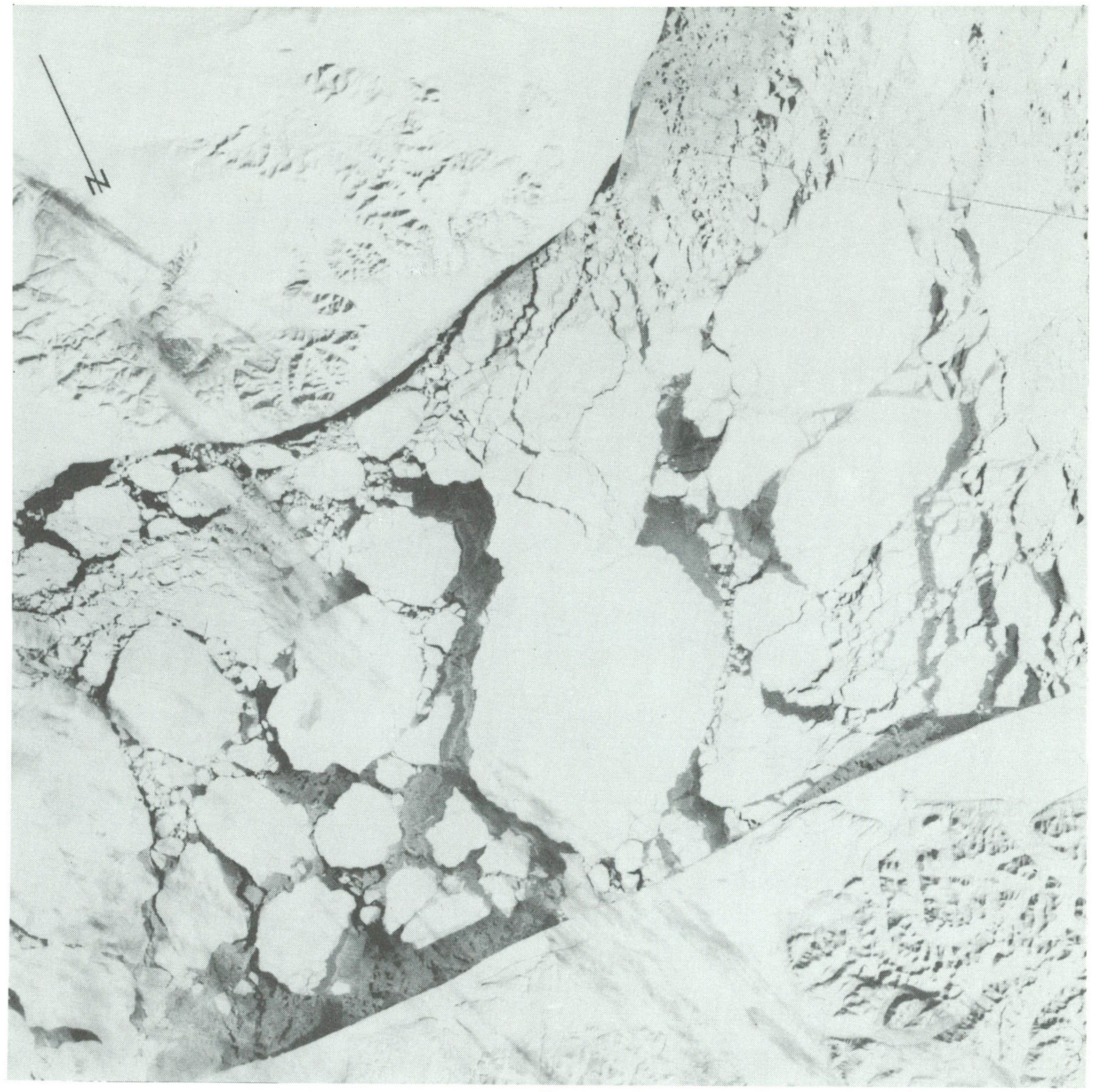
The general weather during the five tracks in the eastern part of the region was excellent and the flight was 95 per cent effective. This was very fortunate because many delays were experienced aclimatizing the aircraft and equipment to the cold. Once these initial problems were countered and the team developed a system to cope with them succeeding flights had fewer tactical problems.

Ice Conditions

The main change from the conditions observed during the previous fall were the redistributions of multi-year concentrations in Norwegian Bay and the area north of Penny Strait before freeze-up consolidated their ice cover in the latter part of October. The first-year ice cover in Kennedy Channel developed as multi-year ice moved south into Kane Basin.

The ice in the western part of Jones Sound was relatively smooth indicating an unmoving ice cover developed by the start of November while the rugged nature of the eastern part indicates that the ice continued in motion until the new year. Freeze-up in Barrow Strait occurred in stages also. The western half could still move slightly in January and movement ceased in the eastern part in late March. Movement persisted in Lancaster Sound and southern Prince Regent Inlet throughout the winter.

Some polynyas were developing in their usual positions while others such as those usually seen in Nares Strait were not observed. Of the developing ones, Hell Gate was the largest. Six smaller areas, too small to show at the scale of the adjacent map, were observed, all in their regular locations but somewhat smaller than usual. In Penny Strait open areas existed on the west coast of Spit Island, at the north tip of the small island in Northumberland Sound, on the west coast of the peninsula south of Spit Island and at the north tip of the small island at 76°35′N, 96°30′W. In Queens Channel open water appeared at the northern tip of Baillie-Hamilton Island and at the south-east extremity of Dundas Island.



Eastern Lancaster Sound, April 20, 1977, T39 F7

No obvious departures from the usual patterns and concentrations were noted. The surface in most areas was snow covered. In areas of new ice a partial snow cover existed.

Unobserved Areas

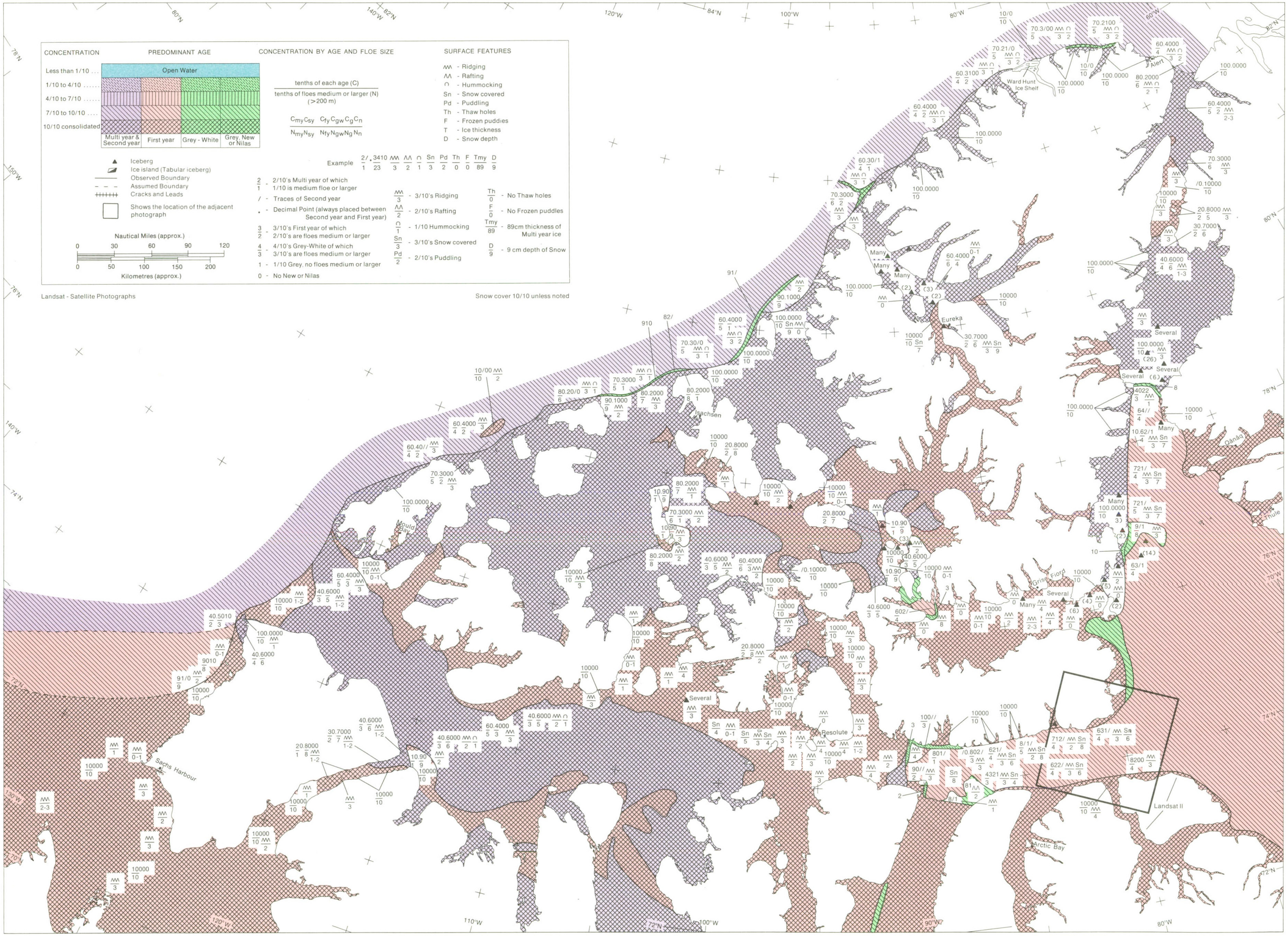
Subsequent observations, previous knowledge and information from adjacent areas were used to establish the ice conditions shown on the accompanying map north of Axel Heiberg Island and in the northern interior channels of Massey Sound, Hassel Sound, Hazen Strait and Hecla and Griper Bay.

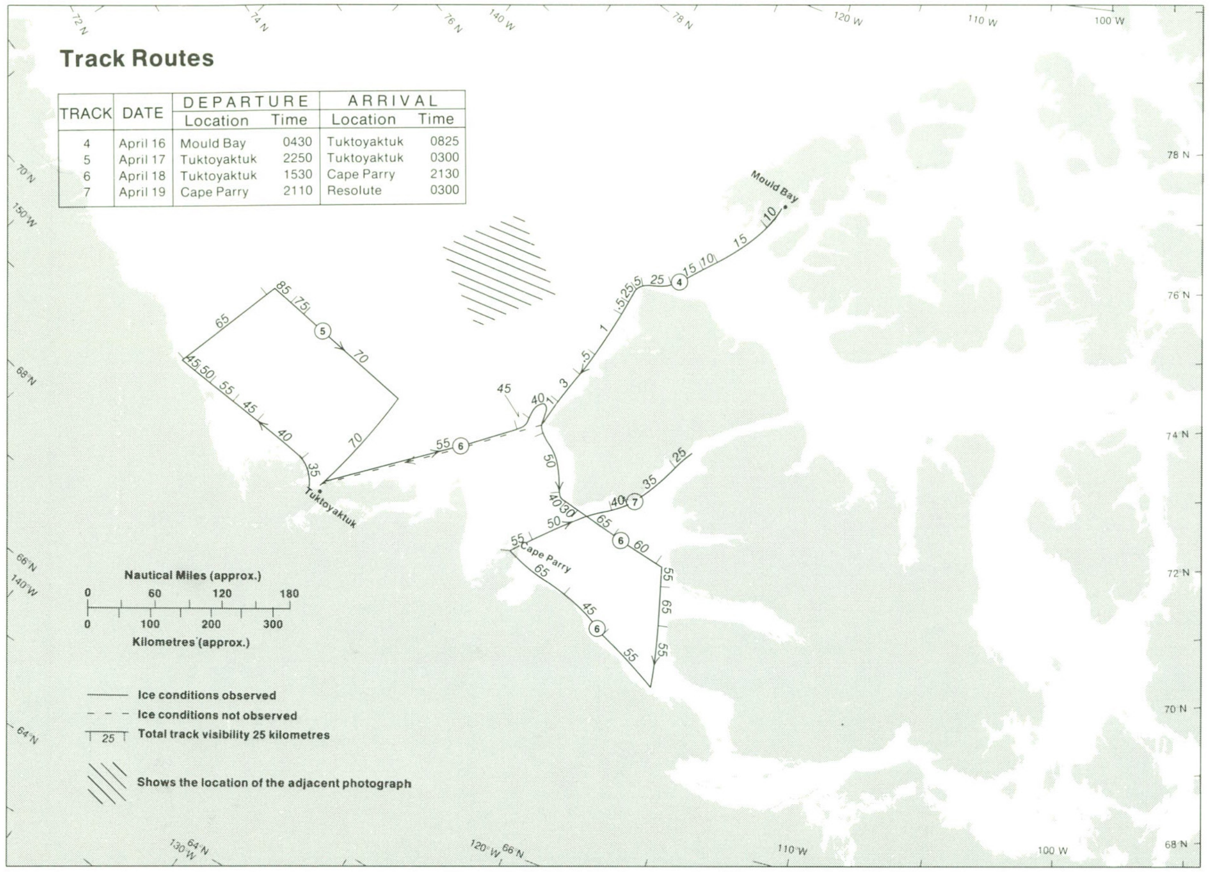
Comments

There were no indications to suggest the season would be advanced or delayed. All seemed to be normal.

The ice edge in the eastern part of Barrow Strait formed with the freeze-up in the area in late March. It was still in the same position in mid-June. This is a very typical occurrence.

The satellite photograph gives an excellent idea of the continuous clearing of ice throughout the winter east through Lancaster Sound.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Nautical Miles (approx.)
Kilometres (approx.)
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Landsat - Satellite Photographs
Snow cover 10/10 unless noted
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Mould Bay
Sachs Harbour
Resolute
Grise Fiord
Qanaq
Thule
Arctic Bay
Landsat II



Northern Beaufort Sea, April 20, 1977, T75 F7

MAP 1-1977 West

April 15-20

Flight Effectiveness

The weather was very good but the flight was only 80 per cent effective as a result of the many delays due to aclimatizing the aircraft to a cold weather operation. Because of delays of up to six hours, surveys were attempted in low level light which reduced the degree of success.

Ice Conditions

Six months elapsed between observations in the western part of the region. The changes that had taken place during this interval were typical. First-year ice had taken the place of all the new ice and open water. The extent of first-year ice in the Beaufort Sea remained the same as in the previous fall. In Larsen Sound, Victoria Strait and the northern part of Queen Maud Gulf late fall movements had distributed the multi-year ice so that a distinct multi-year pattern indicating concentrations of three-tenths or more no longer existed. Late fall movements had also shifted the entire ice cover in Viscount Melville Sound from south to north reducing the first-year area in the north and increasing its width in the south.

With the exception of some areas in eastern Viscount Melville Sound the ice throughout the western part of the region supported a ten-tenths snow cover.

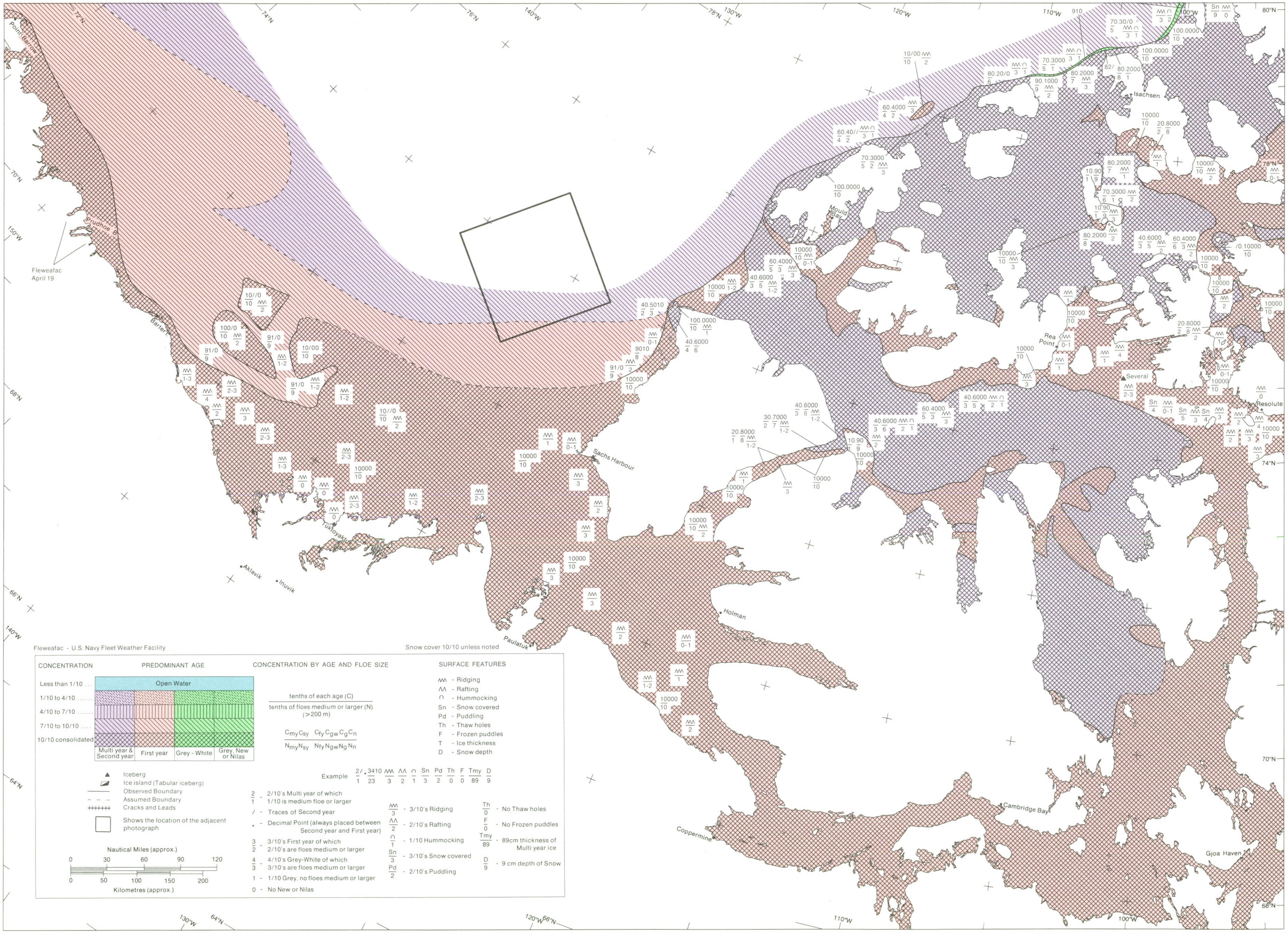
Unobserved Areas

One additional track planned to cover M'Clintock Channel and Peel Sound had to be cancelled because the aircraft was required for another job. Other parts of the western region were deliberately not scheduled for surveys this flight because there would be no change until mid-June. The ice conditions shown on the map for M'Clintock Channel, Peel Sound, the southern channels along the east-west waterway and the central portions of M'Clure Strait and Viscount Melville Sound are based on subsequent observations. The patterns and distributions shown along the north coast of Alaska are interpretations of maps from the U.S. Navy Fleet Weather Facility. Satellite photographs helped establish conditions in the northern part of the Beaufort Sea. Bellot Strait probably had ice-free areas.

Comments

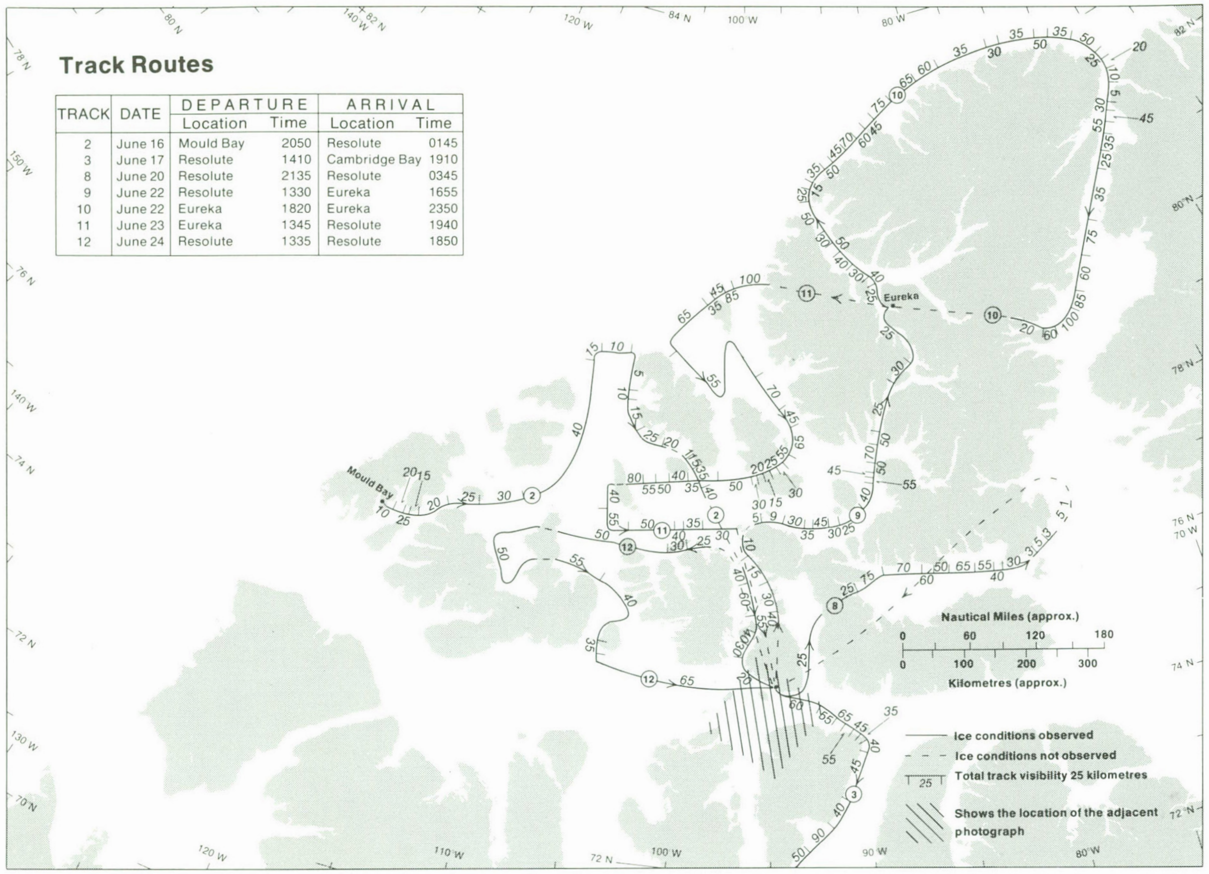
A large part of the ice cover in the Beaufort Sea was unbroken. The Bathurst polynya had not developed. This was the second consecutive year these conditions were observed. Neither of them is a usual occurrence. However, the extent of unbroken ice was not as great as last season and the break-up would soon create the Bathurst polynya.

Crack patterns and the fact that ice exists are all that the satellite shows. The ice types are obscured by ice crystal haze, snow cover and the formation of new ice types between the older floes.

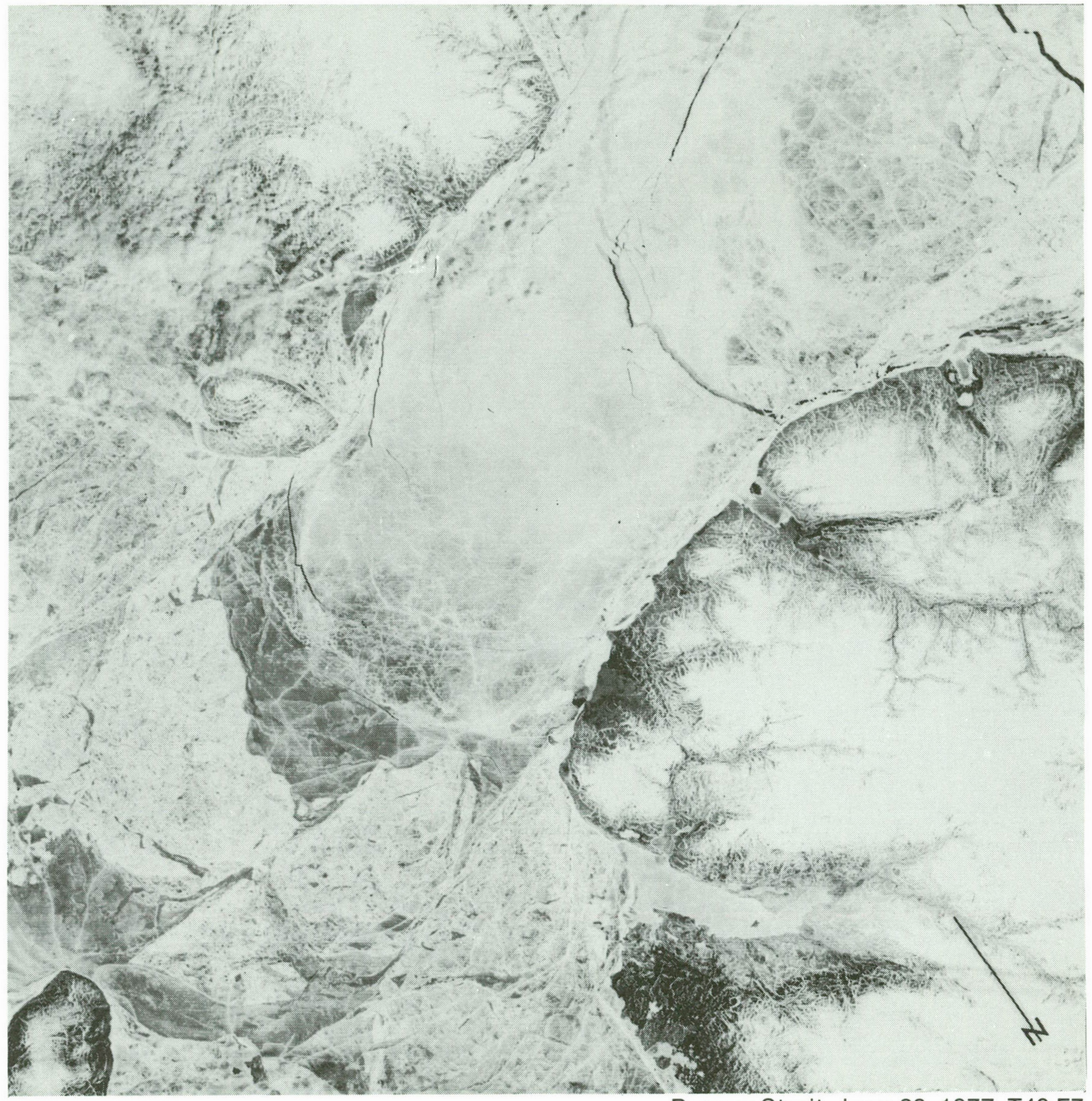


MAP 1 - 1977 WEST

April 15 - 20, 1977



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
2	June 16	Mould Bay	2050	Resolute	0145
3	June 17	Resolute	1410	Cambridge Bay	1910
8	June 20	Resolute	2135	Resolute	0345
9	June 22	Resolute	1330	Eureka	1655
10	June 22	Eureka	1820	Eureka	2350
11	June 23	Eureka	1345	Resolute	1940
12	June 24	Resolute	1335	Resolute	1850


Barrow Strait, June 23, 1977, T49 F7

MAP 2-1977 East

June 16-24

Flight Effectiveness

Except for one track, number 8, the results of the survey over the eastern part of the region were better than 85 per cent effective. For track 8 the weather was poor, the planning was poor, the pilot was poor and the results were poor. Overall the flight was 80 per cent successful.

Ice Conditions

The obvious changes were the development of ice-free areas in Lancaster Sound and Baffin Bay. Open water developed in these areas because no new ice grew in the areas vacated by the first-year ice. The polynyas in Queens Channel, Penny Strait, and Hell Gate continued to expand. Polynyas had appeared in their usual spots in Belcher Channel, Hendriksen Strait and in Kennedy Channel and northern Kane Basin. Another open area, noticed in previous years, developed in the Fay Islands in northern Massey Sound.

Recently the ice edge in Barrow Strait retreated a few km to the west. Additional break-up was imminent. With the exception of the ice adjacent to northern Ellesmere Island puddling was developing throughout the region. Frozen puddles were common in most areas.

The season appeared to be advancing in a typical fashion as far as break-up and clearing were concerned.

Unobserved Areas

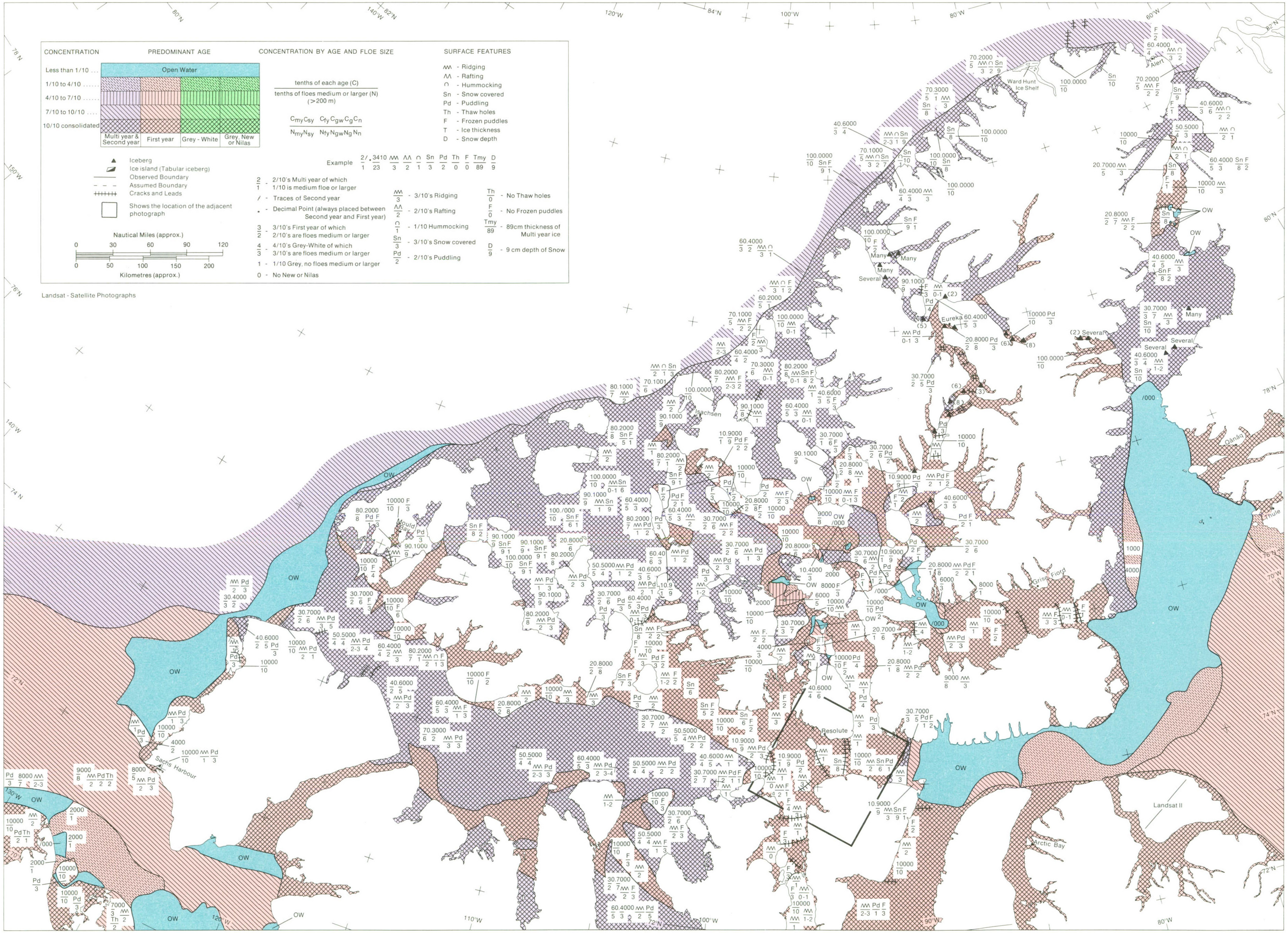
Ice conditions in Admiralty Inlet, Navy Board Inlet, Eclipse Sound, Pond Inlet, Lancaster Sound, northern Baffin Bay and Smith Sound, shown on the adjacent map, are based on interpretations of satellite photographs and subsequent observations. The patterns on the map along the edge of the Arctic Ocean and the northwest part of the archipelago were established on the basis of observations made before and after Flight 2 and on typical conditions that normally exist in the area at this time of year.

Comments

The area of the polynyas was larger than usual and the amount of puddling was much greater than normal for the time of year. Based on these two indicators it was likely that break-up and clearing during the summer of 1977, at least in the eastern part of the region, would be greater than usual.

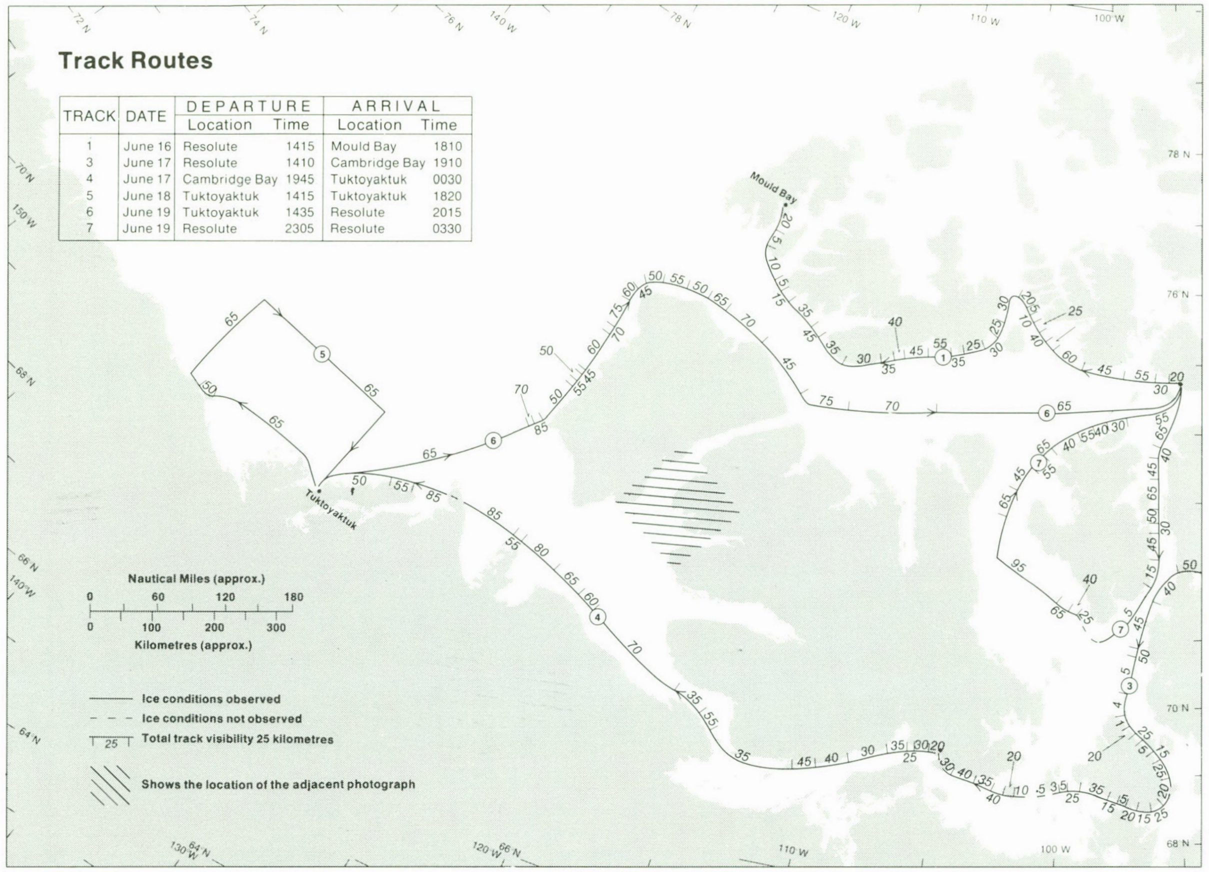
The satellite photograph gives a fine view of the patterns of freeze-up in Barrow Strait. The sequence of freeze-up is obvious: the northwest part around Griffiths Island and in the northern part of Peel Sound froze first, then the narrow channel running east-west from Young Island froze, trapping a large flow that was trying to move east. This freeze-up was probably accomplished by mid-January. The remainder consolidated in March. The patterns of break-up are also indicated on the photograph by the crack patterns. Basically break-up is just the reverse of freeze-up and will occur in a step by step fashion as indicated by the cracks arching across the channel.

The black areas of ice shown on the photo are not new ice. The ice is probably 30 cm to 100 cm thick, but because it is smooth, with limited cracks, the melt water covers most of the surface making it appear black like new ice.

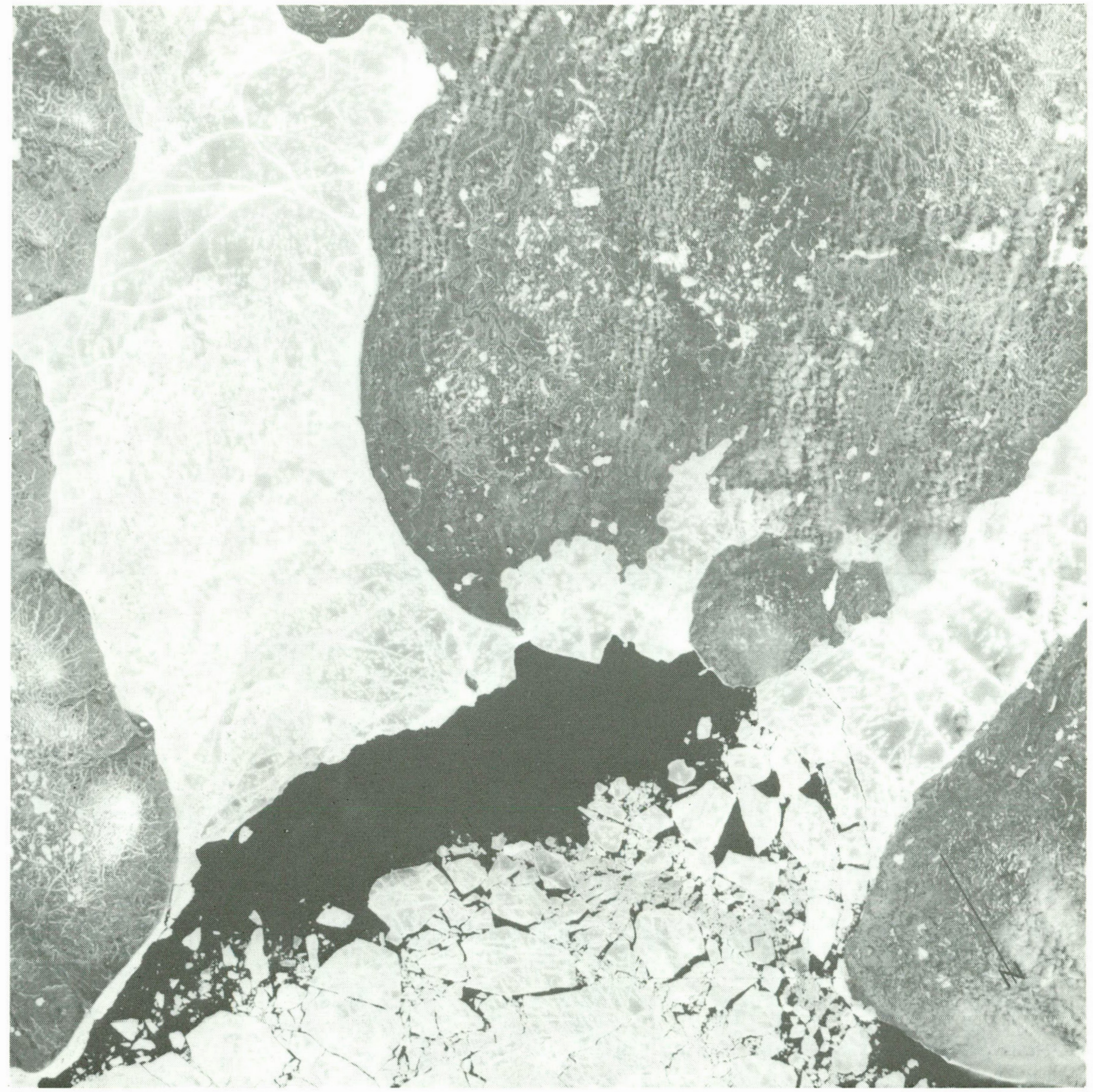


MAP 2 - 1977 EAST

June 16 - 24, 1977



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	June 16	Resolute	1415	Mould Bay	1810
3	June 17	Resolute	1410	Cambridge Bay	1910
4	June 17	Cambridge Bay	1945	Tuktoyaktuk	0030
5	June 18	Tuktoyaktuk	1415	Tuktoyaktuk	1820
6	June 19	Tuktoyaktuk	1435	Resolute	2015
7	June 19	Resolute	2305	Resolute	0330



Prince of Wales Strait, June 17, 1977, T61 F9

MAP 2-1977 West

June 16-24

Flight Effectiveness

Six tracks were completed over the ice in the western part of the region and only once, in the southern part of track 7, was visual contact with the ice surface lost. The ceiling and visibilities were unlimited during tracks 4, 5 and 6. During tracks 5 and 6 observations were made from a minimum altitude of 1000 m. Flight 2 was better than 95 per cent effective.

Ice Conditions

The break-up and partial clearing in the Beaufort Sea and Amundsen Gulf are the obvious changes. Throughout the area all of the snow had melted and puddles were well established. Some areas, for example Liverpool Bay, were hosts to thaw holes. The frozen puddles noted in the northern areas were a temporary occurrence.

No departures from the normal patterns were noted.

Unobserved Areas

The patterns and concentrations shown on the map for the Beaufort Sea and west of Prince Patrick Island were established by interpreting satellite photographs and by adapting data supplied by the U.S. Navy Fleet Weather Facility. Satellite photography was also used to determine the conditions in Prince of Wales Strait and in the large bays of northern Victoria Island. Adjacent conditions and subsequent observations were used to establish the probable conditions in Larsen Sound and Victoria Strait.

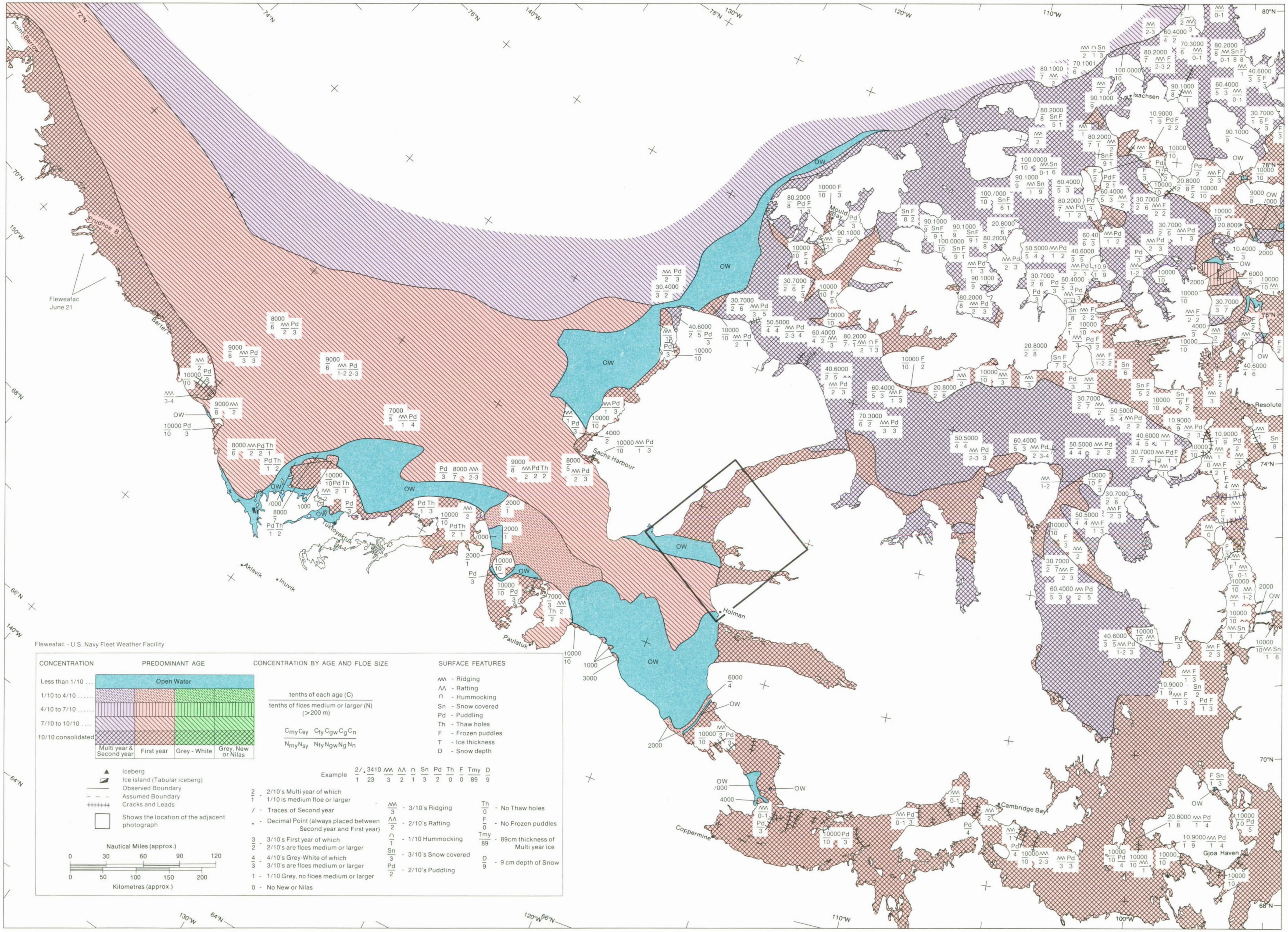
Comments

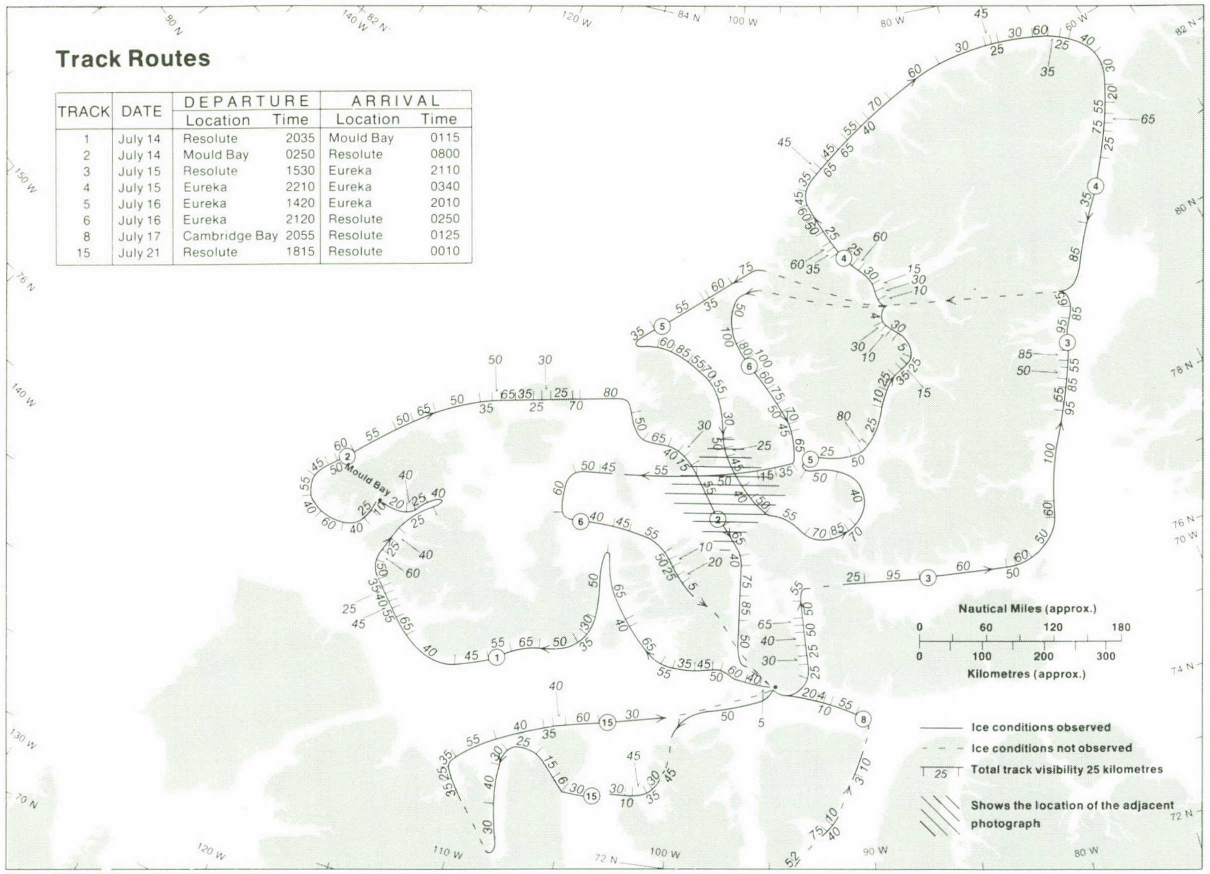
Break-up and clearing in Amundsen Gulf was much ahead of normal. Break-up along the coast of the Beaufort Sea was ahead of normal while clearing in the sea itself was slightly delayed. The amount of puddling in the southern waterway from Amundsen Gulf to Spence Bay was much greater than usual; there was also a complete lack of snow cover. Also the polynya in Dolphin and Union Strait was larger than normal. The season was about a month ahead of the typical year by the third week in June.

The small open area, not shown on the map, at the northern tip of Tasmania Island in Franklin Strait had developed in its usual spot. This open area plus the one at the western side of James Ross Strait indicated that the ice in these areas was weakening also.

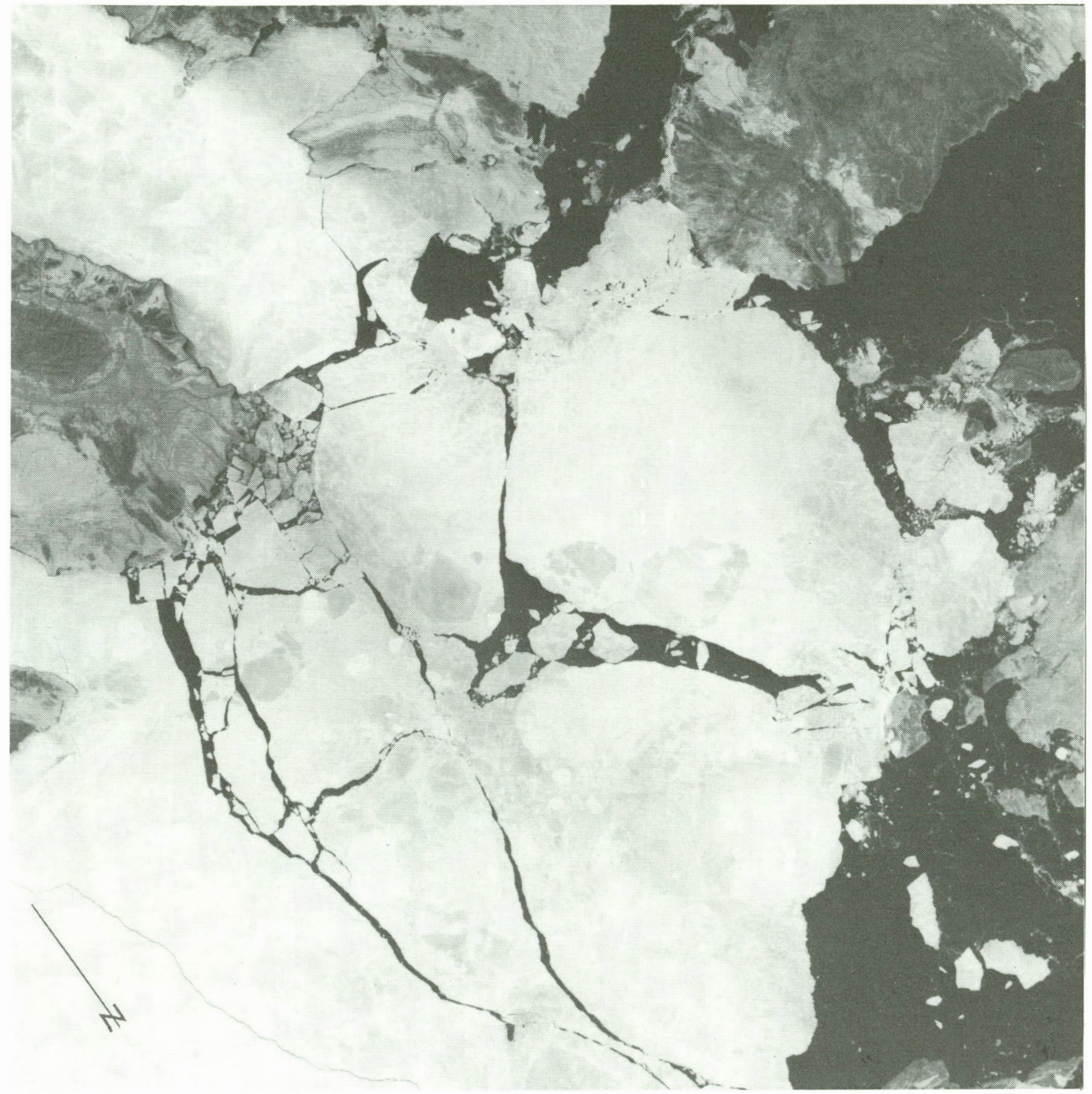
In M'Clure Strait the ice edge shown on the map was established on June 19 during track 6. By June 23 satellite photography showed the edge moved east to a line running south from Eglinton Island to Banks Island. This advance of about 60 km in four days indicated that the southeasterly winds that moved the ice off the coast to create the open areas west of Banks Island and M'Clure Strait continued to persist at least until July 23.

