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Leadex Data Report, Part 1
Weather Analysis and Satellite Images

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This document contains weather analyses, forecast products, and selected satellite images obtained during the Leads Experiment (Leadex) from 25 March to 24 April 1992. This NRL Publication is Part 1 of a two-part data compilation report. Part 2 contains daily rawinsonde data obtained at Deadhorse and at the ice camp, and buoy data from four buoys surrounding the ice camp. A special section of Part 1 introduces the European spacecraft ERS-1 Synthetic Aperture Radar (SAR) data and shows some of the unique images from this sensor - courtesy of the European Space Agency (ESA). The report affords an opportunity to compare SAR data over selected locations with visible and infrared data from the DMSP satellite, with microwave imager (SSM/I) data from the same satellite, and with multispectral images from the NOAA satellite system. Special mesoscale weather depictions over the Leadex area, derived from the Navy's Second Order Closure Mesoscale Model (SOCMM), are shown for each day of the experiment.

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All of the satellite data in this report were collected by USAF Air Weather Service personnel at Elmendorf Air Force Base, Anchorage, Alaska. A special note of thanks is due to Lt Col Richard Clayton, 11th Weather Squadron Commander, Capt Mark Shrader, Satellite Coordinator, and MSgt Allen L. Kirby, NCOIC of the van technicians. Van technicians included SSgt Marianne Honeywell, SrA Michael Krohne, A1C Brian Berry, and A1C Lisa Snook. We are especially indebted to SSgt Honeywell who provided special enhancements of the SSM/I data presented in this report.

It would not have been possible to prepare material for this report as rapidly without the help of Charles Samuels, Fairweather Forecasting, of Anchorage, who offered the use of his satellite workstation and thermal printer to expedite the production of satellite images presented in this report.

NRL personnel in Monterey were responsible for disseminating NORAPS (SOCMM) products to Anchorage. We would like to thank AG1 Elling J. Grinde, ET1(SS) Bruce E. Hotz, PH2 Kathy A. Smith, ET2 Quincy A. Taitt, and AG3 Eva Gonzalez for their efforts. Allen B. Caughey, of NRL, provided on-line software assistance to enable our computer and printer operation at Anchorage to run successfully throughout the experiment.

A final note of thanks is due to AG3 Peter Hoffman (NRL) and Keith Jones (Naval Postgraduate School), who volunteered their time to launch radiosondes (RAOBS) from Deadhorse, Alaska.

LEADEX DATA REPORT, PART 1
WEATHER ANALYSIS AND SATELLITE IMAGES

1. INTRODUCTION

The Leads Experiment, or Leadex, took place on an ice camp initially located approximately 200 nm northeast of Deadhorse, Alaska, during the period of 25 March through 24 April 1992 (the ice camp drifted westward about 4 degrees of longitude during this period). One of the major purposes of the experiment from a meteorological point of view was to determine the effect of weather systems moving through the area on changes in lead configuration and, specifically, on the opening and closing of such leads.

It was recognized quite early that, because of the sparsity of weather reports in the Beaufort Sea region, satellite data would be invaluable and absolutely essential to have in order to understand the nature and evolution of weather events in the region. To facilitate acquisition of such data a cooperative agreement with Air Weather Service (AWS), United States Air Force personnel at Elmendorf Air Force Base, Anchorage, Alaska, was obtained. The DMSP van at Elmendorf was utilized by AWS personnel to acquire and record on 4 mm Digital Audio Tapes (DAT) both NOAA and DMSP satellite data. The DMSP data were recorded in unencrypted format so that further processing could be facilitated at multiple un-classified locations.

One such location was the National Weather Service's (NWS) regional headquarters at Anchorage, where a Leadex Project Office was established for the purpose of providing real time weather analysis and forecast support to the ice camp; to the ice camp logistics support team at Deadhorse; and to flight crews flying assorted research missions over the Leadex area of operations. Weather satellite data, analyses and forecasts, were sent via facsimile transmission to Deadhorse for further relay to the ice camp by HF radio and helicopter or Twin Otter flights. Specialized Deadhorse, ice camp, and enroute flight forecasts were sent every 24 hrs from the Fairbanks NWS office courtesy of NWS. The Leadex Project Office also offered its own daily "Bob Fett Unofficial Leadex Forecast" along with numerous annotated satellite images. Flight crews were personally briefed at the Leadex Office and by special arrangement at the NASA Anchorage Airport hanger. Weather support was provided 12 hours per day, 7 days per week, and any time on special request.

Another important mission of the Leadex Project Office was to obtain the best of the weather analysis and forecast products available to support the operation. For this purpose a "vertically nested physics grid" was implanted in the Navy Operational Regional Atmospheric Prediction System (NORAPS) model and run with a resolution of 20 km to provide initial analyses and 24 hr forecasts. This special version of NORAPS was termed the "Second Order Closure Mesoscale Model" or SOCCM. These products were sent

by facsimile transmissions from Monterey, California to Anchorage on a daily basis every 12 hrs. The Project Office also was linked via modem connection to the Fleet Numerical Oceanography Center's computers so that numerical forecasts over a larger area, based on the Navy Operational Global Atmospheric Prediction System (NOGAPS), could be obtained on a near-real time basis at Anchorage. These products were useful not only for larger scale perspective but for purposes of comparison with the other numerical model outputs. NOGAPS proved especially important when an unexpected request was made to provide NOAA personnel with weather forecasts over the East Siberian Sea. The Anchorage NWS office did not have this capability but the Leadex Project Office was able to adjust the NOGAPS forecast product to cover that region and facilitate the construction of relevant forecasts.

A final collection effort was made to acquire Synthetic Aperture Radar (SAR) data as often as possible during the course of the experiment over the ice camp region. This aspect of the operation, at least from the perspective of the Anchorage office, was a disappointment in terms of near-real time support. Data were not acquired often enough and, when acquired, available software problems in ordering data through the Alaska SAR Facility (ASF) proved too onerous to correct in the amount of time available. Once appropriately ordered, however, the Facility did deliver the data expeditiously through the use of MARK AIR and airport pickup. It is expected that analysis of these data in conjunction with the buoy data and other remotely sensed data will prove invaluable for further research.

The success of the Leadex Project Office in accomplishing its mission can be directly attributed to terrific support from the NWS at Anchorage and at Fairbanks; to the AWS DMSP personnel who acquired all of the satellite data for NRL on 4mm DAT tapes; to NRL personnel at Monterey who devised and transmitted SOCCM products with few failures 7 days per week; to the NRL military and civilian personnel assigned to the project (especially); and through the special generosity of Fairweather Forecasting, a private weather corporation in Anchorage.

2. NORAPS MODEL DESCRIPTION (ANALYSES AND FORECASTS)

a. Second Order Closure Mesoscale Model (SOCMM)

Dr Stephen D. Burk, NRL

The Second Order Closure Mesoscale Model (SOCCM) uses a unique strategy in which a grid having high vertical resolution is nested within the standard coarser vertical resolution grid of the mesoscale Numerical Weather Prediction (NWP) model. Thus, the grid nesting occurs in the vertical rather than in a standard horizontal nesting manner. Physics computations are performed on the high resolution grid and involve time-dependent solution of mean wind components, liquid water, potential temperature, total moisture, and second-order closure turbulence equations. Moist thermodynamic calculations which include liquid water content and fractional cloudiness are done diagnostically. The long- and short-wave radiative fluxes are computed from a broad band radiative transfer equation. The dynamics computations involving pressure gradient and Coriolis terms, as well as nonlinear advection, are performed on the standard mesoscale grid. The two grids interact fully each physics time step.

The mesoscale model in which we have embedded our nested physics grid is the Navy Operational Regional Atmospheric Prediction System (NORAPS). This operational model makes short (to 3 days) forecasts for several selected regions and typically runs with a 109x82x21 domain, having 80 km grid spacing horizontally. In Leadex we use a smaller domain (71x71x24 on both grids, thus no nesting) and 20 km horizontal spacing. This grid structure has much higher resolution in the boundary layer than the global model.

Fields from the Navy's global model archived at the Fleet Oceanography Center (FNOC) are used to form time-dependent lateral boundary conditions for the mesoscale model. For the first forecast of the mesoscale model, fields from the global model (NOGAPS) are used for initialization. Subsequently, the mesoscale's forecast fields are used as first guess fields in the data assimilation process. In this way, mesoscale features which develop during one forecast are not lost during the analysis/initialization phase of a subsequent forecast. We also use a so-called "incremental update" procedure which tends to preserve through the data assimilation cycle the vertical boundary layer structure that develops in a given forecast. For Leadex, 24 h forecasts were produced twice daily (00 and 12 GMT). Thus, the 12 h forecast fields are used as first guess to subsequent forecasts.

In terms of the Mellor and Yamada (1974) turbulence closure hierarchy, we use a level 3 closure in the vertically-nested mesoscale model. Thus we carry prognostic equations for turbulent kinetic energy, temperature variance, moisture variance, and temperature-moisture covariance. Liquid water content and

fractional cloudiness are diagnosed. Stable precipitation rates are computed using the diagnosed liquid water content. Cumulus convection is treated with a Kuo scheme. The model solves the radiative transfer equation for short and long wave radiative fluxes and forms a heating rate from the radiative flux divergence. These radiative calculations include the impact of the modeled clouds on the radiation fields. At the surface over land, prognostic energy budget equations for ground temperature and moisture are solved. Stability-dependent surface layer transfer coefficients over land are computed from similarity theory. Over open ocean, surface layer transfer coefficients and separate roughness lengths for momentum, heat, and moisture are computed. A much more complete description of the vertically-nested model appears in Burk and Thompson (1989), and Burk and Thompson (1992).

b. Leadex Analyses and Forecasts

The SOCCM data set for Leadex consists of analyses and forecasts (labled NORAPS) for the period 25 March through 24 April 1992. Levels shown in this report include the surface, 10 m, 925 mb, and 700 mb data.

Not included but of great potential value for additional research are 24 hr trajectories of air parcels at the surface, 900, 800, 700, 600, and 500 mb levels, and vertical cross sections derived from the vertically-nested mesoscale model. Cross sections were constructed from the surface to 1650 m extending, a) from Deadhorse to the ice camp, b) east and west through the ice camp, and c) east and west along the foothills of the Brooks Range.

Vertical cross sections illustrate, but are not necessarily limited to; fields of potential temperature, temperature, relative humidity, wind speed, and wind direction. Some of the forecast fields were quite amazing in their ability to relate to changes in cloudiness and moisture content implied by direct evidence from acquired satellite data.

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Burk, S.D., and W.T. Thompson, 1989: A vertically-nested regional numerical weather prediction model with second-order closure physics. Mon. Wea. Rev., 117, 2305-2324.

___ and ___, 1992: Airmass modification over the Gulf of Mexico: mesoscale model and airmass transformation model forecasts. J. Appl. Meteor., 31, 925-937.

Mellor, G.L., and T. Yamada, 1974: A hierarcy of turbulence closure models for planetary boundary layers. J. Atmos. Sci., 13, 1232-1240.

25 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

25/0000Z Analyses

Surface Pressure

N-S oriented trough NNW of Barrow with strong pressure gradient to NE over ice camp region (vicinity 73.8N,144.7W).

10 M Winds

Trough not well reflected in 10 M winds. Moderate ENE winds 20-30 kts cross isobars NE of Barrow at approximately 90° angle.

925 MB

Trough shown much better at this level. 40-50 kt winds align with tight pressure gradient NE of Barrow.

700 MB

Winds veer to more southerly and weaken in intensity. Trough not reflected at this level.

26/0000Z 24-hr Forecasts

Surface Pressure

Low center forecast to form near 76N,153W.

10 M

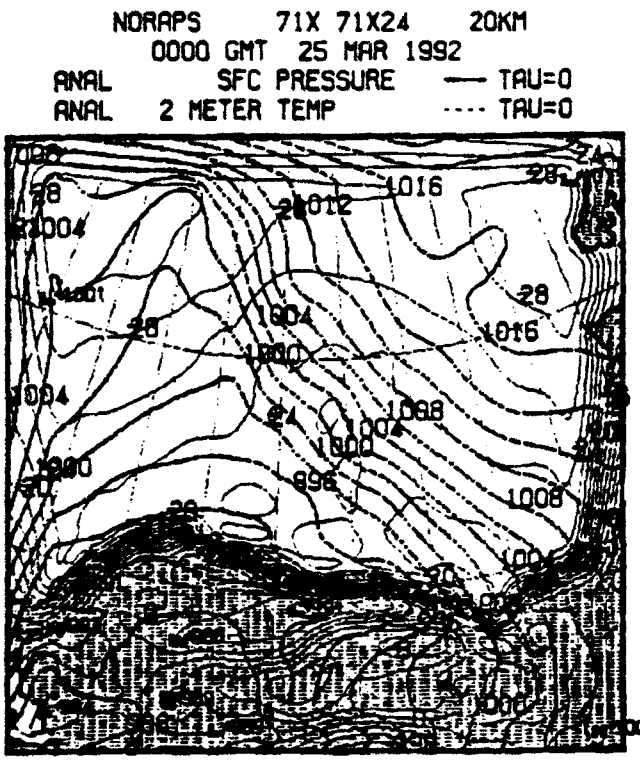
Winds reflect weak circulation near surface center.

925 MB

Well defined closed circulation indicated over surface center.

700 MB

Low center forecast to form over surface center.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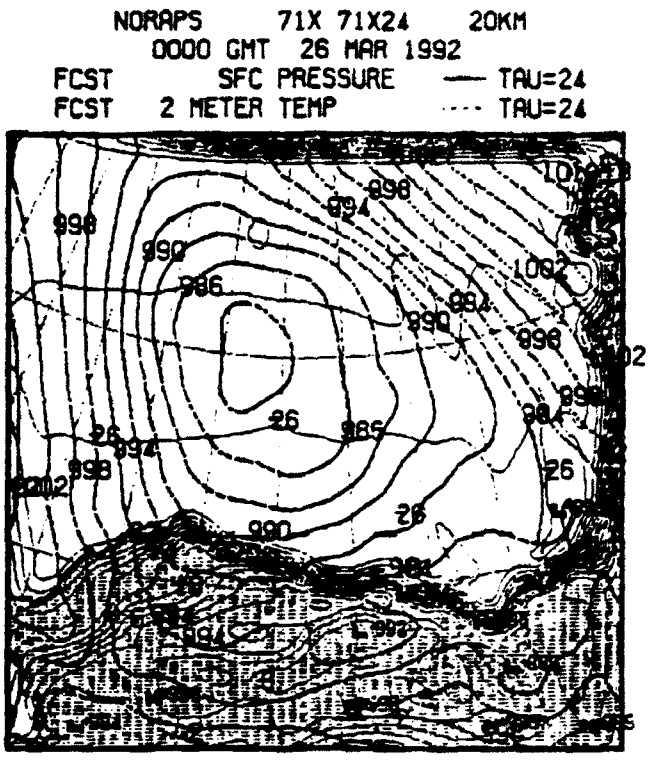
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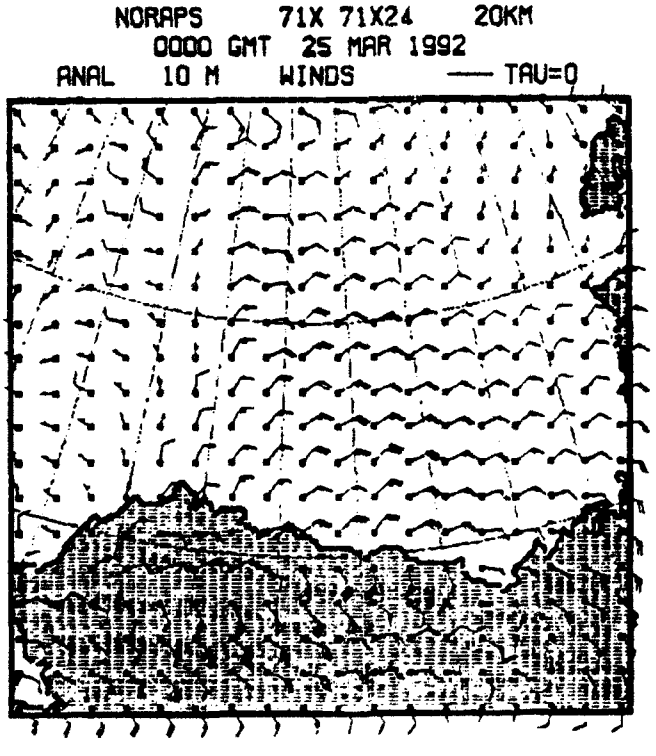
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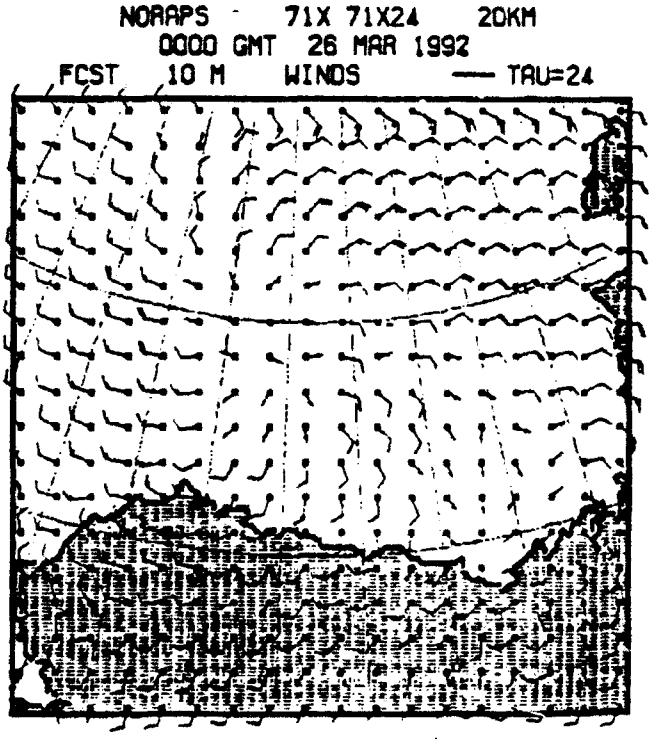
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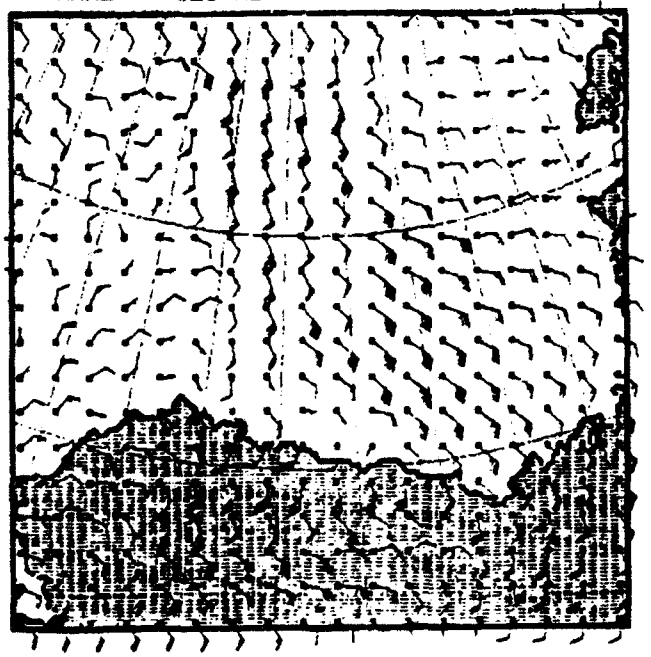

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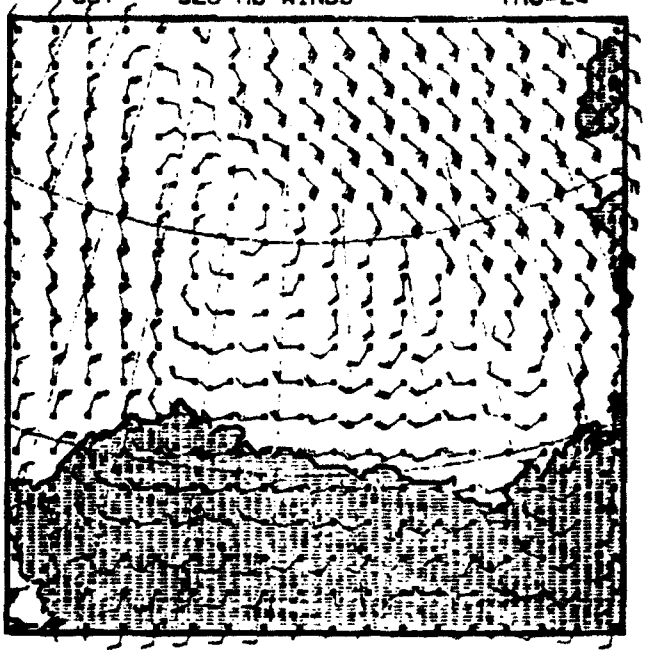

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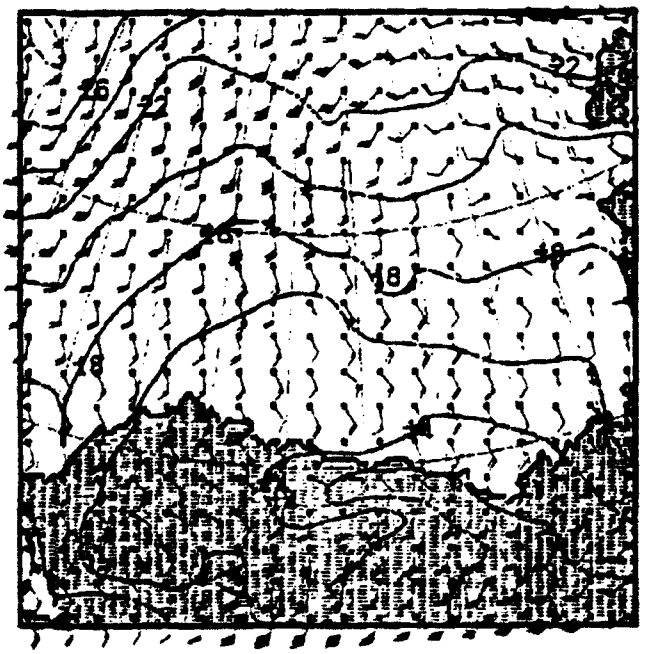

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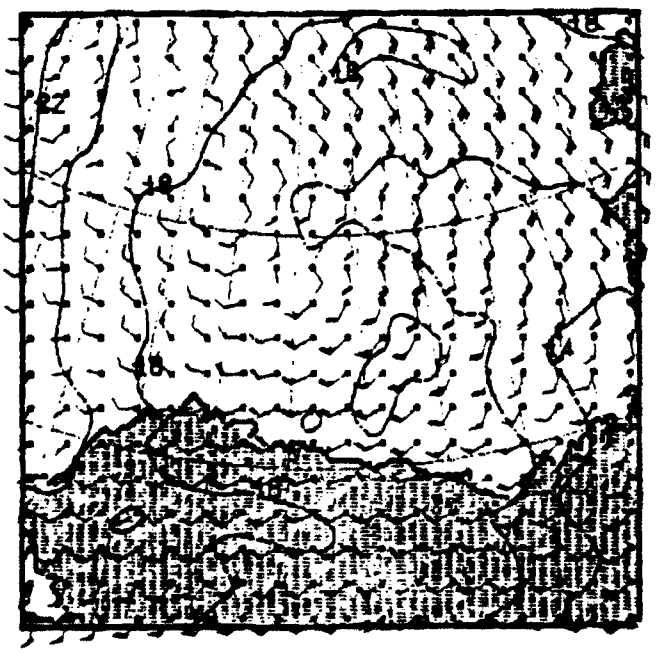

25 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

25/1200Z Analyses and Forecasts (update)

A **surface** low developed with center near Barrow. Some low and trough development is suggested in the **10 M** winds along the North Slope. Winds at this level still cross the isobars to the NE at large angles, with speeds lower than the gradient suggests. The **925 Mb** winds however reflect the strong gradient and are aligned essentially parallel to the surface isobars. **Higher level analyses and other forecast products** not available for this time.

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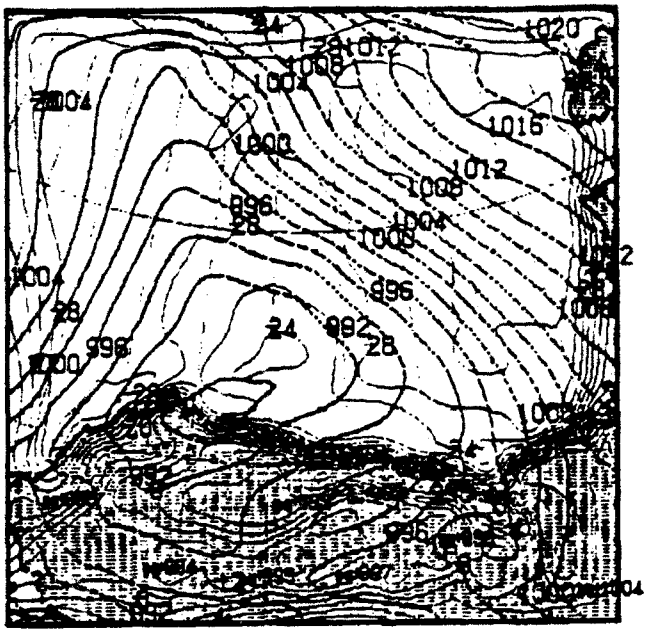

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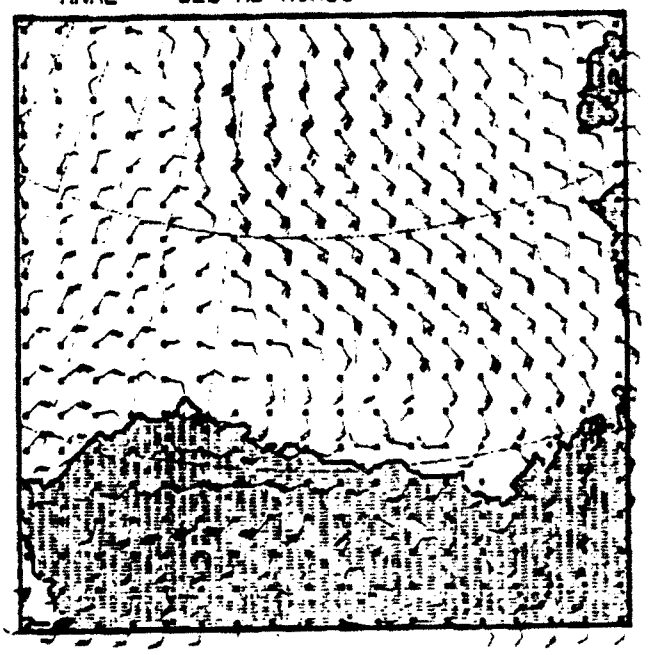

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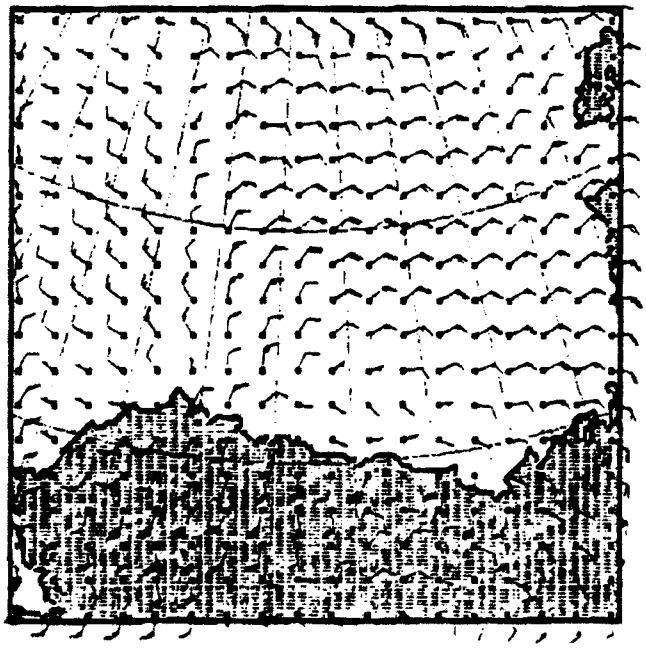


26 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

26/0000Z Analyses

Surface Pressure

NORAPS data not available. Anchorage charts showed a 990 mb low centered approximately 200 nm NE of Barrow. The low moved rapidly NNE'ward during the day.

10 M Winds

925 MB

700 MB

27/0000Z 24-hr Forecasts

Surface Pressure

NORAPS forecast products not available for this period.

10 M

925 MB

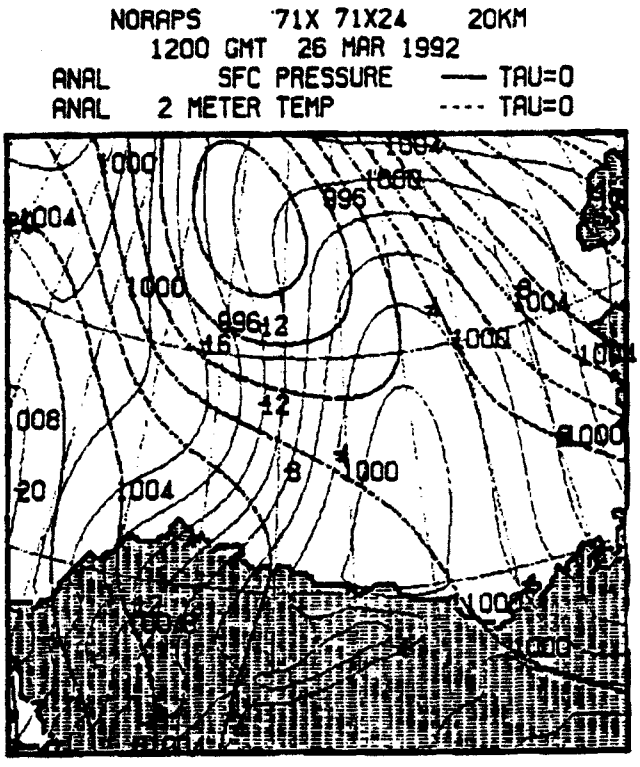
700 MB

26 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

26/1200Z Analyses and Forecasts (update)

A **surface** low moved as predicted rapidly northward to a position near 77N,155W. The low was a large-scale phenomenon, and many new leads opened along the N. Slope fast ice, as winds changed in direction from northerly (25 Mar 00Z) to westerly. Note the strong thermal gradient on the surface analysis and the warm surge over the ice camp region. The forecast for this low was to move eastward at high latitudes. **Satellite data** showed a shallow cold front passing over the ice camp area.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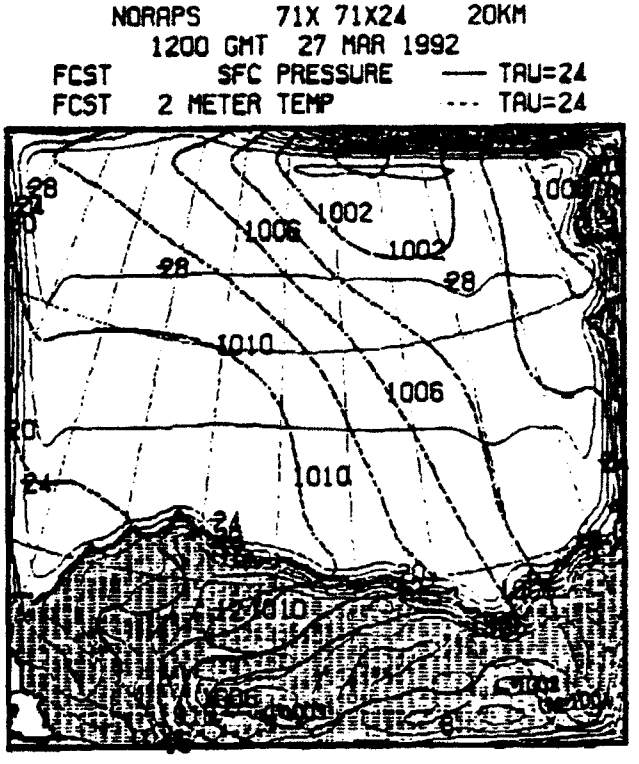
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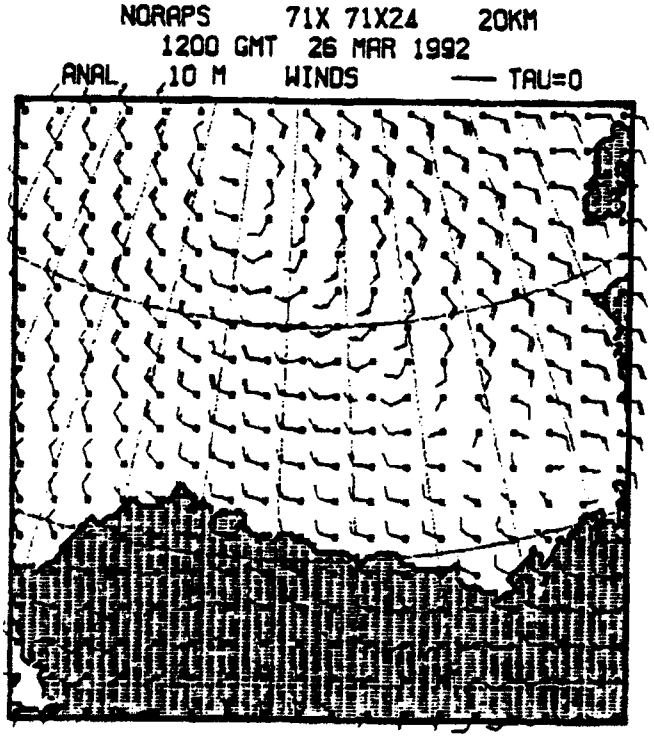
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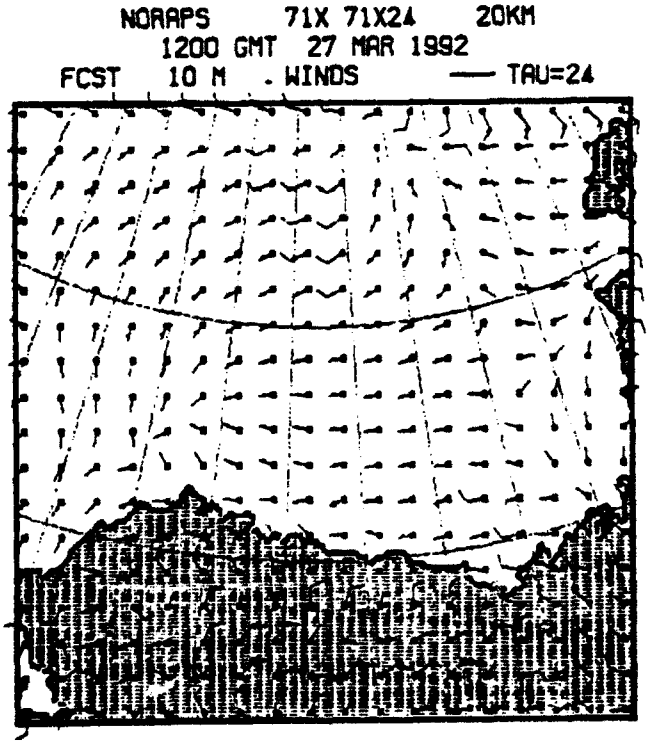
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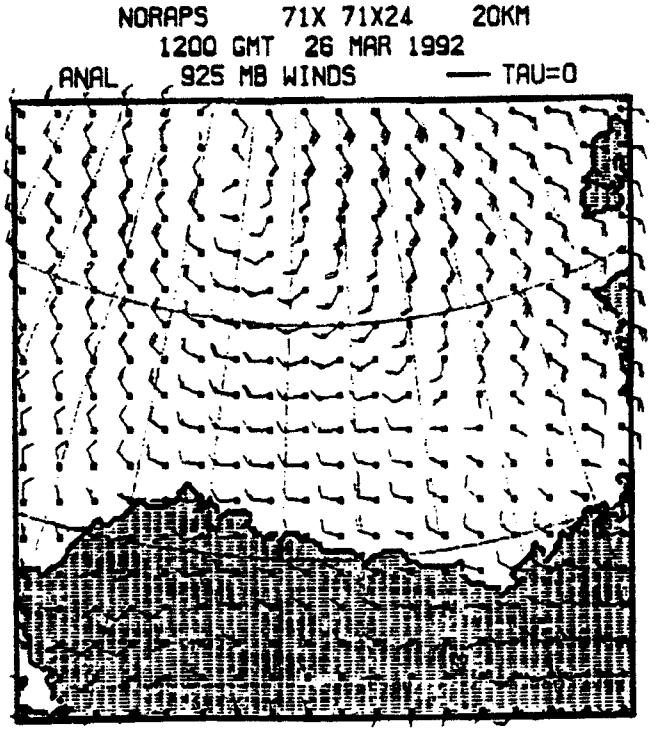
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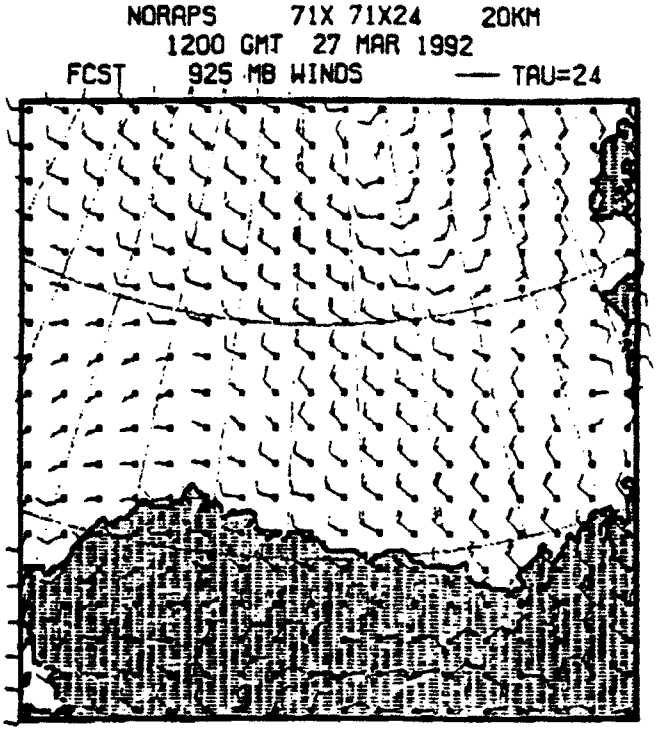
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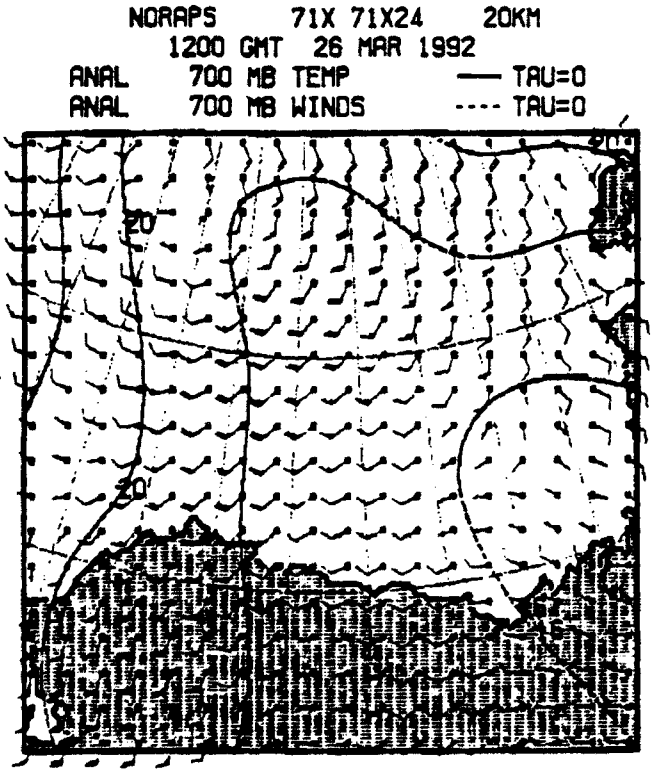
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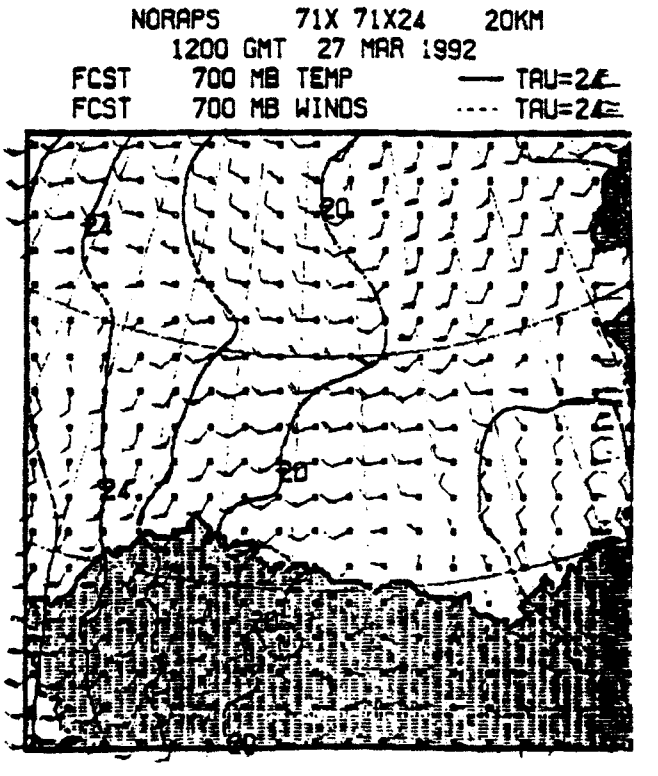
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FCST 700 MB WINDS ---- TAU=24

27 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

27/0000Z Analyses

Surface Pressure

The surface analysis shows that the low continued moving more northward than eastward, as the temperature gradient collapsed.

10 M Winds

Very light winds at this level tending to support the position of the low well to the north.

925 MB

A more vigorous circulation shown here with off-ice flow shown over the W. Beaufort Sea.

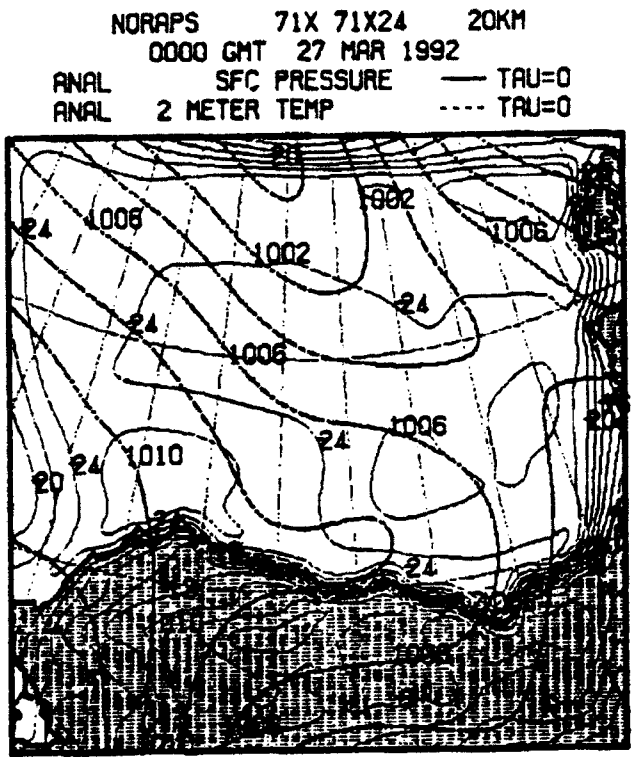
700 MB

Winds turn anticyclonically over the S. Beaufort but do reflect the presence of a low to the north.

28/0000Z 24-hr Forecasts

Surface Pressure

The forecast is still for the low to move eastward with off-ice flow. A sharp N-S trough is shown over the eastern Beaufort at the **925 MB** and **700 MB** levels. Satellite data revealed a N-S oriented front stretching toward the N. Pole with vortex formation just NW of Banks Island (27/2018Z). Even more interesting was the development of a low level vortex in the lee of the Brooks Range that passed to the NE just east of Deadhorse. No evidence of this development can be gleaned from the NORAPS analyses and forecasts - nor from the NWS products which showed a ridge along the N. Slope. Satellite evidence, however, is quite clear.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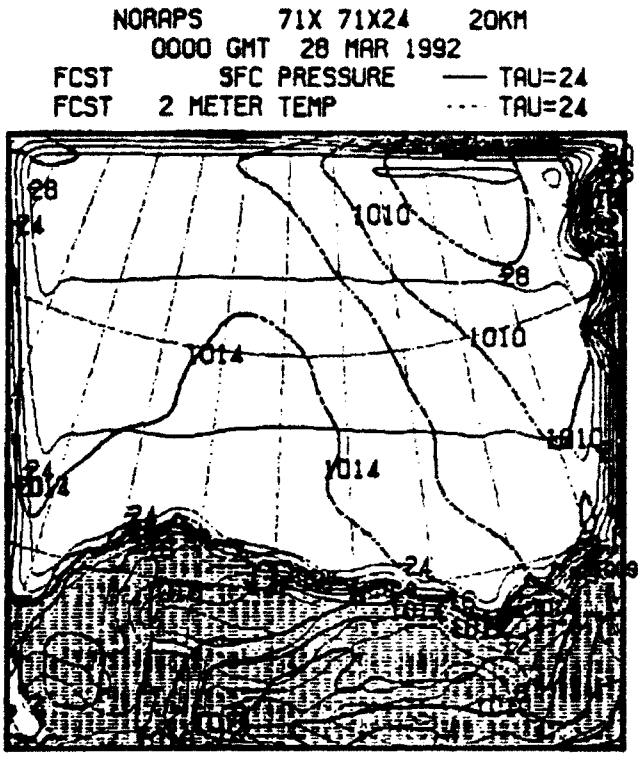
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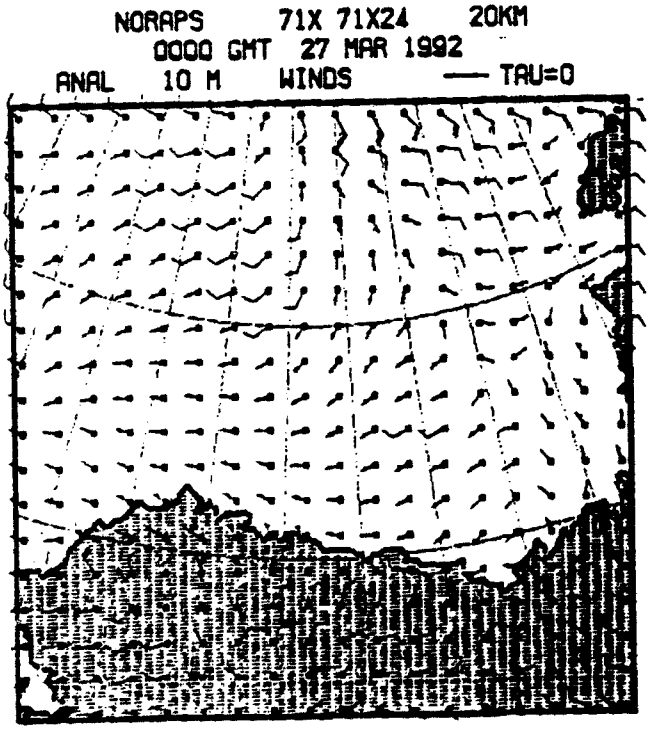
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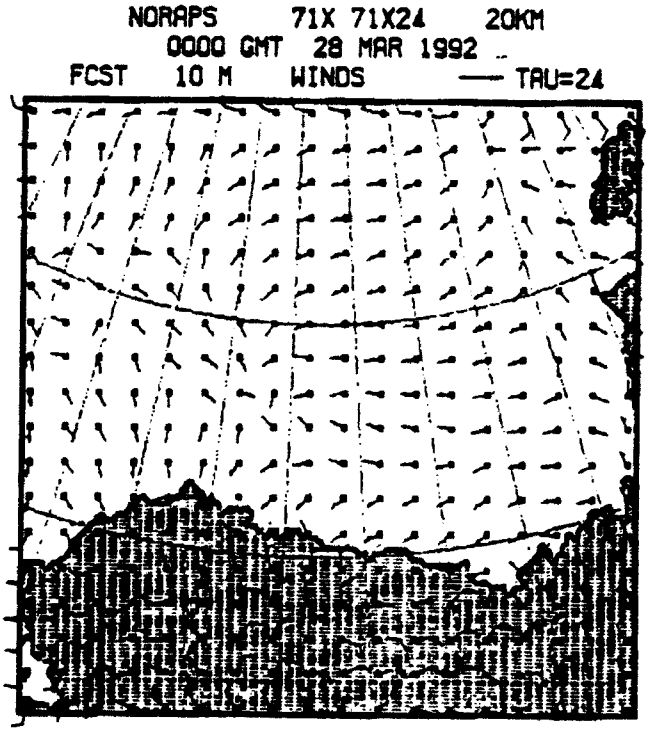
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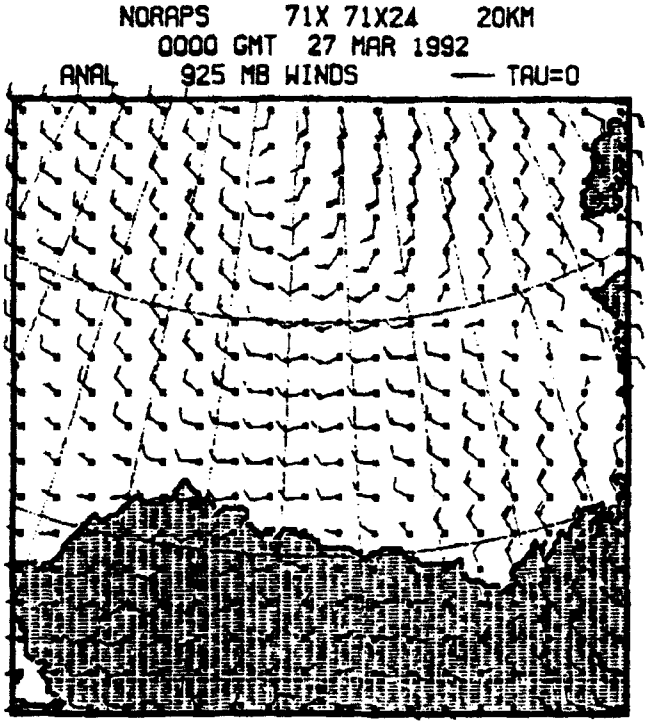
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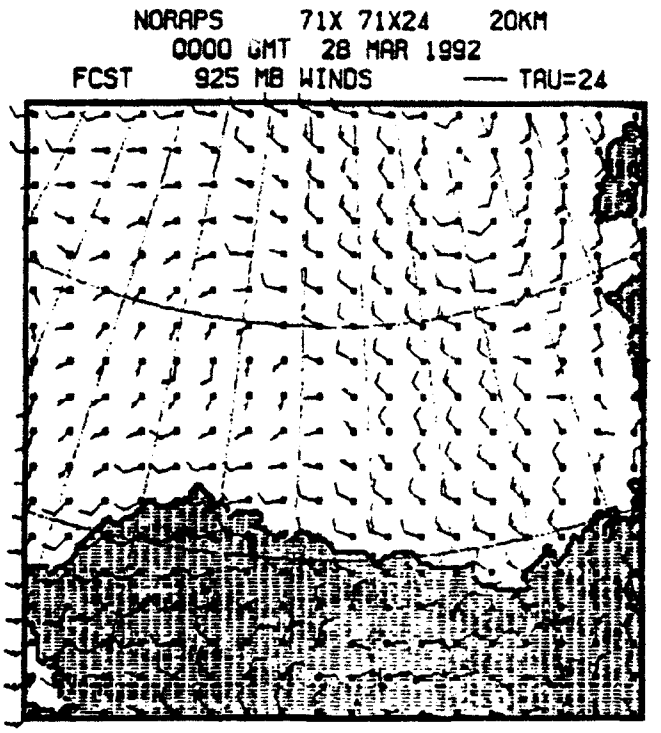
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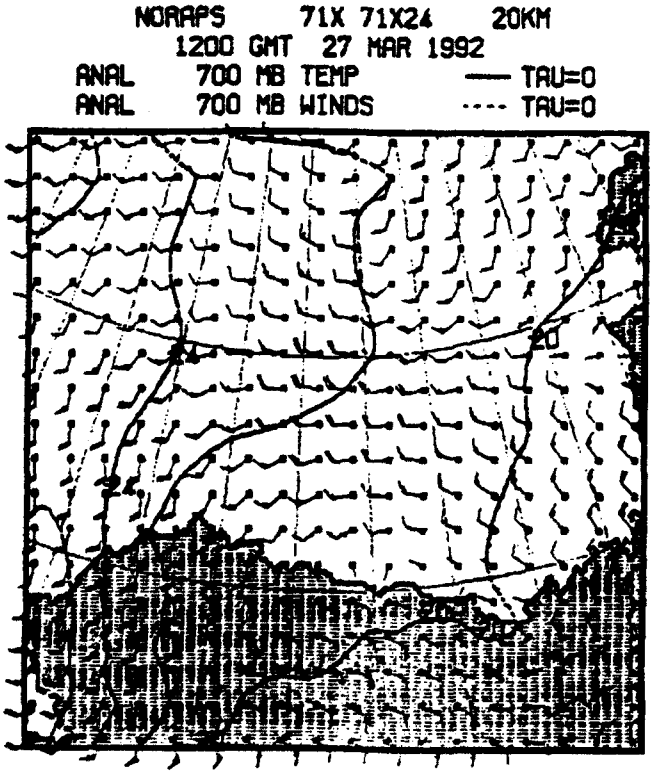
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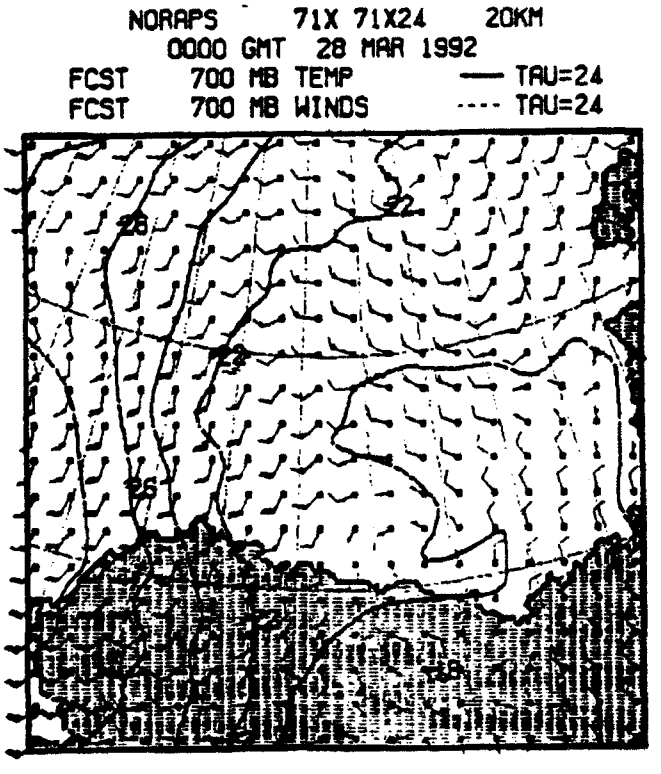
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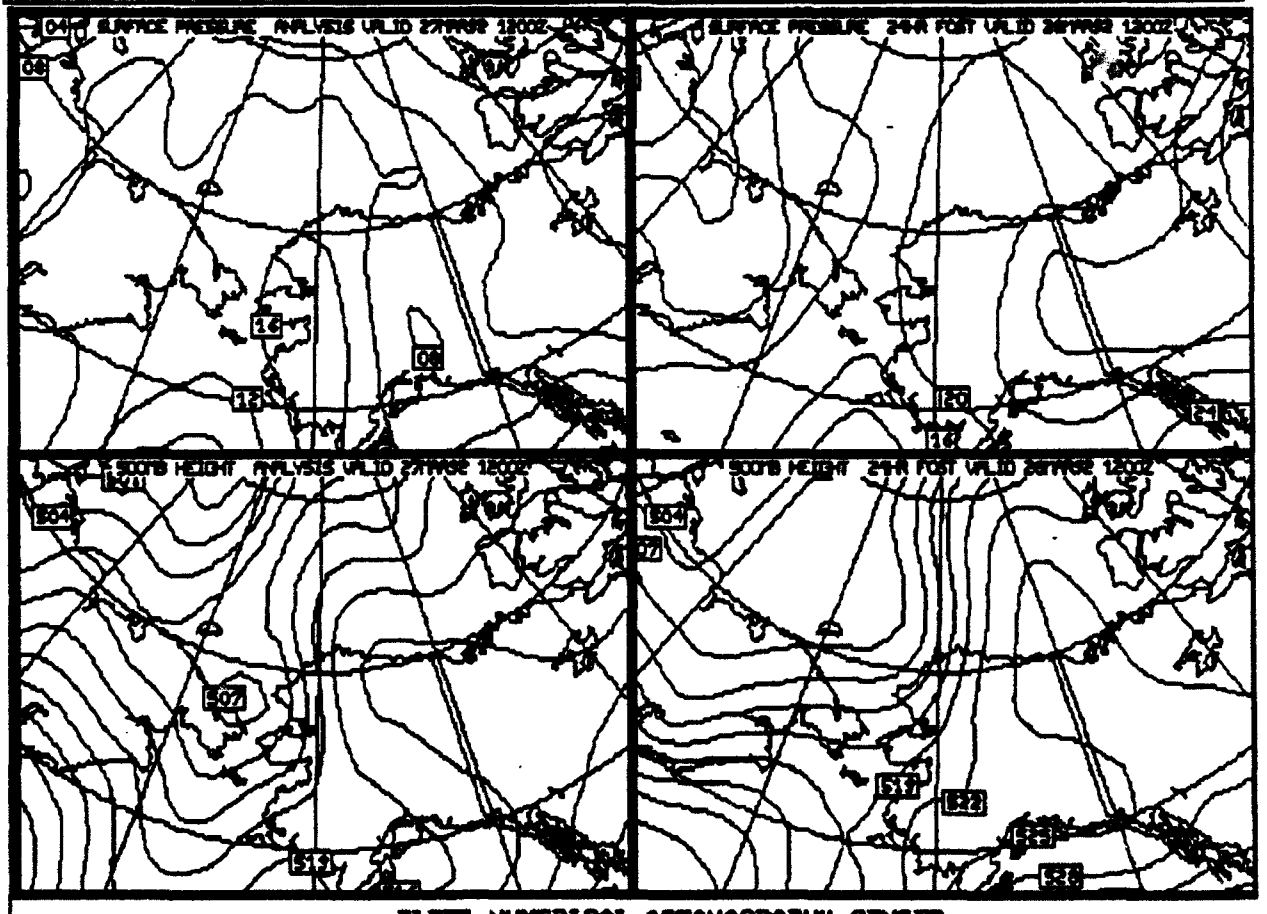
27 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

27/1200Z Analyses and Forecasts (update)

The surface low moved very close to its 27/1200Z forecast position NW of Banks Island and was forecast to drift SE'ward toward Banks during the following 24 hrs. The low shows a well developed circulation at **925 MB** by 28/1200Z, with a sharp ridge over the central Beaufort. The low is also apparent in the **700 MB** forecast pattern. Continued off-ice flow during this period favored lead development near the fast ice east of Barrow. **Most important**, satellite data show a frontal connection from a low over the Bering Strait eastward across the N. Slope to the low level vortex east of Deadhorse (Reflected only weakly in the trough shown on the 27/1200Z analysis). The **NOGAPS** surface analysis (below) fails to resolve the low NW of Banks Island and yields no clue to its existence in the 24 hr forecast. The NOGAPS 500 mb product suggests the approach of a jet stream and frontal zone approaching Barrow by 28/1200Z.



FLEET NUMERICAL OCEANOGRAPHY CENTER

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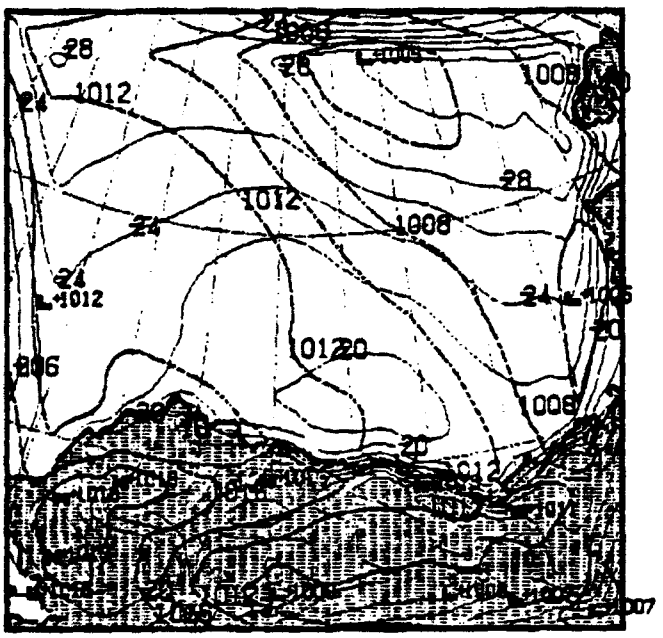

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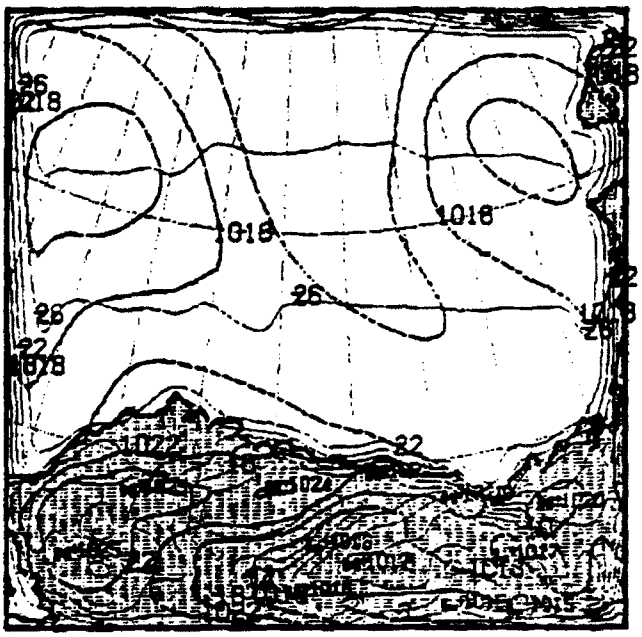

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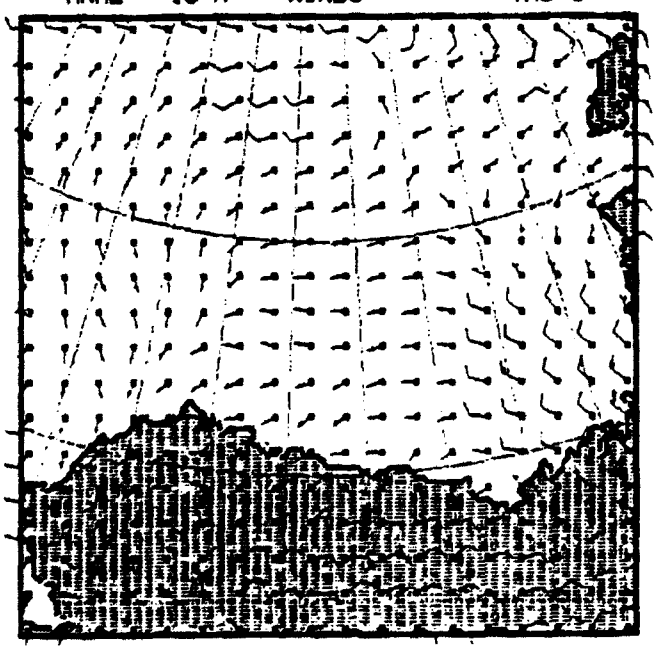

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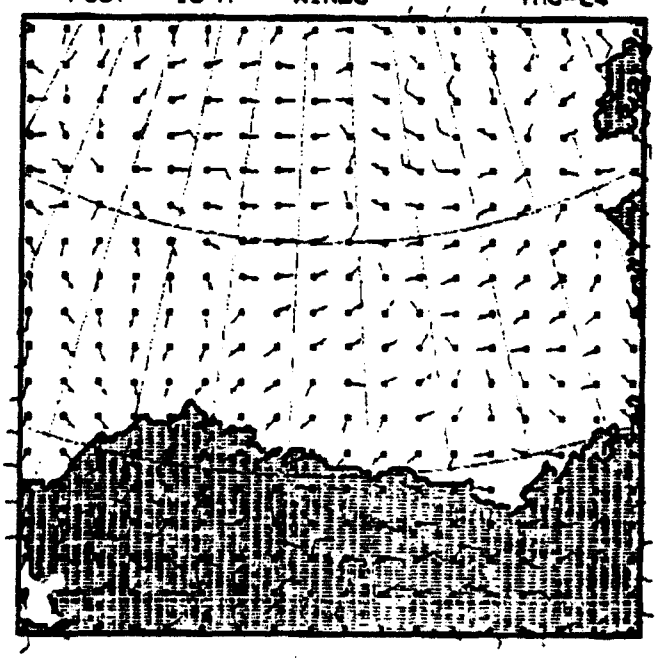

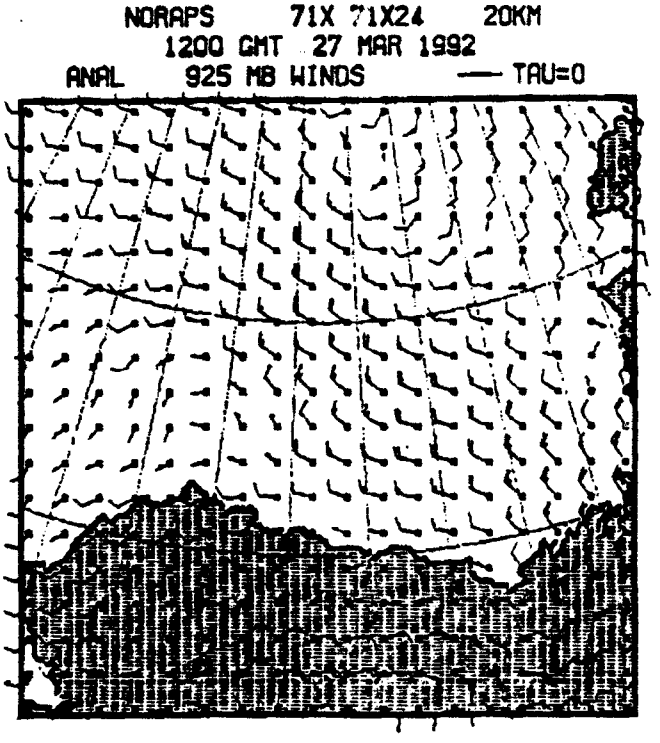
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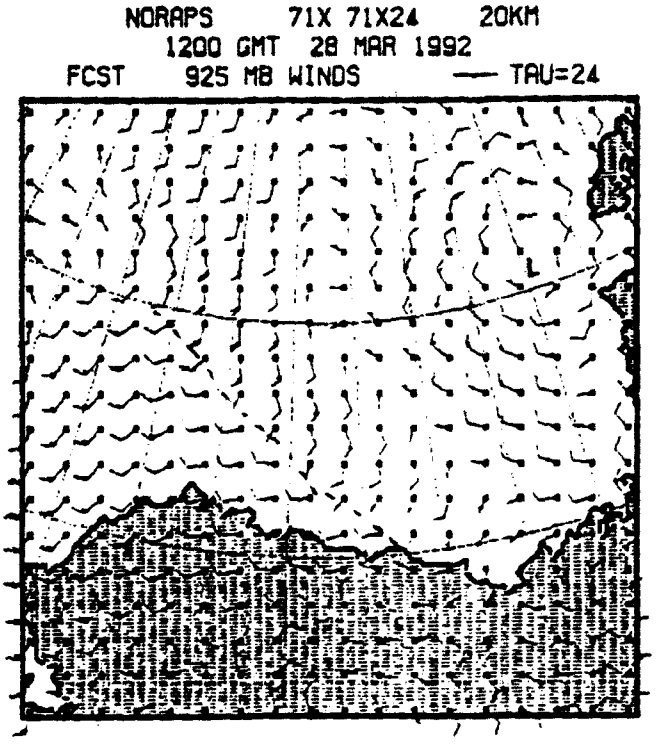
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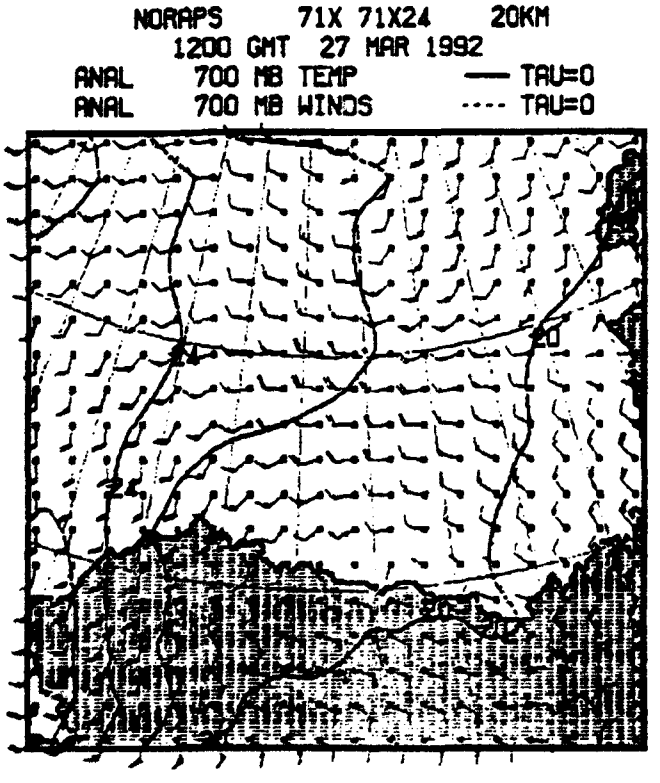
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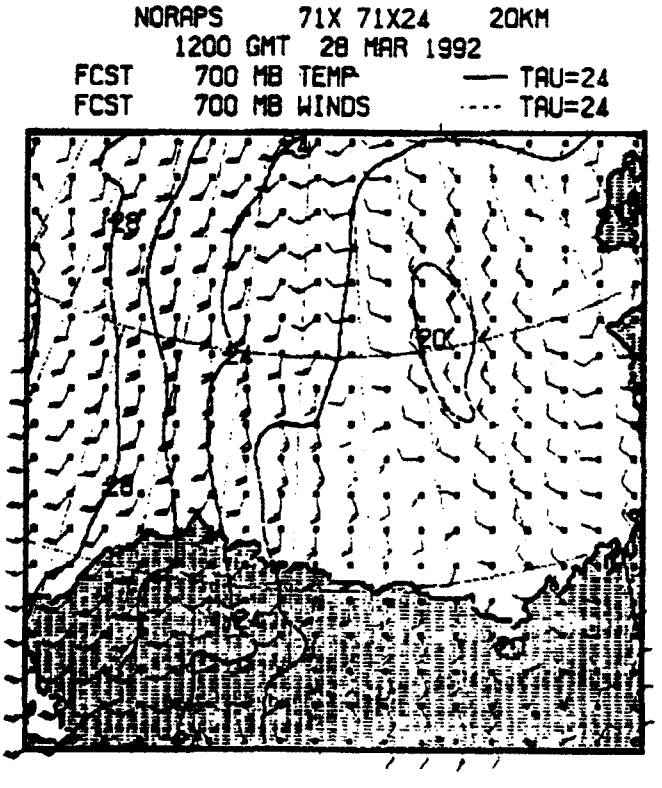
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28 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

28/0000Z Analyses

Surface Pressure

High pressure is shown centered over the central Beaufort Sea near the ice camp, with a low pressure center still positioned NW of Banks, Not well suggested by this analysis was a frontal cloud band extending from the NW corner of the analysis toward Barrow.

10 M Winds

Light winds generally reflect the high pressure cell over the central Beaufort.

925 MB

A closed circulation appears associated with the low NW of Banks. A ridge line is implied extending from near Deadhorse NW'ward. Note the slight indication of a trough extending NW from Barrow.

700 MB

Moderate southerly flow to the west turning anticyclonically over the Beaufort Sea turns to cyclonic motion near the low NW of Banks.

29/0000Z 24-hr Forecasts

Surface Pressure

A low pressure center in the NW corner has a trough line extending through the central Beaufort, repacing earlier high pressure. The low center persists NW of Banks.

10 M

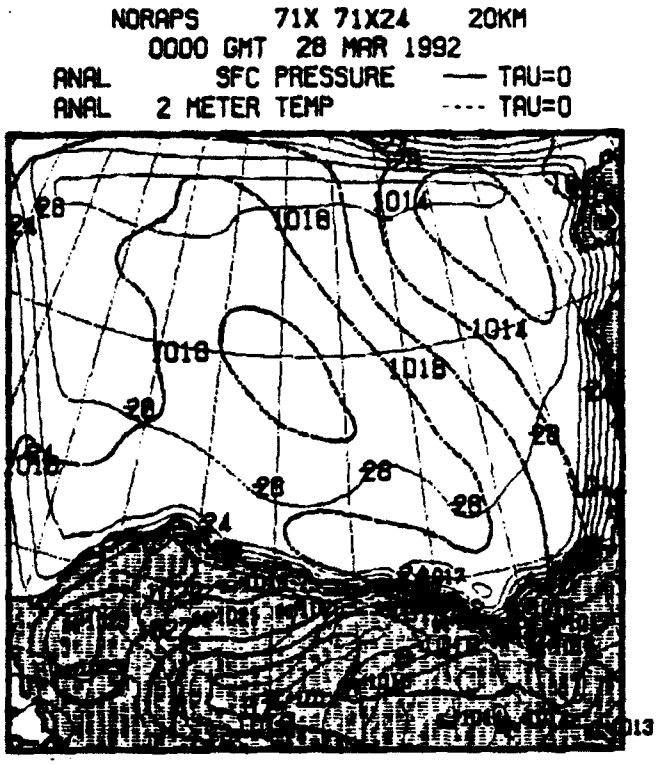
The trough is not shown well at 10 m. Weak cyclonic flow circulates around the low NW of Banks.

925 MB

Here is the beauty! A trough line is implied by the cyclonic turning of winds over the central Beaufort. This relates perfectly to the band of clouds shown in the satellite data moving eastward during the period. **No other operational charts resolved this feature.**

700 MB

No indication of the trough or shear line. A closed cyclonic circulation is evident NW of Banks.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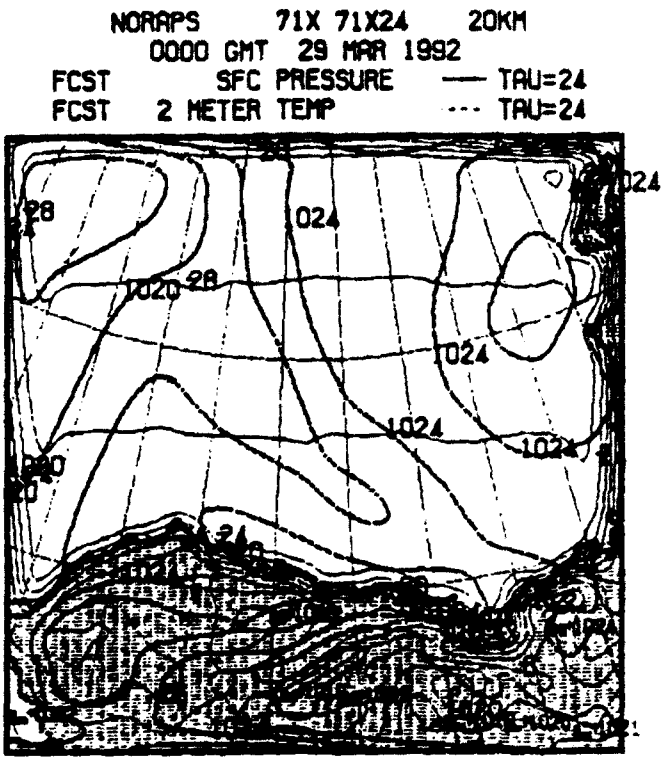
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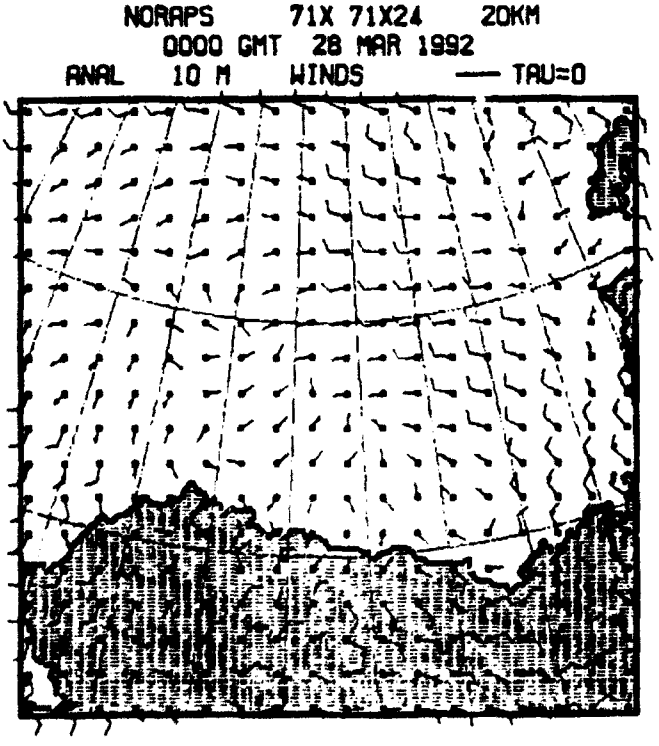
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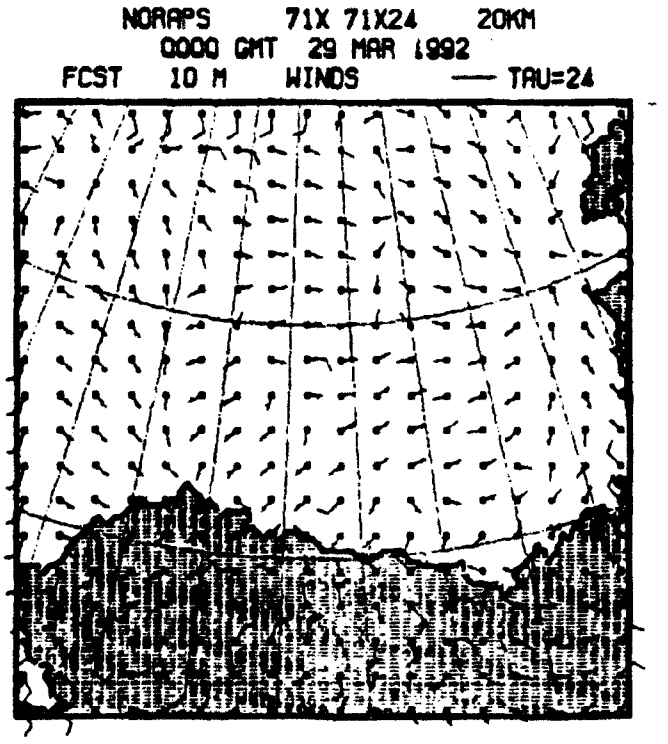
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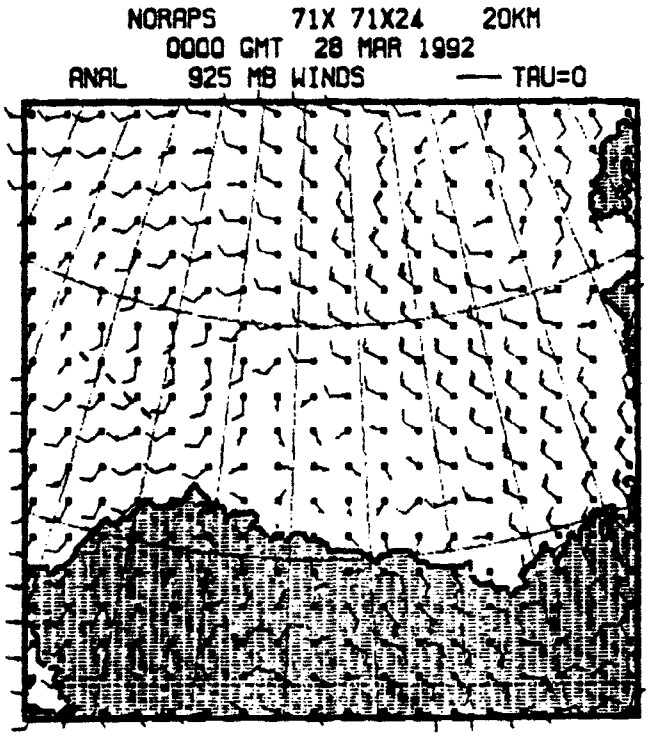
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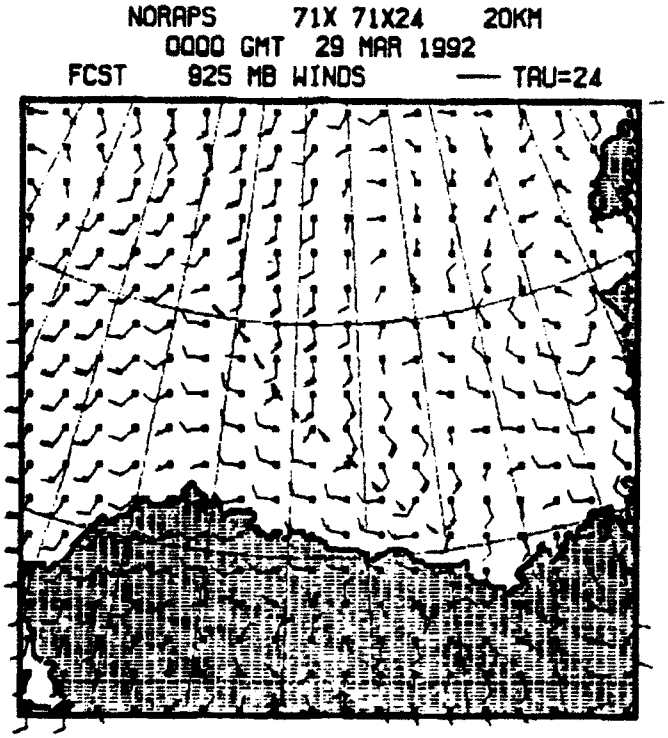
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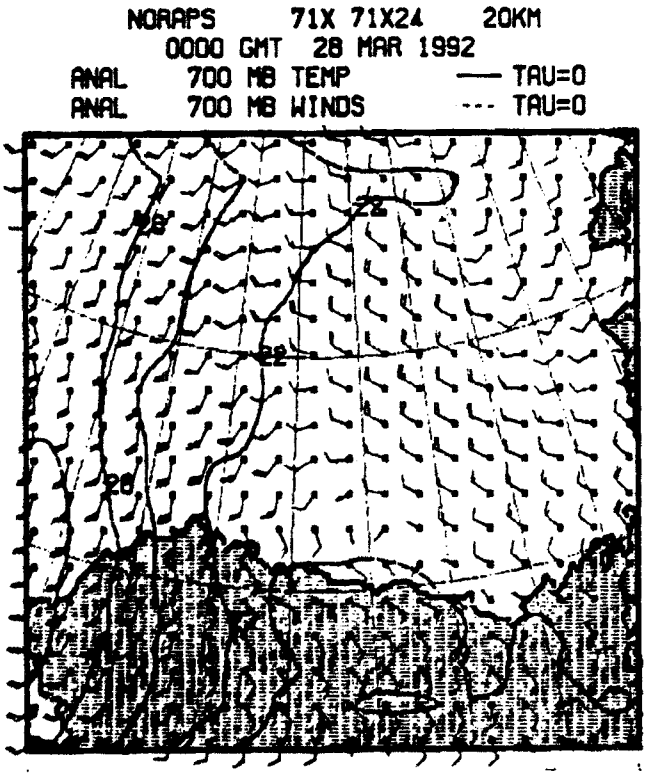
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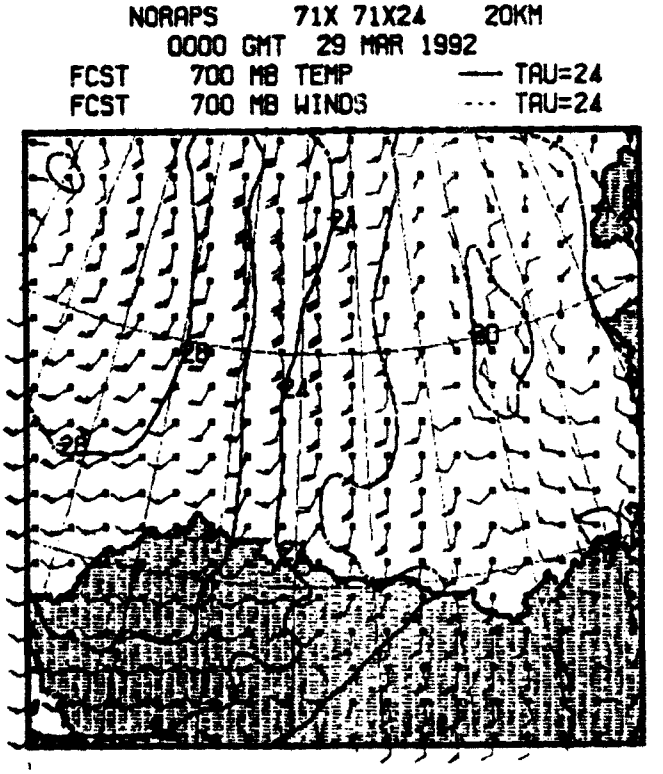
ANAL 700 MB WINDS --- TAU=0
28
22
22
28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21
30
29
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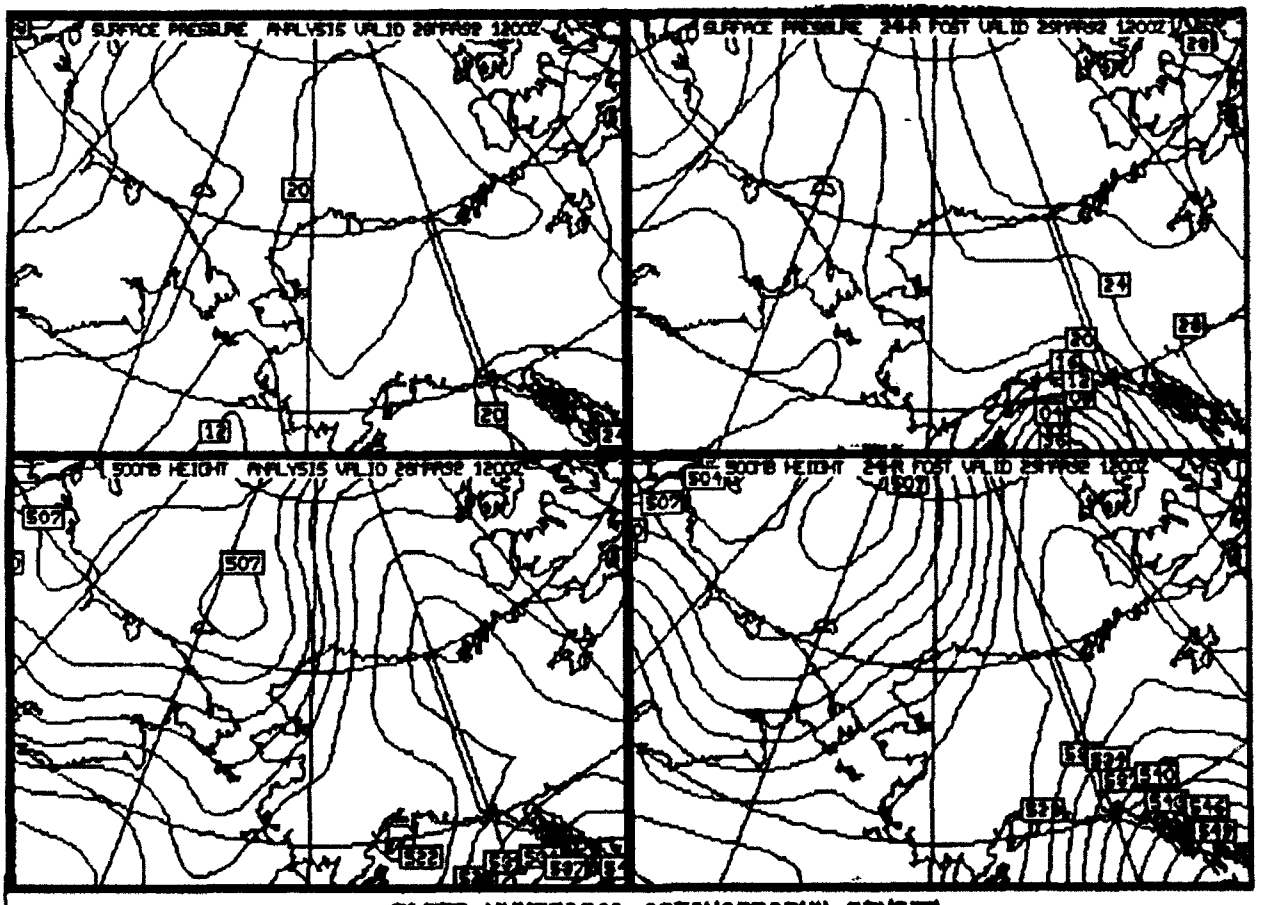
28

28 Mar 92

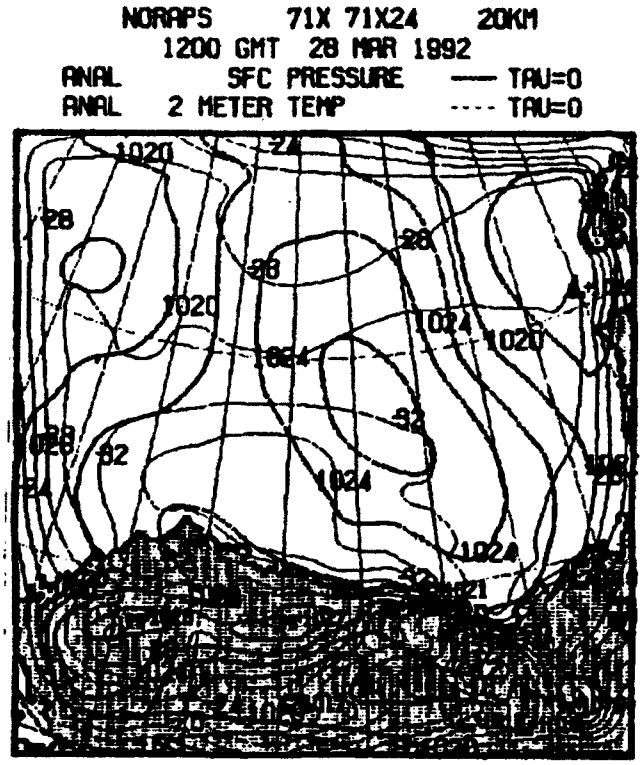
NORAPS ANALYSIS AND FORECAST PRODUCTS

28/1200Z Analyses and Forecasts (update)

The high pressure cell in the central Beaufort is evident on the **surface** analysis and is relected at **10 M. 925 mb** and at the **700 MB** level. A weak trough at **925 MB** is implied extending NW'ward from just east of Barrow. A closed cylonic circulation is forecast to remain NW of Banks at all levels. The trough associated with the satellite-observed frontal band is shown to move only slightly eastward at 925 mbs, stagnating just west of the ice camp area, The **NOGAPS surface** product (below) shows the high pressure cell over the Beaufort but shows no indication of the important trough embedded in the high pressure region or of the low NW of Banks. The **500 MB** analysis and forecast continue to suggest a southerly jet stream ove the E. Beaufort.



FLEET NUMERICAL OCEANOGRAPHY CENTER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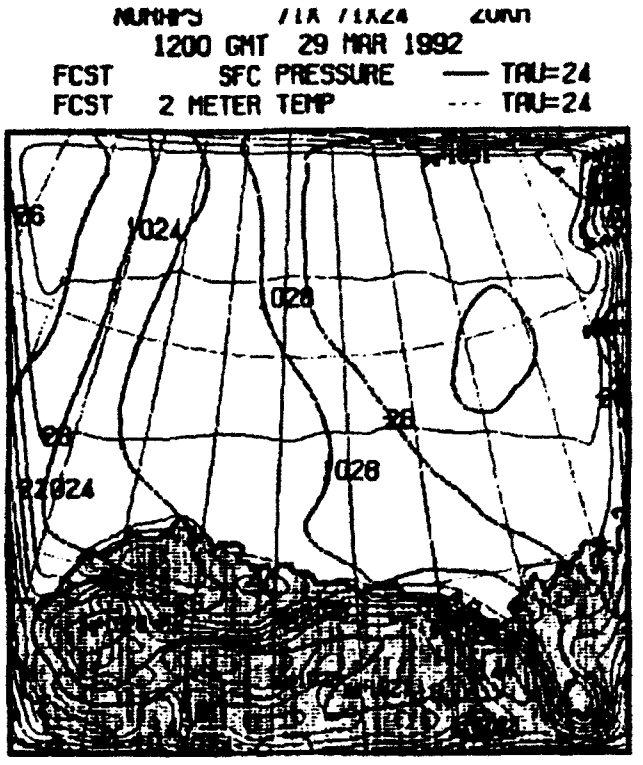
ANAL 2 METER TEMP ---- TAU=0
1020
1024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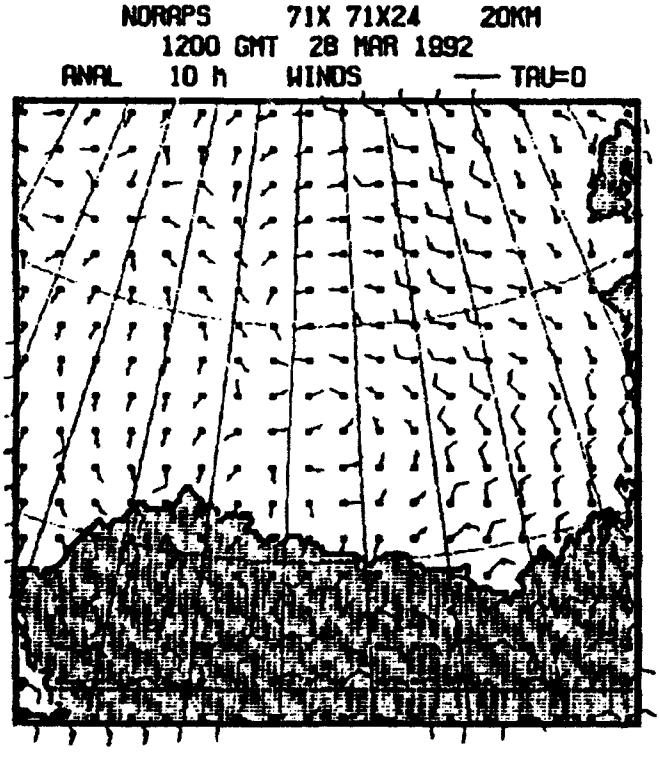
1024
1028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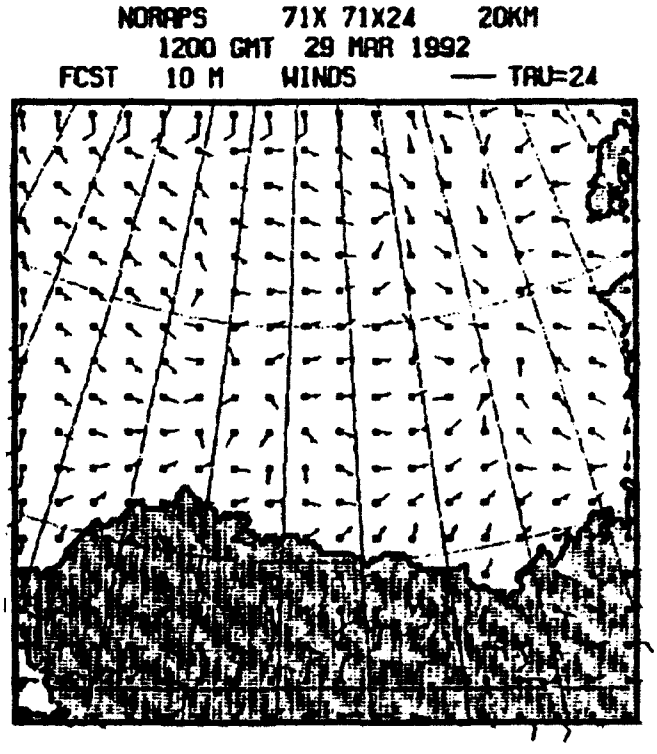
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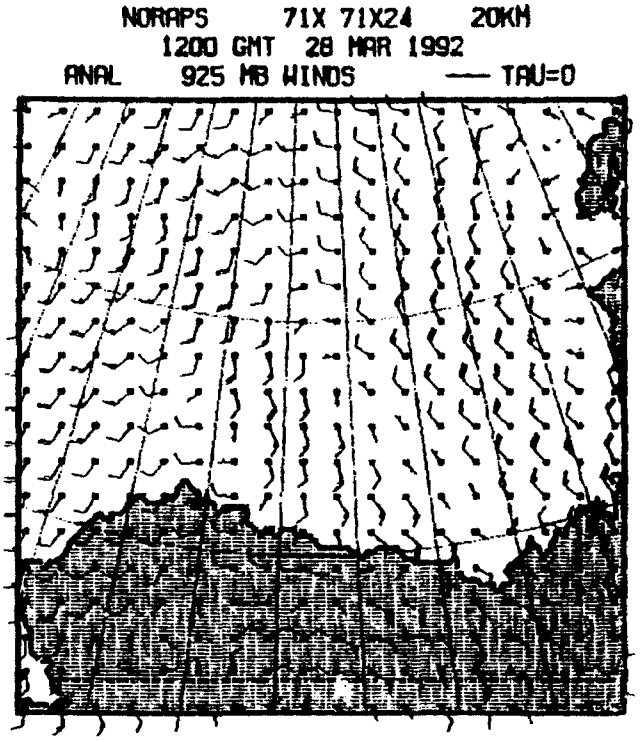
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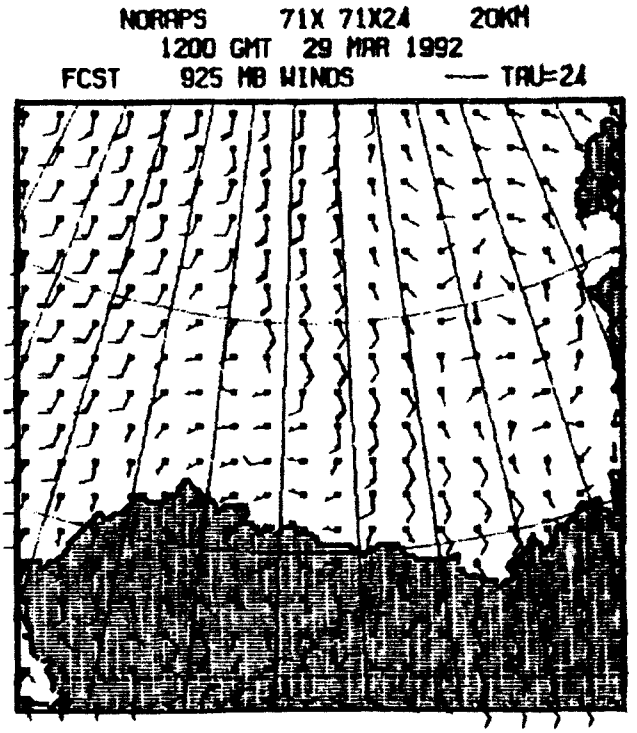
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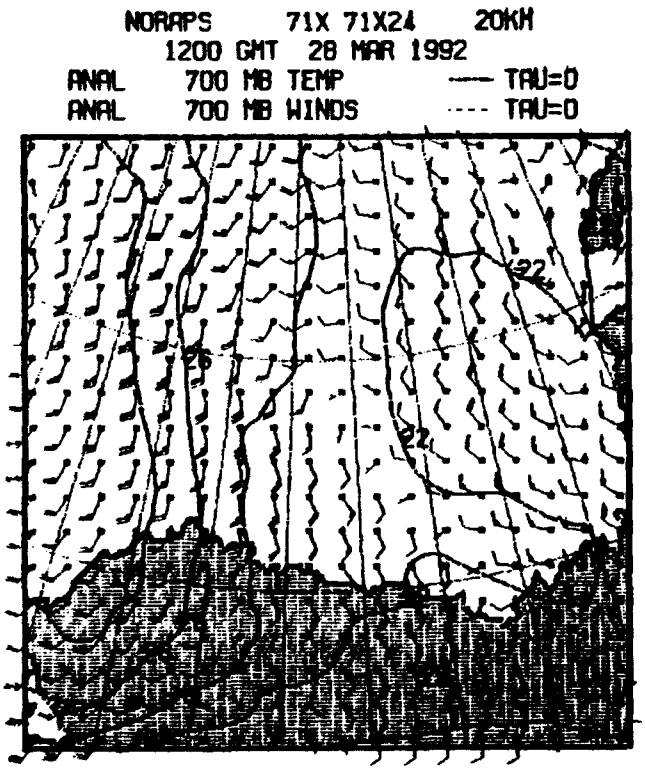
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26
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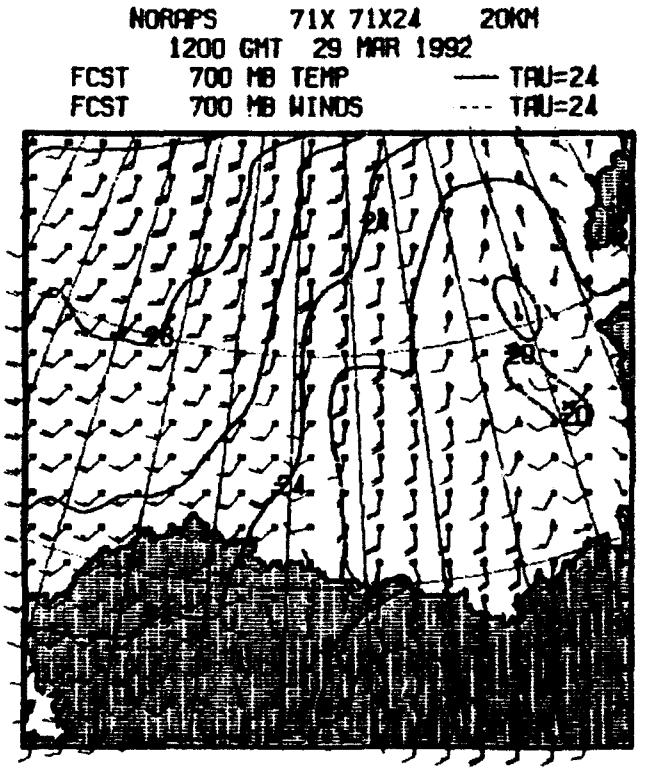
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FCST 700 MB WINDS --- TAU=24
28
24

29 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

29/0000Z Analyses

Surface Pressure

High pressure is shown dominating the central Beaufort Sea with the low persisting NW of Banks. Another low appears in the NW corner. Satellite data show the ice camp area to be clear with a N-S oriented frontal band just west of Banks.

10 M Winds

Winds reflect a fairly deep trough just west of Banks. This relates well to the apparent movement of the trough previously noted in the central Beaufort passing the ice camp in its eastward movement.

925 MB

Anticyclonic turning of the winds in the central Beaufort is shown in conjunction with a closed cyclonic circulation NW of Banks.

700 MB

A very sharp N-S oriented ridge appears in the central Beaufort with a closed cyclonic circulation NW of Banks.

30/0000Z 24-hr Forecasts

Surface Pressure

The low and trough near Banks are forecast to move eastward. The low is replaced by a high pressure cell in the same location.

10 M

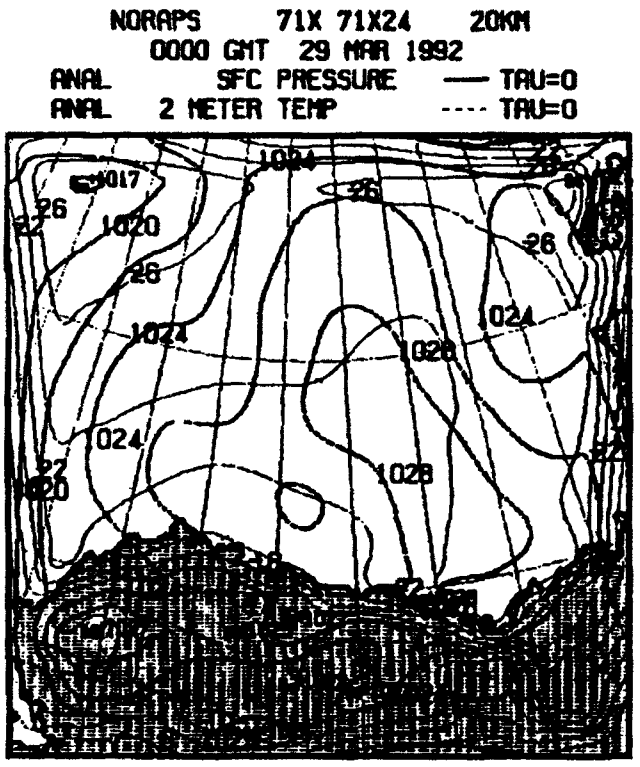
Cyclonic turning of winds SW of Banks is forecast and may be related to a "surprise" system that moved up toward the N. Slope through the Mackenzie River delta.

925 MB

Mainly southerly flow is shown over the entire region.

700 MB

Dominant southerly flow over the area.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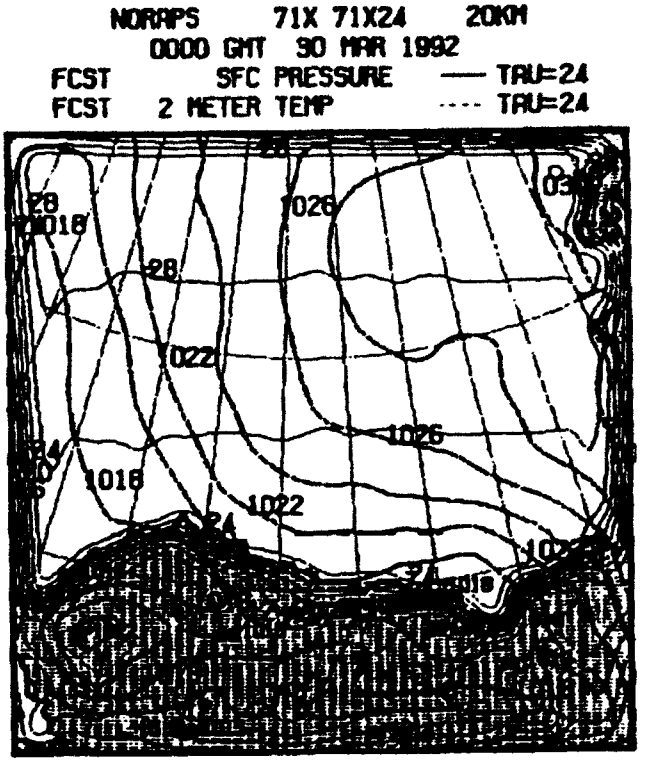
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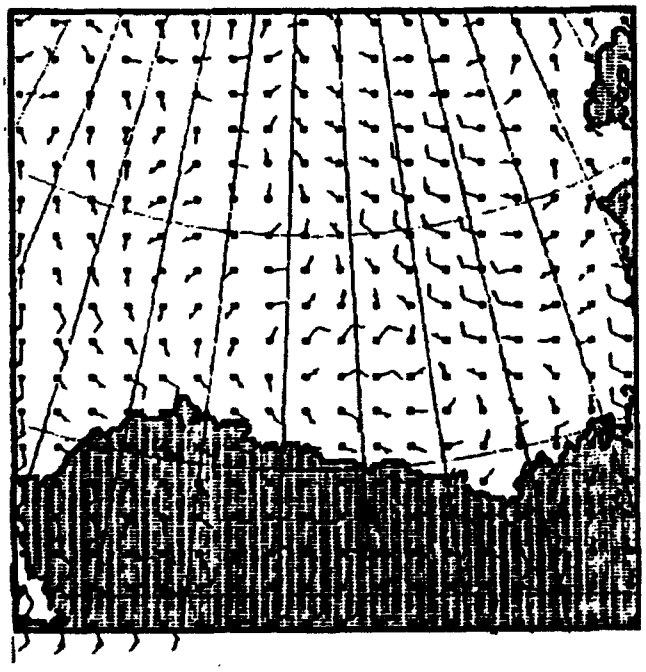
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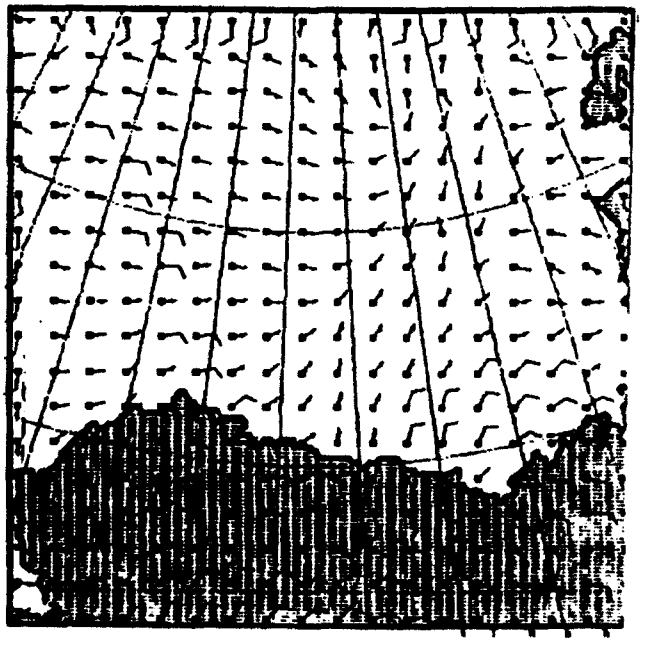
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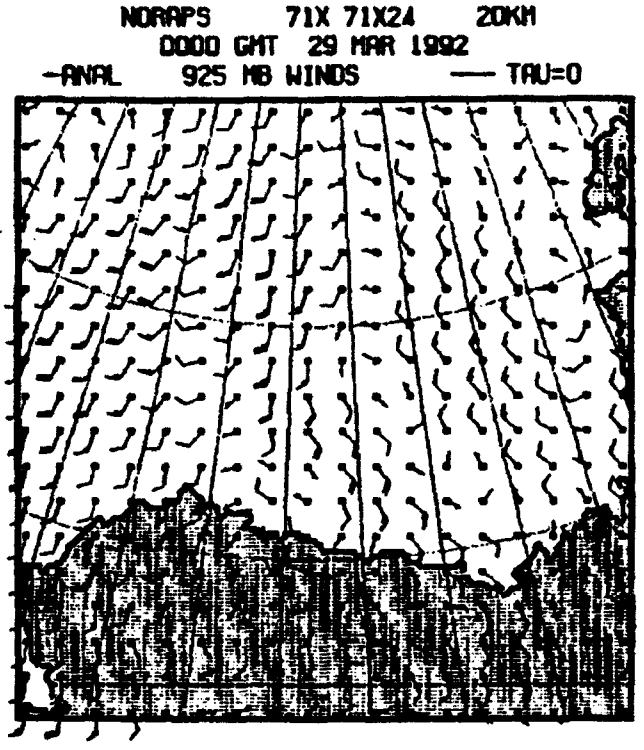
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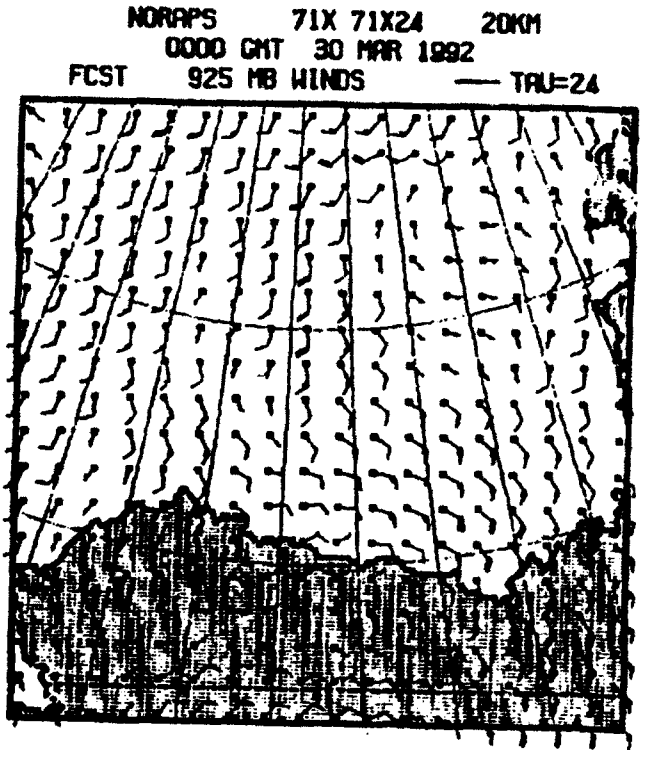
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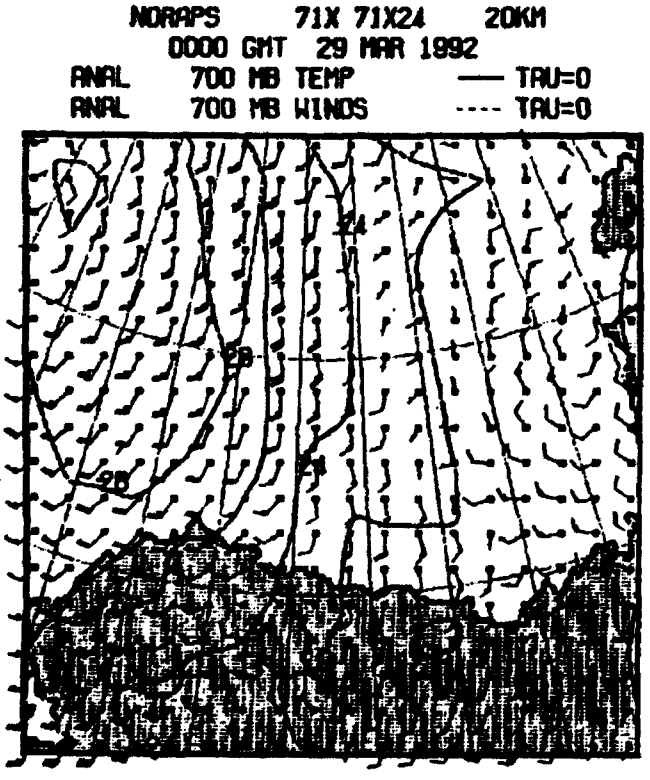
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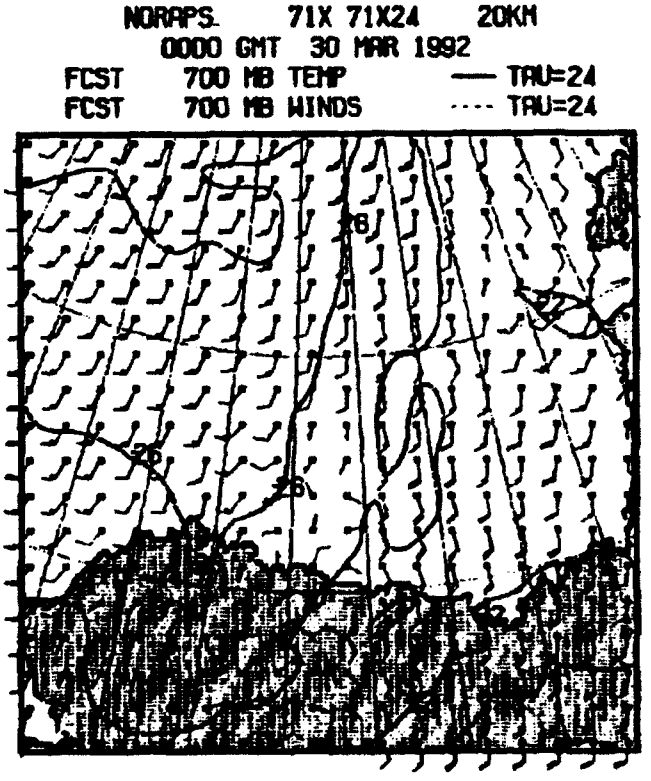
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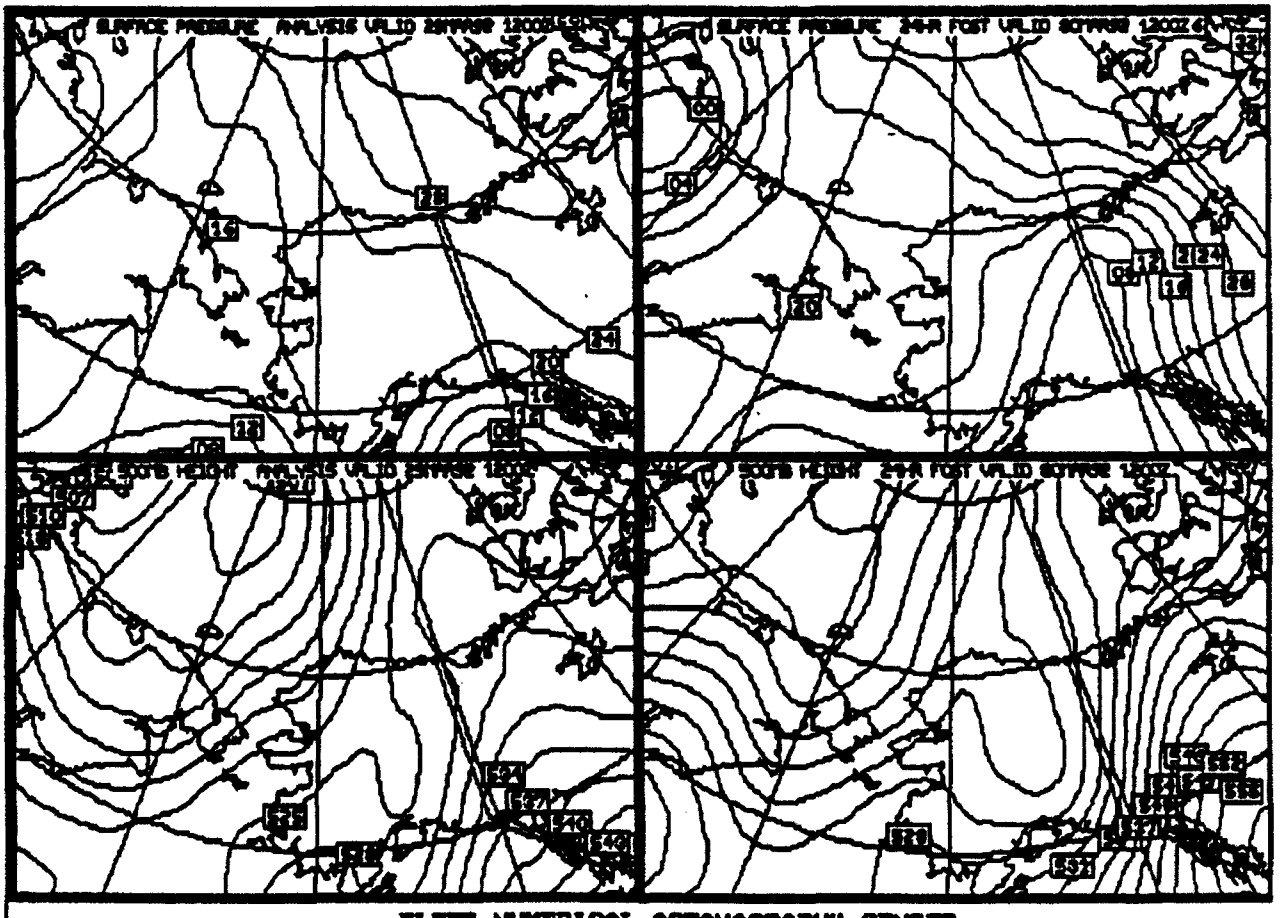
FCST 700 MB WINDS ---- TAU=24

29 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

29/1200Z Analyses and Forecasts (update)

The surface high pressure cell in the E. Beaufort is forecast to move NE'ward. Note that this now gives easterly flow across the Beaufort. This is not shown so much at **10 M** where winds cross icobars at large angles but is well shown in the **925 MB** wind forecast. At **700 MB** a trough is shown over the Deadhorse area - apparently an extension from a large low well to the south. The change in flow direction form west to east caught forecasters by surprise as systems now moved from east to west across the southern Beaufort.



FLEET NUMERICAL OCEANOGRAPHY CENTER

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1200 GMT 29 MAR 1992
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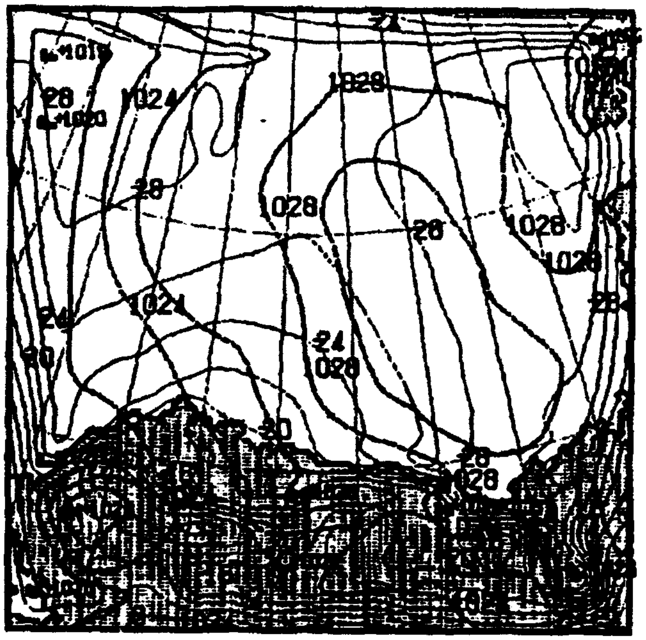
ANAL 2 METER TEMP ---- TAU=0



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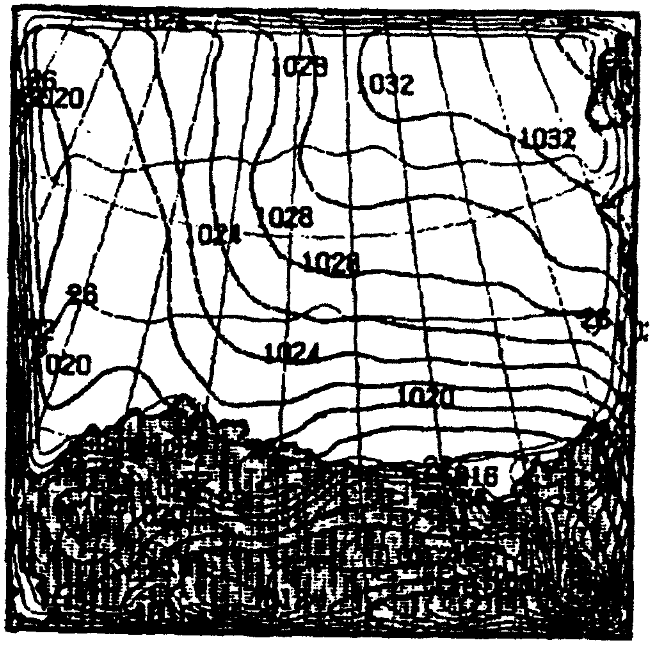

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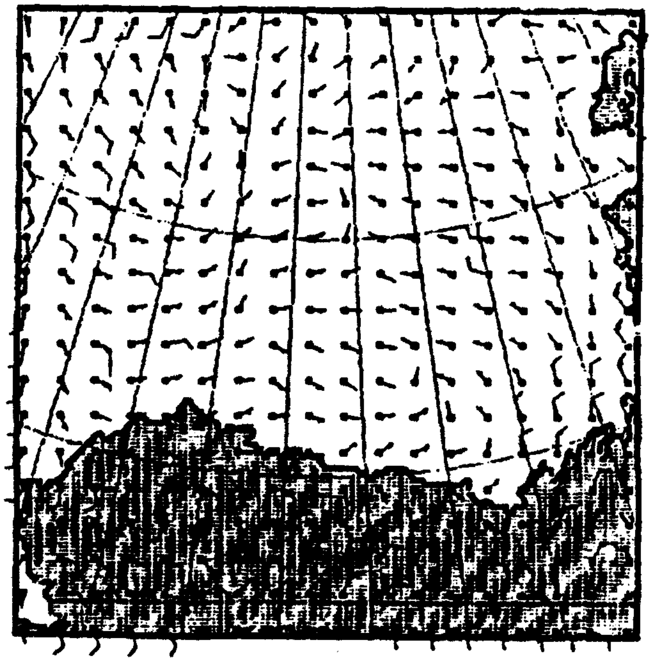

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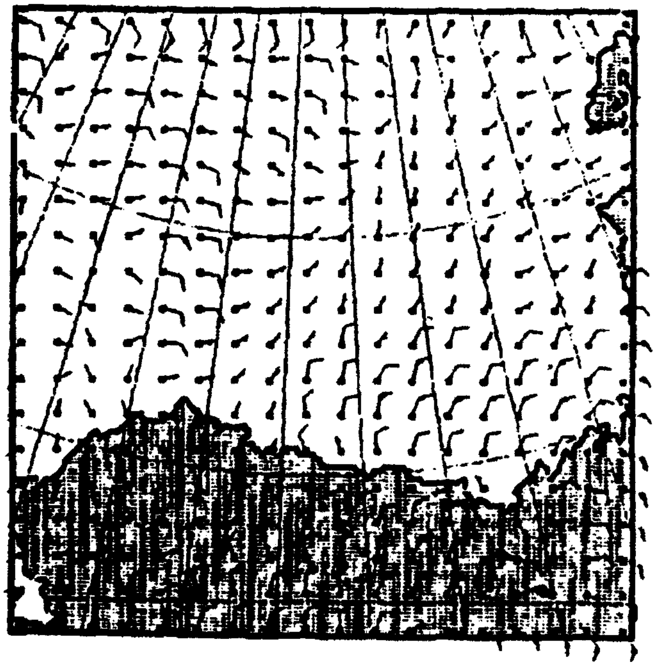

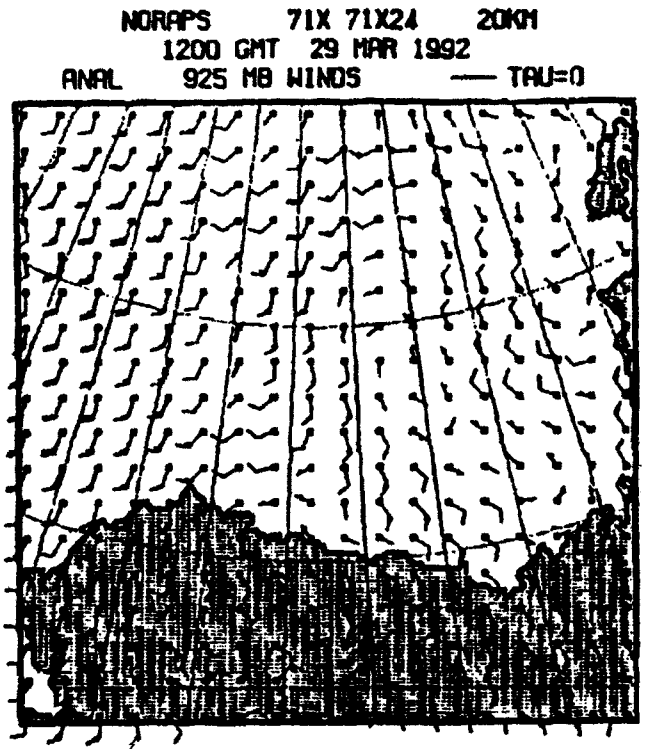
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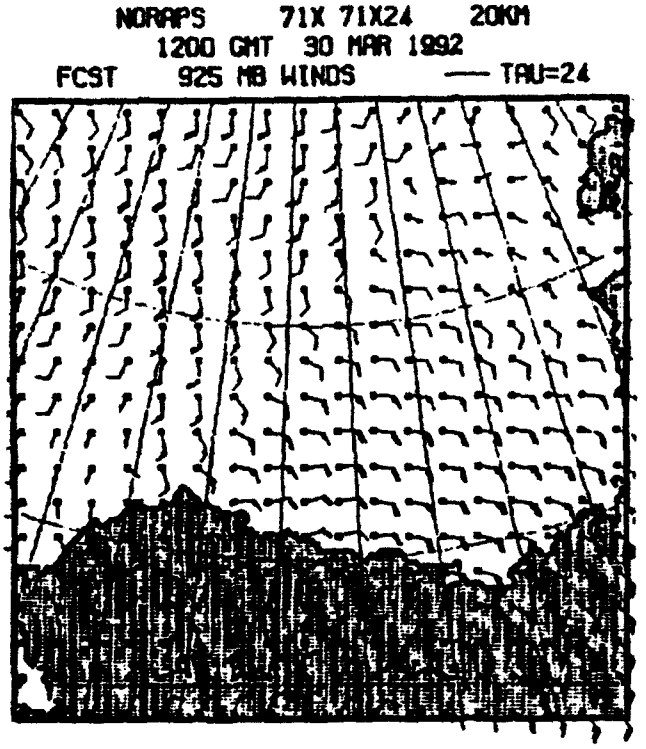
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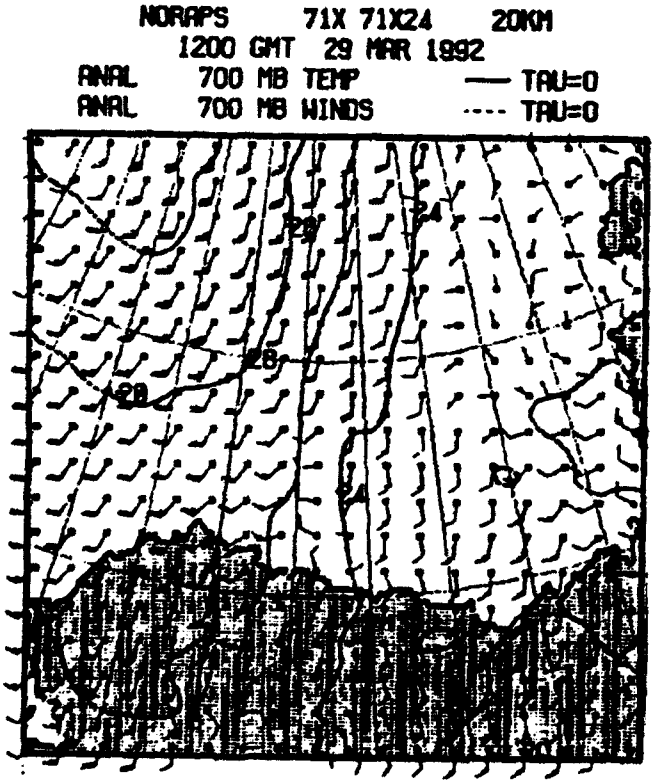
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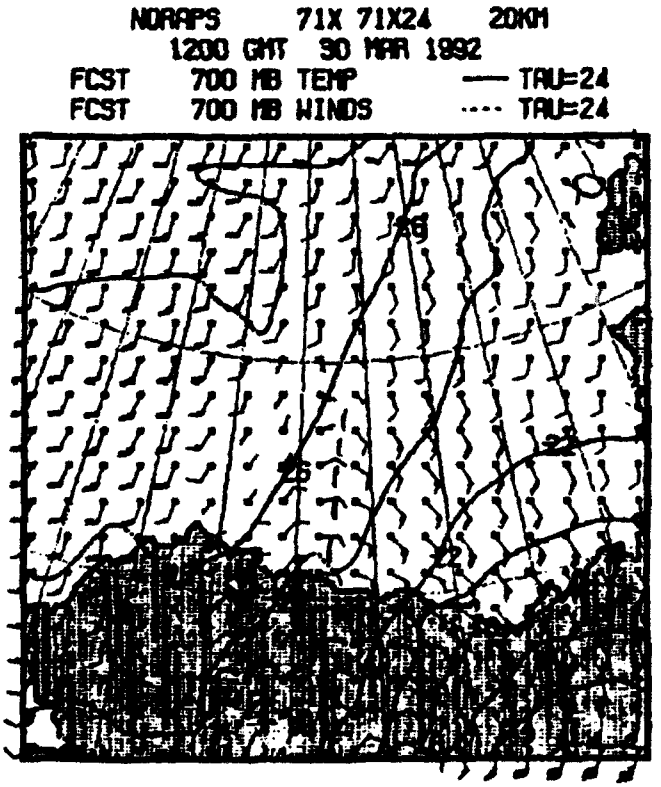
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FCST 700 MB TEMP — TAU=24
FCST 700 MB WINDS ---- TAU=24

30 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

30/0000Z Analyses

Surface Pressure

A high pressure cell is analyzed over the central Beaufort.

10 M Winds

Oddly, instead of reflecting a circulation about the high pressure center, winds turn anticyclonically about a center to the WNW near 71.5N, 156W. Northerly onshore flow is indicated along the N. Slope.

925 MB

The 925 mb wind circulation center is displaced NE of the pressure center to a position near 75N,138W. Winds are mainly easterly to southeasterly south of 75N.

700 MB

The 700 mb wind circulation center is displaced to the SW of the surface high pressure center. Winds are mainly southerly throughout the area.

31 Mar 0000Z 24-hr Forecasts

Surface Pressure

The surface high pressure center is moved NE to a position just east of Prince Patrick Island. A moderate pressure gradient conducive to easterly flow is developed south of the center.

10 M

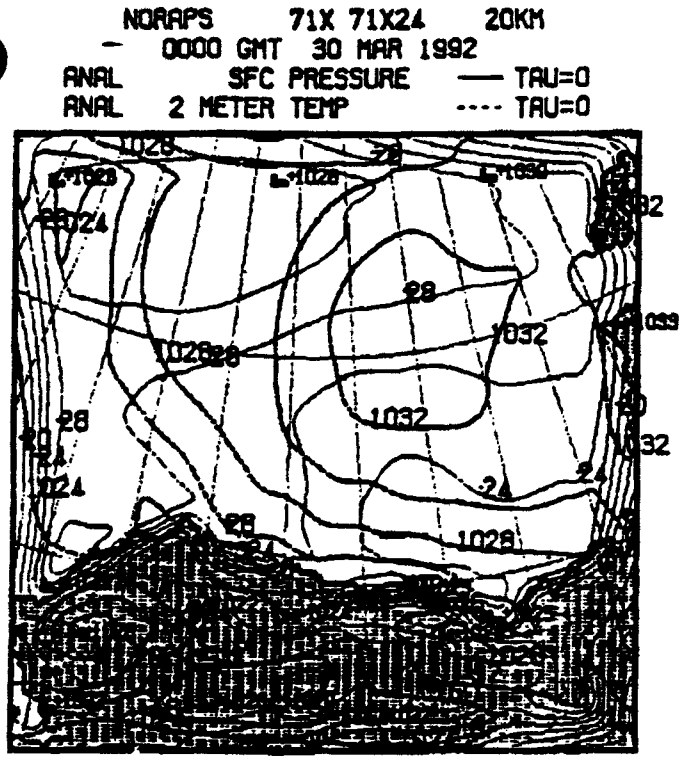
Light northeasterly winds increase to 10-15 kts out of the north over the ice camp area.

925 MB

Moderate 20-25 kt easterly flow is forecast south of 75N until near the longitude of Barrow where winds turn southerly.

700 MB

Some suggestion of an easterly inverted trough is suggested by the wind flow at this level.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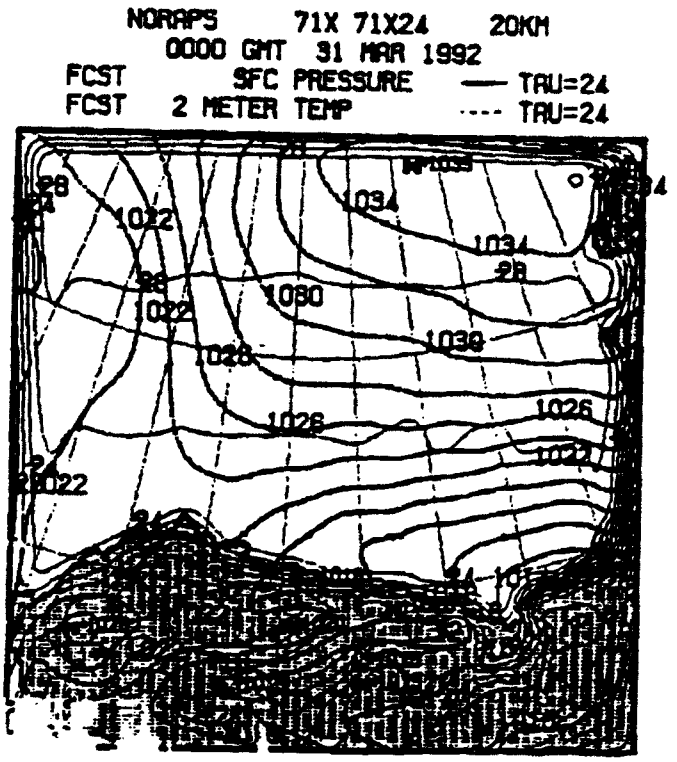
ANAL 2 METER TEMP ---- TAU=0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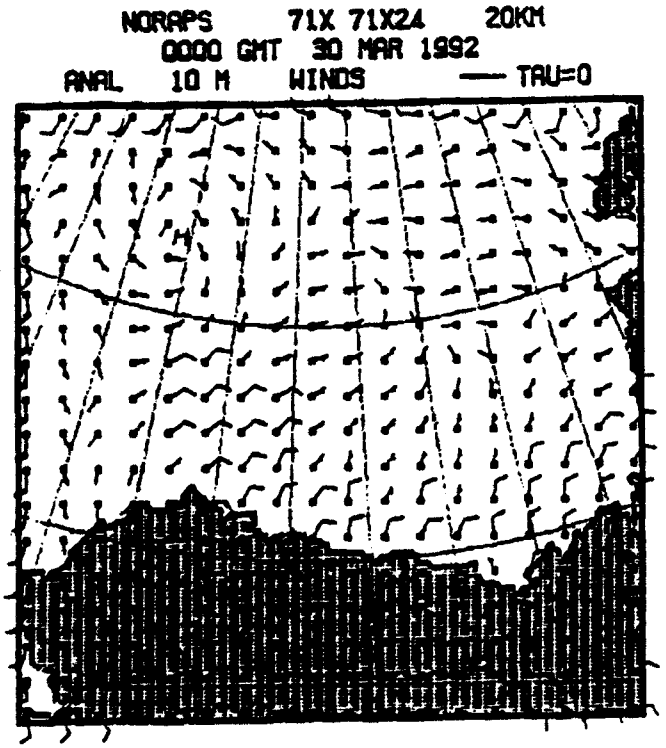
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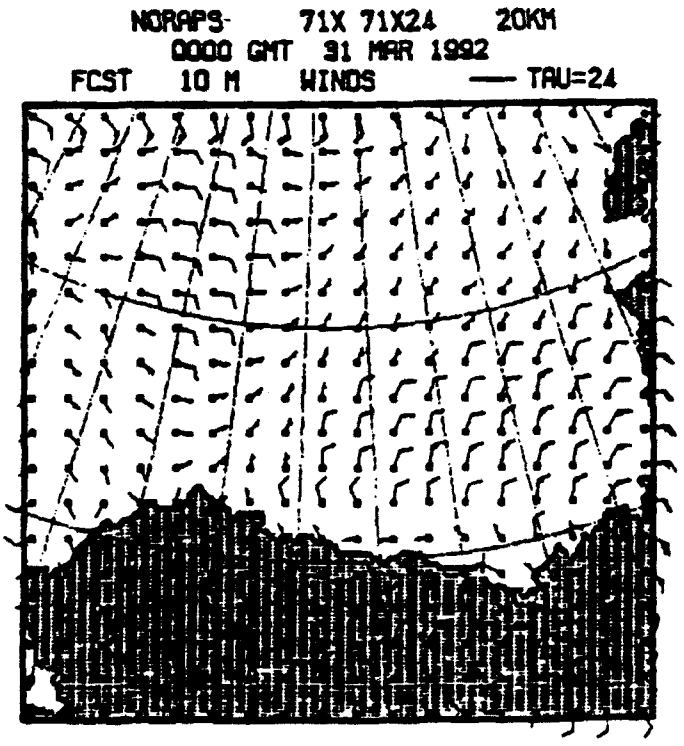
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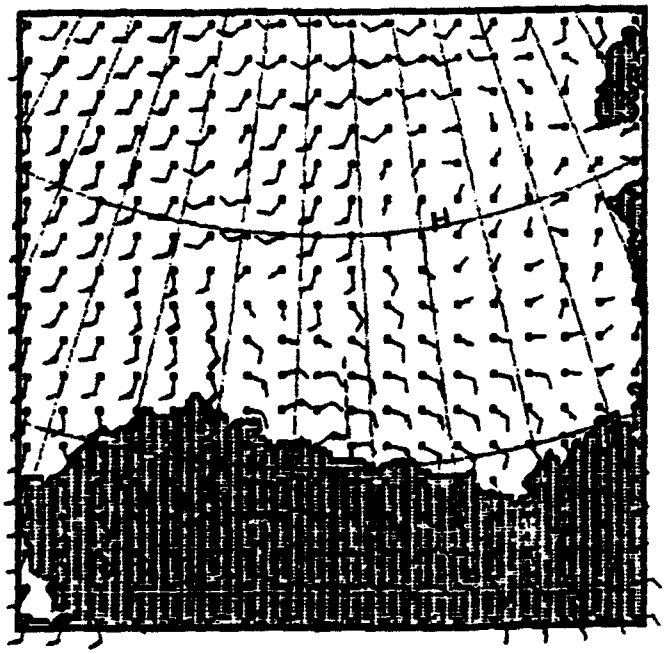

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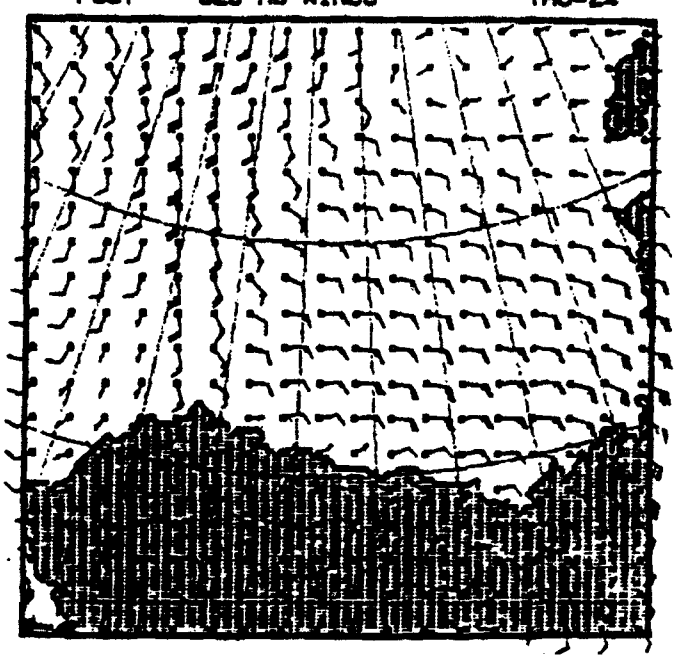

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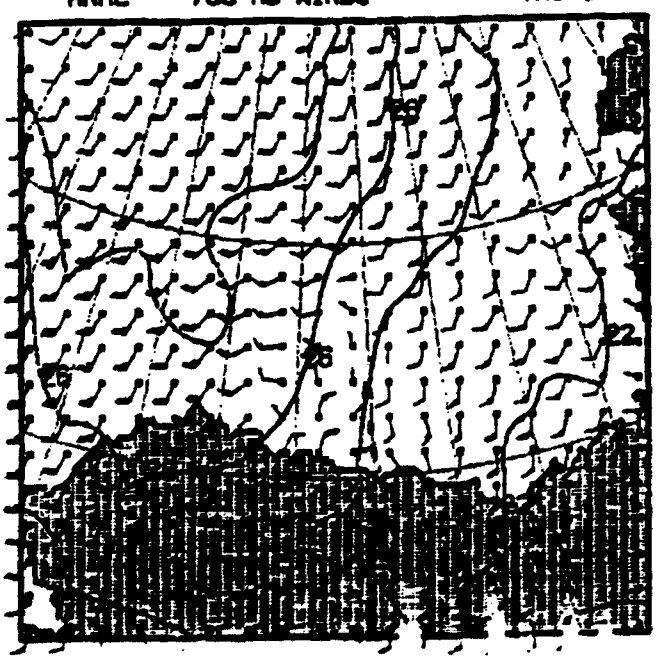

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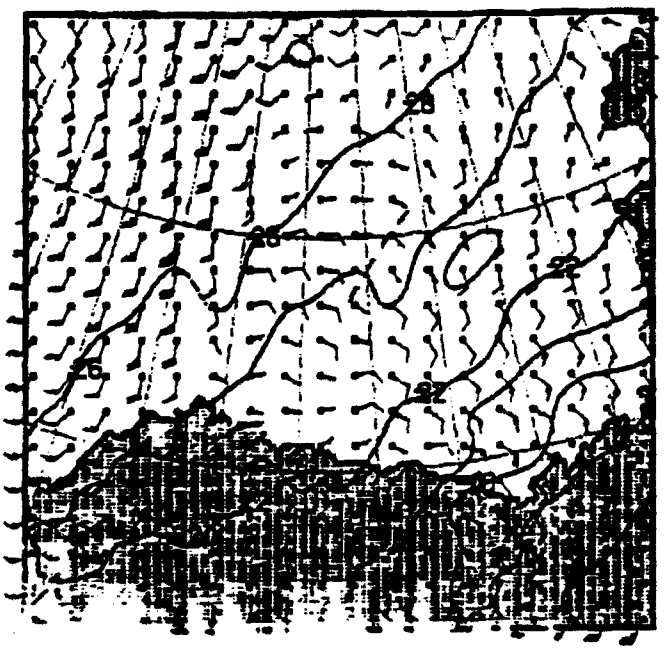
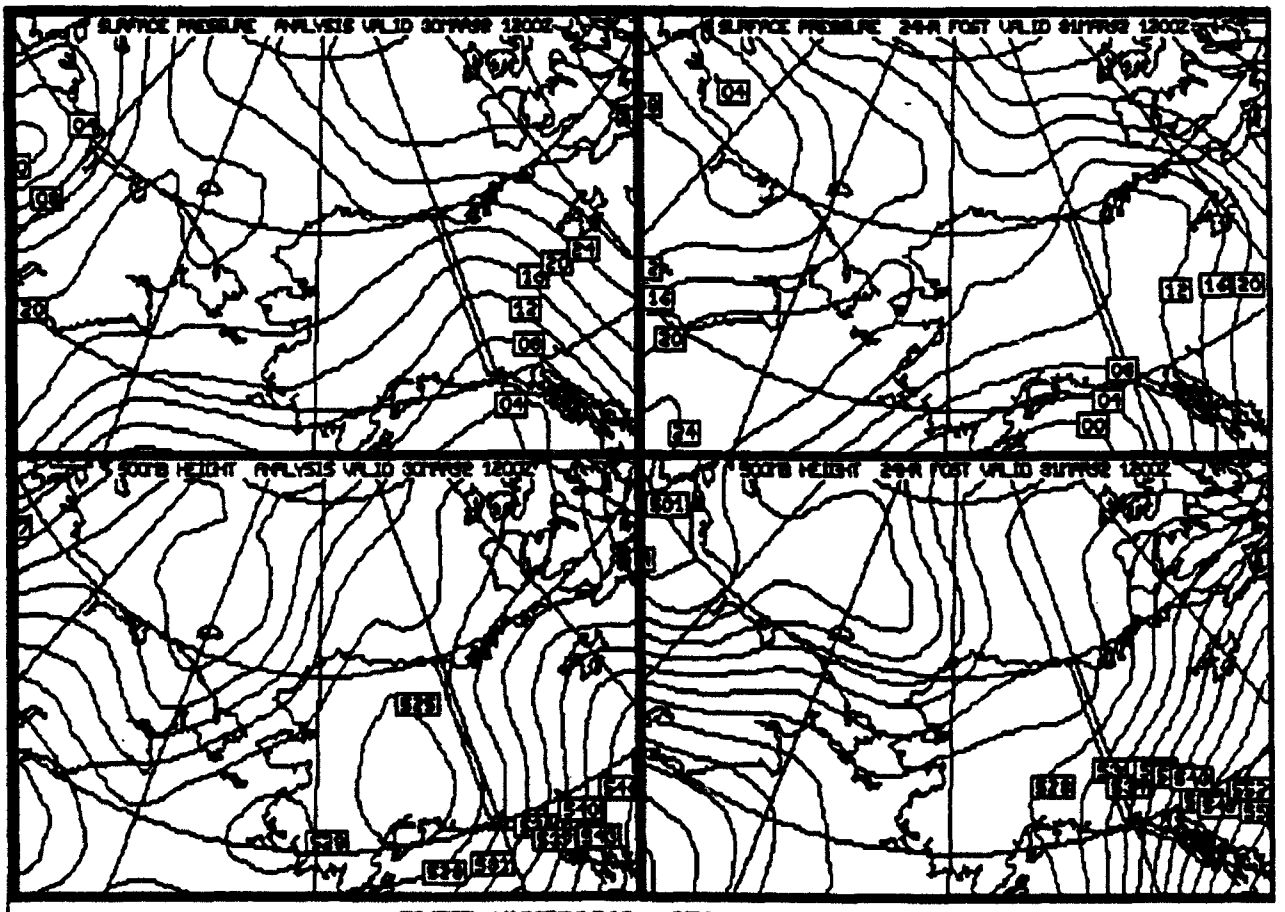


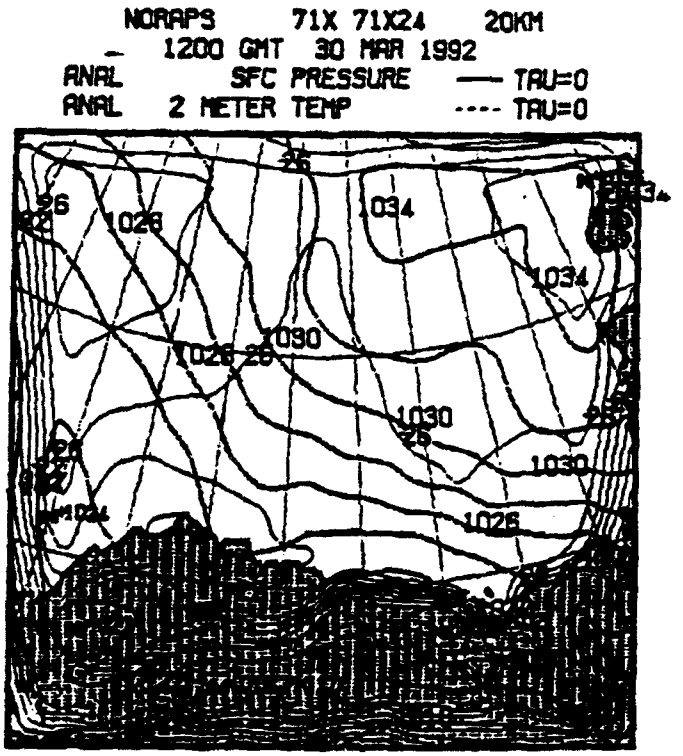
30 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

<u>30/1200Z Analyses and Forecasts (update)</u>
High pressure is maintained west of Prince Patrick Island as the pressure gradient strengthens, producing,quite strong 25-30 kt flow in the 925 mb wind forecast for 31 Mar at 1200Z. The development of low pressure just north of the Mackenzie River delta is quite prominent. An easterly wave-like disturbance, taking on the appearance of an "inverted-V" or "Screaming Eagle" was apparent in satellite data acquired at 1912Z and at 2048Z. This was a flight day and dropsonde data confirmed some of the easterly wave-type structure of the disturbance.



FLEET NUMERICAL OCEANOGRAPHY CENTER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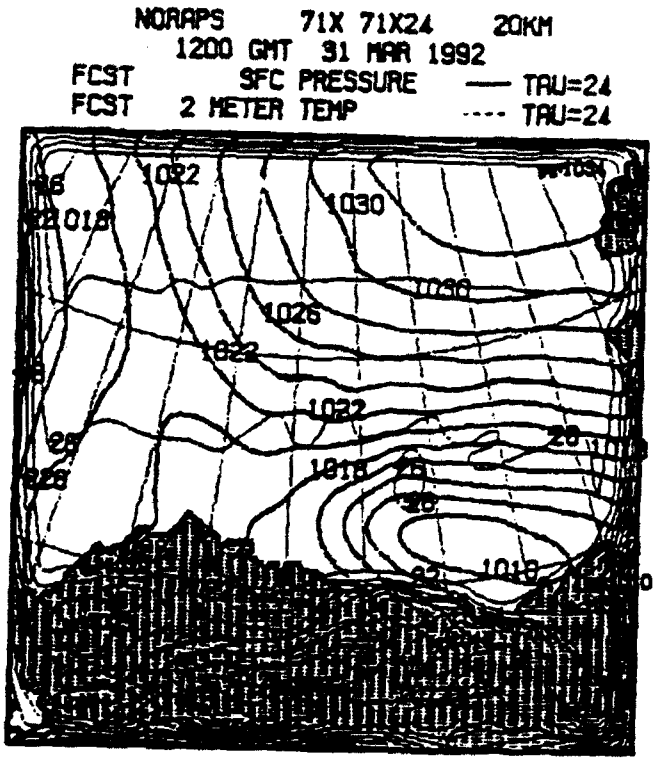
1034
1030
1026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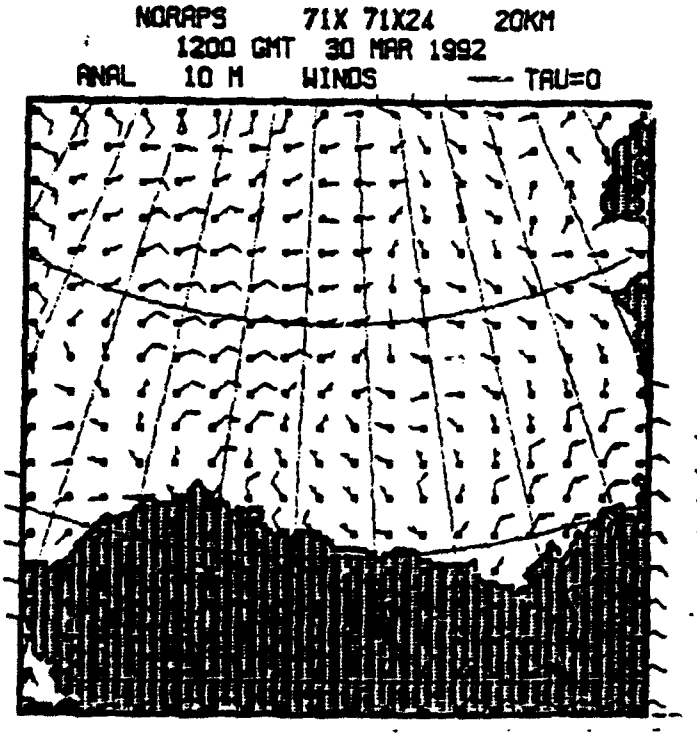
1026
1022
1022
1018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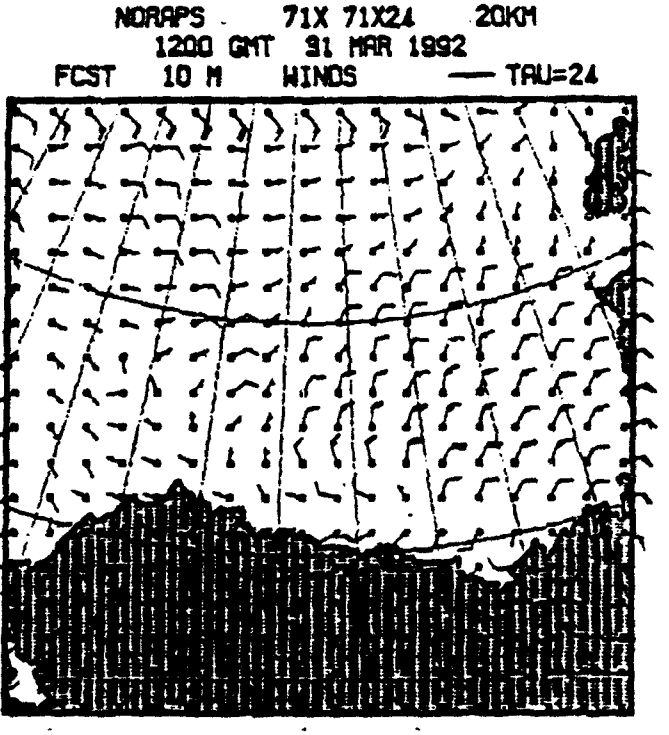
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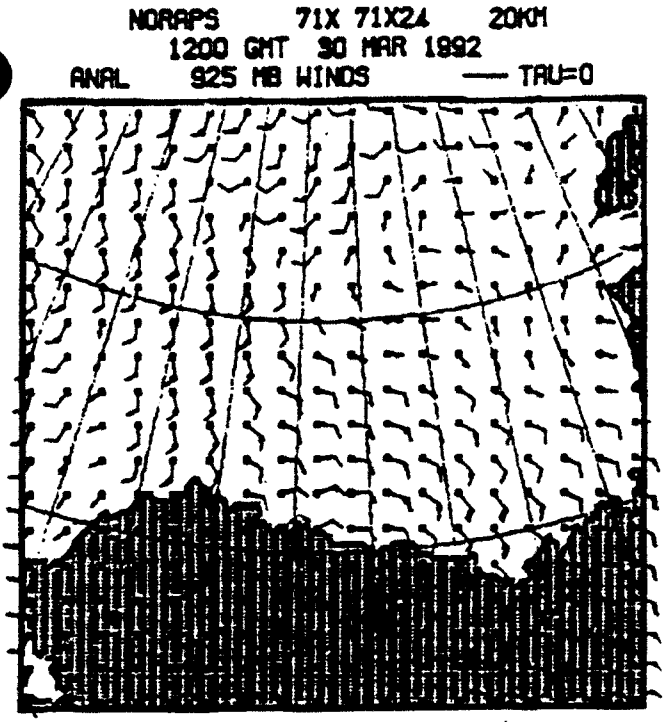
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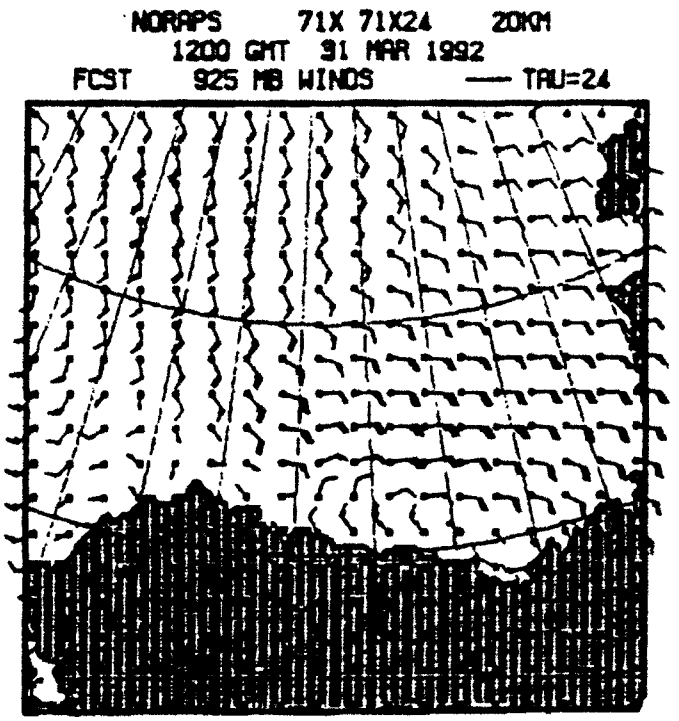
ANAL 925 MB WINDS — TAU=0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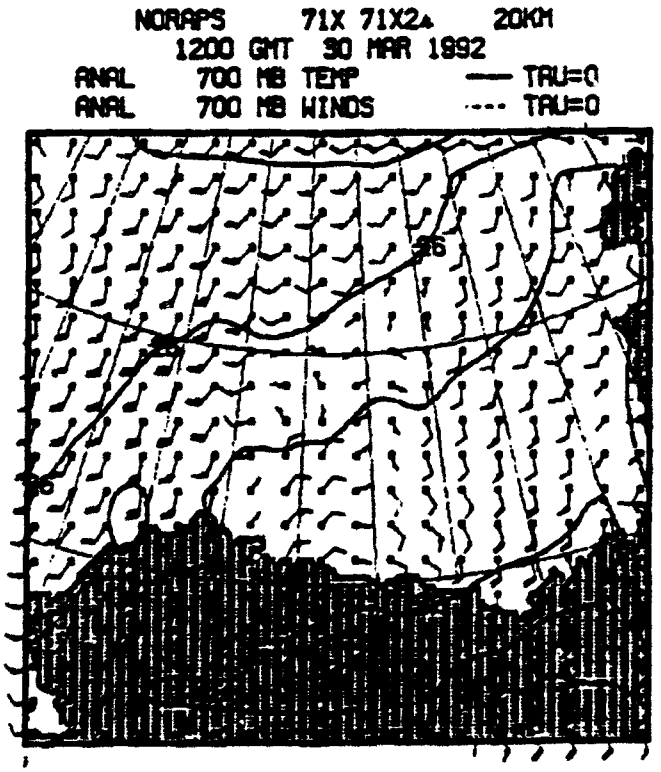
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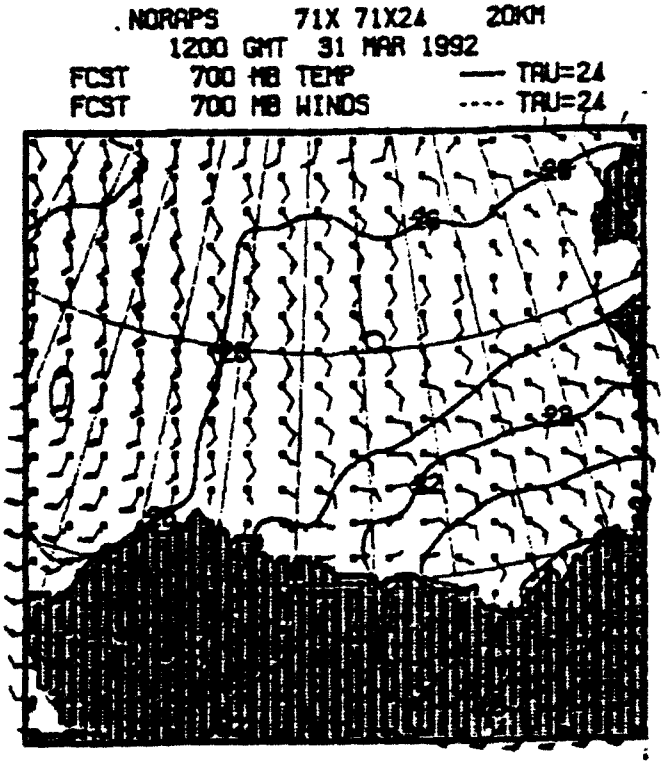
ANAL 700 MB WINDS ---- TAU=0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1200 GMT 31 MAR 1992
FCST 700 MB TEMP — TAU=24
FCST 700 MB WINDS ---- TAU=24

31 Mar 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

31/0000Z Analyses

Surface Pressure

A high pressure cell is analysed just west of Prince Patrick Island. Low pressure cells are shown near the Mackenzie River delta and just north of Deadhorse. Gradient remains conducive to easterly flow north of N. Slope.

10 M Winds

Northerly to northeasterly through most of the area. A small closed circulation is shown just south of Deadhorse.

925 MB

The high pressure circulation is shown east of Prince Patrick. Moderate easterly flow exists over most of the region north of the N. Slope. A minor trough is shown in the vicinity of Deadhorse.

700 MB

A general anticyclonic circulation is shown from the Mackenzie delta across the Beaufort Sea to Prince Patrick. This suggests the steering influence for low level systems.

01/0000Z 24-hr Forecasts

Surface Pressure

High pressure east of Prince Patrick is moved northward. A pronounced trough is shown north of the N. Slope which then curves NW north of Barrow.

10 M

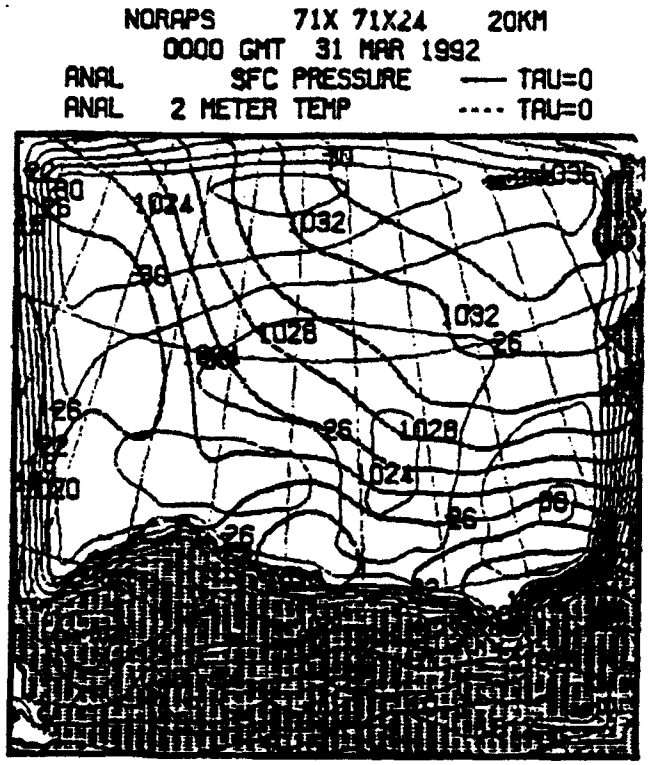
The E-W trough influence is shown along the N. Slope.

925 MB

This level also reflects the E-W trough along the N. Slope. Satellite data (31/0504Z) showed vortex development in the lee of the Brooks Range.