The satellite photograph shows a fine example of relatively smooth first-year ice where the snow has melted and puddling has reached its maximum extent and is beginning to decline.


Point Barrow
Prudhoe B.
Fleweafac
June 21
Barter I.
Aklavik
Inuvik
Tuktoyaktuk
Paulatuk
Sachs Harbour
Holman
Mould Bay
Isachsen
Resolute
Cambridge Bay
Coppermine
Gjoa Haven
OW
Fleweafac - U.S. Navy Fleet Weather Facility
CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/1 - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	July 14	Resolute	2035	Mould Bay	0115
2	July 14	Mould Bay	0250	Resolute	0800
3	July 15	Resolute	1530	Eureka	2110
4	July 15	Eureka	2210	Eureka	0340
5	July 16	Eureka	1420	Eureka	2010
6	July 16	Eureka	2120	Resolute	0250
8	July 17	Cambridge Bay	2055	Resolute	0125
15	July 21	Resolute	1815	Resolute	0010



North of Penny Strait, July 21, 1977, T59 F4

MAP 3-1977 East

July 14-21

Flight Effectiveness

The weather was excellent for flying and observing. Very complete coverage was obtained. The flight was 100 per cent effective.

Ice Conditions

The most obvious changes, but not necessarily the most important, were the break-up of northern Nares Strait and the slight clearing in Lancaster Sound and Baffin Bay. The break-up in Prince Regent Inlet, Admiralty Inlet and Navy Board Inlet was completed and the eastern half of Barrow Strait had broken and was moving east into Lancaster Sound. Other important indicators of the advance of the season developed but were not as obvious, such as the expansion of the open areas in Queens Channel, Penny Strait and Hell Gate. These plus the tremendous three-week expansion in Belcher Channel and Hendricksen Strait indicated the season was ahead of normal. Other evidence, such as the universal puddling, shore leads, open areas at the heads of bays, early appearances of open water, for example, in the channels west of Bathurst Island and in the Fay Islands and near the unnamed island to the south in Sverdrup Channel, all pointed toward a better than usual season for ice melt and the subsequent development of open areas.

The foregoing all indicate the state of advance of break-up. Another factor, often overlooked, that provides a reliable guide for the advance of break-up, is the area off the southwest tip of Bathurst Island. In a typical year break-up is starting by mid-July. By mid-July, 1977 the area had broken and melting had reduced the concentrations to eight-tenths—a considerable advance beyond the normal rate.

Unobserved Areas

Satellite photographs provided sufficient information to establish the types and distributions in Baffin Bay and the Lancaster Sound area. The conditions shown in Hecla and Griper Bay and for northern Prince Gustaf Adolf Sea and Axel Heiberg Island were mapped on the basis of previous records and subsequent observations.

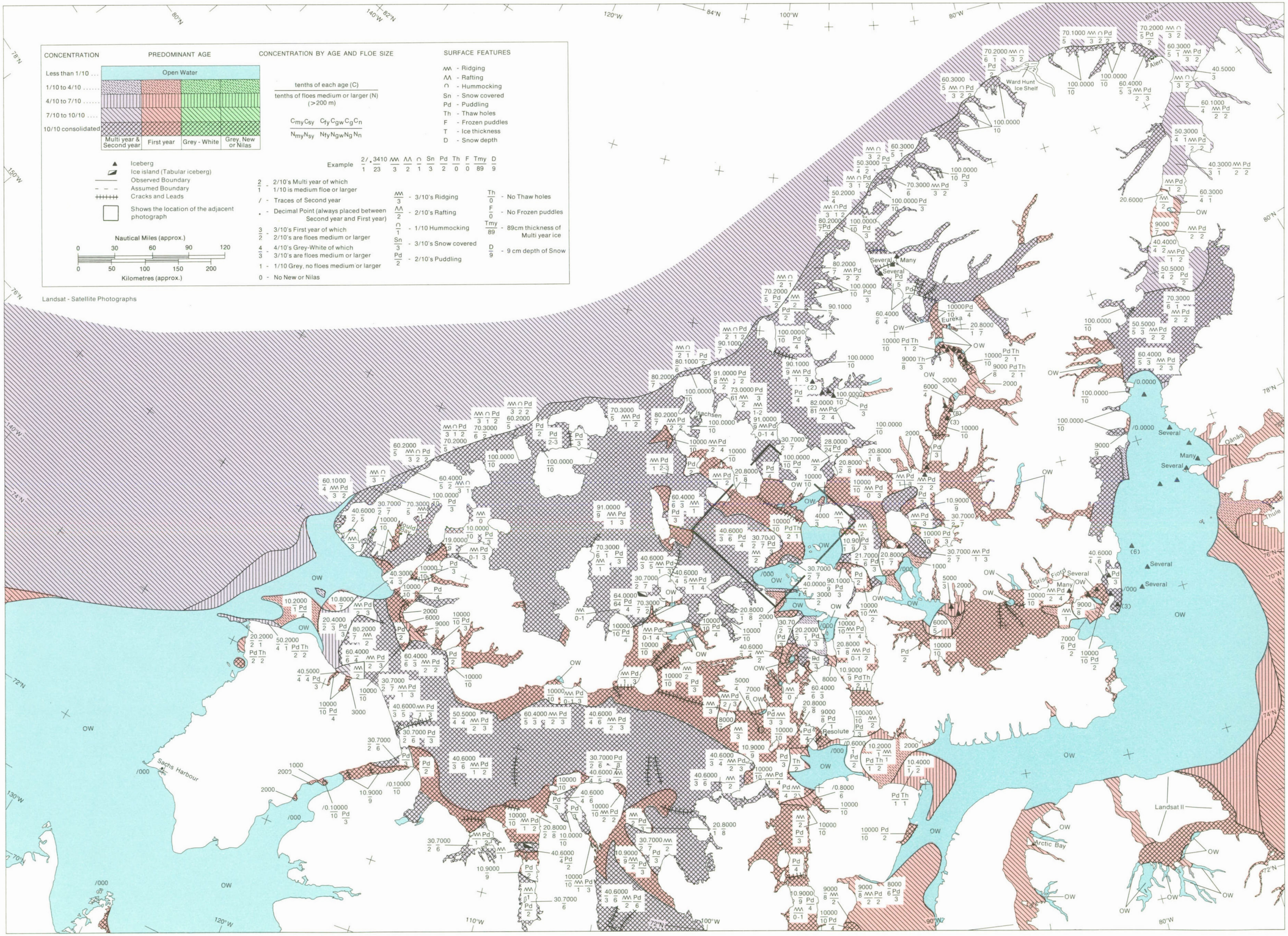
Comments

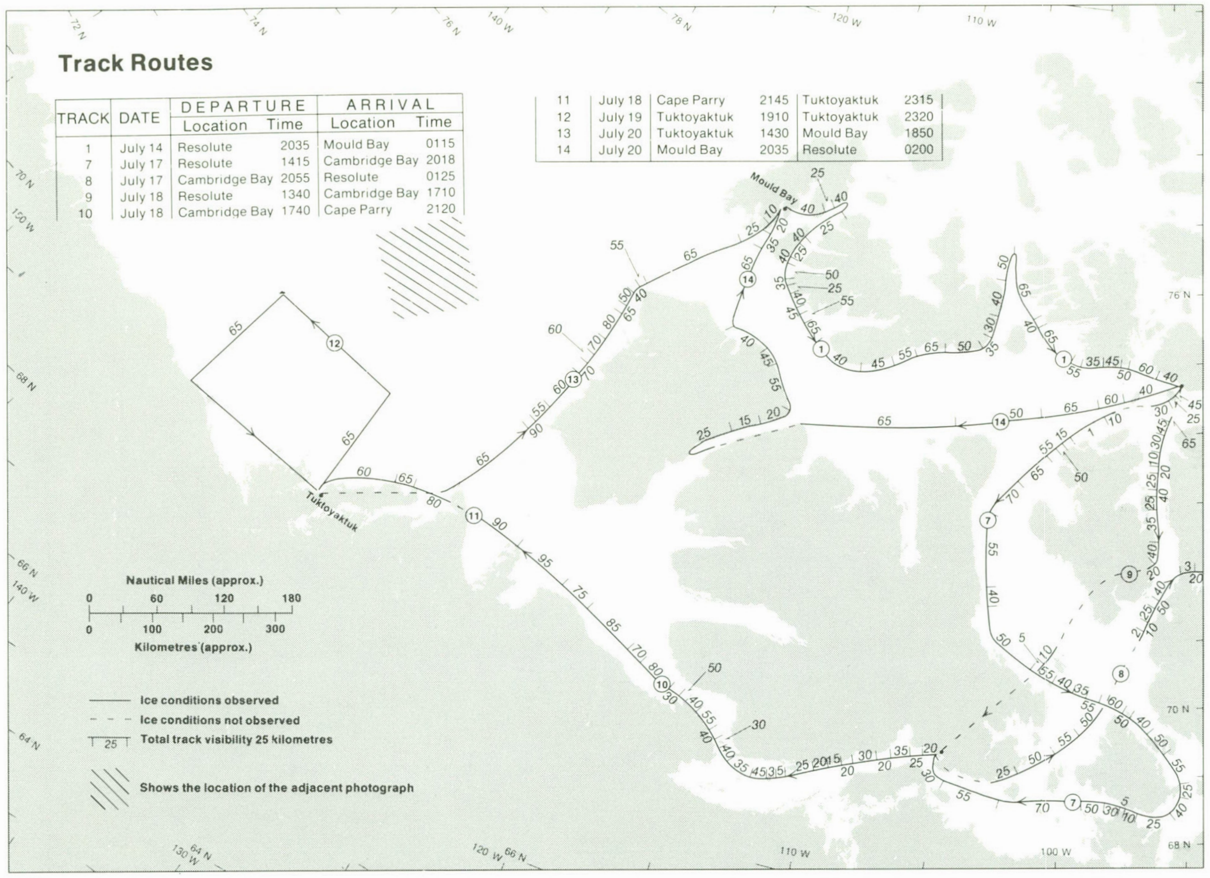
The season was very active and many changes were occurring very rapidly. The timing of break-up and clearing appeared to be two to three weeks ahead of normal or even more if forecasts were made solely on the basis of the timing of the development of the large open areas in Belcher Channel and Hendriksen Strait.

Two examples of the changes developed in the unnamed sea north of Penny Strait and in Barrow Strait. In the former area the map shows the conditions observed on July 14 and 16. The satellite photograph shown above, taken on July 21, indicates that break-up took place about the 20th. The imagery on July 22 shows that the ice had moved about 15 km south. In two days the entire area broke up and moved 15 km. In Barrow Strait the map shows the situation observed on July 18. When surveyed again on July 20, the boundary between solid and moving ice had moved to the western end of the strait, a distance of almost 100 km.

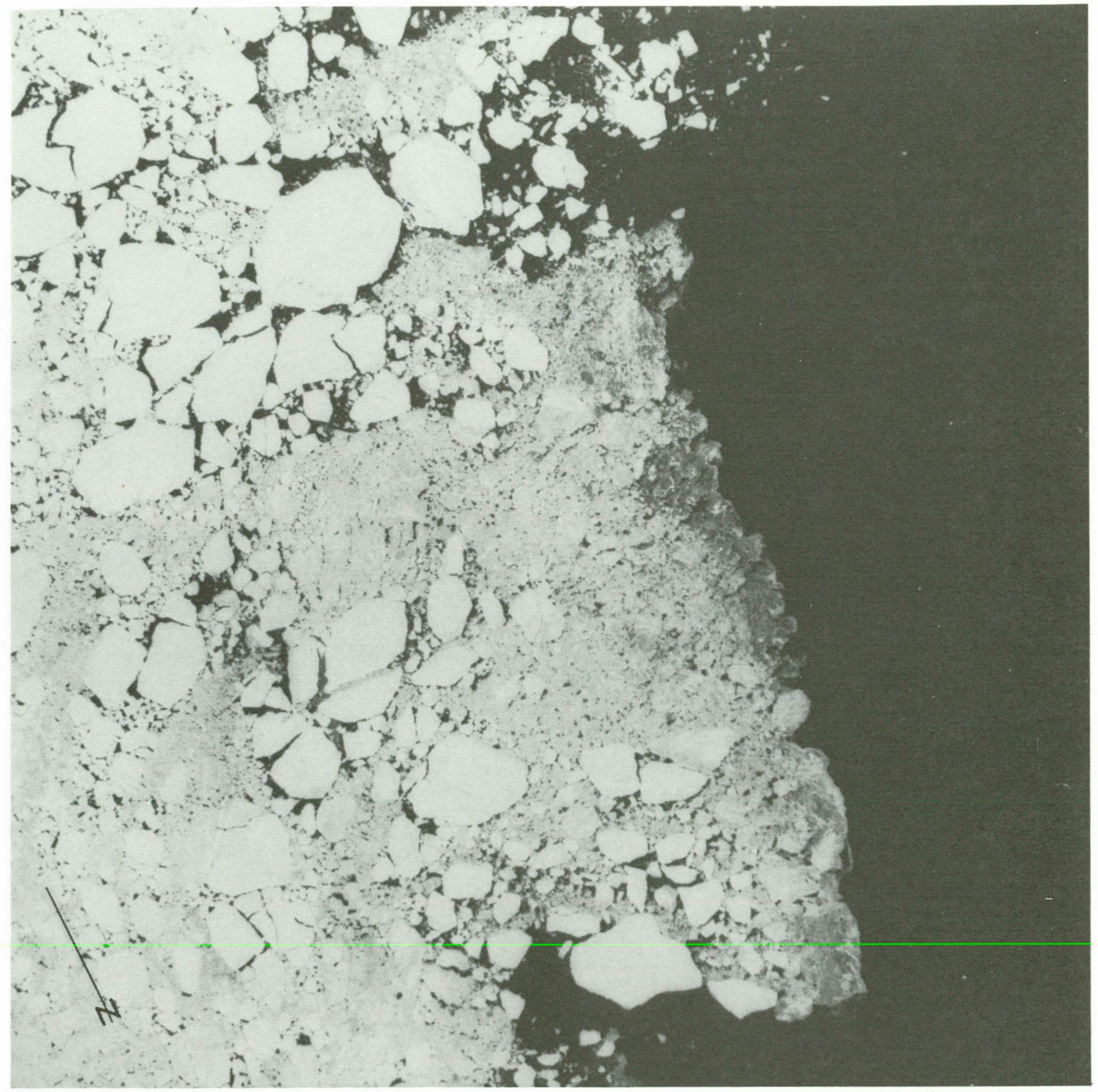
The ice island sighted in Byam Martin Channel was very small.

A dust storm carrying particles up to elevations of 300 m was blowing over the southern part of Danish Strait from Ellef Ringnes Island on July 16. On the previous day an ice breaker was sighted in the North Water opposite Pim Island. The satellite photograph is excellent. Tones are showing as the snow melts to indicate the different ages of floes trapped in the huge areas of drifting ice.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
Ridging
Rafting
Hummocking
Snow covered
Puddling
Thaw holes
Frozen puddles
Ice thickness
Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Resolute
Sachs Harbour
Grise Fiord
Arctic Bay
Qânâq
Thule
Landsat II



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	July 14	Resolute	2035	Mould Bay	0115
7	July 17	Resolute	1415	Cambridge Bay	2018
8	July 17	Cambridge Bay	2055	Resolute	0125
9	July 18	Resolute	1340	Cambridge Bay	1710
10	July 18	Cambridge Bay	1740	Cape Parry	2120
11	July 18	Cape Parry	2145	Tuktoyaktuk	2315
12	July 19	Tuktoyaktuk	1910	Tuktoyaktuk	2320
13	July 20	Tuktoyaktuk	1430	Mould Bay	1850
14	July 20	Mould Bay	2035	Resolute	0200



Mid-Beaufort Sea, July 19, 1977, T75 F8

MAP 3-1977 West

July 14-21

Flight Effectiveness

With the exception of low stratus cloud, fog and heavy rain that interrupted observations during tracks 8 and 9, the weather and observing conditions during the remaining seven tracks were excellent and a very large portion of the area was surveyed. The flight was more than 90 per cent effective.

Ice Conditions

About four weeks separated the observations made in these areas. Significant changes took place during that interval. Amundsen Gulf, Dolphin and Union Strait, and eastern Beaufort Sea became ice-free. Break-up was completed and clearing was underway in Coronation Gulf and Dease Strait. An eastward advance into M'Clure Strait continued. The broken areas in Victoria Strait and in the narrows around King William Island indicated that these areas would soon be broken. Shore leads were developing in all parts of the region and open water patches were established at the heads of most bays.

Puddling had already reached its maximum and was falling back to the three-tenth concentration that remains until the solid cover disintegrates.

The advance of the season was following the usual sequence with Amundsen Gulf clearing first.

Unobserved Areas

Only the northern part of Amundsen Gulf remained unobserved at the end of the very successful series of tracks conducted over the western area during Flight 3. The ice conditions shown for these areas are based on the interpretation of satellite photographs. The conditions along the northern coast of Alaska were determined from satellite imagery and observations by the AES ice reconnaissance unit.

Comments

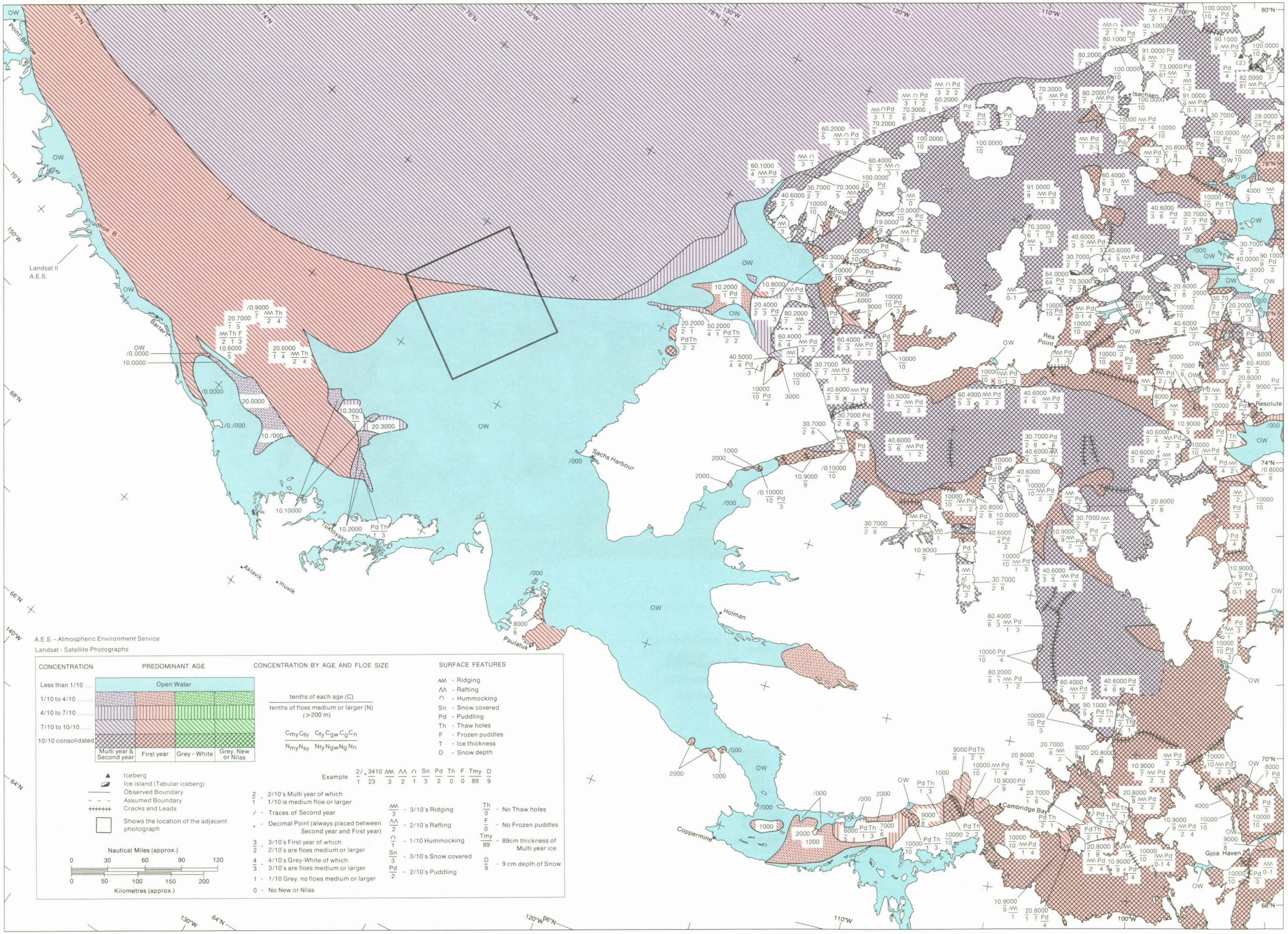
Good weather persisted prior to, during and after surveys were conducted in the area. The results of this sunny weather were obvious. In the southern half of the region the season was about four weeks ahead of normal while in the northern half, the Viscount Melville Sound area, it was about three weeks early.

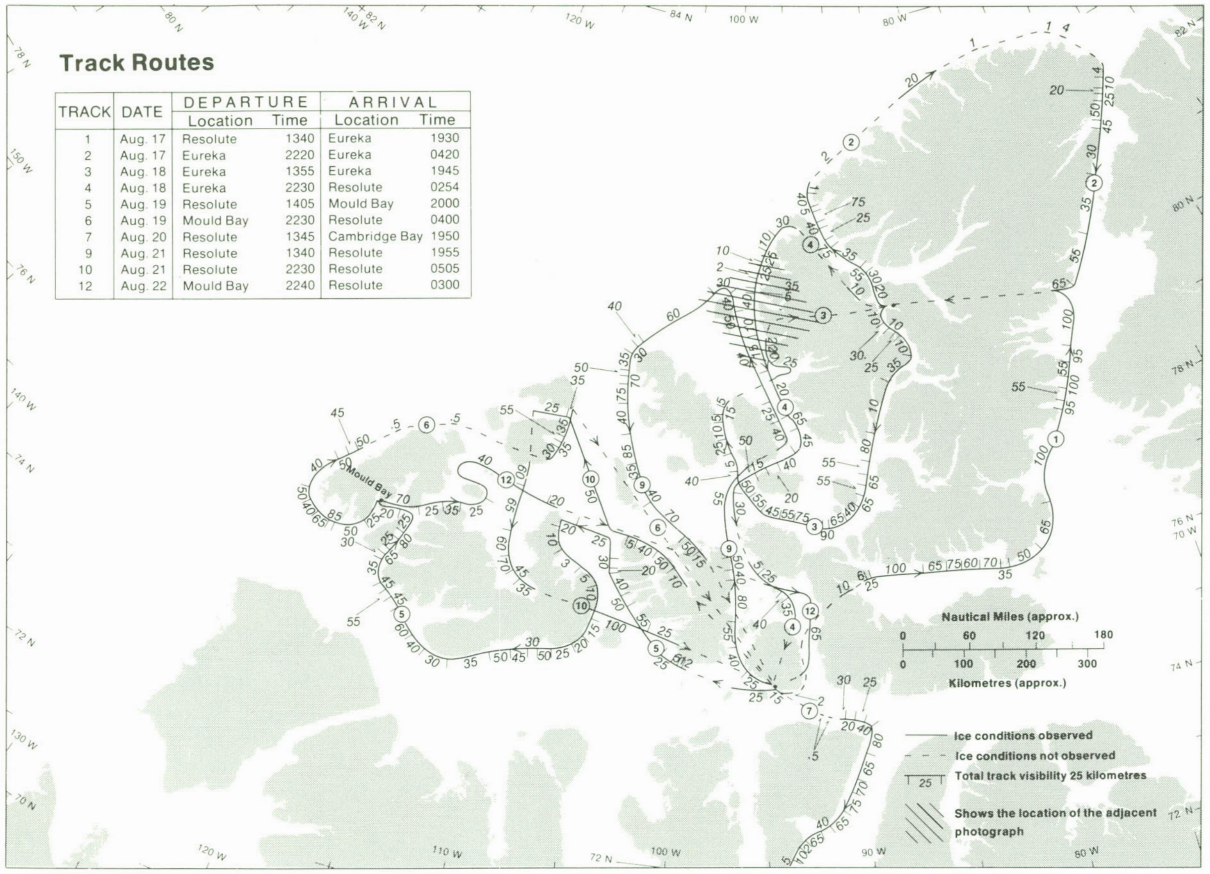
The boundary in the Beaufort Sea between multi-year ice and first-year ice seemed to remain in the same place between the two flights. This indicates a fine balance between the winds keeping the ice from shore and the multi-year ice drifting south to replace the melting ice.

The broken and eight-tenths covered area in Viscount Melville Sound near the southwest tip of Bathurst Island usually begins to appear in mid-July in typical years.

The ice island in the northern part of Hadley Bay was last seen July 17, 1976 about 60 km further north than its present position. Its net southerly drift is typical of wind-induced drifts in the area.

The trend of the ice edge shown on the satellite does not correspond exactly with the direction on the map. However, the location of the ice edge does match up very nicely with observations made during track 12 which, like the photograph, was also made on July 19.


A.E.S. - Atmospheric Environment Service
Landsat - Satellite Photographs
CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Nautical Miles (approx.)
Kilometres (approx.)
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Point Barrow
Prudhoe B.
Barter I.
Landsat II
A.E.S.
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Sachs Harbour
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Mould Bay
Isachsen
Rea Point
Resolute



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 17	Resolute	1340	Eureka	1930
2	Aug. 17	Eureka	2220	Eureka	0420
3	Aug. 18	Eureka	1355	Eureka	1945
4	Aug. 18	Eureka	2230	Resolute	0254
5	Aug. 19	Resolute	1405	Mould Bay	2000
6	Aug. 19	Mould Bay	2230	Resolute	0400
7	Aug. 20	Resolute	1345	Cambridge Bay	1950
9	Aug. 21	Resolute	1340	Resolute	1955
10	Aug. 21	Resolute	2230	Resolute	0505
12	Aug. 22	Mould Bay	2240	Resolute	0300

Sverdrup Channel, August 19, 1977, T70 F1

MAP 4-1977 East

August 17-24

Flight Effectiveness

Unseasonably fine weather prevailed during half of the tracks. The weather for the remainder was typical for the time of year - low stratus clouds, with occasional rain in some areas and snow in others. The flight was about 70 per cent effective.

Ice Conditions

Practically all of the first-year ice that existed at the end of Flight 3 had melted by the end of Flight 4. Large areas of open water developed between the two flights and break-up had advanced considerably. The solid barrier across southern Kane Basin broke and multi-year ice was drifting into Baffin Bay. The break-up and clearing in Jones Sound was remarkable. From a solid cover of first-year ice on July 15 to being completely ice-free on August 17 is a very rapid change. Similar developments took place in the north-south channels flanking Cornwallis Island and Byam Martin Island. The break-up and clearing on Norwegian Bay was considerable and ablation was still taking place. The ice cover in Massey Sound had recently broken but only limited clearing had taken place. The ice cover in Maclean Strait and southeastern Prince Gustaf Adolf Sea had broken within the previous four or five days.

The patterns of break-up and clearing in most areas were typical. The fact that the ice in Byam Martin Channel and the area north of it remained solid while break-up advanced through Maclean Strait and into the southern part of Prince Gustaf Adolf Sea is not usually expected. However, the same pattern was followed in 1976.

The puddles throughout the area were frozen and melting was slowing but had not stopped yet.

Unobserved Areas

Once again, due to unfavourable weather, ice conditions around Borden Island could not be observed. The patterns and distributions shown on the map for these areas are based mainly on subsequent observations.

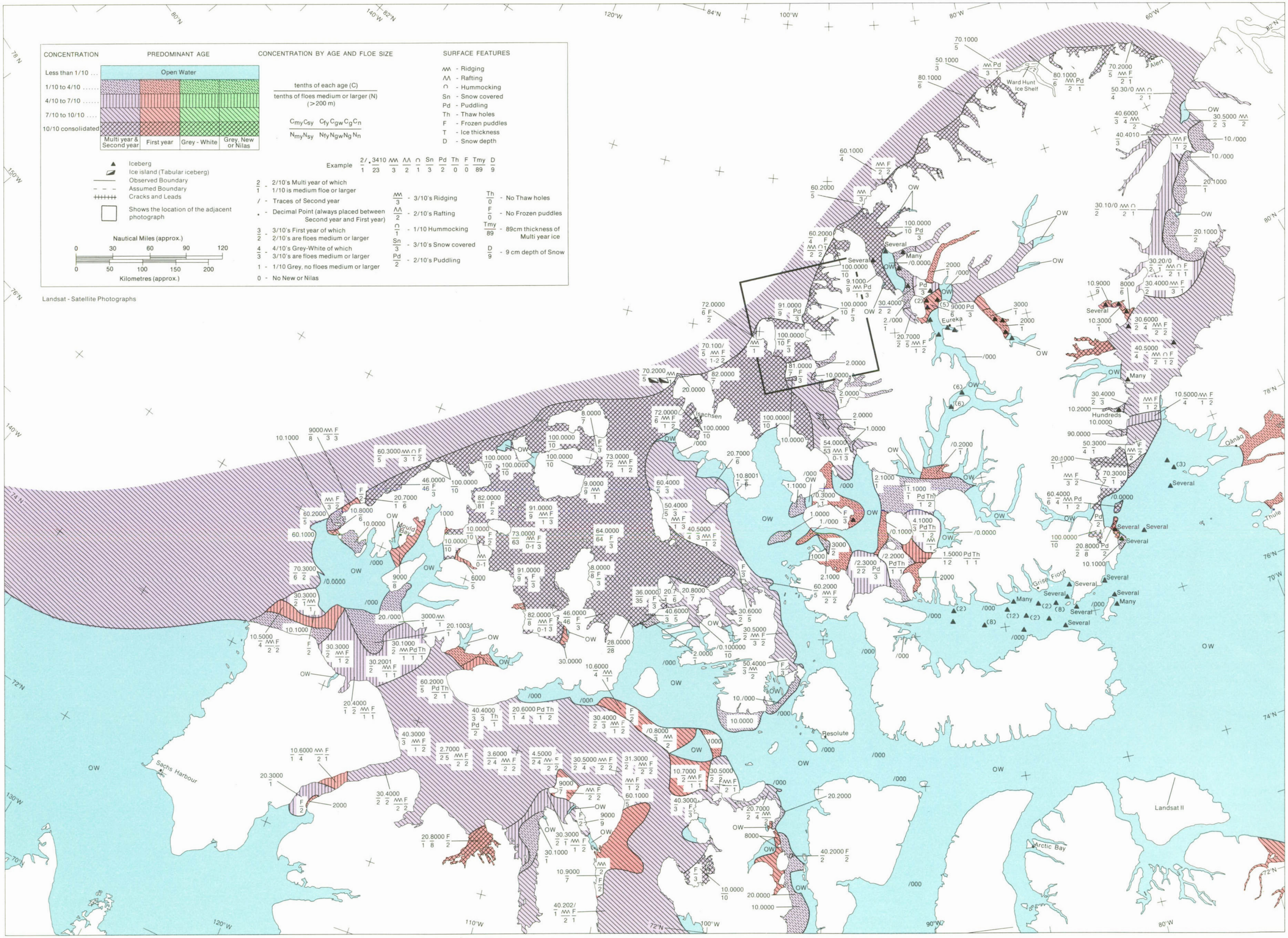
Comments

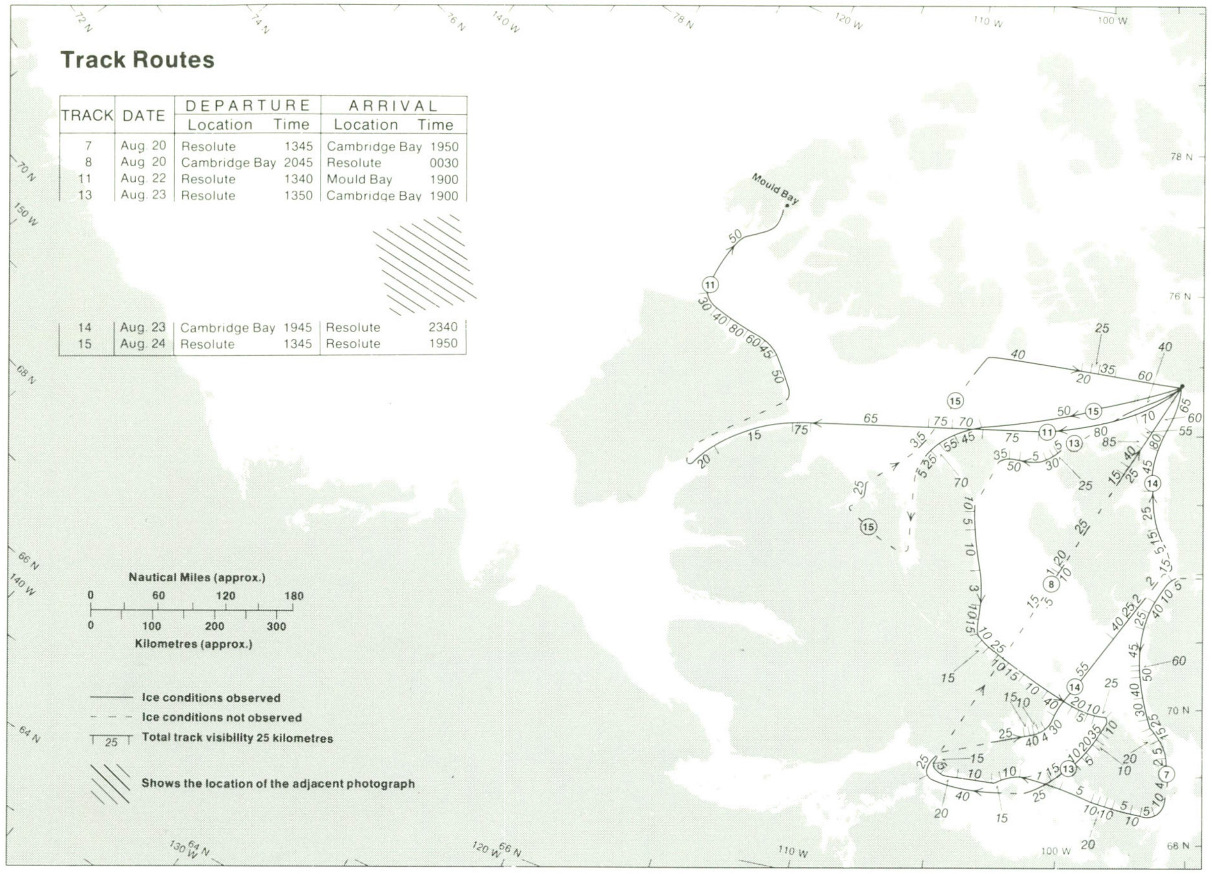
The pattern of break-up and clearing in 1977 was almost identical to the previous season. The timing in 1977 was earlier with the result that the advance, especially in the eastern portion, was at least three weeks ahead of normal.

Movement was taking place in many areas. A southerly drift of multi-year ice into Baffin Bay from Nares Strait had started. A similar drift was underway through Penny Strait from the unnamed sea further north. Icebergs had drifted into Jones Sound via Glacier Strait. The ice in Hassel Sound likely drifted south into the unnamed sea before it melted.

Break-up usually comes to Byam Martin Channel before Prince Gustaf Adolf Sea. The two open water areas on either side of Brock Island were in their usual positions. They only develop in favourable seasons.

Although the ice cover in the satellite photograph is slightly obscured by cloud, the patterns are evident. The weather satellite photograph used to forecast the weather for track 2 also showed the land to be free of cloud but it didn't show the low stratus clouds over the ice which reduced the effectiveness of the track considerably.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Mould Bay
Resolute
Sachs Harbour
Grise Fiord
Arctic Bay
Qanaq
Thule
Landsat II
OW



Mid-Beaufort Sea, August 24, 1977, T75 F8

MAP 4-1977 West

August 17-24

Flight Effectiveness

Seasonable weather, low stratus clouds, and some rain hindered observations during some part of every track. The results from track 8 were poor because a rough running port engine made it prudent to remain at higher altitudes rather than tempting fate by flying under the clouds. The flight was nearly 70 per cent effective.

Ice Conditions

Break-up was completed in M'Clure Strait, Viscount Melville Sound and M'Clintock Channel. Break-up and partial clearing was accomplished in Peel Sound, Franklin Strait and Larsen Sound. Break-up and total clearing spread through the channels in the waterway from Amundsen Gulf to Spence Bay. Generally the development of the open water areas resulted because first-year ice melted and disappeared. The area of multi-year ice was only slightly reduced between the two flights.

Apart from melting of first-year ice in the western part of the Beaufort Sea the expanse of open water and the position of the ice edge were very similar to those noted about four weeks earlier. No obvious departures from the usual conditions for this time of year were noted.

Unobserved Areas

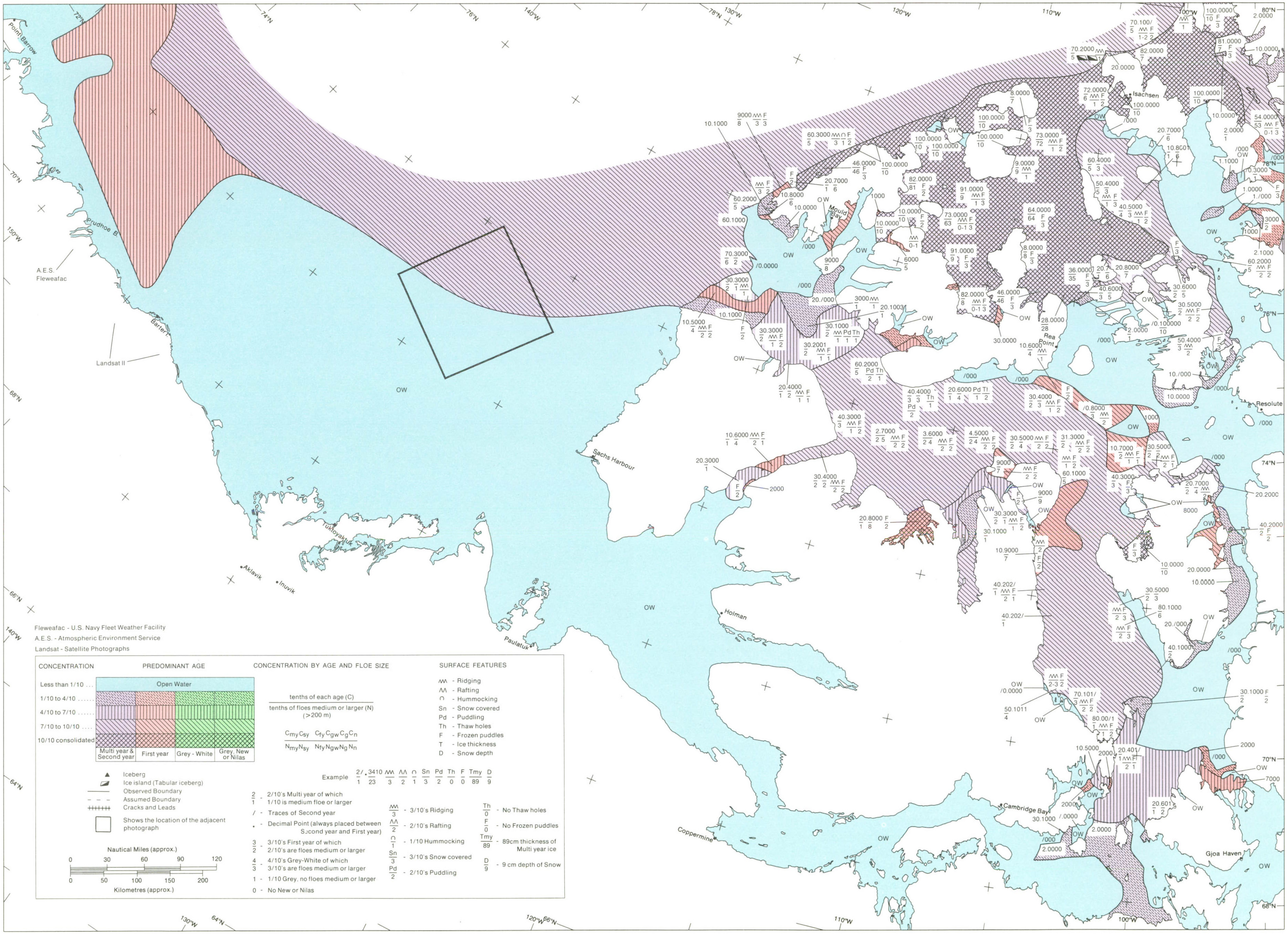
Satellite photographs provided information to establish the ice conditions, or lack of them, in the Beaufort Sea and the waterways from Amundsen Gulf to Spence Bay. The distribution and patterns shown along the north coast of Alaska were determined from U.S Navy Fleet Weather Facility ice maps and information gathered by the ice reconnaissance unit of AES.

Comments

The season was two to three weeks ahead of normal. Typically at this time of year, a solid ice cover may still exist in parts of M'Clintock Channel and in Peel Sound.

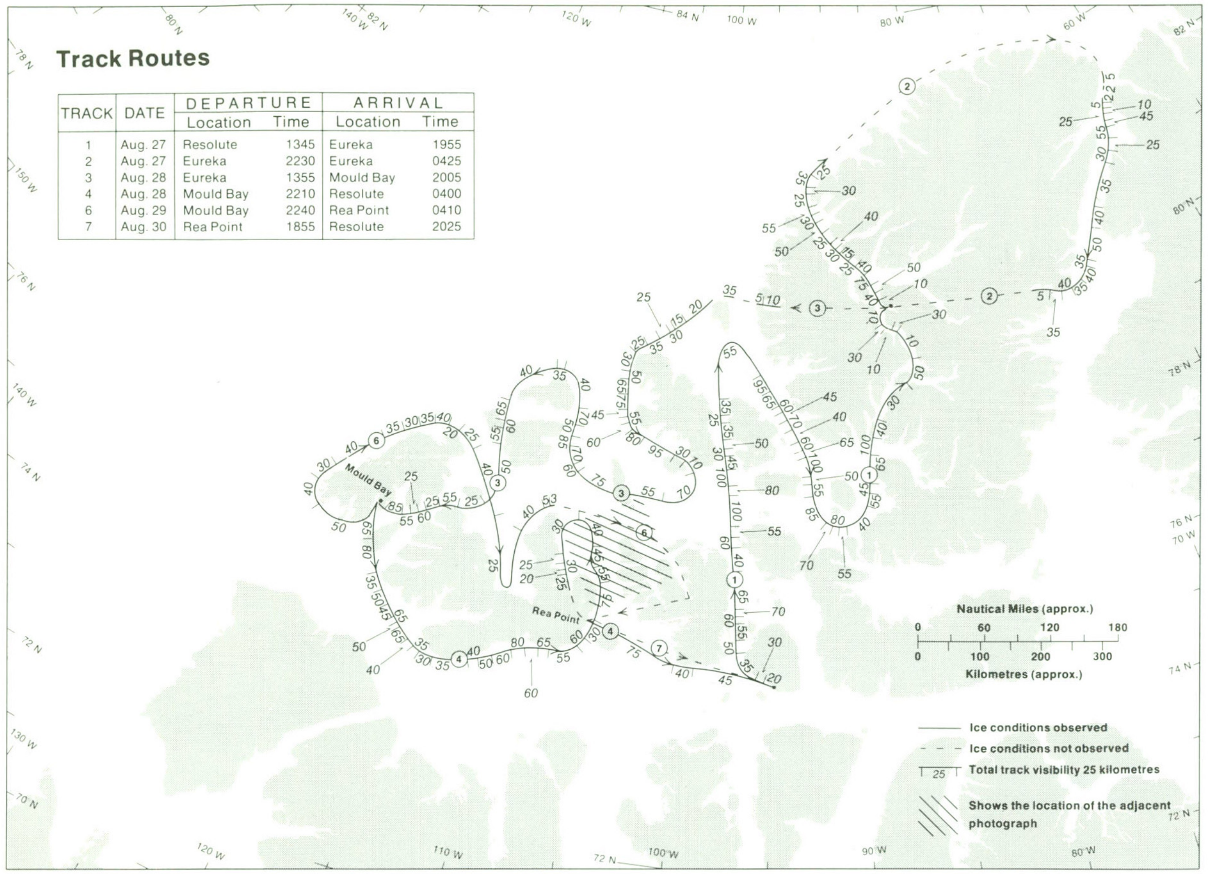
Multi-year ice was drifting south from M'Clintock Channel through Larsen Sound and into Queen Maud Gulf. A similar invasion was underway in the northern part of Prince of Wales Strait.

The satellite photograph of the Beaufort Sea taken on August 24 covers the same area as the image taken on July 19 which is part of Map 3–1977 WEST. During the five-week interval between the two photographs, the ice edge remained in the same position. There is little or no difference in the two photographs taken July 19 and August 24.

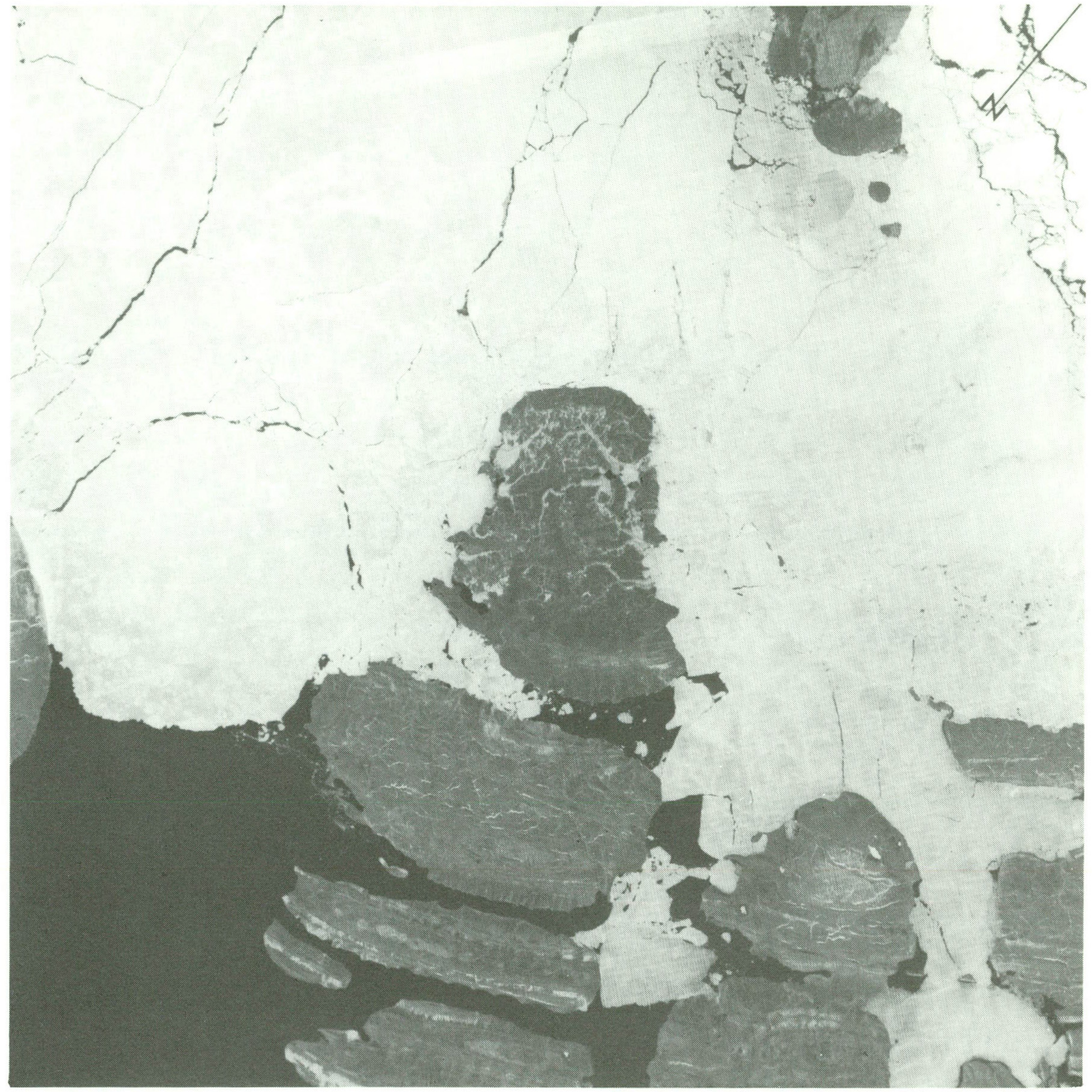


MAP 4 - 1977 WEST

August 17 - 24, 1977



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 27	Resolute	1345	Eureka	1955
2	Aug. 27	Eureka	2230	Eureka	0425
3	Aug. 28	Eureka	1355	Mould Bay	2005
4	Aug. 28	Mould Bay	2210	Resolute	0400
6	Aug. 29	Mould Bay	2240	Rea Point	0410
7	Aug. 30	Rea Point	1855	Resolute	2025



Desbarats Strait, August 27, 1977, T60 F5

MAP 5-1977 East

August 27-31

Flight Effectiveness

Four days were required to complete the tracks for Flight 5. The weather was much better than usual for this time of year and all the key areas and ice edges were observed and mapped. The flight was 80 per cent successful.

Ice Conditions

Flight 5 commenced three days after the previous flight was completed. The noticeable changes were in Nares Strait where multi-year ice had moved further south into Baffin Bay along the southeast coast of Ellesmere Island. The ice edge in Nansen Sound moved further north and the broken ice moved south toward Eureka Sound. In Norwegian Bay the northern half became ice-free. Concentrations in the southern half increased but not as much as expected due to ice moving from the north because ablation and melting were still reducing the extent of the pack ice in the area. The ice edges in Massey Sound, Hassel Sound and Byam Martin Channel remained intact and the solid ice cover did not allow any movement into the areas south of these channels. However, a channel opened up through eastern Prince Gustaf Adolf Sea and this meant that movement from the Arctic Ocean could take place when conditions were favourable. Ballantyne Strait had partially broken and large cracks were appearing throughout the solid ice cover to the north of Byam Martin Channel. New ice started to grow in the open area in the northern part of Massey Sound. The puddles were all frozen.

Apart from the abnormally large area of ice-free water, there were no departures from the usual sequence of break-up ablation and clearing.

Unobserved Areas

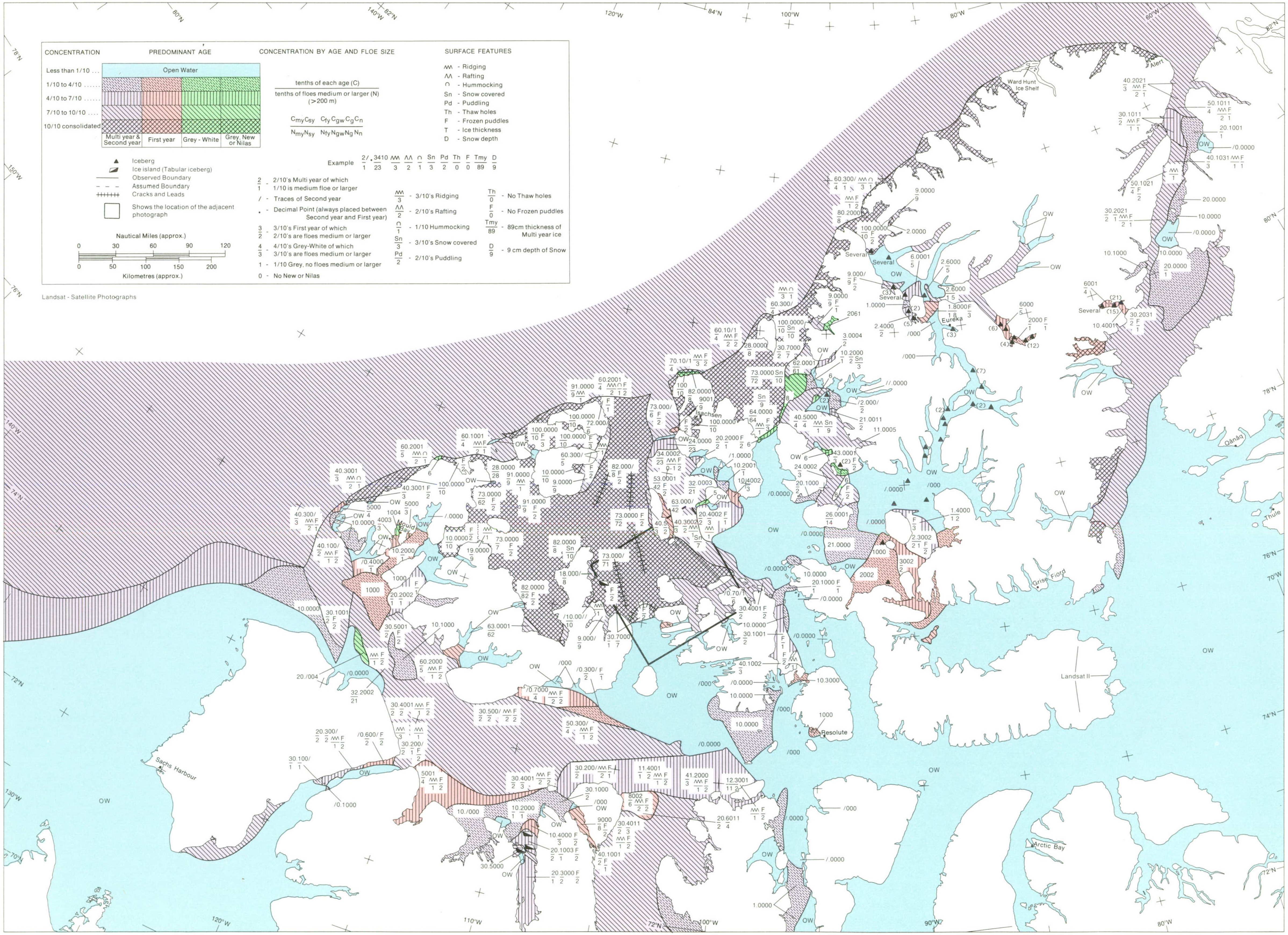
The ice conditions shown on the map for the northern coast of Axel Heiberg Island and Ellesmere Island were established from subsequent tracks over these areas. Landsat 2 satellite photographs were interpreted to show the conditions in eastern Barrow Strait, Lancaster Sound and all of its adjacent channels as well as the northern part of Baffin Bay.

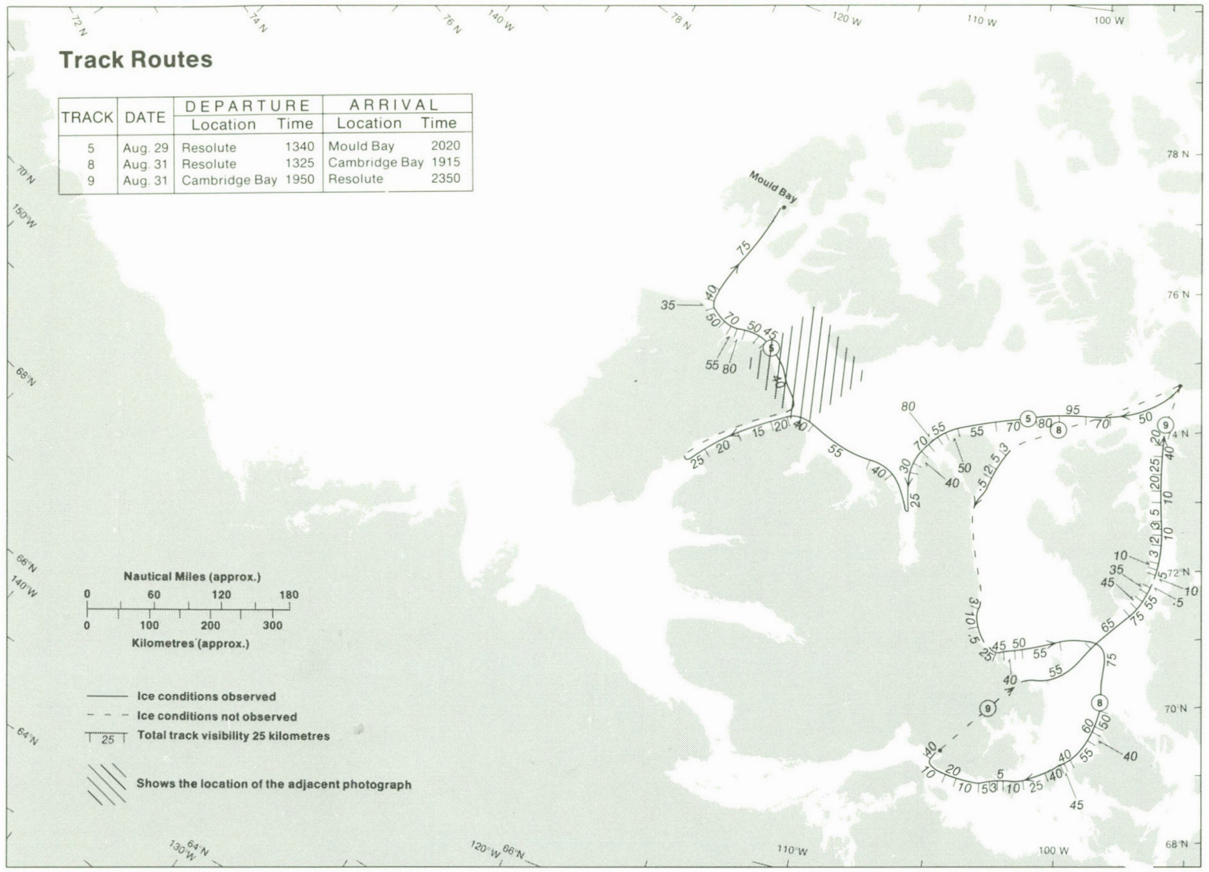
Comments

The area of open water present in the eastern half of the region rivaled the ice-free development of the best seasons (1962, 1973) yet recorded. The season here was much further advanced than usual. In the western part of Map 5 – 1977 EAST the break-up and ablation were just about typical.

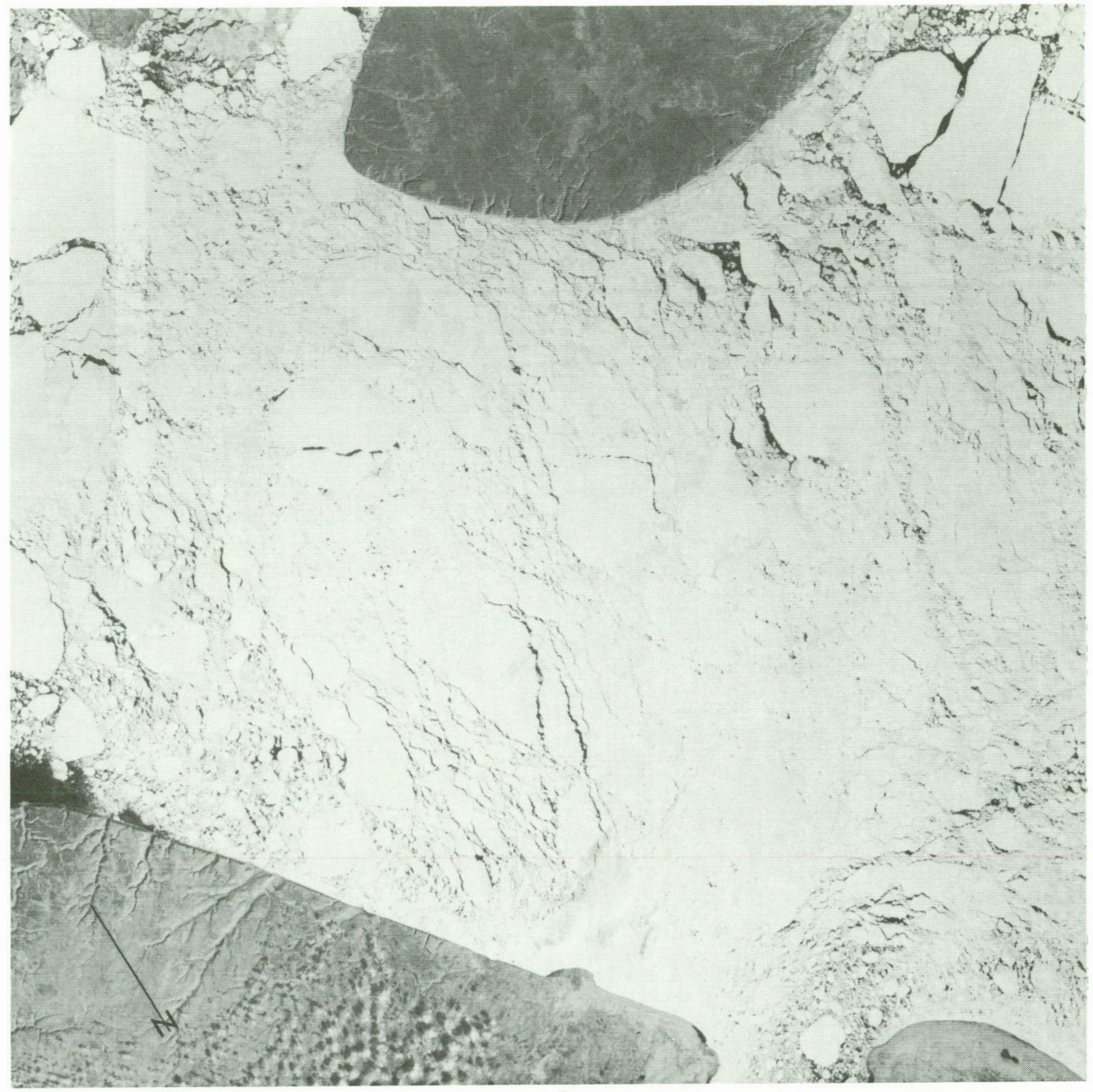
Ice was in motion, mainly toward the south, in many areas. From Nares Strait it was moving into Baffin Bay. Ice was drifting through the narrow channels of Hell Gate into Jones Sound. In Norwegian Bay some of the ice moved, the rest melted, about 70 km further south in nine days between August 18 and 27. Movement in Nansen Sound from August 18 to 27 was about 70 km.

The ice barrier across the southern part of Byam Martin Channel still remained because a giant floe plugged the entrance to the southern channels and did not allow the movement required for break-up to advance north toward Prince Gustaf Adolf Sea. The satellite photograph shows the giant floe and the crack patterns which are ready to expand into a fractured and moving ice cover as soon as the barrier across the strait disintegrates.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Mould Bay
Grise Fiord
Thule
Qânâq
Resolute
Sachs Harbour
Arctic Bay
Landsat II
OW



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
5	Aug. 29	Resolute	1340	Mould Bay	2020
8	Aug. 31	Resolute	1325	Cambridge Bay	1915
9	Aug. 31	Cambridge Bay	1950	Resolute	2350


Eastern M' Clure Strait, August 29, 1977, T62 F7

MAP 5-1977 West

August 27-31

Flight Effectiveness

The weather was excellent for the surveys carried out over the western part of the region on August 28 and 29 and the tracks approached 100 per cent effectiveness. Typical weather prevailed for tracks 8 and 9 and they were a little better than 50 per cent effective. Overall, Flight 5, 1977 WEST was 75 per cent successful.

Ice Conditions

Maps 4 and 5 – 1977 WEST are very similar because no immediately obvious changes have taken place between them. This is reasonable since only about a week separated observations in the same areas. However, as will be noted in the subsequent section, movements had occurred.

No departures from the normal patterns of break-up and clearing were noted.

Unobserved Areas

Satellite imagery established the conditions shown on the map for the channels along the waterway from Spence Bay to Amundsen Gulf as well as the eastern half of the Beaufort Sea. The distributions on the remainder of the Beaufort Sea were established from information provided by AES, U.S. Navy Fleet Weather Facility and Landsat 2 images.

Comments

Ice conditions throughout the area were generally a little better than usually expected at this time of year.

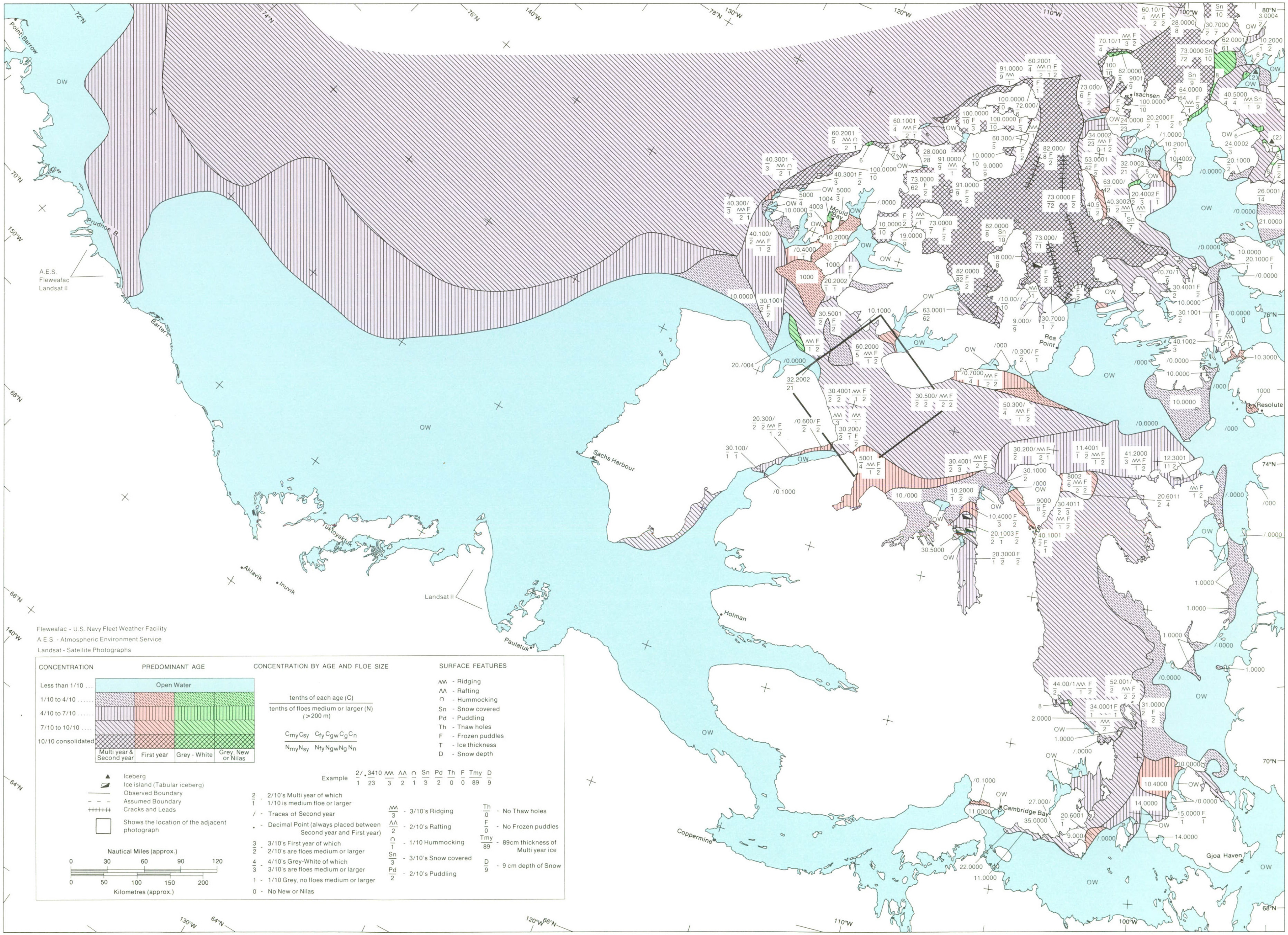
The ice island frozen in Hadley Bay had broken up along with the ice cover in the area into about 30 pieces of varying size. These fragments would remain trapped in the bay.

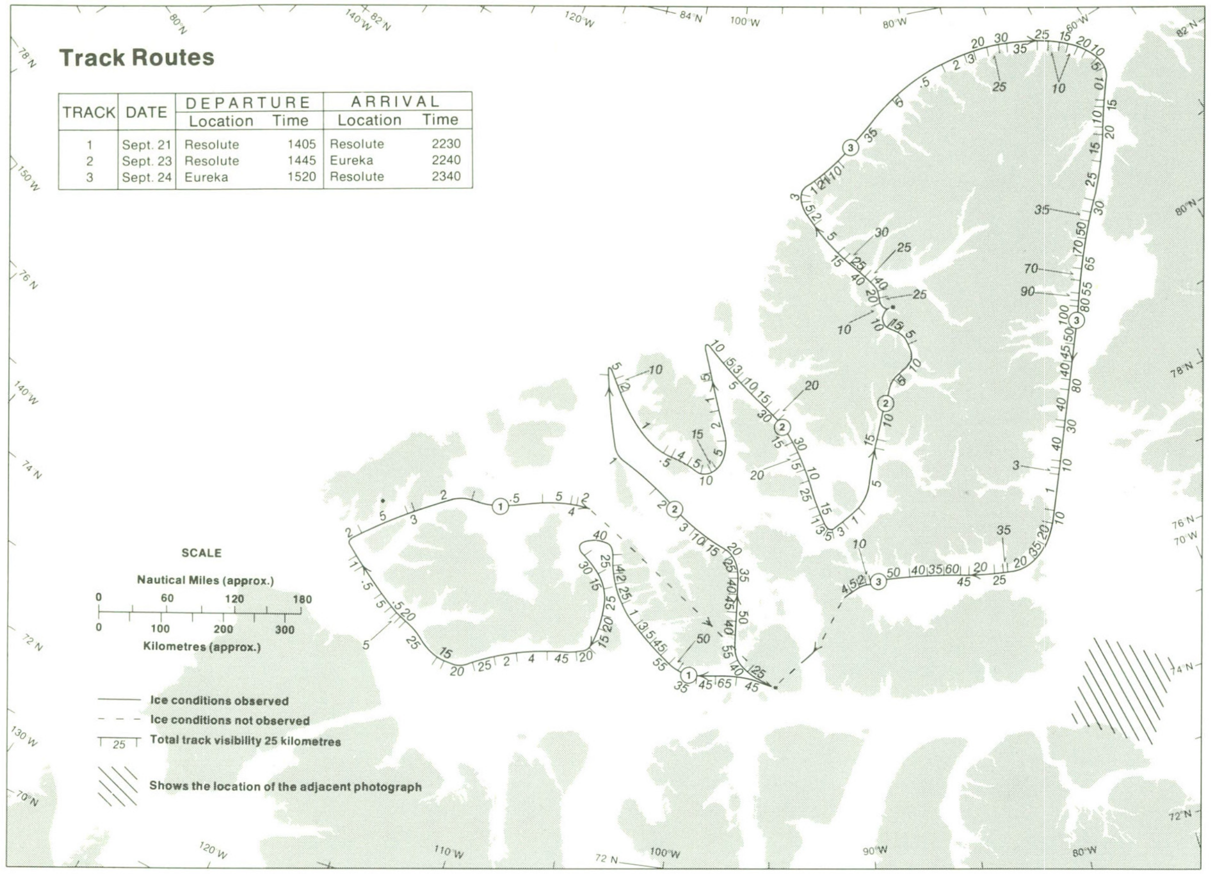
The ice movements that were taking place were easy to overlook but they were numerous. The greatest amount of ice moved south in the Beaufort Sea as the ice edge of the pack drifted about 125 km closer to the coast. This drift took place in less than a week and indicated that the southerly winds that had held the pack ice off shore for so long were now either weakening or being replaced.

Some ice had moved into the northwestern part of M'Clure Strait and the ice in Viscount Melville Sound loosened and expanded north towards the coast of Melville Island. The rate of drift in some areas can be established. Between August 23 and 31 ice moved west in the northern part of Queen Maud Gulf about 150 km. In the same time period ice was squeezed out of Prince of Wales Strait and along the southeast coast of Banks Island, a distance of about 150 km.

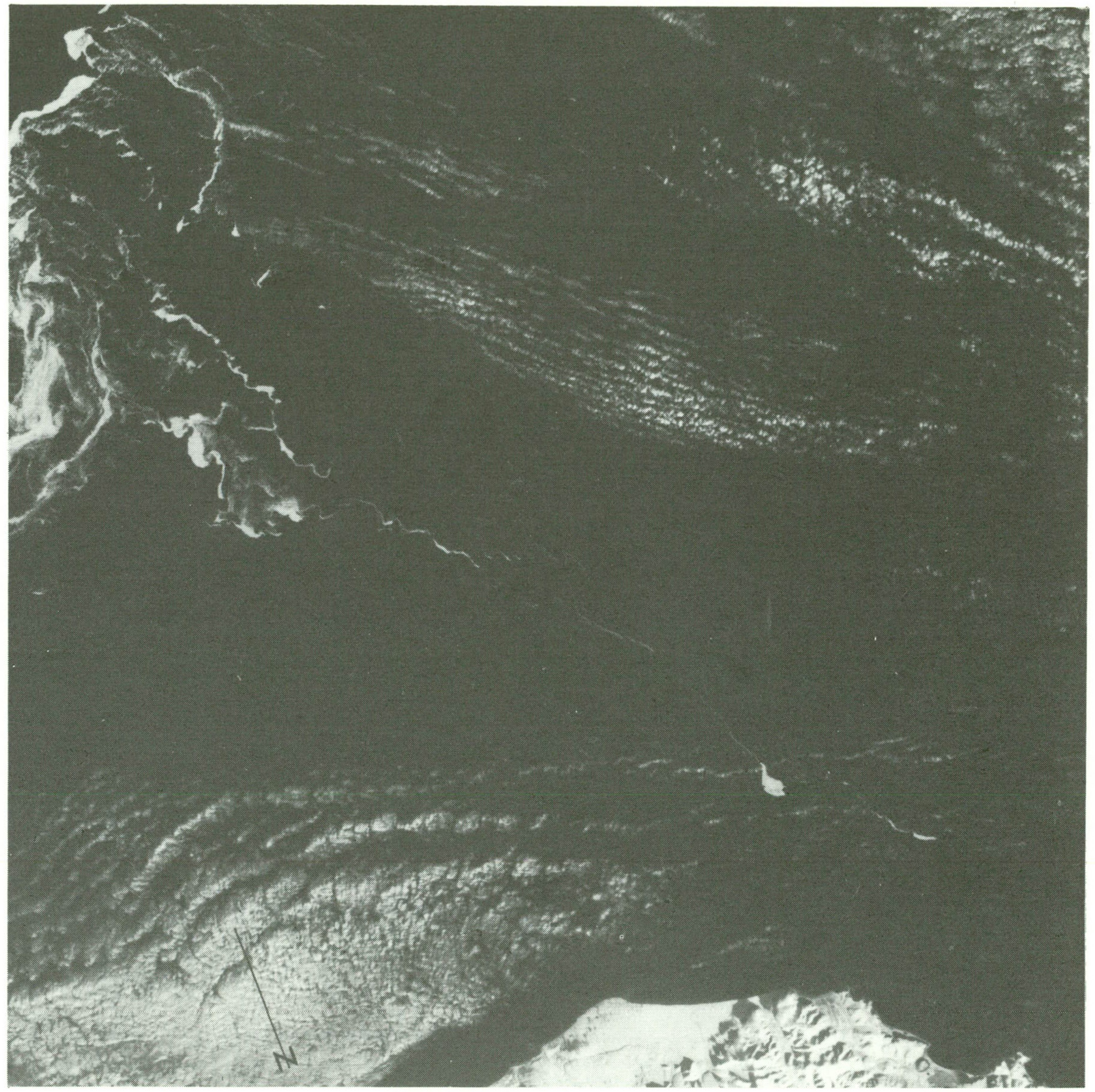
The development of the ice conditions in M'Clintock Channel was a departure from the normal in two ways. First, the ice cover broke up about a month earlier than usual. Secondly, ablation and partial clearing did not occur as expected.

If the resolution of the satellite photograph was good enough it would likely show the ice reconnaissance aircraft as a small speck because both the satellite photo and the observations were made on August 29. The satellite shows the overall conditions and the ground truth results from track 5.


Point Barrow
Prudhoe B.
Barter I.
Sachs Harbour
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Mould Bay
Isachsen
A.E.S. Fleweafac Landsat II
Landsat II
Fleweafac - U.S. Navy Fleet Weather Facility
A.E.S. - Atmospheric Environment Service
Landsat - Satellite Photographs
CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Sept. 21	Resolute	1405	Resolute	2230
2	Sept. 23	Resolute	1445	Eureka	2240
3	Sept. 24	Eureka	1520	Resolute	2340



Eastern Lancaster Sound, September 26, 1977, T36 F7

MAP 6-1977 East

September 21-26

Flight Effectiveness

The flight was 60 per cent effective. The weather throughout the region was exhibiting the usual fall conditions. Very low ceilings under stratus clouds, fog, rain, freezing drizzle and snow reduced visibilities and kept the observing altitude in the range of 100 m. The capabilities of the twin otter to cope with these conditions and the very accurate Global Navigation System were absolute necessities. A radio blackout, due to ionospheric conditions, made it difficult to obtain weather reports and resulted in a few shortened tracks due to the necessity to have some fuel reserve if landing conditions were unfavourable.

The flight started four days late because of other demands on the aircraft. A heavy snowfall on land and ice made it difficult to identify ice types in some areas.

Ice Conditions

Many changes had taken place in the three weeks between flights 5 and 6. New ice types appeared in the open areas in the northern half. The solid covers in Sverdrup Channel, Peary Channel and Prince Gustaf Adolf Sea had fractured. The ice cover in Hazen Strait and all adjoining areas had broken. The multi-year ice in Kennedy Channel had drifted south and concentrations in Smith Sound and northern Baffin Bay were very similar to those noted three weeks earlier.

The ice cover on Nansen Sound remained solid. The winds had shifted the ice in other areas; for example, in Norwegian Bay the ice moved to the northeast, in Massey Sound it moved to the east, in the unnamed sea south of Ellef Ringnes Island it moved east and south into Penny Strait, and it moved south through Byam Martin Channel. Probably some multi-year ice moved into the archipelago through Prince Gustaf Adolf Sea.

The situation was typical and the only slight departure from normal was the lack of southerly drifts through many of the channels. As noted earlier the wind directions were not favourable for these movements.

Fresh snow had fallen and in many areas it appeared to be quite thick.

Unobserved Areas

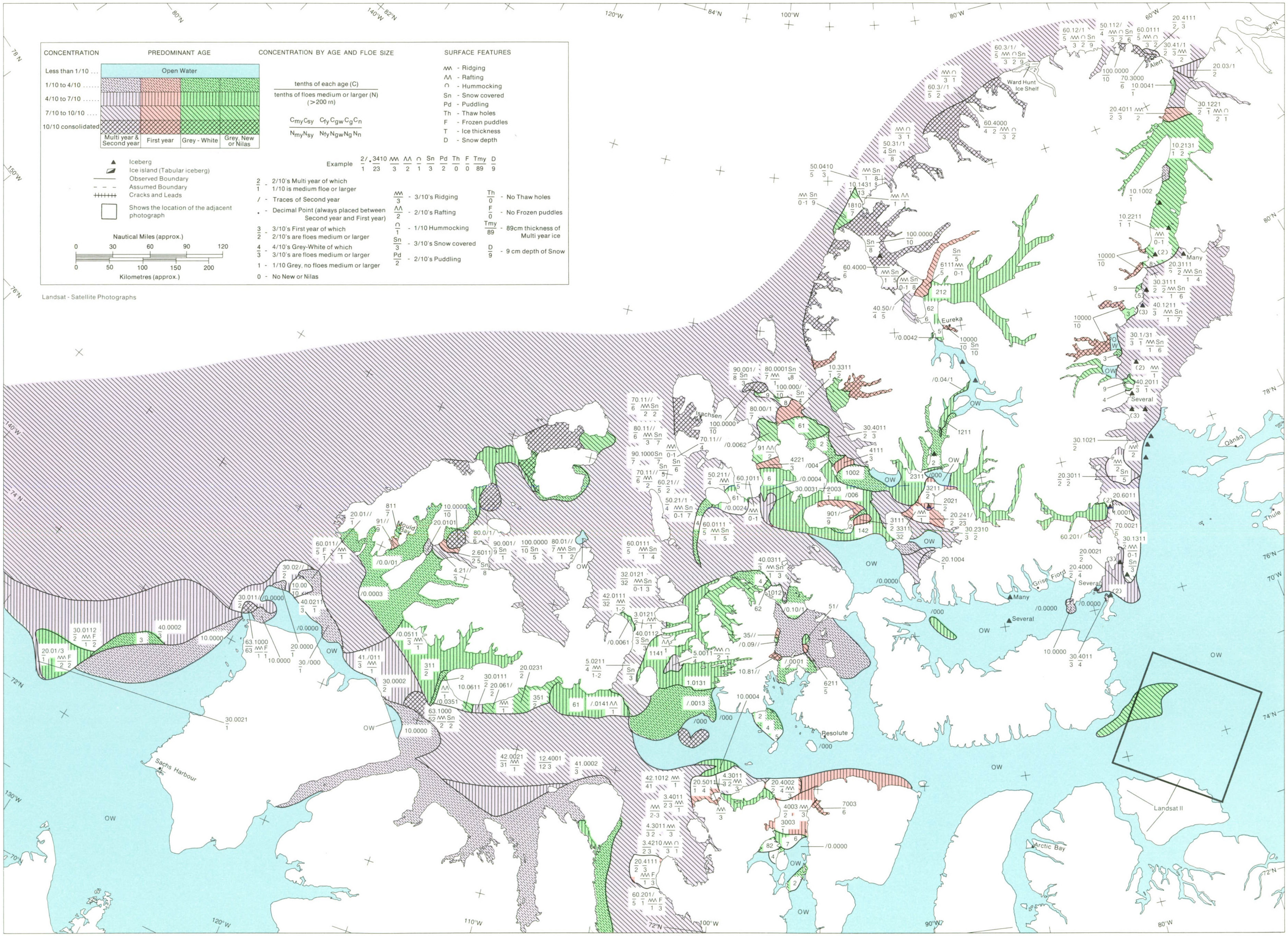
The conditions along the northern part of the archipelago from Prince Patrick Island to Nansen Sound are based on the results of adjacent surveys, typical conditions expected, interpretations of satellite photographs and information from subsequent surveys.

The interpretation of satellite photographs was the main source of information to prepare the map in the southeastern area.

Comments

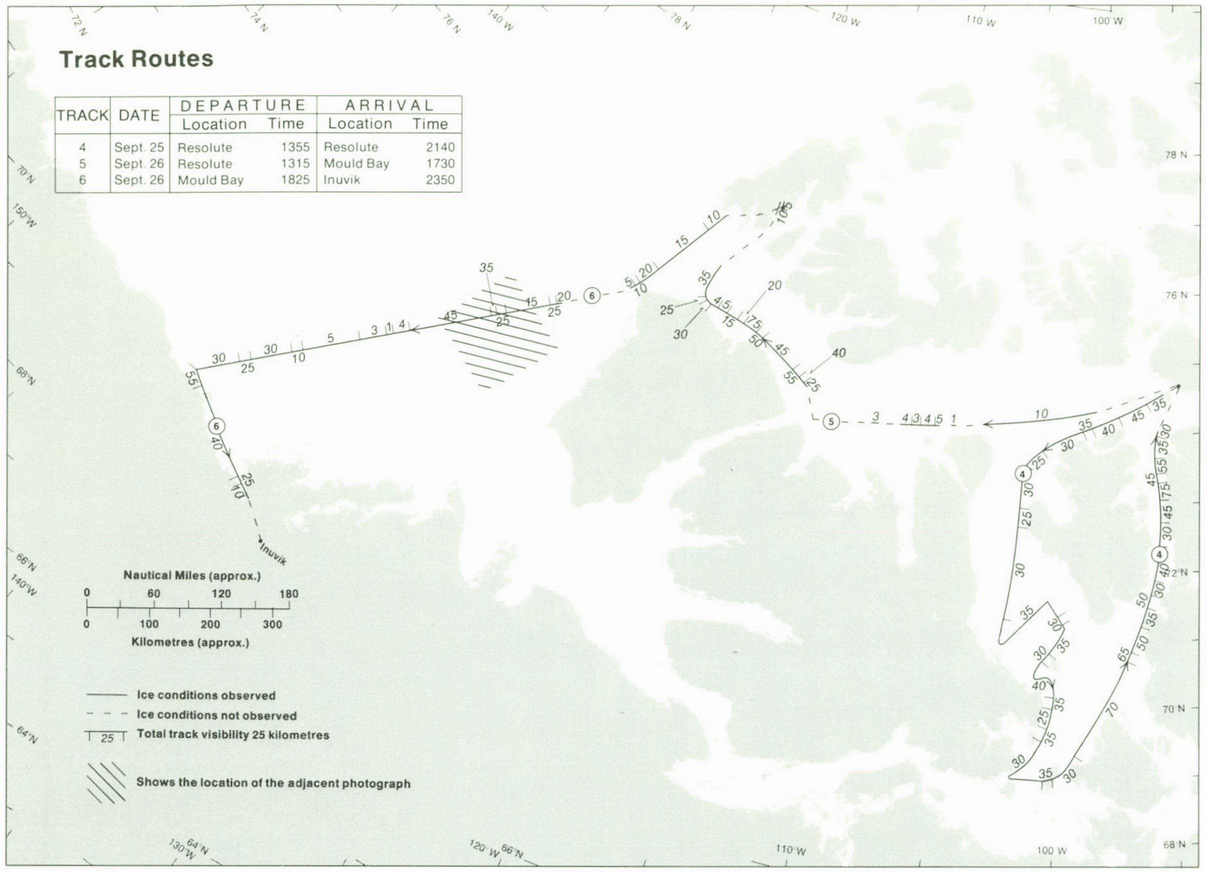
Although all the channels except northern Nansen Sound had broken, leaving unusually large expanses of open water, very little movement to the south had taken place between mid-August and late September.

Some satellite photographs appear to show some types of ice better than they appear to an observer. Clouds are spread out over much of this photo. Ice does appear in the northwest. Probably there is more ice than appears to the eye because the camera cannot resolve individual pieces less than about 80 m across.



MAP 6 - 1977 EAST

September 21 - 26, 1977



Northeastern Beaufort Sea, September 25, 1977, T71 F8

MAP 6-1977 West

September 21-26

Flight Effectiveness

Visibilities during track 4 were very good. Seasonable weather, low stratus cloud, fog, rain, freezing drizzle and snow showers reduced visibilities during parts of the remaining tracks. The flight was 70 per cent effective.

Ice Conditions

New ice was forming and shifts in distributions were the basic changes during the three weeks separating flights 5 and 6. The movements were unique to each area and no overall drift pattern prevailed. For example, the ice edge in the Beaufort Sea moved about 100 km further north and 125 km to the east of its previous position and a northeast drift also took place south of Prince of Wales Island across Larsen Sound and into Franklin Strait and southern Peel Sound. While these drifts were underway, ice moved south into Prince of Wales Strait and a similar shift took place in the northern parts of M'Clure Strait and Viscount Melville Sound. The southerly drift through Byam Martin Channel and into Viscount Melville Sound probably started at the beginning of September. In the three-week interval ice had moved about 200 km south through Byam Channel to the west of Byam Martin Island and two pieces which could have been the remains of the giant floe that plugged the channel, see the photograph for Flight 5, 1977 EAST, had drifted a similar distance through Austin Channel. An easterly drift was obvious in M'Clintock Channel where a band of new ice developed in the open area along the east coast of Victoria Island. The ice was also moving in an easterly direction through the southern part of Barrow Strait. The ice in M'Clure Strait was being moved back toward the north.

No significant departures from the usual patterns of advance and clearing were noted. Very little snow had fallen. The ice in southern M'Clure Strait and northern M'Clintock Channel was very blue in colour.

Unobserved Areas

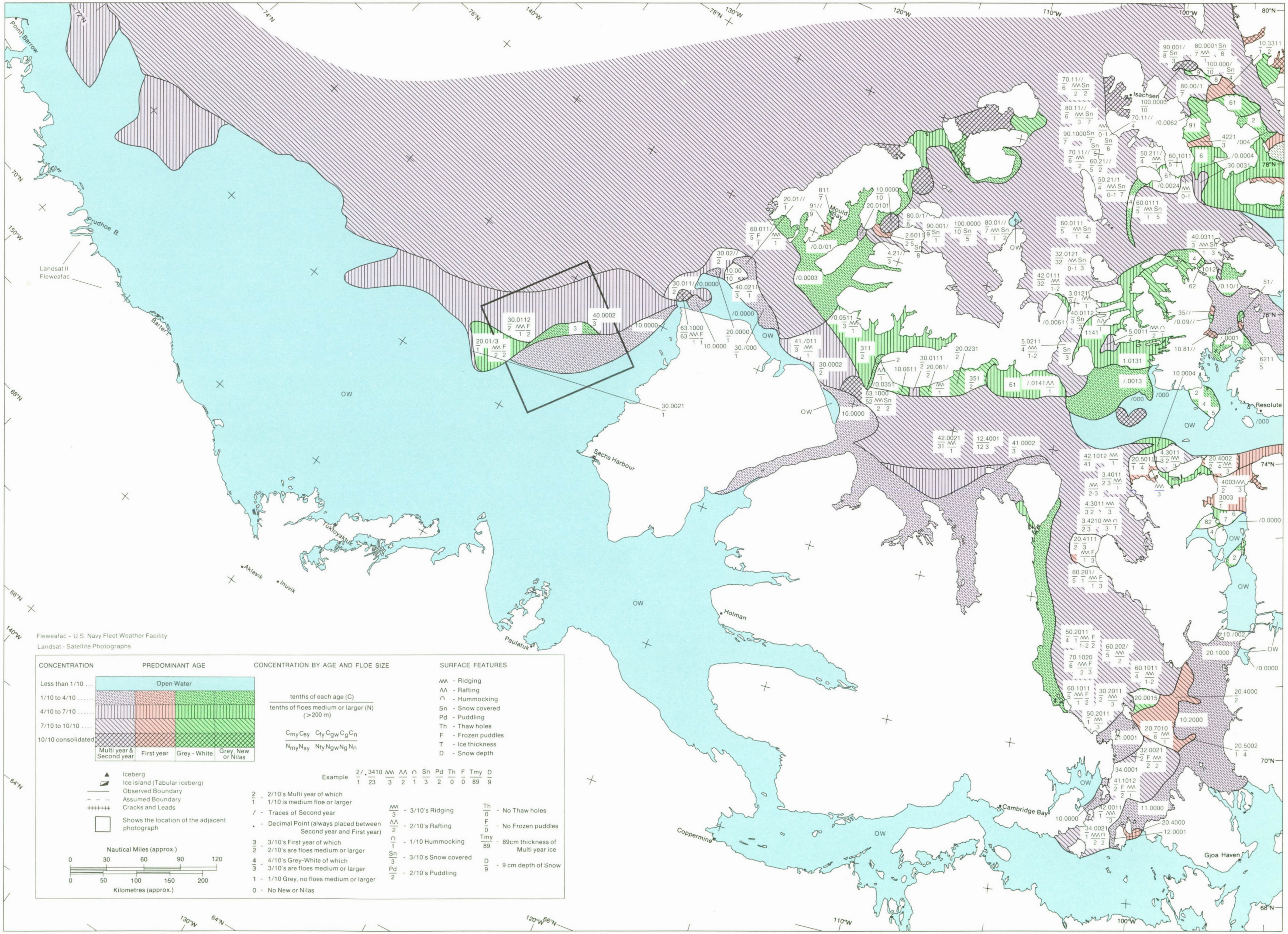
Fortunately the ice edges in the Beaufort Sea and Queen Maud Gulf were established visually. This along with information interpreted from satellite photographs provided the basis to establish the conditions in the southern part of the region from Point Barrow to Spence Bay.

Comments

Generally the ice conditions in the region were much better (i.e. much less concentrated than they usually are at the same time in a typical year.)

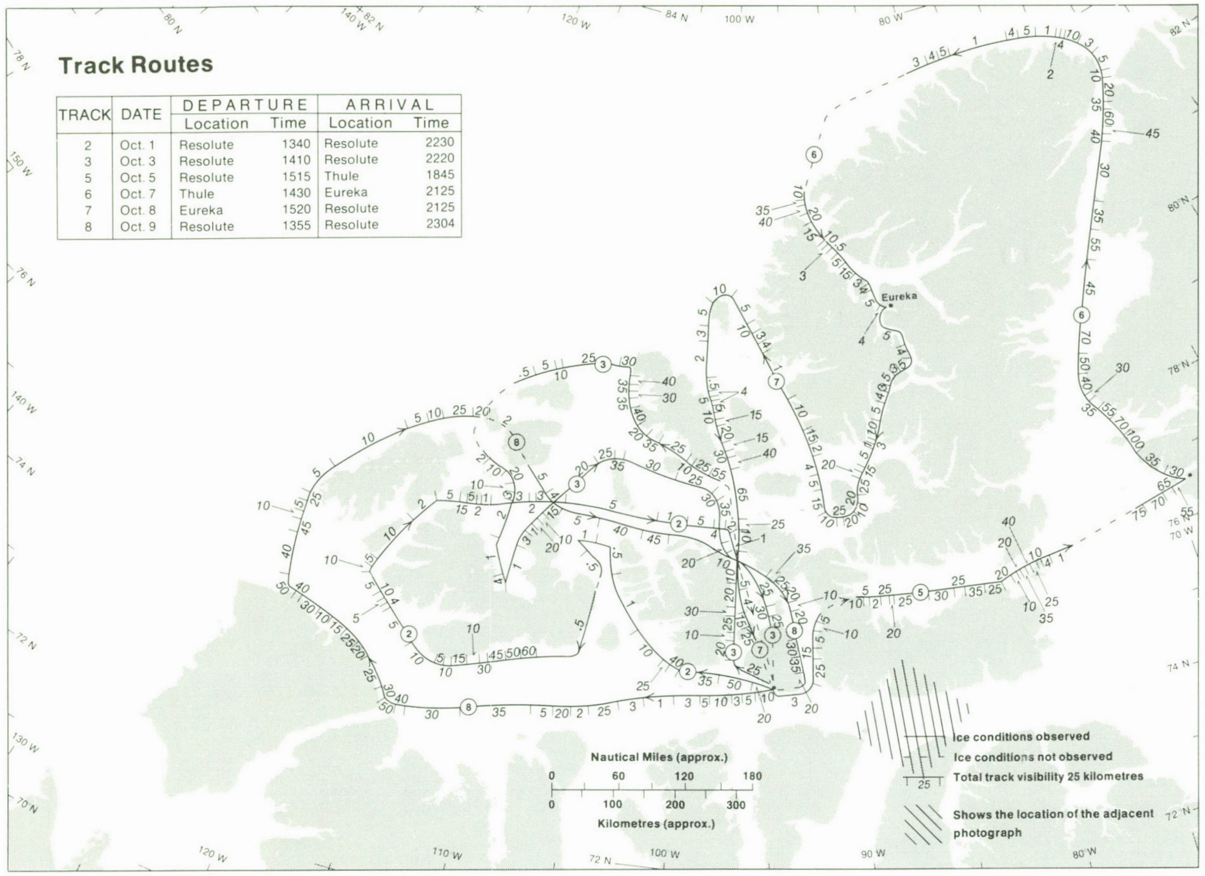
Movements during the first three weeks of September were to the north in some areas, northeast in others, and to the east and south. In most years, a dominant drift direction prevails, but in 1977 instead of any one dominant weather system a series of small systems traversed the area.

The satellite photograph was taken the day before the area was surveyed and although distributions and concentrations have changed the ice edge remained relatively stationary.



MAP 6 - 1977 WEST

September 21 - 26, 1977



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
2	Oct. 1	Resolute	1340	Resolute	2230
3	Oct. 3	Resolute	1410	Resolute	2220
5	Oct. 5	Resolute	1515	Thule	1845
6	Oct. 7	Thule	1430	Eureka	2125
7	Oct. 8	Eureka	1520	Resolute	2125
8	Oct. 9	Resolute	1355	Resolute	2304

MAP 7-1977 East

September 30-October 9

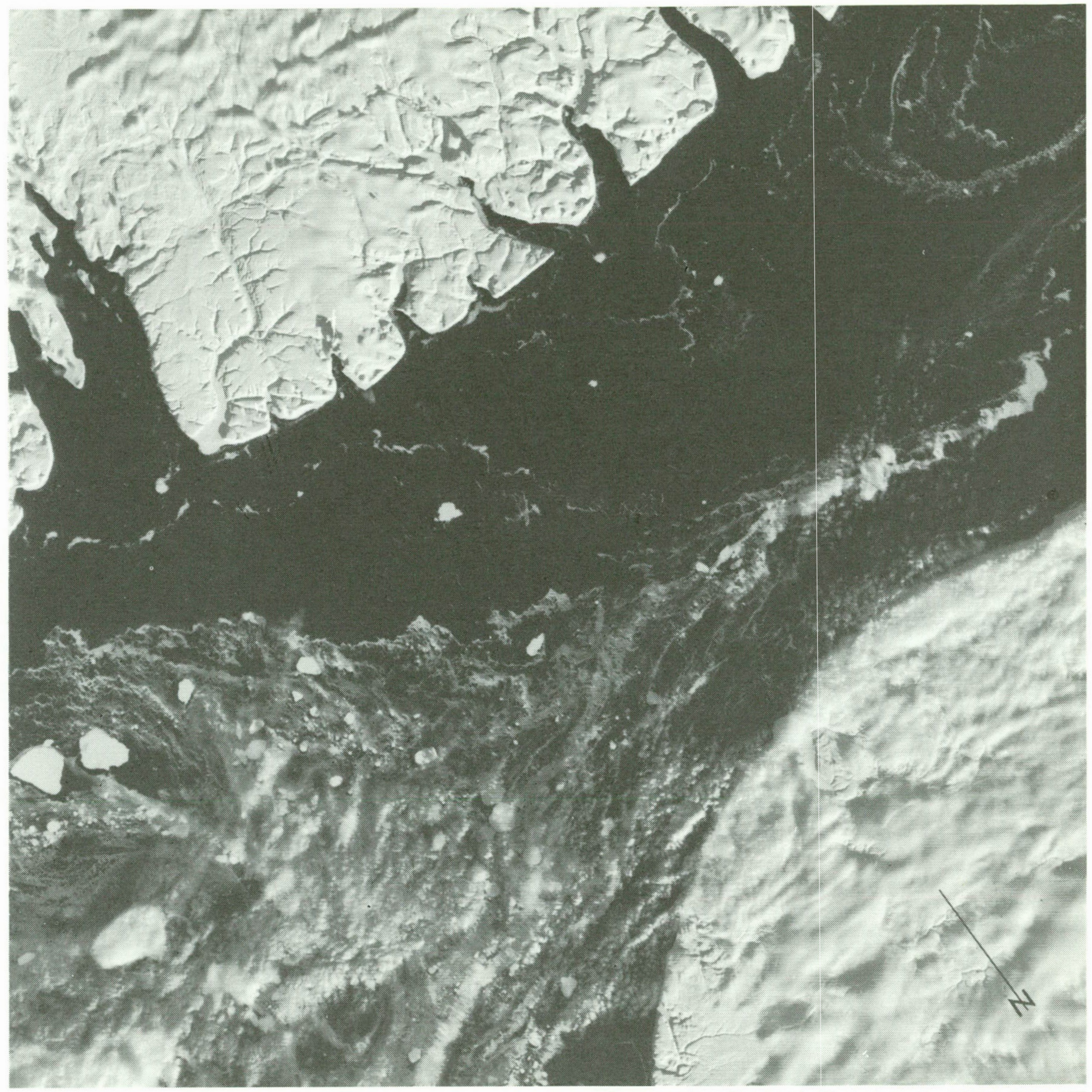
Flight Effectiveness

The weather was bad for the first half of Flight 7. It improved to the usual low cloud, fog and ice haze for the later portion. The Global 500 navigation system was unreliable. This combined with poor visibilities and low sun angle reduced the effectiveness to about 70 per cent. Although the horizontal visibilities were very limited and the overall picture of the ice conditions was not immediately available, it did emerge when it was related to previous and subsequent flights.

Ice Conditions

By the first week in October the mean daily temperatures were hovering around −20°C. New ice had continued to expand in Norwegian Bay, all of Jones Sound, Barrow Strait and throughout the length of Lancaster Sound. Only the central parts of Baffin Bay remained ice-free. Multi-year ice moved south from the Arctic Ocean through Lincoln Sea, Robeson Channel, Hall Basin and invaded Kennedy Channel. Movement in Nansen Sound, Greely Fiord and most of Eureka Sound had ceased but there was still movement in Massey Sound where multi-year ice was making its last push toward the southern part of the sound. The new ice cover in much of Hassel Sound had grown to thin, first-year ice. In the unnamed sea south of Ellef Ringnes Island a part of the ice drifted northeast while the remainder stayed in place near Lougheed Island. Movement into Prince Gustaf Adolf Sea was probably limited. The movement from Byam Martin Channel south was likely a result of the expansion of the broken ice cover. The quantity of ice moving through Maclean Strait from Prince Gustaf Adolf Sea appeared to be very limited. The areas of new ice along the east coasts of Prince Patrick Island and Melville Island indicated a general easterly drift in the adjacent waterways. A long tongue of multi-year ice drifting from Viscount Melville Sound had moved east to Lancaster Sound through the central part of Barrow Strait.

The ice was covered with snow in most areas. In the area south of Ellef Ringnes Island it appeared to be particularly thick.



Lancaster Sound, October 3, 1977, T43 F7

Unobserved Areas

Adjacent observations combined with conditions usually present in the area were used to make the map along the unobserved part of the Arctic Ocean adjacent to the archipelago. Satellite imagery was interpreted to arrive at the conditions shown in Lancaster Sound and adjoining channels and in the unobserved portion of Baffin Bay.