700 MB

This level best shows the vortex with center north of the Mackenzie River delta. This was a synoptic-scale disturbance with a large anticyclonic crown of cirrus flowing over it.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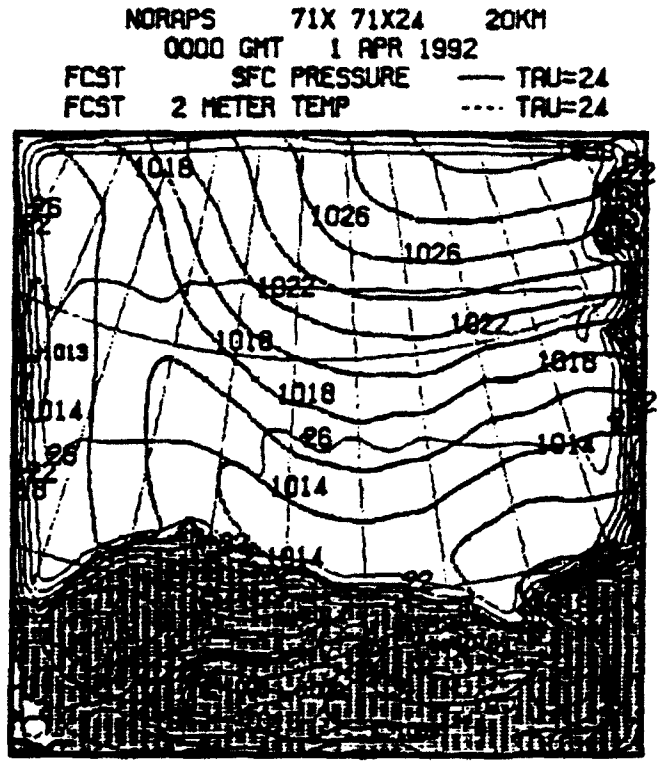
1028
1020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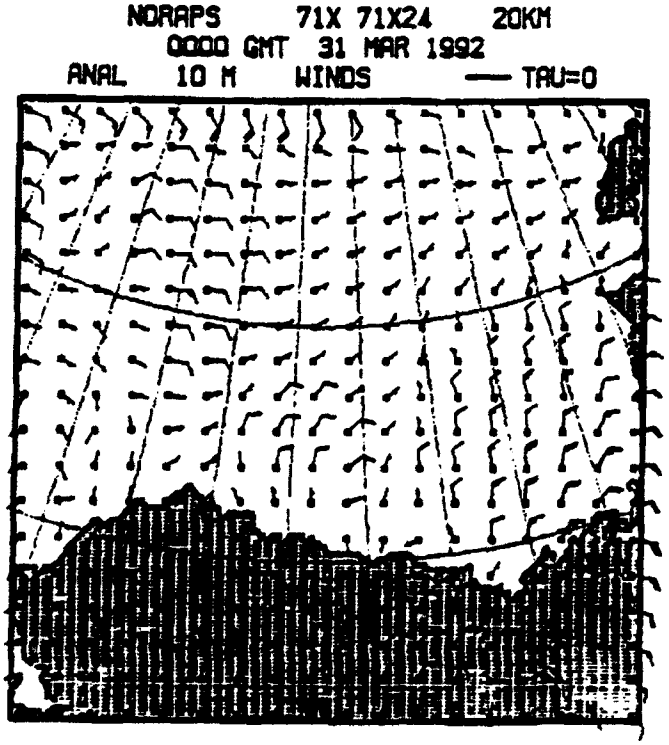
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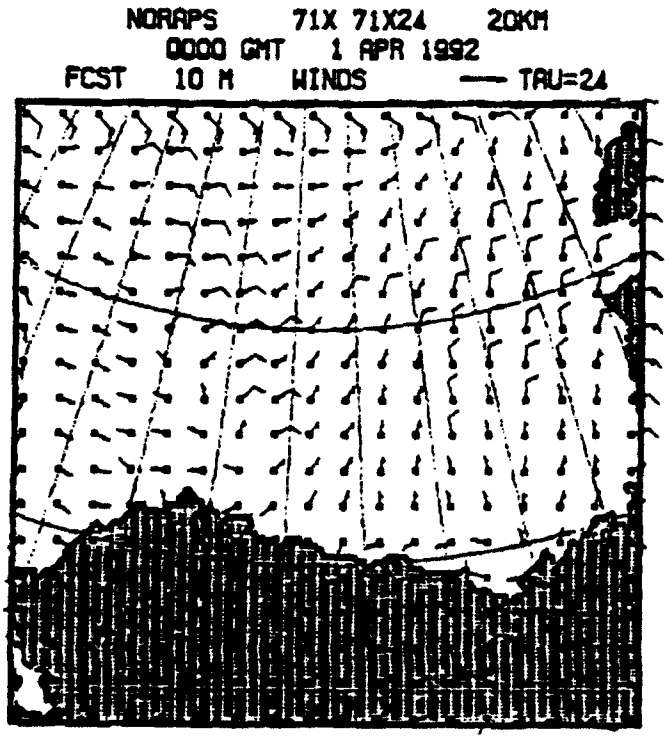
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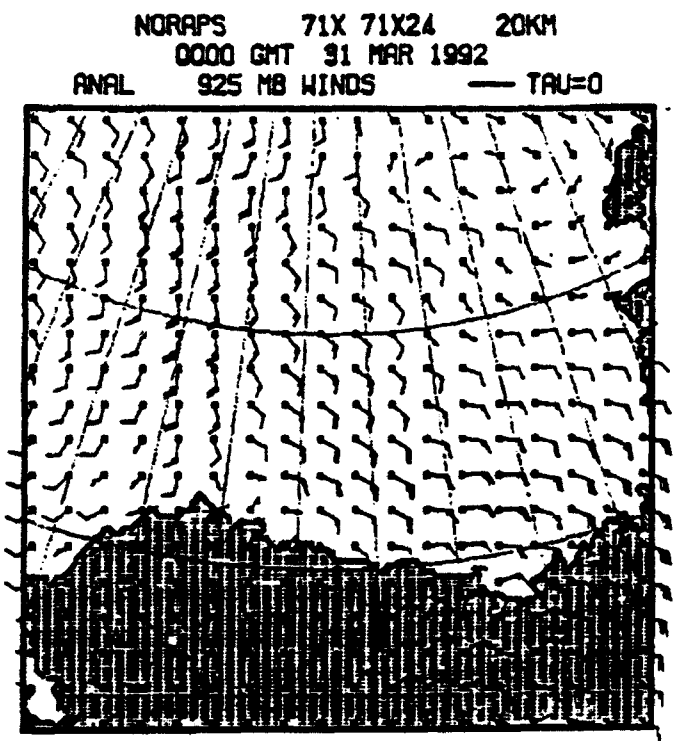
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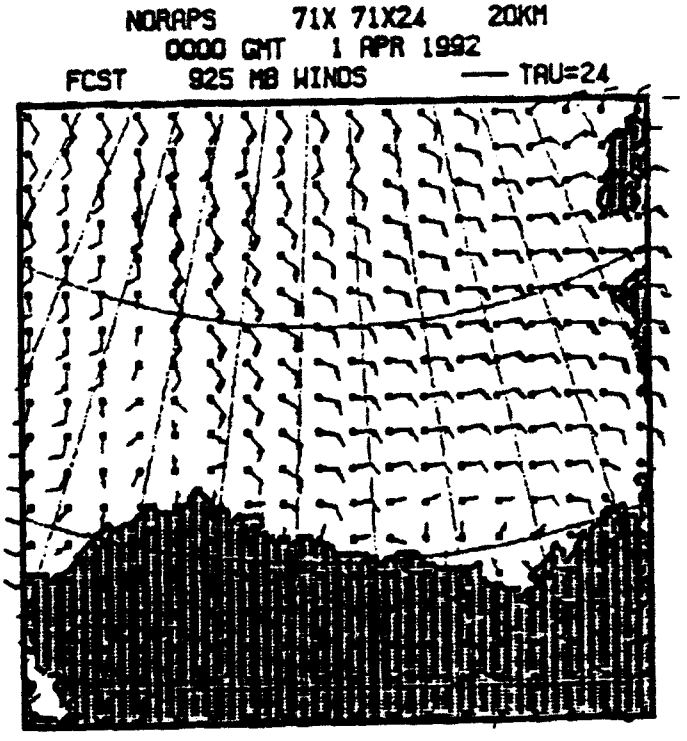
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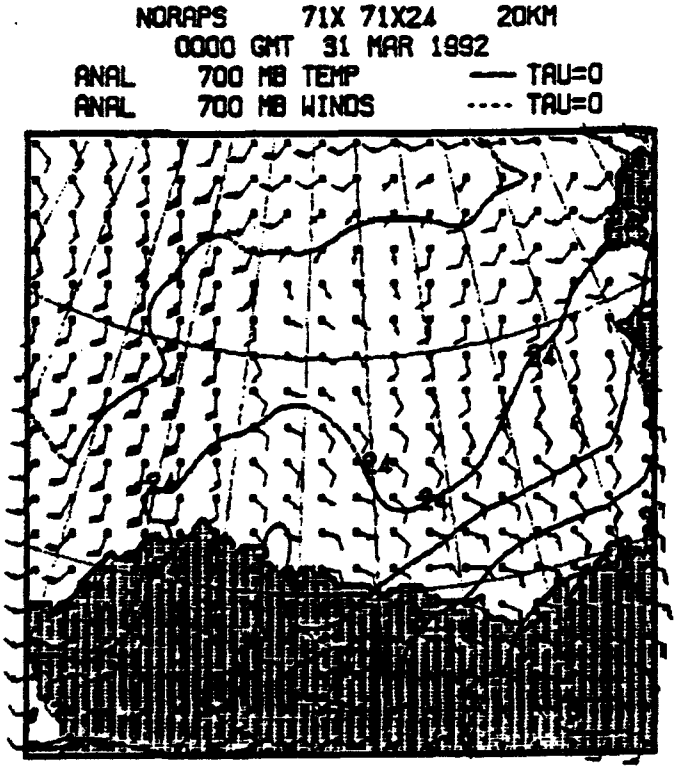
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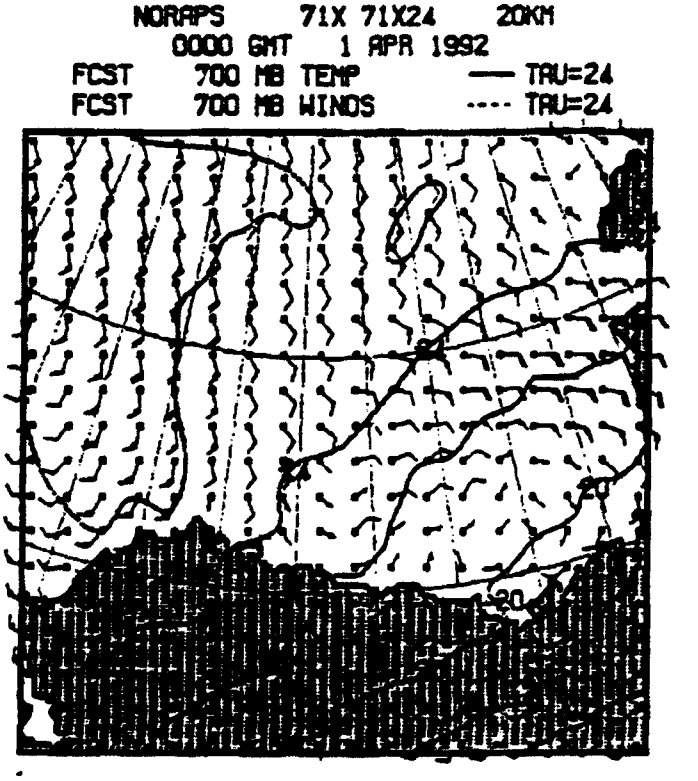
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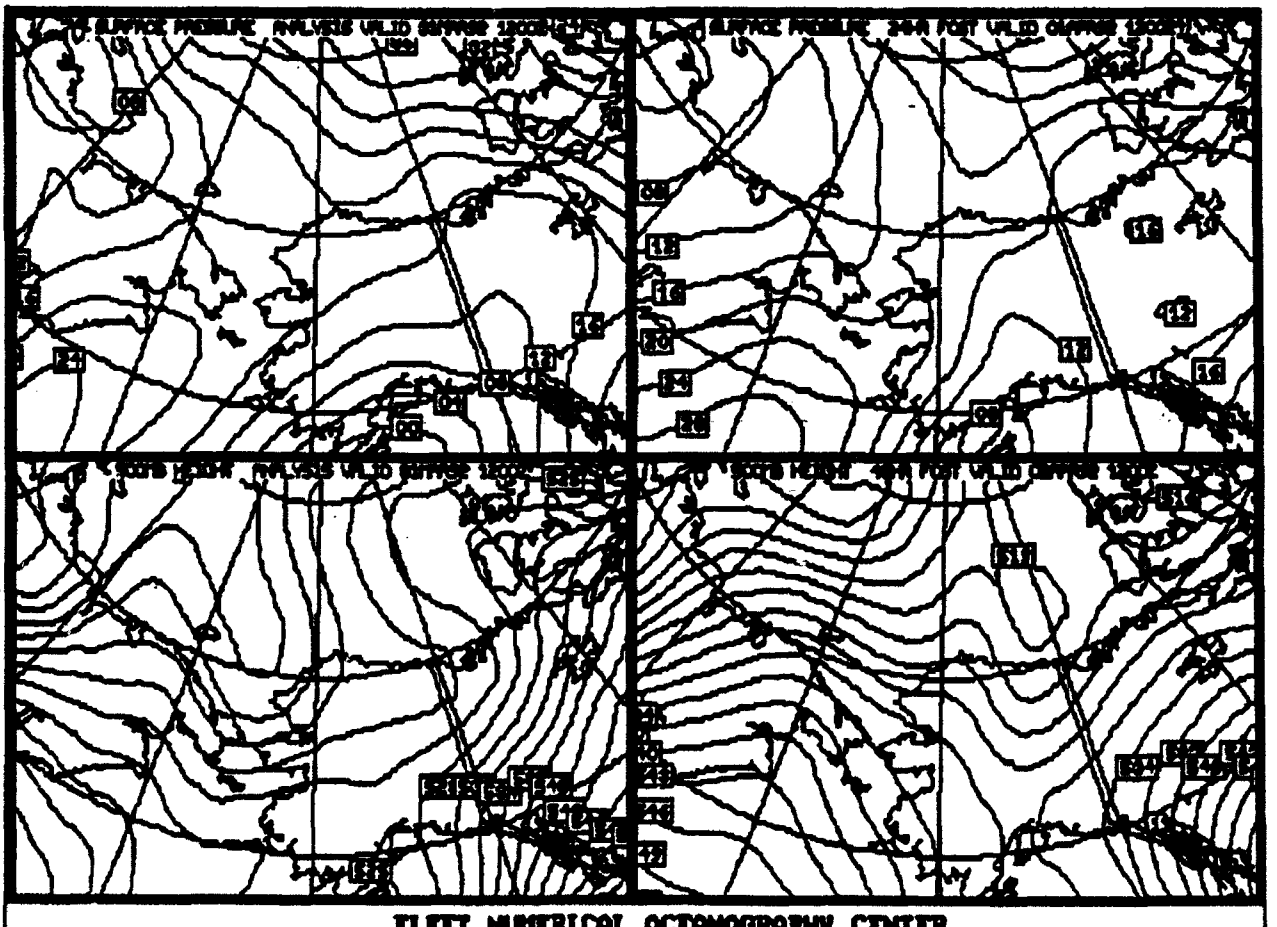
FCST 700 MB WINDS ---- TAU=24

31 Mar 92

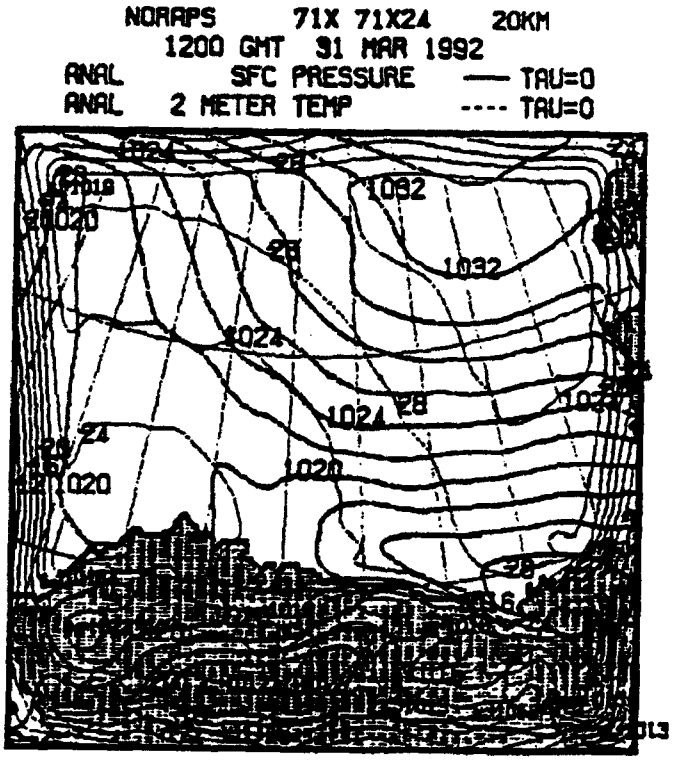
NORAPS ANALYSIS AND FORECAST PRODUCTS

31/1200Z Analyses and Forecasts (update)

The high pressure cell is retained NW of Prince Patrick with major development of the low north of the Mackenzie River delta. A trough from this system is forecast to extend in an E-W orientation north of the N. Slope (925 and 700 mbs). At 700 mbs a trough is also forecast to move in from the west approaching Barrow. Steering flow north of the trough axis is forecast to remain easterly and anticyclonic over the Beaufort Sea. **NOGAPS** fails to resolve the elongated E-W trough along the N. Slope and the forecast low near the Mackenzie River delta. Propagation of a short wave ridge toward Barrow is a dominant effect shown at the **500 Mb** level.



FLEET NUMERICAL OCEANOGRAPHY CENTER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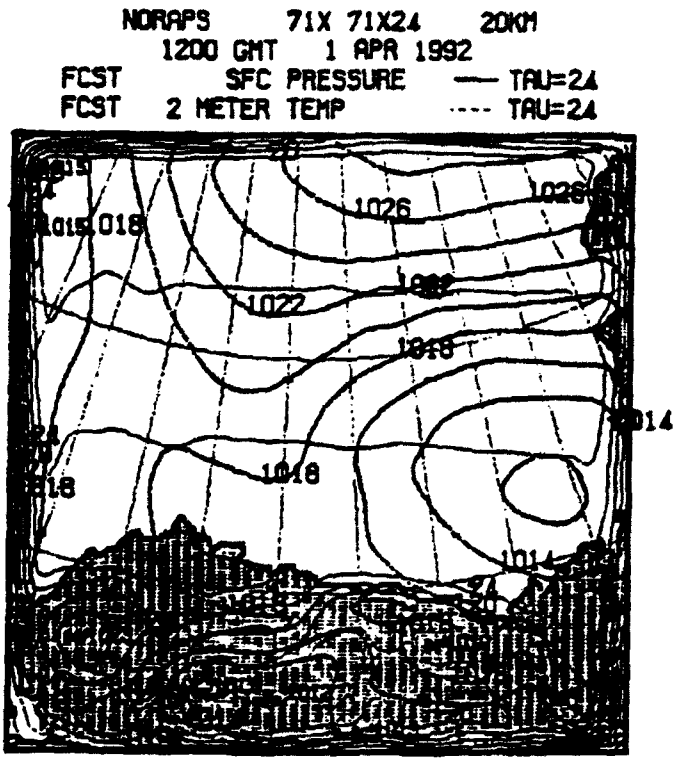
1024
1020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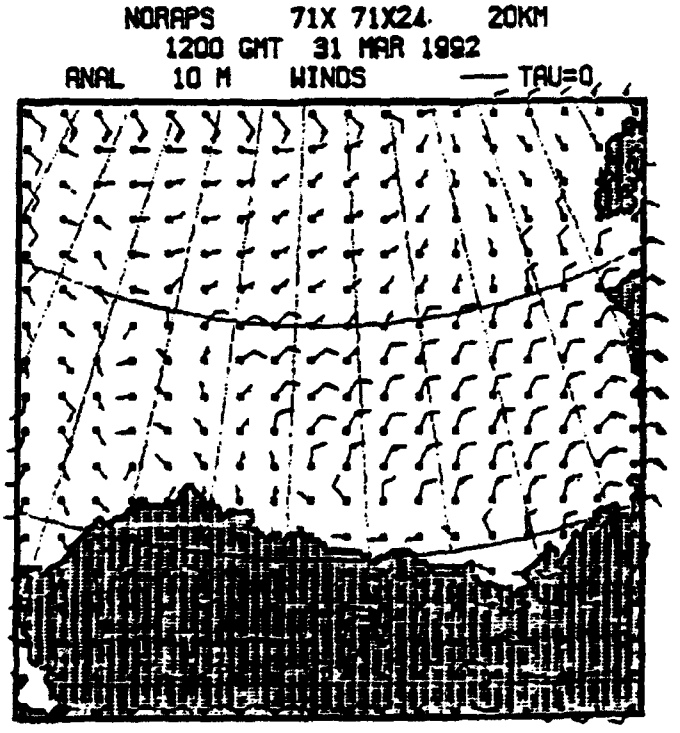
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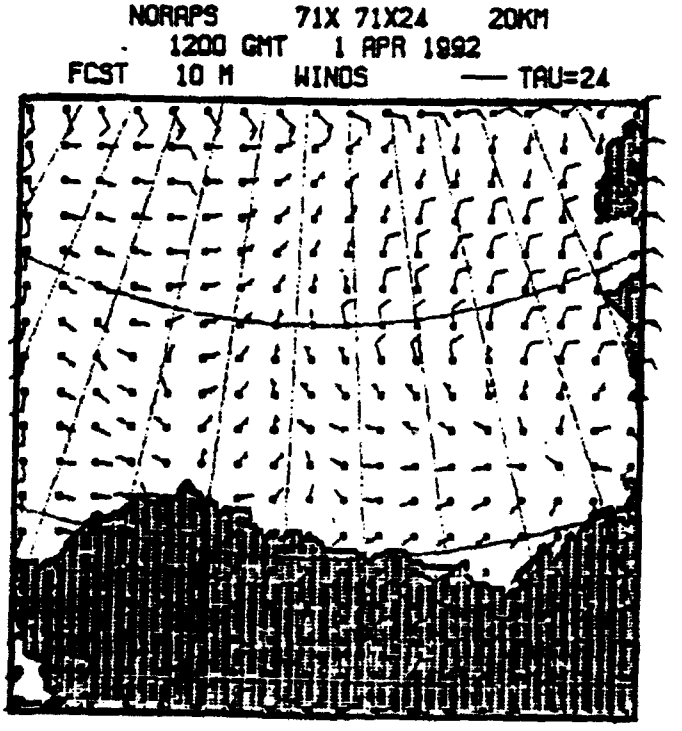
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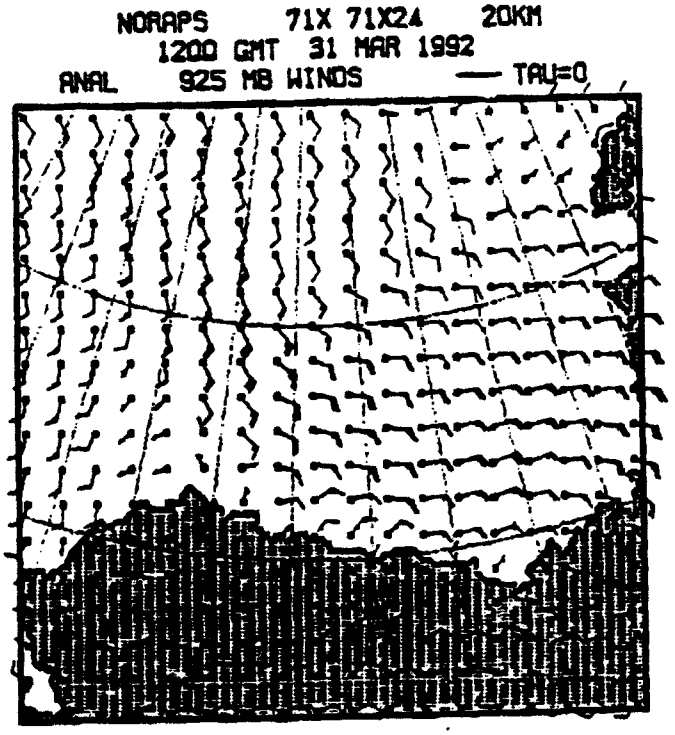
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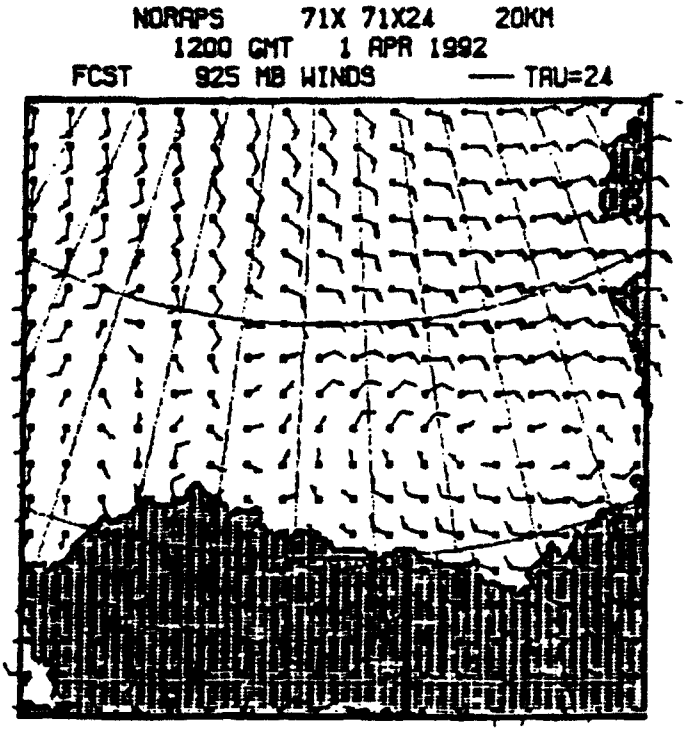
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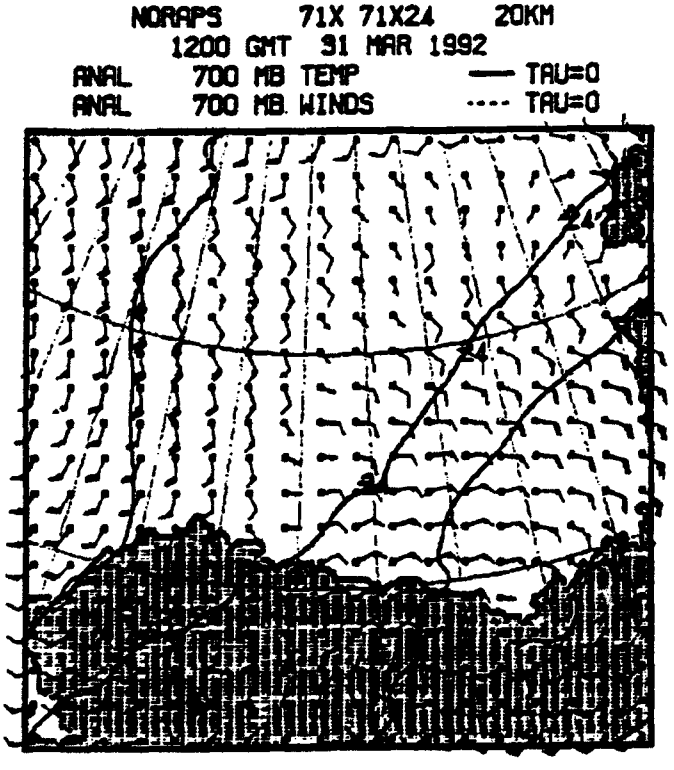
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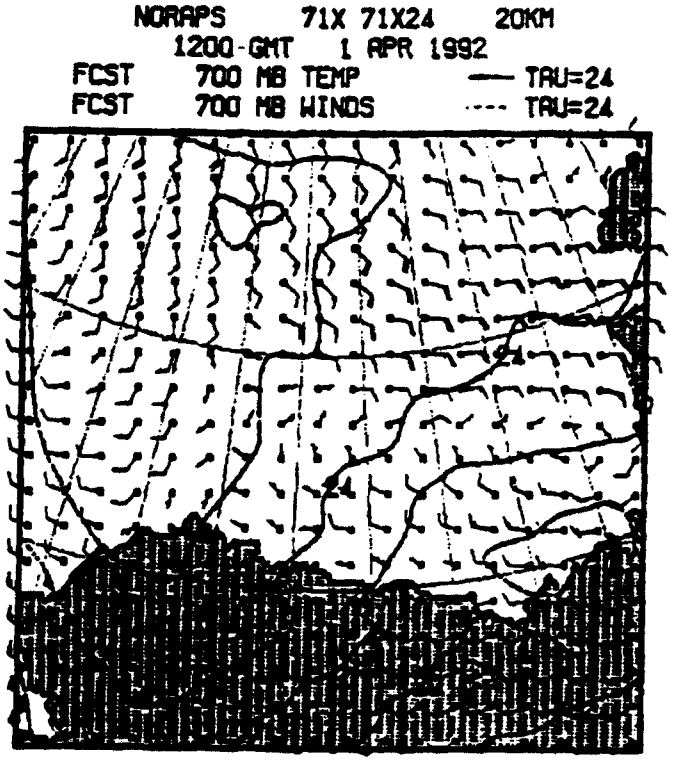
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1 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

01/0000Z Analyses

Surface Pressure

The dominant features at this time are the low near the Mackenzie delta; the trough extending E-W north of the N. Slope; and the continued gradient favoring east to SE flow over the northern Beaufort Sea.

10 M Winds

Winds curve cyclonically from north to south over most of the Beaufort Sea. A small low is indicated near Deadhorse.

925 MB

Flow at this level weakly defines the low north of the Mackenzie delta. Moderate easterly flow turning to southeasterly exists to the north.

700 MB

The low north of the Mackenzie delta is well defined at this level. A weak trough appears to be off the coast of NW Alaska.

02/0000Z 24-hr Forecasts

Surface Pressure

The Mackenzie low is forecast to enlarge its influence without appreciable deepening. High pressure continues west of Prince Patrick.

10 M

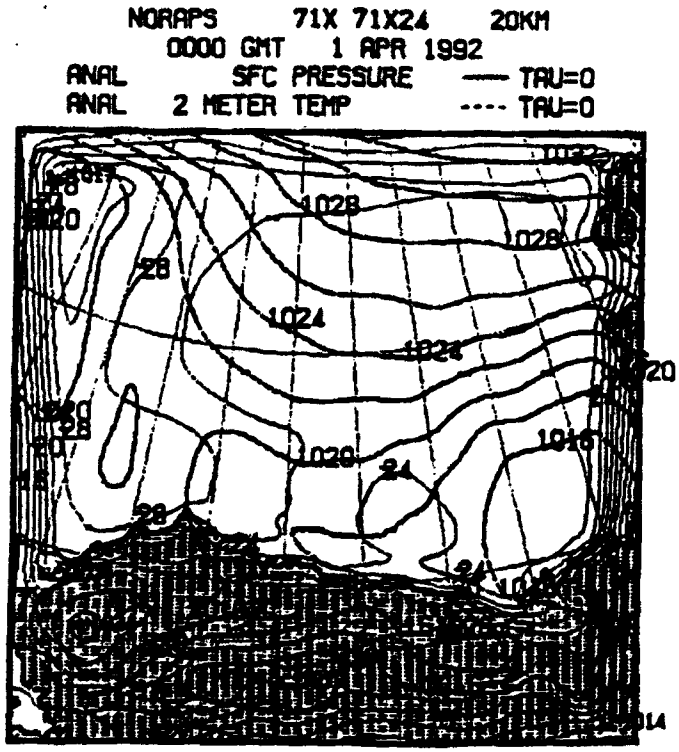
An elongated E-W trough is implied near 72.5N.

925 MB

The E-W trough north of the N. Slope is well defined at this level.

700 MB

Same as 925 mb except the trough is displaced slightly further north. The trough off NW Alaska is forecast to move eastward approaching Barrow.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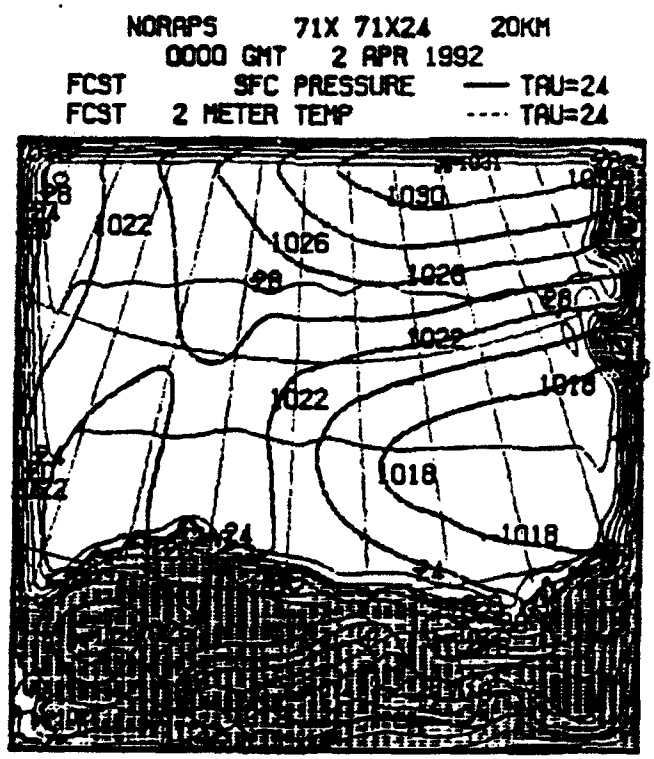
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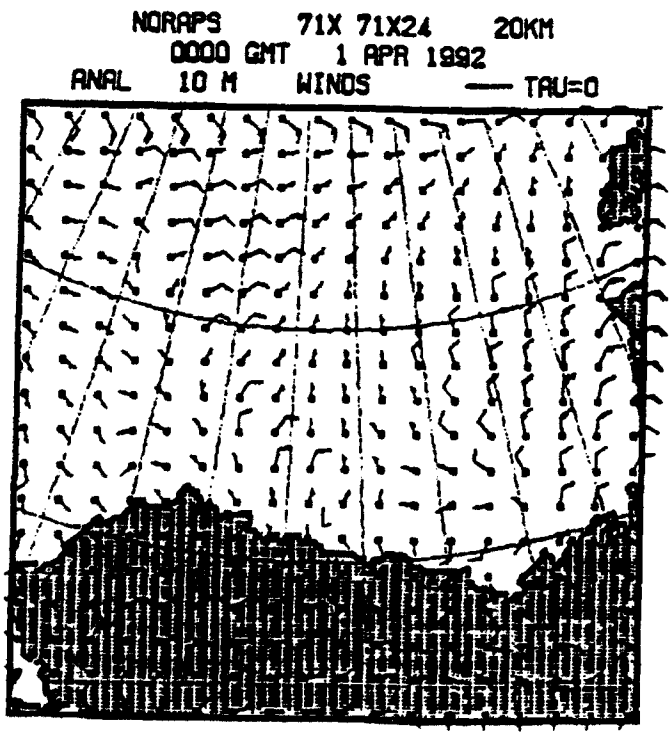
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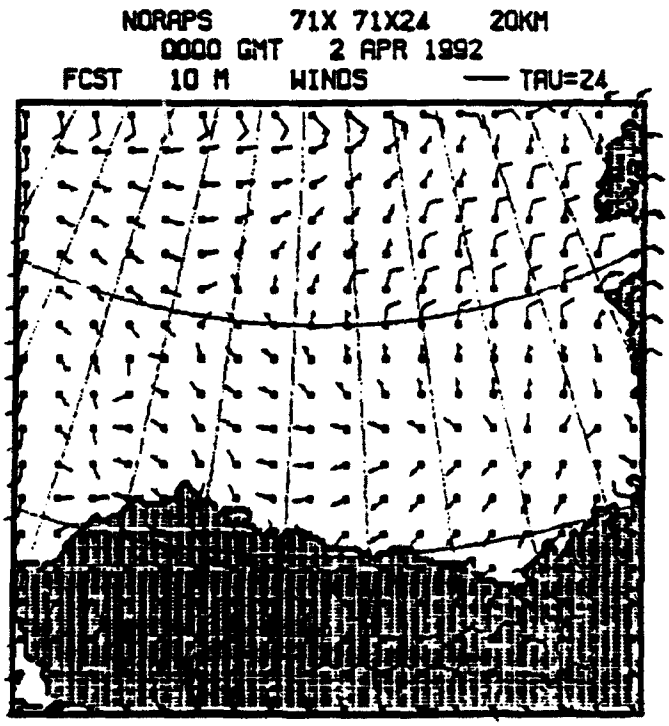
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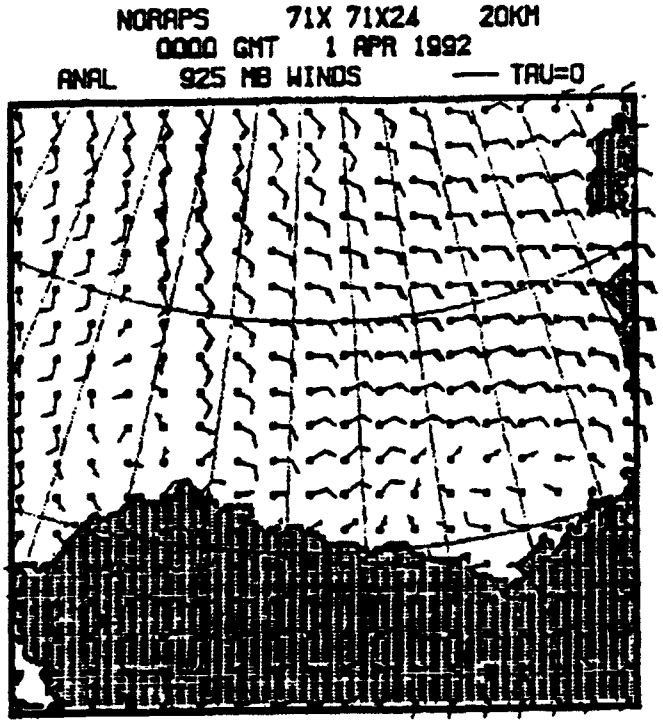
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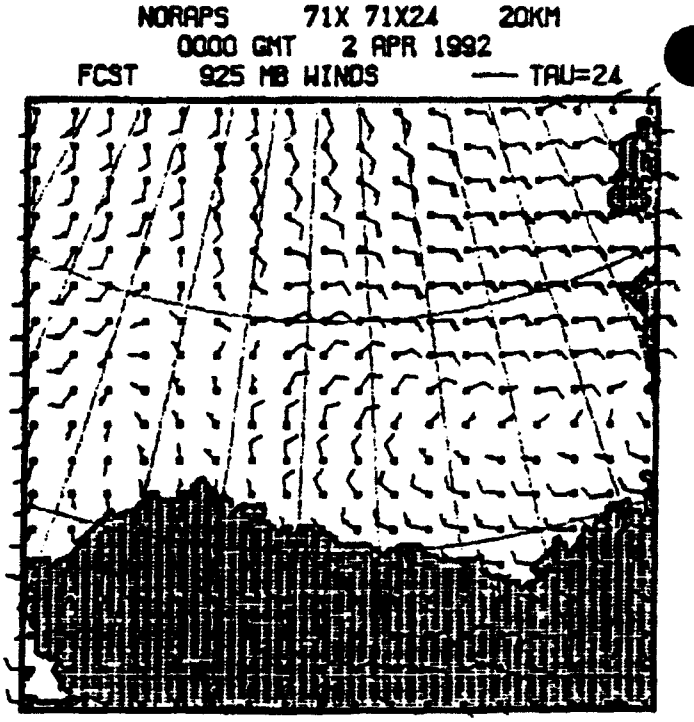
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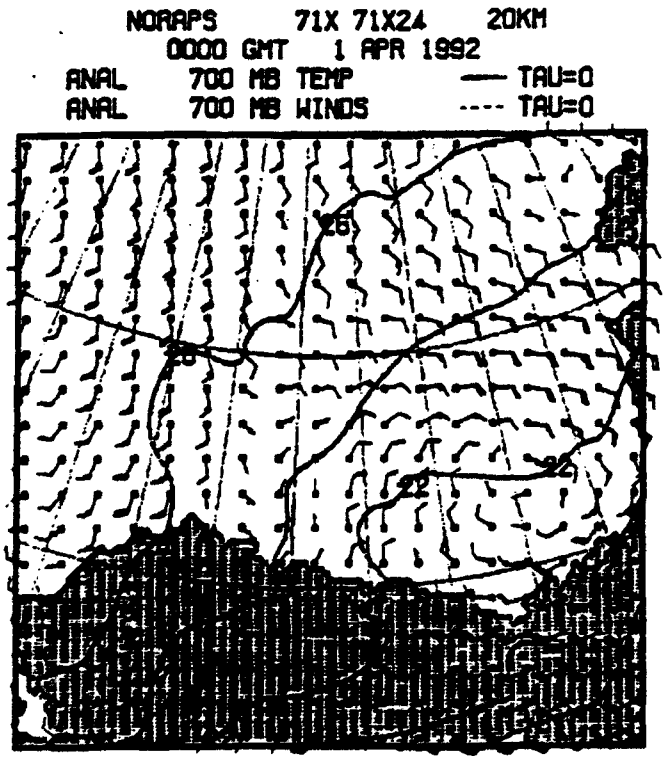
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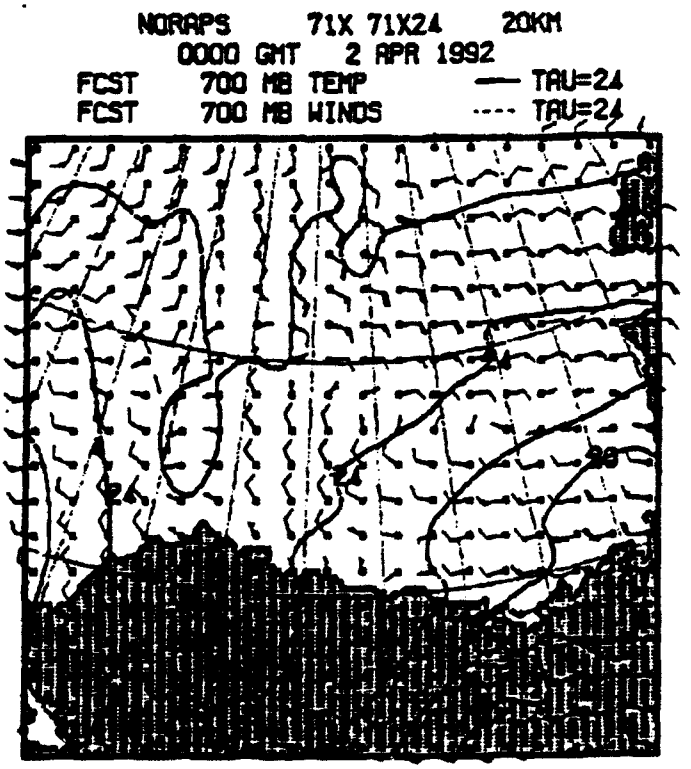
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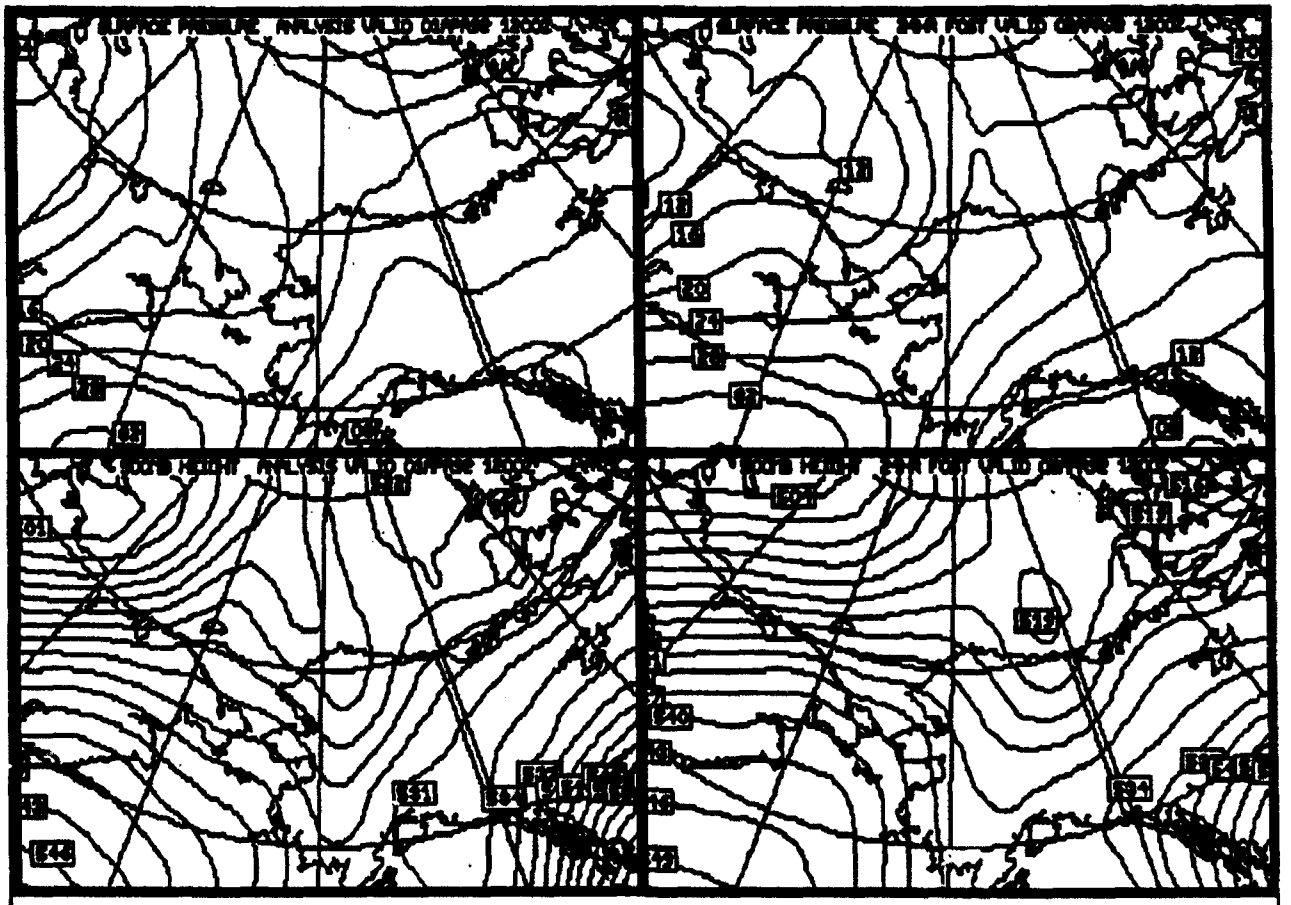
28

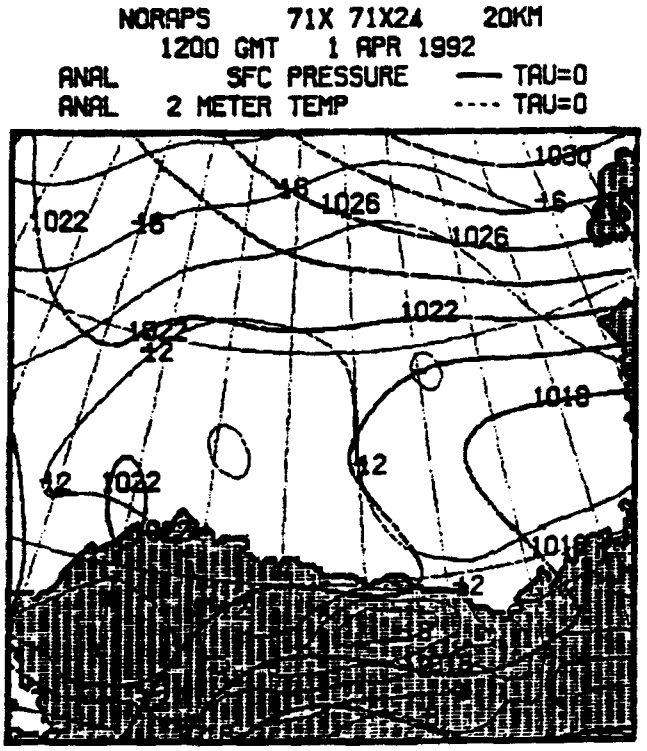
1 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

01/1200Z Analyses and Forecasts (update)
The gradient is weakened to the north as the Mackenzie River delta low is forecast to dominate the entire Beaufort Sea without appreciable deepening. Winds weakly reflect the low at **10 M** but more strongly at **925 MB** and at **700 MB**. This system is not resolved by **NOGAPS** at the surface level but does seem to be as a low at **500 MB**. The implication is that this feature is a **cold low** decreasing in intensity downward.



FLEET NUMERICAL OCEANOGRAPHY CENTER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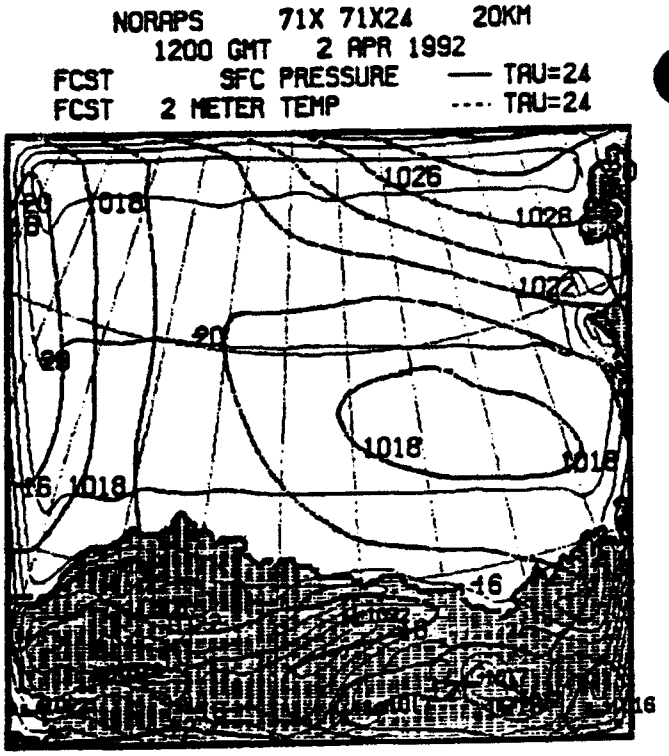
12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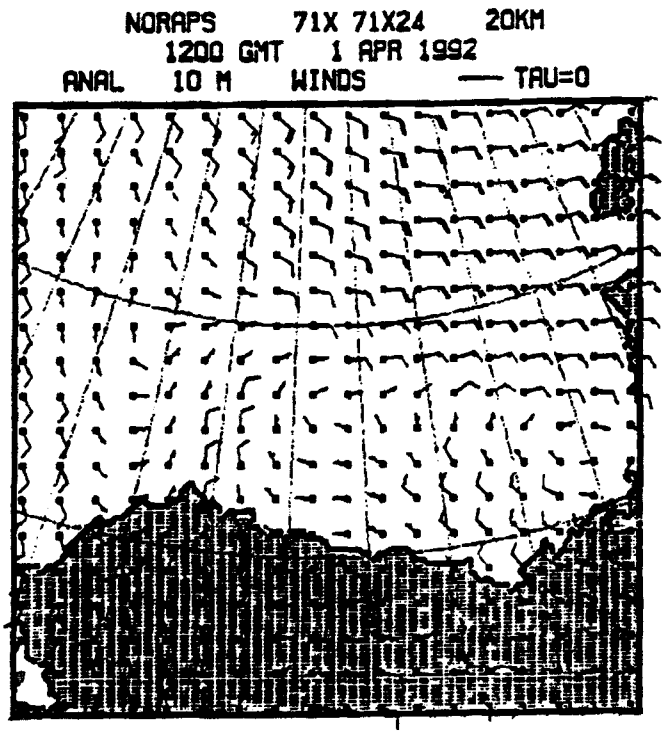
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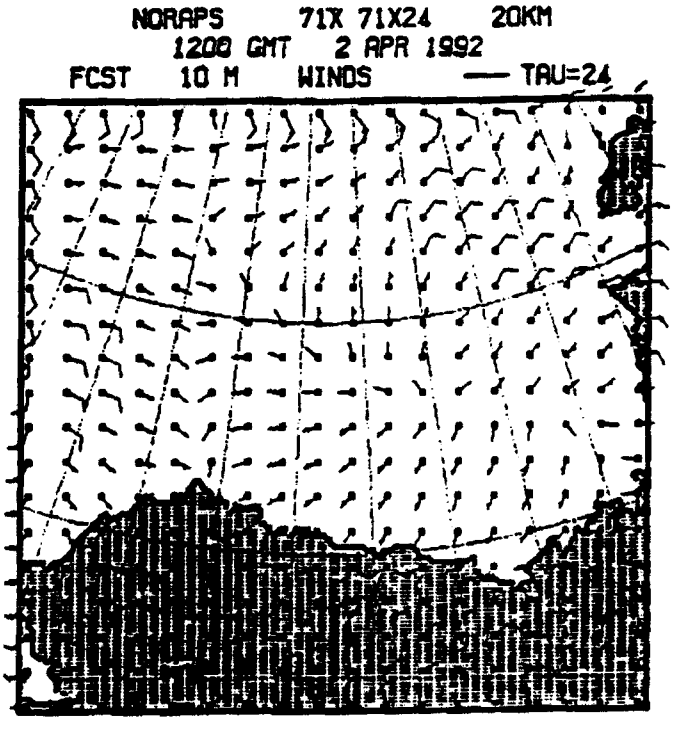
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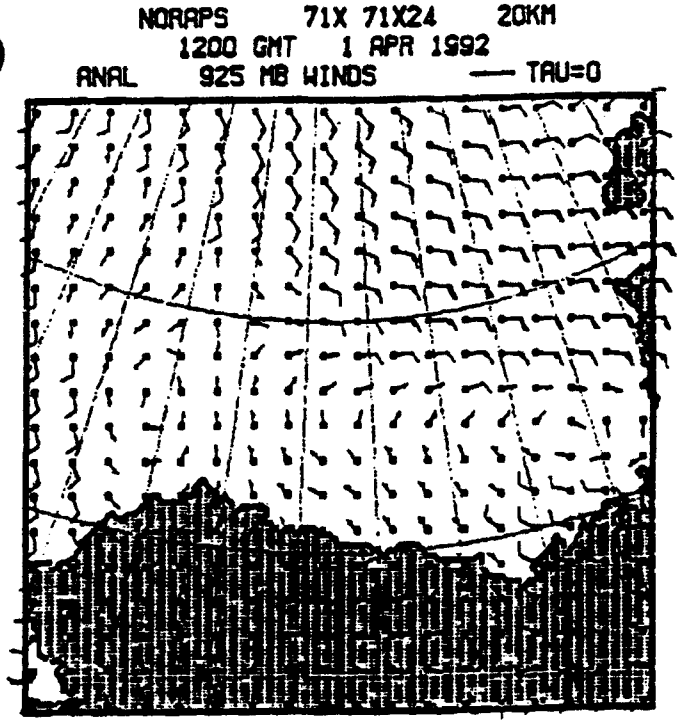
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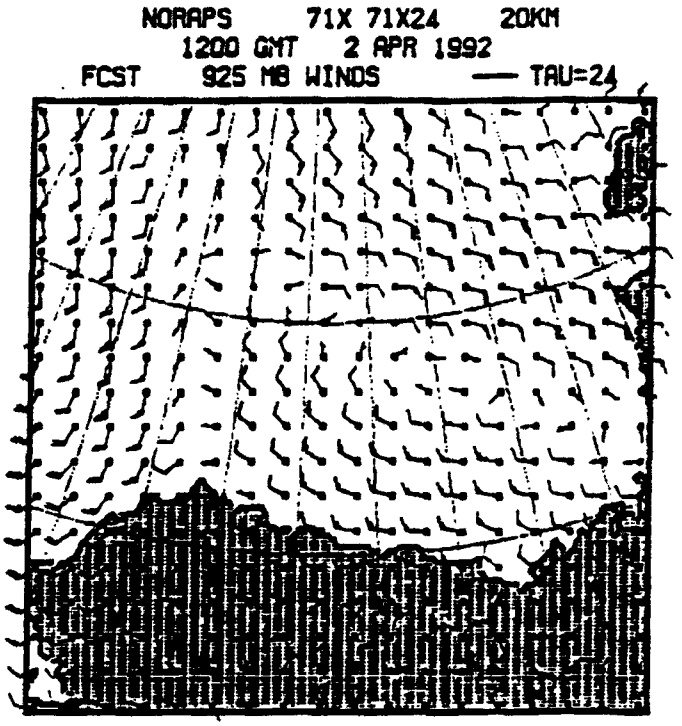
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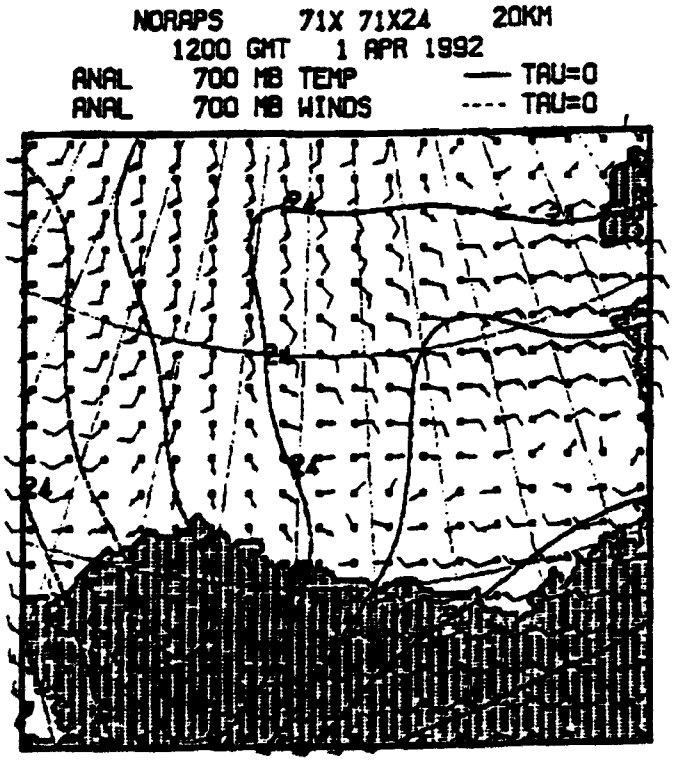
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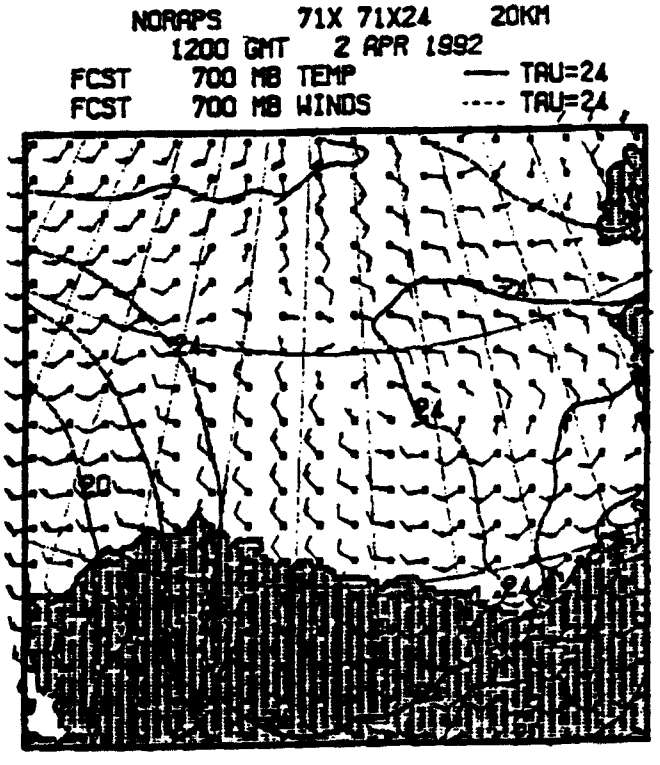
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2 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

02/0000Z Analyses

Surface Pressure

An ESE -WNW trough extends across the central Beaufort.

10 M Winds

The trough is reflected by cyclonic shifts in the 10m winds which are stronger closer to banks Island. Winds have been adjusted by the NORAPS model to more closely conform to reported surface values (Model change made to accommodate comments that earlier representations were too light - i.e. surface stability was too great).

925 MB

This level also shows the elongated trough and notably a N-S oriented sharp ridge line just west of Barrow.

700 MB

A closed circulation is indicated by the 700 mb wind flow near 73N, 145W.

03/0000Z 24-hr Forecasts

Surface Pressure

A closed low is formed SW of Banks Island. **Satellite data** (1529Z) show a vortex in the area. A warm (low) front-like cloud band extends from the vortex across the N. Slope with apparent linkage to a system with center near Wrangel Island.

10 M

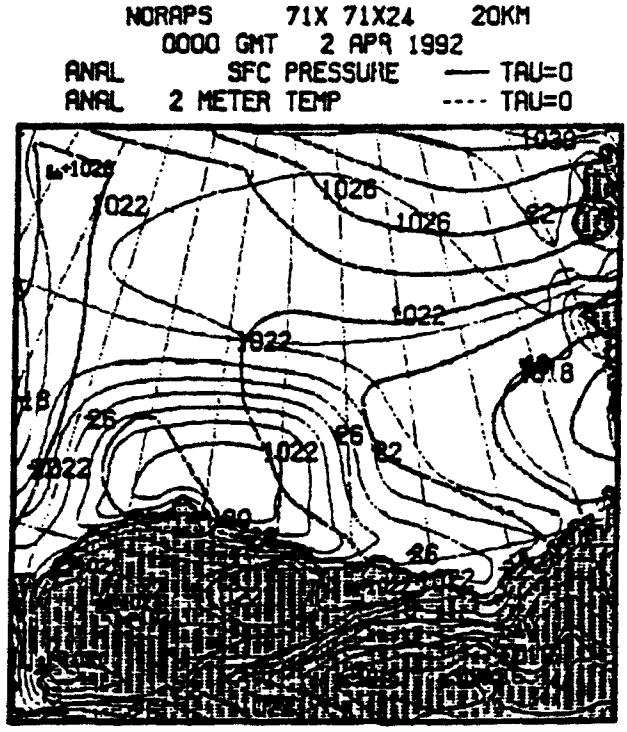
Light winds are shown in the region of the trough axis.

925 MB

A closed circulation is shown near 72.5N, 132.5W. A low appears to be forming near 74N, 172.5W.

700 MB

A closed circulation is well defined with center at 73.5N, 137W. A ridge line protrudes north of Barrow.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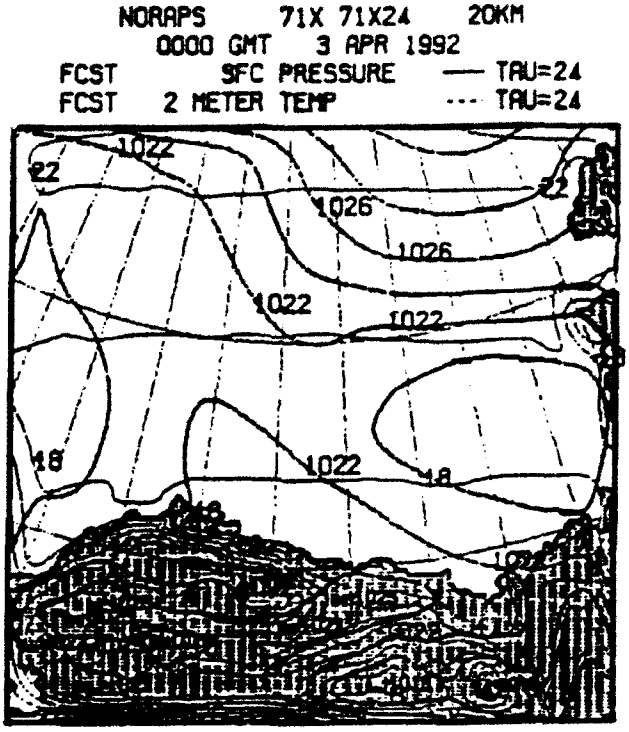
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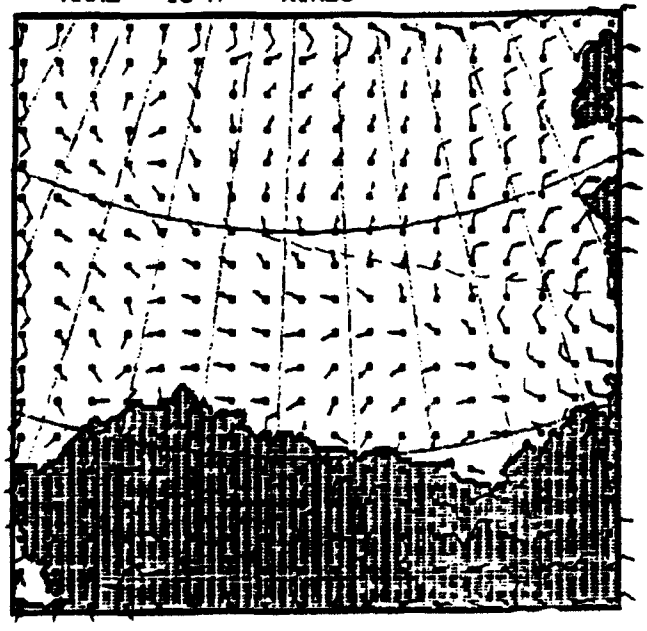
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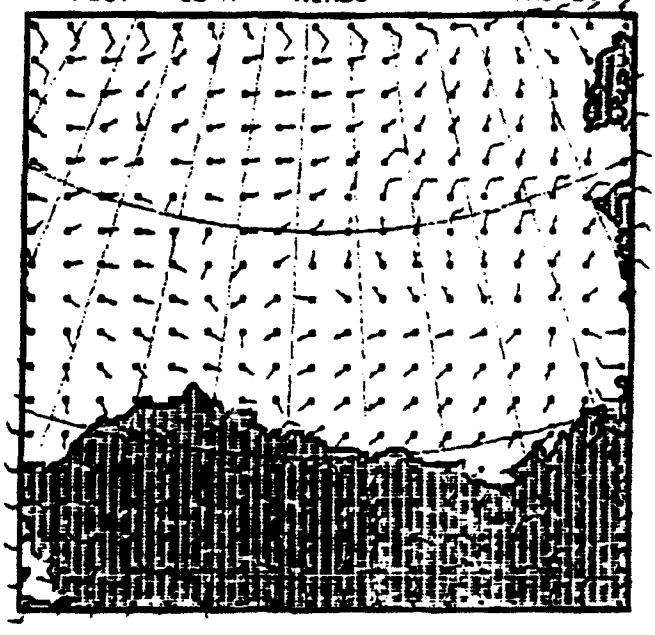
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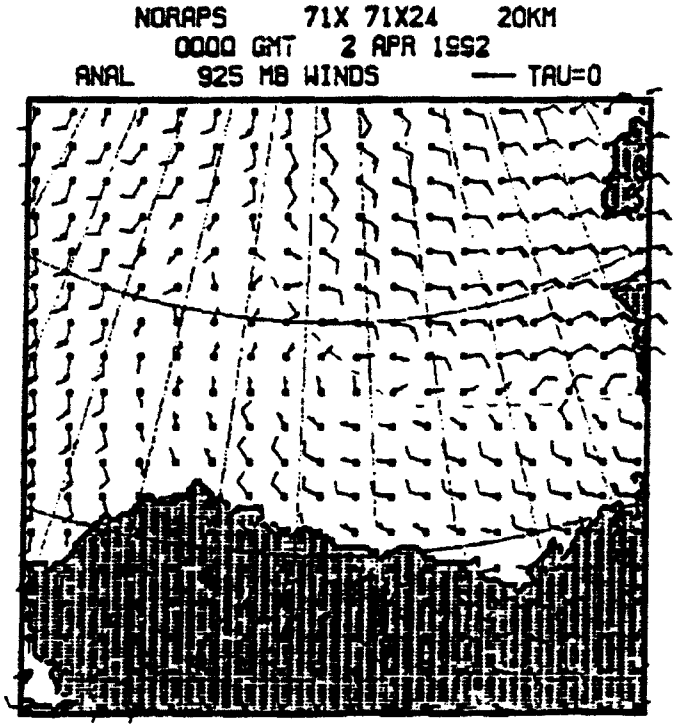
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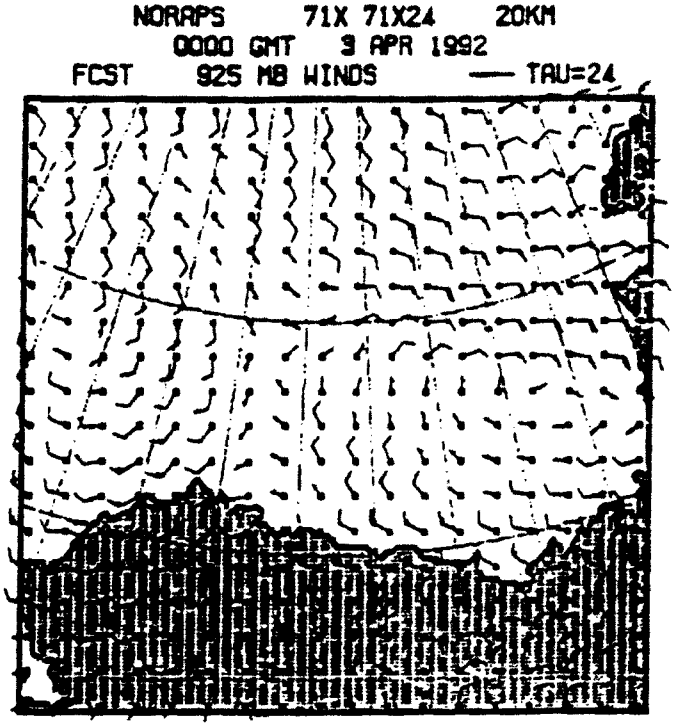
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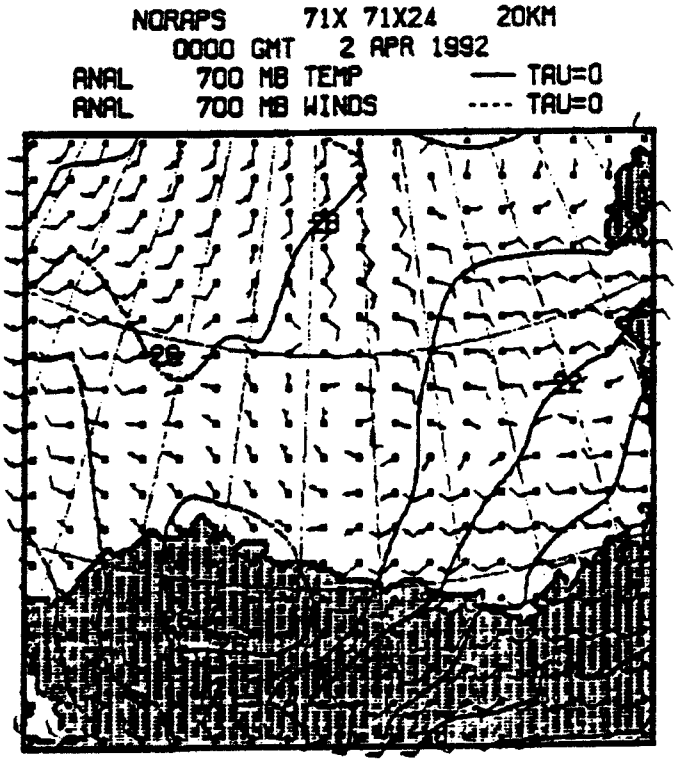
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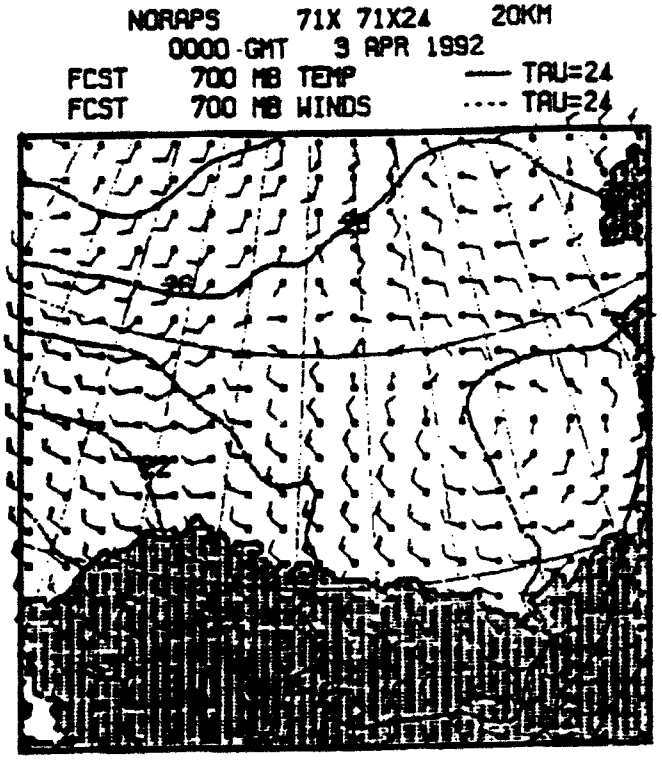
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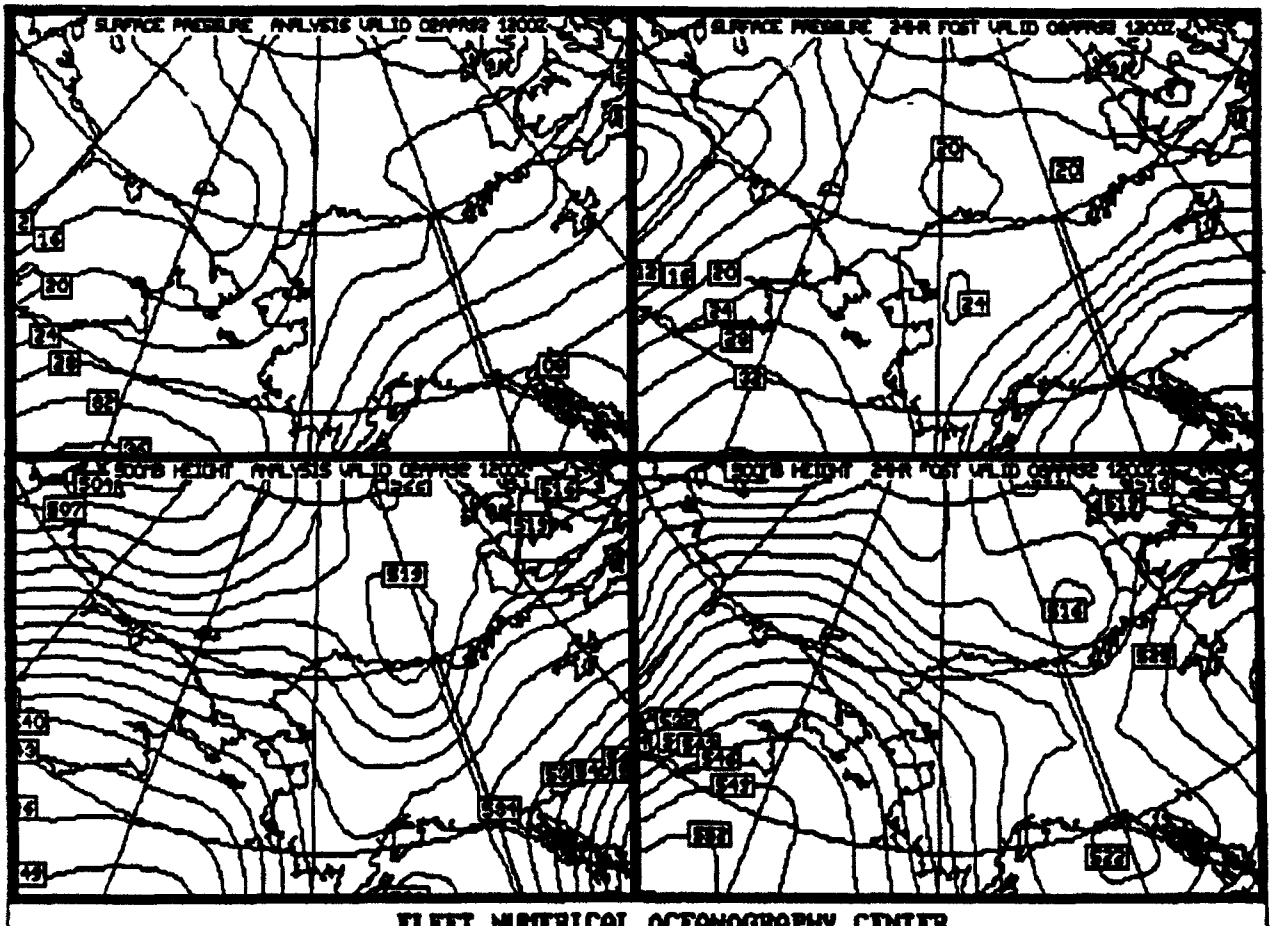
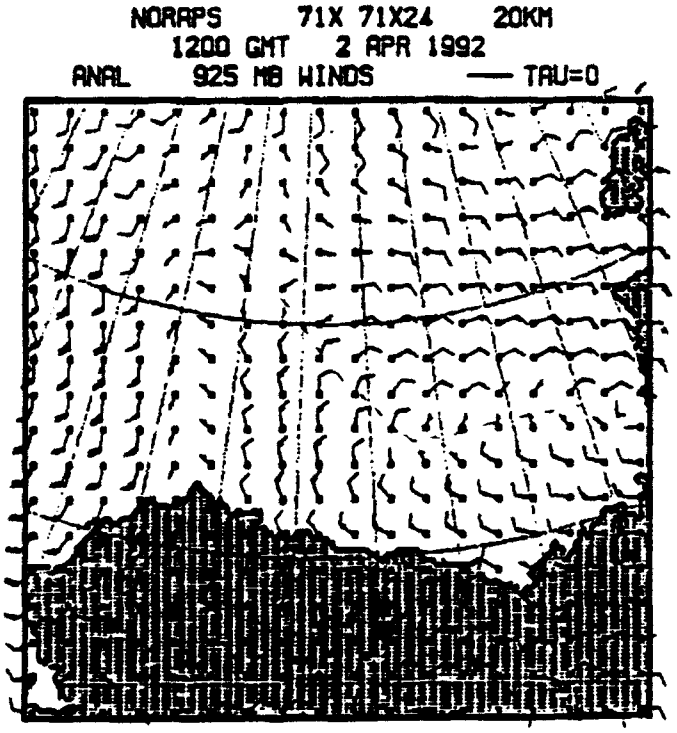
2 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

02/1200Z Analyses and Forecasts (update)

The low pressure and trough across the central Beaufort are forecast to persist during this period.The **925 MB** level is especially interesting in showing the closed circulation near Banks with a second center entering the area north of Barrow by 03/1200Z. These systems are also shown at the **700 MB** level. Why these systems should be connected by a warm low level cloud band dropping down past Barrow and then eastward along the N. Slope is best revealed in the 925 mb wind forecast which shows a streamline trough dropping down toward Barrow. The **NOGAPS** surface analysis and forecast products do not resolve these important features. The **500 mb** is better in at least showing an upper cold low east of Barrow.

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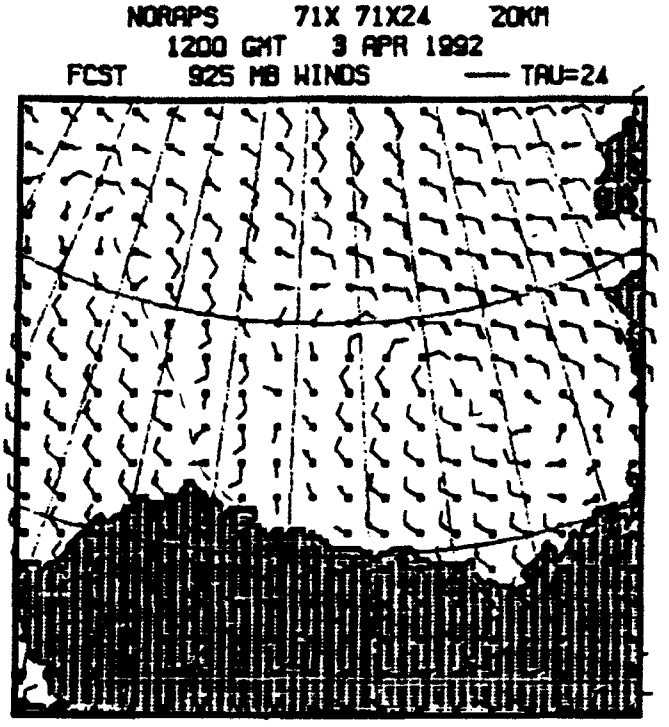
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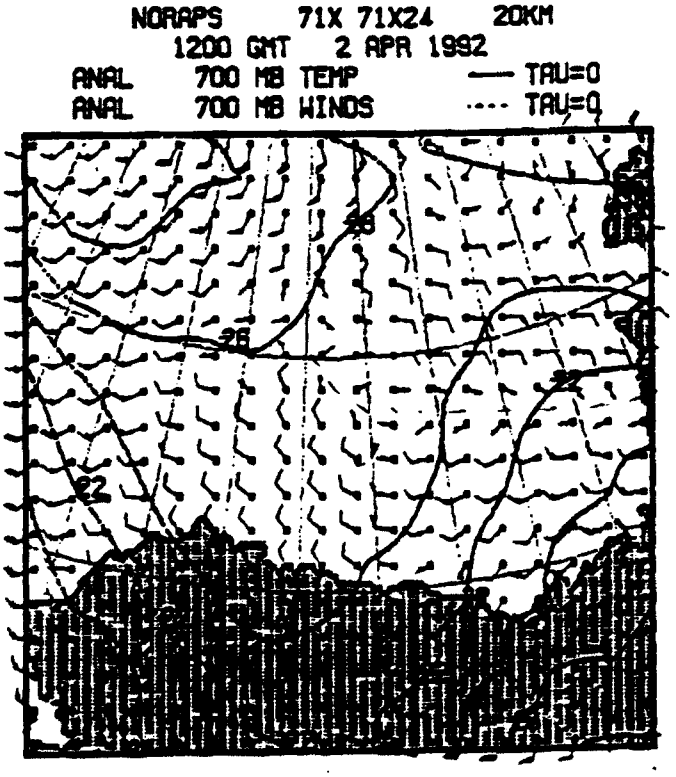
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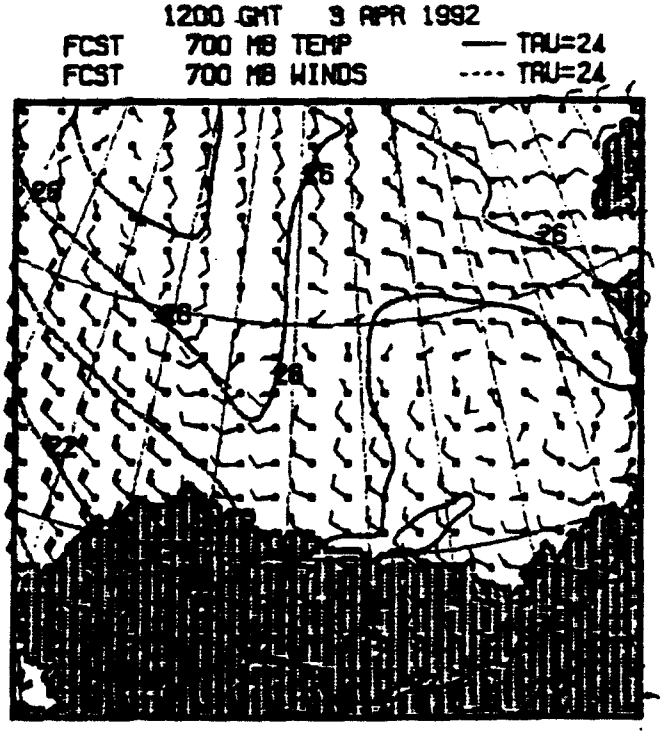
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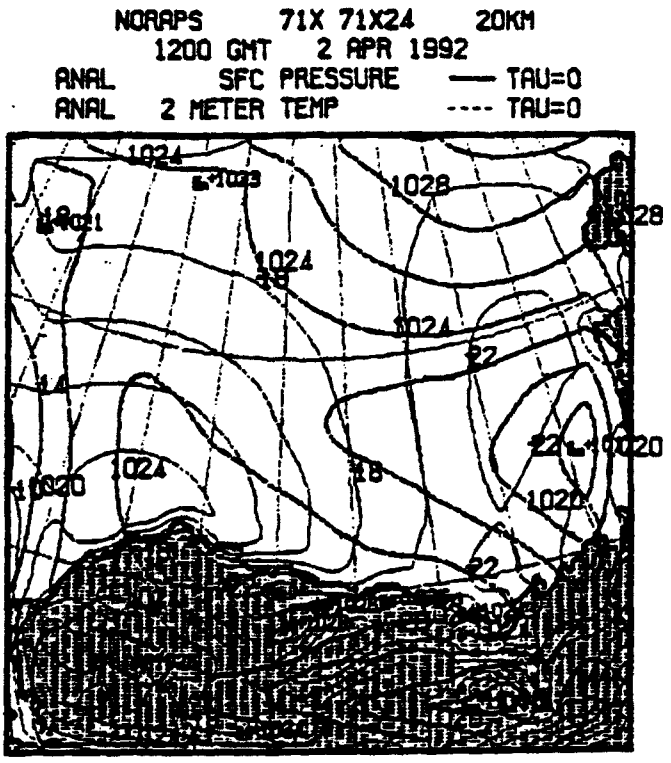
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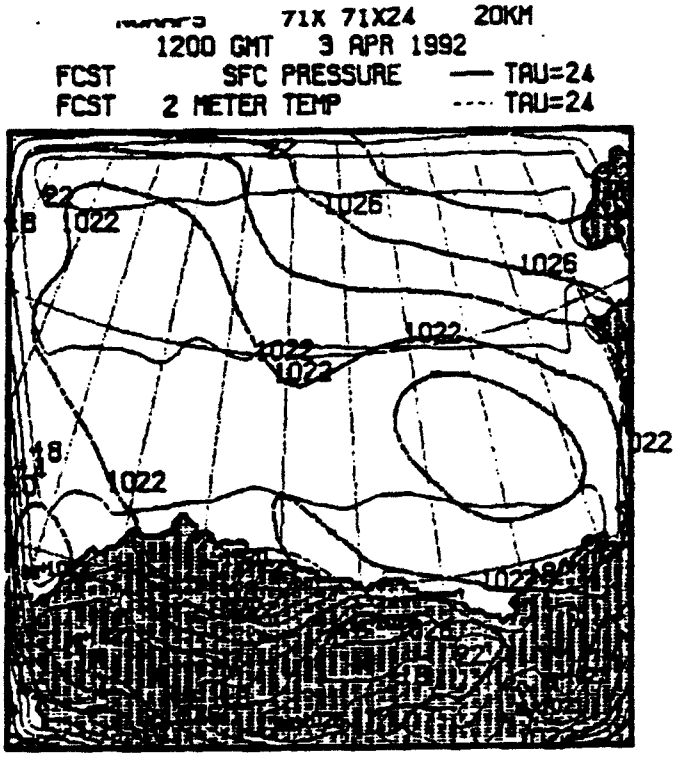
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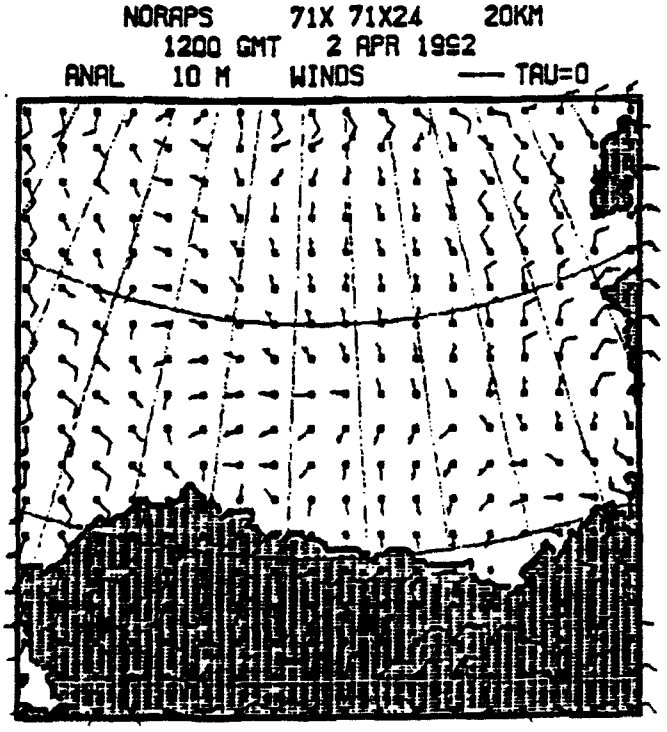
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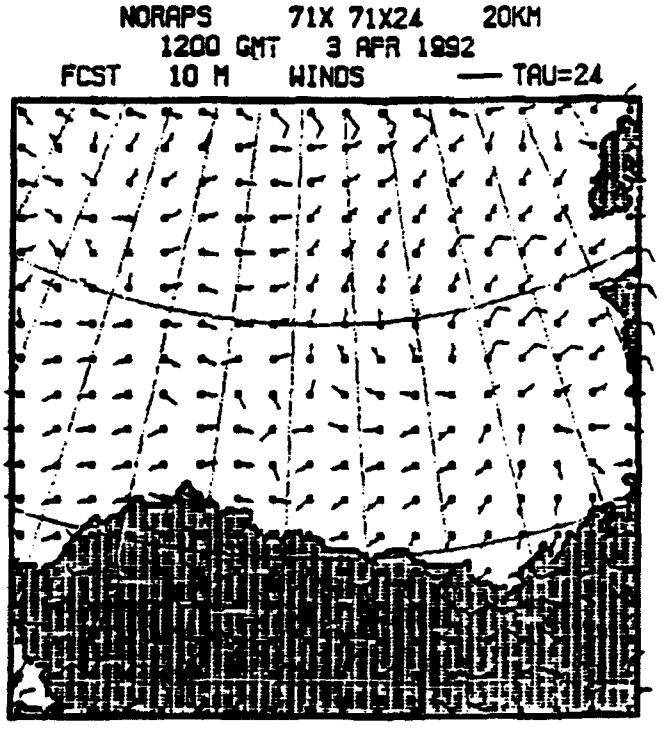
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FCST 10 M WINDS —— TAU=24

3 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

03/0000Z Analyses

Surface Pressure

Satellite data and NORAPS are consistent in showing 2 main features over the ice; a low NW of Barrow; and a second low just west of Banks.

10 M Winds

10m winds reveal weak closed circulations around the two lows.

925 MB

The dominating influence of the closed low west of Banks is shown to cover most of the Beaufort Sea. The 2nd closed low NW of Barrow is shown centered near 75N, 150W.

700 MB

The Banks low appears centered near 73.5N, 132.5W. A trough extends NW from Barrow to a closed low near 77N, 175W.

04/0000Z 24-hr Forecasts

Surface Pressure

Lowest pressure is forecast just west of Banks, with high pressure to the north.

10 M

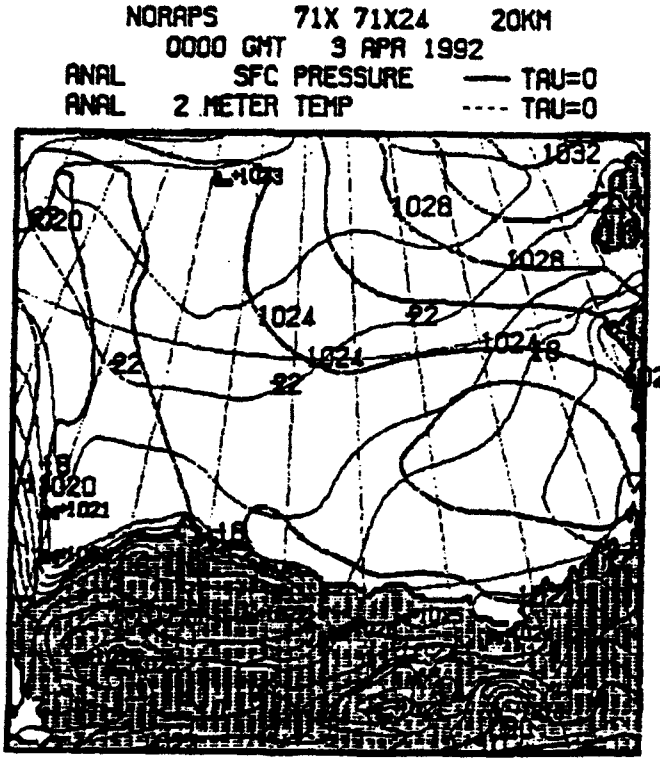
The low NW of Barrow is forecast to move SE'ward to a position just east of Barrow.

925 MB

The Banks low fills to an E-W oriented trough, while the second low is shown NE of Barrow.

700 MB

The main effect shown is an elongated trough extending across the Beaufort in the vicinity of 73N. The trough then stretches NW'ward past Barrow.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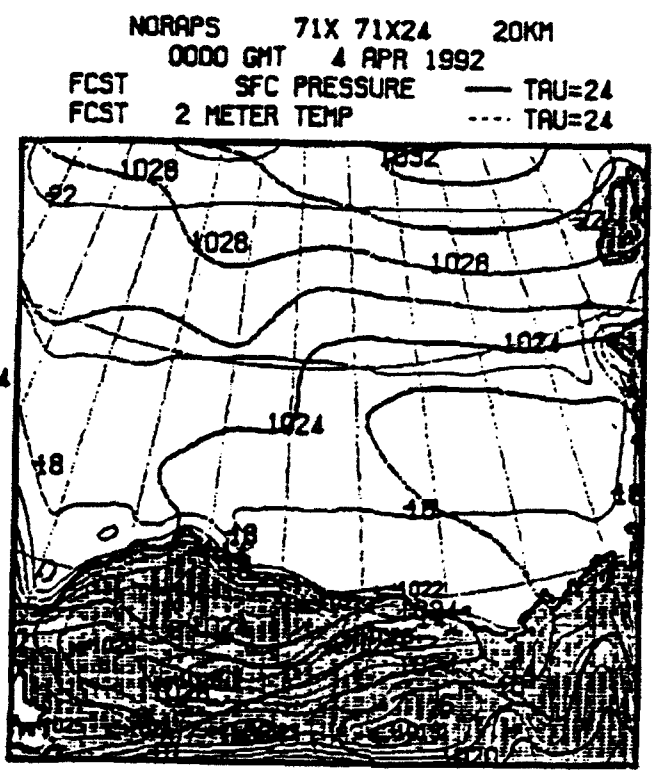
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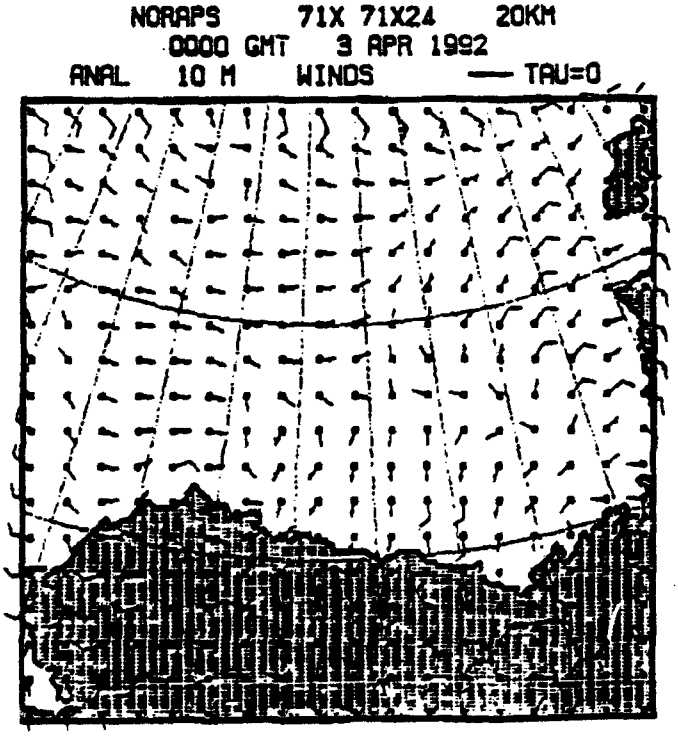
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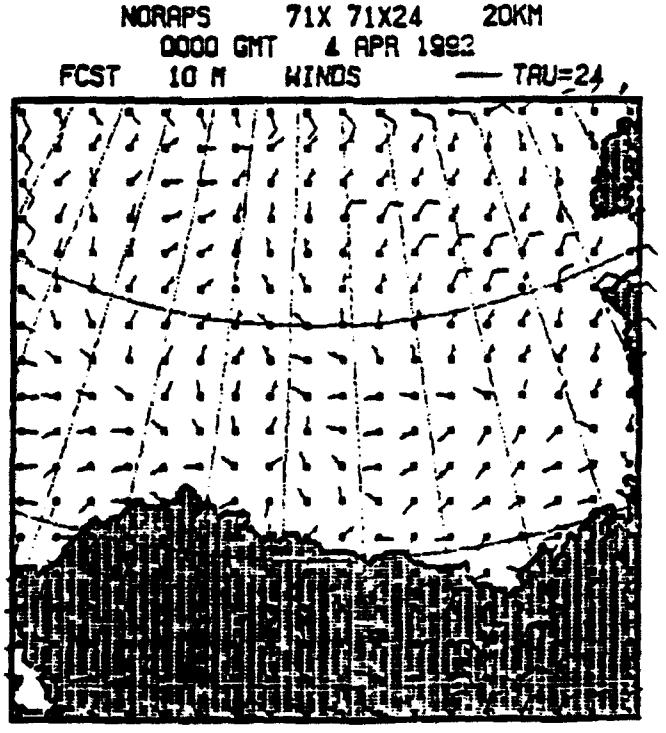
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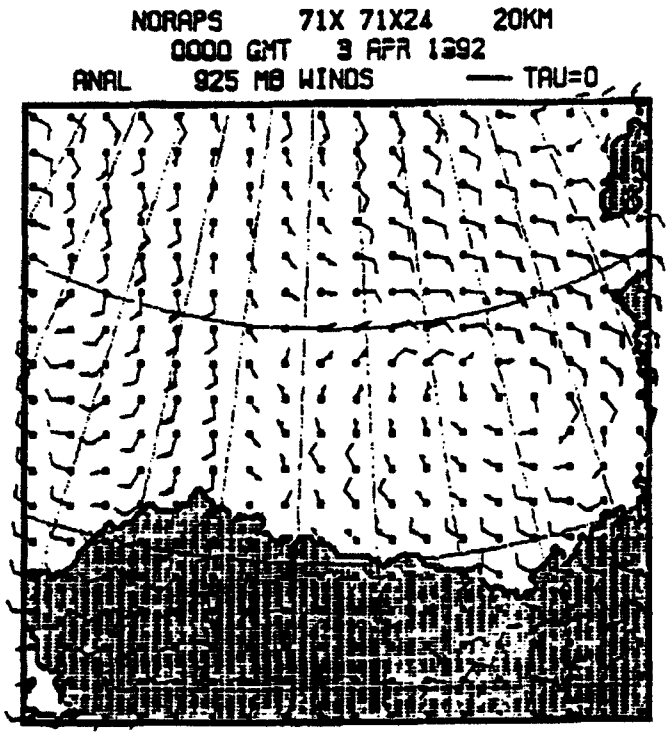
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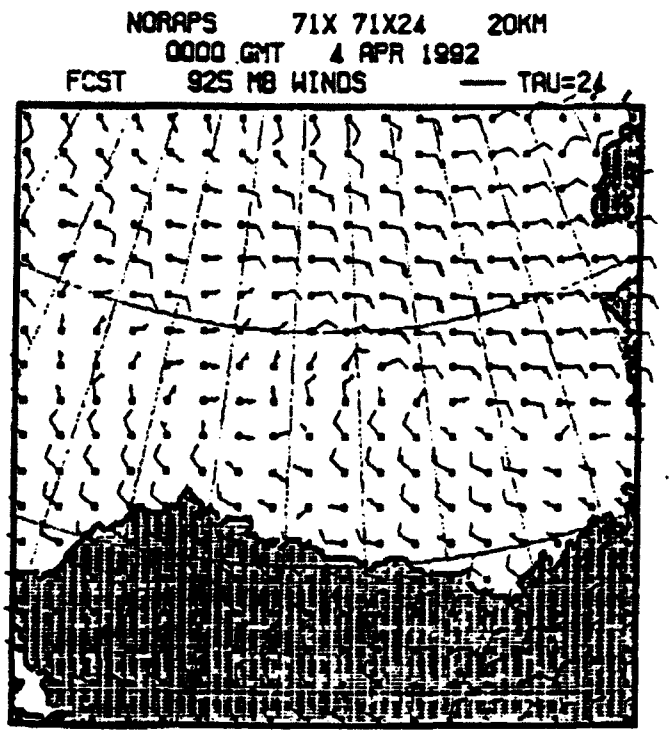
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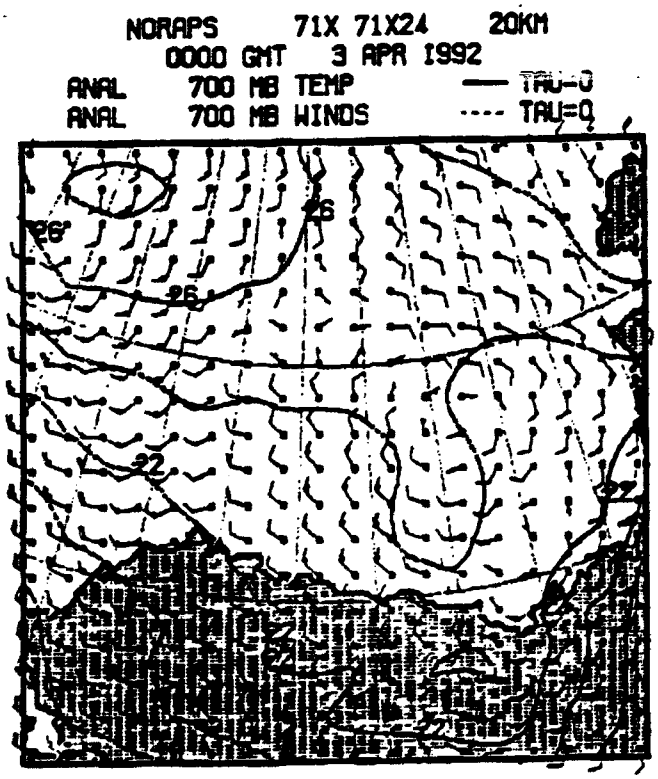
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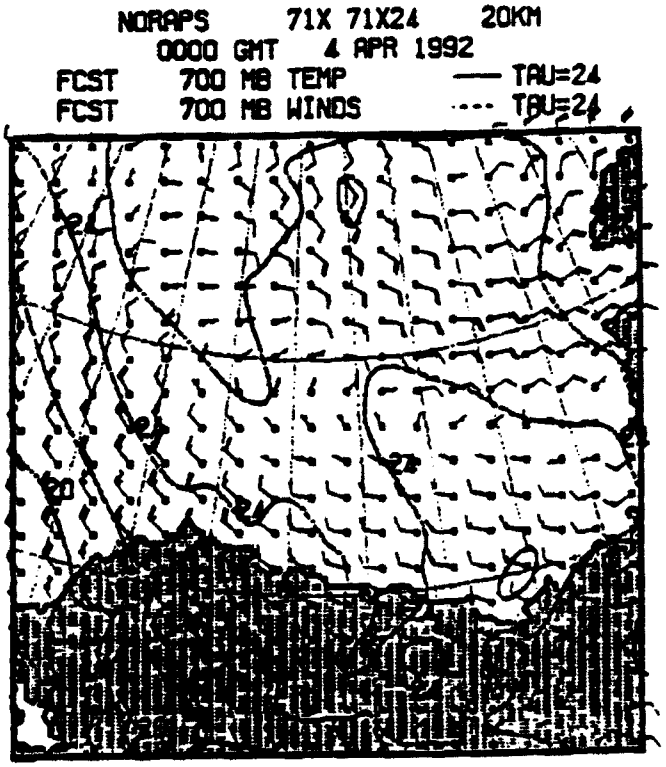
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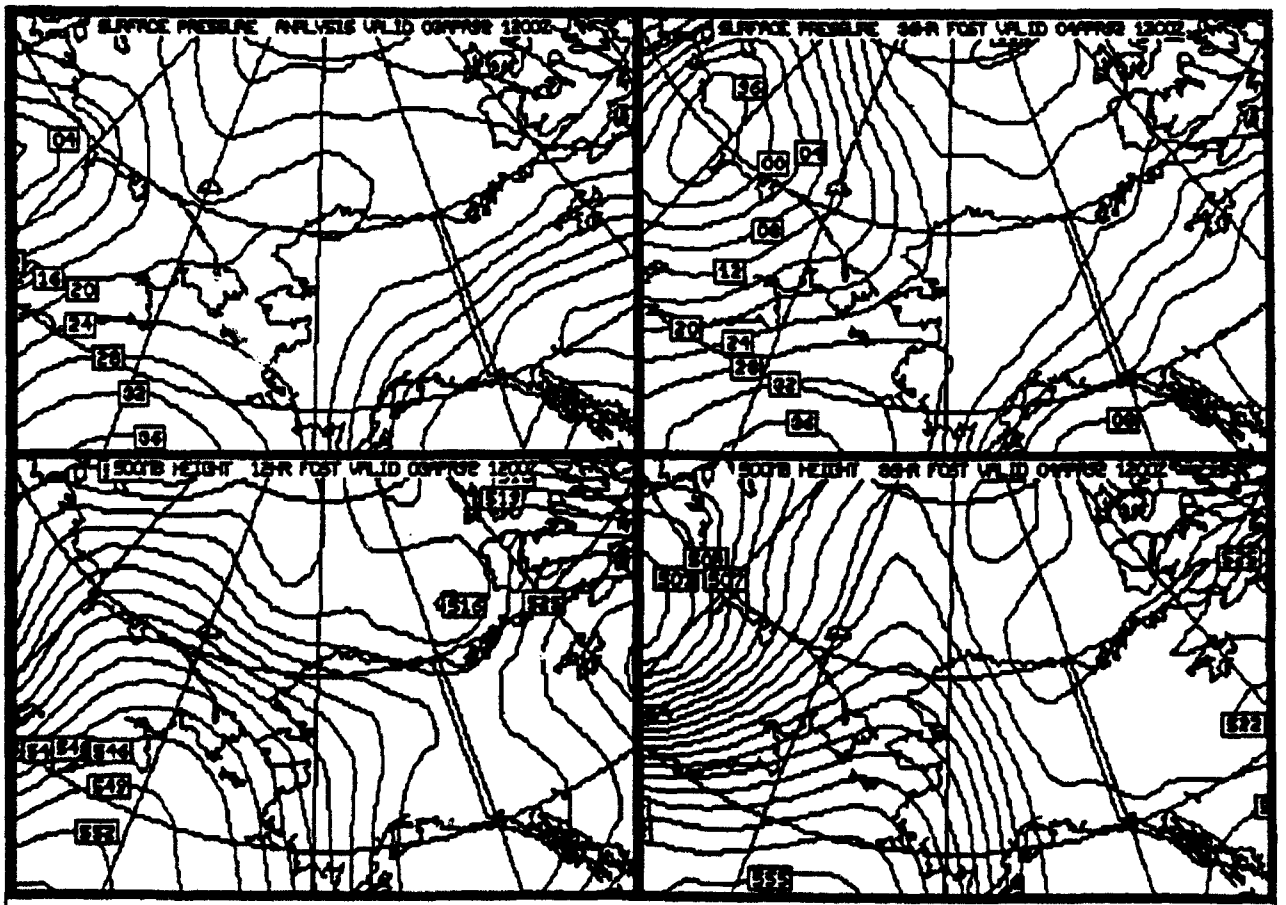
20

3 Apr 92

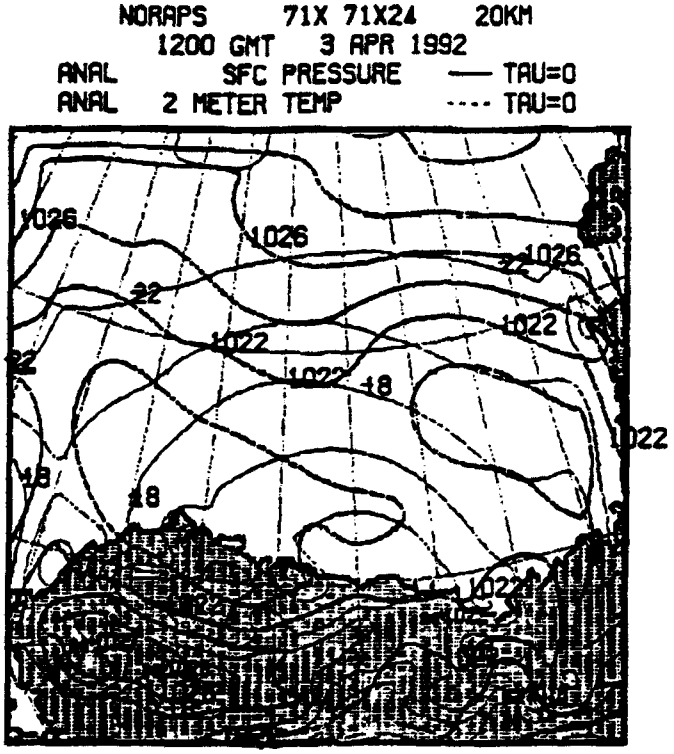
NORAPS ANALYSIS AND FORECAST PRODUCTS

03/1200Z Analyses and Forecasts (update)

Low pressure is shown to have moved over the Barrow region with a second center just west of Banks. This agrees with the satellite indications. The low at 10m is forecast to continue moving eastward with center near 73N, 145W by 04/1200Z. The center is also forecast to a positon NE of Deadhorse at 925 and 700 mb. The **NOGAPS** surface analysis shows only an open trough north of Barrow at 03/1200Z and no indications of the low NE of Deadhorse by 04/1200Z.



FLEET NUMERICAL OCEANOGRAPHY CENTER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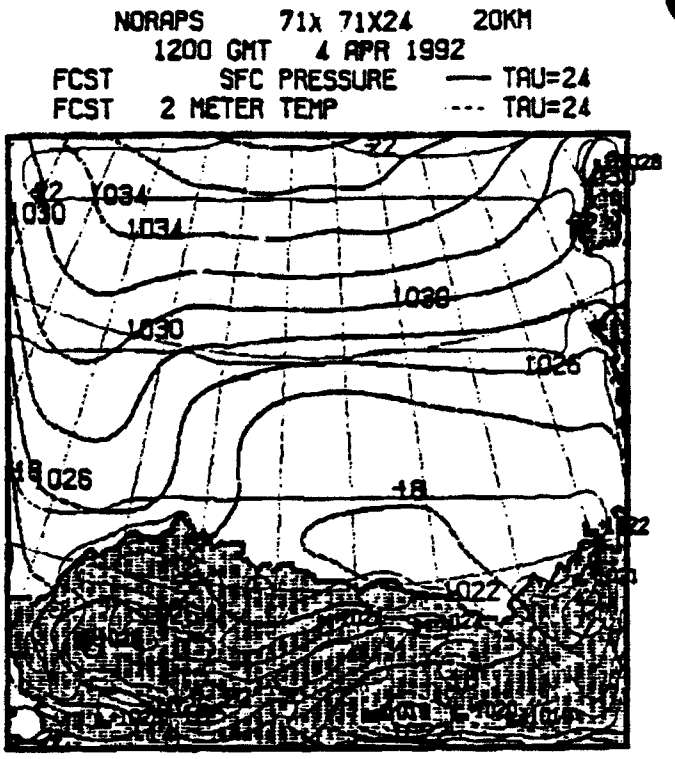
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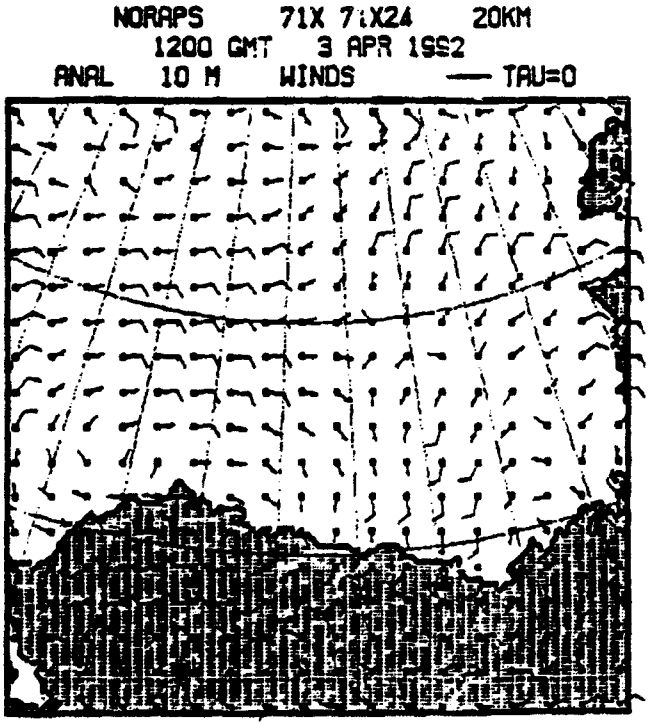
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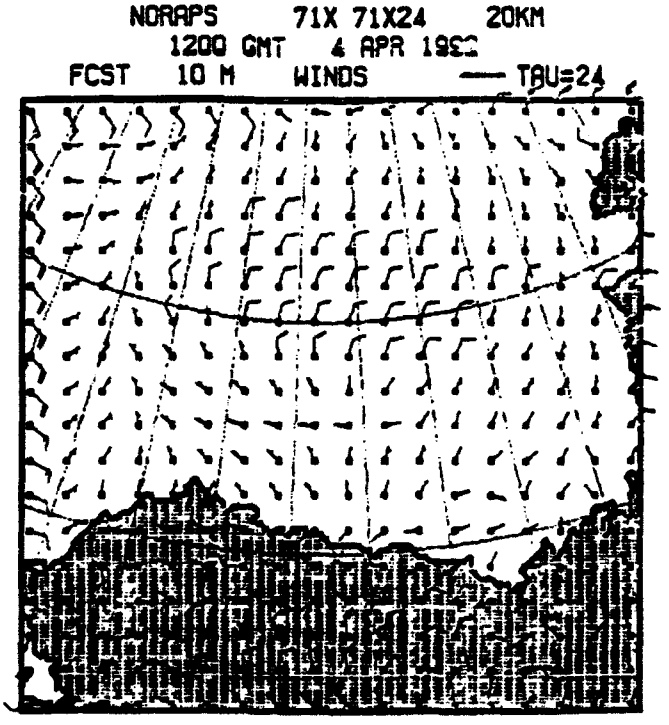
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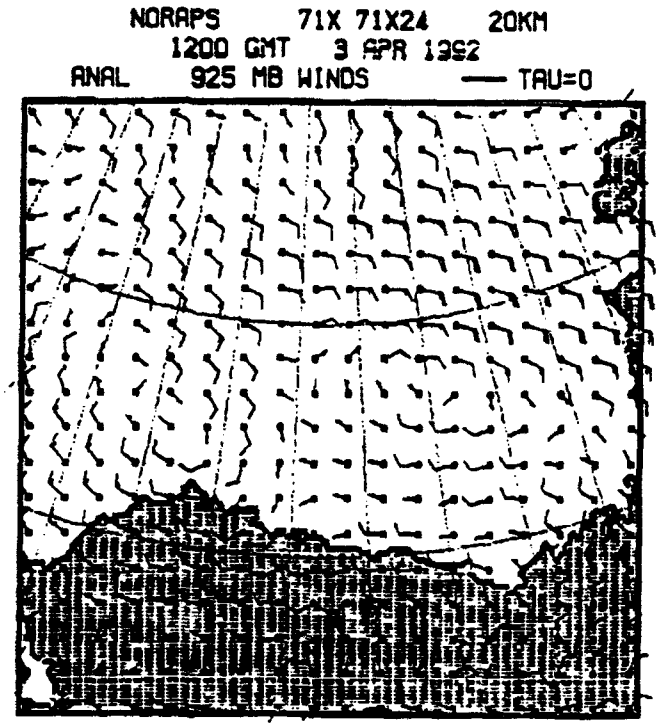
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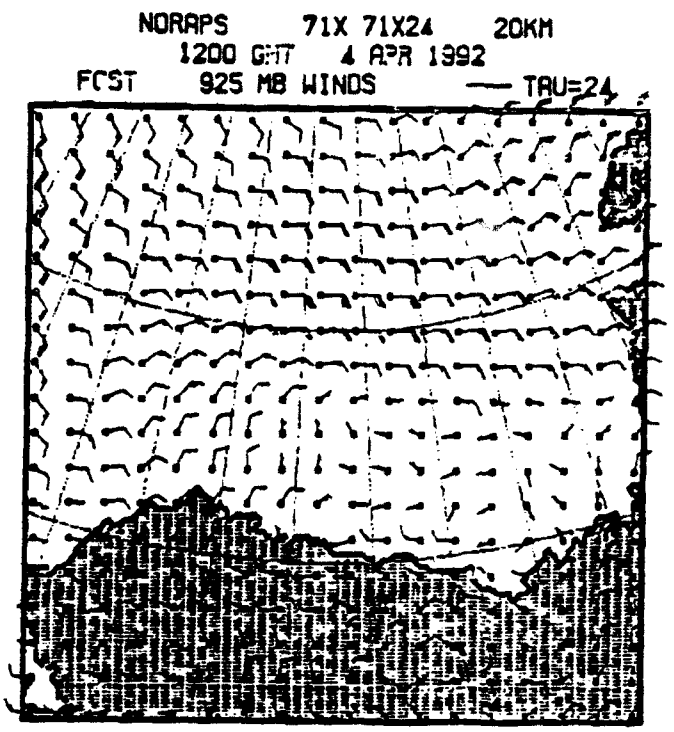
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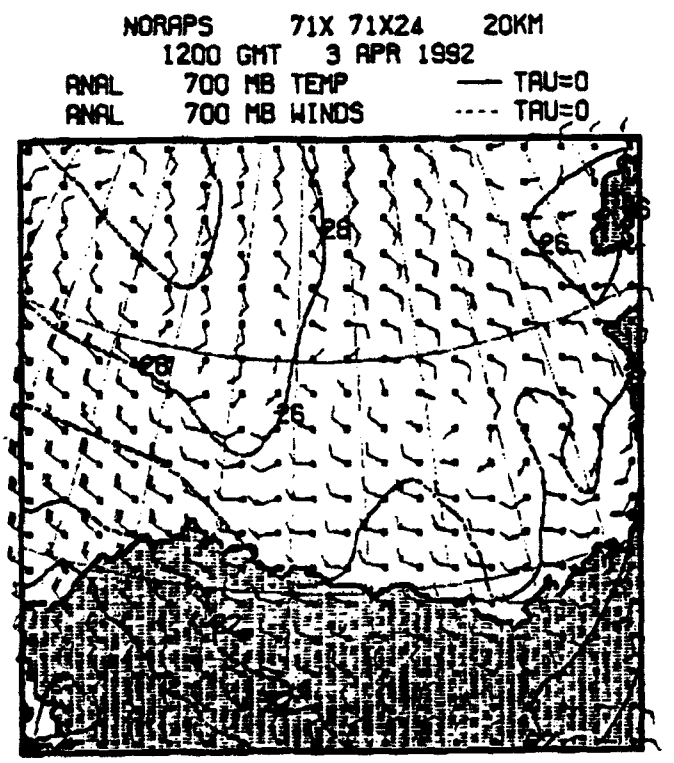
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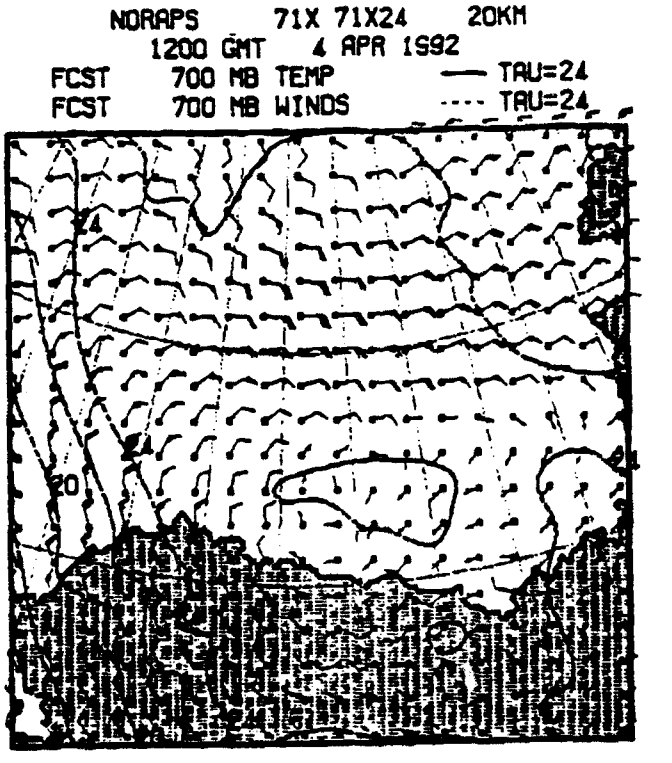
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4 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

04/0000Z Analyses

Surface Pressure

The analysis shows low pressure centered near Deadhorse. A second low is shown west of Banks.

10 M Winds

Very light winds at this level. Difficult to define specific centers.

925 MB

A much better defined low center is shown NE of Barrow with a second center near 74N, 142W.

700 MB

A closed circulation is shown near 74N, 144W. An E-W oriented trough extends from this center towards Banks.

05/0000Z 24-hr Forecasts

Surface Pressure

The lows are pushed south over northern Alaska as a high pressure moves southward setting up basic easterly flow over the entire Beaufort Sea.

10 M

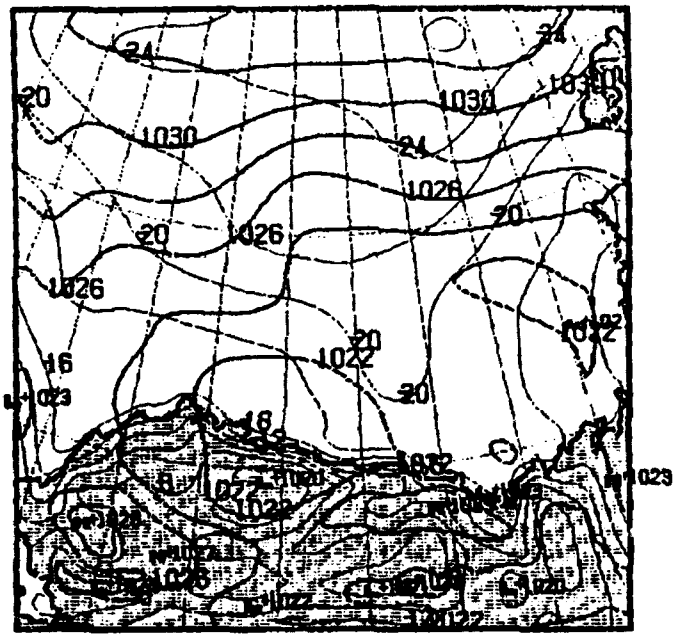
Winds totally reflect the dominating influence of the high to the north.

925 MB

Similar to the 10m winds but a weak closed cyclonic center is indicated near 71N, 142.5W.

700 MB

Winds at 700 mb show a distinct closed cyclonic circulation near 71N, 147.5W. The low is much better organized at this level.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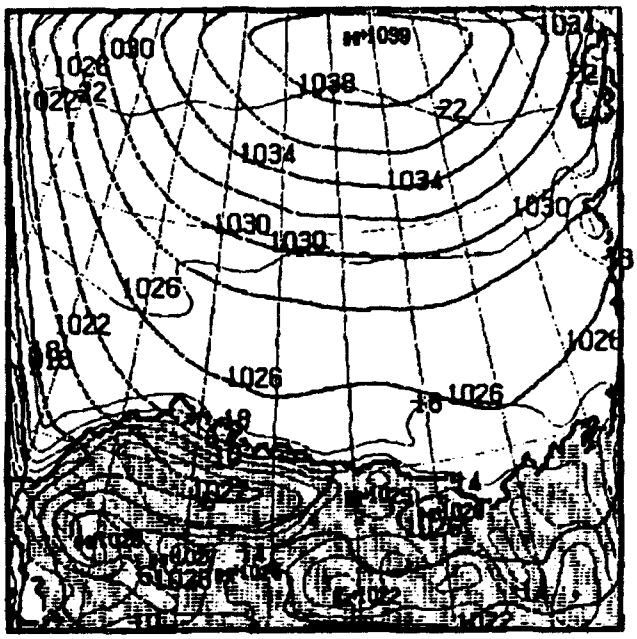
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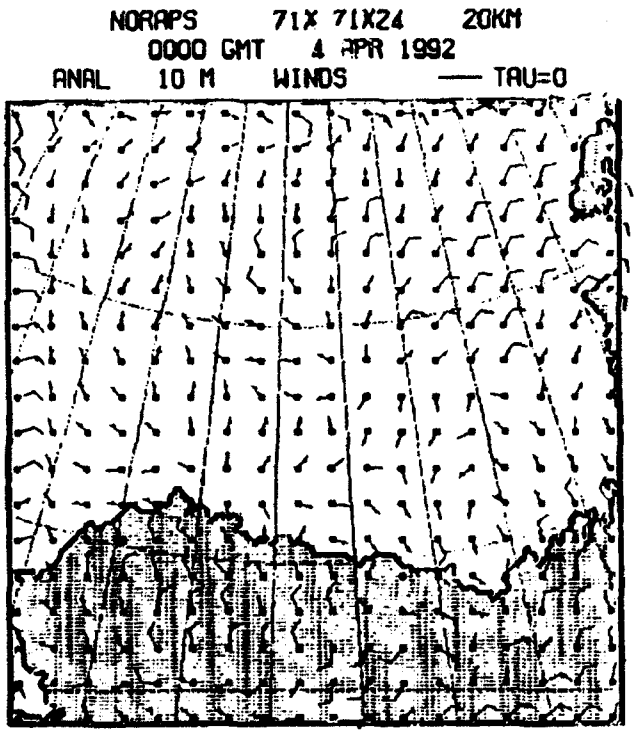
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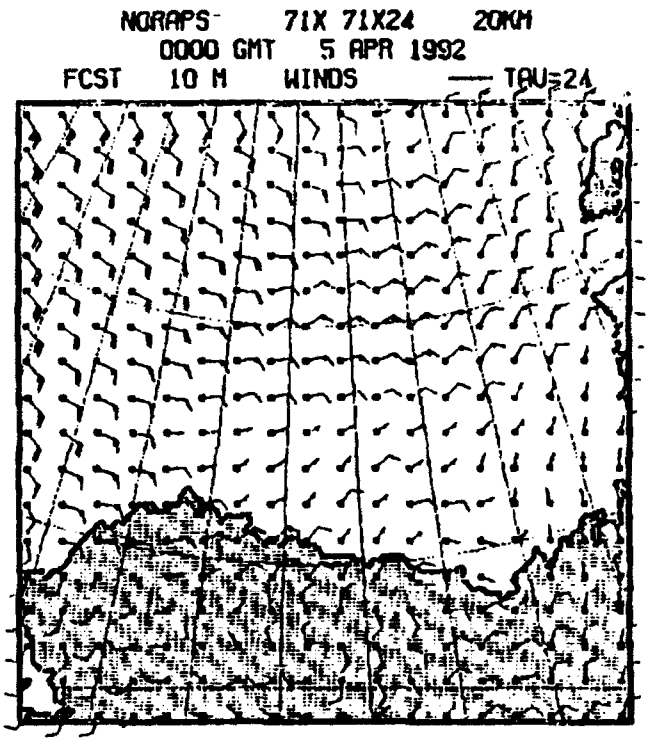
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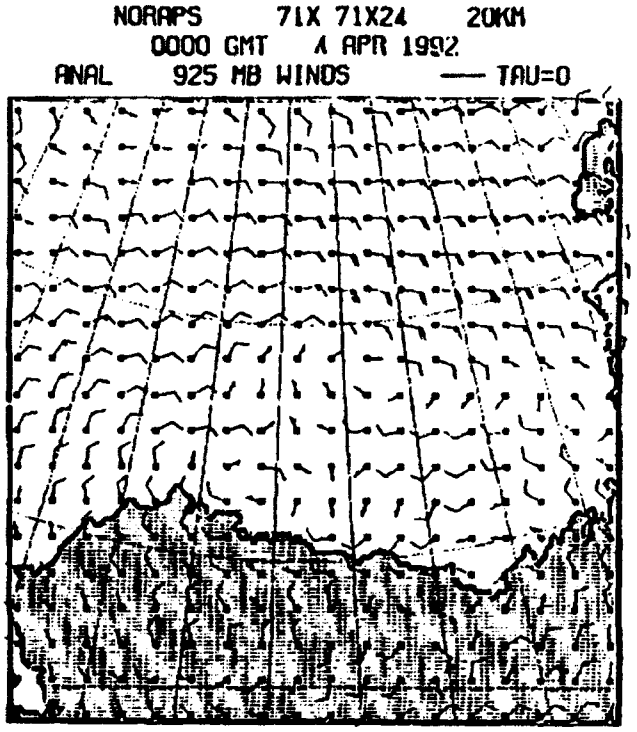
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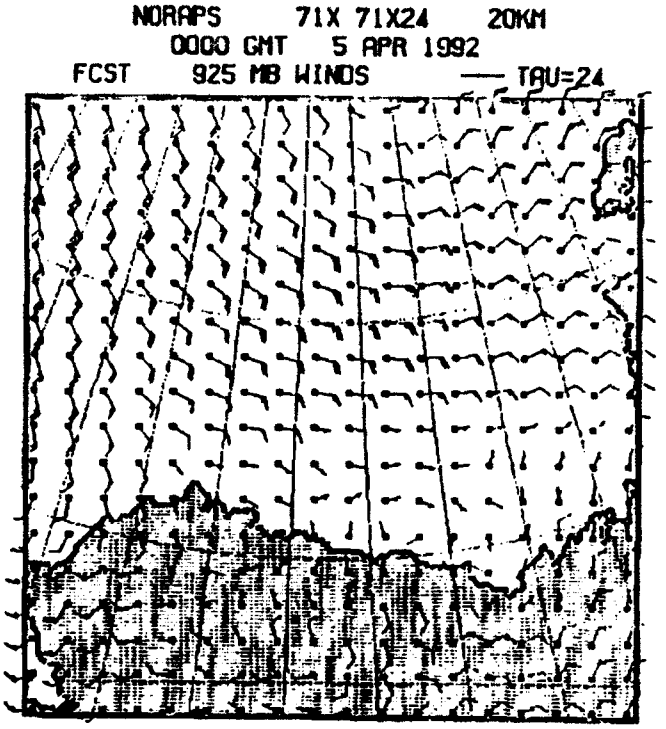
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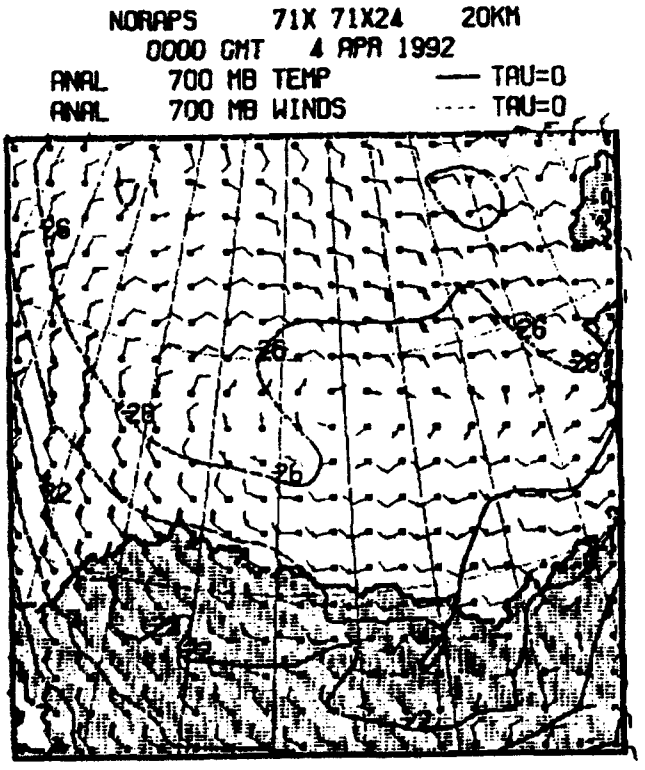
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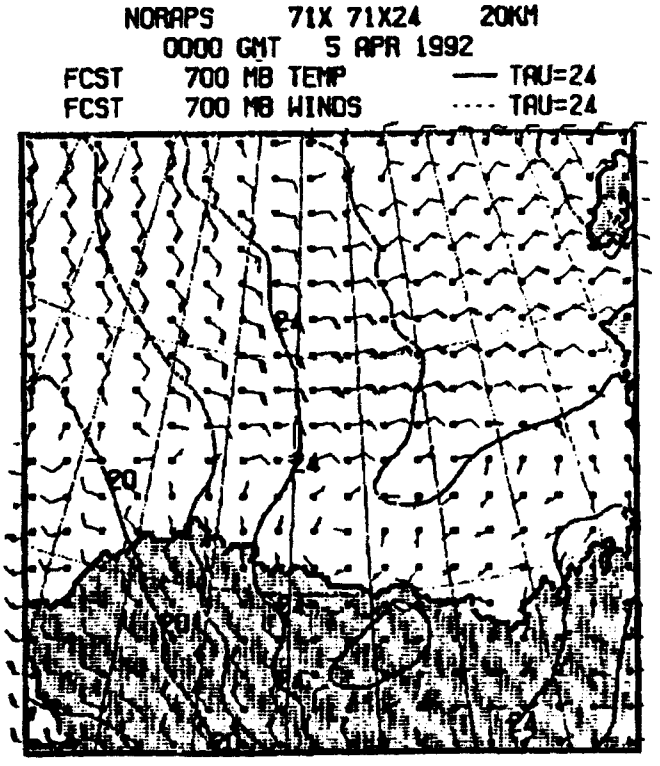
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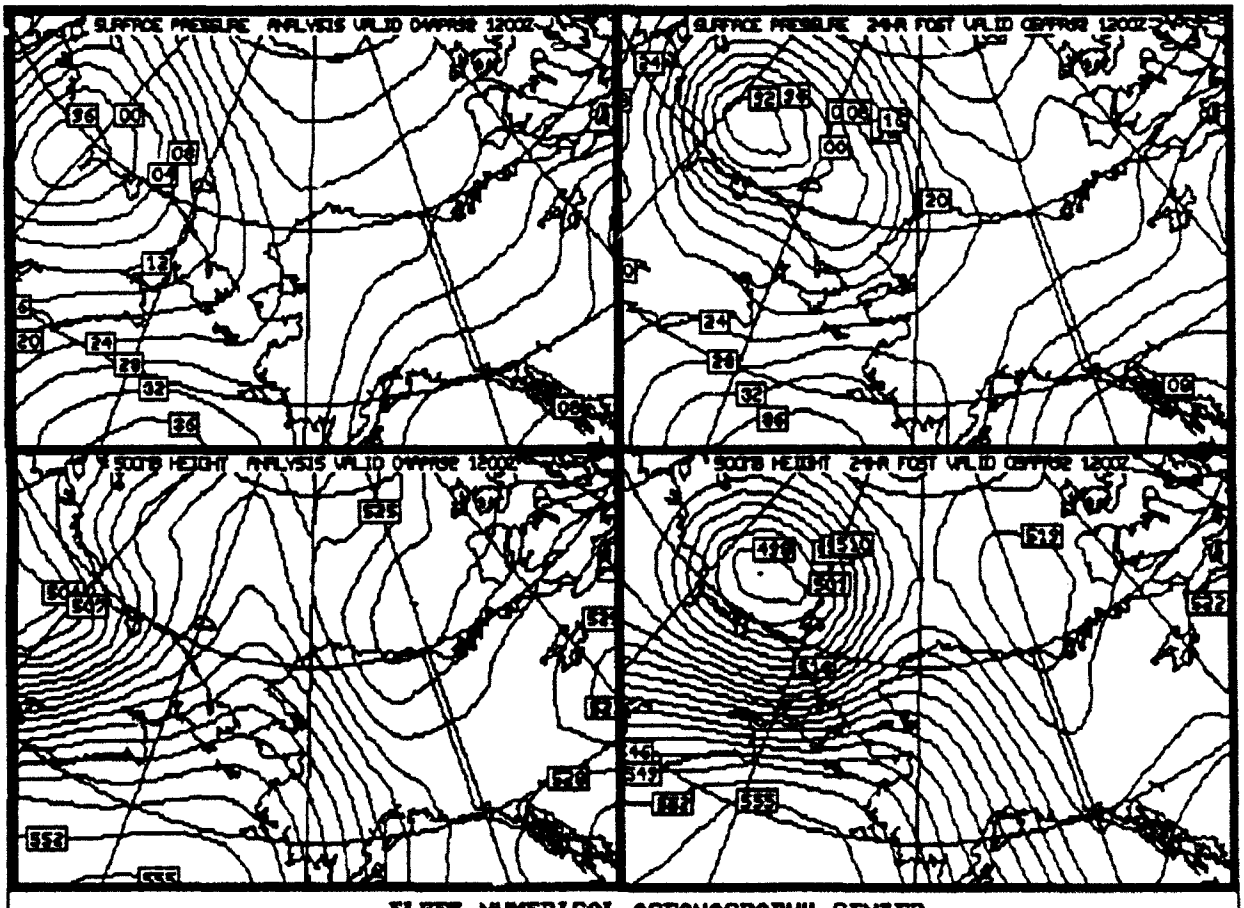
4 Apr 92

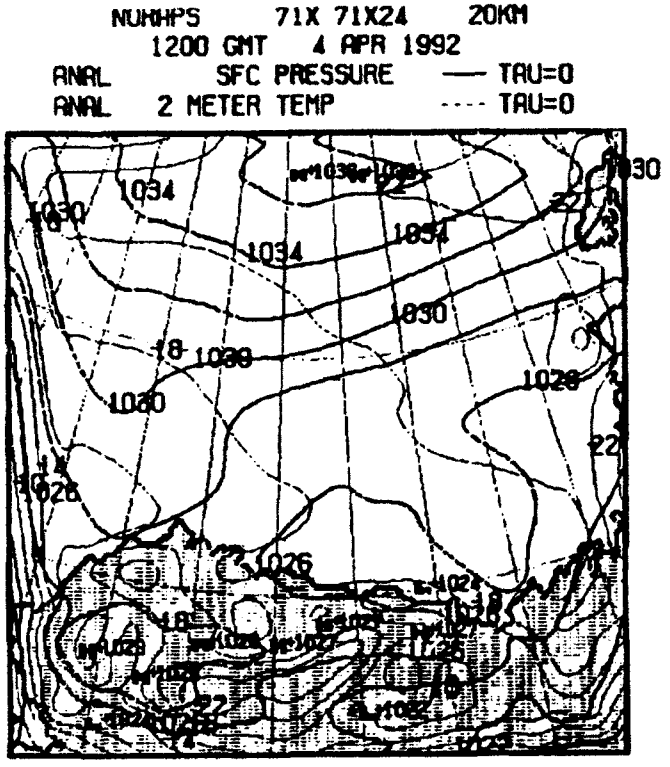
NORAPS ANALYSIS AND FORECAST PRODUCTS

04/1200Z Analyses and Forecasts (update)

Low pressure is maintained better than forecast north of the North Slope. This is reflected in significant cyclonic turning of winds along an E-W line near 72.5N. By 05/1200Z moderate to strong easterlies and southeasterlies provide a steering influence to western locations. At 700 mb a closed cyclonic circulation is very evident near 72.5N, 138W. The NOGAPS 24 hr forecast does show a weak inverted trough in the region of the 700 mb low. A strong low west of Wrangle Island is forecast to move eastward while an upper cold low is centered over the Beaufort.



FLEET NUMERICAL OCEANOGRAPHY CENTER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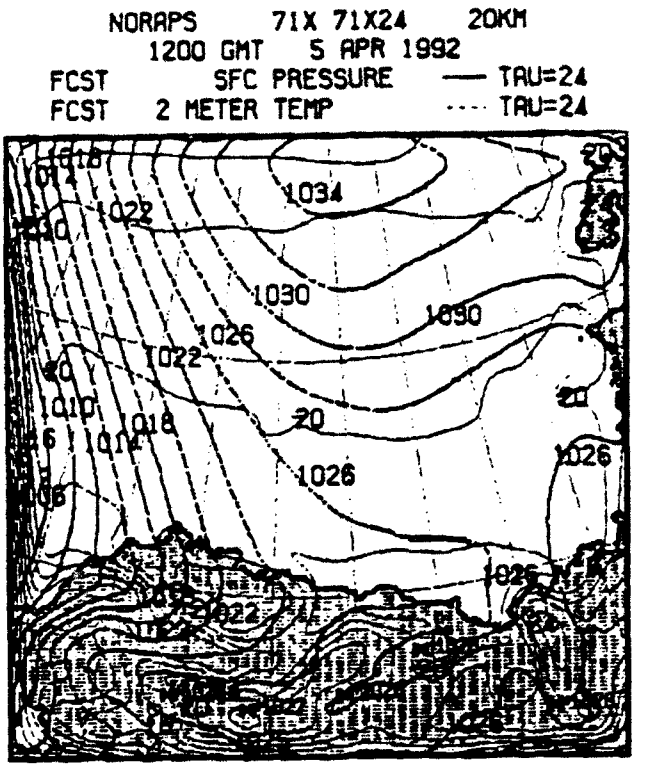
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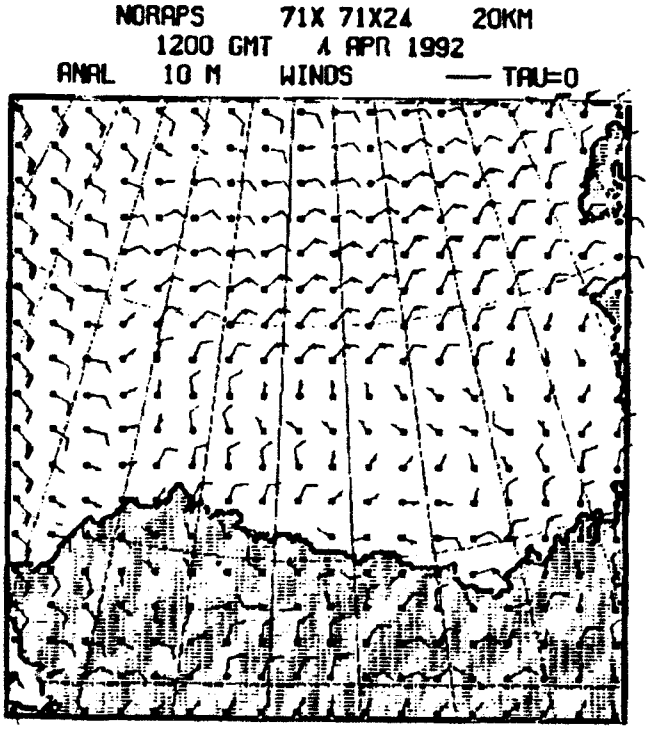
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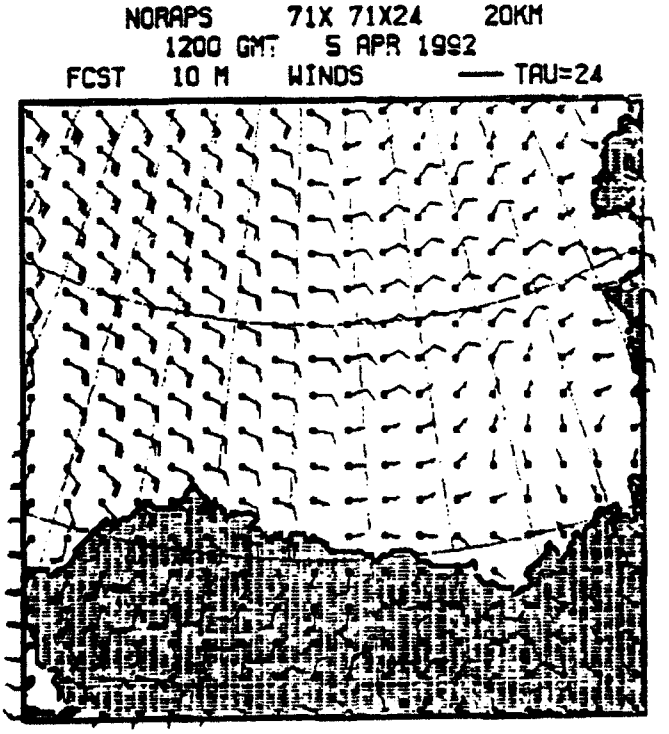
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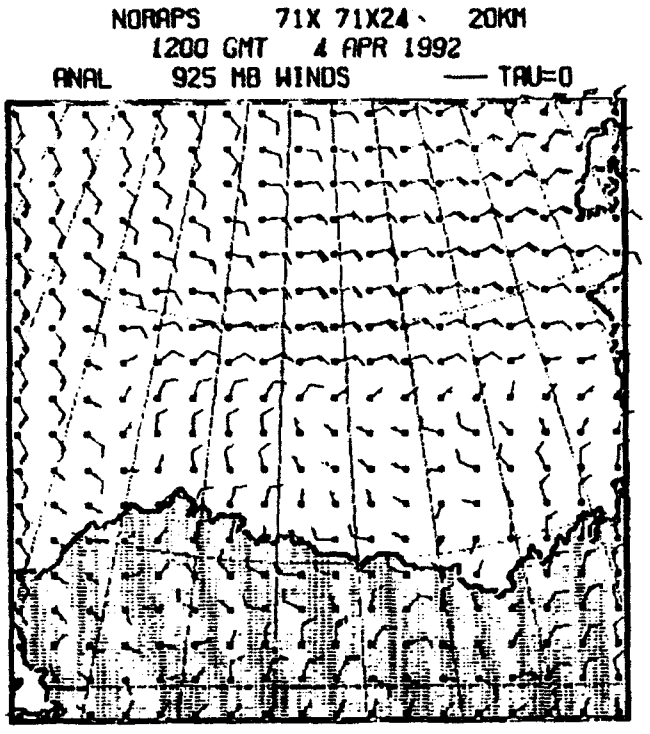
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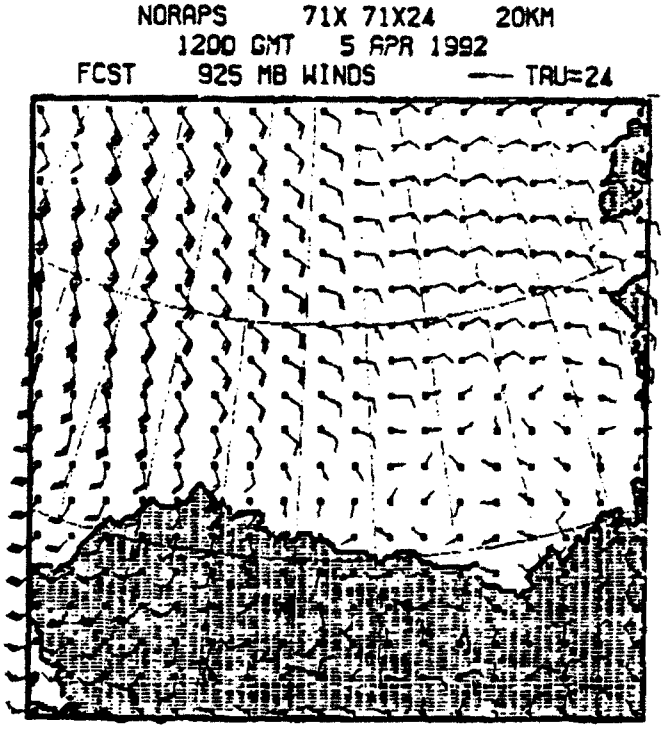
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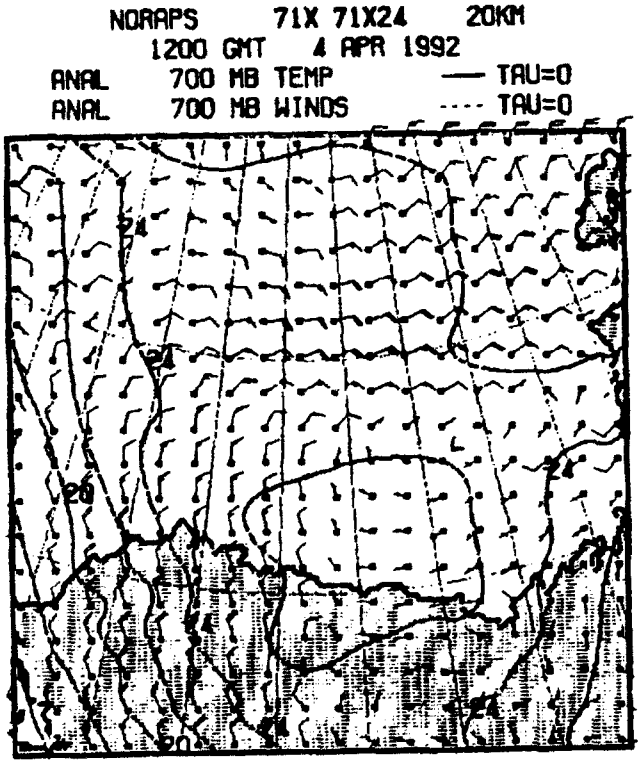
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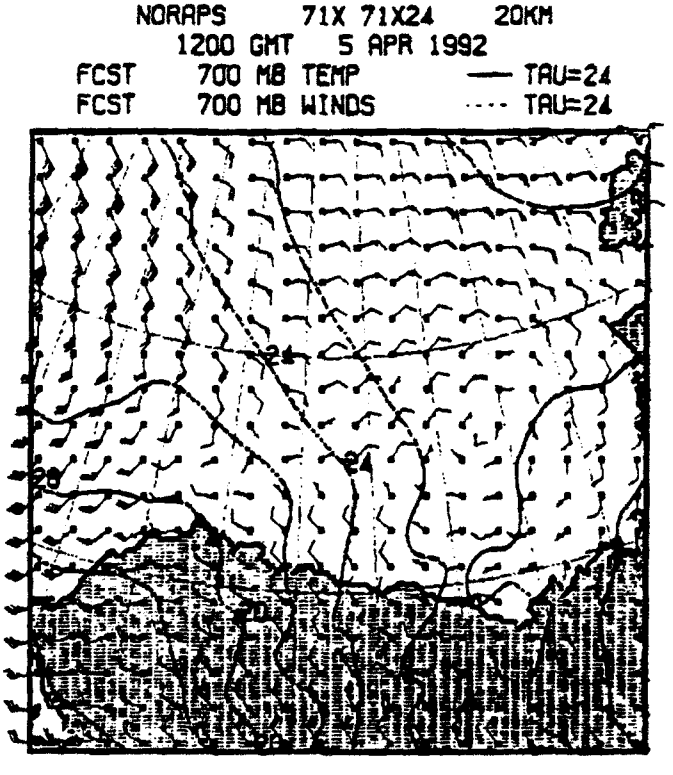
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5 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

05/0000Z Analyses

Surface Pressure

High pressure dominated the central and northern Beaufort with lower pressure along the North Slope.

10 M Winds

A weak cyclonic circulation is evident near 71N, 141W with a cyclonic turning of winds just west of Banks. Anticyclonic flow pervades the Arctic Sea to the north.

925 MB

Similar to the 10m pattern with a closed cyclonic circulation evident near 71N, 141W.

700 MB

A broad trough or shear line extends from the northwest tip of Banks SW'ward toward Barrow. Cyclonic turning of winds NW of Barrow indicates the approach of a new disturbance.

06/0000Z 24-hr Forecasts

Surface Pressure

A low is forecast to move into the region NW of Barrow with a significant tightening of the pressure gradient east of the low. A trough extends along the North Slope.

10 M

A cyclonic turning of winds or shear line is evident extending westward from the Mackenzie Delta toward Barrow and then NW"ward.

925 MB

Similar to 10m except the shear line is very strong NW of Barrow and strong 30-40 kt SW flow exists over the ice east and NE of the shear line.

700 MB

The shear line is slipped northward on this forecast chart and winds weaken in comparison to the 925 mb depiction. A second cyclonic shear line is evident a little further north at the longitude of the Mackenzie River Delta.

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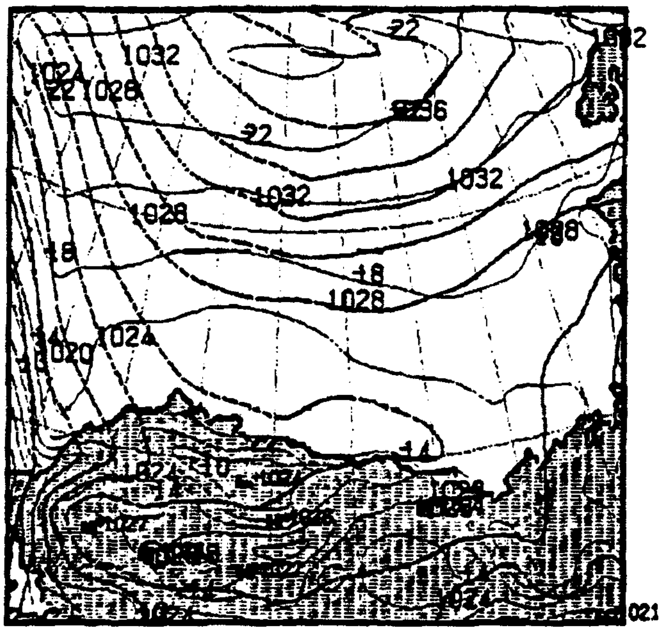

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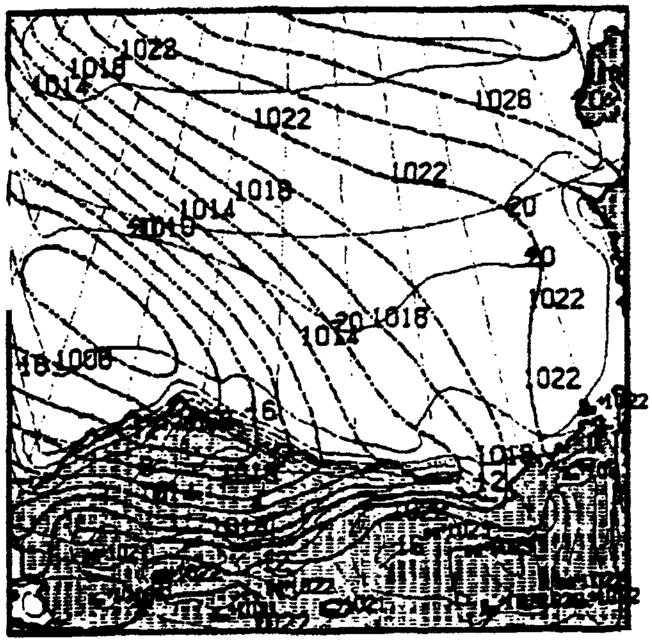

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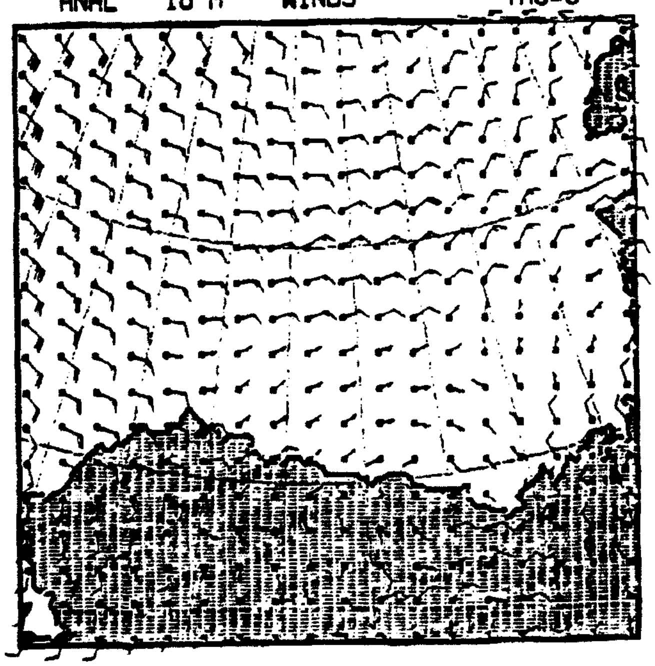

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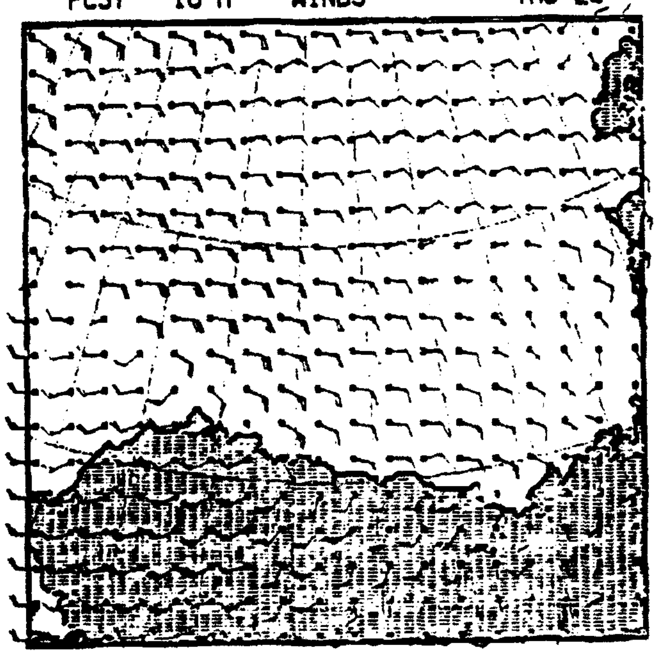

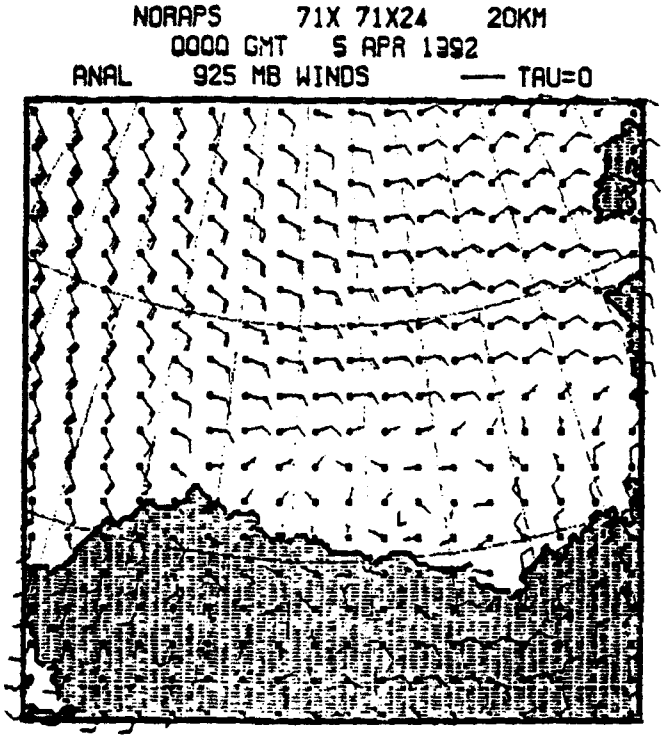
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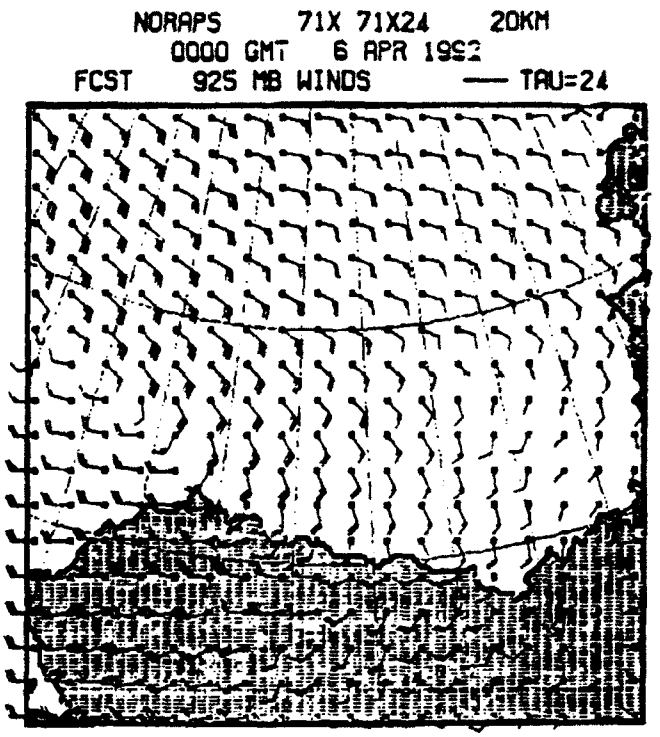
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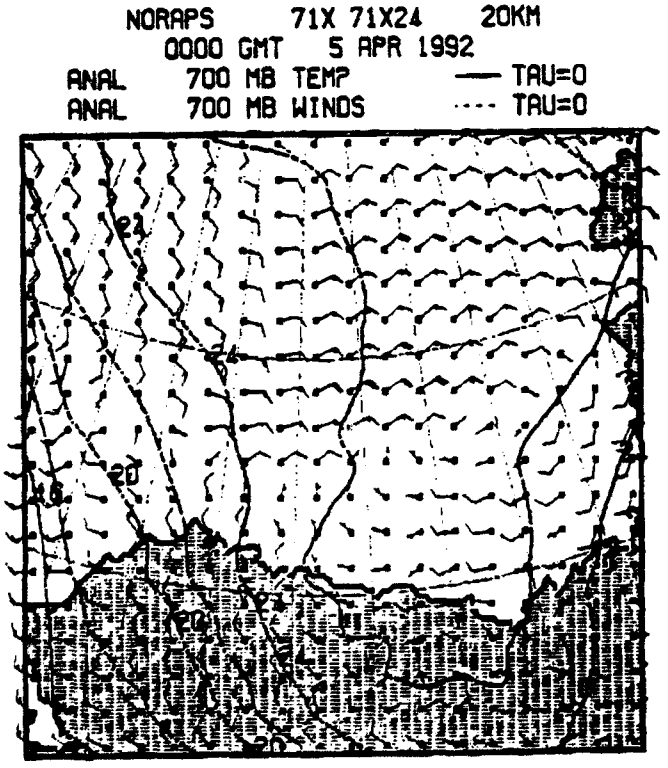
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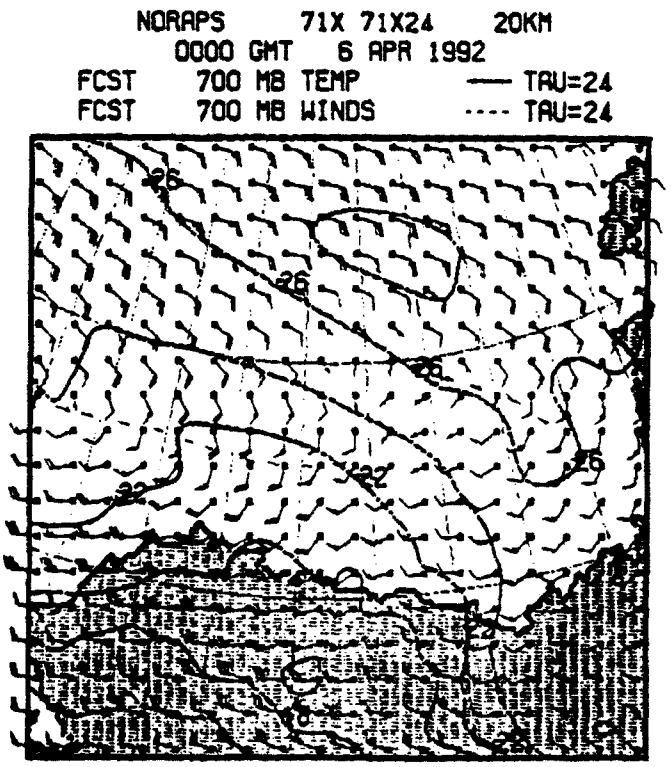
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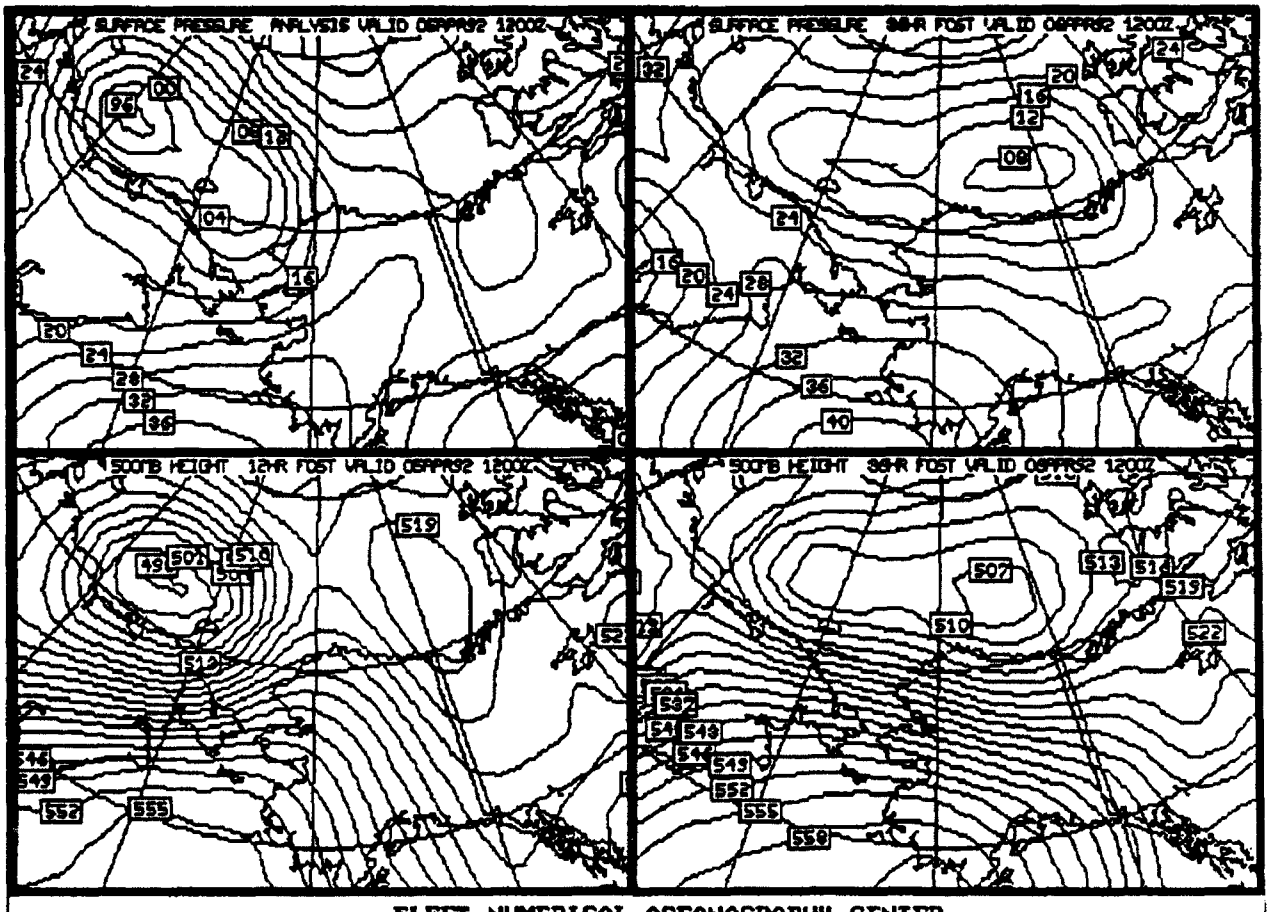
FCST 700 MB WINDS ---- TAU=24

5 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

05/1200Z Analyses and Forecasts (update)

By 06/1200Z an intense low is forecast to move past Barrow to a center position near 72.5N, 148W. This low, in fact, gave very strong winds in low visibilities along most of the North /slope. Visibilities decreased to near zero in blowing snow. The ice camp conditions were less severe being closer to the low's center. The 10m wind forecast reflects the pronounced SE-NW alignment of the axis of the low. The low moves into a pre-existing cyclonic shear region at the 700 mb level with a well defined circulation center near 72N, 148W by 06/1200Z. The **NOGAPS** forecast is excellent in forecasting the movement and location of this **more intense** feature. The low is a deep cold core system as evidenced by its presence at 500 mb (06/1200Z).



FLEET NUMERICAL OCEANOGRAPHY CENTER

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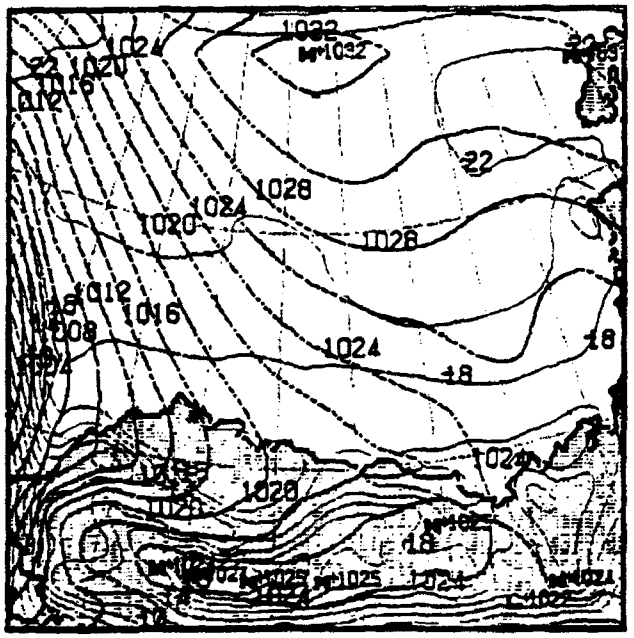

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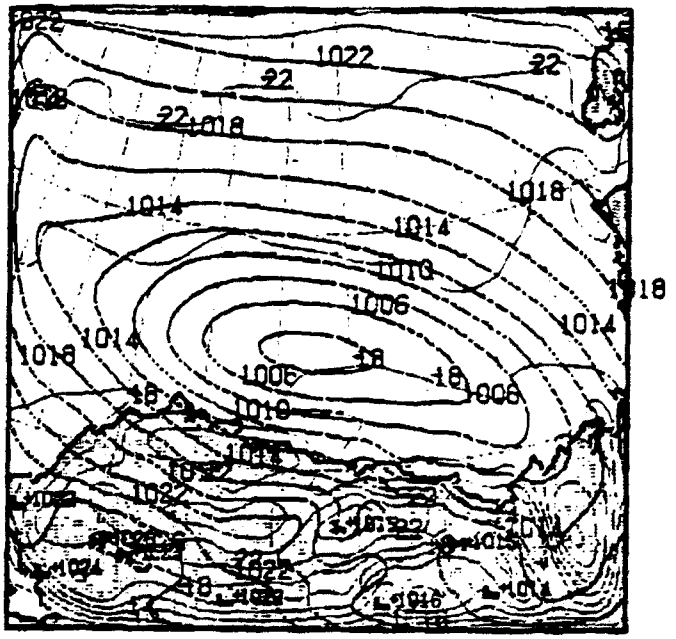

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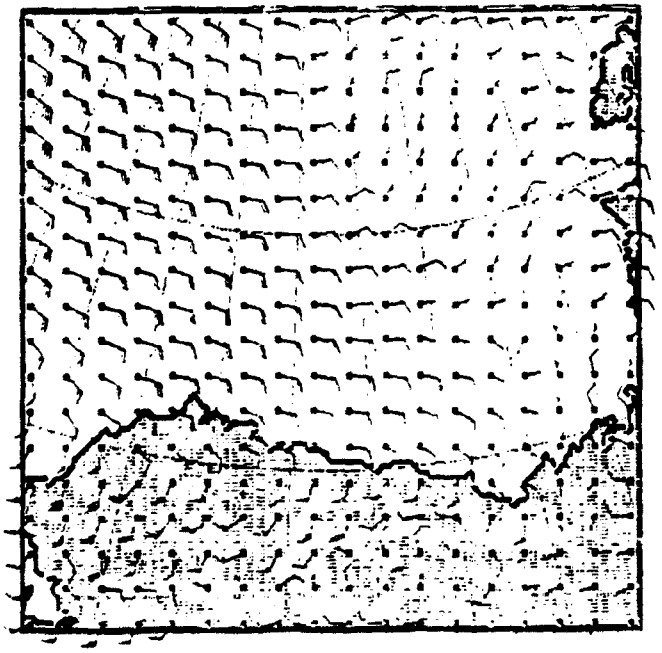

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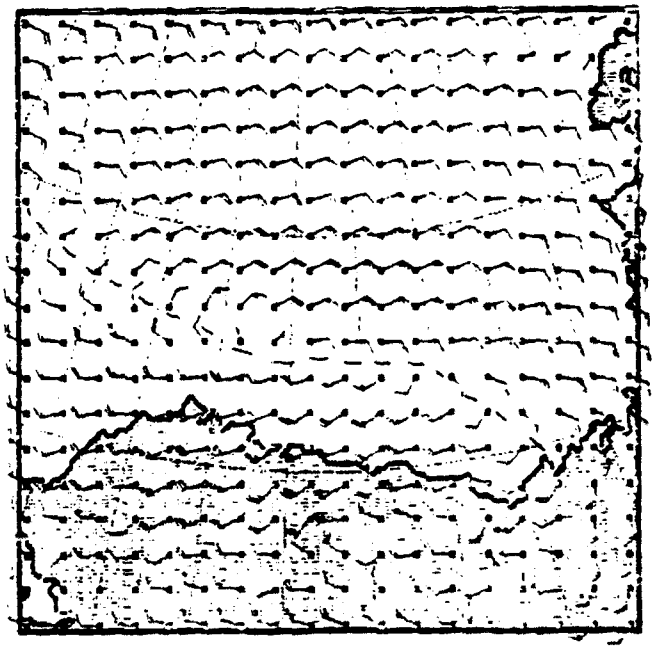

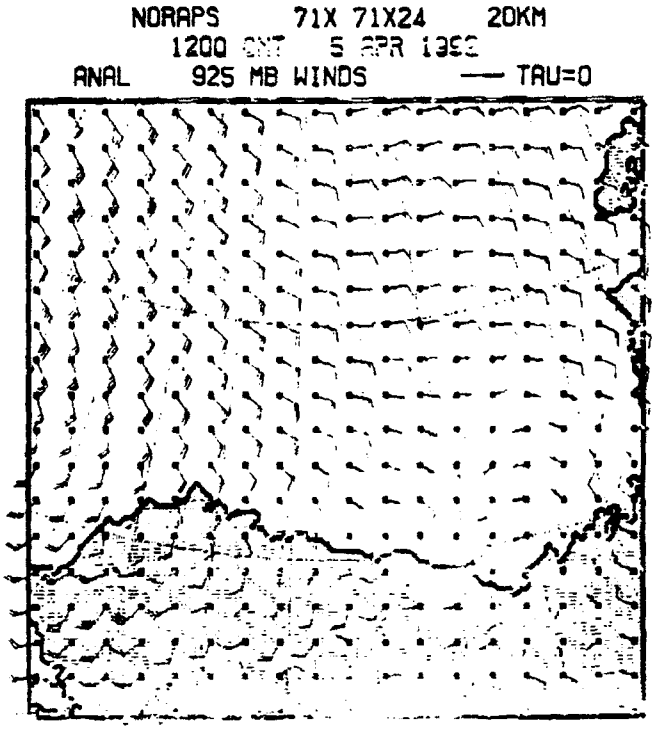
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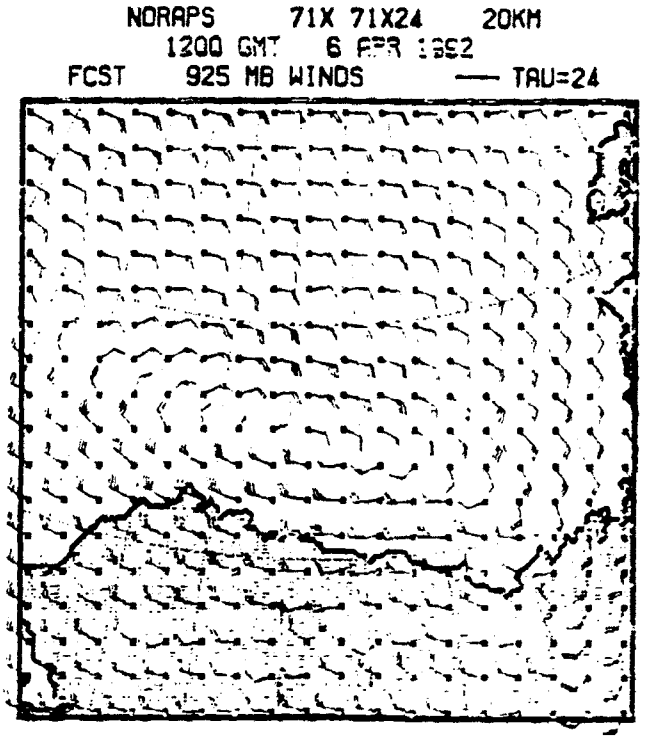
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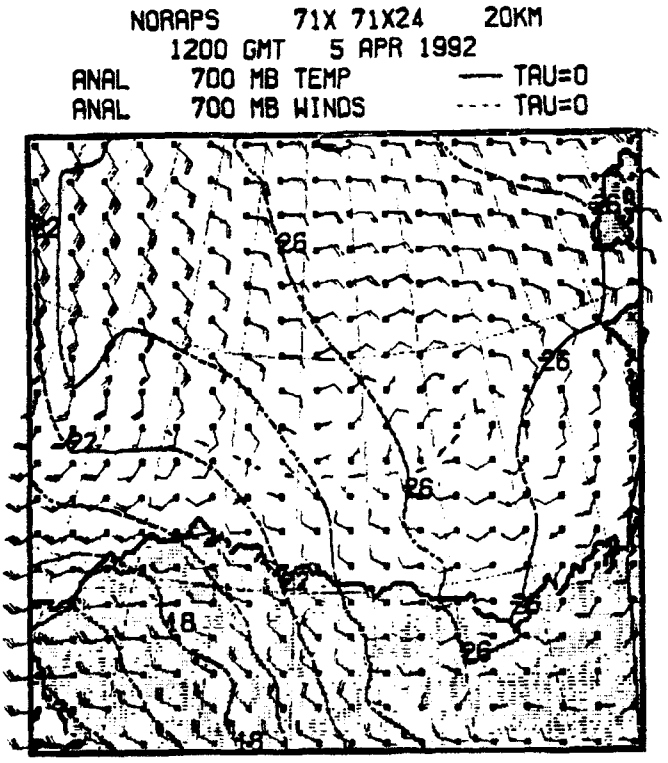
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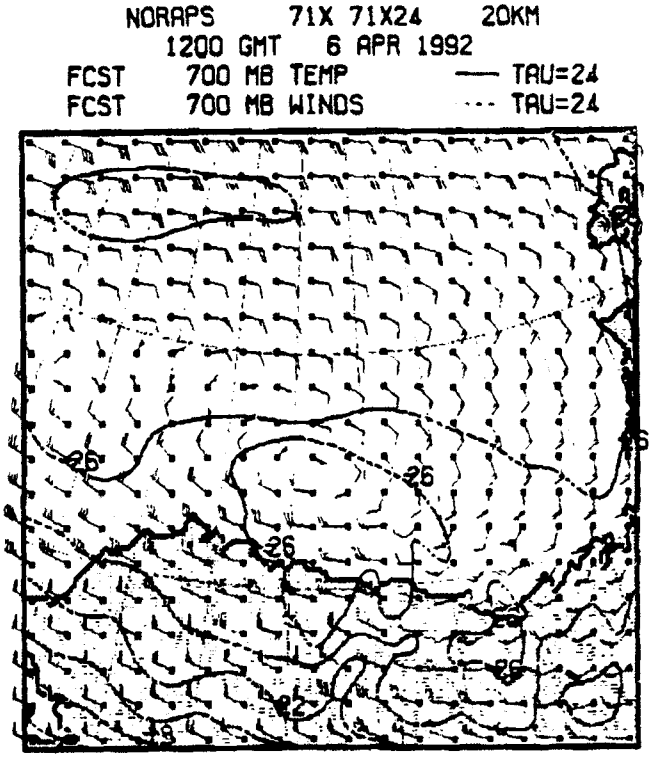
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6 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

06/0000Z Analyses

Surface Pressure

A low moved into the area as forecast to a position north of Barrow.