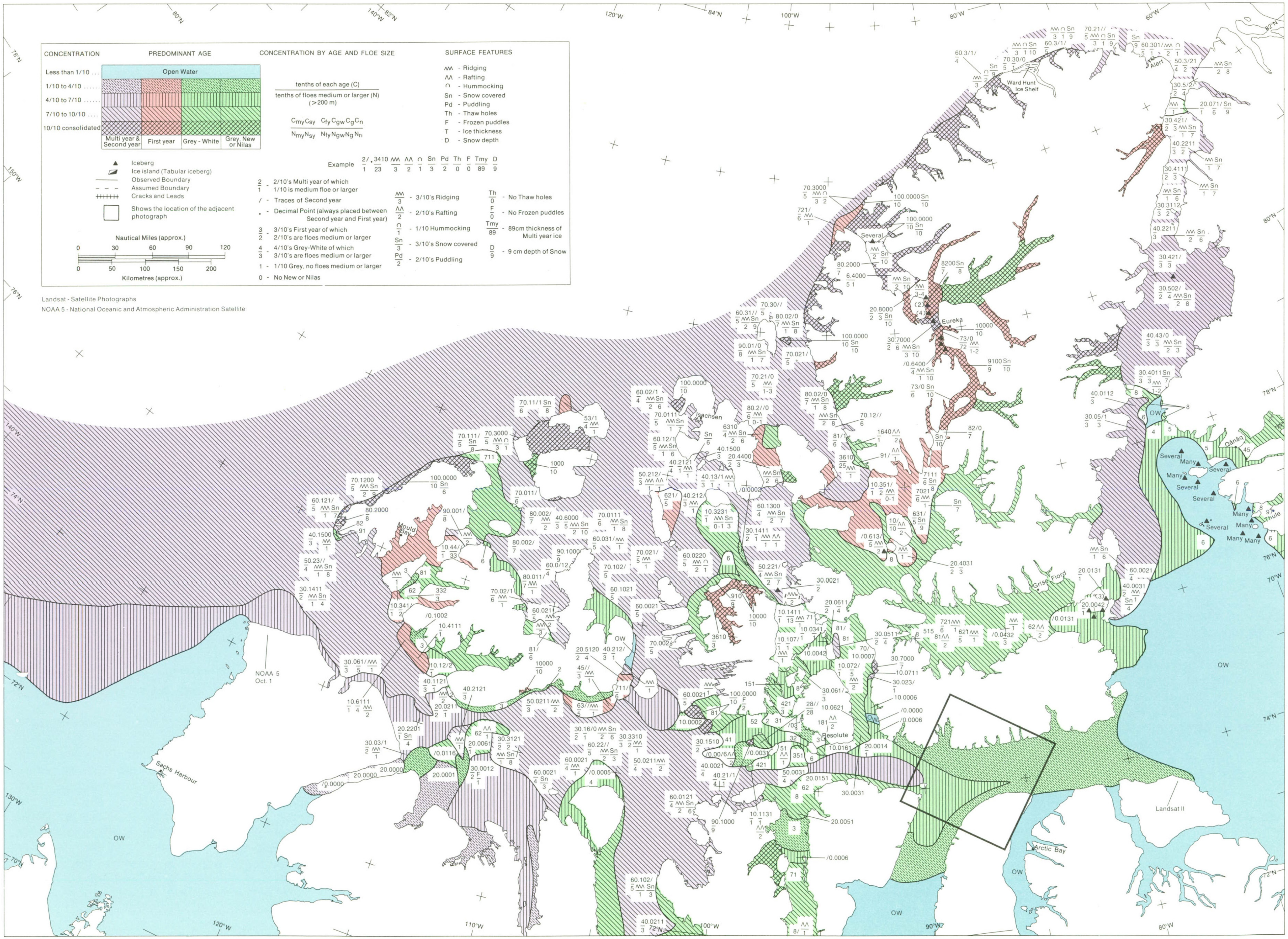
Comments

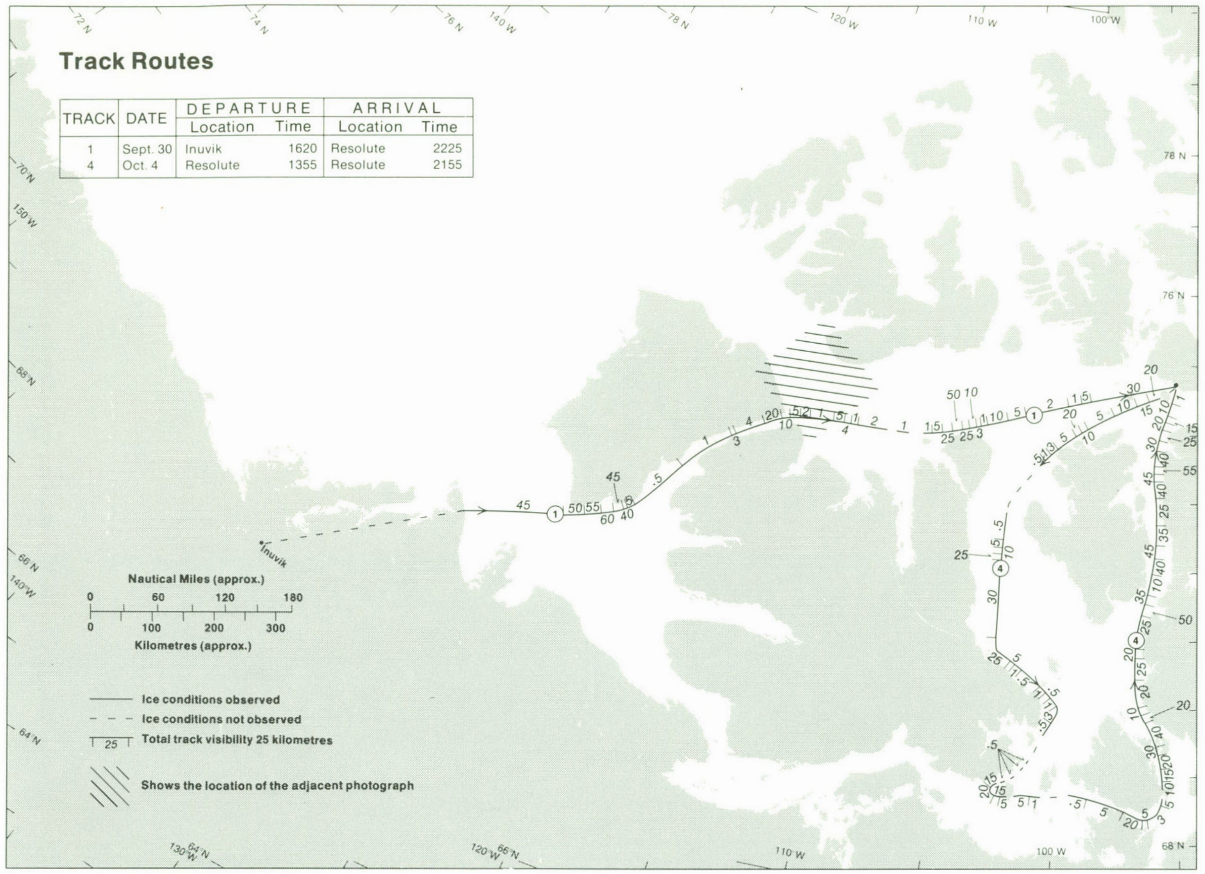
Freeze-up was advancing at its usual rate and in its typical fashion whereby the solid ice cover gradually radiates from north to south.

When Austin Channel was surveyed on September 21 the ice edge was 100 km further north than it was on October 1. The multi-year ice had moved south through the channel while the two massive floes at the southern entrance only moved a few km further northeast.

In Lancaster Sound the map with its continuous colour and line patterns makes it appear that a lot of ice is present. The satellite photograph seems to indicate only limited amounts. Probably a new ice cover existed in Admiralty Inlet and the channels around Bylot Island but there was not even a hint of it on the satellite photographs.

The apparent disappearance of multi-year ice in Norwegian Bay between flights 6 and 7 took place because the snow cover along with limited visibilities masked the telltale characteristics of a multi-year ice cover.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Landsat - Satellite Photographs
NOAA 5 - National Oceanic and Atmospheric Administration Satellite
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Mould Bay
Grise Fiord
Resolute
Sachs Harbour
Arctic Bay
Thule
Qânâq
NOAA 5 Oct. 1
Landsat II
OW



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	Sept. 30	Inuvik	1620	Resolute	2225
4	Oct. 4	Resolute	1355	Resolute	2155

MAP 7-1977 West

September 30-October 9

Flight Effectiveness

Seasonable weather restricted the observing altitude to 30 m in many areas and the ice haze and fog reduced horizontal visibilities to a narrow swath 5 km wide. In spite of these conditions, visual contact with the ice was maintained almost continuously. If the Global 500 navigation system had not broken down, postponing the track across the Beaufort Sea to establish the ice edge, the flight would have been better than 70 per cent successful. In spite of this problem it was 65 per cent effective.

Ice Conditions

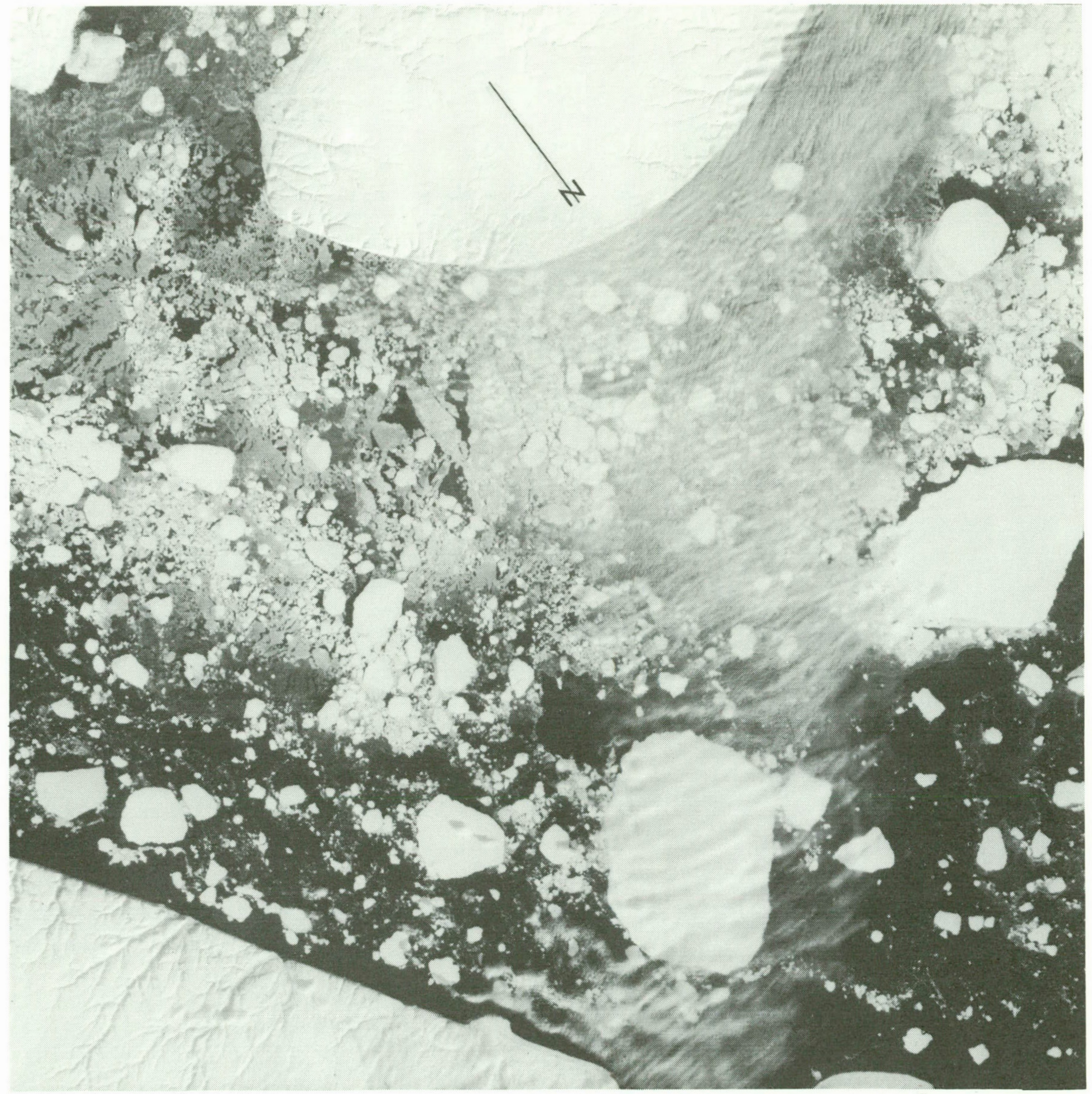
The development of new ice in Peel Sound and Barrow Strait and eastern Viscount Melville Sound was the most obvious change between the two flights. There were a number of other changes particularly related to movement. In the Beaufort Sea the ice edge moved about 75 km south. There was a slight northerly retreat in Prince of Wales Strait, a northerly evacuation in Peel Sound and a small northerly advance in the northern half of M'Clintock Channel. Ice from the Arctic Ocean moved east into M'Clure Strait. This easterly movement continued in Viscount Melville Sound and into Barrow Strait. A northeasterly drift happened in Larsen Sound as the ice shifted to the east side and north into Franklin Strait. The ice in southern M'Clintock Channel shifted further to the west.

The advance of freeze-up was following the usual sequence and timing. No unusual events were noted.

The new snow that covered all the more stable ice types made it difficult to distinguish the older varieties. This problem was mollified somewhat by the fact that all existing first-year ice was now designated as second-year because it had existed for a full year without melting.

Unobserved Areas

Satellite photographs from Landsat 2 and NOAA 5 (U.S. National Oceanic and Atmospheric Administration) were interpreted to make the estimates of ice conditions from Point Barrow to Cambridge Bay.



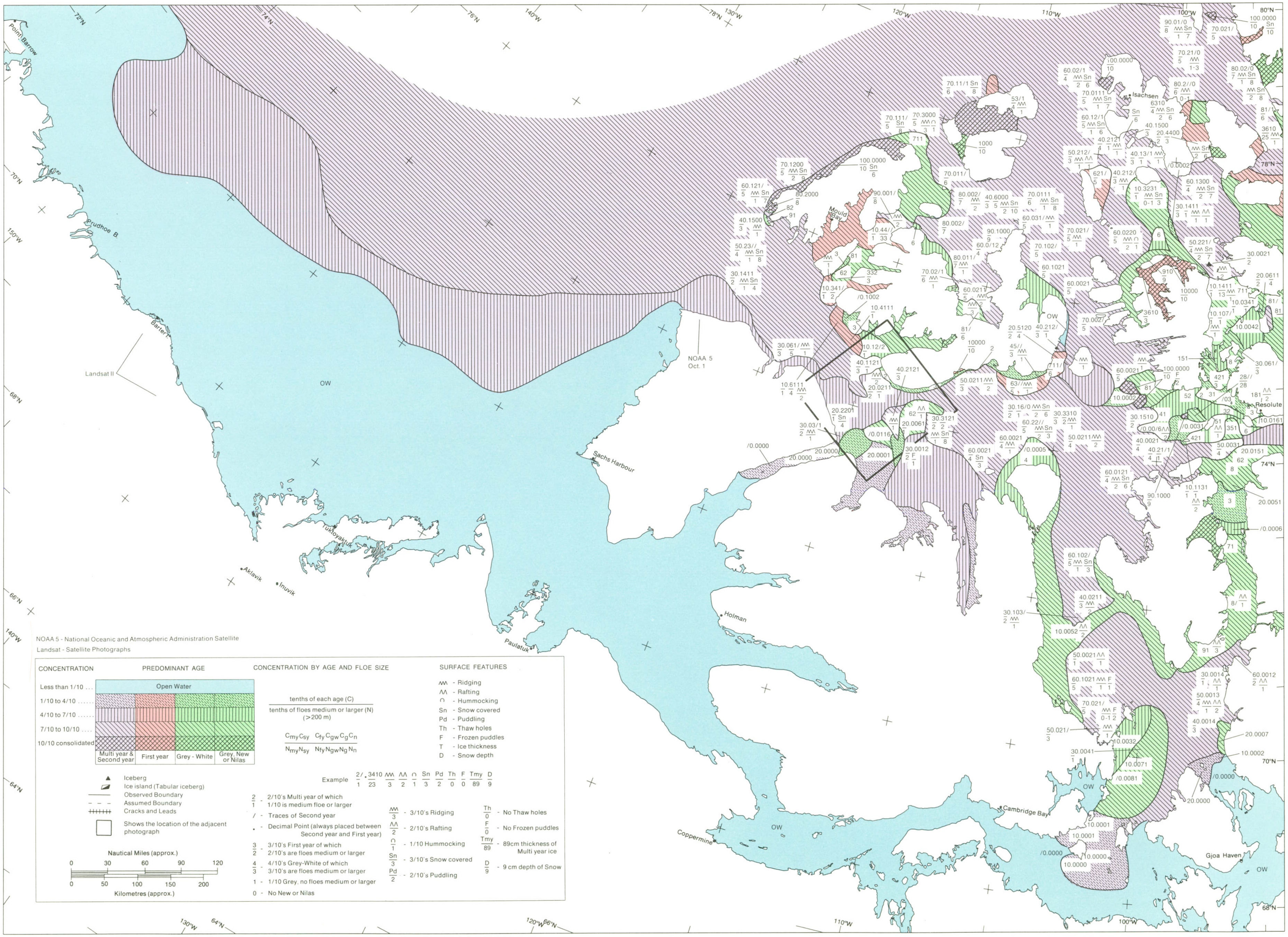
Eastern M' Clure Strait, October 4, 1977, T62 F7

Comments

The ice in the western region, as noted above, had drifted in every direction of the compass during the interval between flights 6 and 7. Two of these many movements, both in Viscount Melville Sound, provide some information on drift rates. The first situation is the movement of the ice edge observed south of Byam Martin Island on September 26. It had moved about 70 km further east by October 9 for a rate of about 5 km per day. The second case requires that the satellite photo accompanying Map 5–1977 WEST be compared with the above photograph. Both photographs cover the same area but they were taken thirty-six days apart. The giant floes, about 25 km per side, shown on both photographs, moved about 150 km. If it is assumed that these were the same floes the drift rate in this area was about 4 km per day.

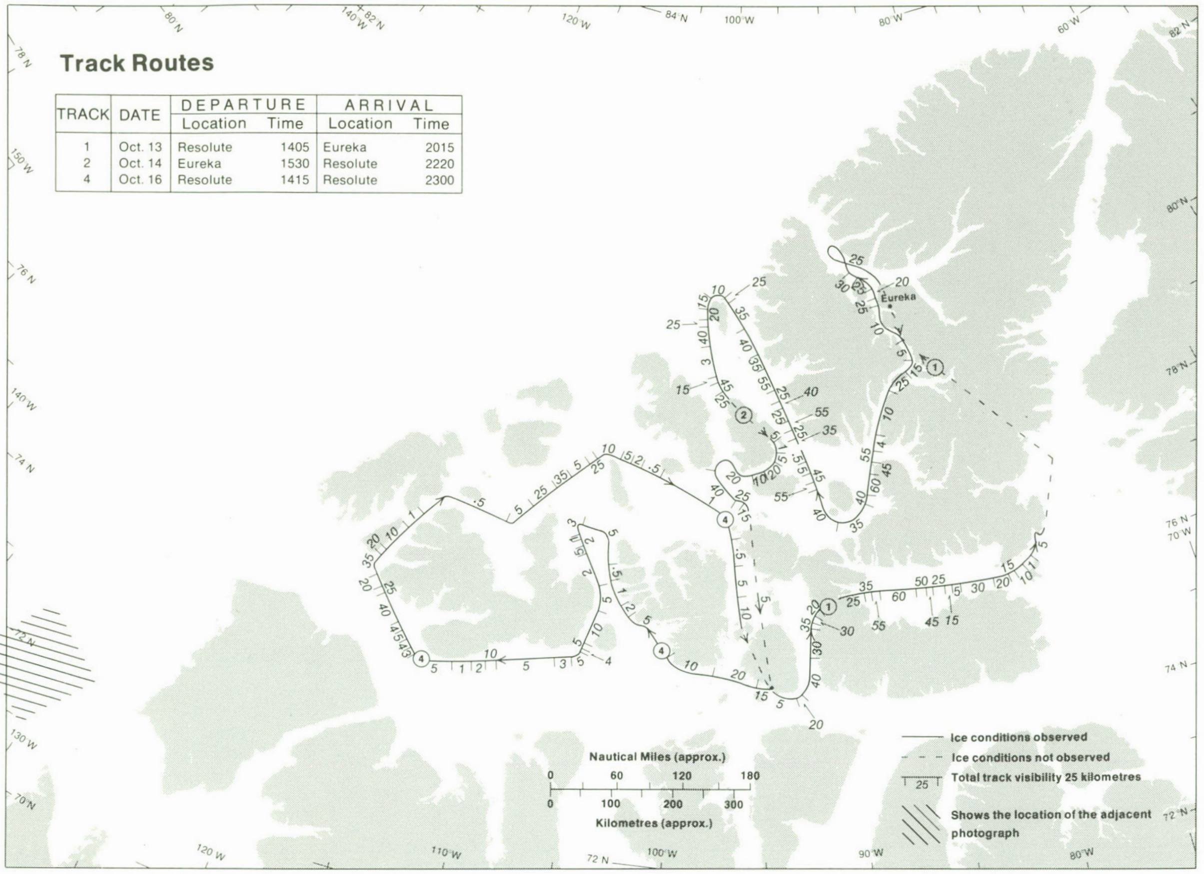
A comparison of the two photographs shows the considerable changes (i.e. clearing) that can take place in September when further ablation and disintegration are least expected.

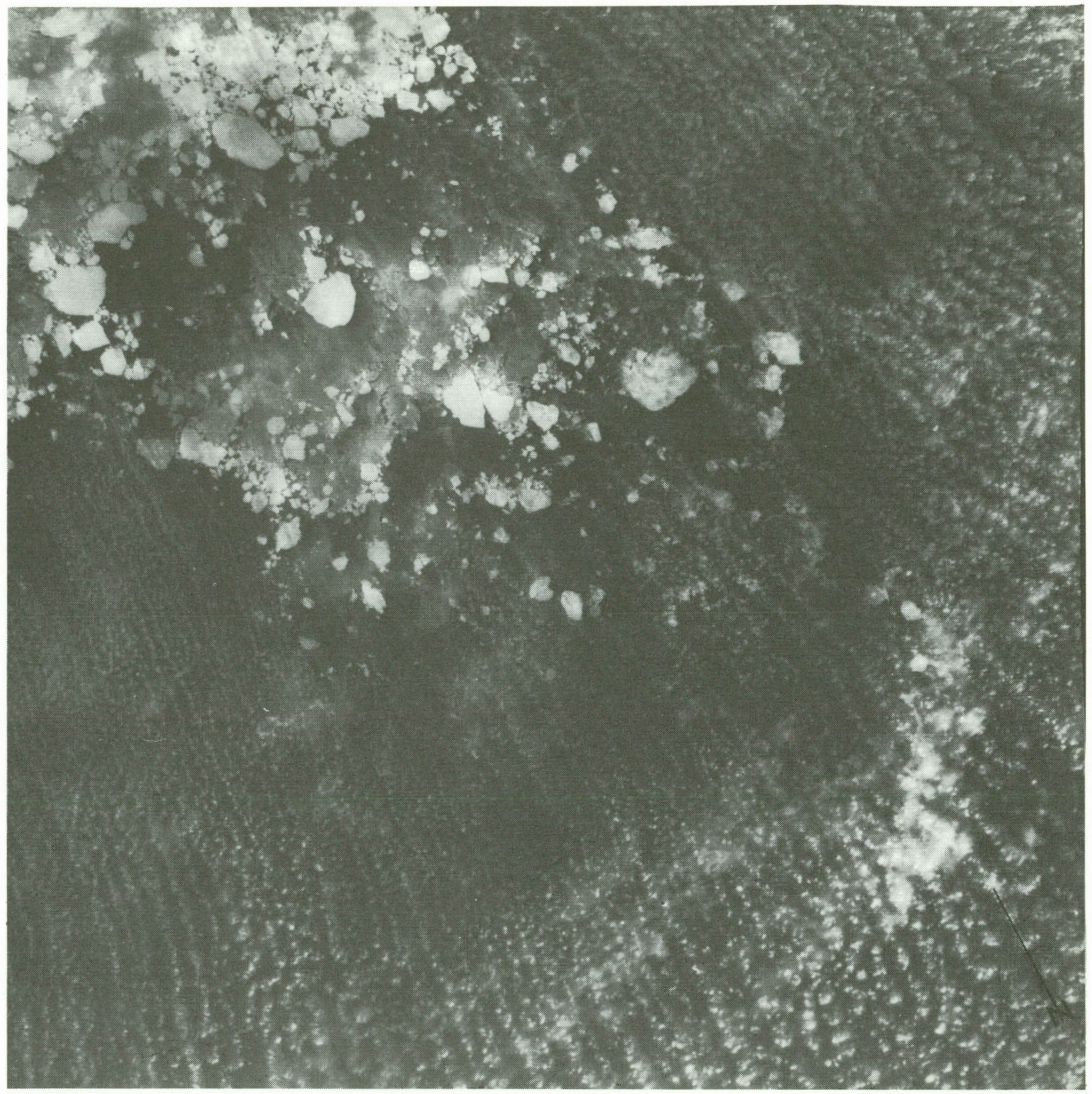
The busy mixture of line patterns, fractions, boundaries and colours shown on the map for the area north of Prince of Wales Strait give the impression of formidable ice conditions. On the other hand, the satellite photograph makes a passage through the area look mistakenly easy. Both sources of information must be carefully interpreted to determine the actual conditions.



MAP 7 - 1977 WEST

September 30 - October 9, 1977





Eastern Beaufort Sea, October 10, 1977, T71 F9

MAP 8-1977 East

October 13-18

Flight Effectiveness

A number of factors reduced the effectiveness of Flight 8, EAST to about 60 per cent. Low cloud ceilings, blowing snow, ice crystals and low light levels reduced visibilities. Rain was encountered while passing through a front west of Axel Heiberg Island during track 2. The on-board navigation system was not working properly and portions of tracks could not be surveyed in low visibilities near land masses. Finally, not enough flying hours remained to survey Nares Strait and the northern fringe of the archipelago.

Ice Conditions

Between the two flights new ice continued to form, a strip of multi-year ice drifted south across the eastern entrance to Jones Sound and the first-year ice in Norwegian Bay shifted its position from northeast to southwest leaving portions of the former area ice-free. In the western section multi-year ice had moved south out of the waterways surrounding Byam Martin Island while westerly winds gradually pushed the floes in Hecla and Griper Bay toward the east. This resulted in the formation of new ice and thin first-year ice in Ballantyne Strait and in the southwestern part of Prince Gustaf Adolf Sea.

Unobserved Areas

Surveys in adjacent areas provided enough information to show the ice conditions along the northern fringe of the archipelago from Prince Patrick Island to Nansen Sound. Satellite images from Landsat 2 and NOAA 5 were interpreted to establish the developments in Baffin Bay and Lancaster Sound and its adjoining channels.

The ice conditions in Nares Strait and along the northern coast of Ellesmere Island were probably very similar to those shown on Map 7–1977 EAST.

Comments

Freeze-up was developing in the typical fashion. Some areas were not consolidating as rapidly as usual due to the relative ease with which the winds could break and move the new ice types.

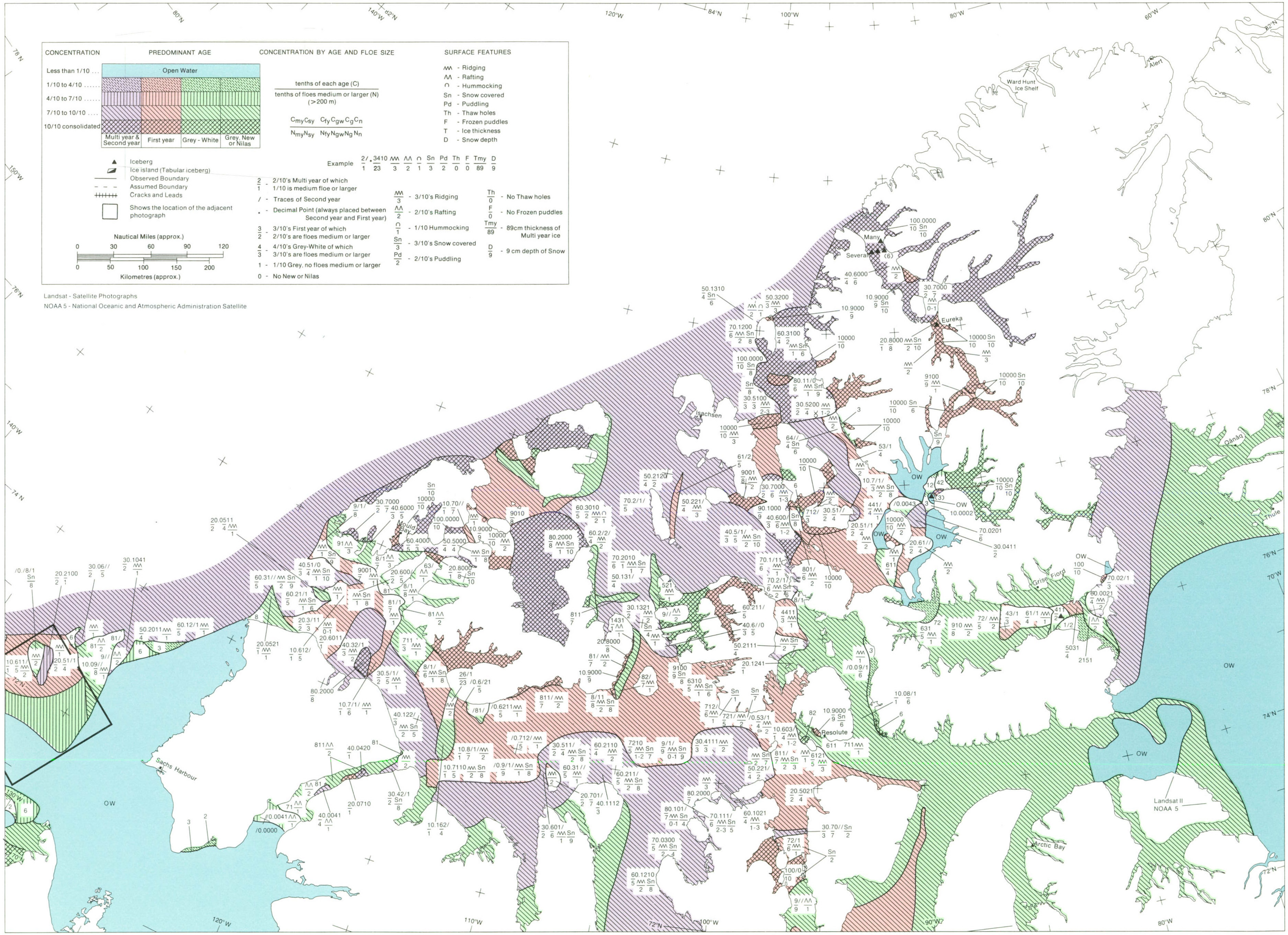
Although some movements, described above, did take place the interval between flights was noteworthy for the lack of north-south movements into, through and out of the northern channels comprised of Sverdrup Channel, Peary Channel, and Prince Gustaf Adolf Sea as well as the southern channels made up of Byam Martin Channel, Penny Strait and Hell Gate. The persistent northerly winds required to effect drifts in these areas did not develop.

The massive clearing of multi-year ice from Austin and Byam channels and the subsequent development of replacement first-year ice took place in a very short time. The first-year ice must have been very thin and its true nature (i.e. grey or grey-white) could have been masked by the snow cover and poor visibilities in the area.

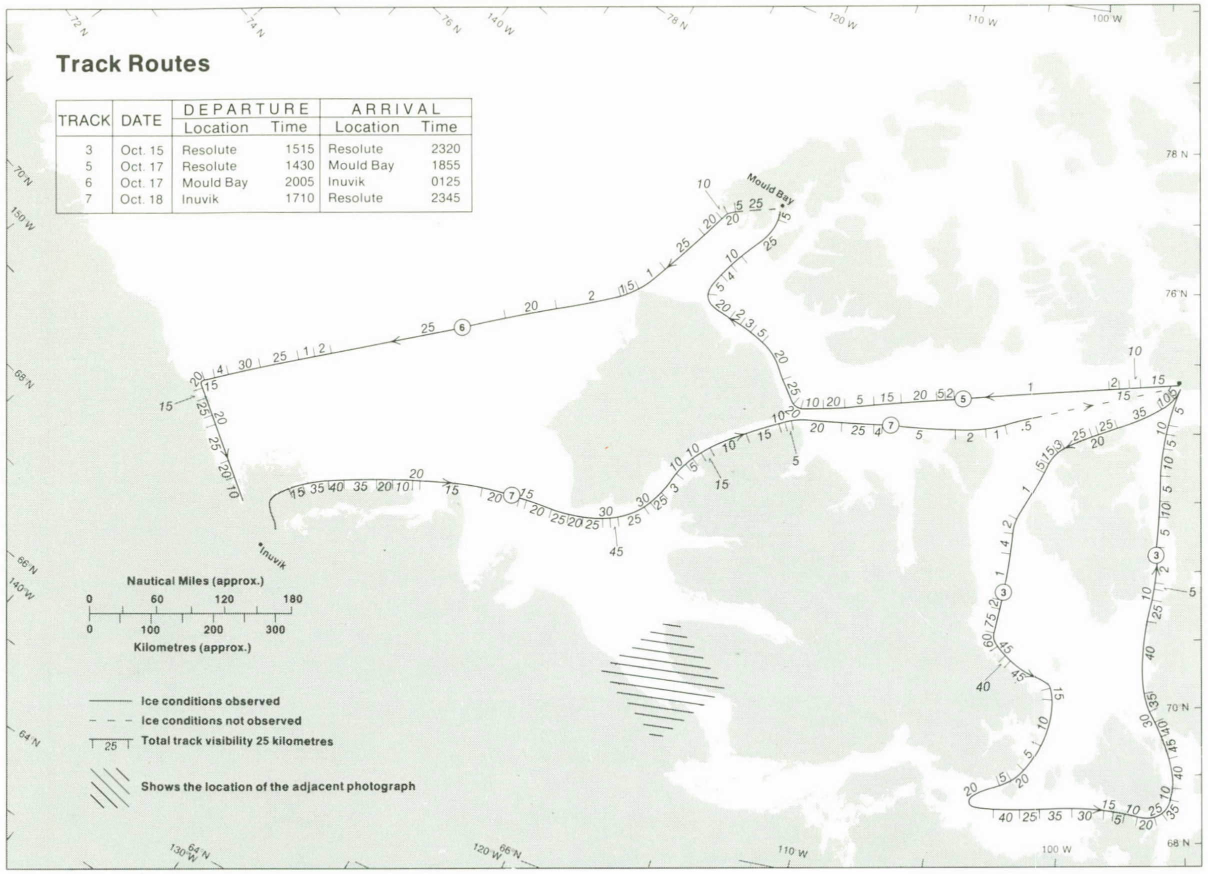
It is difficult to find a relevant satellite photograph for late fall conditions when clouds are ubiquitous and the time window is small due to shortening daylight. This one, with the regular parallel cloud bands, shows the conditions in the eastern Beaufort Sea four days before observations were made. Little change had taken place in the interval.

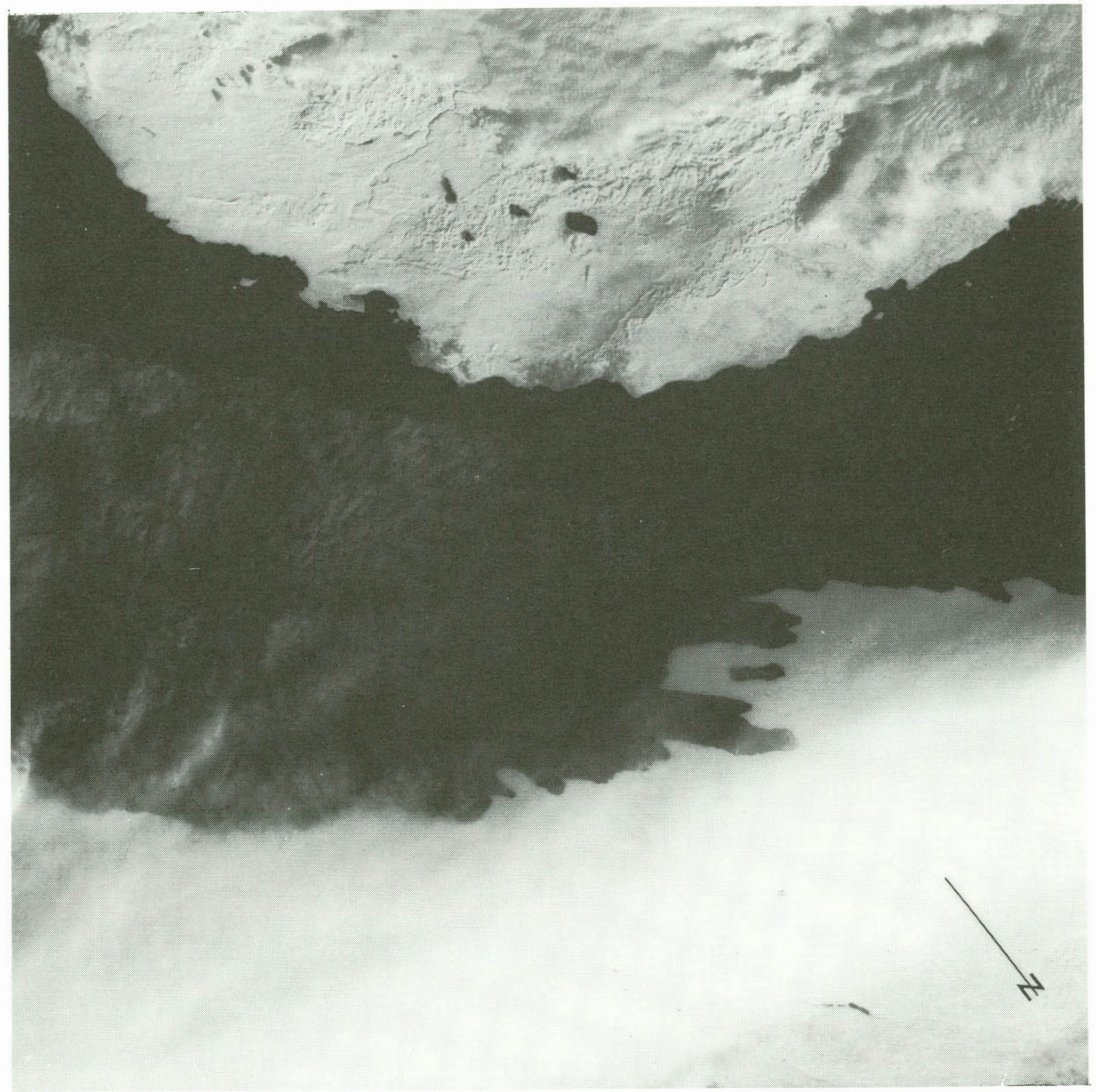
SEA-ICE ATLAS OF ARCTIC CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES
POLAR CONTINENTAL SHELF PROJECT



October 13 - 18, 1977





Dolphin and Union Strait, October 17, 1977, T57 F11

MAP 8-1977 West

October 13-18

Flight Effectiveness

Five tracks were completed in the western area during Flight 8. Low stratus cloud and ice fog and low light levels reduced the visibility in many areas. The key areas were surveyed and the flight was better than 75 per cent effective. The air crew diagnosed the peculiar malfunction of the Global 500 navigation system and devised a means to keep it operational during track 3. With continuous coaxing this important aid functioned for the remaining tracks.

Ice Conditions

A number of changes developed. Typically new ice had expanded throughout the area and was gradually closing in toward the western part of Amundsen Gulf. In many areas the new ice forms had grown to 30 cm thick or younger forms were sufficiently masked by snow to be designated as thin first-year ice. The snowfall was quite thick on the ice in the southeast part of Larsen Sound.

The developments that took place in the western part of Parry Channel between the two flights were not typical. Usually multi-year ice moves in from the west and the ice in the channel moves east. In the first part of October, 1977 the multi-year ice in Western M'Clure Strait seemed to move back into the Arctic Ocean while the multi-year ice in the remainder of the strait was packed into the southeastern quarter. The amount of multi-year ice in Viscount Melville Sound appeared to be dramatically reduced during the interval between the last two flights. Although small amounts did melt, move south into M'Clintock Channel or east into Barrow Strait the main cause of the seeming reduction in the multi-year cover resulted from winds concentrating the older ice in the southern half of the channel leaving the nothern part open for the development of the younger ice types.

In the southern part of M'Clintock Channel the winds moved the multi-year ice east through Larsen Sound and packed it along the coast of the Boothia Peninsula leaving the ice in Victoria Strait time to develop into thin first-year ice with only a small amount of multi-year mixed in.

Unobserved Areas

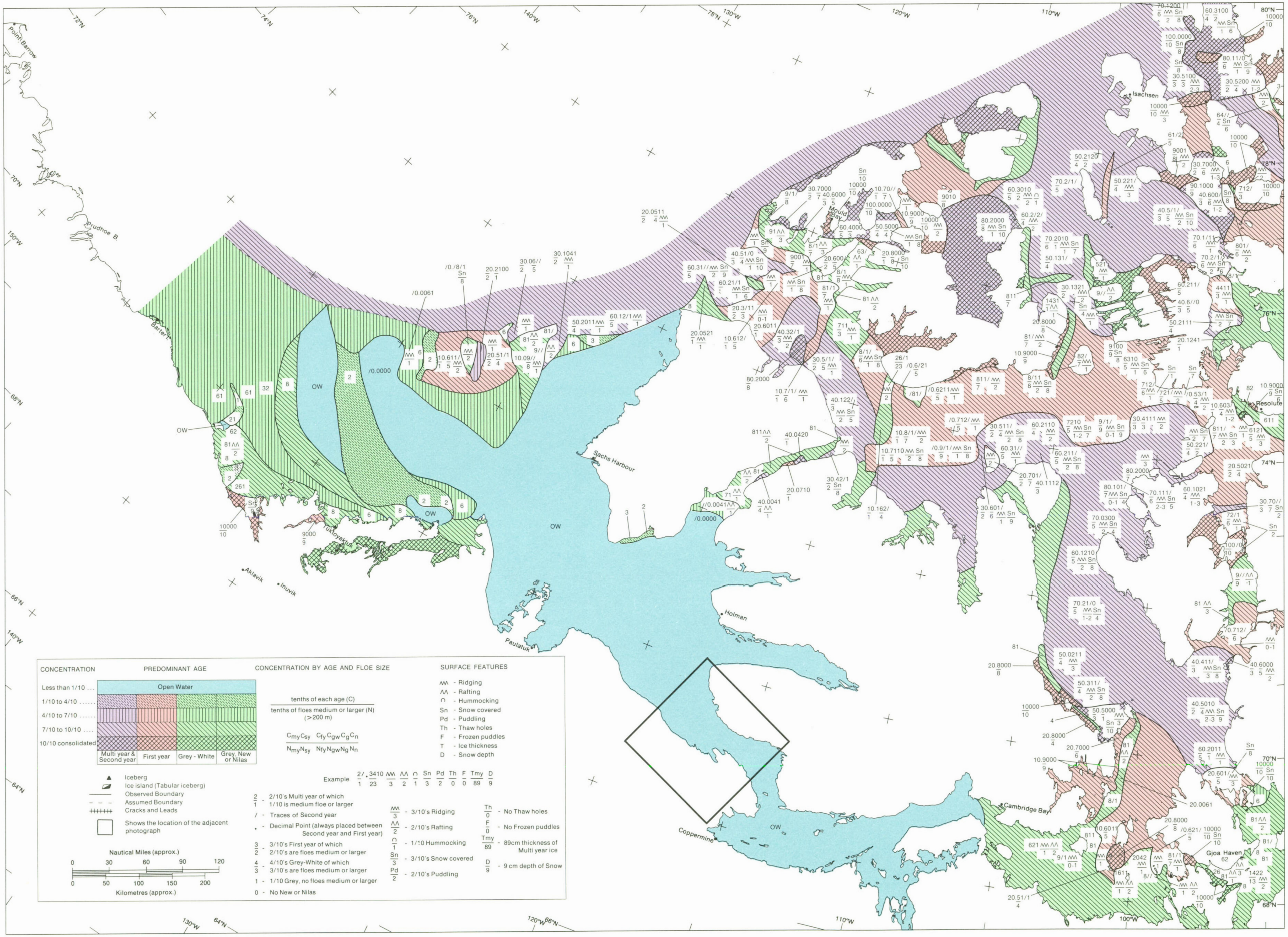
Probably the ice along the north coast of Alaska followed the trend indicated north of Barter Island. The satellite photograph and the observations at both ends were used to establish open water conditions in the channels between Cambridge Bay and Amundsen Gulf.

Comments

Freeze-up was being delayed because the large amount of clearing during the ablation season left considerable areas for new ice to form. This type of ice is readily broken and shifted about until it becomes thick and strong enough to withstand the effects of the winds.

The northern channels of the Mackenzie River were observed on October 17 and 18. The main channels were ice-free while ice had formed in the sub-channels and areas of quieter water.

The satellite photograph shows no trace of new ice developing. This situation would not last much longer.


Point Barrow
Prudhoe B.
Barter I.
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Sachs Harbour
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Isachsen
Mould Bay
OW
CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/1 - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)

SEASONAL SUMMARY 1978

Typical, average, normal, uneventful are all terms that could be used to summarize the general or overall ice conditions that developed during the 1978 season. There were a few special features that make 1978 stand out, such as the late break-up and clearing in Lancaster Sound, but these were not numerous enough or on a large enough scale to influence the type of year. Compared with previous seasons 1978 comes very close to the conditions observed in 1972. See ***Sea Ice Atlas of Arctic Canada 1969-1974***.

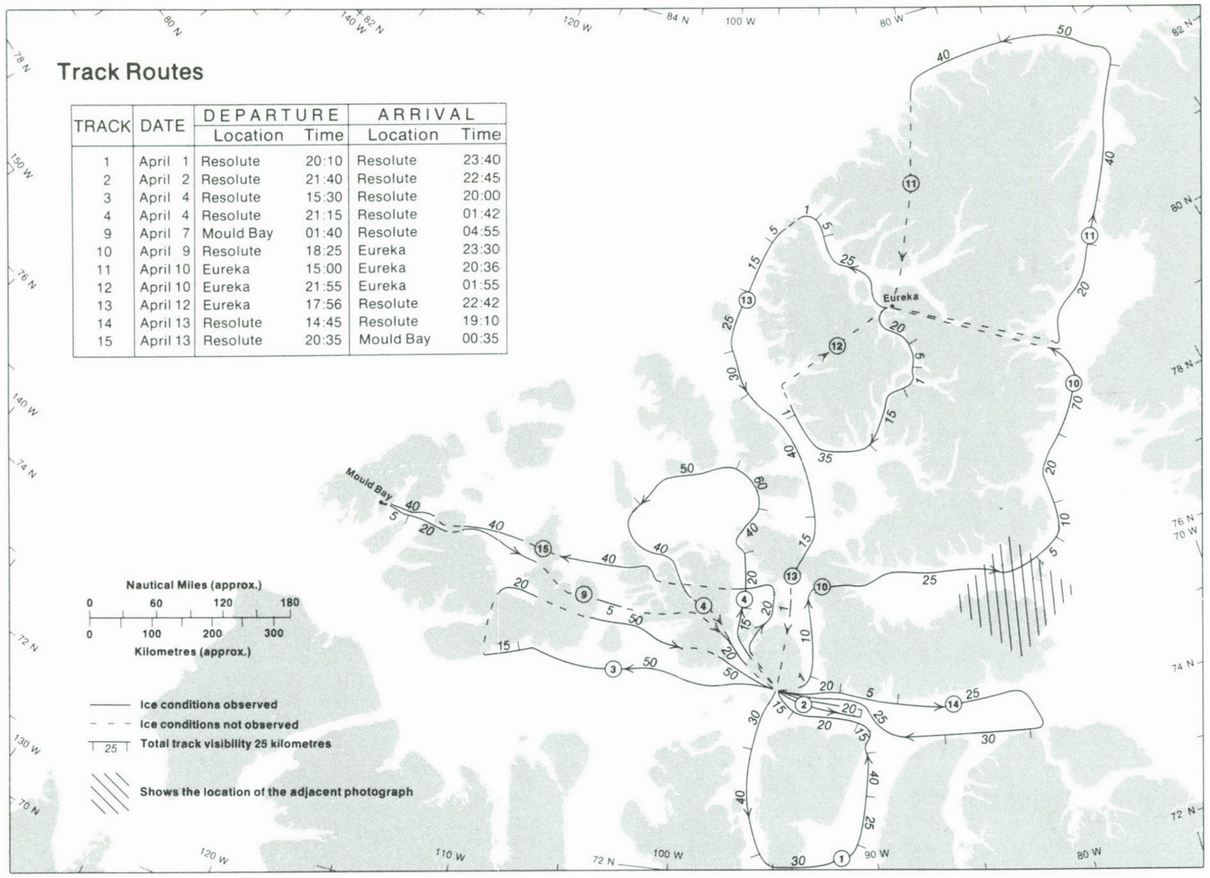
In 1978 the obvious departures from the usual situation were in Barrow Strait and Lancaster Sound. In these areas the ice cover remained solid and unmoving much longer than usual, up to the end of July, and after break-up clearing in the areas was not completed until September. The patterns of melting, break-up and freeze-up in the remaining areas followed the usual sequence.

The weather and resulting conditions for making sea-ice reconnaissance surveys was the reverse of that which is usually expected in that these conditions in the first five flights were much poorer than usual while the fall weather for the last three flights was much better than usual and results for these surveys were excellent.

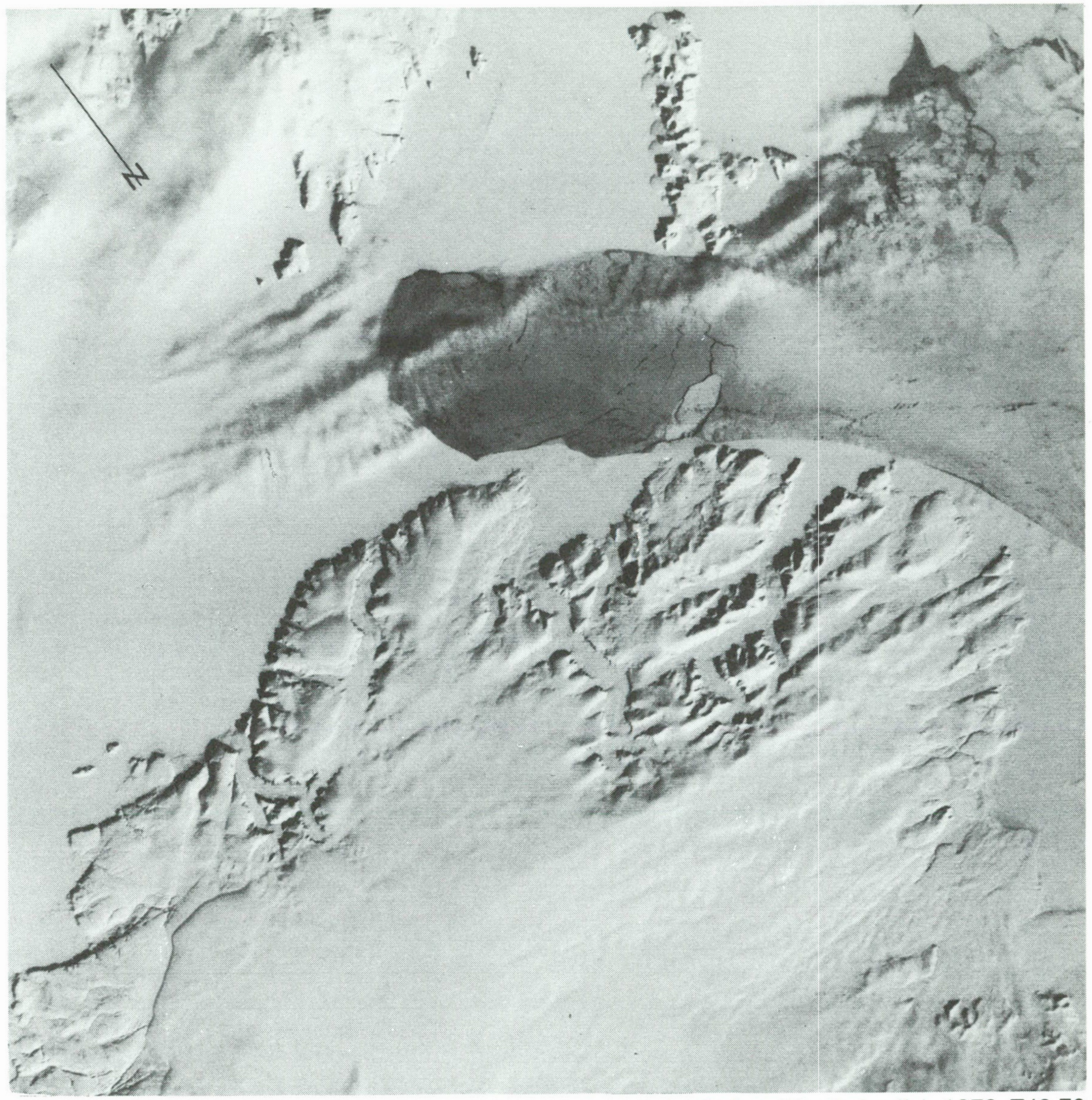
The spring conditions, except for Lancaster Sound, showed the usual distribution and advance of polynyas. The rate of melting in the summer months (June, July and August) and the resulting developments were slightly slower than normally expected. But this changed after Flight 4, at the end of August, and massive melting and clearing in September advanced the season to a point ahead of the usual timing especially in the eastern part of the region. An impressive advance in break-up spread through the central area between August 17 and 30 and this trend continued into the northern areas. The break-up in these areas was much more extensive than normal but the season is still referred to as a typical one because subsequent melting and clearing of the ice in the broken areas was just about usual.

If any trend persisted throughout the 1978 season it was the distinct lack of large-scale movements with one exception noted below, in any of the areas where it is usually expected. For example, only minor amounts of ice moved south through Nares Strait and similar slight movements developed in Parry Channel and M'Clintock Channel. Another feature was the lack of break-up in the large area between Lougheed Island and Hecla and Griper Bay. It is normal for the latter to remain solid but in the past Byam Martin Channel and the area west of Lougheed Island breaks up before Prince Gustaf Adolf Sea.

Probably the reason Lancaster Sound remained unbroken and then did not clear for such a long time was a result of winds or at least the lack of winds from the right direction and strong enough to break and move the ice out of the area. A similar situation developed in the Beaufort Sea as well. Here the boundary or ice edge remained remarkably stationary throughout the season. While the eastern and western extremities and most intermediate regions were not experiencing much movement there was an exception in Norwegian Bay. Here a huge floe drifted south about 100 km during an interval of nineteen days. The definite cause for this drift as well as the conditions in Lancaster Sound and the Beaufort Sea remain to be established.



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	April 1	Resolute	20:10	Resolute	23:40
2	April 2	Resolute	21:40	Resolute	22:45
3	April 4	Resolute	15:30	Resolute	20:00
4	April 4	Resolute	21:15	Resolute	01:42
9	April 7	Mould Bay	01:40	Resolute	04:55
10	April 9	Resolute	18:25	Eureka	23:30
11	April 10	Eureka	15:00	Eureka	20:36
12	April 10	Eureka	21:55	Eureka	01:55
13	April 12	Eureka	17:56	Resolute	22:42
14	April 13	Resolute	14:45	Resolute	19:10
15	April 13	Resolute	20:35	Mould Bay	00:35


Lady Ann Strait, April 1, 1978, T43 F6

MAP 1-1978 East

April 1-13

Flight Effectiveness

Ice fog reduced the visibility during portions of a few tracks but the main limitation to the success of the first flight was related to the problem of aclimatizing the aircraft to the cold, -30°C, temperatures. Delays were due to a malfunctioning radio antenna, carburetor icing, plugged valves and the oil heating system. The need for special facilities to start it in the mornings and limited range of the aircraft were responsible for the partial coverage of tracks 9, 11 and 15 while a fuel shortage at Mould Bay caused track 3 to return to Resolute. The flight was about 75 per cent effective.

Ice Conditions

Freeze-up during the fall of 1977 followed the usual pattern. By comparing Map 8–1977 with Map 1–1978 it is apparent that although movement continued after mid-October no large quantities of ice were imported or exported. For example, Eureka Sound, Norwegian Bay, Jones Sound, Massey Sound, Hassel Sound and the unnamed sea south of Ellef Ringnes Island all have similar distributions on the two maps. Some multi-year ice moved south, about 100 km, around Byam Martin Island and a similar movement occurred in Penny Strait. It is possible that limited amounts of multi-year ice moved east into Barrow Strait from Viscount Melville Sound.

The fact that Lancaster Sound supported a solid ice cover was a departure from the normal. Typically this solid state only lasts a few days before starting to move again. The crack pattern indicates that some motion was still possible in the southern part of Prince Regent Inlet.

The ice surface was snow-covered throughout the region. The polynyas in Hell Gate and at the northern tip of Dundas Island were present but the usual open areas near Baillie-Hamilton Island and in the northeastern part of Penny Strait did not exist.

Unobserved Areas

The ice conditions in Prince Gustaf Adolf Sea and surrounding areas are shown on the map on the basis of a knowledge of the usual state at this time of year combined with the observations made in the surrounding areas and information collected during subsequent flights. Satellite photographs were interpreted to establish the conditions for Baffin Bay.

Comments

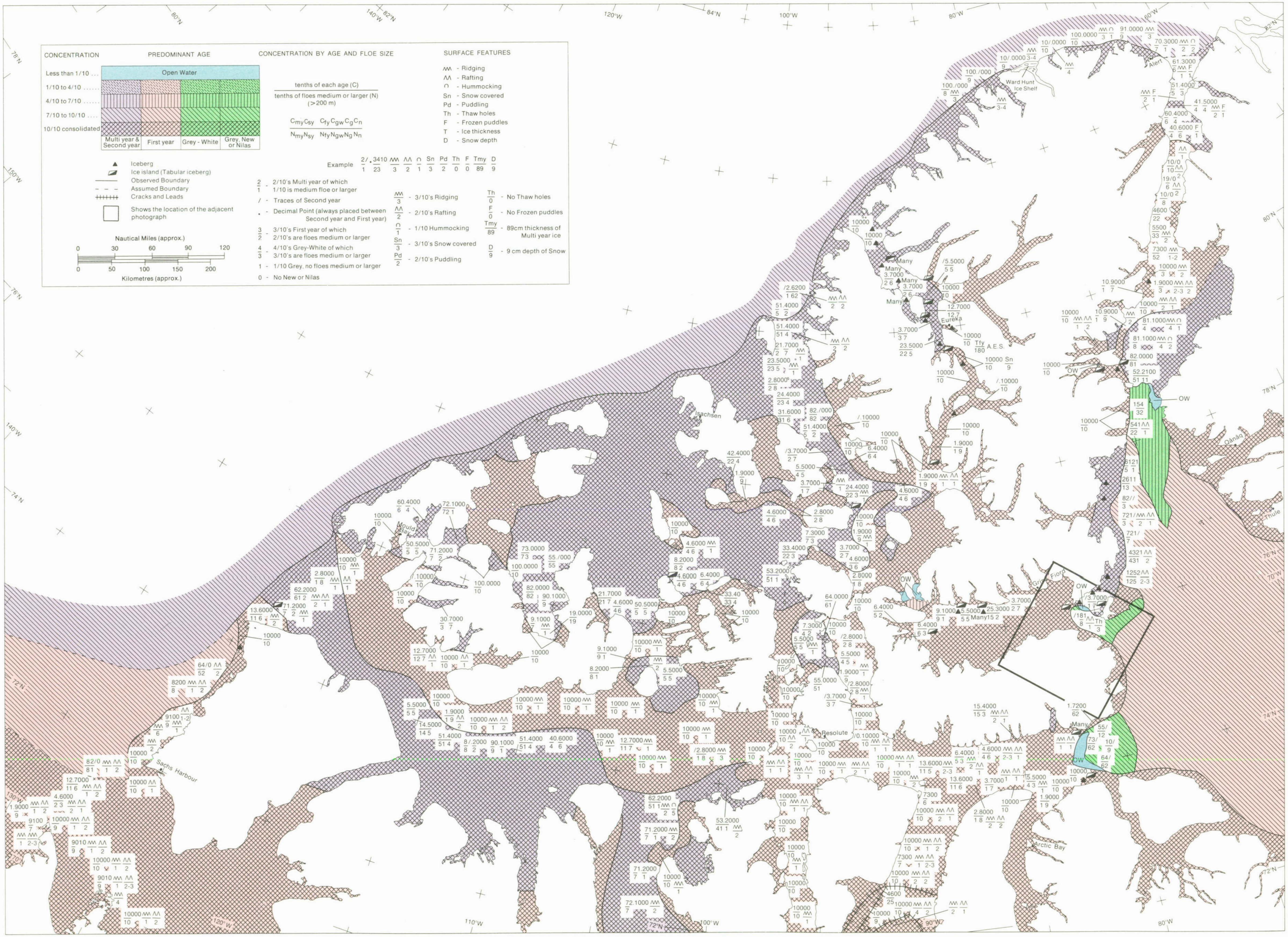
Surface roughness and snow cover combined to make the observer think that considerable quantities of second-year ice existed in Jones Sound and Lancaster Sound. This is a normal reaction as movement into the new year in these areas causes ridging which when covered with snow looks like older ice. Hindsight knowledge that the areas were both ice-free during 1977 and that only limited quantities of older ice entered during the fall of 1977 indicate that the ice in both areas was predominantly first-year with the possibility of a few multi-year pieces.

Lancaster Sound became solid in the early part of March and remained so until the beginning of July. Usually, if it freezes at all, it is only for a brief period in mid-March.

The satellite photograph shows the conditions in Lady Ann Strait on April 1. The area was surveyed on April 10. The changes are minimal.

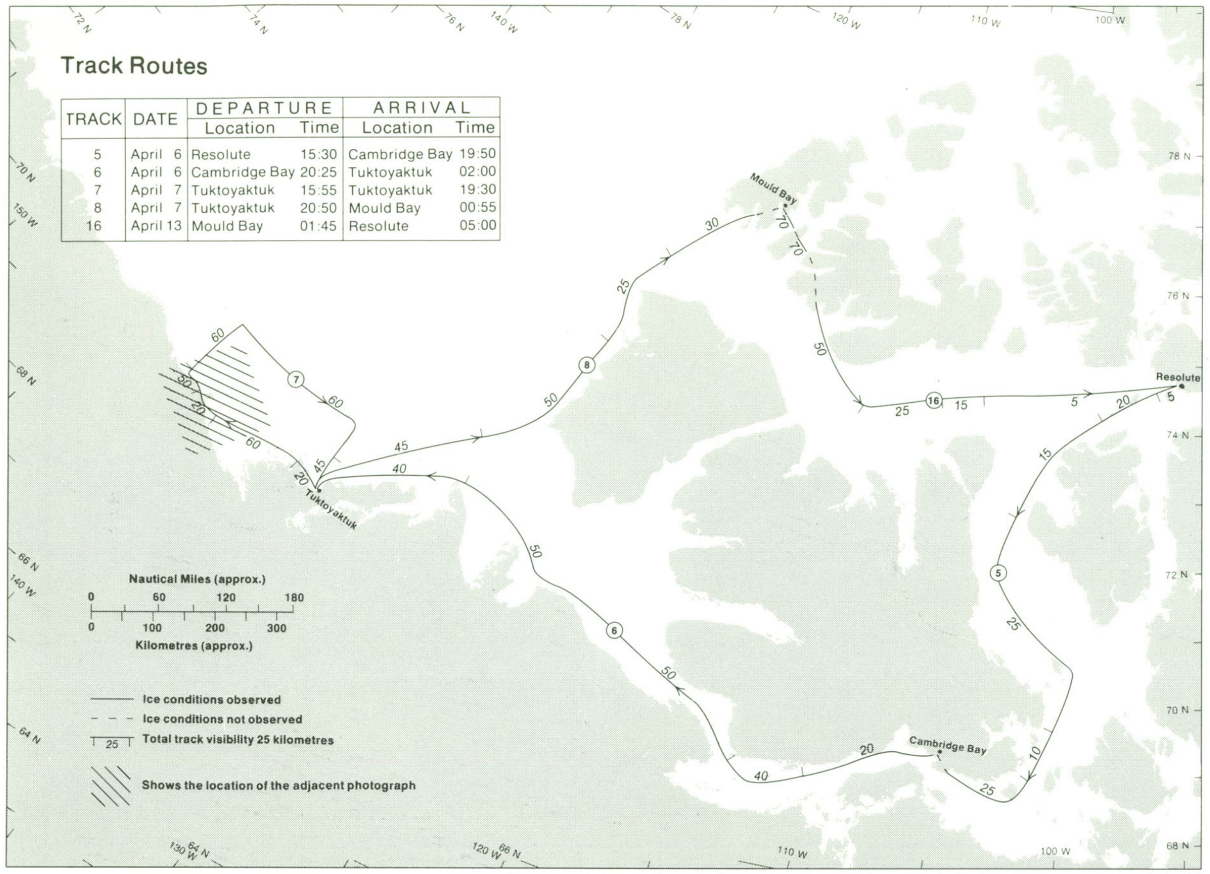
In April the ice in Slidre Fiord at Eureka was 180 cm thick. It had moved about 75 m east on December 9 and remained solid after that.

A herd of about thirty musk-oxen were spotted about 20 km northwest of Winter Harbour during track 3 on April 4.

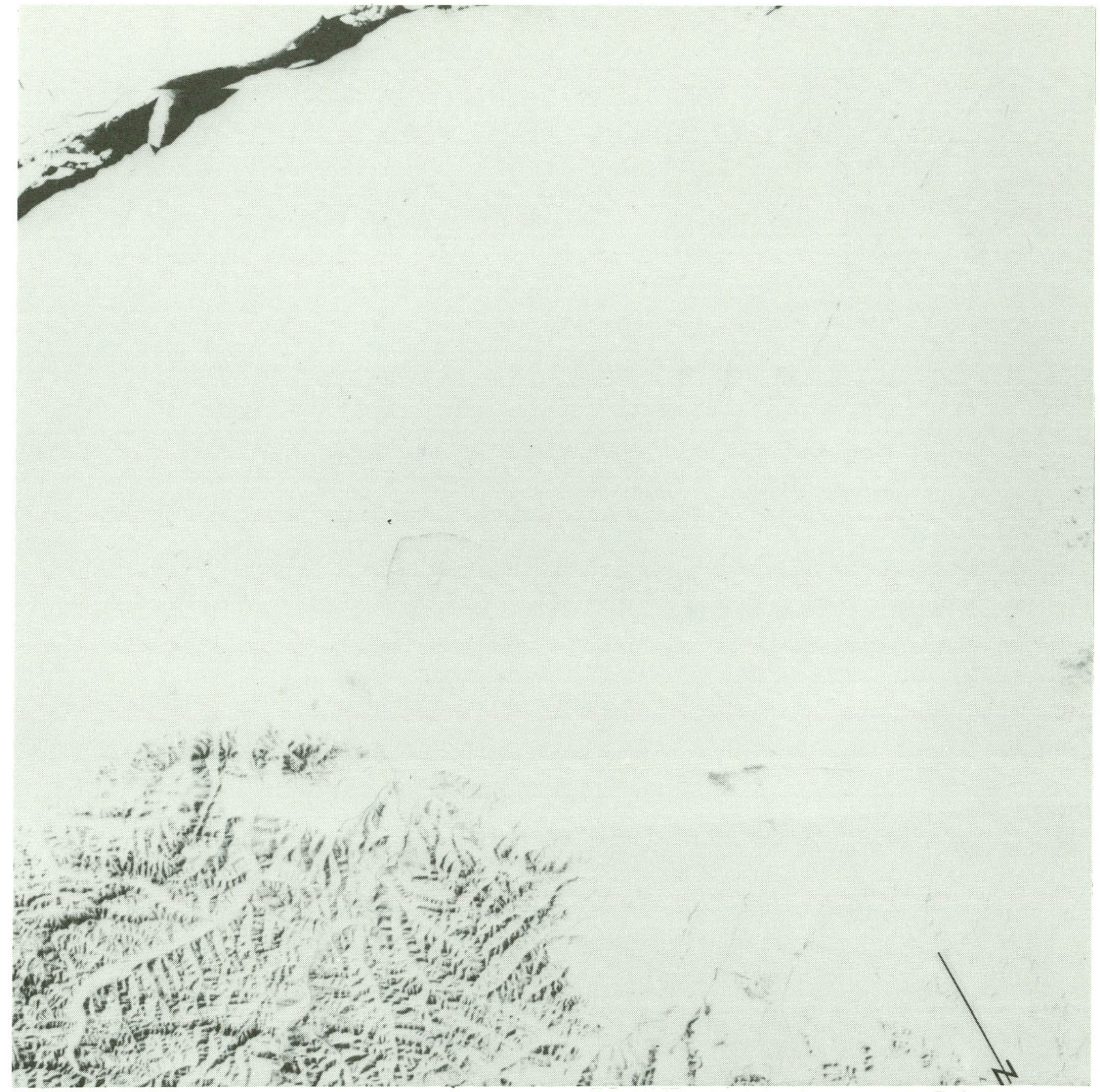


MAP 1 - 1978 EAST

April 1-13, 1978



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
5	April 6	Resolute	15:30	Cambridge Bay	19:50
6	April 6	Cambridge Bay	20:25	Tuktoyaktuk	02:00
7	April 7	Tuktoyaktuk	15:55	Tuktoyaktuk	19:30
8	April 7	Tuktoyaktuk	20:50	Mould Bay	00:55
16	April 13	Mould Bay	01:45	Resolute	05:00



N. of Herschel Island, April 13, 1978, T73 F11

MAP 1-1978 West

April 1-13

Flight Effectiveness

The aircraft problems and poor visibilities of the eastern flight vanished. The flight was better than 90 per cent effective.

Ice Conditions

Freeze-up during the preceding fall was relatively quiet and no major changes took place. The boundary in the Beaufort Sea between multi-year and first-year ice remained in the same location and once again a large portion of the sea was covered with first-year ice. In M'Clure Strait the late fall movements concentrated the older ice in the southern part of the strait and some multi-year ice from the Arctic Ocean moved into the western part of the strait. The amount of multi-year ice in Viscount Melville Sound seemed to increase considerably during the latter part of October 1977. Probably some older ice moved into the western part from M'Clure Strait. This movement combined with the winds that spread out existing older ice over a larger part of the sound are responsible for the change in the pattern between Map 8–1977 WEST and Map 1–1978 WEST. The main changes took place in M'Clintock Channel, Larsen Sound and Victoria Strait. Some time after mid-October and before freeze-up, ice in eastern Viscount Melville Sound moved about 50 km south into M'Clintock Channel and this invasion was probably made possible by a southerly drift along the length of the channel. The older ice in Franklin Strait moved south across Larsen Sound and into Victoria Strait. In these two areas, the ice moved distances as great as 150 km.

The entire ice cover in the Beaufort Sea and Amundsen Gulf was solid and unmoving and the Bathurst polynya was not present. A similar state had developed in this area at the same time for the last three years. As a result it is not known whether the situation is a departure from the normal or not. The small open areas in Bellot Strait were in their usual location as were the little pools of open water in Dolphin and Union Strait. These small areas are marked on Map 1–1978 by the fractions. The snow cover was complete.

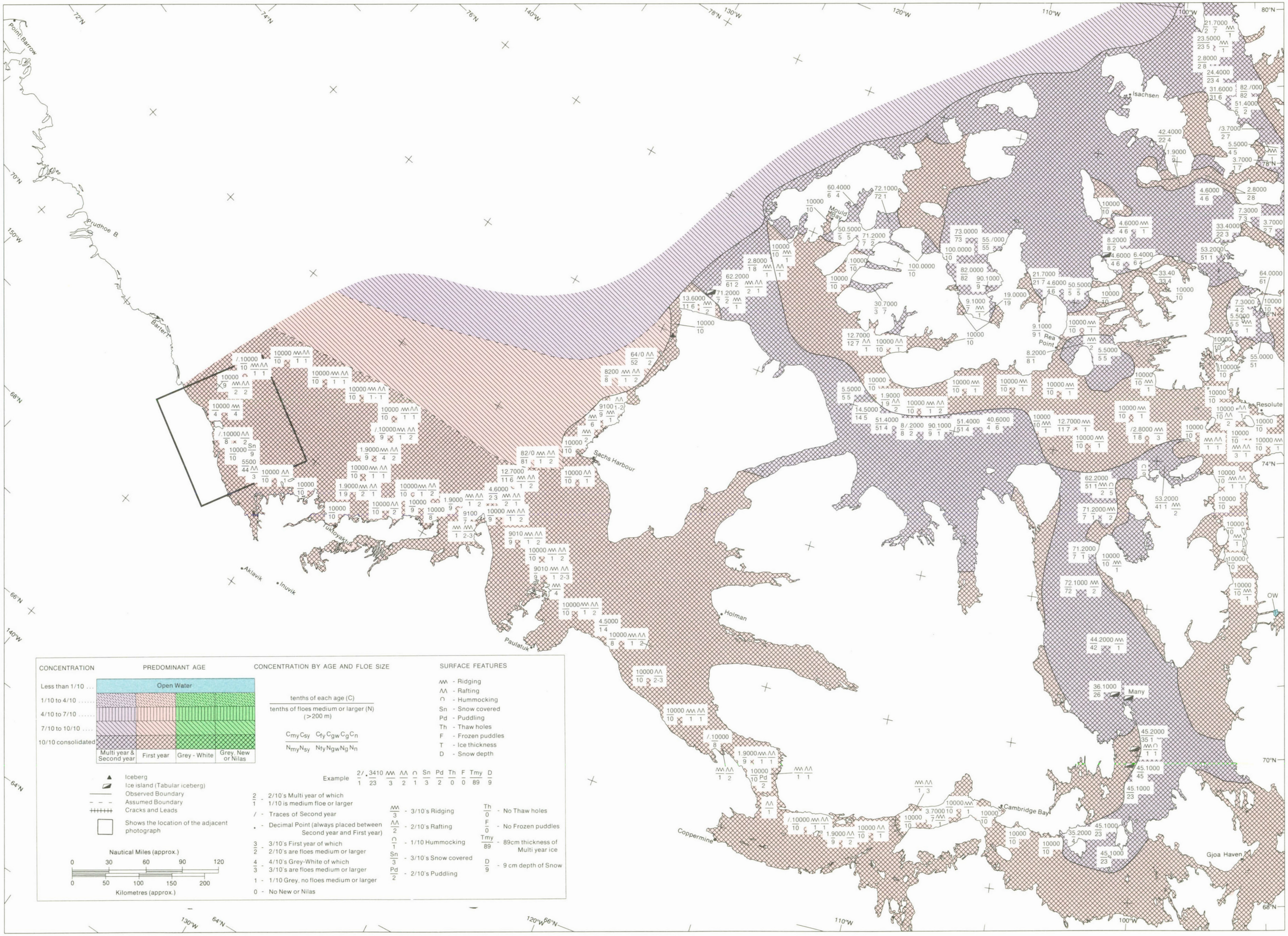
Unobserved Areas

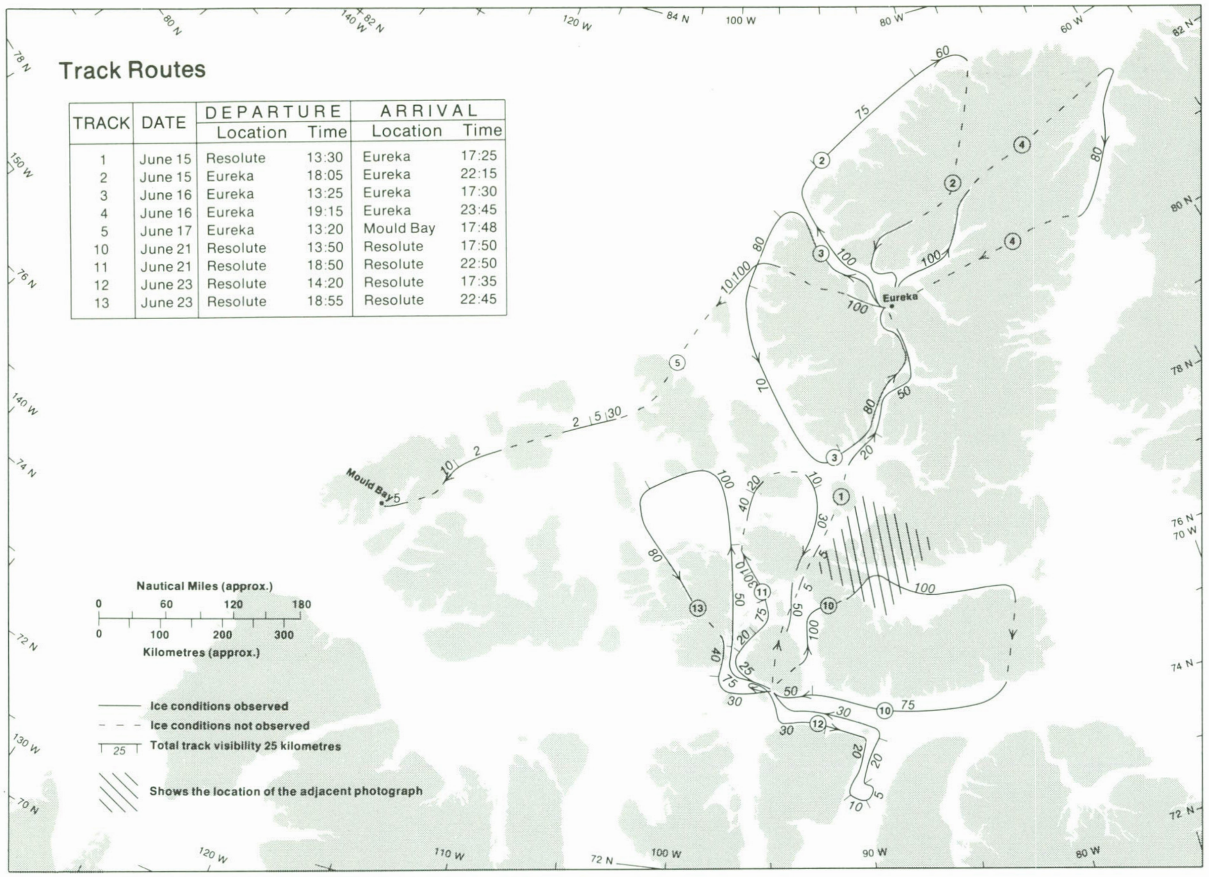
The assumed boundary between multi-year ice and first-year ice across the Beaufort Sea was established on the basis of the adjacent ice conditions, satellite information and the typical pattern. Ice conditions shown for Prince of Wales Strait and western M'Clure Strait are based on subsequent observations.

Comments

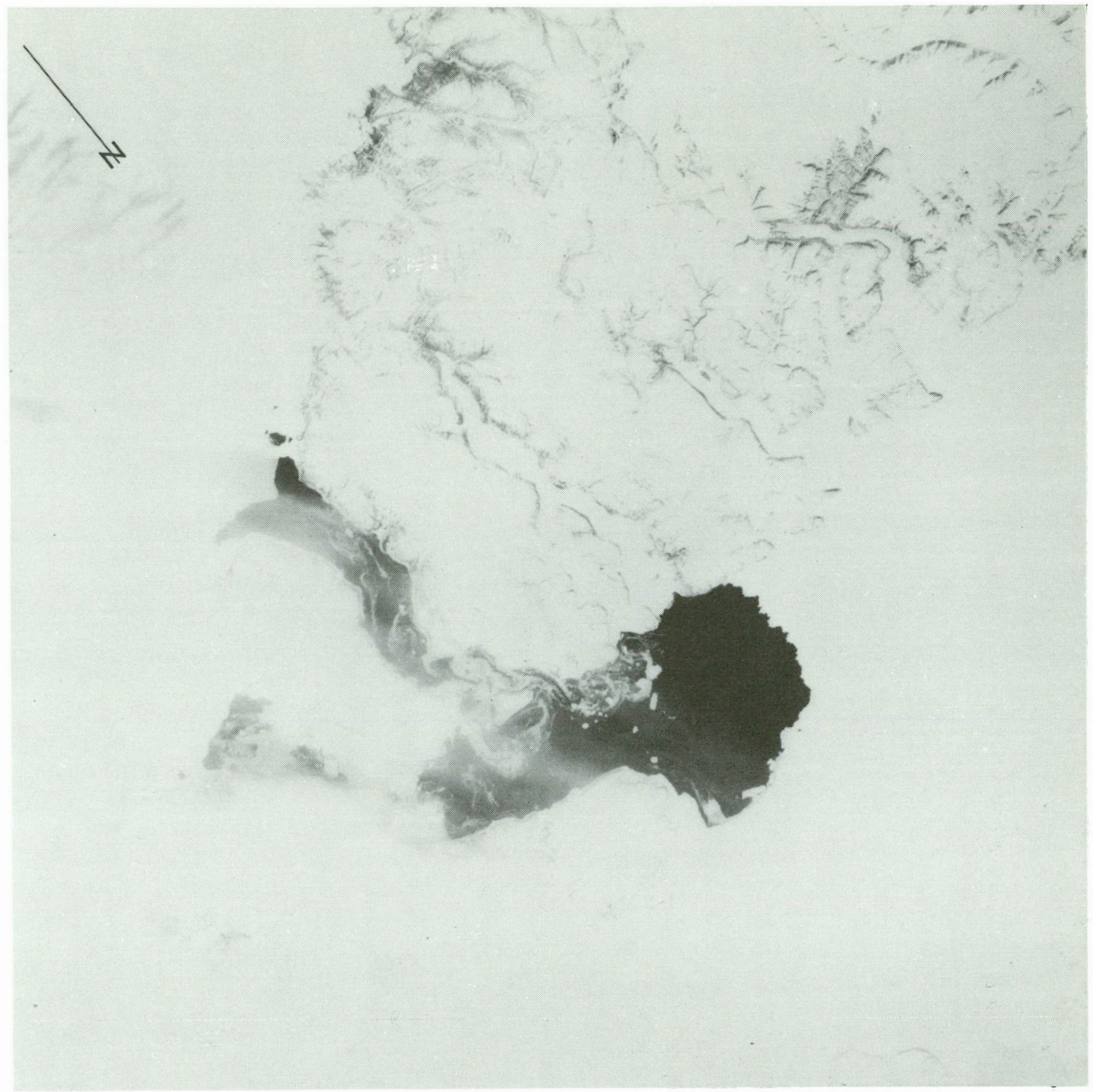
When Amundsen Gulf and the western part of the Beaufort Sea were surveyed on April 6 and 7 the ice cover was solid and unmoving and the usual boundary between the landfast ice and the moving pack could not be determined. One week later the ice in the Beaufort Sea was in motion again and the boundary between solid and moving ice appeared about 150 km north of the coast.

The lead that opened and closed along the ice edge appears near the northwest corner of the satellite photograph taken on April 13, 1978.


Point Barrow
Prudhoe B.
Barter I.
Tuktoyaktuk
Aklavik
Inuvik
Sachs Harbour
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Isachsen
Rea Point
Mould Bay
CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Nautical Miles (approx.)
Kilometres (approx.)
Example
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	June 15	Resolute	13:30	Eureka	17:25
2	June 15	Eureka	18:05	Eureka	22:15
3	June 16	Eureka	13:25	Eureka	17:30
4	June 16	Eureka	19:15	Eureka	23:45
5	June 17	Eureka	13:20	Mould Bay	17:48
10	June 21	Resolute	13:50	Resolute	17:50
11	June 21	Resolute	18:50	Resolute	22:50
12	June 23	Resolute	14:20	Resolute	17:35
13	June 23	Resolute	18:55	Resolute	22:45



Hell Gate, June 20, 1978, T51 F5

MAP 2-1978 East

June 15-23

Flight Effectiveness

Some unfavourable weather, difficulties establishing radio contact with Eureka, mushy brakes and limited fuel range were factors that reduced the effectiveness of this flight to about 75 per cent.

Ice Conditions

Between the two flights the polynyas in Penny Strait, Queens Channel and Hell Gate expanded a little. The polynya in Hendriksen Strait appeared and there was a good expansion of the ice-free area in northern Baffin Bay connected with Smith Sound and North Water. The polynya south of Bache Peninsula was developing. Other changes included the break-up of the ice cover in Kennedy Channel and a similar development in the southern part of Prince Regent Inlet.

In all areas except Eureka Sound the snow cover on the ice was ten-tenths. The ice in Eureka Sound had developed puddles of up to eight-tenths of the ice surface. This early puddling and the solid ice cover on Lancaster Sound along with the break-up of the ice cover in Kennedy Channel were the main departures from the normal situation at this time of year.

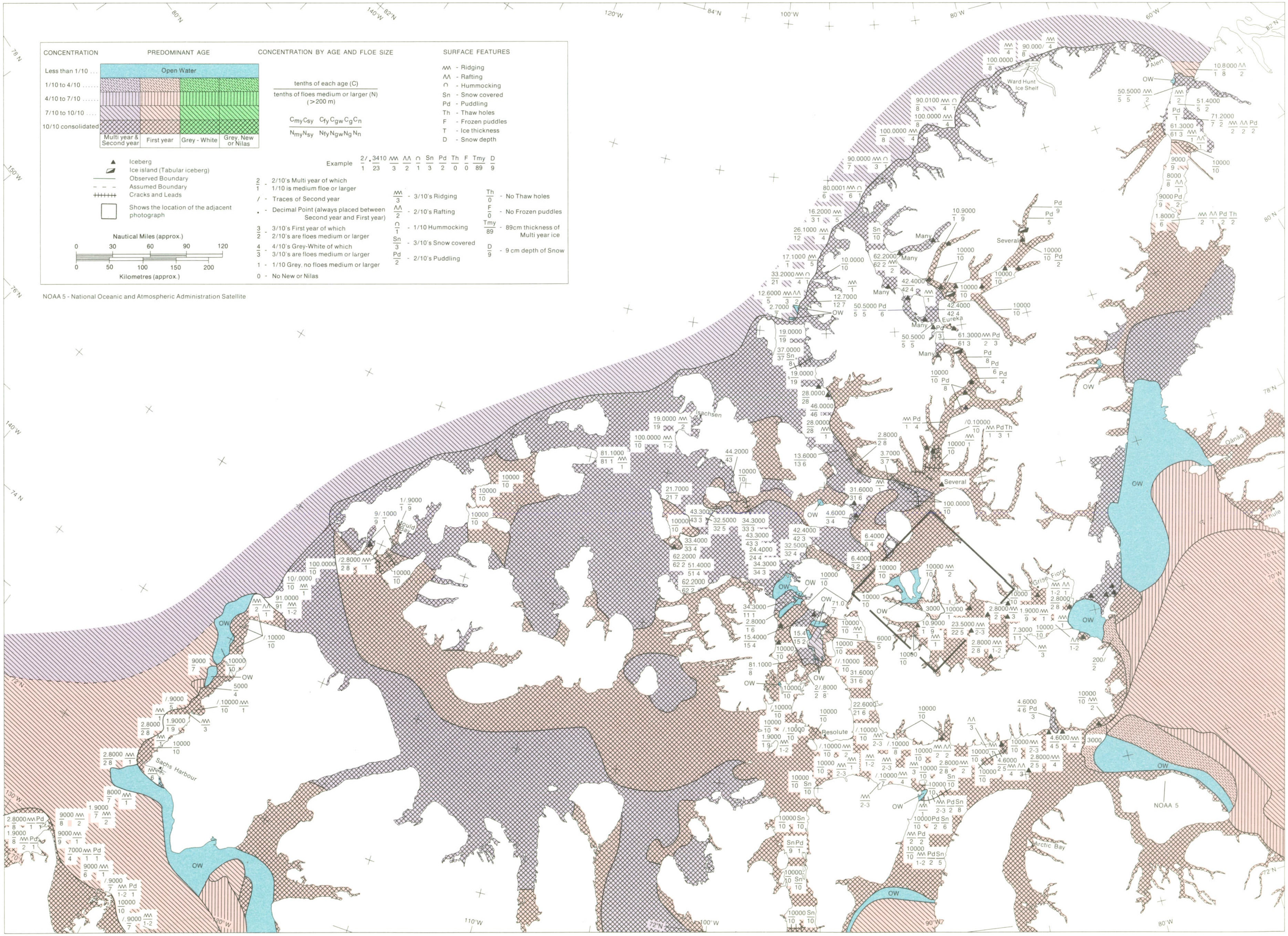
Unobserved Areas

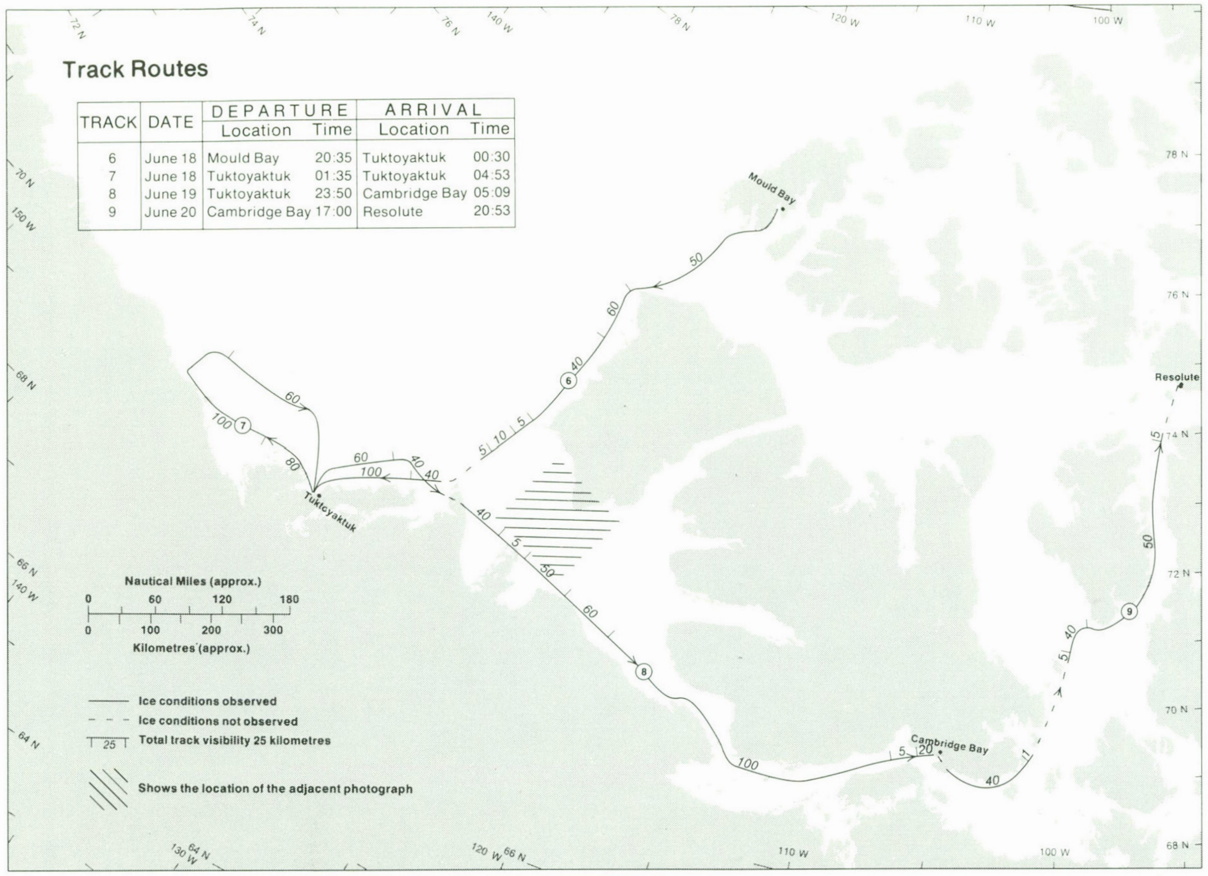
The ice conditions in the unobserved parts of Nares Strait and Baffin Bay were established from satellite photos with ground truth from adjoining areas to confirm ice types. In the central section and along the fringe of the Arctic Ocean the distributions shown were established based on surveys in adjacent areas, subsequent observations and typical trends.

Comments

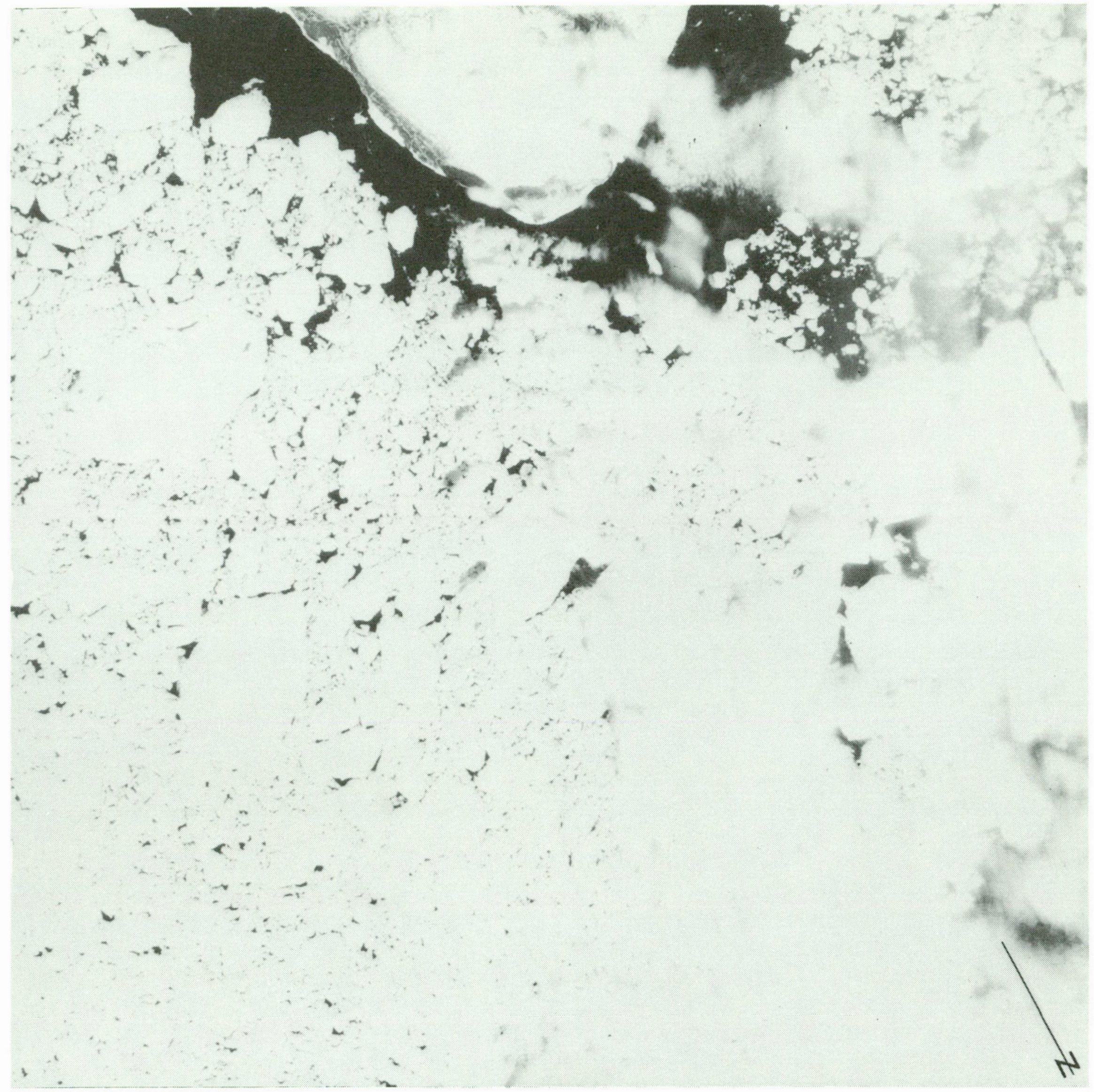
Based upon the unusually large and early amount of puddling in Eureka Sound and the earlier than usual break-up in Kennedy Channel the season seemed to be advancing much faster than usual. This may have been true for these specific areas but the signs, or lack of them (i.e. no puddles, no indication of polynyas in Belcher Channel) made it appear that the rate of development was normal. Others (observers), basing their assessment on the unbroken ice cover in Lancaster Sound, might believe that the season was advancing at a slower than usual rate. The state of the ice conditions in Lancaster Sound from March through June is not a reliable indication for forecasting the type of ice year to follow. The ice in Lancaster Sound had remained in motion since it started to form in the fall of 1977, until early March 1978, when the ice cover consolidated and stopped moving. This solid ice cover remained until it broke up completely near the end of July. In the fifteen years of ice observations since 1964 this was only the second time, 1970 being the first, that the sound maintained a solid ice cover for such a long time. The reasons for the irregular development are not known but very likely are concerned primarily with wind directions, durations and strengths in the area.

The satellite photograph taken on June 20 over Hell Gate shows that winter is still very much a fact in the area. However, the size and position of the open area in Jones Sound indicates that it is mid-June in a typical season. The channels remain ice-free because of the currents that rush through as the tides come in and go out.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which
1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which
2/10's are floes medium or larger
4/10's Grey-White of which
3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
NOAA 5 - National Oceanic and Atmospheric Administration Satellite
Alert
Ward Hunt Ice Shelf
Eureka
Isachsen
Grise Fiord
Resolute
Sachs Harbour
Arctic Bay
Thule
Qânâq
NOAA 5



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
6	June 18	Mould Bay	20:35	Tuktoyaktuk	00:30
7	June 18	Tuktoyaktuk	01:35	Tuktoyaktuk	04:53
8	June 19	Tuktoyaktuk	23:50	Cambridge Bay	05:09
9	June 20	Cambridge Bay	17:00	Resolute	20:53


Amundsen Gulf, June 15, 1978, T64 F10

MAP 2-1978 West

June 15-23

Flight Effectiveness

Other than rain during track 6 and fog during tracks 7 and 8, the weather was very good for this flight resulting in better than 90 per cent effectiveness.

Ice Conditions

The ice cover in the southern part of the Beaufort Sea had been in motion since mid-April. The boundary between the moving and landfast ice along the north coast was in its usual position for the time of year but the solid band did not seem to be as wide as usual. The ice-free areas at the mouth of the Mackenzie River had developed to their usual extent and the solid ice bridges across Mackenzie Bay and Kugmallit Bay were slowly being undermined. The change in Amundsen Gulf was considerable. Likely the western portion, north of Cape Bathurst, had been in motion for some time. The large floe ridges indicate that break-up in the eastern half of Amundsen Gulf was a recent event. Puddling had appeared and was developing throughout the length of the waterway from Amundsen Gulf to Spence Bay as well as in Peel Sound.

No departures from the usual pattern of break-up were evident; however, the timing in some areas was a little ahead while in others it was slightly behind.

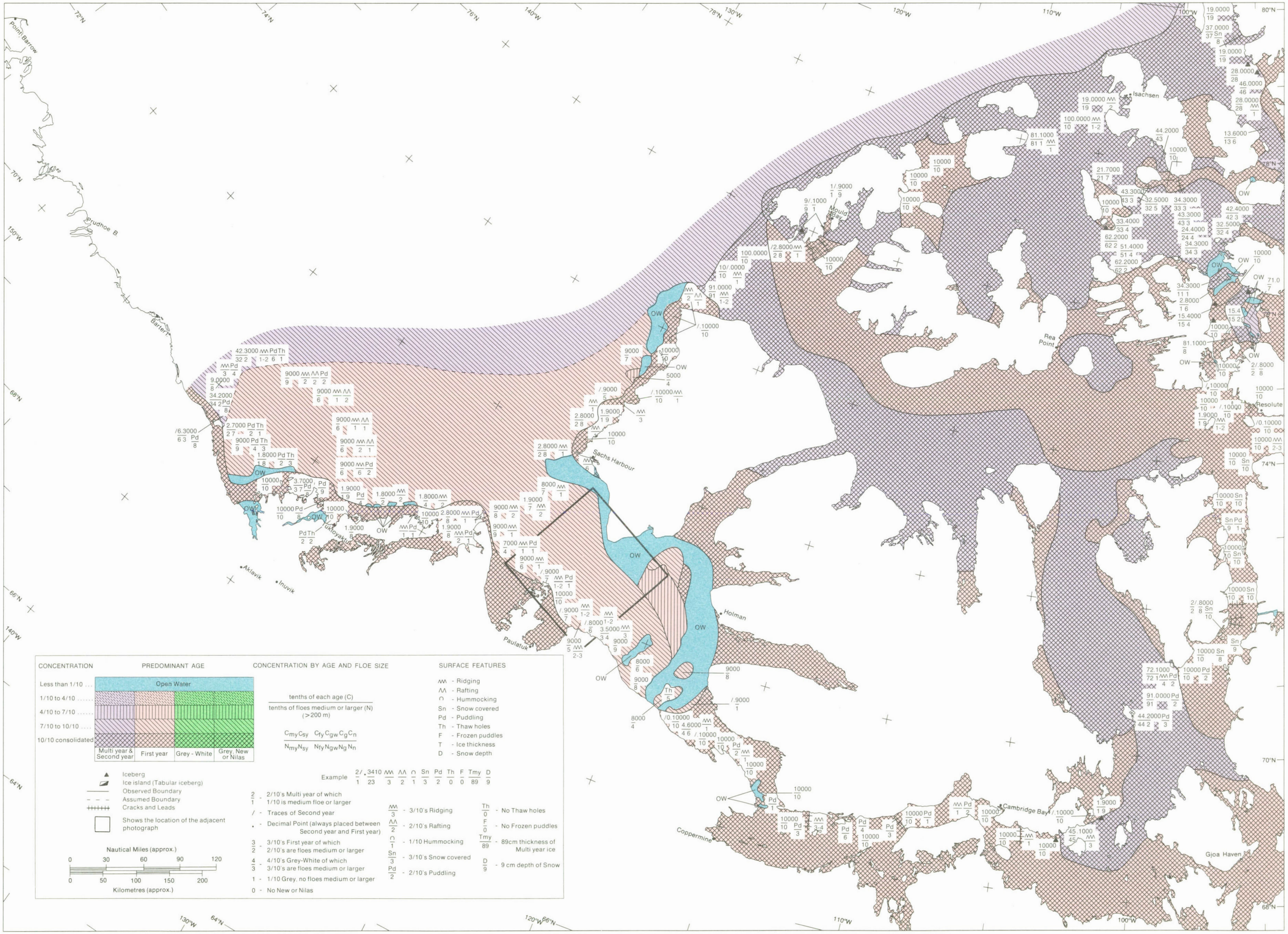
Unobserved Areas

The conditions shown in the unobserved portion of Parry Channel and M'Clintock Channel were based on previous surveys and confirmed by later ones. For northern Amundsen Gulf and Prince of Wales Strait satellite photographs were interpreted. Assumed conditions based on adjacent information, usual conditions and subsequent data are shown for the mid-Beaufort Sea.