10 M Winds

These winds reflect the cyclonic circulation about the low. The ice camp was experiencing clear conditions in light easterly flow at the time of this analysis.

925 MB

The elongated nature of the low with 20-30 kt winds east and NE of its center is shown by this analysis.

700 MB

The low center is displaced well to the northwest. Cyclonic flow brings westerly winds along the North Slope turning to southerlies and southeasterlies further north.

07/0000Z 24-hr Forecasts

Surface Pressure

The low is forecast to move rapidly eastward to a position north of the Mackenzie River Delta by 07/0000Z.

10 M

These winds reflect the rapid eastward movement of the low.

925 MB

Moderate 25 kt northerly winds now replace the light southeasterly winds over the ice camp earlier in the day.

700 MB

An elongated shear line extends NW'ward from a 700 mb cyclonic center SE of Banks.

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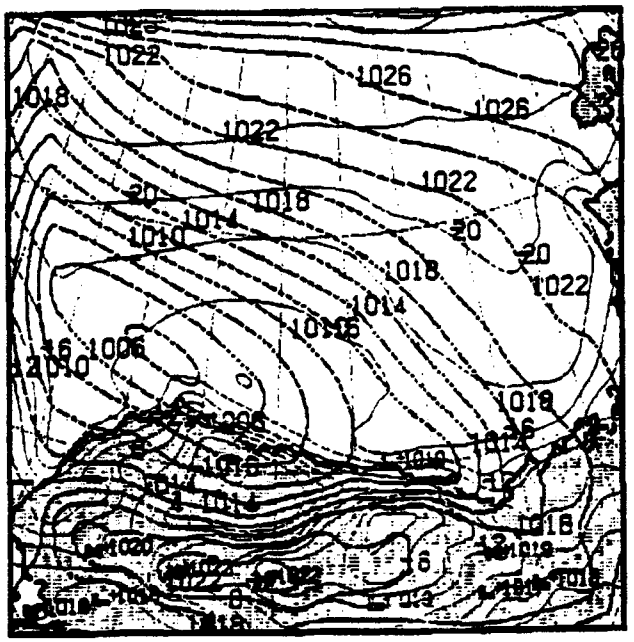

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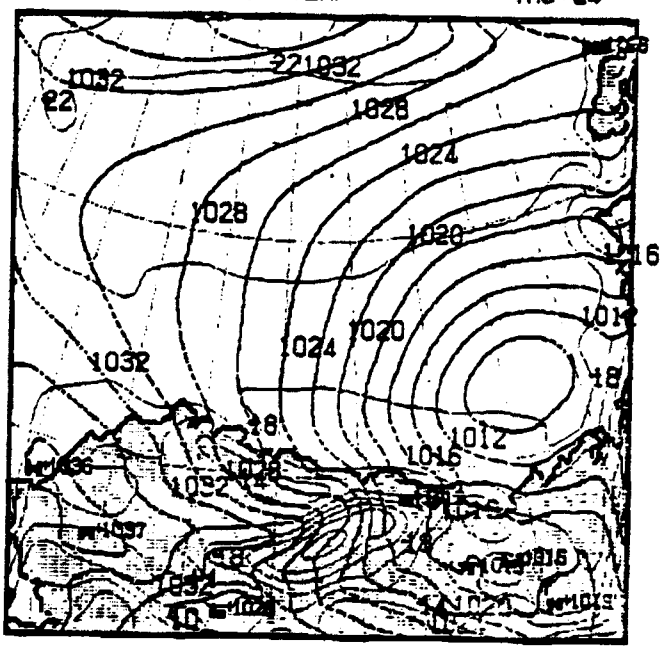

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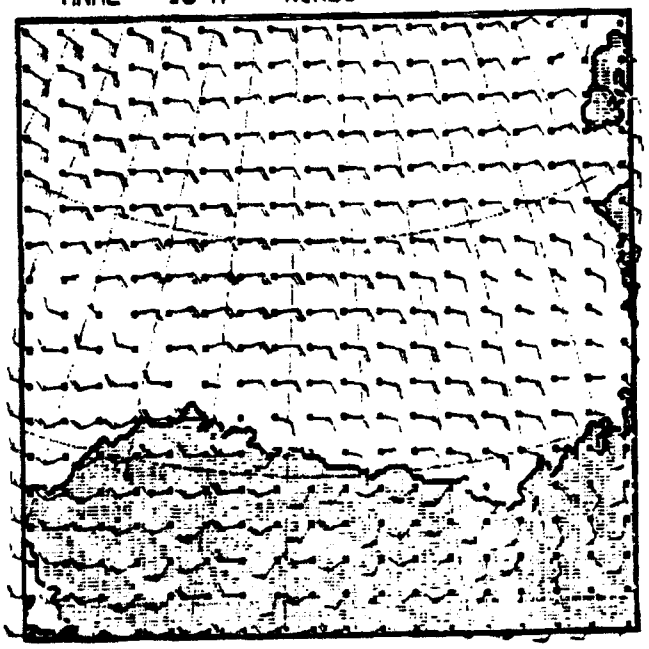

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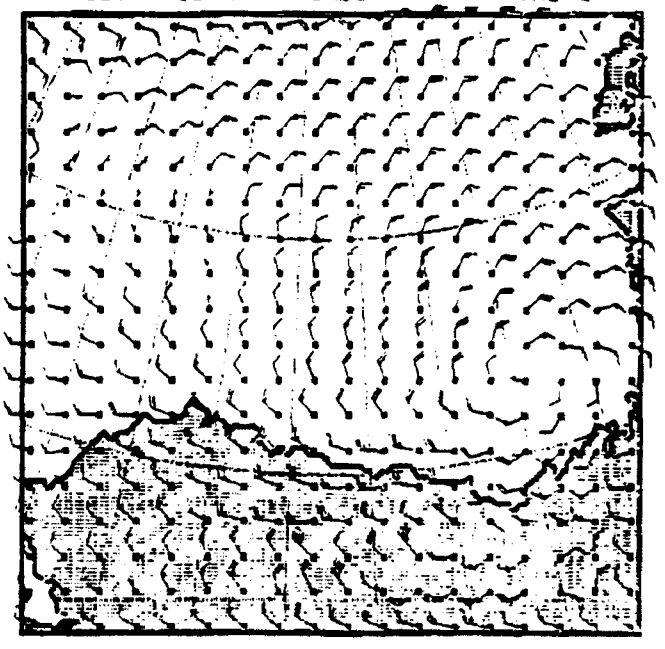

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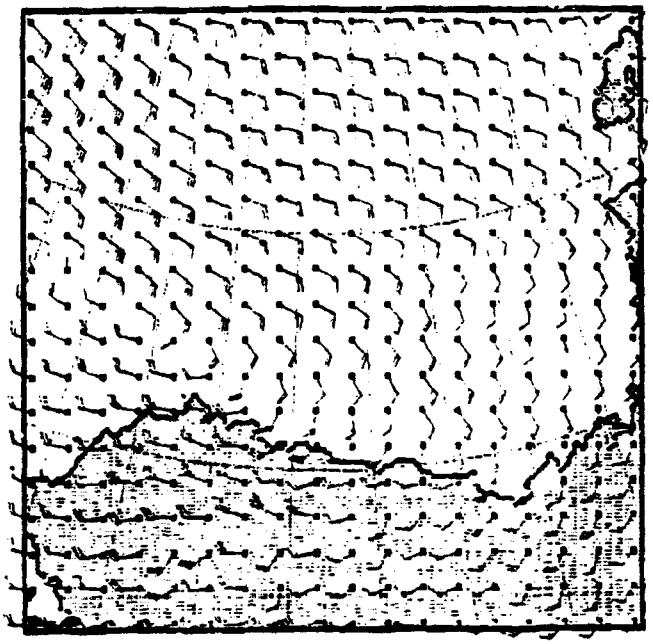

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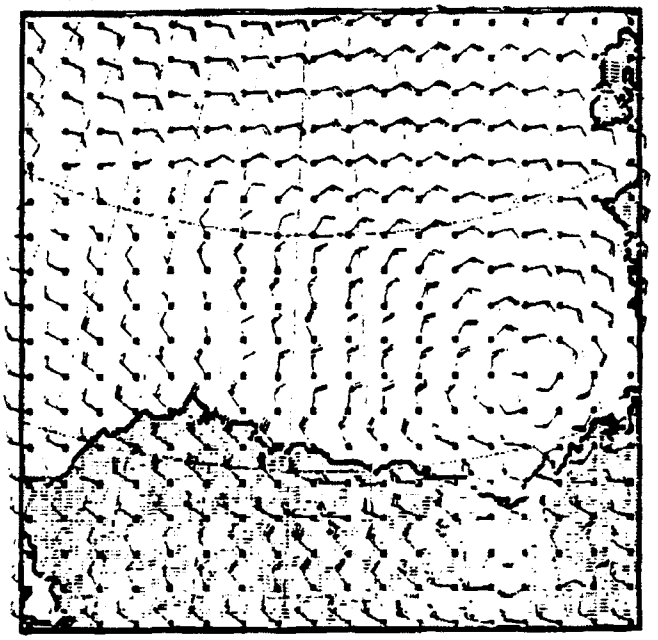

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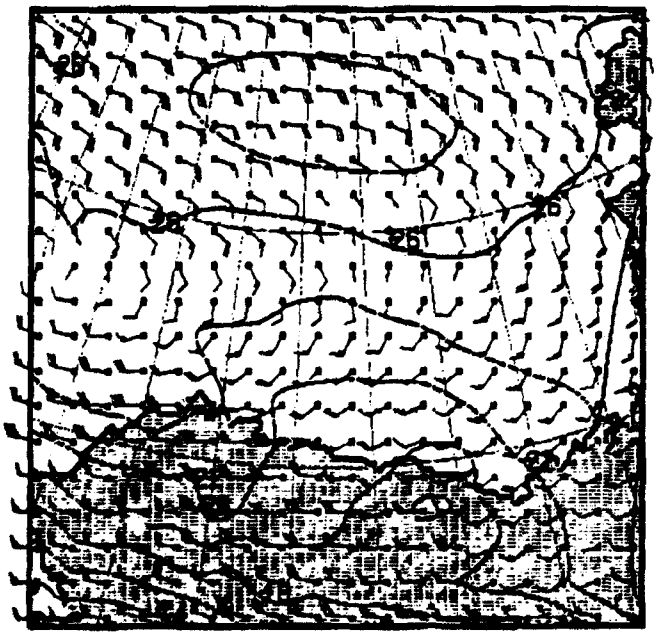

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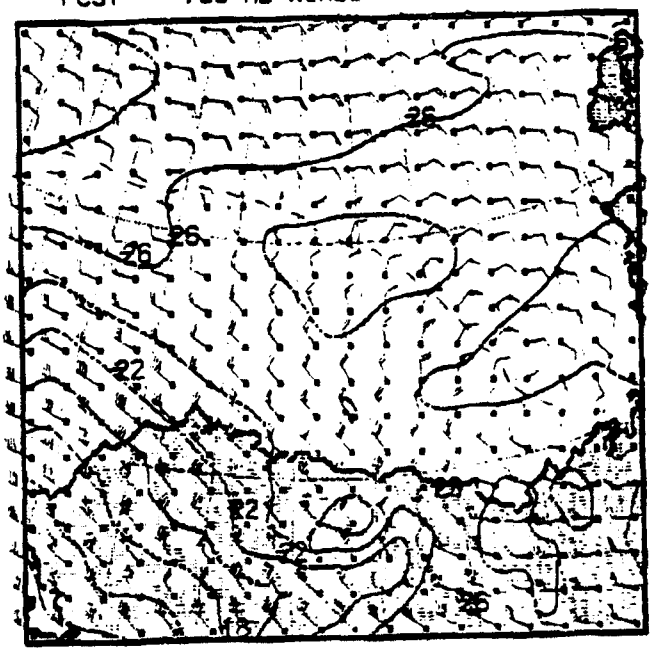
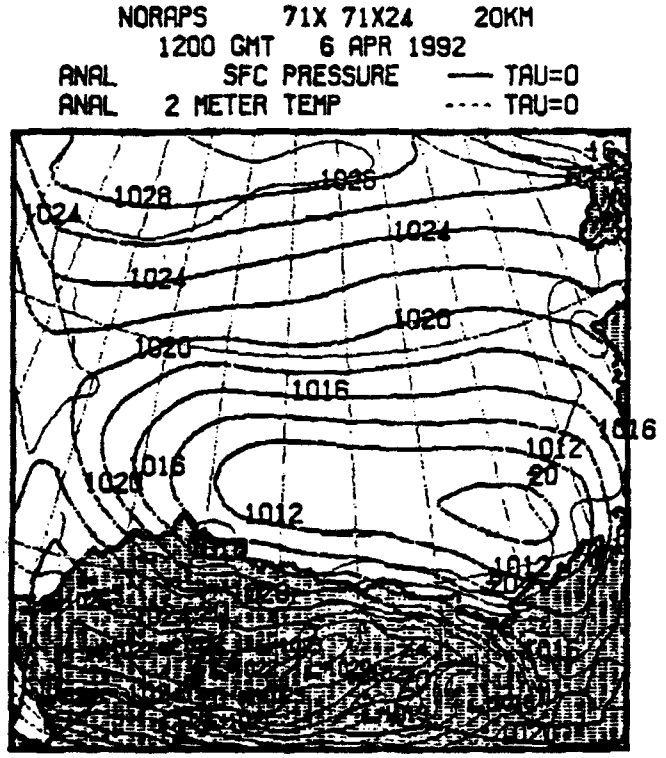


6 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

06/1200Z Analyses and Forecasts (update)
The elongated structure of the low in an E_W direction combined with higher pressure moving up into northern Alaska produced a very tight gradient along the North Slope. Winds persisted blowing in excess of 30 kts from the west for most of the stations for most of the day. Satellite data revealed significant changes in lead structure because of this storm with large floes of former fast ice breaking loose just east of Barrow (Compare data 06/2346Z with earlier 26 March satellite data).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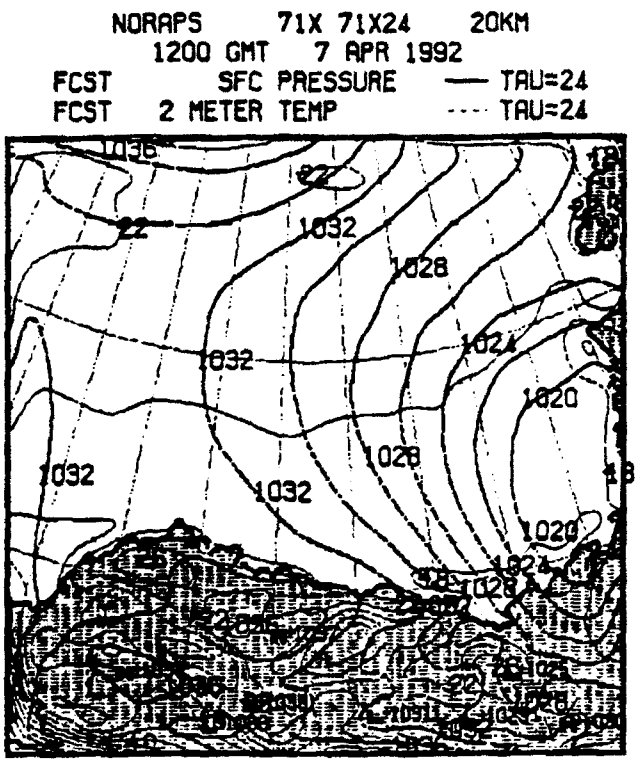
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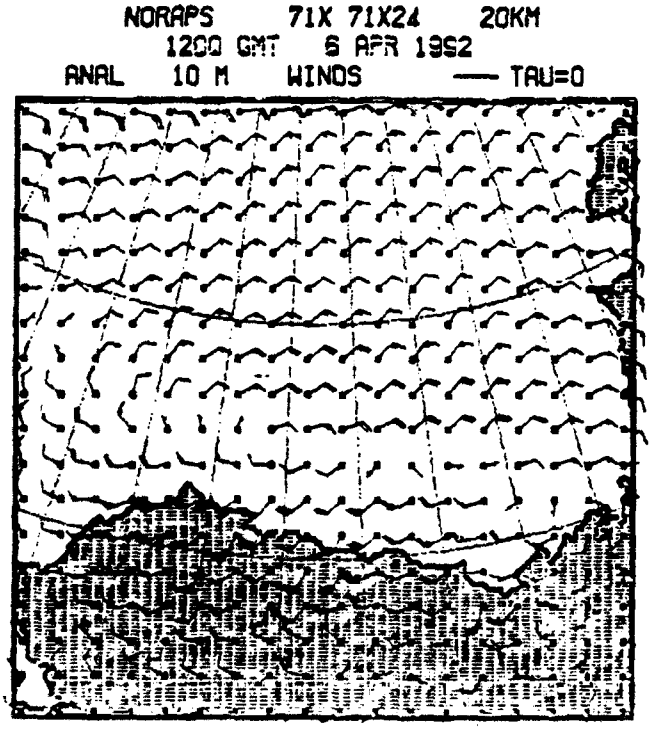
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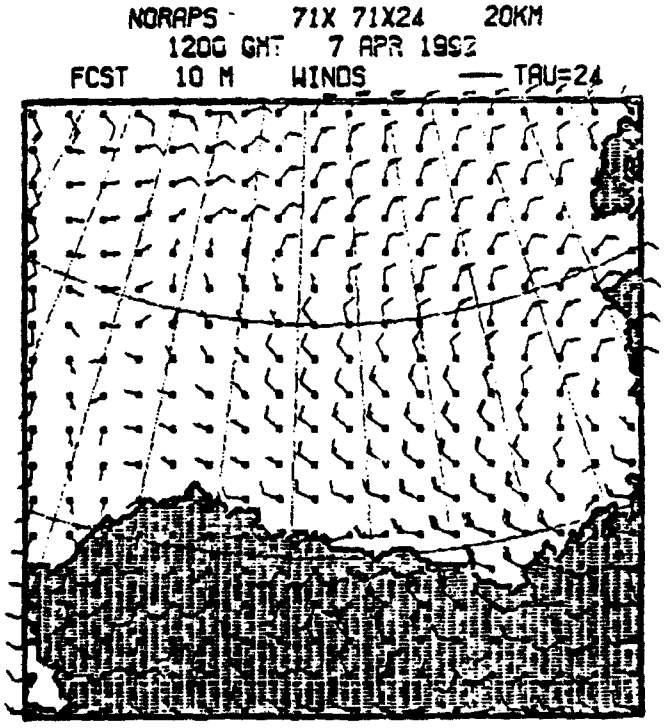
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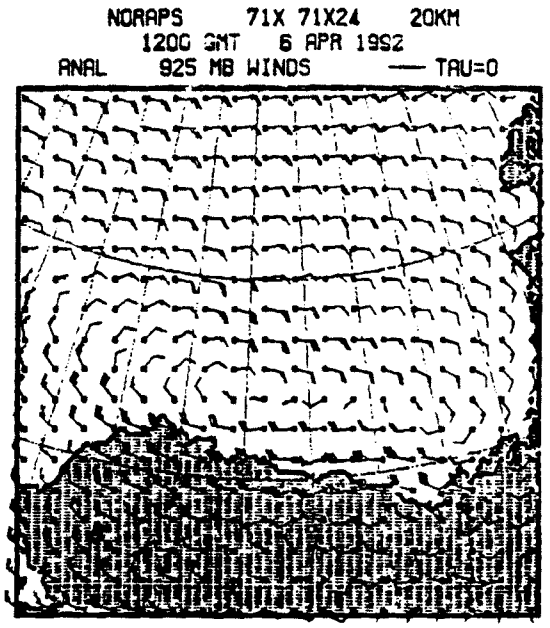
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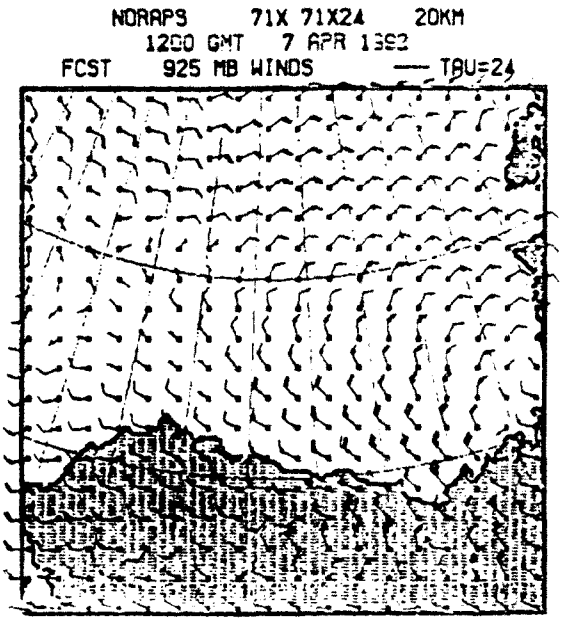
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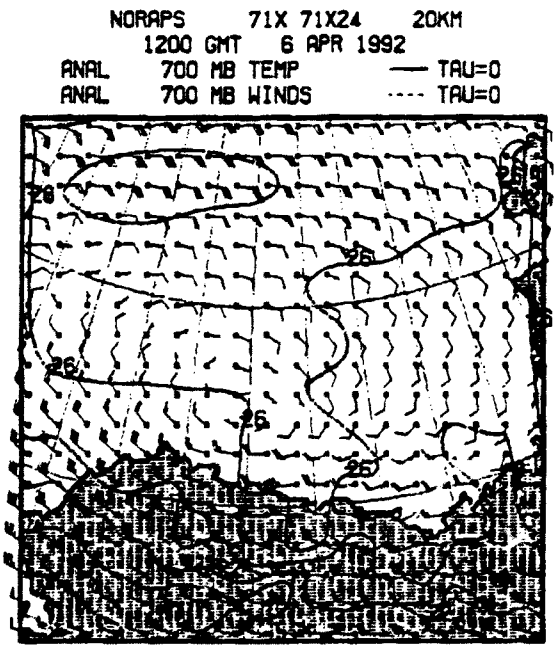
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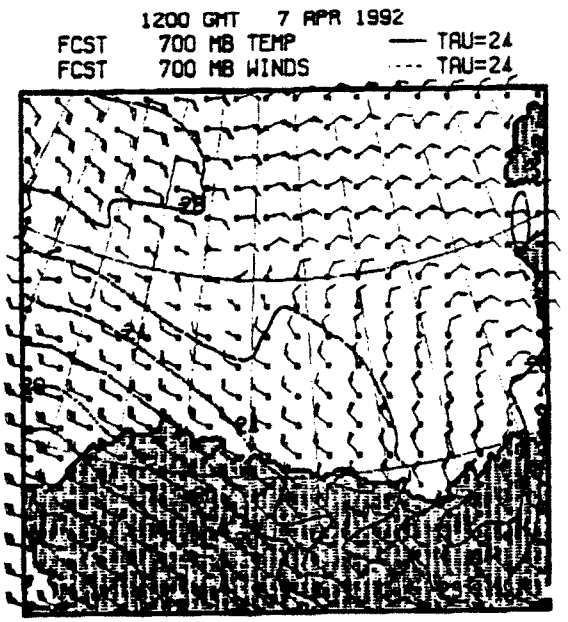
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7 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

07/0000Z Analyses

Surface Pressure

A 1012 mb low is analyzed west of Banks with a trough extending from this low SW toward Deadhorse.

10 M Winds

The trough is reflected in a cyclonic shear extending toward Deadhorse.

925 MB

The low is well organized as a closed circulation at this level.

700 MB

This level also shows a closed circulation around the low west of Banks.

08/0000Z 24-hr Forecasts

Surface Pressure

High pressure is forecast to move in over the western Beaufort while the low near Banks moves only slightly SE'ward.

10 M

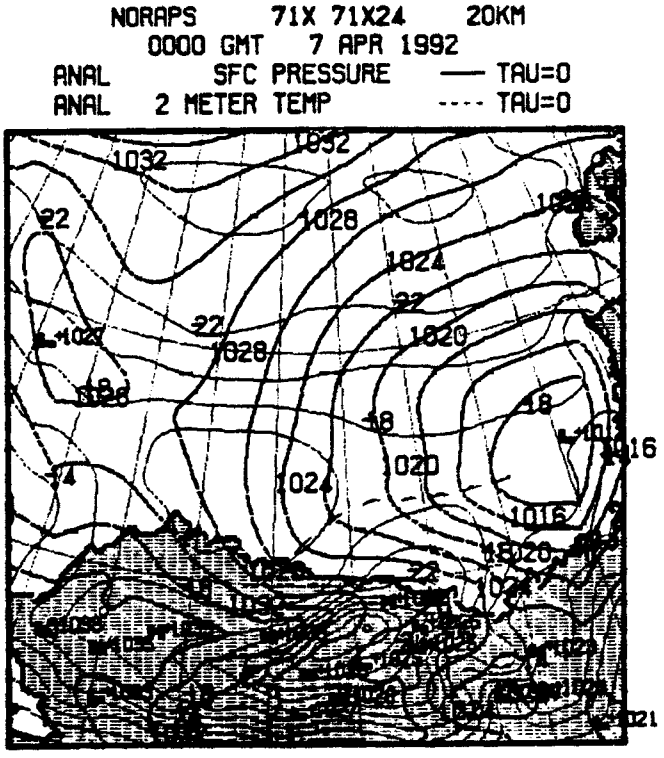
Pronounced diffluence is shown over the Beaufort along 150W longitude.

925 MB

The cyclonic circulation from the Banks low extends to Deadhorse. A col is shown north of Barrow while another low is evident to the west.

700 MB

Strong WNW winds enter from the west extending beyond the Mackenzie Delta. A trough crosses the central Beaufort from SE to NW.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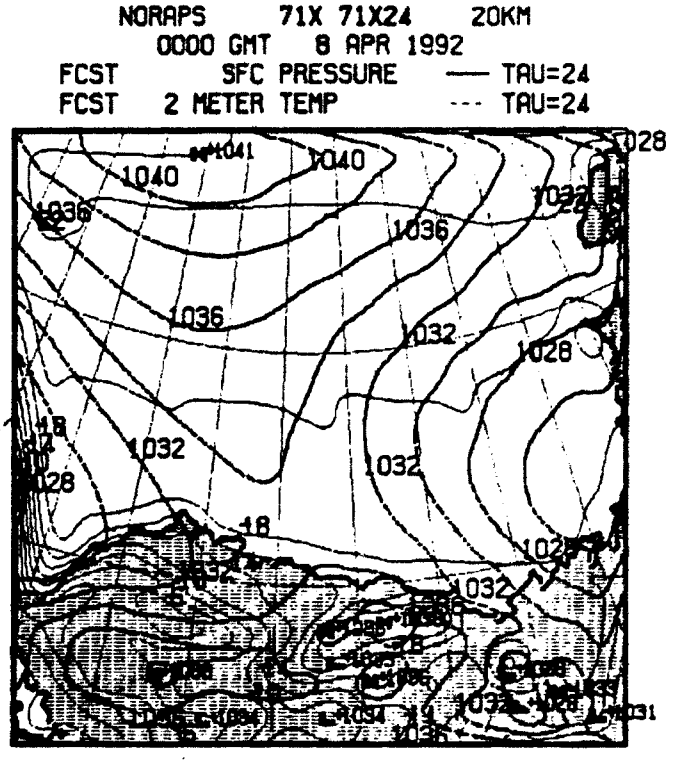
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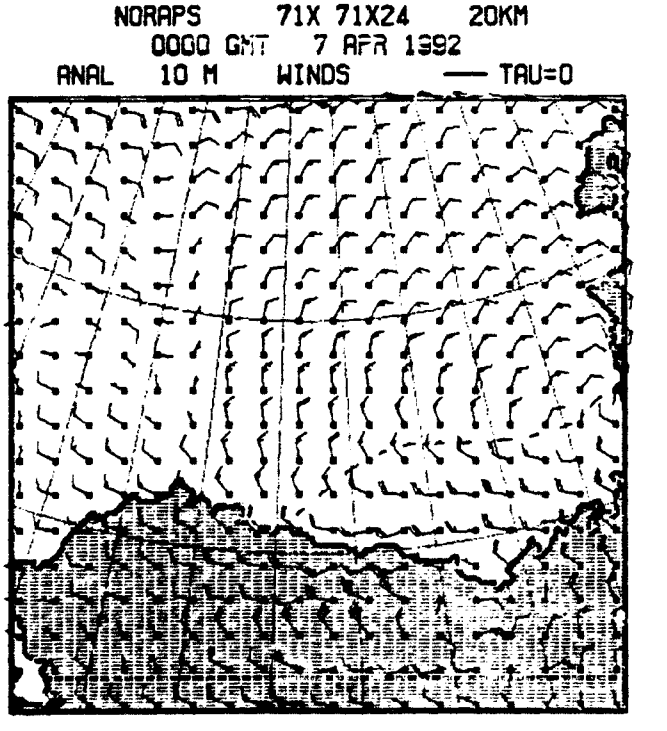
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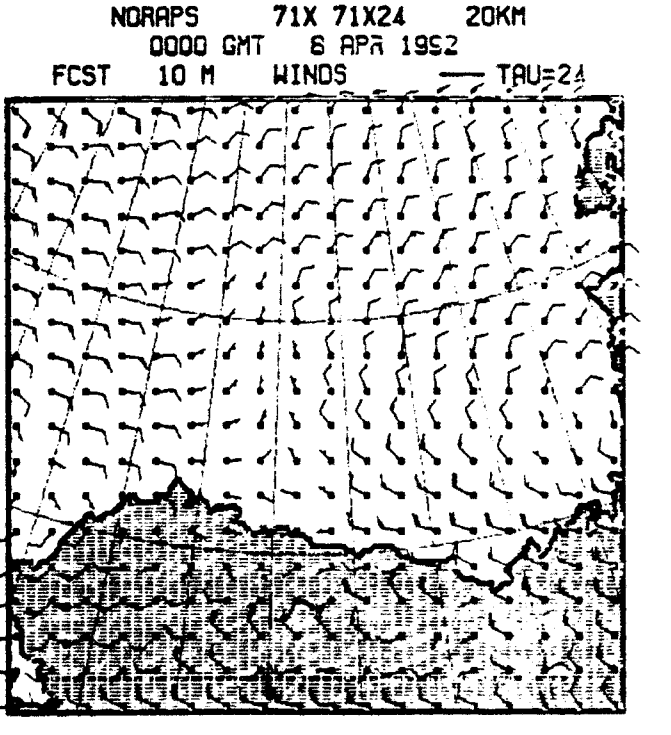
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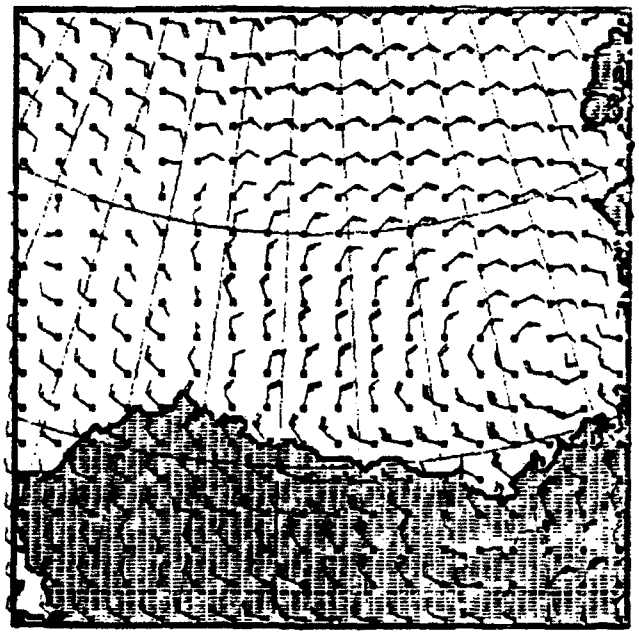

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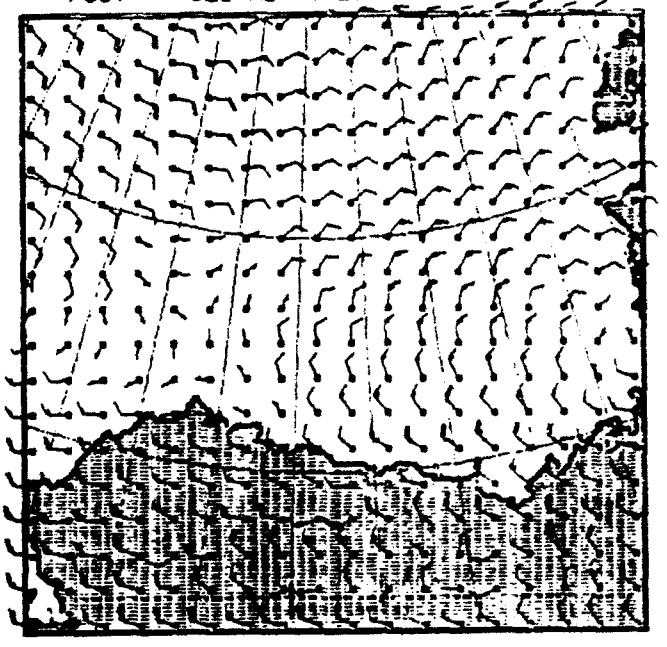

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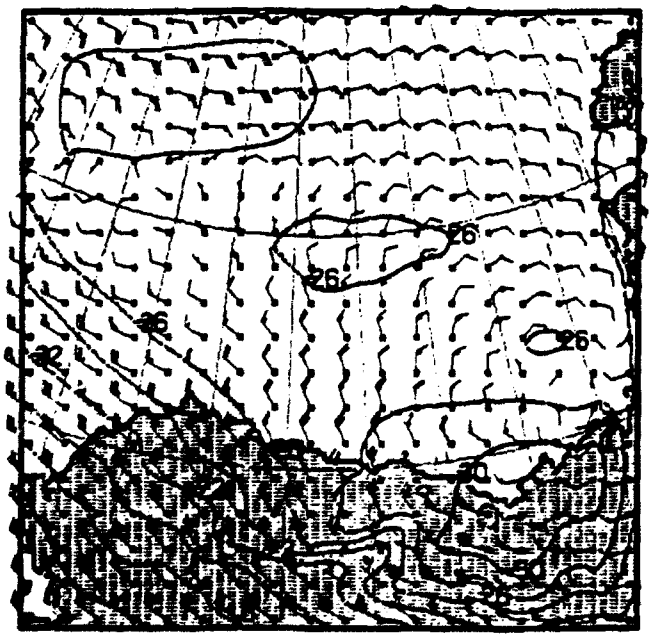

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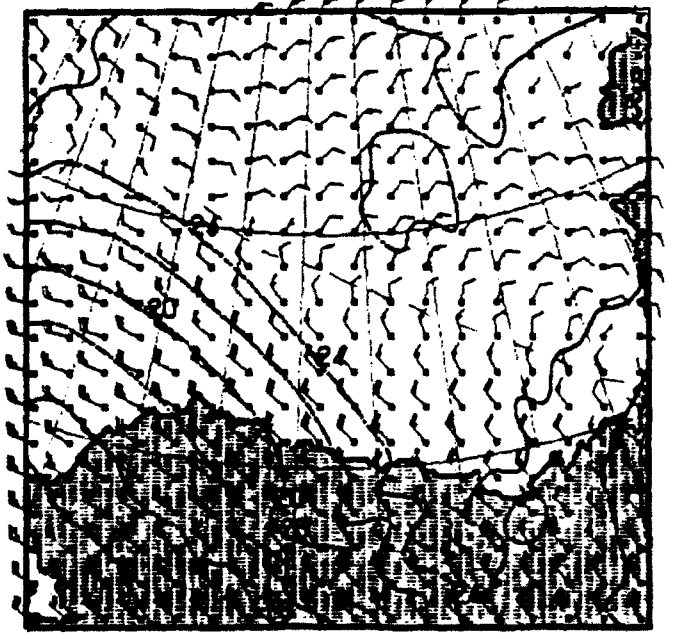
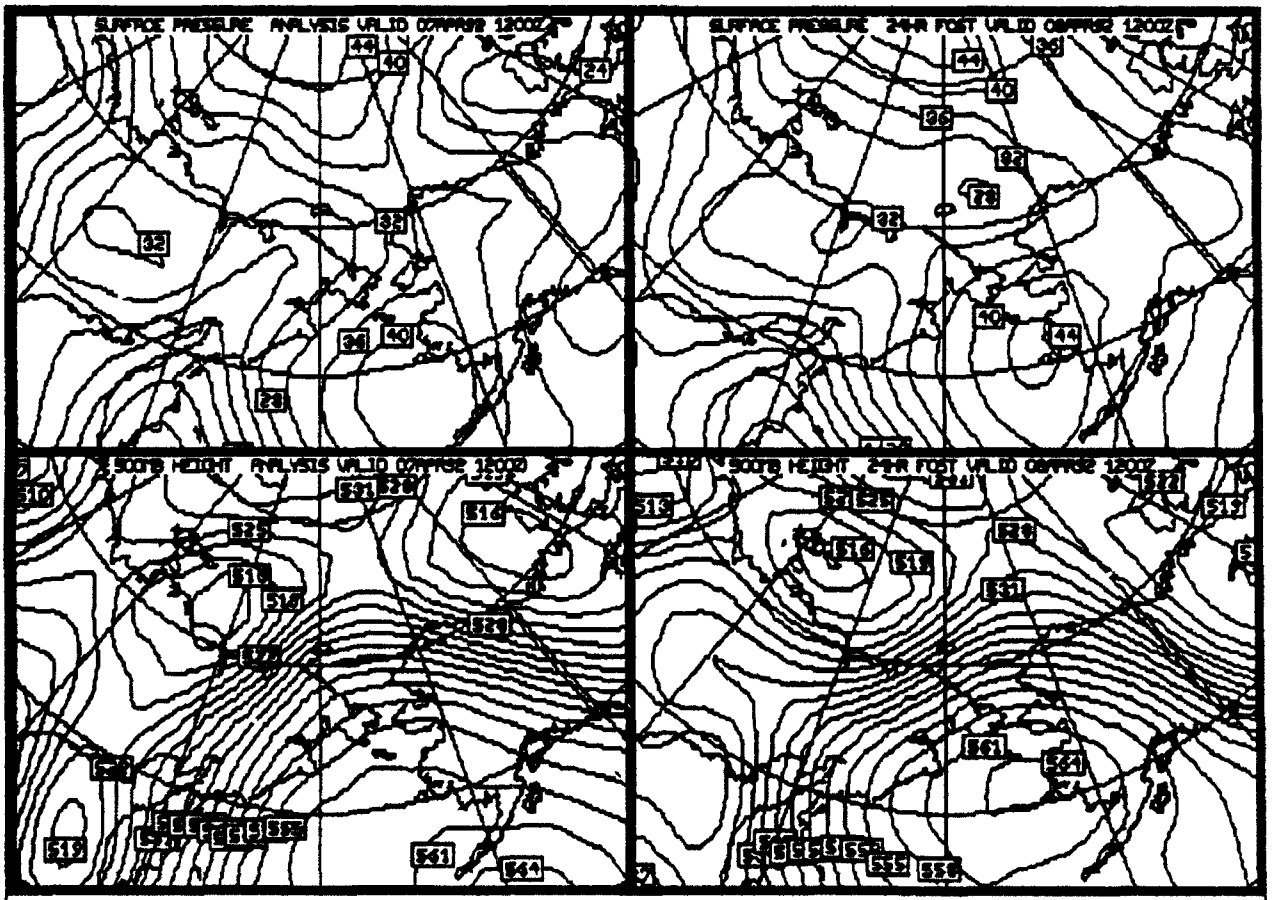


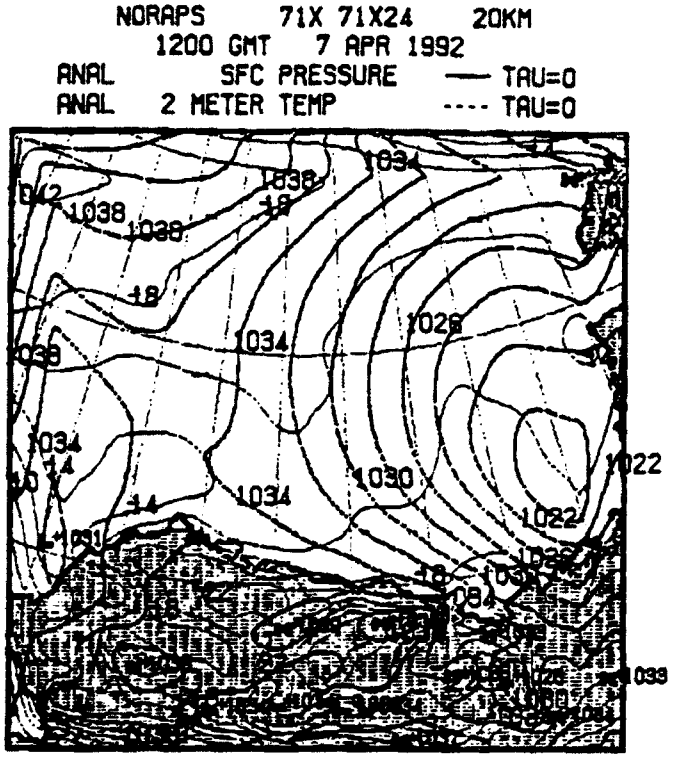
7 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

07/1200Z Analyses and Forecasts (update)
Low pressure is verified remaining just west of Banks. A weak circulation is still forecast to remain in that location at **10 M** by 08/1200Z and is reflected as an area of cyclonically turning winds at **925 MB** and at **700 MB**. Strong cold air advection in northerly flow over the central Beaufort expected to bring much lower temperatures. **NOGAPS** surface analysis appears in good agreement with NORAPS. **Satellite data** show excellent lead configurations on this date.



FLEET NUMERICAL OCEANOGRAPHY CENTER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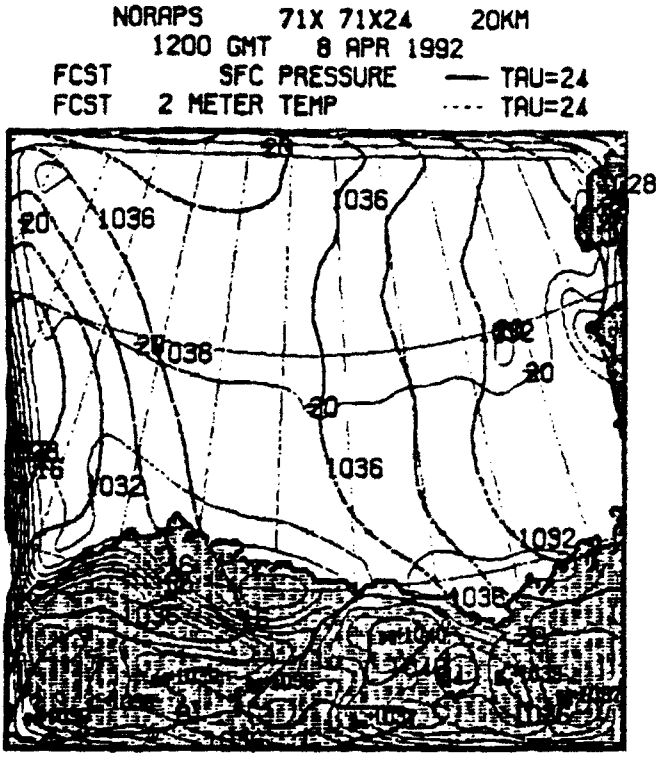
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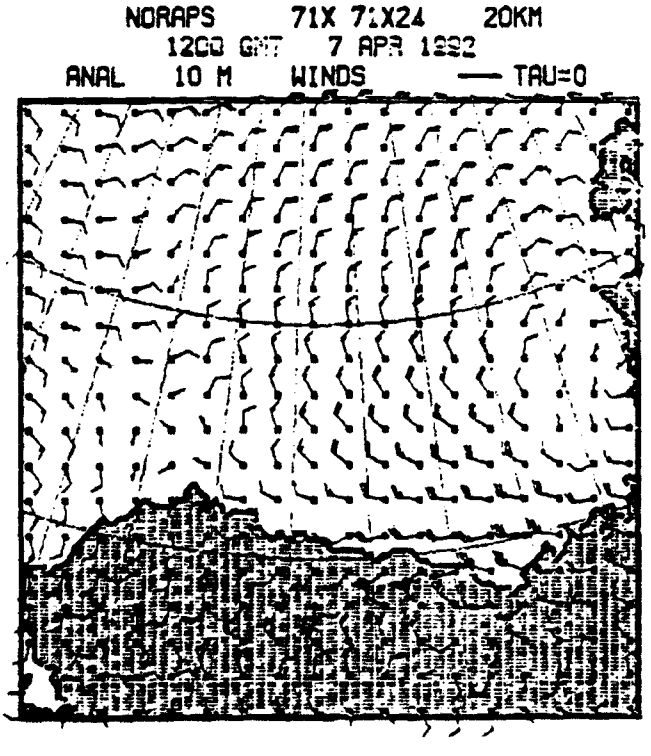
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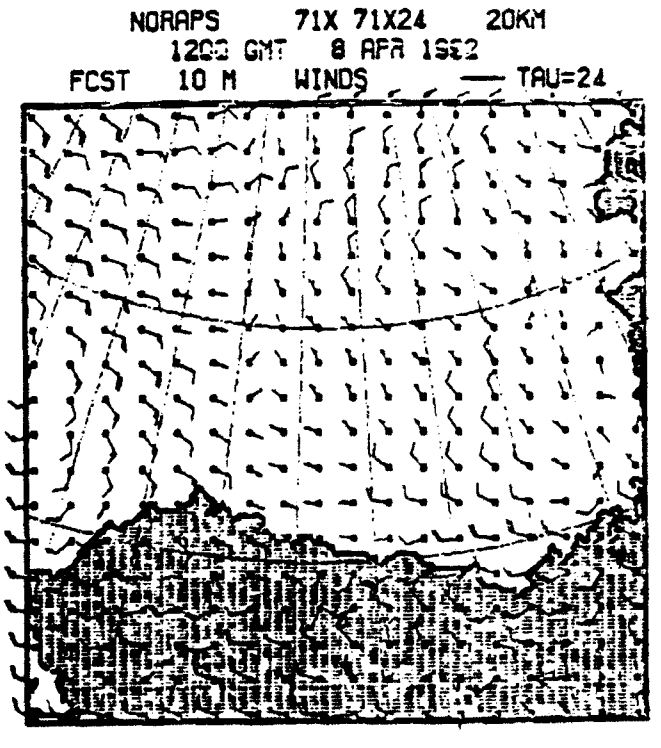
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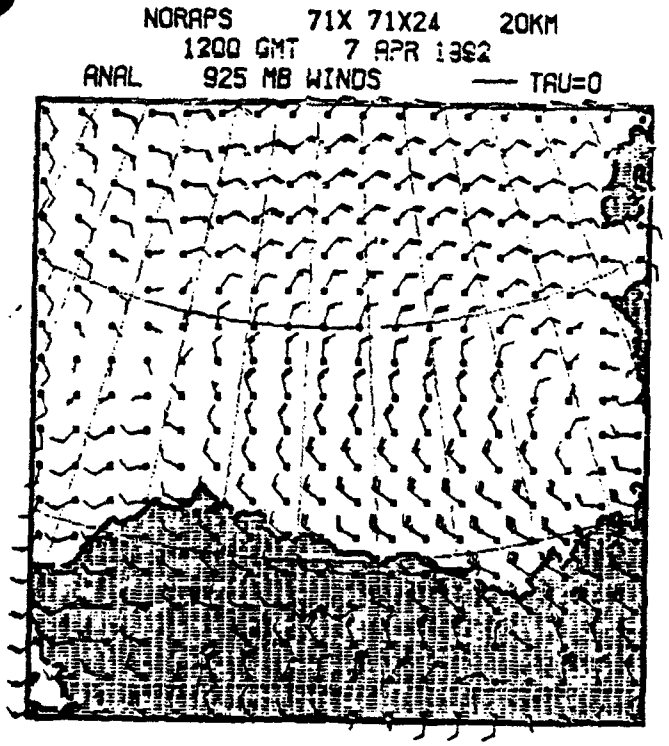
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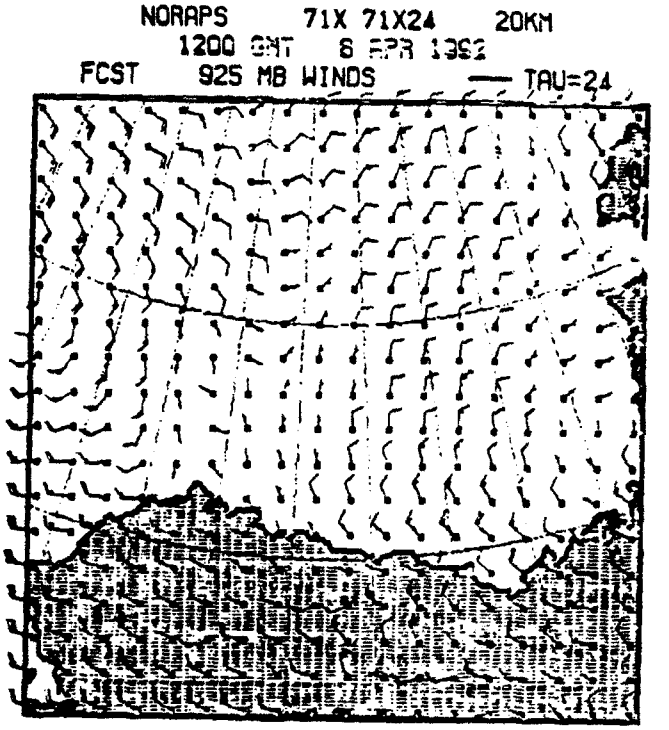
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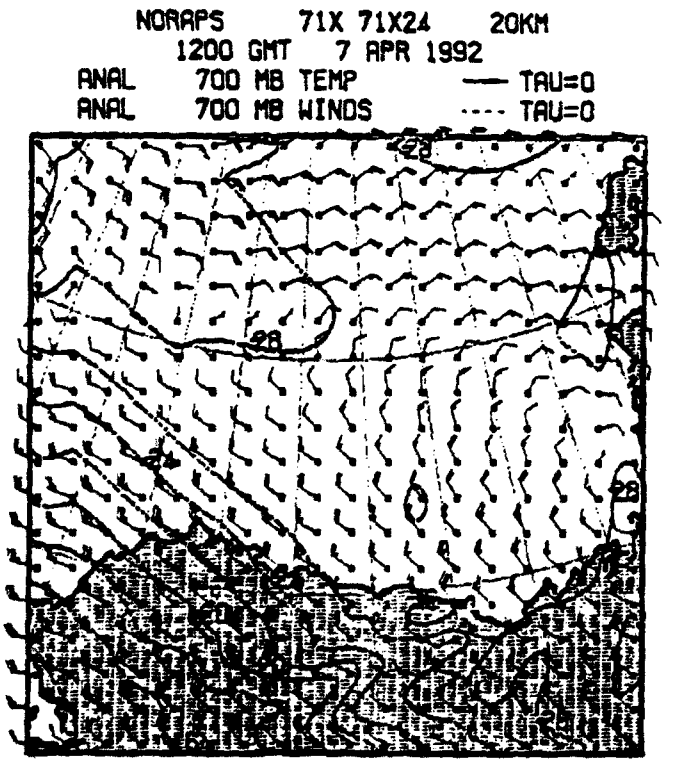
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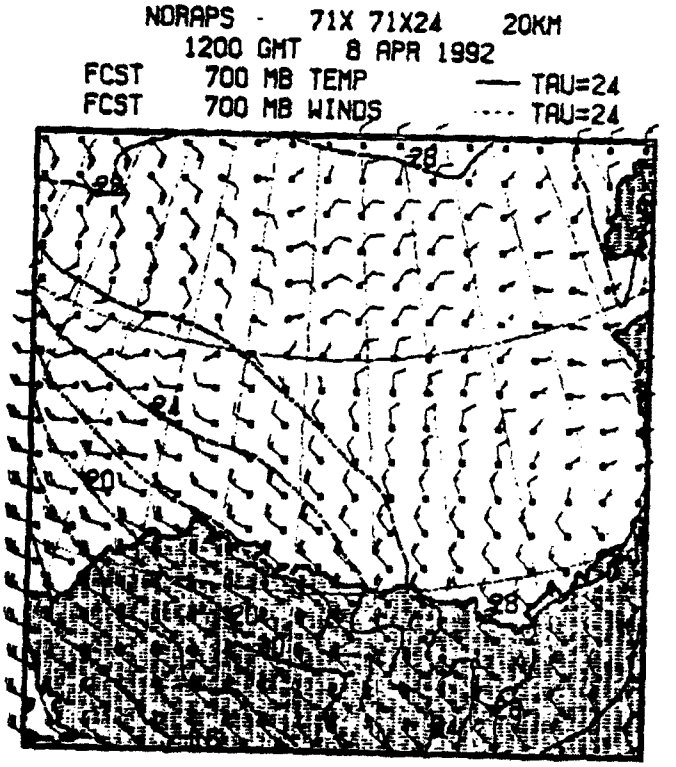
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FCST 700 MB WINDS ---- TAU=24

8 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

08/0000Z Analyses

Surface Pressure

Ice camp position 72.9N,145.7W. Cyclonic flow extends over the ice camp linked to low north of Tuktoyaktuk Peninsula. A col separates this low from a new low west of Barrow.

10 M Winds

Diffluence shown in col region NNE of Barrow. Winds turn mainly cyclonically from northerly in northern Beaufort to westerly along the North Slope east of Barrow.

925 MB

Similar flow regime as 10m but with higher wind speeds.

700 MB

A closed cyclonic circulation is shown west of Banks. Moderate westerly winds cover most of the northern Beaufort from Barrow to Herschel Island.

09/0000Z 24-hr Forecasts

Surface Pressure

The col region moves eastward over the ice camp area as a new low enters the region NW of Barrow.

10 M

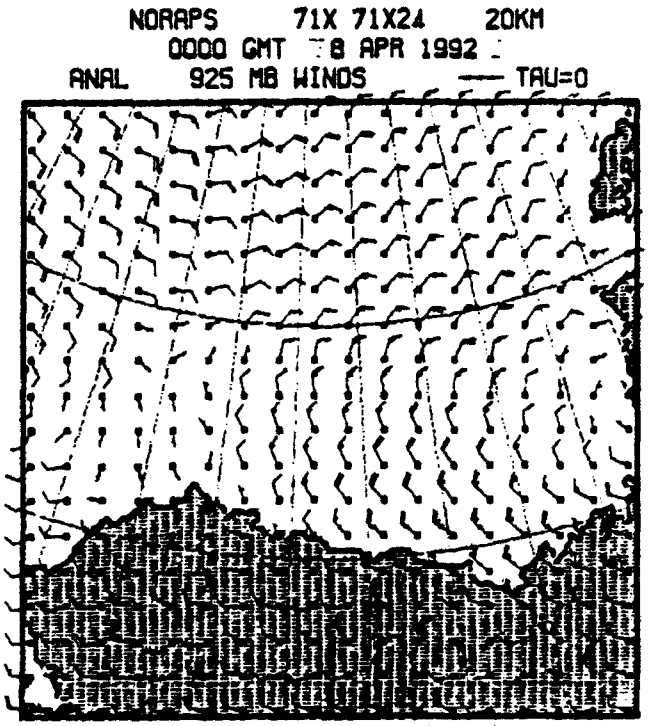
The new low is shown as a synoptic-scale circulation. The area of diffluence has moved eastward.

925 MB

Very similar forecast as that for the 10m level.

700 MB

The new low is displaced northward while moderate westerly to northwesterly winds flow across the North Slope.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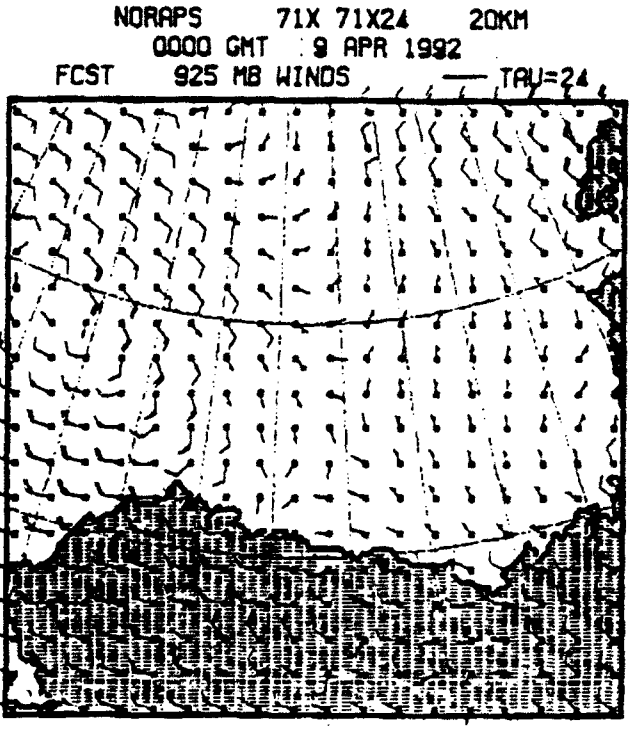
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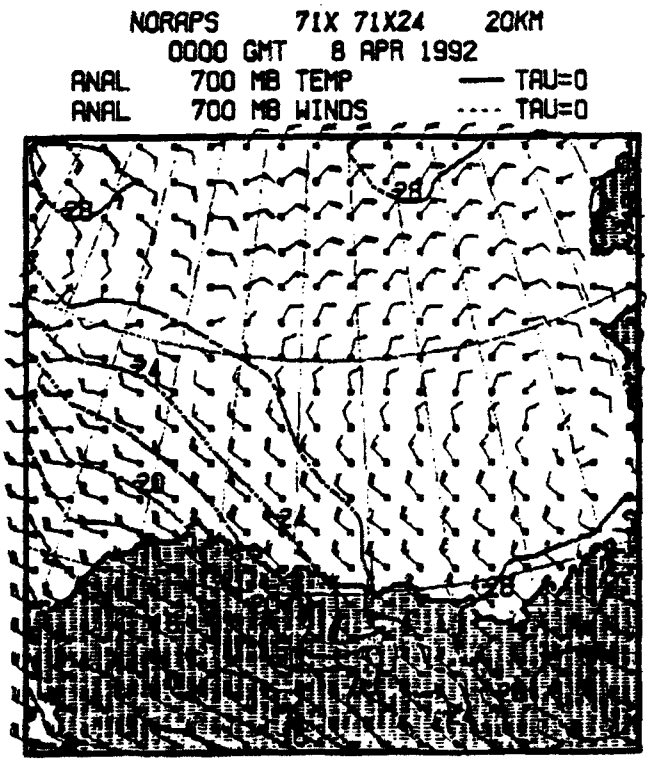
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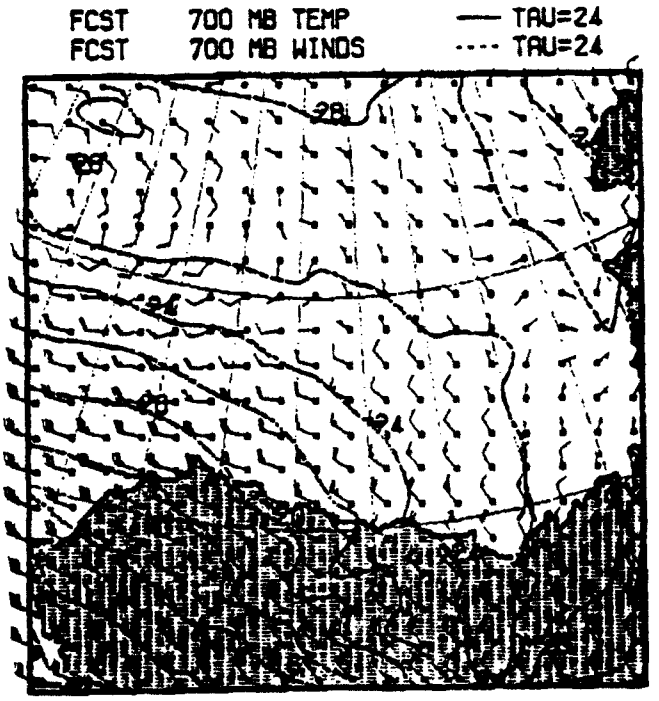
ANAL 700 MB WINDS ···· TAU=0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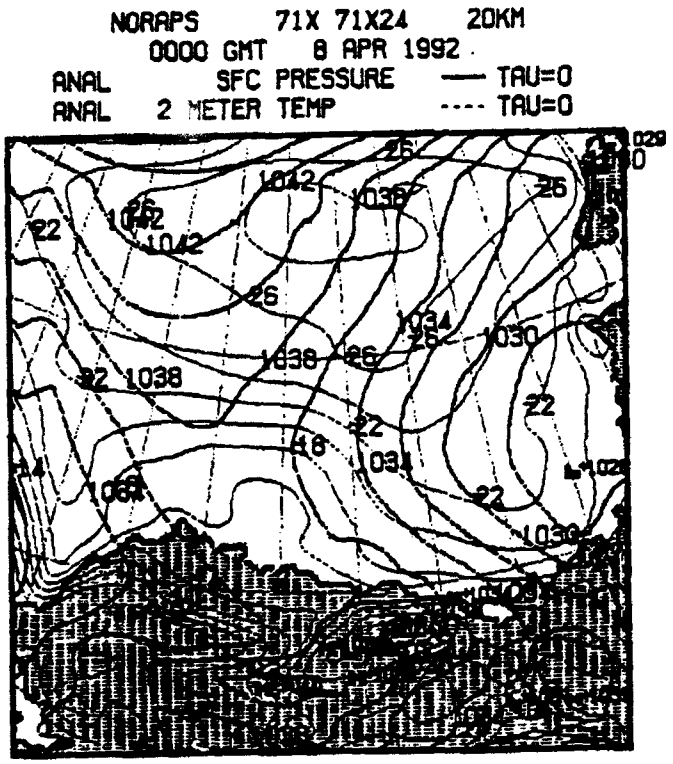
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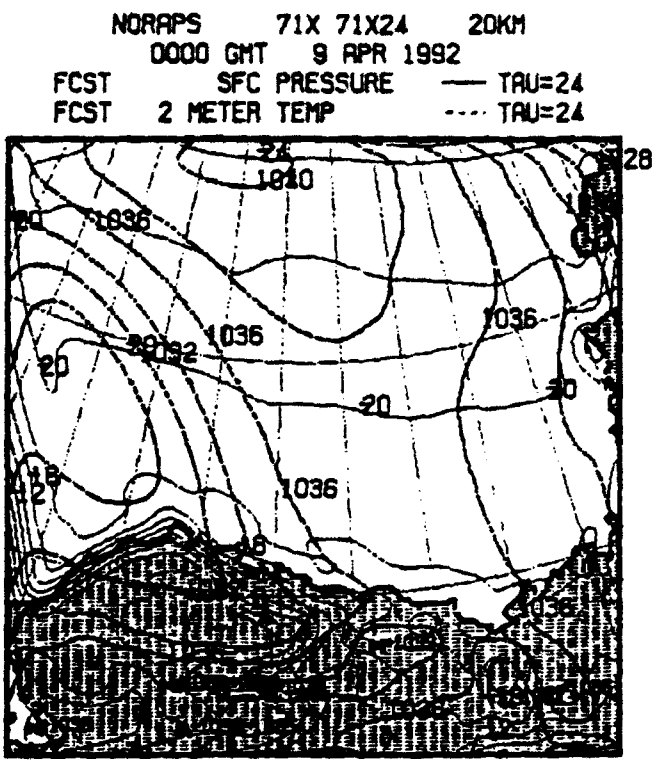
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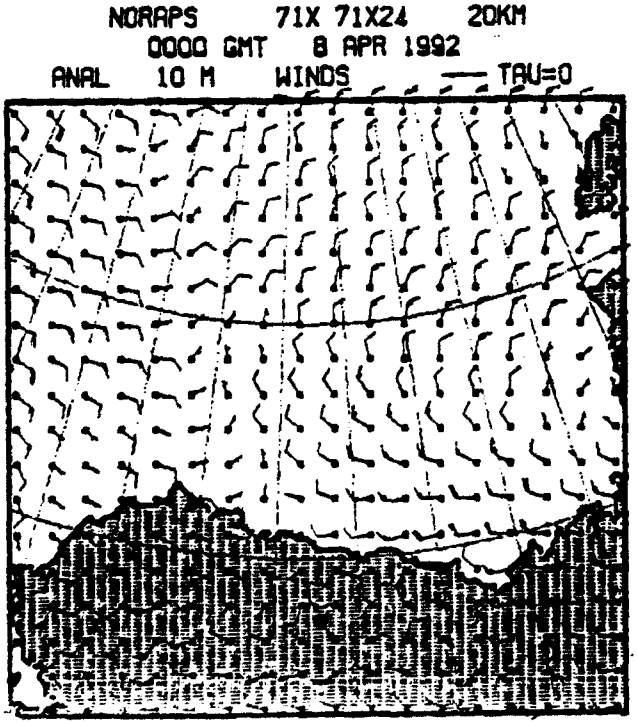
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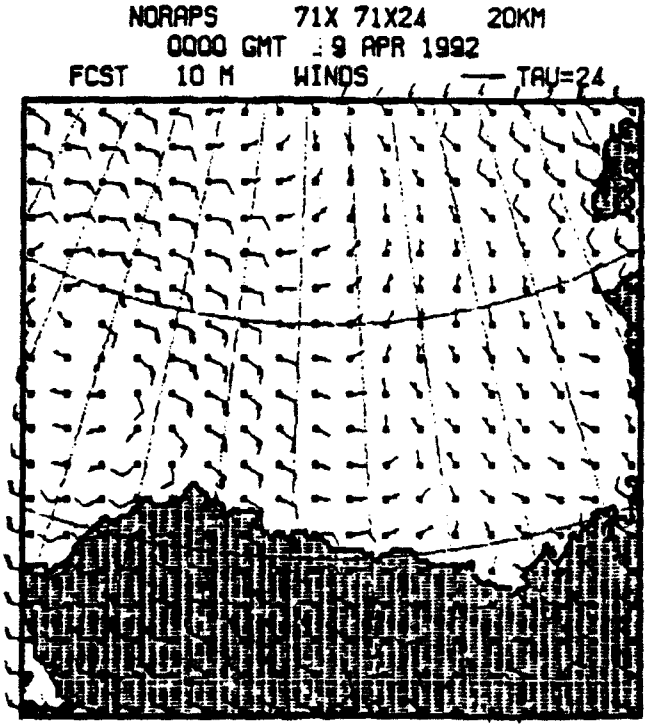
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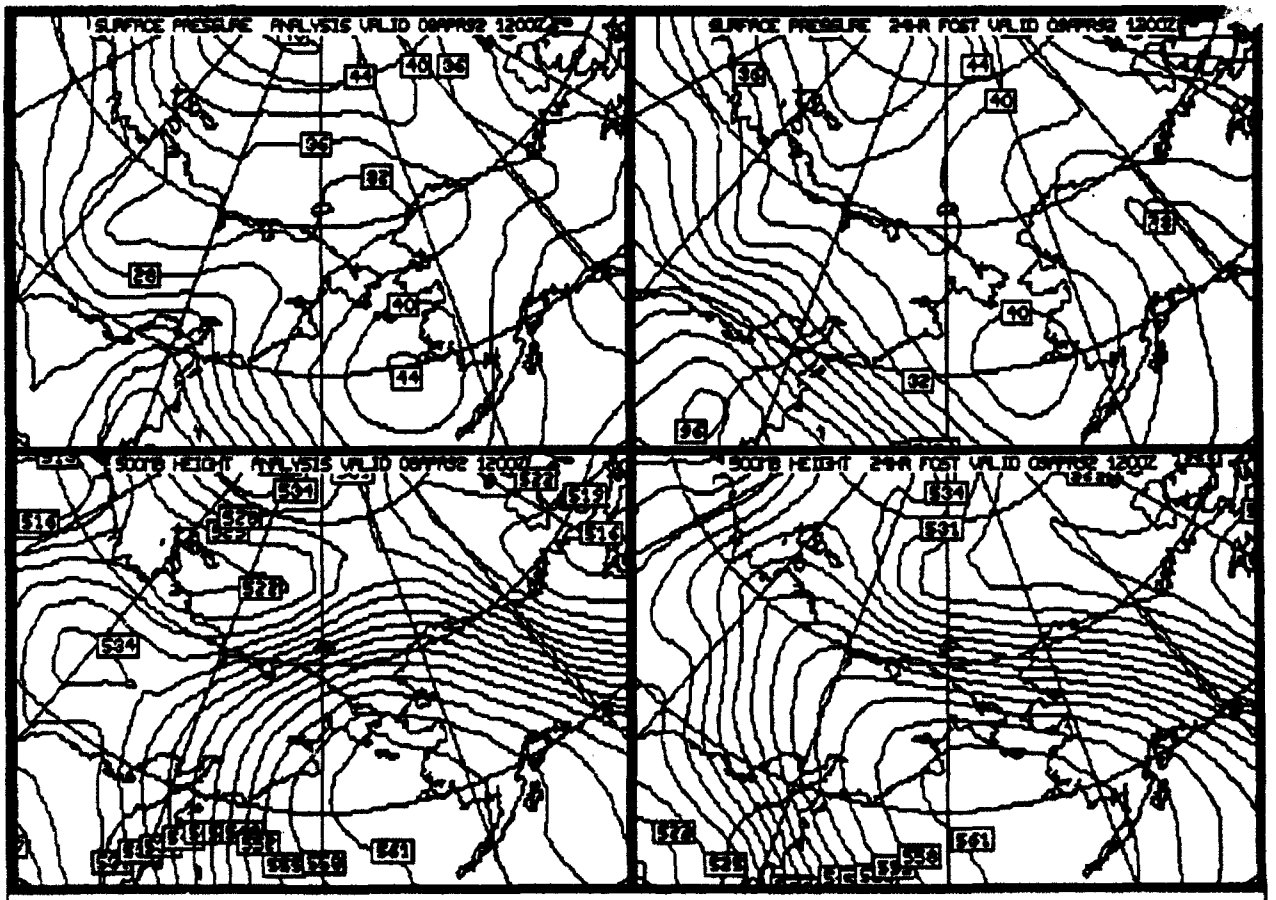
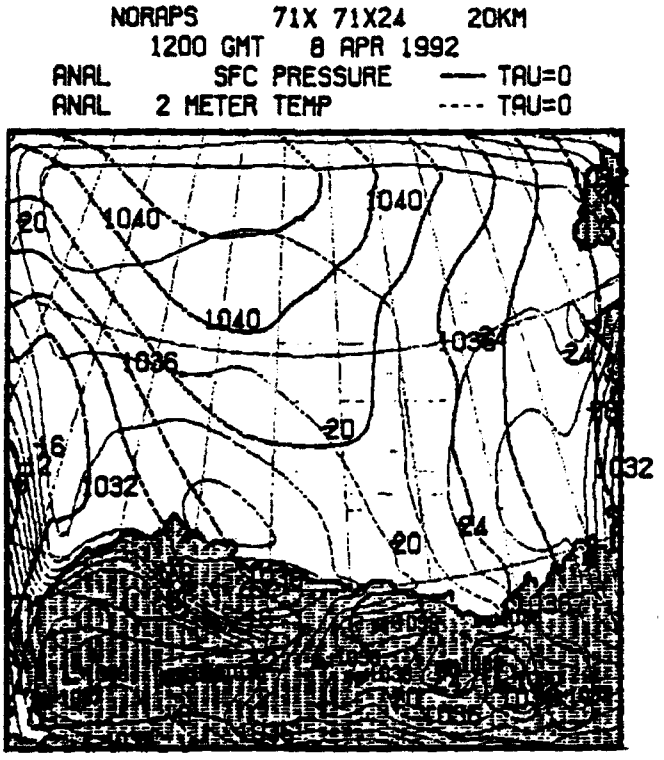
8 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

<u>08/1200Z Analyses and Forecasts (update)</u>
<u>Satellite data</u> revealed a cloud vortex associated with the Banks area low moving southeastward during the day. The ice camp remained in total clear conditions throughout the period as the col moved overhead and eastward. Upper level cloudiness associated with the westernmost low moved over Barrow and Deadhorse. The westernmost low was forecast to move onto the North slope by 09/1200Z while the eastern low moved eastward out of the area. Significant change from westerly winds over the N. Slope (08/0000Z) to easterly (09/1200Z). An E-W trough along the N. Slope at <u>10 M</u> and <u>925 MB</u> shifts northward to 72-73N at 700 mb by 09/1200Z where a closed cyclonic circulation is shown (72.5N, 142W).



FLEET NUMERICAL OCEANOGRAPHY CENTER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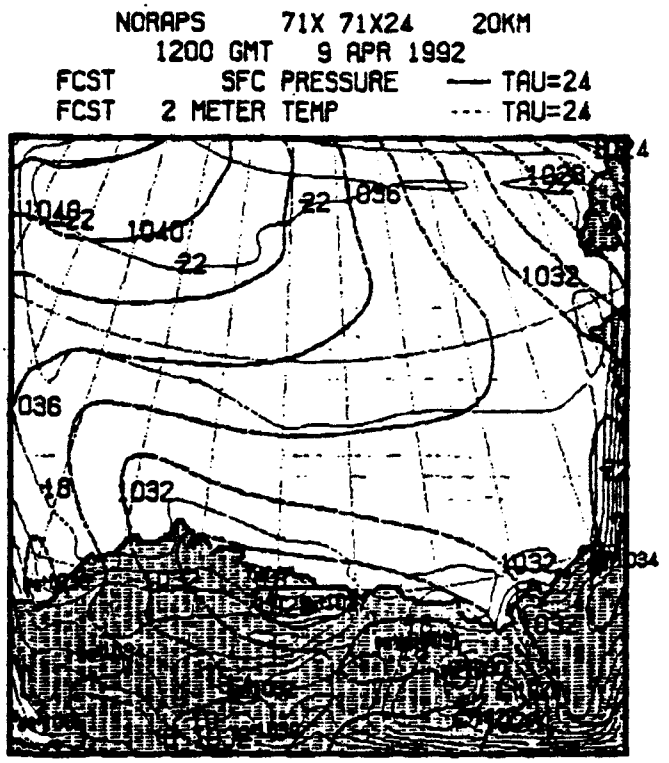
16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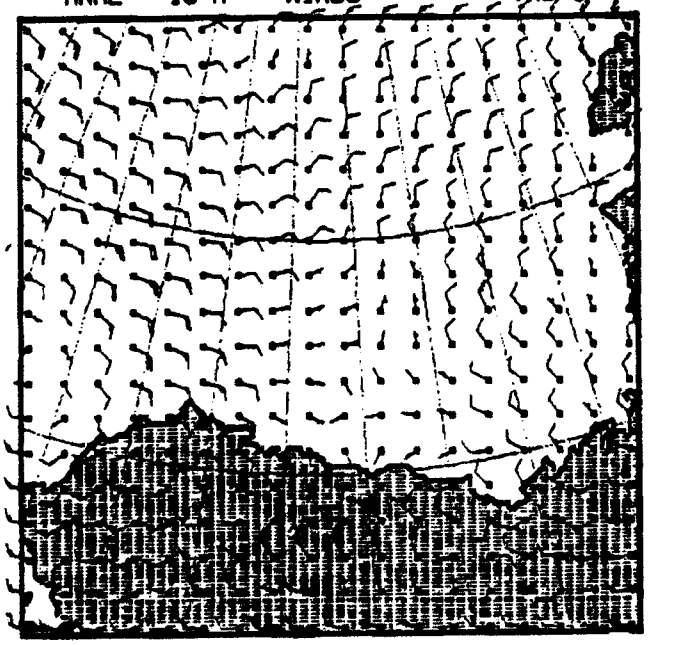
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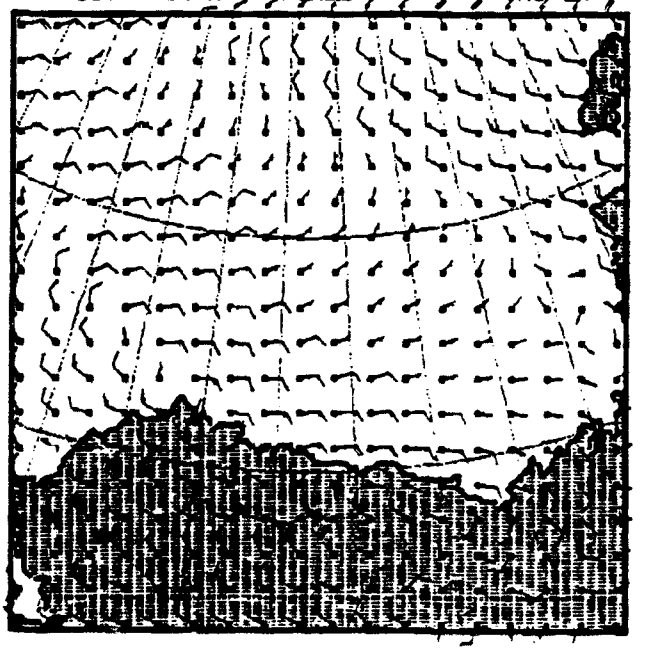
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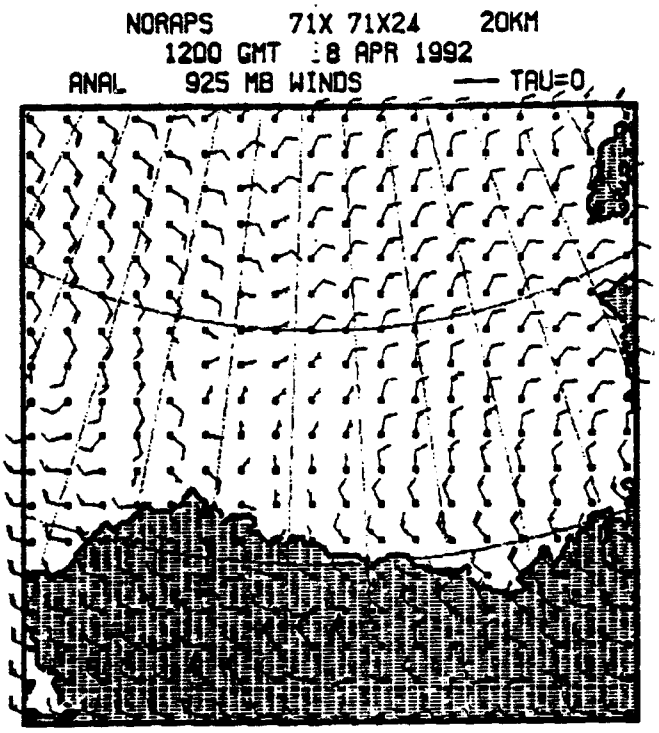
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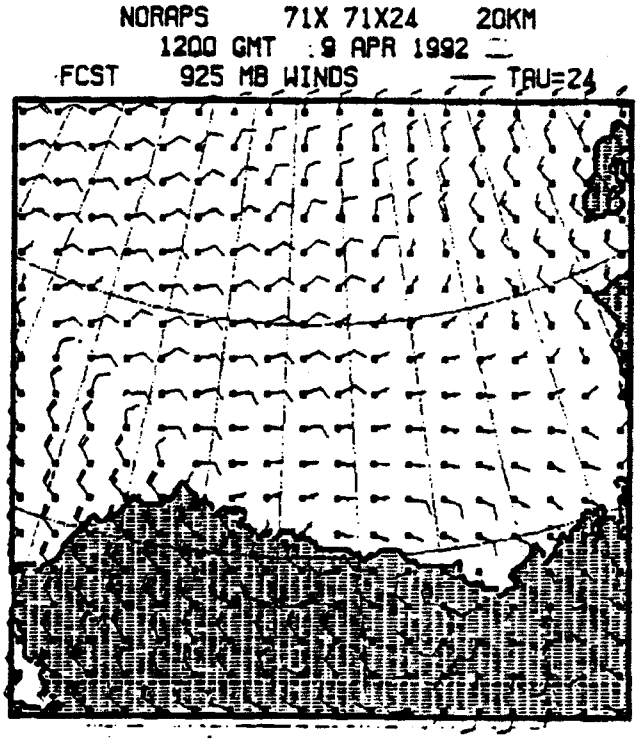
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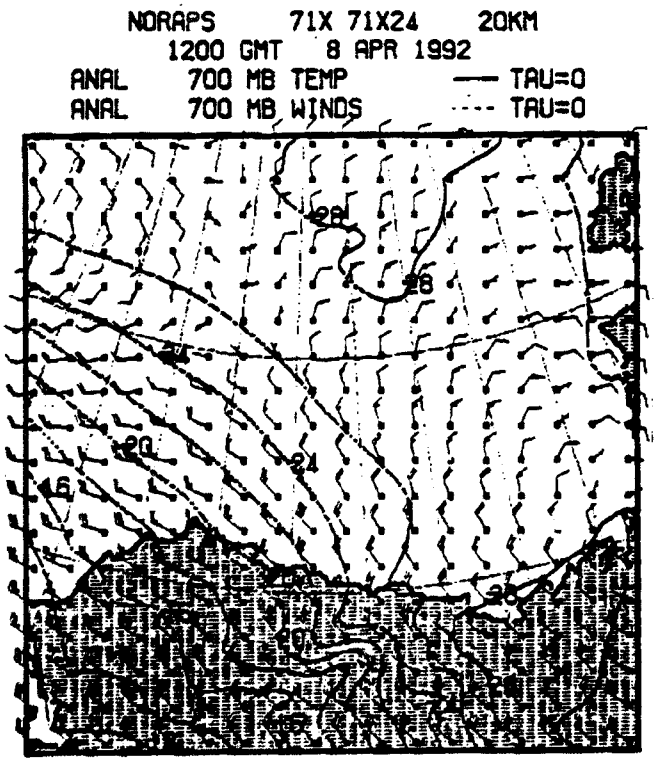
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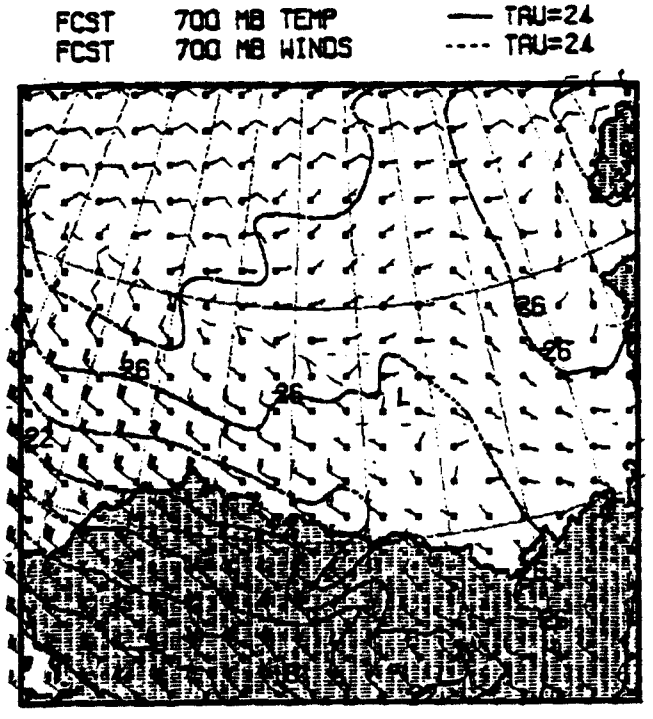
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FCST 700 MB WINDS ---- TAU=24

9 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

09/0000Z Analyses

Surface Pressure

The western low moved onto NW Alaska faster than had been forecast with ridging over most of the Beaufort Sea. The ice camp (72.9N, 145.9W) was under clear conditions for most of the day.

10 M Winds

These winds reveal the closed circulation about the low with a trough extending form this low into NW Alaska.

925 MB

A similar pattern with stronger winds about the low is shown at this level.

700 MB

The low is displaced well to the north at 700 mb with no ridging over the Beaufort and, in fact, a second trough extending NW'ward from the Tuktoyaktuk Peninsula.

10/0000Z 24-hr Forecasts

Surface Pressure

The western low is forecast to move into north central Alaska and the ridge to move eastward toward Canada.

10 M

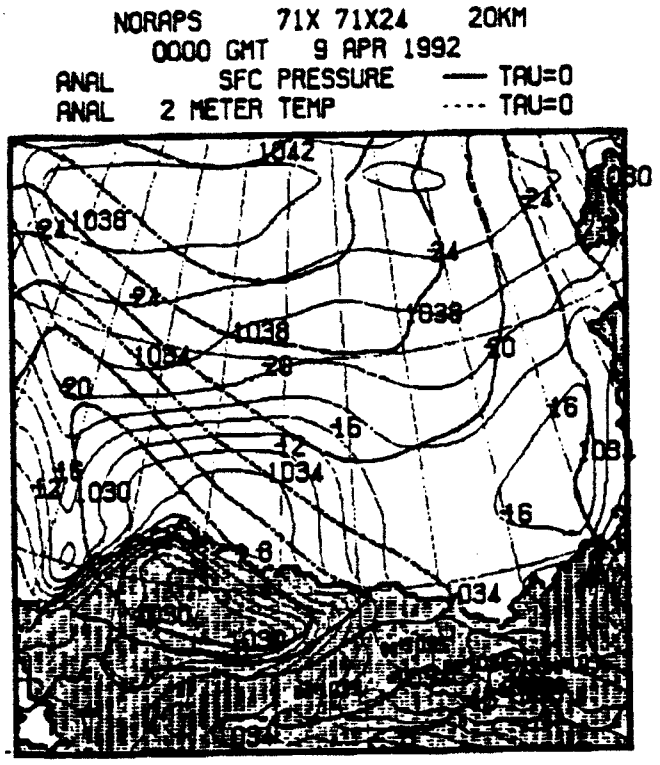
Winds reflect the trough and low pressure over north central Alaska with a ridge line extending NW from the Tuktoyaktuk Peninsula.

925 MB

Similar conditions are shown at this level.

700 MB

A well defined closed cyclonic circulation is shown just north of the N. Slope at 145W. A trough line extends WNW from this low past Barrow.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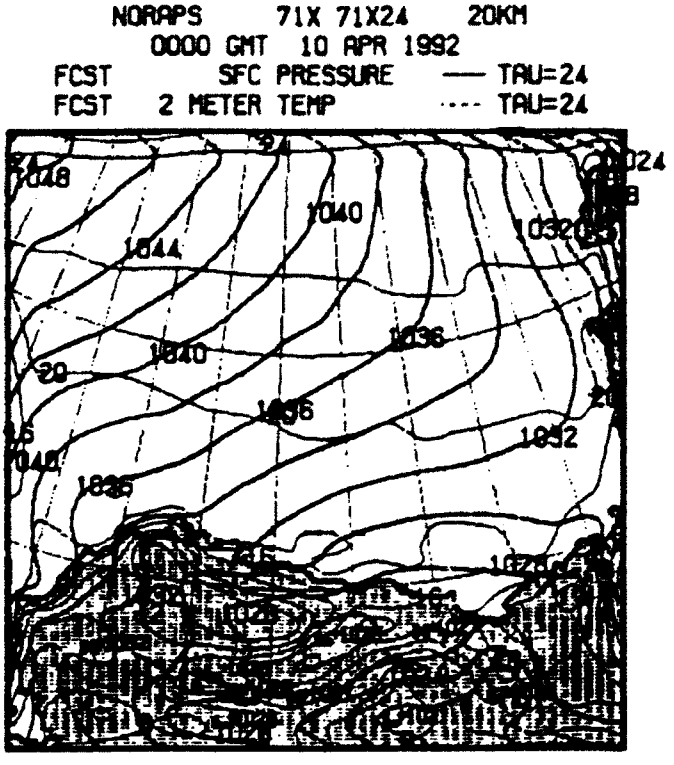
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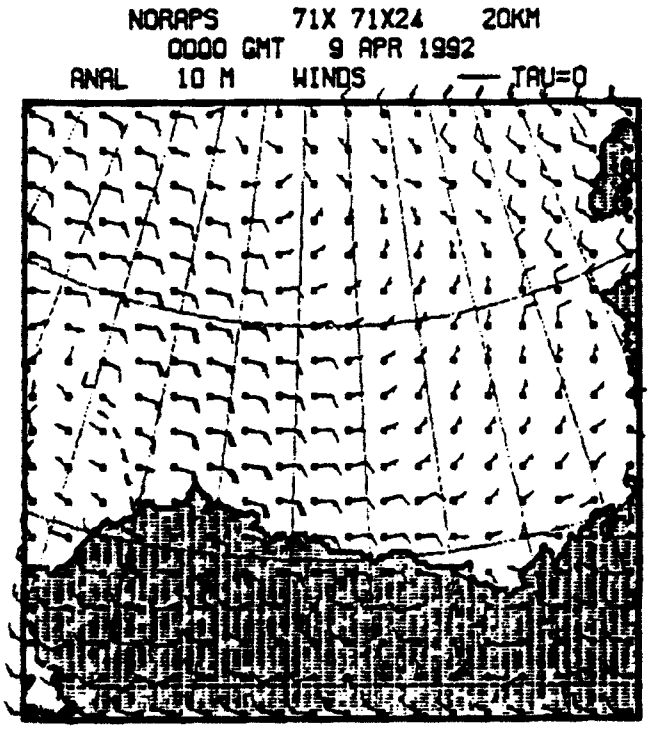
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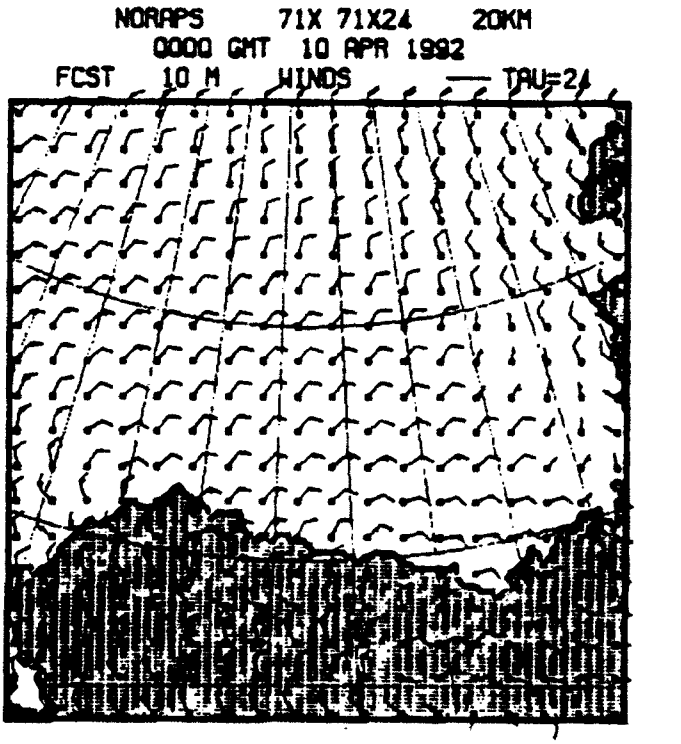
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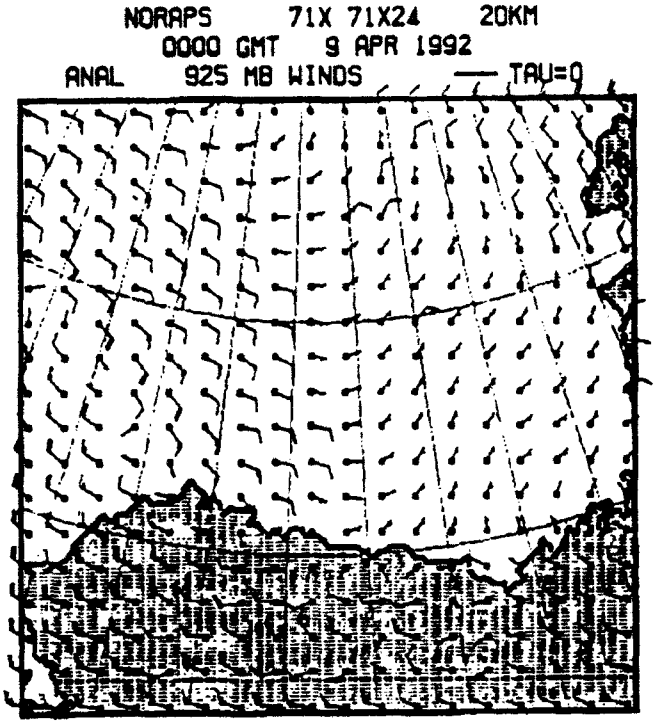
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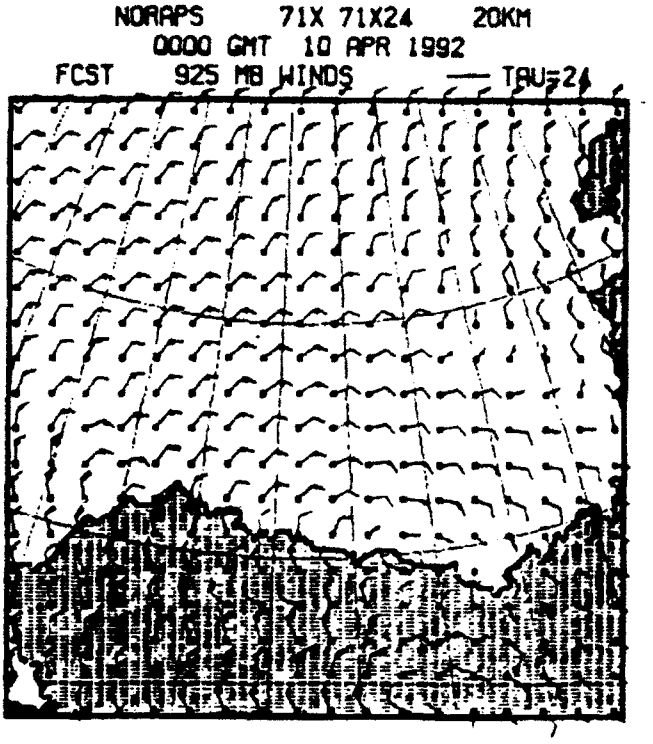
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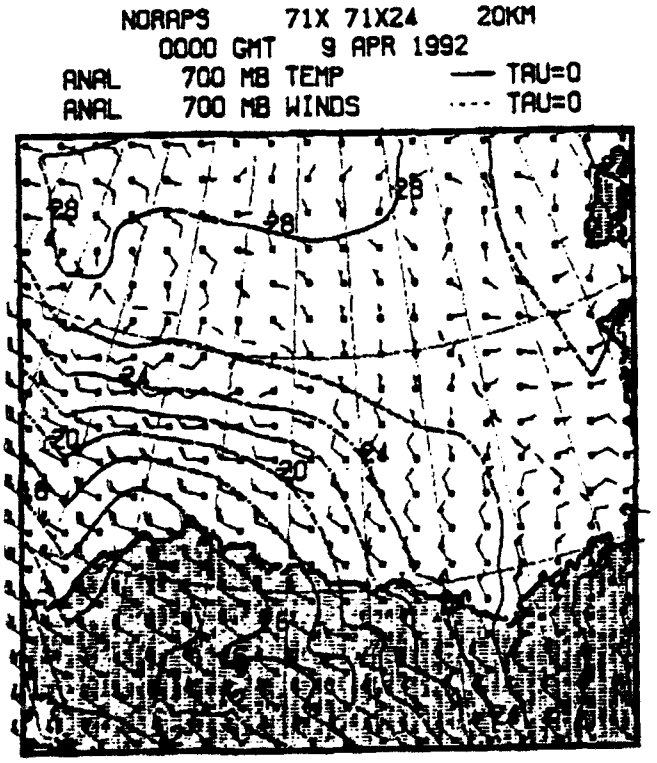
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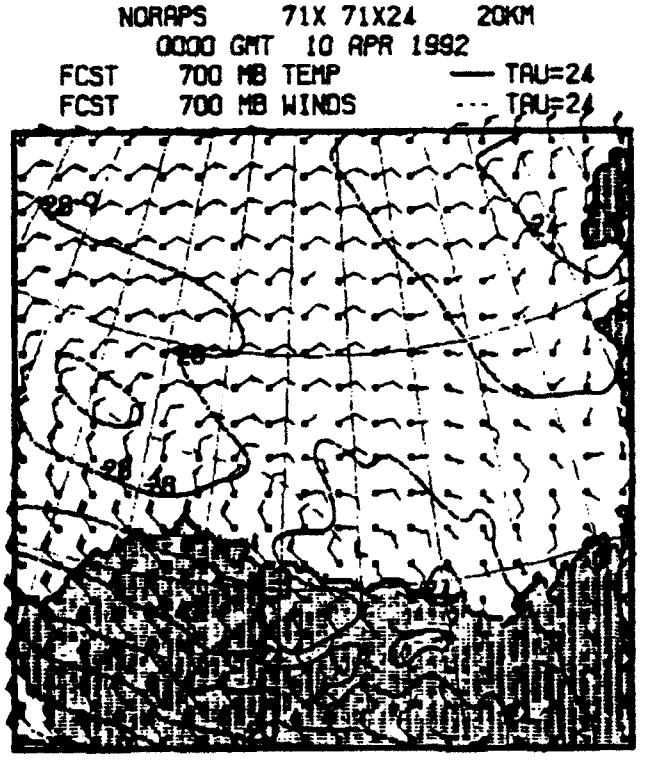
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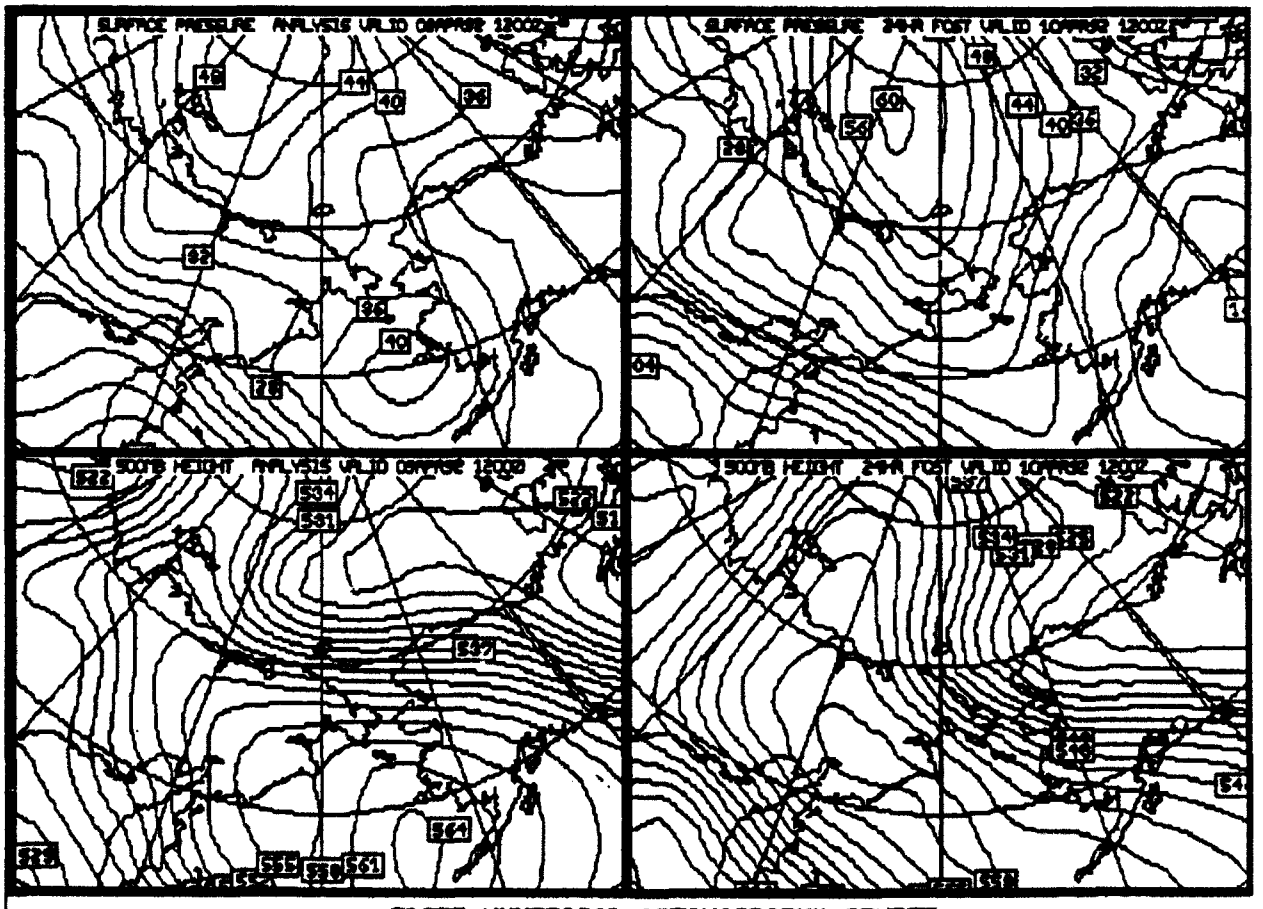
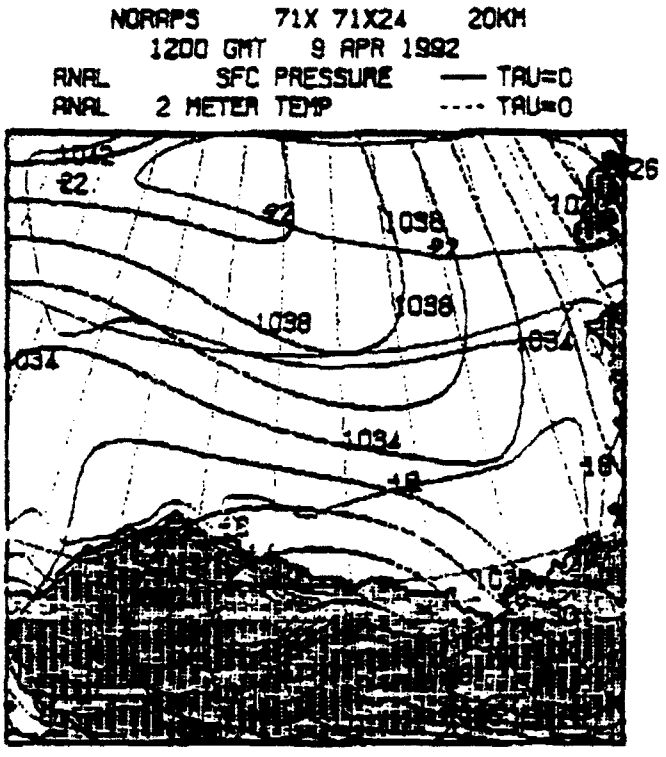
9 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

09/1200Z Analyses and Forecasts (update)
Satellite data revealed the in-situ development of significant middle and high clouds on the north side of the 700 mb trough. It is speculated that northerly flow into the north-central Beaufort over progressively warmer ice may have deepened the boundary layer giving rise to condensation then caught up and defined by the 700 mb flow. The ice camp remained relatively clear during this period as northerly flow and severe cold air advection was predicted. The main action in terms of cloudiness was that associated with the 700 mb trough. **NOGAPS** correctly shows the ridging and northerly flow the Beaufort Sea.



FLEET NUMERICAL OCEANOGRAPHY CENTER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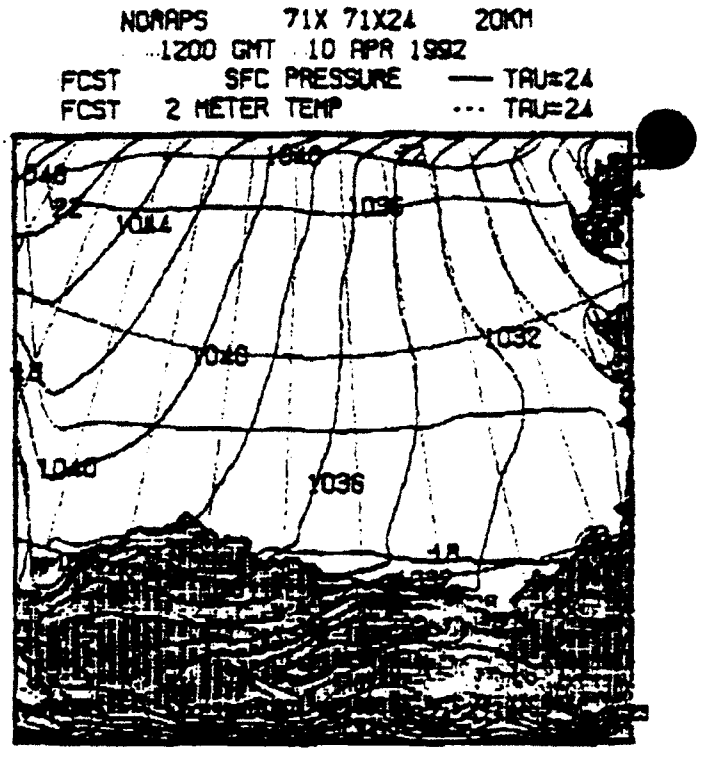
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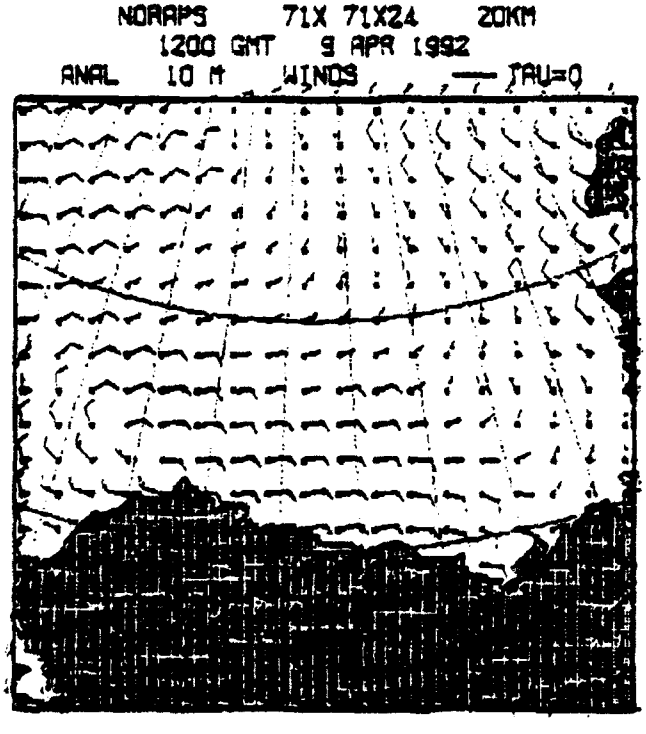
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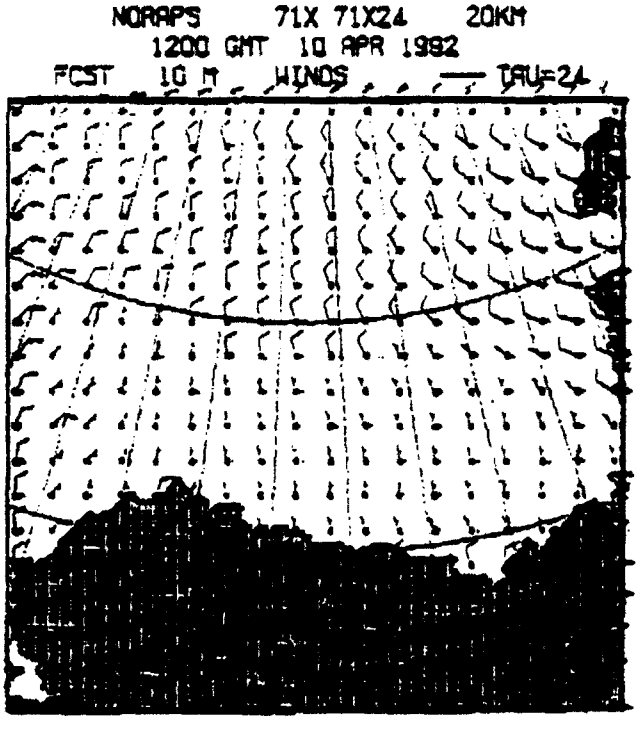
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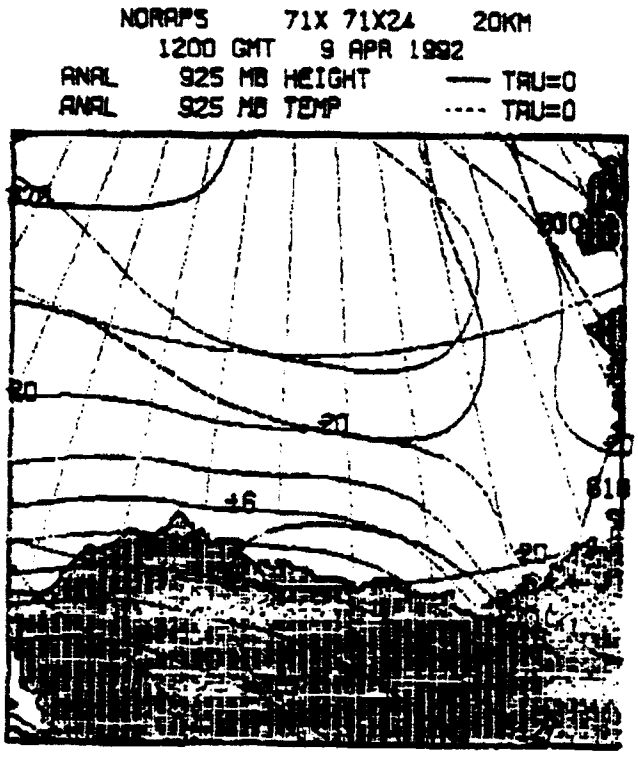
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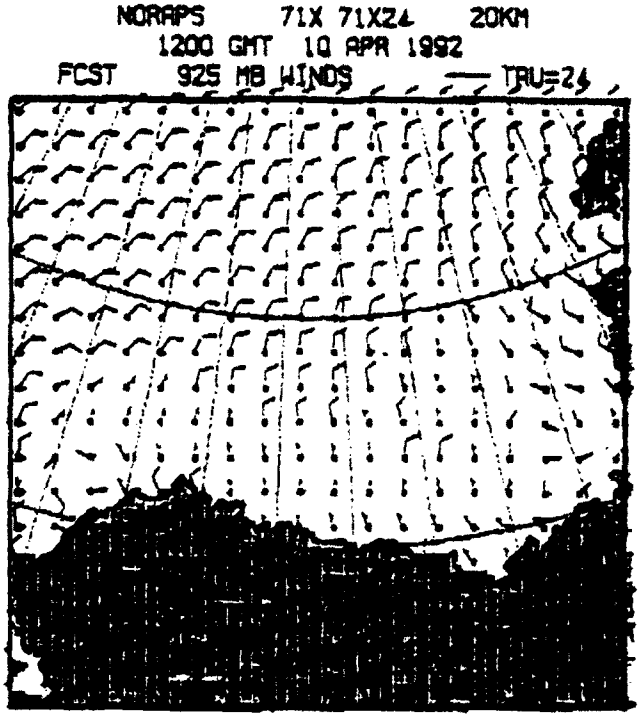
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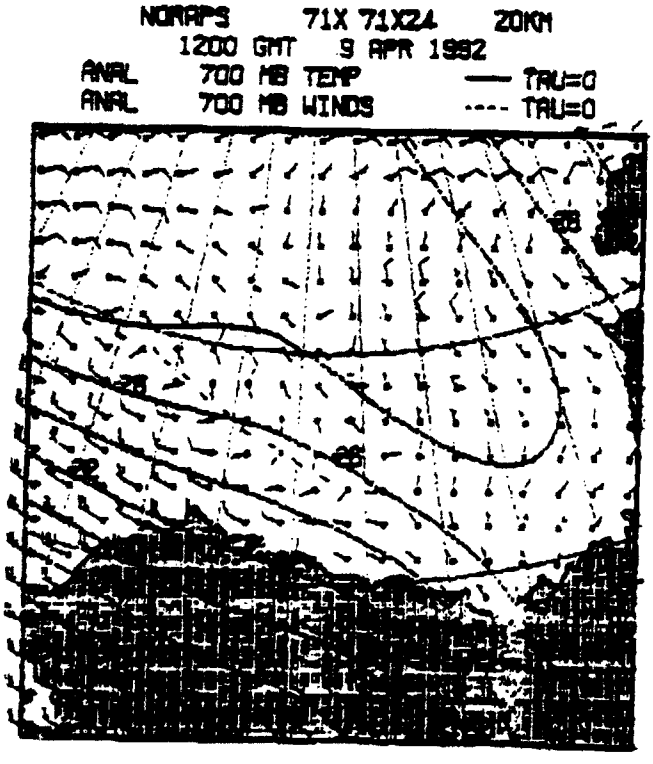
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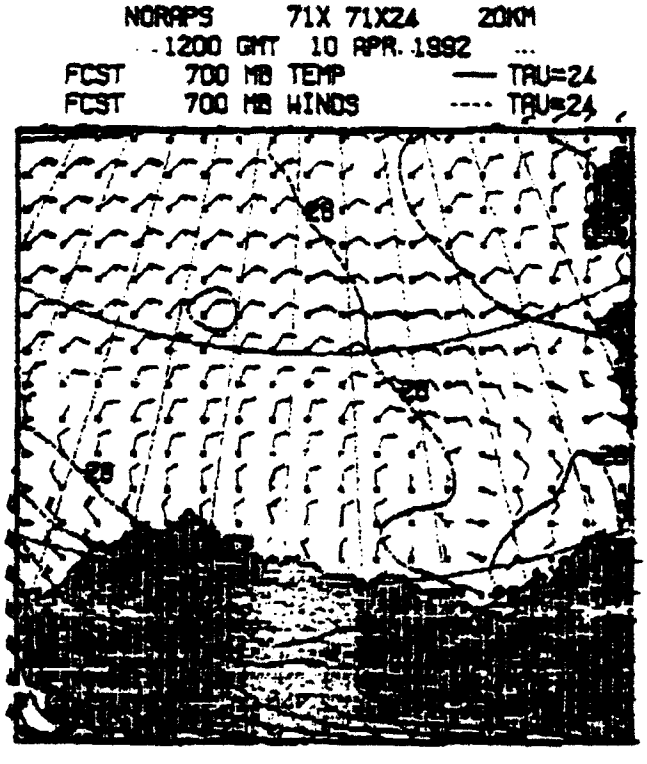
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10 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

10/0000Z Analyses

Surface Pressure

Ridging is shown to persist over the Beaufort Sea in northerly flow turning to easterly flow along the North Slope.

10 M Winds

A trough is noticeable stretching E_W on the north side of the Brooks Range.

925 MB

Similar troughing action shown at this level.

700 MB

A closed low is apparent north of Barrow. Satellite data (0437Z) suggest a center near that location. Main cloudiness appears east of the center which seems to be under the influence of northwesterly upper level anticyclonic flow.

11/0000Z 24-hr Forecasts

Surface Pressure

High pressure sets up a strong gradient bringing northerly flow all across the Beaufort.

10 M

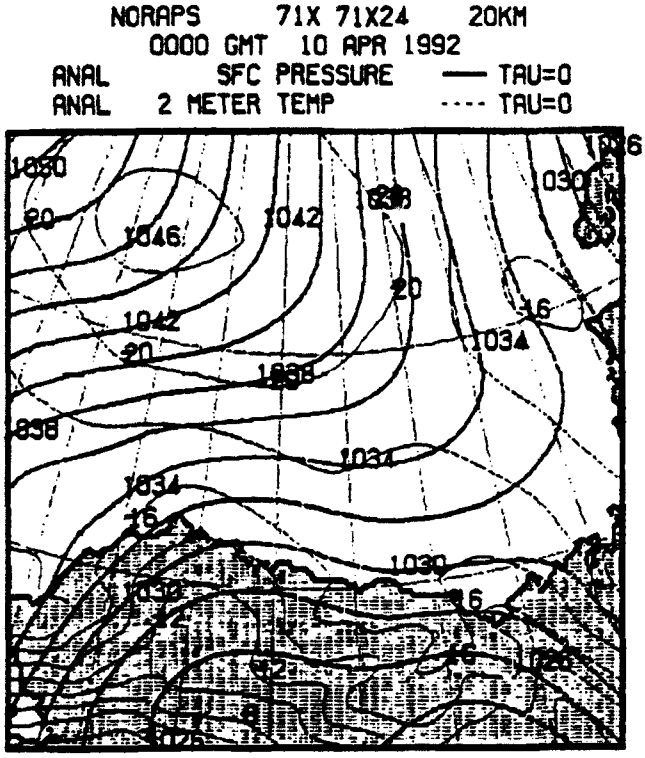
The trough previously noted on the north side of the Brooks Range has moved south.

925 MB

Same as the 10m flow but stronger.

700 MB

Strong northerly flow is shown which merges into a cyclonic pattern in the SE section of the prog.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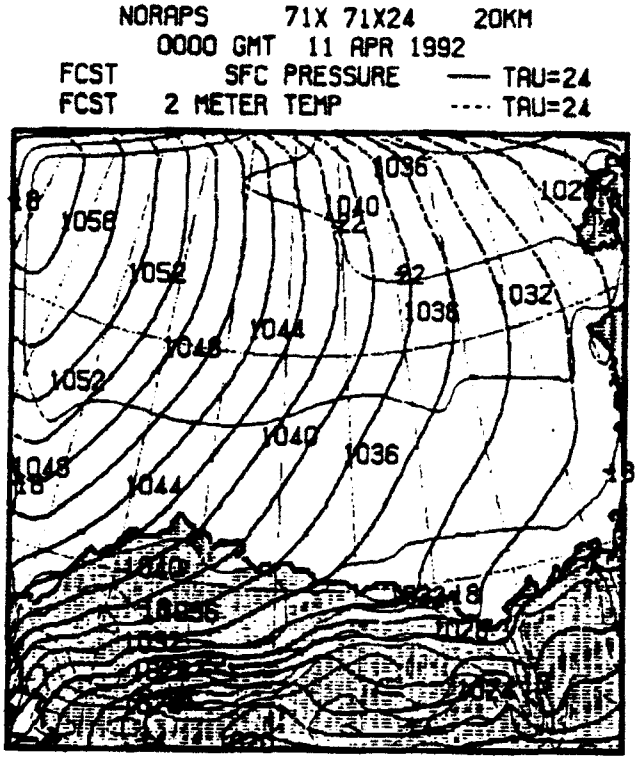
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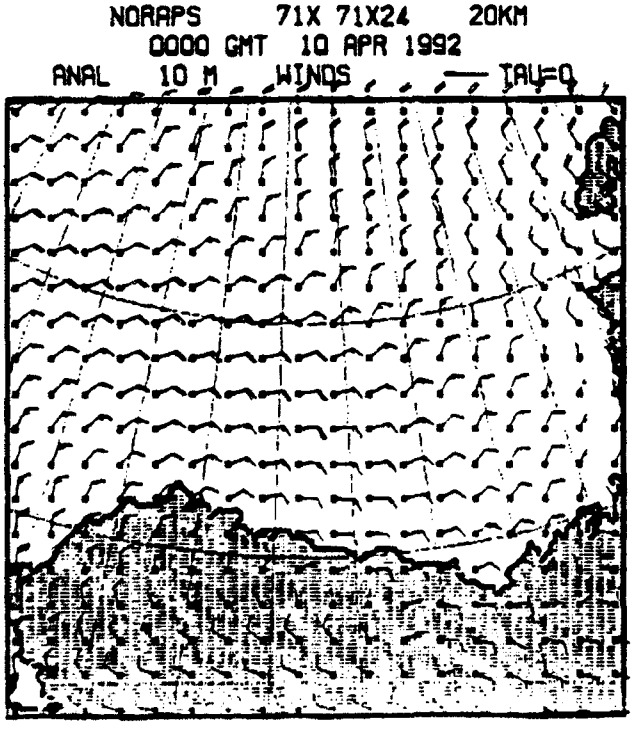
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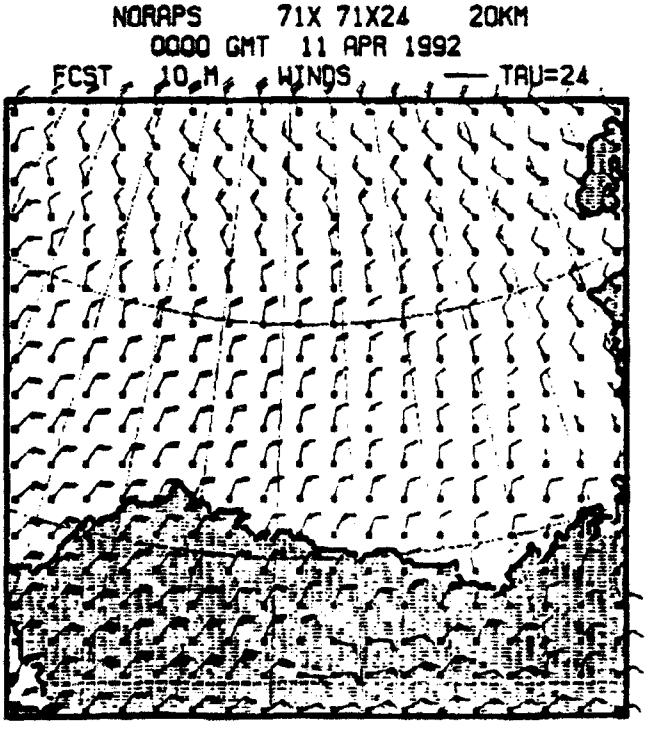
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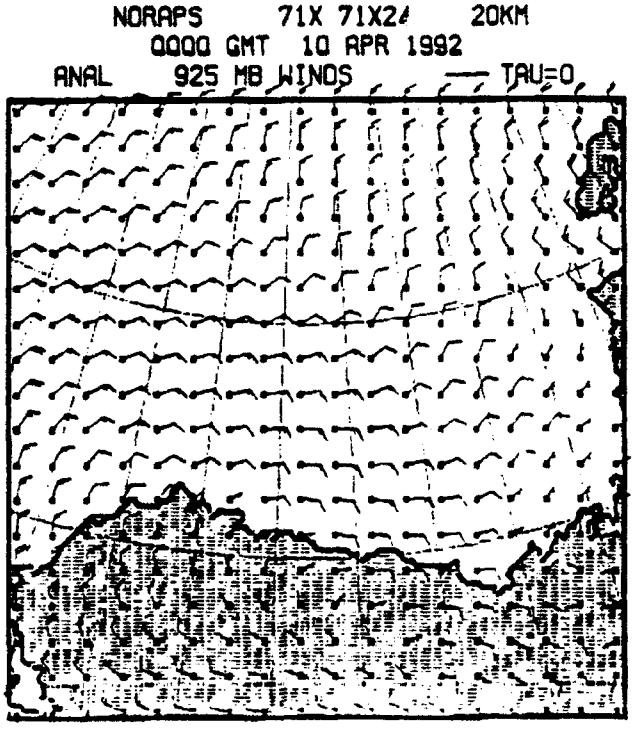
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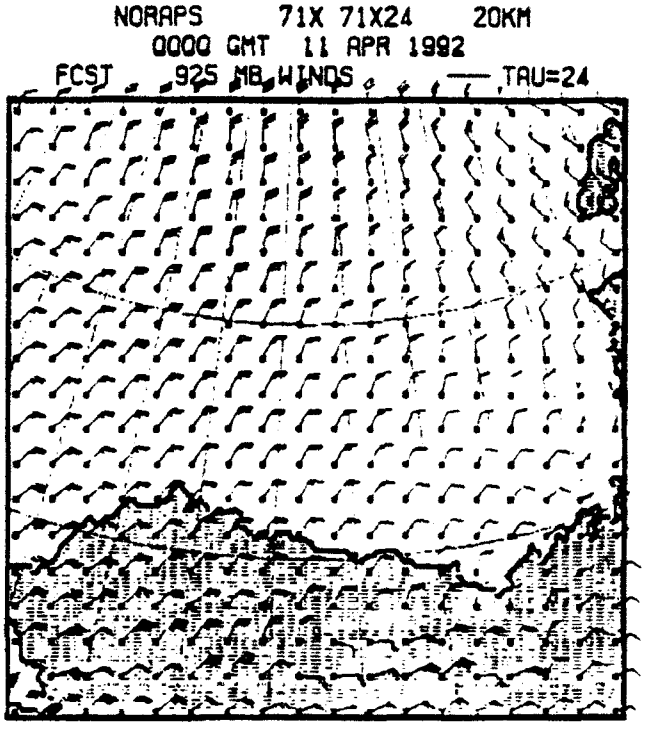
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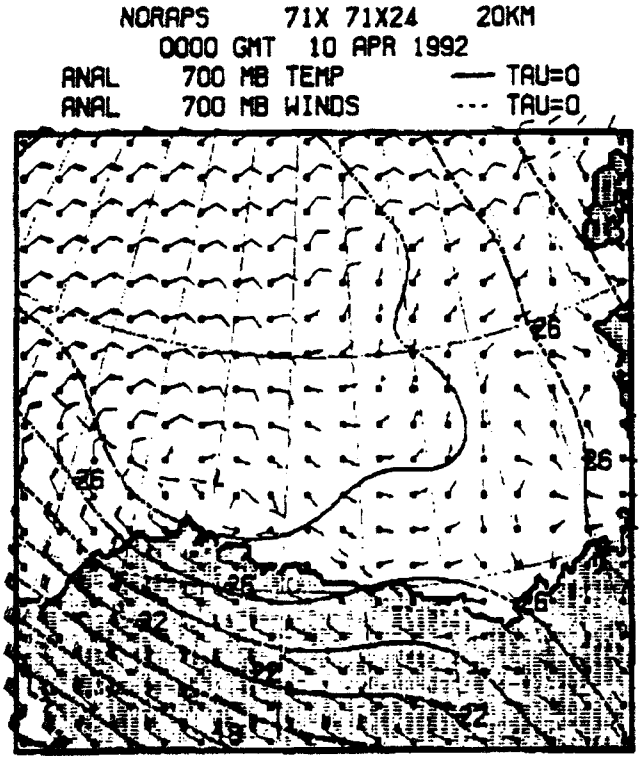
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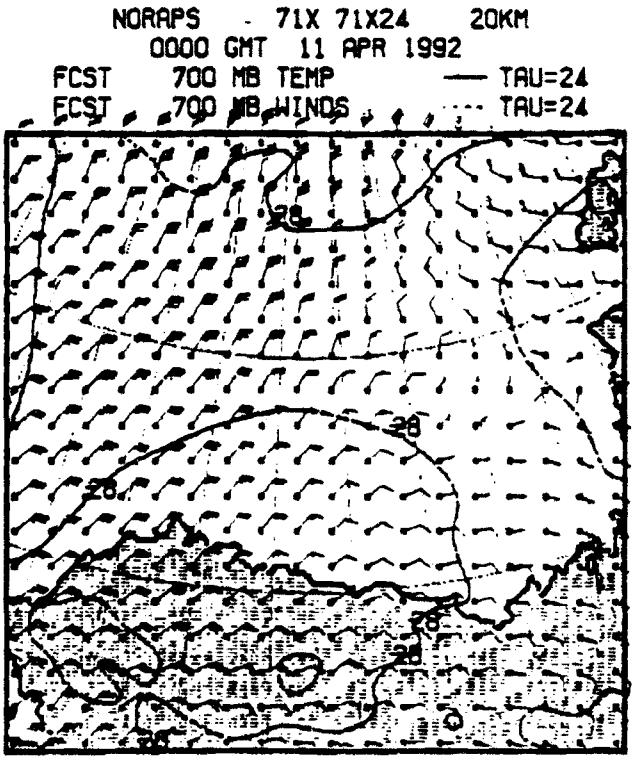
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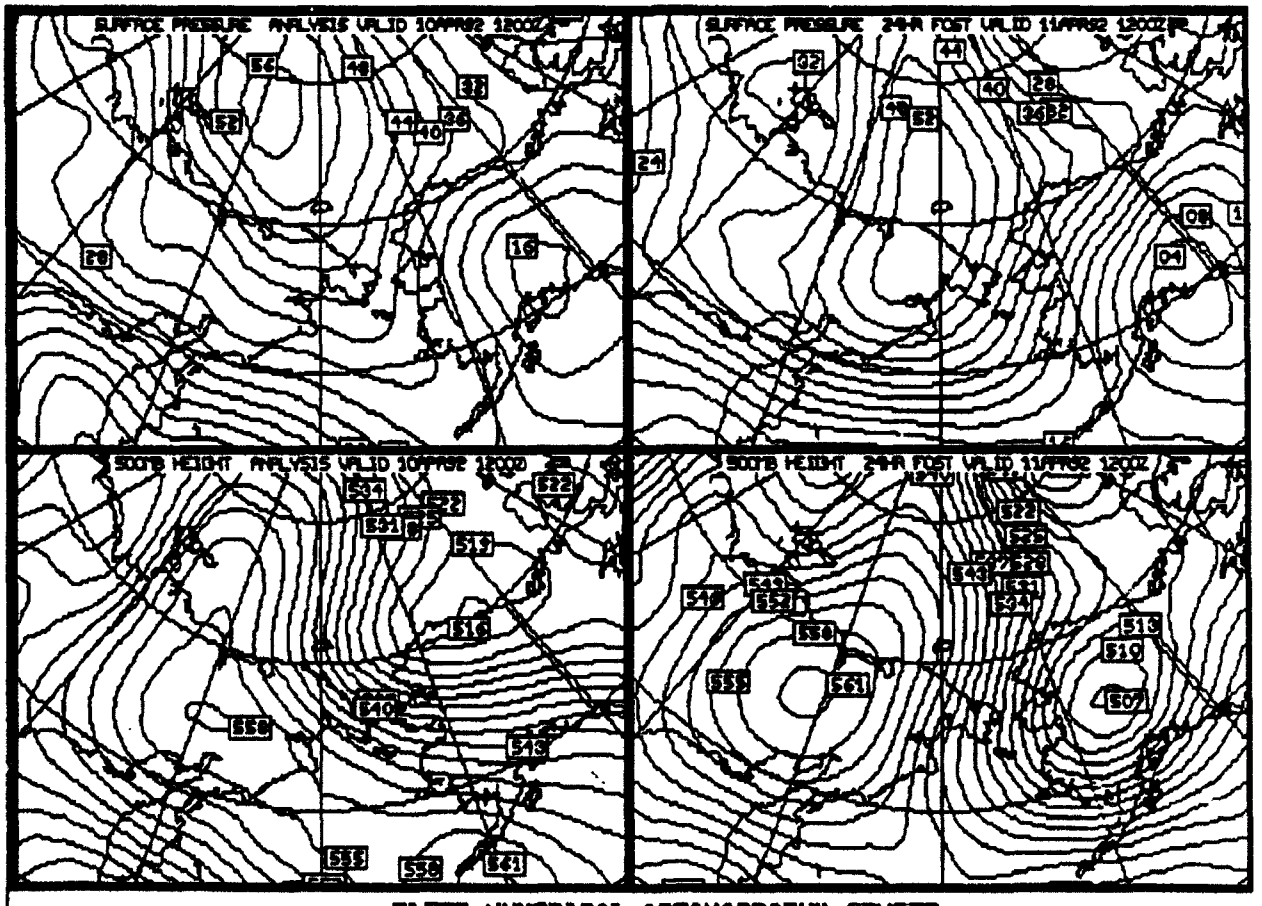
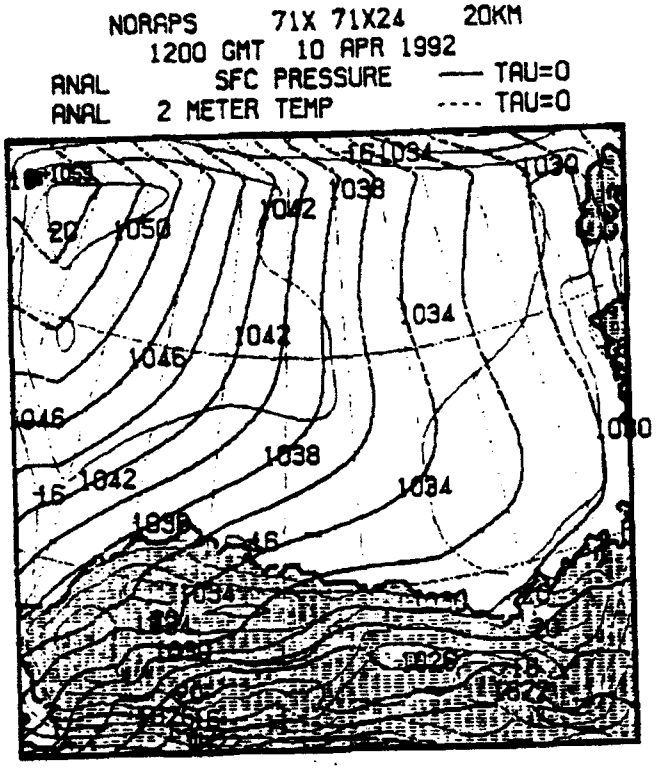
10 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

10/1200Z Analyses and Forecasts (update)
The main system producing cloudiness over the southern Beaufort is not revealed by any of these lower level analyses except perhaps the 700 mb analysis which shows an E-W trough over the region of the Brooks Range. A possible vortex is apparent on the north side of Brooks Range SE of Deadhorse in satellite imagery (0451Z). The NOGAPS 500 mb analysis shows a deep low centered north of Deadhorse. This is surely related to the observed satellite features but structure is undefined at this time. Perhaps good case study potential with RAOBS and NORAPS cross-section products.



FLEET NUMERICAL OCEANOGRAPHY CENTER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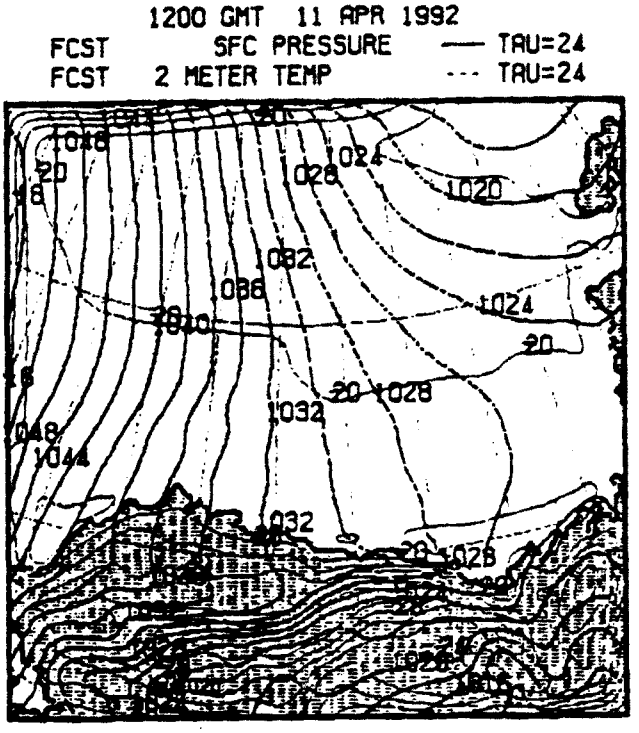
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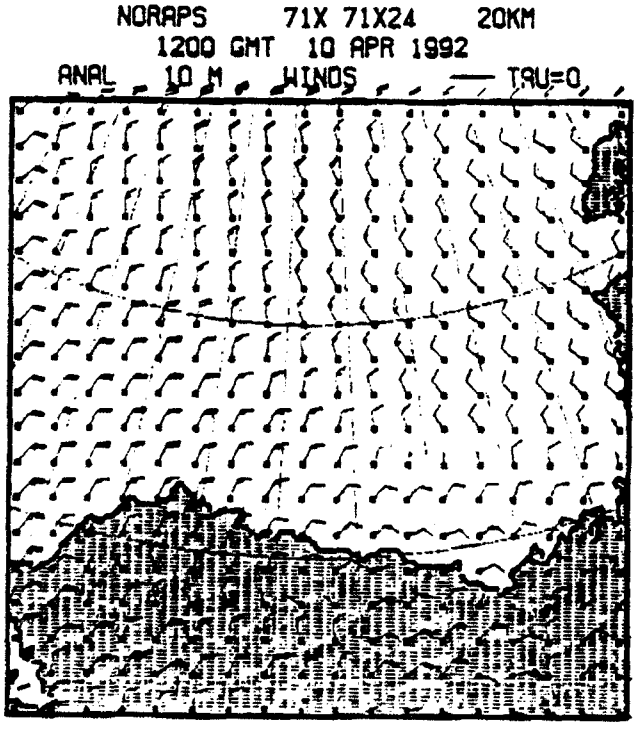
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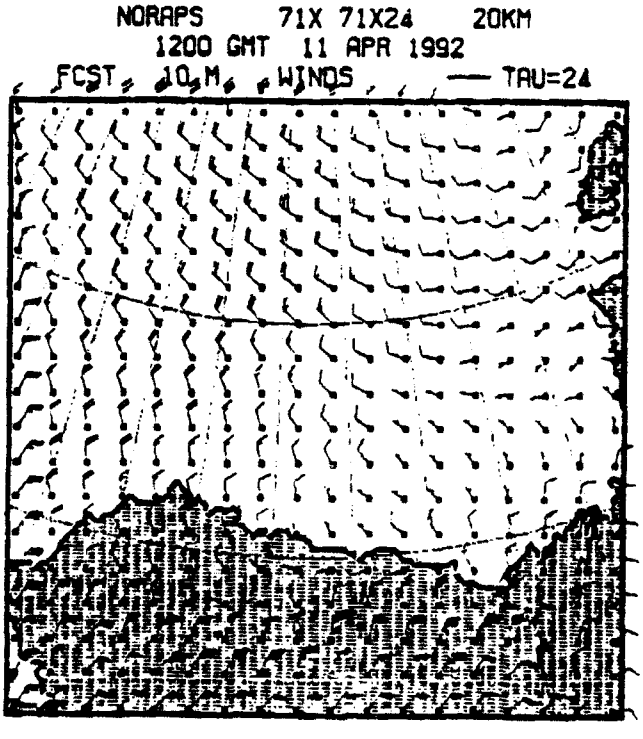
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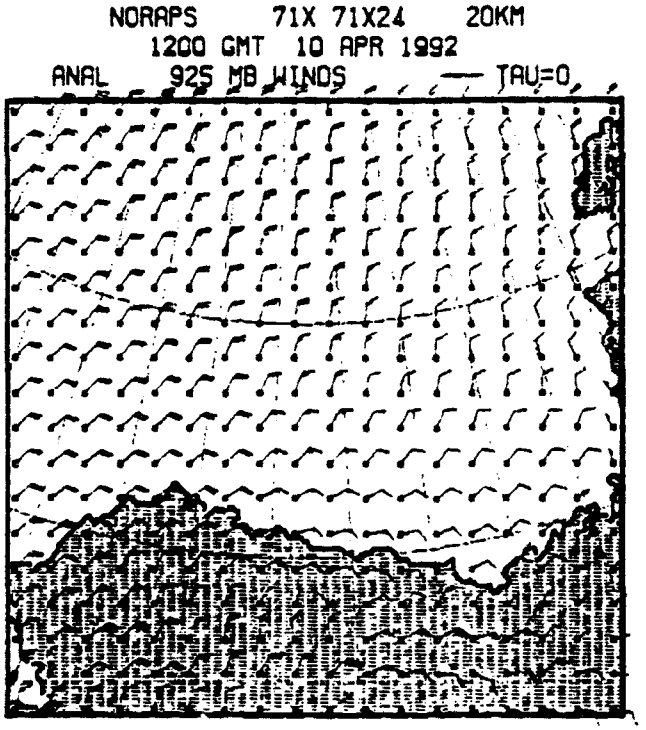
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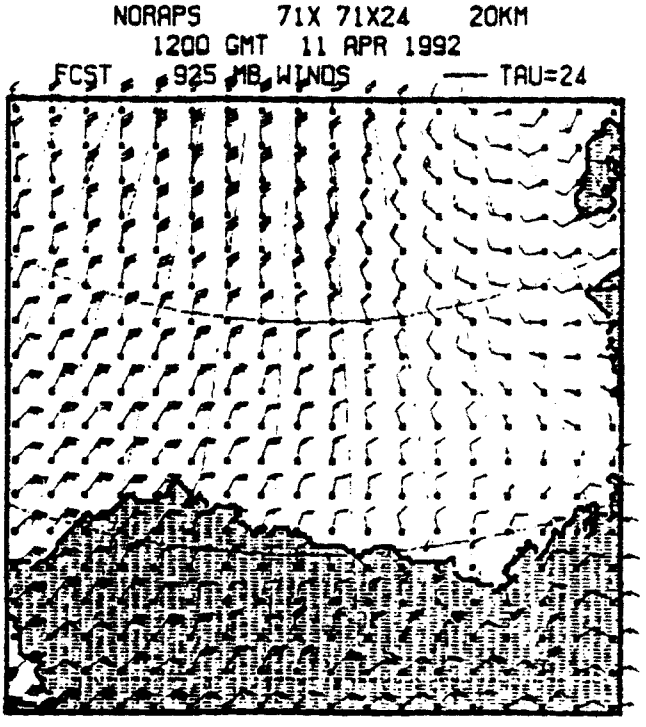
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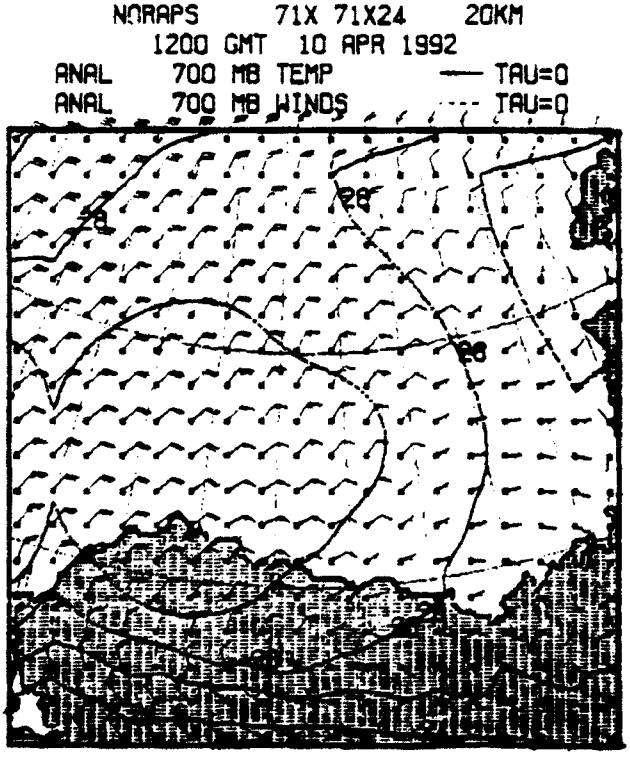
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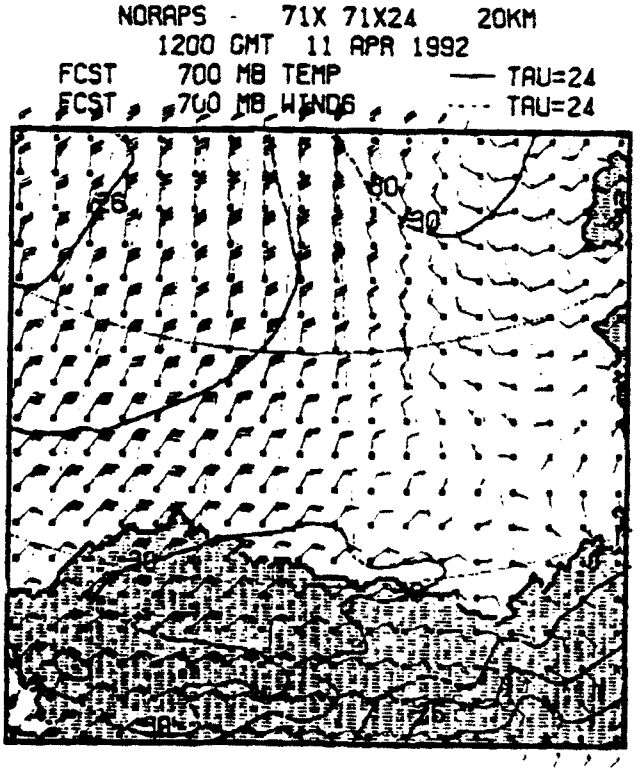
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11 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

11/0000Z Analyses

Surface Pressure

Ridging in northerly flow with pronounced cold air advection is show across the Beaufort Sea.

10 M Winds

Reflect the surface isobaric pattern. Note cyclonic turning of winds NW of Banks. This reflects presence of "surprise" low that will drop down from northern latitudes drastically changing local weather conditions over the Beaufort.

925 MB

Same as 10m but stronger.

700 MB

A similar pattern is shown at this level.

12/0000Z 24-hr Forecasts

Surface Pressure

"Surprise " low drops down in region NW of Banks.

10 M

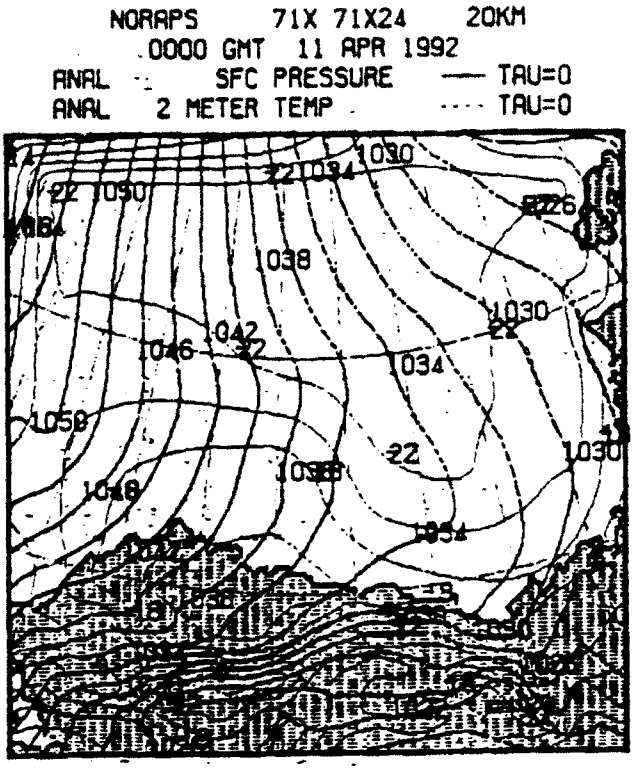
Note large scale cyclonic flow associated with the low NW of Banks.

925 MB

Same as 10m but stronger and more northerly flow to the west.

700 MB

A closed cyclonic circulation is also shown at this level (See also 11/1200Z analysis which shows a 500 mb low over the E. Beaufort Sea).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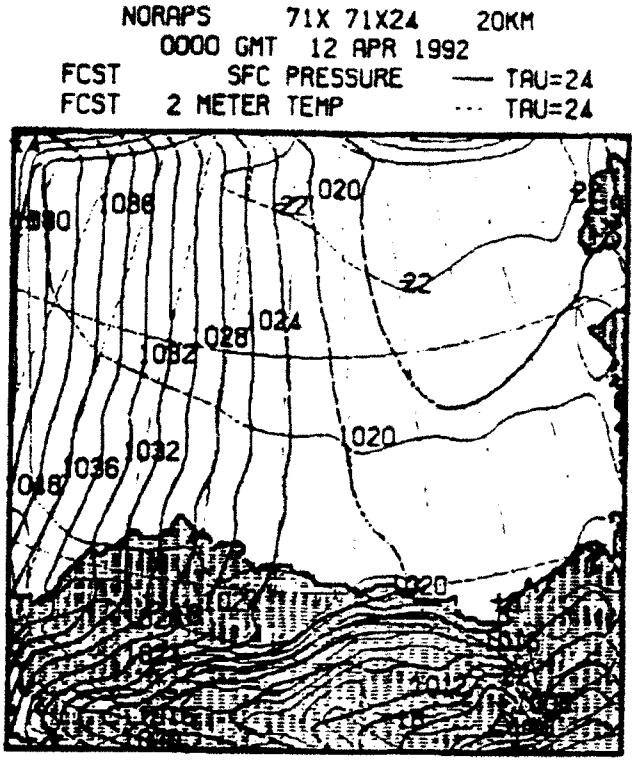
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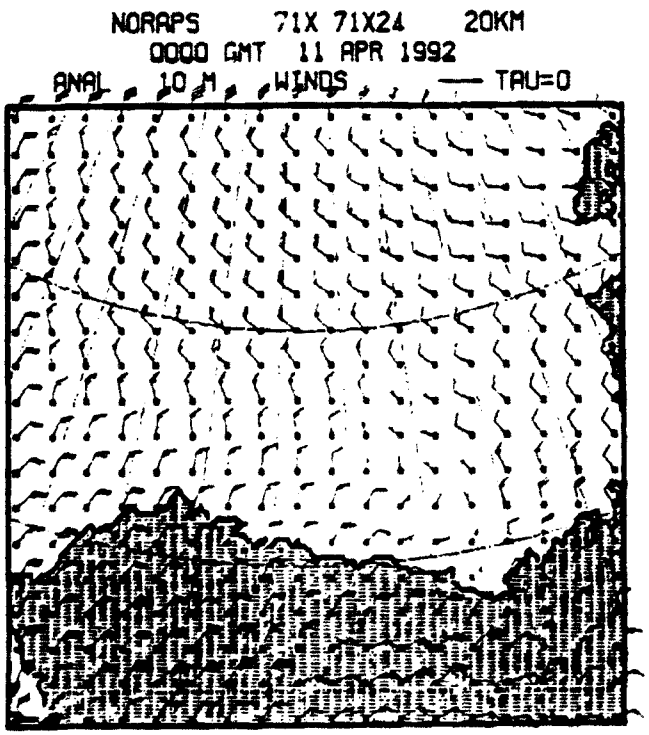
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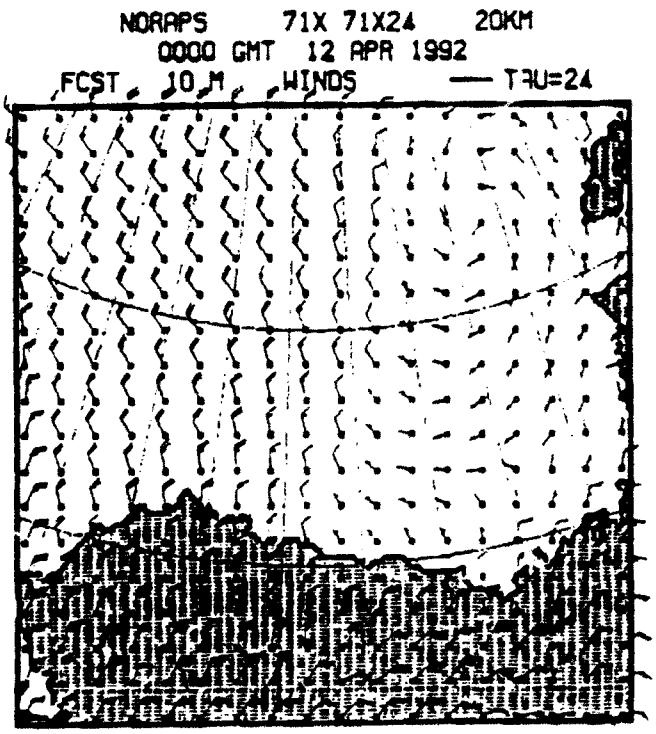
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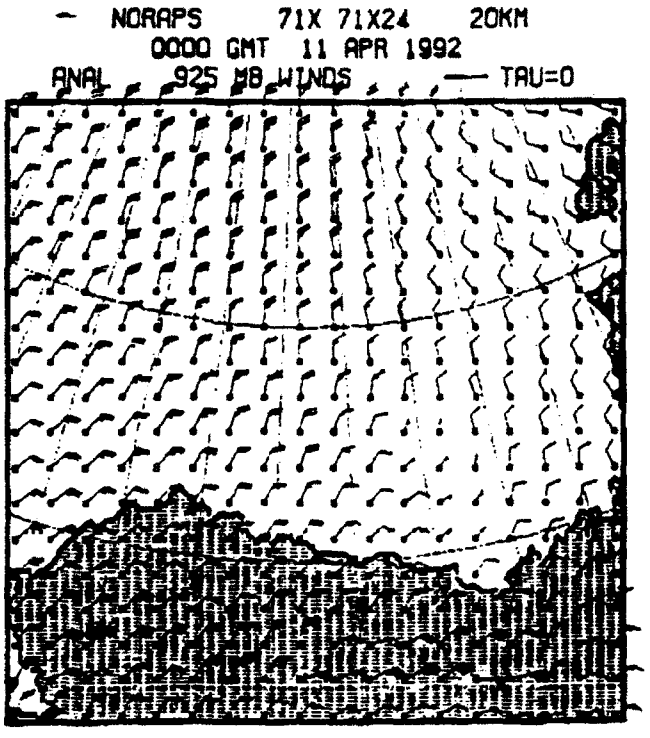
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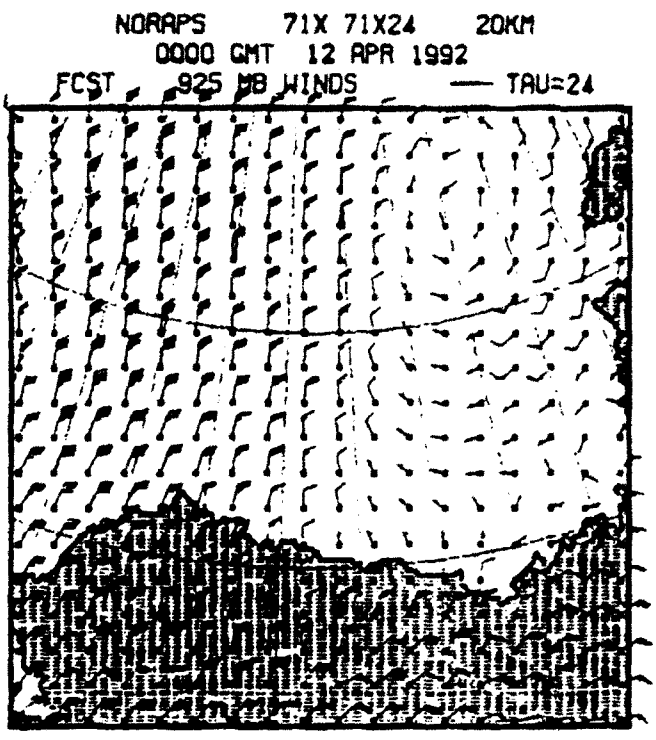
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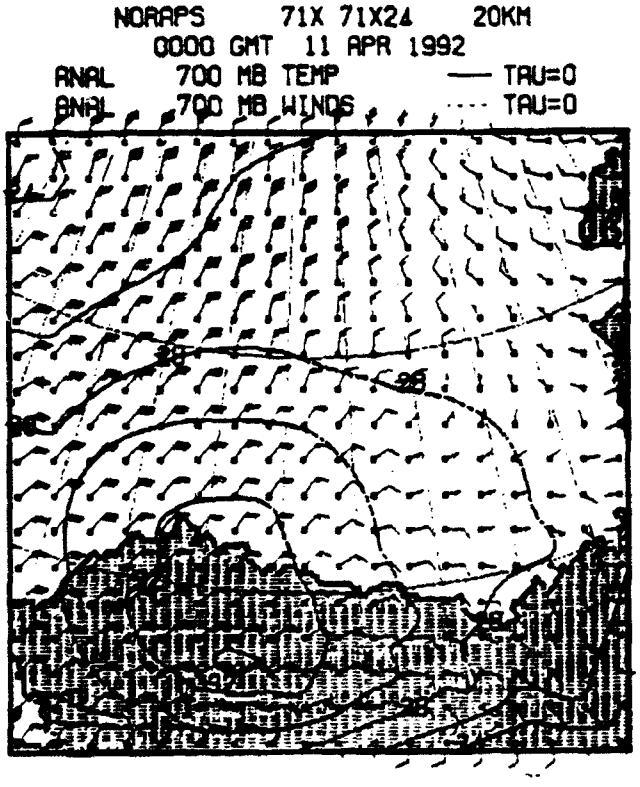
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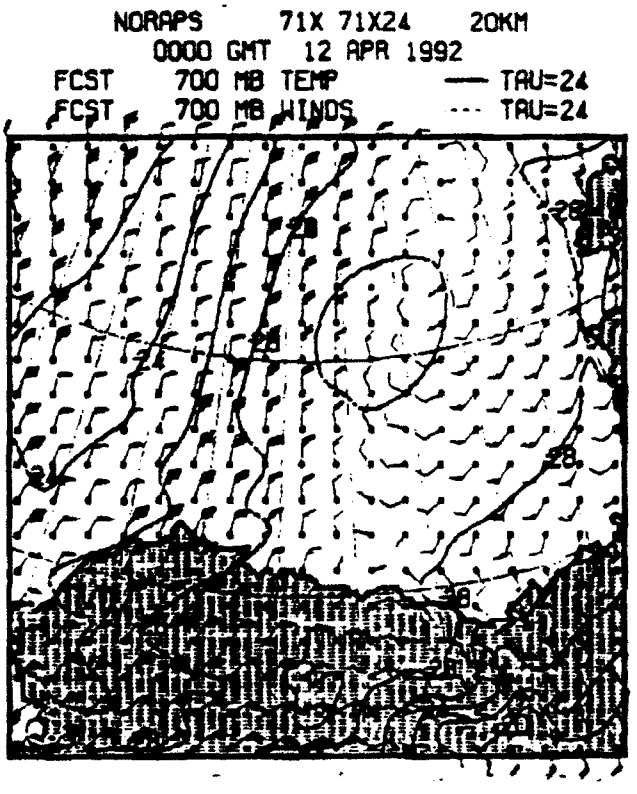
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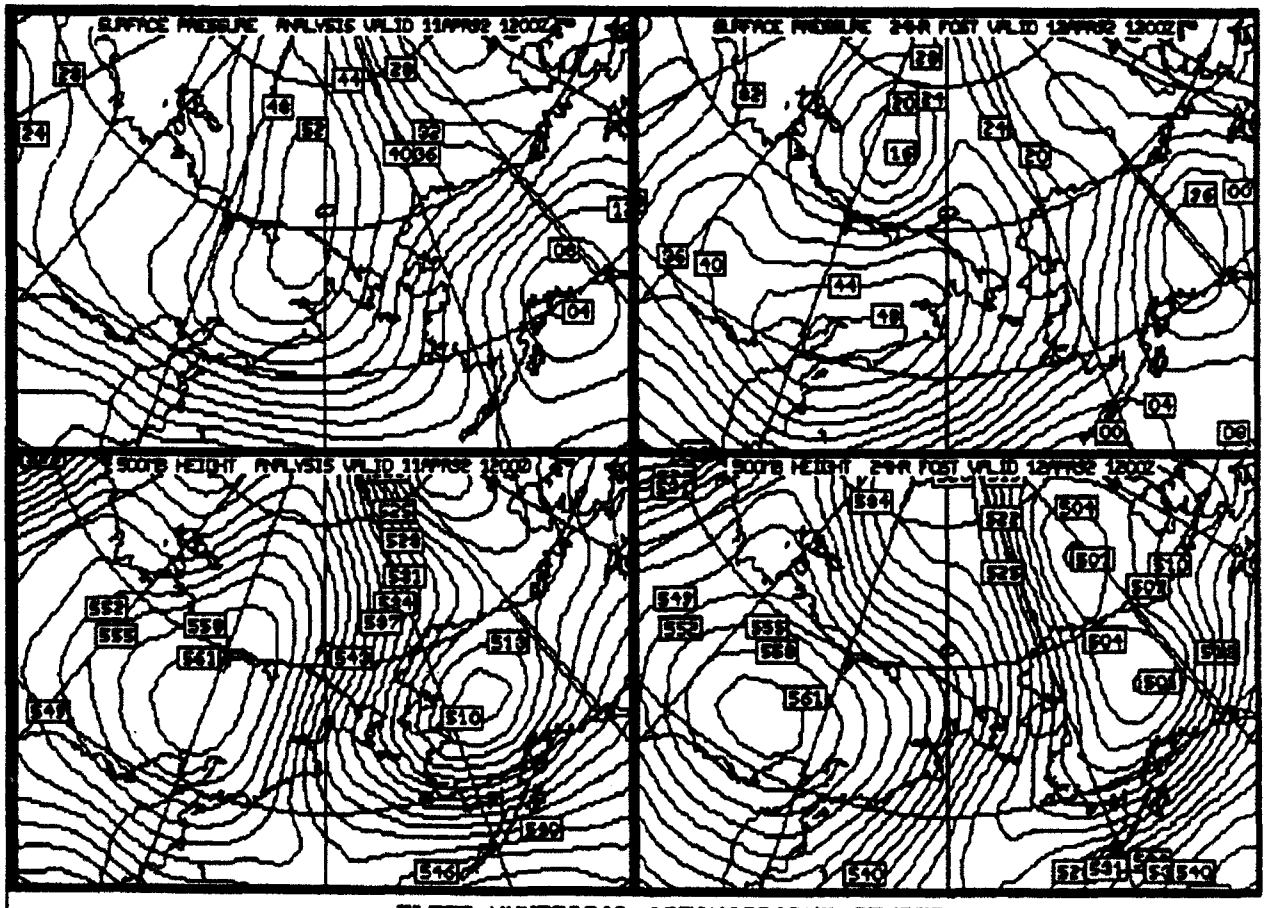
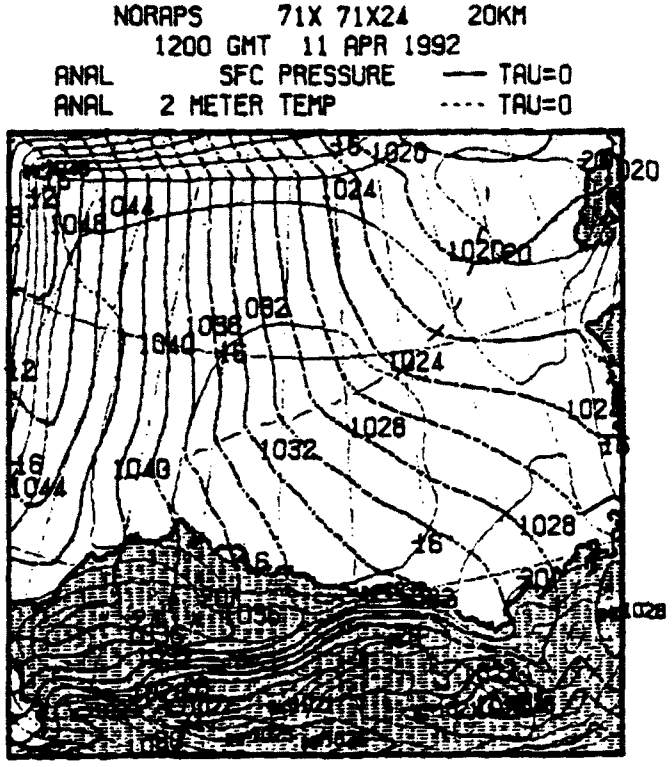
FCST 700 MB WINDS ···· TAU=24

11 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

11/1200Z Analyses and Forecasts (update)
A trough is shown extending across the central Beaufort at analysis time. Weather from the low had already passed over the ice camp by 11/1425Z. Satellite data revealed marked SW-NE striations in a frontal-like band over the camp (72.8N, 145.9W). By 12/1200Z the low was centered just NE of the camp position. Anchorage NWS products (surface analyses) do poorly in revealing this type of major synoptic change since charts are routinely terminated near 78N. By 12/1200Z cloudiness from this system already covered Barrow and other North Slope stations which experienced a change from clear to overcast conditions. Hope for improved forecasts to reveal such systems will await expanded areal coverage.