Comments

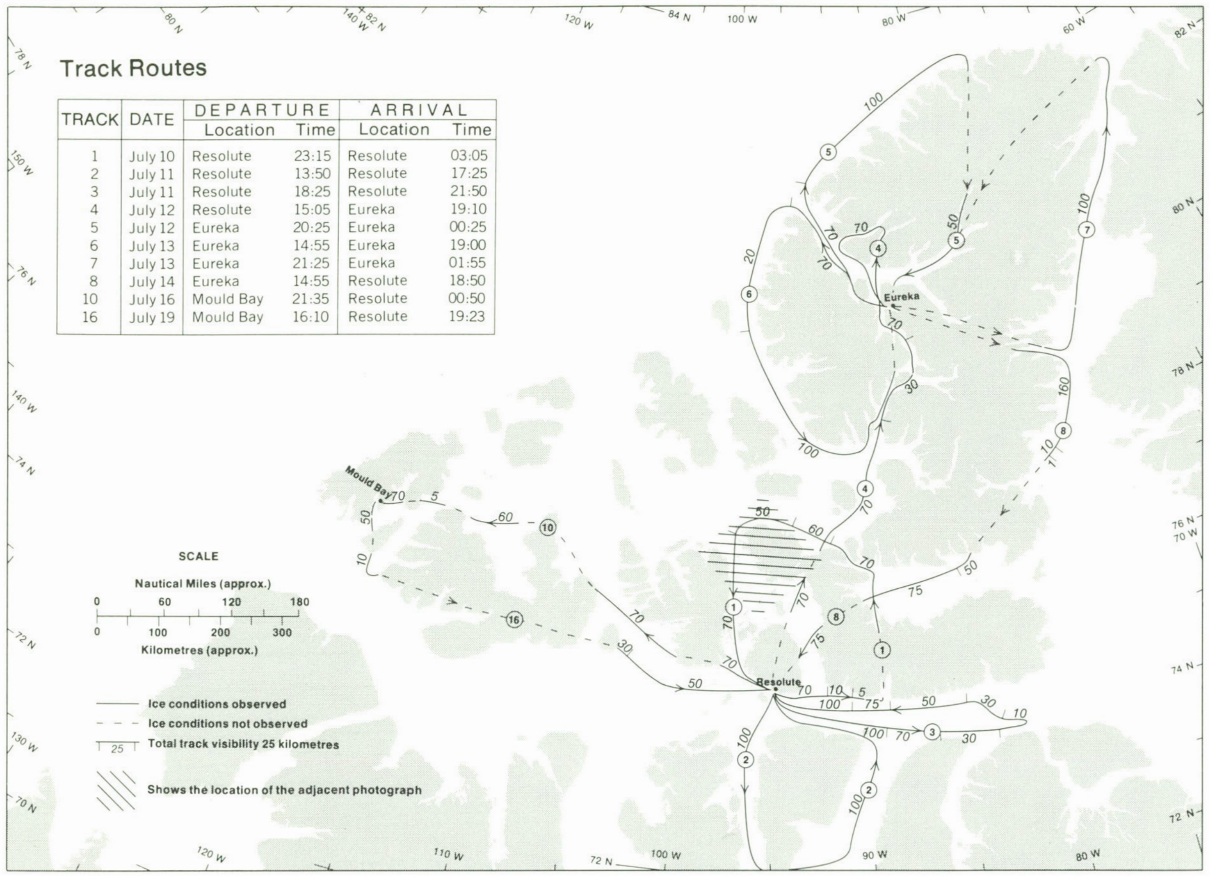
The rate the season advanced varied from place to place. For example, the ice cover in Amundsen Gulf does not usually break up in the eastern part as early as this. On the other hand the polynya in Dolphin and Union Strait is usually slightly larger and there was less puddling in the area than usually develops by this time. Puddling in Larsen Sound and in northern Peel Sound was appearing ahead of the usual time. Overall the season appeared to be advancing slightly faster than a typical year.

The satellite photograph was taken on June 15 and the area was surveyed on June 19. Noticeable changes had taken place in the extent of open water north of Banks Island.

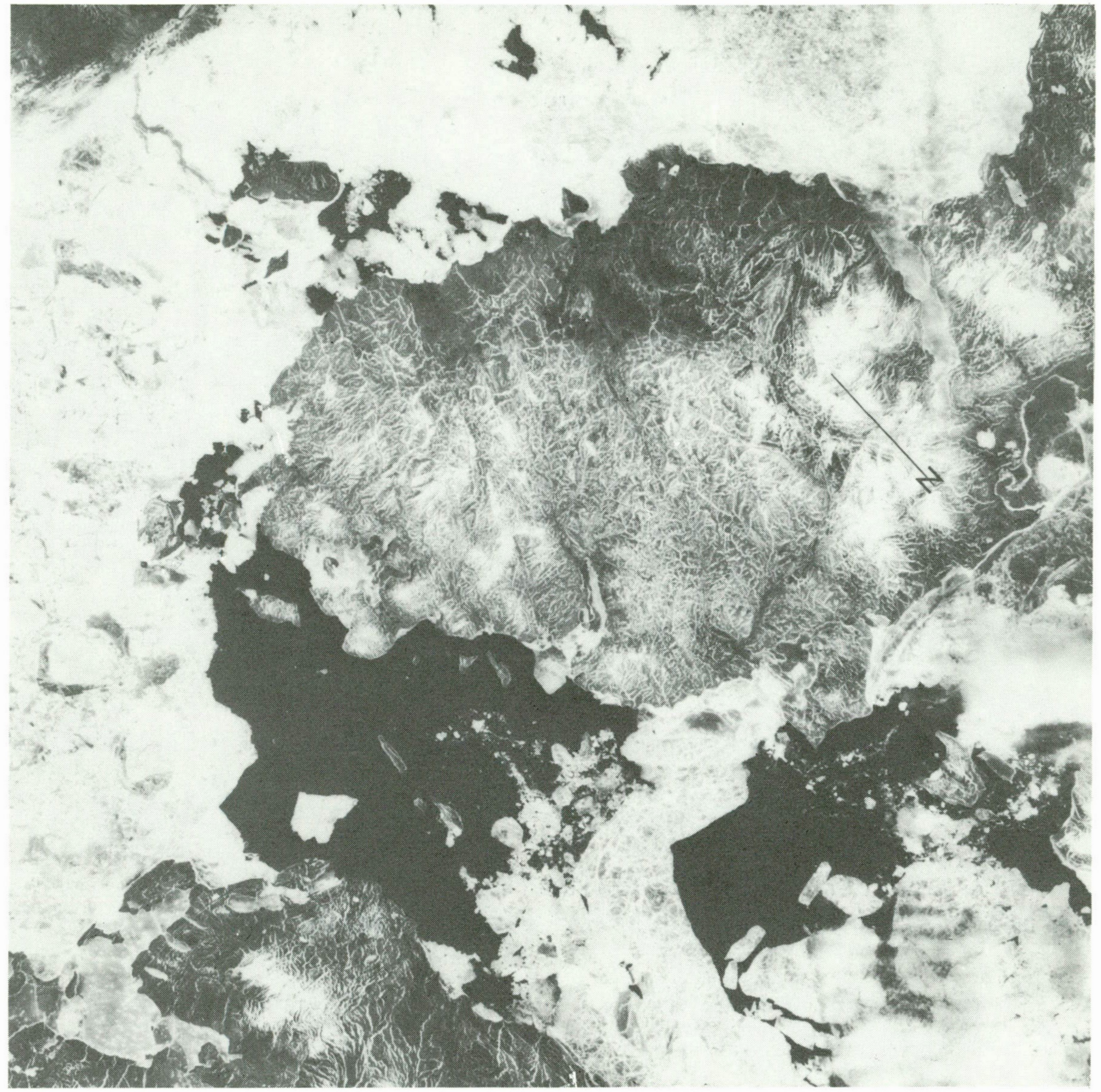


MAP 2 - 1978 WEST

June 15-23, 1978



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	July 10	Resolute	23:15	Resolute	03:05
2	July 11	Resolute	13:50	Resolute	17:25
3	July 11	Resolute	18:25	Resolute	21:50
4	July 12	Resolute	15:05	Eureka	19:10
5	July 12	Eureka	20:25	Eureka	00:25
6	July 13	Eureka	14:55	Eureka	19:00
7	July 13	Eureka	21:25	Eureka	01:55
8	July 14	Eureka	14:55	Resolute	18:50
10	July 16	Mould Bay	21:35	Resolute	00:50
16	July 19	Mould Bay	16:10	Resolute	19:23



Penny Strait, July 13, 1978, T56 F5

MAP 3-1978 East

July 10-19

Flight Effectiveness

The flight was almost 70 per cent effective. Low ceilings and fog along with rain and some airframe icing were all factors that limited observations during some tracks. Poor radio communications around Eureka and Alert reduced the effectiveness of tracks 5 and 7. Because of poor weather forecasts no surveys were made in the central northern area.

Ice Conditions

During the seventeen days between flights 2 and 3 puddling had developed throughout the entire region to a considerable extent. Thaw holes were developing rapidly as the puddles gradually melted through the ice cover. A rotten ice cover had developed in central Eureka Sound and in the northern part of M'Clure Strait.

The existence of cracks and leads in Hall Basin and Robeson Channel indicated that break-up was imminent. The same situation prevailed in the portion of Barrow Strait south of Bathurst Island.

The concentration of multi-year ice along the northern coast of Ellesmere Island was typical but ridging was more prevalent than usual.

When Lancaster Sound was surveyed during track 3 on July 11 it was entirely solid. On or just before July 19 the ice in the western part broke up and this is shown on the map. This break-up allowed the ice in eastern Barrow Strait to move to the east creating a sizeable lead arching across the strait from Cornwallis Island near Resolute to Somerset Island. By July 26 the solid plug in the eastern part of Lancaster Sound was finally breaking up and by the end of the month the ice in Lancaster Sound and Barrow Strait had broken as far west as Lowther Island. Peel Sound and Wellington Channel held fast.

The conditions shown for Prince Regent Inlet on Map 3–1978 EAST were observed on July 11. By July 19 the ice in the northern part had broken, very rapid melting in situ had taken place and a wide open area had developed along the length of the Brodeur Peninsula shown on the map.

Unobserved Areas

Satellite photographs were interpreted to try to determine the conditions in Baffin Bay. Near Alert the boundaries shown were based on adjacent surveys and the usual situation. Satellite photography along the fringe of the Arctic Ocean from Prince Patrick Island to Ellef Ringnes Island was used to determine the ice conditions in these areas. Typical conditions were assumed to exist across the northern entrance to Peary Channel.

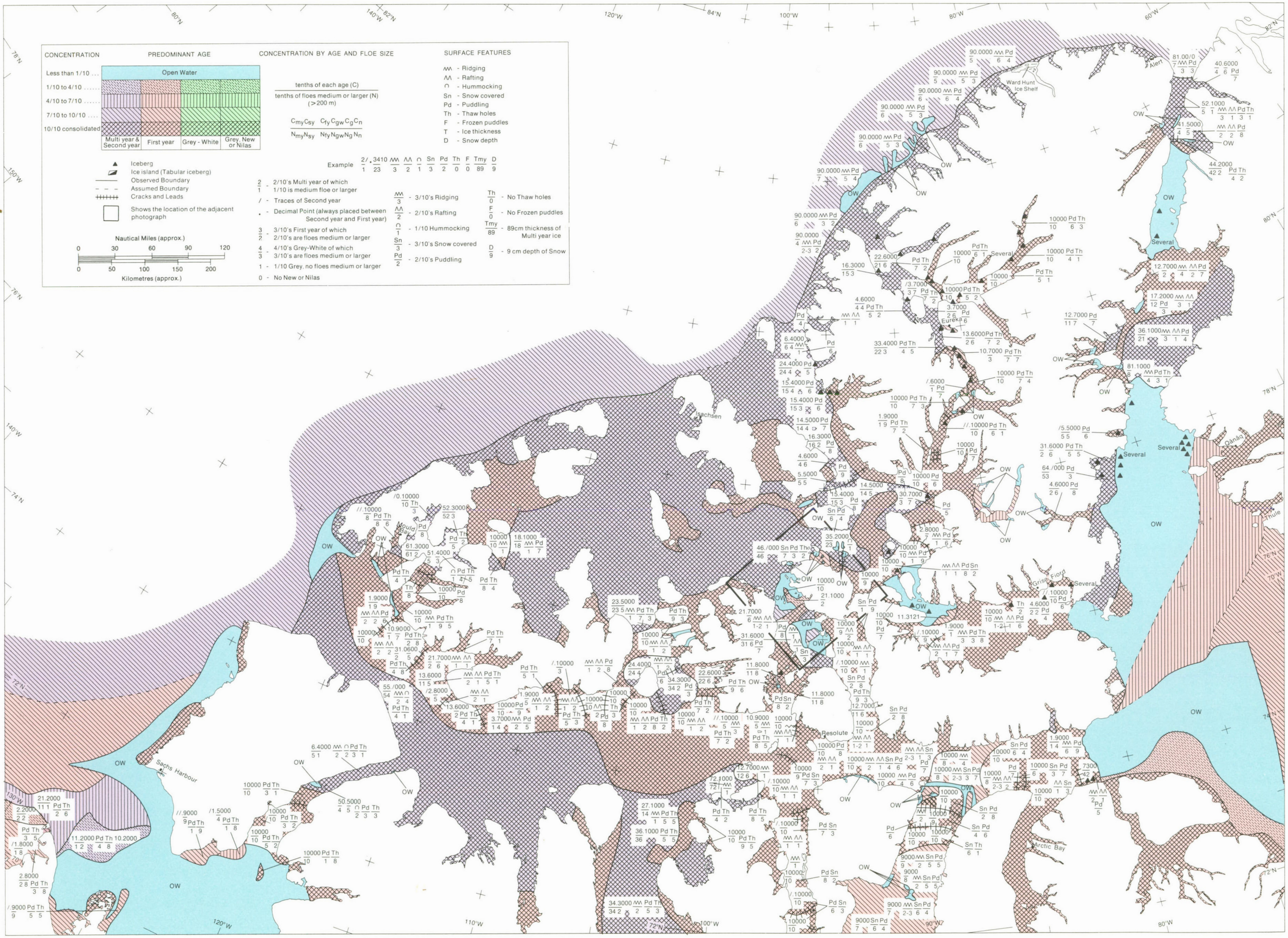
Comments

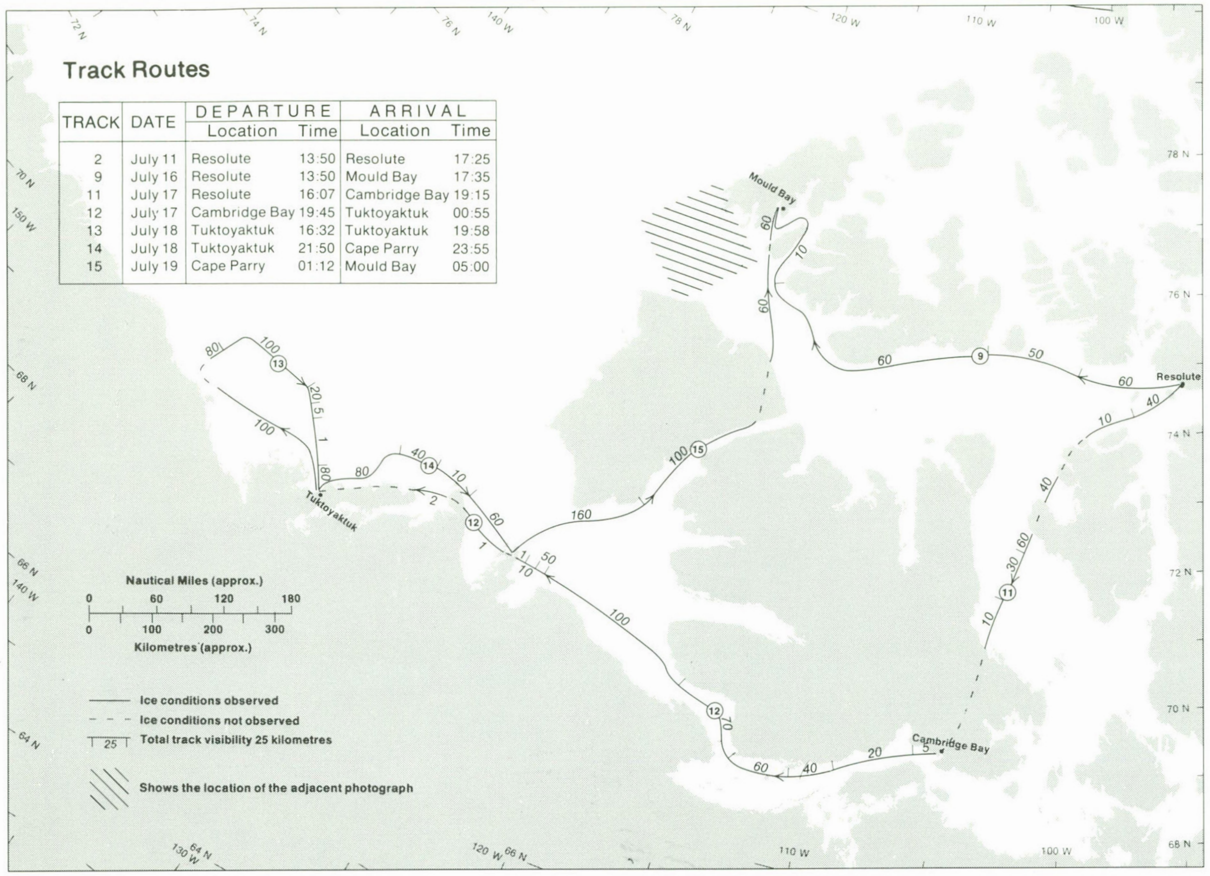
Puddling is usually expected at this time of year but the concentrations in 1978 seemed to be at least one-tenth and in some areas two-tenths greater than usual. Thaw holes were very prominent. Although these signs of break-up were evident, drifting snow was observed blowing on the ice near Brodeur Peninsula on July 11.

Apart from the unusual situation in Lancaster Sound and the extremely early clearing in Kennedy Channel the season on the remaining areas appeared to be advancing slightly faster than usual.

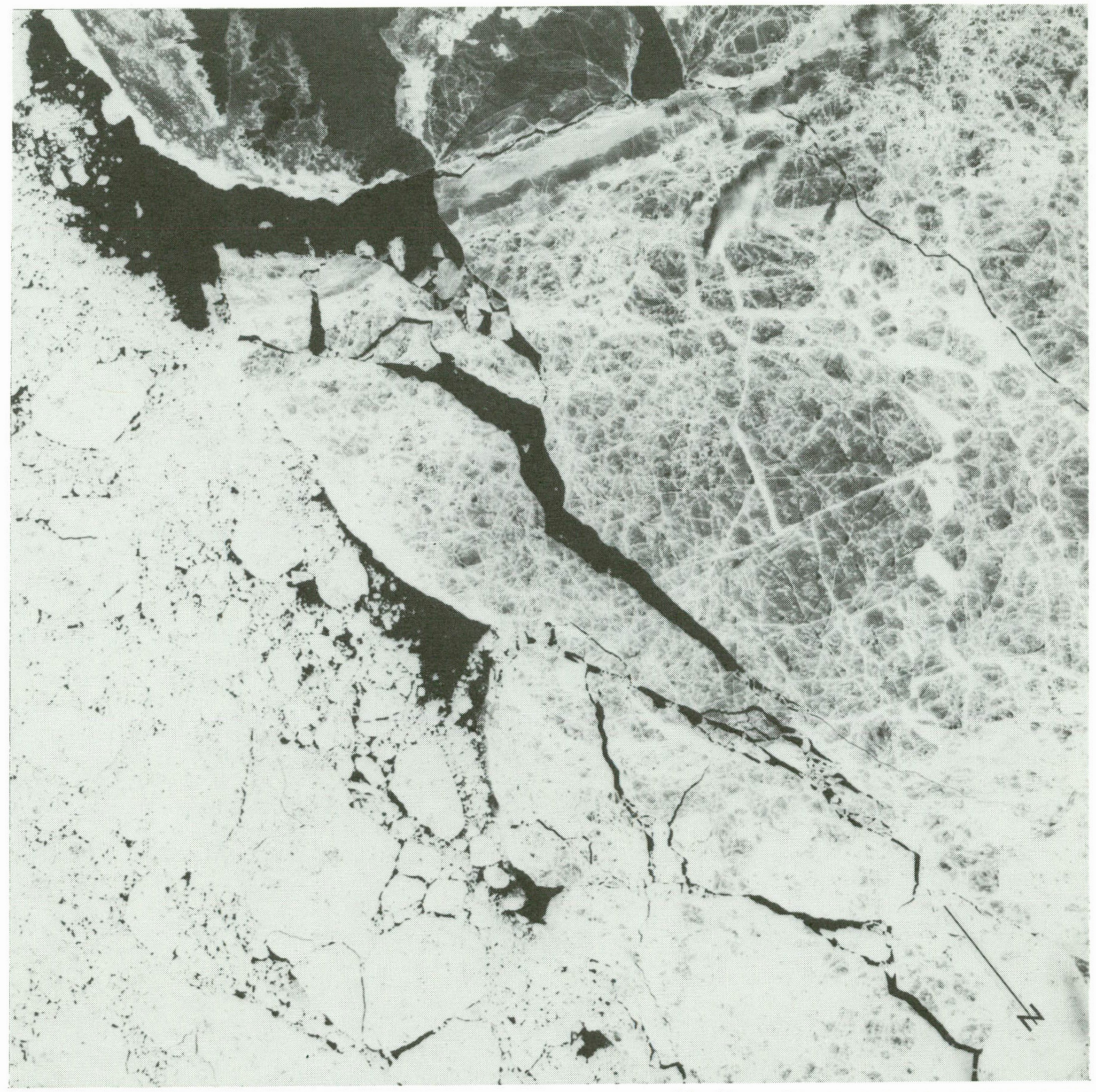
The scallop in the ice edge across North Water was an unusual development.

The satellite photograph shows the classic advance of the break-up in Queens Channel, Penny Strait and Belcher Channel. Each year the progression is similar; however, the timing changes. This year the situation was normal.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
Open Water
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Resolute
Sachs Harbour
Arctic Bay
Grise Fiord
Thule
Qânâq
OW
Several



TRACK	DATE	DEPARTURE Location	Time	ARRIVAL Location	Time
2	July 11	Resolute	13:50	Resolute	17:25
9	July 16	Resolute	13:50	Mould Bay	17:35
11	July 17	Resolute	16:07	Cambridge Bay	19:15
12	July 17	Cambridge Bay	19:45	Tuktoyaktuk	00:55
13	July 18	Tuktoyaktuk	16:32	Tuktoyaktuk	19:58
14	July 18	Tuktoyaktuk	21:50	Cape Parry	23:55
15	July 19	Cape Parry	01:12	Mould Bay	05:00



M' Clure Strait, July 11, 1978, T72 F6

MAP 3-1978 West

July 10-19

Flight Effectiveness

The weather during the tracks over the western part of the region was generally very fine. The lack of data for the central part of the Beaufort Sea and the Victoria Strait area, especially the former, is regrettable. The flight was 85 per cent effective.

Ice Conditions

The developments between the two flights were typical. The snow cover had disappeared. Puddling had increased and thaw holes were developing. Practically all of the ice in Amundsen Gulf had disappeared, likely by melting. The ice edges around the perimeter of the gulf had retreated slightly. In the Beaufort Sea melting had reduced the concentration considerably and open areas were developing along the coast. While this clearing was underway the multi-year ice drifted further south to take the place of the ablating younger forms. Areas of mostly multi-year ice appeared in the southern part of the Beaufort Sea because the once dominant concentrations of first-year ice had melted and disappeared faster than the older ice forms spread throughout it.

Unobserved Areas

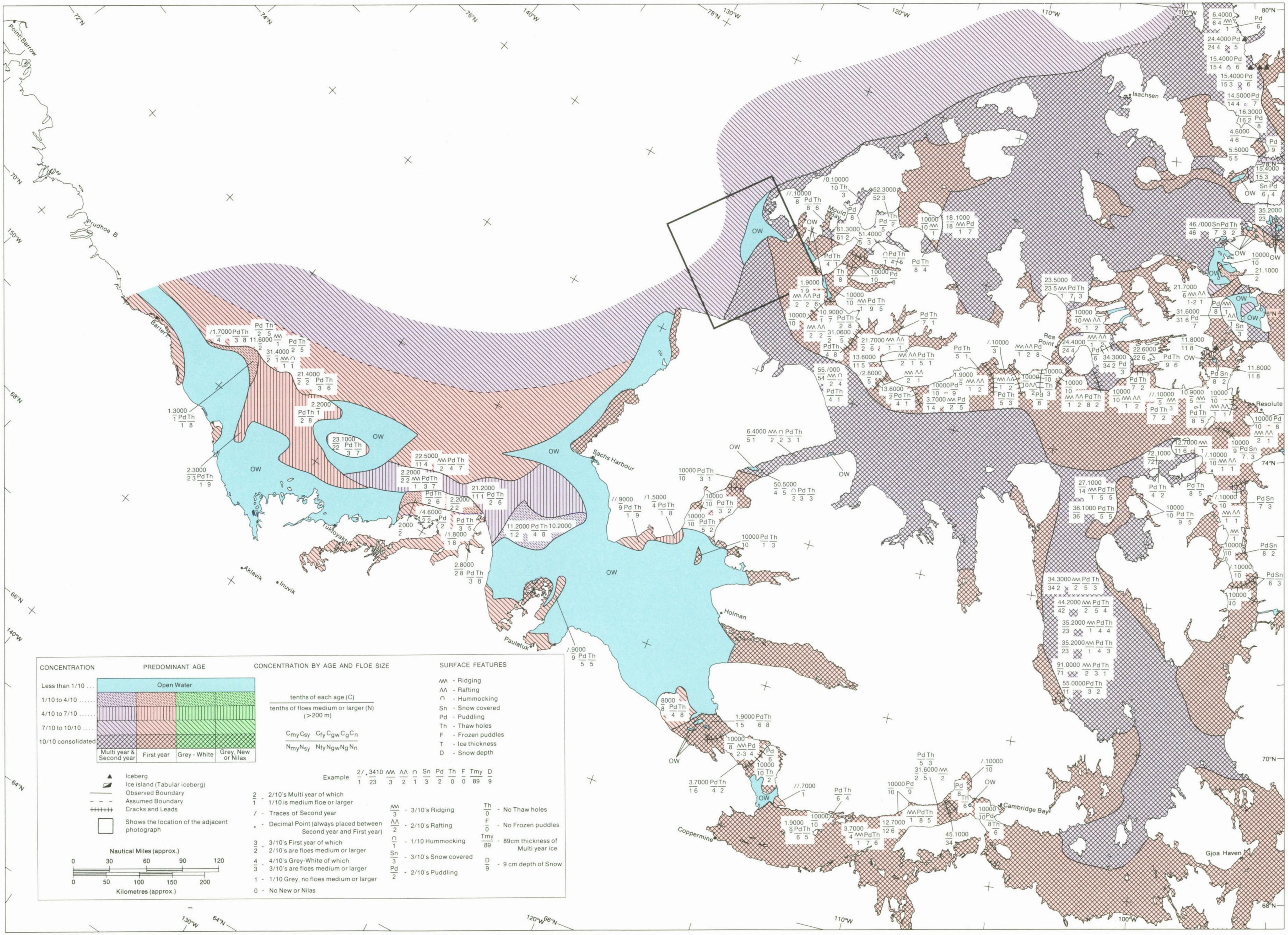
The conditions in Larsen Sound, the channels around King William Island and in Queen Maud Gulf were established on the basis of adjacent observations. It is likely that areas of open water had developed in their usual spots in the narrows to the south and east of King William Island. The polynya at the northern tip of Tasmania Island in Franklin Strait was probably developing.

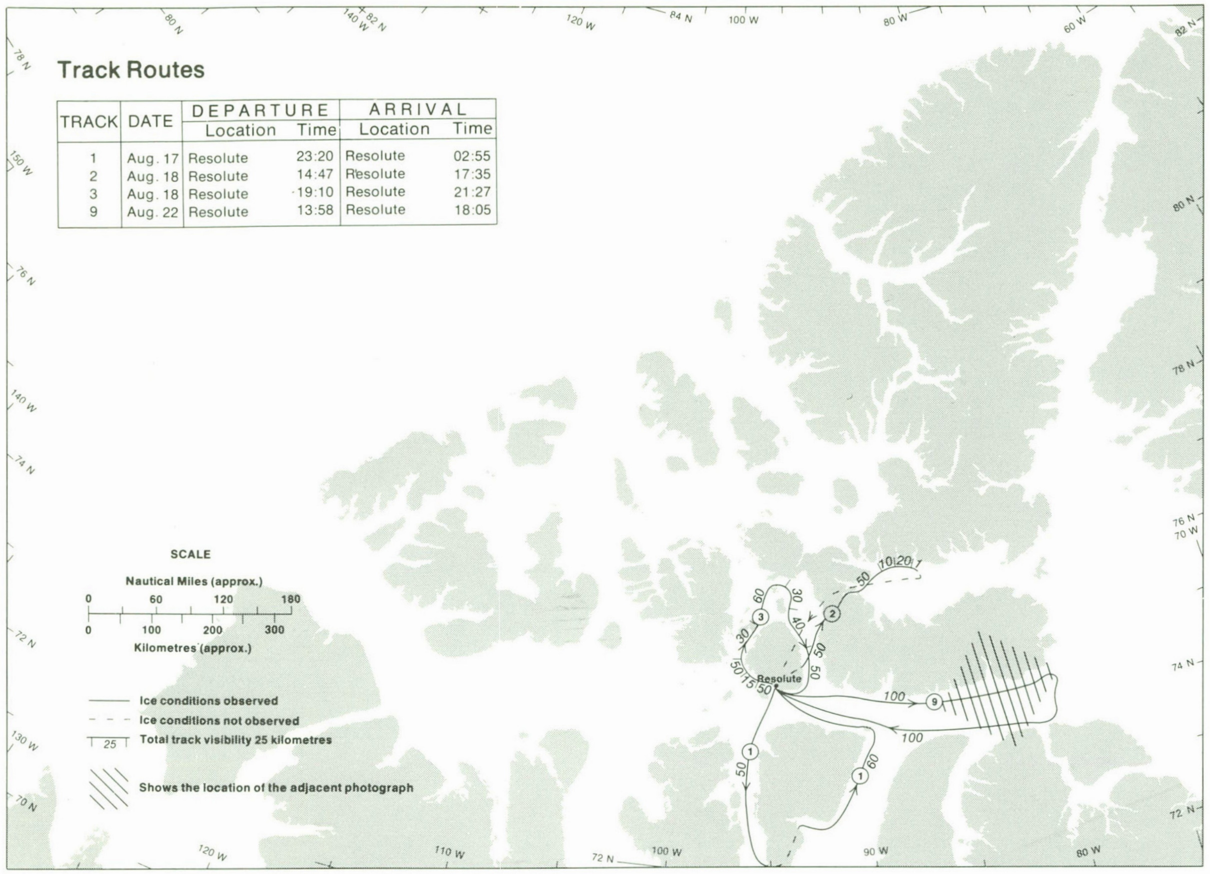
The satellite photographs helped to arrive at the conditions shown in the Beaufort Sea. However, the boundary between multi-year and first-year ice was not definitely determined.

Comments

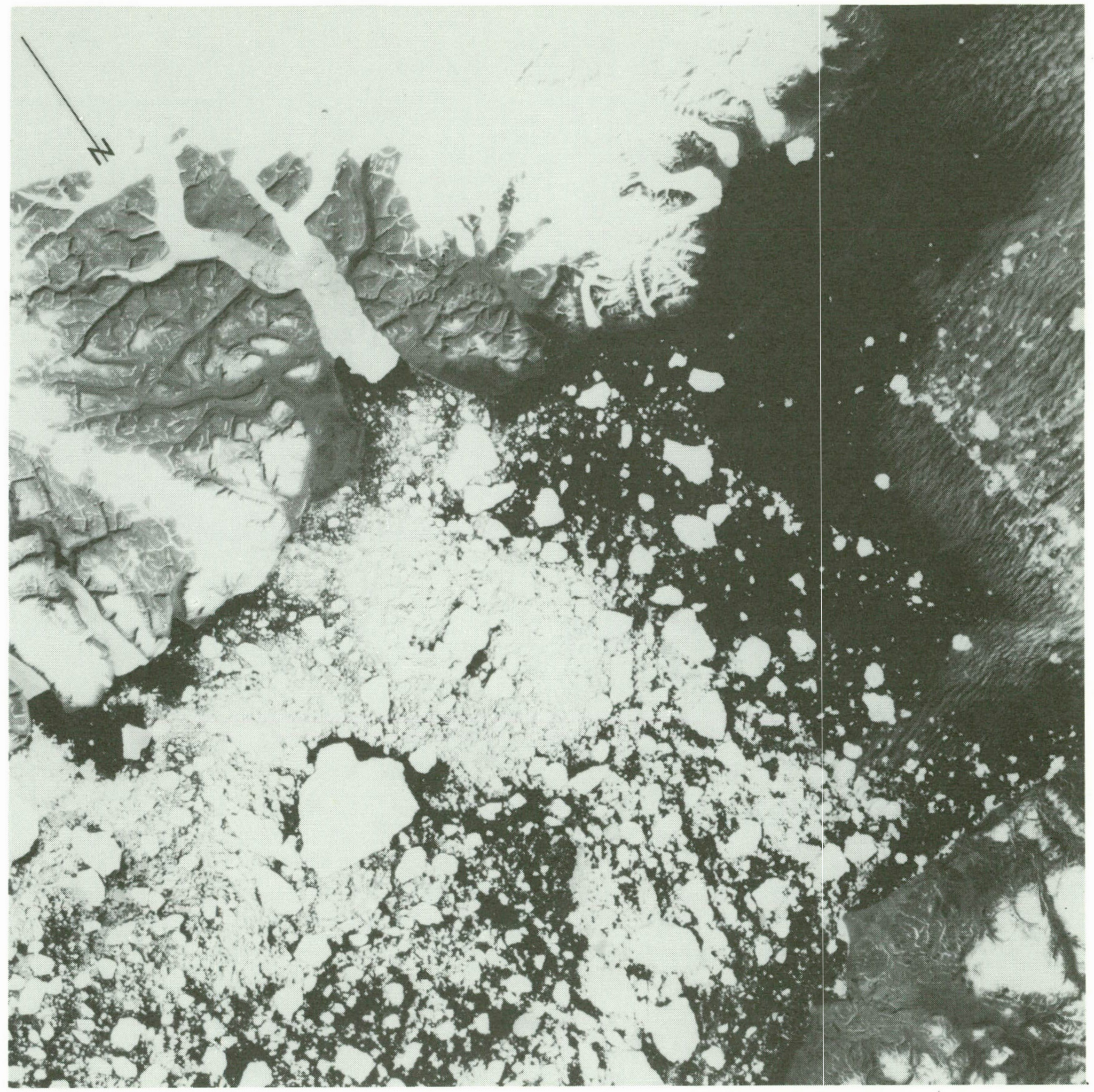
The type of ice year that was developing seemed to vary according to the indicator selected. For example, the amount of puddling in the region was greater than usual at this time of year. However, the break-up and clearing in the polynya in Dolphin and Union Strait was not as extensive as usual. A similar divergence was noted in Amundsen Gulf where clearing had taken place much faster than usual while clearing in the southern part of the Beaufort Sea was delayed. Overall the season was a little ahead of the usual rate of advance.

The satellite photograph provides a fine view of M'Clure Strait. It is possible to distinguish the multi-year ice from the first-year ice. The older ice appears almost white seemingly snow-covered while the younger or first-year ice is darker. This temporary situation allowing the types to be distinguished from one another developed primarily because of puddling. The multi-year ice is more rugged and the puddles are small and separated from one another so that the satellite shows the area predominantly white. The first-year ice is relatively flat and the puddling expanded very rapidly and flooded larger areas resulting in a dark image for the first-year ice. This situation would soon change because puddling would decline as drainage systems and thaw holes developed.


Point Barrow
Prudhoe B
Barter I
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Sachs Harbour
Holman
Mould Bay
Isachsen
Rea Point
Resolute
Cambridge Bay
Coppermine
Gjoa Haven
OW
CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Nautical Miles (approx.)
Kilometres (approx.)
Example
2/1 - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
1	Aug. 17	Resolute	23:20	Resolute	02:55
2	Aug. 18	Resolute	14:47	Resolute	17:35
3	Aug. 18	Resolute	19:10	Resolute	21:27
9	Aug. 22	Resolute	13:58	Resolute	18:05



Lancaster Sound, August 21, 1978, T41 F7

MAP 4-1978 East

August 17-26

Flight Effectiveness

The weather throughout much of the eastern region was unfavourable during scheduled tracks. As a result a large portion was unobserved and dropped flight effectiveness to less than 20 per cent. Fortunately satellite data were available and increased the effectiveness threefold.

Ice Conditions

As usual, the changes that took place between mid-July and mid-August were very noticeable as break-up advanced into the region. The ice cover throughout Lancaster Sound and Barrow Strait, as far west as Lowther Island, had broken up by July 26. Probably the sequence continued as Belcher Channel, weakened by the polynyas along with Eureka Sound, broke up by the end of July followed by Wellington Channel and Jones Sound in the second week in August. The ice in the southern part of Norwegian Bay was probably broken early in August while the advance through the northern part was very rapid and was completed in two days starting on August 17. The map shows the ice edge on August 17. Break-up raced on into southern Massey Sound and this entire area had broken by August 20. The consolidated ice cover in the southern half of the unnamed sea north of Penny Strait shown on the map for August 17 broke up about four days later. The timing of the break-up in Austin Channel was similar. After August 22 the ice cover in Prince Gustaf Adolf Sea began to break up.

During the interval between flights 3 and 4 puddling had reached its maximum and declined to a stable three- to four-tenths while thaw holes rapidly developed. The ice in Robeson Channel and Kane Basin had given way and multi-year ice spread along the length of Nares Strait. In Baffin Bay the concentrations of first-year ice had been reduced by melting to the point where the older forms, although very sparse, became the dominant type.

The main departure from the usual situation was the large amount of ice remaining in Lancaster Sound and Barrow Strait. The break-up of the ice in the northern part of Prince Gustaf Adolf Sea was also unusual. Apart from these the advance of break-up in the other areas was following the typical pattern.

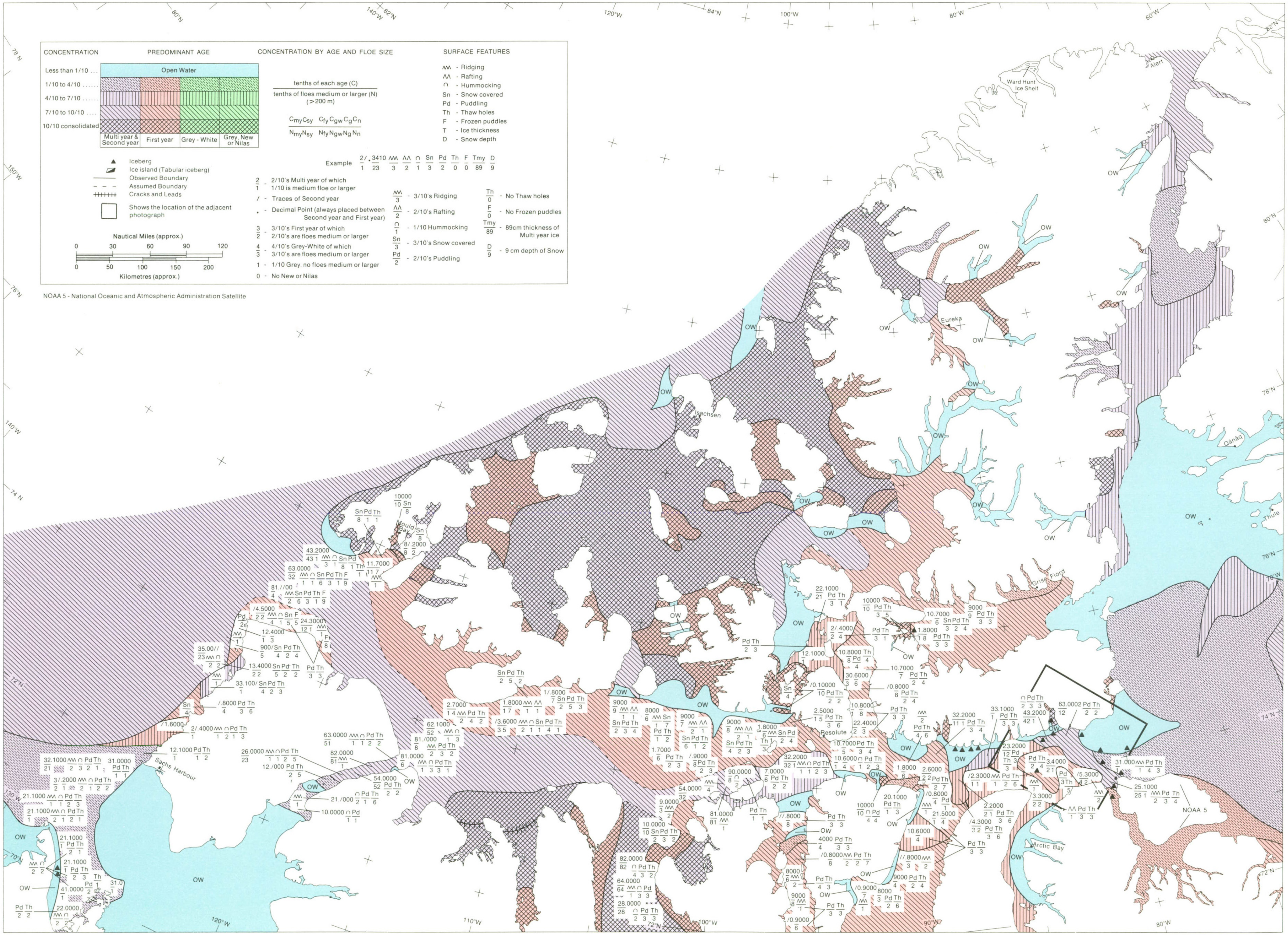
Unobserved Areas

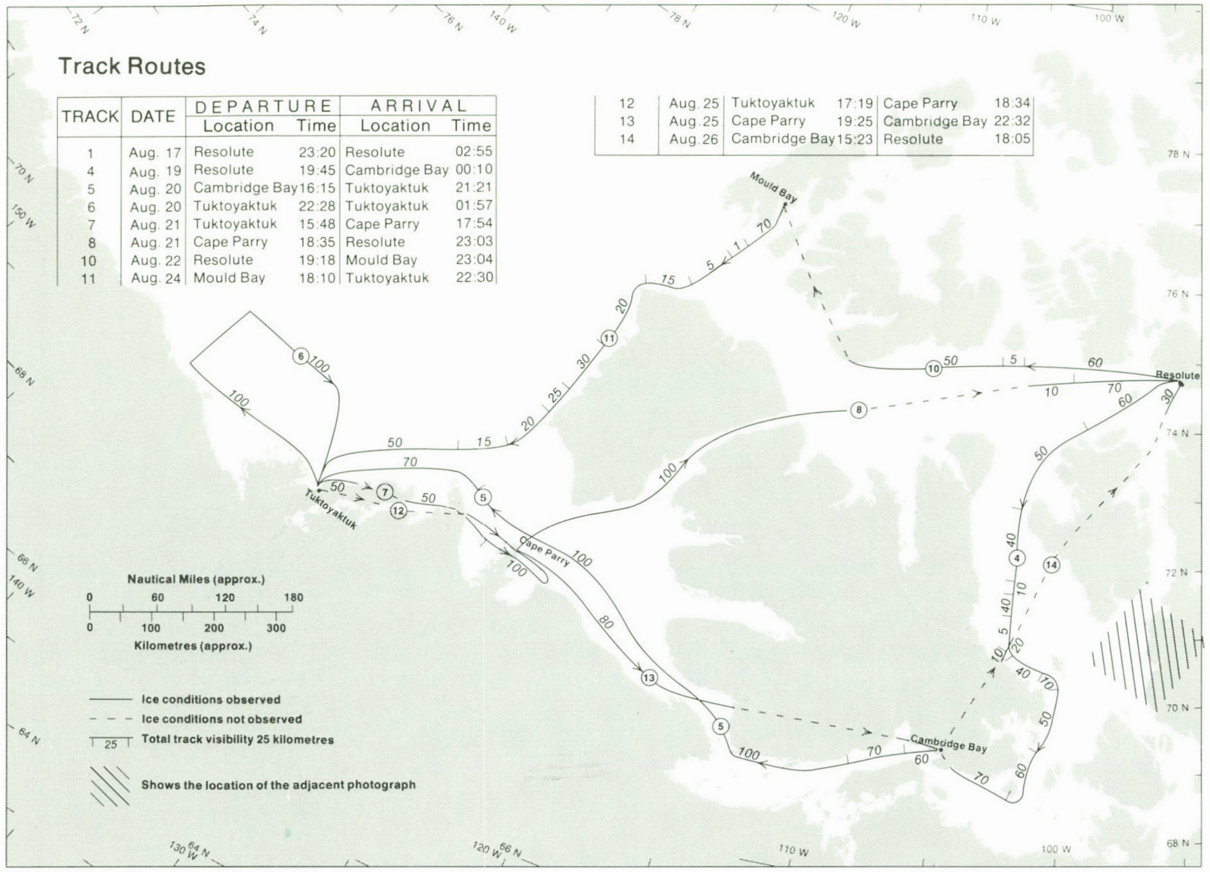
Satellite photographs were interpreted to try to determine the ice conditions in the extensive unobserved area that remained after Flight 4 was finished. Probably the situation along the northern coast of Ellesmere Island was very similar to the one shown on Map 3–1978 EAST.

Comments

Usually Lancaster Sound and Barrow Strait are almost totally free of ice at this time of the year. In eighteen consecutive years (the PCSP started making observations in the area in 1961) only one similar case of high ice concentrations was noted. This was in 1963. See ***Sea Ice Atlas of Arctic Canada 1961-1968***. Apart from the abnormal conditions in Lancaster Sound and Barrow Strait the sequence of the advance of break-up in the remainder of the area was normal and the timing was only slightly slower than usual.

The satellite photo shows the distribution in eastern Lancaster Sound one day after track 9 was completed. Little change had taken place.


CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
0 - No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
NOAA 5 - National Oceanic and Atmospheric Administration Satellite
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Qanaq
Thule
Grise Fiord
Resolute
Sachs Harbour
Arctic Bay
NOAA 5
OW



TRACK	DATE	DEPARTURE Location	Time	ARRIVAL Location	Time
1	Aug. 17	Resolute	23:20	Resolute	02:55
4	Aug. 19	Resolute	19:45	Cambridge Bay	00:10
5	Aug. 20	Cambridge Bay	16:15	Tuktoyaktuk	21:21
6	Aug. 20	Tuktoyaktuk	22:28	Tuktoyaktuk	01:57
7	Aug. 21	Tuktoyaktuk	15:48	Cape Parry	17:54
8	Aug. 21	Cape Parry	18:35	Resolute	23:03
10	Aug. 22	Resolute	19:18	Mould Bay	23:04
11	Aug. 24	Mould Bay	18:10	Tuktoyaktuk	22:30
12	Aug. 25	Tuktoyaktuk	17:19	Cape Parry	18:34
13	Aug. 25	Cape Parry	19:25	Cambridge Bay	22:32
14	Aug. 26	Cambridge Bay	15:23	Resolute	18:05

Southeastern M' Clintock Channel, August 25, 1978, T45 F10

MAP 4-1978 West

August 17-26

Flight Effectiveness

Generally the weather in the western part of the region was as favourable for ice reconnaissance surveys as it was poor in the eastern area. The flight was better than 80 per cent effective.

Ice Conditions

Between the two flights the first-year ice in the Beaufort Sea had almost melted away while the multi-year ice moved about 100 km further south. Break-up and clearing had almost been completed in the waterway from Amundsen Gulf to Spence Bay. Only Dease Strait and the eastern part of Queen Maud Gulf hosted notable quantities of ice.

The break-up in Peel Sound and the western part of Parry Channel was probably completed during the second week of August. By the end of the third week the floe sizes south of Byam Martin Island were radically reduced. About the same time, after August 19, the ice cover in the eastern part of Larsen Sound was starting to break up.

No departures from the usual patterns followed by break-up and clearing were noted. Thaw holes continued to develop throughout the region.

Adjacent Areas

Satellite photographs along with the observations made to the south and east were used to establish ice conditions in the central part of the Beaufort Sea. Previous and subsequent information provided clues for the ice cover shown in unobserved portions of M'Clure Strait and Viscount Melville Sound. The interpretation of satellite photographs was the main tool used to show the ice conditions in the channels surrounding King William Island.

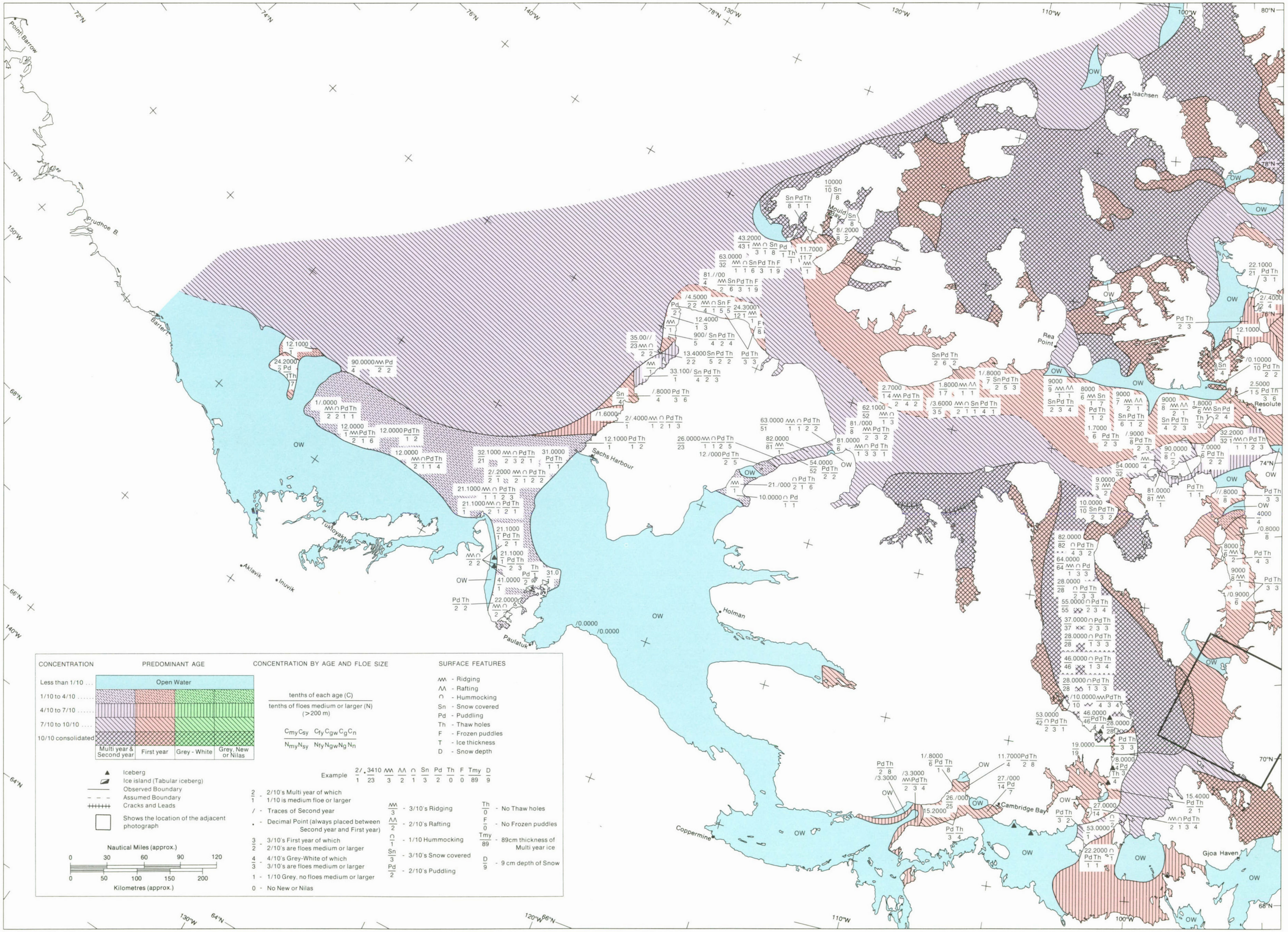
Comments

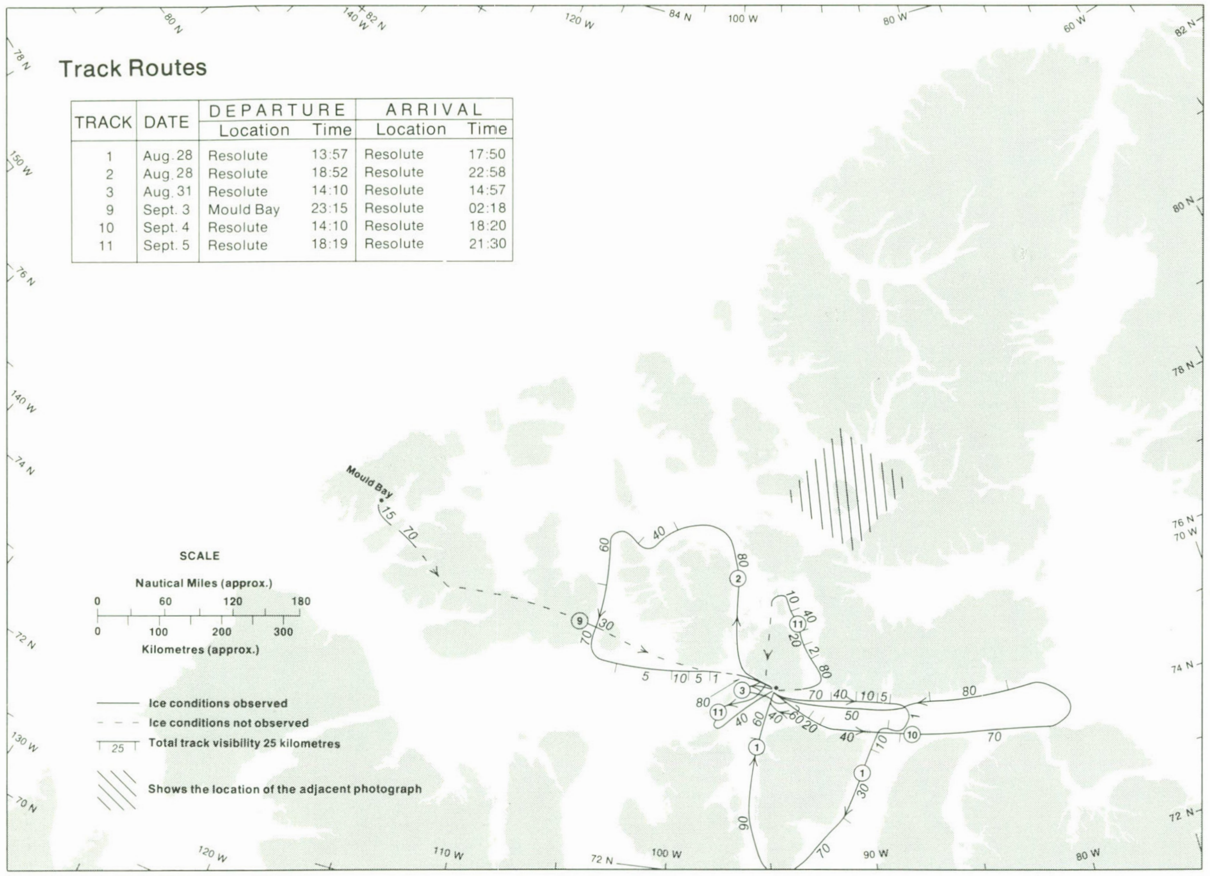
Two different sets of clues gave conflicting input as to the rate of advance of the season. From the amount and timing of break-up it seemed that the season was a little ahead of normal, especially in the Parry Channel, Peel Sound area. On the basis of delayed clearing in Dease Strait and to some extent the eastern part of Queen Maud Gulf it seemed that the season was slightly behind the usual.

Break-up in Peel Sound and the western part of Parry Channel was early compared with the advance of the season in other areas. No major departures from the usual situation were noted.

The solid scallop of ice in the south central part of Austin Channel probably developed because of the restraining effect of the shoal halfway between the southern part of Byam Martin Island and the southwestern tip of Bathurst Island. Ice occasionally piles up in the area and can briefly slow the rate of break-up through the remainder' of the channel. Austin Channel was broken by August 21.

Probably Larsen Sound was still solid at the end of the third week in August. The satellite photograph shows the advances made by August 25.


Point Barrow
Prudhoe B
Barter I
Sachs Harbour
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Isachsen
Mould Bay
OW
CONCENTRATION
PREDOMINANT AGE
CONCENTRATION BY AGE AND FLOE SIZE
SURFACE FEATURES
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Aug. 28	Resolute	13:57	Resolute	17:50
2	Aug. 28	Resolute	18:52	Resolute	22:58
3	Aug. 31	Resolute	14:10	Resolute	14:57
9	Sept. 3	Mould Bay	23:15	Resolute	02:18
10	Sept. 4	Resolute	14:10	Resolute	18:20
11	Sept. 5	Resolute	18:19	Resolute	21:30


Norwegian Bay, September 3, 1978, T54 F4

MAP 5-1978 East

August 28-September 7

Flight Effectiveness

After a long career, this was to be the last series of sea-ice surveys using the Beechcraft CF-TAE. It was a memorable flight not only because the weather was unfavourable but also because an exciting and fortunate finale to track 2 was experienced despite a capricious undercarriage. Visual information was obtained for only about 15 per cent of the area. Fortunately satellite photographs improved this to about 55 per cent effectiveness.

Ice Conditions

Approximately ten days separated observations over similar areas during flights 4 and 5. Generally melting was the root of most of the changes between the two flights. Concentrations in Jones Sound were dramatically reduced. Less obvious, but still important, was the reduction in Nares Strait, Norwegian Bay and Wellington Channel. In Lancaster Sound concentrations dropped about two-tenths while the ice cover in Barrow Strait declined nearly one-tenth.

The break-up that was steadily advancing through Massey Sound on August 20 continued on through Peary Channel to the Arctic Ocean. A similar advance from the unnamed sea north of Bathurst Island through Maclean Strait and Prince Gustaf Adolf Sea was also completed to provide a passageway for the multi-year ice of the Arctic Ocean to move south into the archipelago. Solid ice barriers remained in Byam Martin Channel, Hassel Sound, Sverdrup Channel and Nansen Sound.

New snow had fallen in most areas and this made it a little more difficult to distinguish ice types one from another. However, the visibility in eastern Lancaster Sound was good, about 70 km and 60 m and ice with multi-year characteristics was observed and is shown on the map.

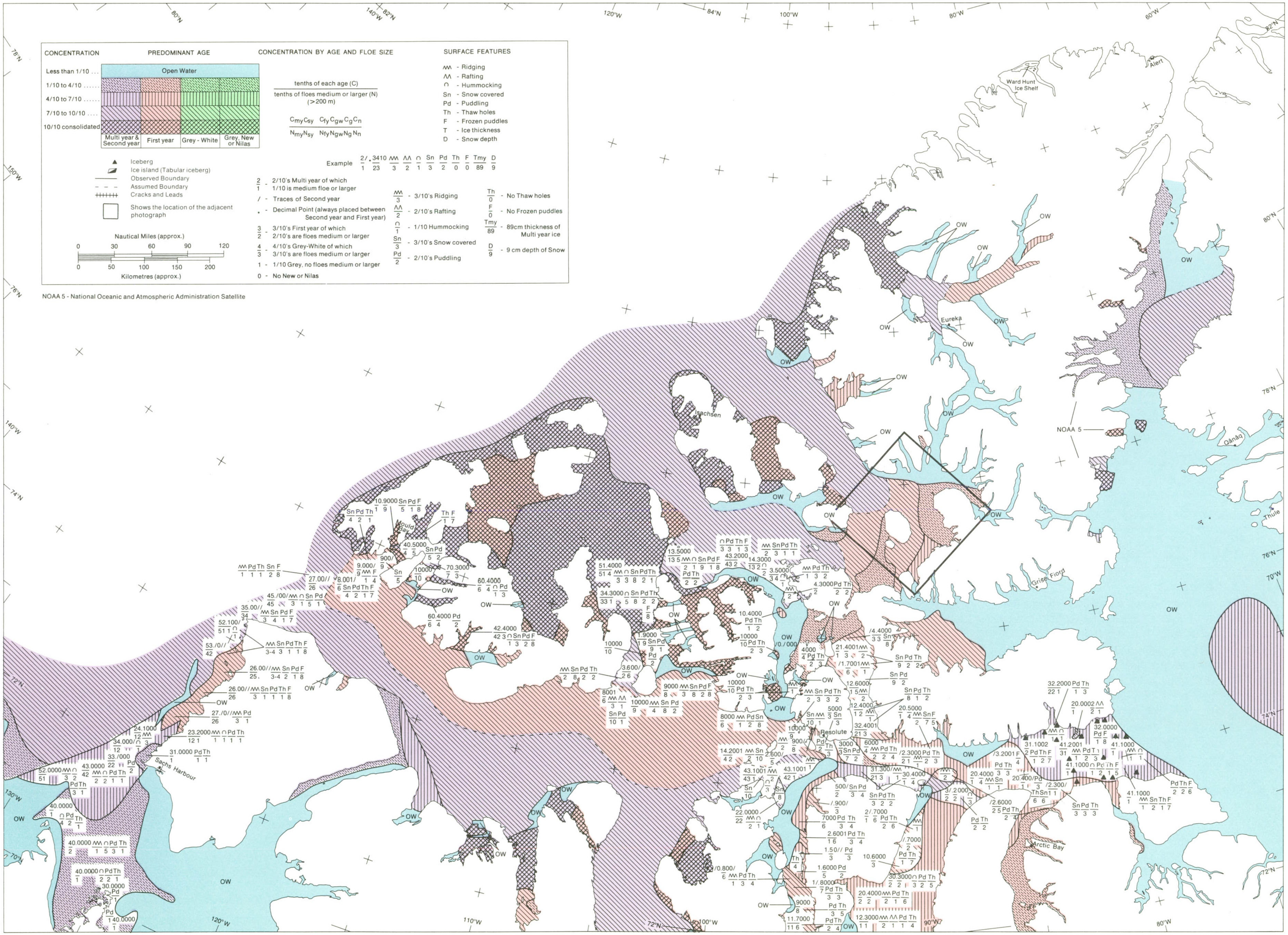
Unobserved Areas

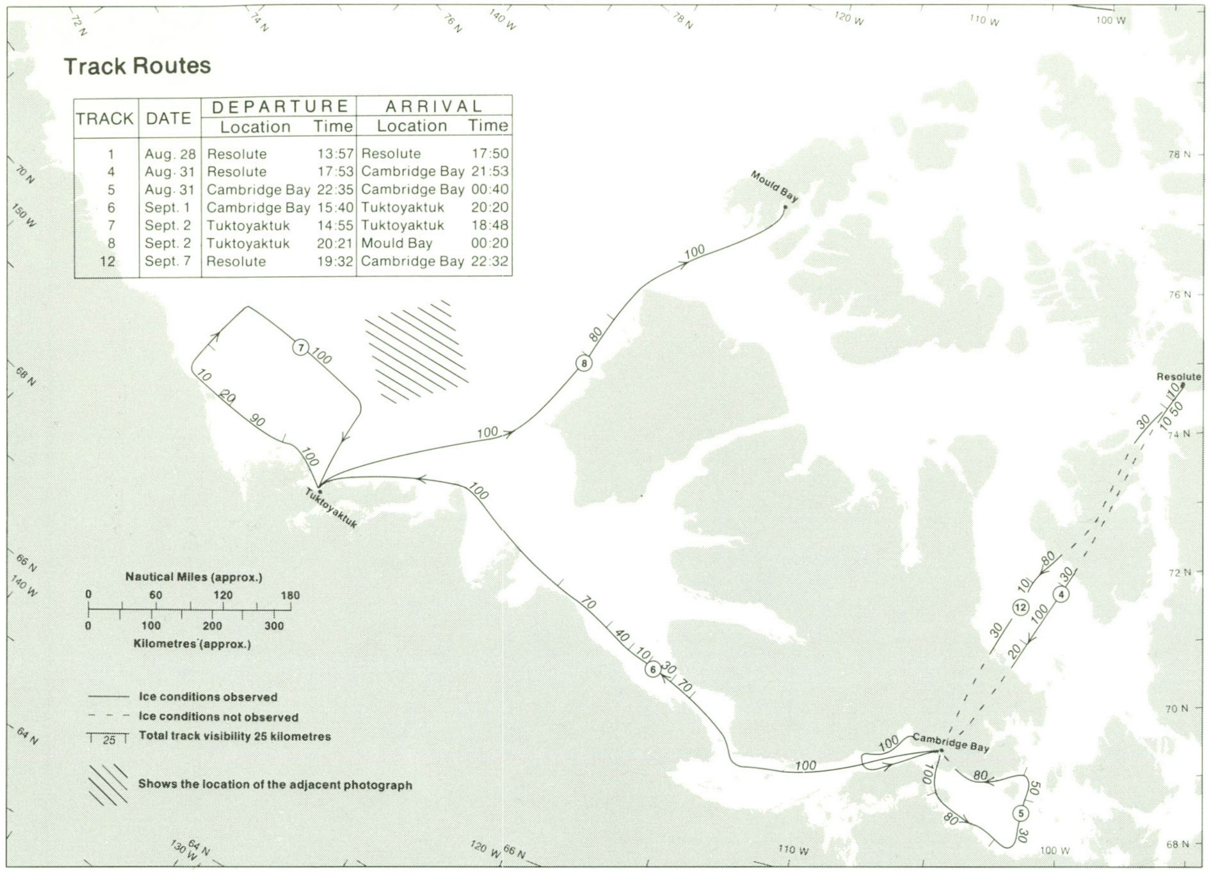
Satellite imagery was a very useful tool to help make out the ice conditions in the large part of the area that was not observed during the flight. Conditions around the northern coast of Ellesmere Island likely resemble those shown on Map 4–1977 EAST.

Comments

It is difficult to establish the type of year because the concentrations in Lancaster Sound and Barrow Strait were so unseasonably large while in the remaining areas break-up was ahead of normal and clearing was just about normal. The pattern of break-up was similar to 1976 and 1977 with Prince Gustaf Adolf Sea breaking before Byam Martin Channel and the area west of Lougheed Island. The fact that Hassel Sound remained solid while the other areas broke up is also a departure from the usual. The main divergence from the norm was the lack of clearing in Lancaster Sound, Admiralty Inlet, Prince Regent Inlet, Barrow Strait and Wellington Channel. Usually these areas are open water at this time of year. This problem and the reason for the large amount of multi-year ice which suddenly appeared still require solutions. In any case the ice was guarded at the eastern entrance to Lancaster Sound by an impressive number of icebergs, at least two polar bears and one Canadian Coast Guard Vessel.

The satellite photograph shows the distribution in Norwegian Bay. The map, made from this and companion photographs, indicates some of the difficulties of trying to show reality on a map.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Nautical Miles (approx.)
Kilometres (approx.)
NOAA 5 - National Oceanic and Atmospheric Administration Satellite
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Mould Bay
Sachs Harbour
Resolute
Grise Fiord
Arctic Bay
Qânâq
Thule
NOAA 5
OW



MAP 5-1978 West

August 28-September 7

Flight Effectiveness

Except during track 12 when the aircraft was leaving the Arctic area the weather was generally favourable for all tracks over the western part of the region during Flight 5. The lack of surveys along the lengths of M'Clure Strait, Viscount Melville Sound and M'Clintock Channel at this time of year would have considerably reduced the effectiveness of the flight if satellite data were not available. Fortunately it was, and the degree of success ranges slightly above 80 per cent.

Ice Conditions

Little change took place in the interval, about ten days, between flights 4 and 5. If the ice edge in the Beaufort Sea separating open water from the multi-year pack ice moved at all it may have advanced toward the coast. Movement in M'Clure Strait and Viscount Melville Sound was enough to cause some shifting especially at the western entrance to M'Clure Strait. There was a little melting and clearing in Peel Sound and Queen Maud Gulf. The obvious developments were the break-up in M'Clintock Channel and the clearing in Dease Strait.

Frozen puddles and a new snow cover were common in the northern areas but the ice was still melting in both the northern and southern parts of the region.

No unusual patterns or movements were noted.

Unobserved Areas

Satellite photographs were interpreted and the results of subsequent surveys were used to try to piece together the probable ice conditions in the western half of Parry Channel and M'Clintock Channel.

Comments

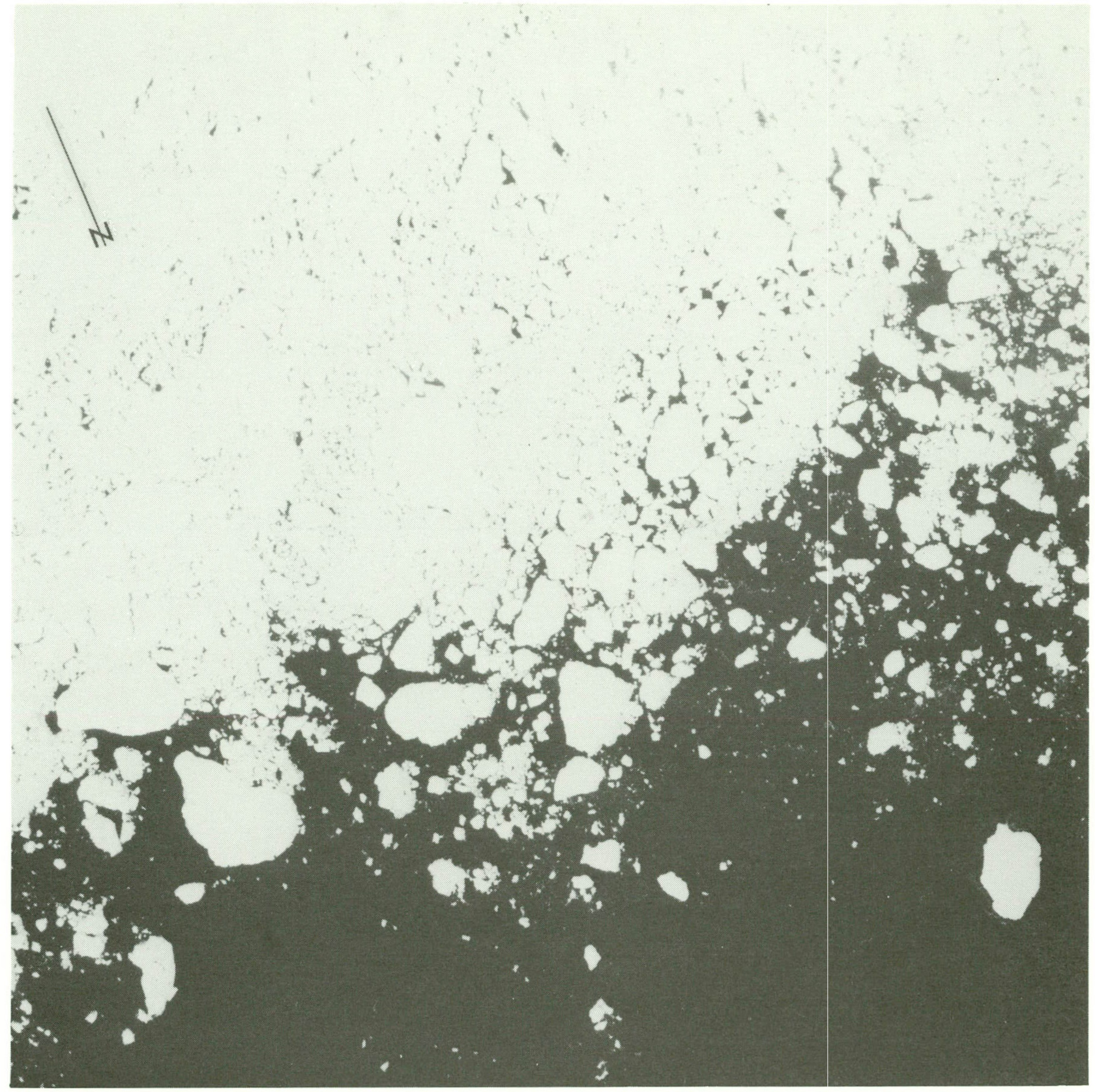
Except for the strip of ice that extended through Amundsen Gulf the overall ice conditions were slightly better than usual for this time of year.

Usually around this time northerly winds shift the ice to the south in Viscount Melville Sound leaving a strip of open water from Resolute to Winter Harbour. These winds developed during the second week of September in 1978.

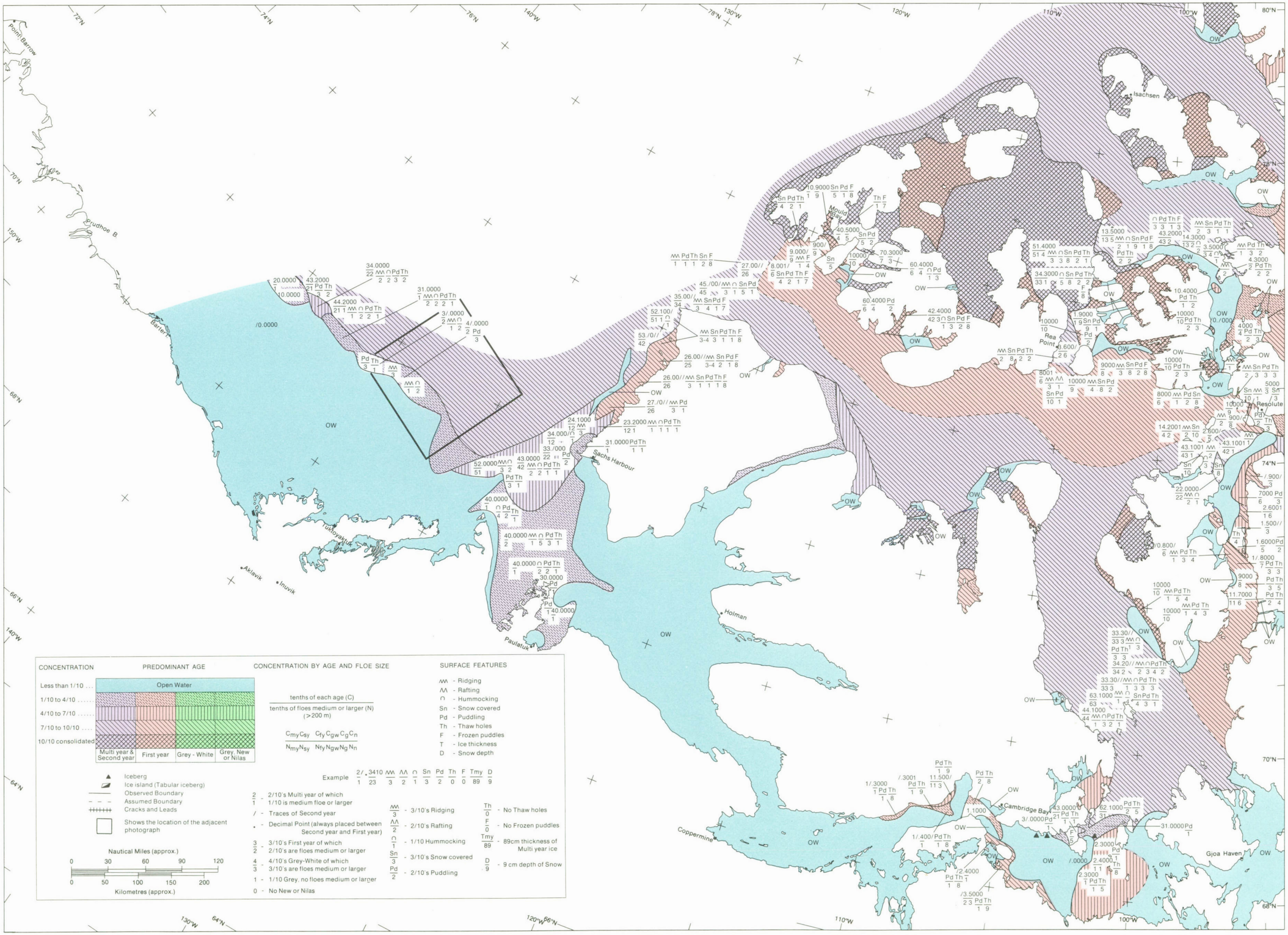
The strip of ice that extends from the pack in the Beaufort Sea into Amundsen Gulf is a typical development in seasons like 1978 when the ice in the Beaufort Sea remains in this location and normal melting conditions are found throughout the region.

The drill ship located about 100 km north of Tuktoyaktuk was in no imminent danger from the pack ice.

The satellite photograph is useful to show the presence of ice and its boundary but the ice types must be established by other means.

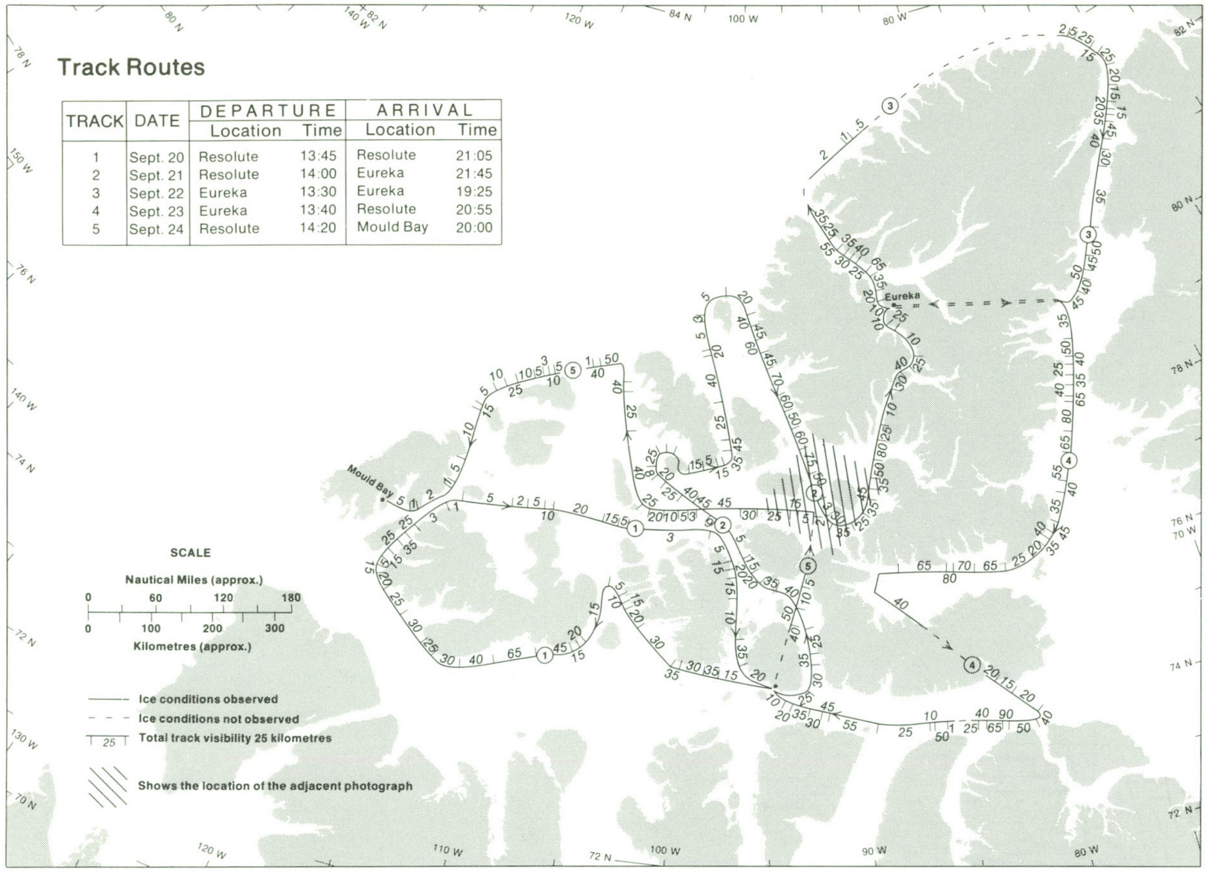


Beaufort Sea, September 3, 1978, T72 F9



MAP 5 - 1978 WEST

August 28 - September 7, 1978



Track Routes

TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Sept. 20	Resolute	13:45	Resolute	21:05
2	Sept. 21	Resolute	14:00	Eureka	21:45
3	Sept. 22	Eureka	13:30	Eureka	19:25
4	Sept. 23	Eureka	13:40	Resolute	20:55
5	Sept. 24	Resolute	14:20	Mould Bay	20:00

Norwegian Bay, September 22, 1978, T55 F4

MAP 6-1978 East

September 20-25

Flight Effectiveness

The weather was unseasonably good for ice observing during Flight 6. In general horizontal visibilities were reduced by low cloud ceilings and fog but visual contact with the ice was maintained during most tracks except number 3 around northern Ellesmere Island where severe aircraft icing forced the aircraft above the clouds. Apart from this the other tracks were very efficiently planned and executed and gained the greatest coverage using the fewest number of flying hours making the flight nearly 90 per cent effective.

Ice Conditions

Impressive changes took place during the two weeks in mid-September that separated flights 5 and 6. The changes were mainly a result of melting, clearing movements and the formation of new ice. Extensive melting and/or possible eastward movement freed Lancaster Sound of the older forms and new ice types were developing. Considerable amounts of older ice disappeared mainly by melting with some movement in Wellington Channel, western Barrow Strait and southern Nansen Sound. The ice in Nares Strait appeared to be creeping south along the east coast of Ellesmere Island and some multi-year ice made it through Belcher Channel into southern Norwegian Bay. Probably multi-year ice was moving south through Prince Gustaf Adolf Sea, Peary Channel and recently broken Sverdrup Channel but the greatest movements were taking place from Massey Sound into Norwegian Bay. New ice was rapidly forming in all open areas. The solid multi-year plugs in Nansen Sound and Byam Martin Channel remained and stopped older ice types from moving further south.

The trend for the ice west of Lougheed Island to remain solid after Prince Gustaf Adolf Sea broke up continued. In the past this sequence was usually reversed. Compared with other seasons the amount of ice moving south through Nares Strait was limited.

Snow was beginning to spread across the ice surface in many areas and puddling was non-existent.

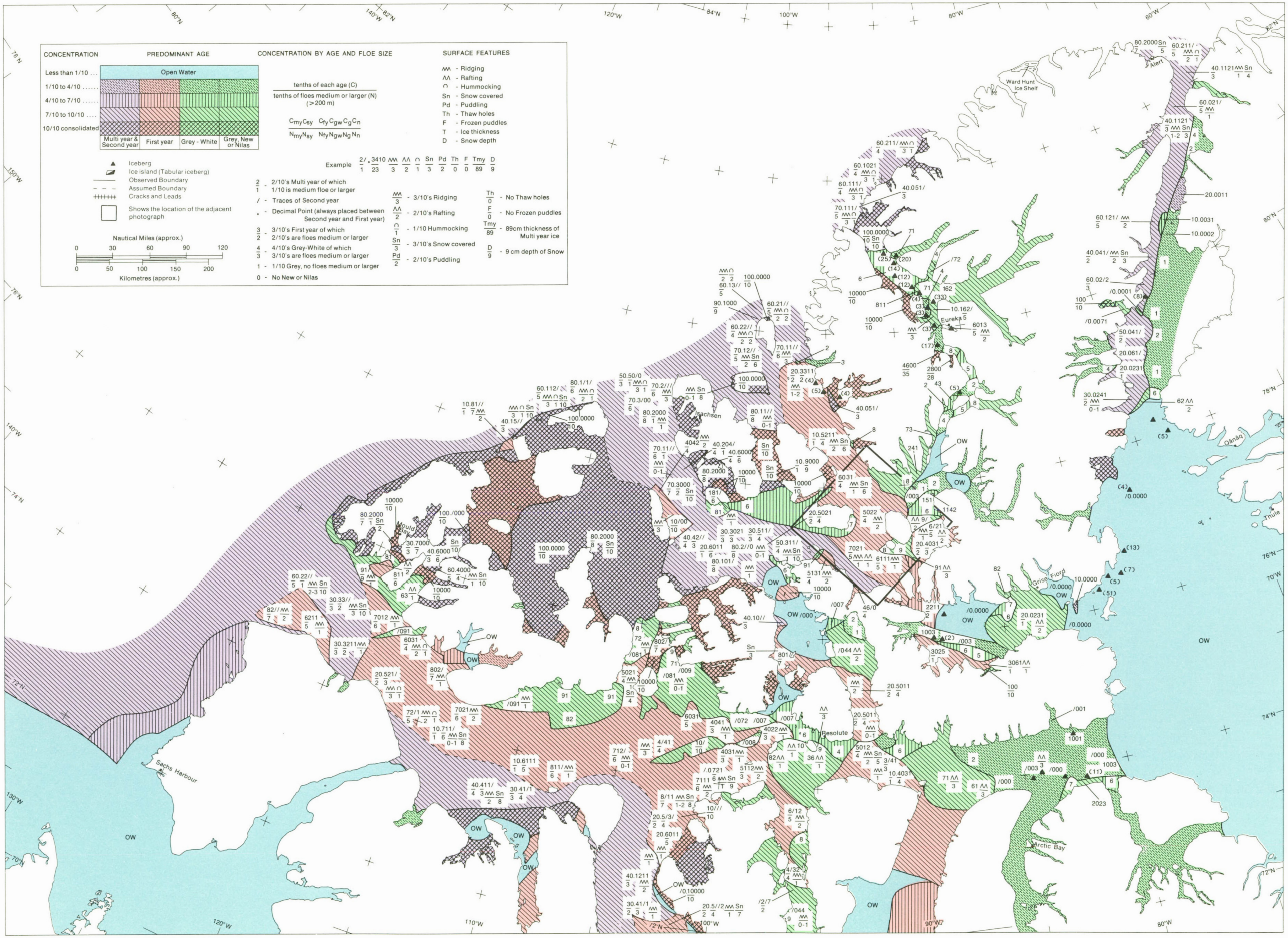
Unobserved Areas

The ice-free conditions in Baffin Bay were interpreted from satellite photographs. Probably the ice conditions along the north coasts of Axel Heiberg and Ellesmere islands closely resembled those shown on Map 6 - 1977 EAST.

Comments

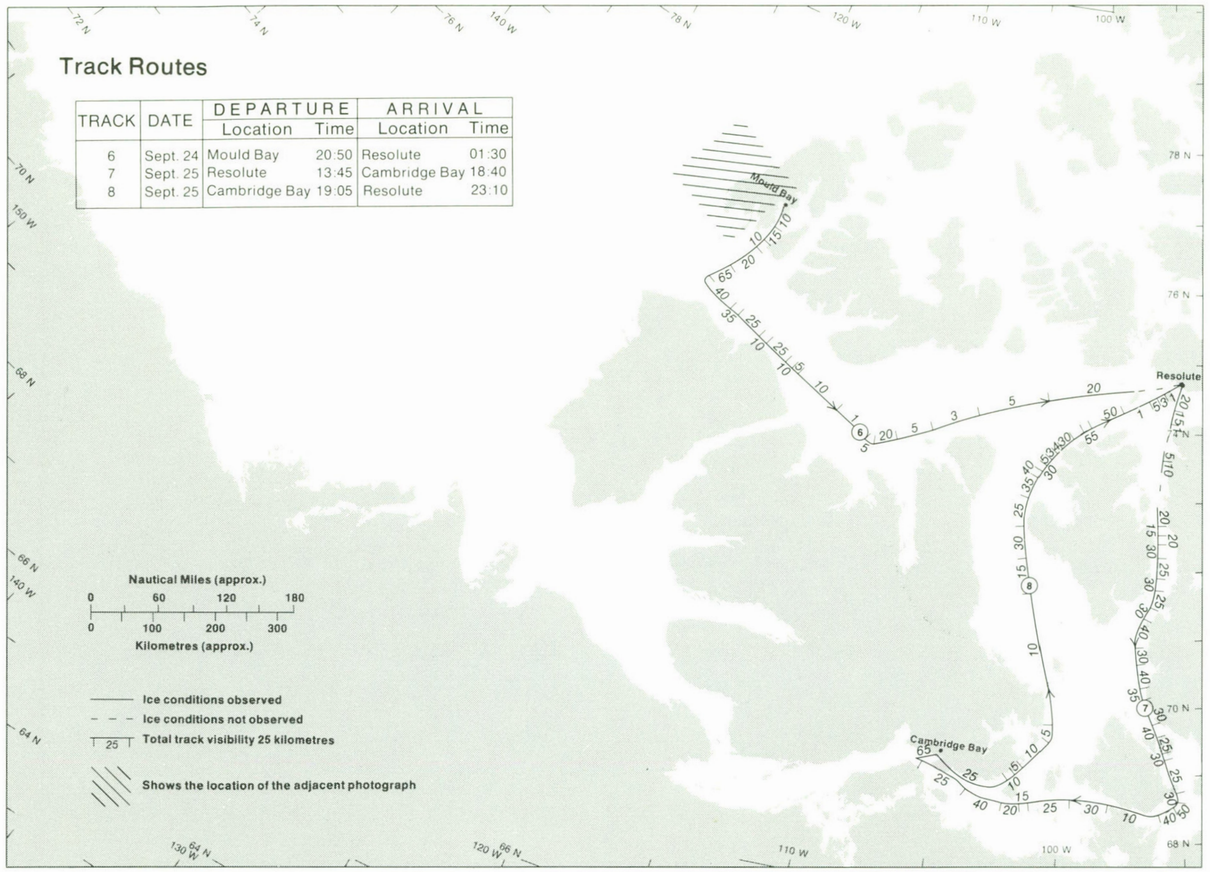
The extent of break-up by the end of Flight 6 was much greater than usual and the amount of clearing was greater also.

There are three interesting developments. The first is the existence of the solid mass of multi-year ice jutting into northern Baffin Bay from Talbot Inlet. Why did it persist? Second is the radical change from multi-year to first-year ice in Massey Sound. Was this a result of redistribution through movement and ablation, masking of the surface by snow or a change in ice observers or a combination of all three? The third point depends on locating the large floe, with a small plus sign on it, near the left margin mid-way between Cornwall Island and Axel Heiberg Island on the satellite photograph accompanying Map 5 - 1978 EAST. Then locate what could be the same large floe, also marked with a small plus sign, on the adjacent photograph in the centre of the southwest quarter of Norwegian Sea. The floe drifted about 100 km in nineteen days. This indicates the general movement in Massey Sound and gives an idea of the clearing that must have taken place in Norwegian Bay to allow this older ice room to drift south.



MAP 6 - 1978 EAST

September 20 - 25, 1978




West of Prince Patrick Island, September 22, 1978, T73 F5

MAP 6-1978 West

September 20-25

Flight Effectiveness

Low stratus clouds restricted the observing altitude for most tracks to between 30 and 120 m and this cut down the horizontal visibility. Although restrictive, the weather was much better than usual at this time of year and visual contact with the ice surface was only lost briefly during track 7. If allocated flying time had been sufficient to allow two tracks over the Beaufort Sea the flight would have been better than 90 per cent effective. In spite of this it was at least 80 per cent successful.

Ice Conditions

It is difficult to accept the fact that sea ice can melt when air temperatures are below freezing and new ice is beginning to form. The main change between the two flights completed in September was the amount of ice that disappeared because of melting. Other changes were results of movements and redistributions and the formation of new ice types. Most obvious of the changes was the amount of melting, movement redistribution and area of new ice that formed in M'Clure Strait and Viscount Melville Sound. Here melting reduced concentrations, winds shifted and mixed ice types to create new patterns and the usual strip of open water along the northern part of Parry Channel was created and then filled with a cover of new ice. In M'Clintock Channel considerable quantities of first-year ice seemed to appear in an area where older ice forms had been noted. Probably the effects of melting, movement and fresh snow along with poor visibilities from low altitudes combined to mask the true amount of multi-year ice actually present. Clearing of the older ice, primarily by melting in situ, was completed in Amundsen Gulf, Prince of Wales Strait, Dease Strait, Queen Maud Gulf and Peel Sound. New ice was forming in Queen Maud Gulf and some multi-year ice had drifted into northern Peel Sound. The clearing in Peel Sound was probably completed by the second week in September and the older forms and new ice appeared after that. Changes in the position of the ice edge between the pack and open water in the Beaufort Sea were slightly favourable; the edge moved a little further north away from the coast.

The advance of break-up and the sequence of melting and clearing and the signs of impending freeze-up were all following the typical pattern.

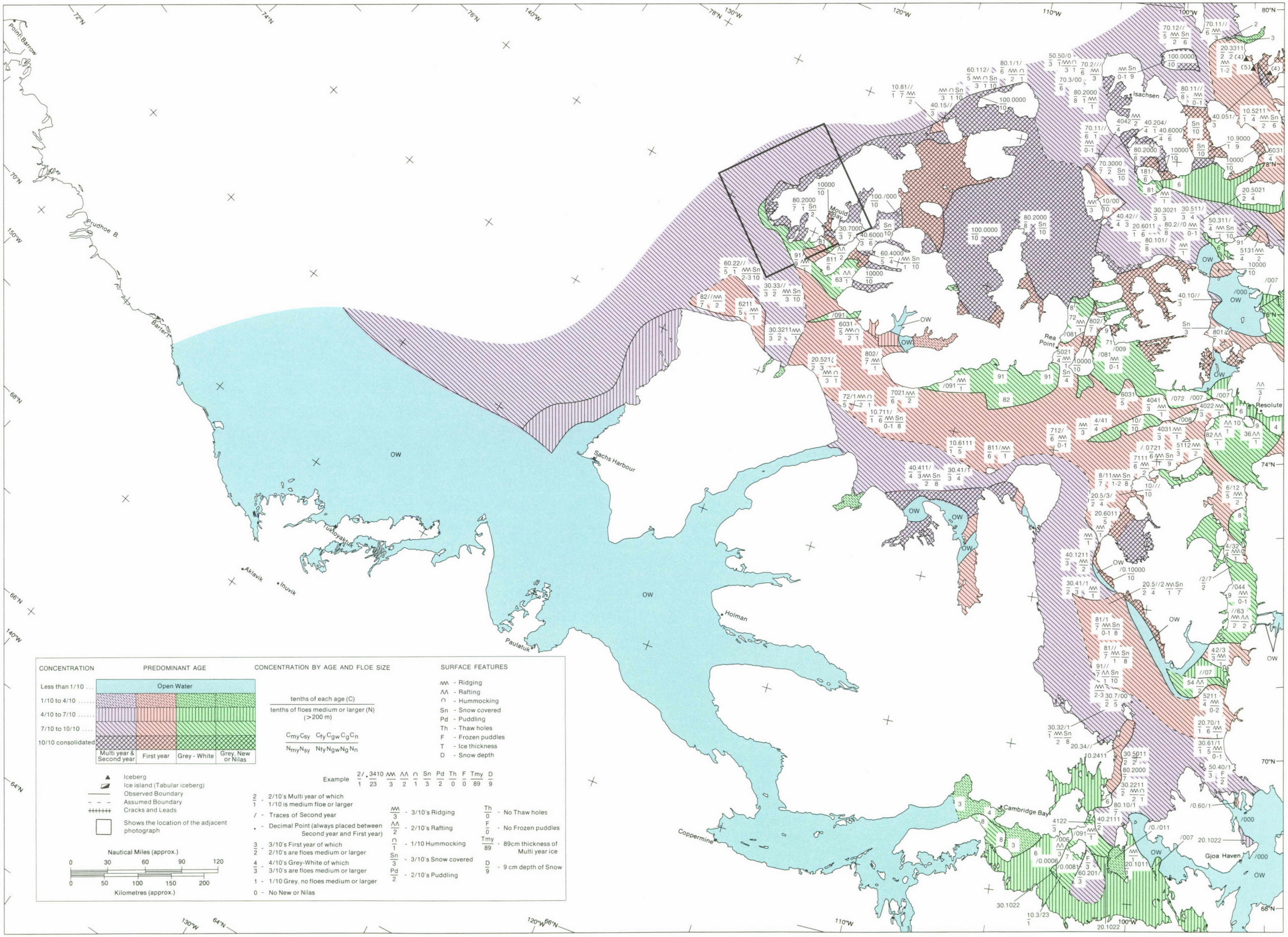
Unobserved Areas

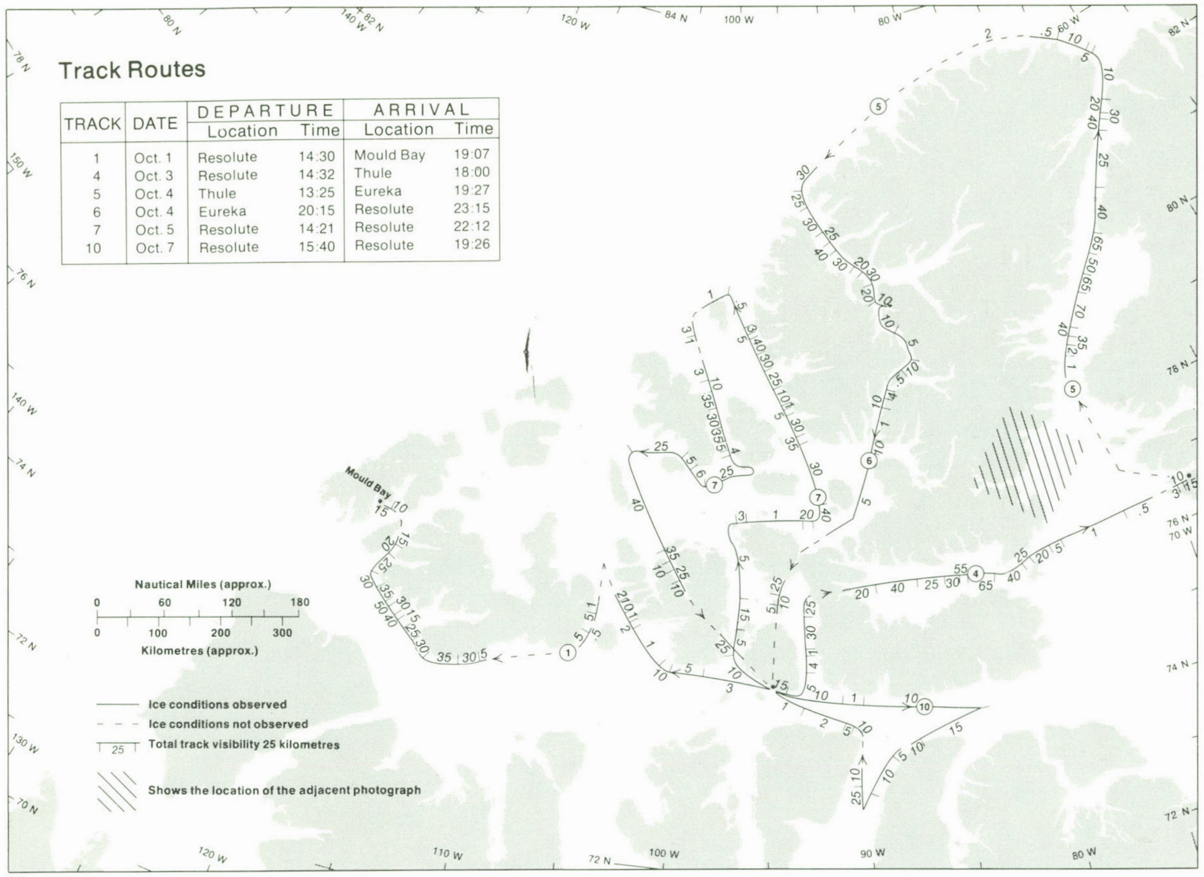
Satellite photographs were interpreted to prepare the patterns shown on the map in the Beaufort Sea and in waterways extending east towards Cambridge Bay from Amundsen Gulf.

Comments

The amount of melting and clearing in the first part of September was considerable. As a result, the season at the end of Flight 6 was more advanced than usual.

The satellite photograph gives an excellent view of the typical extent of the landfast fringe, including the indentation near Lands End, that usually forms around Prince Patrick Island. The amount of break-up in Dyer Bay is slightly greater than usual.


Point Barrow
Prudhoe B
Barter I
Sachs Harbour
Holman
Tuktoyaktuk
Aklavik
Inuvik
Paulatuk
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Isachsen
Mould Bay
OW
CONCENTRATION
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
PREDOMINANT AGE
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Oct. 1	Resolute	14:30	Mould Bay	19:07
4	Oct. 3	Resolute	14:32	Thule	18:00
5	Oct. 4	Thule	13:25	Eureka	19:27
6	Oct. 4	Eureka	20:15	Resolute	23:15
7	Oct. 5	Resolute	14:21	Resolute	22:12
10	Oct. 7	Resolute	15:40	Resolute	19:26

Makinson Inlet, October 1, 1978, T46 F4

MAP 7-1978 East

October 1-7

Flight Effectiveness

The observers' considerable arctic experience helped to plan and execute a fine series of tracks during the seven days it took to complete the fifty hours of flying time set aside for Flight 7. The weather and the visibility were better than usually expected. In general horizontal visibilities were limited but the flight was about 75 per cent effective. Visual contact with the ice was lost during some part of each track due to a variety of reasons. For example, in track 1 airframe icing forced the aircraft above the clouds south of Melville Island. During track 4, over the open water across Baffin Bay, the ceiling gradually lowered and the visibilities declined to the point where there was a danger of flying into an iceberg so the observations ceased as the track was completed above the clouds. North of Ellesmere Island a cloud 600 m thick right to the ice surface thwarted all efforts to gain a glimpse of the ice conditions. Fresh snow, drifting snow and darkness hindered observations in track 6 and ice crystals and low cloud ceilings reduced the effectiveness of tracks 7 and 10.

Ice Conditions

All of the ice shown in red on Map 7–1978 formed since freeze-up began in 1978. In order to display this colour at least three-tenths of the ice in the area must be at least 30 cm thick, the deciding limit for first-year ice. The remaining seven-tenths could be made up of a variety of new types as well as up to three-tenths of multi-year ice. Throughout the area freeze-up was in earnest and first-year ice along with grey-white, grey and new and nilas types of sea ice were forming rapidly throughout the region. Freeze-up was completed in Nansen Sound, Greely Fiord and the northern half of Eureka Sound.

In spite of the restricting effects the formation of new ice types have on existing floes, movement was still possible in many areas; for example, the multi-year ice was drifting south through Nares Strait into Baffin Bay.

Generally the situation was normal as far as patterns and sequence are concerned. One area, Hassel Sound, remained solid while the areas at its extremities were in motion. Usually Hassel Sound breaks up before Peary Channel.