FLEET NUMERICAL OCEANOGRAPHY CENTER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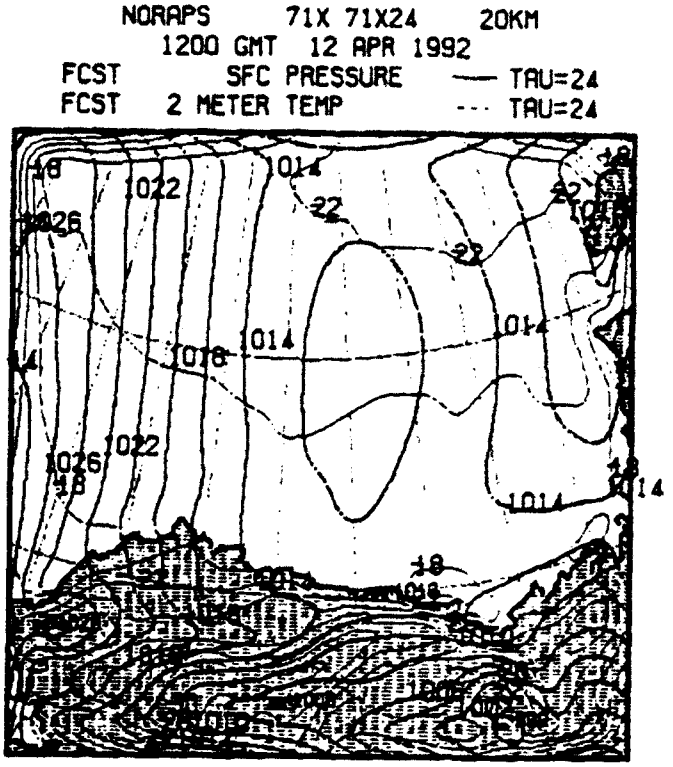
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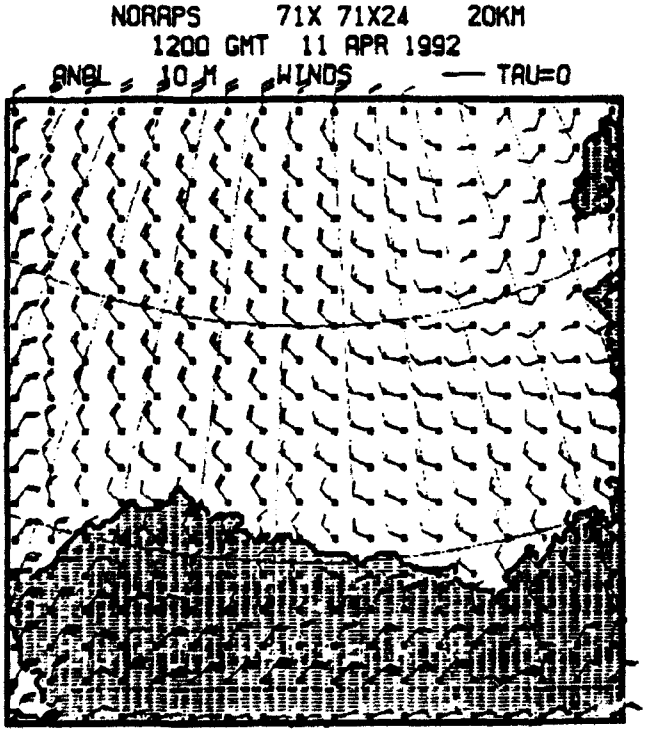
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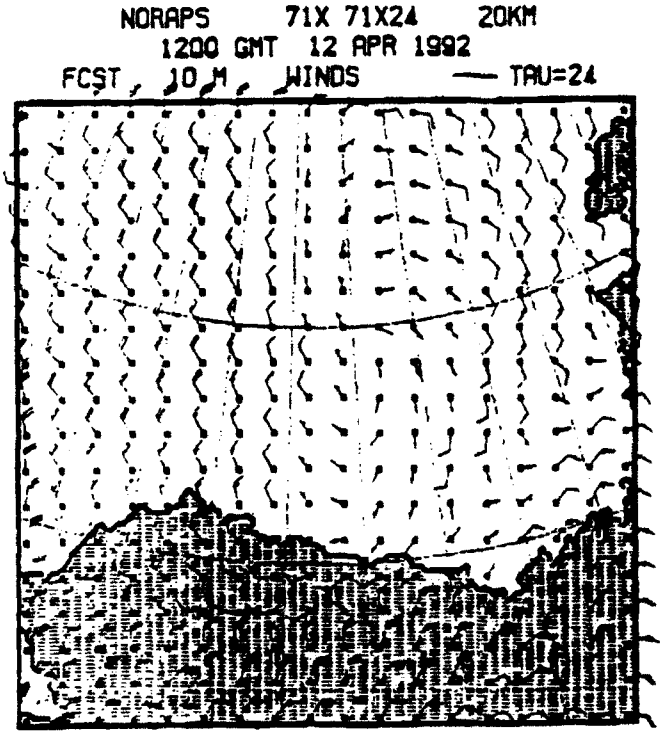
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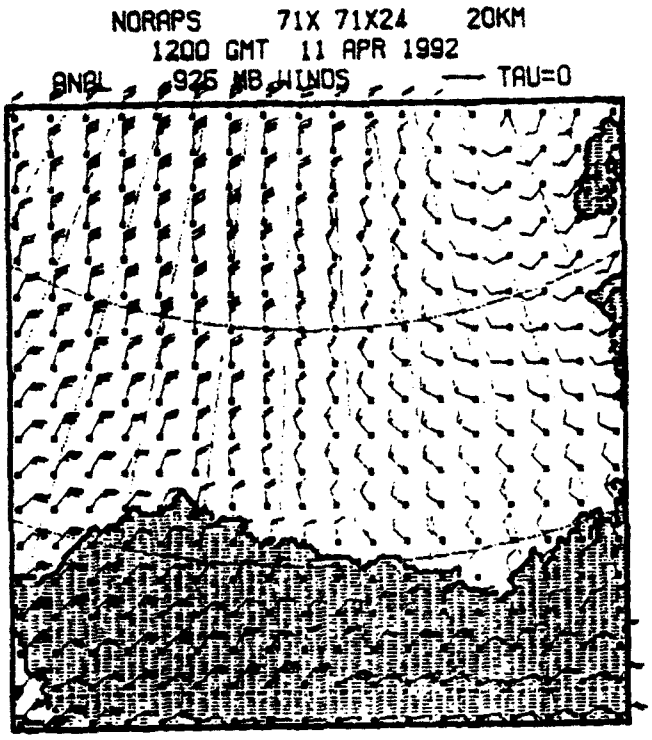
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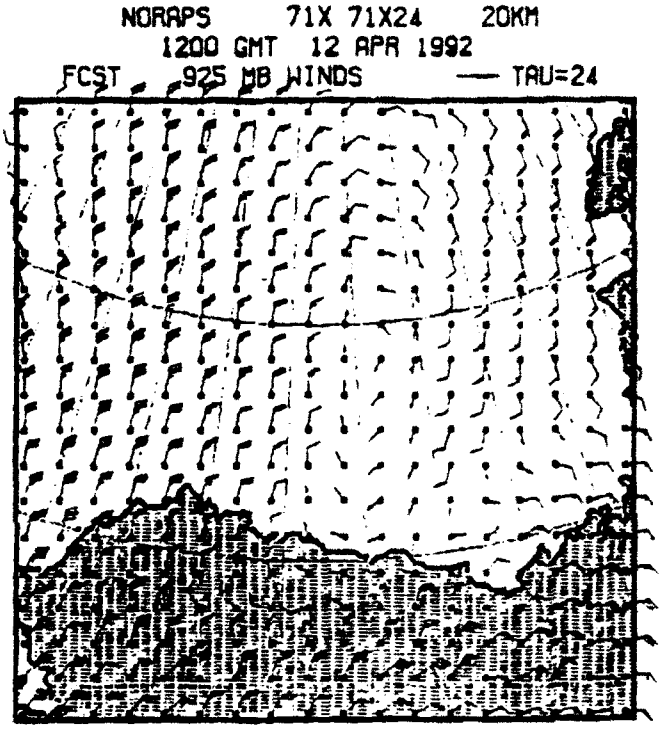
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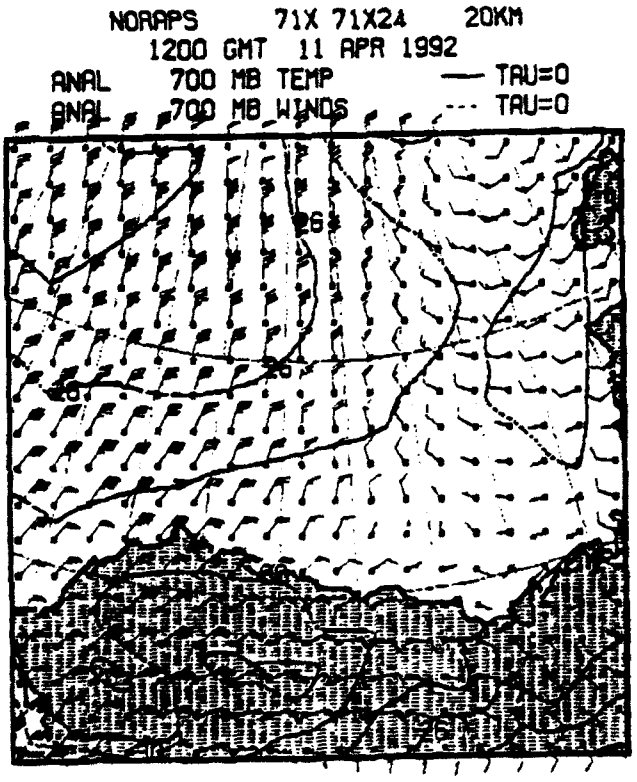
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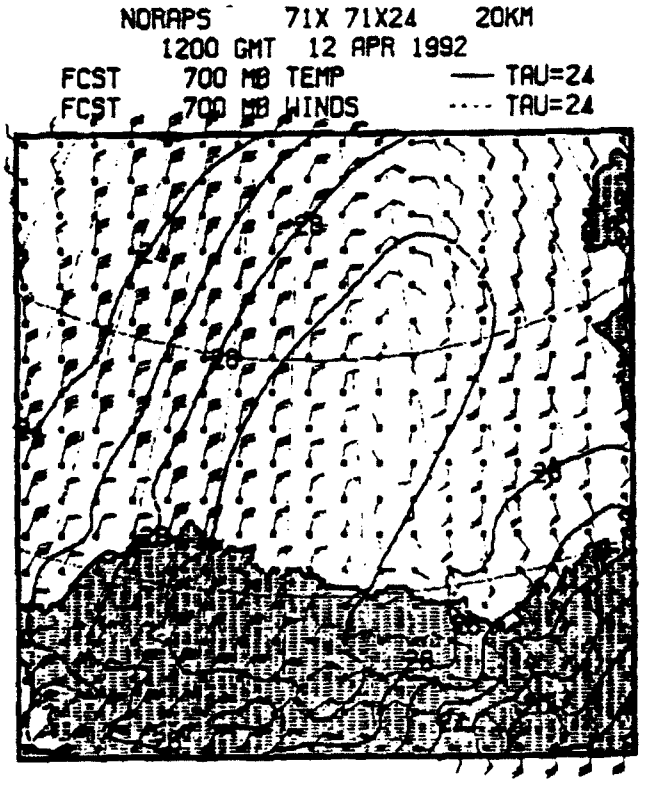
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12 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

12/0000Z Analyses

Surface Pressure

A closed 1016 mb low is shown NW of Banks. Most of the cloudiness of this system was to the west while the ice camp enjoyed relatively clear conditions.

10 M Winds

The anticyclonic turning of winds over the Brooks Range is shown on this analysis. This flow pattern set up one of the most spectacular mountain wave cloud formations ever documented by satellite.

925 MB

Strong winds of 40-50 kts are shown lifting up over the Brooks Range. Wave clouds first formed over the western portion and then move progressively eastward until the entire range was crowned at 1935Z by a spectacular wave cloud formation.

700 MB

The flow at this level is similar but stronger than at 925 mb.

13/0000Z 24-hr Forecasts

Surface Pressure

Low pressure slips further southward as the pressure gradient to the west weakens.

10 M

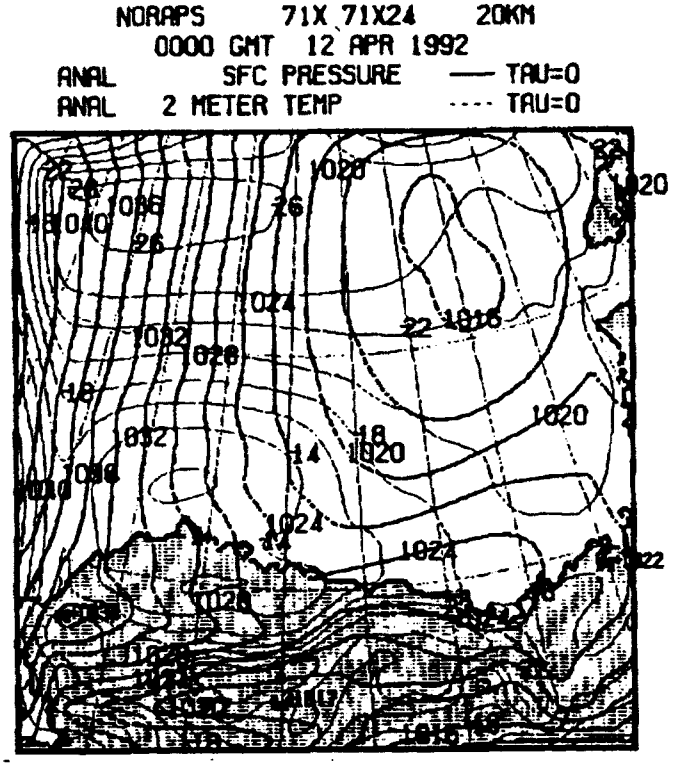
A small low center is also suggested at this level near 71N,145W and to the east over the NW Territories.

925 MB

A small low is also suggested at this level near 71N, 145W and another to the east over the NW Territories.

700 MB

This level also shows the N. Slope low but it is displaced further west near 71.5N, 150W. The low over the NW Territories appears further south.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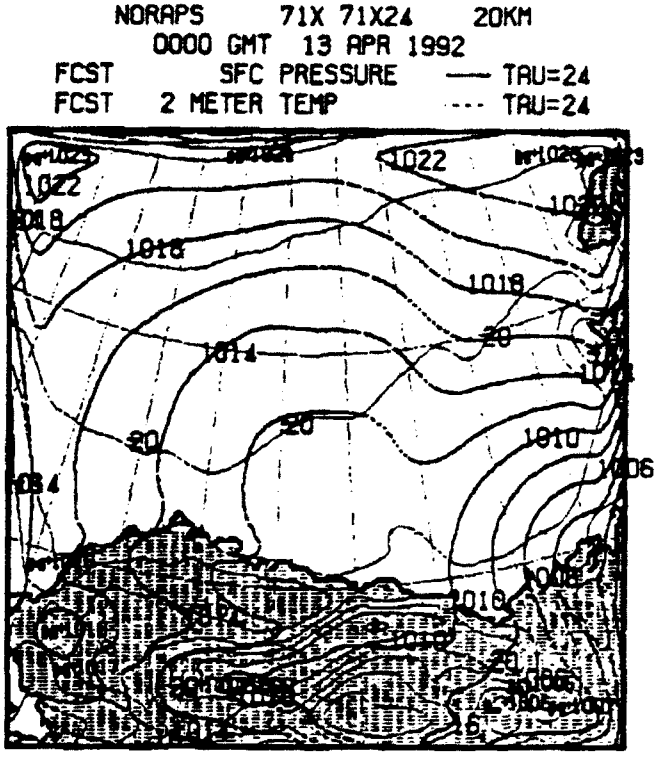
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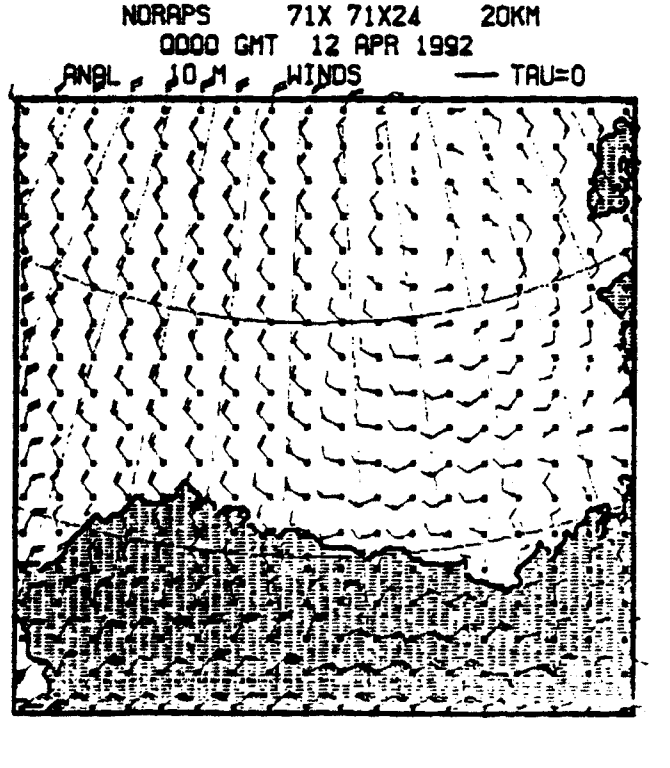
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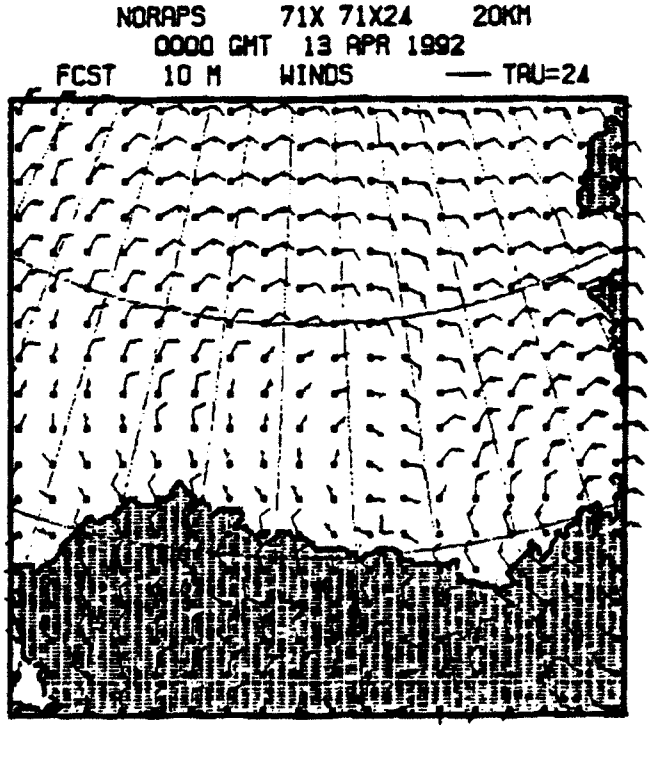
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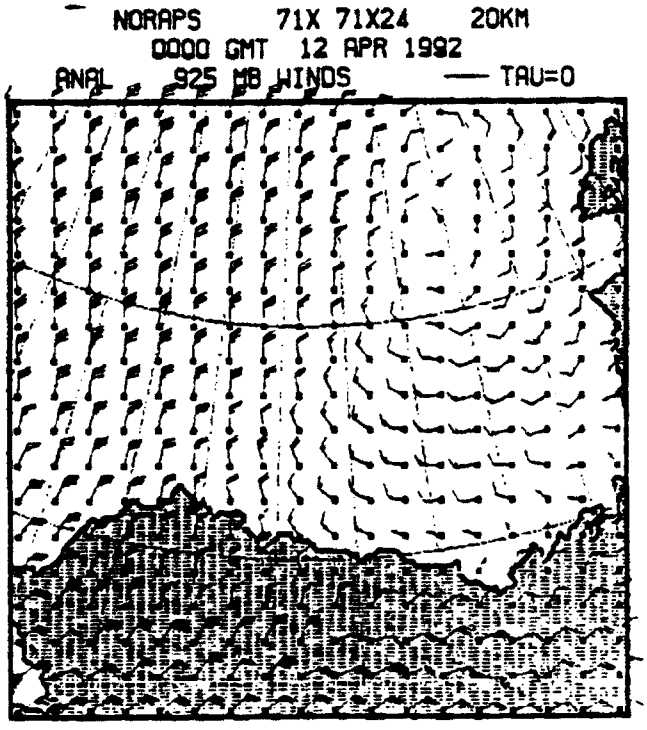
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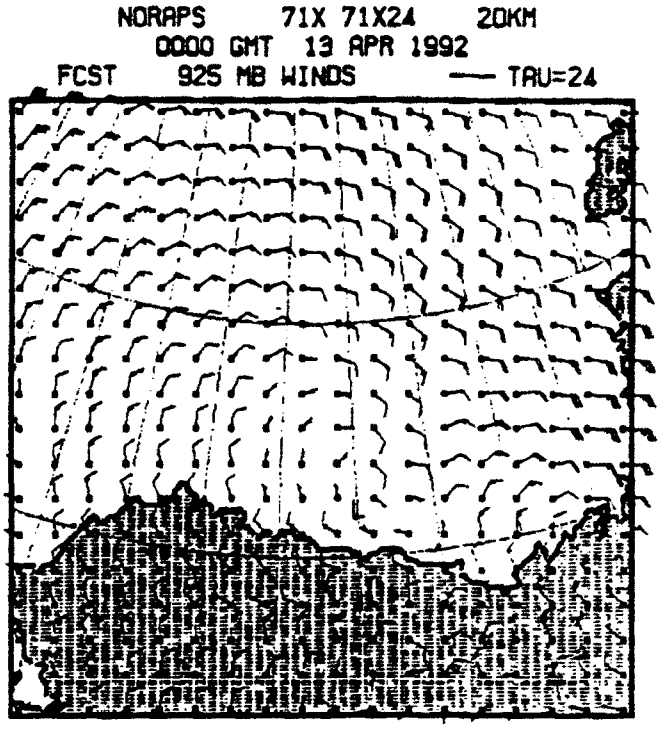
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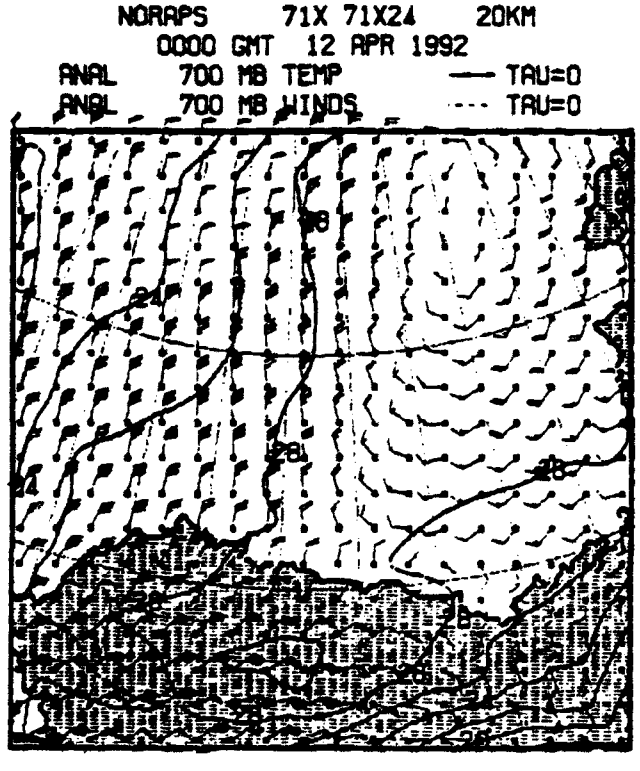
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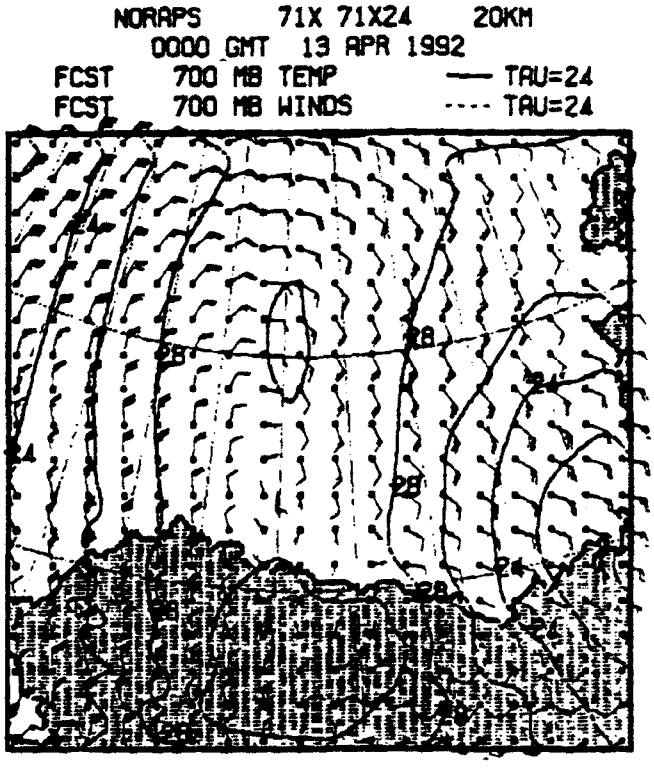
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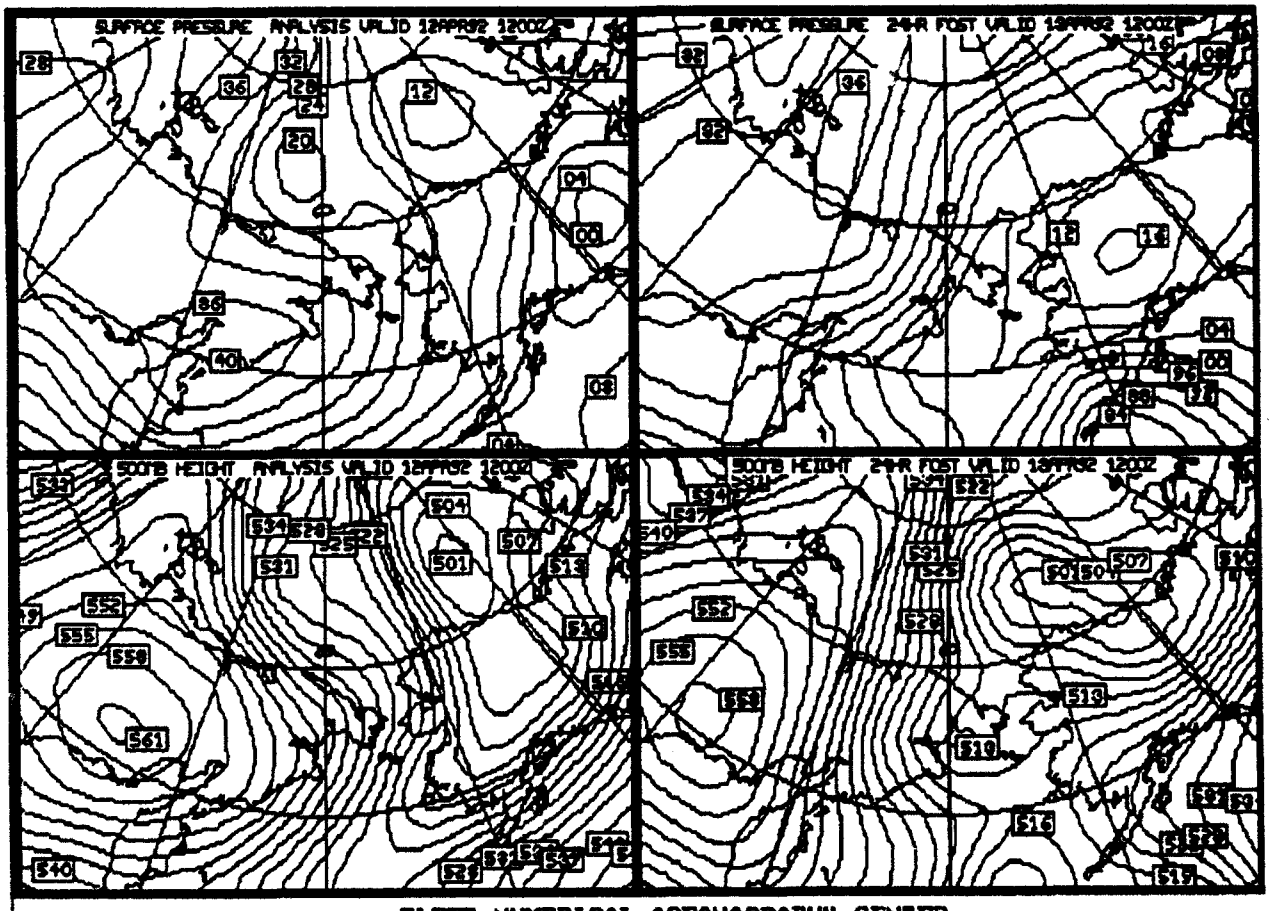
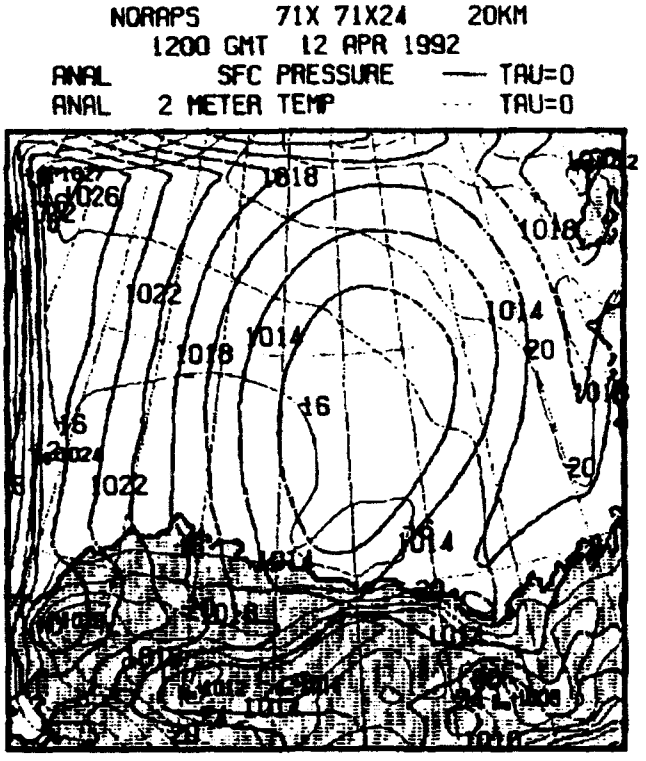
12 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

12/1200Z Analyses and Forecasts (update)
The analyzed low center covers an area mostly clear as revealed in the satellite data. At 1200Z the western half of the Brooks Range was covered by wave clouds. The entire range was crowned by such clouds seven hours later. Satellite data revealed a potent-looking cloud formation over the Mackenzie River Delta by 1755Z. NORAPS 13/1200Z forecast correctly shows a low center near that location. An E-W trough along the North Slope is suggested at the 10m, 925 mb, and 700 mb forecast charts. Strong SE winds are indicated covering the eastern Beaufort at the 700 mb level. The **NOGAPS** product does better than normal in revealing these larger scale effects.



FLEET NUMERICAL OCEANOGRAPHY CENTER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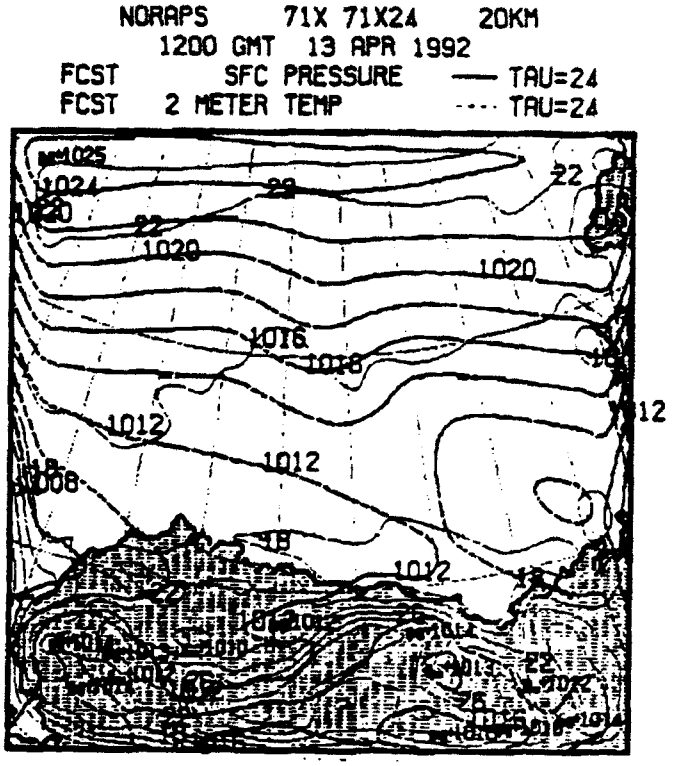
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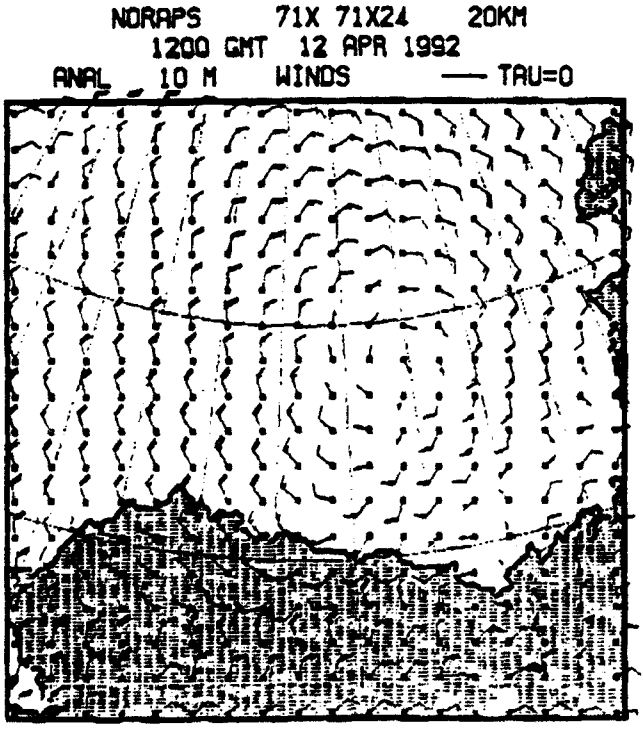
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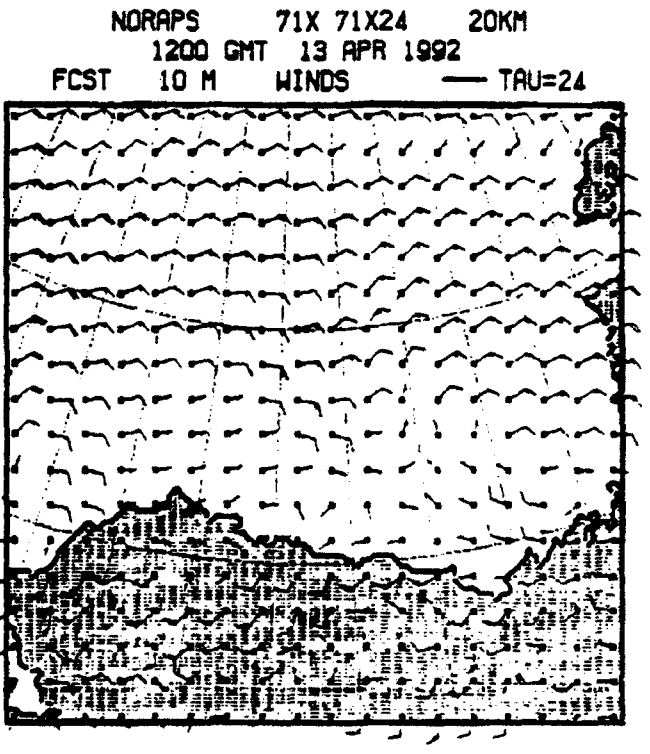
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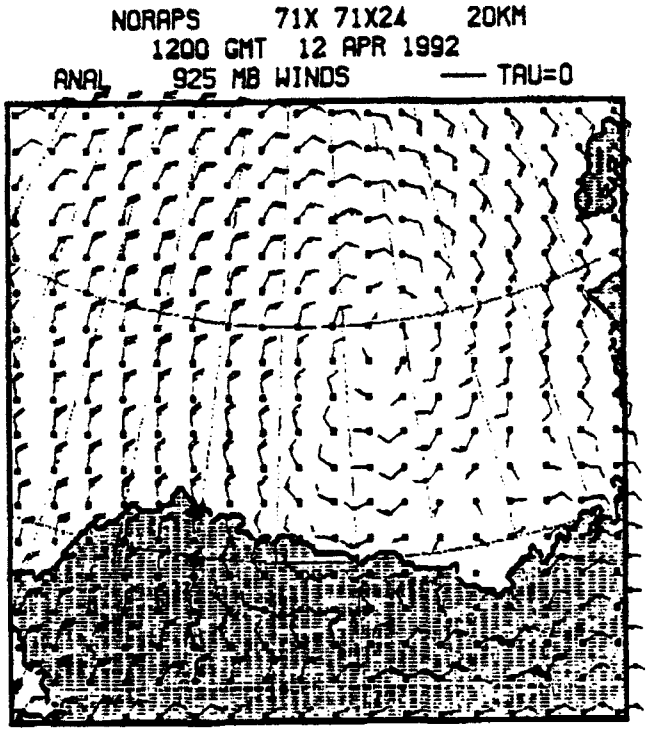
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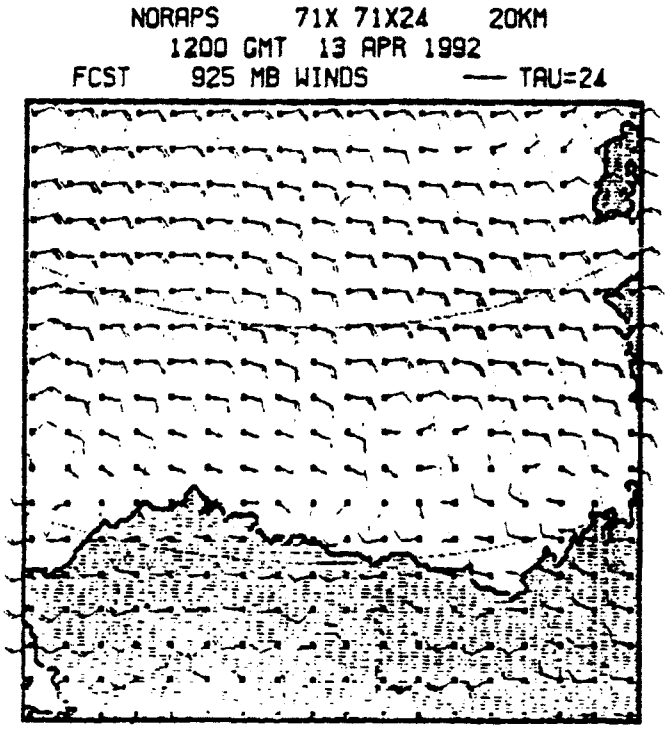
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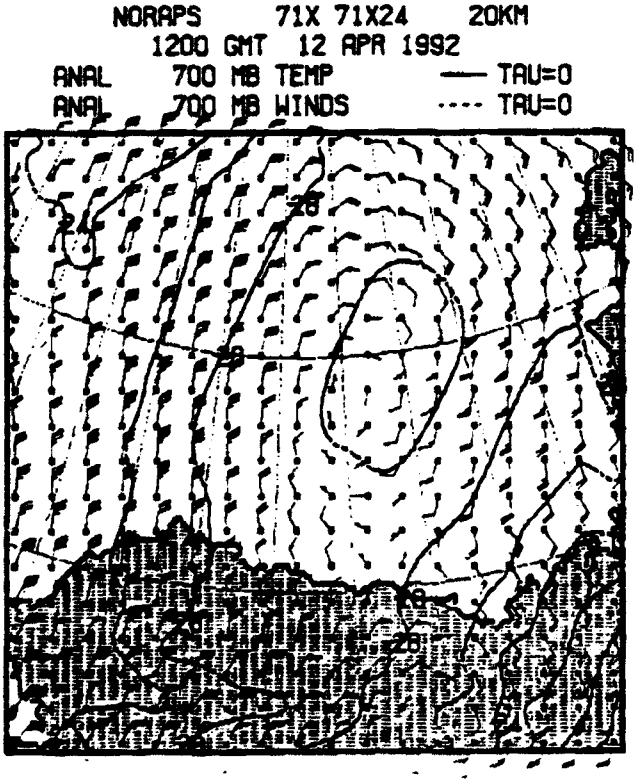
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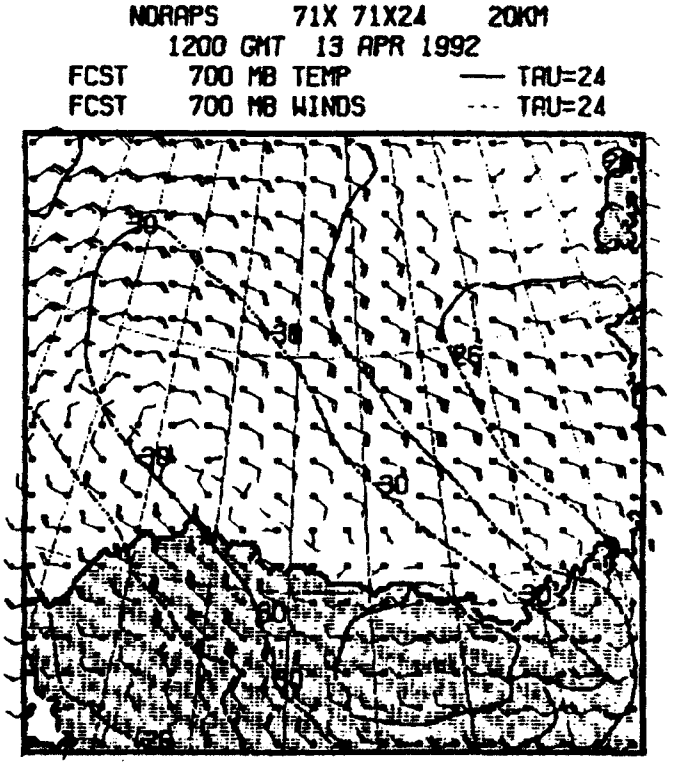
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FCST 700 MB WINDS --- TAU=24

13 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

13/0000Z Analyses

Surface Pressure

Low pressure analyzed with center NE of Barrow. Satellite data reveal this area to be quite open with only thin middle or high clouds.

10 M Winds

A well defined cyclonic circulation defines the low pressure area. Low pressure is also suggested by trough connections to the east and west.

925 MB

Similar to the 10m level.

700 MB

Much higher amplitude indicated with trough connections to the north and SE. Winds also stronger at this level.

14/0000Z 24-hr Forecasts

Surface Pressure

The low is shifted westward with a trough indicated along the N. Slope.

10 M

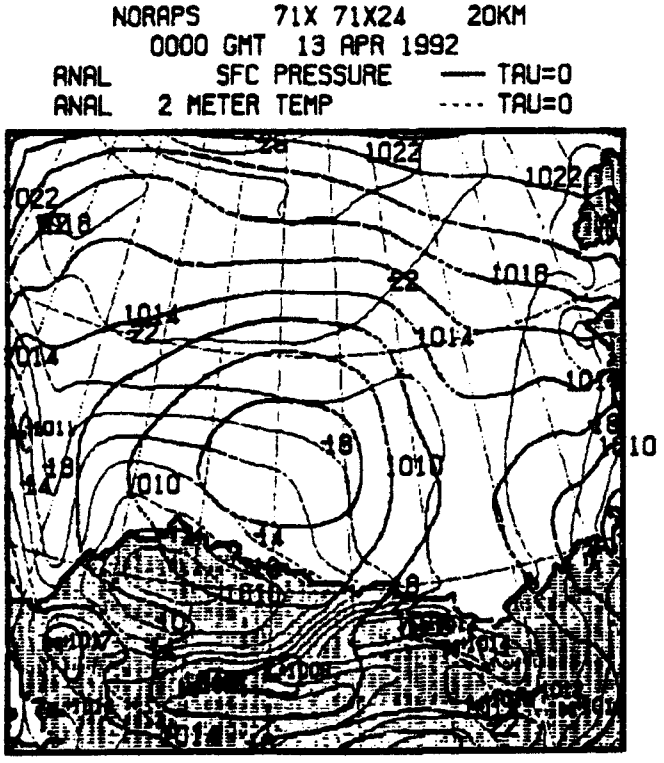
Winds quite light at this level with trough evidence along the N. Slope. Some minor vortices are shown in the E. Beaufort Sea.

925 MB

An E-W trough is indicated along approximately 71.5N.

700 MB

A well defined E_W trough is predicted in the region from 71-72,5N.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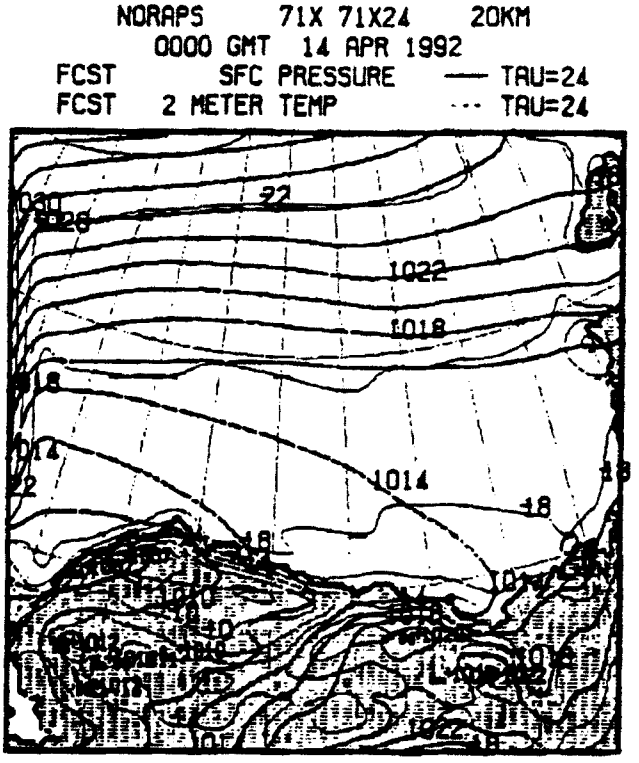
ANAL 2 METER TEMP ---- TAU=0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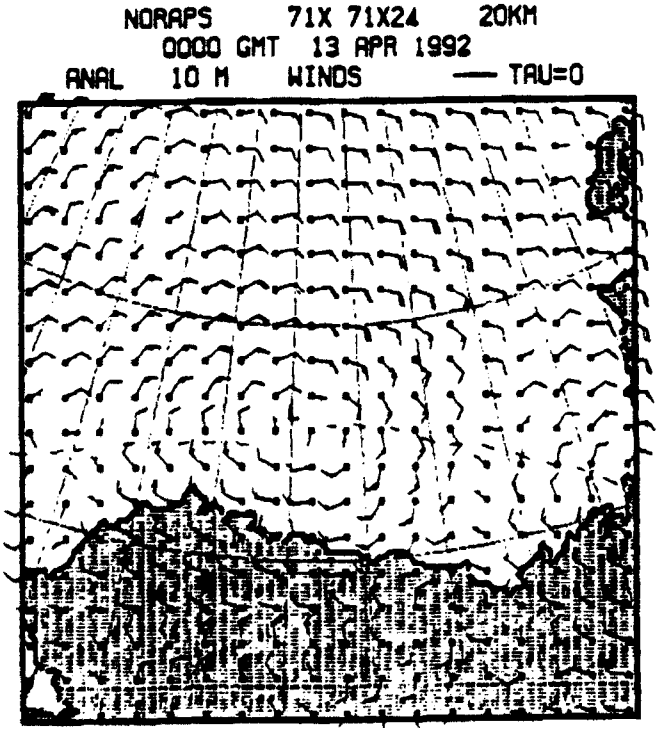
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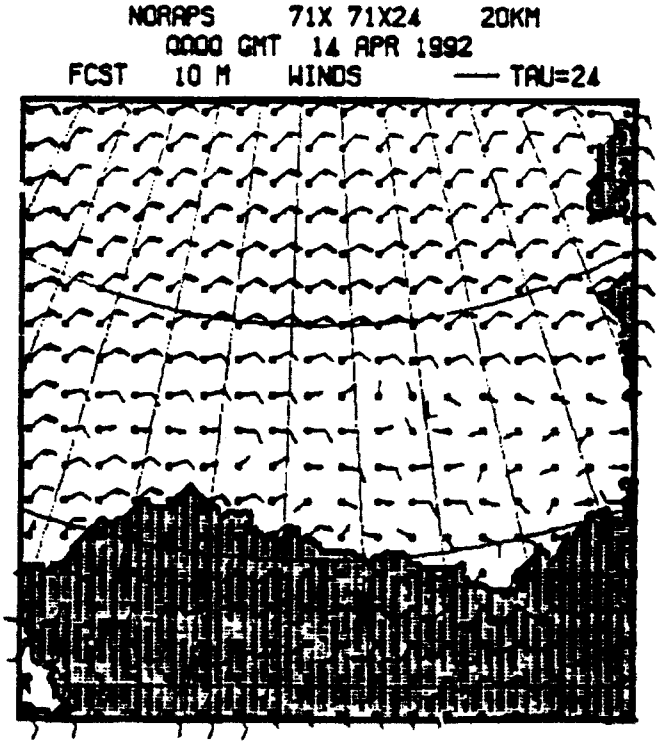
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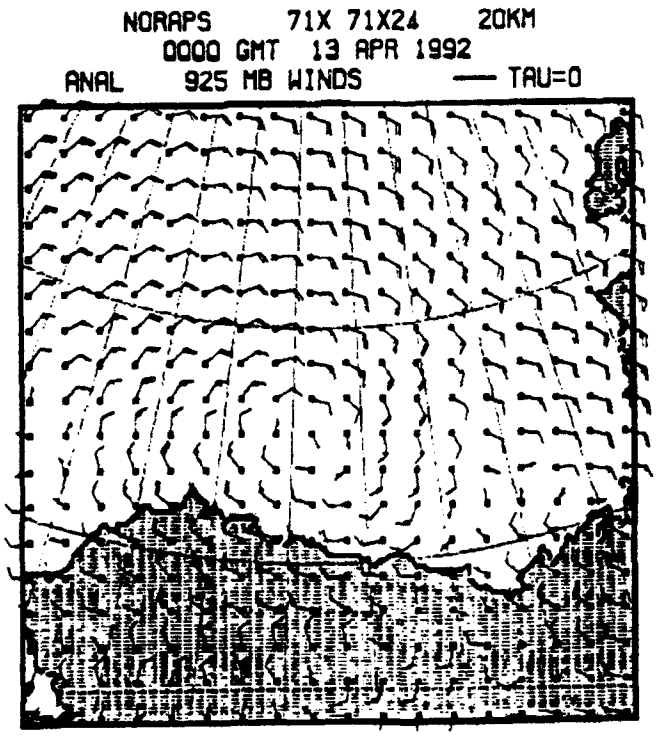
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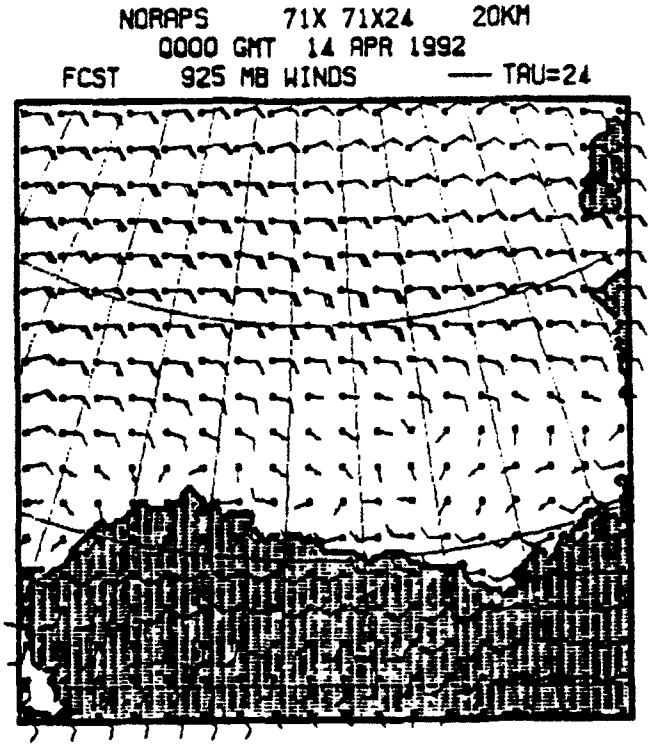
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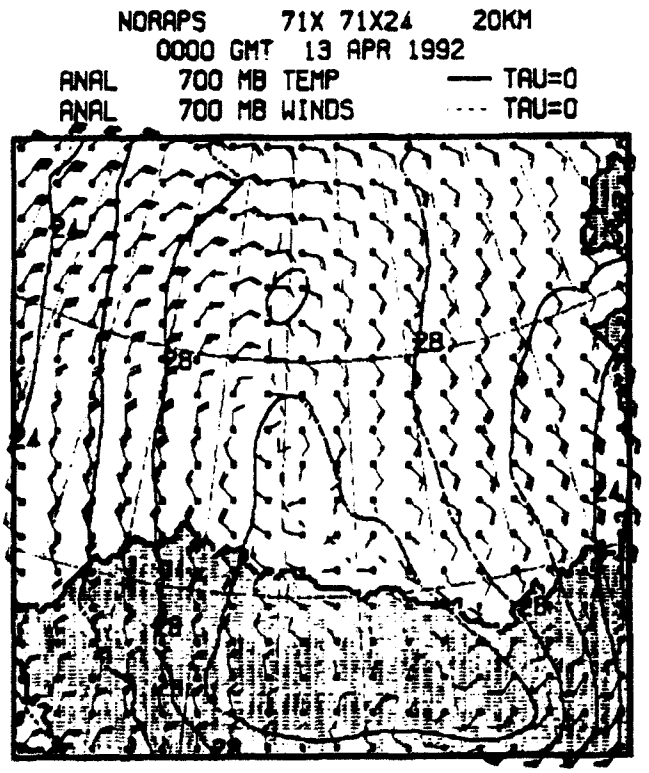
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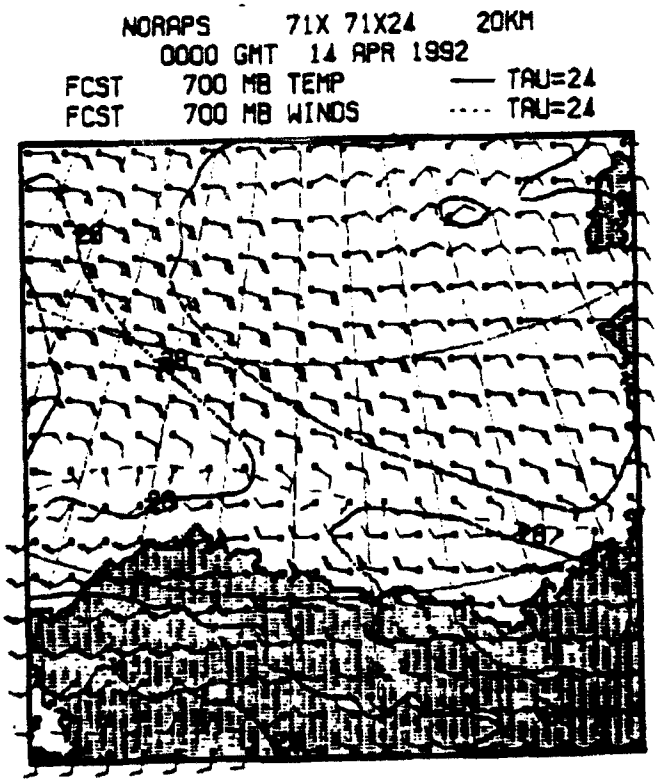
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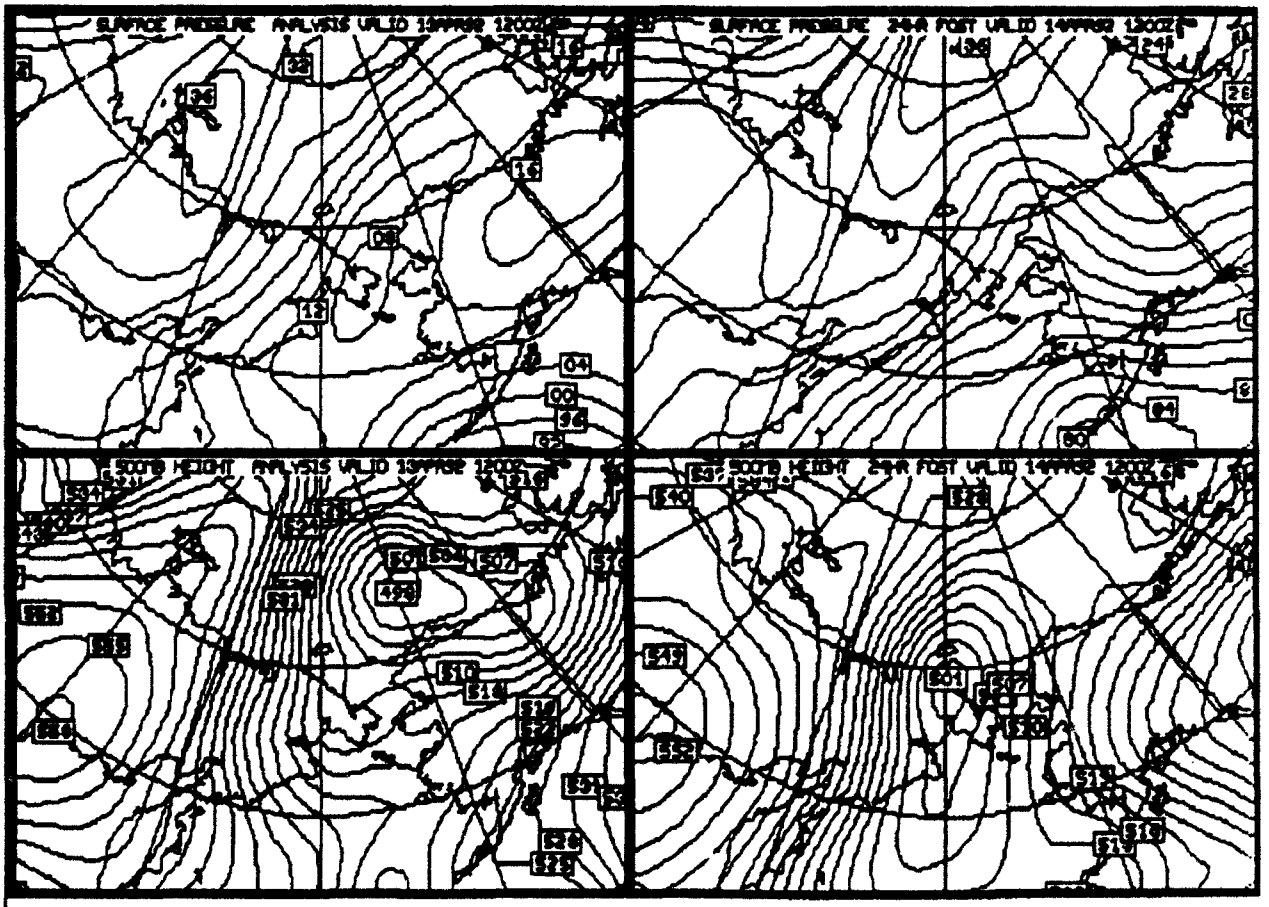
FCST 700 MB WINDS ---- TAU=24

I3 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

13/1200Z Analyses and Forecasts (update)
A col area is shown in the central Beaufort with lows on either end; one near Barrow, and the other just east of Banks. The ice camp (72.8N, 145.8W) experienced mainly clear conditions while N. Slope locations had mostly broken to overcast cloud conditions with low visibilities in light snow and fog. This may have resulted because of troughing over the area. A disturbed area in the eastern Beaufort seems to be associated with a 700 mb shear line in the region. A front-like band of clouds appears in satellite data (2016Z) stretching WNW from the Amundson Gulf region.



FLEET NUMERICAL OCEANOGRAPHY CENTER

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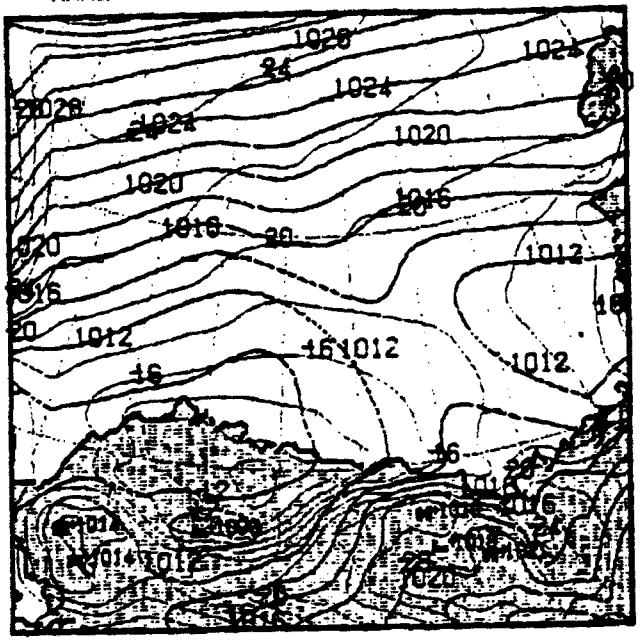
ANAL 2 METER TEMP ---- TAU=0



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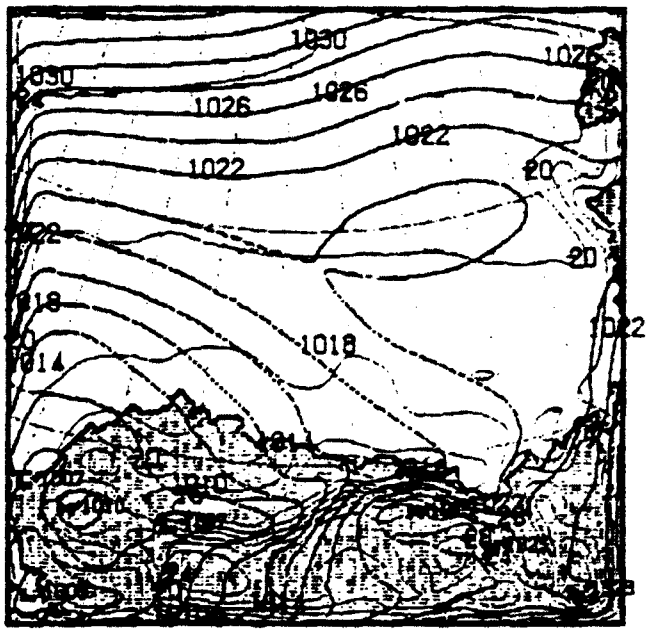

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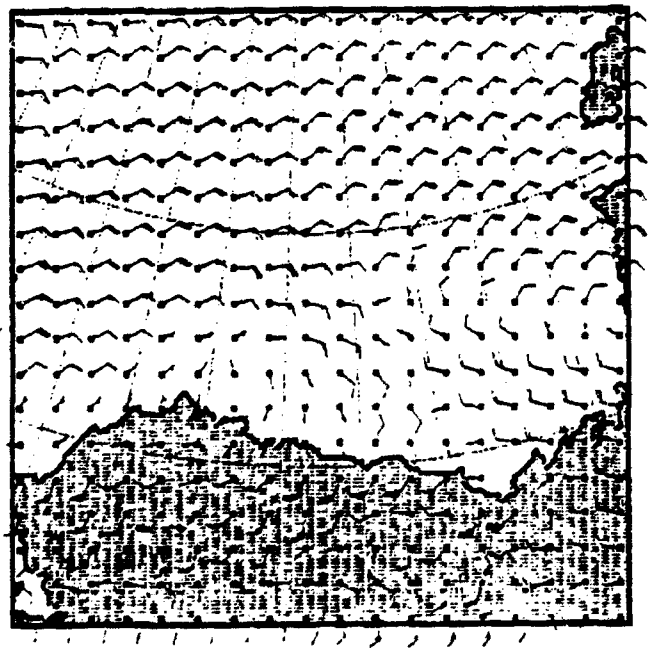

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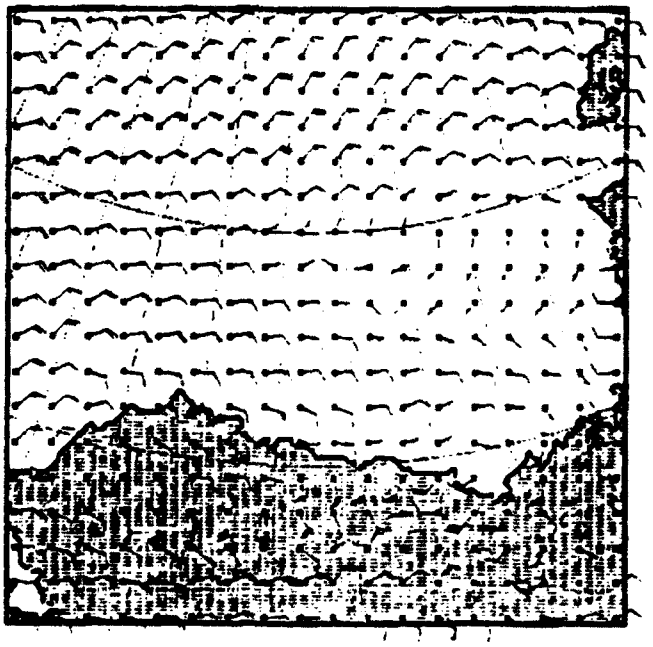

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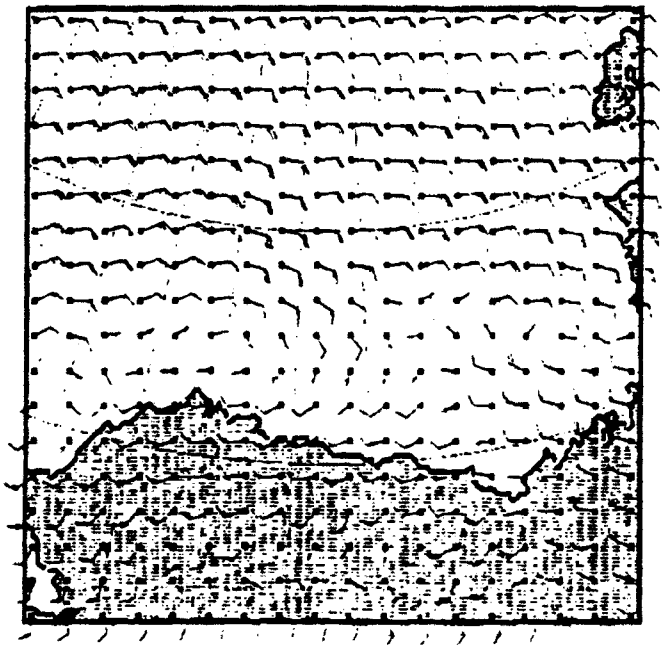

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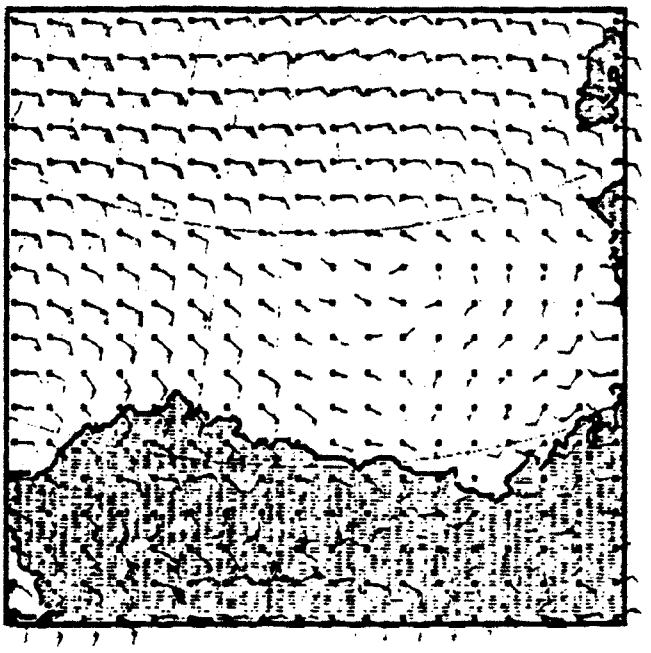

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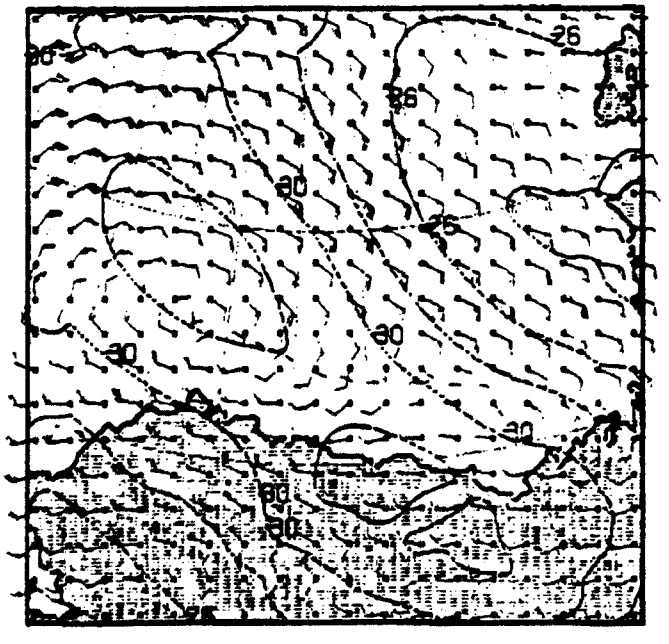
ANAL 700 MB WINDS ---- TAU=0



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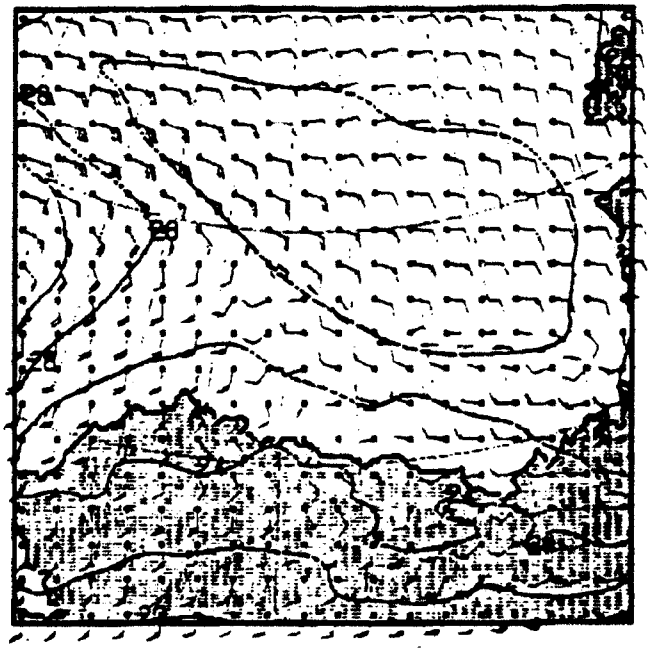

14 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

14/0000Z Analyses

Surface Pressure

Troughing is apparent near Banks and Barrow with a strong gradient to the north promoting easterly flow.

10 M Winds

An E-W trough extends west of Banks while a weak NE-SW oriented trough exists north of Barrow.

925 MB

The Banks trough is seen to link with the Banks trough shown as a shear line on this analysis.

700 MB

The Banks trough is displaced southward on the 700 mb analysis. A cold trough is shown by the isotherm analysis.

15/0000Z 24-hr Forecasts

Surface Pressure

The gradient is forecast to strengthen appreciably over the N. Slope and ice camp as low pressure slips to the south.

10 M

Some indication of the previous trough now over northern Alaska while moderate ENE winds of 20-25 kts are shown over the southern Beaufort.

925 MB

Similar to the 10m indications.

700 MB

Faint indications of troughing along the N. Slope. A weak trough is also shown in the east central Beaufort. Satellite data revealed weak evidence of a NW-SE oriented cloud band in the region.

NORAPS 71X 71X24 20KM
0000 GMT 14 APR 1992
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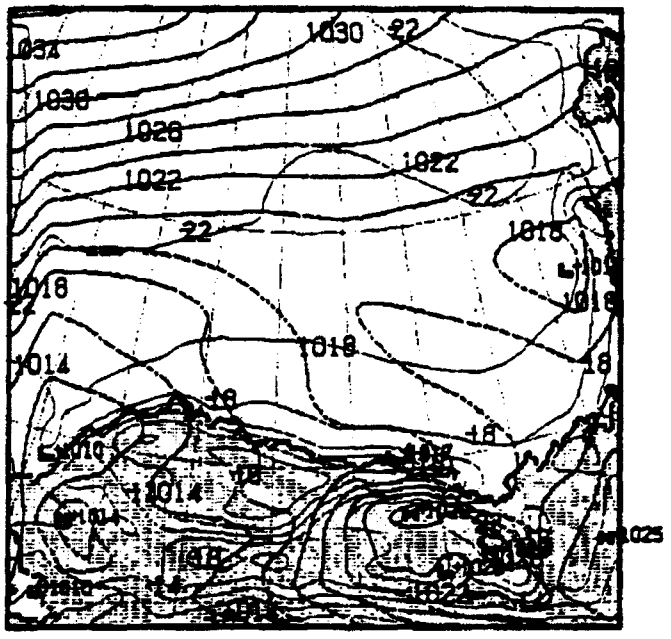
ANAL 2 METER TEMP ---- TAU=0



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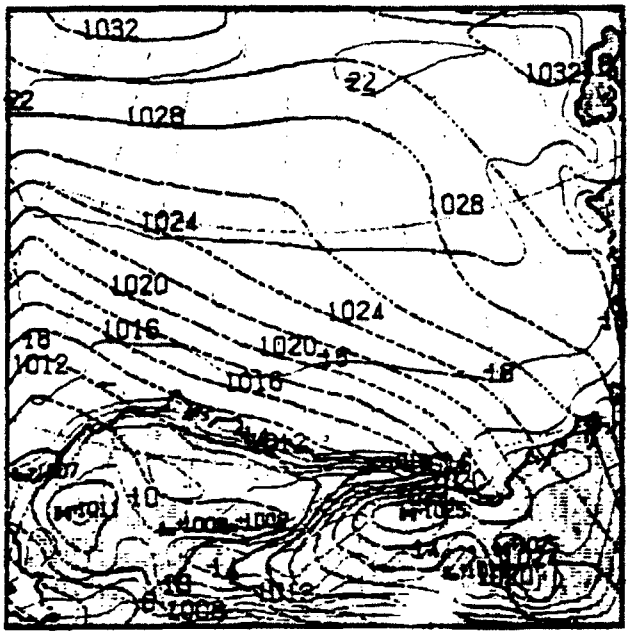

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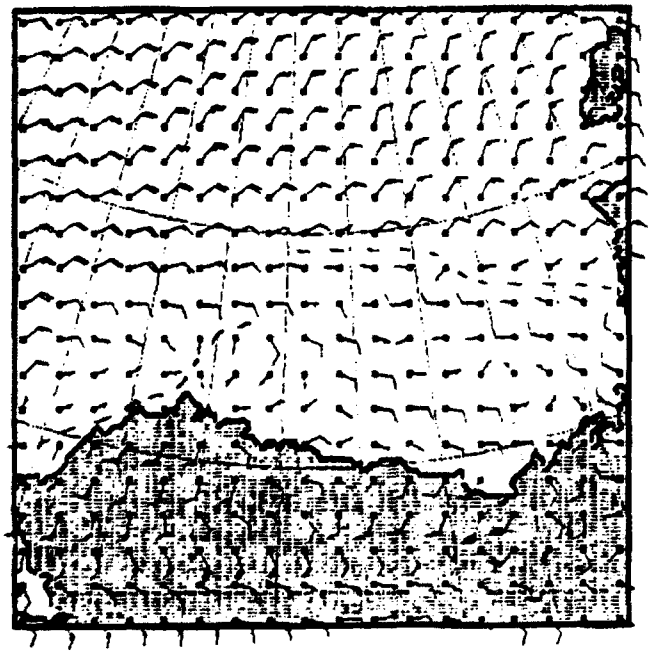

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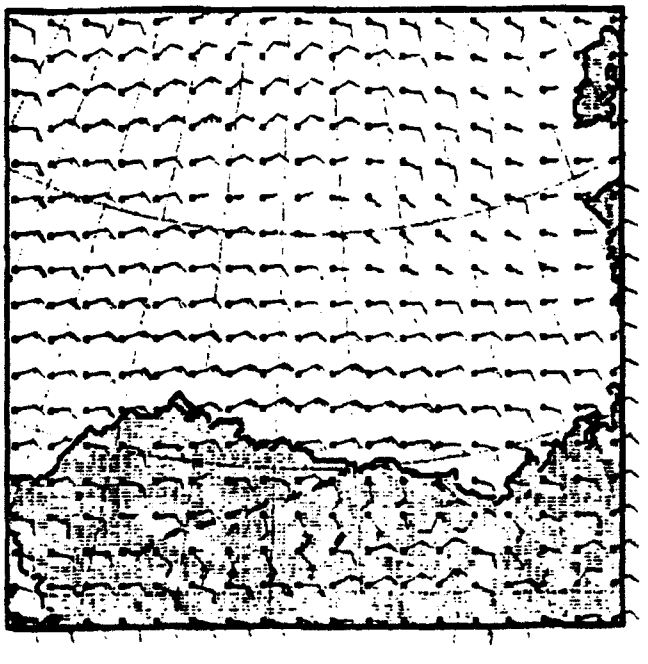

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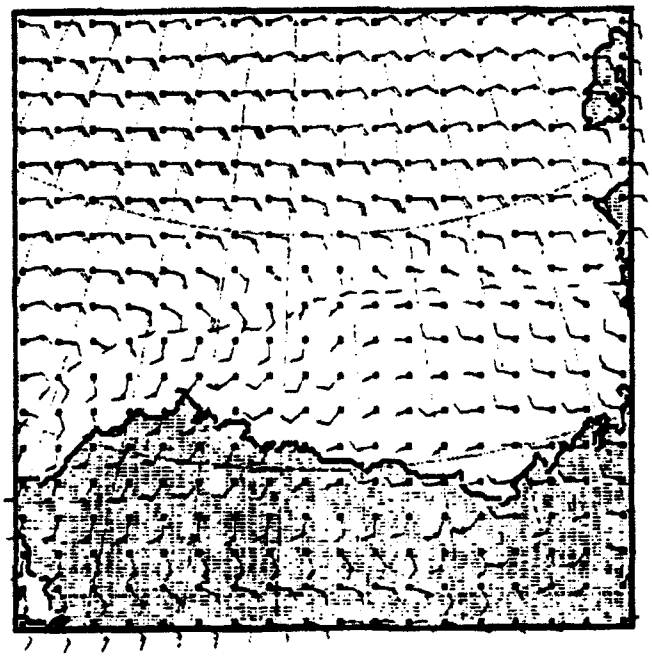

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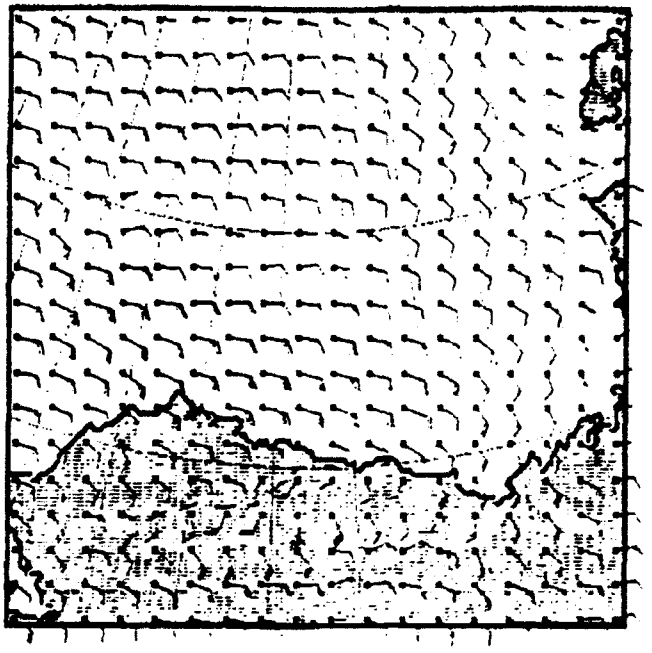

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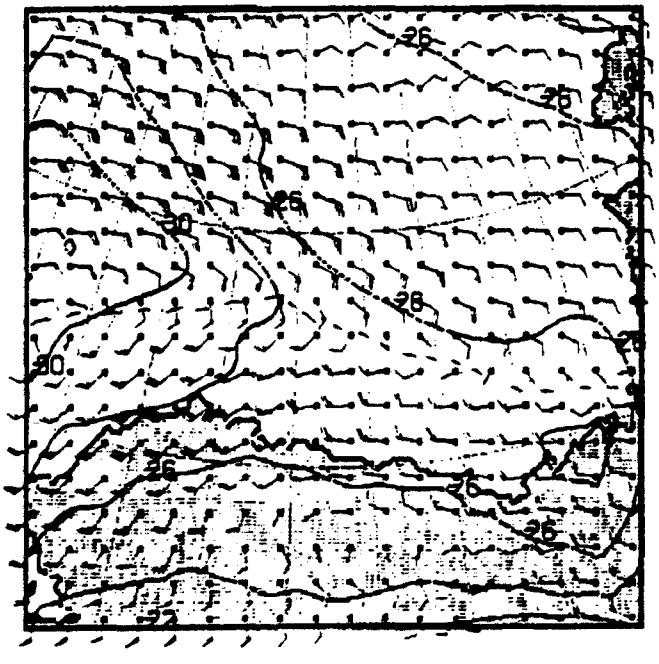
ANAL 700 MB WINDS ---- TAU=0



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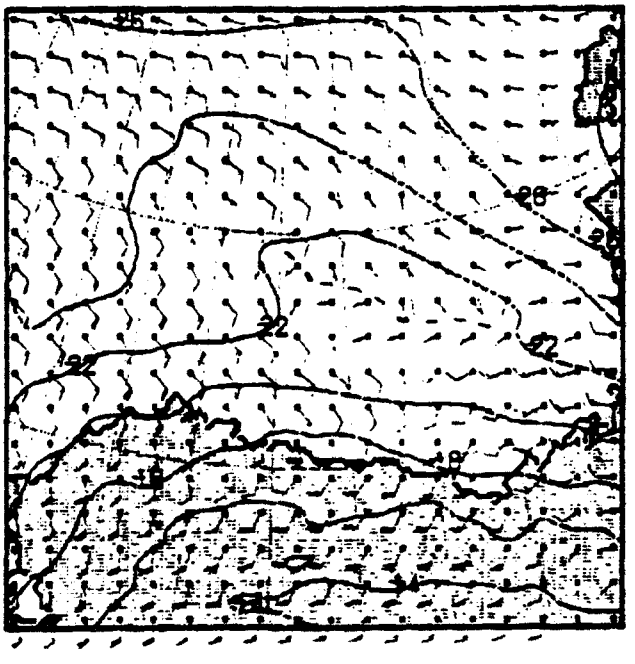
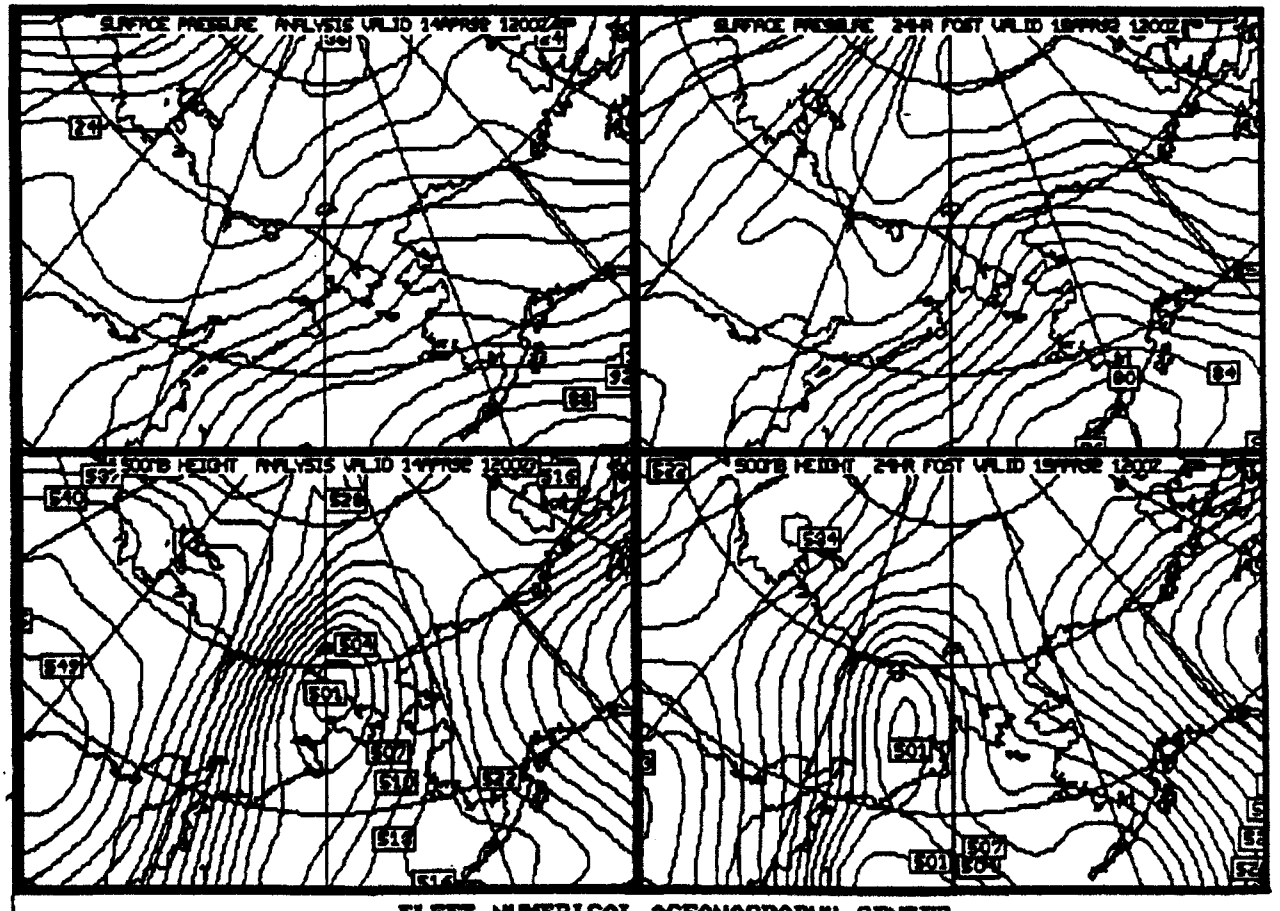


14 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

<u>14/1200Z Analyses and Forecasts (update)</u>
The ice camp (73.8N, 145.8W) enjoyed clear skies throughout the day in light NE flow. A gradual strengthening of the gradient tended to promote stronger undisturbed easterly flow late in the period. A closed cyclonic circulation is shown at he surface and 925 mb levels at 14/1200Z. This is associated with a trough shown on the 14/1200Z 700 mb analysis extending across the central Beaufort from southern Banks Island. This coincides rather well with an unexplained bright streak appearing in the satellite data(14/1349Z). The <u>NOGAPS</u> surface analysis reveals none of these important features, although the forecast product agrees quite well with NORAPS.



FLEET NUMERICAL OCEANOGRAPHY CENTER

NORAPS 71X 71X24 20KM
1200 GMT 14 APR 1992
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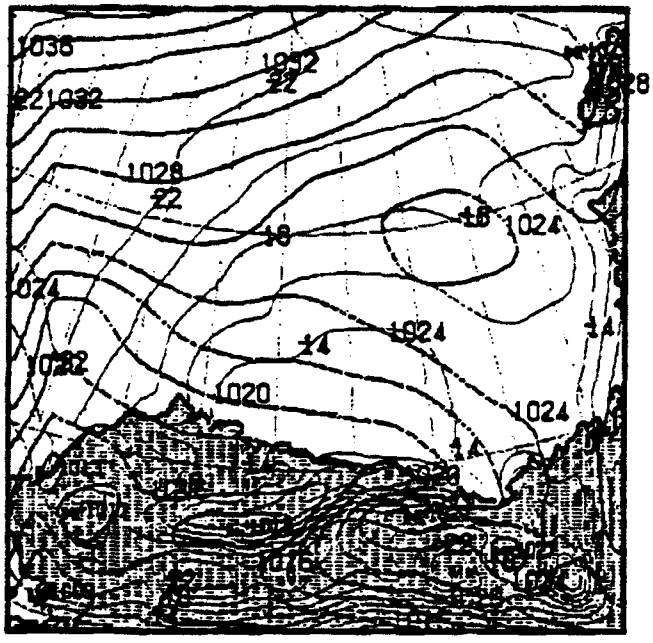
ANAL 2 METER TEMP ---- TAU=0



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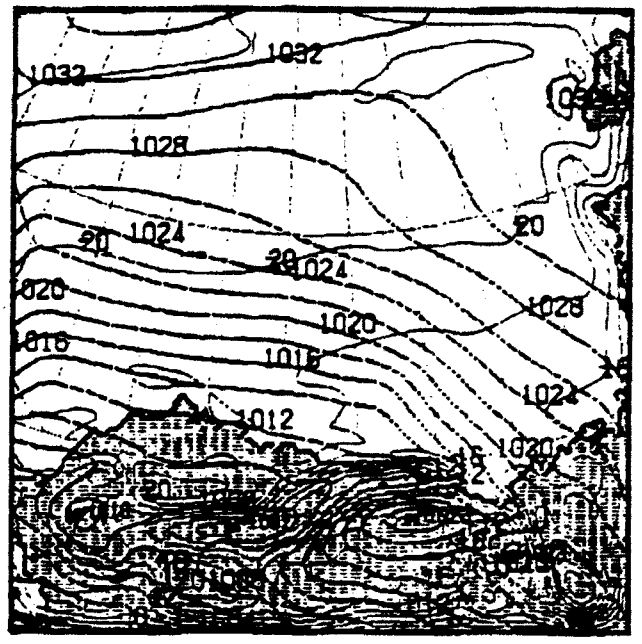
FCST 2 METER TEMP ---- TAU=24



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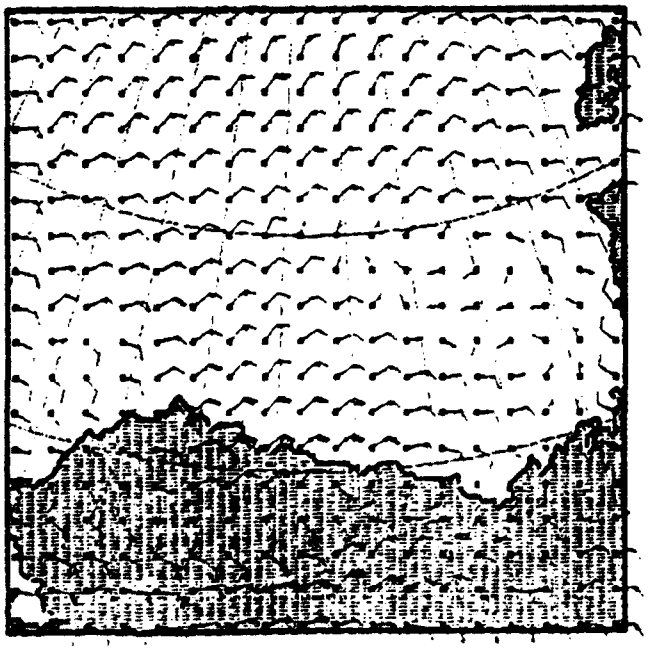

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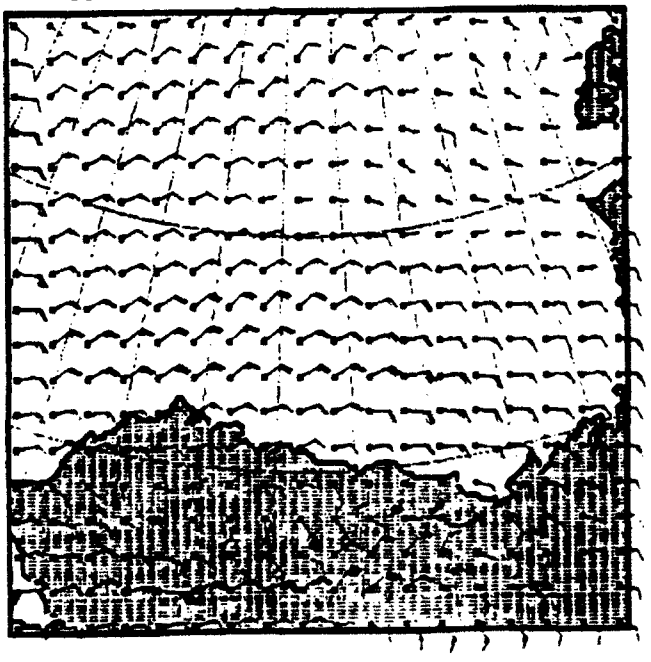

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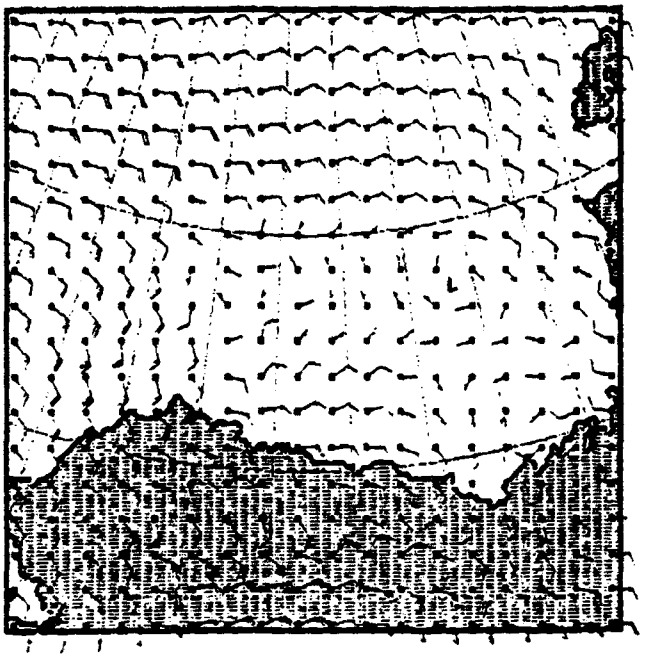
ANAL 925 MB WINDS —— TAU=0



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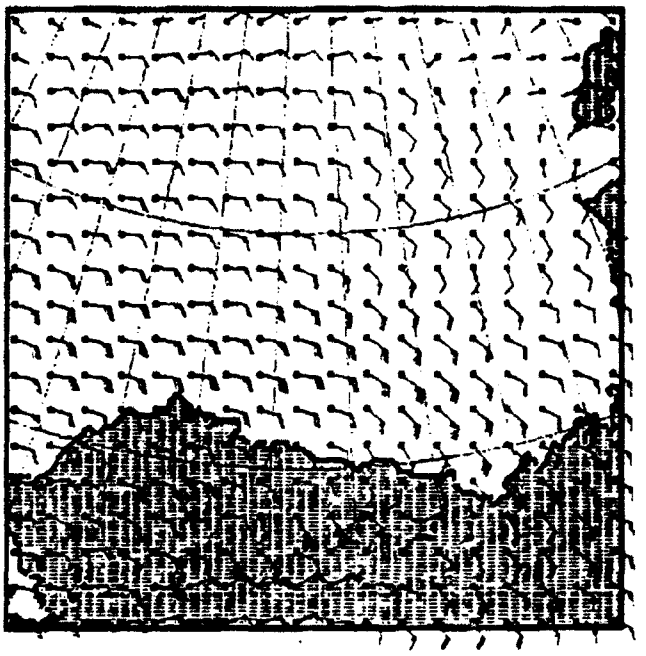

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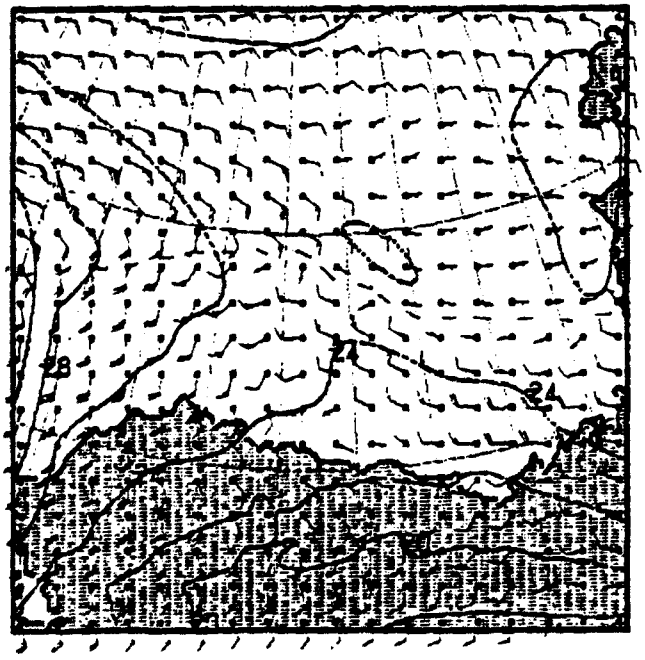

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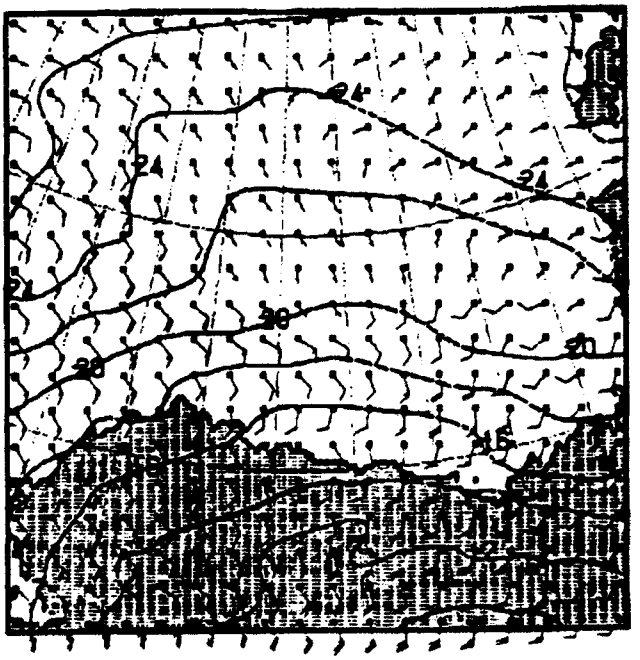

15 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

15/0000Z Analyses

Surface Pressure

Strengthening of gradient over N. Slope appeared as forecast.

10 M Winds

20-25 kt easterly winds over the N.Slope region. Lighter at the ice camp (72.8N, 146.1W). Station weather clear all day.

925 MB

An increase in wind speeds to easterly at 30 kts shown over the fast ice.

700 MB

Much more complicated flow at this level, with a ridge line NNE of Barrow and a trough indicated NW of Banks.

16/0000Z 24-hr Forecasts

Surface Pressure

A very strong pressure gradient promoting easterly flow is shown to develop encompassing the N. Slope and ice camp region.

10 M

Winds forecast to increase to 25-35 kts between Deadhorse and the ice camp.

925 MB

Winds increase to 35 kts at this level.

700 MB

Much lighter wind speeds with the ridge line moving NE'ward.

NORAPS 71X 71X24 20KM
0000 GMT 15 APR 1992
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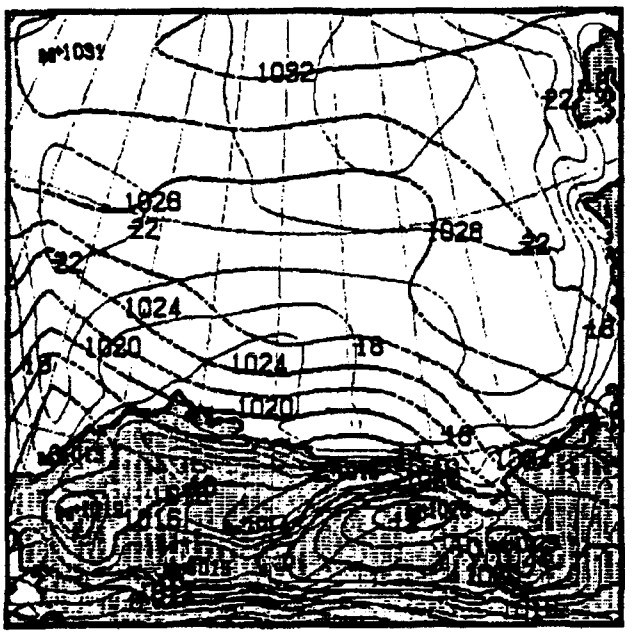
ANAL 2 METER TEMP ---- TAU=0



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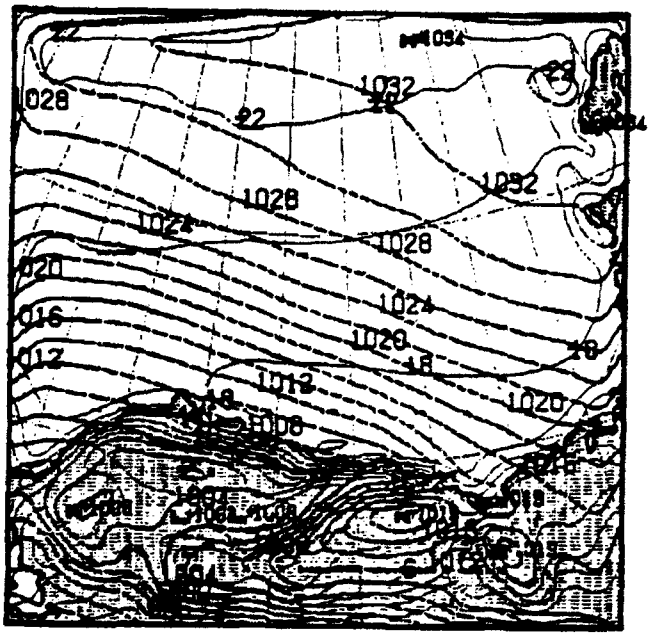

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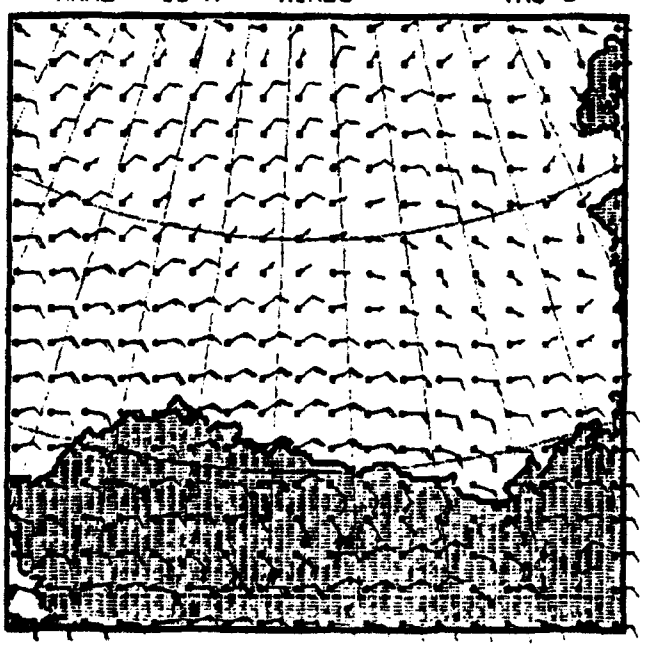

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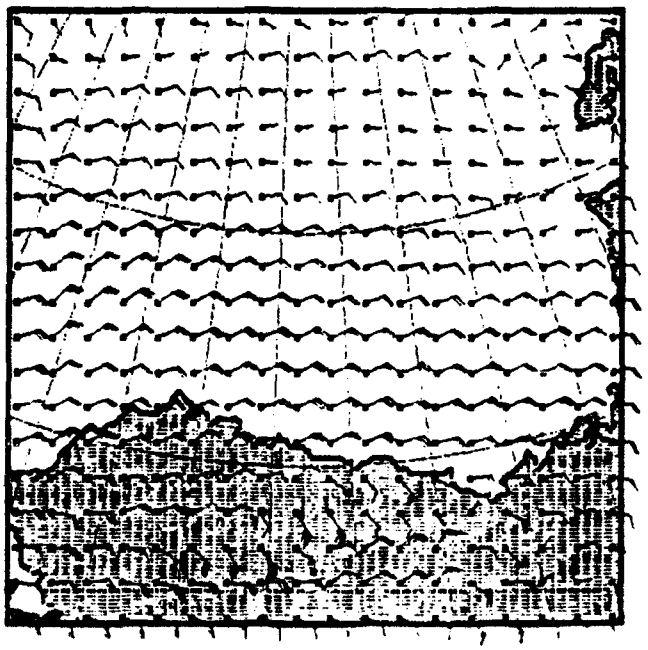

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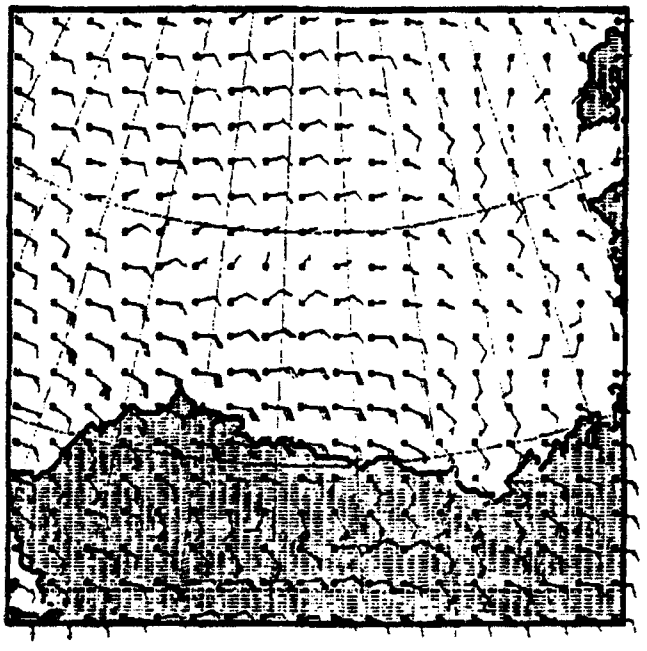

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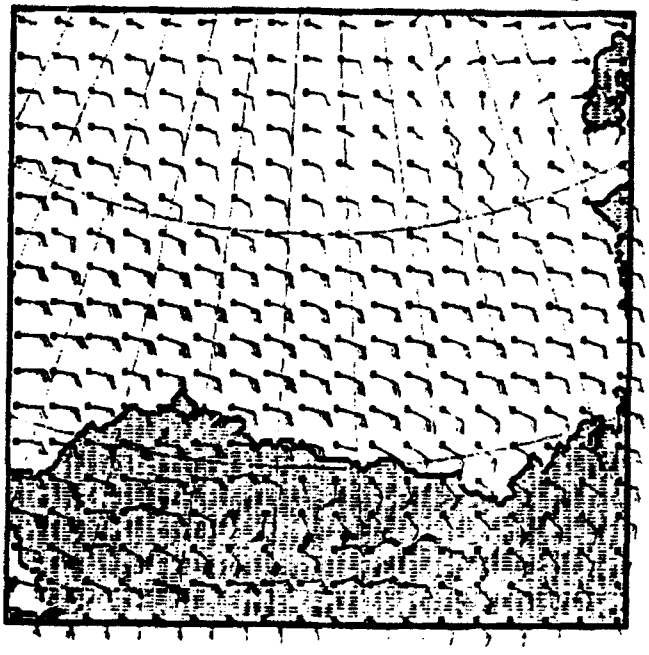

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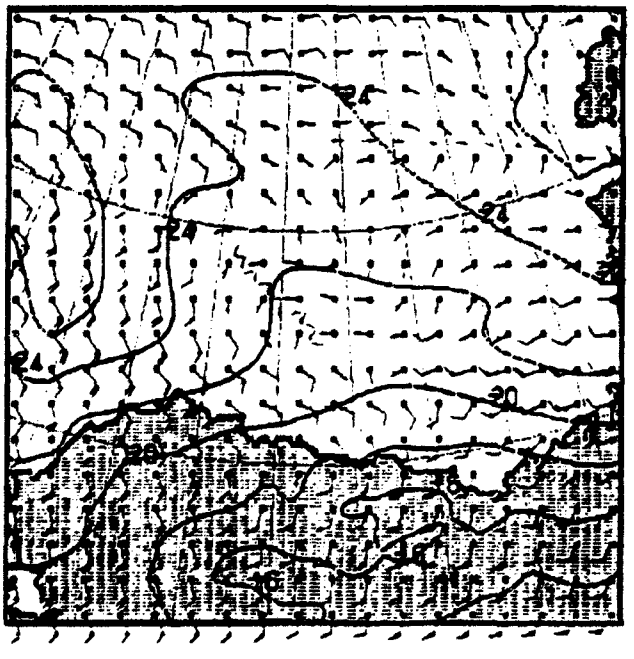
ANAL 700 MB WINDS ··· TAU=0



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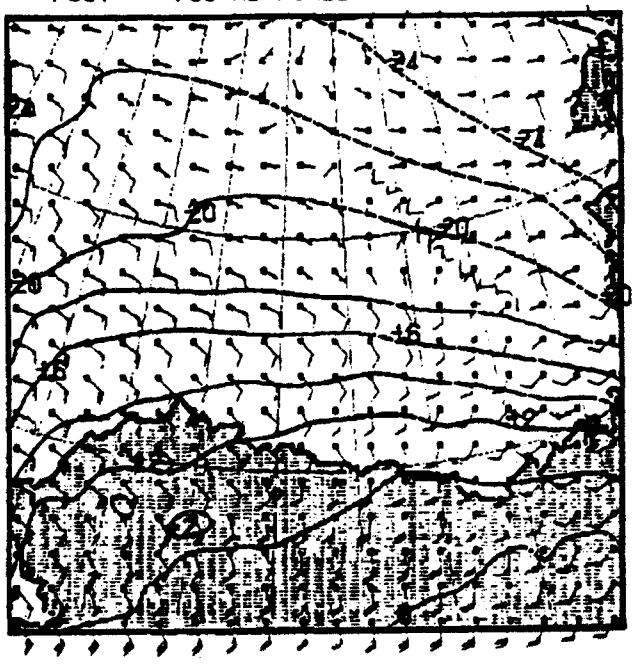
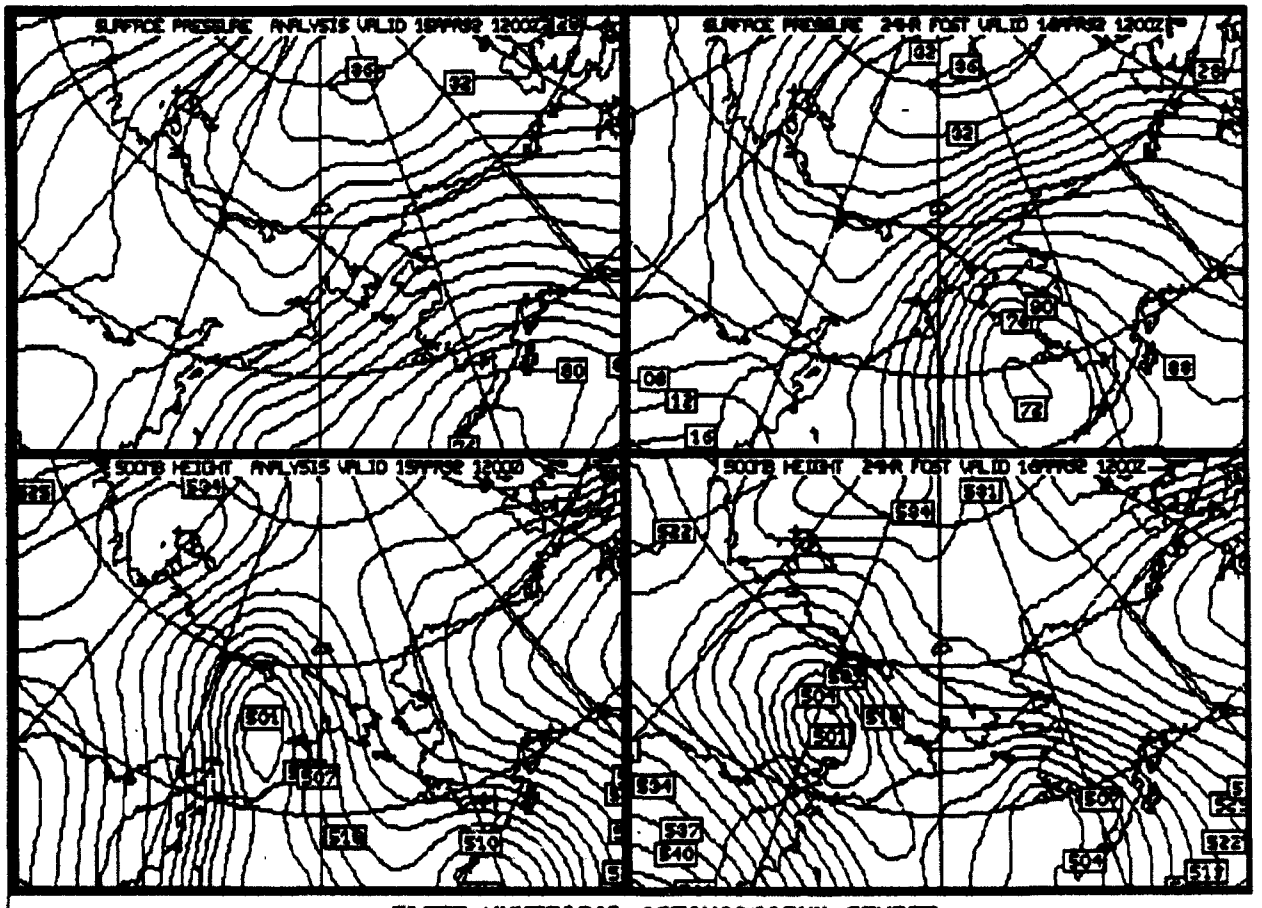
FCST 700 MB WINDS ···· TAU=24



15 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

15/1200Z Analyses and Forecasts (update)
The pressure gradient strengthened more slowly than originally forecast but at later hours out to 16/0000Z was forecast to strengthen even more. Winds shifted to northeasterly from Deadhorse to the ice camp with sustained speeds up to 35 kts at 10m. Winds tended to weaken at higher elevations with a high pressure cell evident on the 15/0000Z analysis at 700 mb. Sustained winds up to 50 kts, however, were indicated on the 925 mb 24 hr forecast. Flow remained undisturbed in clear skies. The **NOGAPS** analysis and 24 hr forecasts for this period were in excellent agreement with that of NORAPS.



FLEET NUMERICAL OCEANOGRAPHY CENTER

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1200 GMT 15 APR 1992
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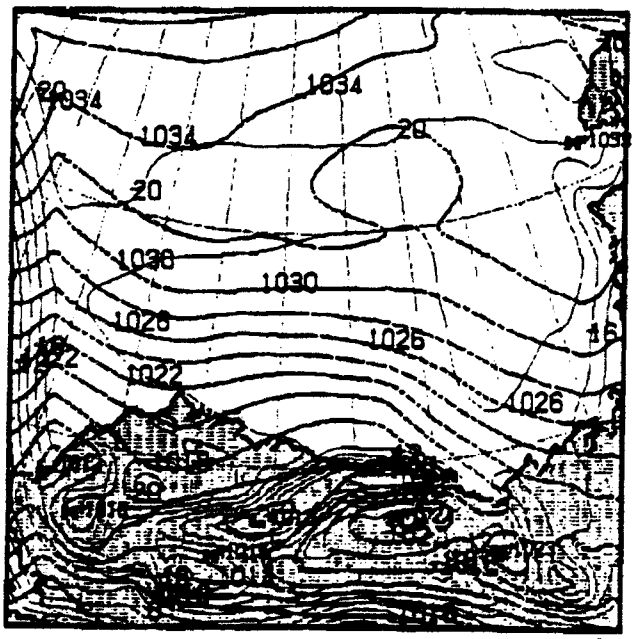
ANAL 2 METER TEMP ---- TAU=0



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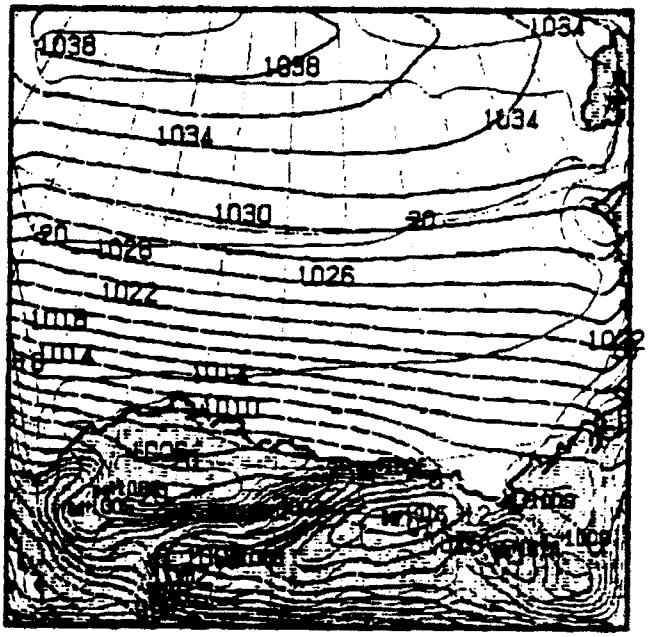

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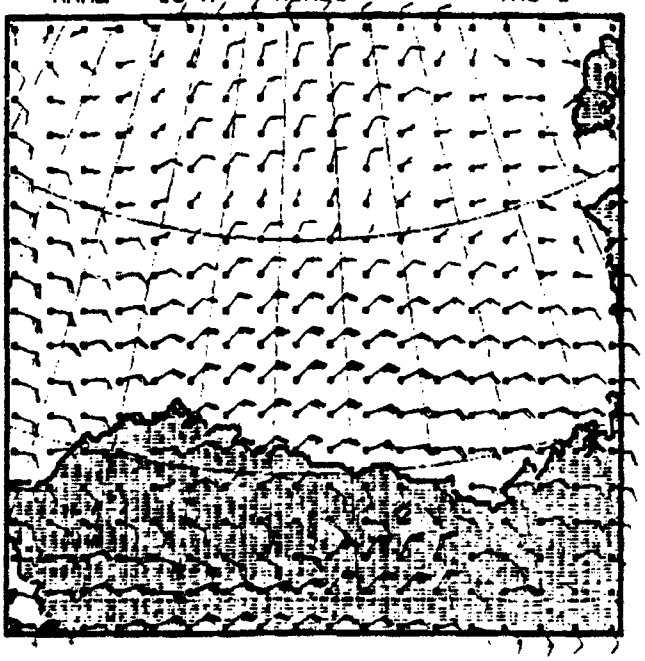

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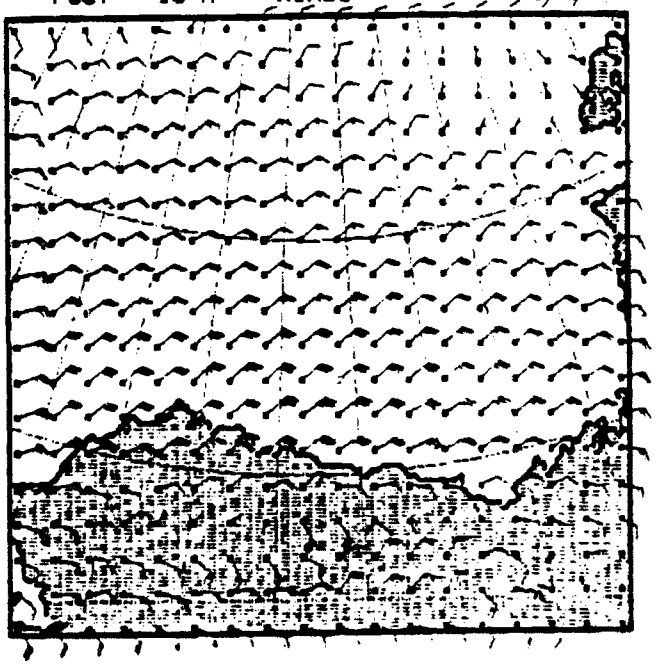

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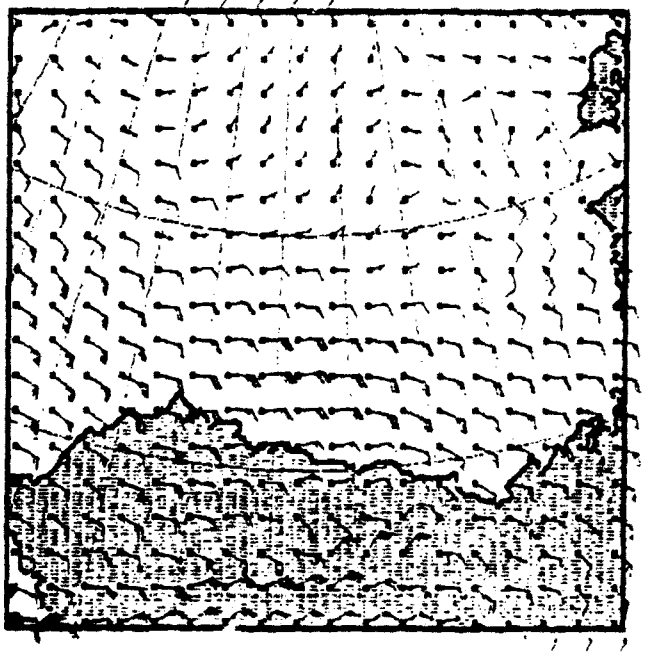

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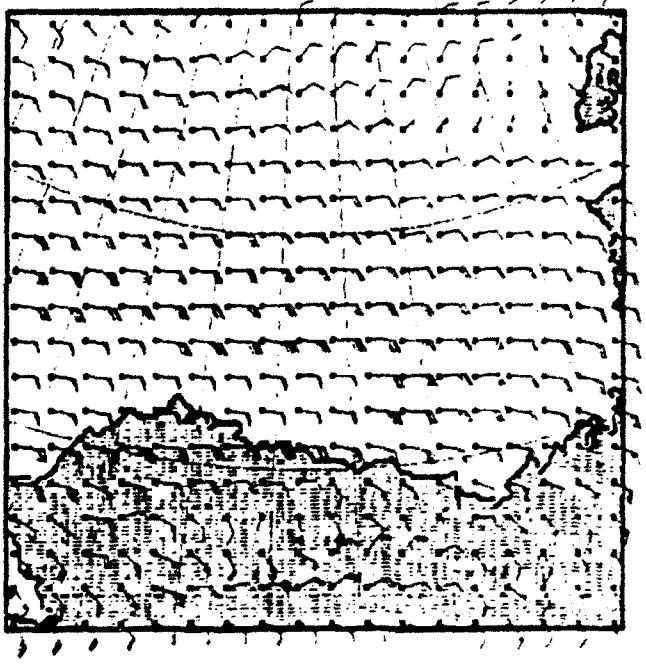

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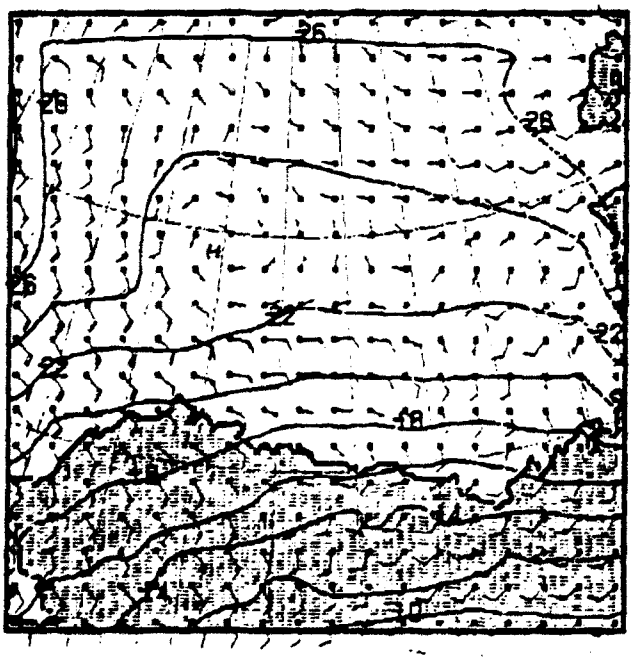

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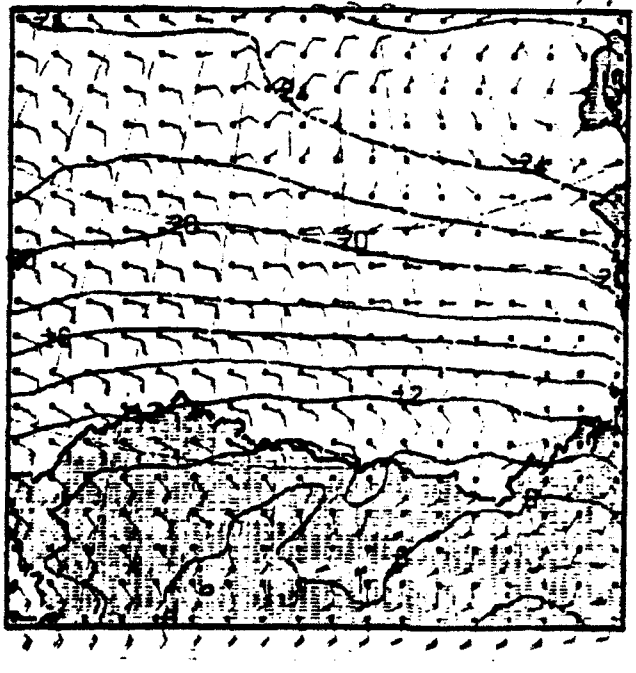

16 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

16/0000Z Analyses

Surface Pressure

An intense pressure gradient promoting northeasterly flow across the central and southern Beaufort is established.

10 M Winds

25-30 kt NE winds exist uniformly across the Beaufort Sea.

925 MB

Wind speeds veer to more easterly at this level with speeds of 30-40 kts.

700 MB

Wind speeds decrease markedly at this level. A diffluent pattern is shown near longitude 150W. Winds turn cyclonically to the east and anticyclonically to the west of the line of diffluence.

17/0000Z 24-hr Forecasts

Surface Pressure

An even stronger pressure gradient is forecast with a 1036 mb high centered near 78N, 150W.

10 M

Wind speeds up to 45 kts from the NE are shown across the southern Beaufort.

925 MB

Veering winds to easterly at 50 kts are shown across the southern Beaufort.

700 MB

Decreased wind speeds in more regular flow from the NE to the north and southeast to the south are shown.

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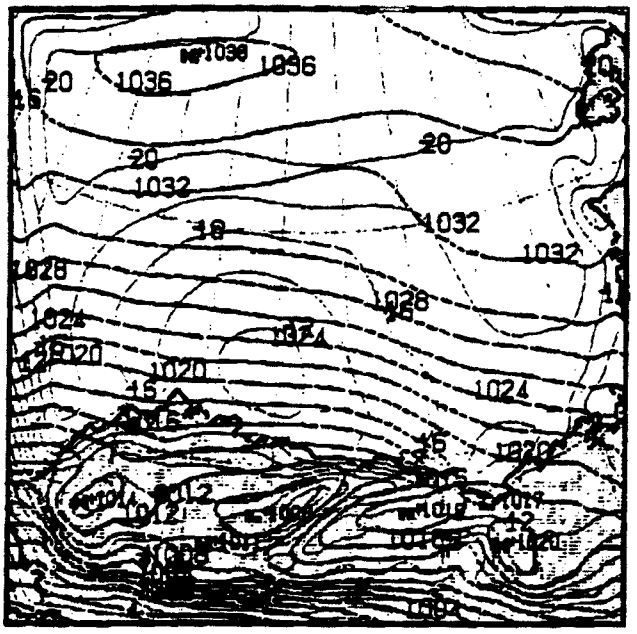
ANAL 2 METER TEMP ---- TAU=0



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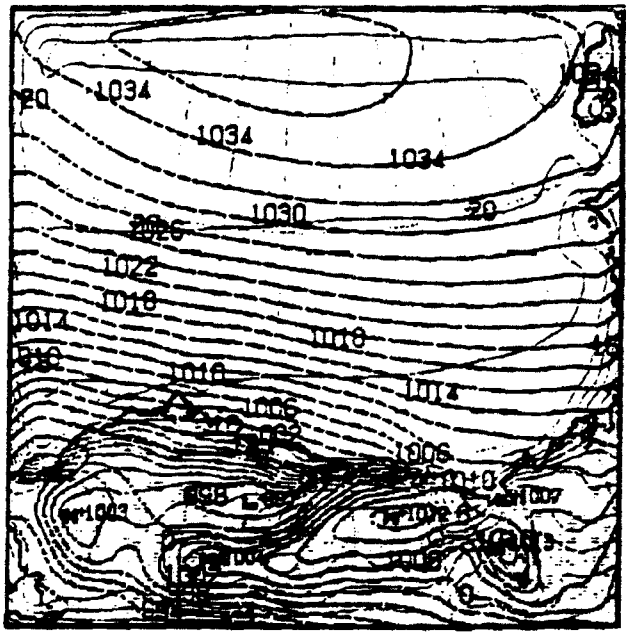

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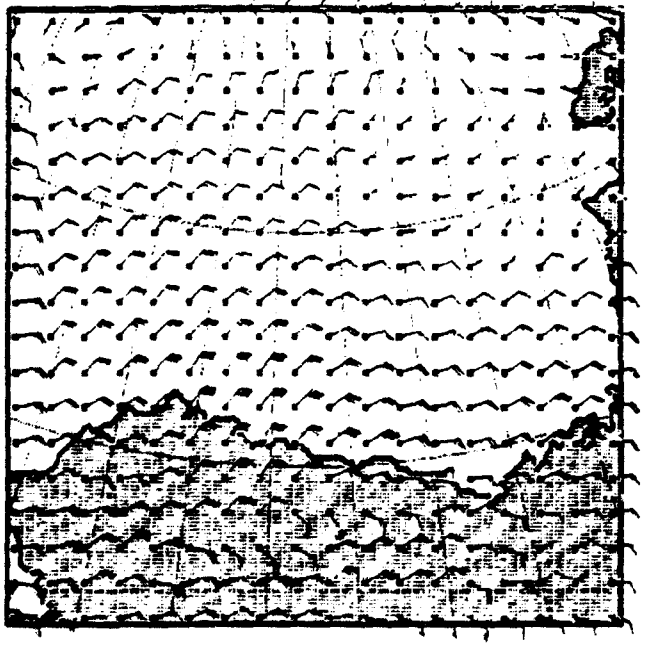

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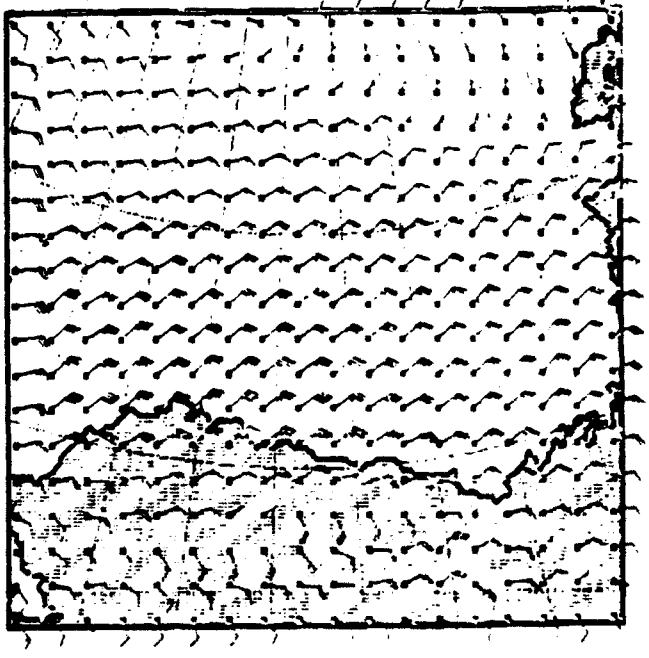

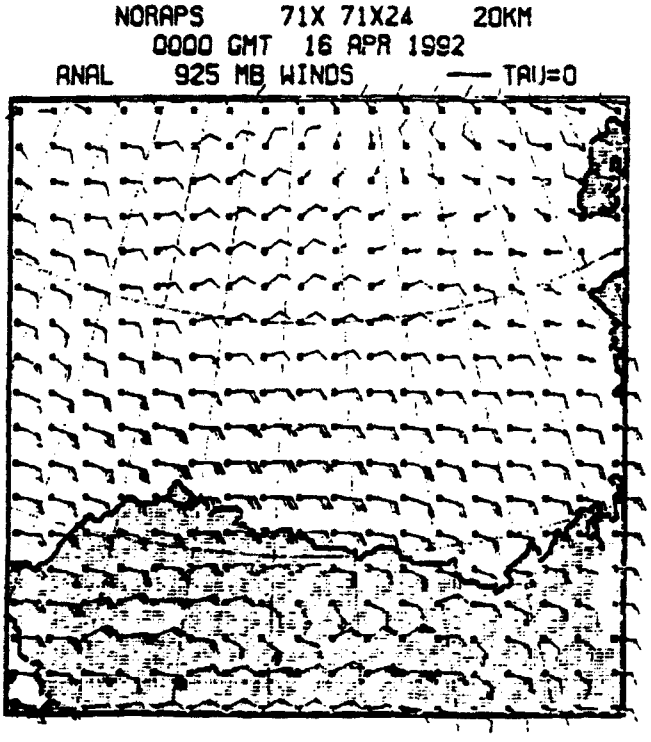
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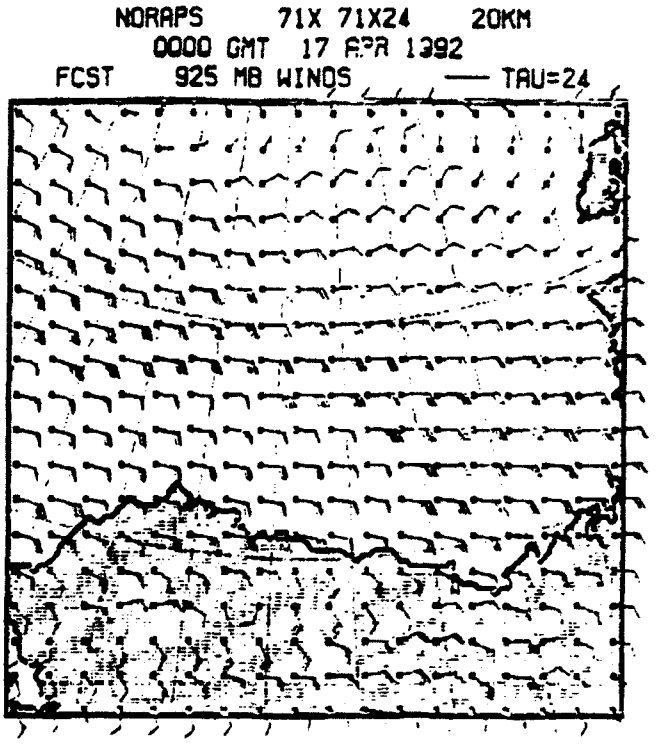
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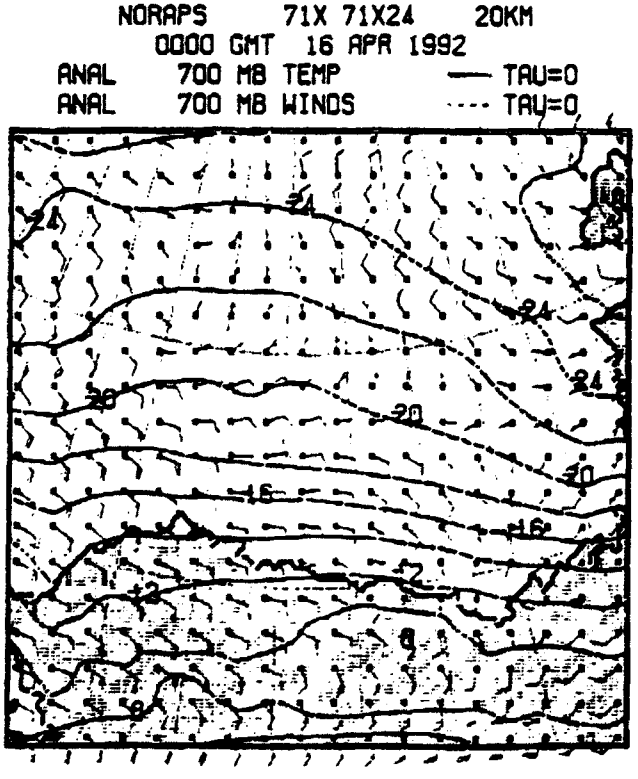
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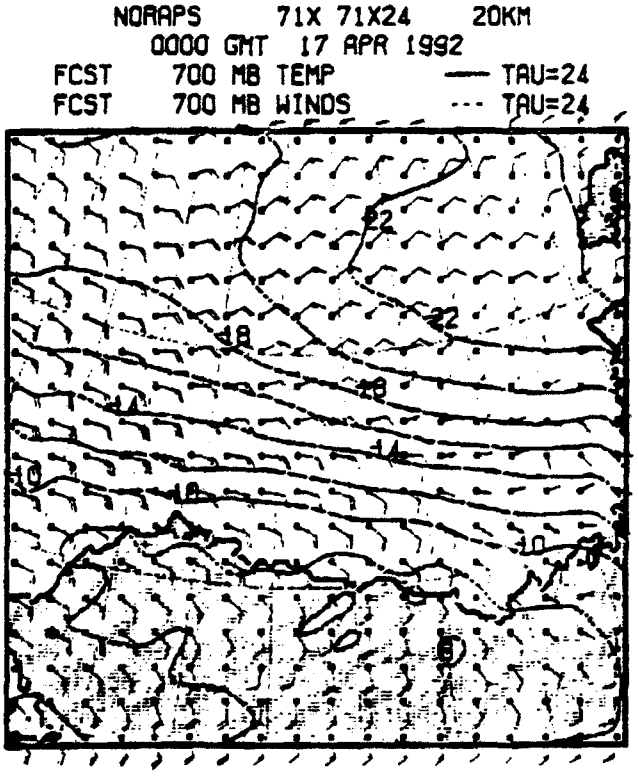
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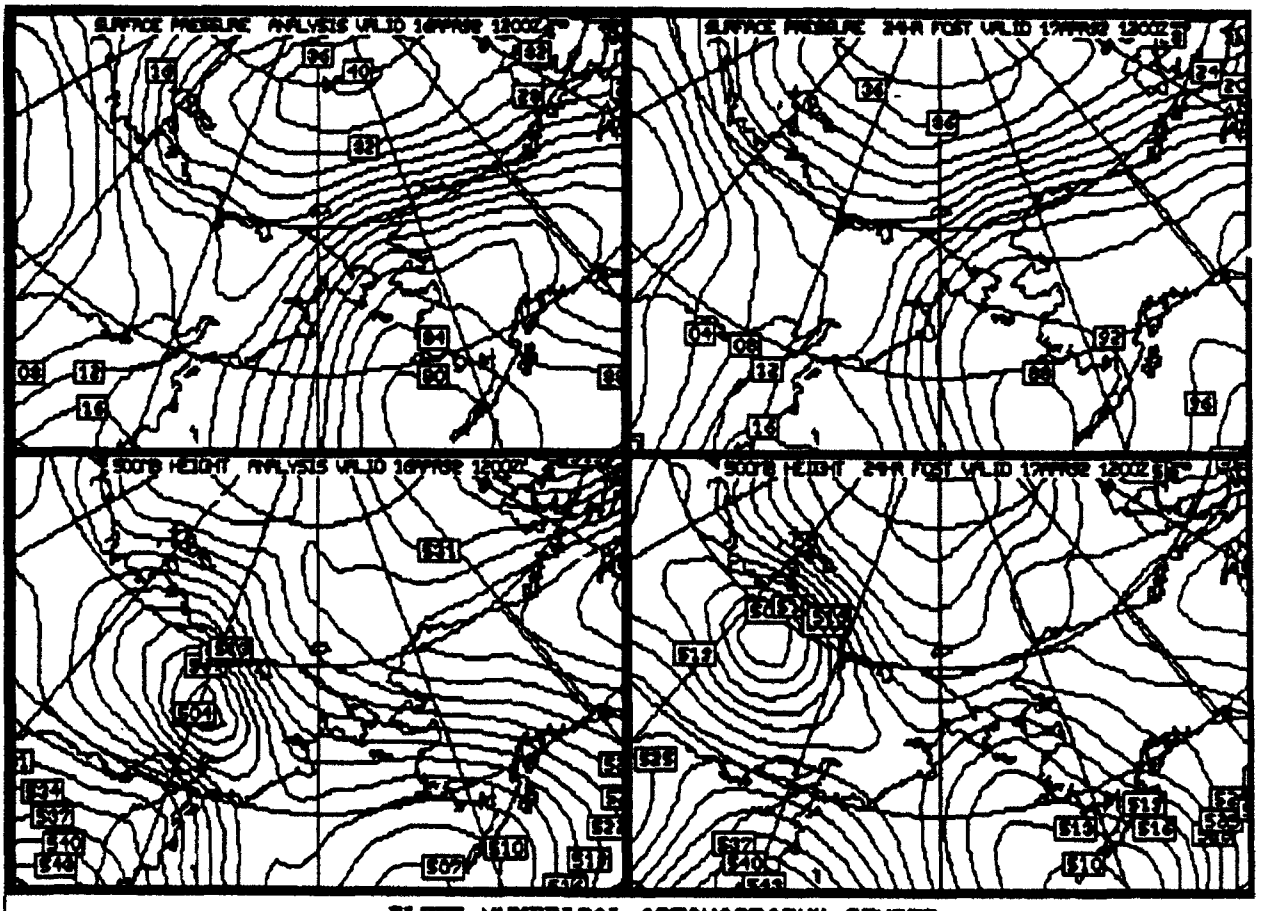
16 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

16/1200Z Analyses and Forecasts (update)

The increased gradient forms as forecast with little change predicted in the 24 hr forecast to 17/0000Z. Uniform NE winds to 40 kts blow across the North Slope with nearly all stations experiencing near zero visiblility in blowing snow throughout the day. **Satellite data** reveal a sudden apparent break in the ice at 1505Z when a major water plume along a WNW-ESE line can be detected. The line extends from approximately 75N, 155W to 72.5N, 130W. Plume detection was facilitated by subtracting NOAA channel 3 data from channel 4. The fracture was not along a pre-existing lead but apparently formed simultaneously in a "zig-Zag" pattern along a line where wind speeds were undergoing maximum acceleration. Wind speeds again diminish at the 700 mb level. **NOGAPS** retains the intense pressure gradient in its 24 hr surface forecast similar to NORAPS.



FLEET NUMERICAL OCEANOGRAPHY CENTER

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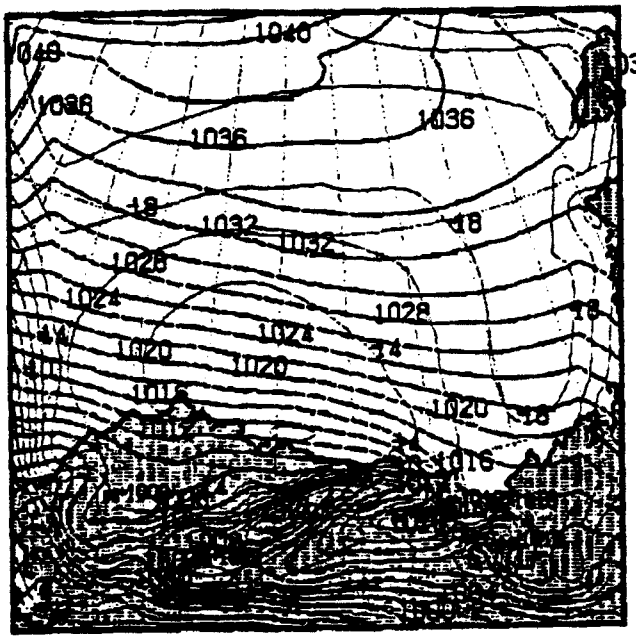
ANAL 2 METER TEMP ---- TAU=0



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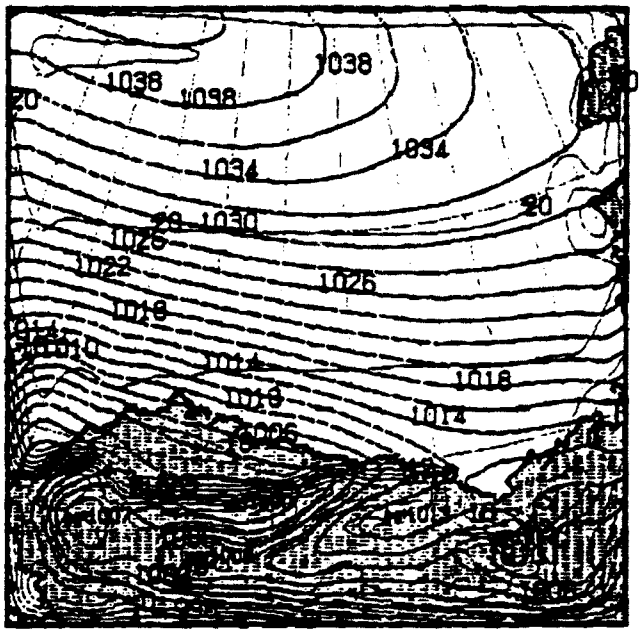

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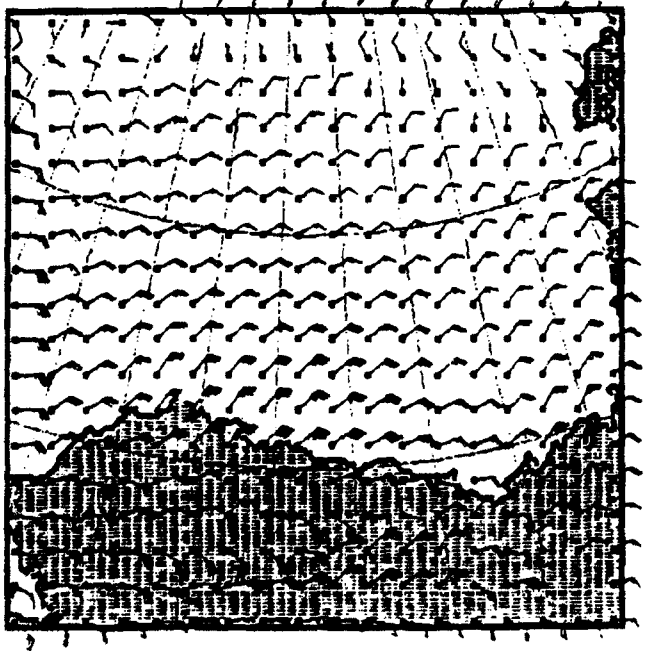

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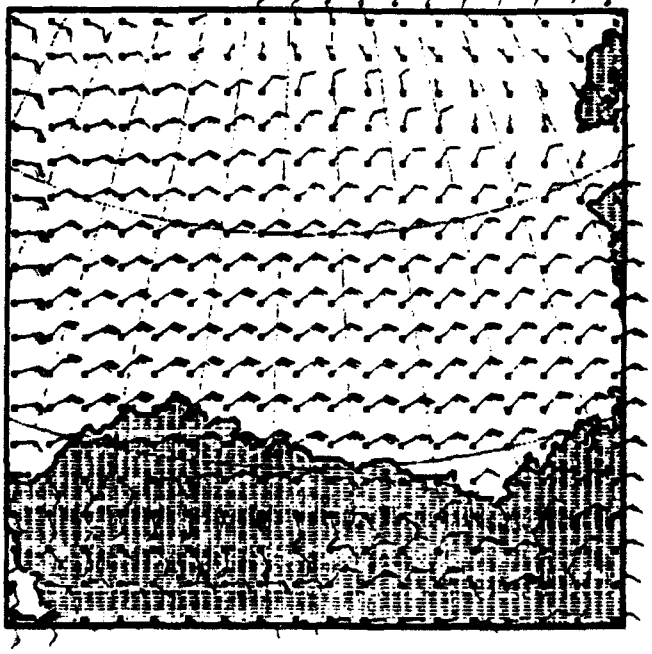

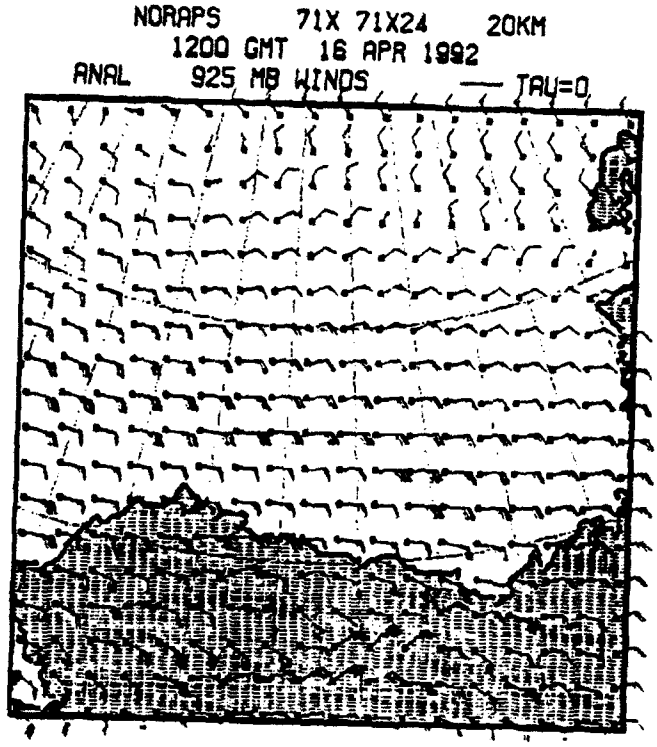
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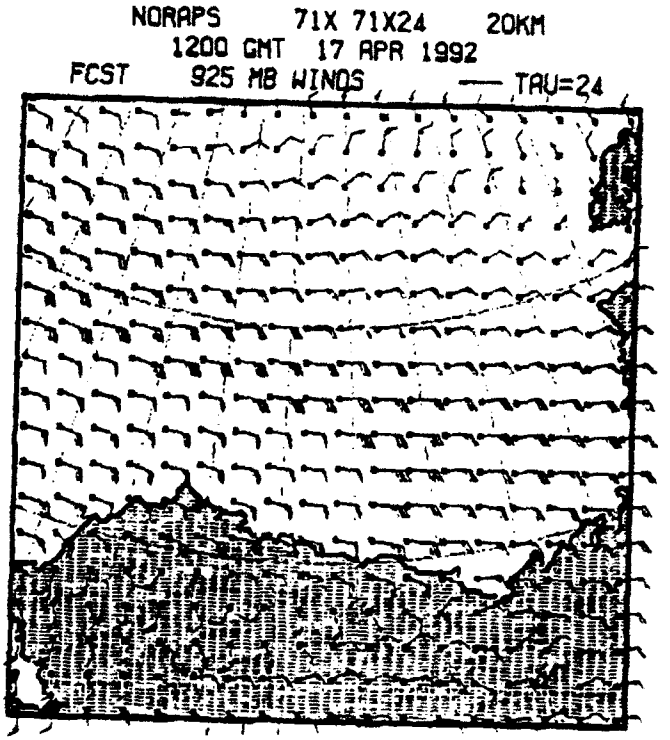
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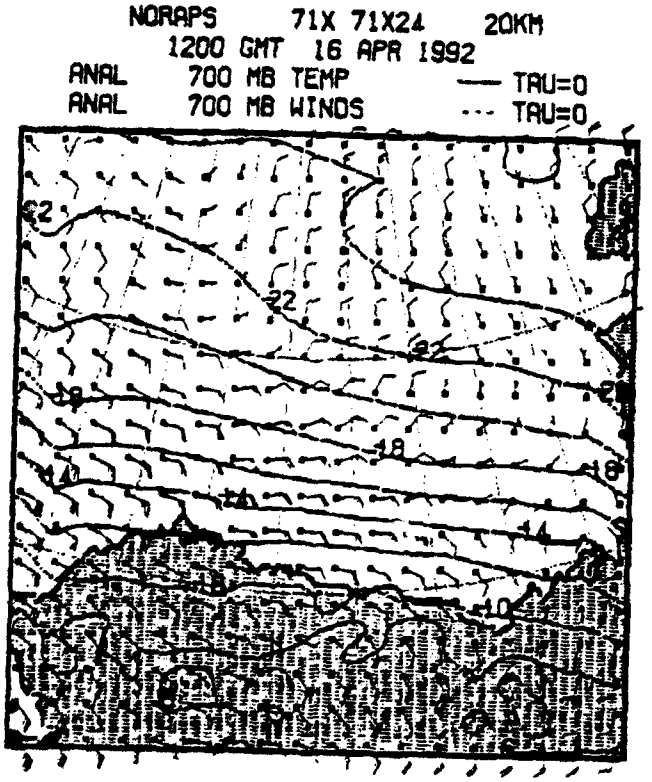
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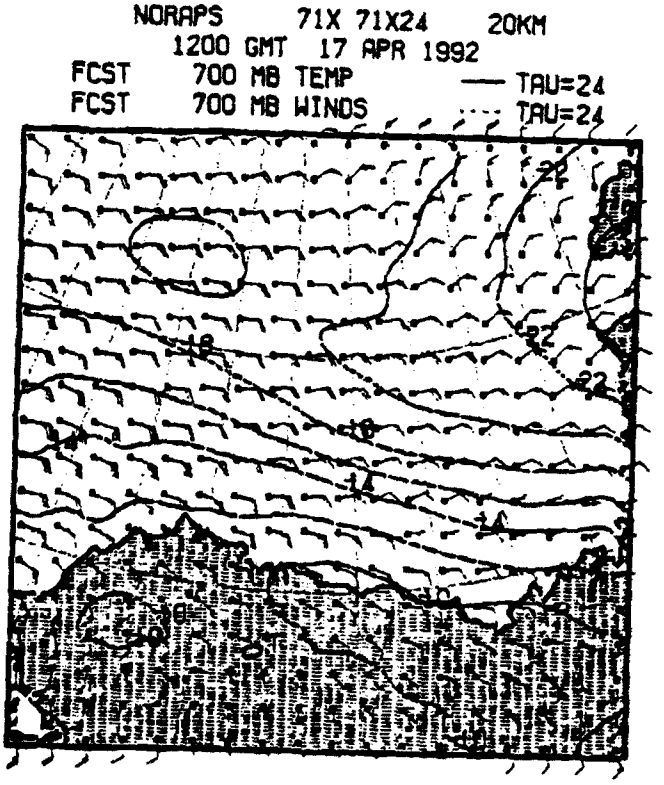
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1200 GMT 17 APR 1992
FCST 700 MB TEMP — TAU=24
FCST 700 MB WINDS --- TAU=24

17 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

17/0000Z Analyses

Surface Pressure

Very strong gradient becoming stronger further to the west, encouraging speed divergence.

10 M Winds

Northeast winds extend across the entire Beaufort. Wind speeds are lightest near Banks Island and to the north with maximum speeds of 35 kts attained near Barrow

925 MB

Winds shift to easterly reaching speeds of 60 kts near Barrow.

700 MB

Lighter winds at this level aligned with the general flow pattern at lower elevations.

18/0000Z 24-hr Forecasts

Surface Pressure

Little change projected in the 24 hr forecast.

10 M

Little change.

925 MB

Little change.

700 MB

Winds strengthen southwest of Banks in general ESE flow.

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0000 GMT 17 APR 1992
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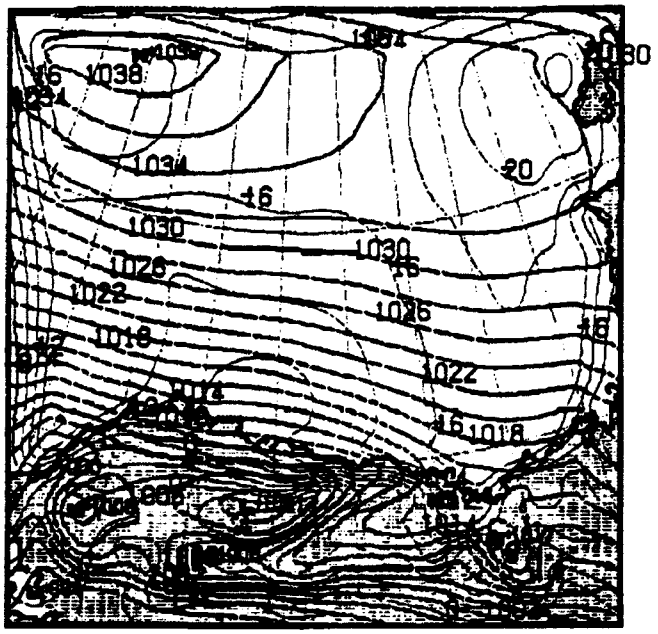
ANAL 2 METER TEMP ---- TAU=0



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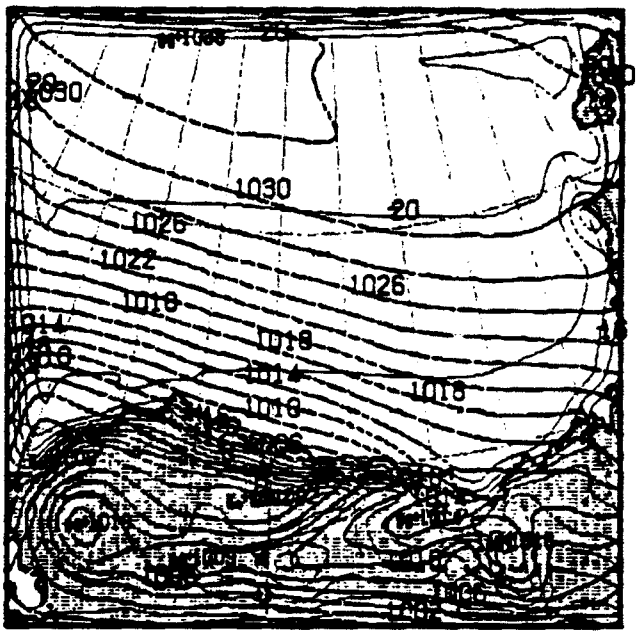

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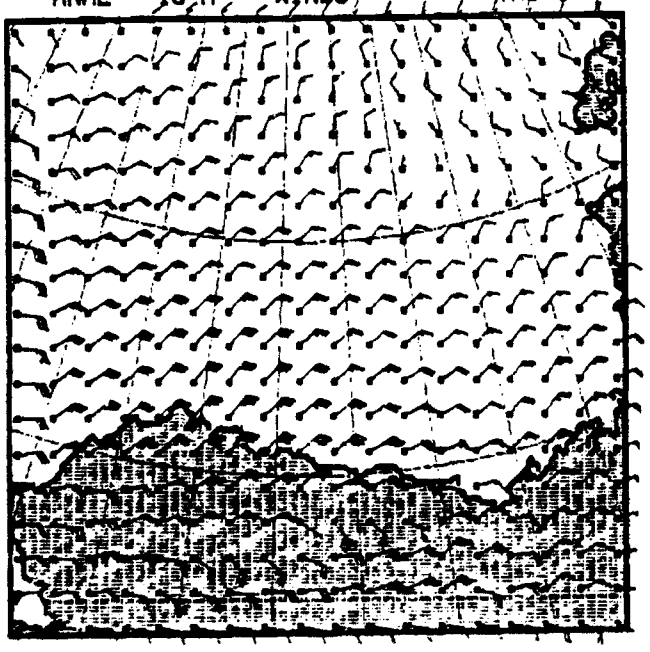

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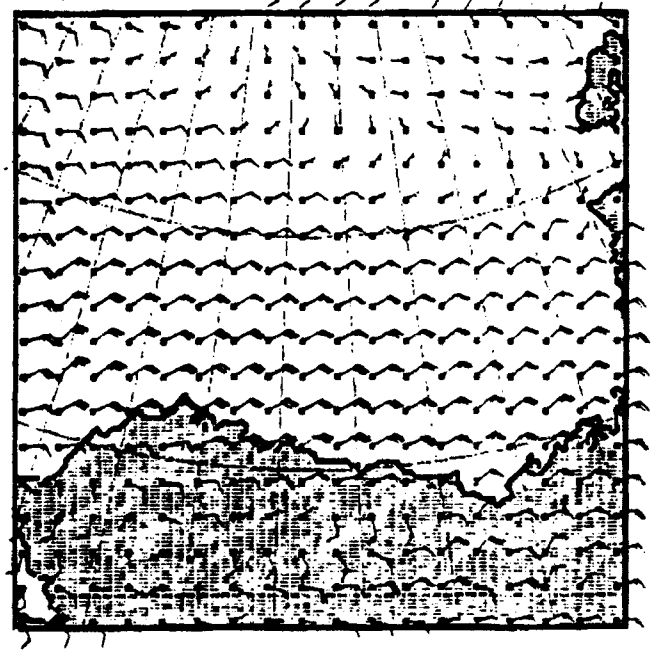

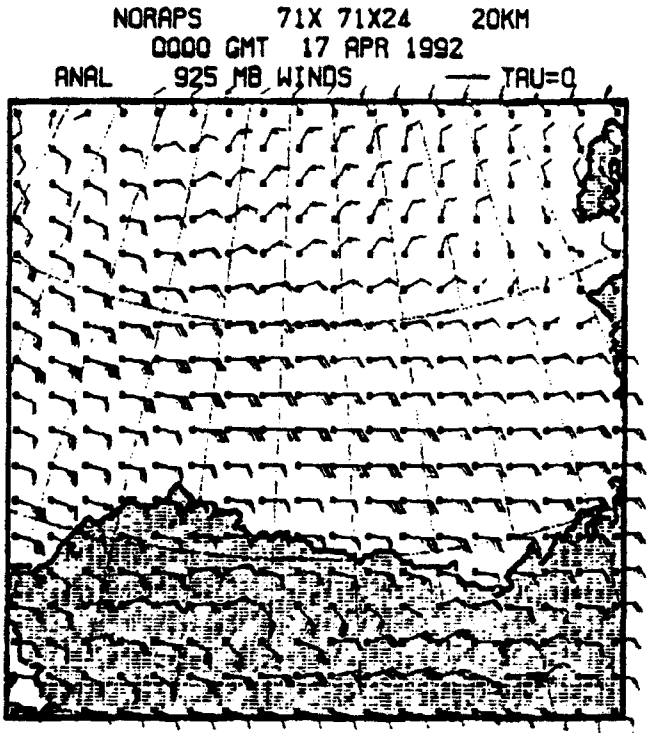
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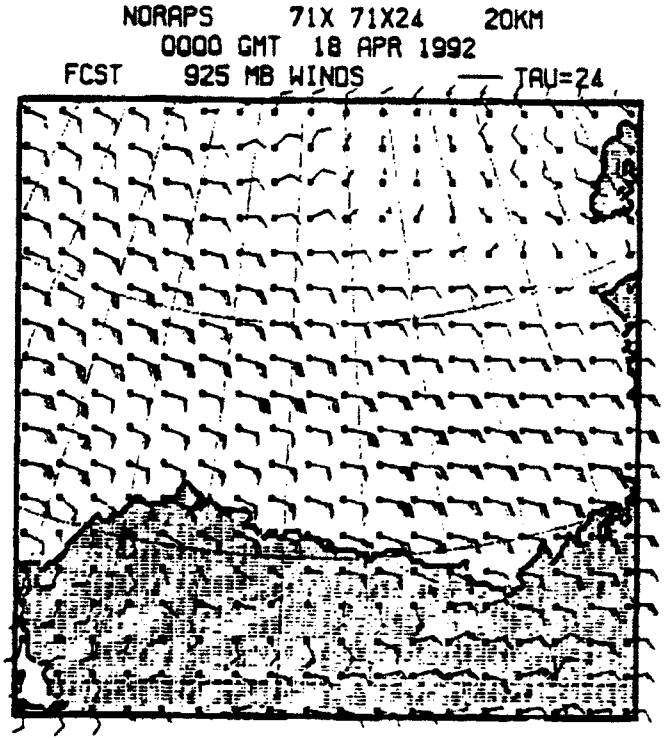
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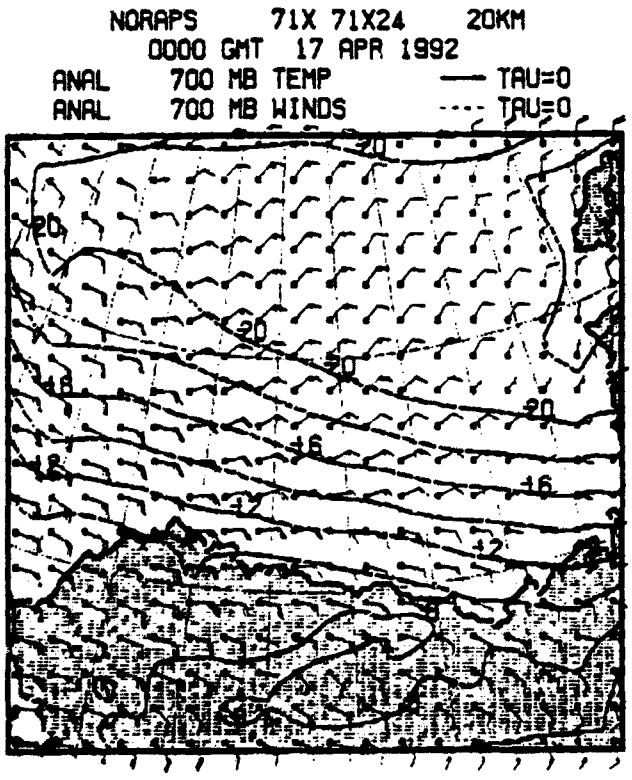
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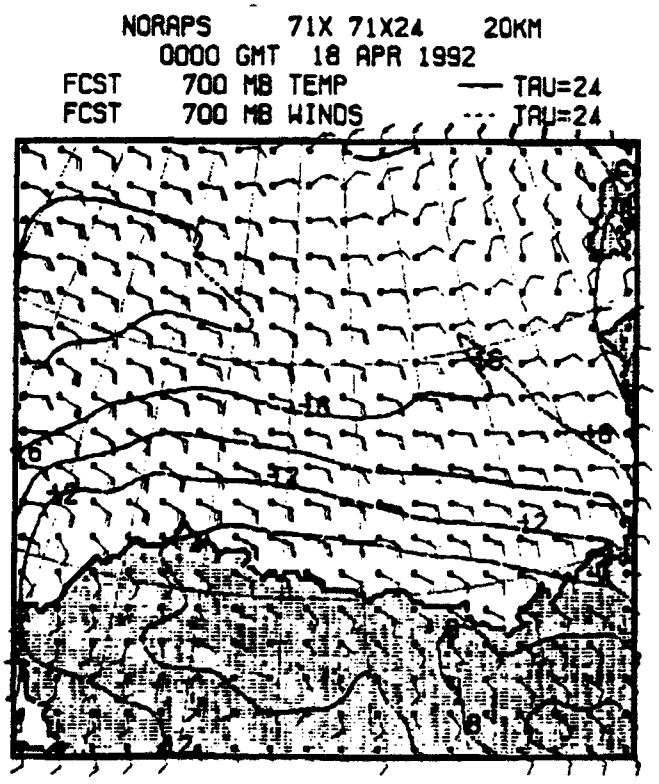
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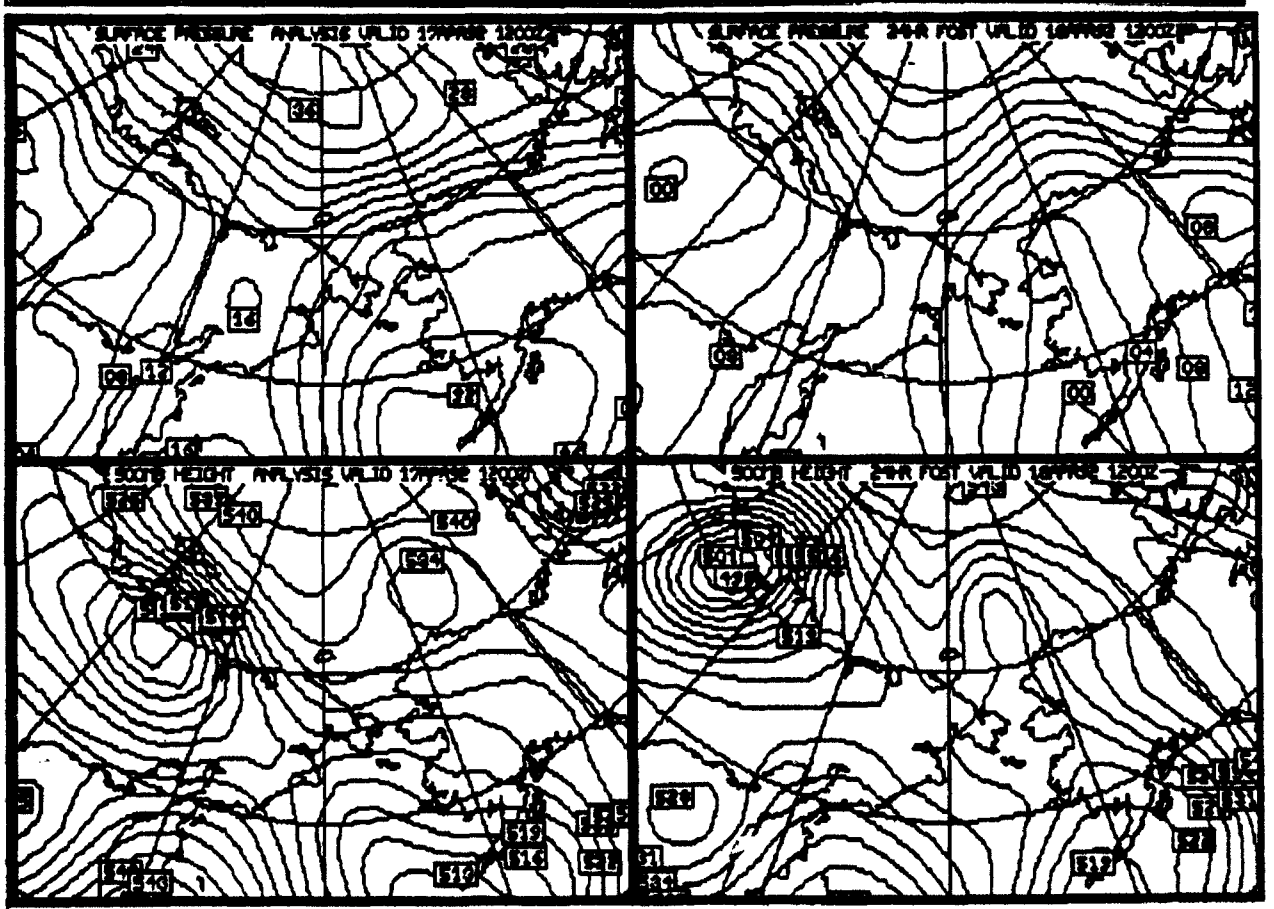
17 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

17/1200Z Analyses and Forecasts (update)
The analysis confirms continued strong winds at 17/1200Z with a forecast for more southeasterly rather than northeasterly flow. Low pressure is shown developing SW of Barrow. The shift to SE is shown primarily at the 925 and 700 mb levels as 10m winds abate in speed and switch to more easterly than northeasterly. Satellite data on this date are especially interesting because of the development of long NE-SW oriented streaks appearing in the IR data over much of the Beaufort and into the Chukchi Sea. The streaks are basically aligned with the low level flow and could be the result of a heat and moisture flux into the air because of numerous lead openings caused by the unusually high wind speeds. The regular appearance of rows of streaks implies a cellular circulation pattern of alternately rising and sinking motion. The NOGAPS analysis and forecast agree very well with that of NORAPS. An inverted 500 mb trough NW of Barrow seems to be a remnant of the 500 mb low analyzed earlier, now moving westward. Excellent case study potential.



FLEET NUMERICAL OCEANOGRAPHY CENTER

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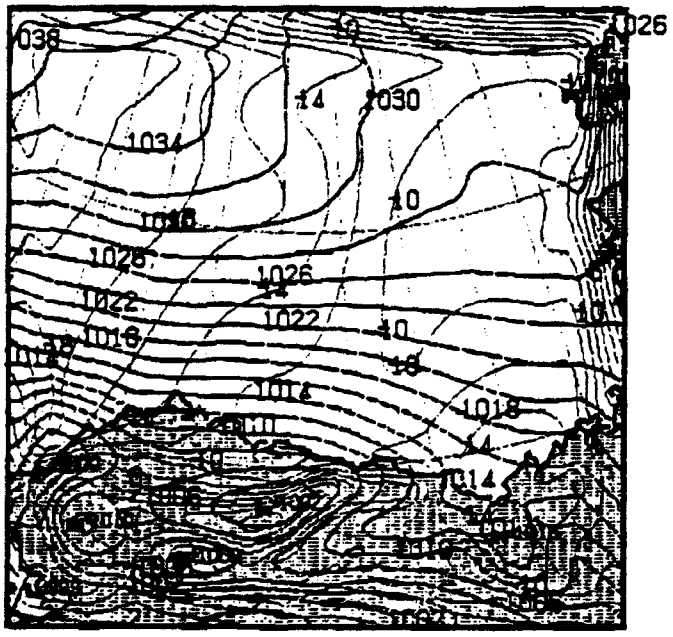

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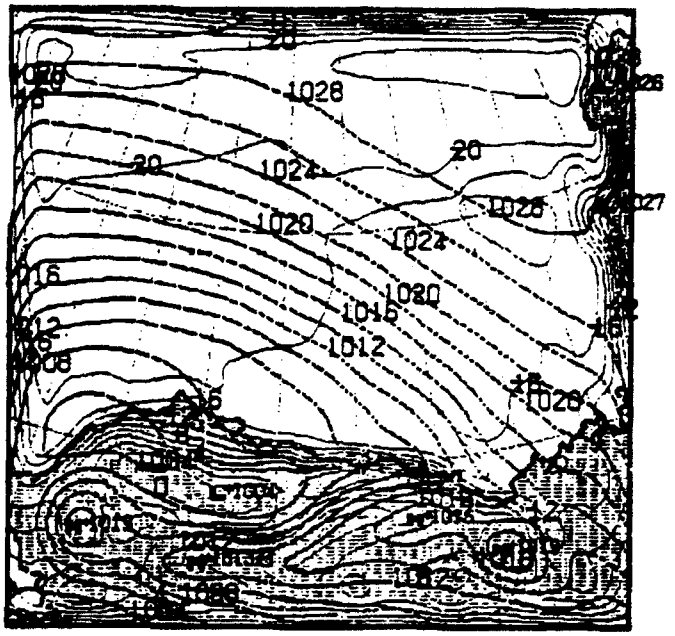

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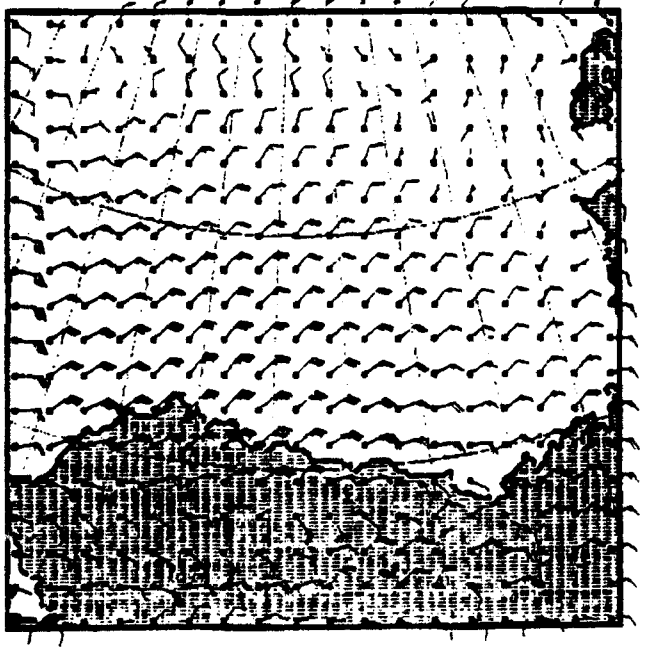

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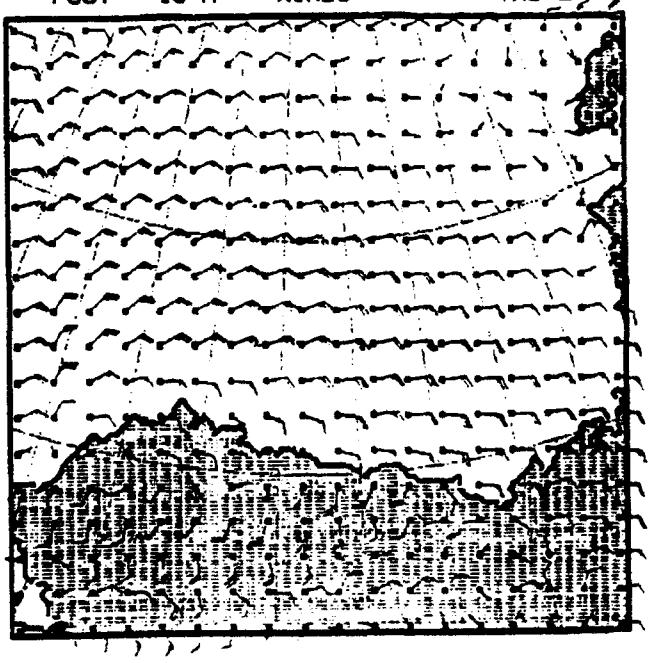

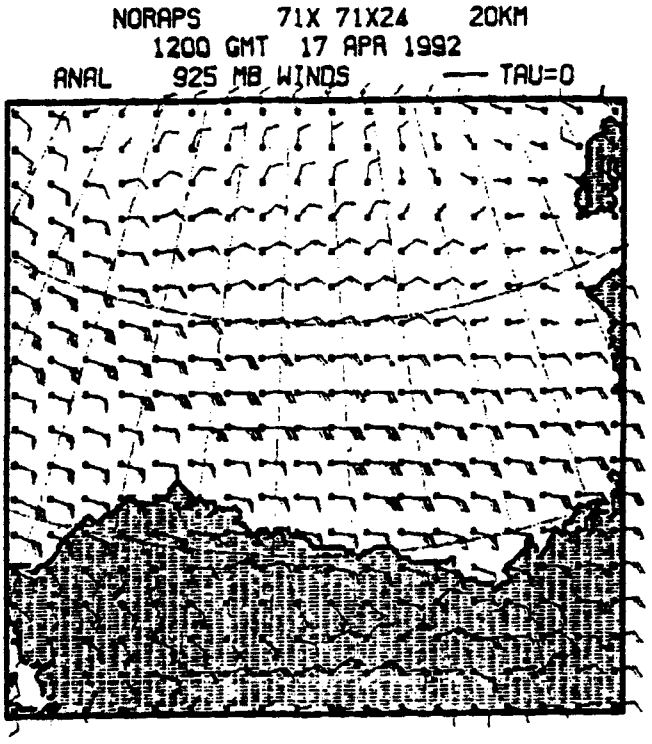
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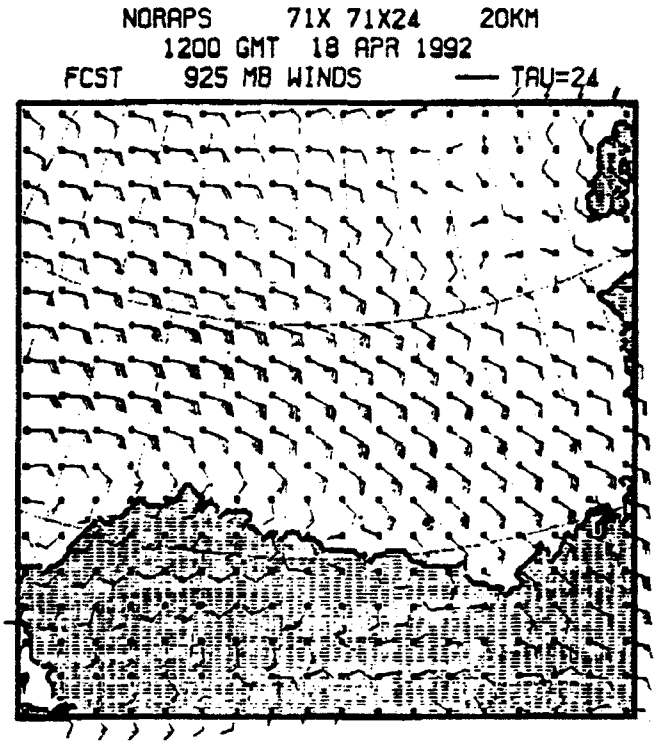
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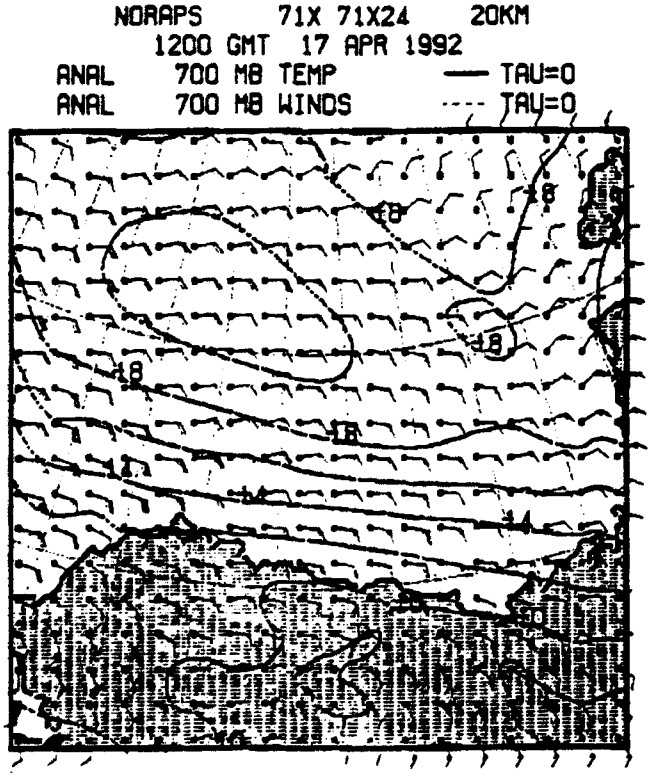
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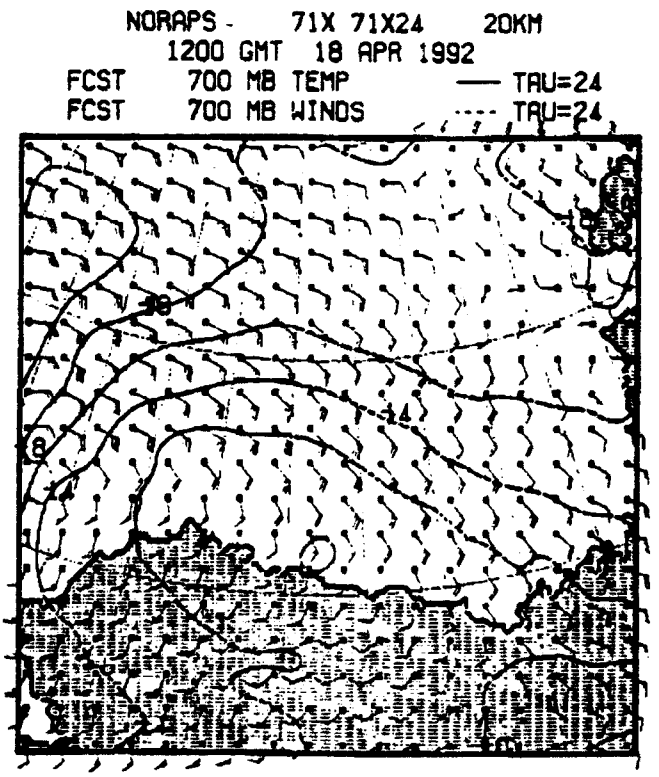
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FCST 700 MB WINDS ---- TAU=24

18 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

18/0000Z Analyses

Surface Pressure

The strong gradient giving northeasterly winds persists at analysis time.

10 M Winds

Wind speeds up to 35 kts impinge on the North Slope.

925 MB

Strong 40-45 kt east winds sweep across the Beaufort.

700 MB

Lighter ESE flow is evident at this level.

19/0000Z 24-hr Forecasts

Surface Pressure

Low pressure is shown off the NW coast of Alaska with a trough extending eastward along the North Slope. Pressure gradient is increased over the ice camp.

10 M

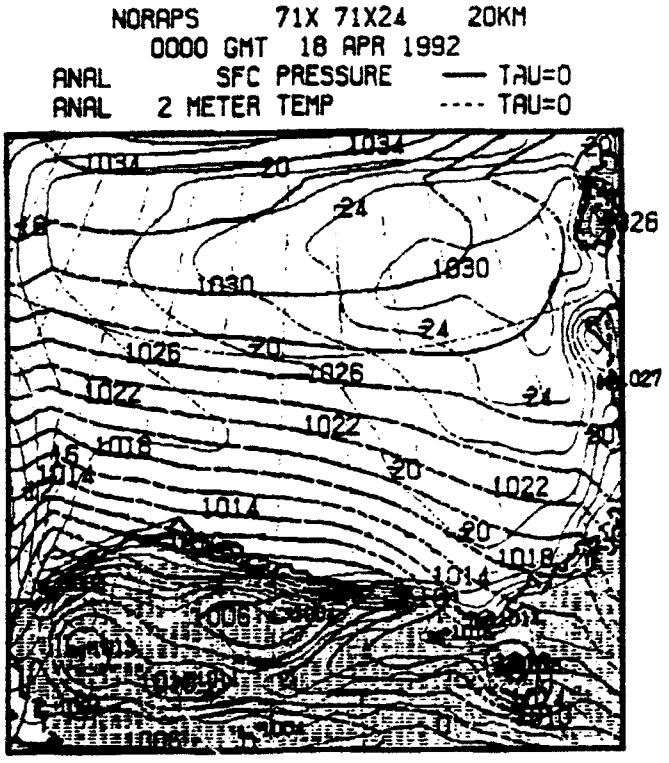
Winds abate along the North Slope. However a trough in the region gives rise to abundant low level cloudiness.

925 MB

The trough shows up well at the 925 mb level. Vortical appearing clouds are evident between Barrow and Deadhorse.

700 MB

The trough appears offshore at this level. East-west troughs seem to appear regularly along the N. Slope. Is this a Brooks Range effect?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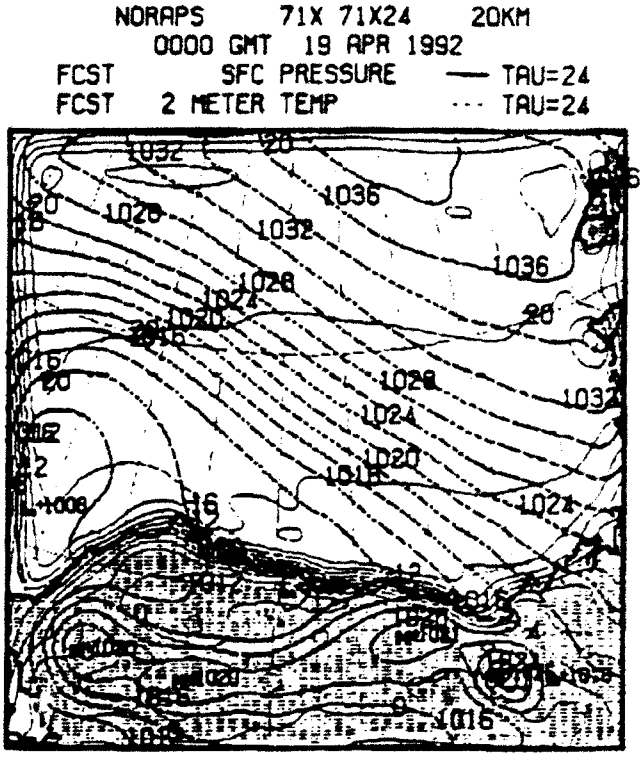
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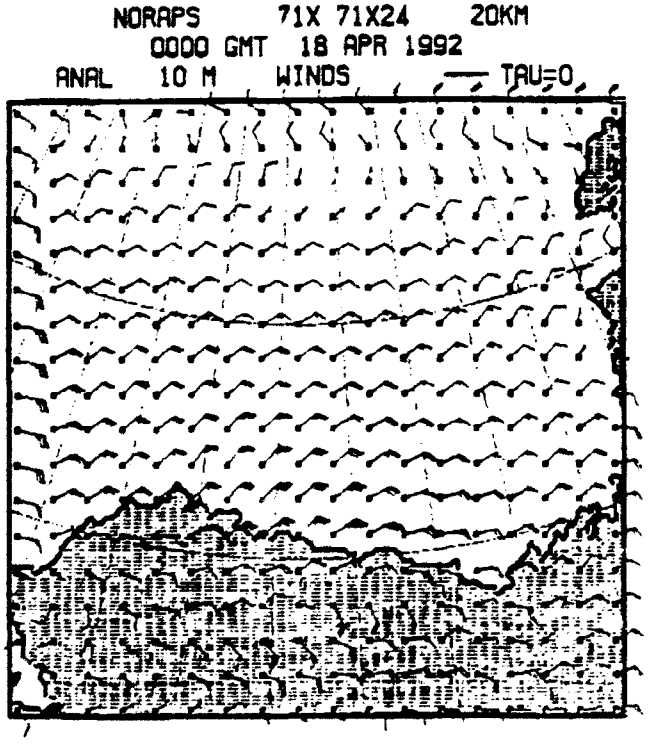
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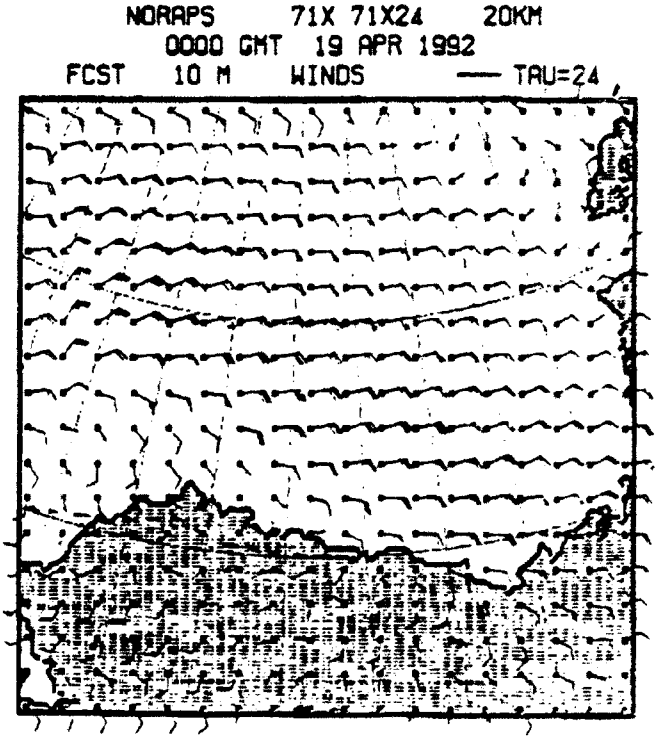
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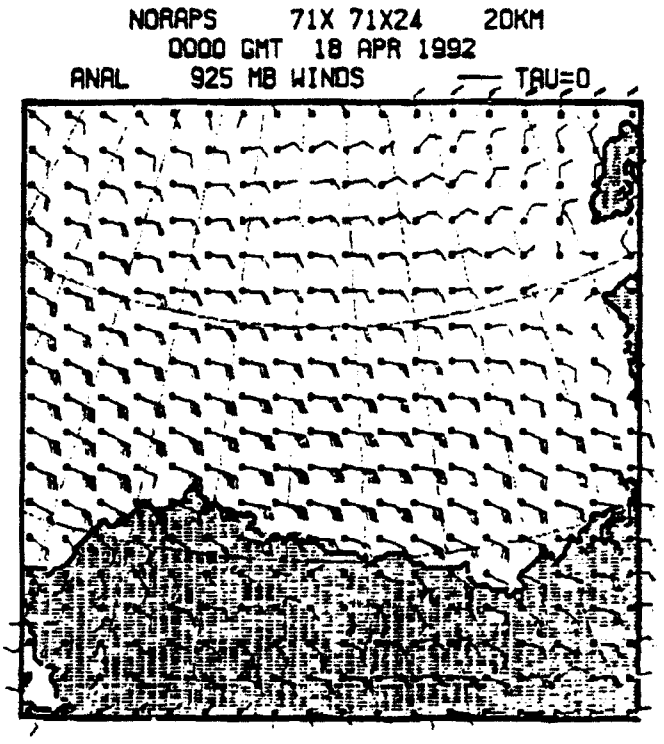
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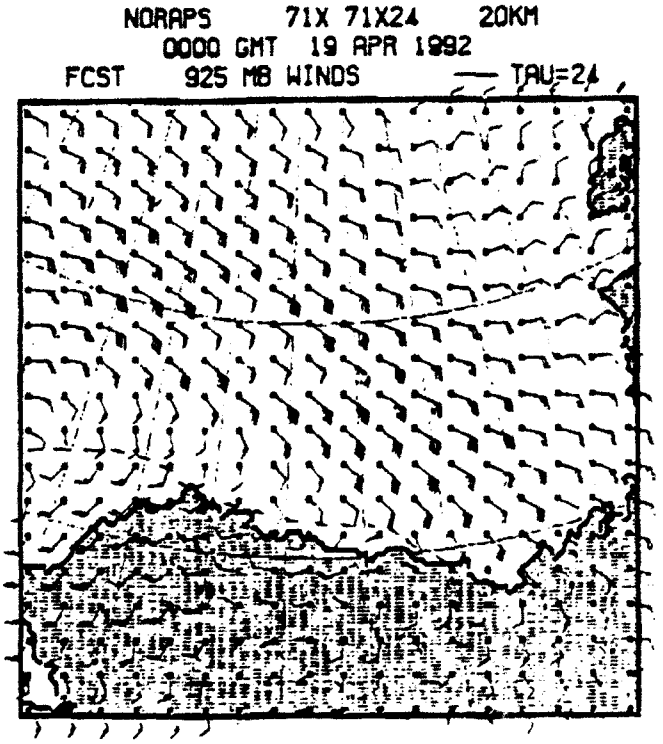
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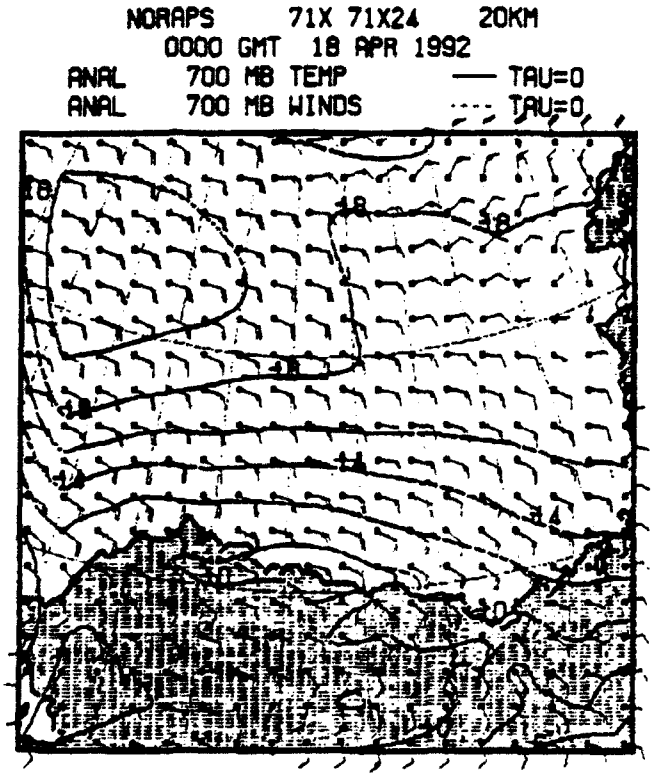
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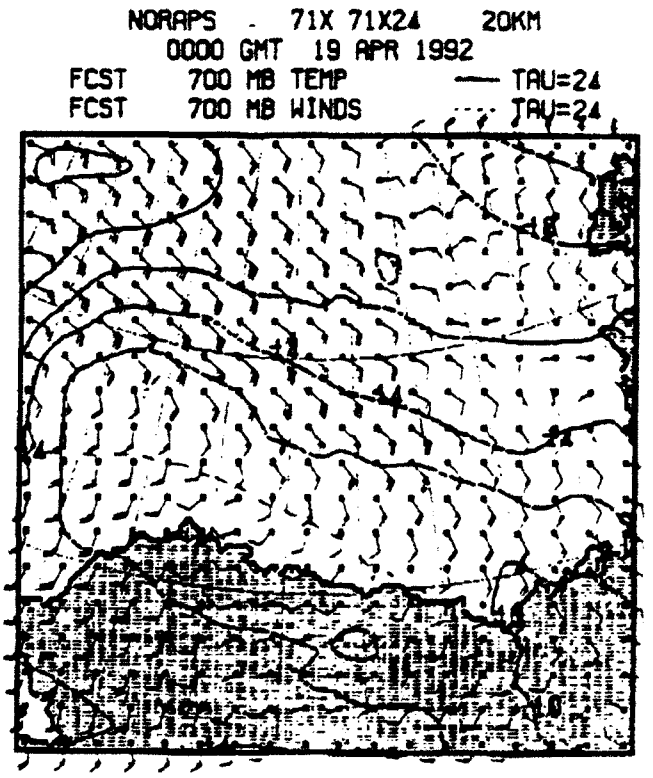
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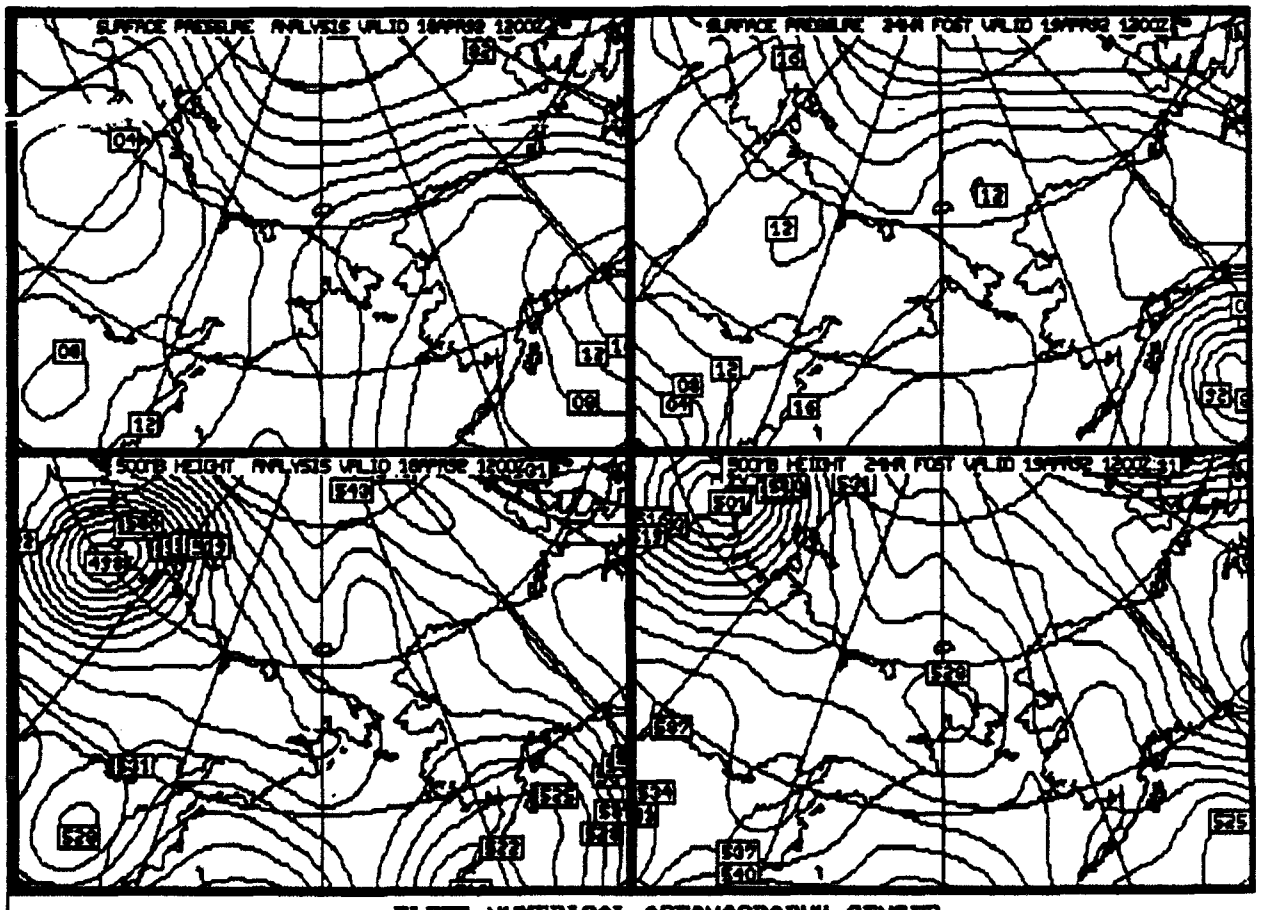
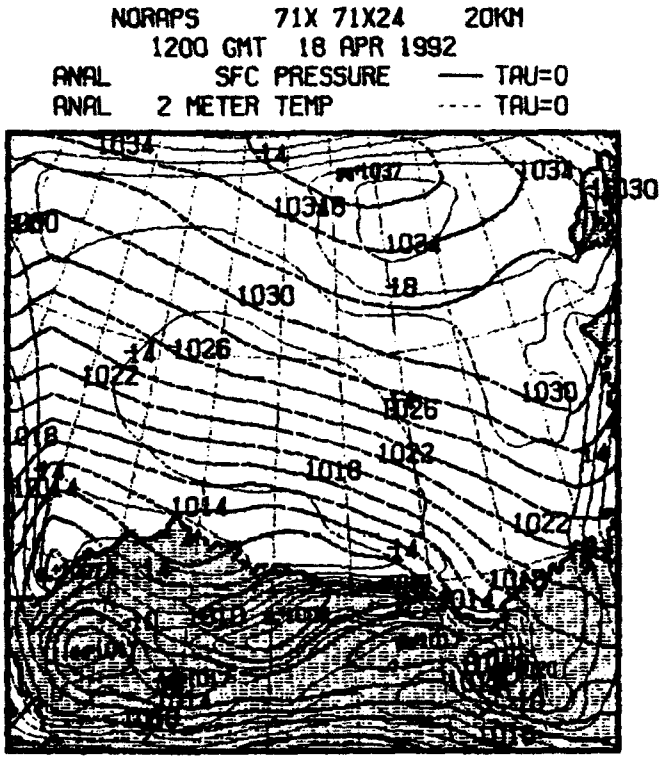
18 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

18/1200Z Analyses and Forecasts (update)
A very similar condition to that of 12 hrs earlier is shown on the analysis product. However drastic changes are suggested as low pressure is forecast over Barrow and all along the N. Slope. The ice camp is experiencing its highest winds during this period severely restricting visibility and preventing helicopter flights due to poor surface contrast. The 925 MB forecast depicts the elongated cyclonic wind shear area which seems to be the prominent feature on this date. This would be an interesting day for cross-section analysis through the trough region. Some sort of westerly jet overhead is suggested by the satellite data.



FLEET NUMERICAL OCEANOGRAPHY CENTER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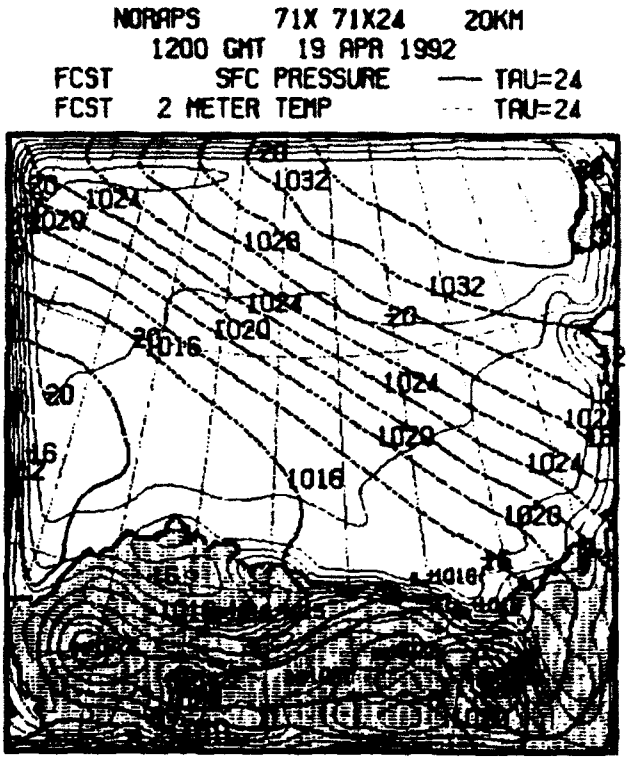
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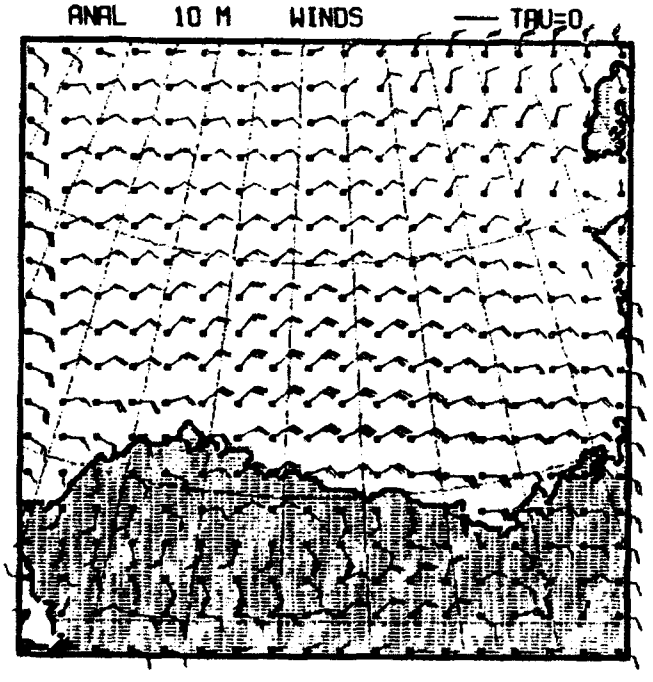
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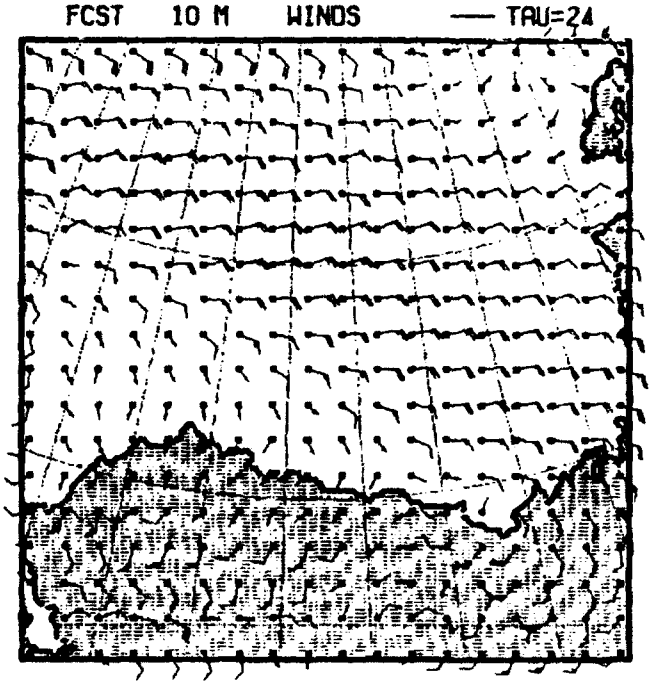
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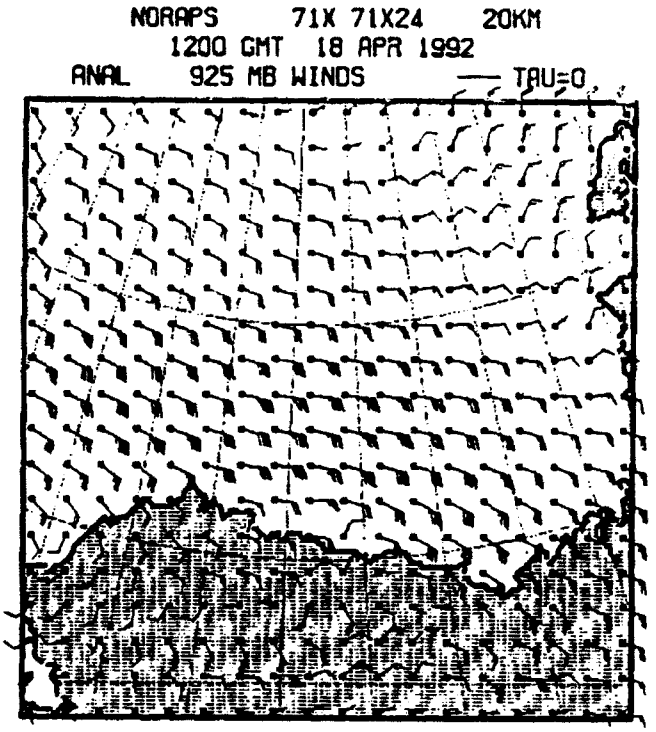
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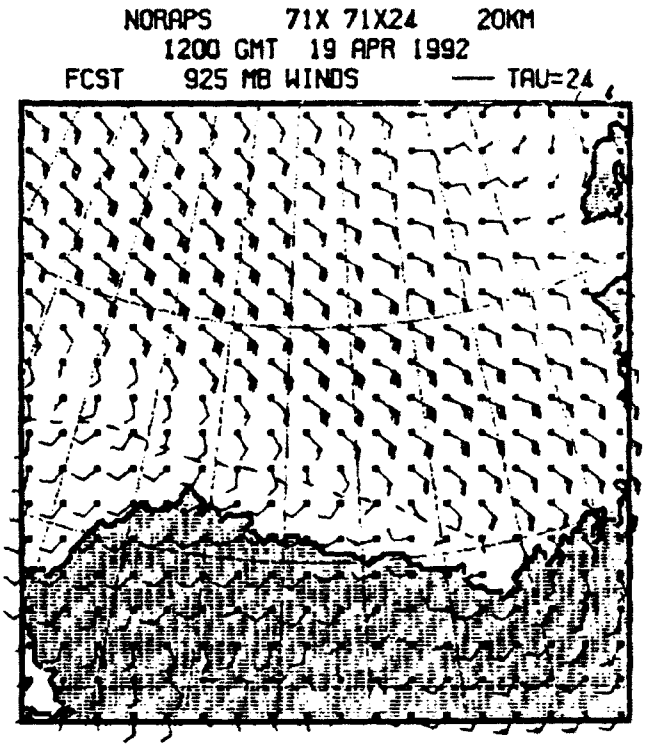
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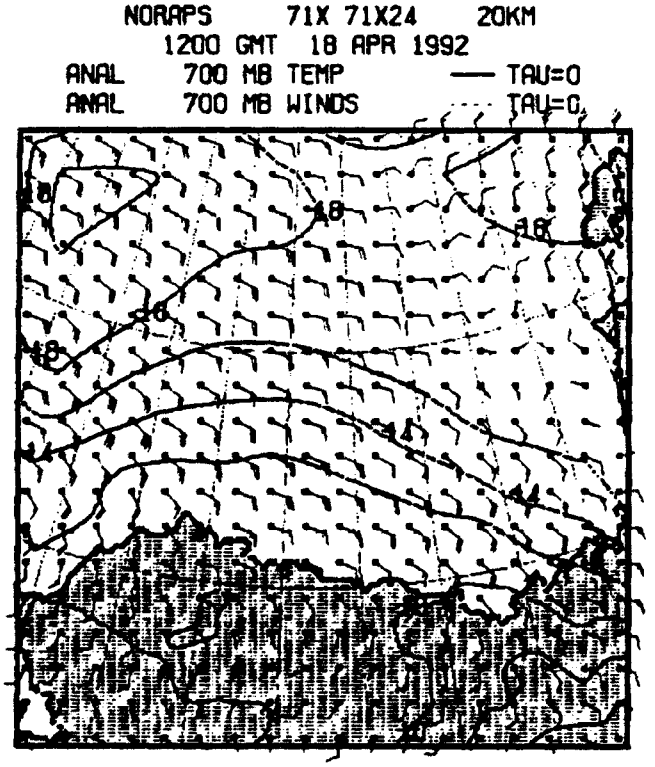
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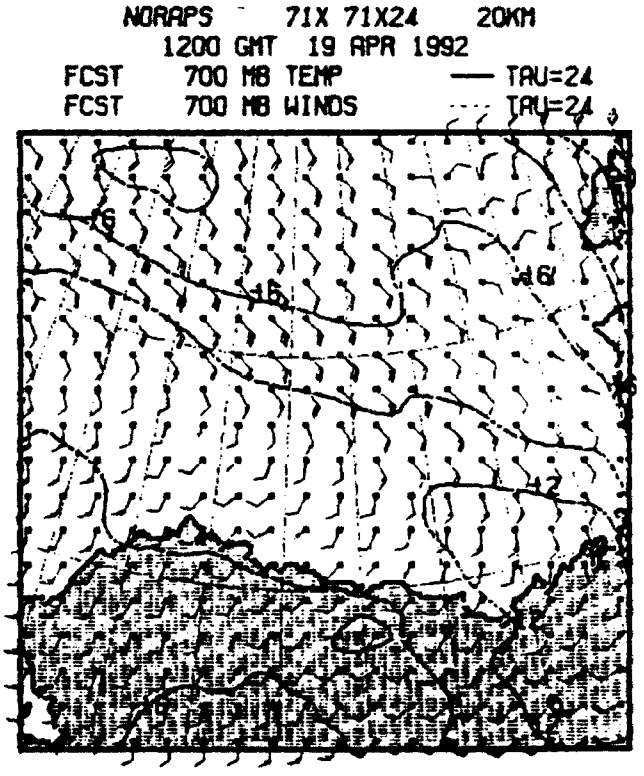
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FCST 700 MB WINDS --- TAU=24

19 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

19/0000Z Analyses

Surface Pressure

NORAPS products not available at this time. Satellite data revealed weak vortices propagating from west to east over the southern Beaufort. Winds were much weaker than on previous days. A massive amount of low level cloudiness was generated in association with these systems. Two prominent vortices, one near the ice camp, and the other approximately 300 nm to the ESE appeared in a spectacular image at 2030Z.

10 M Winds

925 MB

700 MB

20/0000Z 24-hr Forecasts

Surface Pressure

NORAPS forecast products not available.

10 M

925 MB

700 MB

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19 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

19/1200Z Analyses and Forecasts (update)
NORAPS products not available at this time. Interesting vortex development over the southern Beaufort. The NOGAPS product does not resolve these smaller scale but important developments. Ice camp position at 0000Z was 72.9N, 148W. At 1500Z the ice camp surface report indicated 4500' overcast, with visibility 1 mile in blowing snow. Temperature was +5F, winds 080/14 kts.

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20 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

20/0000Z Analyses

Surface Pressure

A warm pocket of air in a trough region is shown south of Deadhorse. The strong pressure gradient has moved northward as has the high pressure center.

10 M Winds

A general cyclonic turning of winds is evident from the ice camp northward.

925 MB

Southerly flow prevails in the eastern Beaufort while a NW-SE oriented trough of shear line appears to the west, north of Barrow.

700 MB

A sharp shear line is seen extending north of Barrow. To the east light southerly flow prevails.

21/0000Z 24-hr Forecasts

Surface Pressure

The high is forecast to further recede to the north with a weak gradient from the North Slope to the ice camp.

10 M

Light easterly flow covers the central and western Beaufort with stronger wind speeds to the east near Banks Island.

925 MB

Light to moderate easterlies cover the Beaufort until near Barrow where a N-S oriented shear line is evident.

700 MB

Winds turn more southerly at this level with evidence of a trough or cyclonic shear line west of Barrow.

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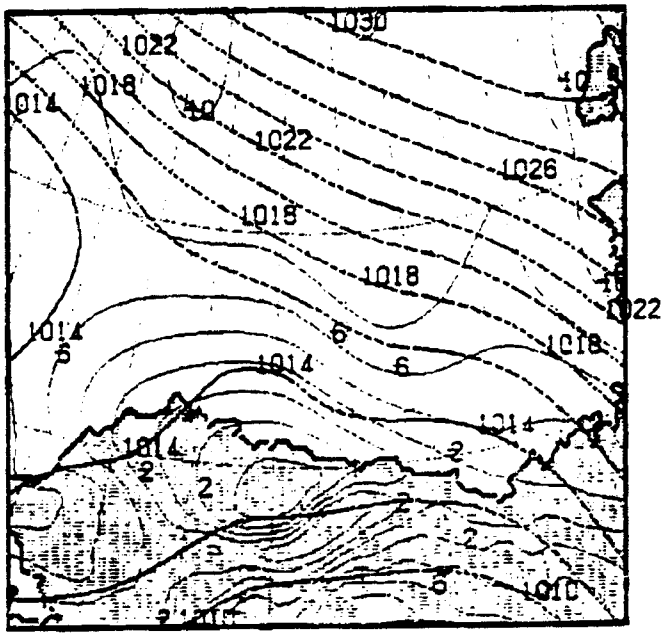
ANAL 2 METER TEMP ···· TAU=0



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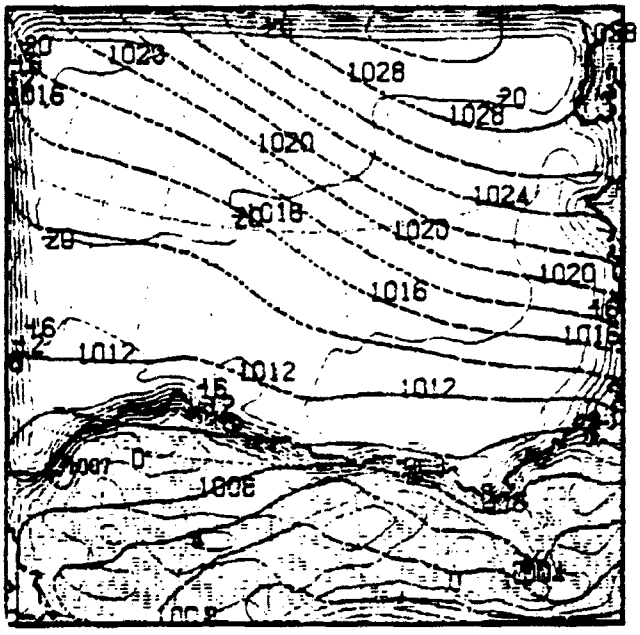

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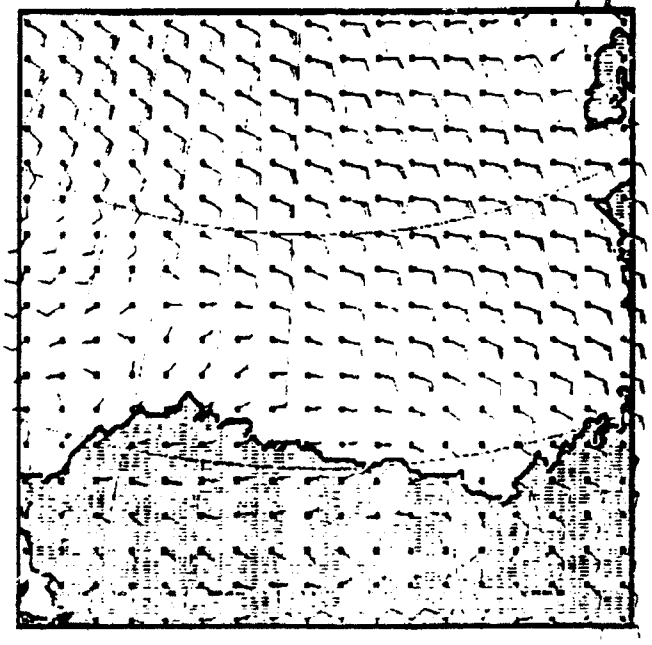

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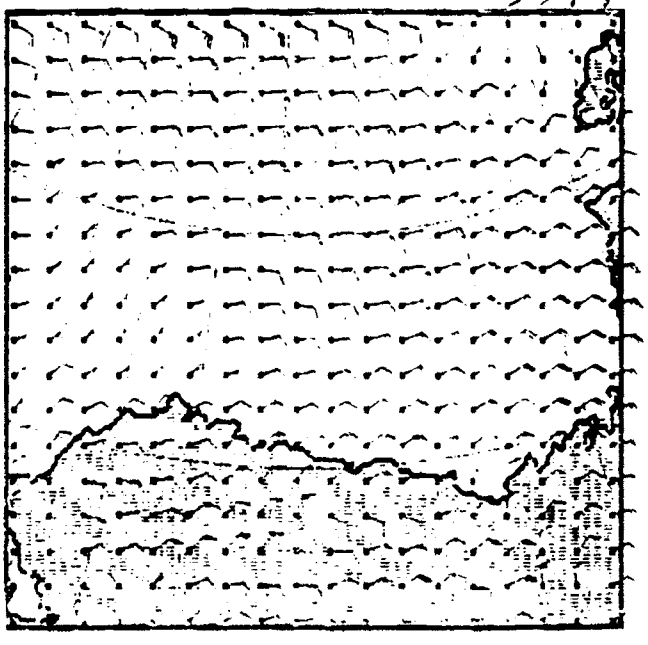

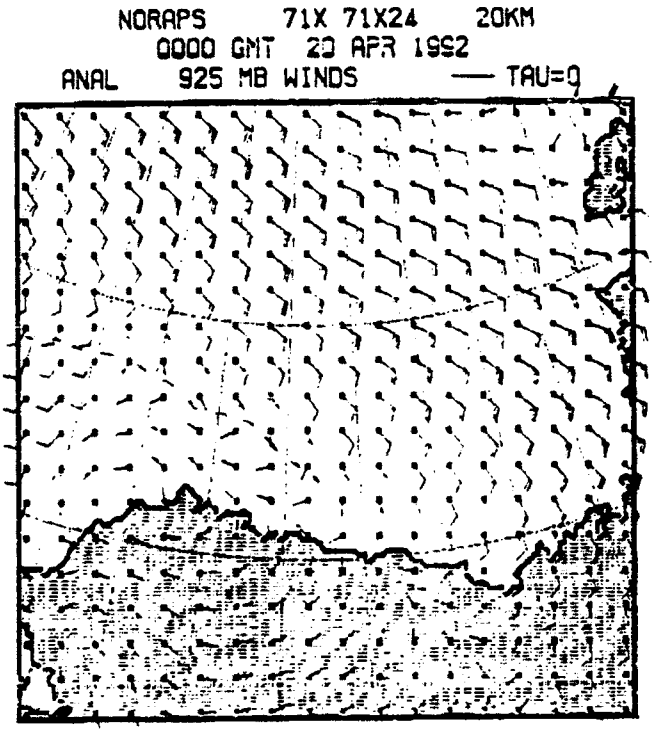
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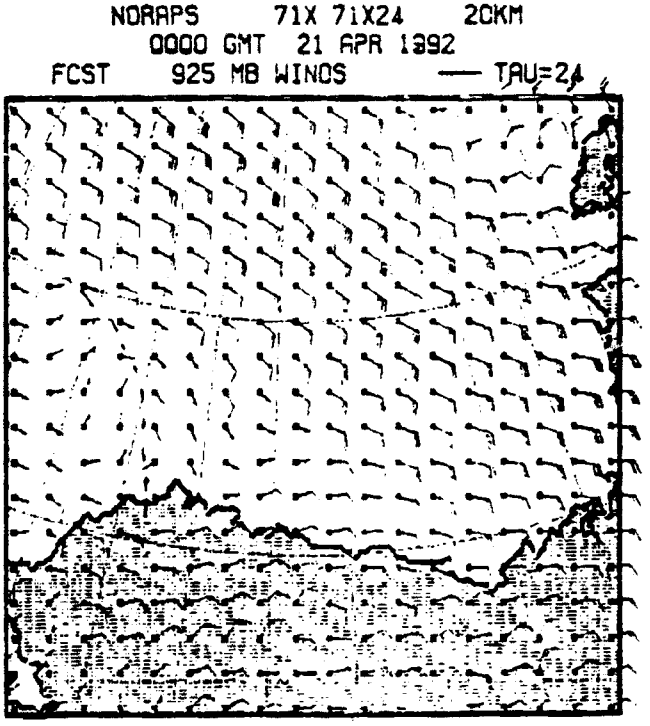
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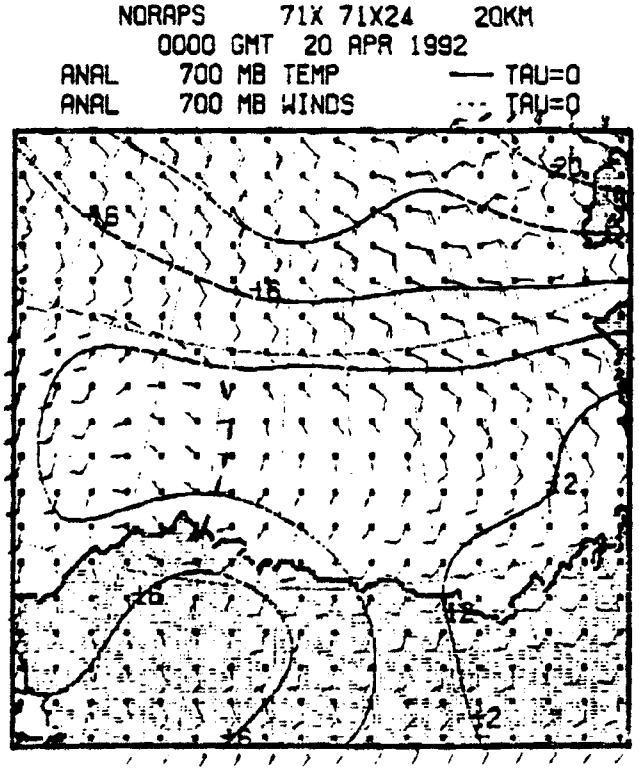
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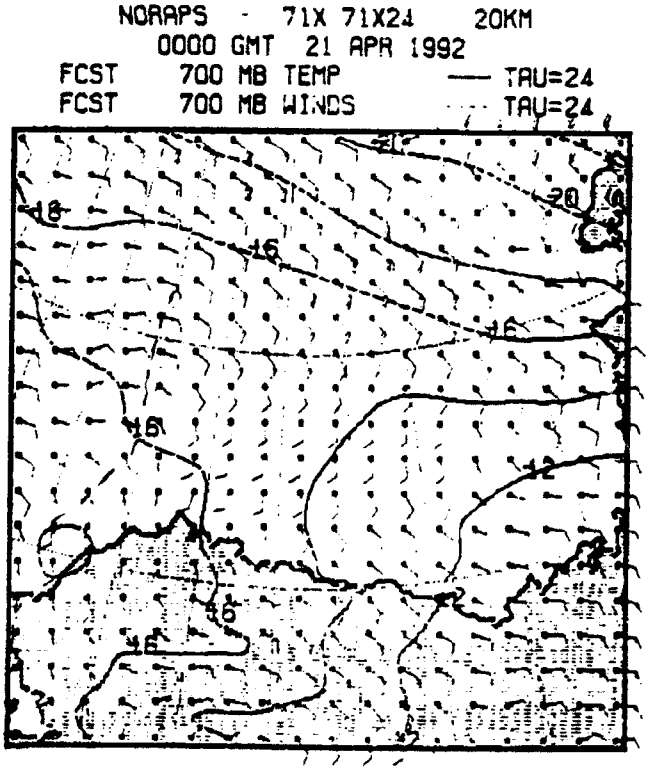
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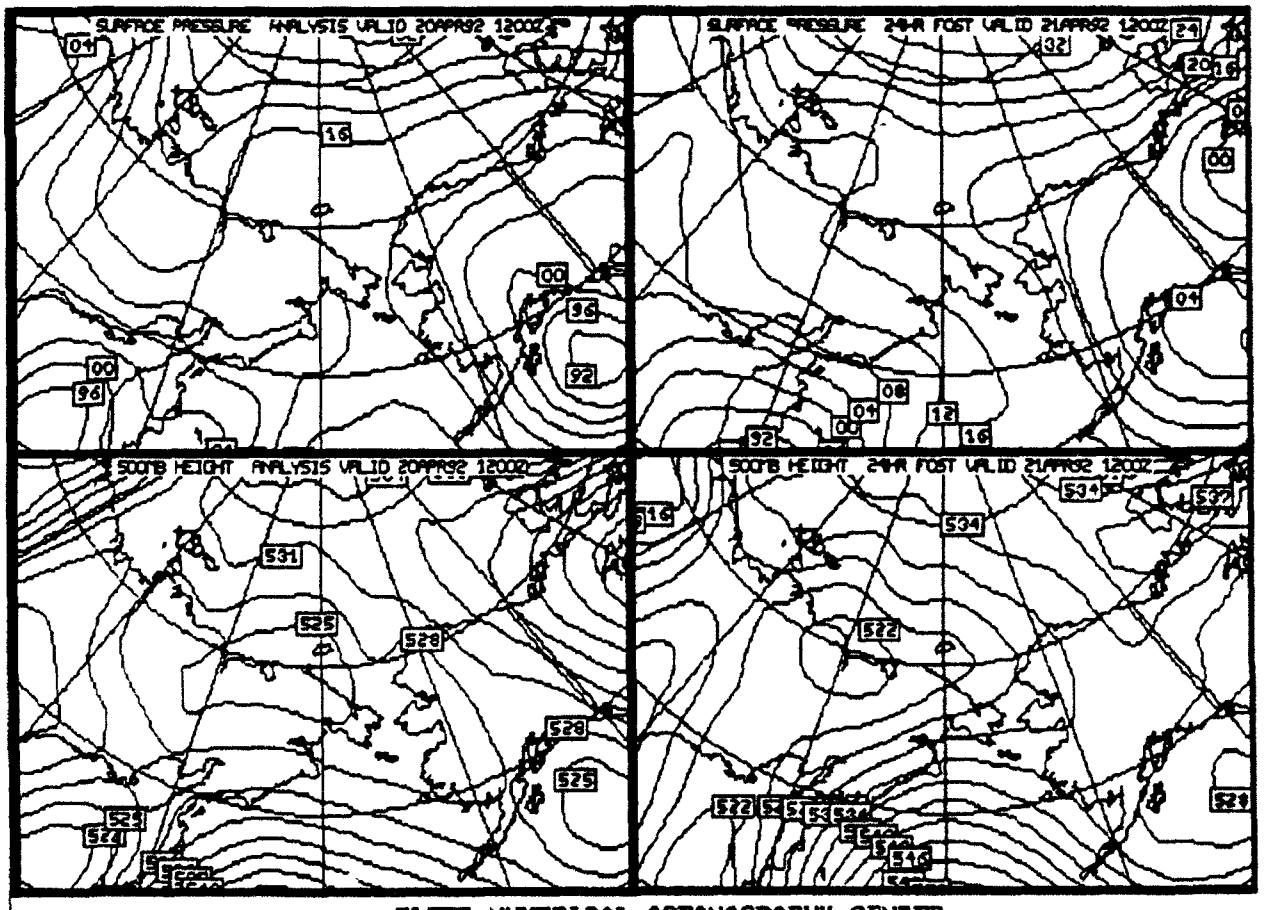
FCST 700 MB WINDS ··· TAU=24

20 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

20/1200Z Analyses and Forecasts (update)
The surface gradient further weakens as low pressure is forecast to develop south of Banks Island. Not well revealed by **NORAPS** products on this date was a synoptic scale vortex revealed in satellite data at 0033Z near 72.5N, 136W. This vortex moved NNW during the day associated with abundant cloudiness north of the camp. Another vortex appeared southwest of the camp at 1823Z This vortex may be associated with troughs or shear lines evident in the region of vortex formation north of Barrow at the 925 and 700 MB levels. The **NOGAPS** product supports weak easterly flow with no indication of disturbances in the area.



FLEET NUMERICAL OCEANOGRAPHY CENTER

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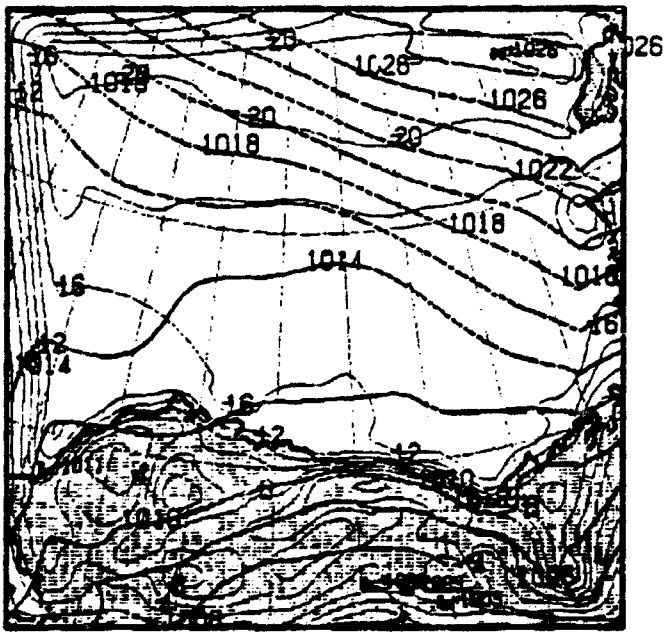
ANAL 2 METER TEMP ---- TAU=0



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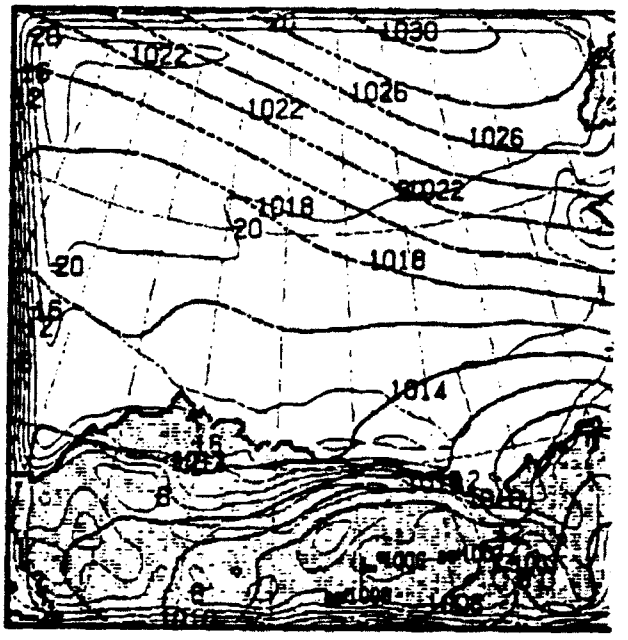

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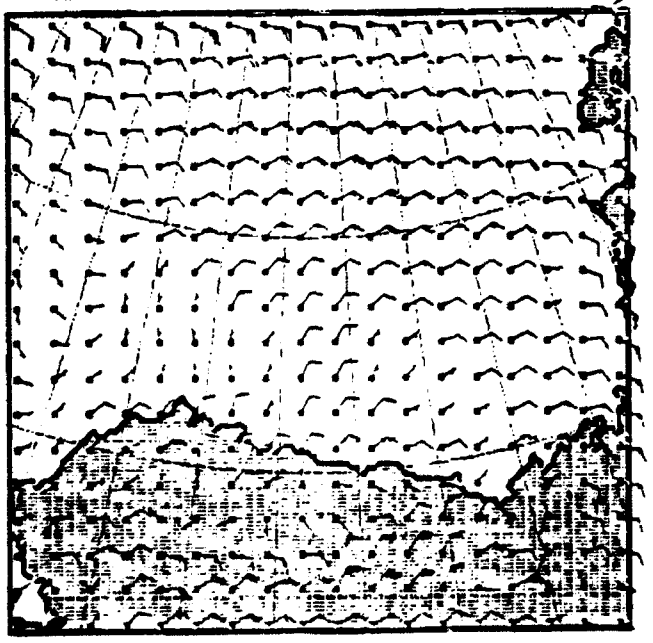
ANAL 10 M WINDS —— TAU=0



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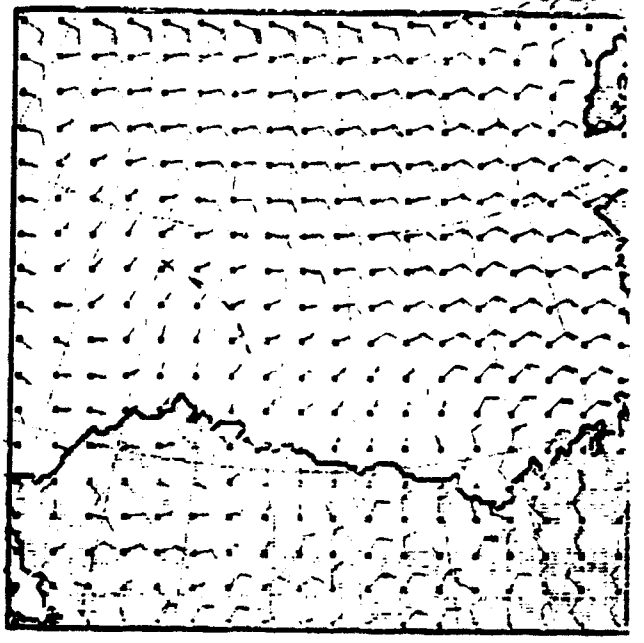

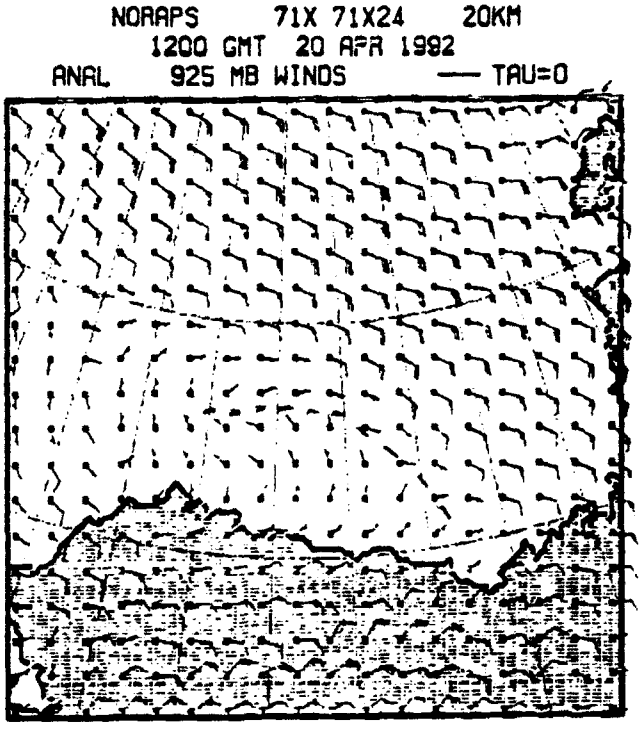
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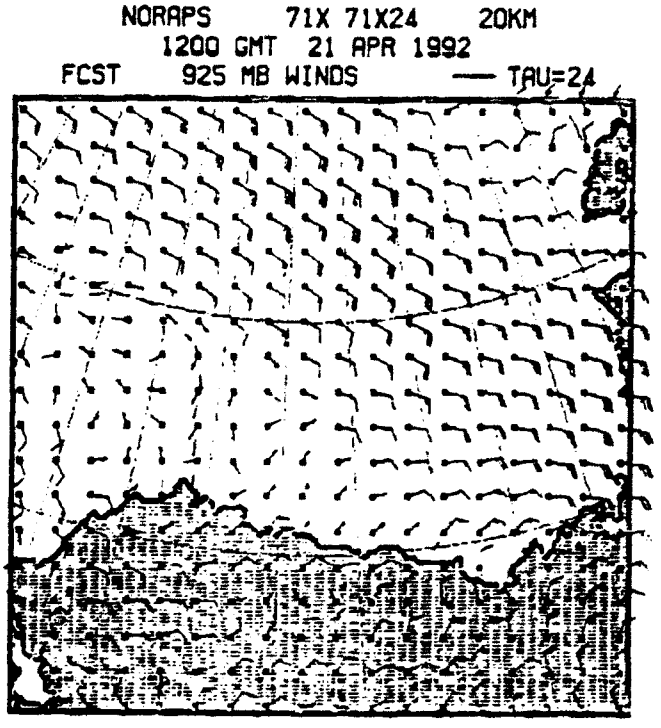
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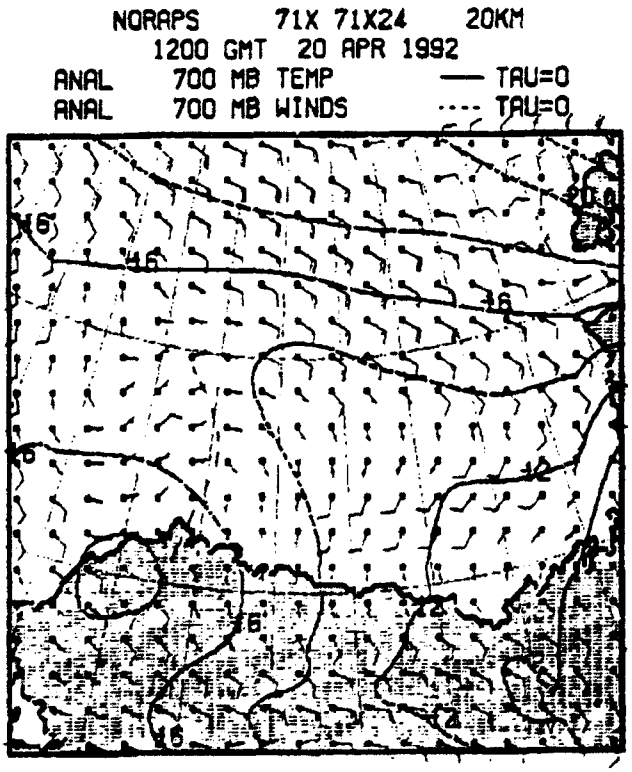
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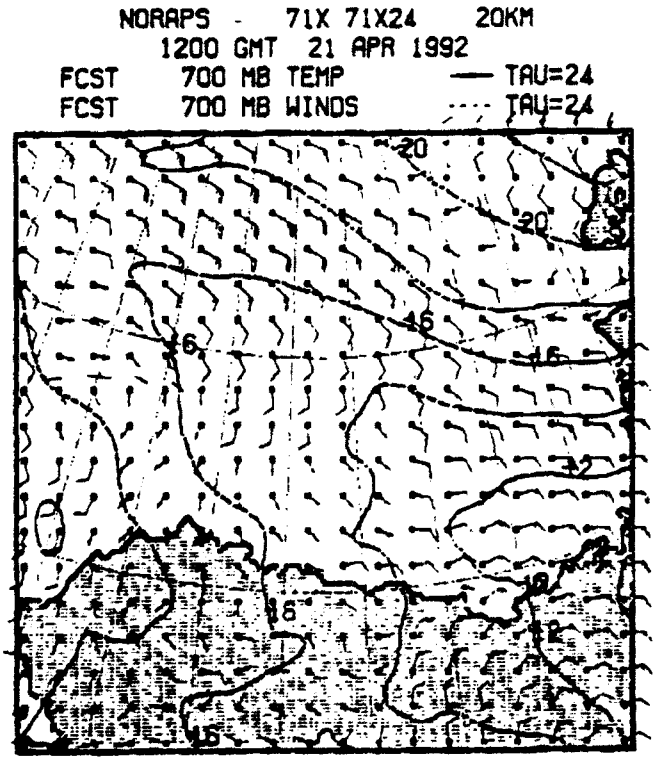
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FCST 700 MB WINDS ···· TAU=24

21 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

21/0000Z Analyses

Surface Pressure

A weak pressure gradient promoting easterly flow is shown over the central and southern Beaufort.

10 M Winds

A cyclonic shear area appears north of Barrow.

925 MB

A closed cyclonic circulation with center near 72.8N, 155W appears north of Barrow. Southeasterly flow is strong to the north.

700 MB

A southerly current flows into the south and central Beaufort while a NE-SW oriented cyclonic shear area appears NW of Barrow.

22/0000Z 24-hr Forecasts

Surface Pressure

The high is projected to start building down from the north while the pressure gradient over the central and southern Beaufort remains weak.

10 M

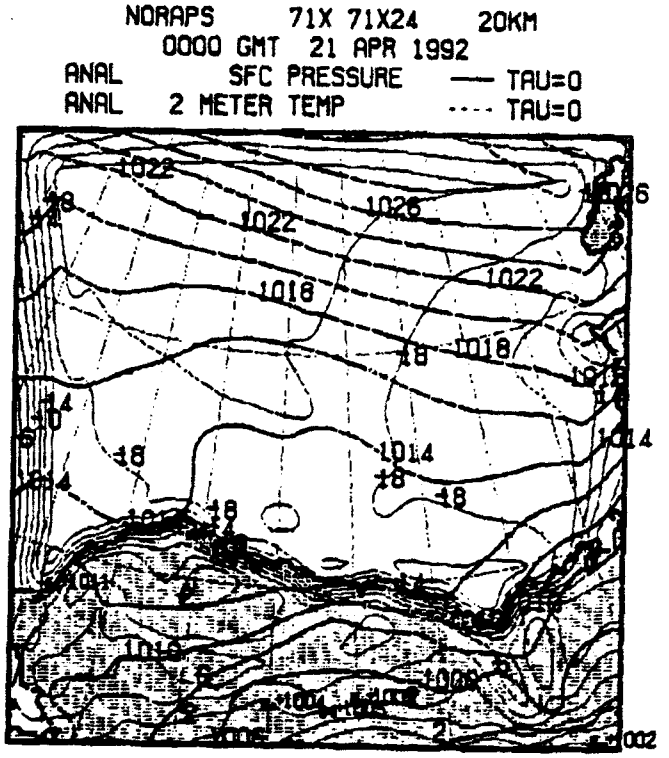
Moderate NE flow in the eastern Beaufort becomes much lighter to the west. No closed circulations apparent.

925 MB

Moderate easterly flow over the eastern and central Beaufort with a cyclonic shear area extending to a low NW of Barrow is apparent.

700 MB

Similar to 925 mb but with no closed circulation apparent.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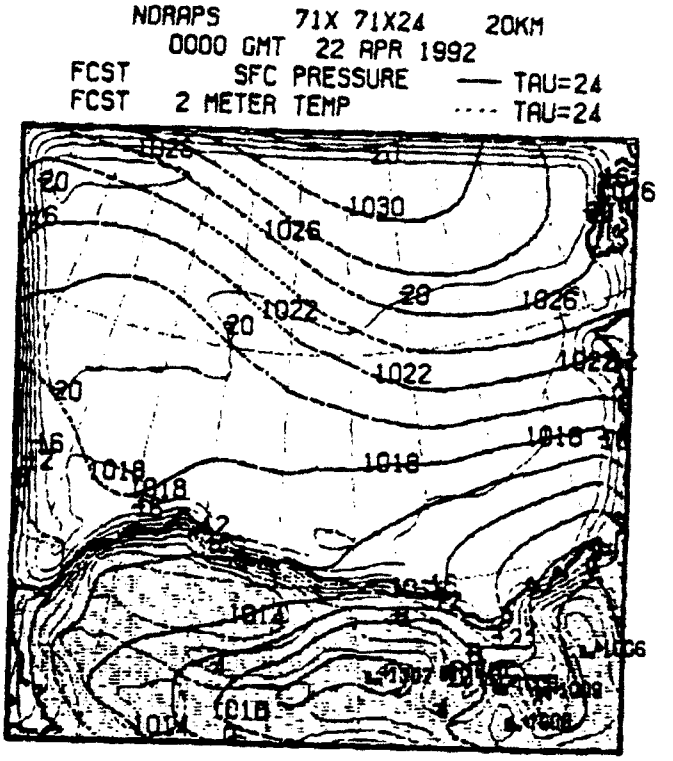
ANAL 2 METER TEMP ···· TAU=0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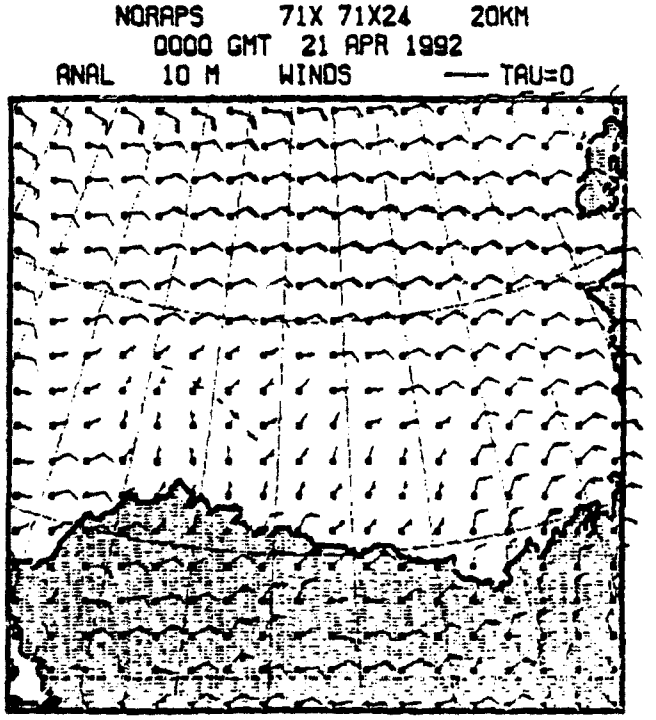
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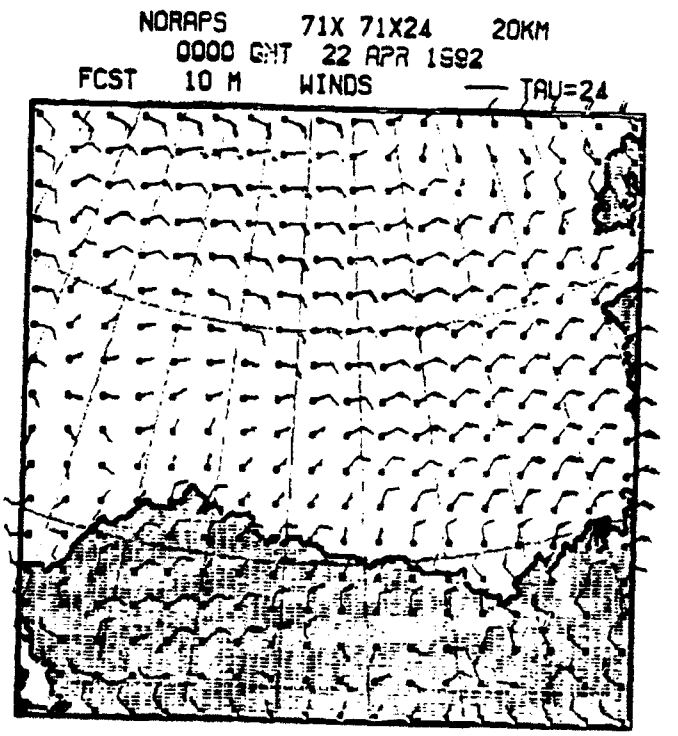
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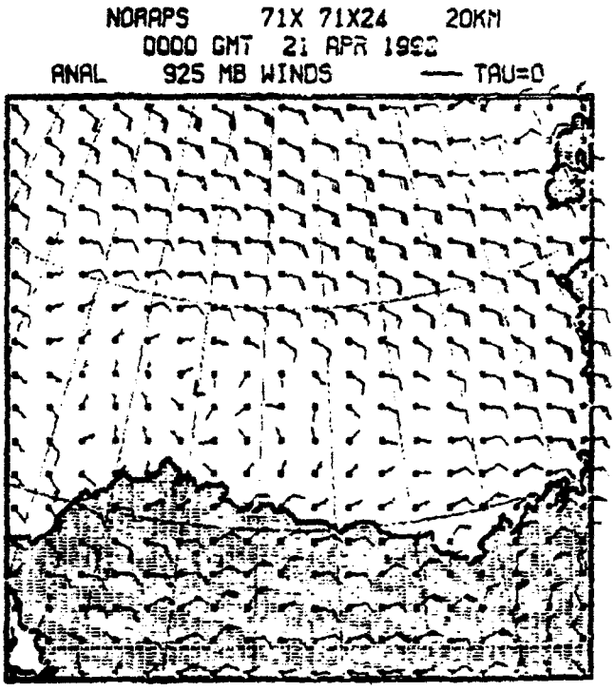
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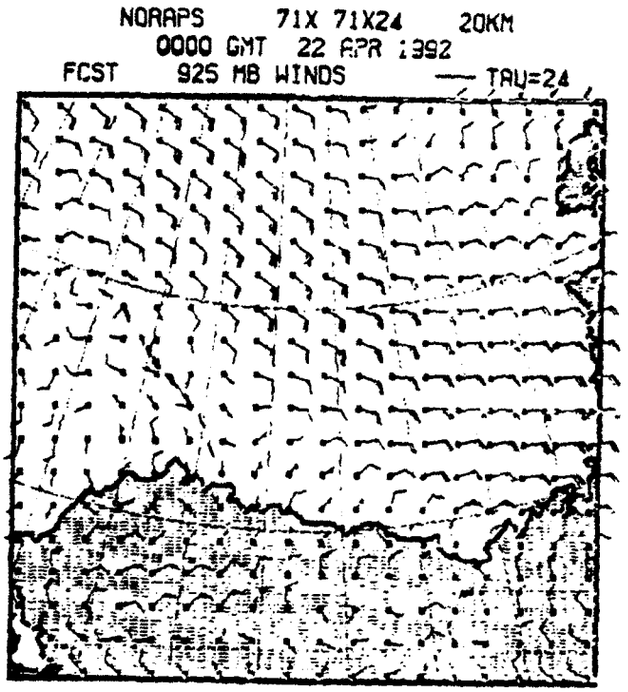
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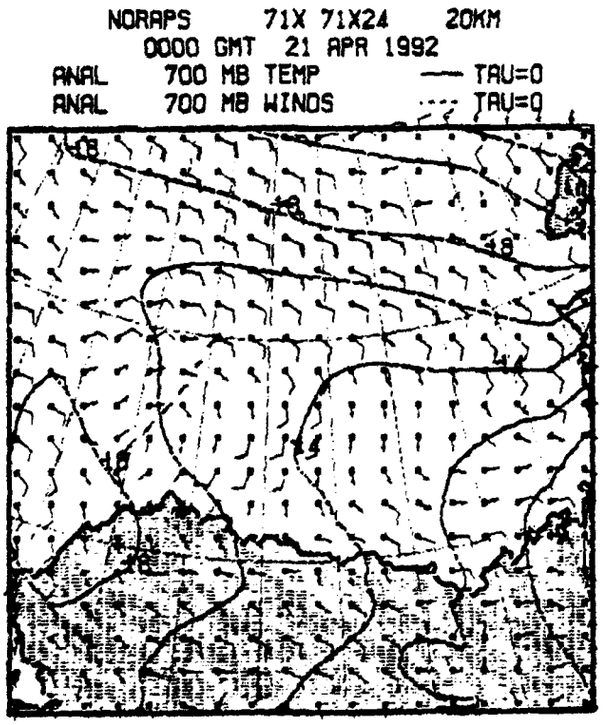
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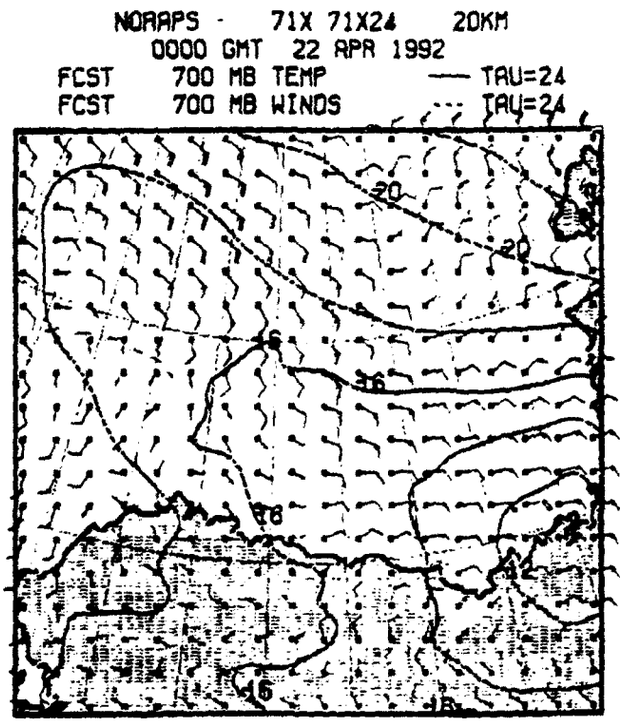
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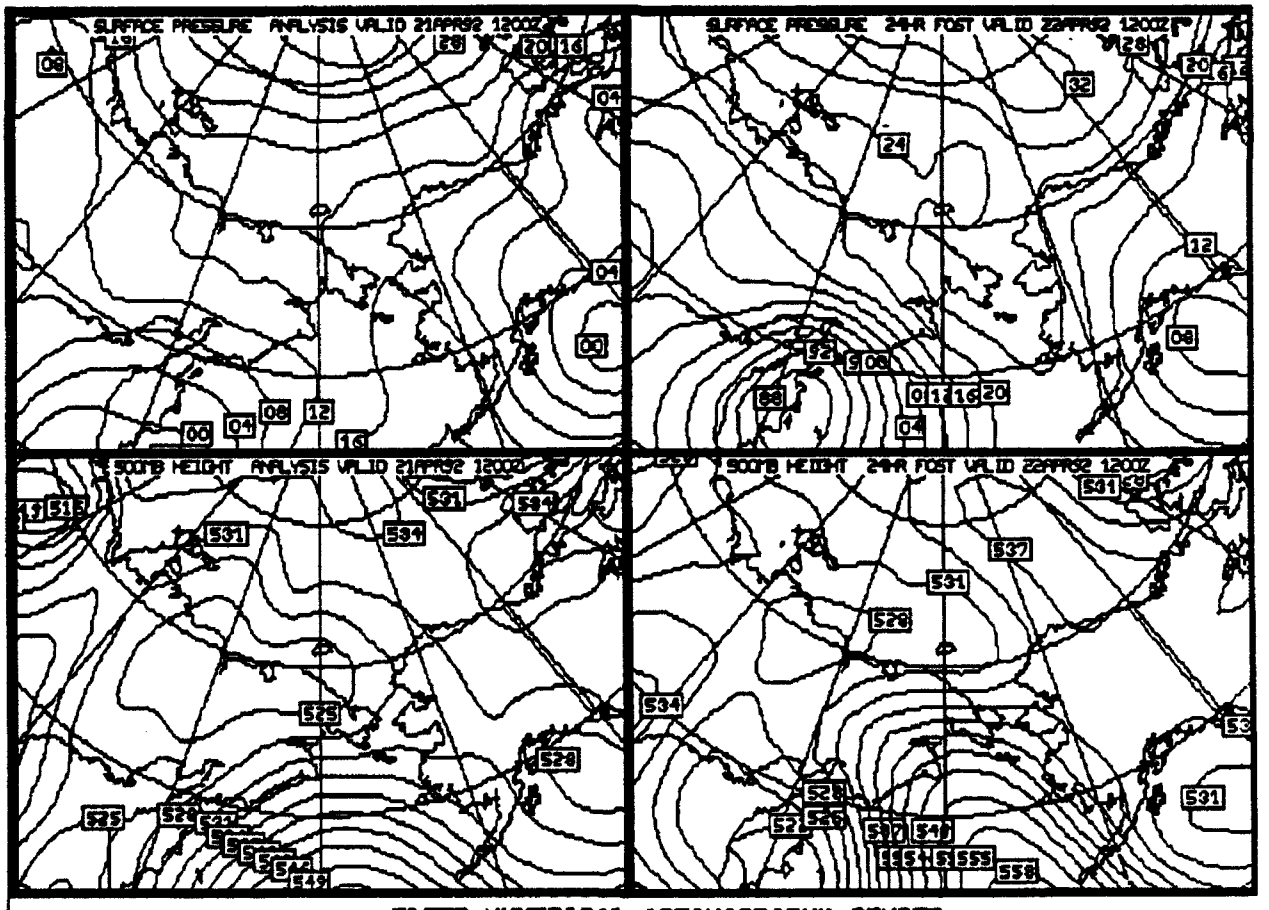
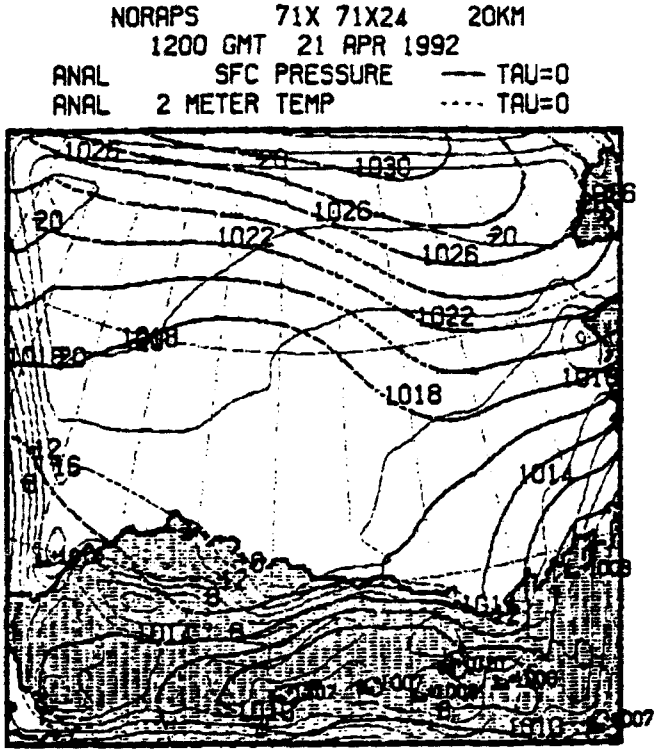
21 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

21/1200Z Analyses and Forecasts (update)
A very weak pressure gradient is shown at analysis time with a forecast for higher pressure to build southward into the area. An E-W oriented shear line north of Barrow is shown as a closed circulation at **925** and at **700 MB**. The low apparently does not develop in the 24 hr forecast. **Satellite data** showed a significant series of vortices at 1944Z leading from one south of the ice camp, near 70.5N, 146W, and then further west to a vortex near 75.2N, 165.5W, and then past Wrangel Island to another vortex over Siberia. The concept suggested is one of a frontal zone through the region with intermittent vortex development. At 1712Z a sharp, front-like boundary was located approximately 110 nm east of the ice camp. The boundary was moving westward and forecast to pass the ice camp by the following AM. This case is worth looking at in more detail since all available conventional analyses yielded little clue to significant weather happenings over the area.



FLEET NUMERICAL OCEANOGRAPHY CENTER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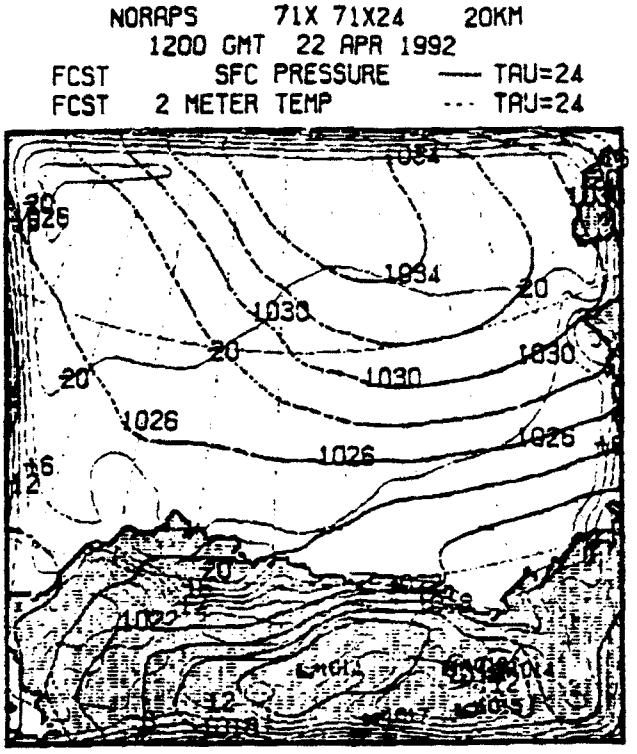
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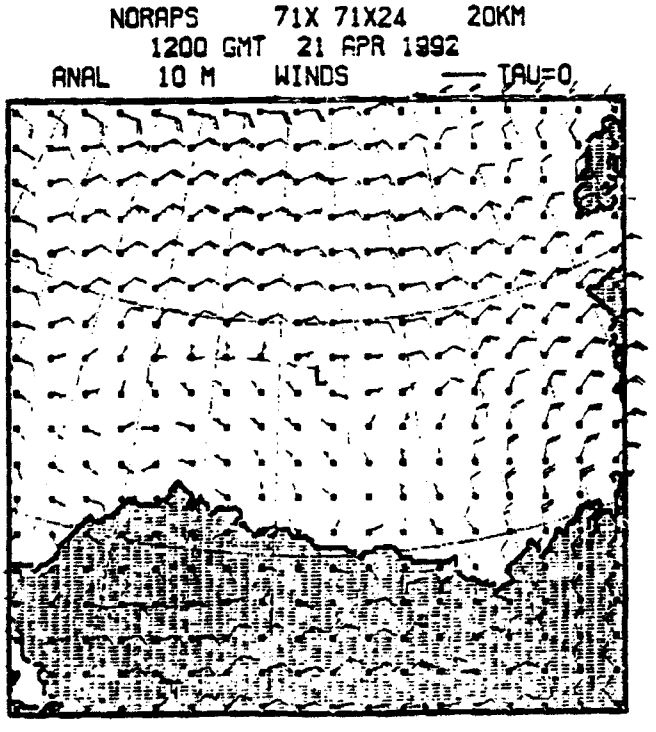
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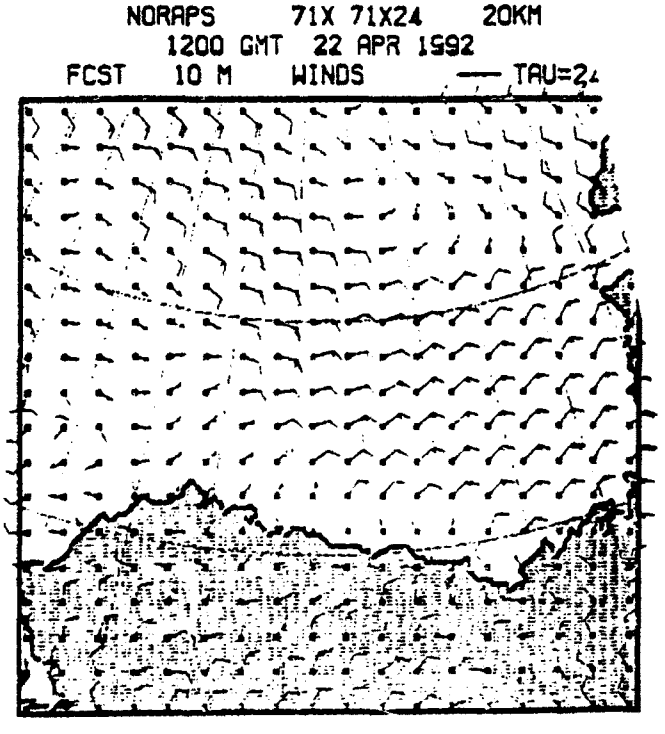
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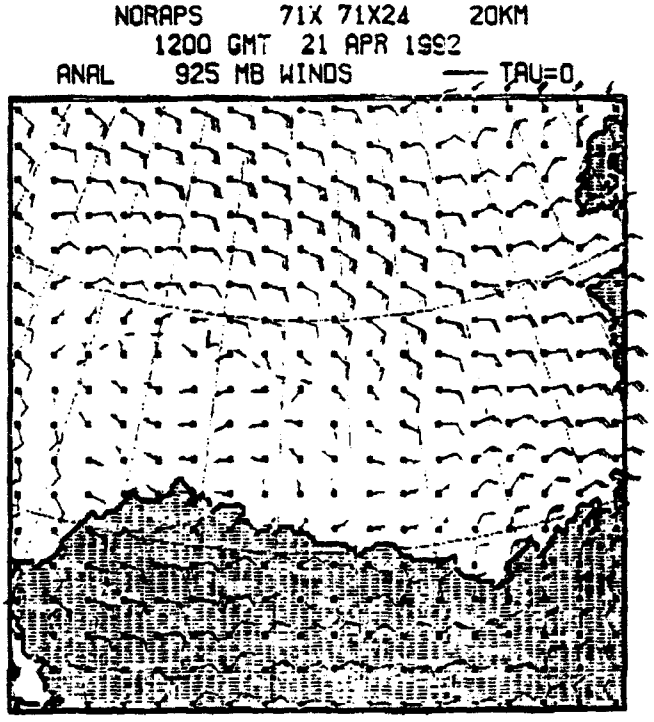
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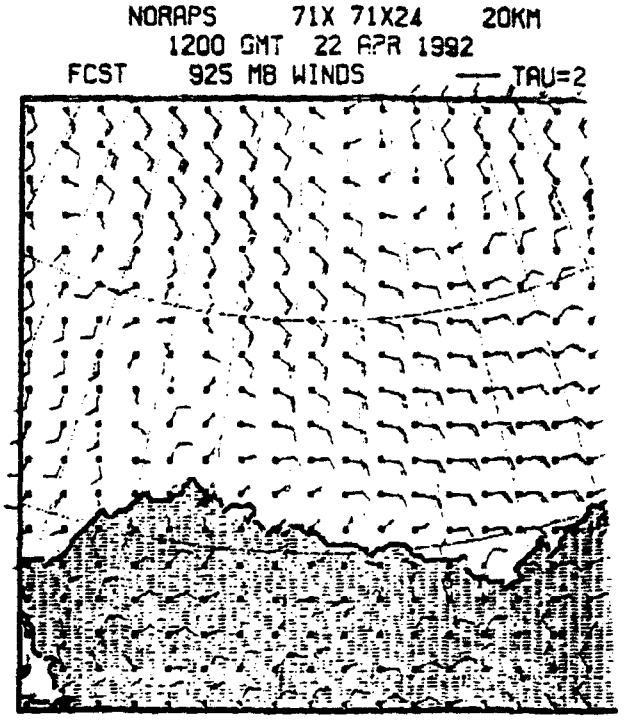
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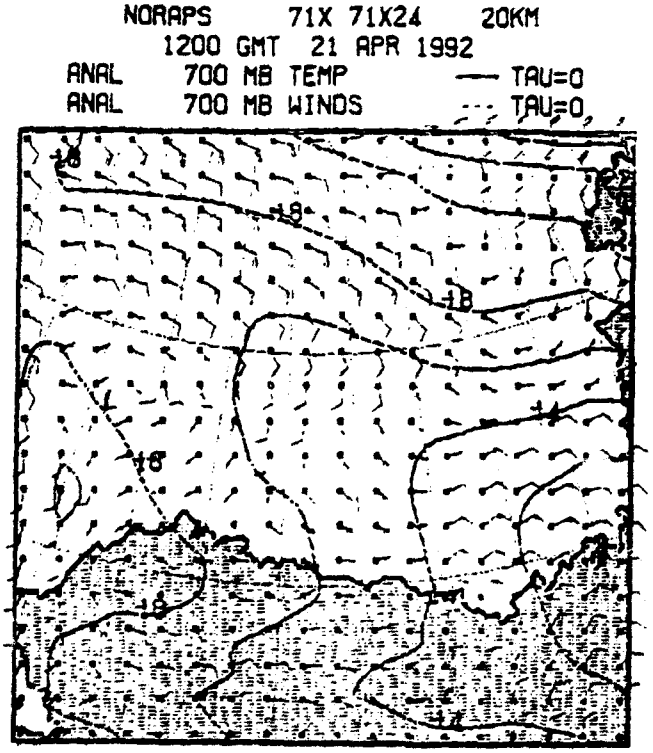
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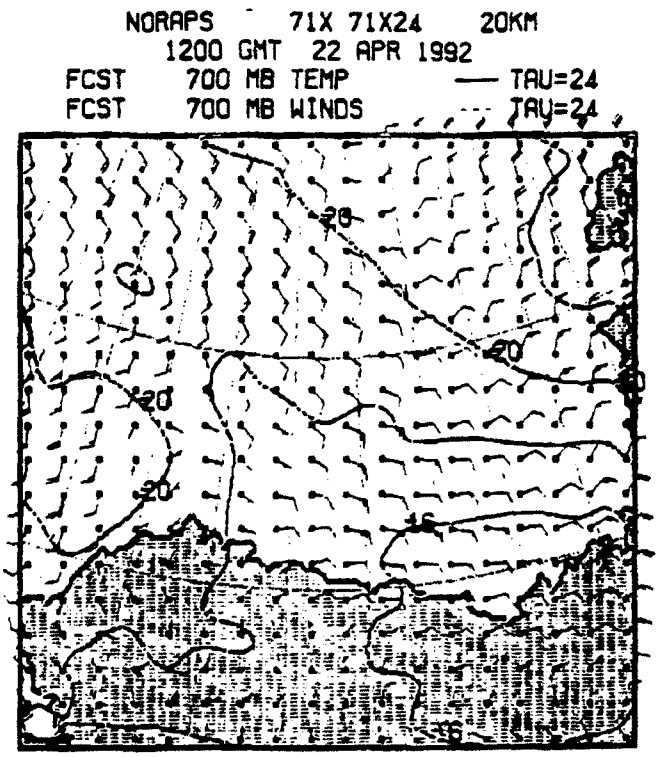
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22 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

22/0000Z Analyses

Surface Pressure

High pressure sags down into the central Beaufort following the frontal structure noted the previous day. The pressure gradient to the west remains very weak.

10 M Winds

These winds reflect the anticyclonic turning of winds in the central Beaufort becoming southeasterly to the west.

925 MB

Anticyclonic turning of flow NW of Barrow leads to a sharp shear line associated with the front-like structure seen in the satellite imagery.

700 MB

A shear line also appears north of Barrow as in the 925 mb data.

23/0000Z 24-hr Forecasts

Surface Pressure

High pressure is forecast to extend even further into the central and eastern Beaufort.

10 M

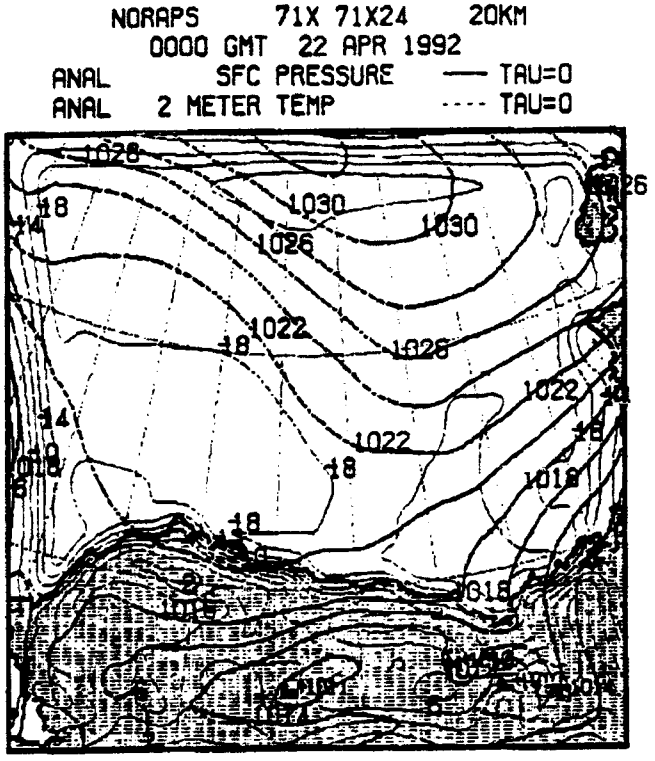
Some remnant of the shear line can still be seen north of Barrow.

925 MB

A weak trough extends north of Barrow.

700 MB

Easterly to southeasterly winds cover most of the Beaufort at this level with no shear line evident.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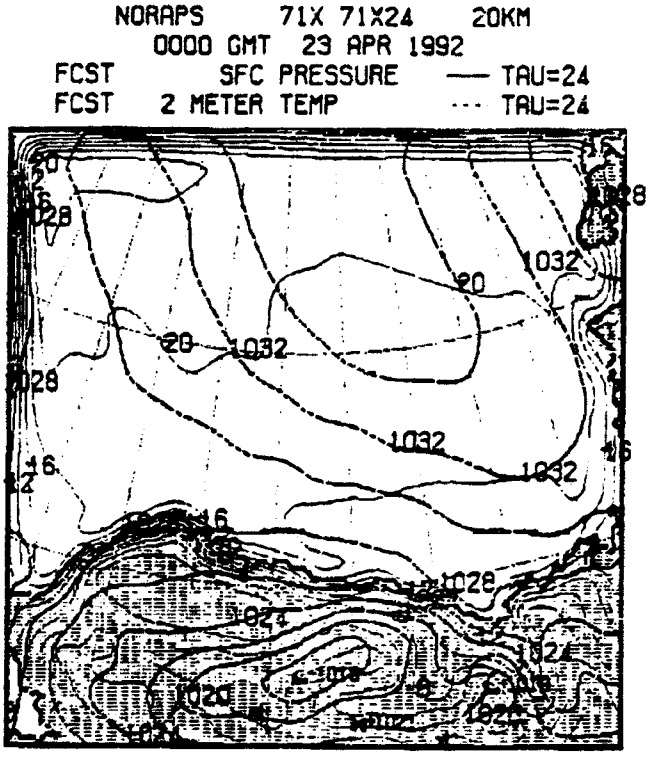
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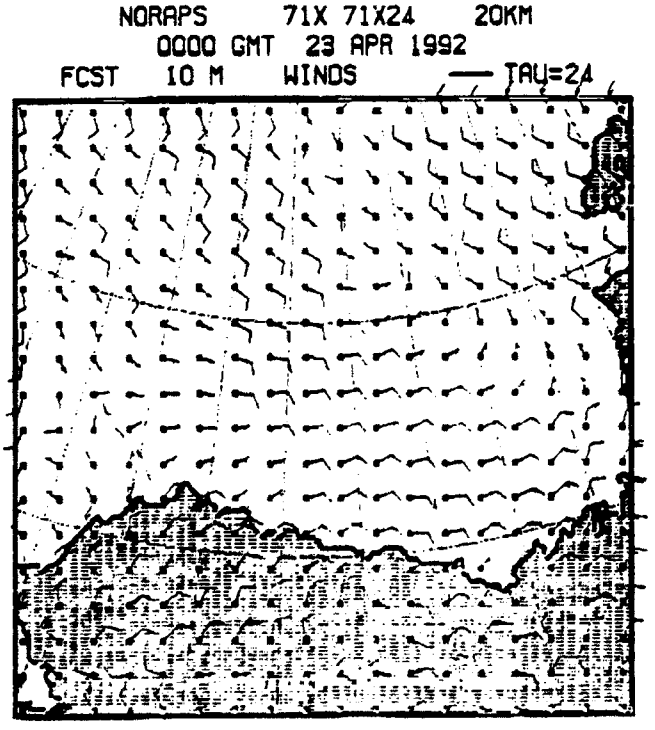
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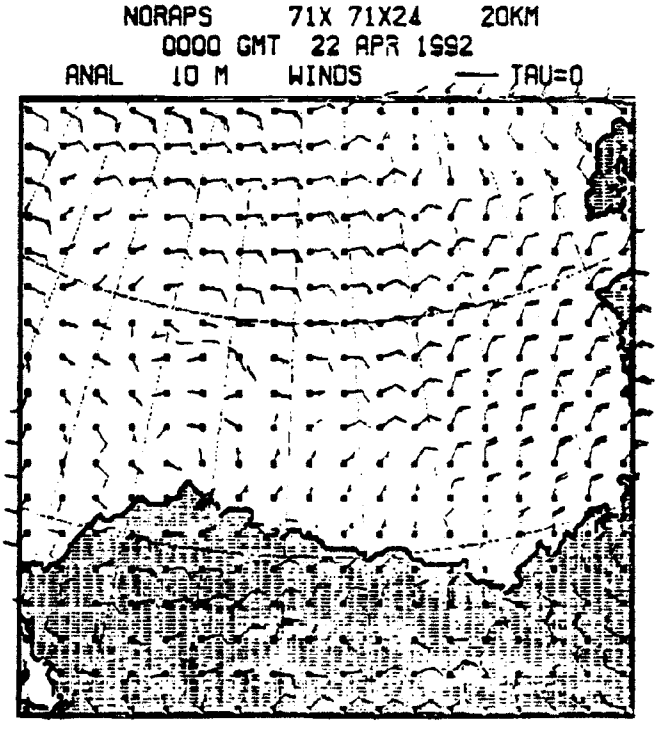
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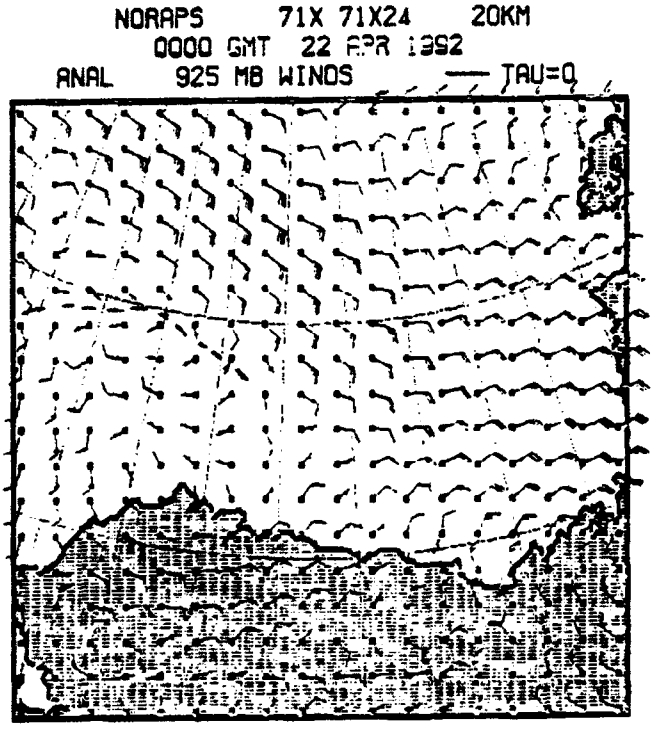
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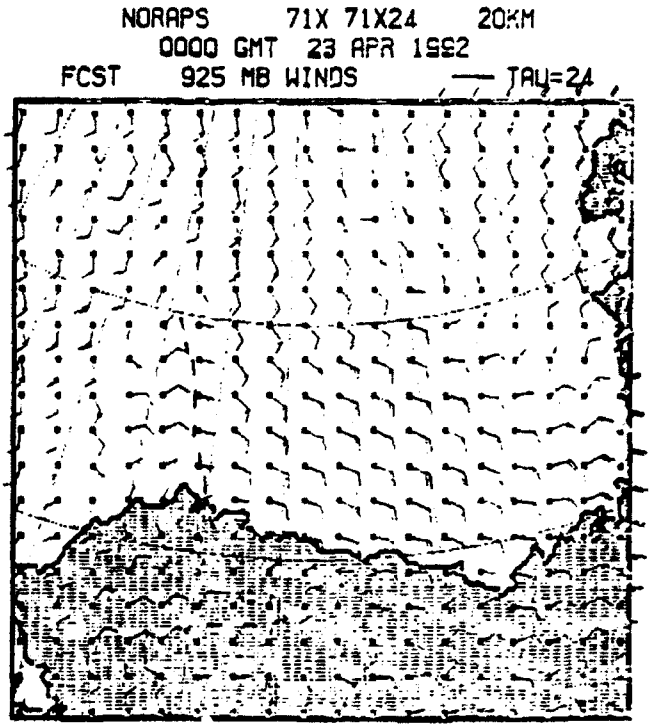
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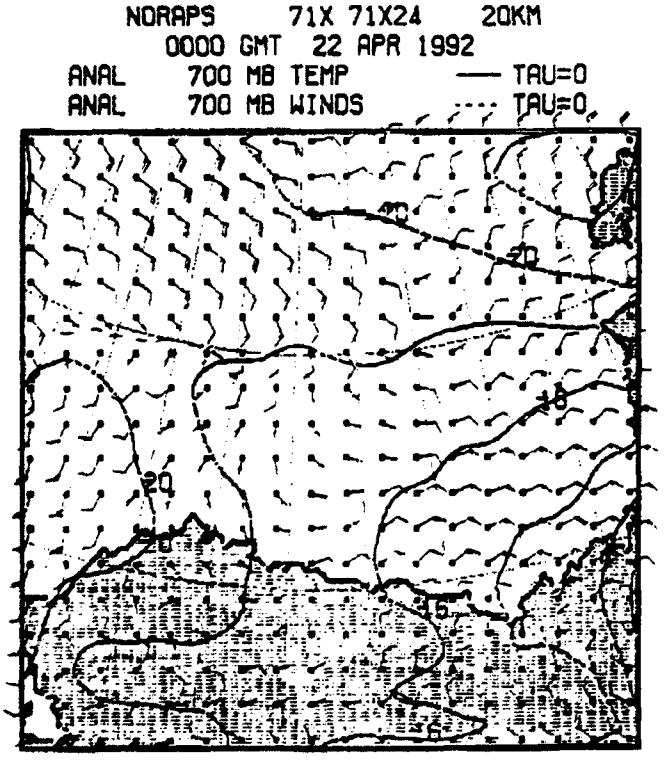
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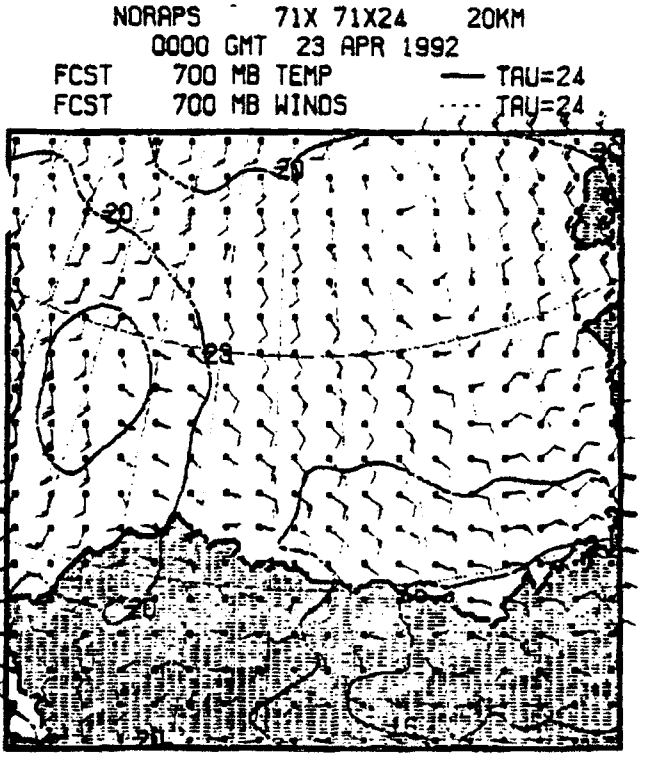
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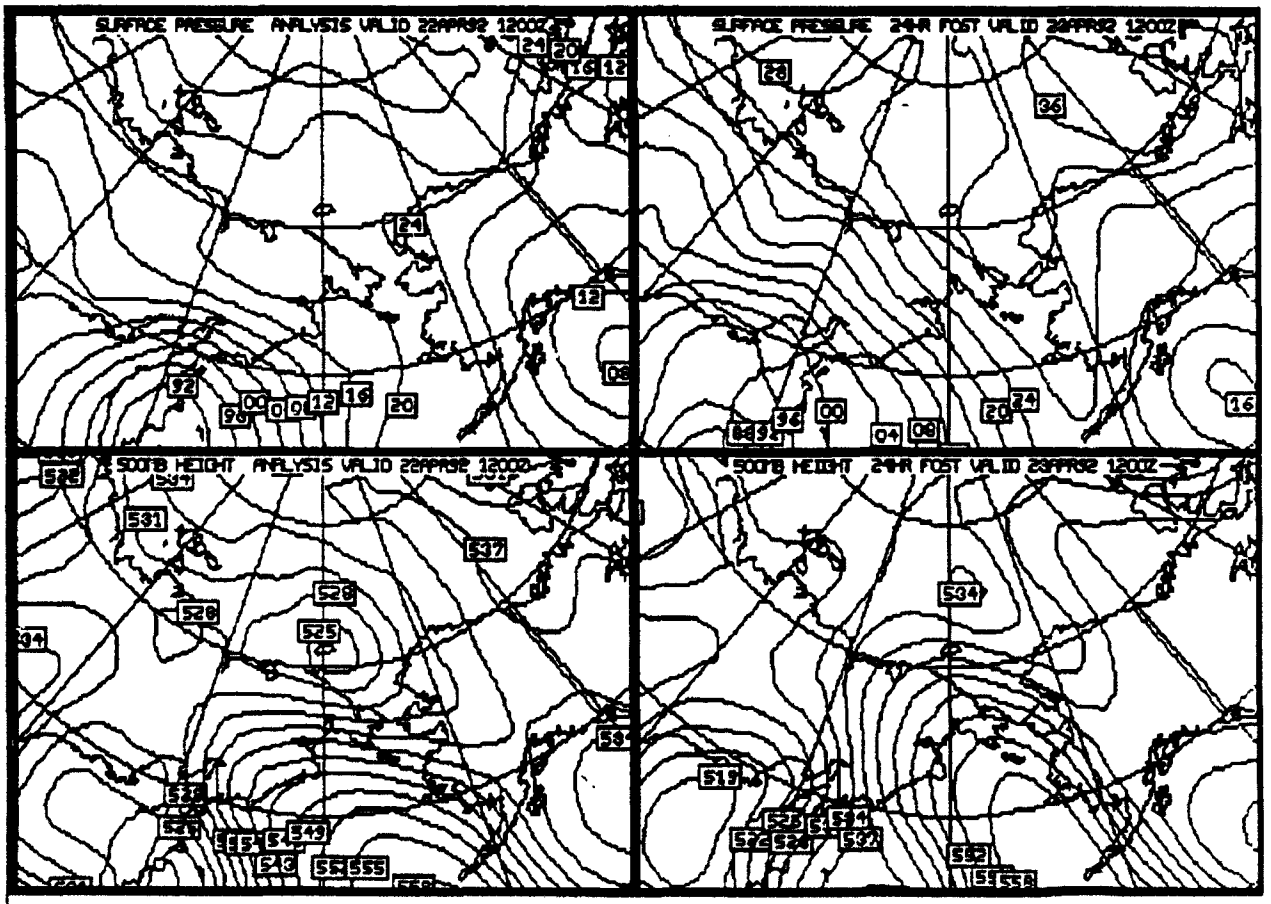
22 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

22/1200Z Analyses and Forecasts (update)
NORAPS analysis and forecast products are not available for this period. **Satellite data** show cyclonic activity extending north of Barrow. The edge of this structure does move past the ice camp by 2000Z. **NOGAPS** yields little clue to these significant happenings which are difficult to follow even in the satellite data.



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23 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

23/0000Z Analyses

Surface Pressure

NORAPS analysis and forecast products are not available for this time period. Anchorage charts showed a ridge over the central Beaufort Sea, with a frontal zone connecting vortices near Barrow and Tuktoyaktuk.

10 M Winds

925 MB

700 MB

24/0000Z 24-hr Forecasts

Surface Pressure

NORAPS forecasts not available for this period.

10 M

925 MB

700 MB

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23 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

23/1200Z Analyses and Forecasts (update)
A sharp inverted trough develops near Barrow in association with the frontal structure with a small vortex appearing near 72.5N, 158W. A closed anticyclonic circulation also formed NW of Banks Island. The closed circulation does not show up at higher elevations although a cyclonic wind shear region is evident at 700 mb. The forecast gradient is very weak with minor troughs and vortices appearing throughout the region. **Satellite data** (0129Z) reveal a fairly intense looking vortex just east of Barrow in the region of the inverted trough. Low cloudiness from this circulation extends northward in a front-like region, while the eastern Beaufort is mainly clear. The vortex moves northward to a position just east of the ice camp by 1339Z and continues north throughout the day as and extension from this vortex moves eastward across the N. Slope, where another vortex forms by 2042Z just north of Deadhorse. The **NOGAPS** product was not available for this time period.

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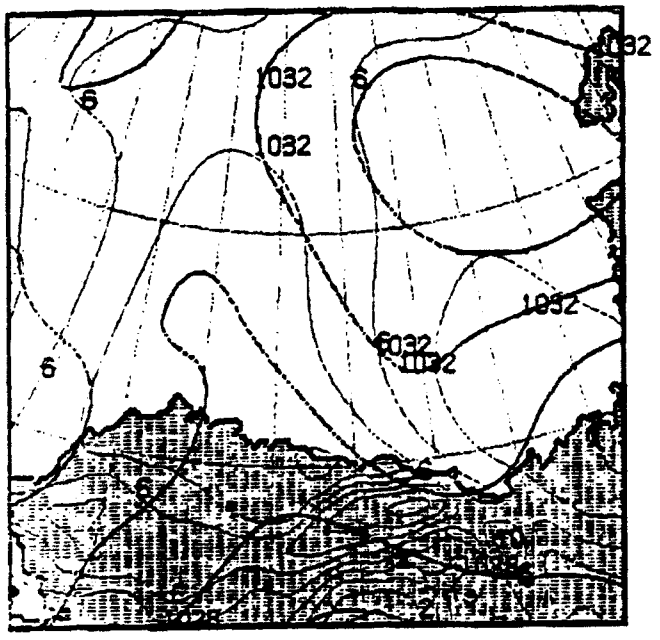

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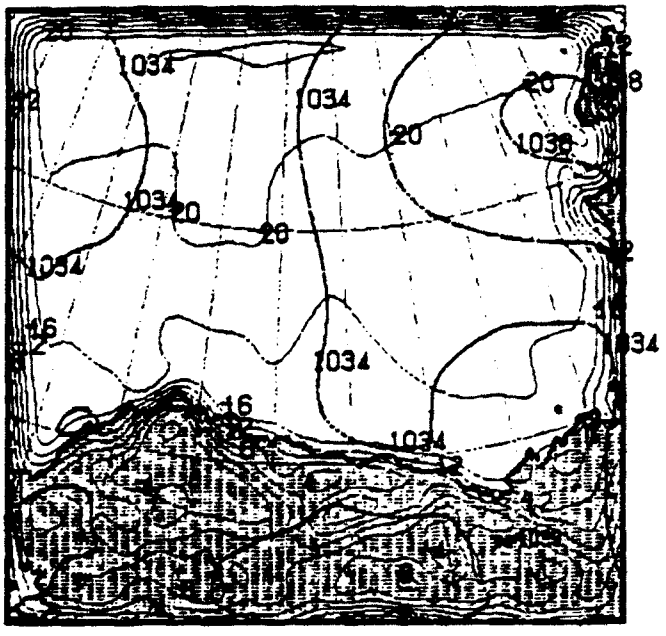

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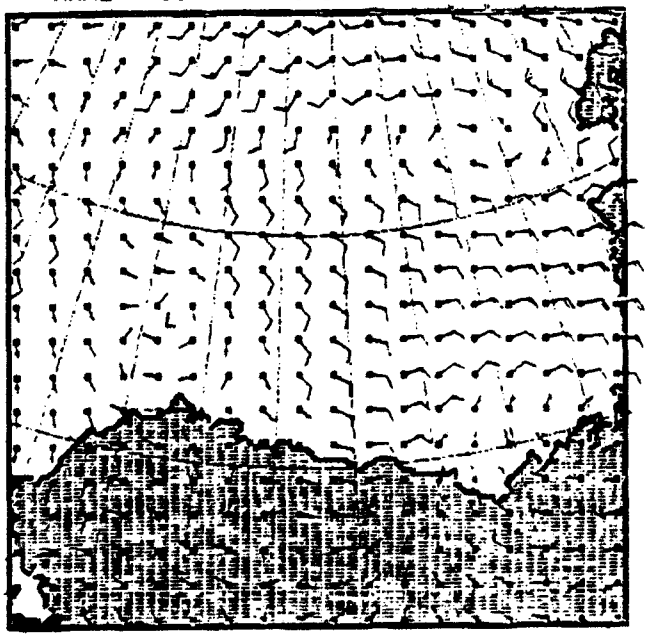

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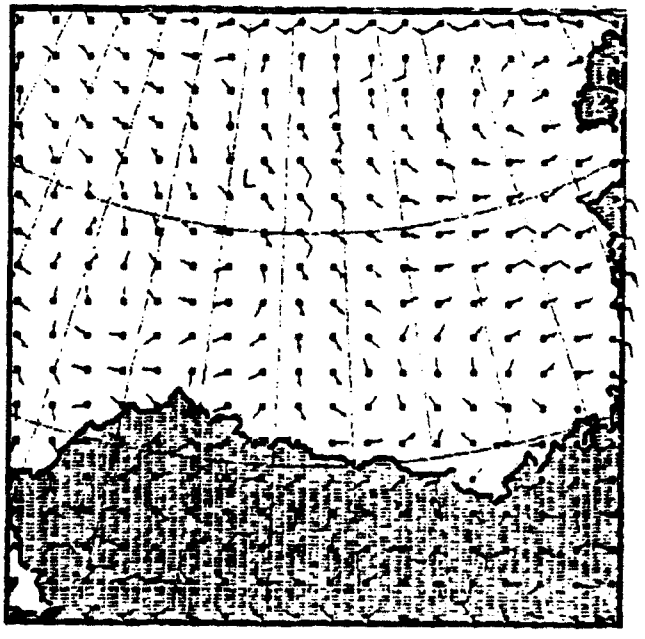

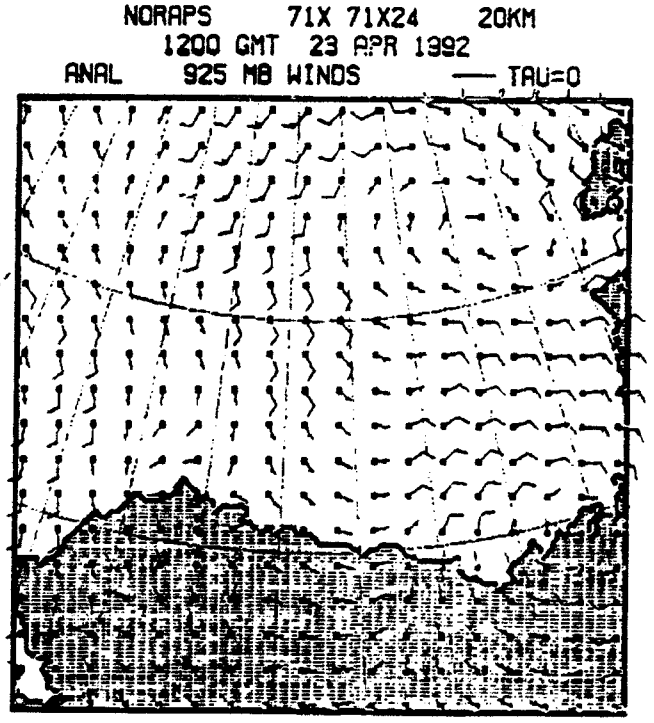
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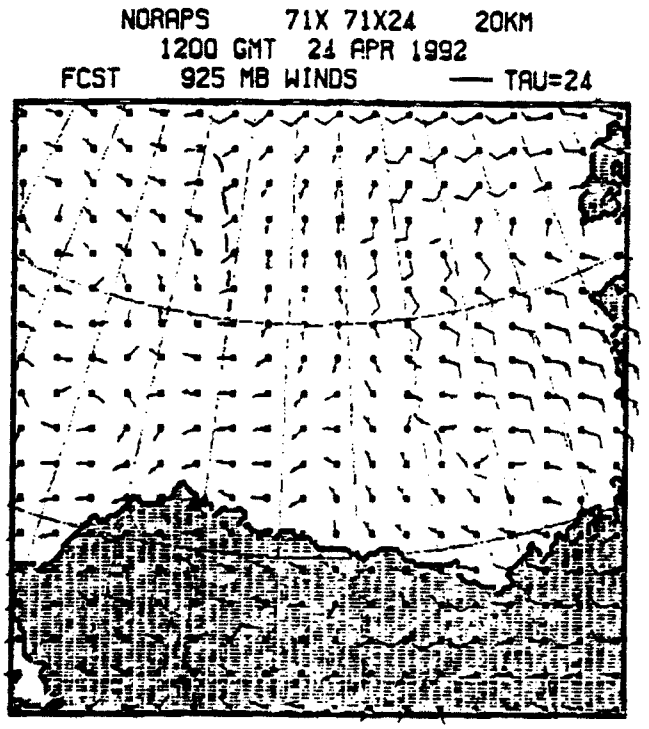
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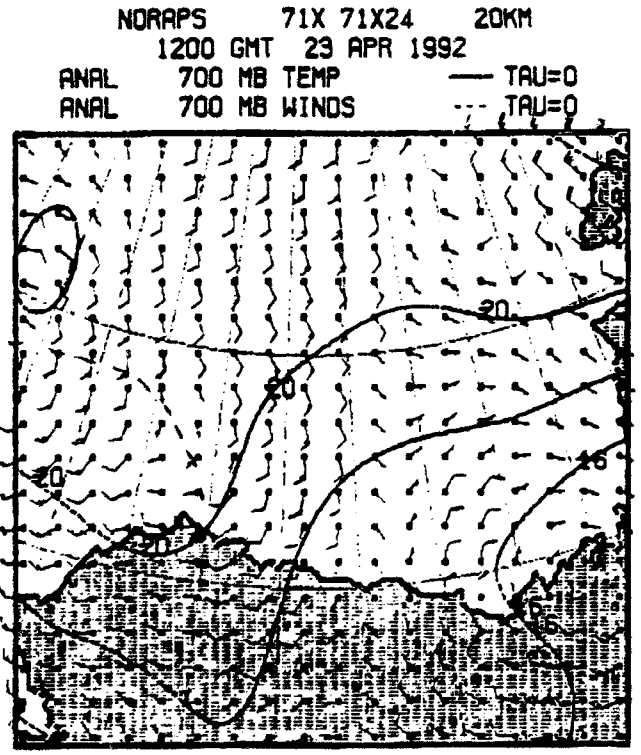
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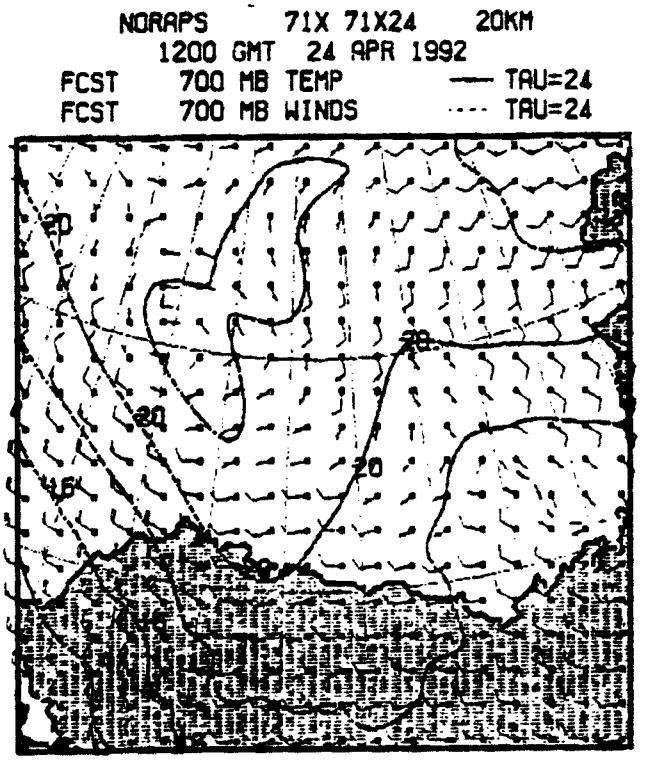
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24 Apr 92

NORAPS ANALYSIS AND FORECAST PRODUCTS

24/0000Z Analyses

Surface Pressure

A low pressure center forms north of Barrow with a very weak gradient throughout the rest of the area.

10 M Winds

A closed cyclonic circulation is shown near 73N, 155W, while a closed anticyclonic circulation is centered just NE of Deadhorse. Pronounced diffluence occurs over the north central Beaufort near 75N.

925 MB

A small closed cyclonic circulation appears near 75N, 160W with another center appearing near the Tutoyaktut Peninsula. An anticyclonic center appears NW of Banks Island.

700 MB

A 700 mb cyclonic shear line appears to the NW near 170W while southerly flow covers most of the central Beaufort.

25/0000Z 24-hr Forecasts

Surface Pressure

The low pressure center is forecast to move eastward, with a very weak gradient throughout the region.

10 M

A major cyclonic center appears near 74.5N, 147.5W, with a shear line extension eastward toward Banks.

925 MB

A cyclonic center is forecast near 74.5N, 147.5W, with another center at 72.3N, 130W, near Banks.

700 MB

A cyclonic shear line axis is shown along 147.5N north of 75N.

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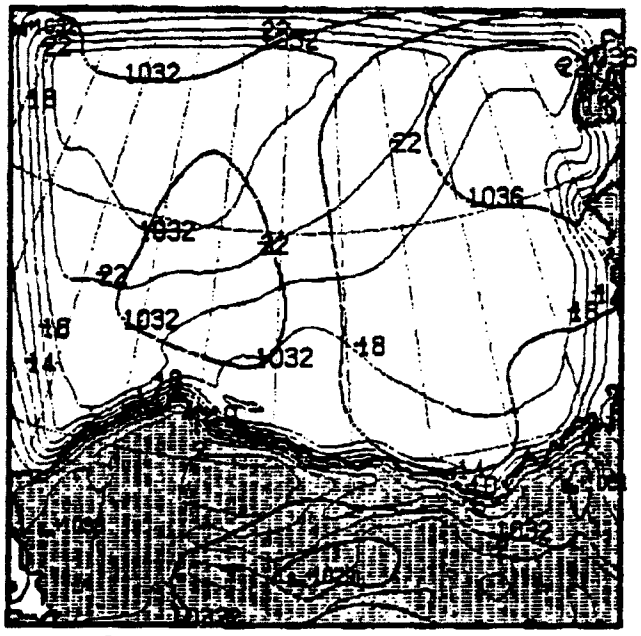

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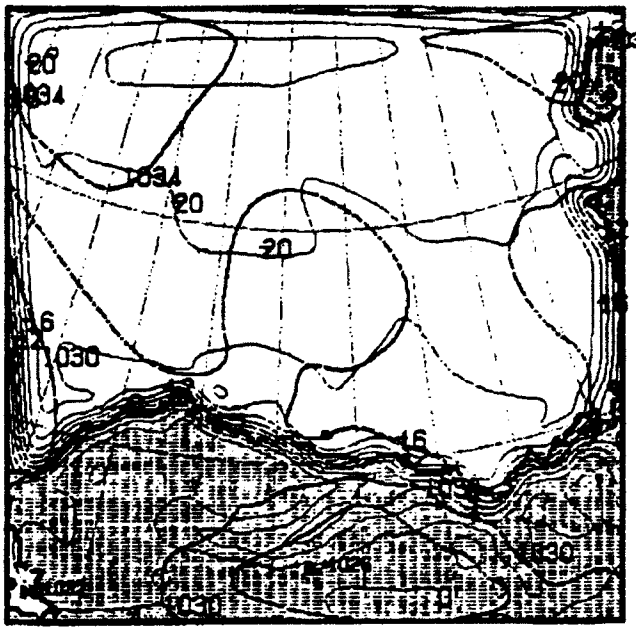

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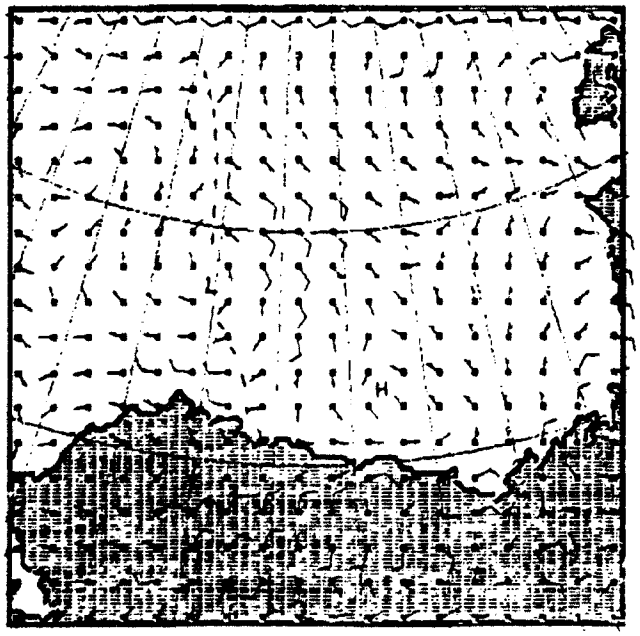

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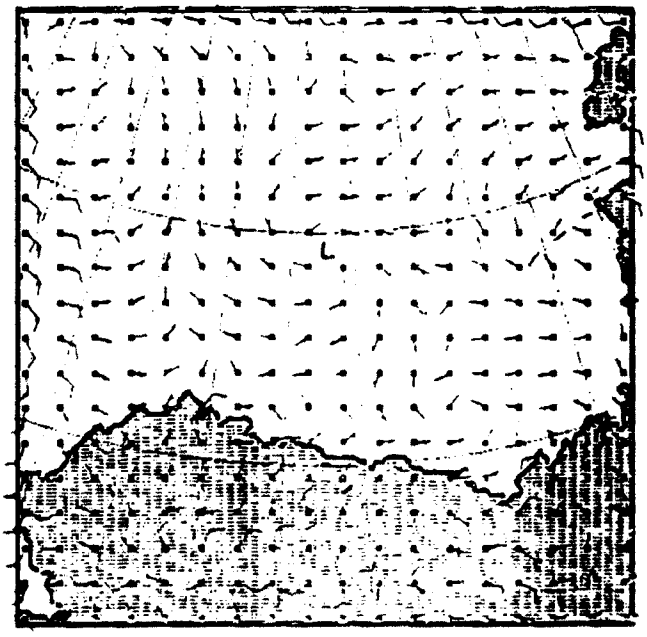

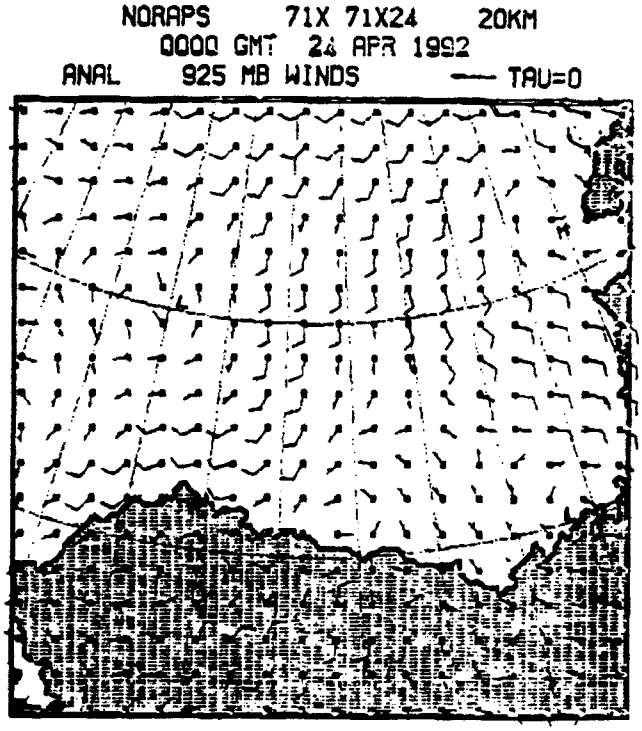
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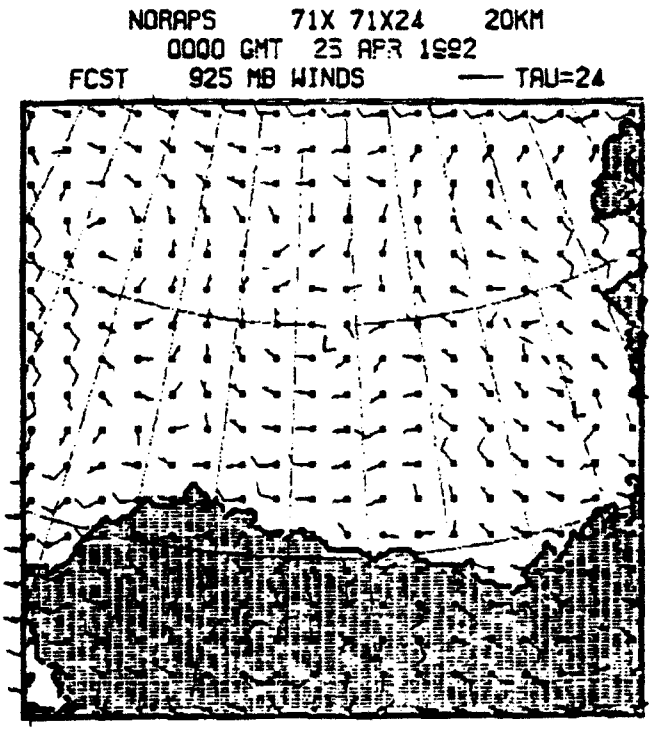
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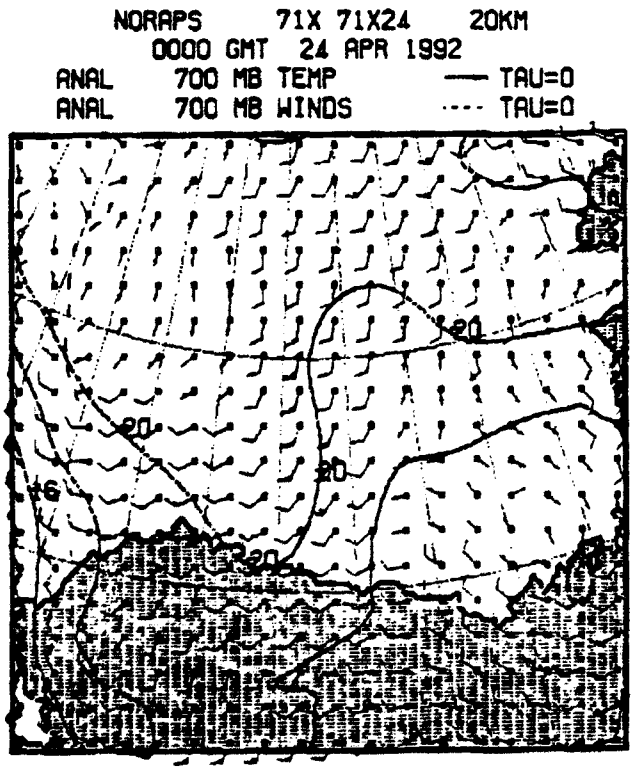
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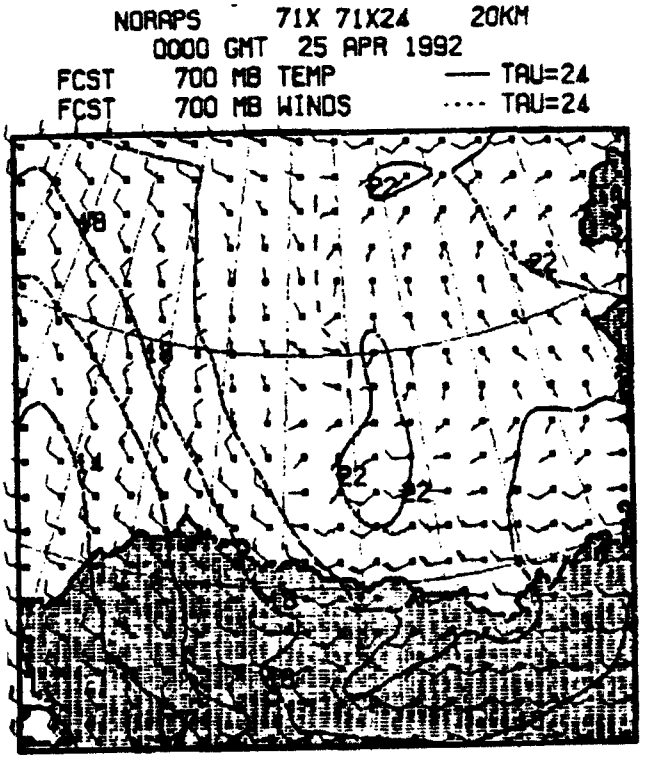
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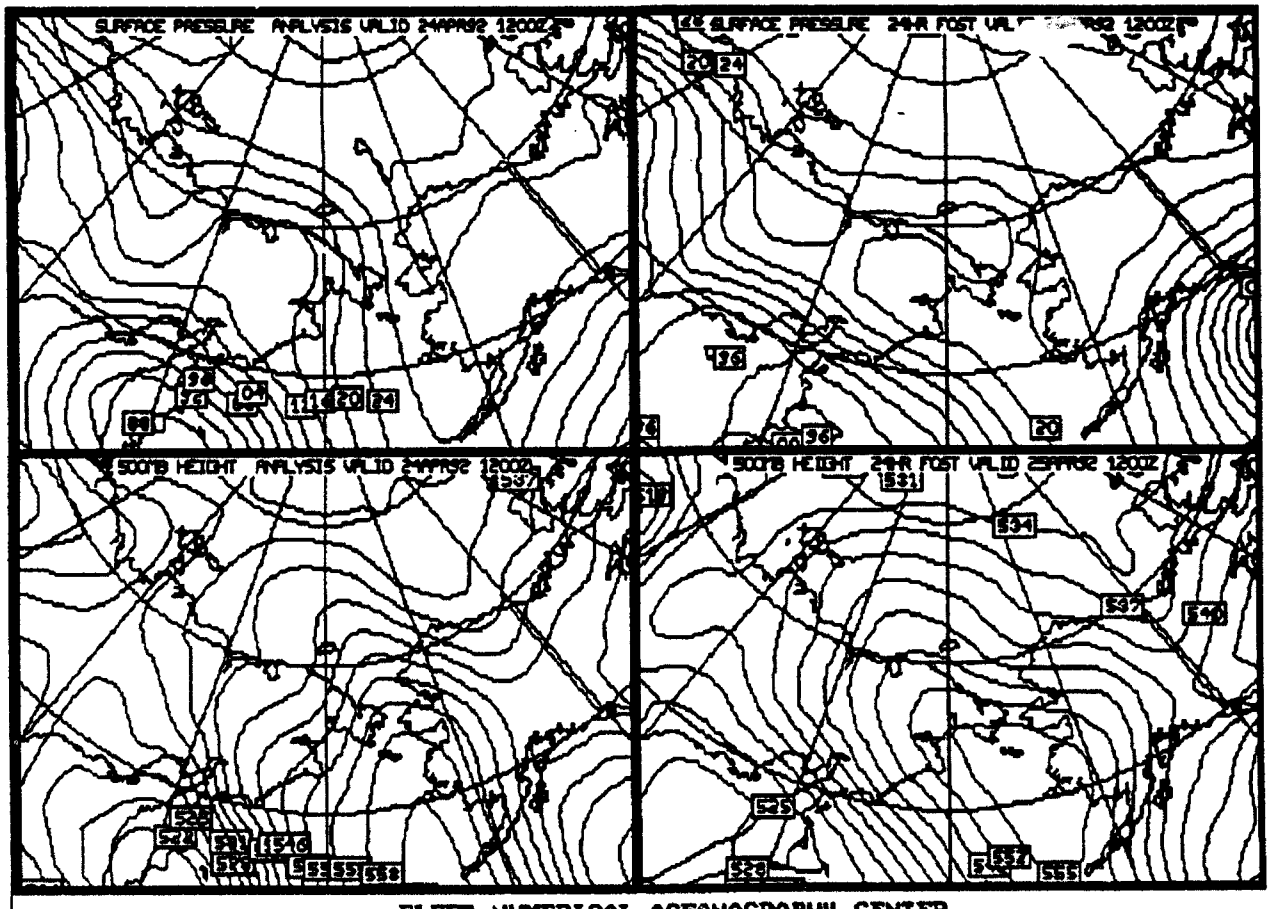
24 Apr 92
NORAPS ANALYSIS AND FORECAST PRODUCTS

24/1200Z Analyses and Forecasts (update)
A P-3 flight was scheduled during this time period over the Bering Strait. **NORAPS** shows pronounced warm air advection, producing very stable conditions over the region. Southerly flow with few perturbations is evident at all levels during the analysis and forecast period. **Satellite data** show very interesting and active vortex formations in the Beaufort area. A banded structure is seen through the Bering Strait leading to a vortex south of Wrangel Island. **NOGAPS** substantiates little except a gradient promoting southerly flow through the Bering Strait.



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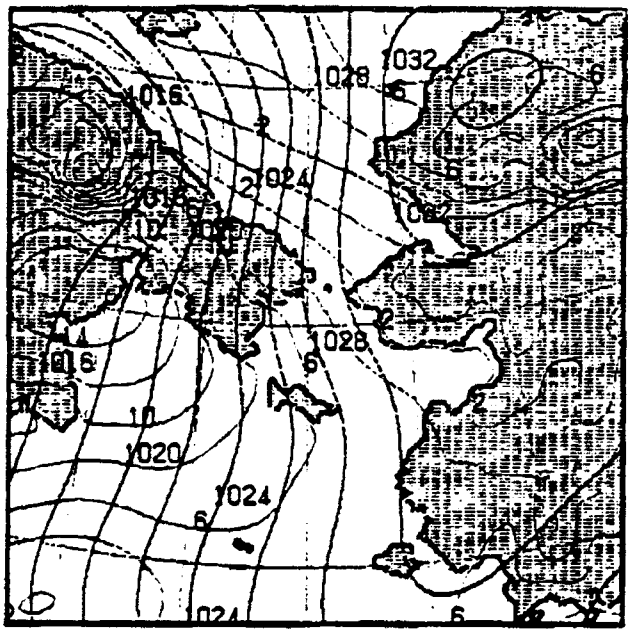
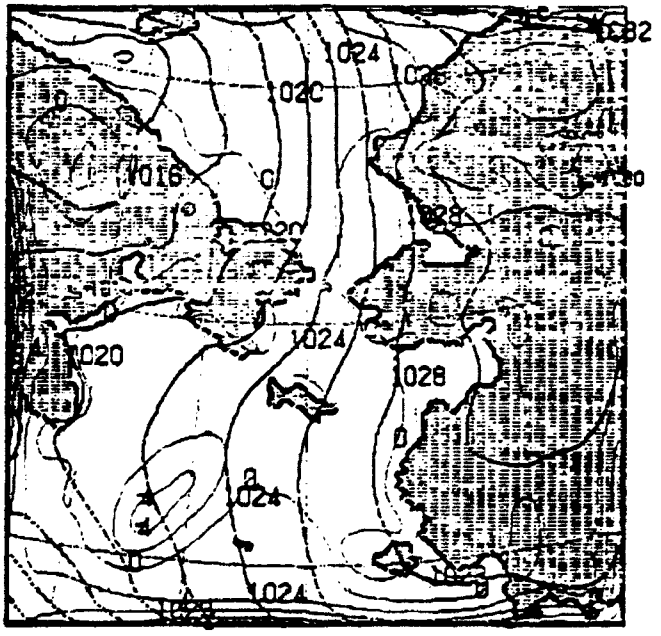
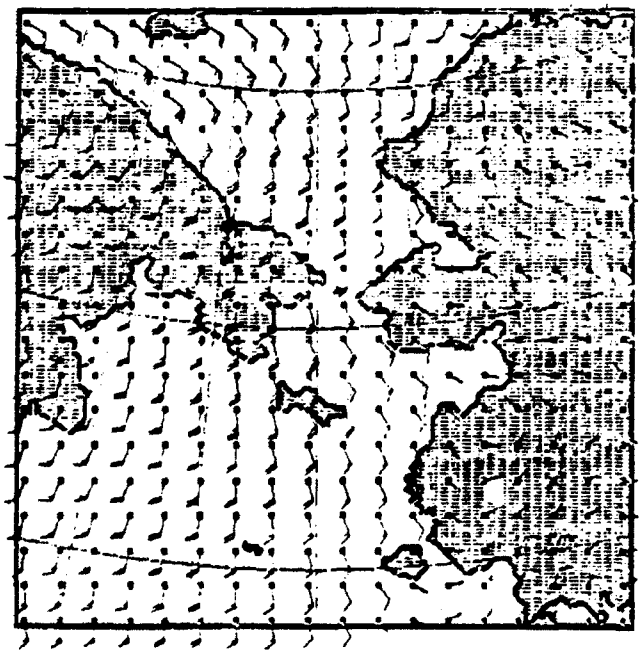
ANAL 2 METER TEMP ---- TAU=0



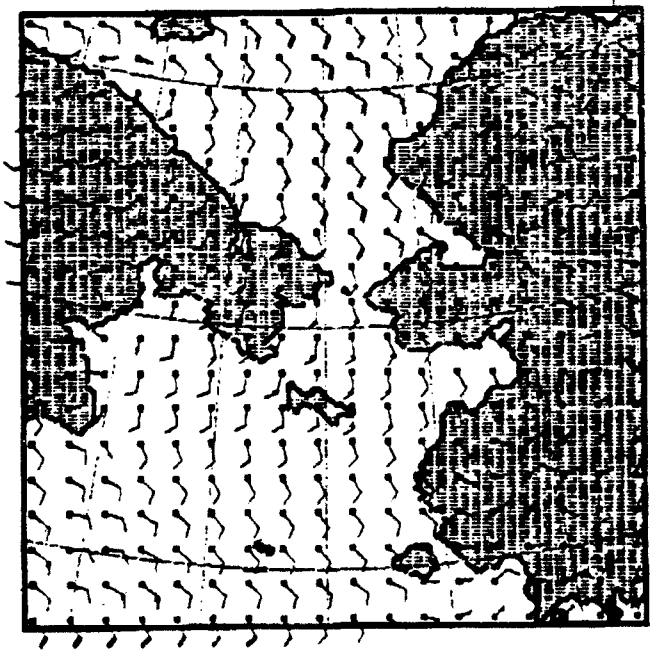
NORAPS 71X 71X24 20KM
0000 GMT 25 APR 1992
FCST SFC PRESSURE —— TAU=12
FCST 2 METER TEMP ---- TAU=12



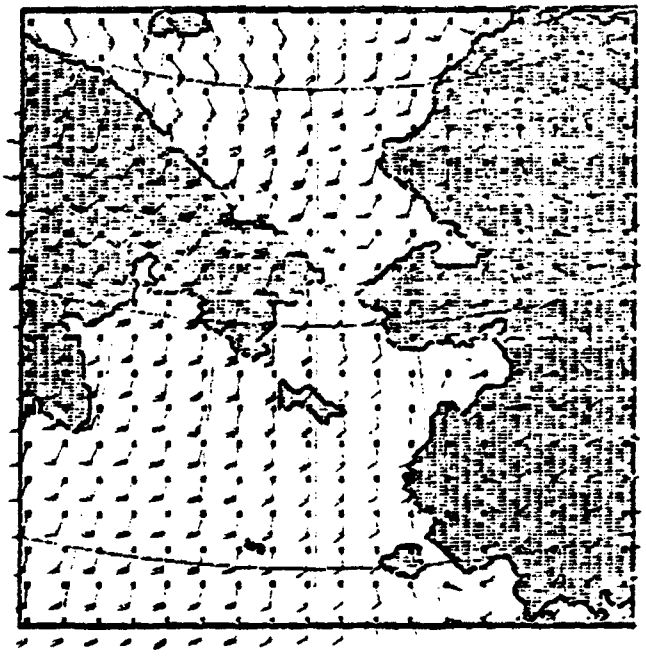
NORAPS 71X 71X24 20KM
1200 GMT 24 APR 1992
ANAL 10 M WINDS —— TAU=0



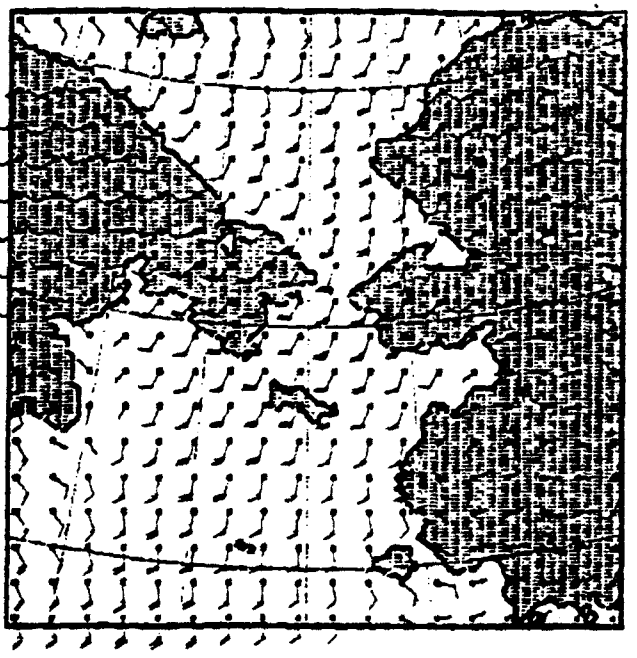
NORAPS 71X 71X24 20KM
0000 GMT 25 APR 1992
FCST 10 M WINDS —— TAU=12



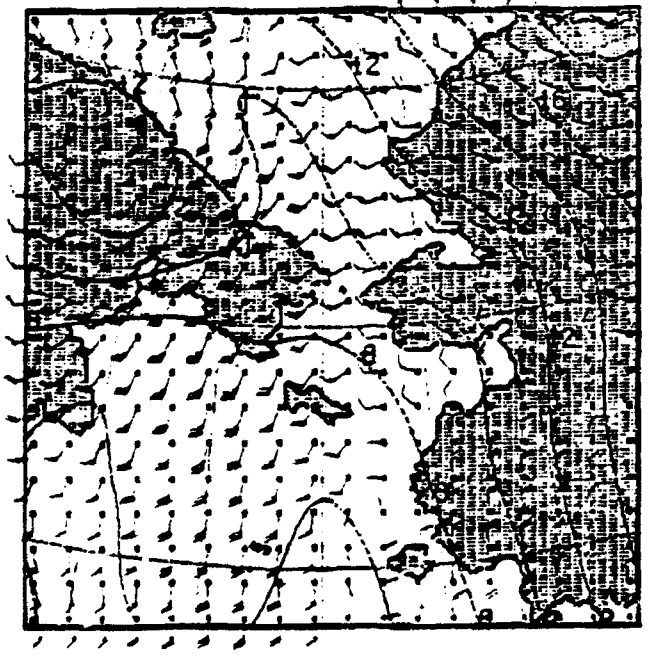
NORAPS 71X 71X24 20KM
1200 GMT 24 APR 1992
ANAL 925 MB WINDS —— TAU=0



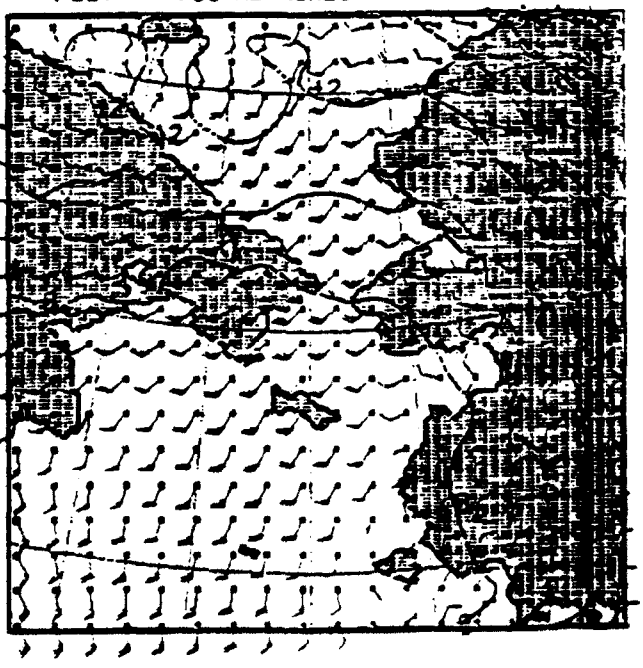
NORAPS 71X 71X24 20KM
0000 GMT 25 APR 1992
FCST 925 MB WINDS —— TAU=12



NORAPS 71X 71X24 20KM
1200 GMT 24 APR 1992
ANAL 700 MB TEMP —— TAU=0
ANAL 700 MB WINDS ···· TAU=0



NORAPS 71X 71X24 20KM
0000 GMT 25 APR 1992
FCST 700 MB TEMP —— TAU=12
FCST 700 MB WINDS ···· TAU=12



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3. SATELLITE IMAGERY

NOAA AND DMSP data were recorded in direct readout format and archived on 4 mm DAT tapes at the AWS DMSP van at Elmendorf AFB, Anchorage, Alaska. Fairweather Forecasting, a private weather corporation in Anchorage, made possible the free and essentially unlimited use of their Codonics thermal printer to produce the imagery illustrated in this report.

The imagery, as can readily be determined from perusing this report, produces generally excellent quality images in a matter of seconds, directly as formatted by a Sun workstation and presented on a monitor utilizing software from SeaSpace Corporation, San Diego, California.

Utilizing TeraScan software provided by SeaSpace it was possible to quite accurately navigate most images and optimize contrast for quality presentation. If some of the images appear "washed out" this was probably mirrored by the appearance of the data on the TV monitor and a result of the mass production effort we were attempting to mount in order to record as much data in as many variations as possible over a very limited amount of time. Over 200 images are presented in this report - an average of almost 7 a day (an additional 100 images or so were processed and printed but not included). Additional imagery not included in this report were many NOAA images processed utilizing the NWS system and printed on 11x17" Hewlett Packard PaintJet sheets.

The data shown include the DMSP visual and IR data from the Operational Line Scanner (OLS) instrument, and visual and IR AVHRR data from the 5 channeled NOAA spacecraft sensor. Special Sensor SSM/I data are also included as obtained from the DMSP data stream. The simultaneous collection of these data with the OLS data permits useful comparisons for increased understanding of ambiguous presentations.

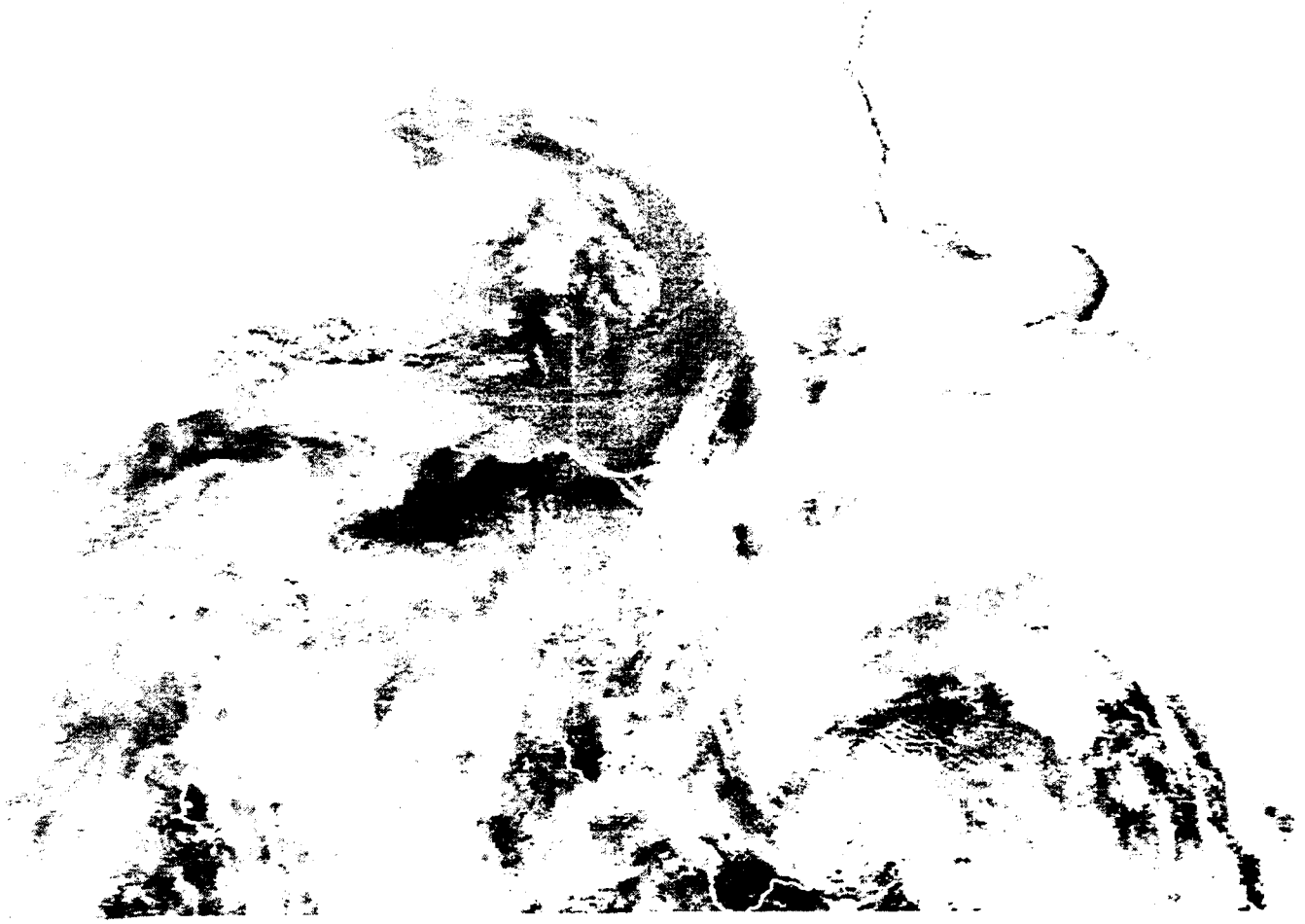
Individual comments are made for each image in this report in an attempt to provide some focus on salient features and to provide some continuity in terms of relationship to NORAPS and NOGAPS analyses and forecast products and to preceding charts and data.

It will be noted that the meteorology of the Arctic is not nearly as well understood as that of lower latitudes and indeed of the tropics. Mesoscale events and small scale circulations are evident in almost every image and there is usually little or no clue to their existence in conventional analyses. Storms move over the Beaufort Sea from all directions, not at one time, but in a sequence difficult to anticipate so that one must always be wondering when and how the next change will occur, and from what direction the next storm may strike.

Some intriguing events were noted when systems moved from east to west, similar to movement in the tropical latitudes. In such circumstances cloud formations sometimes took on the appearance of systems in the tropics. Thus, "Screaming Eagles of the North" were detected as well as their associated "Inverted-V" cloud formations.

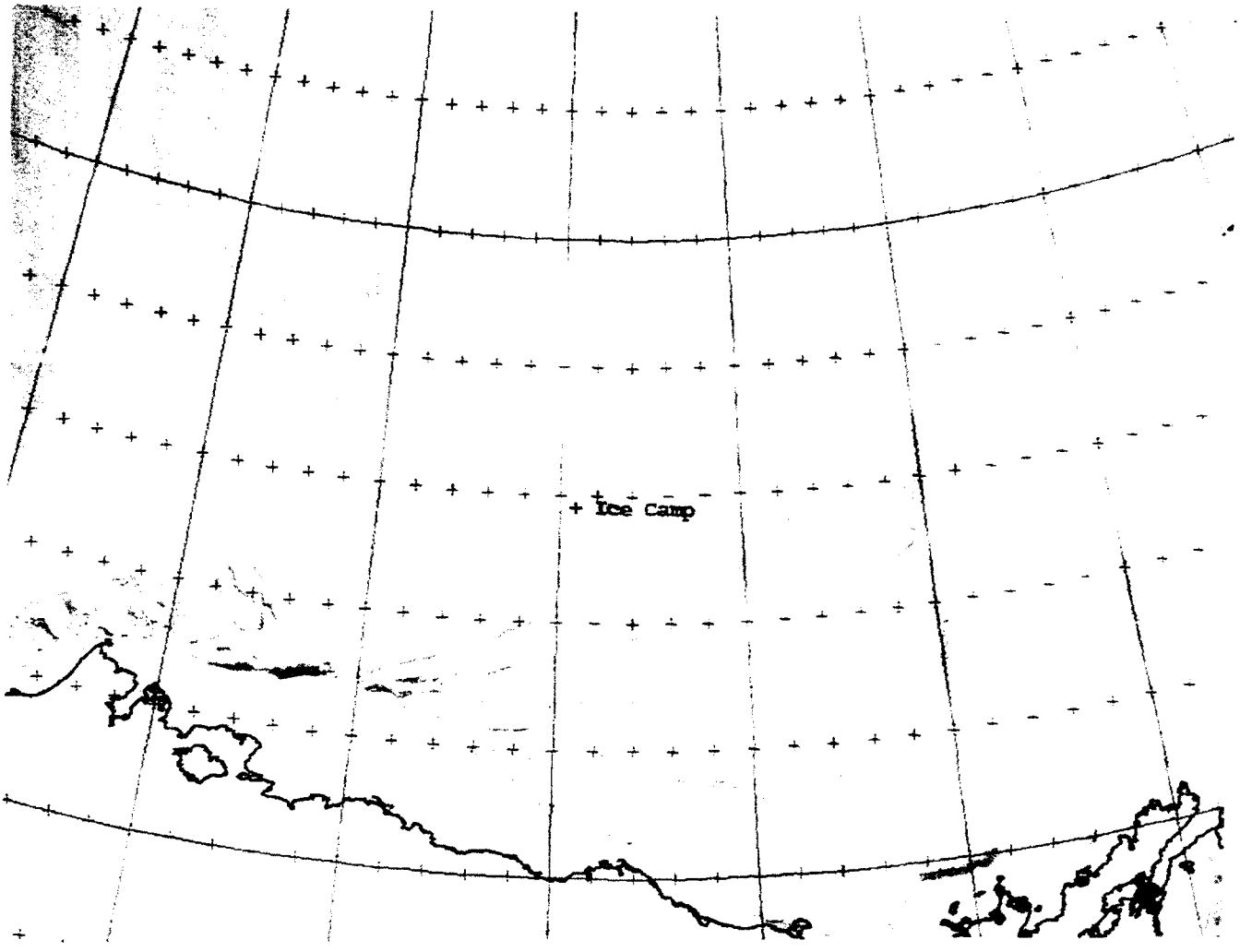
The SSM/I data collected are a special source of information chiefly related to ice characteristics over the frozen areas and to gap wind effects over open water near coastal mountainous regions. The ability of this sensor to detect such characteristics through a cloud-covered atmosphere is important since many areas in the Arctic experience clear skies only occasionally for prolonged periods. The ability of the ice to move and change configuration over relatively short intervals of time is well known and represented in this report.

A final note should be made concerning the special ability of the NOAA channel 3 data to reveal low clouds over ice; of the channel 3/channel 4 difference patterns in terms of revealing water cloud plumes; and of the channel 1/channel 2 difference patterns in terms of this presentation providing marked detail of ice features in leads and polynyi and in marginal ice zones. All are presented in this data collection. Further research using this methodology is certain to be productive in yielding greater understanding of environmental happenings in the Arctic.



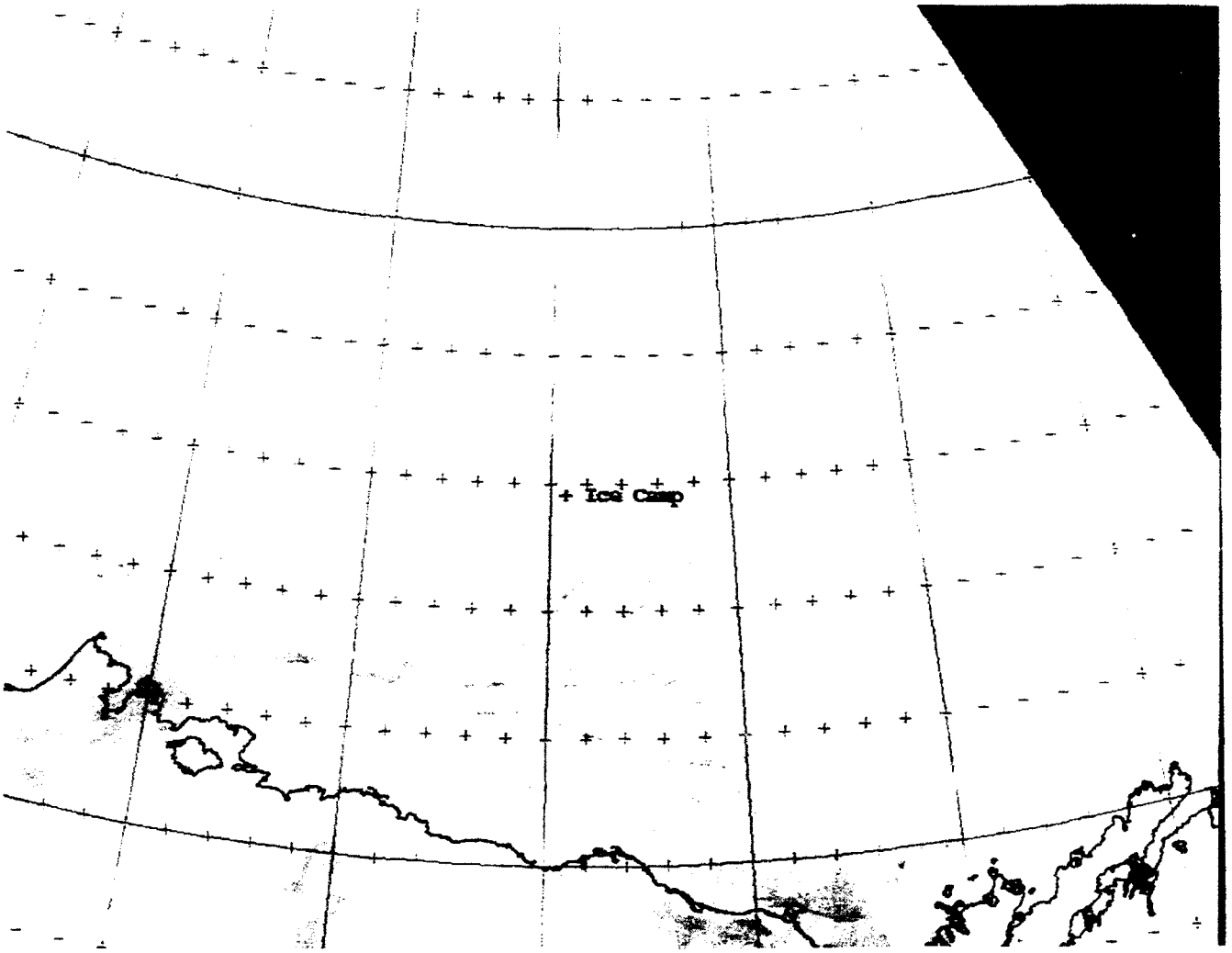
25 Mar 92 1530Z
DMSP OLS IR
Notable Features:

1. Fast ice boundary clearly differentiated from drift ice north of North Slope.
2. Large synoptic scale vortex in north central Beaufort Sea.
3. This vortex was not well located by NORAPS in its 25/1200Z analysis. However, the 26/0000Z forecast is better.