Unobserved Areas

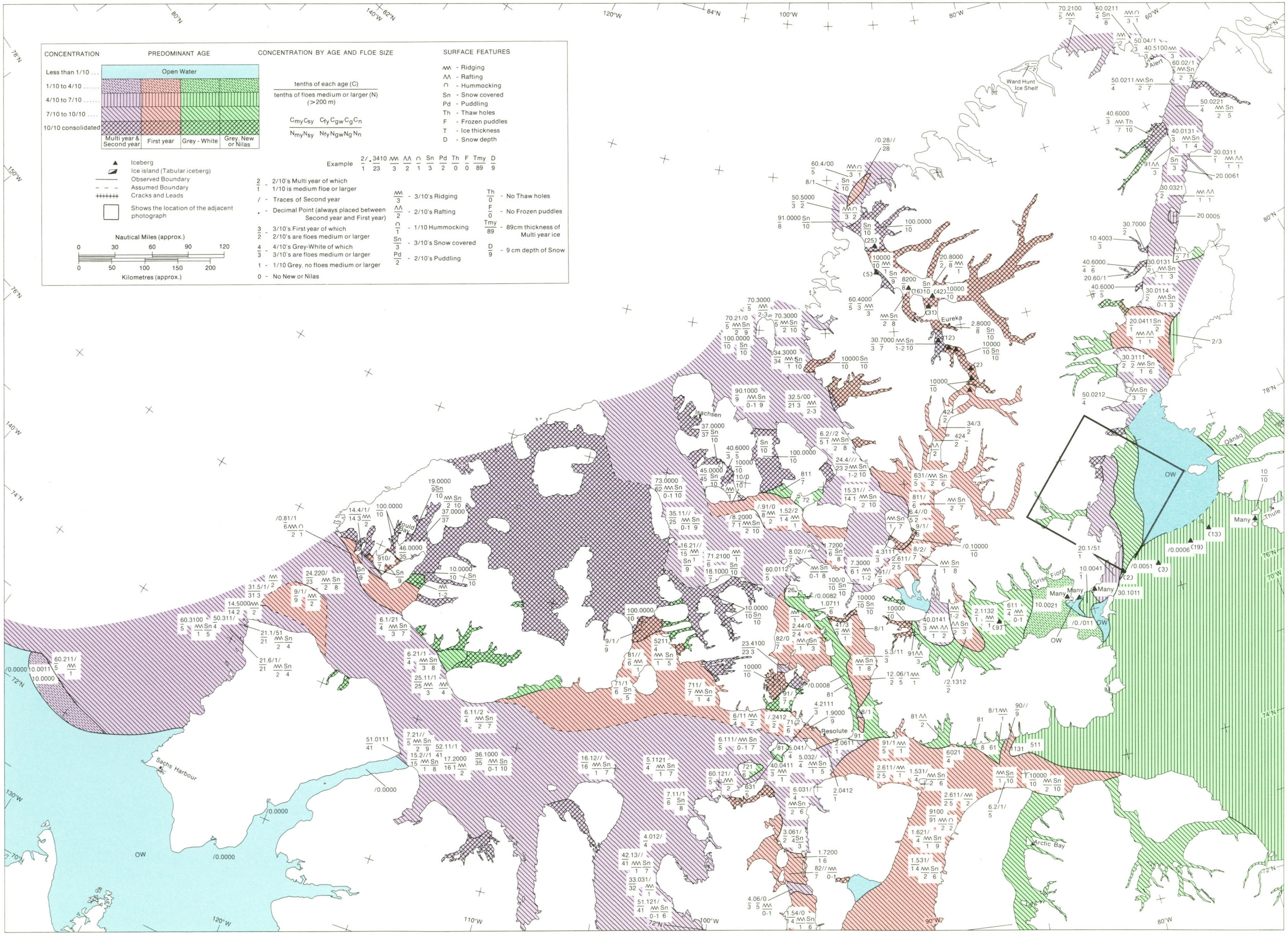
The conditions in Baffin Bay and the northwestern channels were established based on typical conditions expected bearing in mind previous and subsequent observations. For the second time in a row (sometimes it is three times in a row) the weather precluded observations north of Ellesmere Island. The conditions there and north of Axel Heiberg Island were likely similar to those shown on Map 7–1977 EAST.

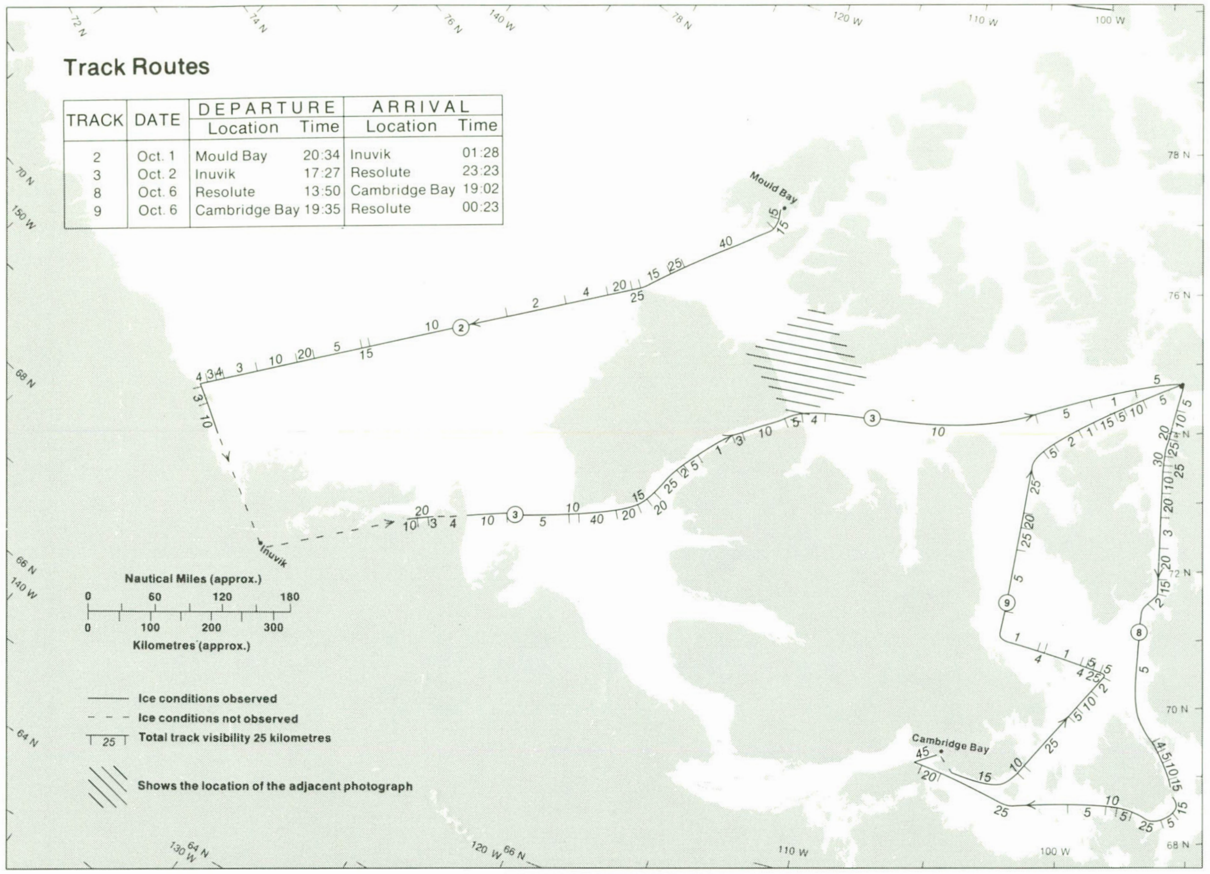
Comments

Icebergs that originated in Otto Fiord and had reached Nansen Sound were released by the break-up in that area around mid-September. By freeze-up, about two weeks later, they had moved about 100 km further south. It is difficult to imagine the number of icebergs that would have been seen in northern Baffin Bay if the visibility during track 4 had been greater than a tiny path ranging in width from 1 to 5 km.

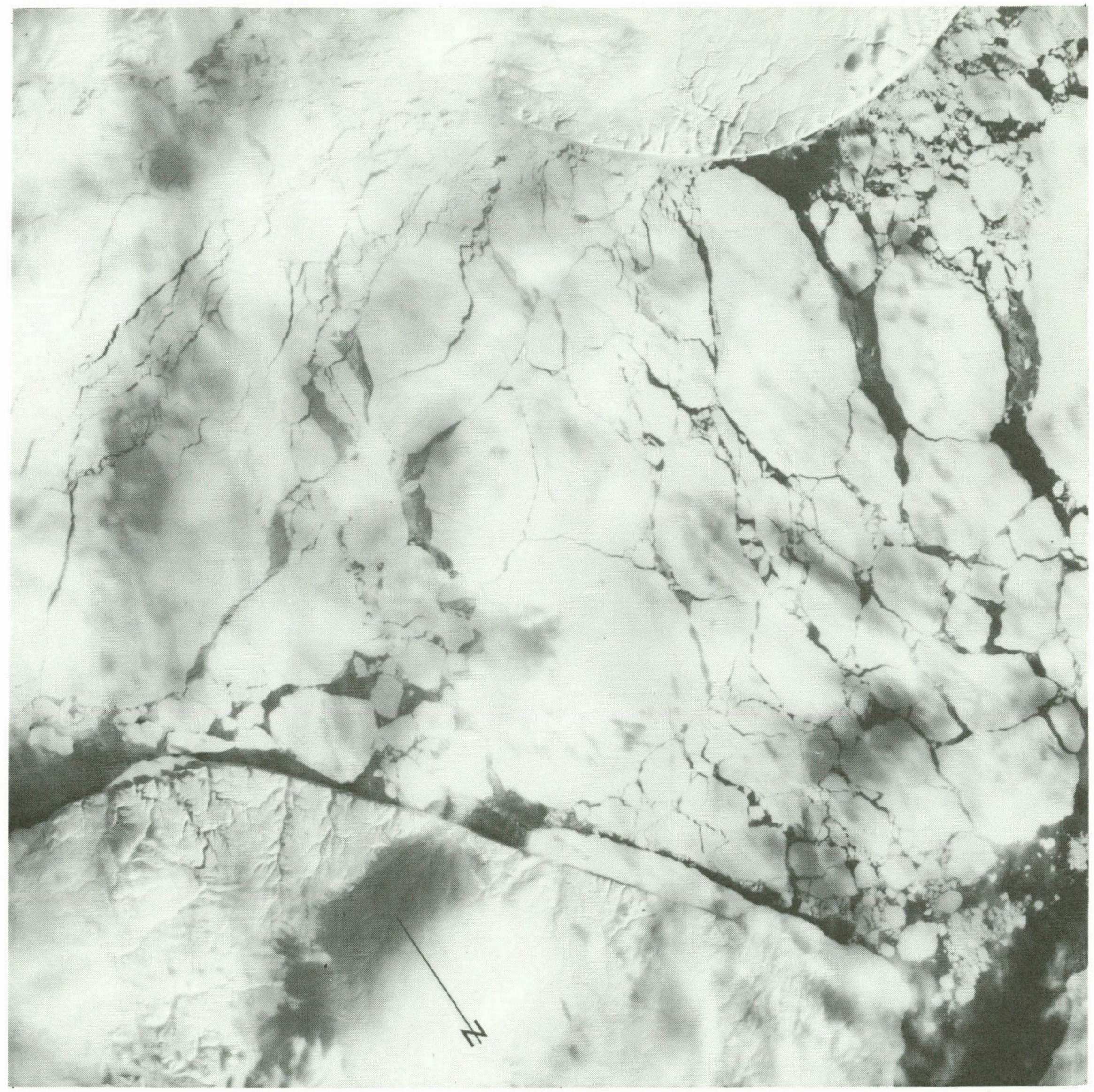
The first heavy snow of the year came to Resolute on October 1; a similar 12 to 15 cm fell at Thule on October 3.

The satellite photograph shows the spectacular scenery of the southeastern part of Ellesmere Island and some of the multi-year floes moving south from Nares Strait.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Example
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Nautical Miles (approx.)
Kilometres (approx.)
2/10's Multi year of which 1/10 is medium floe or larger
Traces of Second year
Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1/10 Grey, no floes medium or larger
No New or Nilas
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Ward Hunt Ice Shelf
Alert
Eureka
Isachsen
Grise Fiord
Resolute
Sachs Harbour
Arctic Bay
Qânâq
Thule
OW
Many



TRACK	DATE	DEPARTURE Location	DEPARTURE Time	ARRIVAL Location	ARRIVAL Time
2	Oct. 1	Mould Bay	20:34	Inuvik	01:28
3	Oct. 2	Inuvik	17:27	Resolute	23:23
8	Oct. 6	Resolute	13:50	Cambridge Bay	19:02
9	Oct. 6	Cambridge Bay	19:35	Resolute	00:23



Eastern M' Clure Strait, October 1, 1978, T64 F7

MAP 7-1978 West

October 1-7

Flight Effectiveness

The tracks over the western region were carefully timed to make the best use of the weather and amount of useable daylight. The weather, considering the time of year, was much better than expected and the flight was about 85 per cent effective. Generally the horizontal visibilities were low and occasionally visual contact was lost due to airframe icing, very low clouds and fog, low light levels as well as ice crystals which were encountered in patches. The track through Prince of Wales Strait on October 2 was extremely rough due to strong westerly winds.

Ice Conditions

On October 1 all first-year ice that had lasted through the summer melt was renamed second-year ice and the birthday also increased the age of second-year to multi-year ice. Apart from the colour and pattern changes made on the map to conform with this custom, there is very little difference between Map 6 and Map 7–1978 WEST. At first it seems as if time had stood still during the interval but there were some developments. In Peel Sound and along the northern part of Viscount Melville Sound the new ice forms had rapidly increased in thickness through the grey and grey-white stage until at least three-tenths of the ice cover was at least 30 cm thick. This concentration of thin, first-year ice results in a red colour on the map providing concentrations of multi-year ice do not exceed three-tenths. The rapid development of the large area of thin, first-year ice in the southeastern part of M'Clure Strait was interesting. Possibly the fresh snow that had fallen in the northern half of the region was masking the true age of the ice.

No departures from the normal sequence of freeze-up were observed.

Unobserved Areas

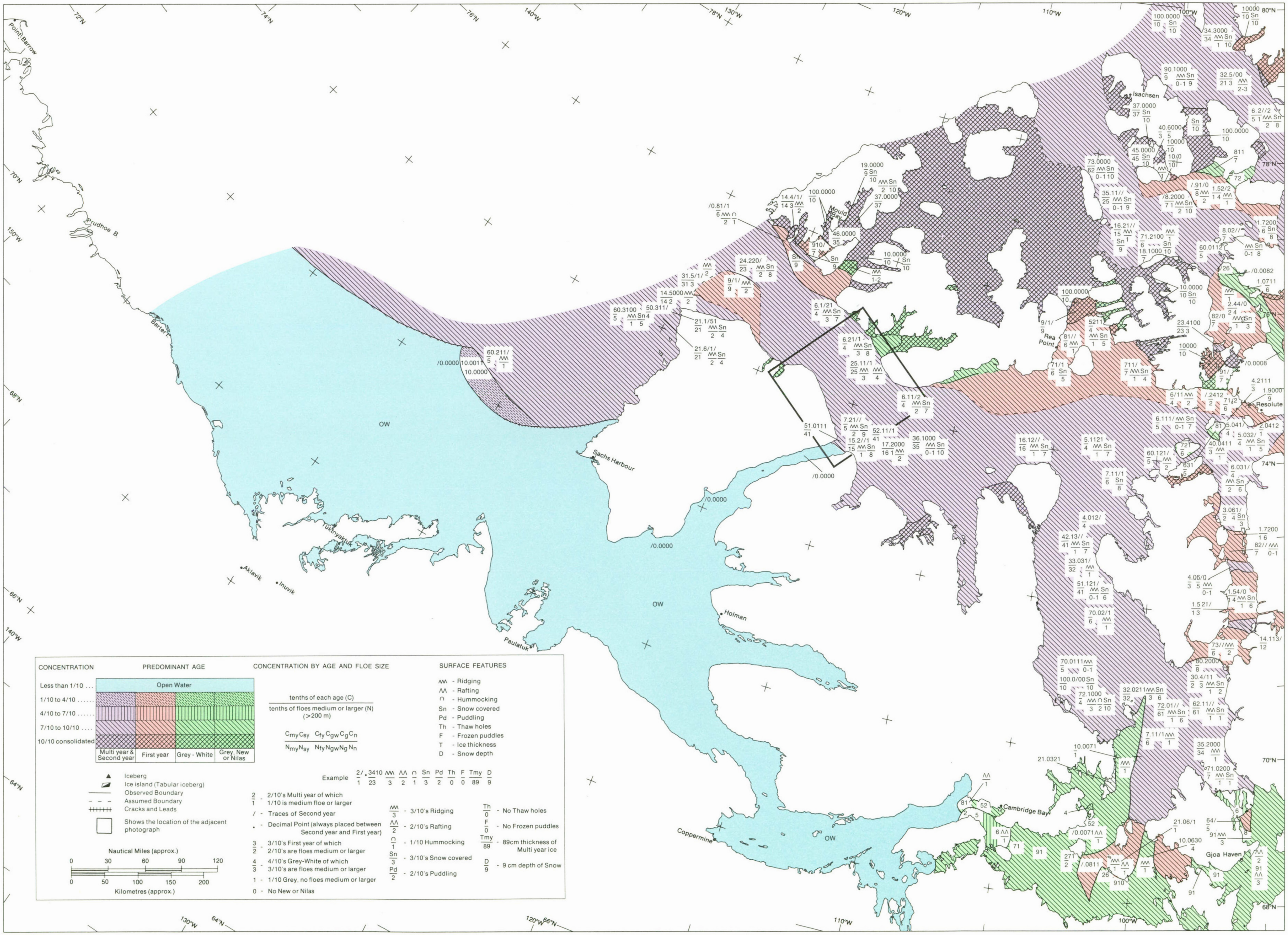
The ice-free conditions along the length of the waterway east from Amundsen Gulf were established from satellite photographs as well as from the knowledge of the ice conditions at both ends, and the typical conditions at this time of year.

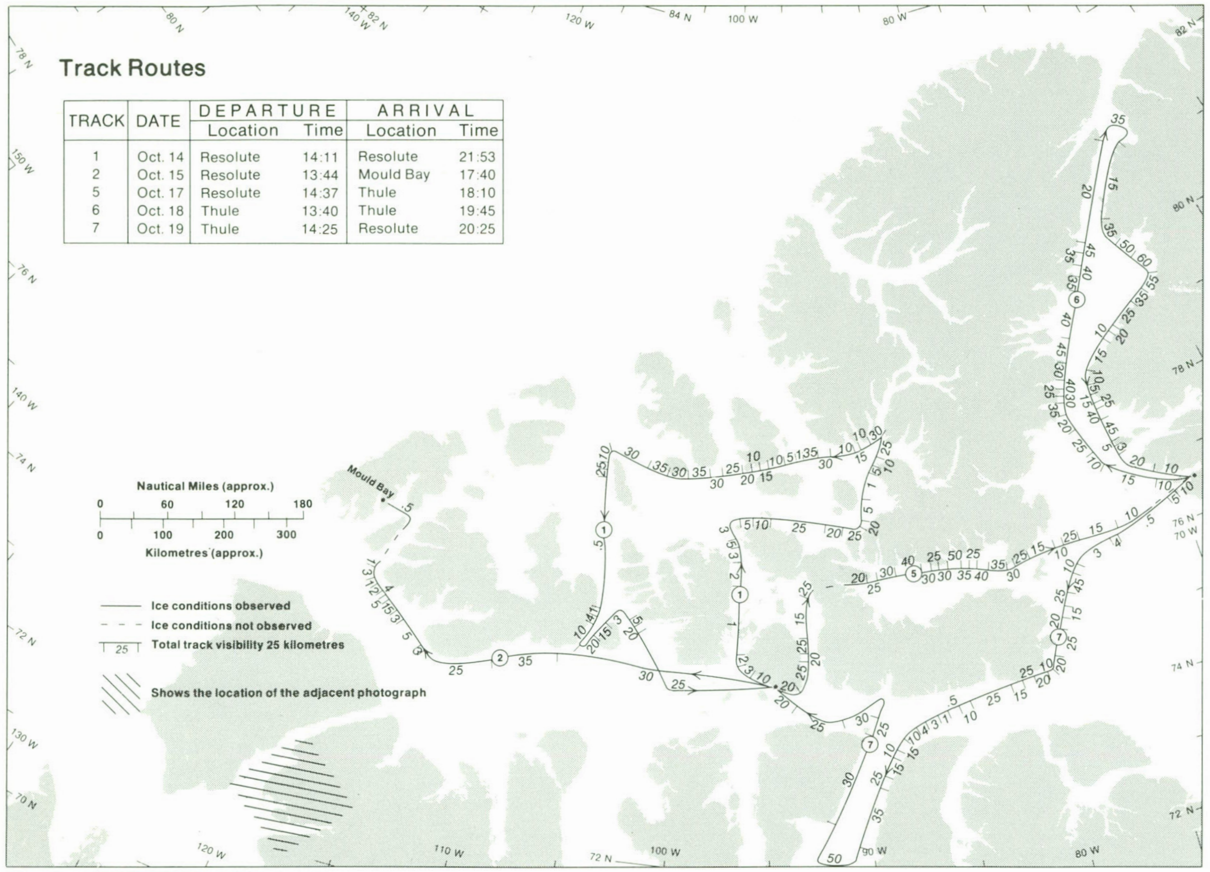
Comments

Amundsen Gulf was ice-free on October 2. By October 6 a nine-tenths cover of new ice had developed in the area. Rapidly-forming new ice was spreading through the remaining open areas as well.

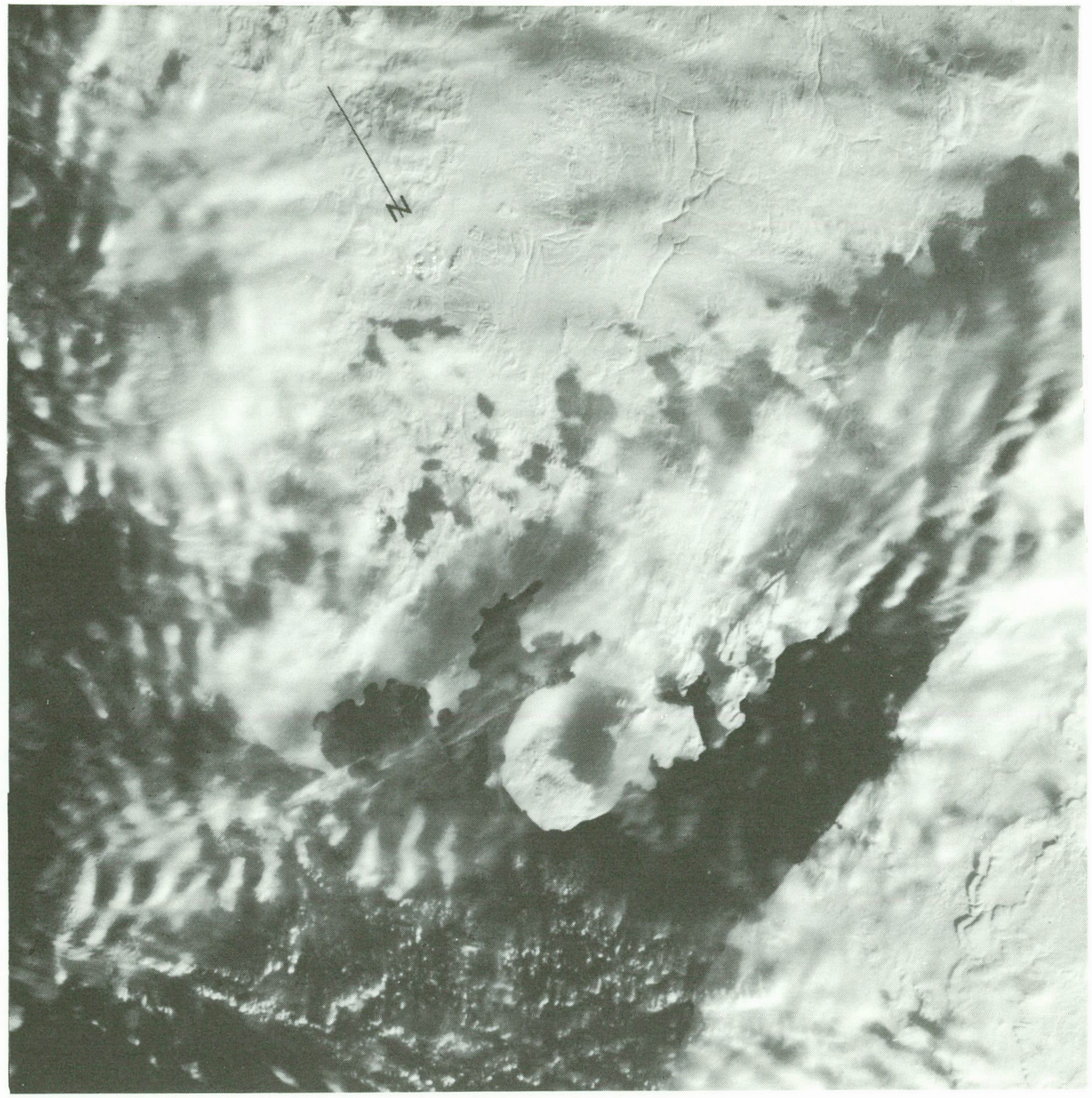
Very little movement was noted in any part of the region during the interval between the two flights. A good example of this lack of movement is the ice edge of the pack in the Beaufort Sea.

This volume has seven satellite photographs which show the many moods of the sea ice in the area north of Prince of Wales Strait where M'Clure Strait and Viscount Melville Sound meet. Four of these seven photographs show conditions in the area in October. The first pair which accompany Maps 7–1975 WEST and 7–1976 WEST were taken on October 9 and 11, a little too late for comparison. However, the photograph accompanying this map, taken on October 1, should be compared with that accompanying Map 7–1977 WEST which was taken on October 4. The difference between the ice conditions in a favourable year, 1977, compared with a typical year, 1978, are immediately evident.


CONCENTRATION
PREDOMINANT AGE
Less than 1/10 ...
1/10 to 4/10 ......
4/10 to 7/10 ......
7/10 to 10/10 ....
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
SURFACE FEATURES
- Ridging
- Rafting
- Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Nautical Miles (approx.)
Kilometres (approx.)
Example
2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/10's First year of which 2/10's are floes medium or larger
4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
- 3/10's Ridging
- 2/10's Rafting
- 1/10 Hummocking
- 3/10's Snow covered
- 2/10's Puddling
- No Thaw holes
- No Frozen puddles
- 89cm thickness of Multi year ice
- 9 cm depth of Snow
Point Barrow
Prudhoe B.
Barter I.
Aklavik
Inuvik
Tuktoyaktuk
Paulatuk
Sachs Harbour
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Mould Bay
Isachsen
Rea Point
Resolute
OW



TRACK	DATE	DEPARTURE		ARRIVAL	
		Location	Time	Location	Time
1	Oct. 14	Resolute	14:11	Resolute	21:53
2	Oct. 15	Resolute	13:44	Mould Bay	17:40
5	Oct. 17	Resolute	14:37	Thule	18:10
6	Oct. 18	Thule	13:40	Thule	19:45
7	Oct. 19	Thule	14:25	Resolute	20:25



Northeastern Amundsen Gulf, October 16, 1978, T61 F9

MAP 8-1978 East

October 14-20

Flight Effectiveness

Considering the time of year, the weather and resulting observing conditions were excellent and the flight was 90 per cent effective. Horizontal visibilities were occasionally reduced during most tracks by patches of ice crystals and periodic plunges of the cloud ceiling toward the ice surface. Lack of daylight hours affected tracks 5 and 6. Track 5 had to be short because both the earth and the aircraft were moving east. Track 6 experienced a sunset northbound in Kane Basin and dull light in Kennedy Channel and then a sunrise after the track had turned and moved south into Kane Basin. The dull light conditions and the lack of fuel at Eureka effectively curtailed any tracks in the northern areas.

Ice Conditions

The weather from October 7 through October 20 was generally calm, cold and clear. This meant that the new ice types in the region grew rapidly and movements were small. The main change between the two flights was the appearance of the very thin first-year ice cover in many areas. Also all previously open areas supported an ice cover.

Freeze-up was following the usual sequence.

Unobserved Areas

The ice conditions shown in the unobserved areas of the maps were established on the basis of the adjacent conditions and the usual distributions and patterns expected at this time of year.

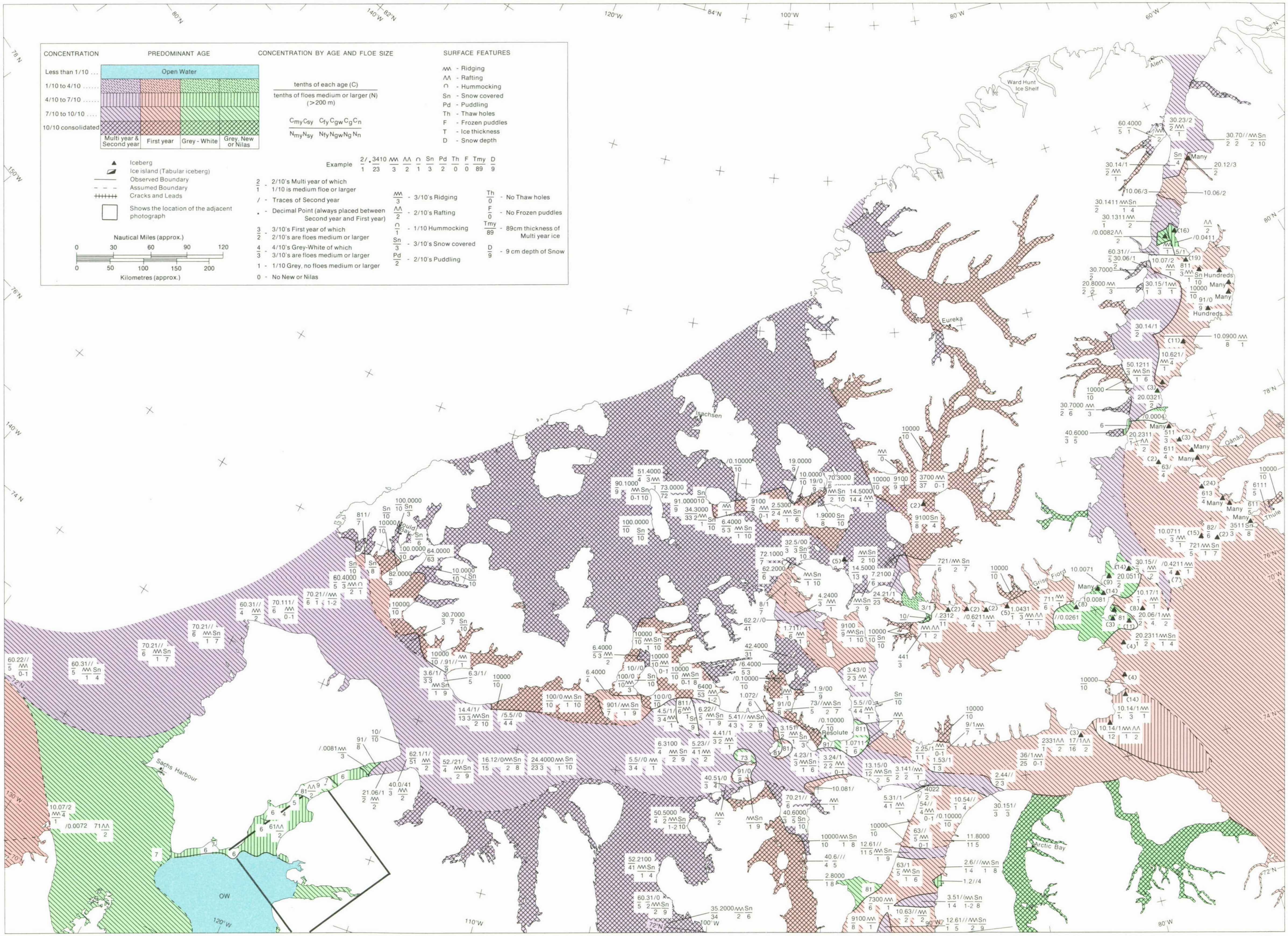
Comments

The cold, clear and relatively windless weeks in mid-October permitted the new ice types to form and grow. It is difficult to estimate the thickness of the young ice types, especially when the light level is low and the ice is snow-covered. Although much of the area is shown as first-year, the concentrations hovered around the three-tenths level, the threshold for the red colour. Also the first-year ice was very thin. Freeze-up seemed to be advancing faster than usual. Movements were very limited. An easterly drift in Barrow Strait and a little southerly drift in Penny Strait took place. In Nares Strait the gentle, slow southerly drift continued.

Thousands of icebergs populated Peabody Bay and the density appeared greatest in the northern end.

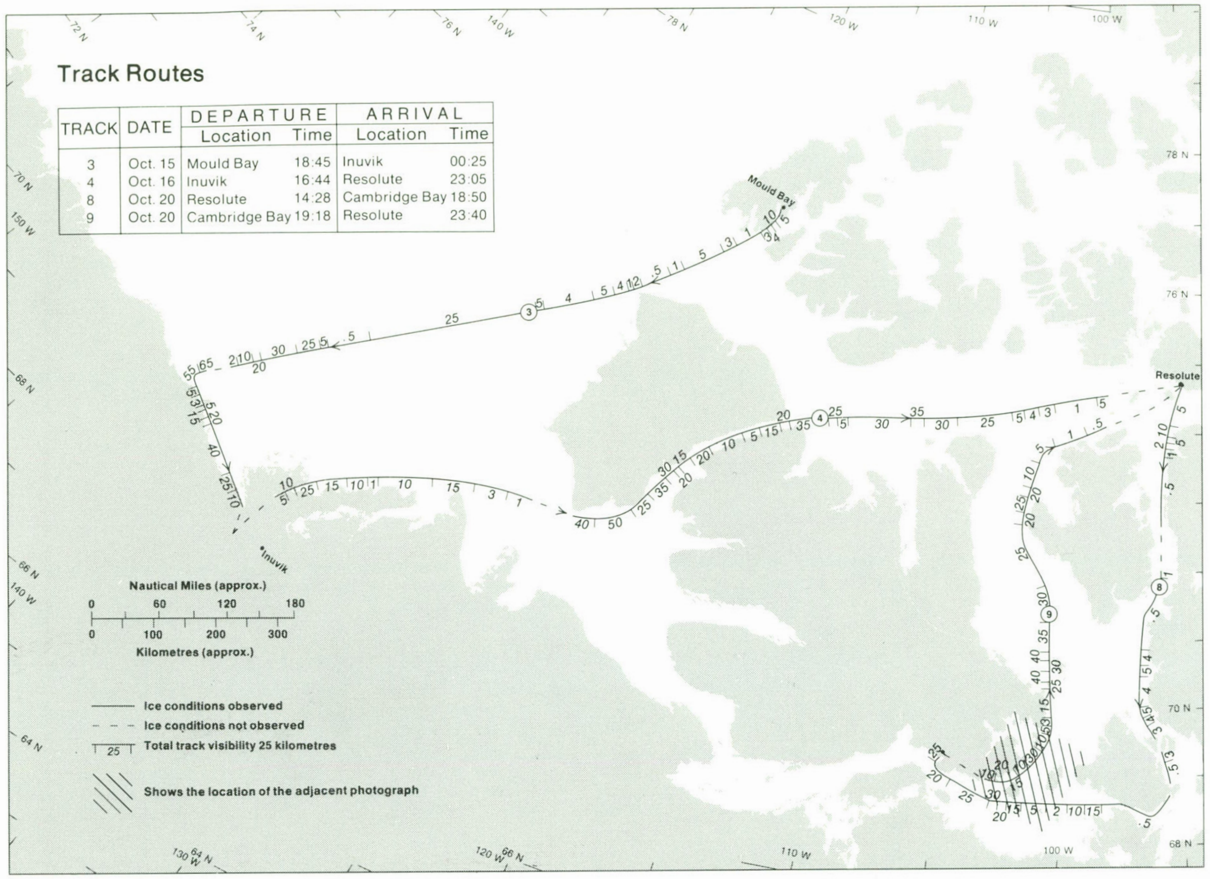
The map shows a solid ice cover in the northern areas. This could be partially broken and small movements could be made up to mid-November. Barrow Strait and Wellington Channel probably supported ice drift until the new year and the ice in Lancaster Sound likely remained in motion throughout the winter.

At this time of year with low light levels combined with clouds, satellite photographs of the northern part of the region are difficult to interpret. The accompanying one is a typical example.



MAP 8 - 1978 EAST

October 14 - 20, 1978



Victoria Strait, October 20, 1978, T47 F11

MAP 8-1978 West

October 14-20

Flight Effectiveness

Limitations reducing horizontal visibility during the tracks over the western part of the region during Flight 8 were primarily a result of ice crystal haze and low cloud ceilings. Also rapidly shortening periods of daylight reduced effectiveness. For example, in order to complete the surveys on October 20, track 8 was underway before sunrise and the sun had set before track 9 was completed. In spite of all of these factors, the weather and observing conditions were excellent for the time of year and the flight was nearly 80 per cent effective.

Ice Conditions

Two weeks separated the surveys made for flights 7 and 8. During this interval the young forms of ice rapidly developed in the open areas and in the spaces between the older floes. A solid cover developed on M'Clintock Channel and Peel Sound. In the former area the ice cover could be set in motion if appropriate winds developed. Probably Peel Sound would remain mainly solid for the rest of the year. Movements, if any, in Queen Maud Gulf would be very limited.

The young ice types were expanding very rapidly in addition to increasing in thickness. The large open area in the central part of Amundsen Gulf observed on October 16 during track 4 was ice-covered a day later. The thickness of the young ice types in the Beaufort Sea had dramatically increased to the point where it looked like thin first-year ice at least 30 cm thick.

Unobserved Areas

The amount of data collected during the surveys over the western part of the region during Flight 8 surpassed those made at the same time in the previous seventeen years. Only the three channels between Amundsen Gulf and Cambridge Bay remained unobserved at the end of the flight and their ice conditions were established based on adjacent observations and by interpreting satellite photographs.

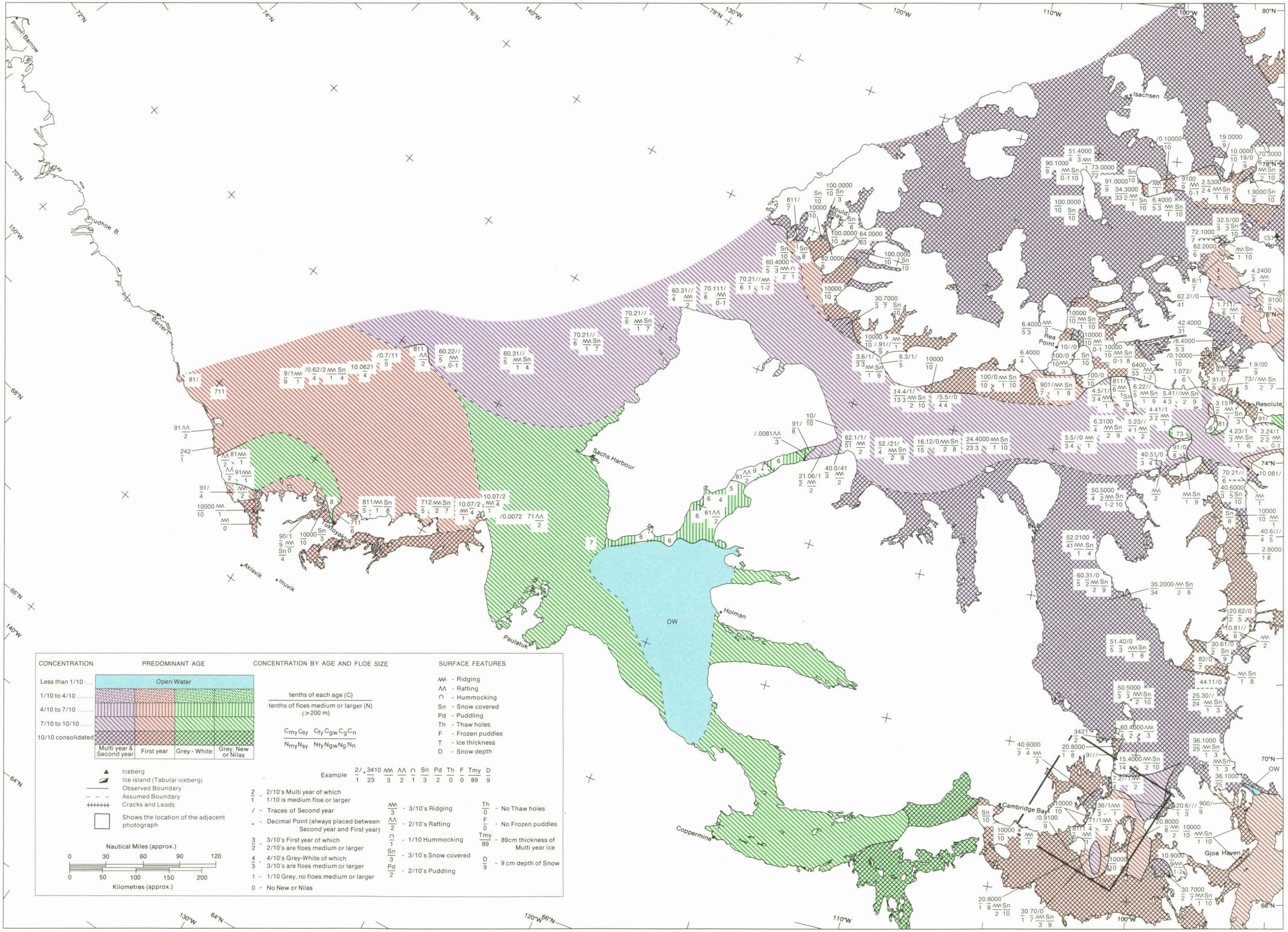
Comments

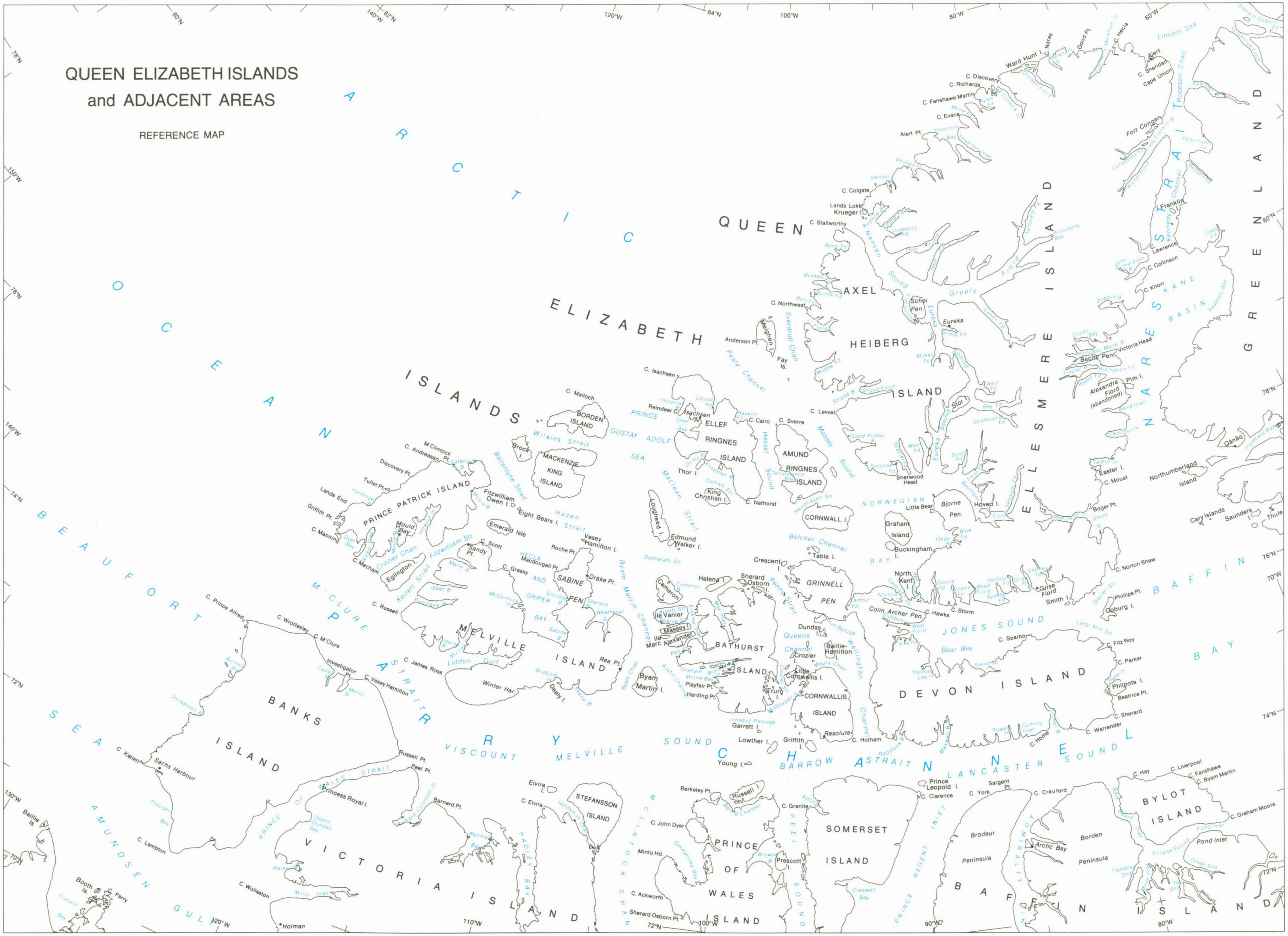
Freeze-up was advancing in a normal fashion and in the typical time frame.

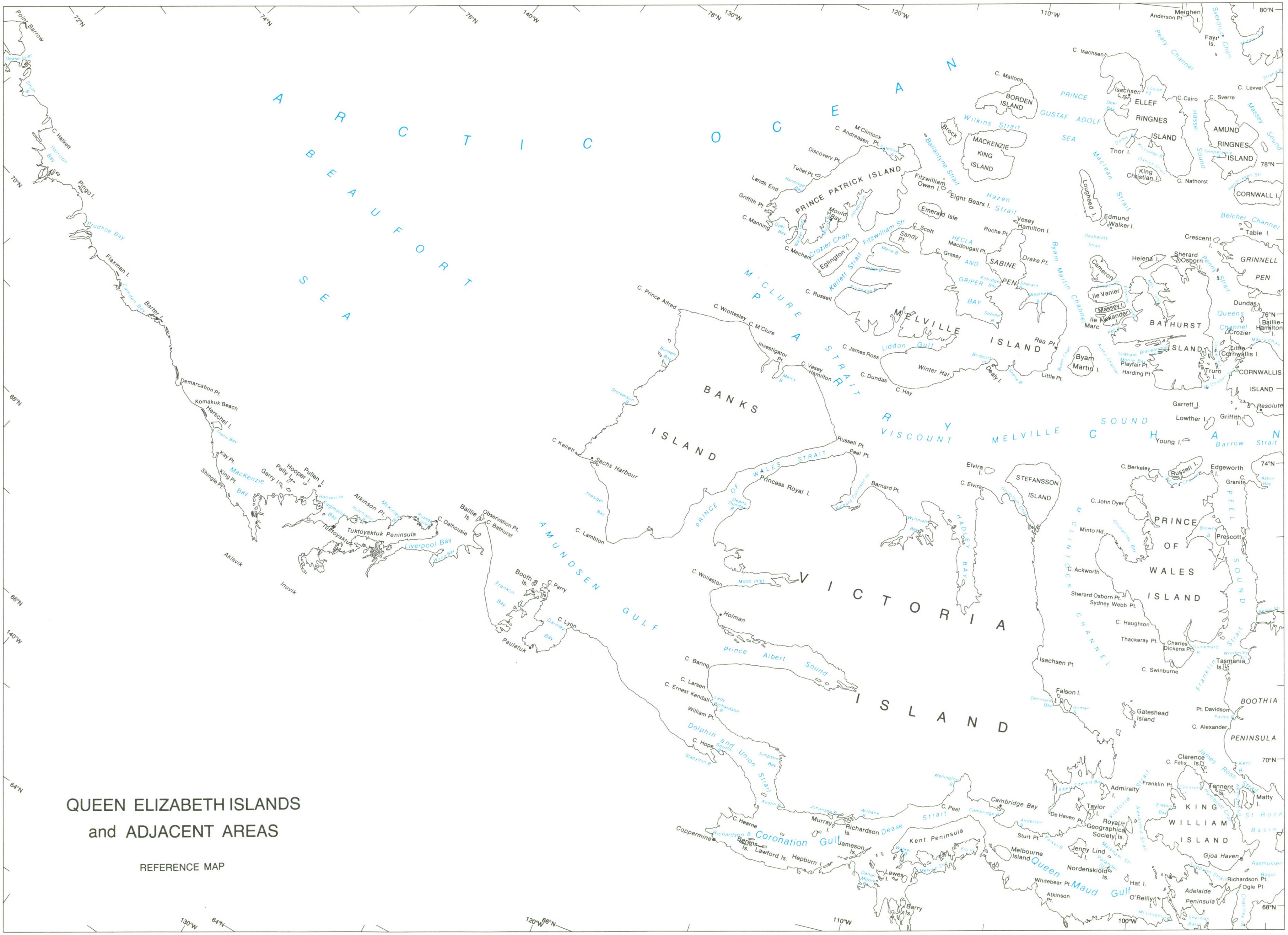
Although a solid ice cover existed in some areas, it could still be broken and moved by strong winds. This situation developed on October 21 when northerly winds shifted the ice in Barrow Strait. Probably the ice in M'Clintock Channel and Peel Sound was affected as well.

The Mackenzie River was observed on October 15 and 16. A solid cover had developed in most areas. In the other parts new ice covered at least nine-tenths of the channels.

The satellite photograph is excellent. It was taken just before track 9 passed through the area on October 20. Fortunately both sources of information compliment one another. However, if ground truth was not available then the satellite photo would have to be interpreted very carefully to establish the conditions.


Point Barrow
Prudhoe B.
Barter I.
Aklavik
Inuvik
Tuktoyaktuk
Sachs Harbour
Paulatuk
Holman
Coppermine
Cambridge Bay
Gjoa Haven
Resolute
Rea Point
Mould Bay
Isachsen
OW
CONCENTRATION
PREDOMINANT AGE
Less than 1/10
1/10 to 4/10
4/10 to 7/10
7/10 to 10/10
10/10 consolidated
Open Water
Multi year & Second year
First year
Grey - White
Grey, New or Nilas
CONCENTRATION BY AGE AND FLOE SIZE
tenths of each age (C)
tenths of floes medium or larger (N) (>200 m)
Example
2/ - 2/10's Multi year of which 1/10 is medium floe or larger
/ - Traces of Second year
. - Decimal Point (always placed between Second year and First year)
3/2 - 3/10's First year of which 2/10's are floes medium or larger
4/3 - 4/10's Grey-White of which 3/10's are floes medium or larger
1 - 1/10 Grey, no floes medium or larger
0 - No New or Nilas
SURFACE FEATURES
Ridging
Rafting
Hummocking
Sn - Snow covered
Pd - Puddling
Th - Thaw holes
F - Frozen puddles
T - Ice thickness
D - Snow depth
3/10's Ridging
2/10's Rafting
1/10 Hummocking
3/10's Snow covered
2/10's Puddling
No Thaw holes
No Frozen puddles
89cm thickness of Multi year ice
9 cm depth of Snow
Iceberg
Ice island (Tabular iceberg)
Observed Boundary
Assumed Boundary
Cracks and Leads
Shows the location of the adjacent photograph
Nautical Miles (approx.)
0 30 60 90 120
0 50 100 150 200
Kilometres (approx.)


QUEEN ELIZABETH ISLANDS
and ADJACENT AREAS
REFERENCE MAP
ARCTIC OCEAN
QUEEN ELIZABETH ISLANDS
BEAUFORT SEA
AMUNDSEN GULF
M'CLURE STRAIT
PARRY CHANNEL
VISCOUNT MELVILLE SOUND
BARROW STRAIT
LANCASTER SOUND
JONES SOUND
BAFFIN BAY
NARES STRAIT
KANE BASIN
GREENLAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
DEVON ISLAND
BANKS ISLAND
VICTORIA ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BORDEN ISLAND
MACKENZIE KING ISLAND
ELLEF RINGNES ISLAND
AMUND RINGNES ISLAND
CORNWALLIS ISLAND
BATHURST ISLAND
SOMERSET ISLAND
PRINCE OF WALES ISLAND
STEFANSSON ISLAND
BYLOT ISLAND
BAFFIN ISLAND
GRINNELL PEN
SABINE PEN
Wilkins Strait
Peary Channel
Sverdrup Chan
Eureka Sound
Nansen Sound
Greely Fiord
Norwegian Bay
Belcher Channel
Penny Strait
Queens Channel
Wellington Channel
Byam Martin Channel
Hazen Strait
Crozier Chan
Fitzwilliam Str
Kellett Strait
Liddon Gulf
Winter Har.
Prince of Wales Strait
Hadley Bay
M'Clintock Chan
Peel Sound
Prince Regent Inlet
Admiralty Inlet
Brodeur Peninsula
Borden Peninsula
Eclipse Sound
Pond Inlet
Robeson Chan
Kennedy Channel
Lincoln Sea
Alert
Eureka
Resolute
Grise Fiord
Sachs Harbour
Holman
Thule
Qânâq
Sherard Osborn Fd
120°W
100°W
80°W
60°W
140°W
150°W
130°W
110°W
90°W
84°N
82°N
80°N
78°N
76°N
74°N
72°N



QUEEN ELIZABETH ISLANDS
and ADJACENT AREAS

REFERENCE MAP