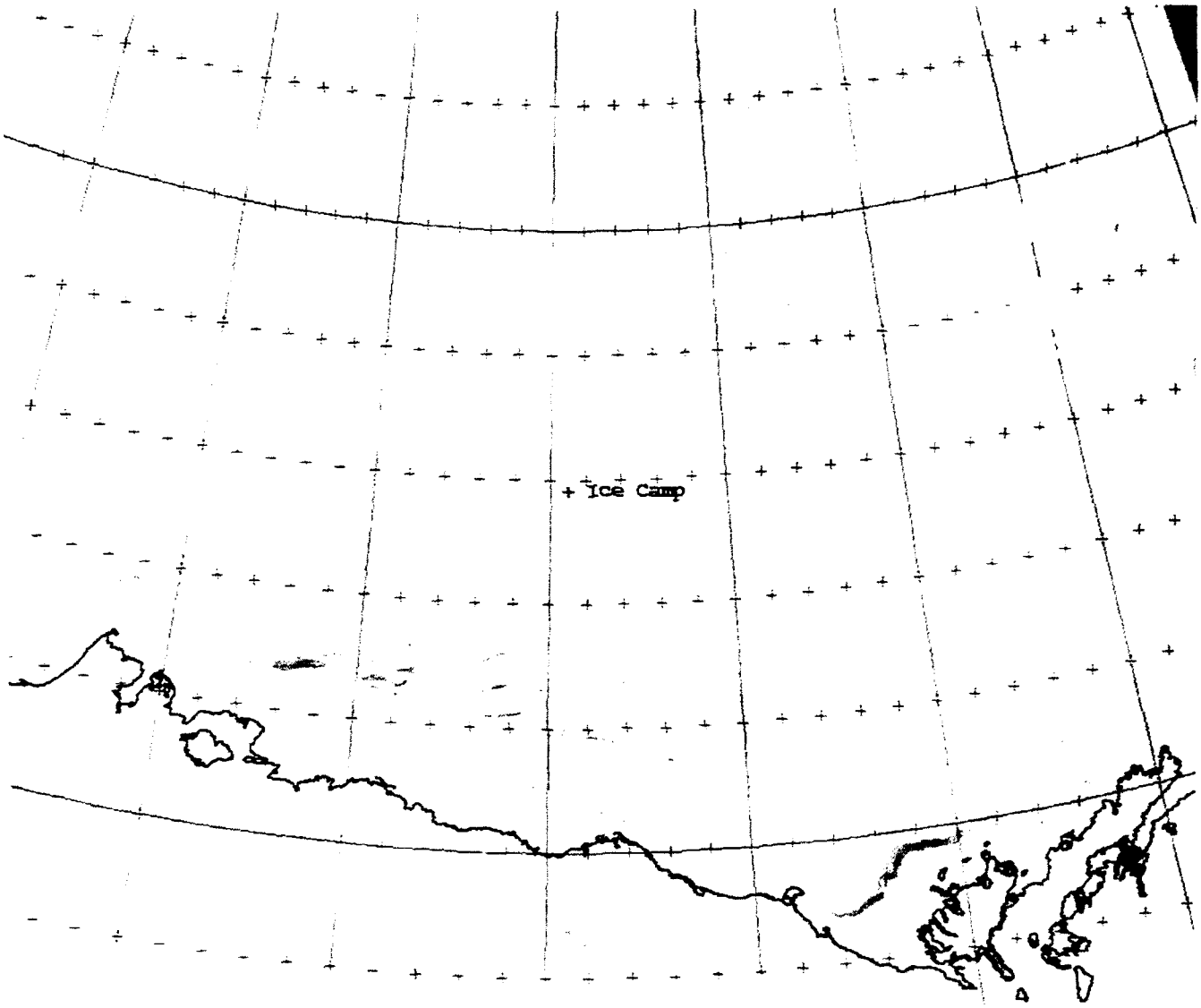
25 Mar 92 1711Z
DMSP OLS Vis
Notable Features:

1. Large flaw lead opening NW of Barrow.
2. Vortex center near 74.5N, 151W.



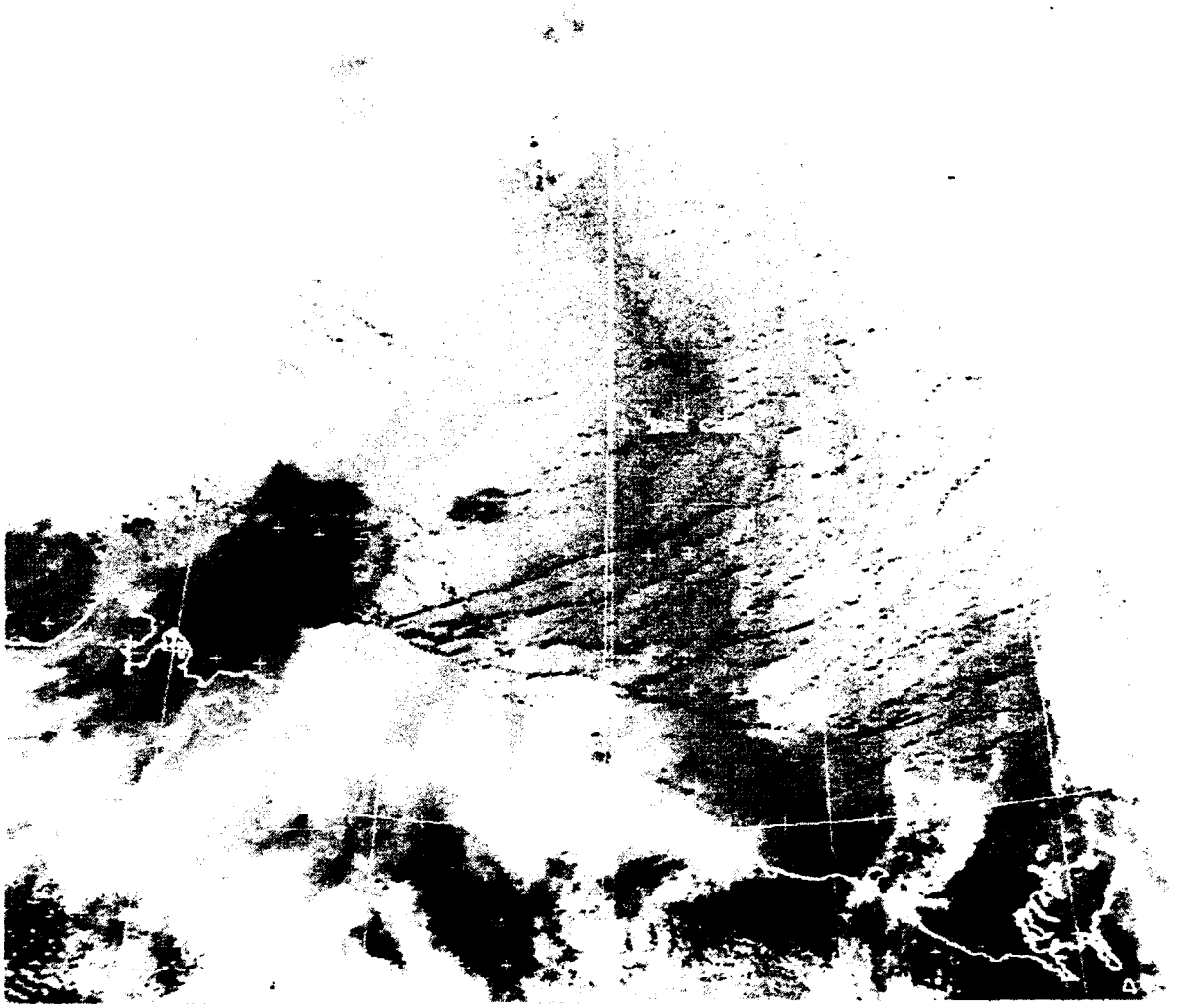
25 Mar 92 2146Z
DMSP OLS IR
Notable Features:

1. Ice camp in clear at this time.



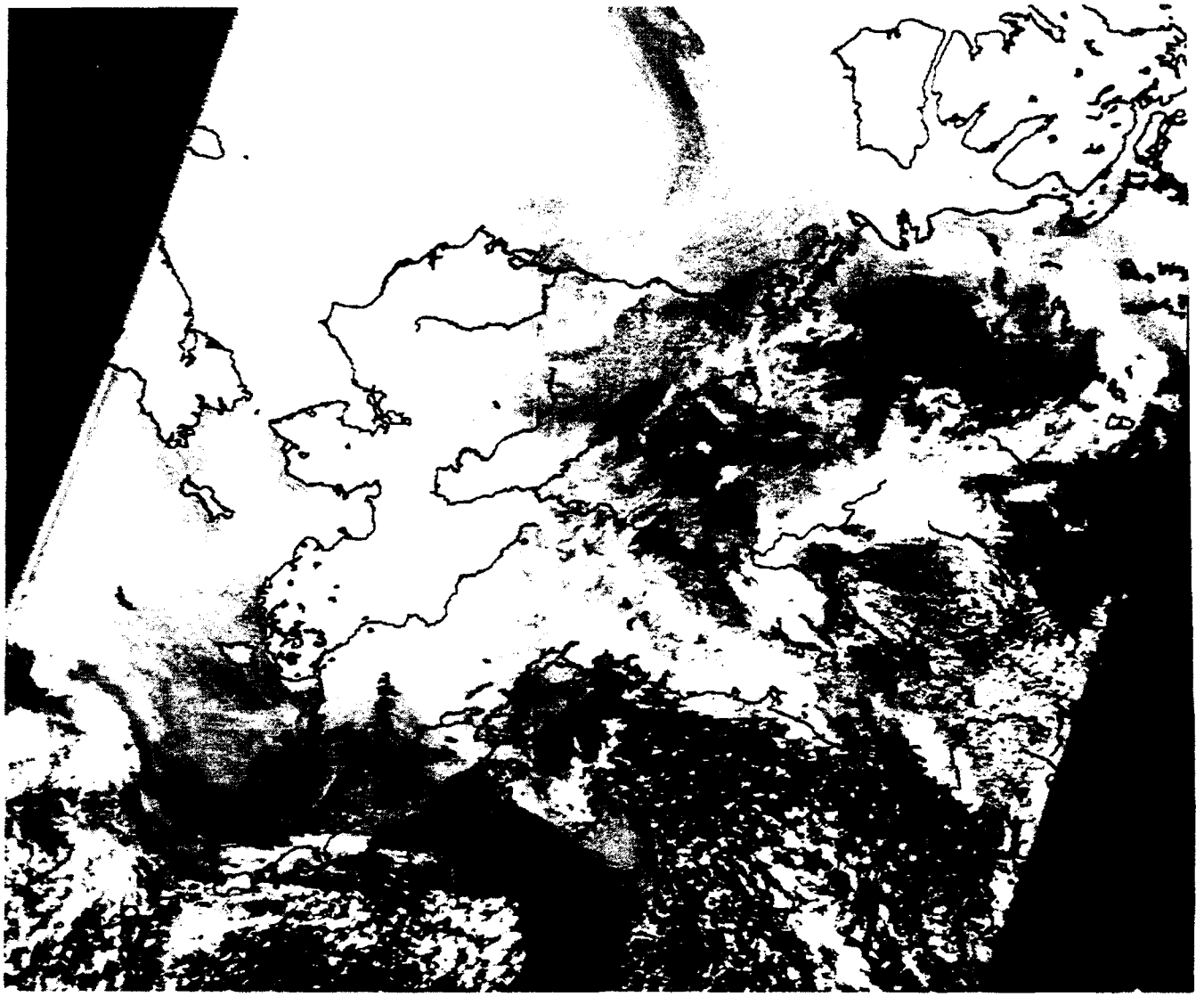
26 Mar 92 0132Z
DMSP OLS VIS
Notable Features:

1. Ice camp in clear.
2. Vortex apparent with center near 75.8N, 158W.
3. Note WSW-ESE orientation of leads at this time. Prevailing stronger easterly flow nearer the coast (not necessarily at this time) may be an important factor in this alignment.



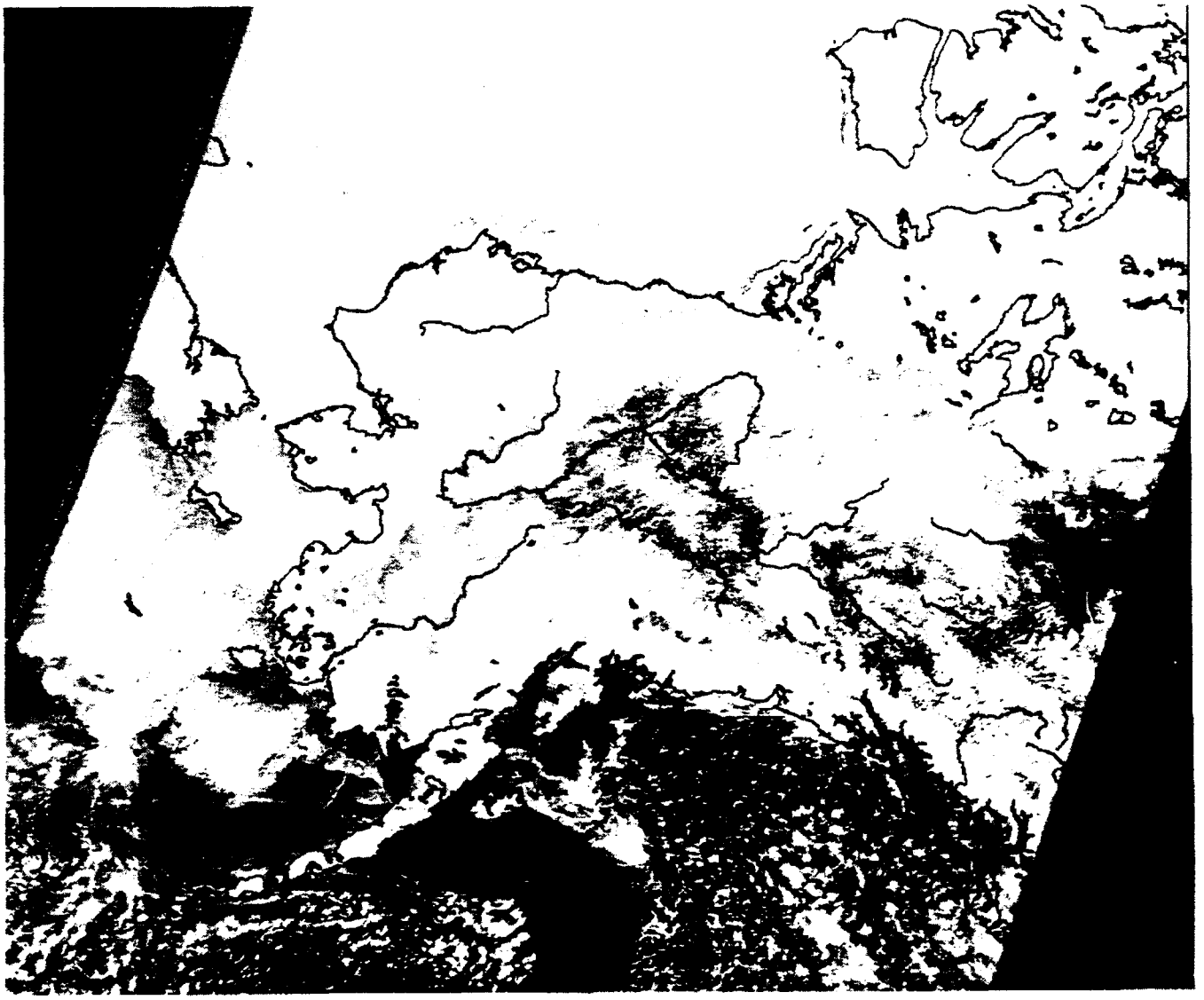
26 Mar 92 0132Z
DMSP OLS IR
Notable Features:

1. Companion infrared view to previous example suggests a second vortex more clearly with center near 76N,147W.
2. Note low (warm) cloudiness over the Barrow region which must be thin because it is largely transparent in the previous visible view.



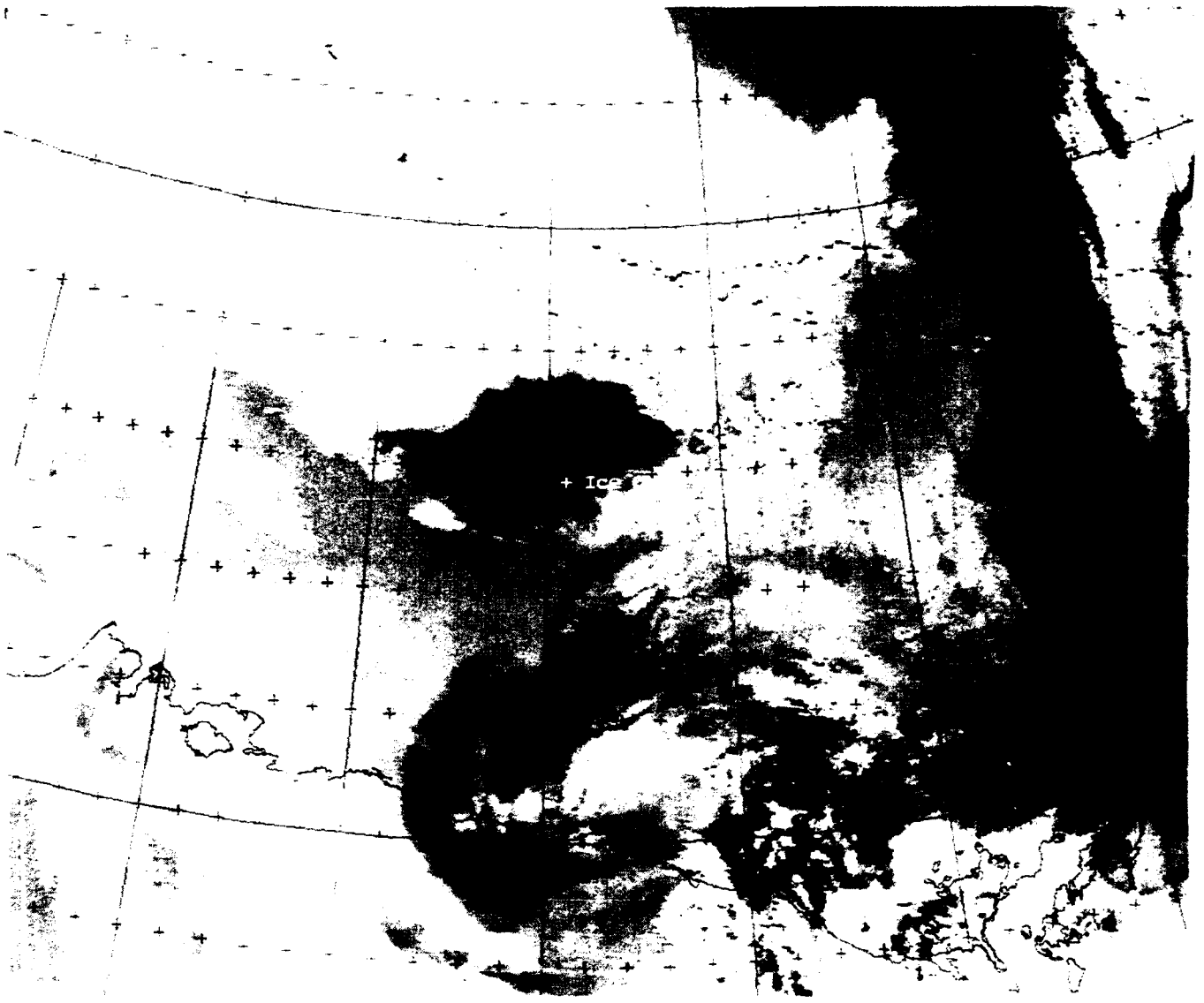
26 Mar 92 1935Z
DMSP OLS IR
Notable Features:

1. Frontal cloud band evident stretching NNE from the Brooks Range.
2. Thin ice or open lead in Mackenzie River Delta area.



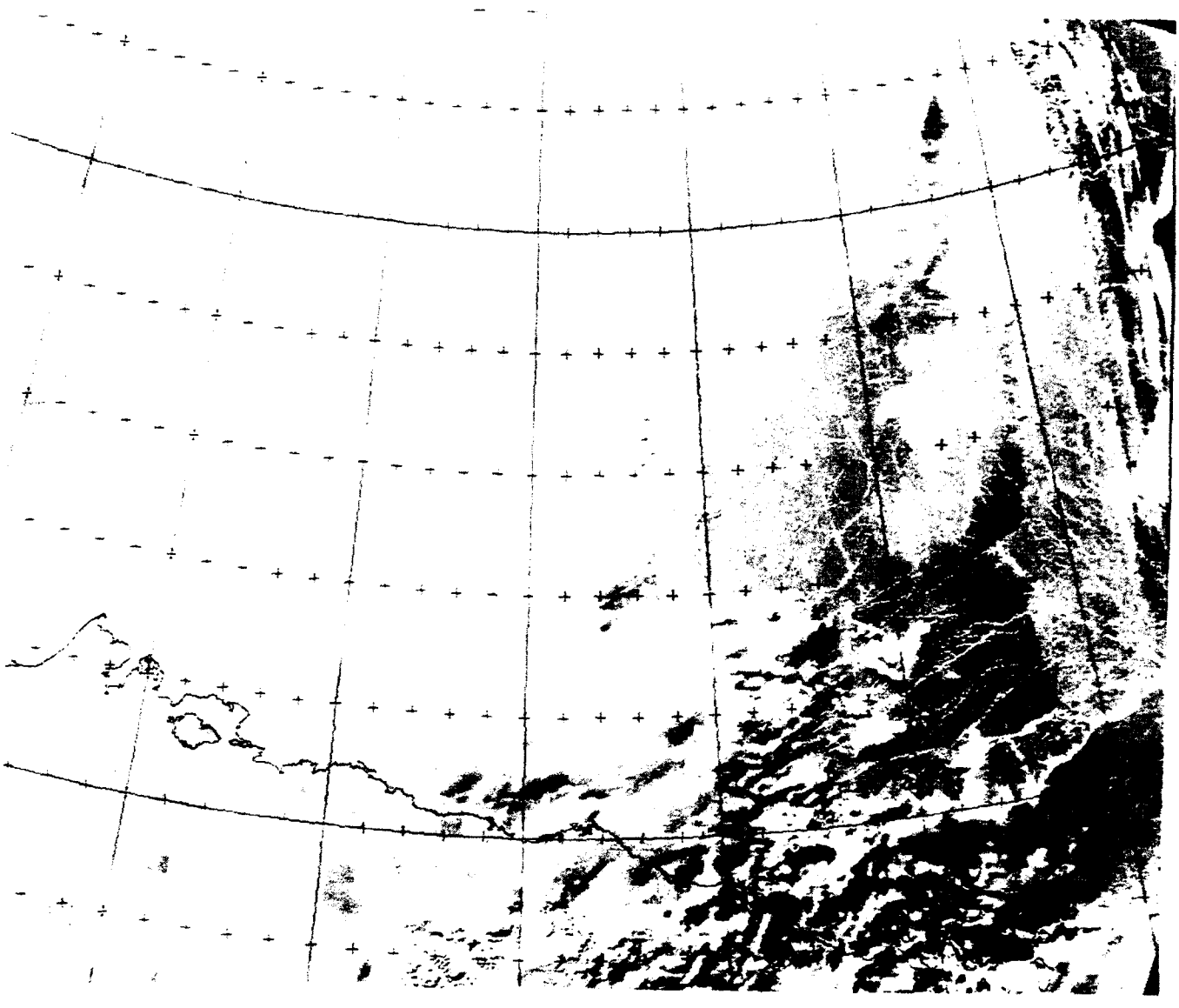
26 Mar 92 1935Z
DMSP OLS VIS
Notable Features:

1. Companion visible view. Note that darker gray shade west of frontal cloudiness coincides with warmer temperature effect (darker area) in the previous IR view. See especially the area north of Barrow.



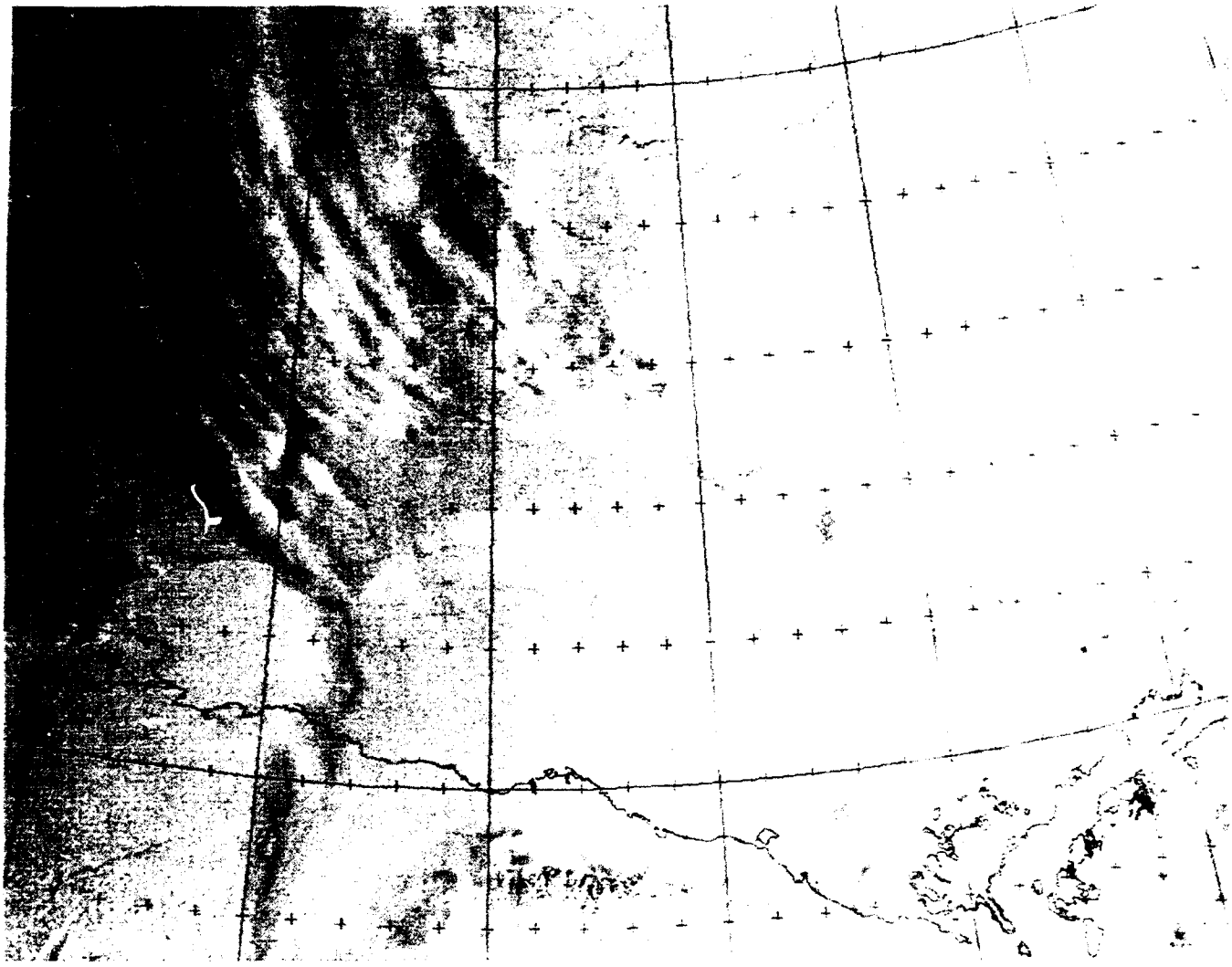
27 Mar 92 1504Z
DMSP OLS IR
Notable Features:

1. N-S oriented dark band to east is a frontal zone with vortex to the north.
2. Frontal band connects to a vortex east of Deadhorse. This is further connected to the NW, past Barrow, to another frontal zone to the west.
3. The ice camp is covered by a thin low overcast.



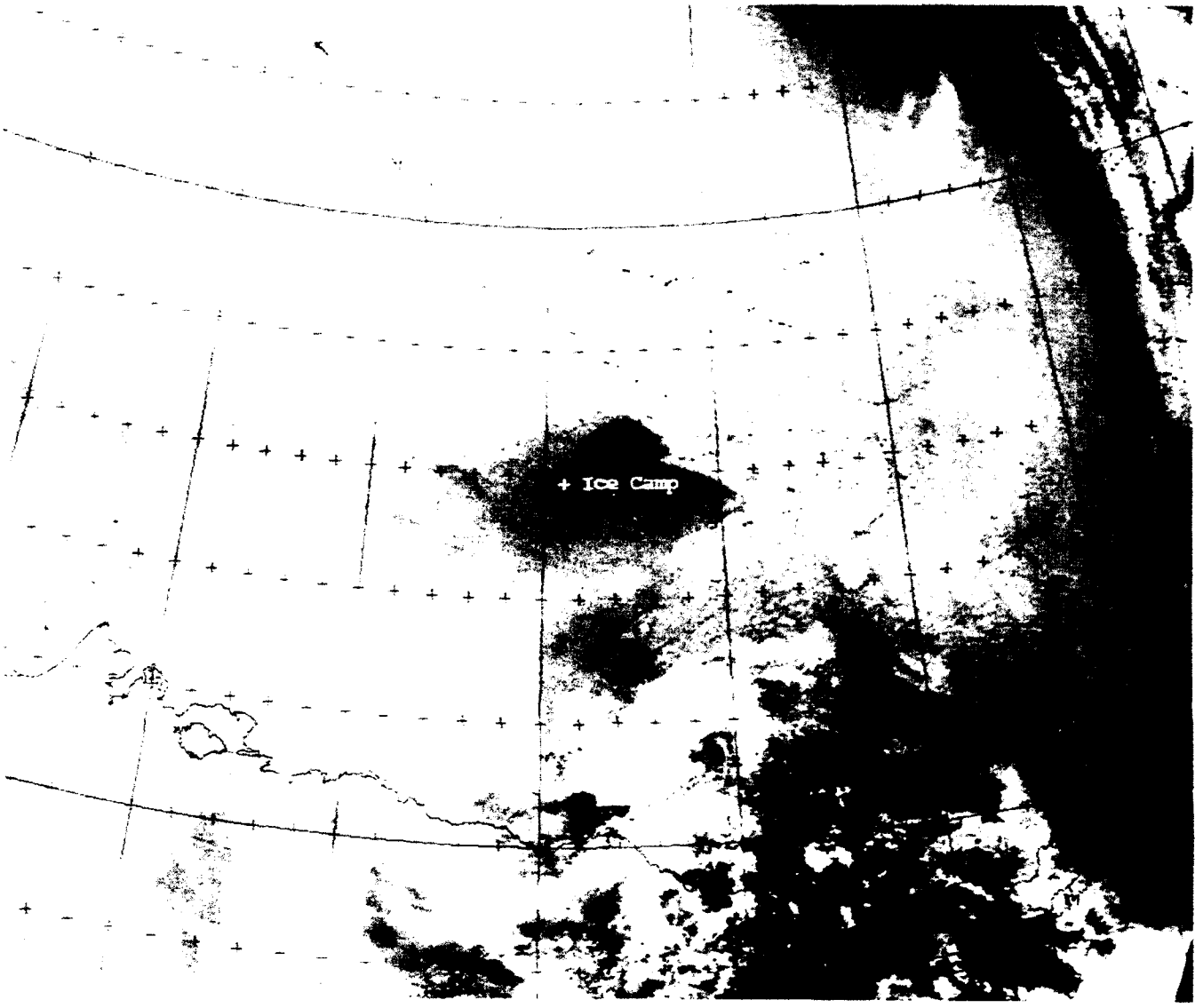
27 Mar 92 1905Z
DMSP OLS VIS
Notable Features:

1. **This is an invert visible view of the Leadex area. Leads normally appear darker than the ice floes which they surround because of their smoother surfaces, which reflect more light away from the satellite sensor. The inversion technique is an excellent method to clearly reveal leads and individual ice floes.**
2. **The <u>thin transparent cloud</u> west of Banks appears lighter than the <u>clear area</u> immediately east of the ice camp.**



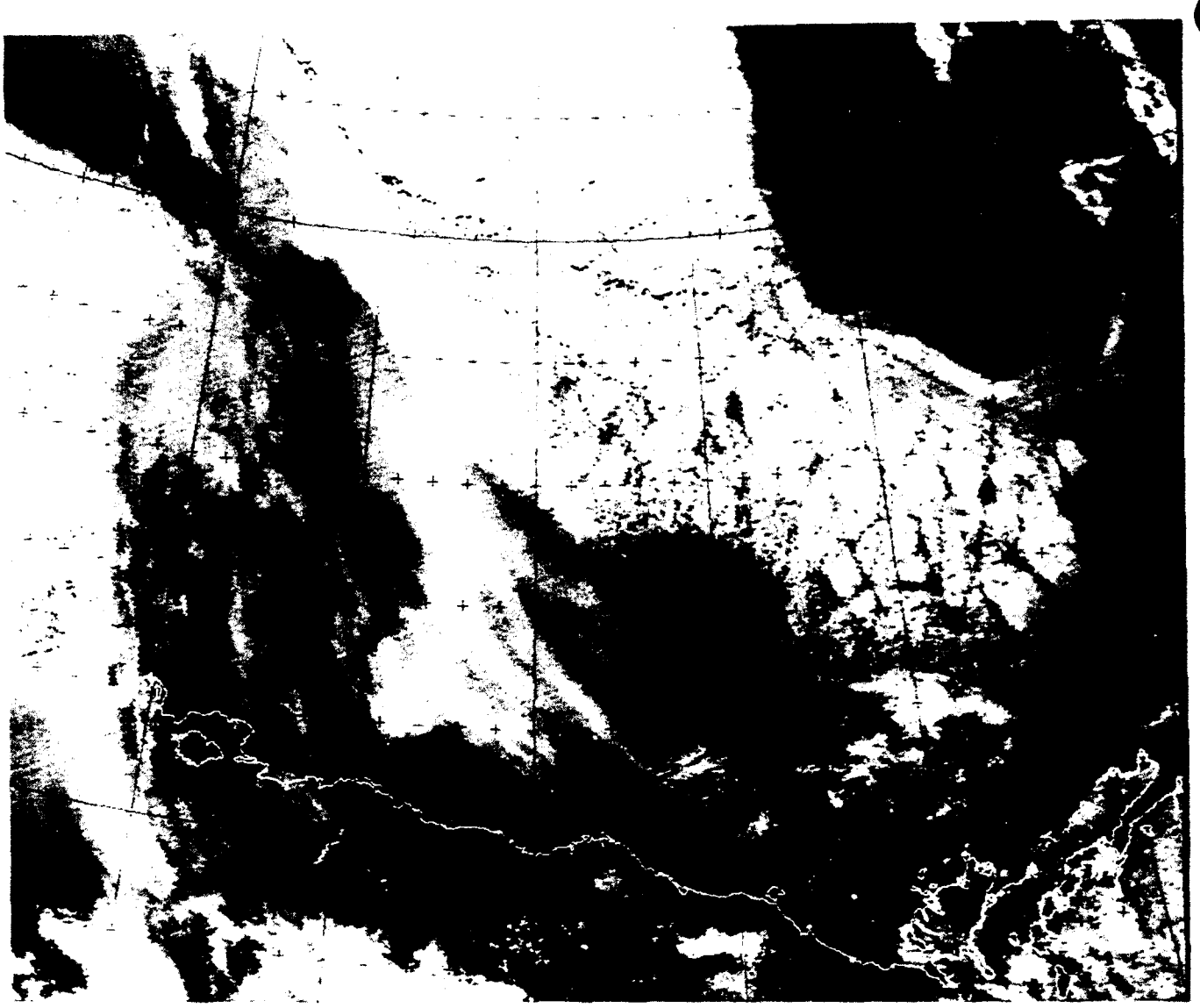
27 Mar 92 1633Z
DMSP OLS VIS
Notable Features:

1. Note differentiation of the clear area immediately east of the ice camp with the transparent cloud a little further east.



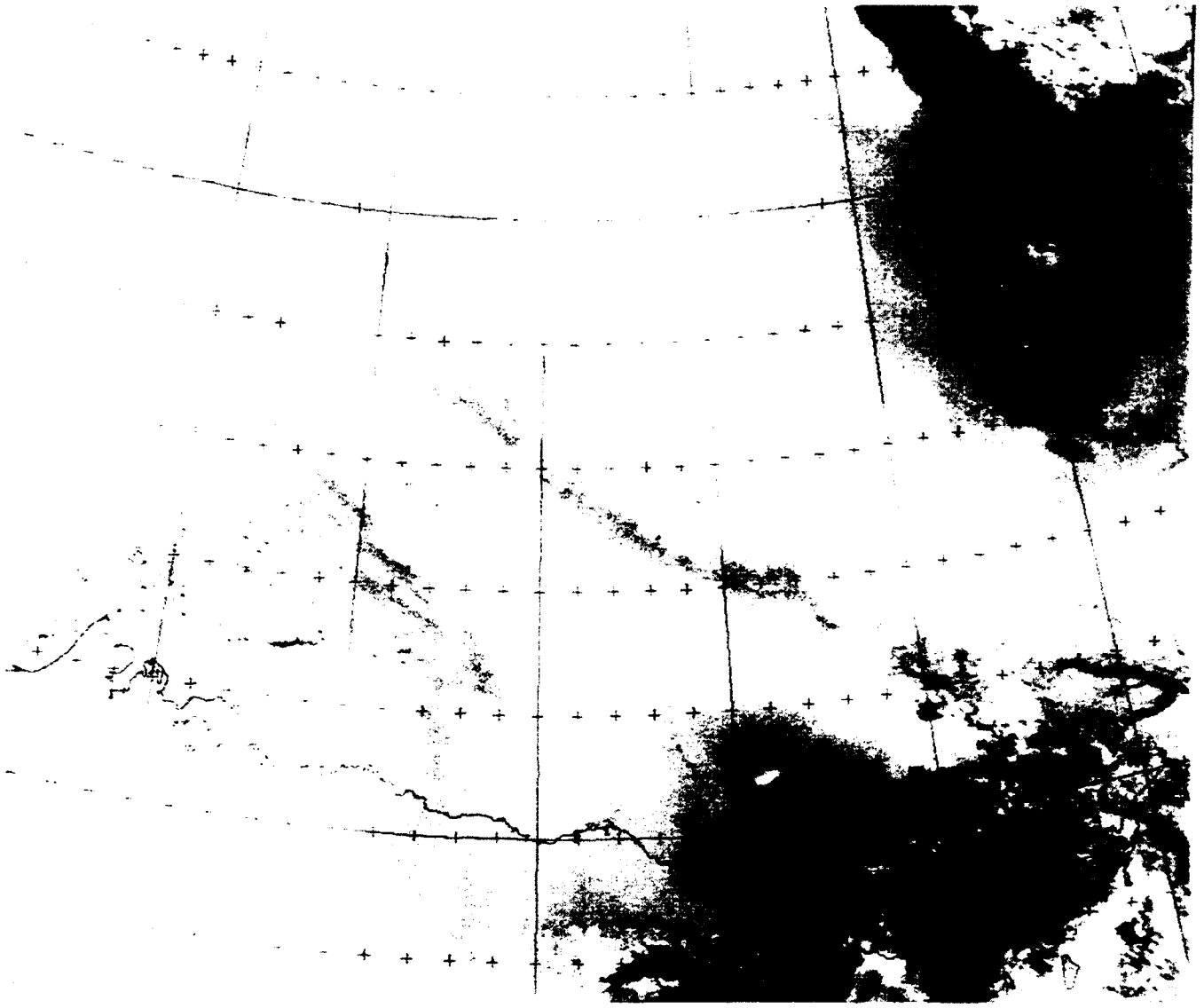
27 Mar 92 1915Z
DMSP OLS IR
Notable Features:

1. Continued evolution of frontal band near Banks and NW of Barrow. Apparent vortex east of Deadhorse. (See 28/12Z 925 mb forecast for suggestion of evolution.



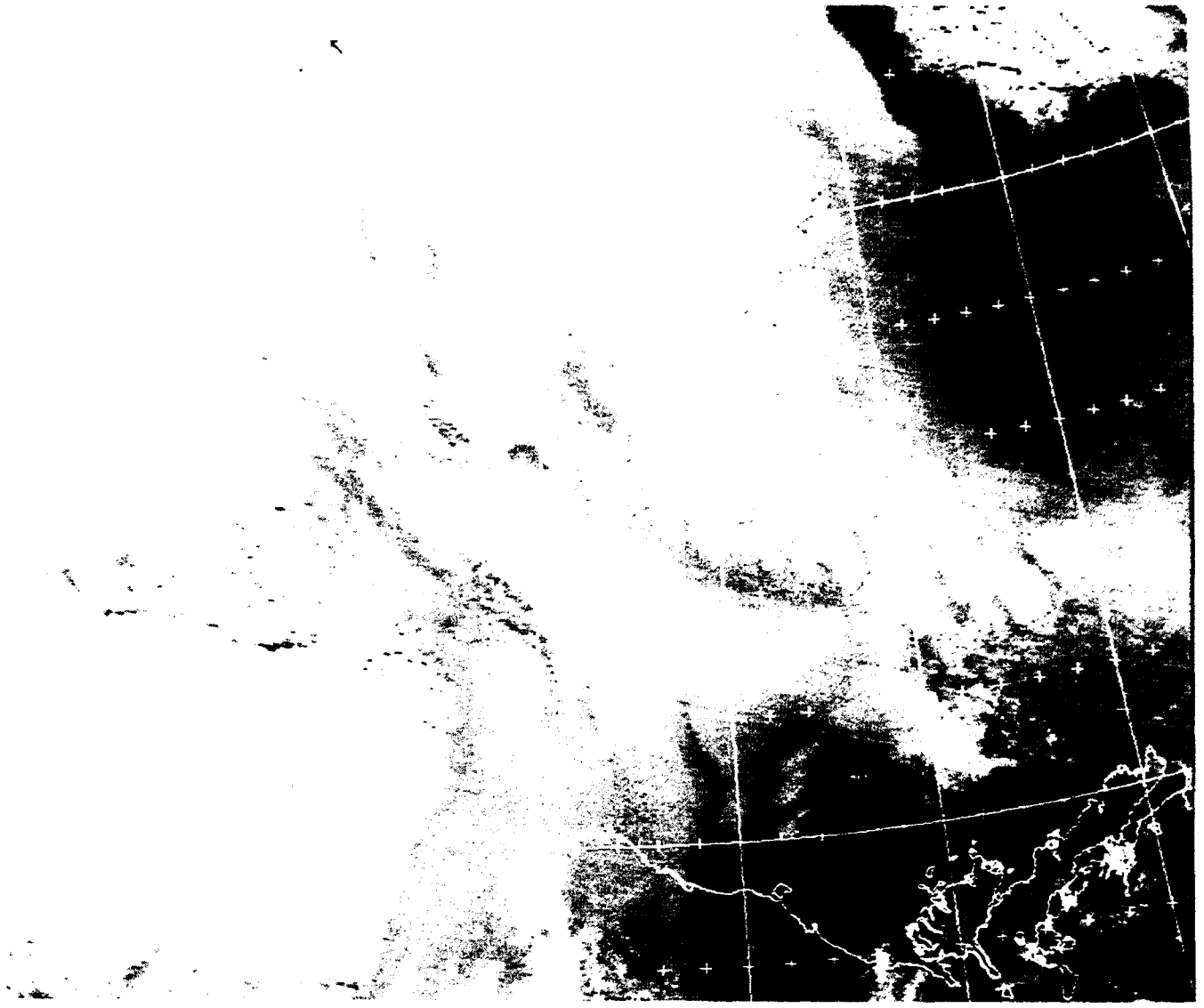
28 Mar 92 0459Z
DMSP OLS IR
Notable Features:

1. Vortex NW of Banks with clear area implying high pressure over the ice camp.
2. A frontal band extends NW past Barrow from the N. Slope.



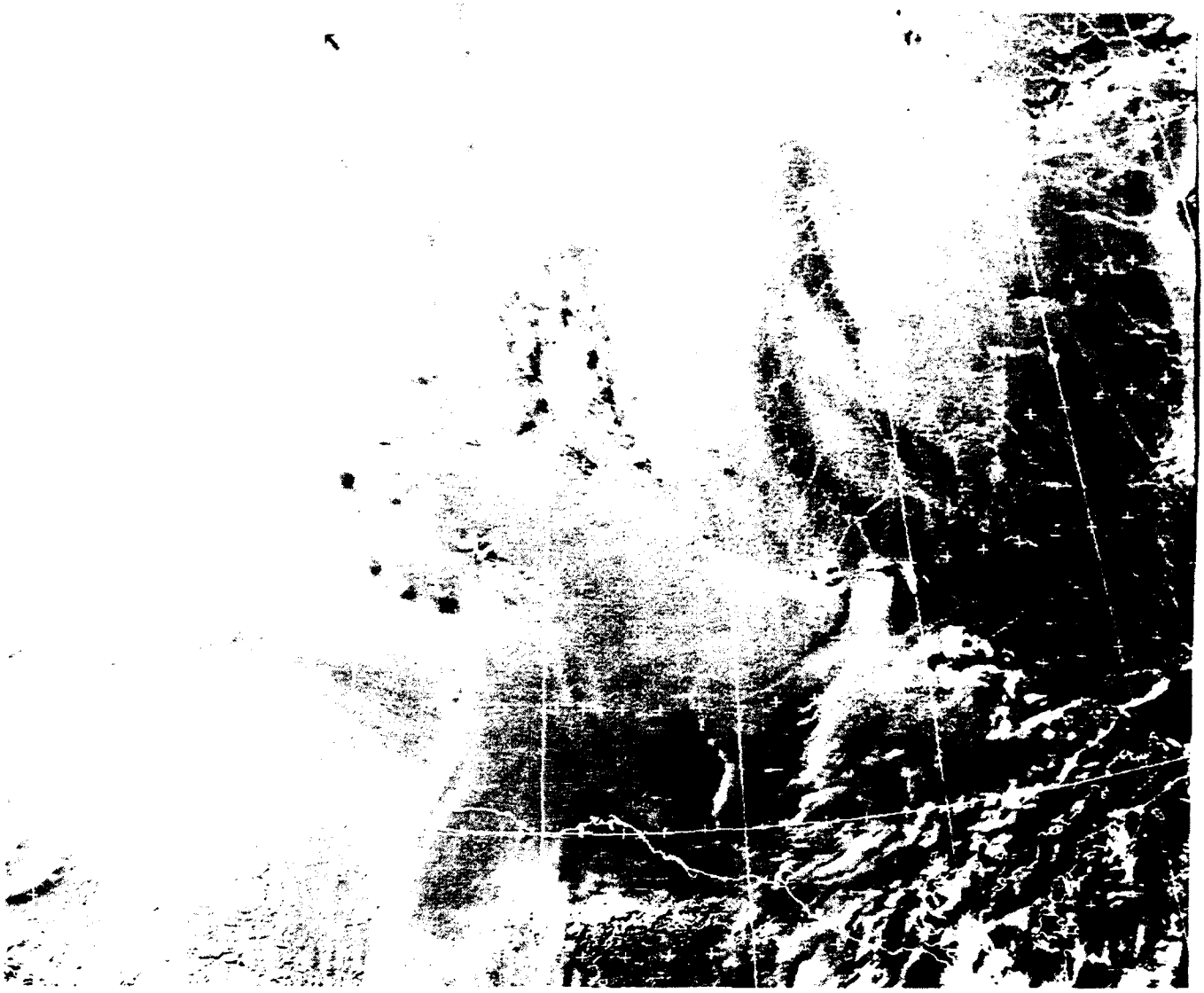
28 Mar 92 1633ZZ
DMSP OLS IR
Notable Features:

1. The frontal band has moved eastward and now covers the ice camp location.
2. Hook-like protuberances on frontal band and a vortex appear near Banks Island.
3. Some dark gray shades near apparent leads suggest cloud plumes arising from air/sea interactions.



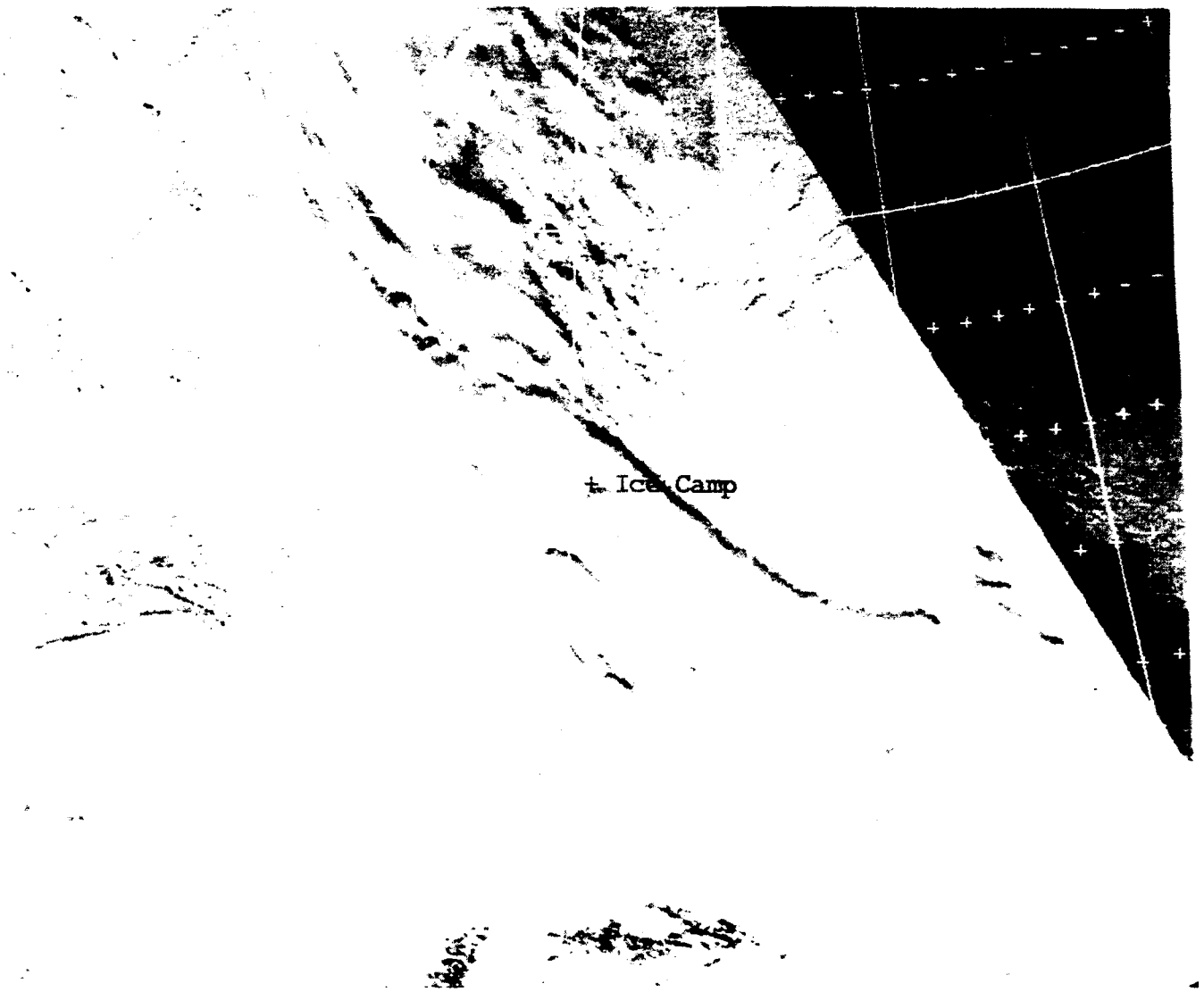
28 Mar 92 1834Z
DMSP OLS IR
Notable Features:

1. The low overcast over the ice camp and south of 73N is actually capped by high pressure and anticylonically-turning winds. It has the appearance of a "col" cloud (See NTAG Vol. 8, Pt. 2). The front becomes more active to the northwest once out of this influence.



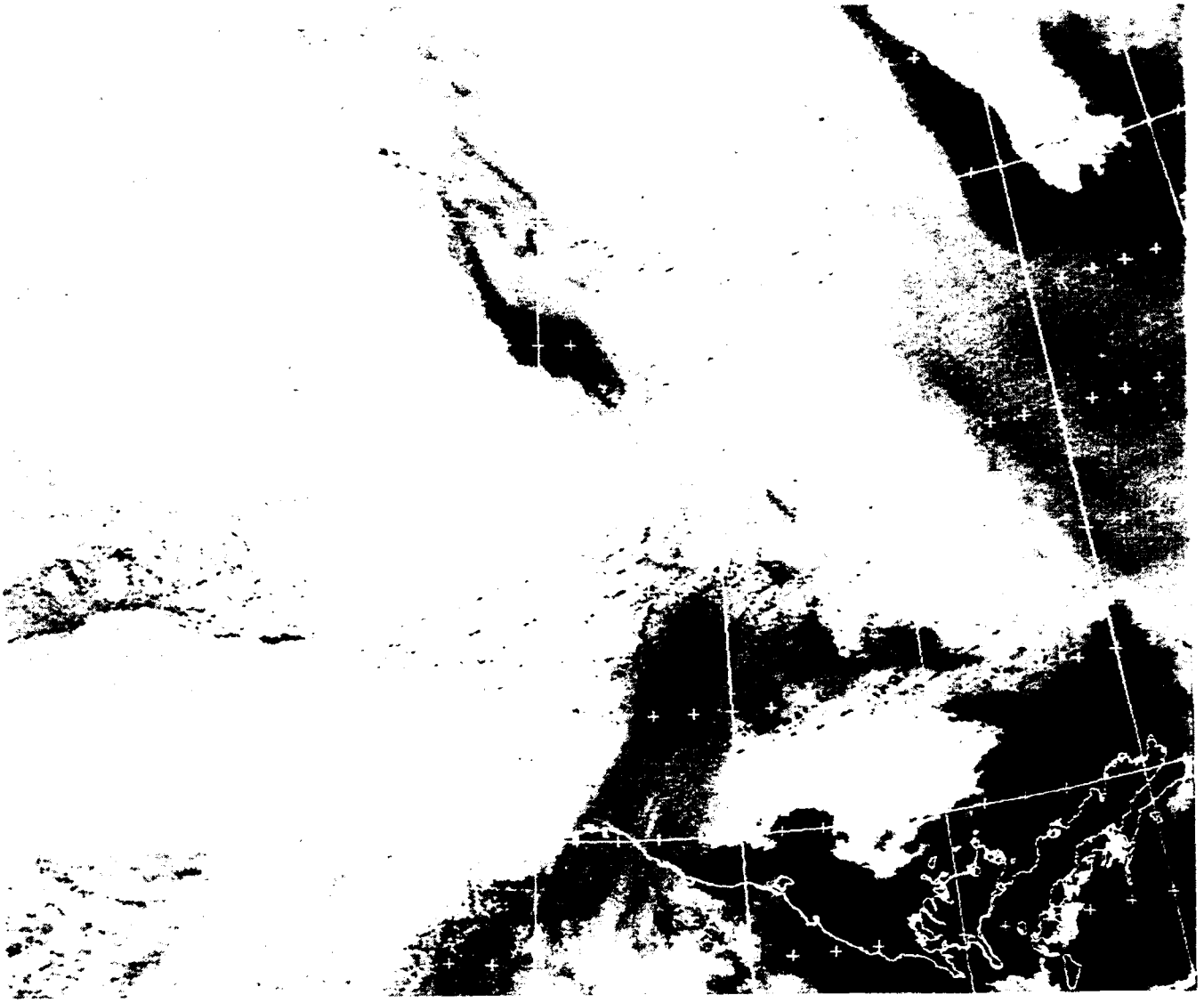
28 Mar 92 1834Z
DMSP OLS VIS
Notable Features:

1. **<u>Another inverted visible depiction</u>** of the Leadex area. The "col" cloud south of the ice camp is very thin. Some leads are apparent below the cloud.
2. An even thinner cloud covers most of the Beaufort to the east toward Banks. Note darker clear regions within this cloud mask.



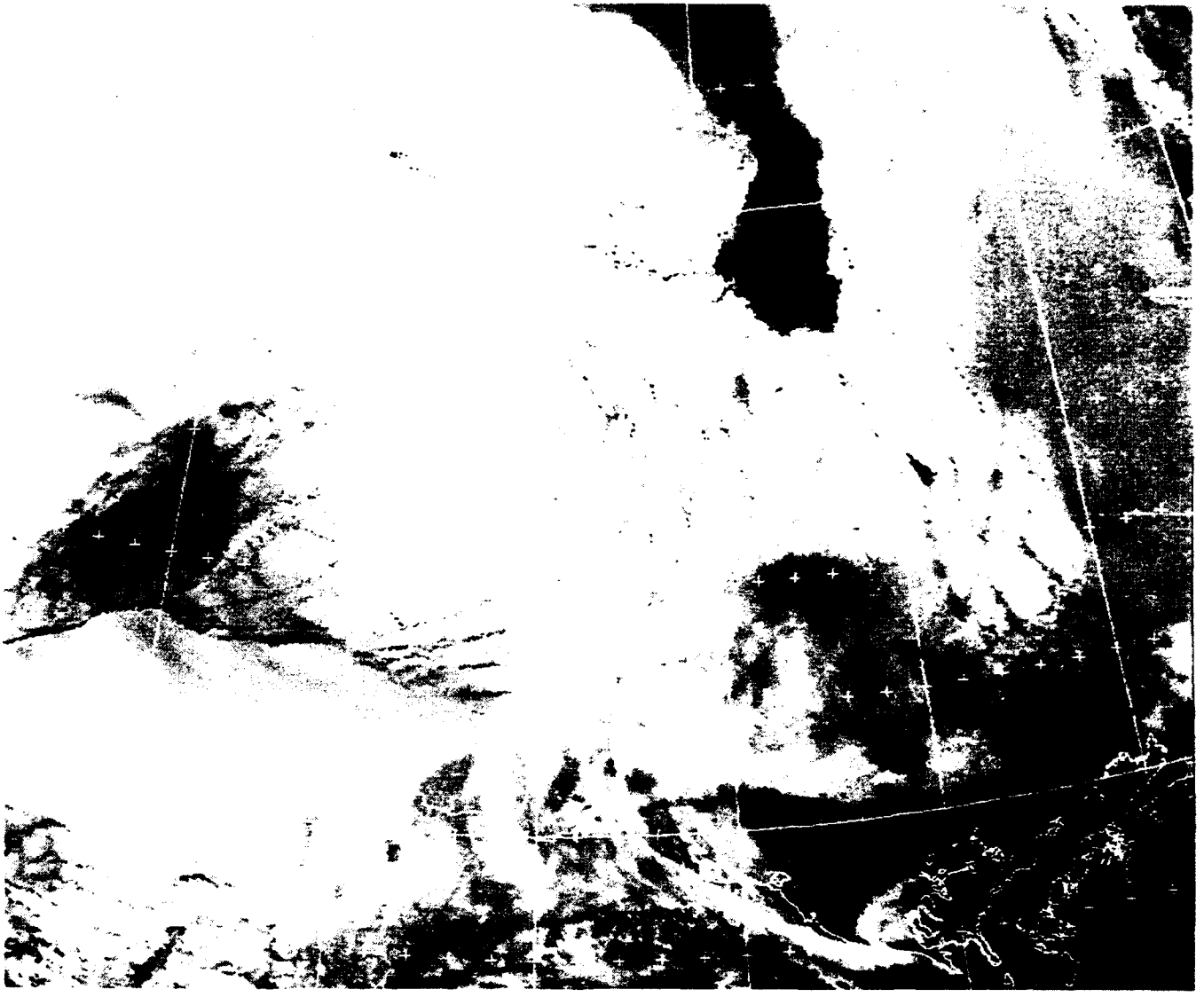
28 Mar 92 2153Z
DMSP OLS VIS
Notable Features:

1. The frontal zone shows further <u>eastward</u> <u>progression</u> past the ice camp.



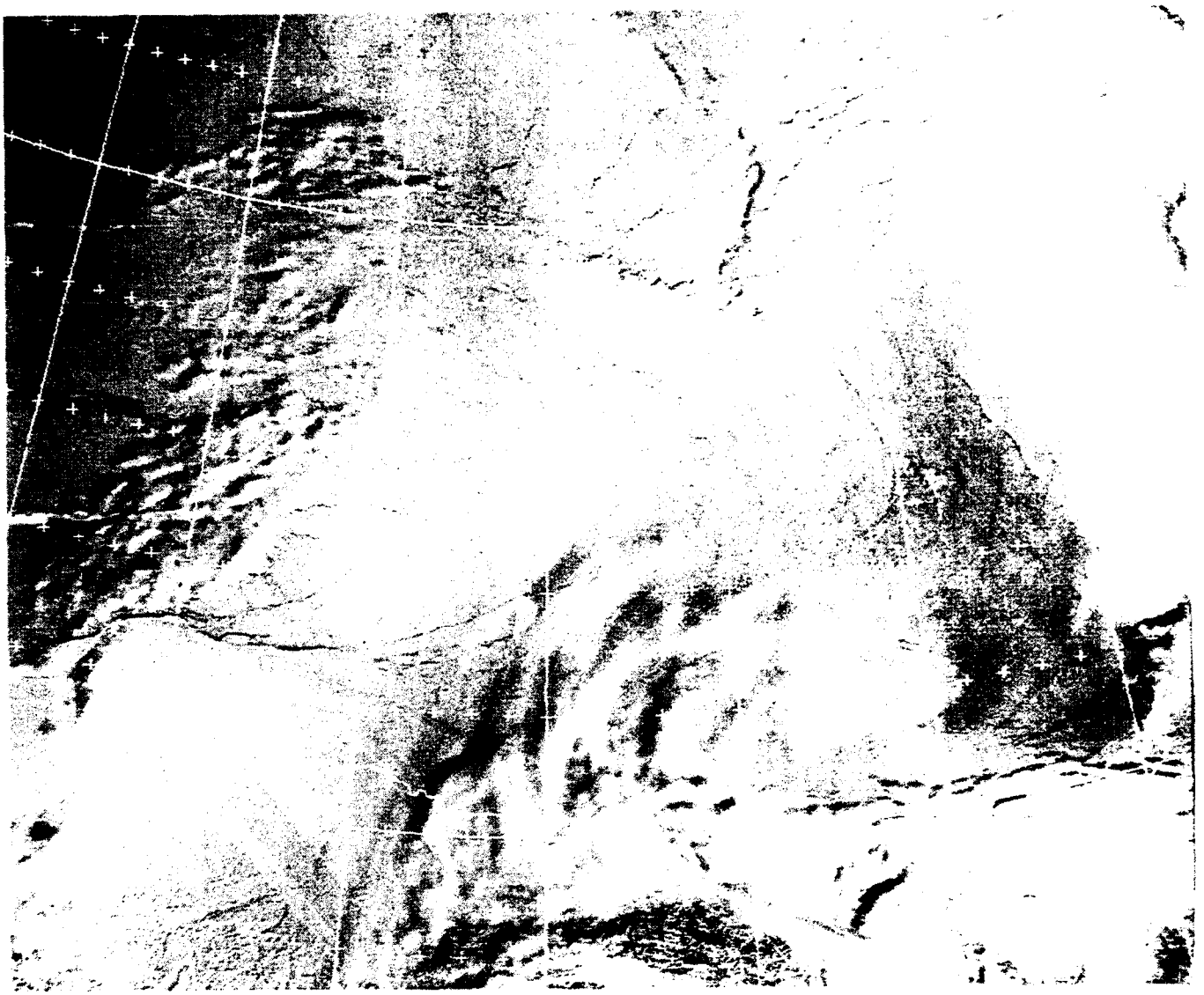
29 Mar 92 0428Z
DMSP OLS IR
Notable Features:

1. The frontal zone has dissipated over the ice camp region, while the N-S oriented frontal region near Banks persists.
2. Some localized lead plumes are evident.



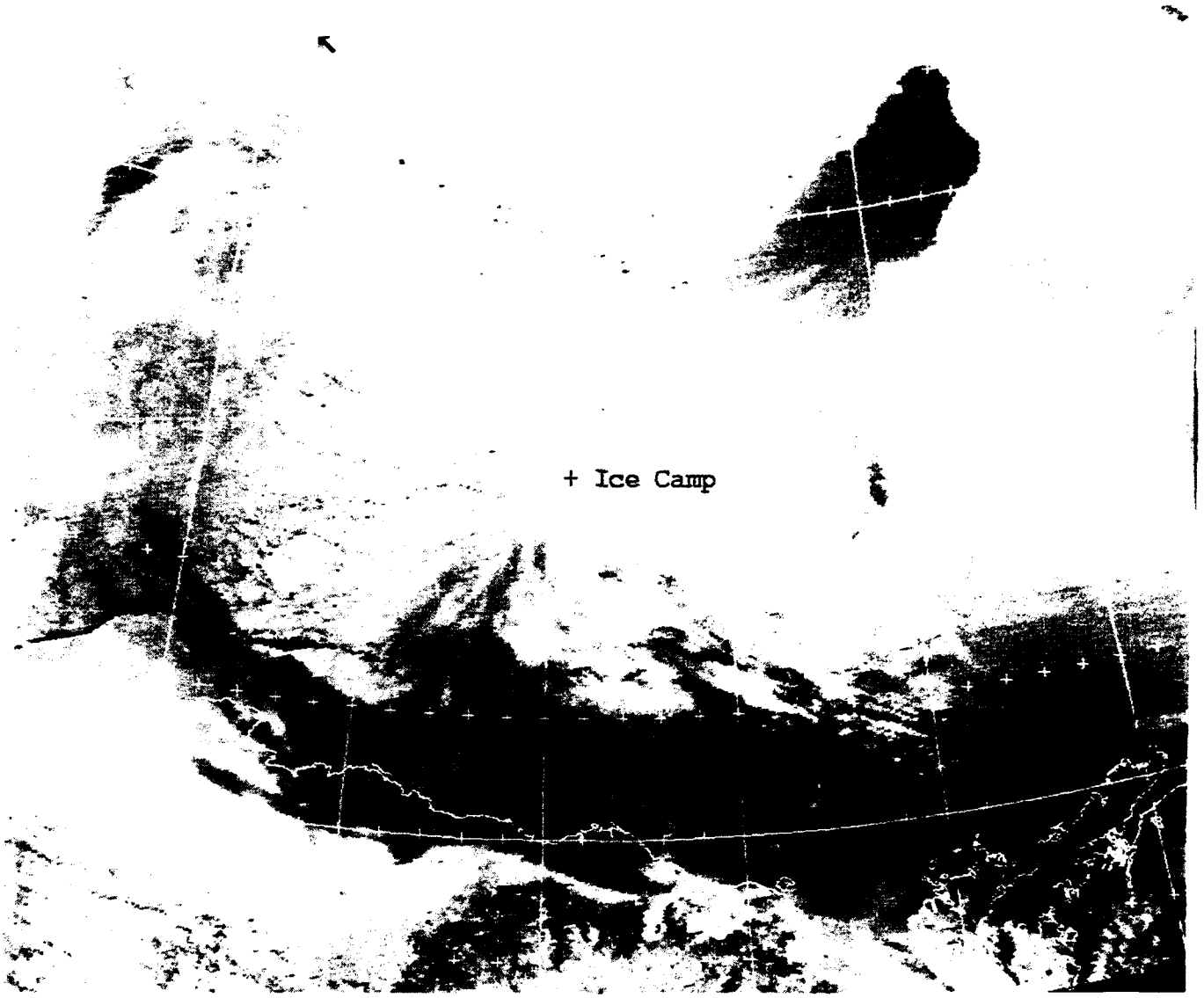
29 Mar 92 1800Z
DMSP OLS IR
Notable Features:

1. An anticyclonic flare of high clouds covers the central portion of the N. Slope.
2. The ice camp enjoys clear high pressure conditions as flow changes to easterly.



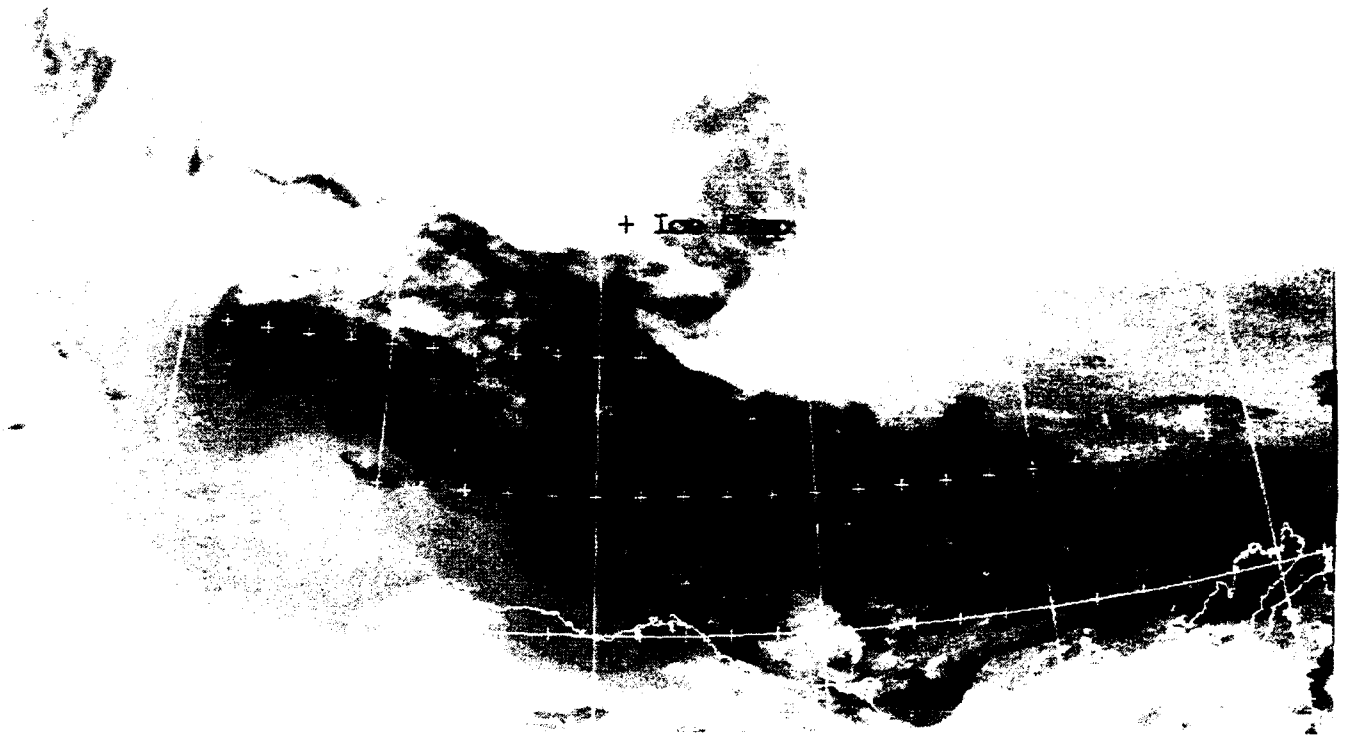
29 Mar 92 1800Z
DMSP OLS VIS
Notable Features:

1. A companion visible view resolves some of the ambiguity inherent in IR data interpretation. Note details of cloud features north of Barrow and in the protuberance coming into the image from right top center. This cloudiness appears very warm and imposing in the IR. The visible data show this as a very thin transparent cloud.



30 Mar 92 0537Z
DMSP OLS IR
Notable Features:

1. A vorticle - appearing system appears approaching the ice camp. Low level winds in the region have changed to ENE. The only indication in the NORAPS products of some disturbance in the region are trough indications south of the ice camp on the **925 and 700 mb analyses.**
2. This example should be looked at closely. The P-3 flew on this date. Additional RAOB data from the ice camp and Deadhorse may be revealing.



30 Mar 92 1326Z
NOAA AVHRR CH 4 IR
Notable Features:

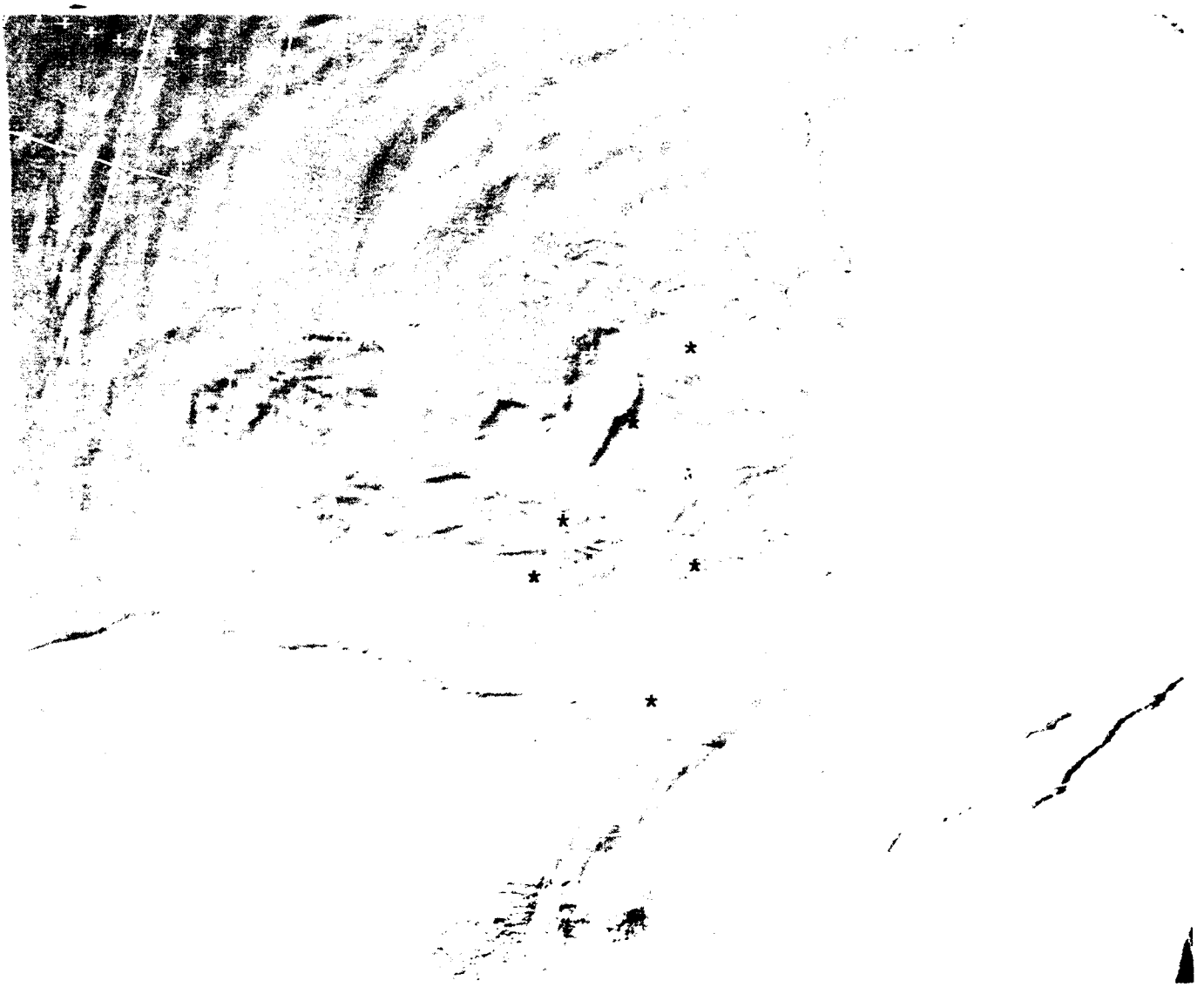
1. Banded cloudiness extends past the ice camp to the NE. Imbedded vortices are evident near 72.3N, 143W and further north near 77N, 137W.
2. The N. Slope area to about 72-73N is covered by a low overcast.
3. The vortices are moving westward, similar to easterly waves.

30 Mar 92 1748Z
DMSP OLS VIS
Notable Features:

1. This visible view shows the vortex moving past the ice camp.
2. Very suppressed low cloudiness is evident covering a large area just west of Banks Island.

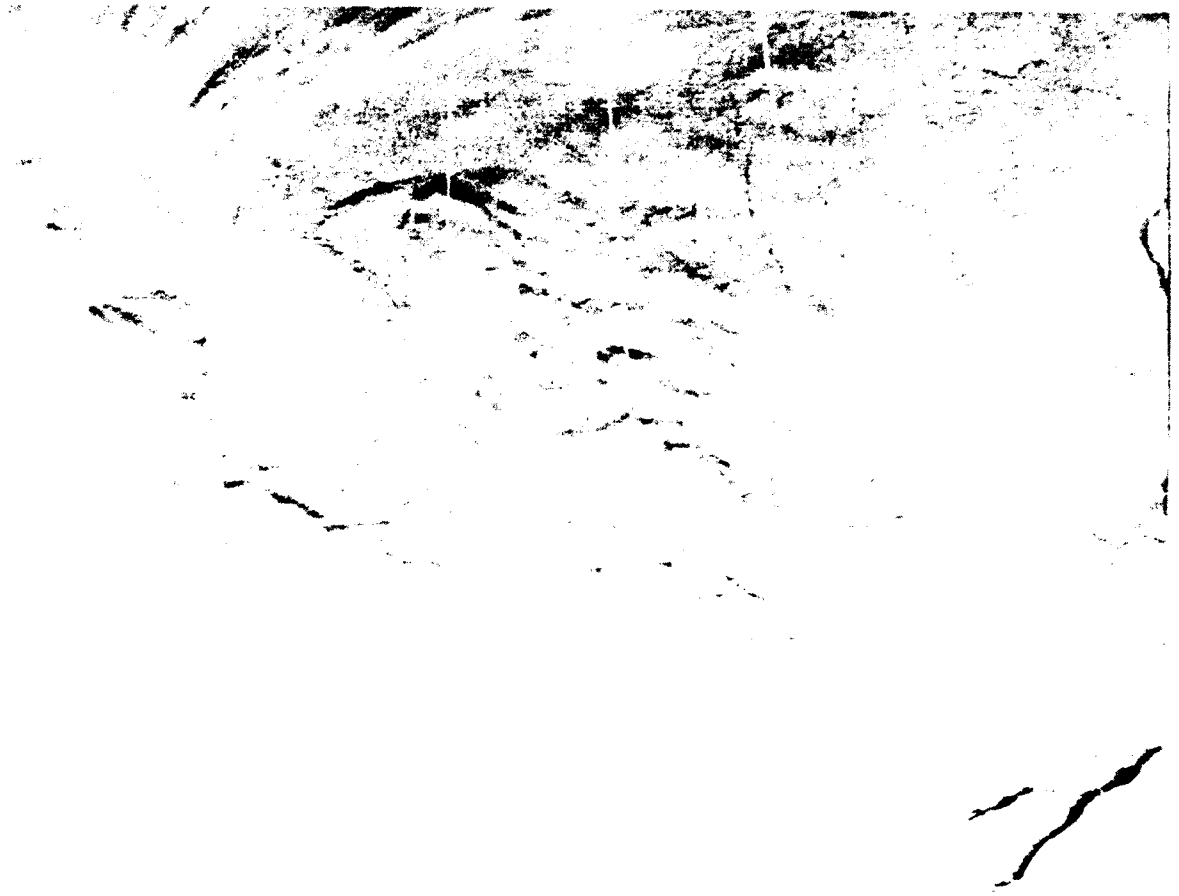
30 Mar 92 1748Z
DMSP OLS IR
Notable Features:

1. This IR view shows that the vortex has moved past the ice camp to the northwest.



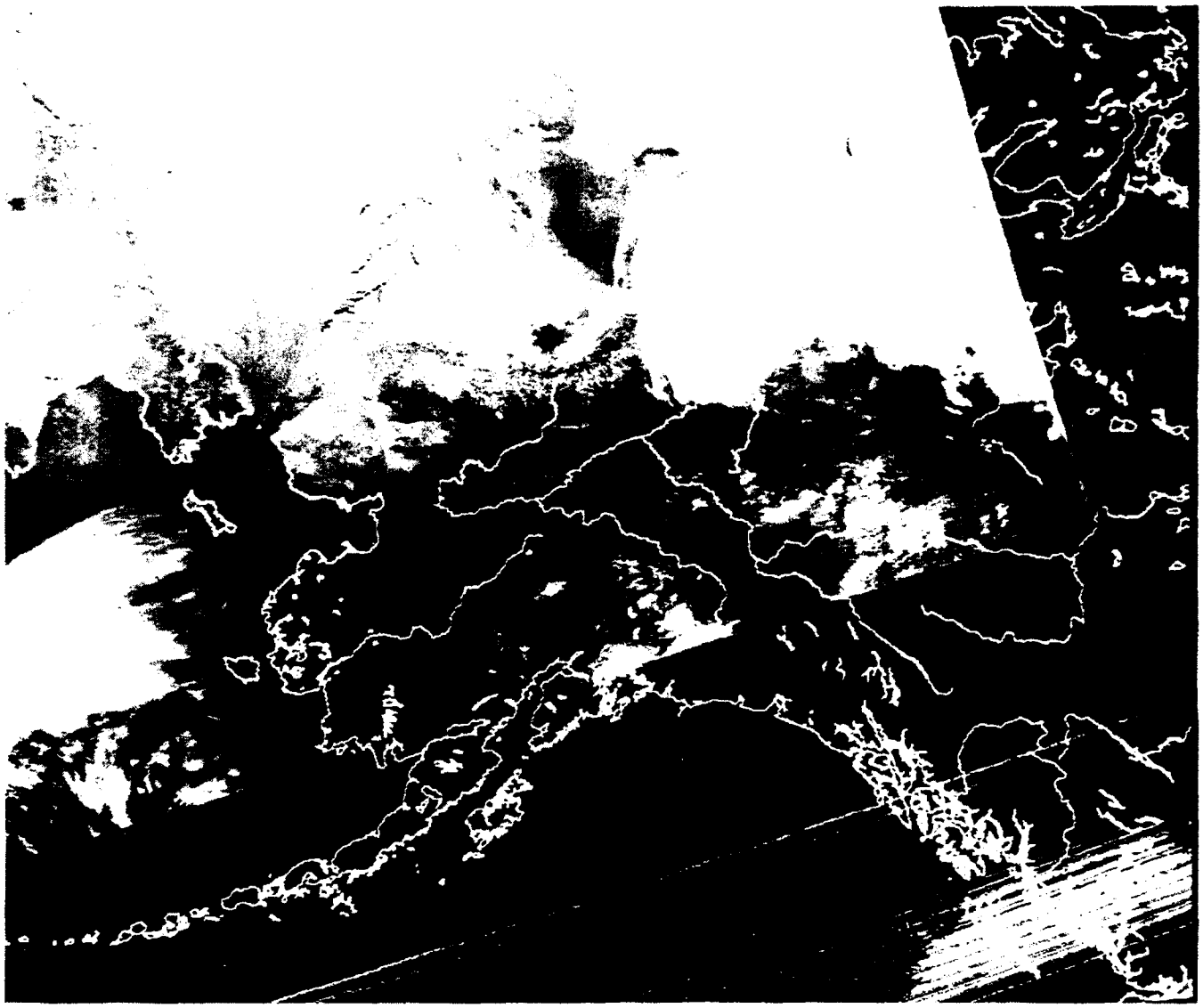
30 Mar 92 1912Z
DMSP OLS VIS
Notable Features:

1. The disturbance appears NW of the ice camp having the appearance of a northern "Screaming Eagle".
2. "Stars" denote dropsonde positions from a P-3 flight which had to abort the mission because of engine failure.



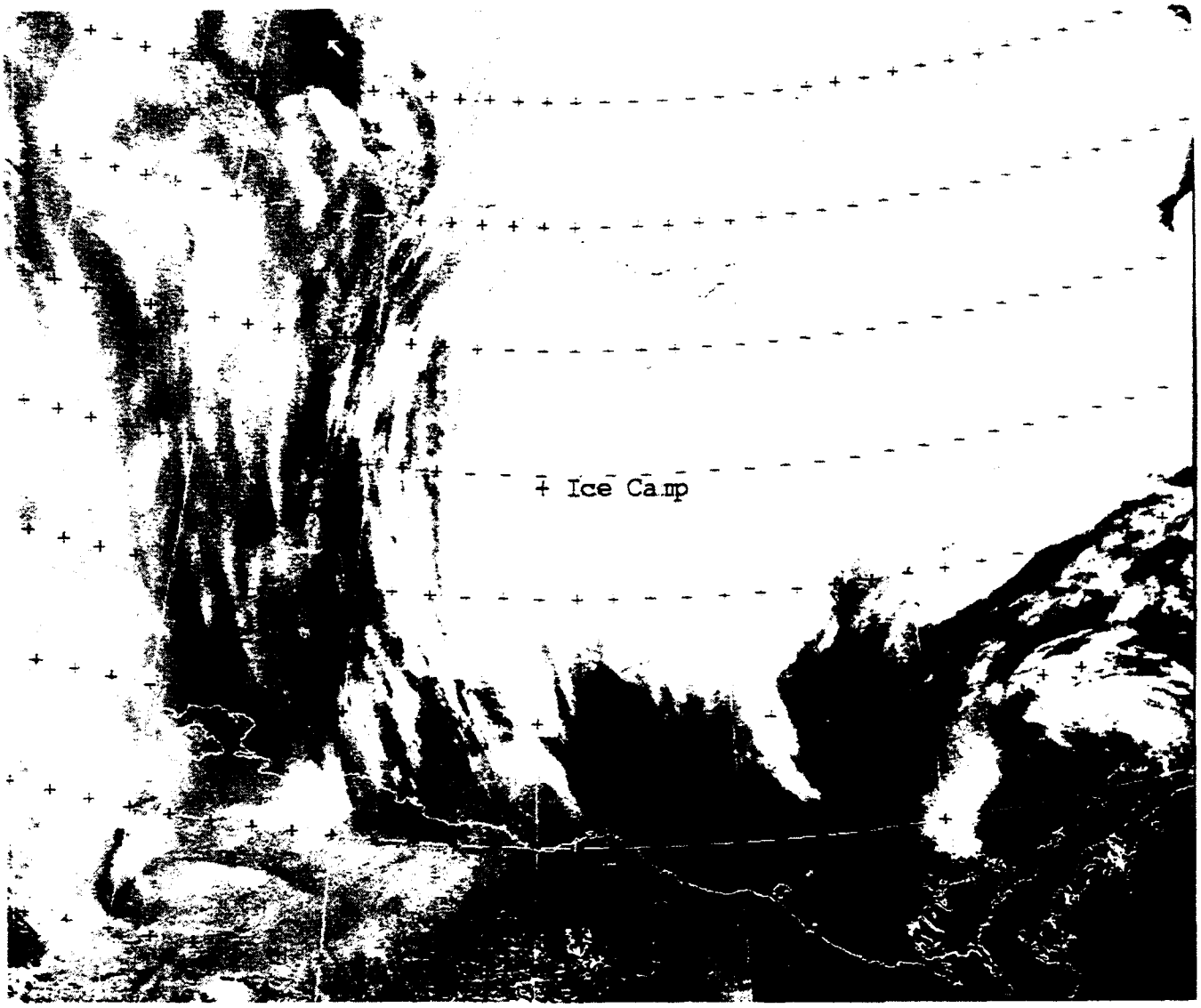
30 Mar 92 2148Z
DMSP OLS VIS
Notable Features:

1. The "Screaming Eagle" appears northwest of the ice camp in fully developed form.
2. Note "Inverted V" appearance of banded clouds east of the ice camp.
3. Anticyclonic cirrus flow is evident to the SE from a storm over the Northwest Territories that was moving northward.



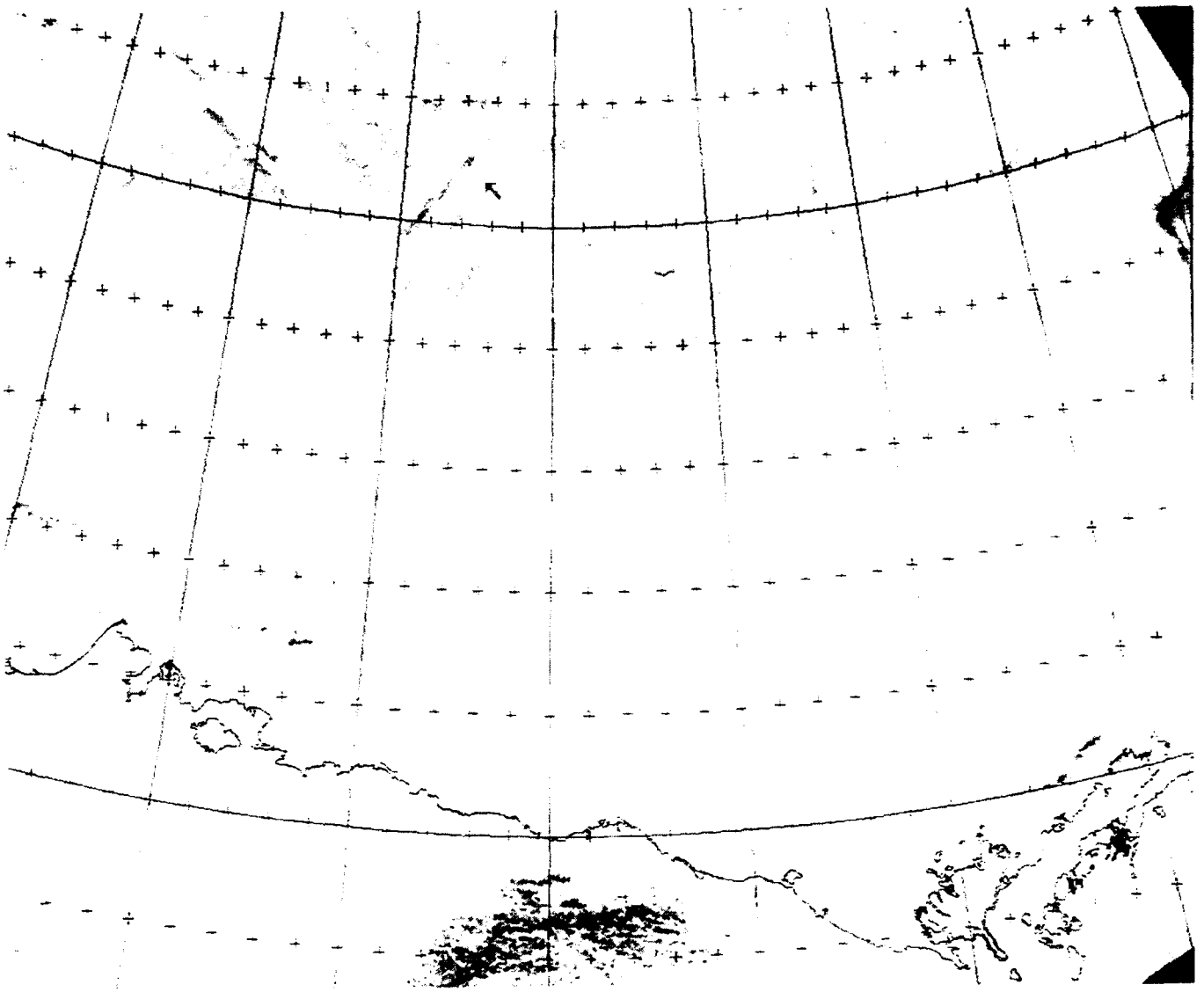
31 Mar 92 0205Z
DMSP OLS IR
Notable Features:

1. A large scale view which shows the heavy cloudiness from a storm in the NW Territories that was moving into the SE Beaufort Sea.
2. The "Screaming Eagle" has continued its NW movement.



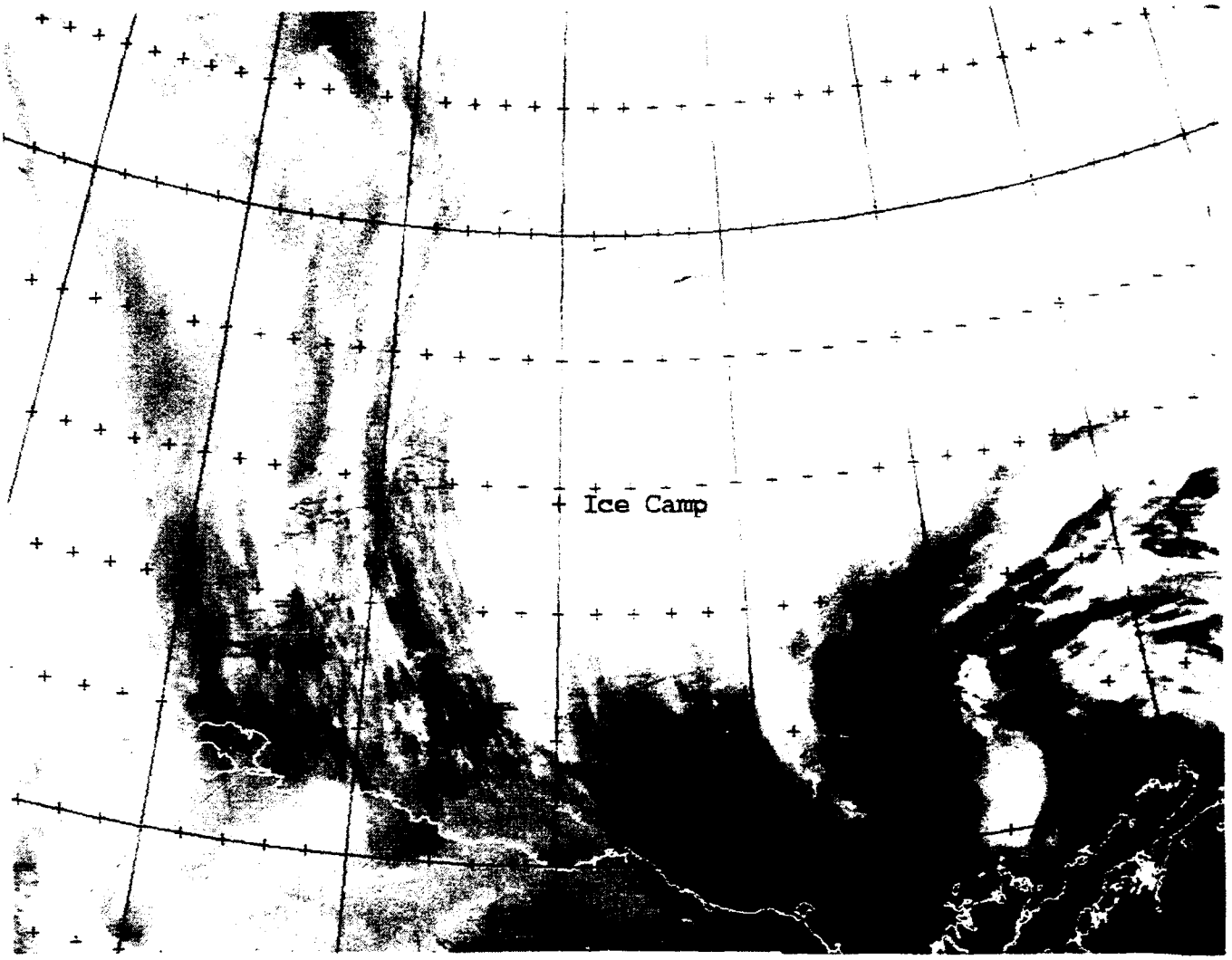
31 Mar 92 2159Z
DMSP OLS IR
Notable Features:

1. **Anticyclonic flow from the storm to the SE moves past the ice camp and covers the eastern and central Beaufort Sea.**



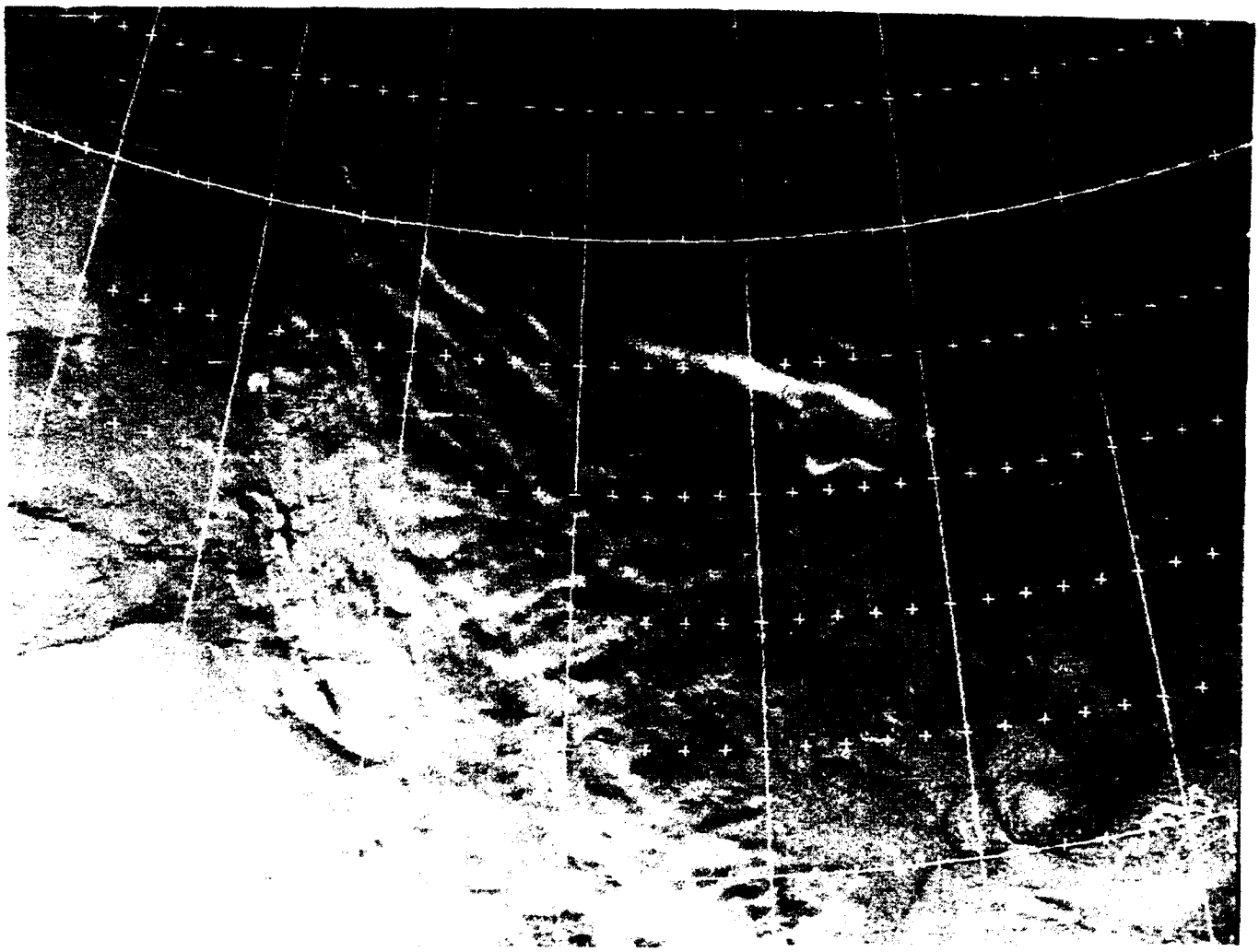
31 Mar 92 2317Z
DMSP OLS VIS
Notable Features:

1. A visible view showing the anticyclonic flow from the storm with center now near the Mackenzie River Delta.



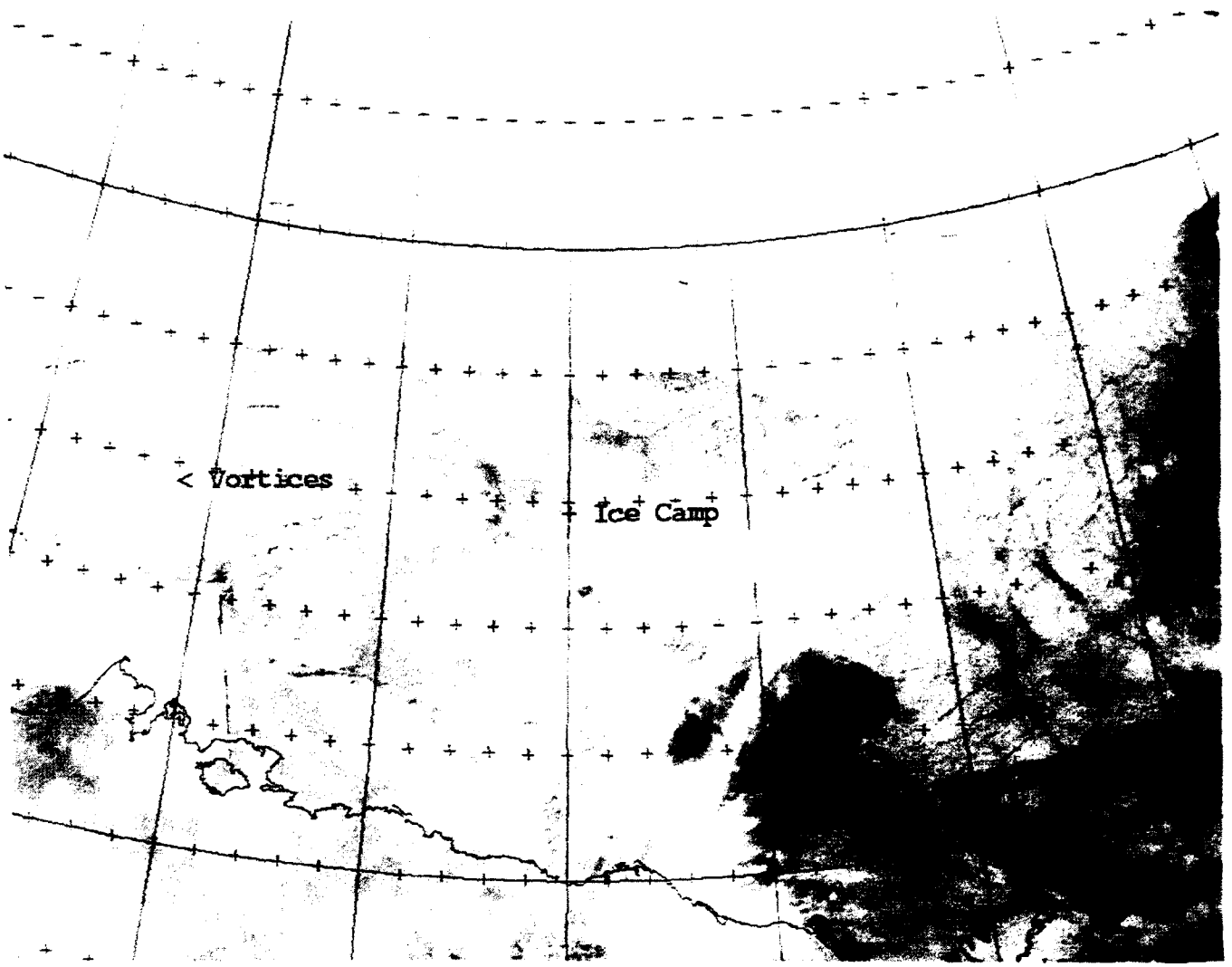
31 Mar 92 2317Z
NOAA AVHRR CH 4 IR
Notable Features:

1. A NOAA IR view of the storm to the SE. An ill-defined storm center is suggested near 71N, 135W.



1 Apr 92 2305Z
DMSP OLS VIS
Notable Features:

1. Dissipating cloudiness from the Mackenzie Delta low has advected westward past the ice camp region.
2. The western boundary is quite distinct. Here winds at 925 and 700 mbs shift abruptly from easterly to southerly.

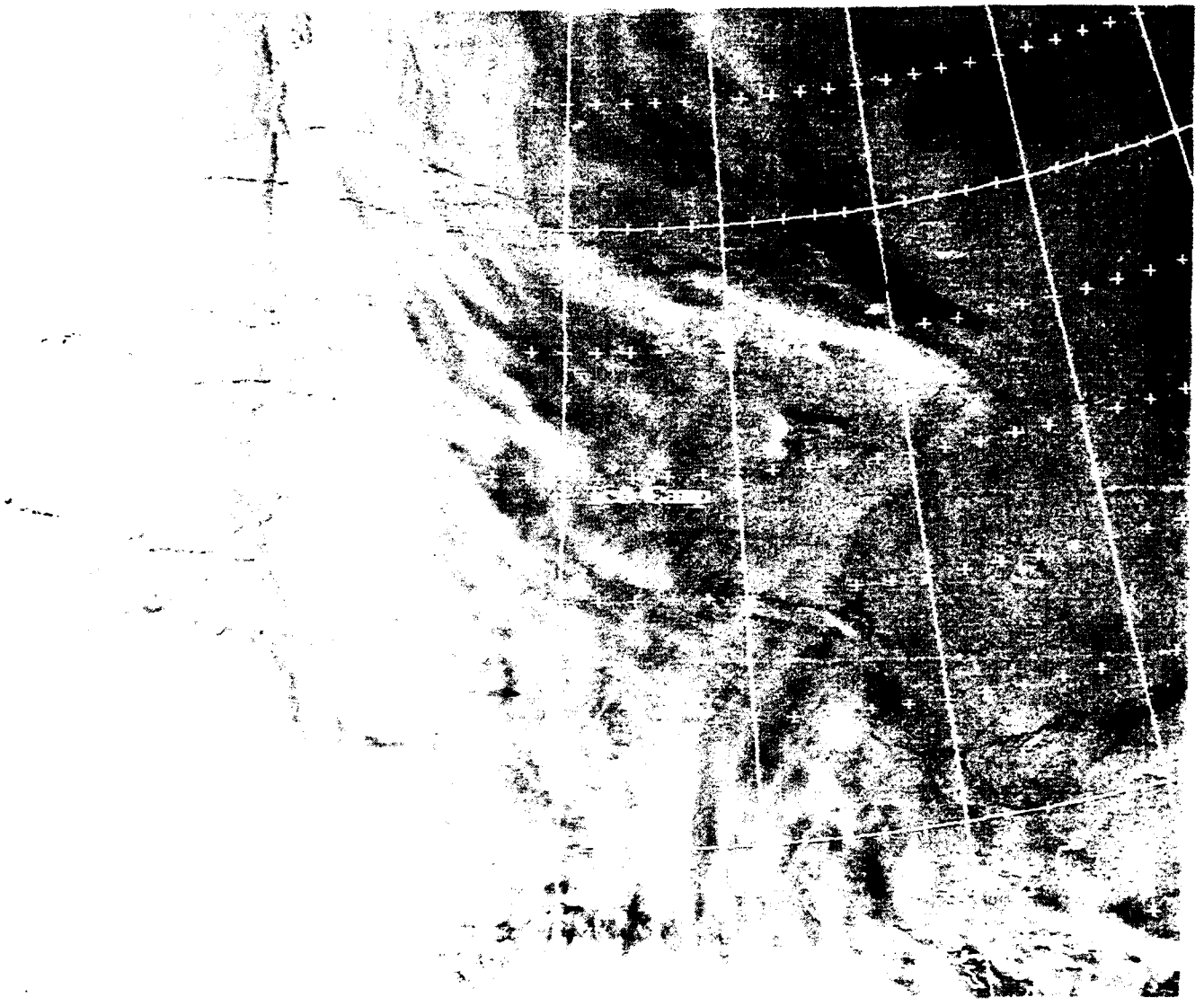


1 Apr 92 2305Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Mesoscale vortices have formed in the southerly flow north of Barrow.
2. The heavy overcast to the north is difficult to interpret. It overlies a surface ridge line as drawn by Anchorage forecasters. However, NORAPS shows an WNW-ESE trough aligned with the feature by 02/00Z. It has the appearance of a baroclinic leaf but moved rapidly to the north so that further development is not observed over the Leadex area of operation.

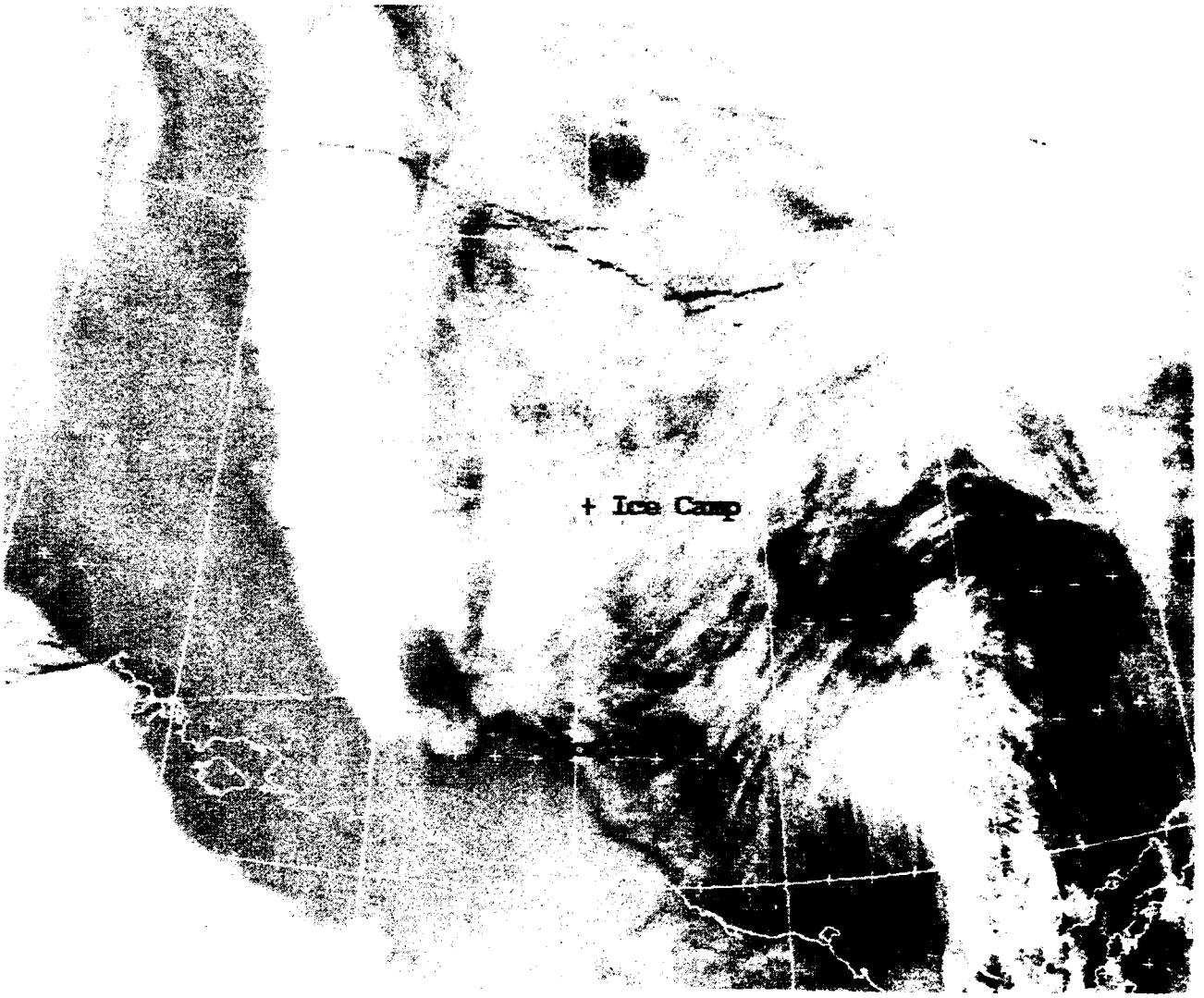
2 Apr 92 0144Z
DMSP OLS IR
Notable Features:

1. Well defined low level frontal band extending north of Barrow with waves along the western edge.
2. Baroclinic leaf formation over north central Beaufort. This does align with a surface trough and shear lines at 10m and 925 mb. A closed low is shown near 73N, 145W at the 700 mb level. This is an interesting formation which could be explored as an excellent case study if satellite data further north at later time periods were available.



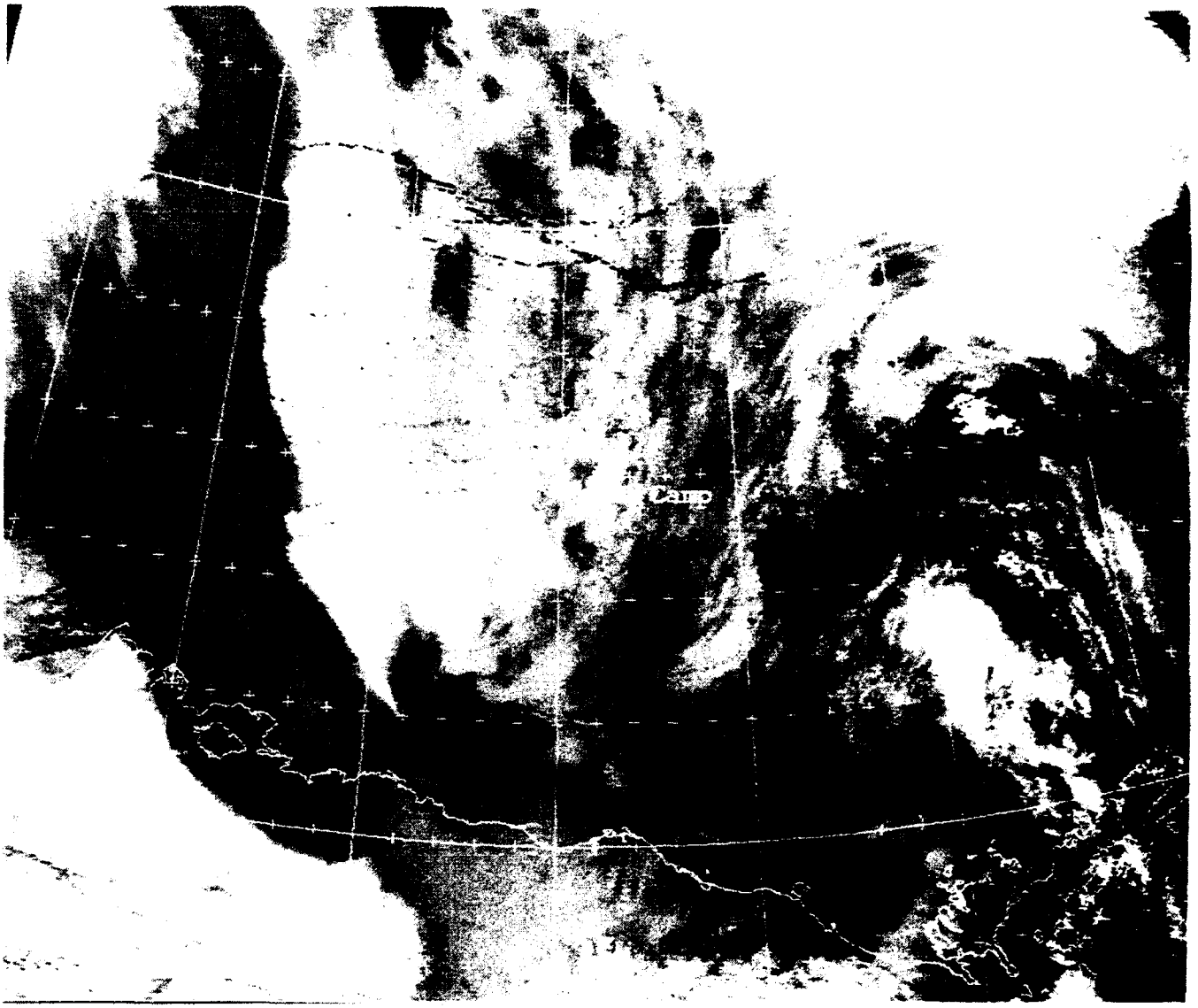
2 Apr 92 0144Z
DMSP OLS VIS
Notable Features:

1. This is the companion visible view to the previous IR. The "frontal" cloud north of Barrow is revealed to be a thin, transparent, stratus cloud. There may even be a question as to whether or not this is a true front. It exists in pronounced southerly flow at low levels. There is a surface trough to the west drawn on Anchorage operational analyses and there appears to be a strong temperature contrast.



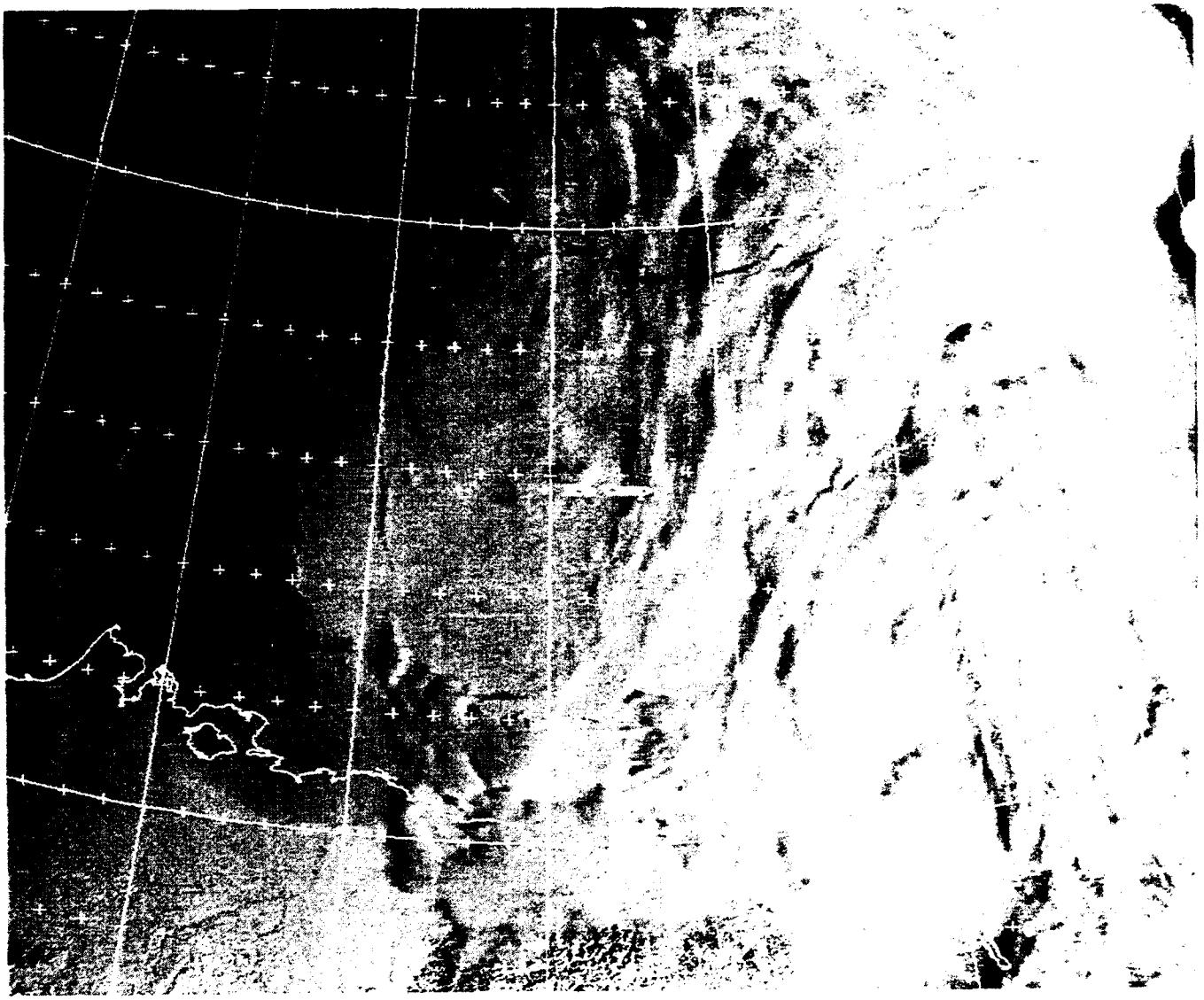
2 Apr 92 1250Z
NOAA AVHRR CH 4 IR
Notable Features:

1. "Frontal" band extends north of Barrow and connects along the N. Slope to a vortex north of Deadhorse.
2. A cloud vortex has moved into the Mackenzie River Delta area. This is not precisely located by NORAPS but a trough shows up at all levels just north of this feature.
3. The baroclinic leaf has moved north.



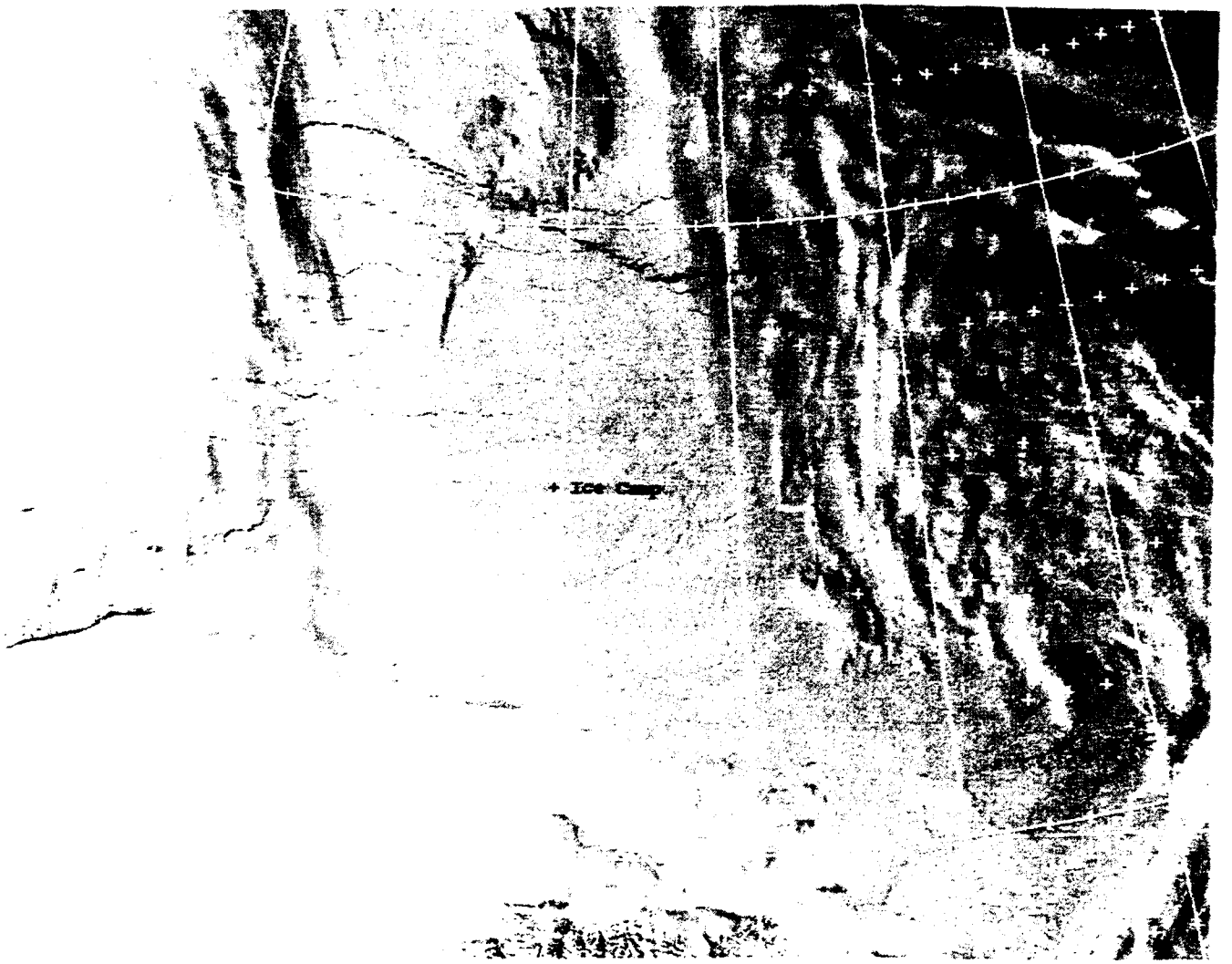
2 Apr 92 1529Z
DMSP OLS IR
Notable Features:

1. Similar to the previous view. Note apparent frontal connection along the N. Slope to the Mackenzie River Delta low. Operational analyses show only a trough along the N.Slope extending out of the NW Territories.



2 Apr 92 1710Z
DMSP OLS VIS
Notable Features:

1. A large amplitude N-S elongated low is suggested by the apparent vortex in the Mackenzie River Delta.
2. The front to the east remains transparent thickening only east of Deadhorse.

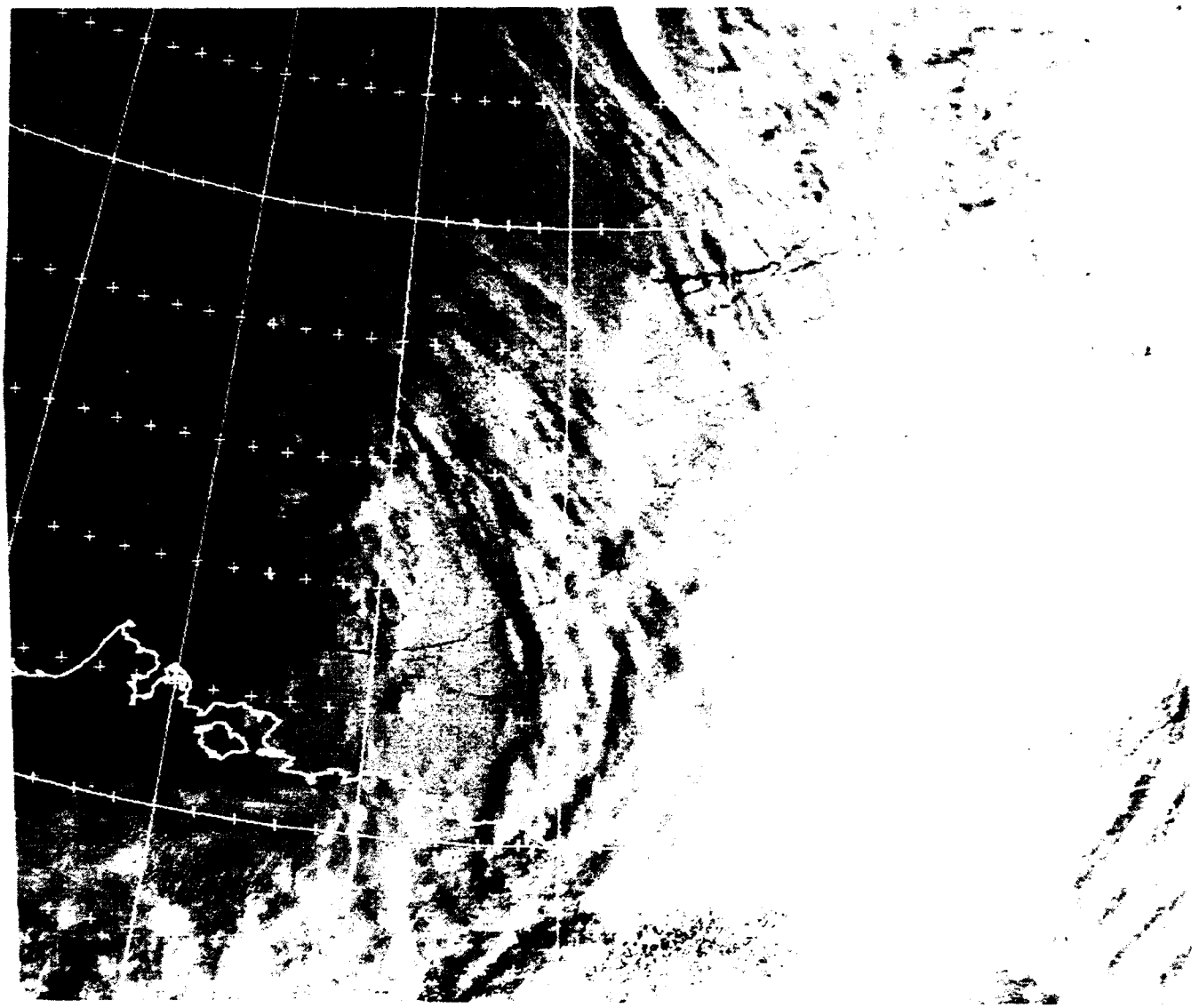


2 Apr 92 2245Z
DMSP OLS VIS
Notable Feature:

1. The time is mis-labeled on the figure top.
2. A vigorous system has moved in from the west overtaking the thin transparent "frontal" band.
3. The "Mackenzie River Delta" low has a well-developed closed circulation at 925 and 700 mbs covering most of the eastern and central Beaufort. <u>Note a key rule in Arctic forecasting.</u> "Clear conditions may be reliably forecast in the col region between two lows (Fett, Englebretson and Perryman, 1992). This surely is true for the ice camp which was now enjoying crystal clear skies.

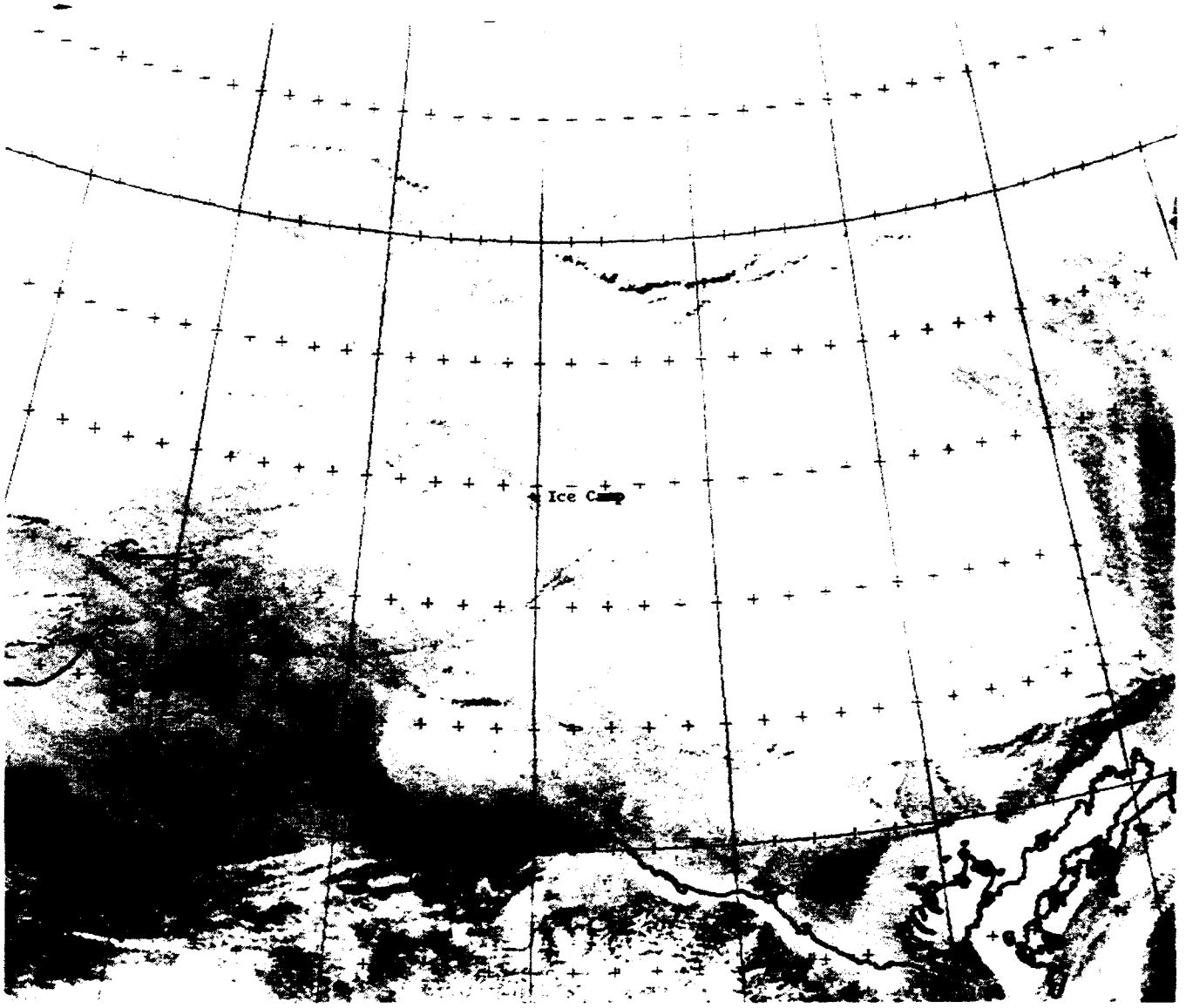
3 Apr 92 1600Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Earlier data showed the Barrow low moving eastward and the Mackenzie Delta low moving fairly rapidly northeastward. In this image cloudiness from the Barrow low has now moved over the ice camp. The Mackenzie Delta low is apparent to the northeast with center near 73.5N, 127.5W. <u>The col area it should be noted remains clear with clearing occurring as the col moves along eastward.</u>



3 Apr 92 1657Z
DMSP OLS VIS
Notable Features:

1. NORAPS shows a closed low north of Barrow. An exact center cannot be discerned from the satellite image but a center is suggested N-NE of Barrow.
2. The ice camp is located in a cloud band surrounding the low.
3. The low to the east is apparent in the top right center of the image.

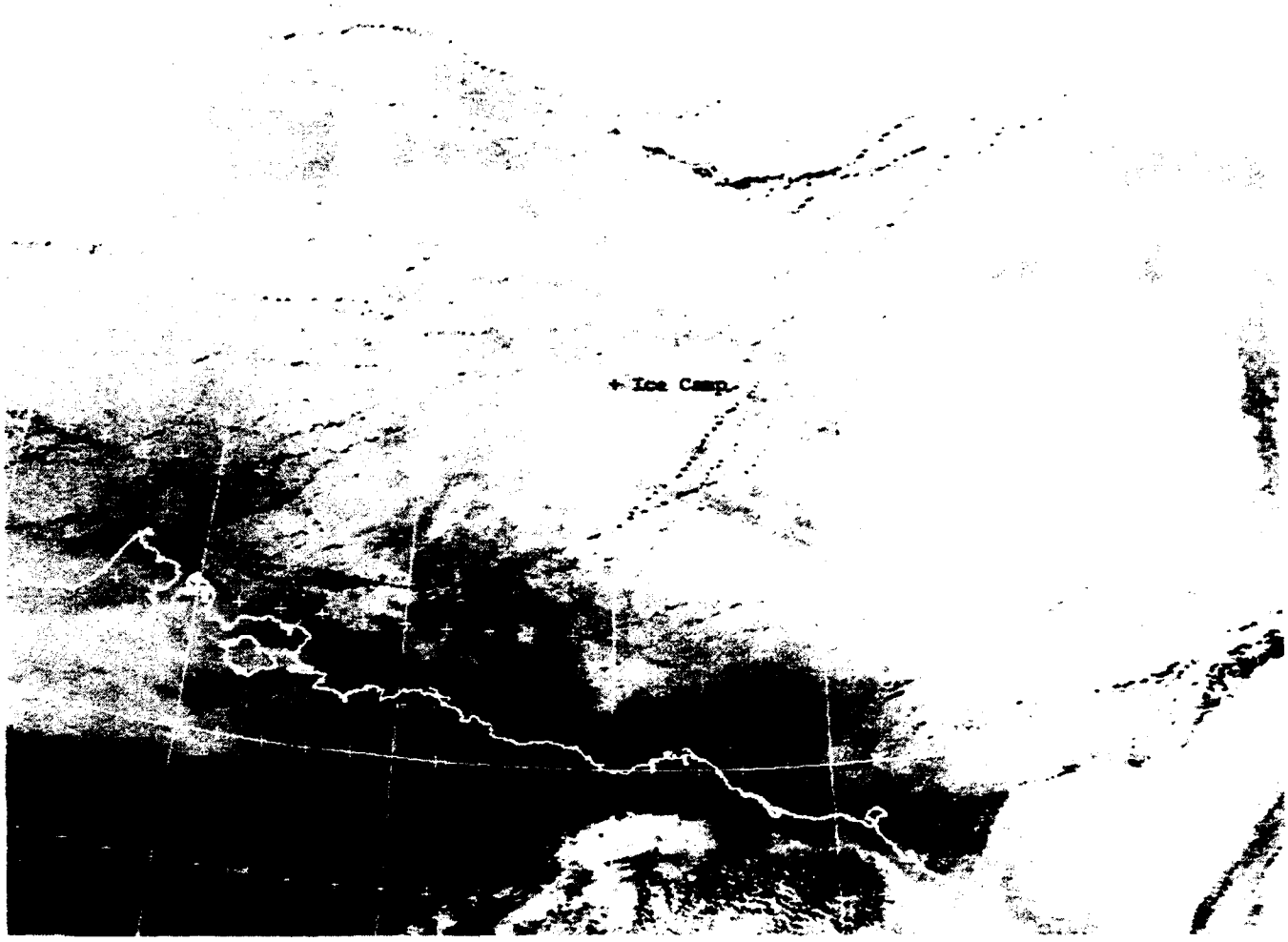


3 Apr 92 2027Z
DMSP OLS IR
Notable Features:

1. The Barrow low remains ill-defined with an apparent N-S trough extending along 155W. Some upper level NW flow is apparent over the system. This is not shown up to 700 mb.
2. The second low is still apparent NW of Banks.

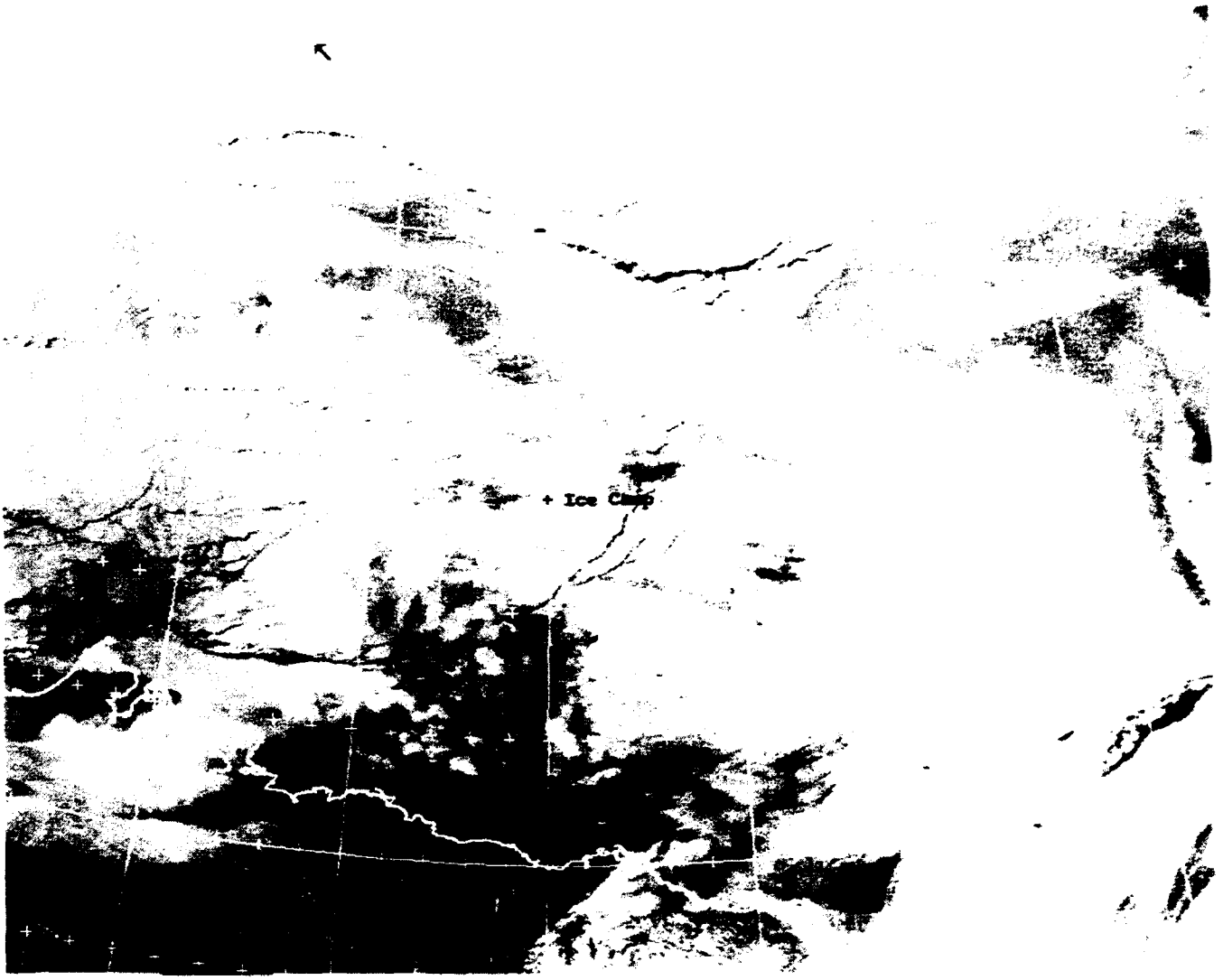
4 Apr 92 0022Z
DMSP OLS VIS
Notable Features:

1. Both lows are visible with the Barrow center ill-defined. The second low shows a cloud vortex center near 75N, 129W.
2. Note prominent lead feature extending NE from Barrow. A second major lead appears north of the ice camp.



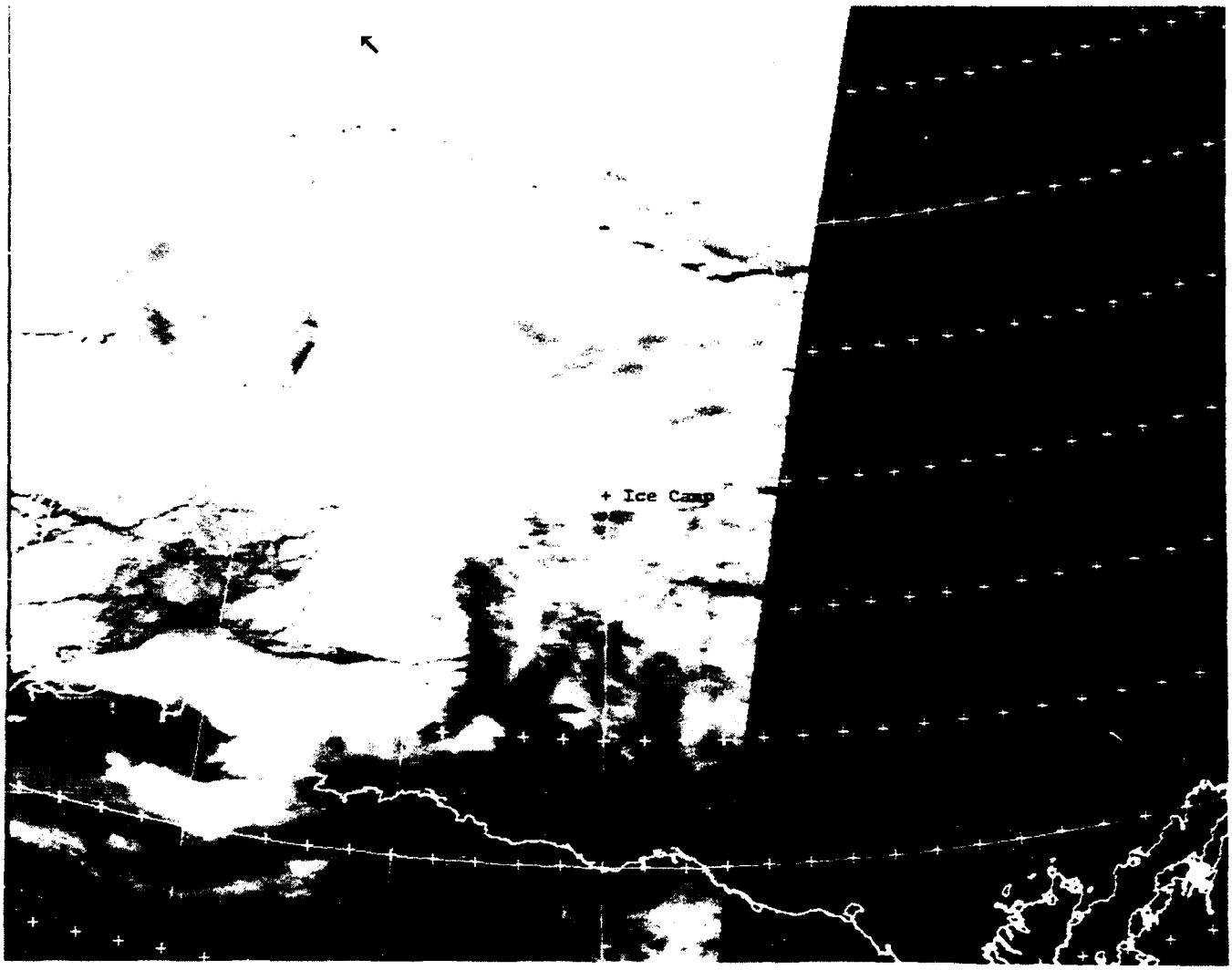
4 Apr 92 0118Z
DMSP OLS IR
Notable Features:

1. Both systems appear to have weakened in this image.



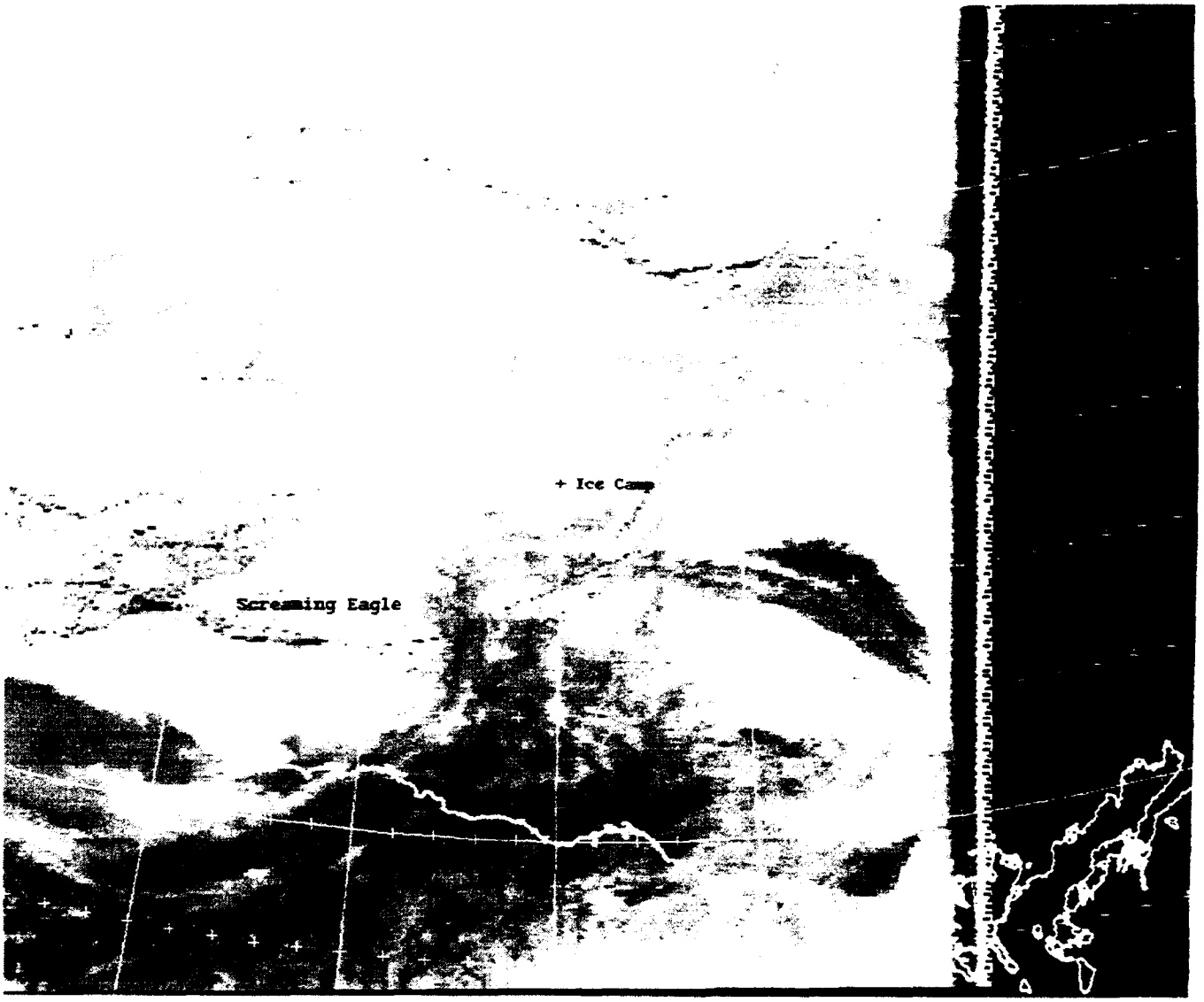
4 Apr 92 0339Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The Barrow low is taking on the appearance of a "Screaming Eagle" (with wings sweeping to the east). However, it is an eastward moving system at this time.
2. Note flaw lead along fast ice separating from the lead that extends up toward the ice camp.



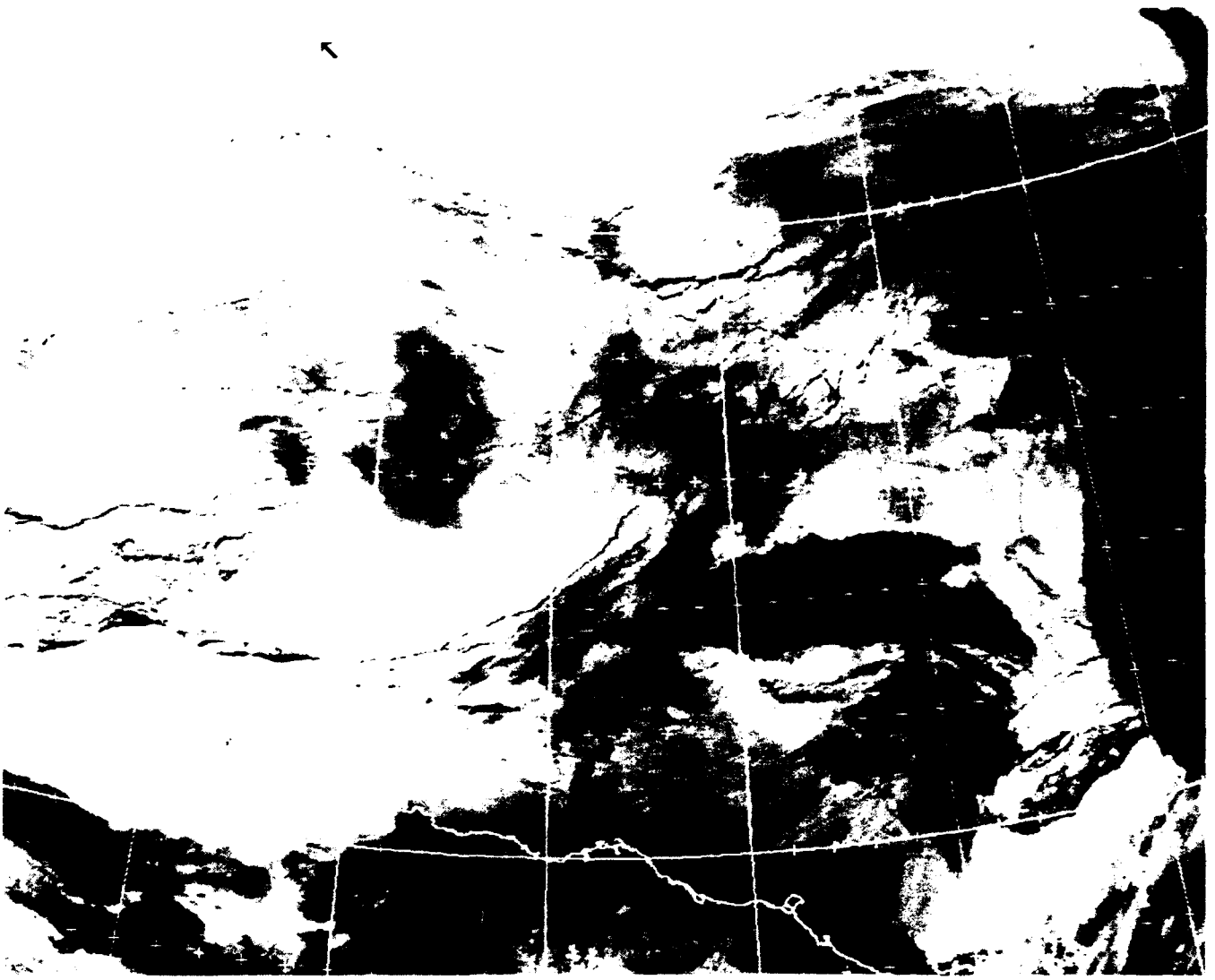
4 Apr 92 0520Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Screaming Eagle disturbance SW of ice camp.
2. Major open lead areas are visible north of Barrow.



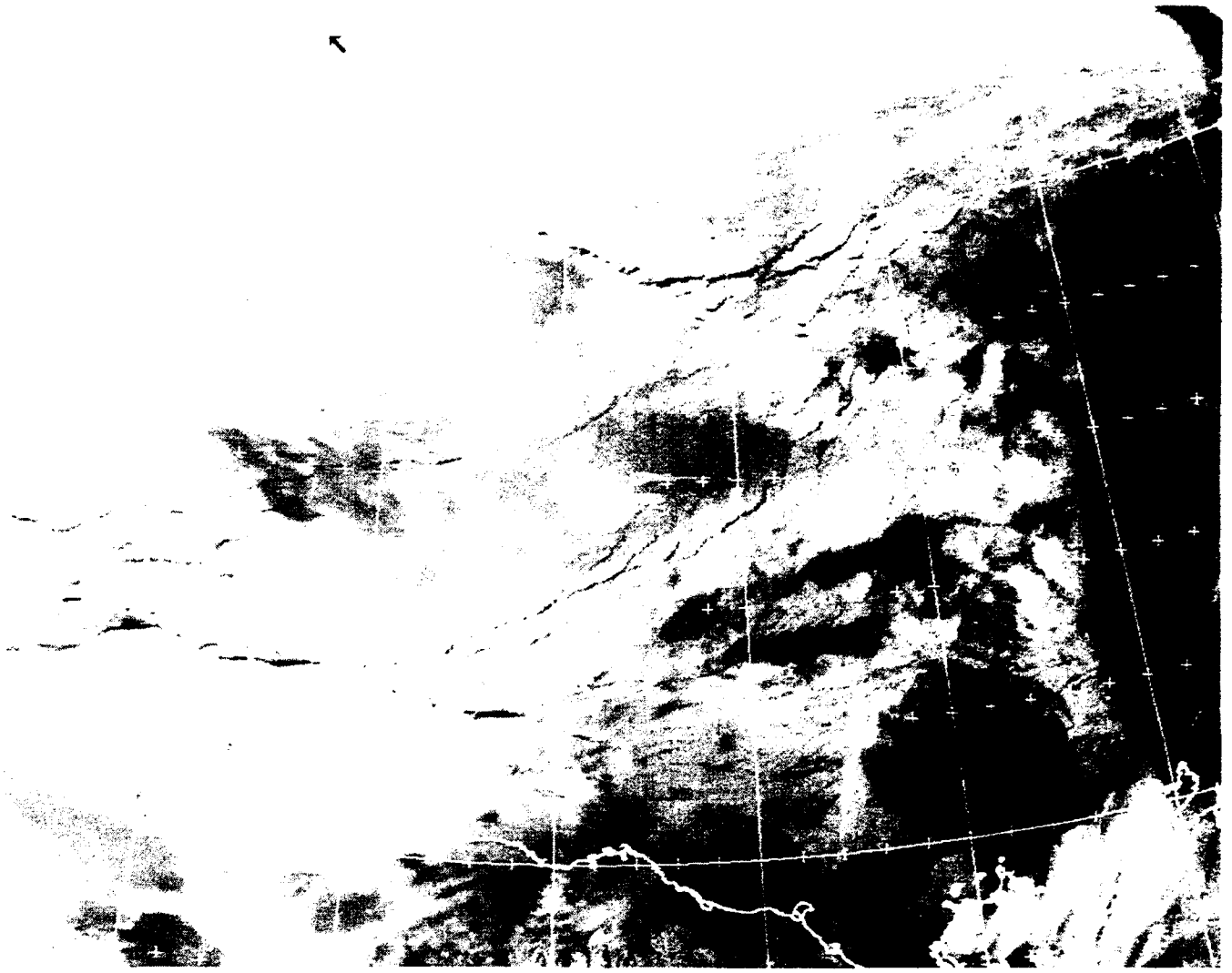
4 Apr 92 0623Z
DMSP OLS IR
Notable Features:

1. Another view of the Screaming Eagle disturbance.



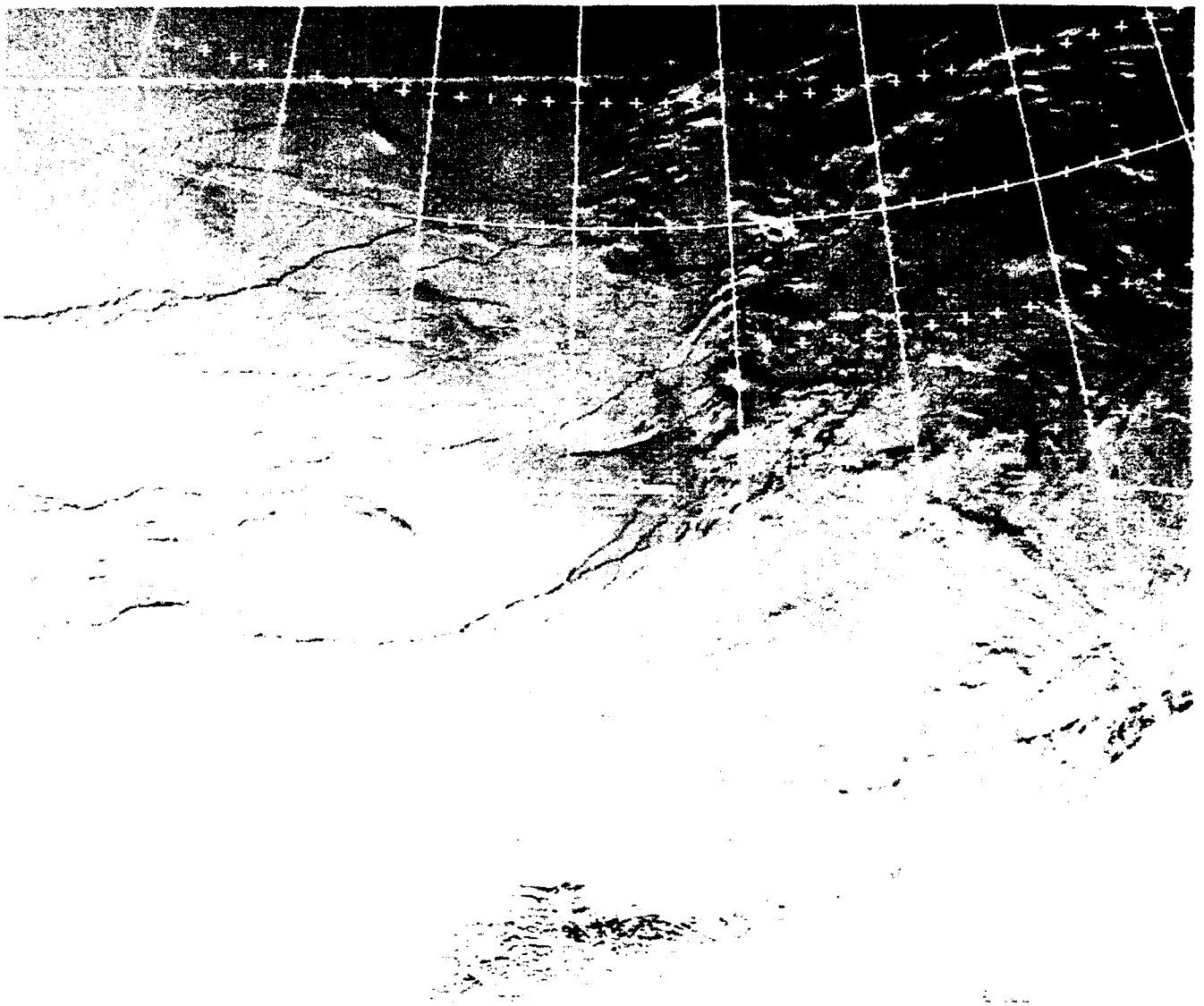
4 Apr 92 1408Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Cloudiness south of the ice camp seems to be associated with east-west shear lines at low levels and a closed cyclonic center near 72.5N, 137.5W at 700 mb.
2. Note that the frozen land near Barrow can be distinguished from the adjoining fast ice in this IR view.



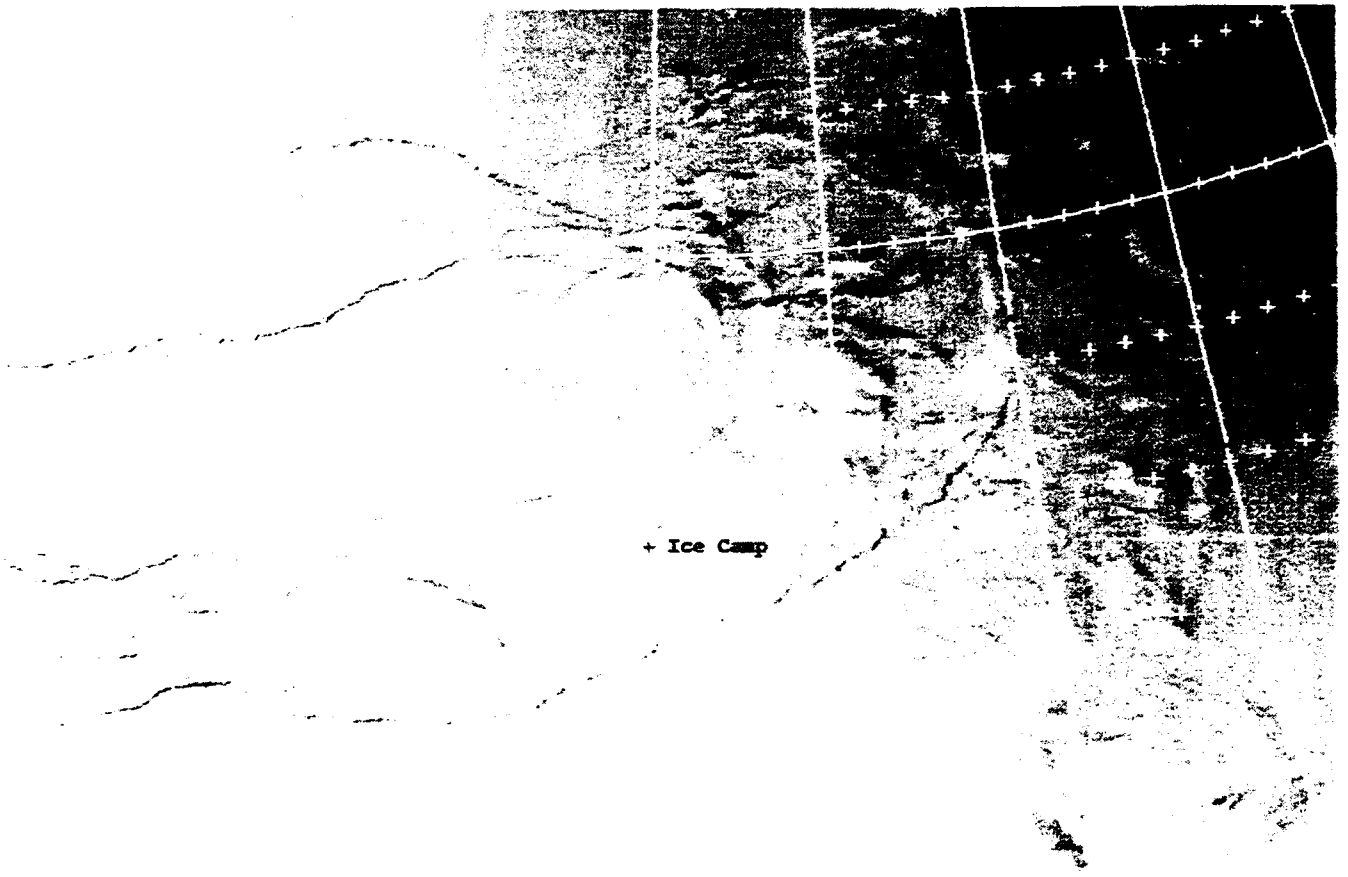
4 Apr 92 1717Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Cloudiness appears very fragmented in this IR view.
2. NORAPS shows a return to easterly flow north of the N. Slope with a trough tendency along the Slope.



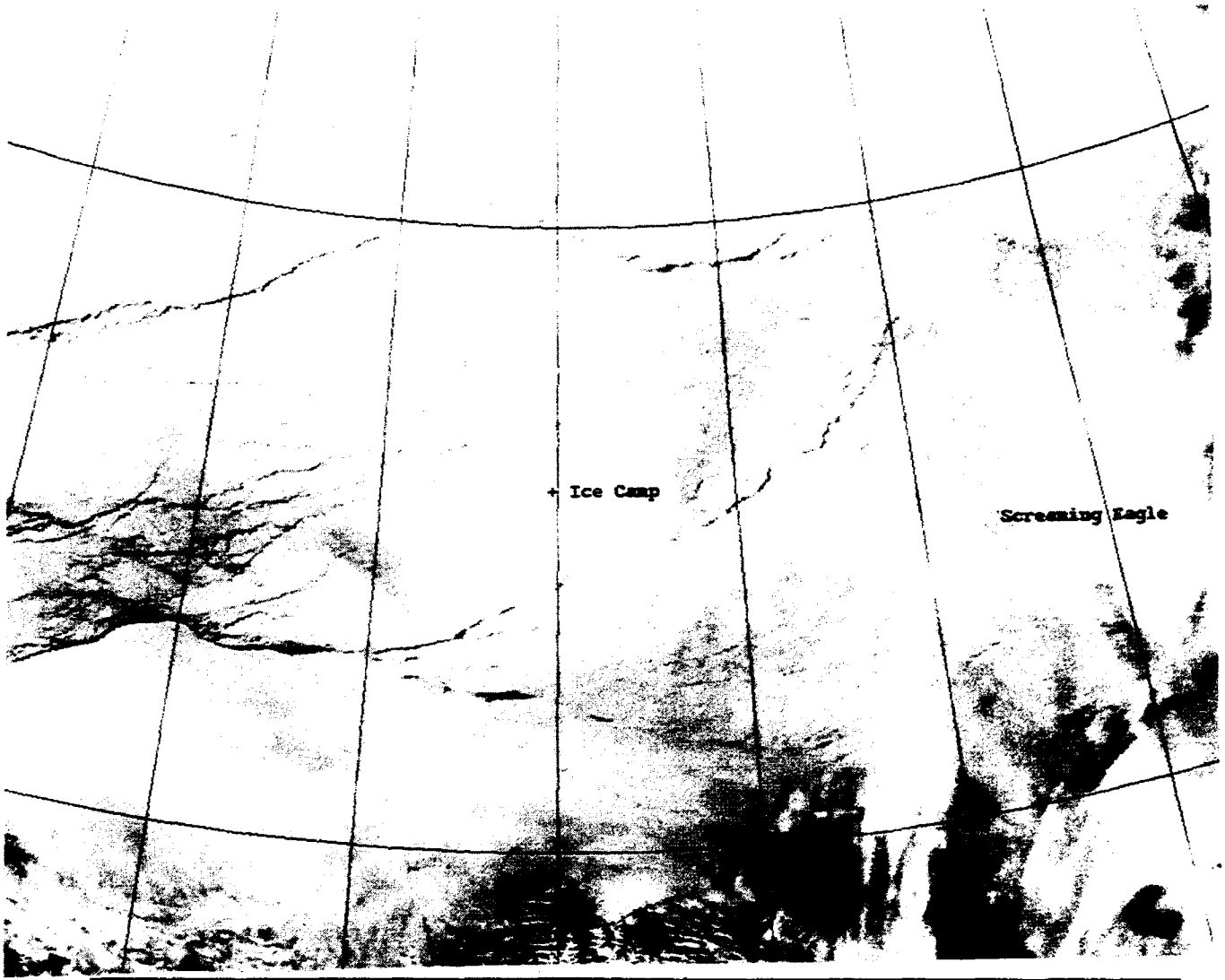
4 Apr 92 2229Z
DMSP OLS VIS
Notable Features:

1. Apparently disjointed patches of cloud areas typify this image.



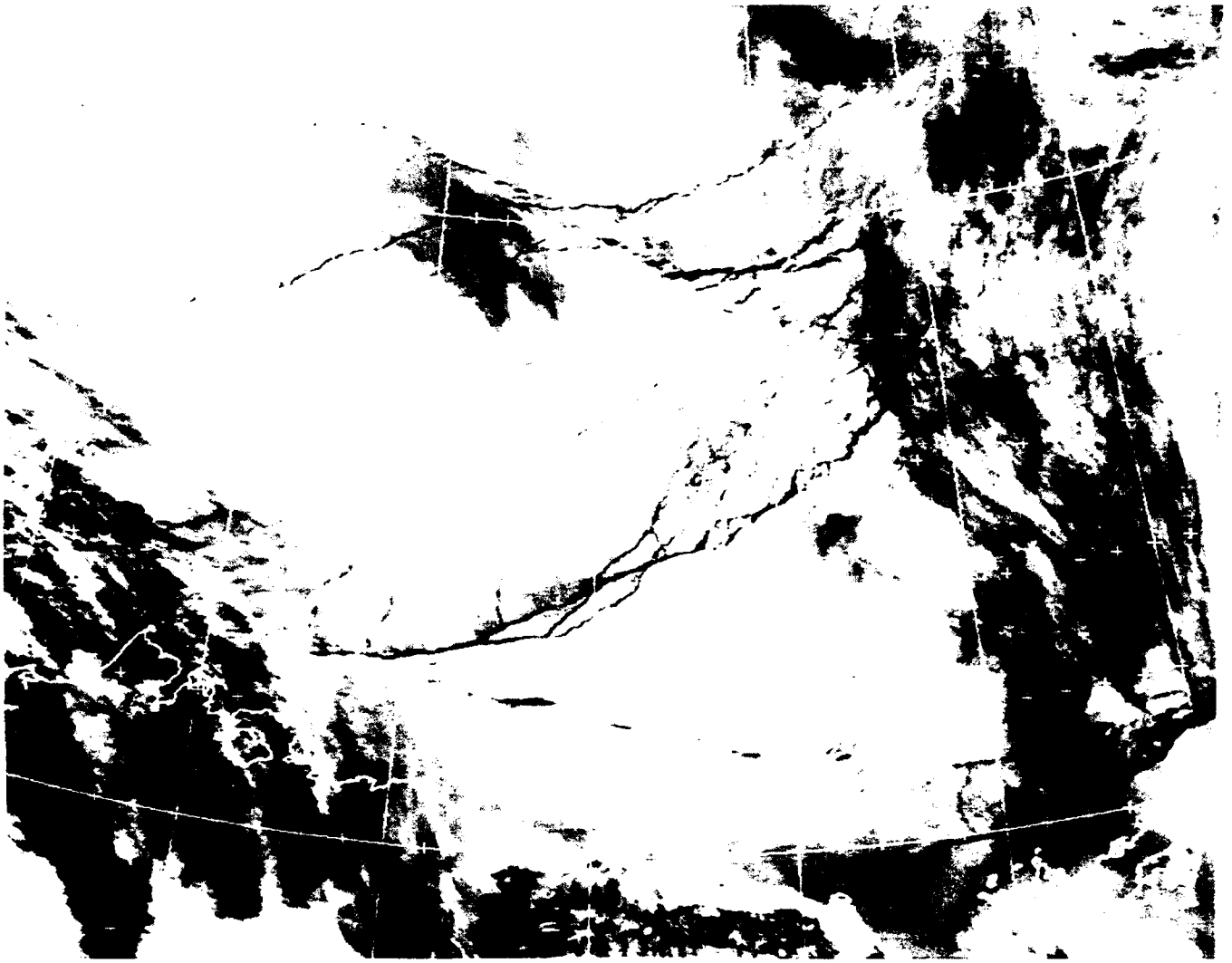
5 Apr 92 0010Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. The ice camp is now in the clear with no sign of organized disturbances in the area.



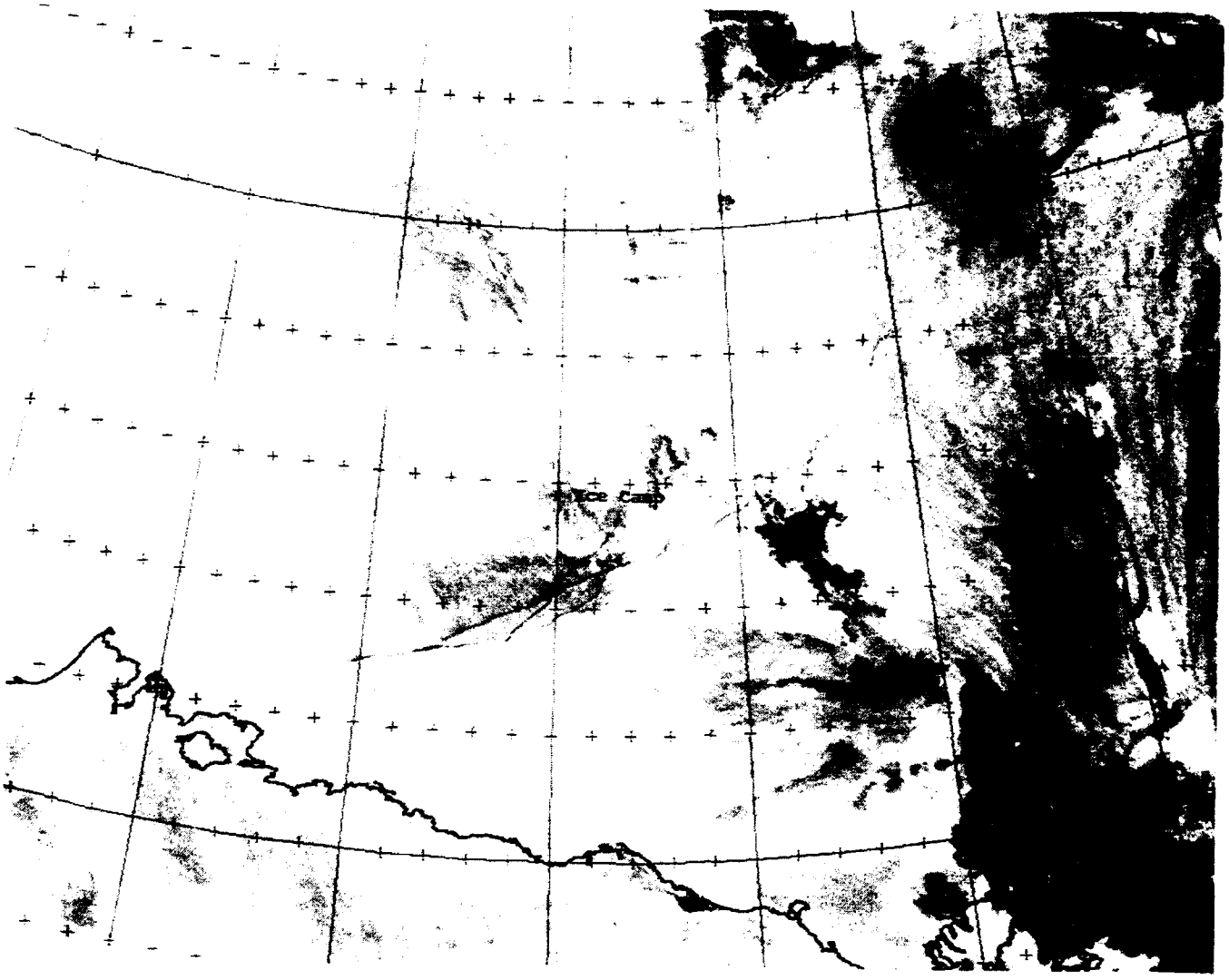
5 Apr 92 0010Z
NOAA AVHRR CH 4 IR
Notable Features:

1. New cloudiness appears to be entering the area from the east with vorticle cloud formations apparent in that region.



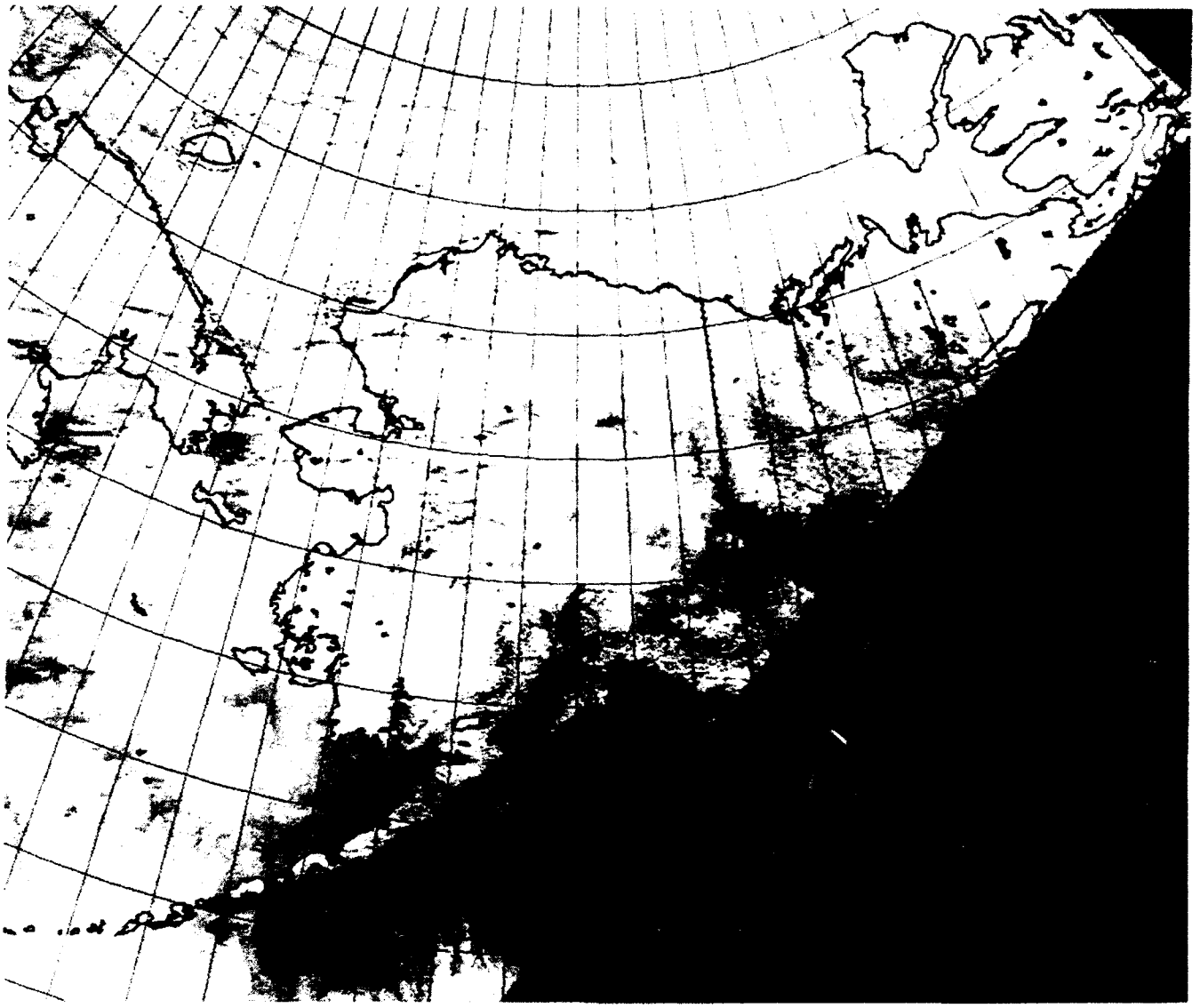
5 Apr 92 1536Z
NOAA AVHRR CH 4 IR
Notable Features:

1. A major change is apparent over the area as high clouds from and intense system to the west move over the Barrow area, and to the east a similarly strong alignment of cloud features is shown.
2. The forecast is for the low west of Barrow to move into the southern Beaufort within 24 hrs.



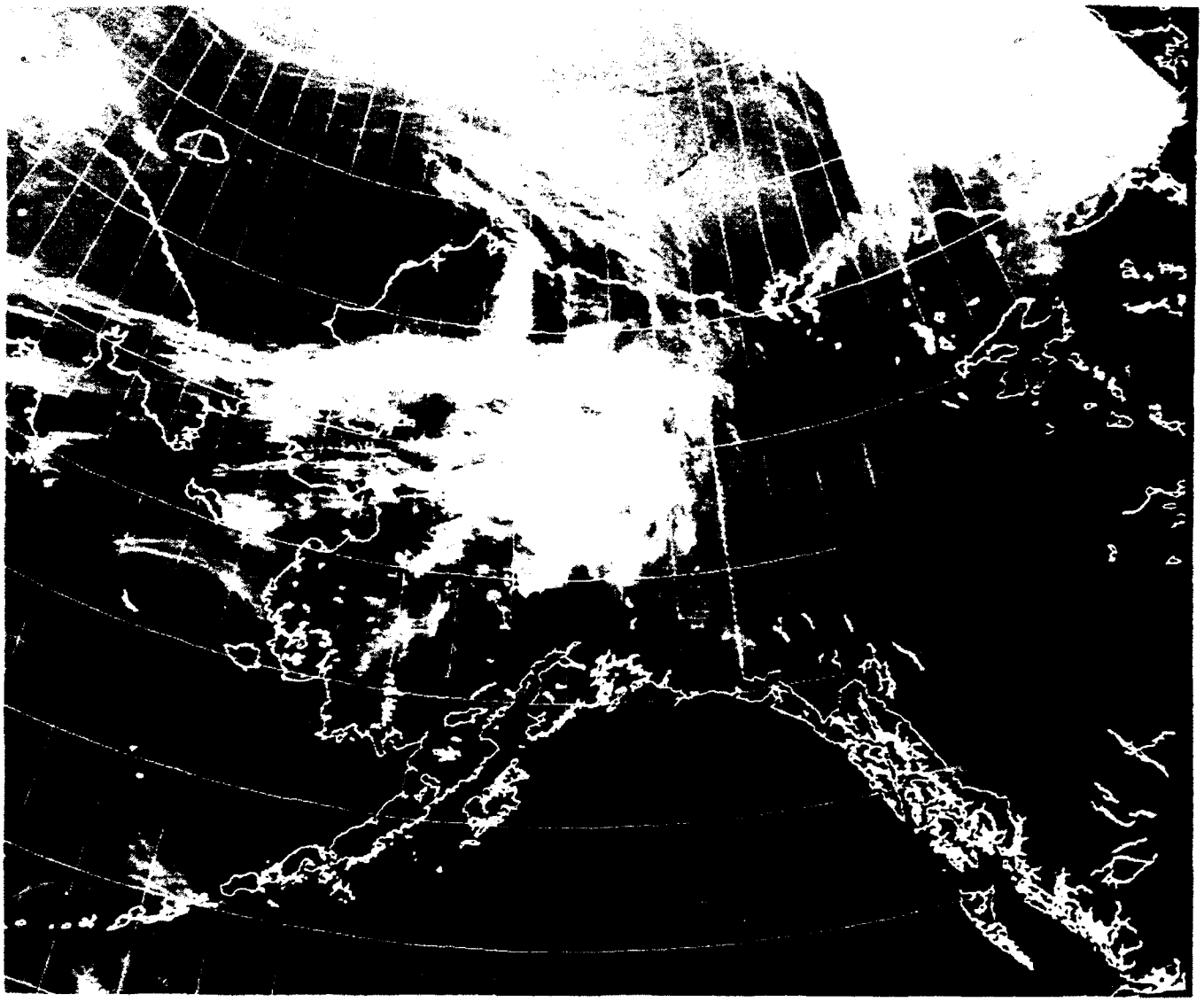
5 Apr 92 1536Z
NOAA AVHRR CH 3 IR
Notable Features:

1. A companion channel 3 view of the area. The black cloud region shown is quite different from the channel 4 view, as is the region north of 71N between 135-140W. Since this is a daylight view channel 3 senses reflected energy as well as an IR signal. Thus low bright clouds under an inversion appear black. Fog over ice has a temperature close to the surface temperature. Channel 3 can reveal such fog which reflects brighter than the ice whereas it appears invisible in channel 4.



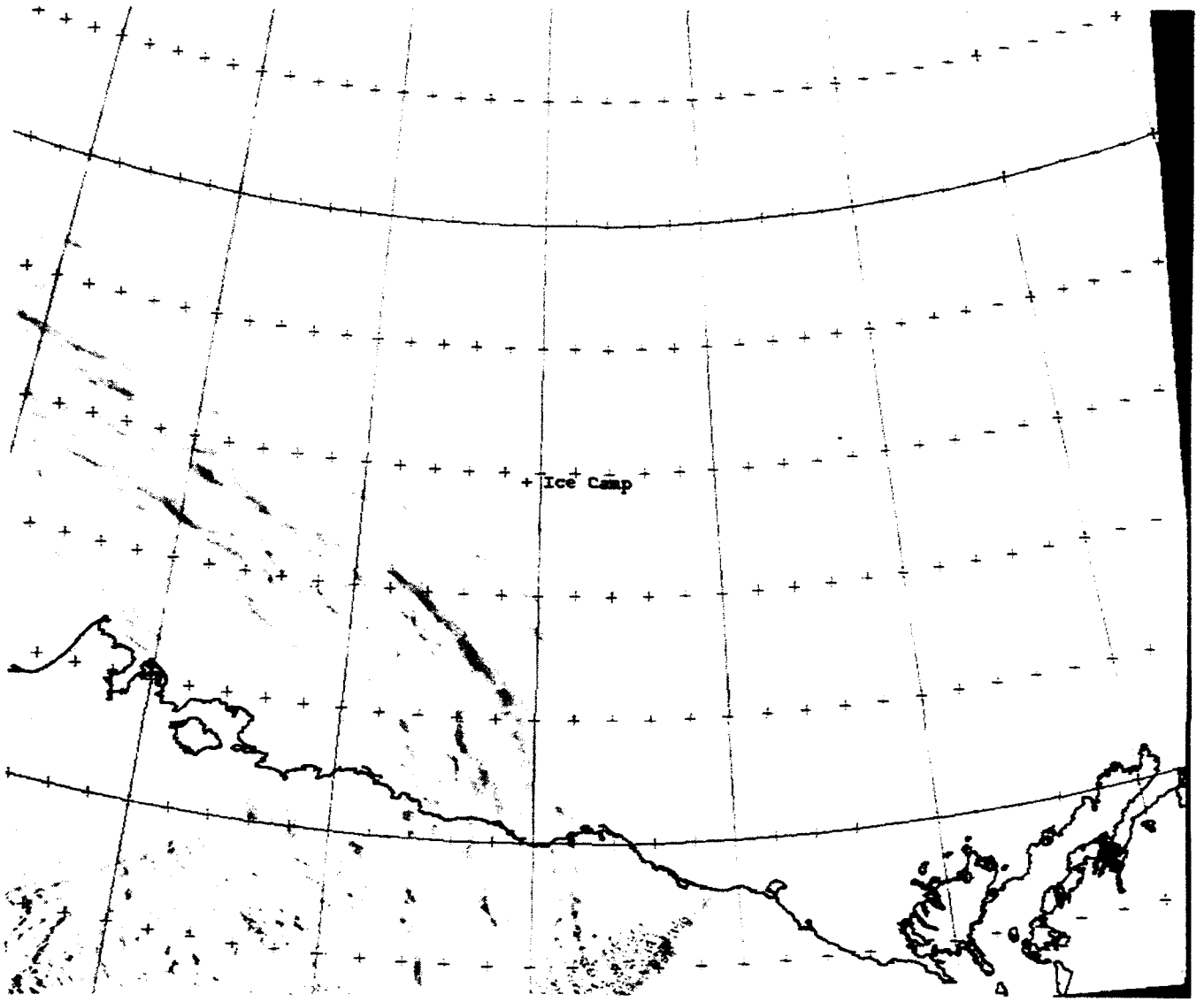
5 Apr 92 2104Z
DMSP OLS VIS
Notable Features:

1. Large scale visible view shows a frontal band and developing center NW of Barrow.
2. A prominent lead exists form offshore NW Alaska past Barrow toward the ice camp.



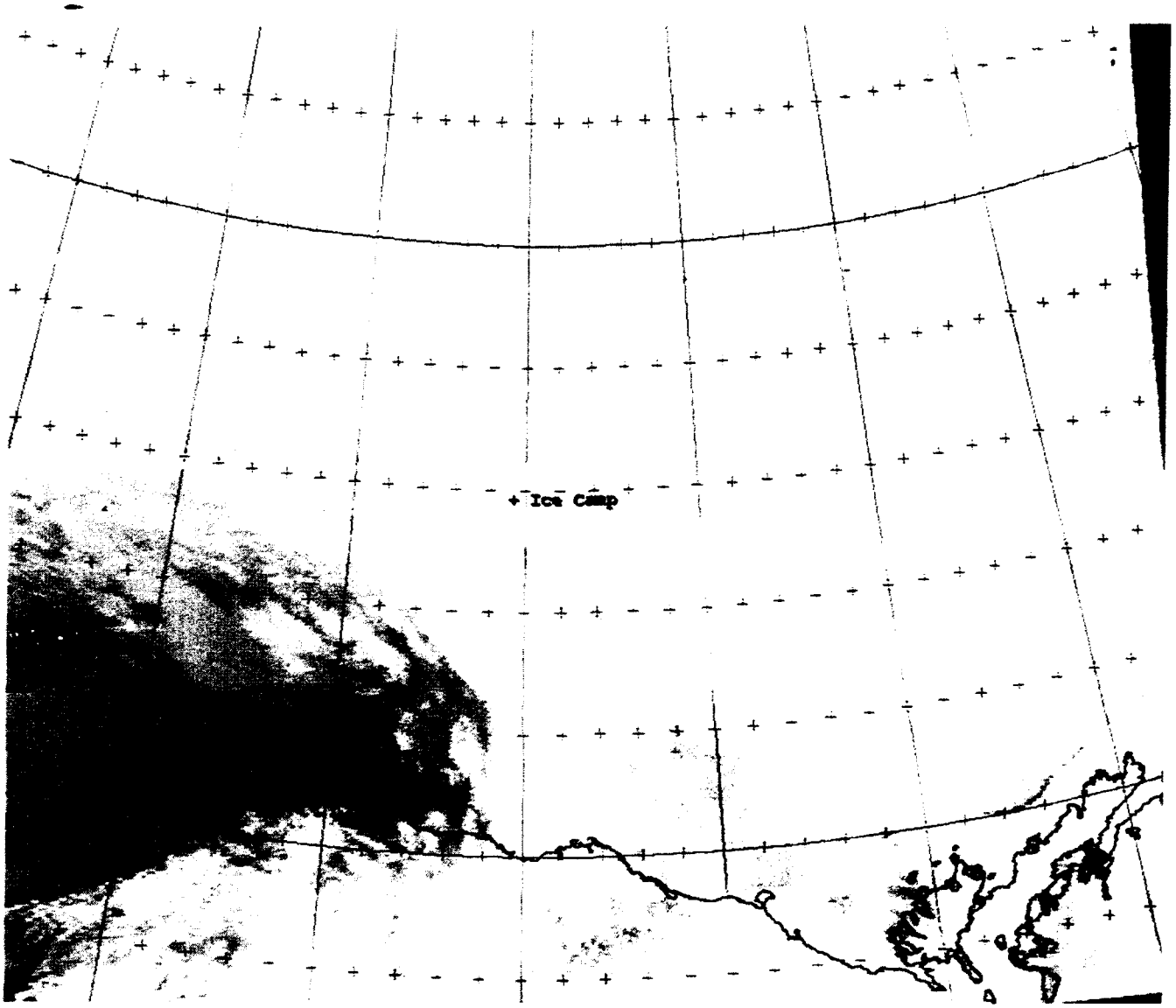
5 Apr 92 2104Z
DMSP OLS IR
Notable Features:

1. The companion infrared view is shown in this image. The low center developed where the frontal band "kinks" to the left near Barrow.
2. Cause for the heavy cloudiness over Banks Island is unknown since high pressure is shown over the area in Anchorage analyses.



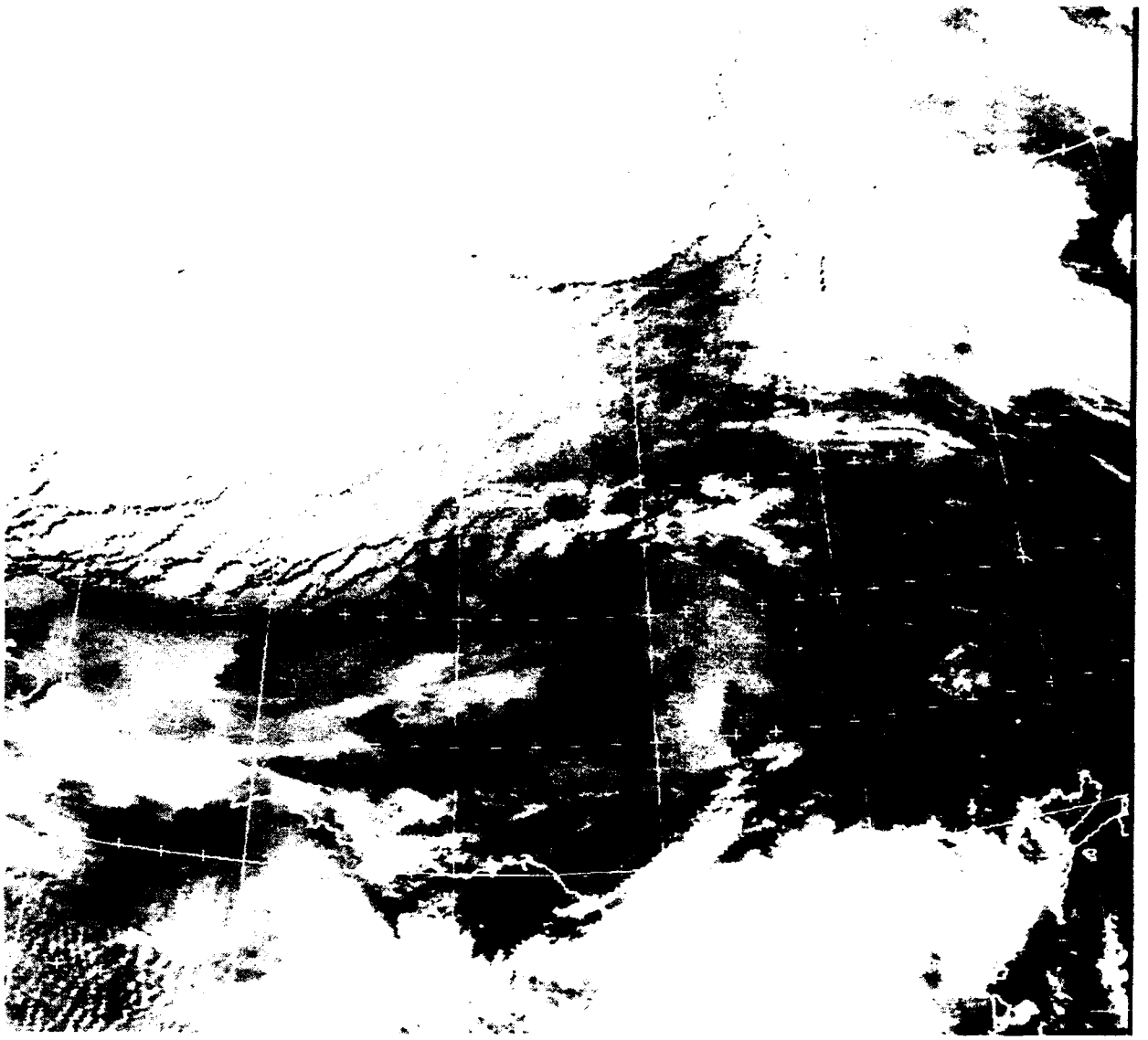
6 Apr 92 0235Z
DMSP OLS VIS
Notable Features:

1. The low center had moved past Barrow at this time. Barrow's winds were westerly at 30 kts sustained.
2. Note wave clouds south of Barrow indicating strong southwesterly winds aloft. A bright cloud streak off the NW tip of Barrow is a lead plume which extends well to the east.



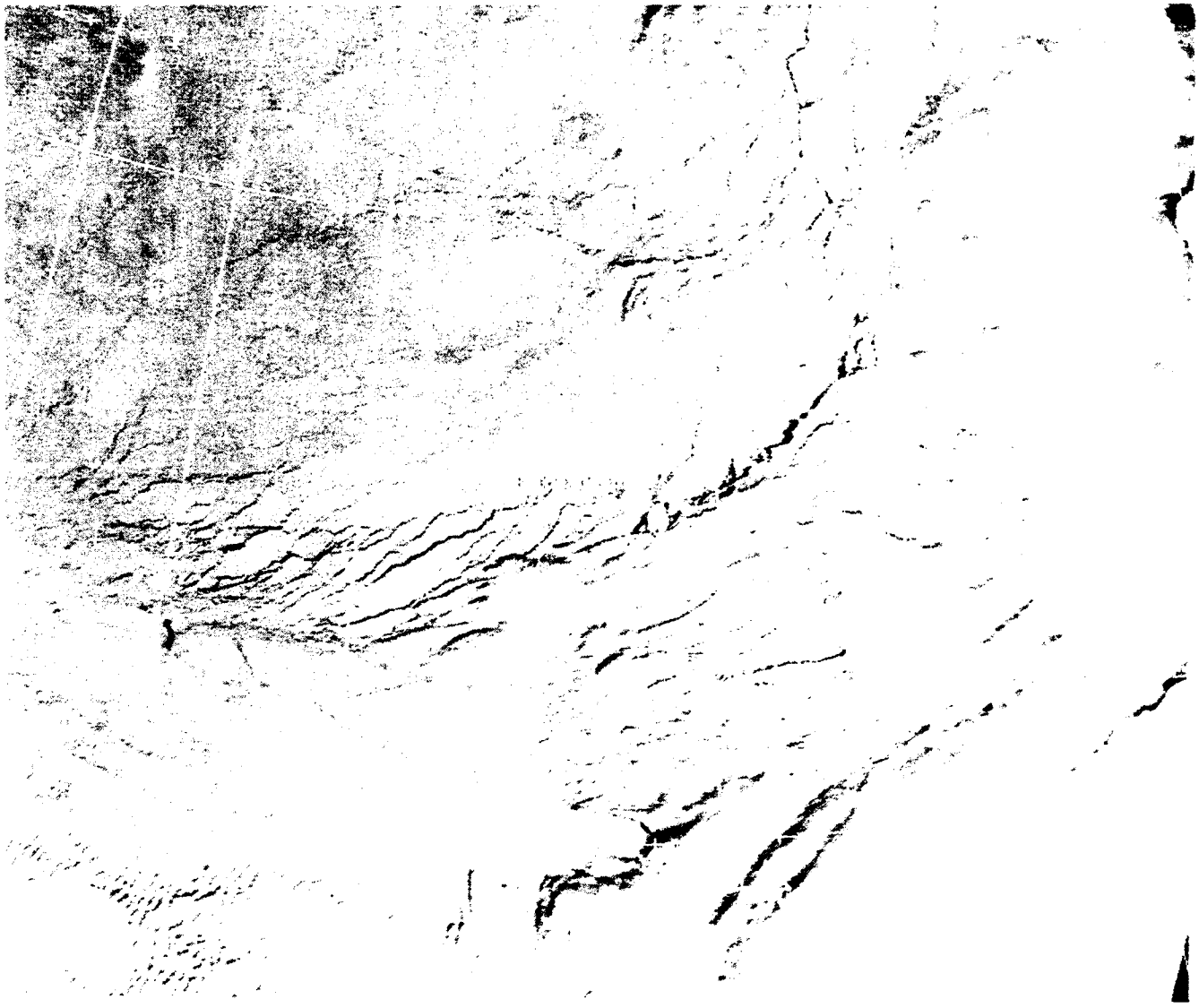
6 Apr 92 0235Z
DMSP OLS IR
Notable Features:

1. The companion IR view. Note the warm lead feature shown off the NW tip of Barrow. This aligns perfectly with the bright plume noticeable in the visible view. Apparently plume generation was instantaneous as the cold air passed over the open lead.



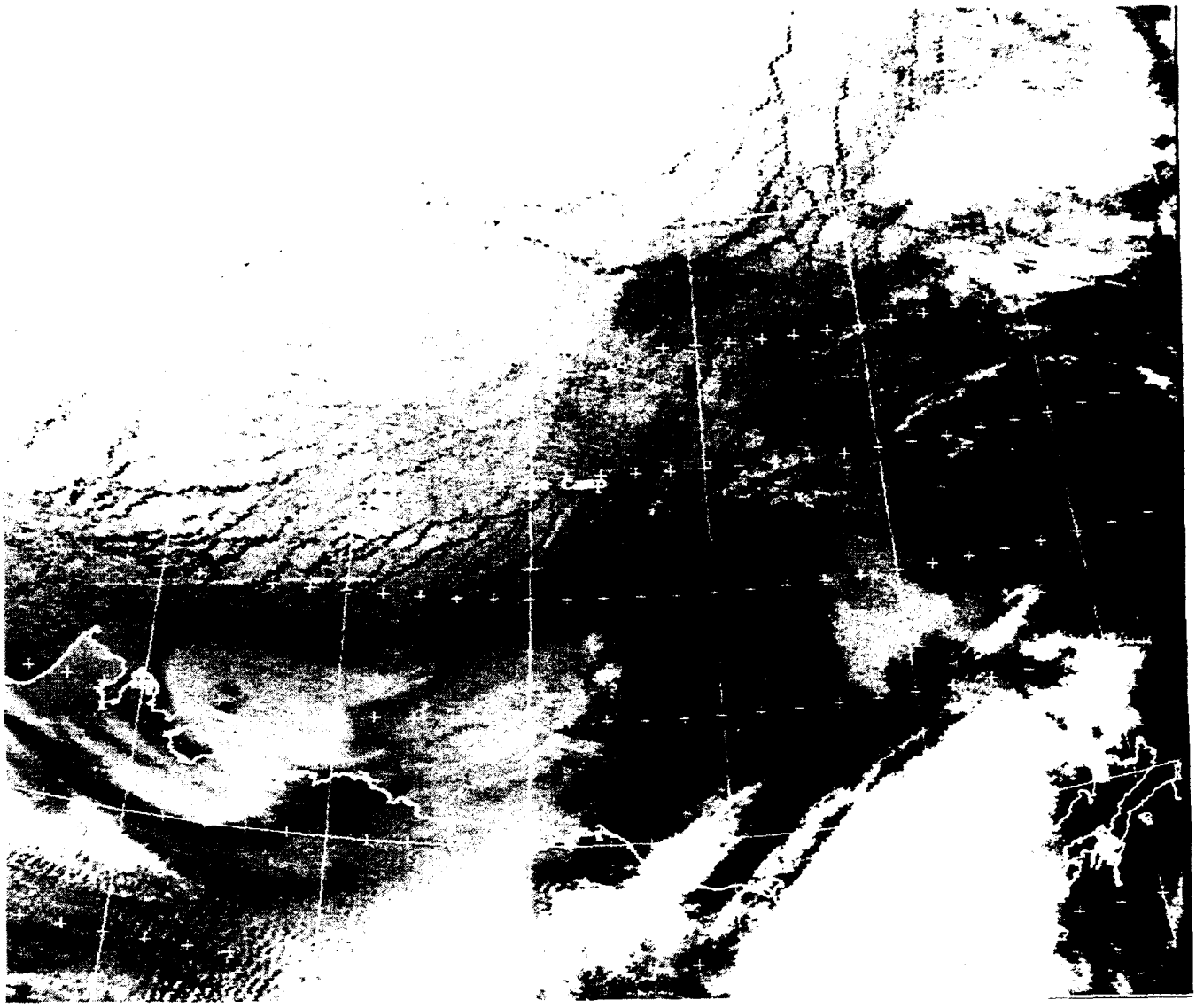
6 Apr 92 1619Z
DMSP OLS IR
Notable Features:

1. Apparent cloud forms near Barrow and to the east consist of blowing snow and fog generated in the strong cold winds of this storm. Westerly winds from 20-35 kts extend past Deadhorse.
2. Many new breaks in the drift ice are occurring north of the major lead leading NE of Barrow. Compare this image with the 4 April 0022Z visible view only two days earlier to appreciate this change.



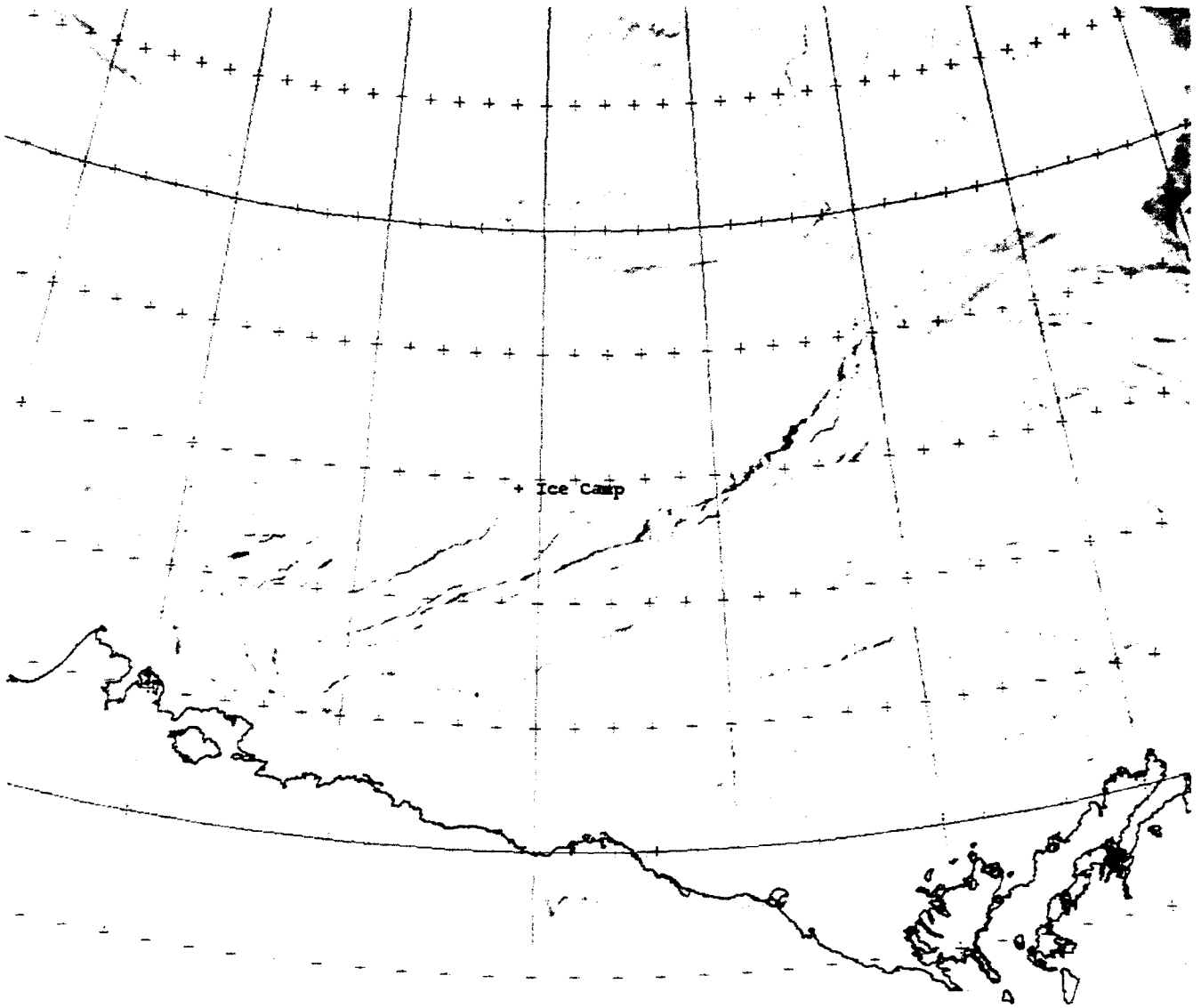
6 Apr 92 1855Z
DMSP OLS VIS
Notable Features:

1. The area from Barrow past Deadhorse is still experiencing strong westerly flow with near zero visibility in blowing snow and fog. Note wave cloud action to the south reflecting the intensity of this flow.
2. Chunks of the fast ice are beginning to break near Barrow.



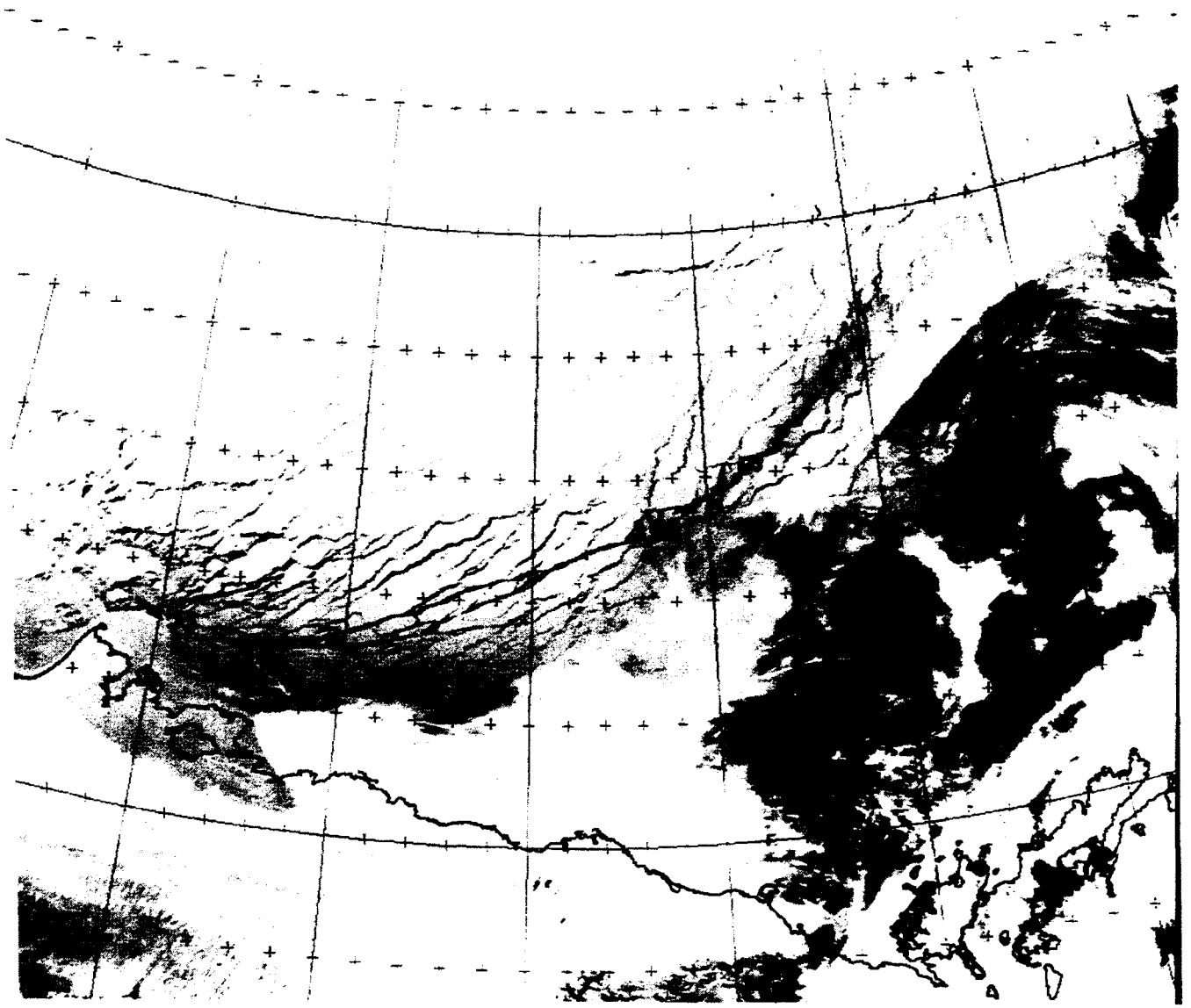
6 Apr 92 1855Z
DMSP OLS IR
Notable Features:

1. The companion IR view reveals a shear-induced vortex in the cloud form just east of Barrow.



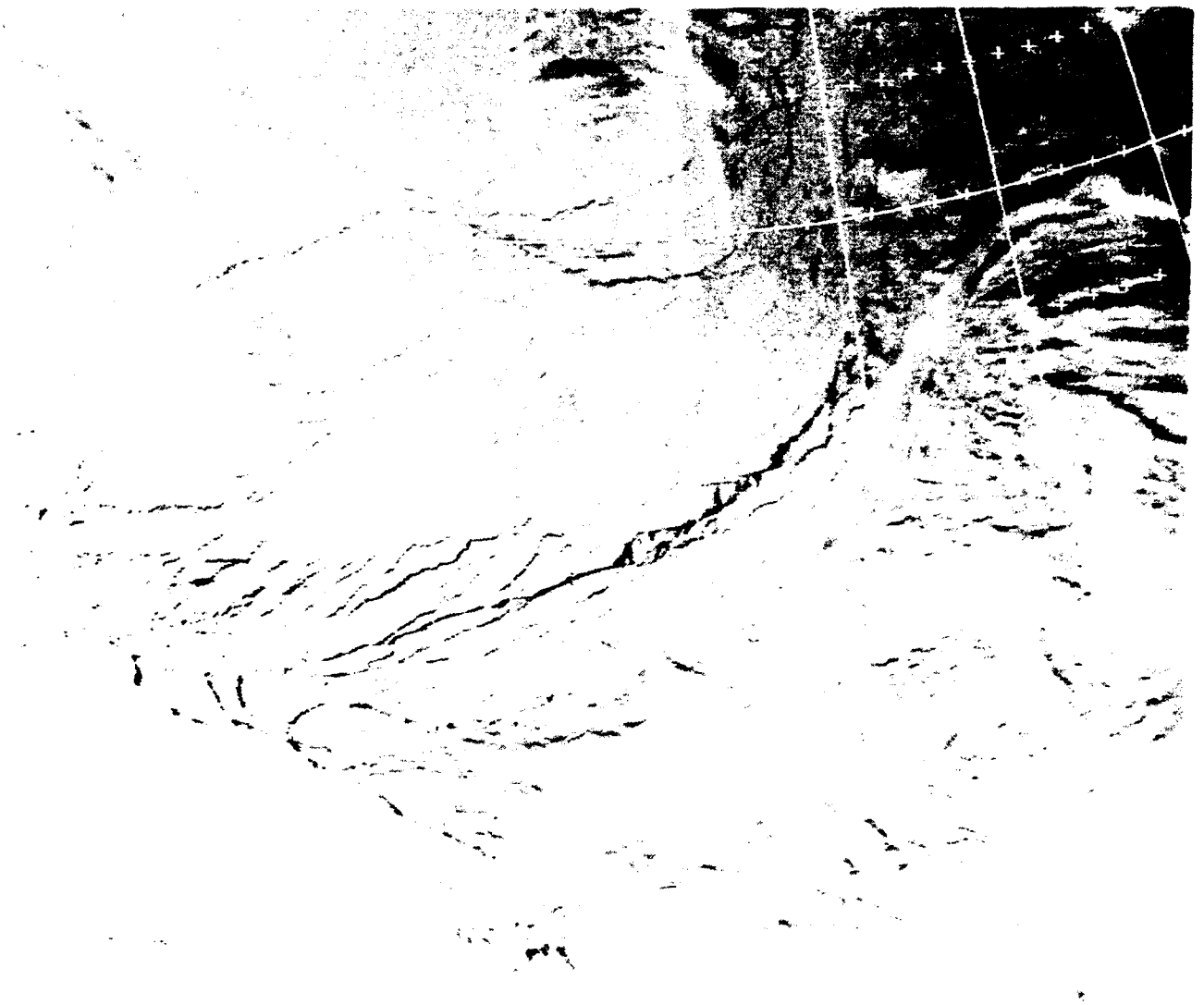
6 Apr 92 2205Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. A NOAA visible channel view of the area reveals the large floes of fast ice that have broken loose because of this storm.
2. Numerous lead fractures now appear north of the major lead noticeable south of the ice camp.
3. Note the small vortex SE of the ice camp in the frontal zone (Near 72N,139W).



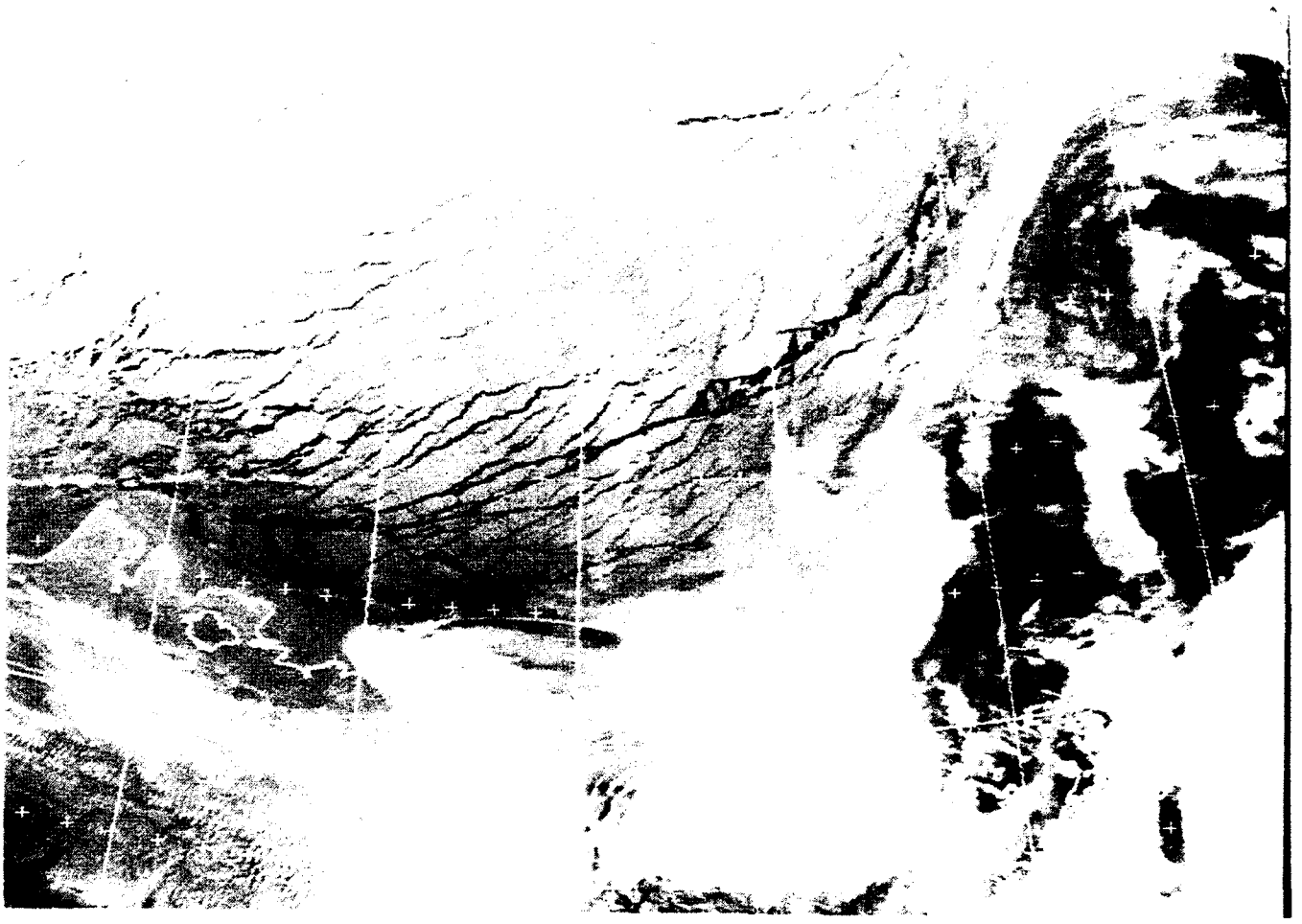
6 Apr 92 2205Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The companion NOAA IR view of the area shows the small vortex SE of the ice camp more distinctly.
2. Compare this view with the DMSP visible view less than 48 hrs earlier (5 April 0010Z) to appreciate the massive breaks that have been induced in the drift ice NE of Barrow.



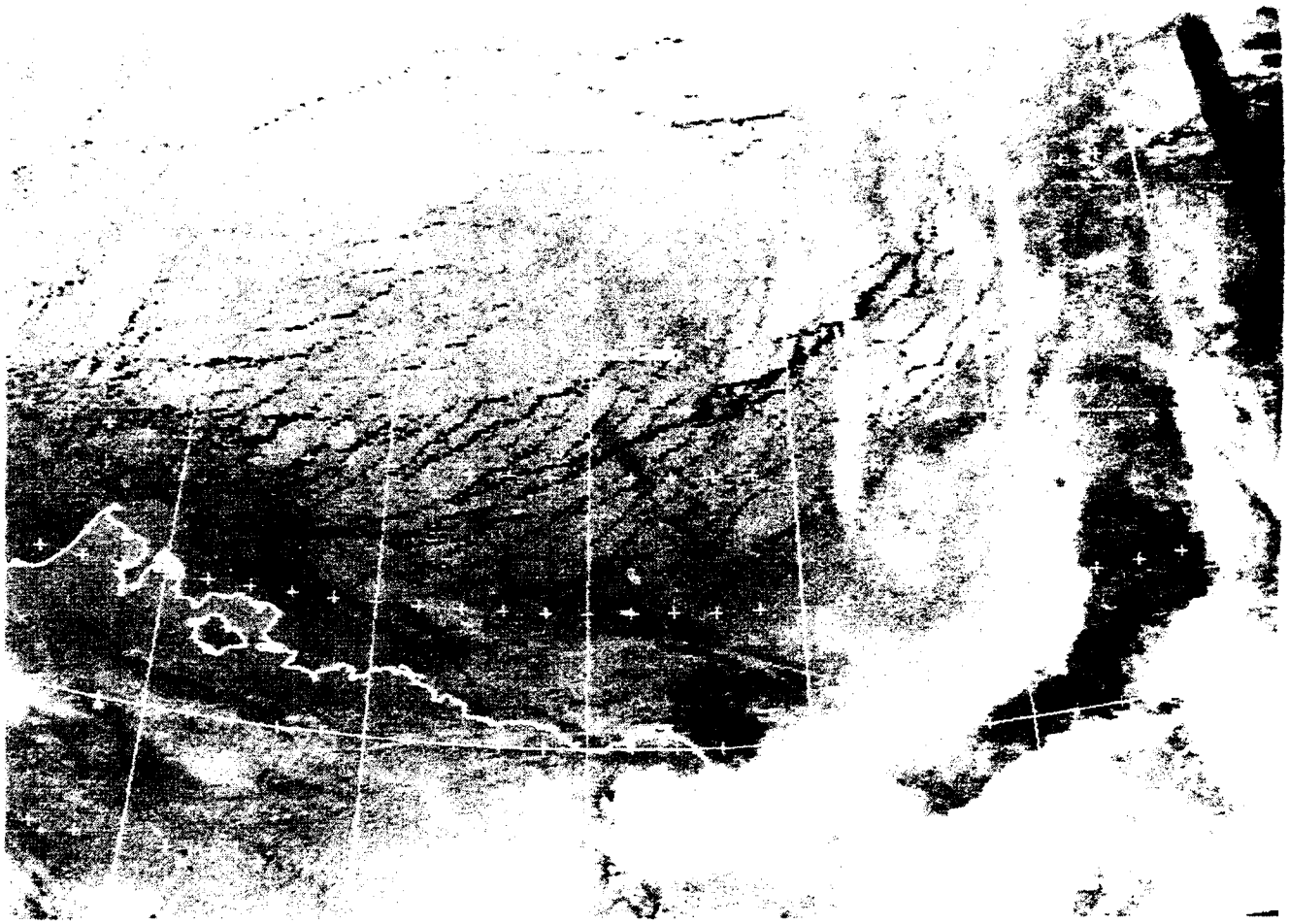
6 Apr 92 2346Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. Careful inspection will reveal cloud plumes extending from newly opened leads.
2. Cyclonic development is occurring in the area north of Herschel Island.



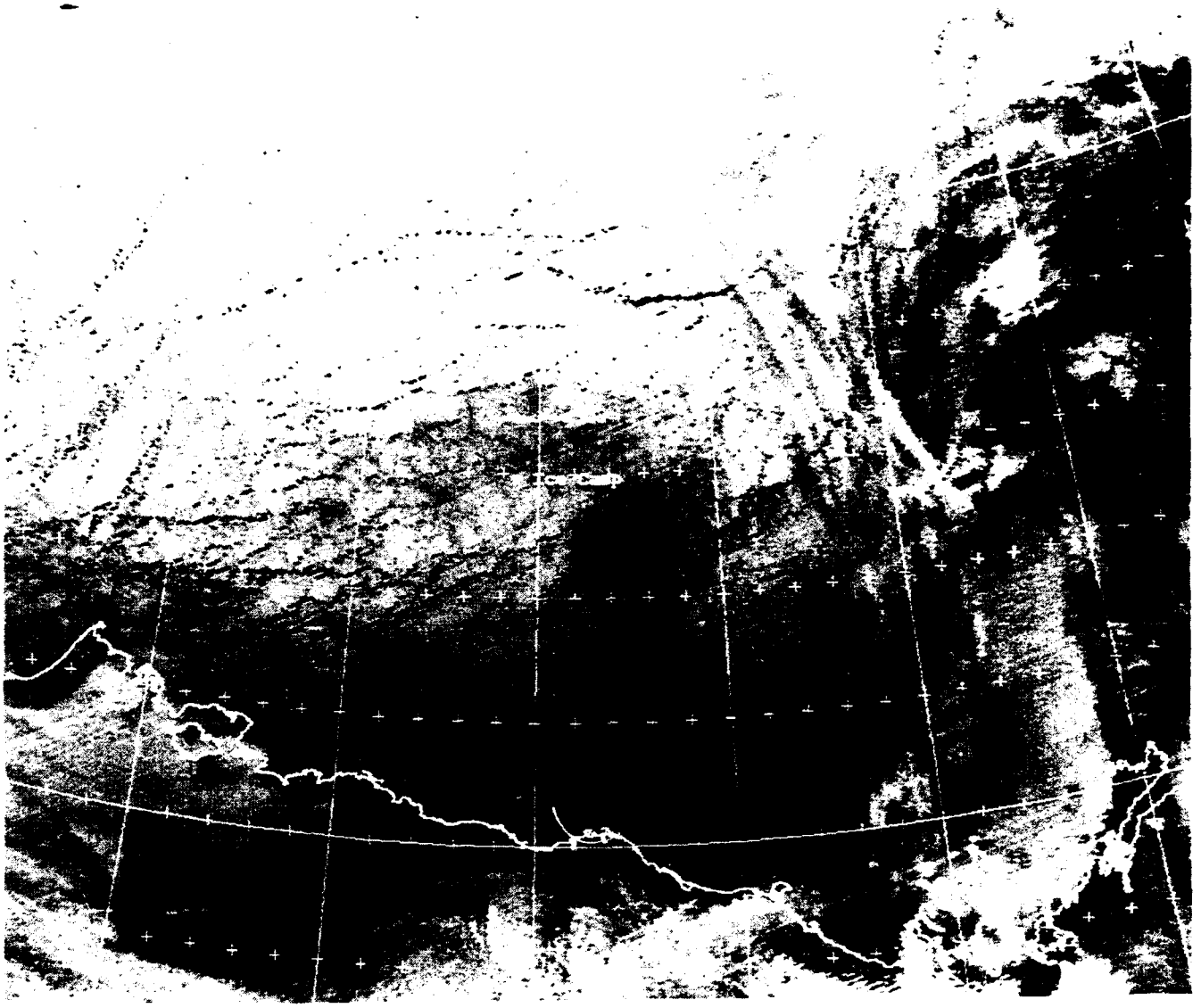
6 Apr 92 2346Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The companion NOAA IR view shows vortex development on the south end of the front.



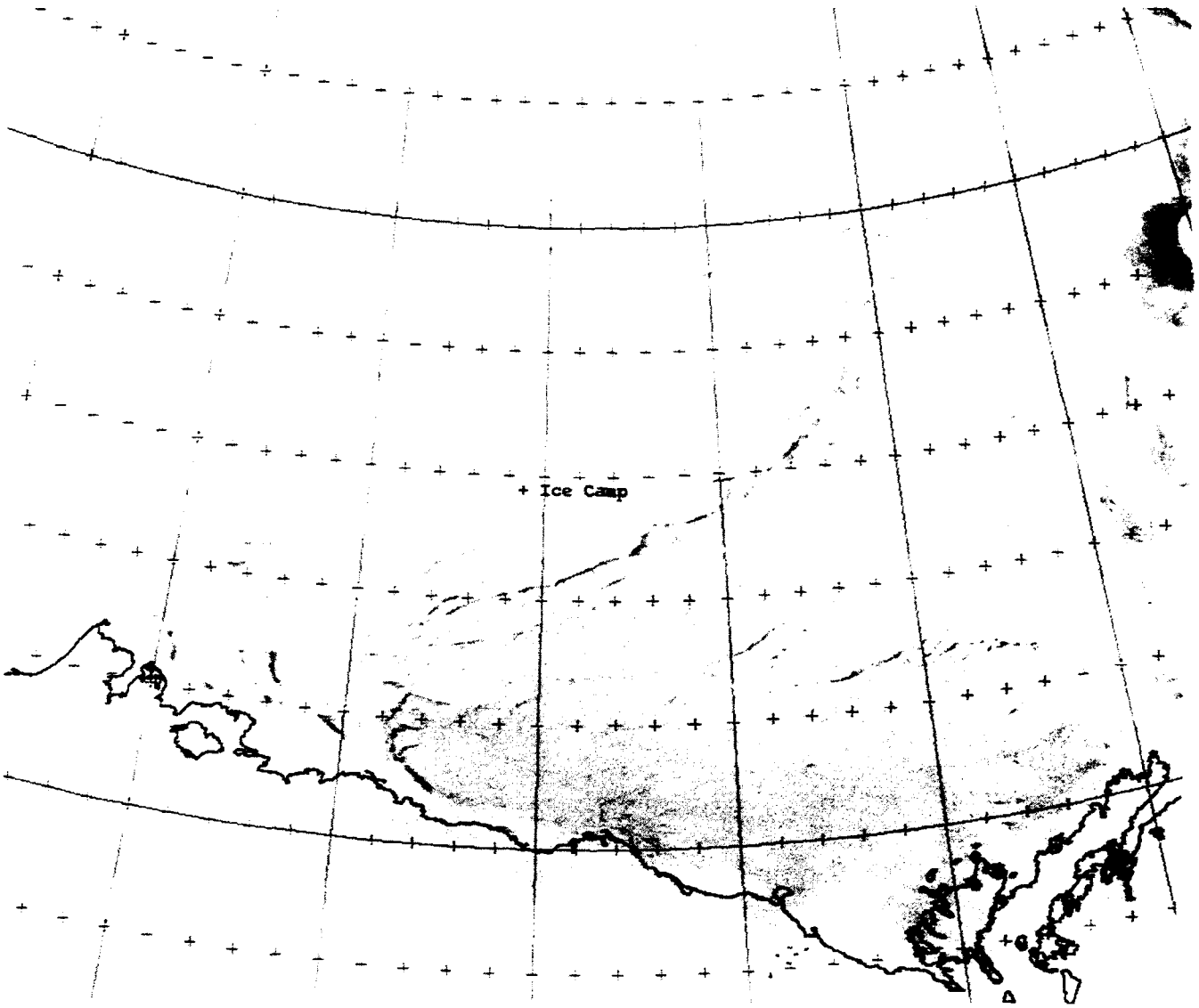
7 Apr 92 0222Z
DMSP OLS IR
Notable Features:

1. A vortex appears at the south end of the front. The vortex is located in a cyclonic shear region as analyzed by NORAPS with a closed circulation indicated further east (This analysis may be in error).



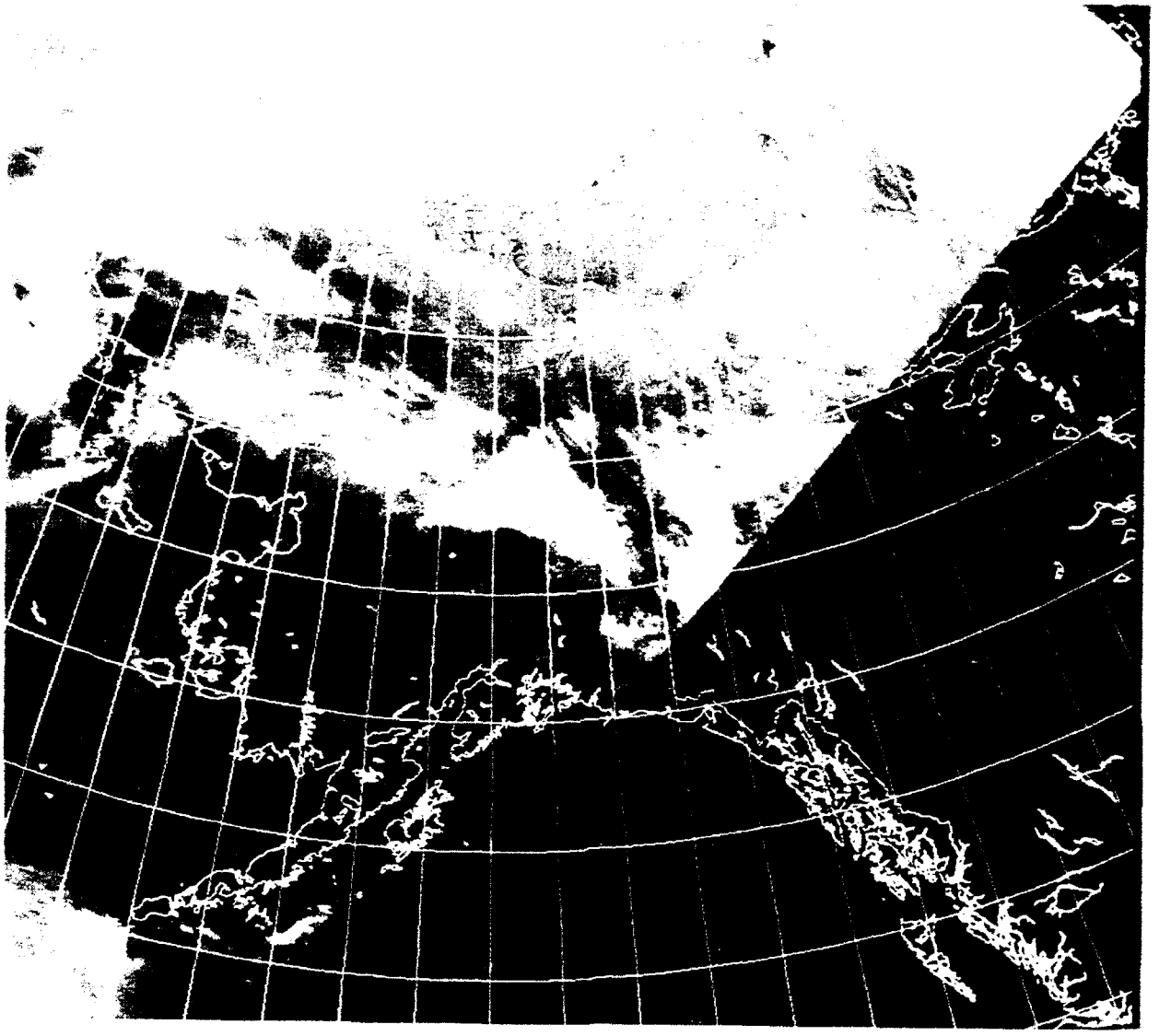
7 Apr 92 0449Z
DMSP OLS IR
Notable Features:

1. Some low, thin overcast is obscuring the ice camp area.
2. A vortex is apparent north of the Tuktoyaktuk Peninsula.
3. Wave clouds near the Mackenzie Delta reflect movement of a low level wind max over the area.



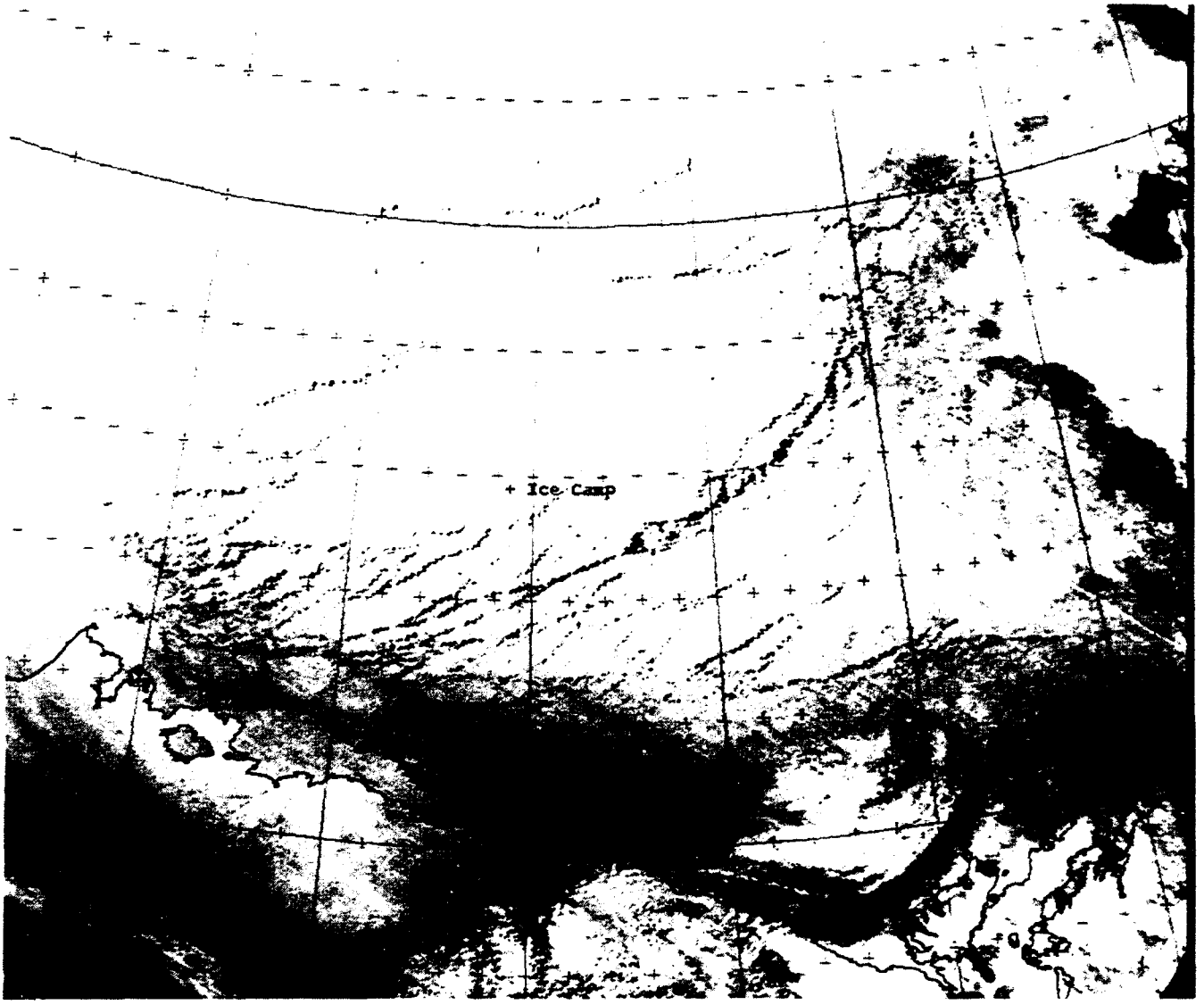
7 Apr 92 1332Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Strong westerly winds still persist along the N. Slope.
2. Wave clouds reflect the strong WNW North Slope winds.
3. The low has now moved to a position near Banks Island.



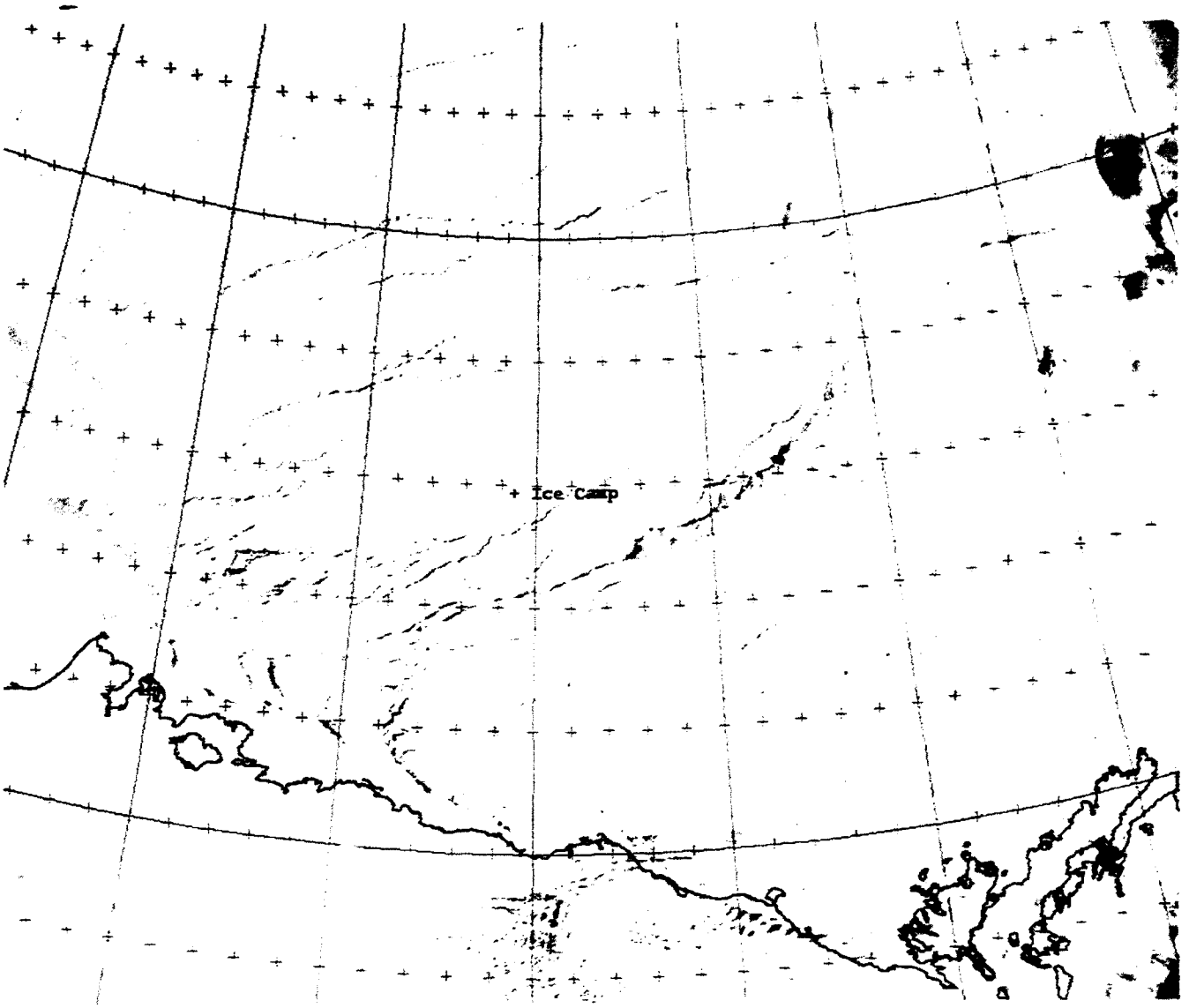
7 Apr 92 2002Z
DMSP OLS IR
Notable Features:

1. Most of the Beaufort Sea appears clear.
2. The surface analysis reveals that the Beaufort Sea is in an atmospheric col region between two lows.
3. High level northwesterly flow is implied passing over Barrow.



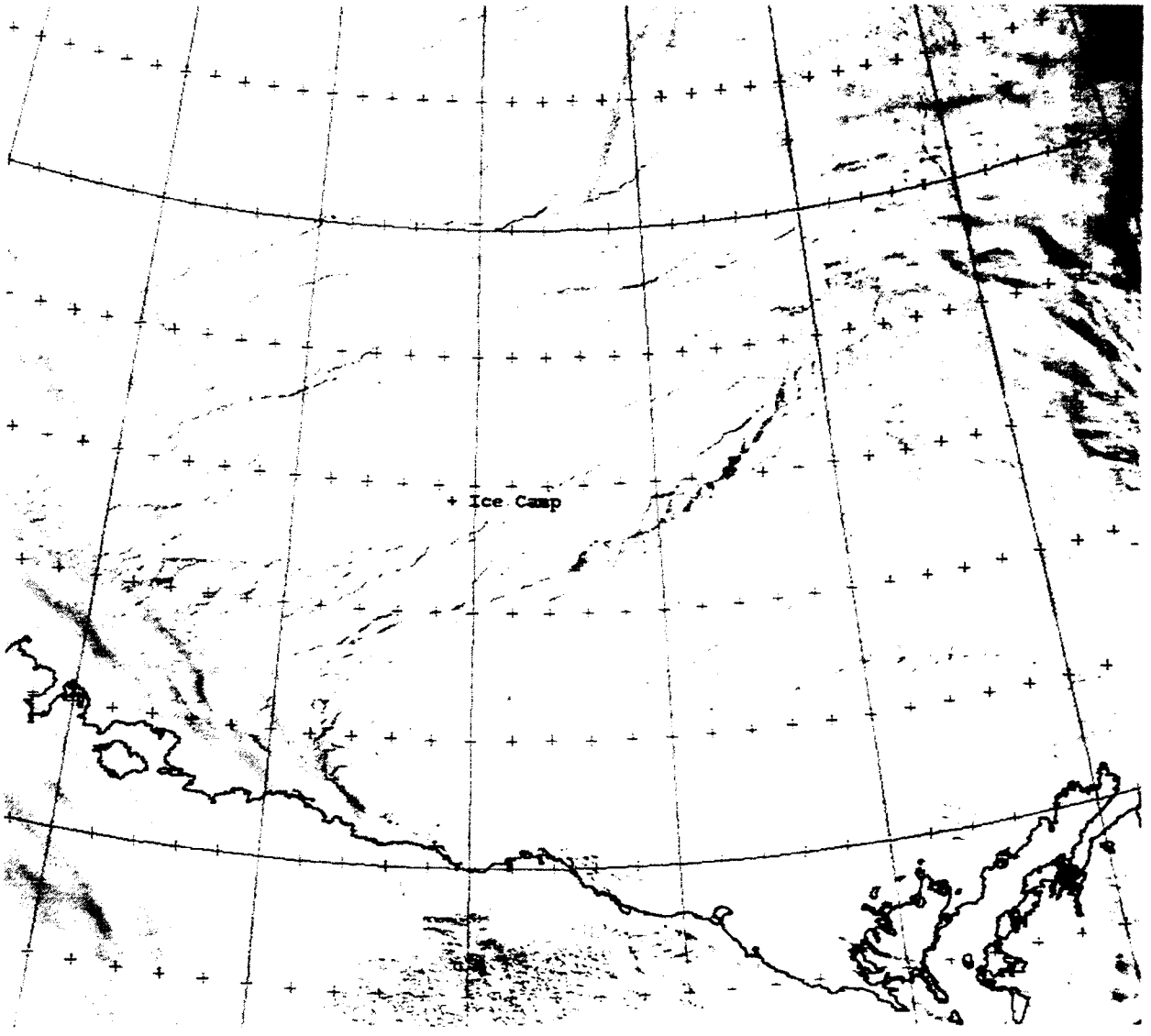
7 Apr 92 2003Z
DMSP OLS IR
Notable Features:

1. Details of lead structure appear in this largely clear view of the Beaufort Sea.
2. Indications of a vortex are suggested north of the Mackenzie River Delta.
3. NW-SE striations are an artifact of the image processing at this time.



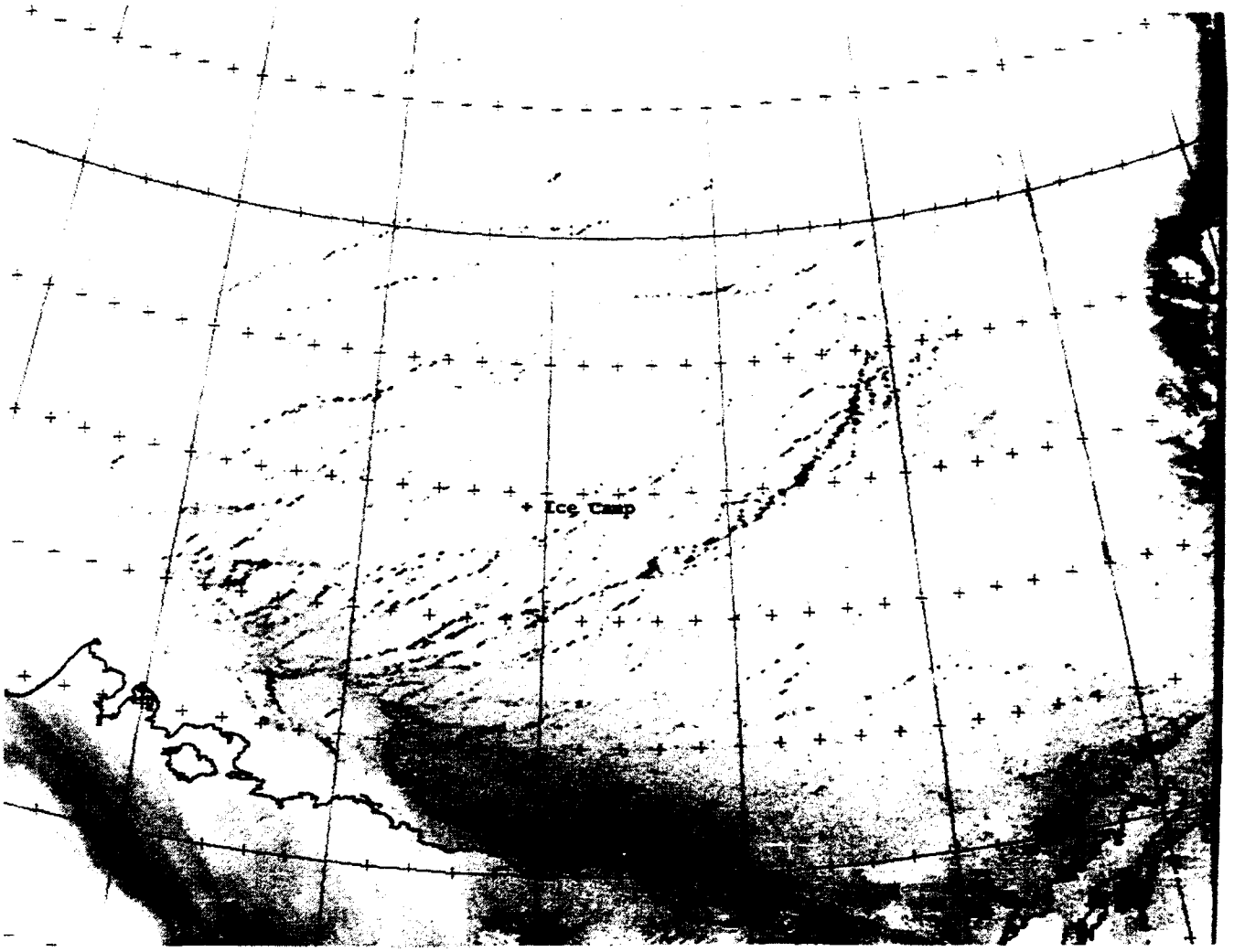
7 Apr 92 2003Z
DMSP OLS VIS
Notable Features:

1. This image shows the importance of having a visible view to compare with the IR. In this companion image to the previous view a vortex is now apparent west of Banks Island near 73.5N, 133W. A trough must extend from the feature north of the Mackenzie Delta to this low. A closed cyclonic circulation does appear on the NORAPS 700 mb analysis near 72.5N, 130W. The low represents the same low noted earlier at 07/0449Z.



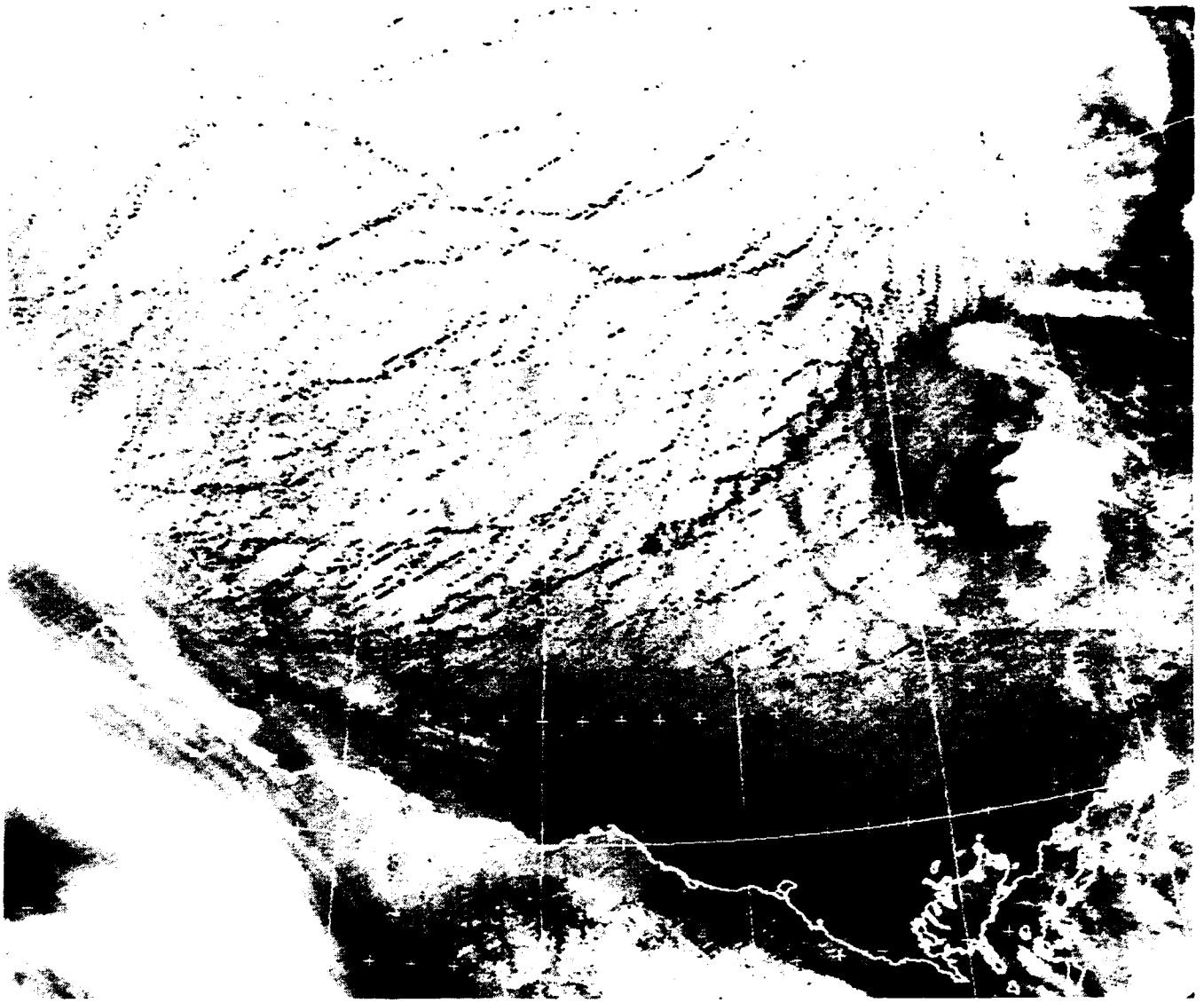
8 Apr 92 0027Z
DMSP OLS VIS
Notable Features:

1. The vortex west of Banks is very evident on this image near 72.5N, 132W.
2. Cirrus from NW flow of a disturbance to the west is now covering much of the western N. Slope area to Deadhorse.



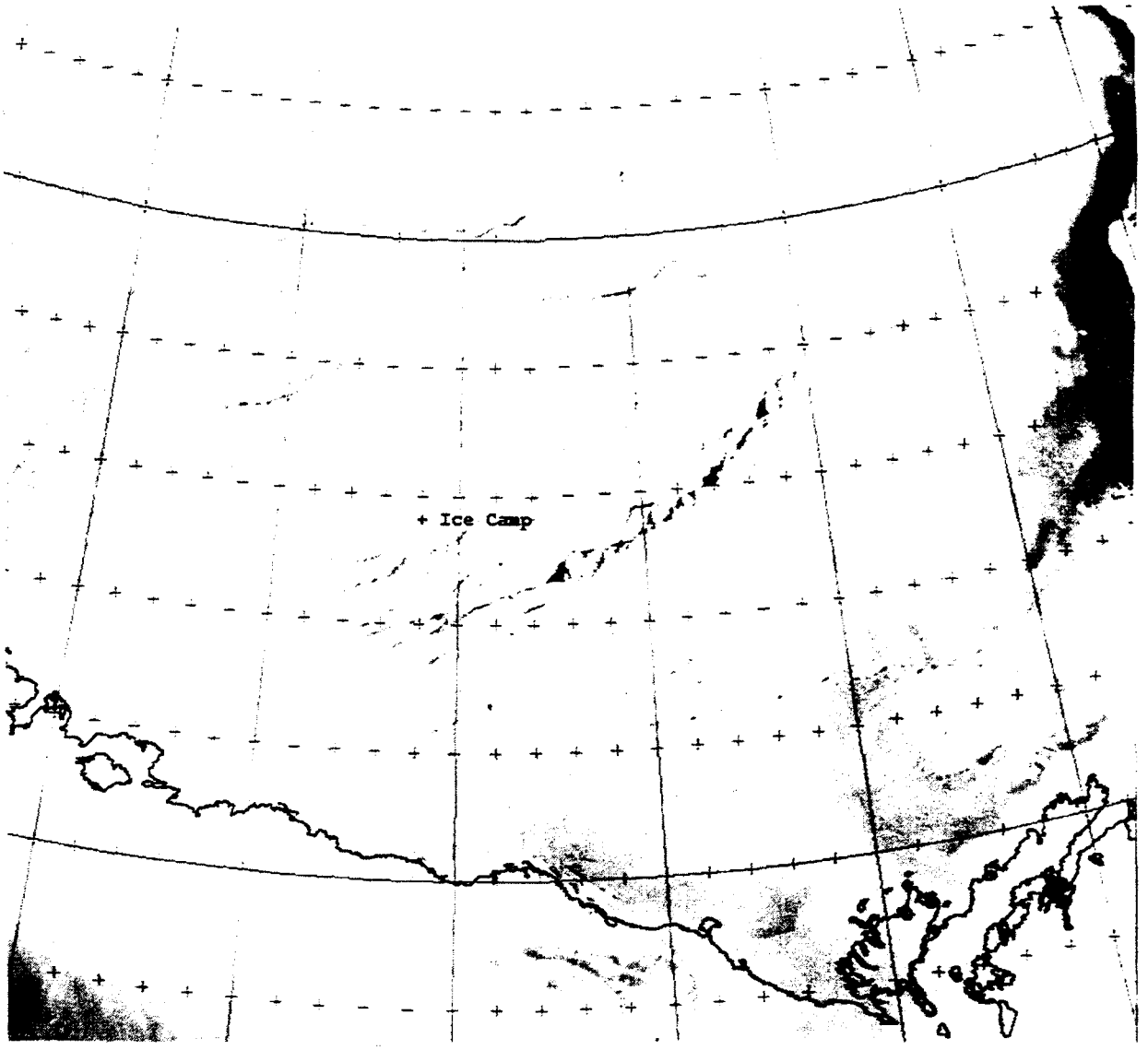
8 Apr 92 0027Z
DMSP OLS IR
Notable Features:

1. The companion IR view to the previous image loses much of the cloud form detail seen in the previous image which was necessary to delineate the vortex circulation center.
2. It may be concluded that visible imagery over ice is essential for the highest discrimination capability in terms of revealing cloud detail. (By the way, who ever suggested that it was difficult or impossible to recognize cloud detail over a snow or ice covered surface? They must have been unaware of multi-channel satellite data analysis).



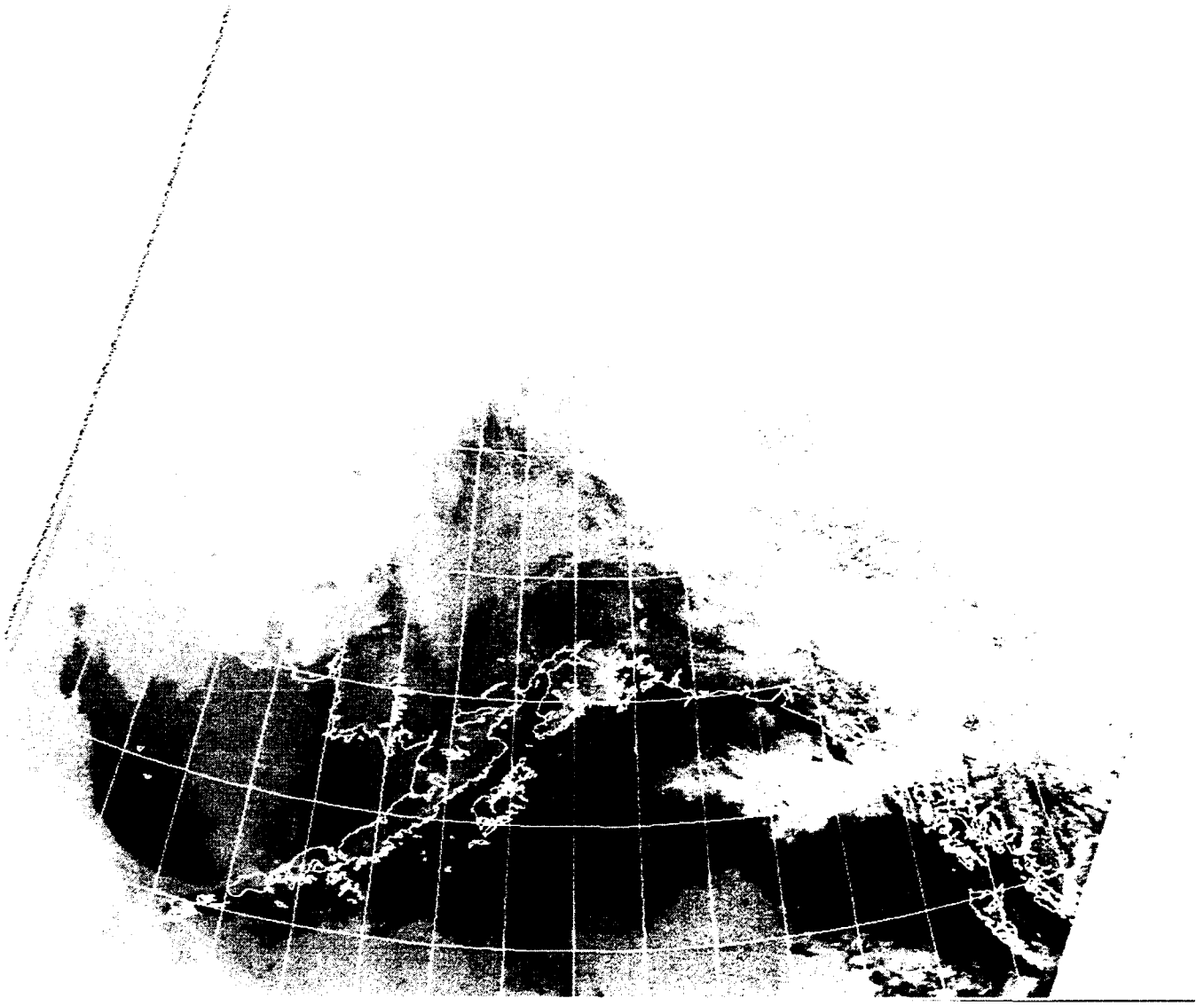
8 Apr 92 0418Z
DMSP OLS IR
Notable Features:

1. A beautiful example of the vortex centered west of Banks Island is shown in this depiction.
2. Note further fragmentation of the previous fast ice shelf with huge floes breaking off north and northeast of Deadhorse.
3. The tendency toward warmer ice temperatures further south is real and clearly revealed in this image with a very warm ice area surrounding Herschel Island.



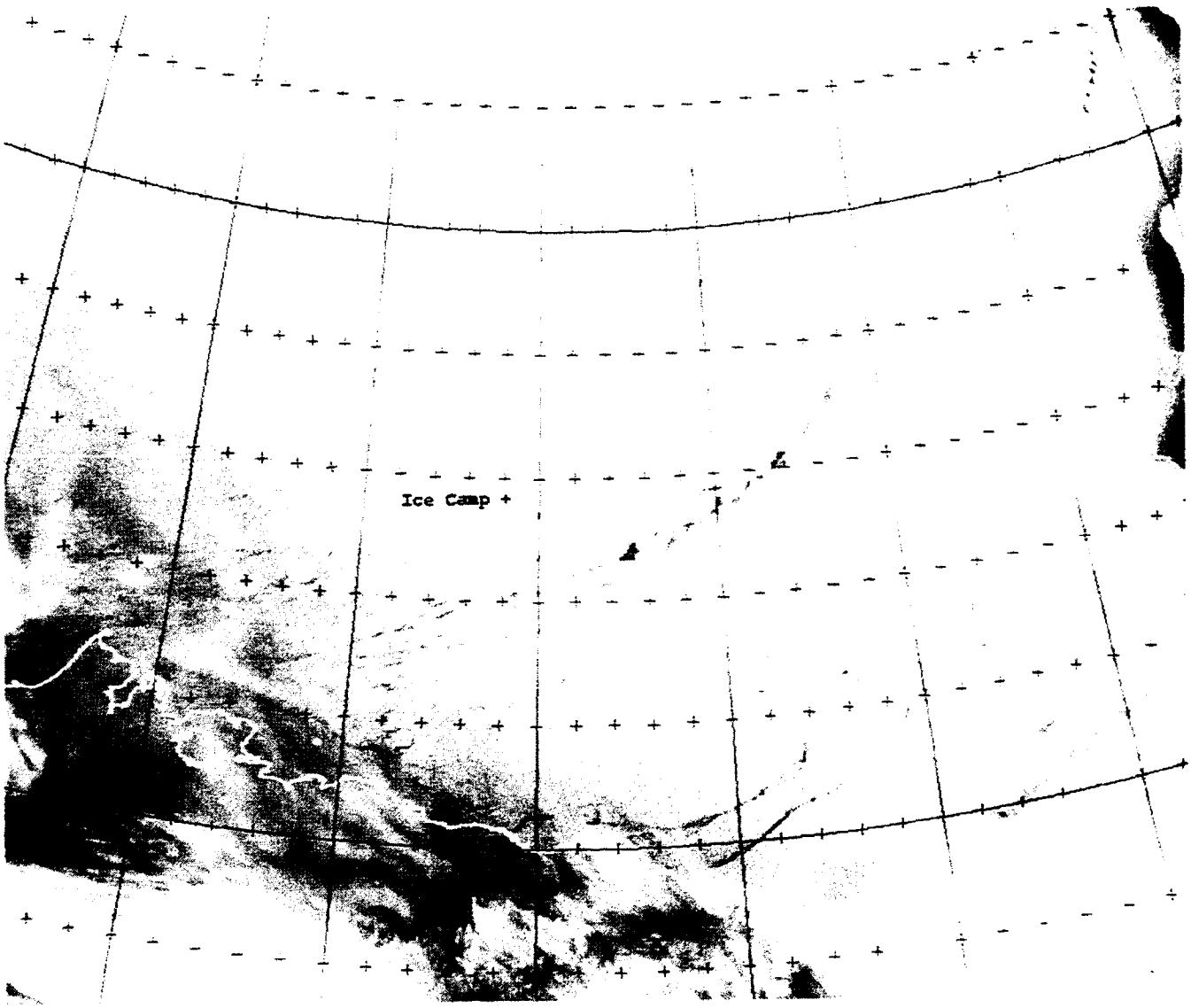
8 Apr 92 1500Z
NOAA AVHRR CH 4 IR
Notable Features:

1. A NOAA depiction suggests that the Banks vortex is moving eastward out of the area.



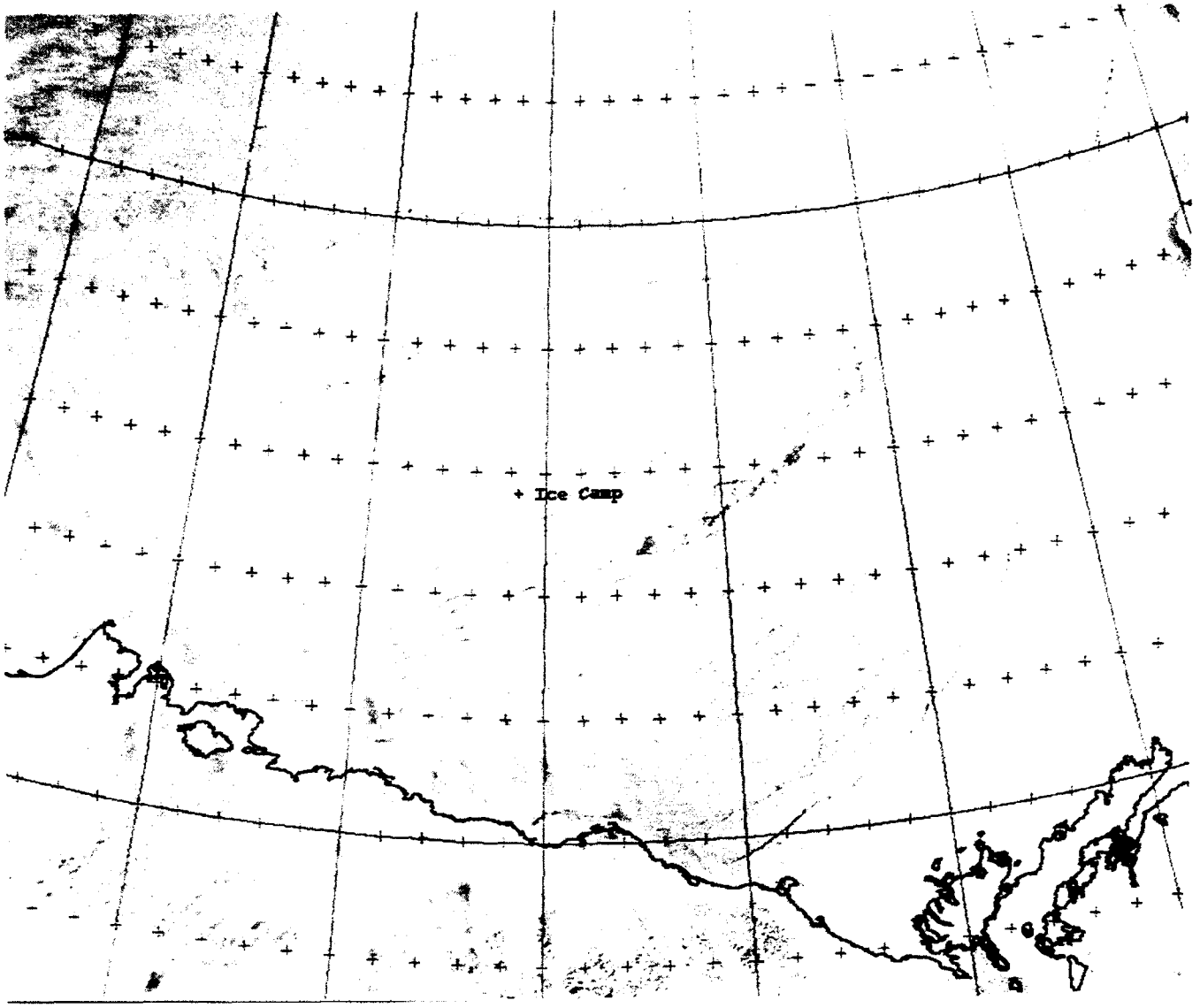
8 Apr 92 1932Z
DMSP OLS IR
Notable Features:

1. This larger scale image reveals a massive system to the west presumably moving into the Leadex area.



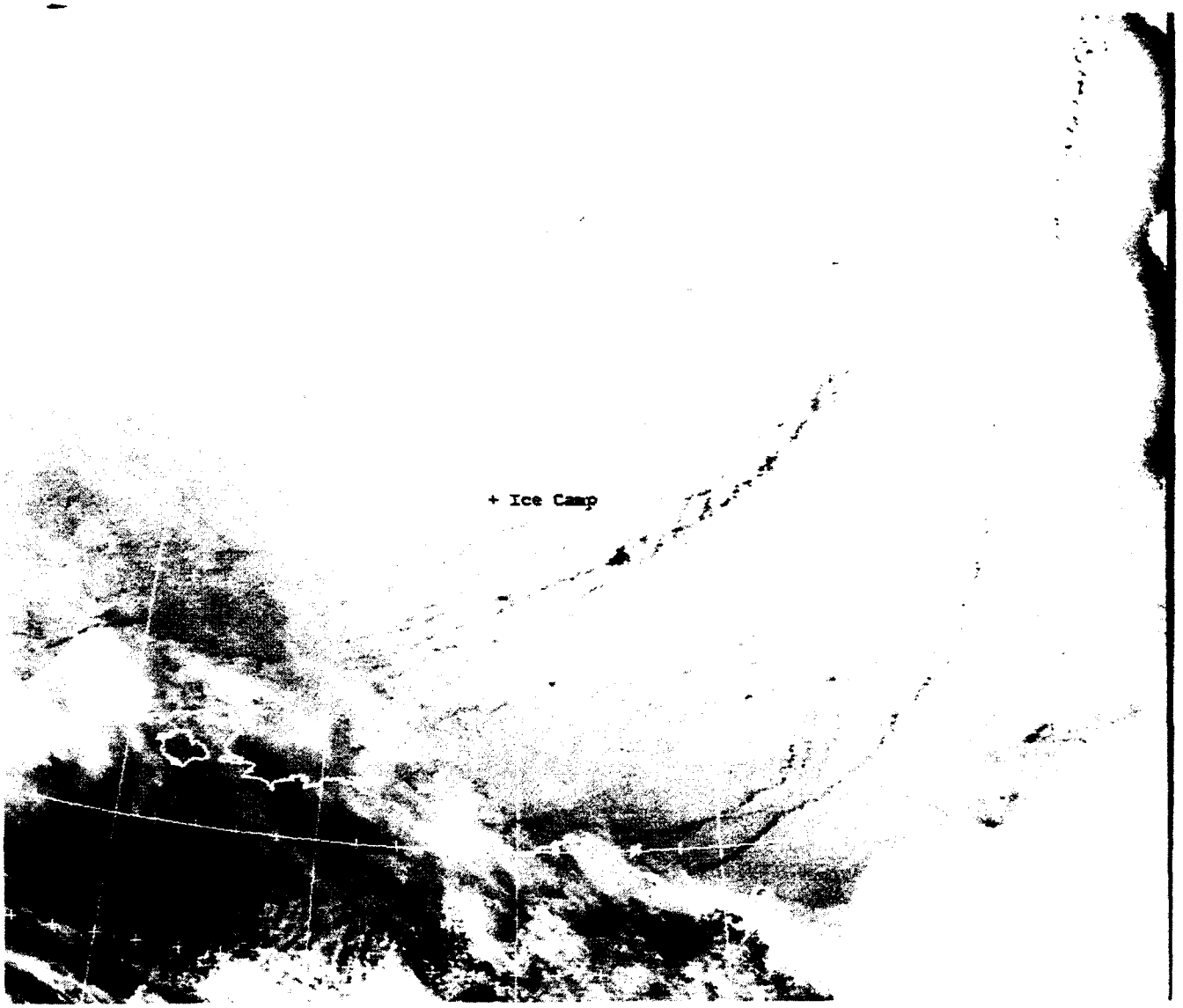
9 Apr 92 1448Z
NOAA AVH R CH 4 IR
Notable Features:

1. Not much change weather-wise. Some new leads are evident north of Herschel Island.



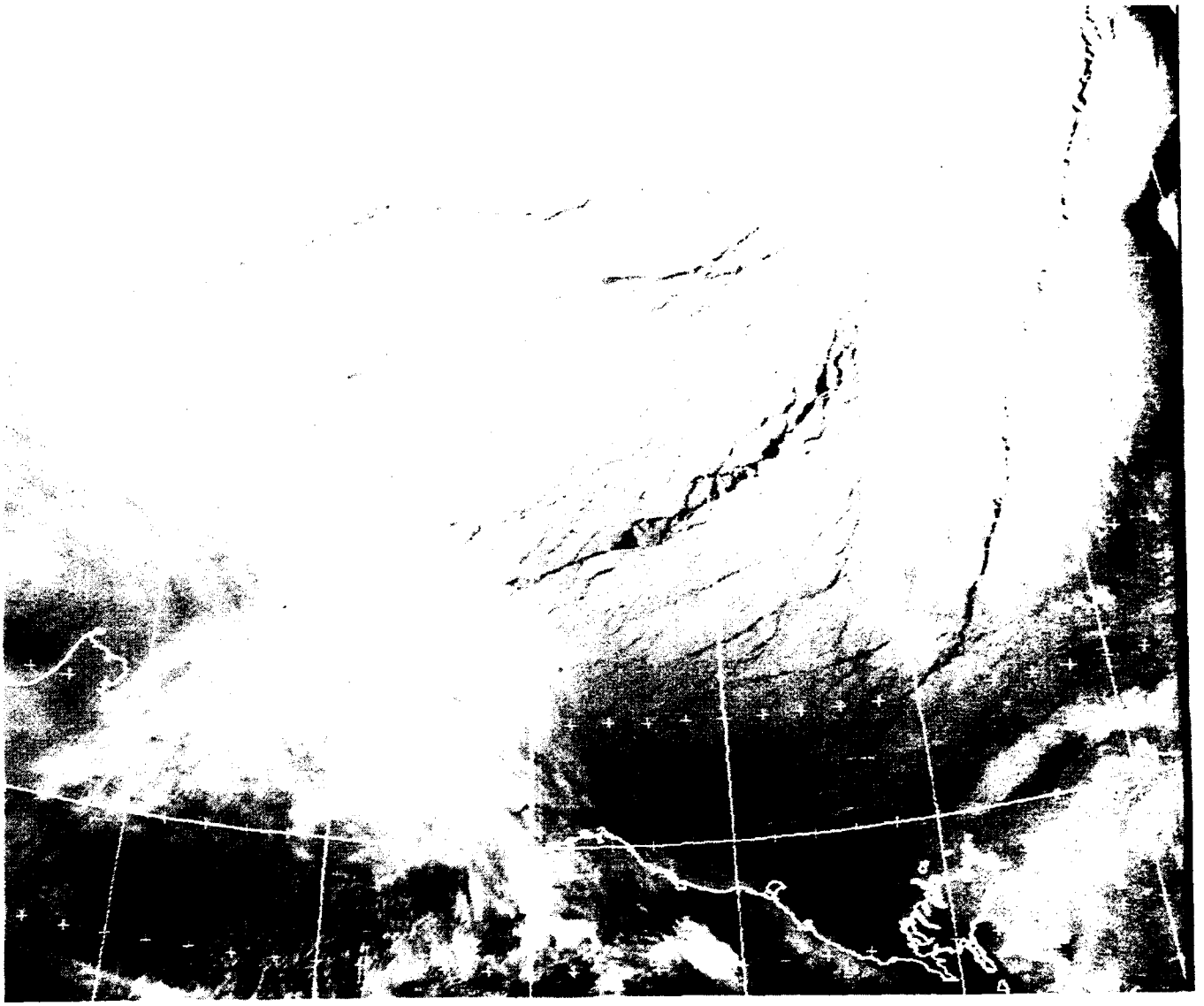
9 Apr 92 1722Z
DMSP OLS VIS
Notable Features:

1. Now we see the encroachment of the system to the west over the Leadex area.
2. Strong upper level NW flow is indicated by the cirrus stramers. This is confirmed by the 08/12Z NOGAPS 500 mb analysis. Further rapid eastward movement of this flow however is not suggested in the NOGAPS 24 hr forecast (However, NORAPS shows a closed cyclonic center moving over Barrow by 09/12Z).



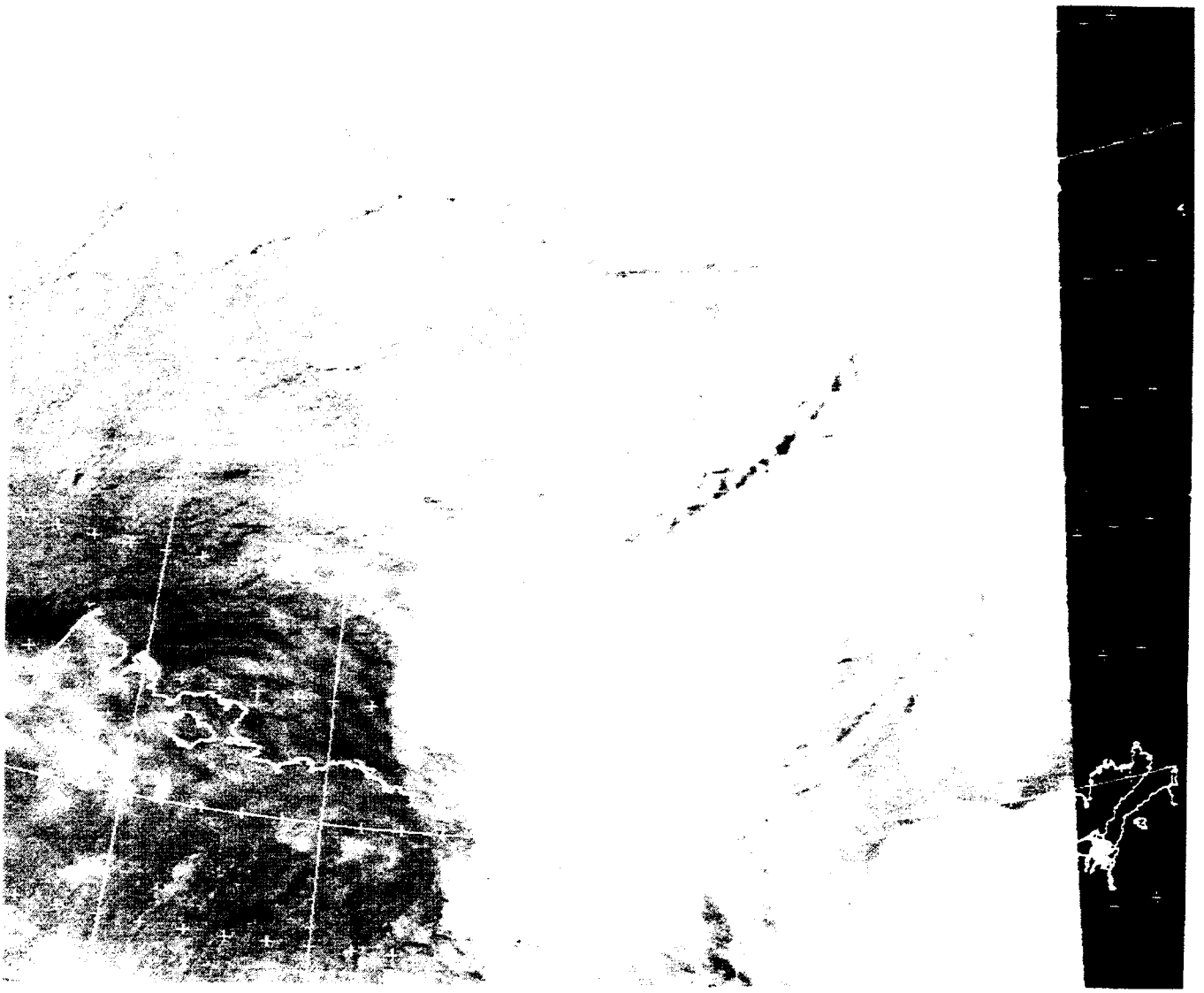
9 Apr 92 1722Z
DMSP OLS IR
Notable Features:

1. The companion DMSP IR image shows effects of warming north of the Mackenzie Delta.
2. Note ice thickness (age) gradient suggested by the IR data surrounding the Banks Island polynya.



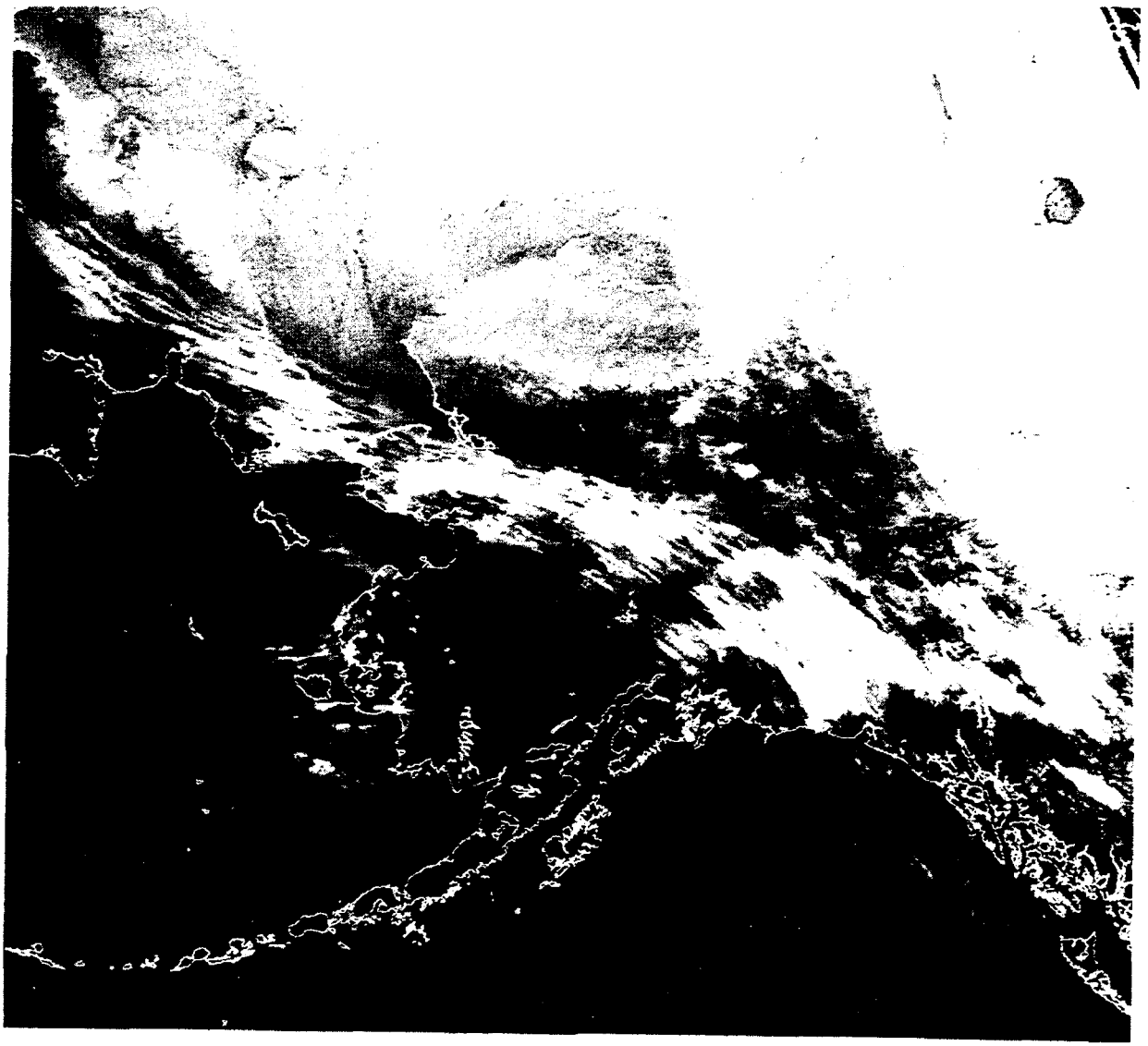
9 Apr 92 2129Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The low west of Barrow moved into the area faster than forecast. A center is evident in this image just NW of Barrow.
2. The lead extending from 70N, 140W, NW of Herschel Island reaches NE'ward over 500 nm to beyond the image boundary.



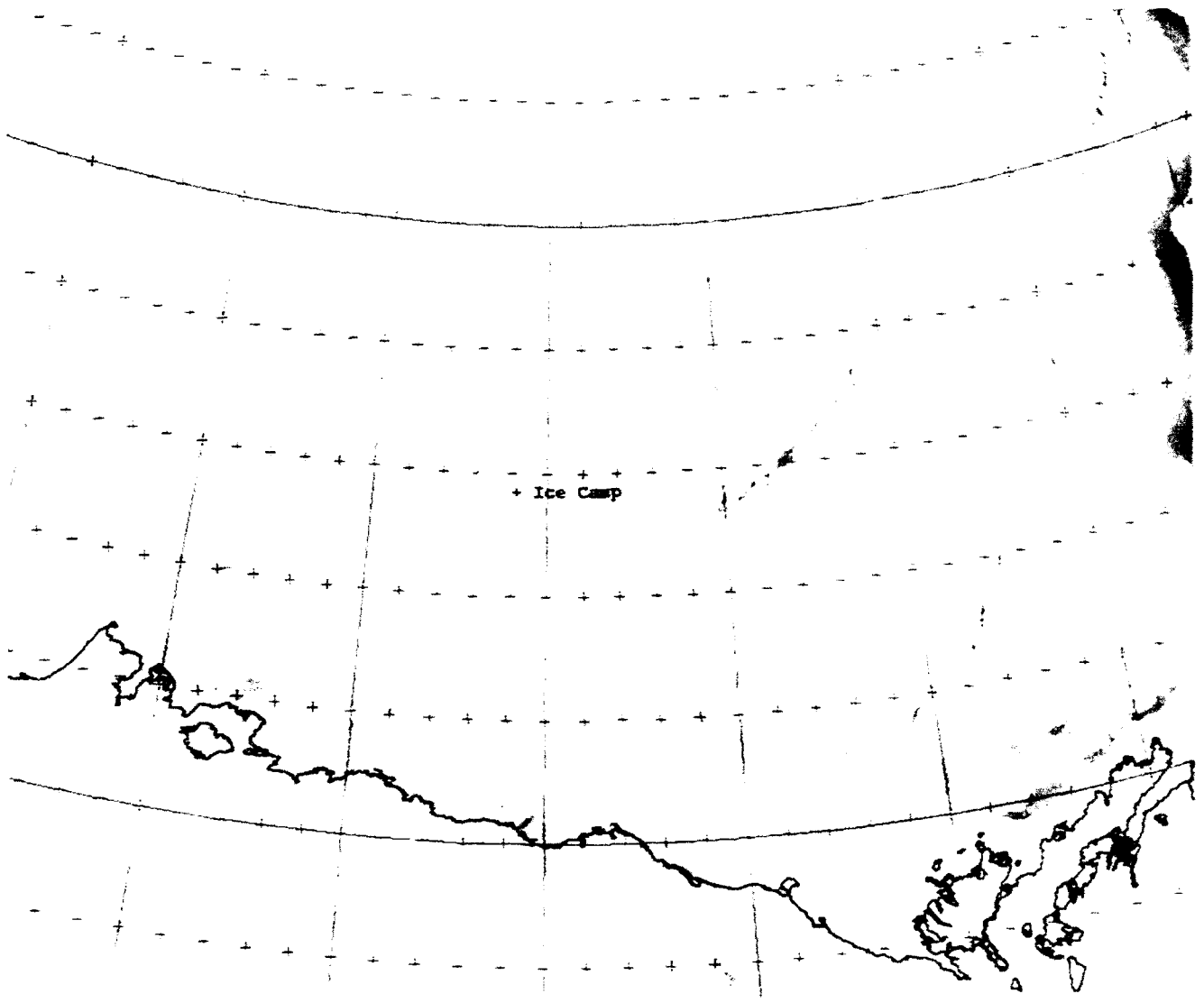
10 Apr 92 0437Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Although Anchorage surface charts now show the low deep in central Alaska this image suggests a center just SE of Barrow. Surface wind shifts in the region confirm a center near Barrow.



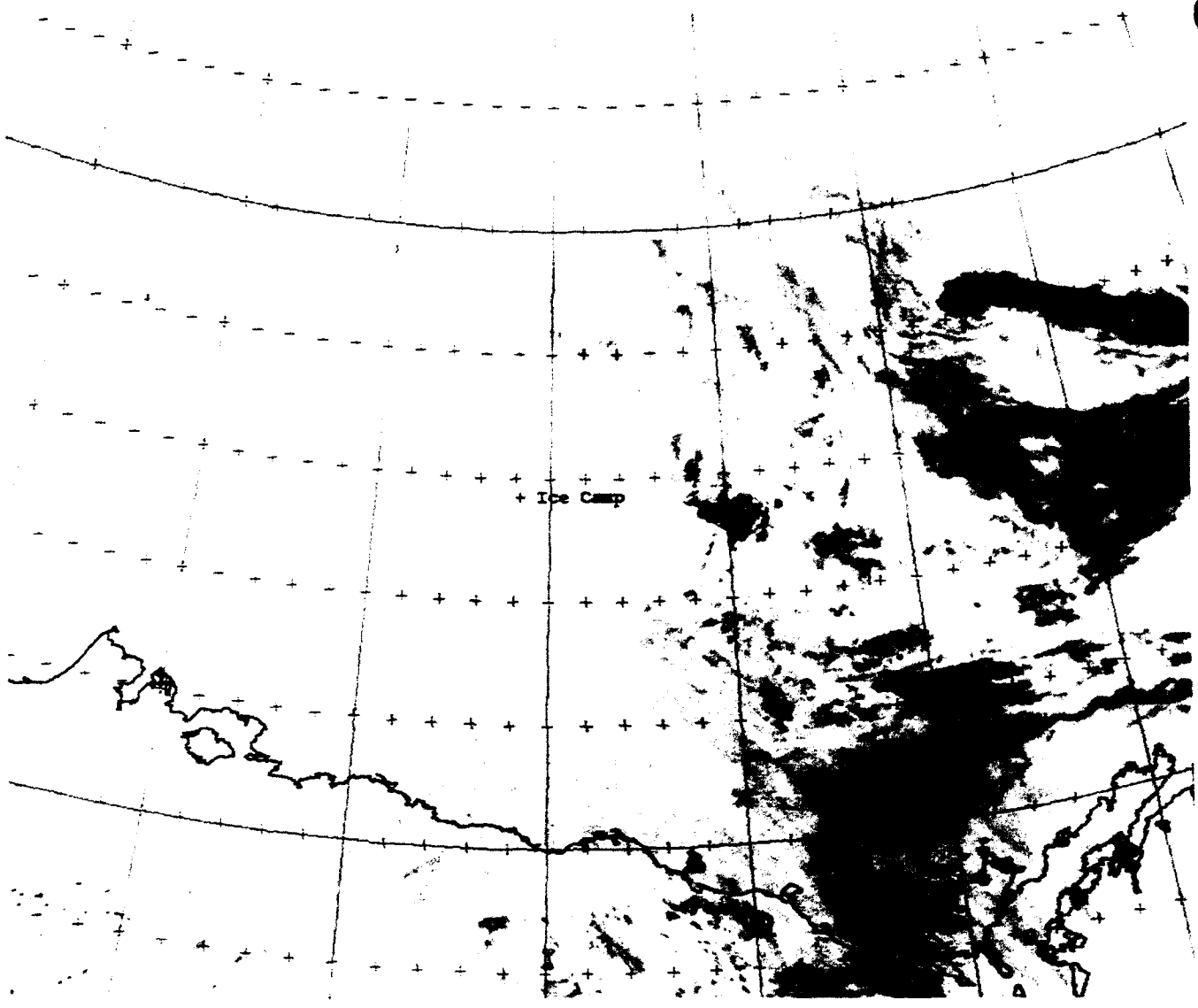
10 Apr 92 0451Z
DMSP OLS IR
Notable Features:

1. A larger-scale DMSP view confirms trough or low activity near the N. Slope east of Barrow, with a possible secondary vortex developing SE of Deadhorse in the lee of the Brooks Range.
2. Note vertically propagating wave clouds under jet stream passing through central Alaska.
3. The ice is weakening markedly in the western Amundson Gulf area.



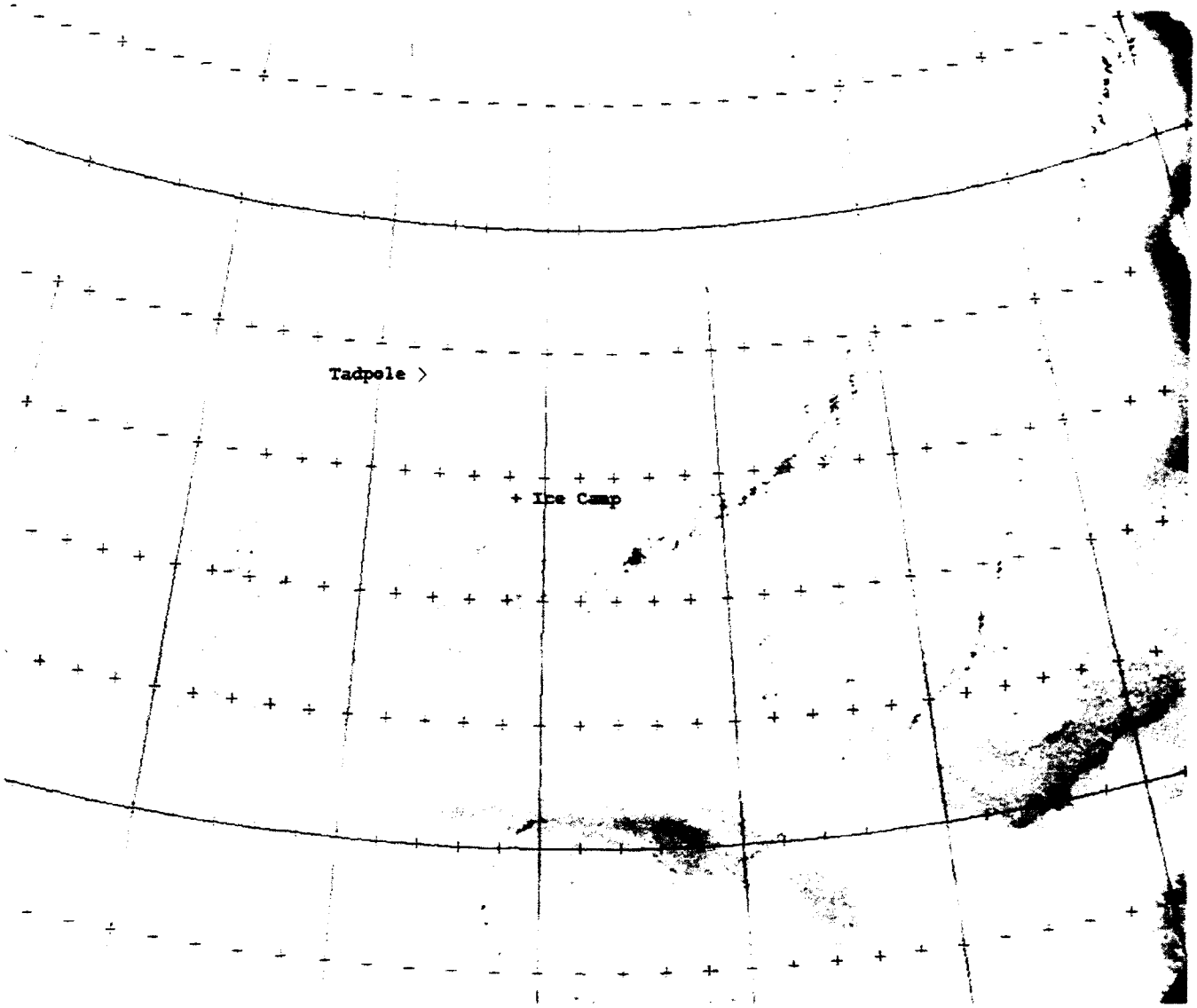
10 Apr 92 1256Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Wind shifts indicated that the trough had passed Deadhorse in good agreement with the indication of this satellite image.



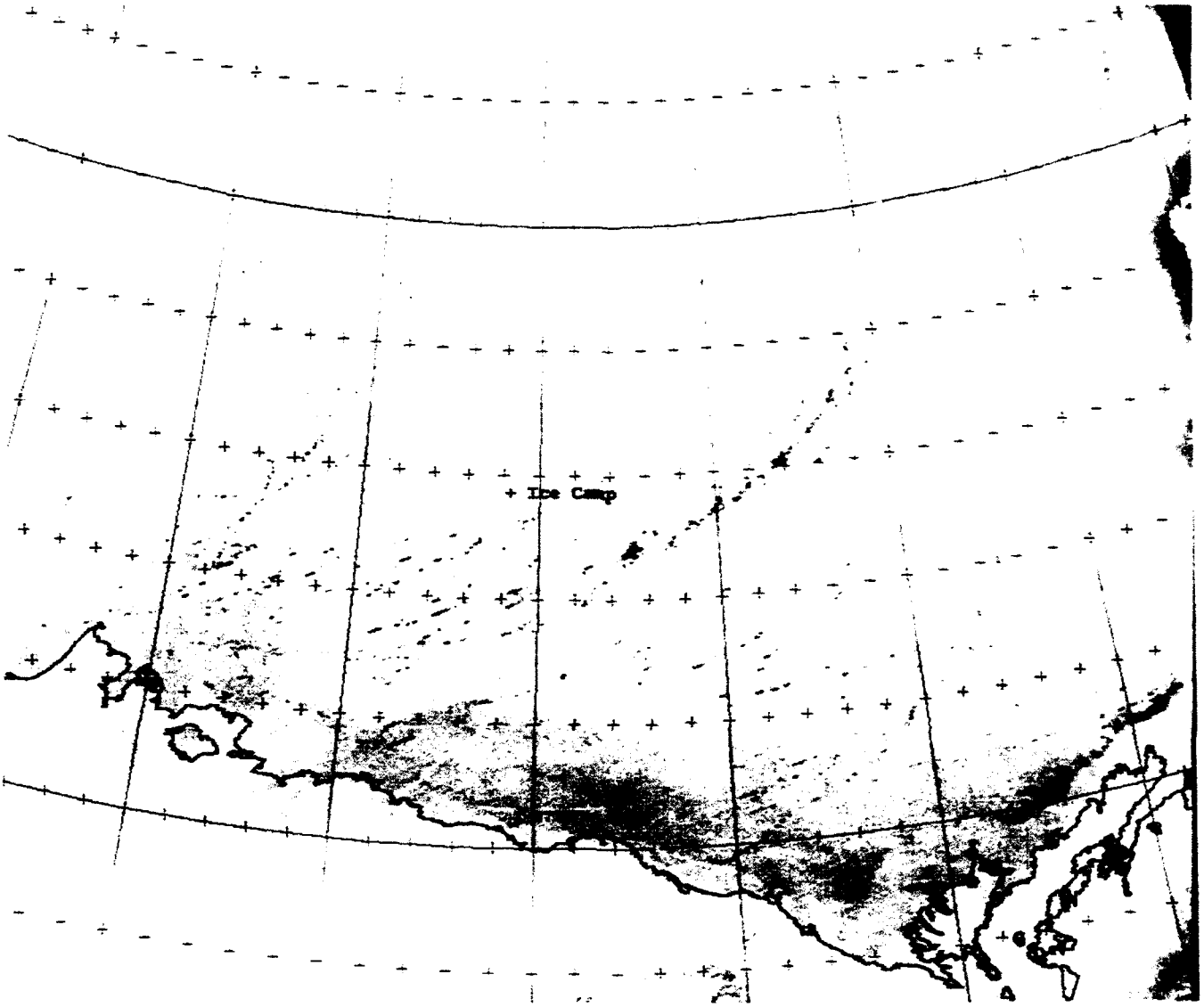
10 Apr 92 1617Z
NOAA AVHRR CH 3 IR
Notable Features:

1. This NOAA channel 3 image shows low (black) clouds near the surface often poorly revealed by normal visible or IR channels.



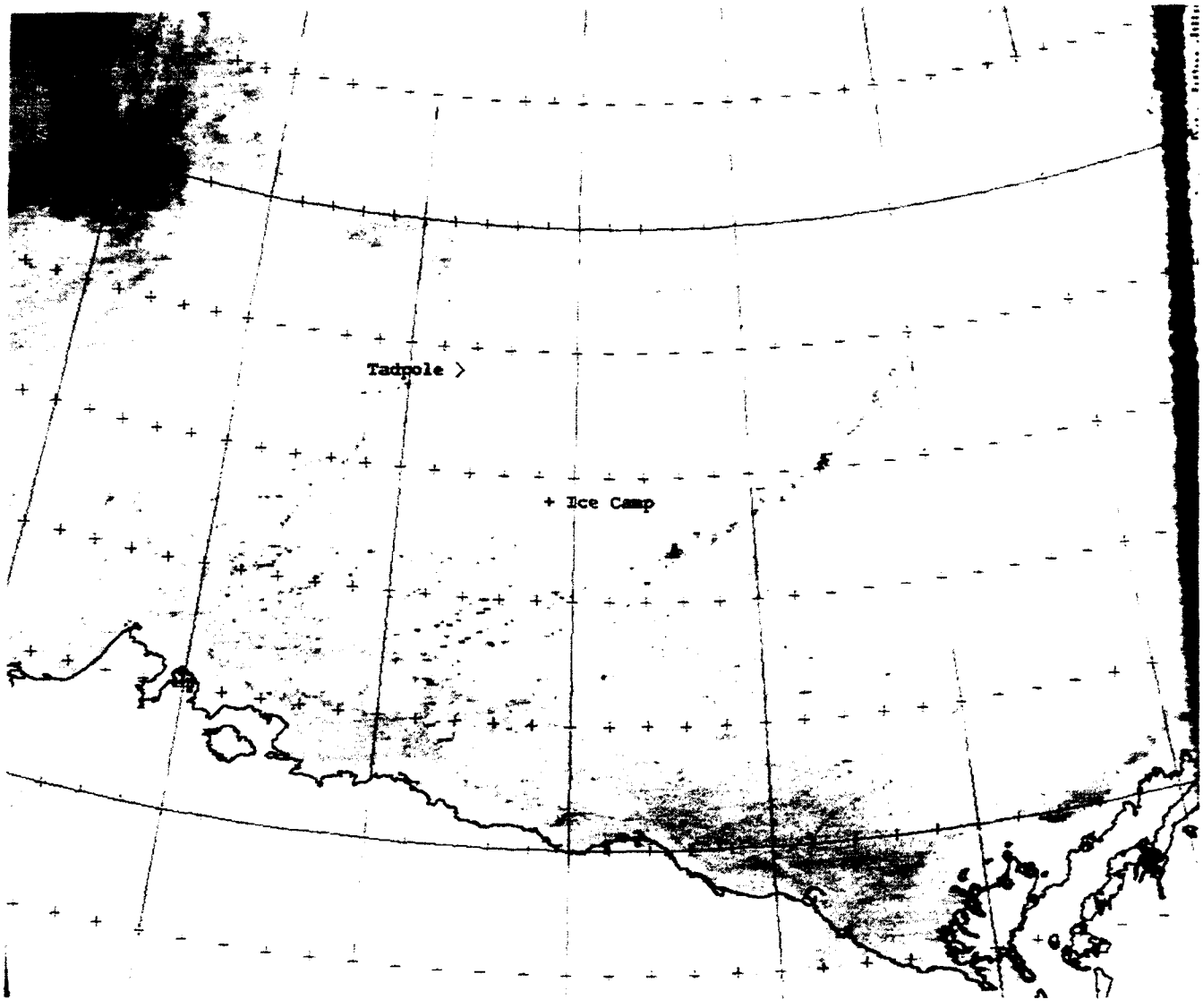
10 Apr 92 2010Z
DMSP OLS IR
Notable Features:

1. Overcast upper level cloudiness from the low system now extends past the Mackenzie River Delta. Anchorage forecasters finally acknowledged the presence of something along the N. Slope by drawing a trough in the region.
2. "Tadpole" refers to an ice floe/lead arrangement that had the appearance of a "tadpole". It proved possible to track individual ice floes (including that on which the ice camp was located) through their consistent appearance day-after-day.



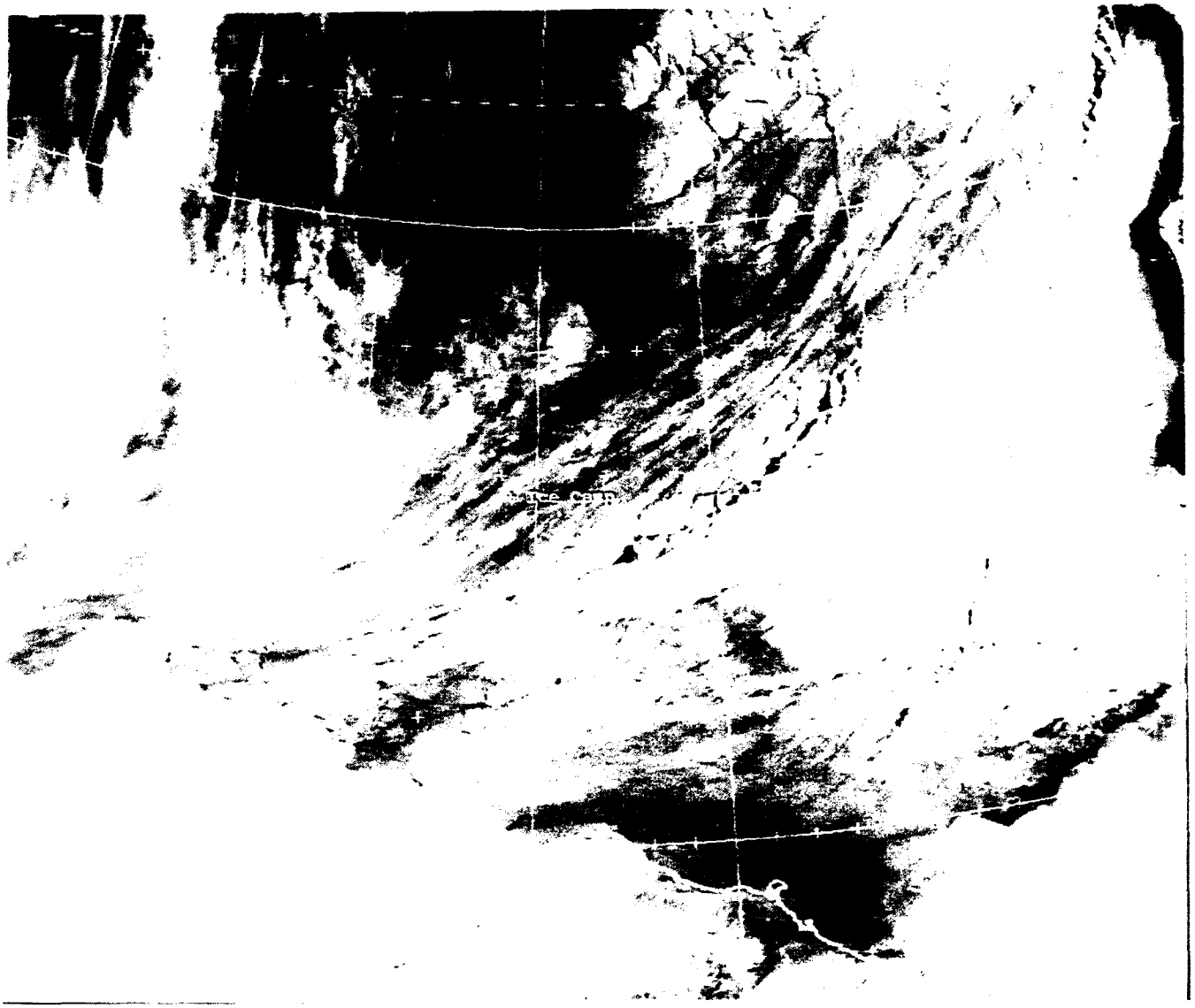
11 Apr 92 0130Z
DMSP OLS IR
Notable Features:

1. The low system has finally disappeared to the south judging from this image.
2. Note the C-131 contrail extending out of Deadhorse toward the ice camp. This is an indication of the saturation of the air on this date.



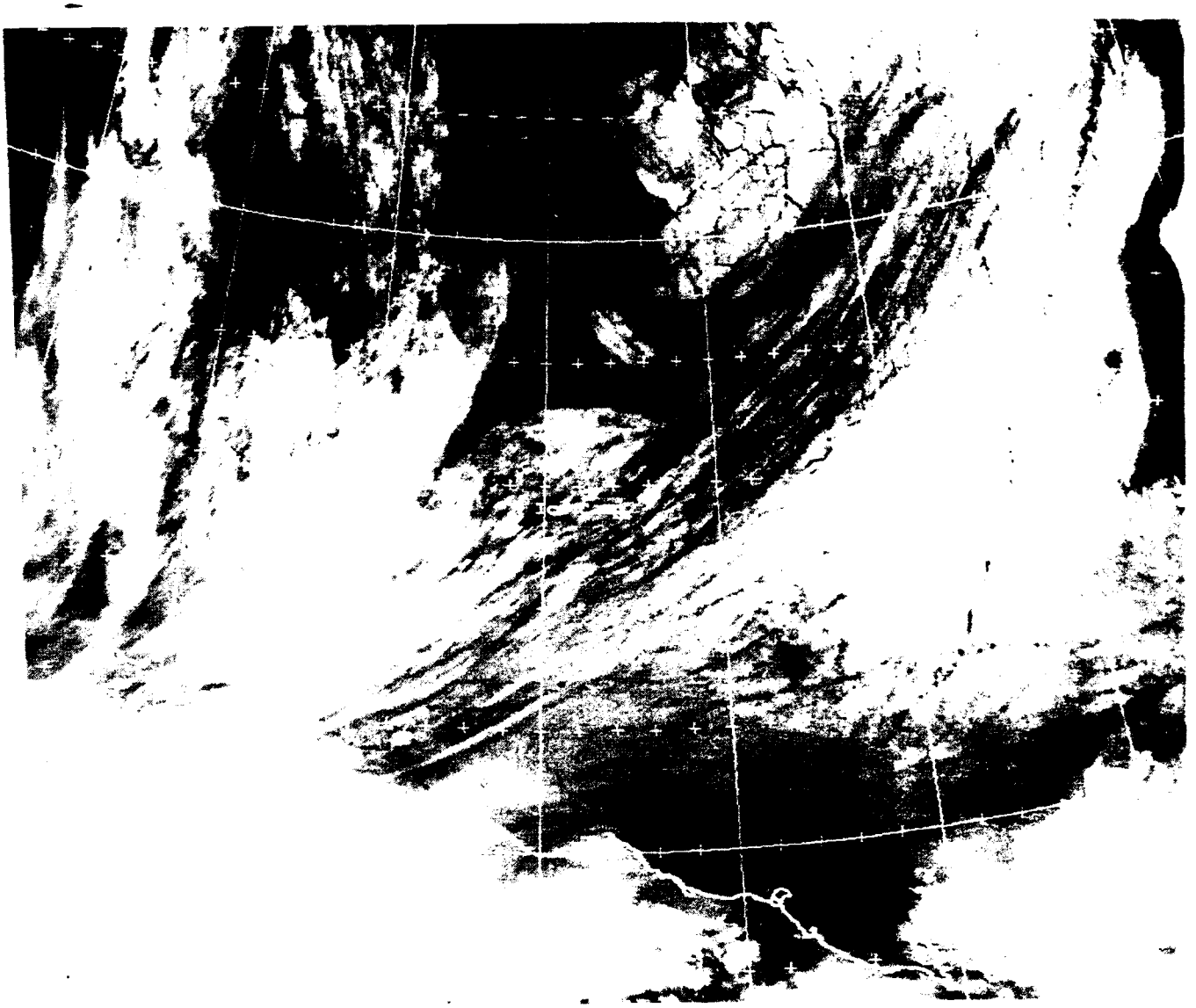
11 Apr 92 0805Z
DMSP OLS IR
Notable Features:

1. Although Anchorage surface analyses showed ridging over the entire Beaufort Sea, this image shows that something is moving in from the north. NORAPS shows a NE-SW oriented trough across the Beaufort by 11/12Z, with a forecast low pressure center sitting in the center of the Beaufort by 12/12Z



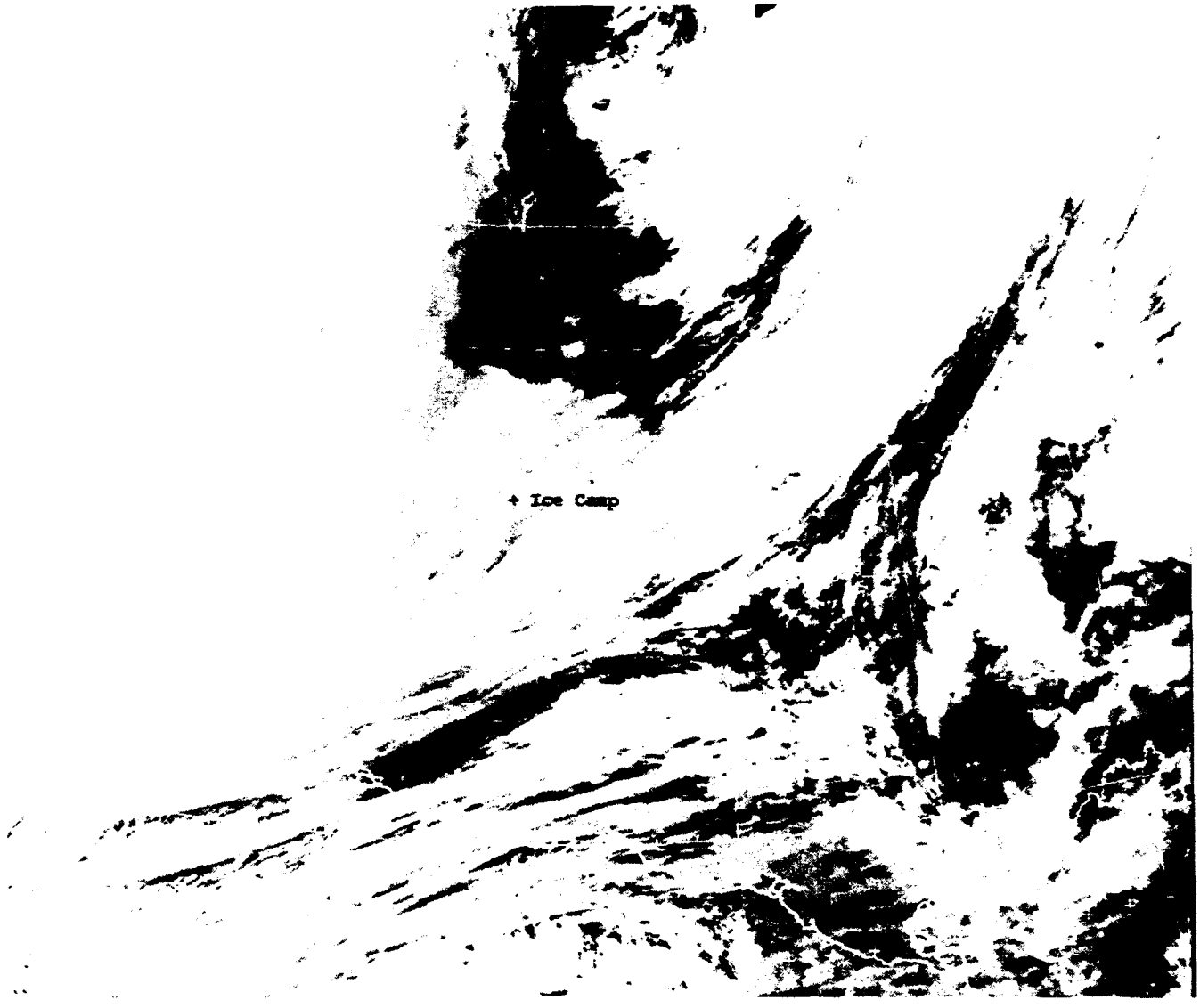
11 Apr 92 1425Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Pronounced NE-SW striations extend from Prince Patrick Island toward the Barrow region. It is possible there is an axis of deformation here with winds to the NE blowing from the SW, and winds to the SW blowing from the NE. No consistent wind at any level can explain this pattern. Ice camp data buoy data, and NORAPS cross sections will be important to consider for a thorough evaluation of this date.



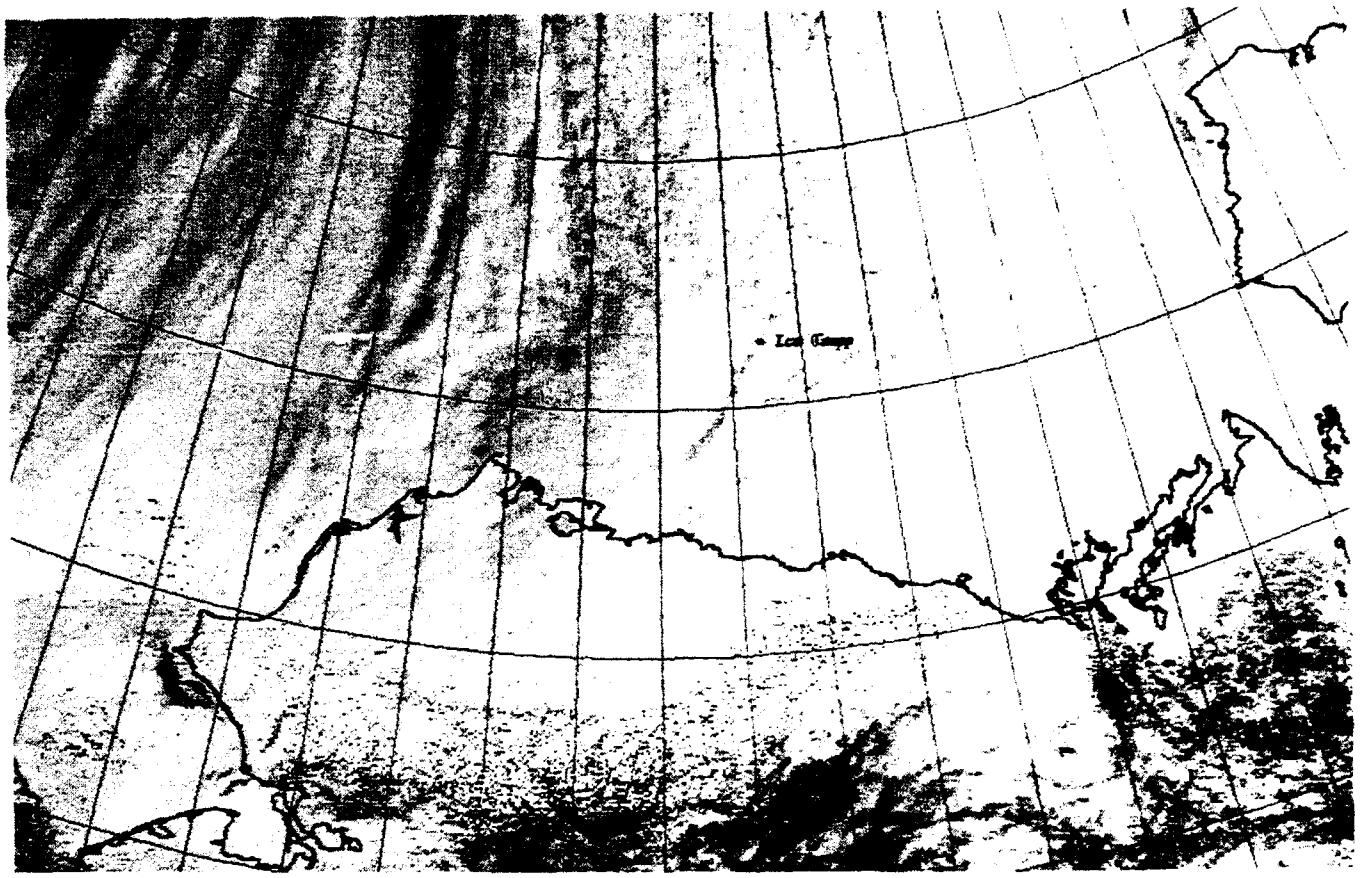
11 Apr 92 1605Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Comparing this view with the previous view it can be seen that the southern edge of the banded striations is dropping south.



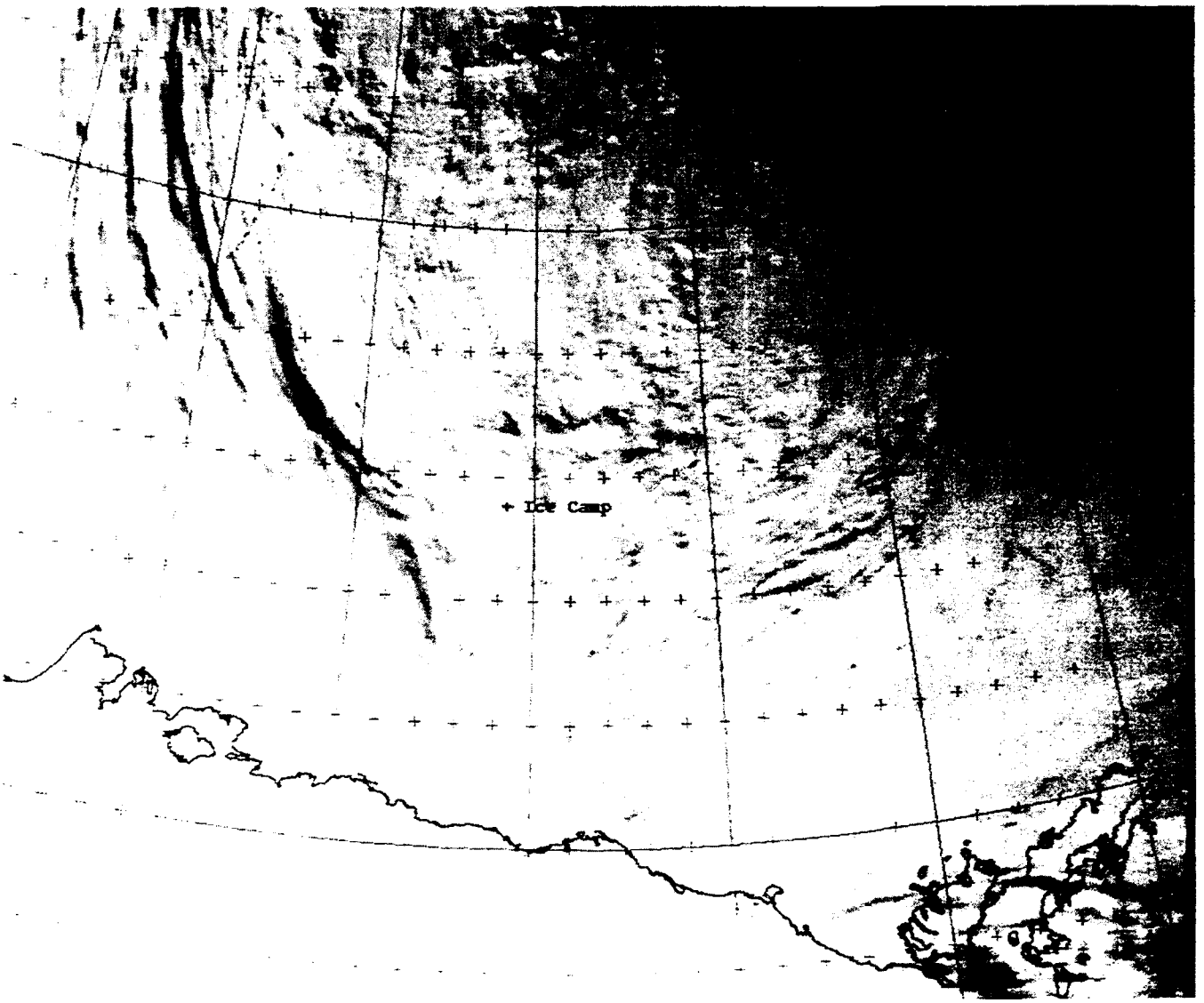
11 Apr 92 1605Z
NOAA AVHRR CH 3 IR
Notable Features:

1. A hyperbolic point with center SE of the ice camp is suggested by the streamline flow shown on this image.



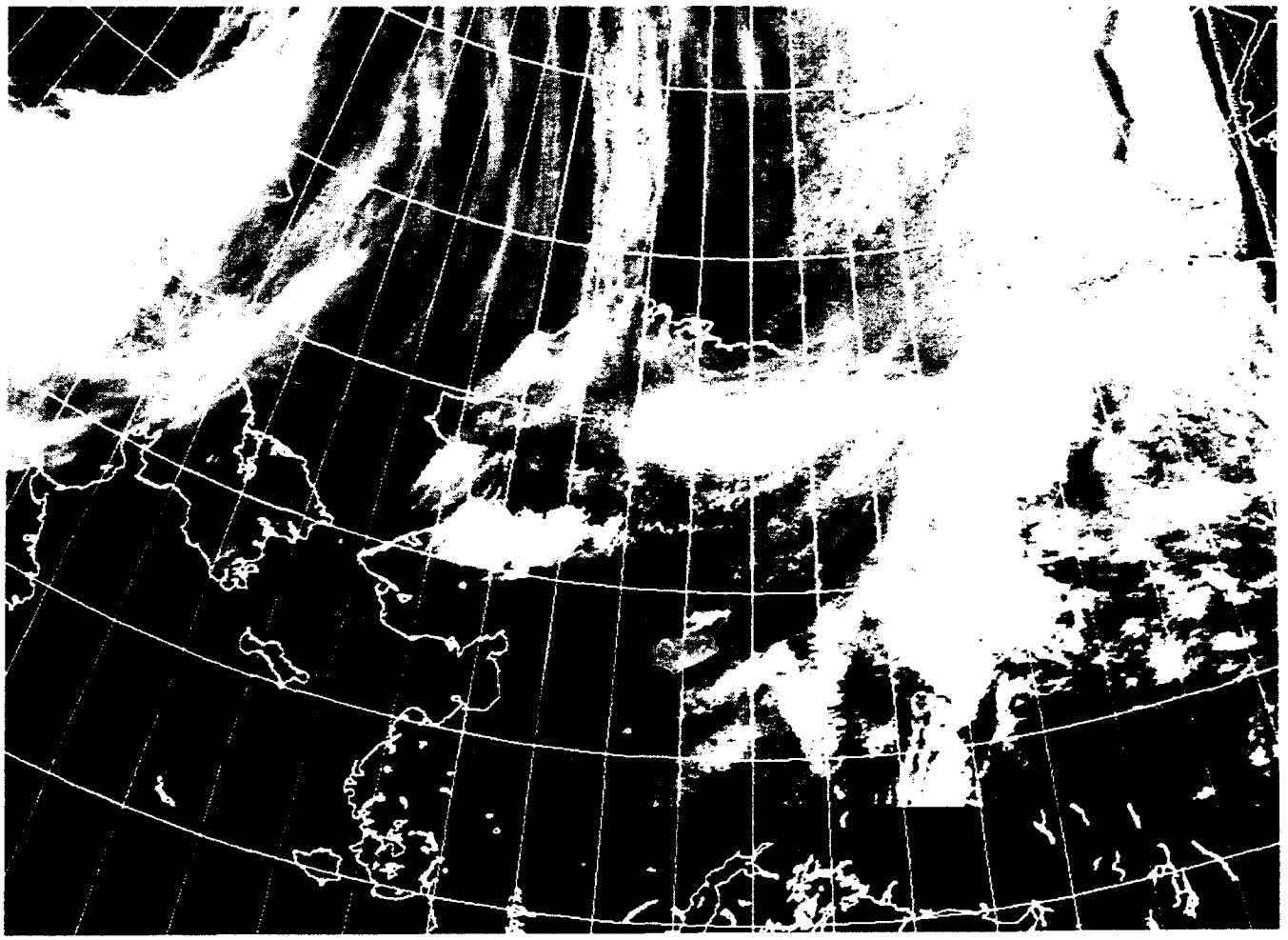
11 Apr 92 1939Z
DMSP OLS VIS
Notable Features:

1. A larger scale visible view of the area. Something now seems to be happening near Barrow as surface pressure tendencies fall dramatically all along the western N. Slope.



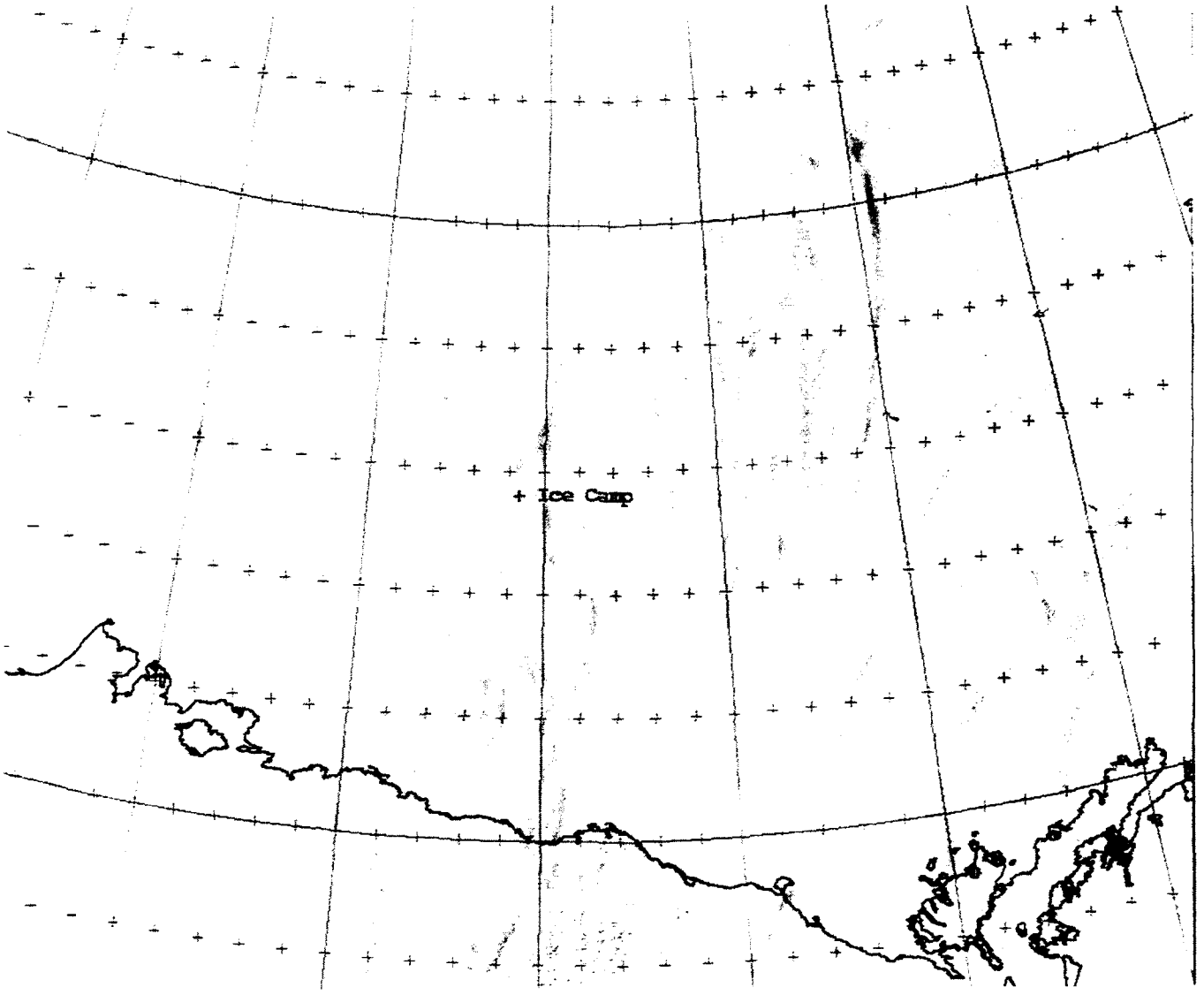
12 Apr 92 0028Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. A wave-like purturbation appears on the cloud band west of the ice camp as N. Slope pressures tumble.



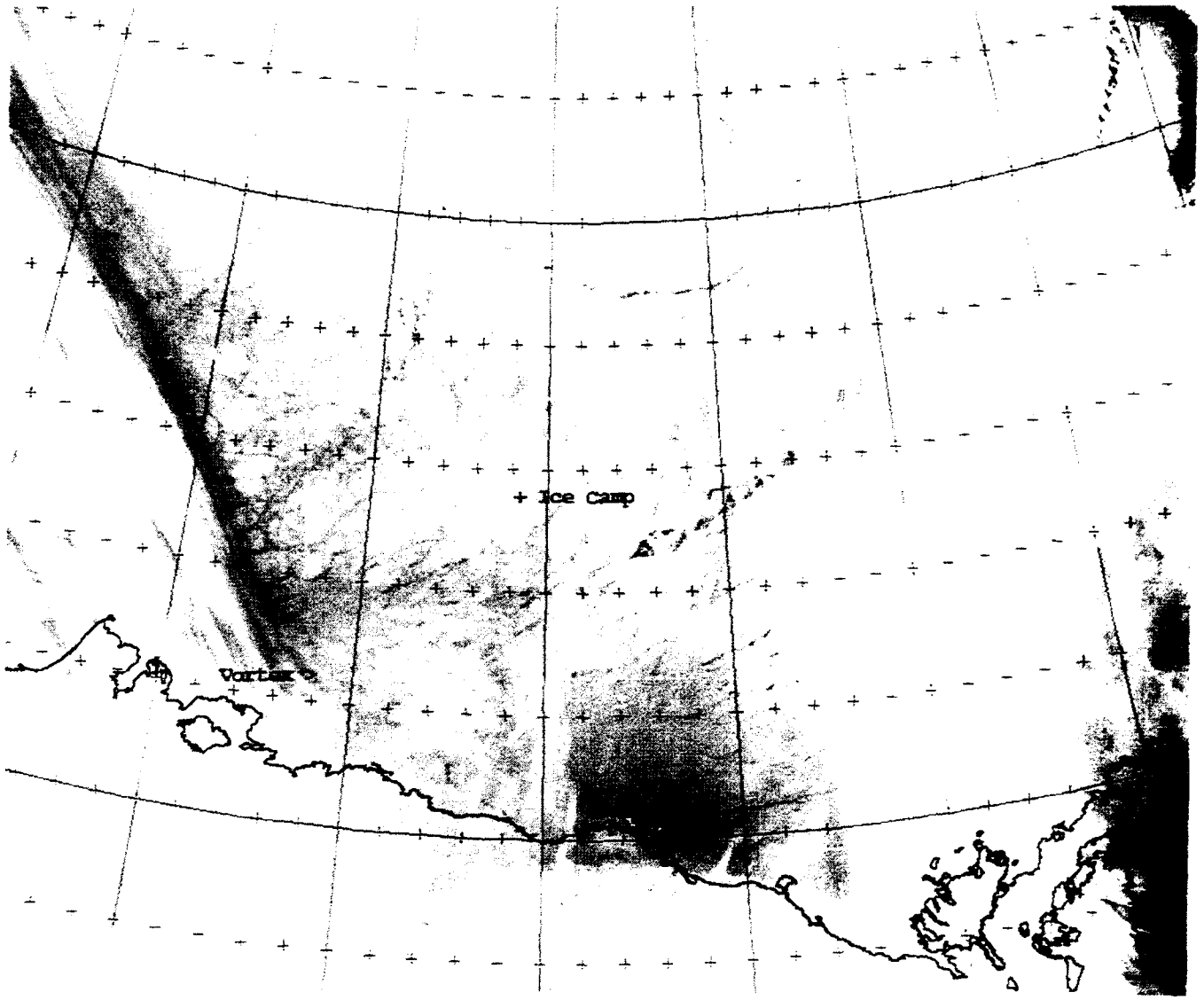
12 Apr 92 0529Z
DMSP OLS IR
Notable Features:

1. The larger scale view shows no development as cloudiness previously north of Barrrow slips southward against the Brooks Range.
2. Note plume clouds over the western end of the Brooks Range. By 12/2046Z the entire range will be covered by such wave clouds.



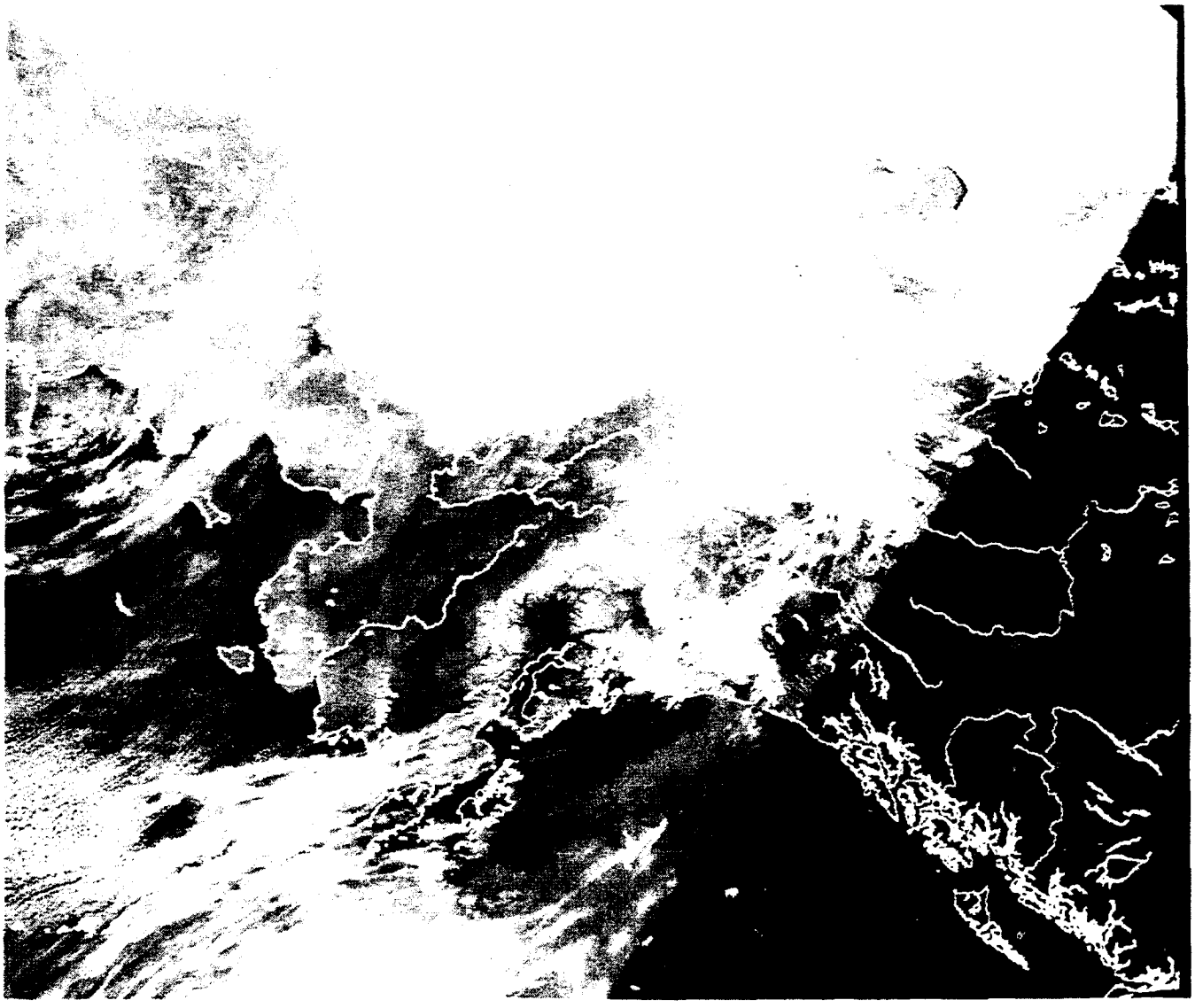
12 Apr 92 1644Z
DMSP OLS VIS
Notable Features:

1. Low pressure is analyzed with center in the central Beaufort Sea. The **NOGAPS** 500 mb analysis also has a 500 mb low centered over the area. Upper level NW winds are suggested over Barrow with SW winds in the eastern Beaufort. This correlates with the upper low or trough over the area.



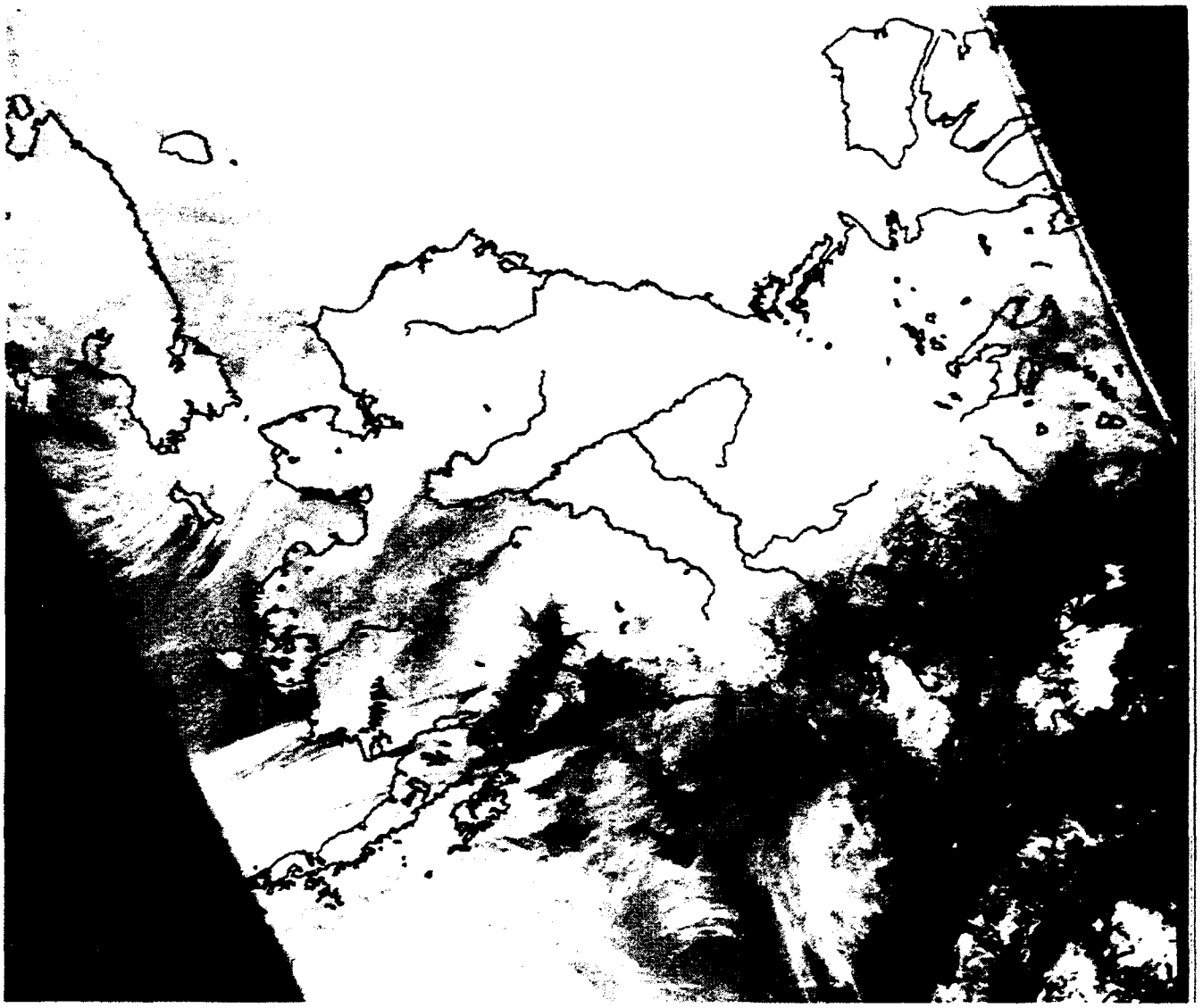
12 Apr 92 1727Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The channel 4 data also suggest a low center north of Deadhorse. A low is drawn near that area by Anchorage forecasters.



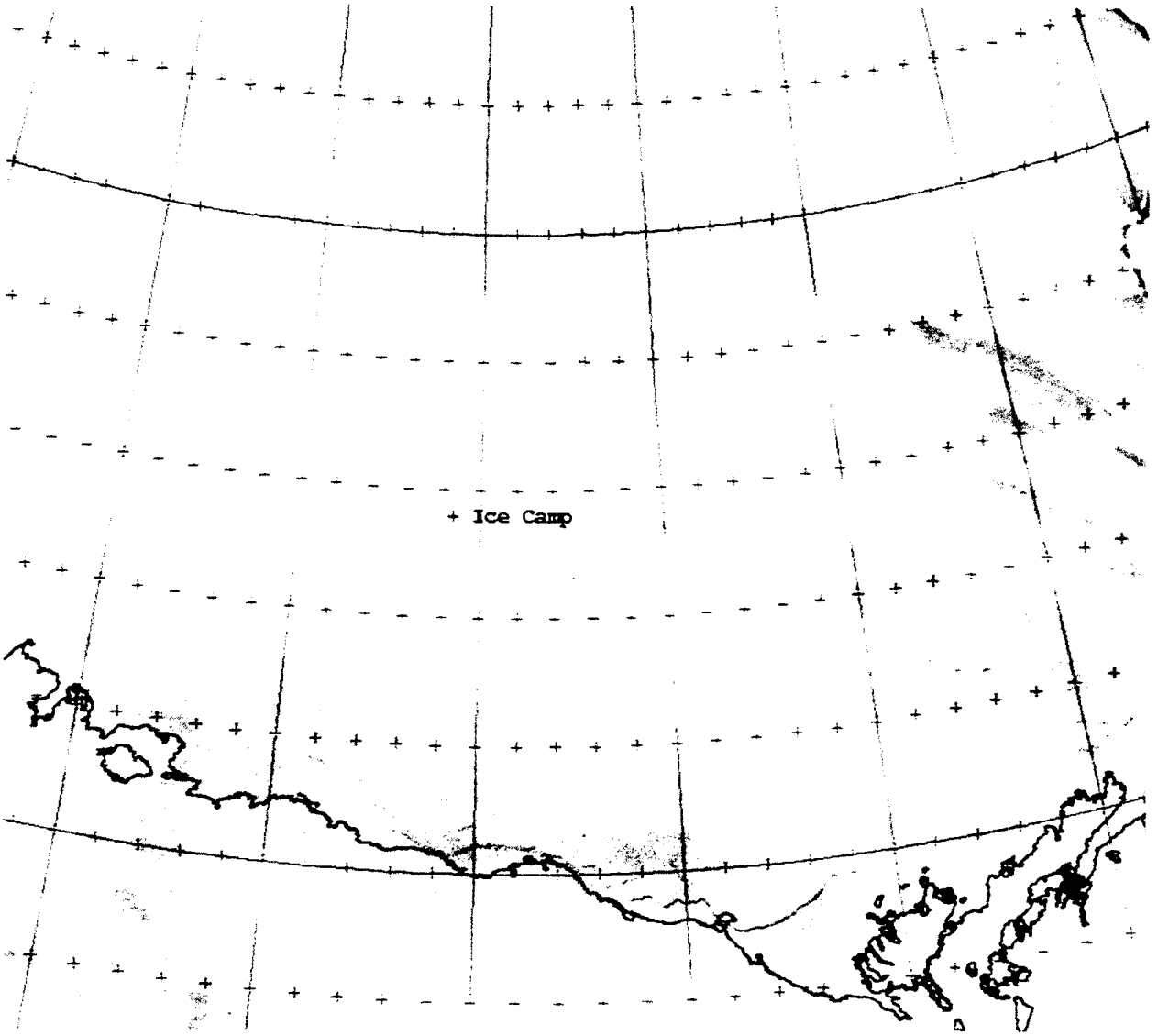
12 Apr 92 2046Z
DMSP OLS IR
Notable Features:

1. The wave plume crown over the Brooks Range is completed. <u>This was one of the most spectacular examples of plume cloud generation ever recorded</u>. Individual images hour by hour are available recording this event.



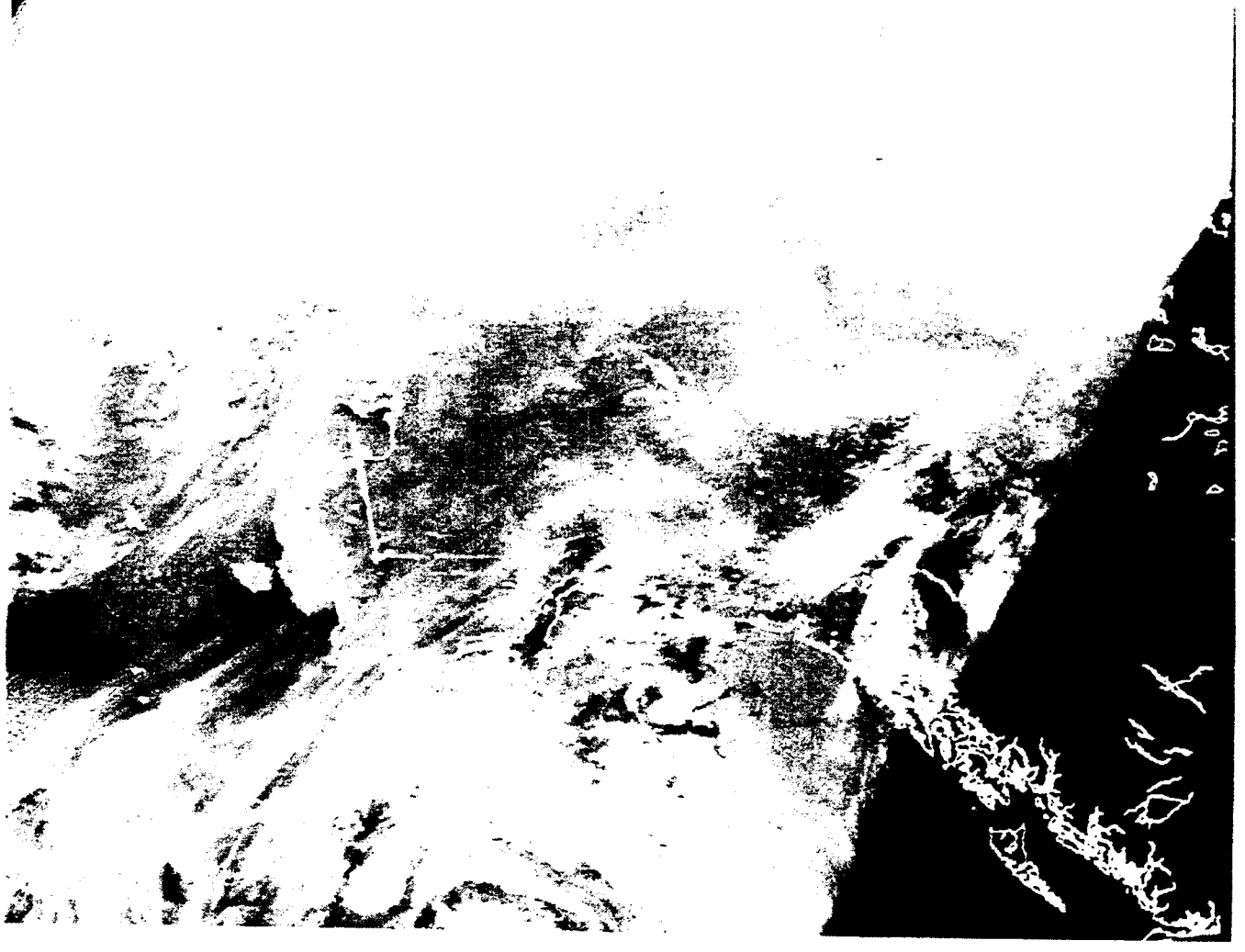
13 Apr 92 0457Z
DMSP OLS IR
Notable Features:

1. A large scale view that shows the continued NW jet flow over the Brooks Range.
2. The central Beaufort appears clear despite low pressure over the area.
3. Note the cloud plume extending south of Ostrov Herald (just east of Wrangle Island). This plume persisted for over 16 hours anchored to the island.



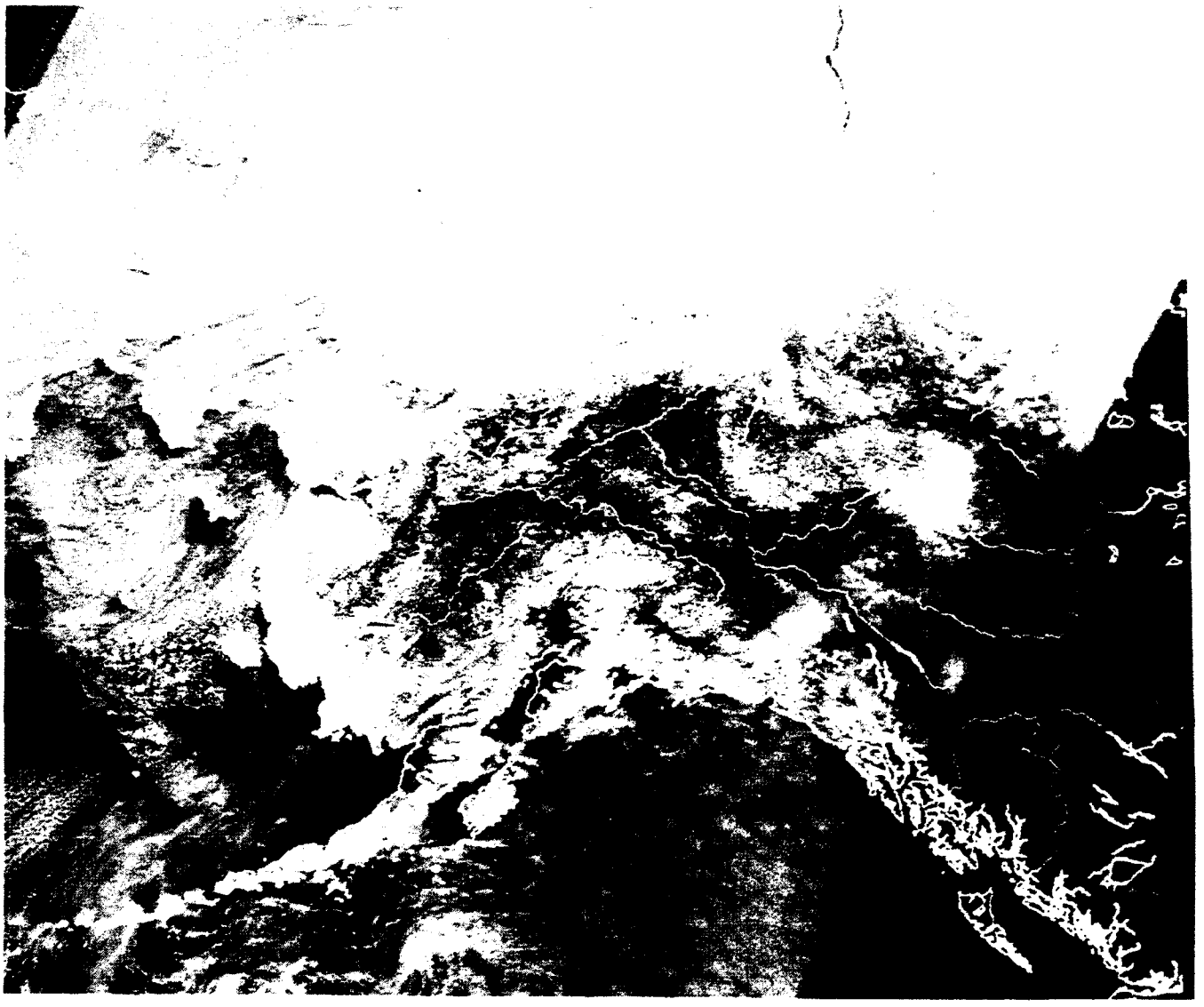
13 Apr 92 1401Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The ice camp is located in a col region between two surface lows and experiences clear skies.
2. A 700 mb low exists north of Barrow with a trough extending ESE from the low.
3. Gridding for this example is erroneous since the image shows a lead extending through Herschel Island.



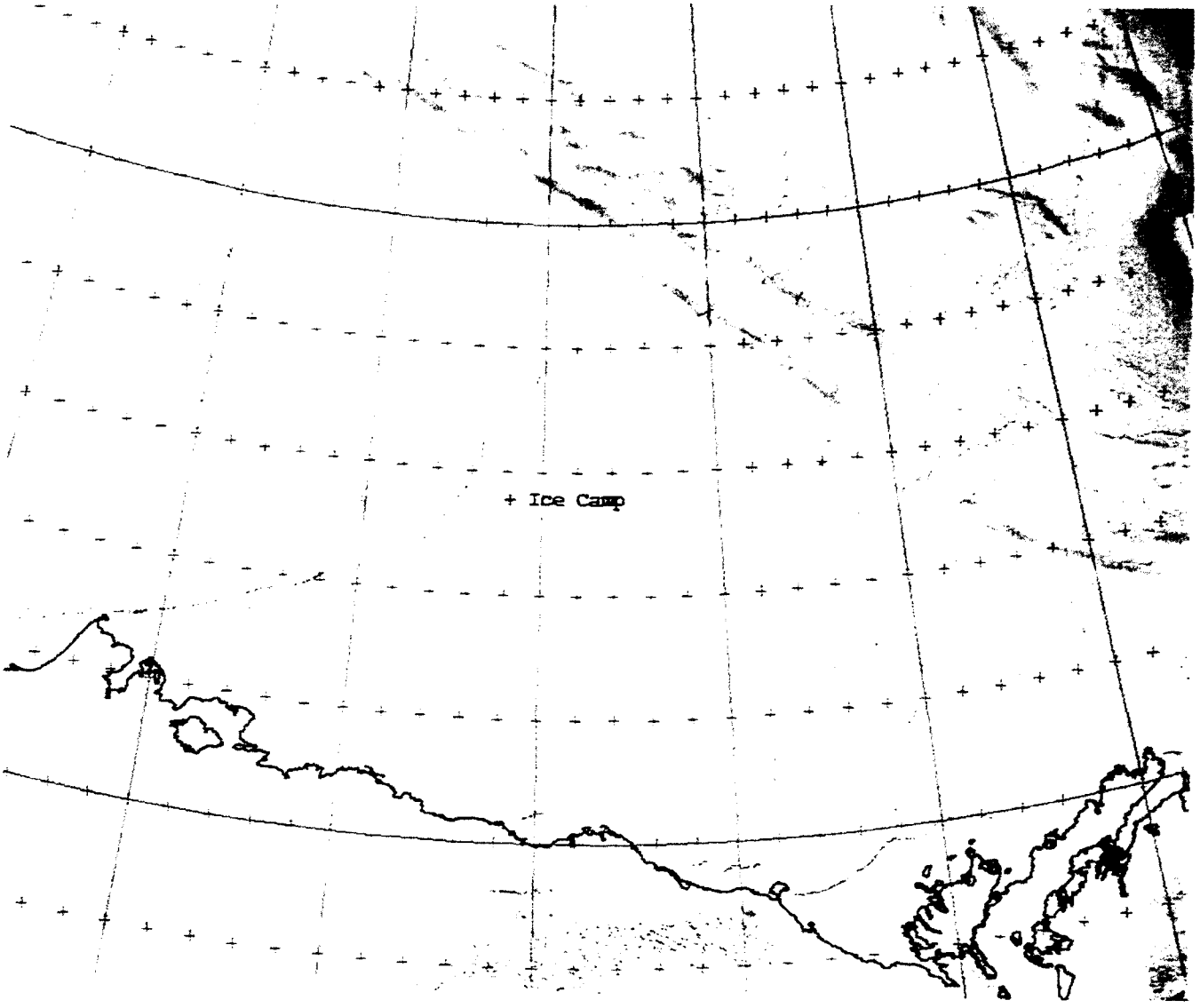
13 Apr 92 2016Z
DMSP OLS IR
Notable Features:

1. This large scale IR view shows the plume persisting south of Ostrov Herald.
2. NW flow over the Brooks Range has ceased.
3. The Beaufort remins relatively clear except for banded upper clouds sweeping past the southern end of Banks Island.



13 Apr 92 2016Z
DMSP OLS VIS
Notable Features:

1. The companion visible view suggests the band sweeping NW'ward may be frontal in character.
2. The shadow from the Ostrov Herald plume indicates a high altitude for this plume.
3. A significant low center is revealed WSW of St Lawrence Island.

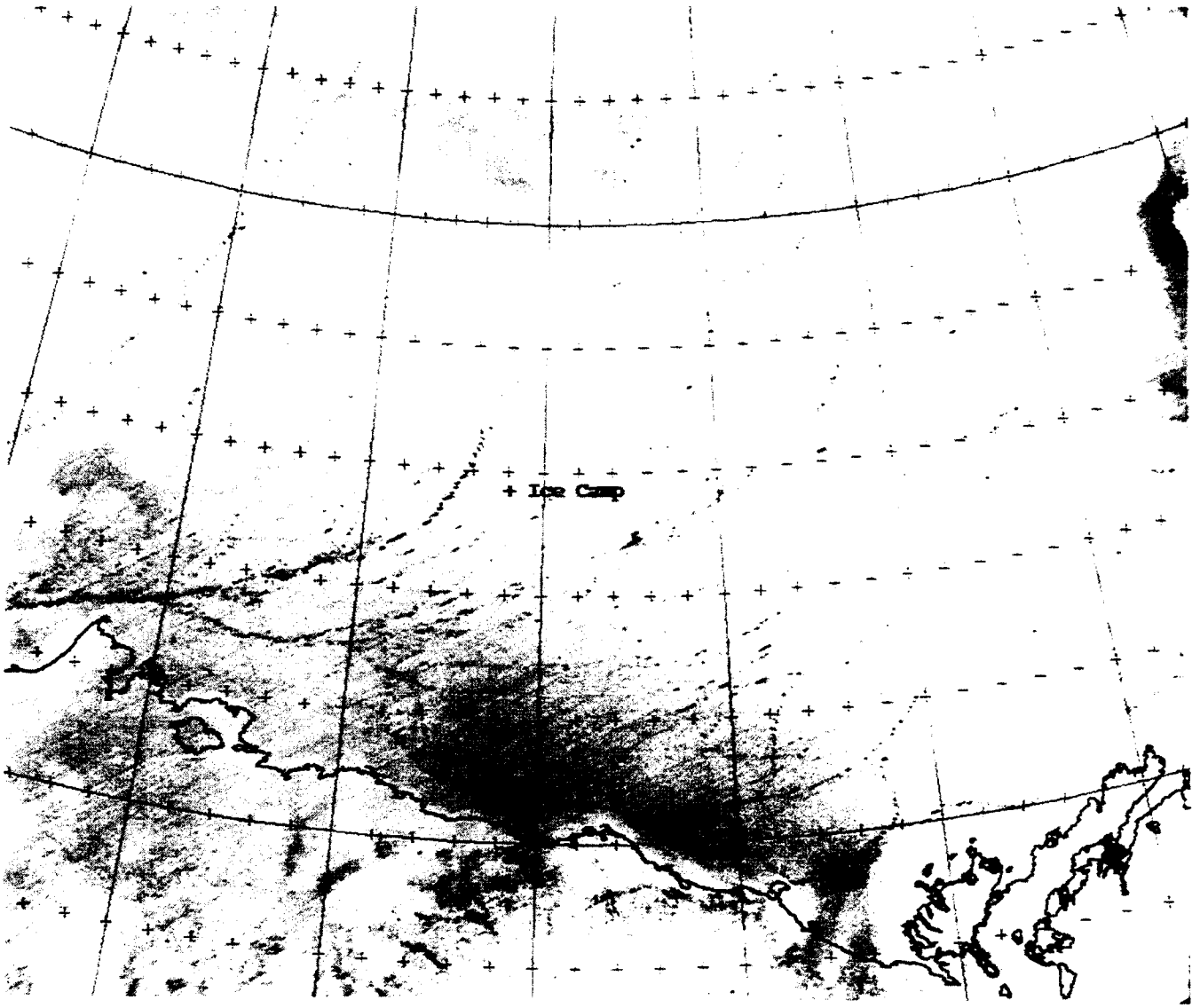


14 Apr 92 0052Z
DMSP OLS VIS
Notable Features:

1. Gridding still remains slightly off since a lead still extends through northern Herschel Island.
2. Some obscuration seems to be occurring between the ice camp and Deadhorse since leads cannot be discerned in that region.

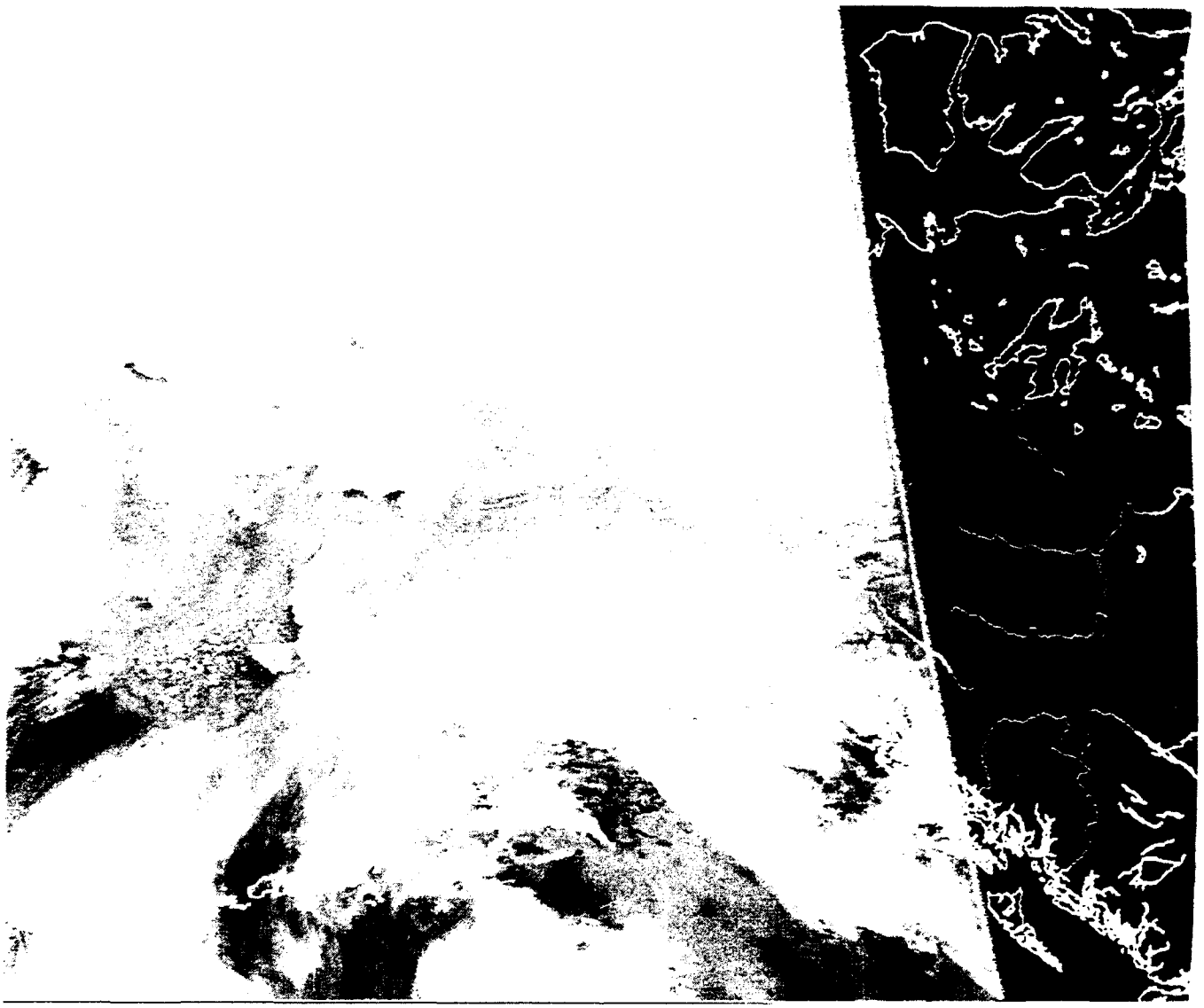
14 Apr 92 0426Z
DMSP OLS IR
Notable Features:

1. The plume still persists SW of Ostrov Herald.
2. Apparent warm ice temperatures in the southern Beaufort may be related to some release of moisture through many lead openings in the area (as well as the general tendency for ice temperatures to warm from north to south).
3. Note image processing NE-SW streaks especially evident over the Chukchi and E. Siberian Seas. These apparently pervade the entire image thus creating image interpretation problems.



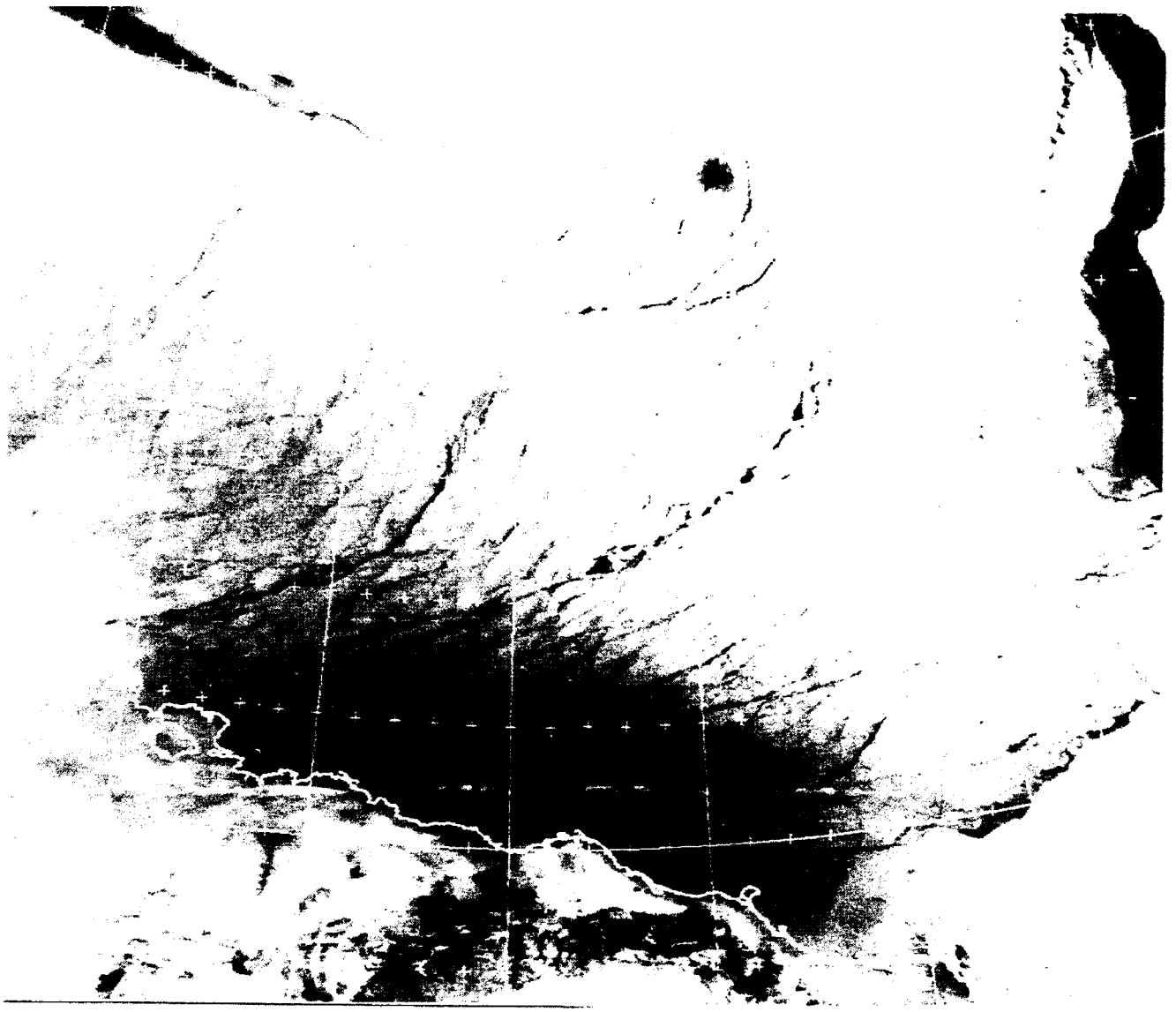
14 Apr 92 0431Z
DMSP OLS IR
Notable Features:

1. An enlarged view reveals artificial streaks south of the ice camp, which appears to be in the clear.
2. NORAPS shows a cyclonic shear line extending across the Beaufort from north of Barrow to Banks Island.
3. Note lead correctly positioned north of Herschel Island.



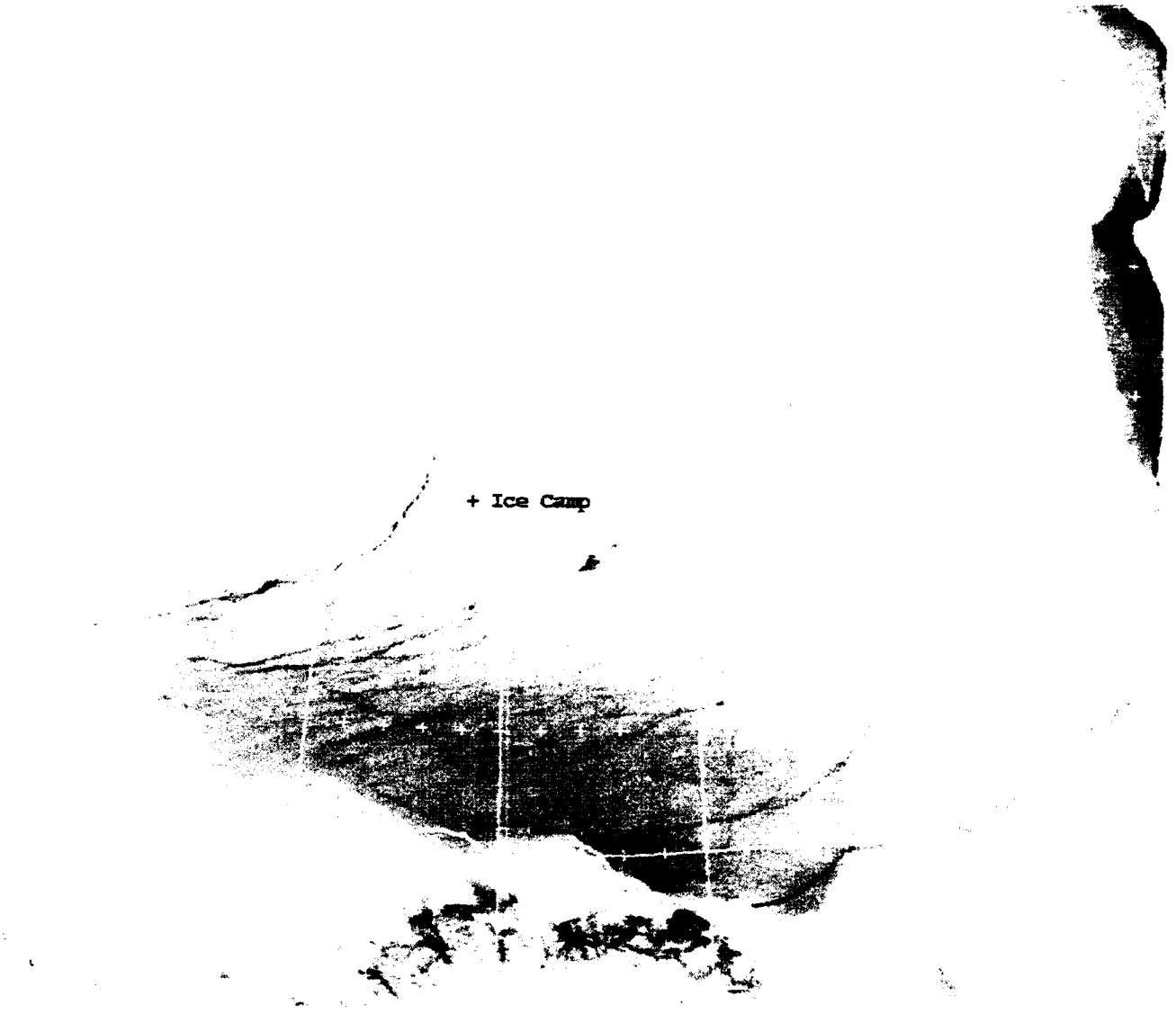
14 Apr 92 0607Z
DMSP OLS IR
Notable Features:

1. This large scale view shows that the entire ice region north of Alaska remains remarkably cloud-free.
2. A cloud plume is still evident extending SW of Ostrov Herald.



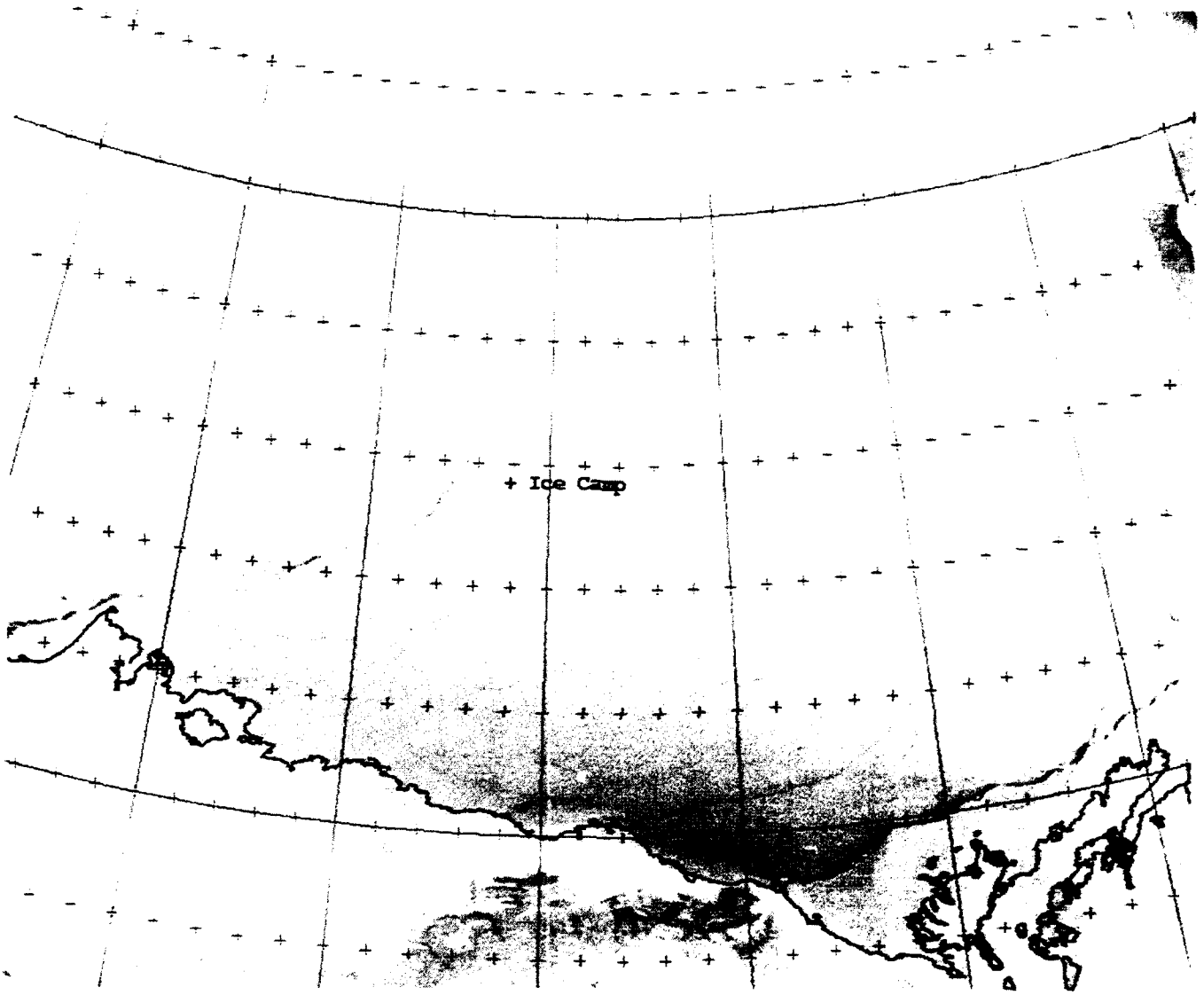
14 Apr 92 1349Z
DMSP OLS IR
Notable Features:

1. Spurious streak patterns not evident in this image.
2. Note "clear" NW-SW oriented clear streak in center of image. This is in a region of a 700 mb shear line crossing the area.
3. Cloudiness near Barrow is associated with a trough in that region.



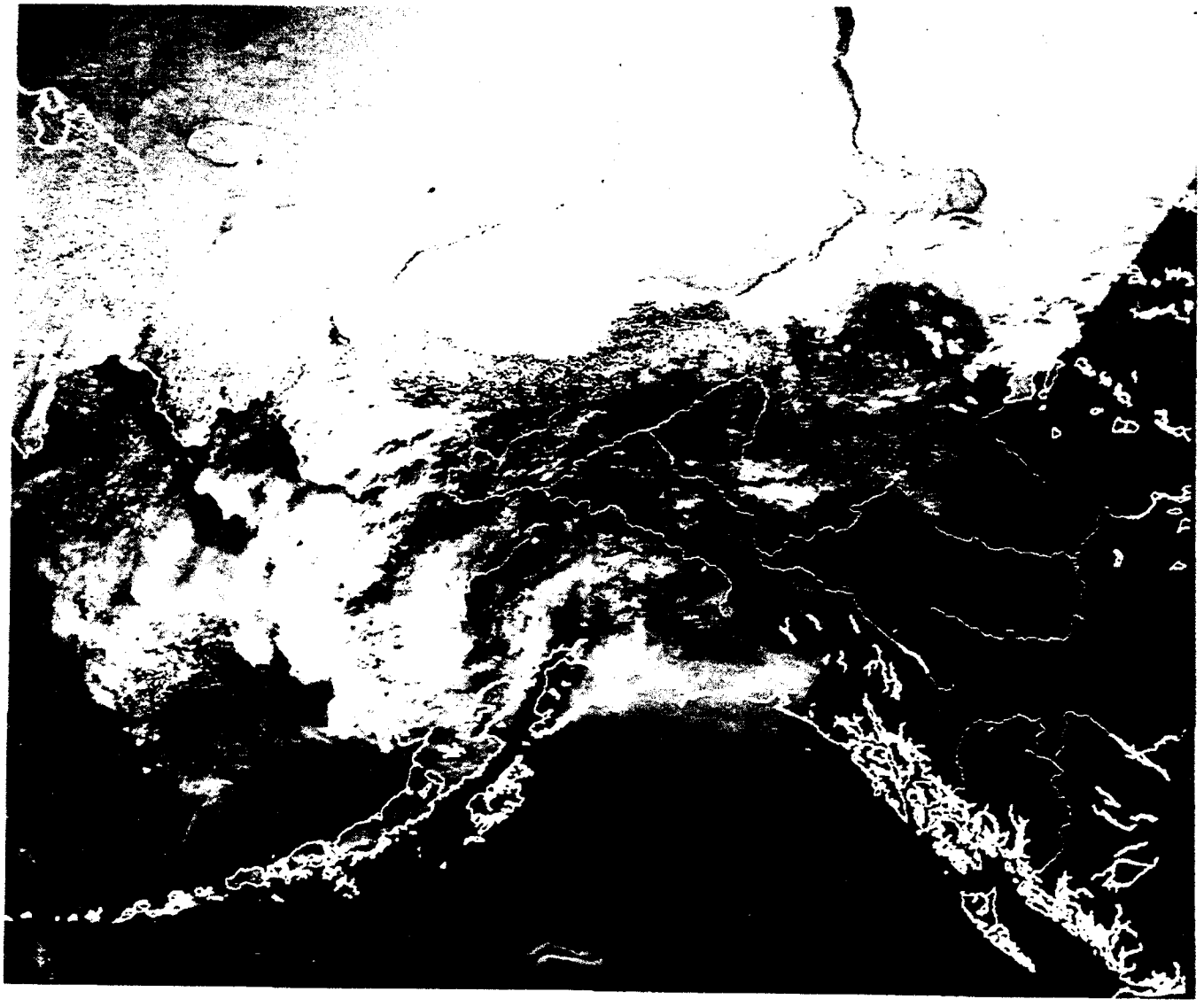
14 Apr 92 1529Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The NW-SE clear streak persists in this view. A cross-section (NORAPS) through this feature would be of great interest.
2. Apparent banding or streaking along N. Slope ice appears real and not evidence of the artifact discussed earlier.



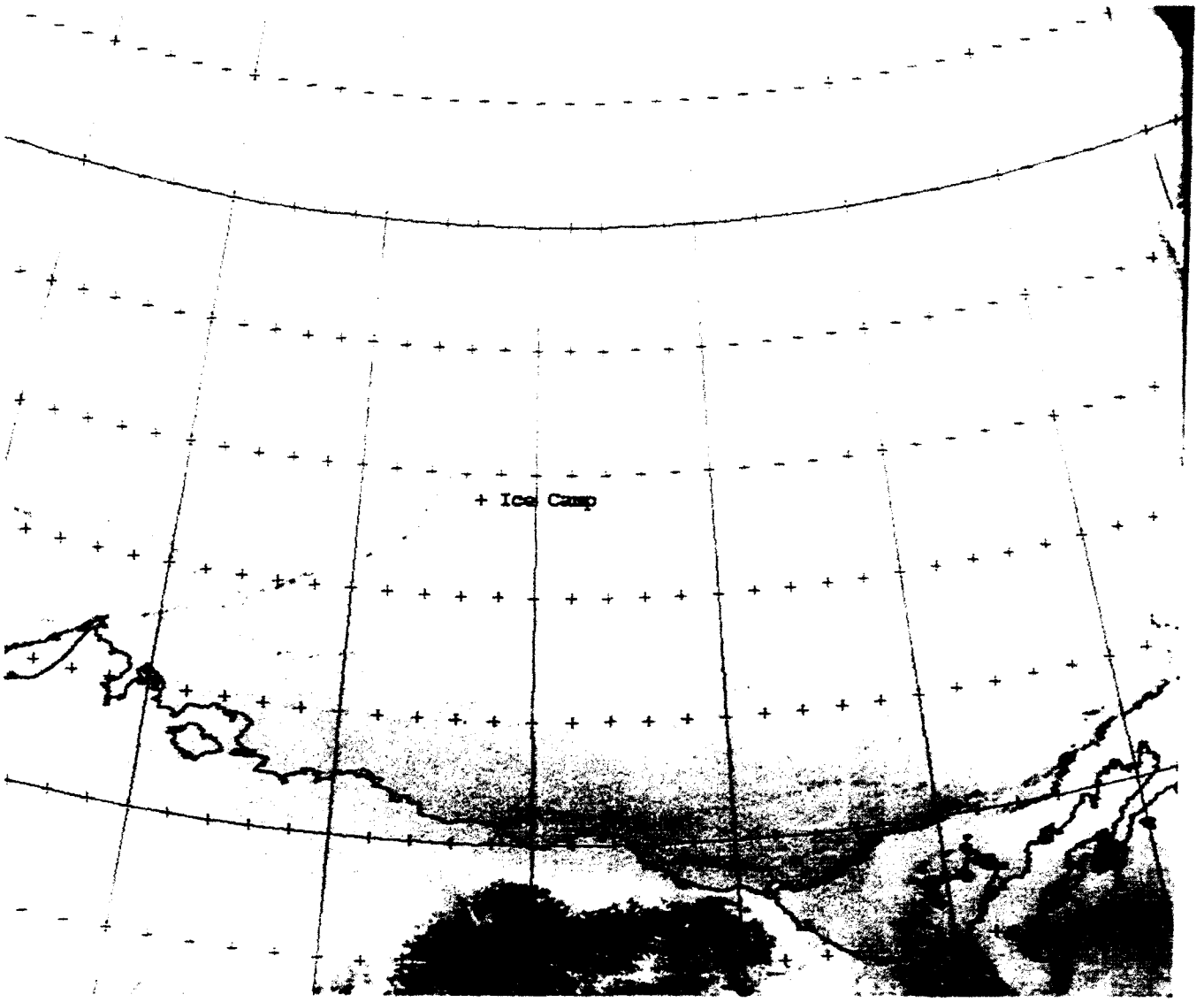
15 Apr 92 1337Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Note apparent open lead extending NE of Herschel Island.
2. Very strong NE flow, up to 35 kts at 10m, extended across the central and eastern Beaufort. Winds are much lighter north of 72N. Much ice particulate accumulation in the atmosphere causes a "smudged" appearance to this IR view.



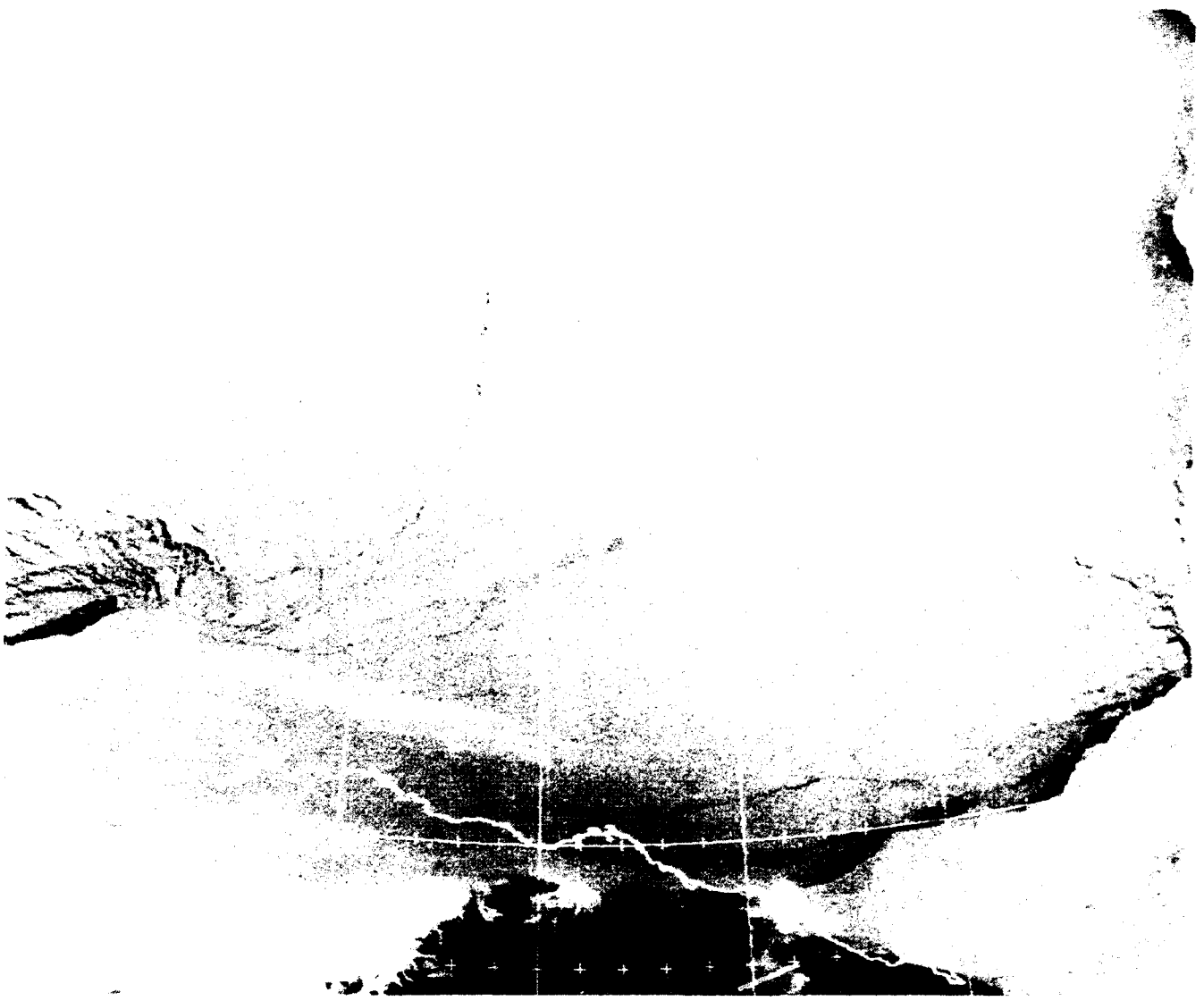
15 Apr 92 2053Z
DMSP OLS VIS
Notable Features:

1. An intense gradient across the Beaufort causing NE winds up to 35 kts across the central and southern Beaufort persists at the time of this image.
2. A total lack of disturbances in the region is shown by this image.
3. Note major open lead extending NE of Herschel Island.



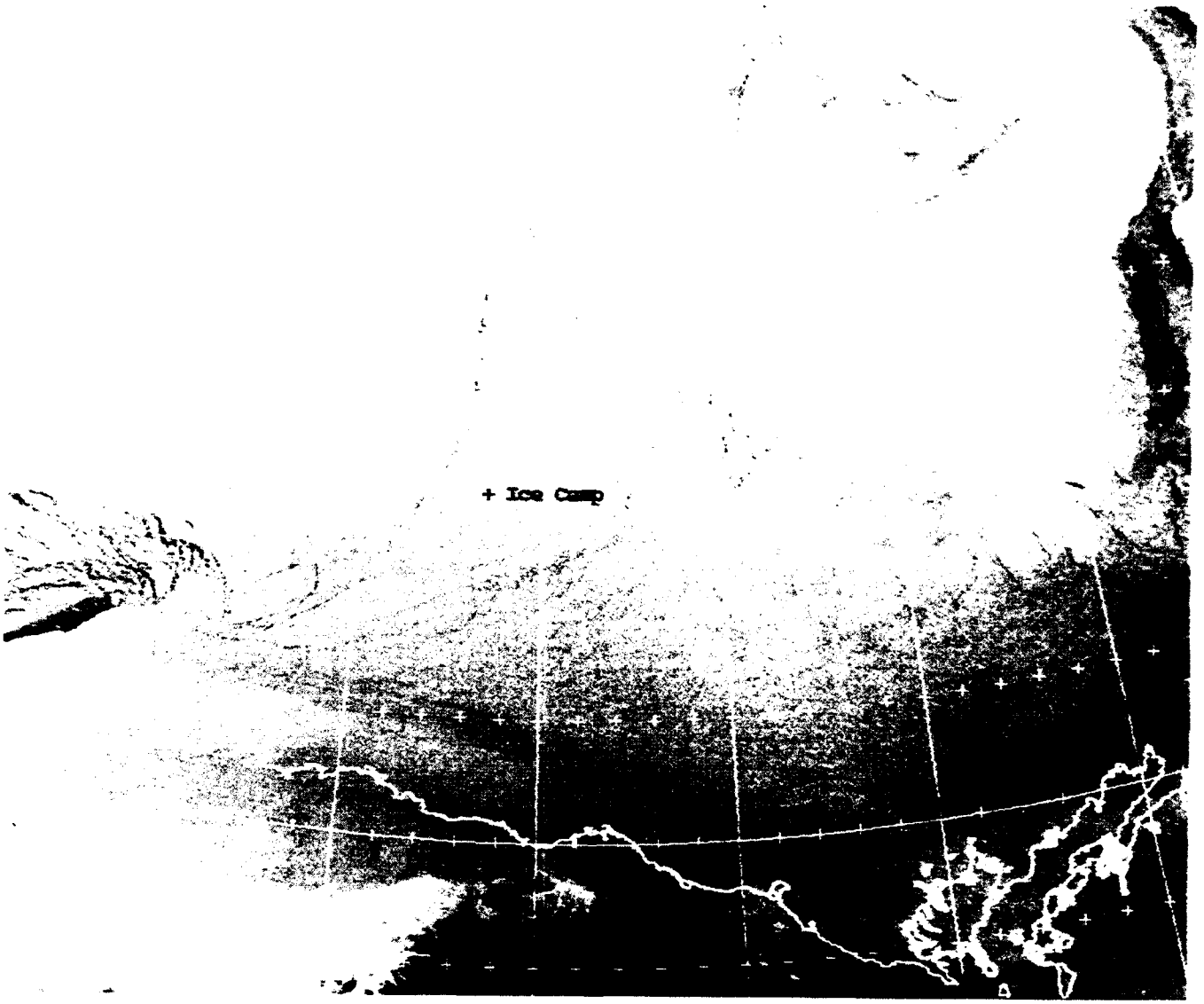
16 Apr 92 0027Z
DMSP OLS IR
Notable Features:

1. Obscuration caused by ice particles in the air in a high wind speed regime is shown by this "apparently clear" image.



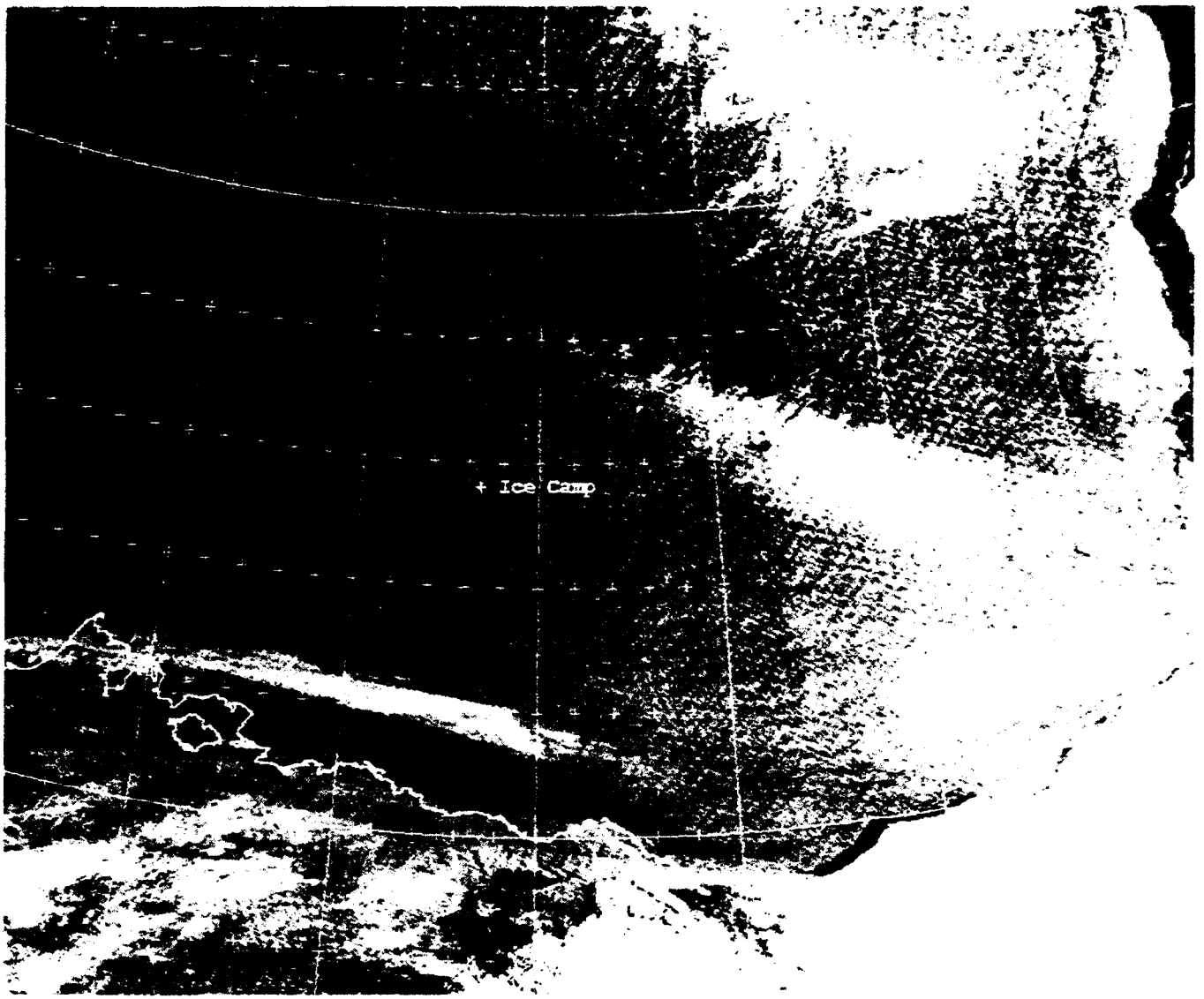
16 Apr 92 1505Z
NOAA AVHRR CH 4 IR
Notable Features:

1. NE-SW streaks cover the entire Beaufort south of 75N.
2. Much detail in lead and floe configuration is obscured in the region south of 73N.



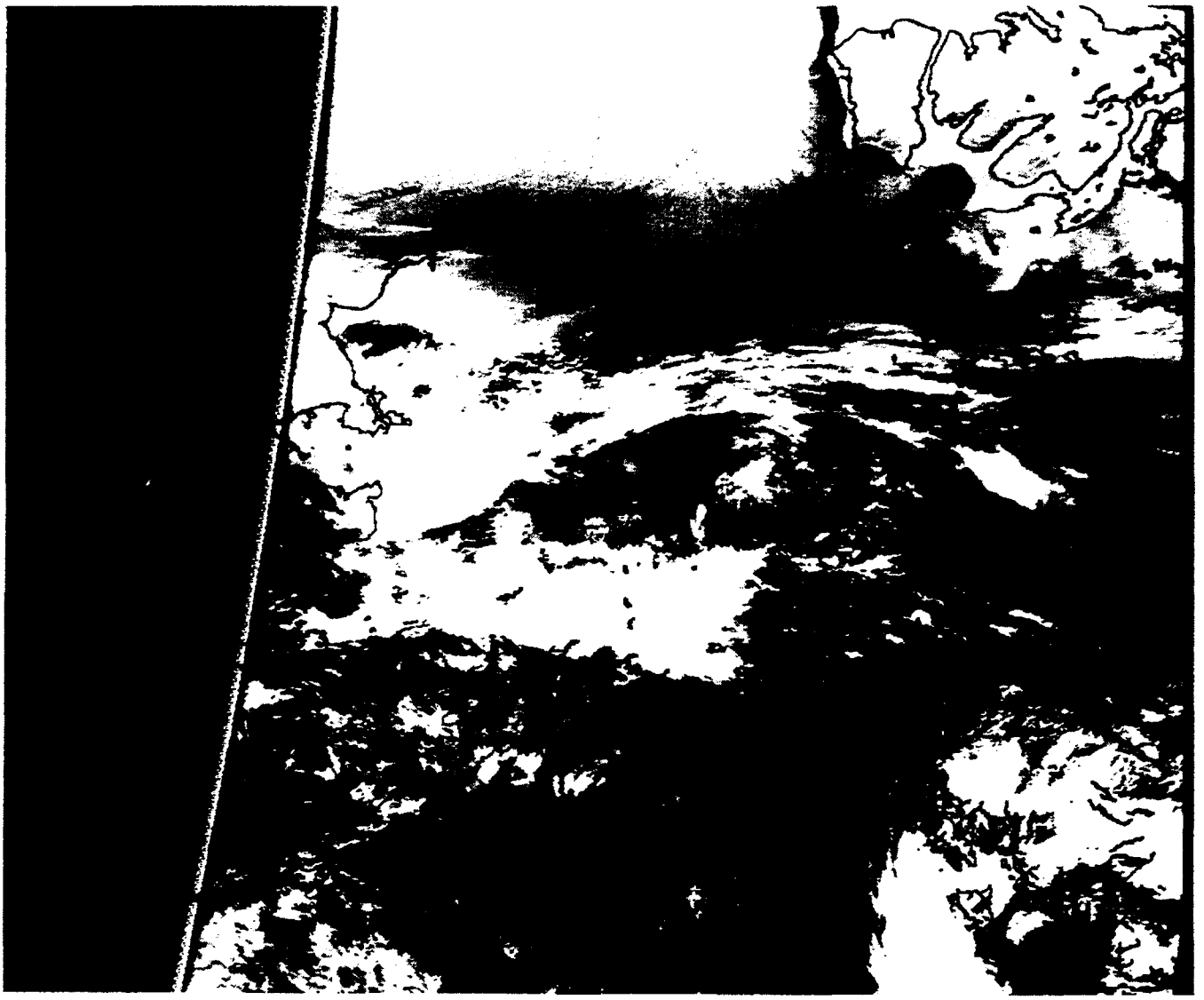
16 Apr 92 1505Z
NOAA AVHRR CH 3 IR
Notable Features:

1. One of the most interesting features observed during the entire experiment appears in this view. Note the NW-SE oriented line appearing NE of the ice camp. A sudden "zig-zag" break in the drift ice apparently occurred along this line permitting the immediate formation of cloud plumes extending southwestward over the ice camp and southern Beaufort region. (See next image for further discussion).



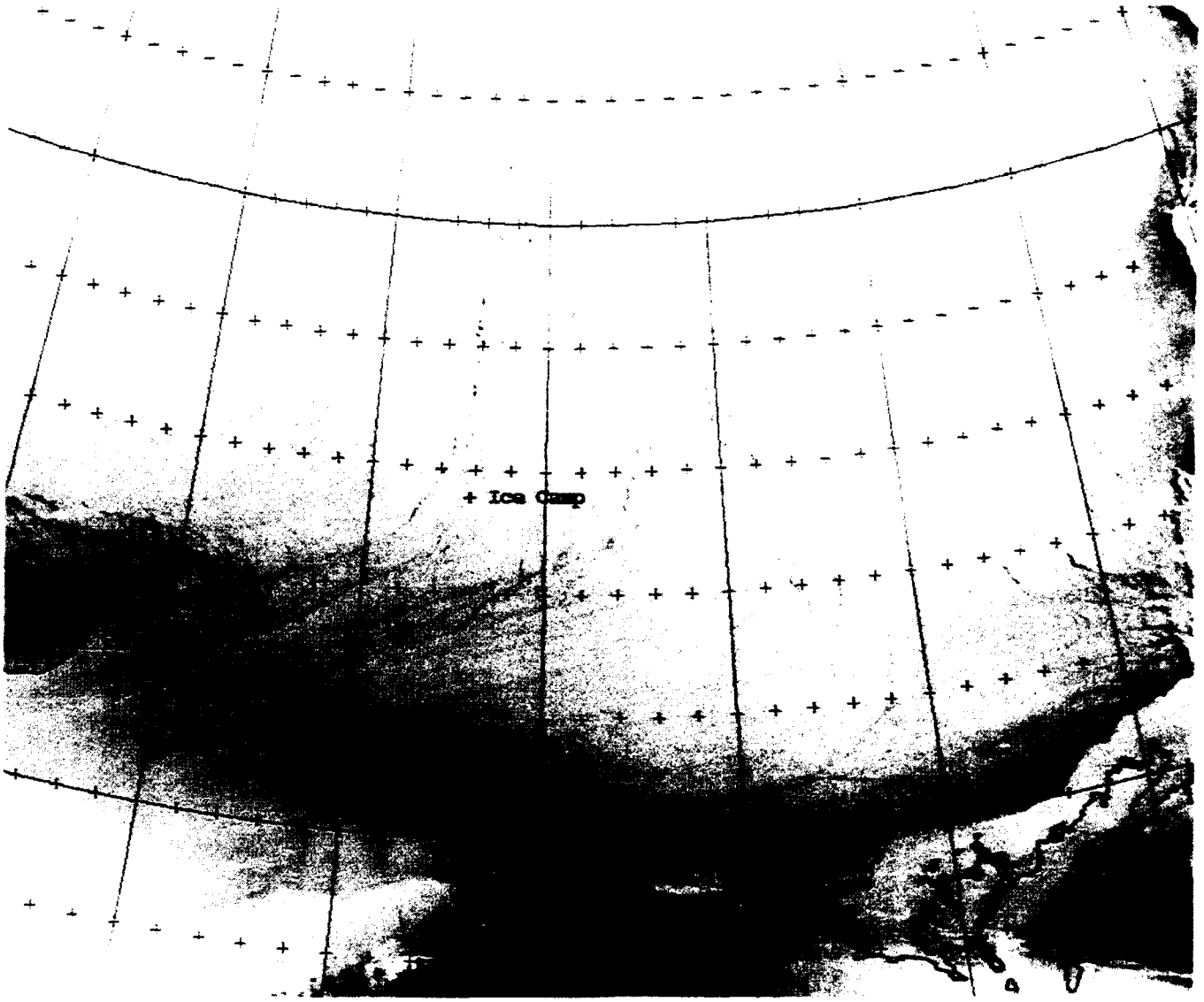
16 Apr 92 1505Z
NOAA AVHRR CH 3-4 Dif
Notable Features:

1. In this channel 3 minus channel 4 difference depiction, a water cloud plume is rendered visible extending from the source region break in the ice.
2. The water plume appears differentiated here since channel 3 gives a stronger response over a water cloud than channel 4. Further downstream, where the plume assumes an ice cloud configuration, the channel 3 response is very similar to that of channel 4; hence, no variation is shown in the difference pattern.



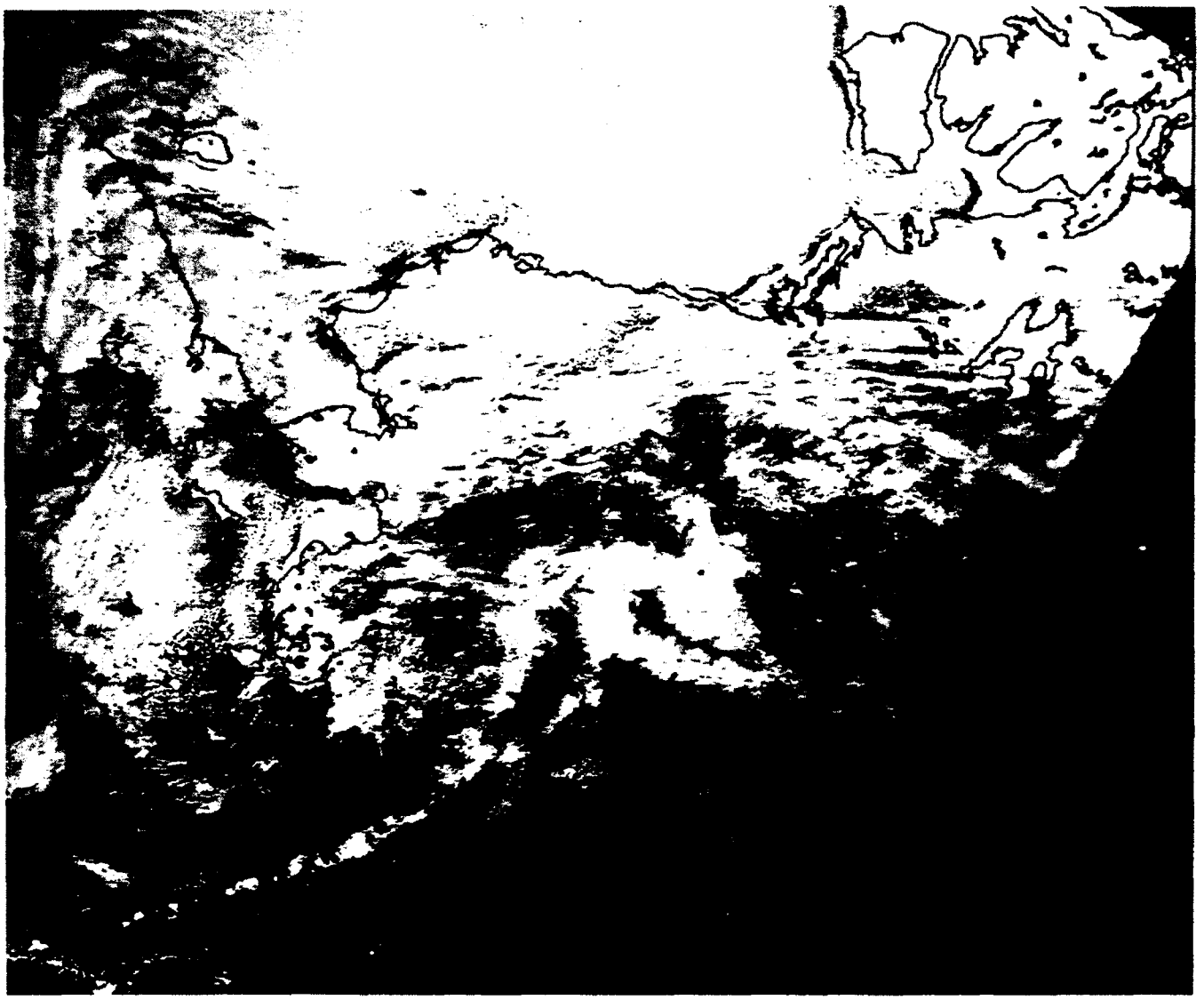
16 Apr 92 1844Z
DMSP OLS IR
Notable Features:

1. Streaks across the Beaufort and Chukchi Seas are not seen over the Canadian archepelago and are therefore considered real. Strong NE winds dominated the entire region from Banks to Wrangel Island (which reported a NE wind at 40 kts at 16/18Z).
2. Note the length of the polynya SW of Katie's floeberg, NW of Barrow. This indicates tremendous wind-induced ice stress.



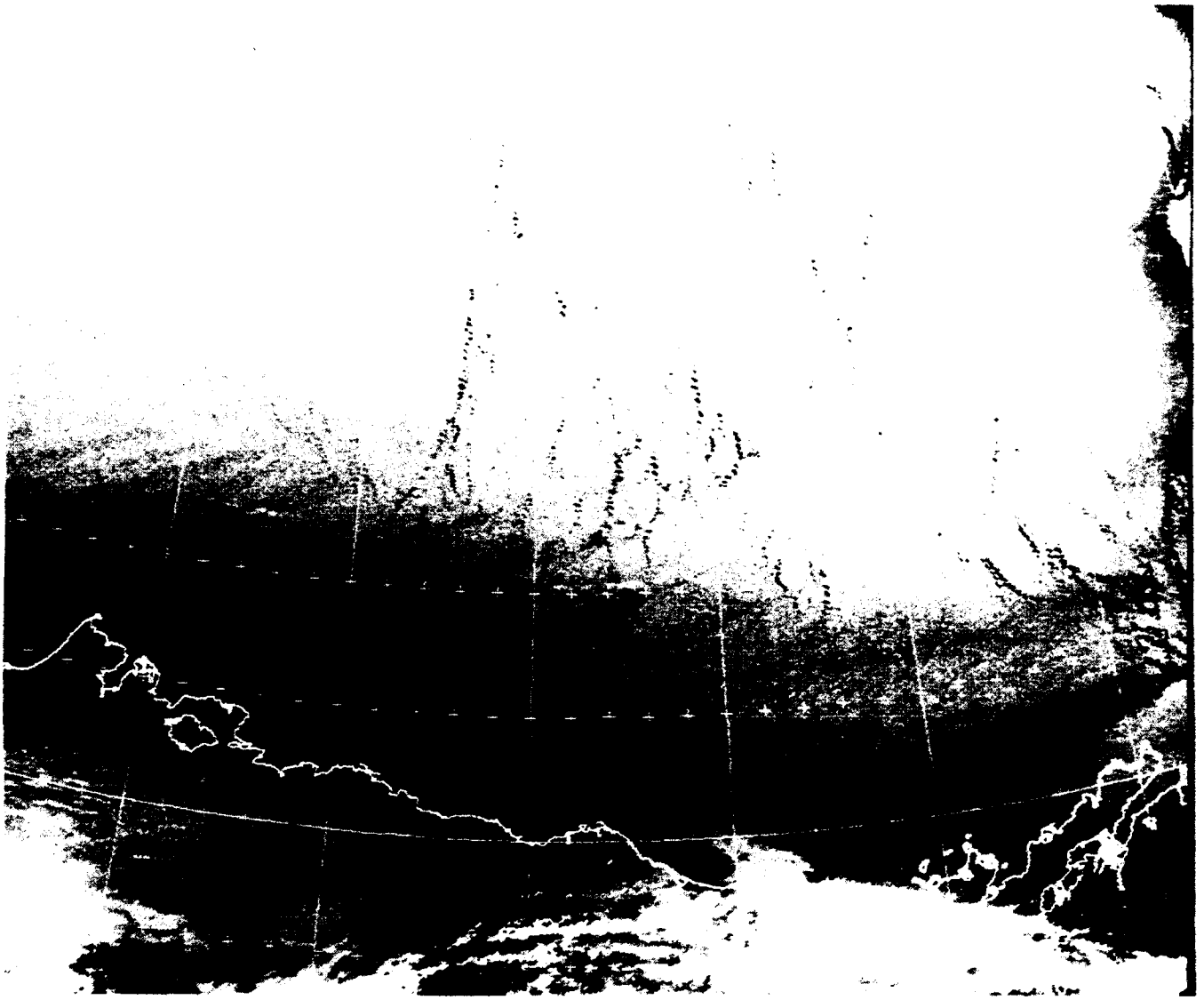
16 Apr 92 1911Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The streaks are more east-northeasterly SE of the ice camp; they turn more northeasterly NW of the ice camp. This is in agreement with a similar change in wind direction as shown on the NORAPS 10m analyses at 16/00Z, 16/12Z, and 17/00Z.
2. The alternation of light and dark bands implies a mechanism of low level ascending and descending air in a cellular type of circulation.



16 Apr 92 2023Z
DMSP OLS VIS
Notable Features:

1. A large scale view of the region shows loss of detail over the southern Beaufort Sea.
2. No disturbances are apparent north of the N. Slope.

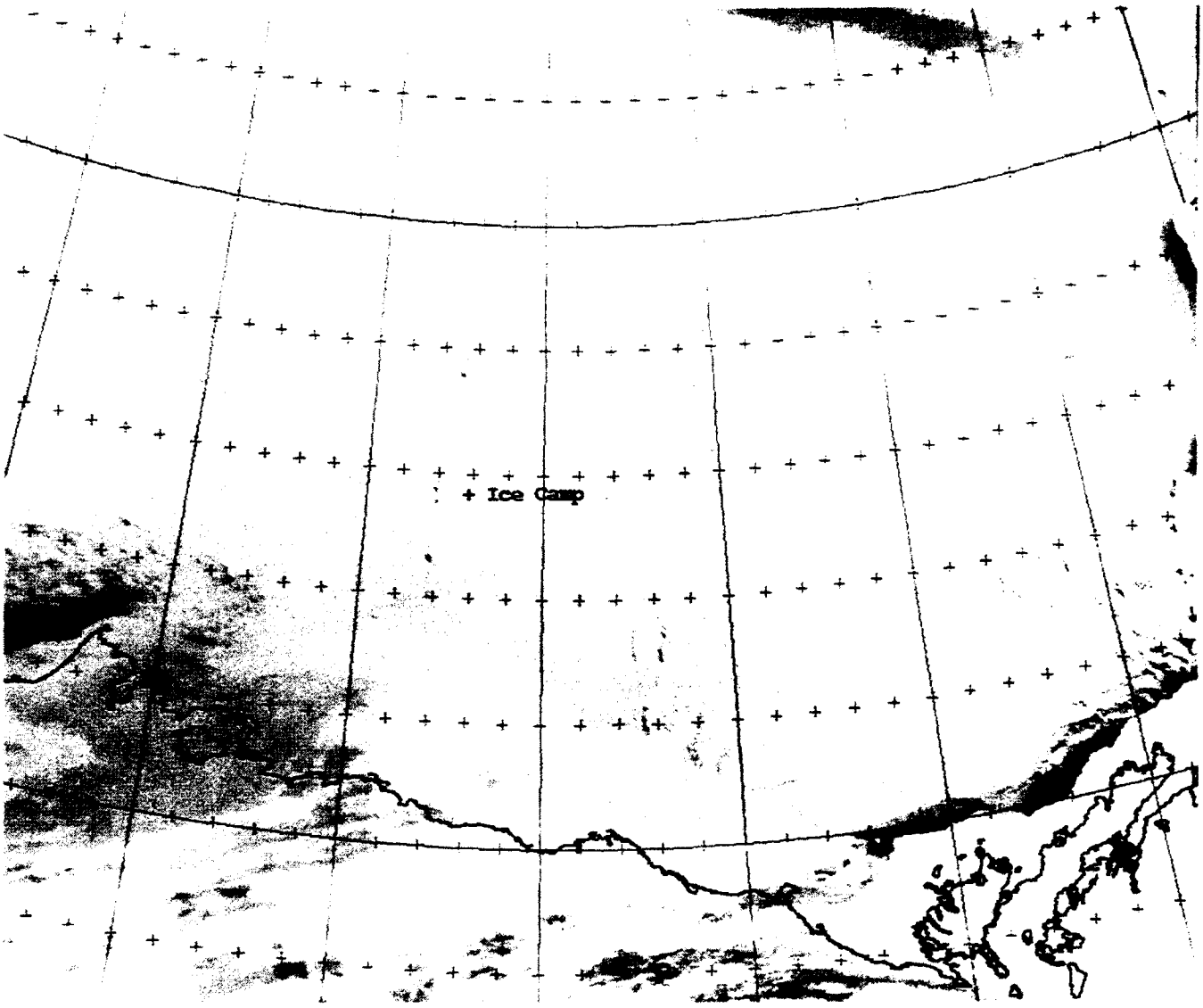


17 Apr 92 0014Z
DMSP OLS IR
Notable Features:

1. 30-35 kt NE winds are prevalent along the N. Slope from Barter Island to Barrow.
2. A strong gradient exists almost to 75N.
3. The "streak pattern" appears real and related to cellular circulations of low level ascending and descending motion.

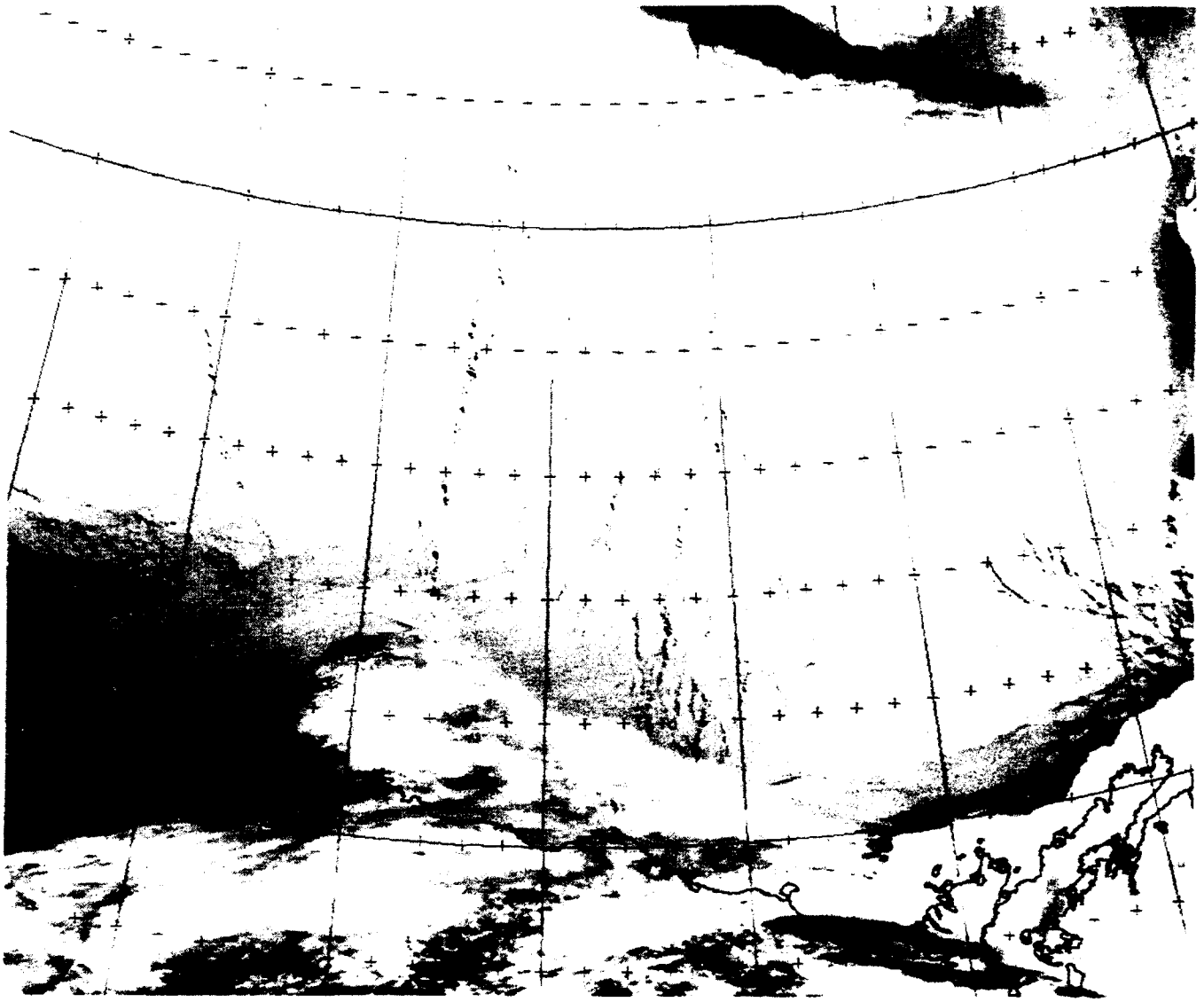
17 Apr 92 0433Z
DMSP OLS IR
Notable Features:

1. A larger scale view shows streaks persisting over the Beaufort and Chukchi Seas. This is not unreasonable since the strong gradient persists westward to Wrangle Island.



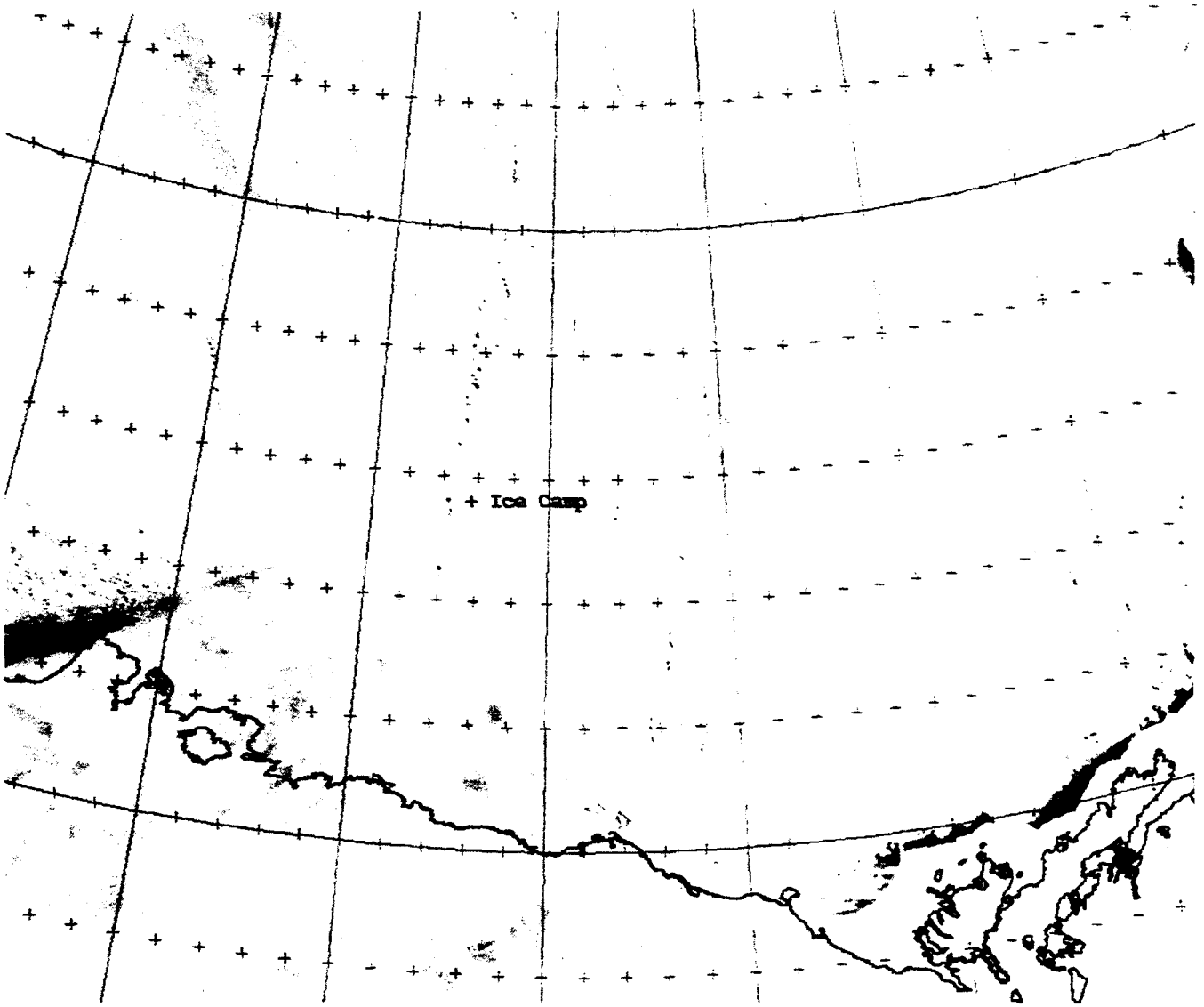
17 Apr 92 1313Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Middle or upper level cloudiness from interior Alaska has moved northward over the N. Slope.
2. Streaks are still evident at this time over the S. Beaufort Sea.



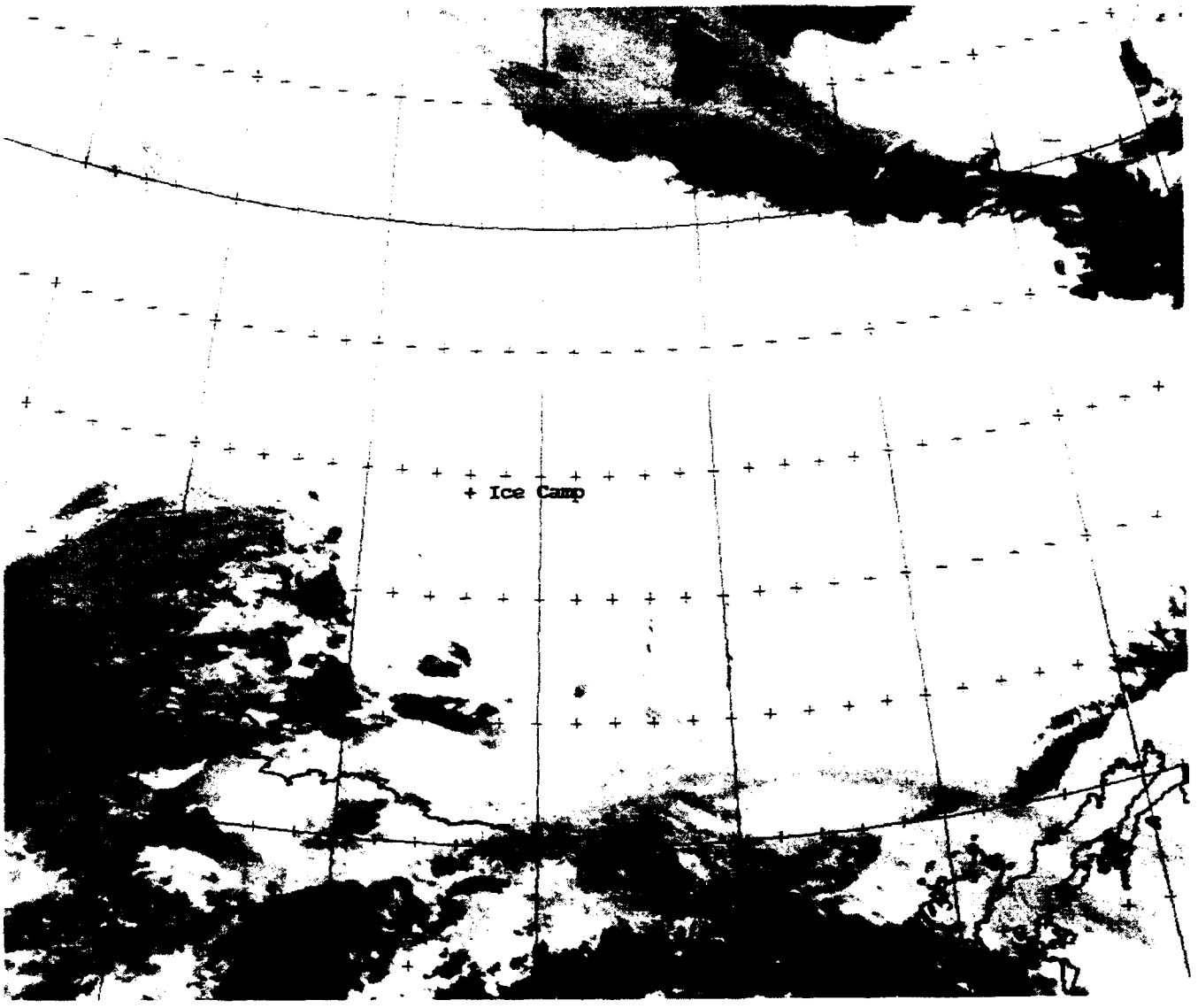
17 Apr 92 1454Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Streaks are very evident in this depiction.
2. NORAPS shows a low pressure cell centered over the Brooks Range south of Deadhorse.
3. If this image is compared with one 9 days earlier (8 April 0027Z) it will be seen that the lead configuration has changed drastically to a more N-S orientation whereas previously it was more NE-SW configured.



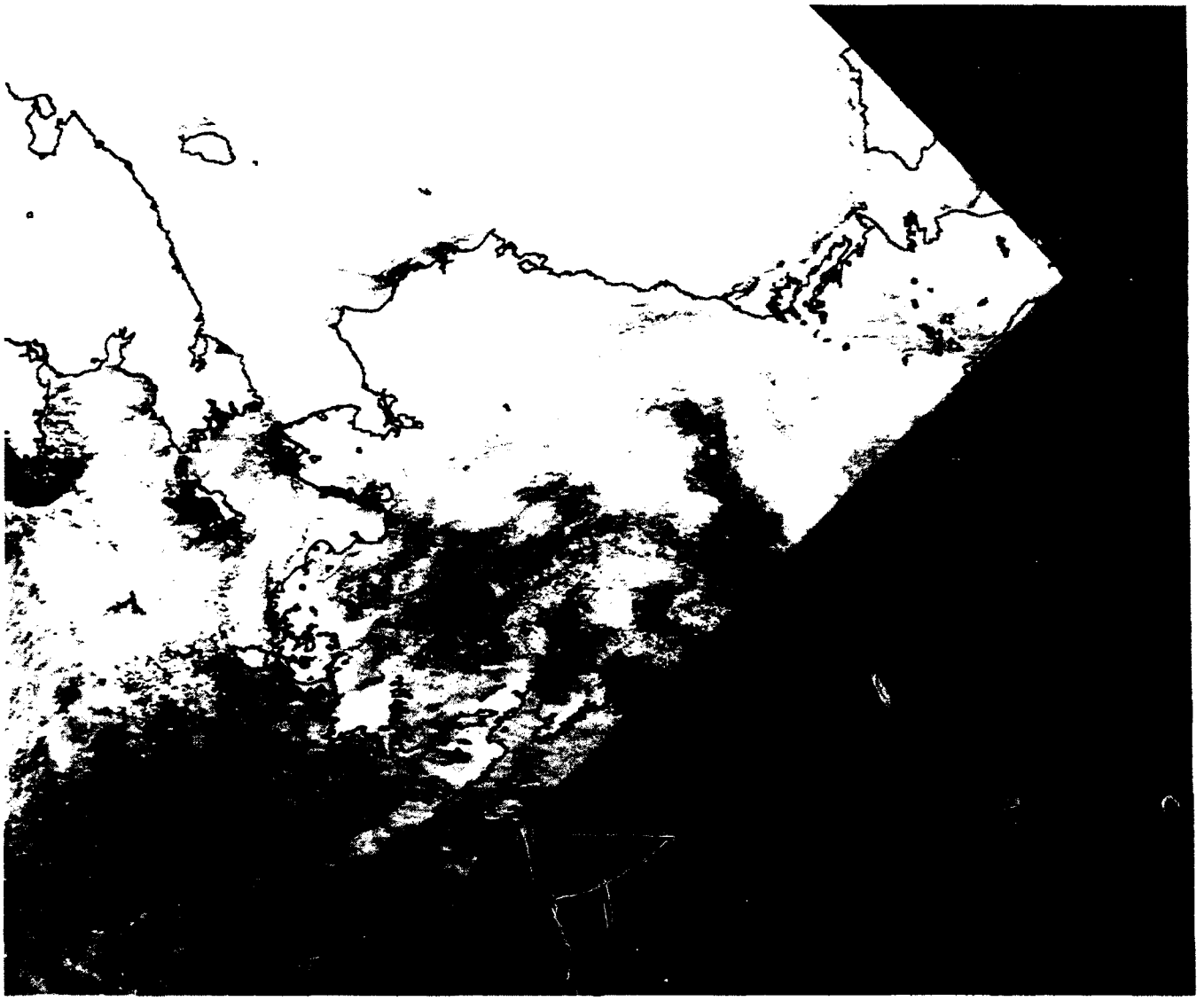
17 Apr 92 1540Z
DMSP OLS VIS
Notable Features:

1. Dense blowing snow covers most of the N. Slope stations.
2. Fairly heavy cloudiness appears NE of Barrow. This cloud mass is moving westward.



17 Apr 92 2027Z
NOAA AVHRR CH 3 IR
Notable Features:

1. A dense water plume is evident west of Banks Island. The plume extends in an ever-widening fashion NW'ward.
2. Cloudiness from a short wave trough moves east of Barrow.
3. Apparent open lead N. of Tuktoyaktuk Peninsula is probably low clouds over the open lead rather than the lead itself.

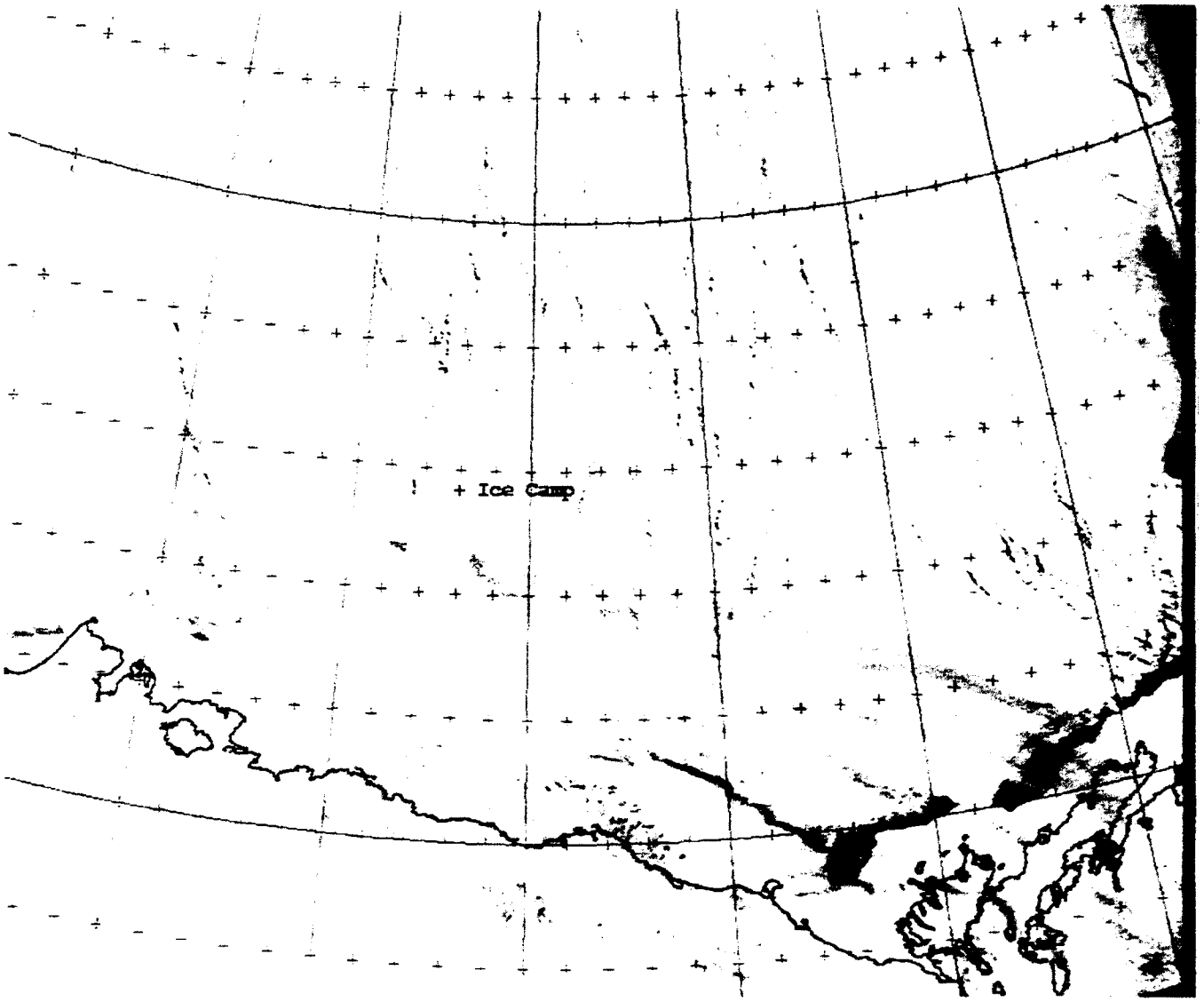


17 Apr 92 2132Z
DMSP OLS VIS
Notable Features:

1. Cloudiness from an apparent short wave trough extends north of Barrow in this larger scale view.
2. Active cloud plumes are evident emanating from the polynya on the west coast of Banks Island. This plume extends westward for several hundred miles! Note also the plume from the large polynya near Wainwright and Point Lay.

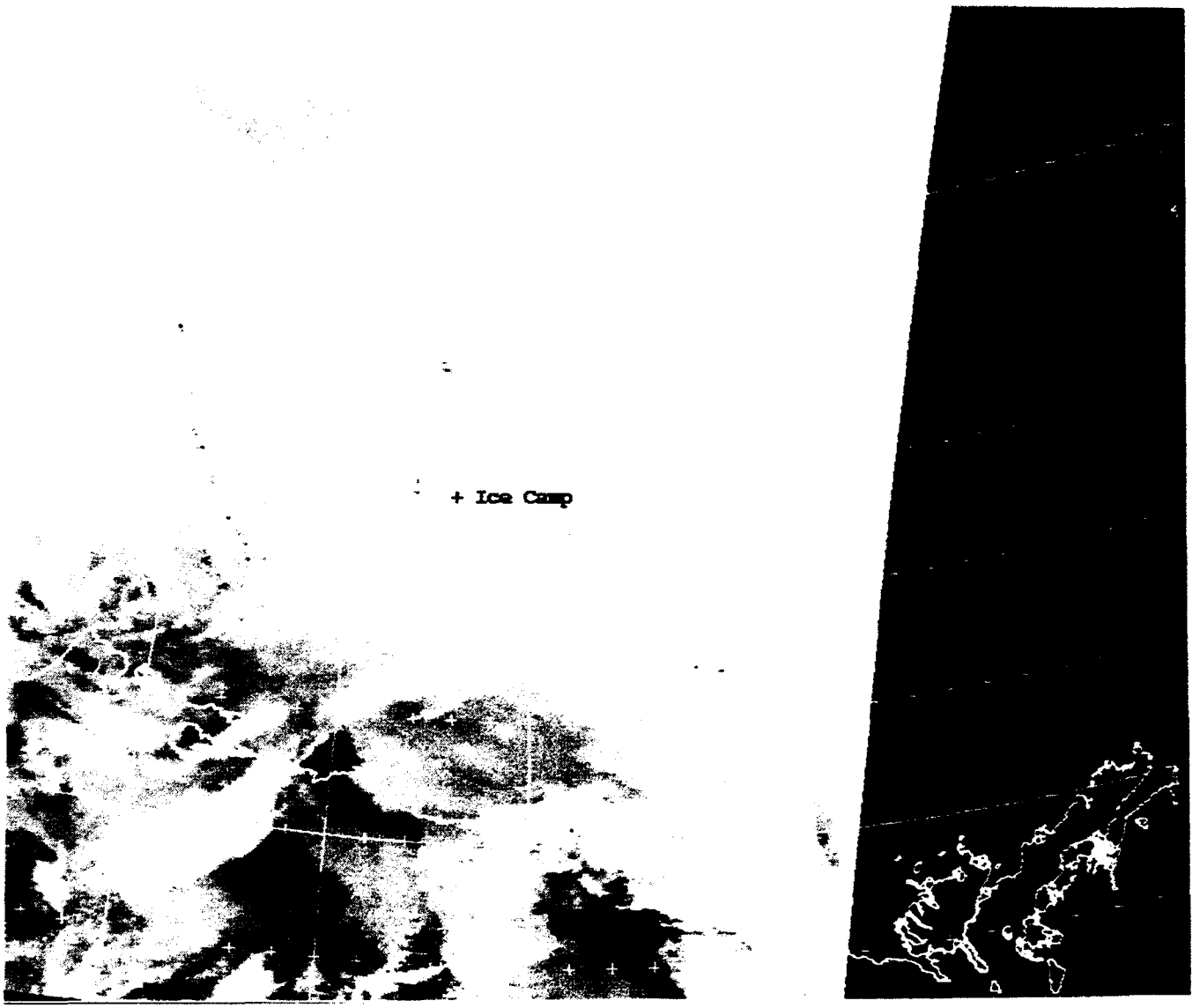
17 Apr 92 2315Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The Banks Island polynya plume is also evident on this image.
2. The large curved cloud band north of Barter Island is outer cloudiness from a system to the south.



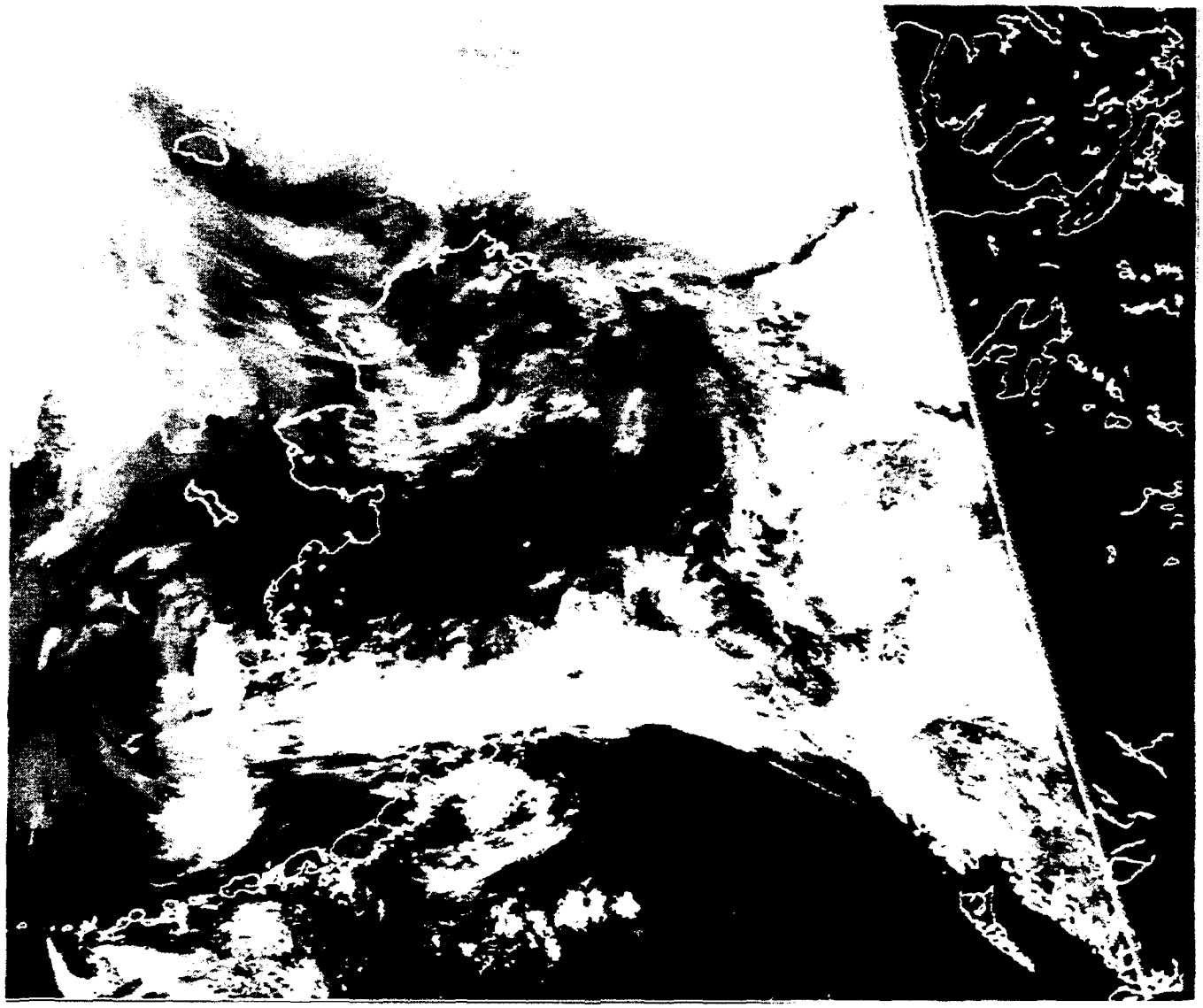
18 Apr 92 0142Z
DMSP OLS VIS
Notable Features:

1. The Banks Island cloud plume is shown as thin and transparent in the top center of this image.
2. The large open leads or polynyi north of the Tuktoyaktuk Peninsula are noteworthy in this example.



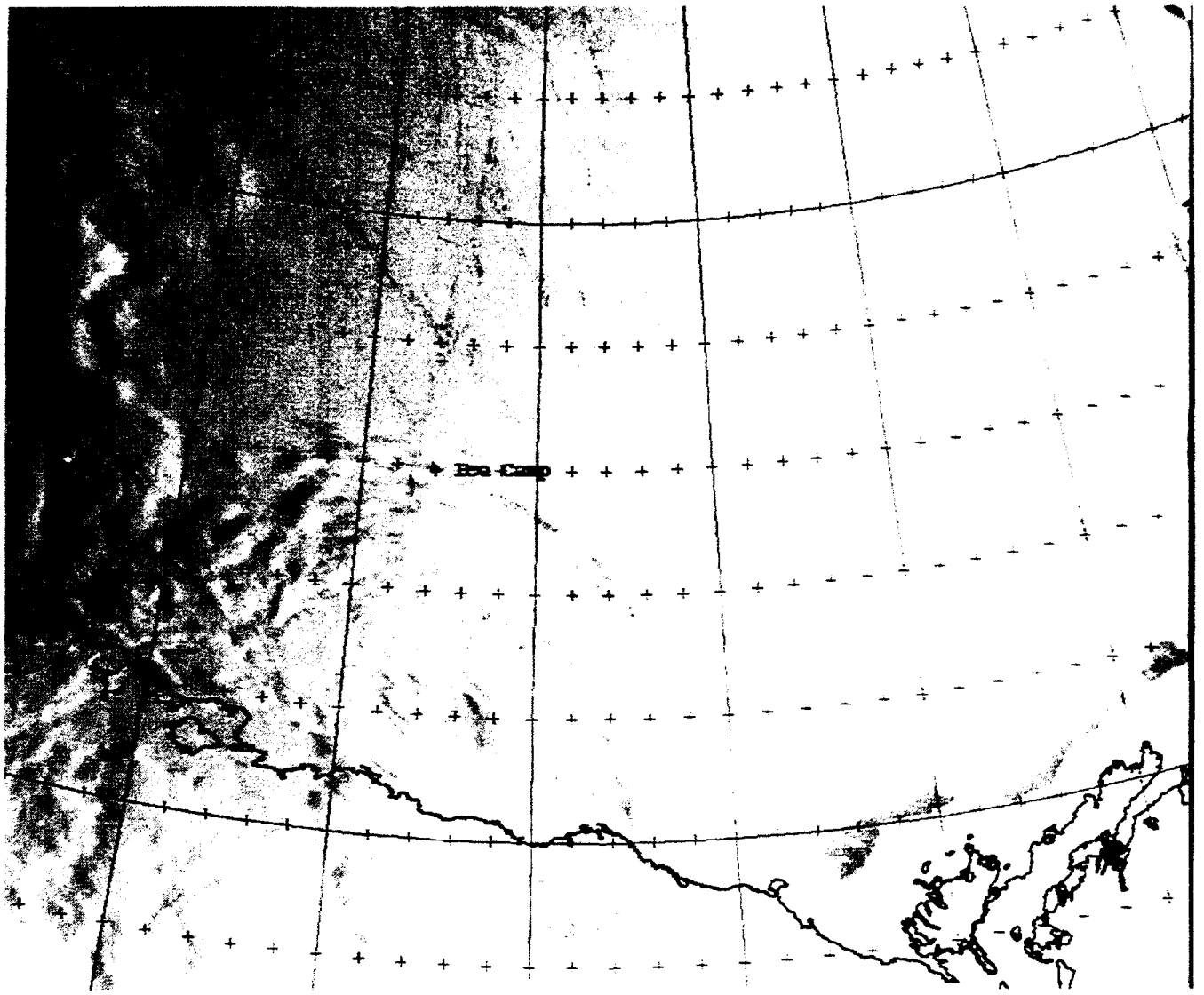
18 Apr 92 0324Z
DMSP OLS IR
Notable Features:

1. An IR view of the region showing little change.



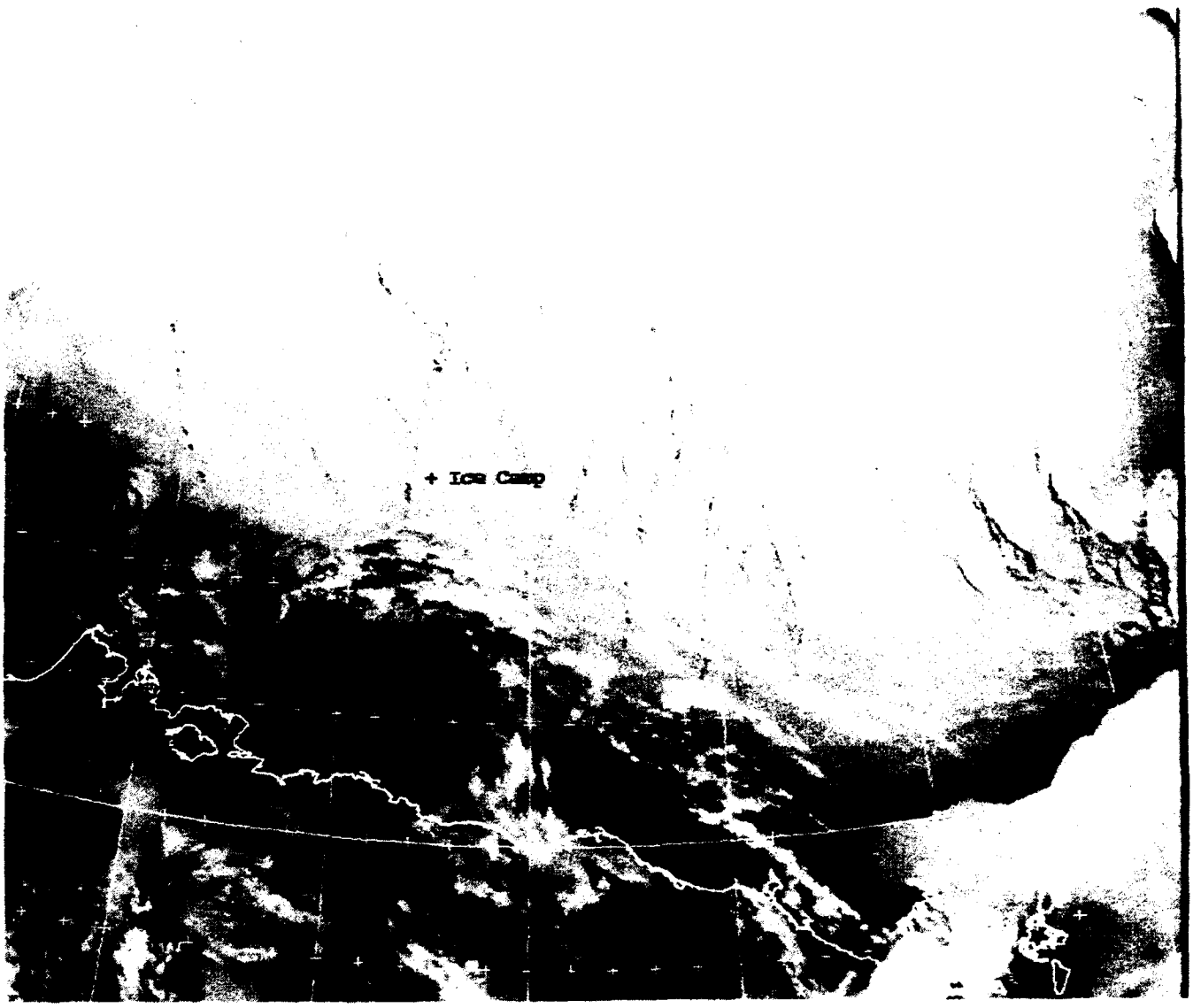
18 Apr 92 0542Z
DMSP OLS IR
Notable Features:

1. The short wave trough west of Barrow has increased in amplitude.
2. Some cloudiness from the Bank polynya has swept back over the island. NORAPS shows the winds beginning to shift from easterly to westerly near the island.



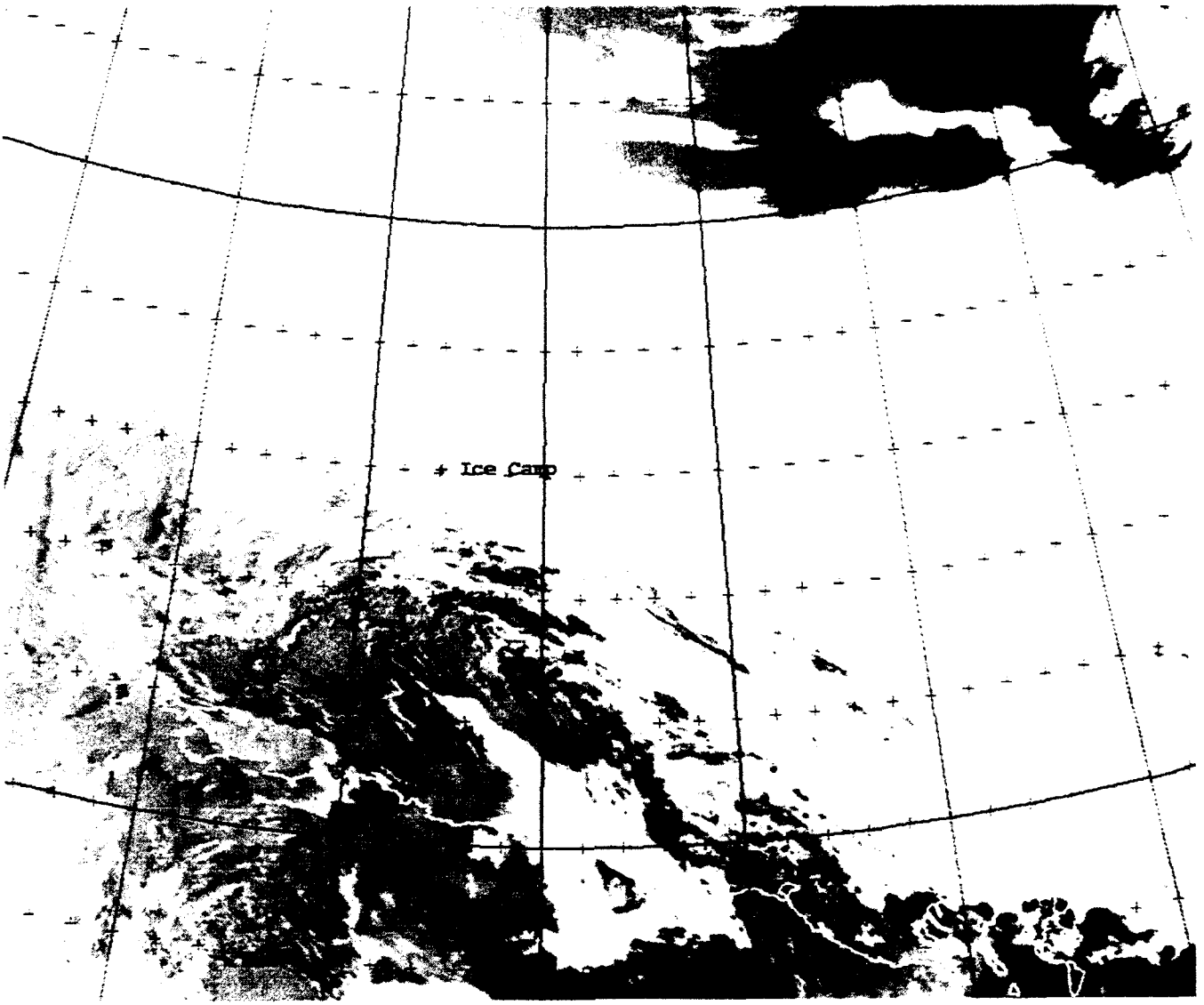
18 Apr 92 1622Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. A new vortex has developed east of Barrow. It seems quite active as convective towers are evident.
2. Some gray shades in the polynya area north of the Tuktoyaktuk Peninsula suggest lead is not completely open.



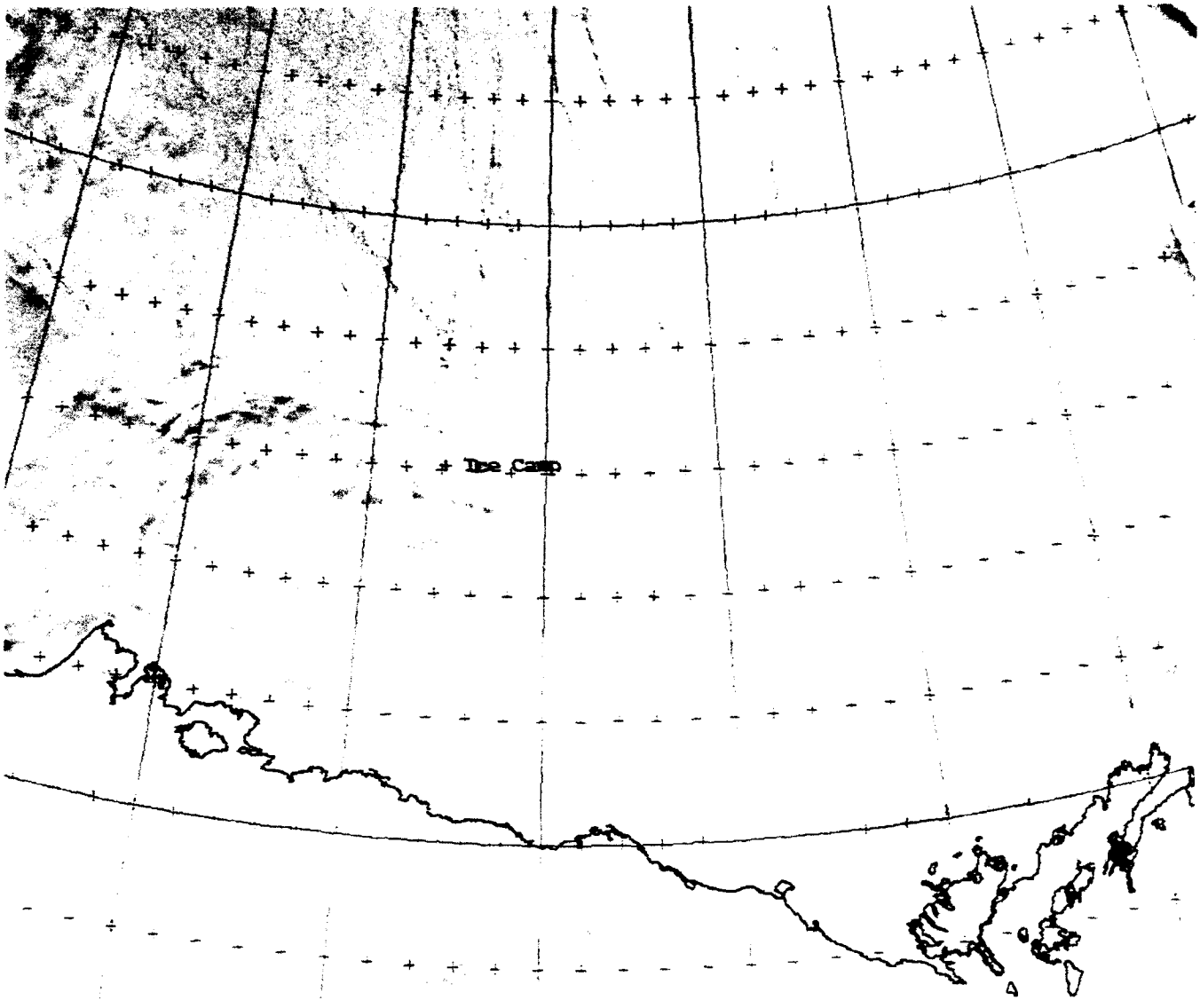
18 Apr 92 1622Z
NOAA AVHRR CH 4 IR
Notable Features:

1. High, cold, convective towers are delineated in this IR view.
2. Cooler temperatures can be detected in "apparently" open lead area.



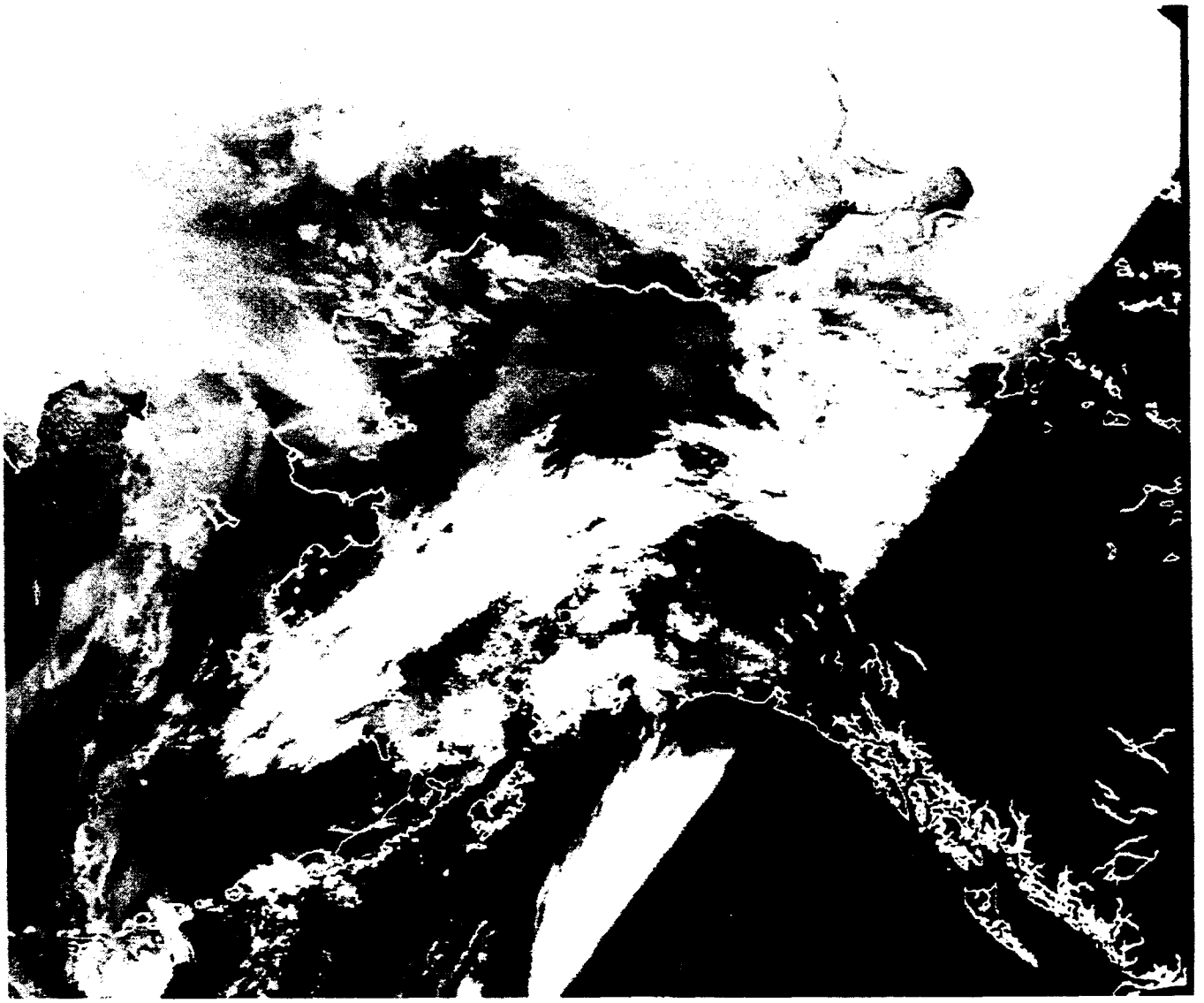
18 Apr 92 1622Z
NOAA AVHRR CH 3 IR
Notable Features:

1. Vorticle nature of cloud area east of Barrow readily apparent in this image.
2. Note open lead area not so clearly evident in this channel 3 image.
3. Low cloudiness to the north barely perceptible in previous vis and IR images clearly delineated by channel 3.



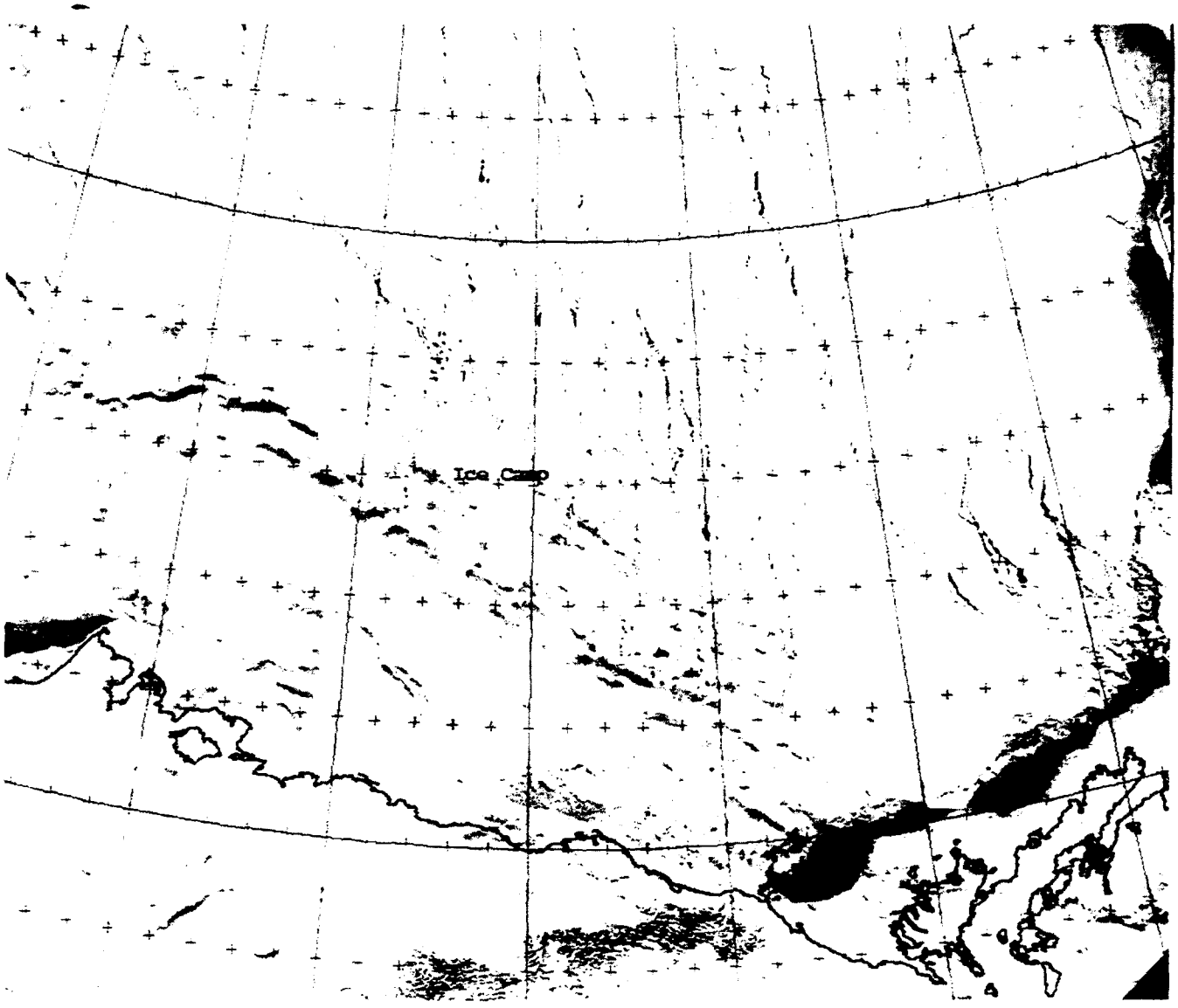
18 Apr 92 2003Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. Further development and westward movement of the vortex east of Barrow is evident in this image.



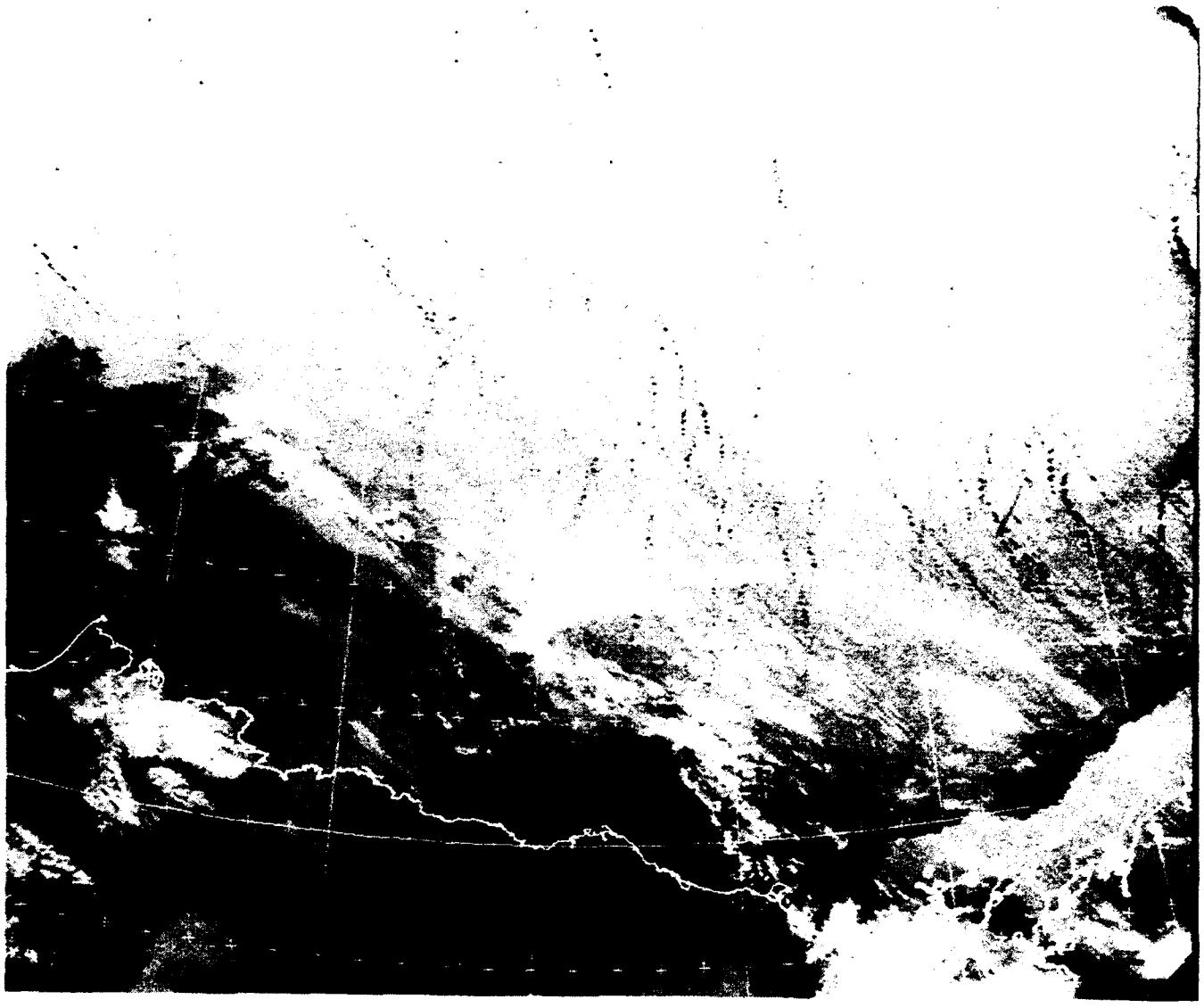
19 Apr 92 2100Z
DMSP OLS IR
Notable Features:

1. A large scale view of the region suggests a series of short waves progressing along the N. Slope of Alaska.



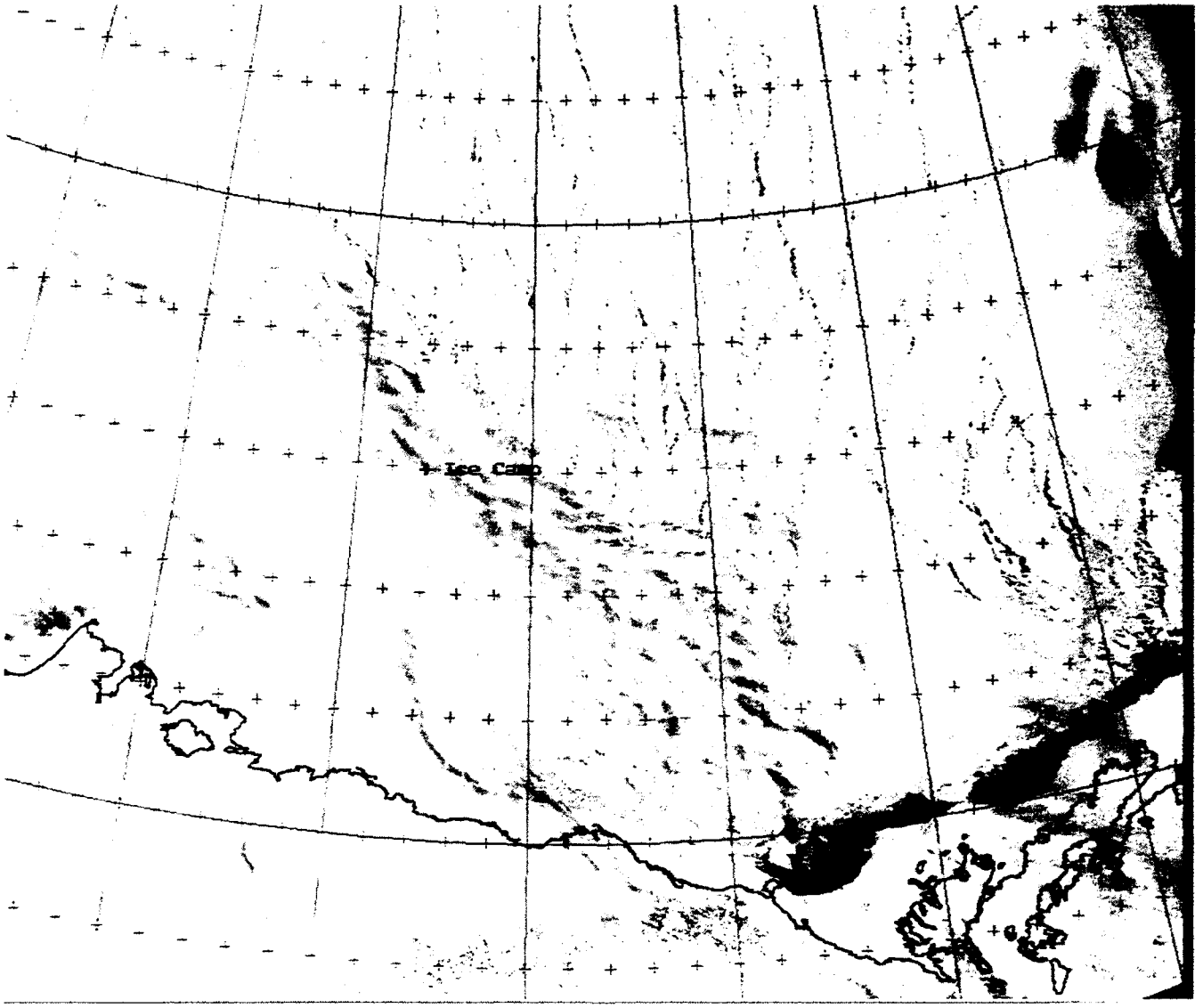
19 Apr 92 2101Z
DMSP OLS VIS
Notable Features:

1. Clear delineation of lead features apparent in this image.
2. Heavy low cloudiness approaches Barrow.



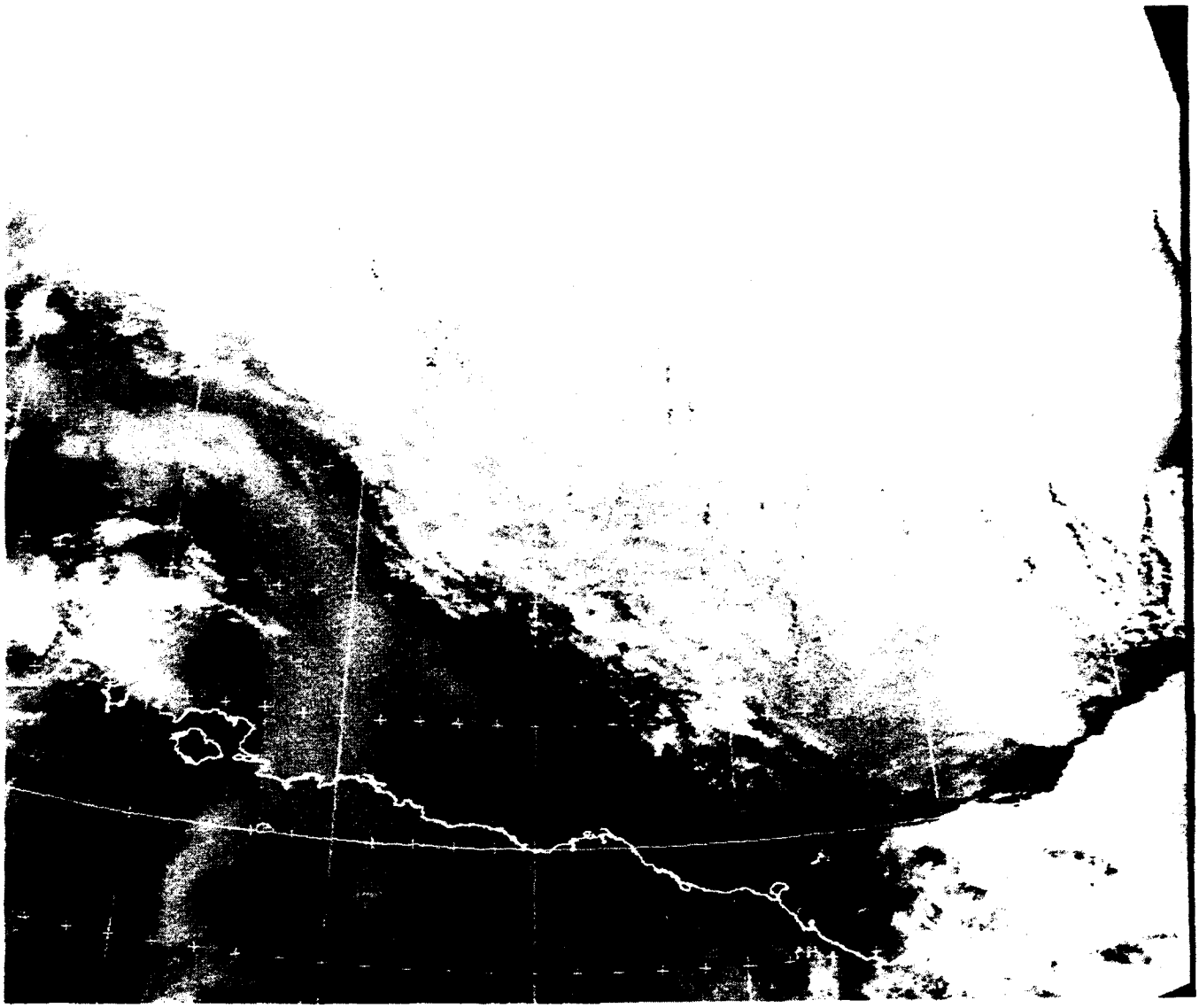
18 Apr 92 2101Z
DMSP OLS IR
Notable Features:

1. Note vortex S. of Barrow in this companion IR view.
2. Another short wave appears N. of Barter Island.



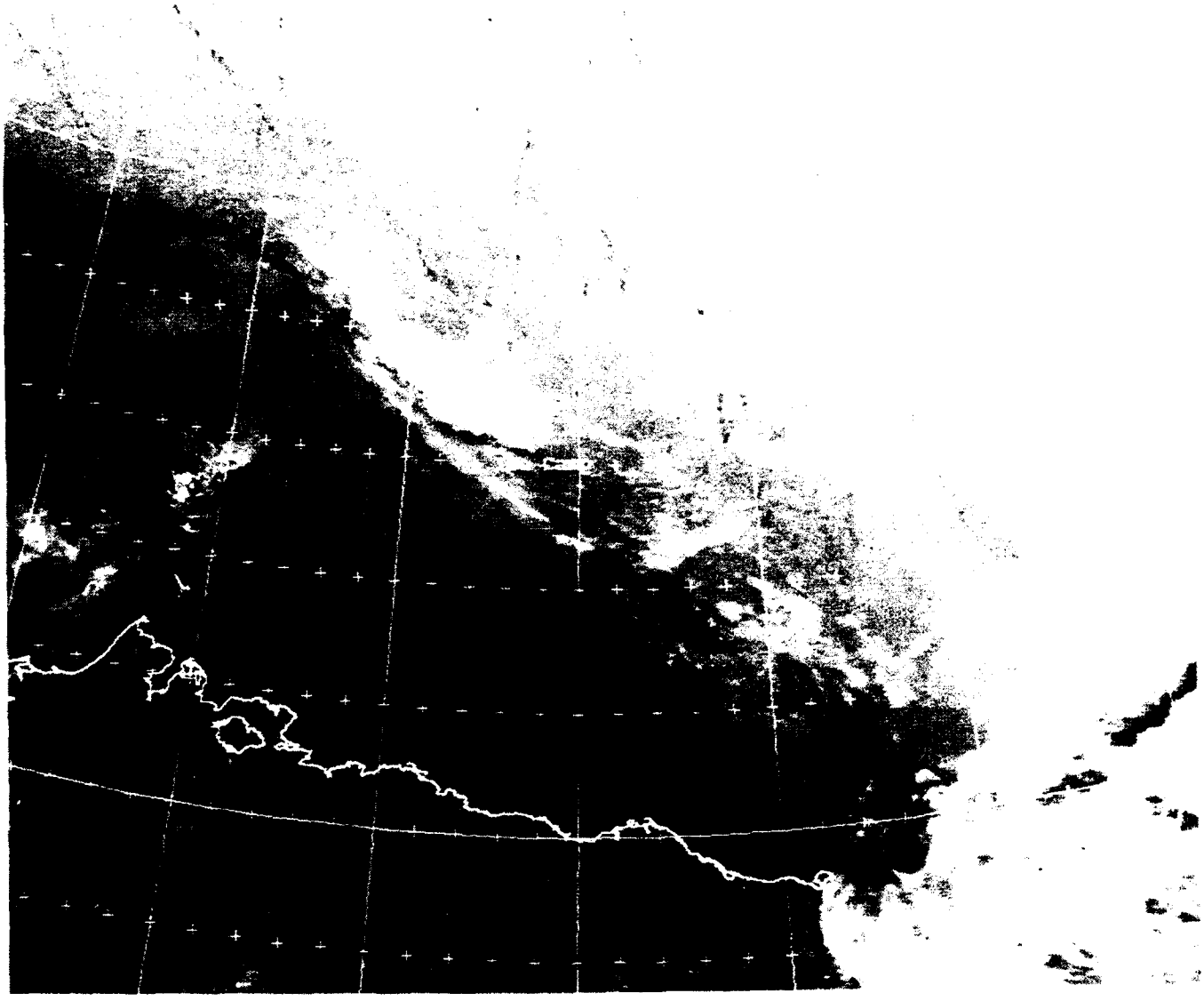
19 Apr 92 0129Z
DMSP OLS VIS
Notable Features:

1. Surface analyses on this date showed a low centered west of Barrow; a moderate gradient producing NE flow over the S. Beaufort; and a frontal feature moving northward over the N. Slope from northern Alaska.
2. This visible depiction shows evidence supporting a vortex and frontal cloudiness north of Barrow.



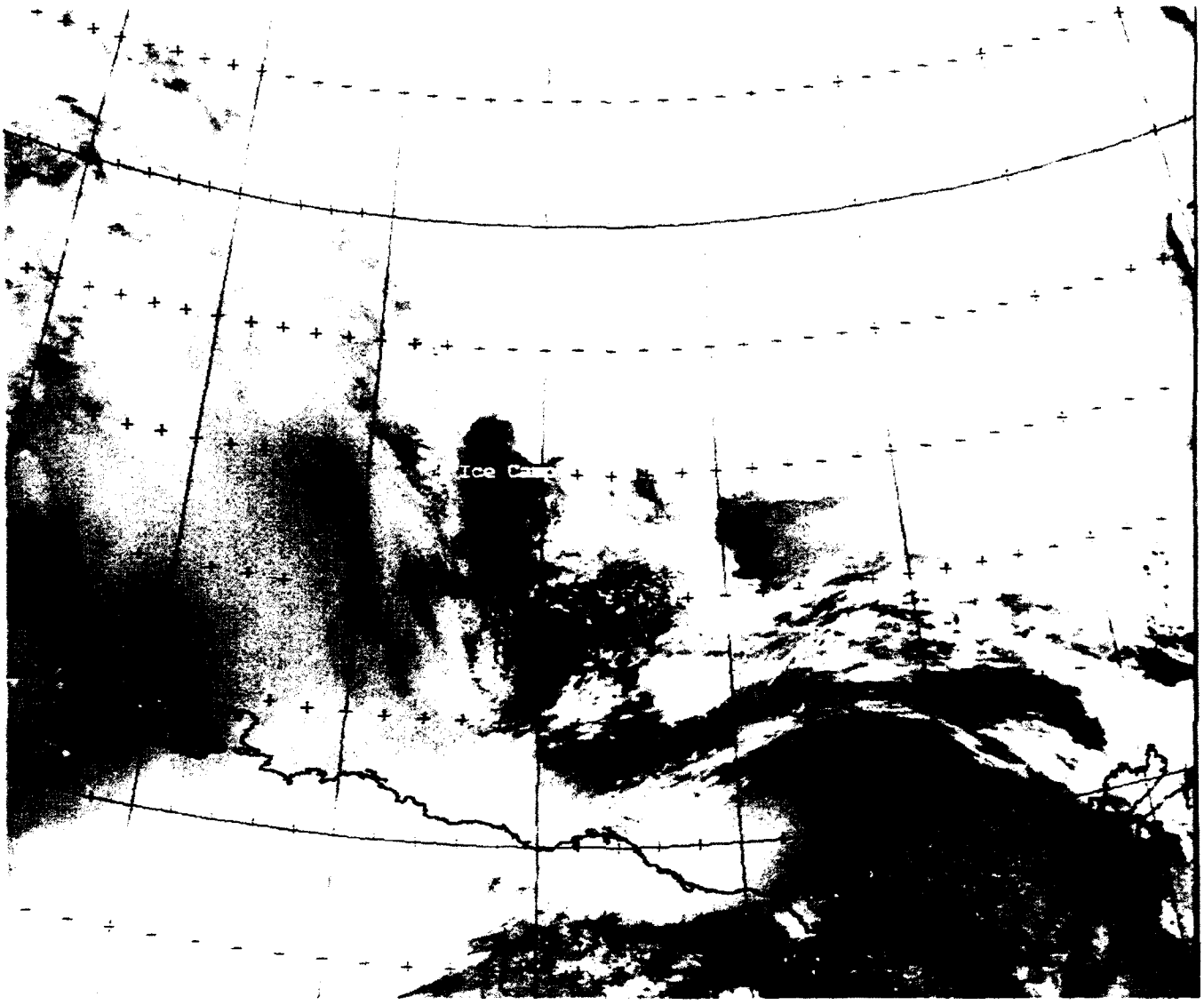
19 Apr 92 0129Z
DMSP OLS IR
Notable Features:

1. This companion IR view provides detail on cloud top height and shows very low clouds swirling into the vortes N. of Barrow, fringed by an upper level cloud band to the north and east.



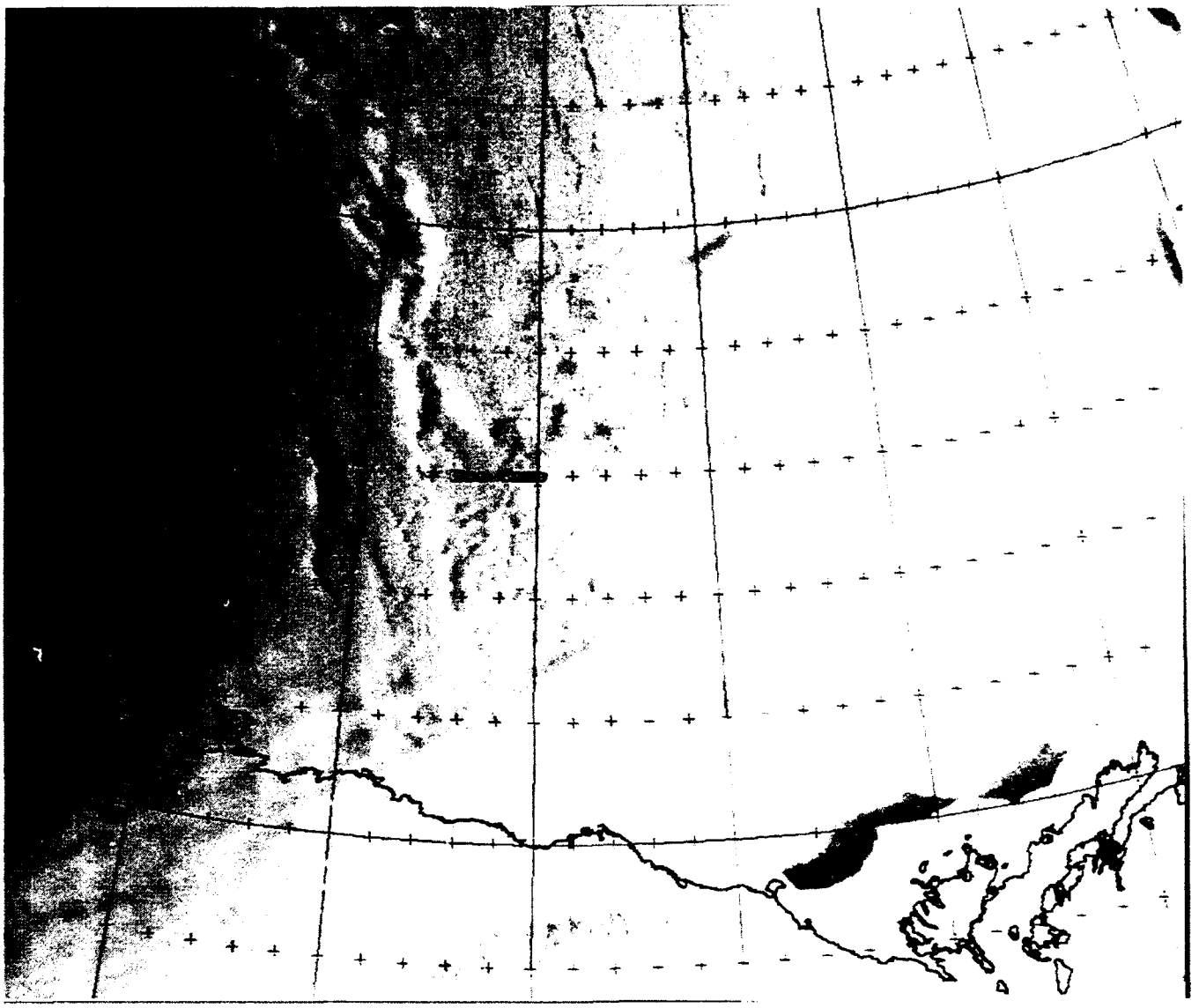
19 Apr 92 0422Z
NOAA AVHRR CH 4 IR
Notable Features:

1. A vortex is more clearly defined NW of Barrow with a second vortex, as earlier suggested, ESE of the ice camp.
2. **A NORAPS CROSS-SECTION THROUGH THE ICE CAMP COULD BE REVEALING AT THIS TIME.** Ice camp RAOB data and also buoy data may be helpful.



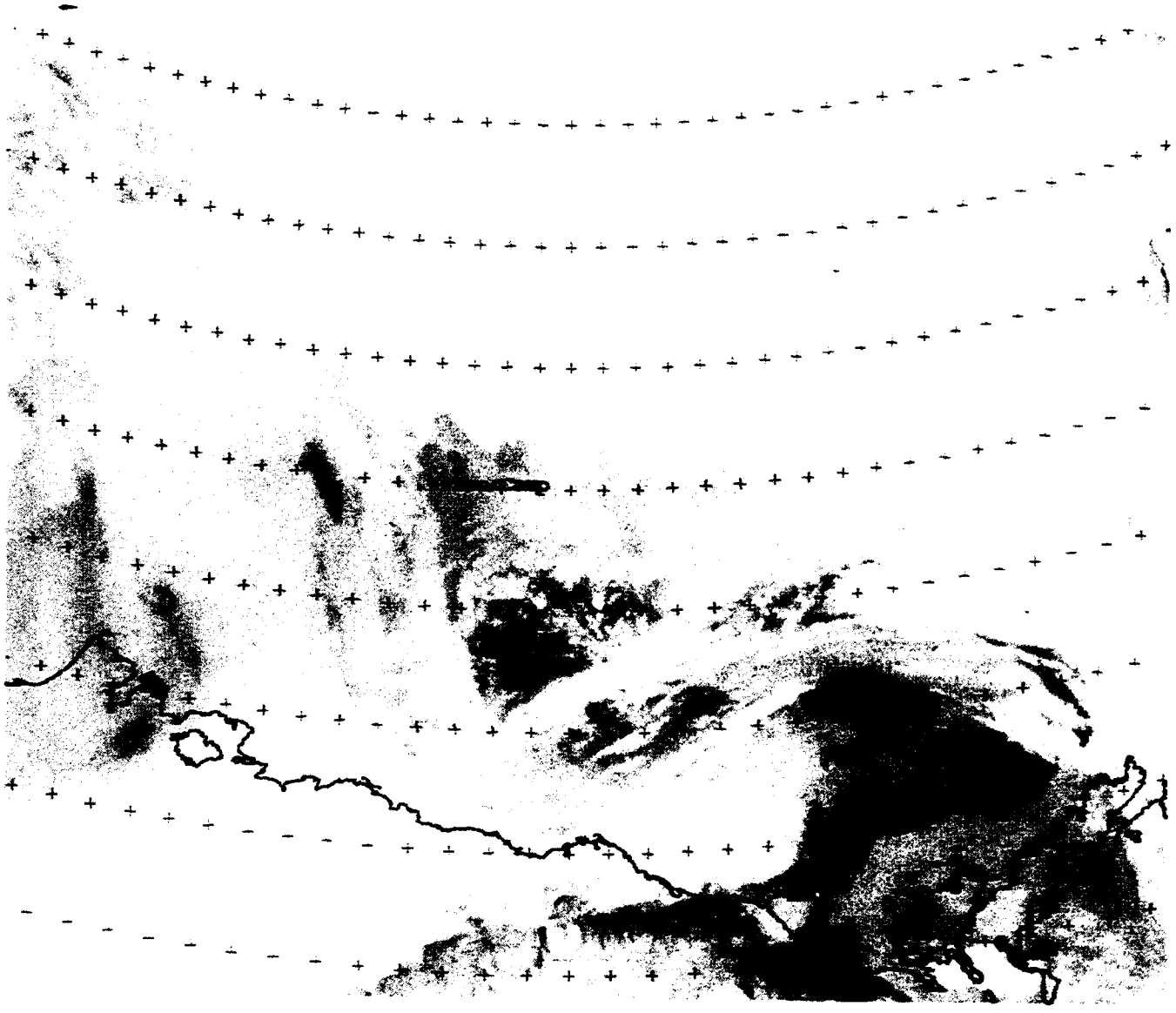
19 Apr 92 1430Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The vortex east of the ice camp has dipped southward and is now SSE of the camp.
2. A heavy low overcast band still persists north and east of Barrow.



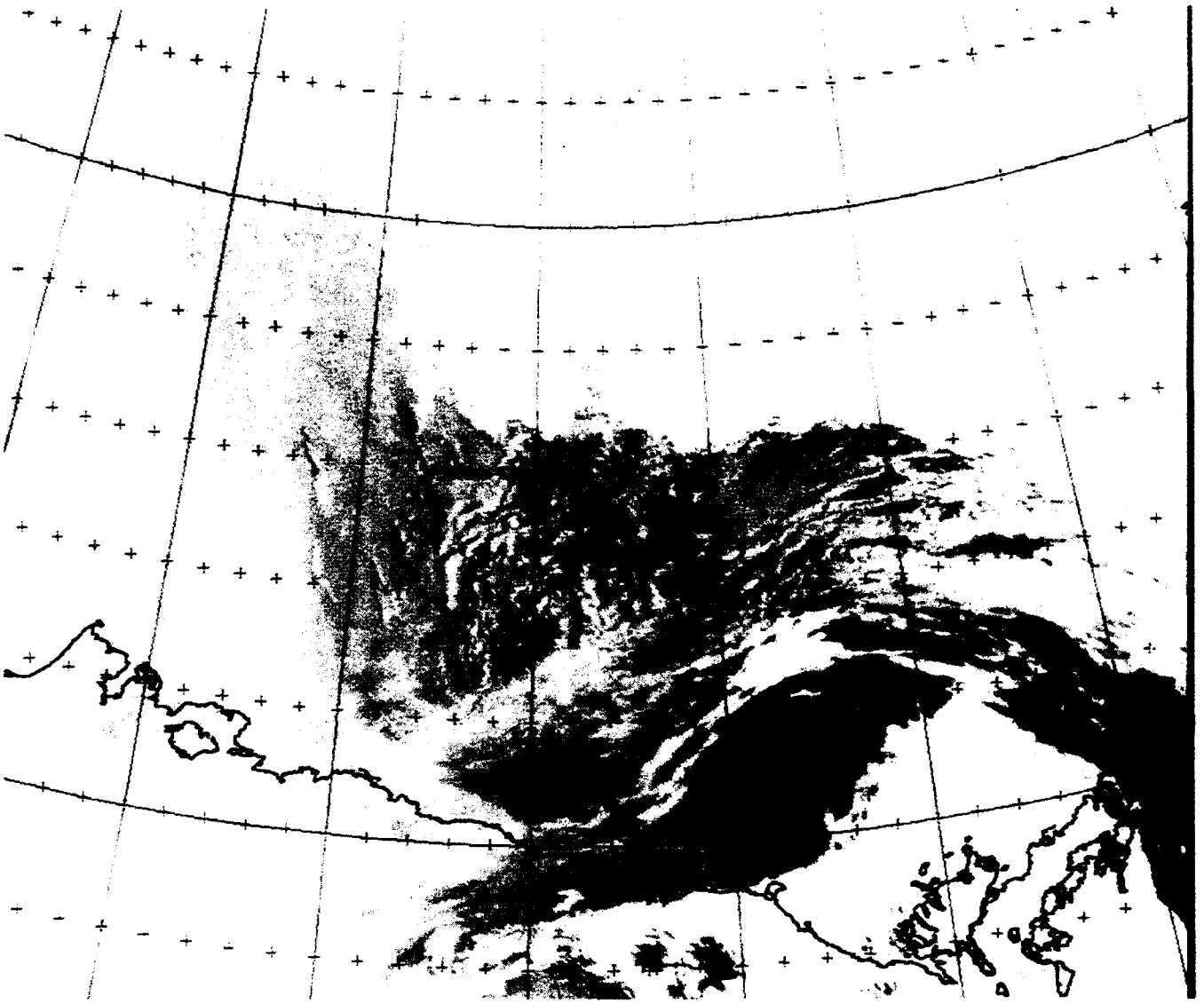
19 Apr 92 1610Z
NOAA AVHRR CH 1 VIS
Notable Features:

1. The "flat" appearance of the cloud band north and east of Barrow indicates formation <u>under</u> a strong low level inversion.
2. The vortex SSE of the ice camp is not well defined at this time.



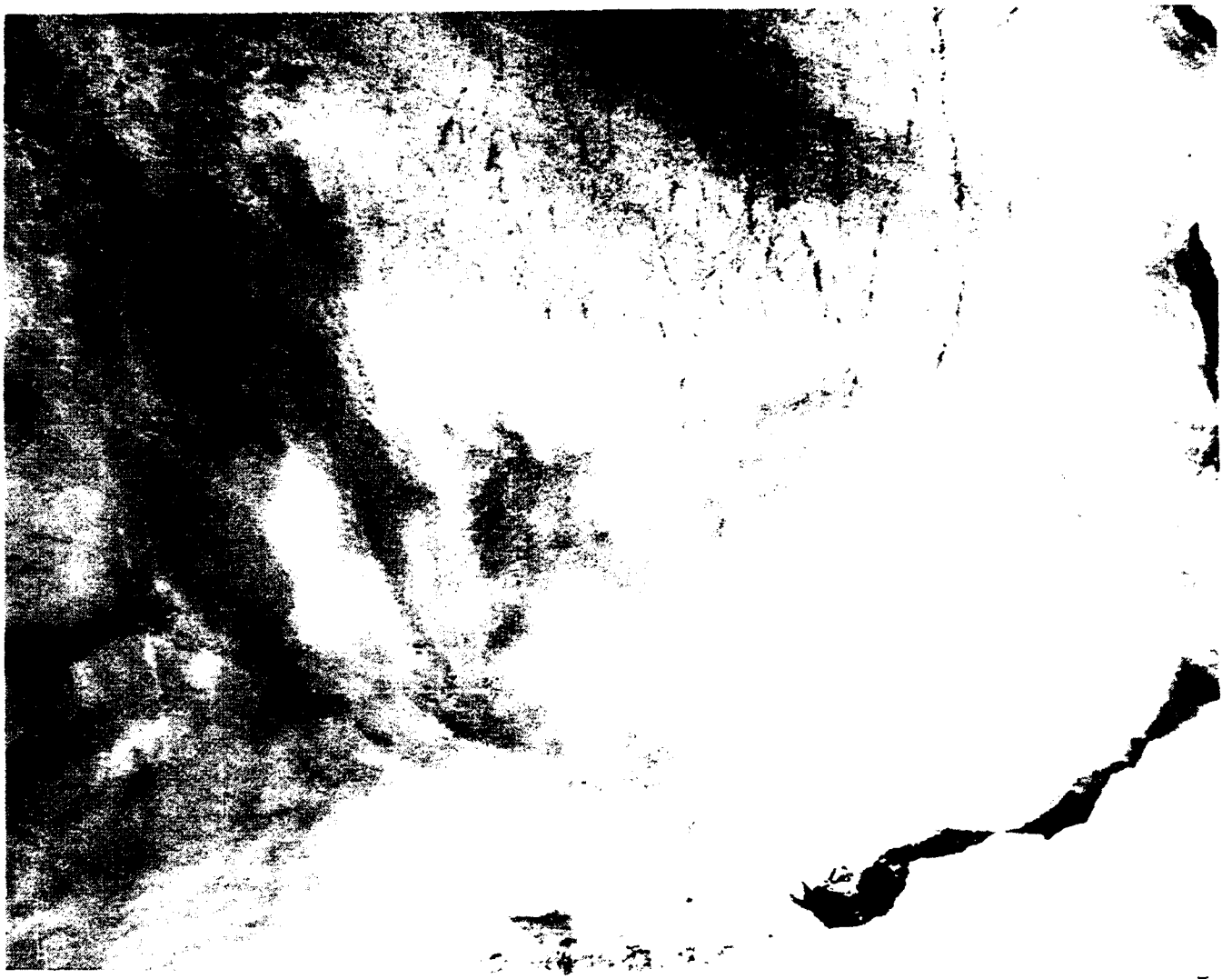
19 Apr 92 1610Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The companion IR provides additional information on cloud top heights.



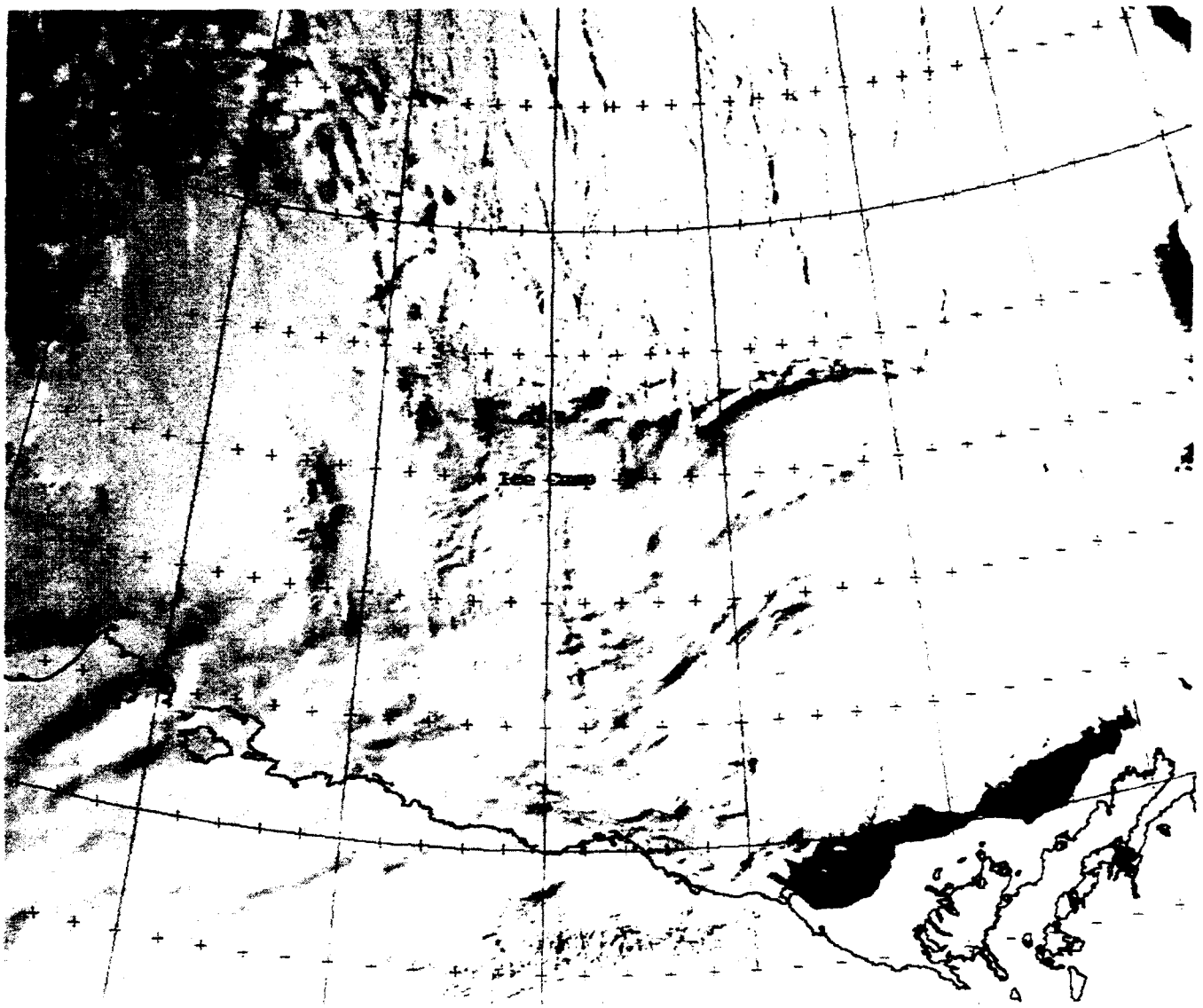
19 Apr 92 1610Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The simultaneous channel 3 data provides additional detail in revealing a mesoscale vortex NNE of Herschel Island. Anchorage forecasters were showing a frontal vortex moving up from the south to near that position (70.3N, 140W).



19 Apr 92 1800Z
NOAA AVHRR CH2/CH1 DIF
Notable Features:

1. The difference pattern between channel 2 and channel 1 has been found useful in providing enhanced detail at ice/water boundaries. The reason for this is that channel 2 extends into the near-IR and any, even slightly water-covered surface, appears black in channel 2, whereas the same area in channel 1, for example, ice covered by a thin film of water, will appear white. The difference between the 2 channels will therefore be large.
2. In this respect note increased ice detail in the open lead in the SE corner of the image and in the ice pattern surrounding Banks Island.

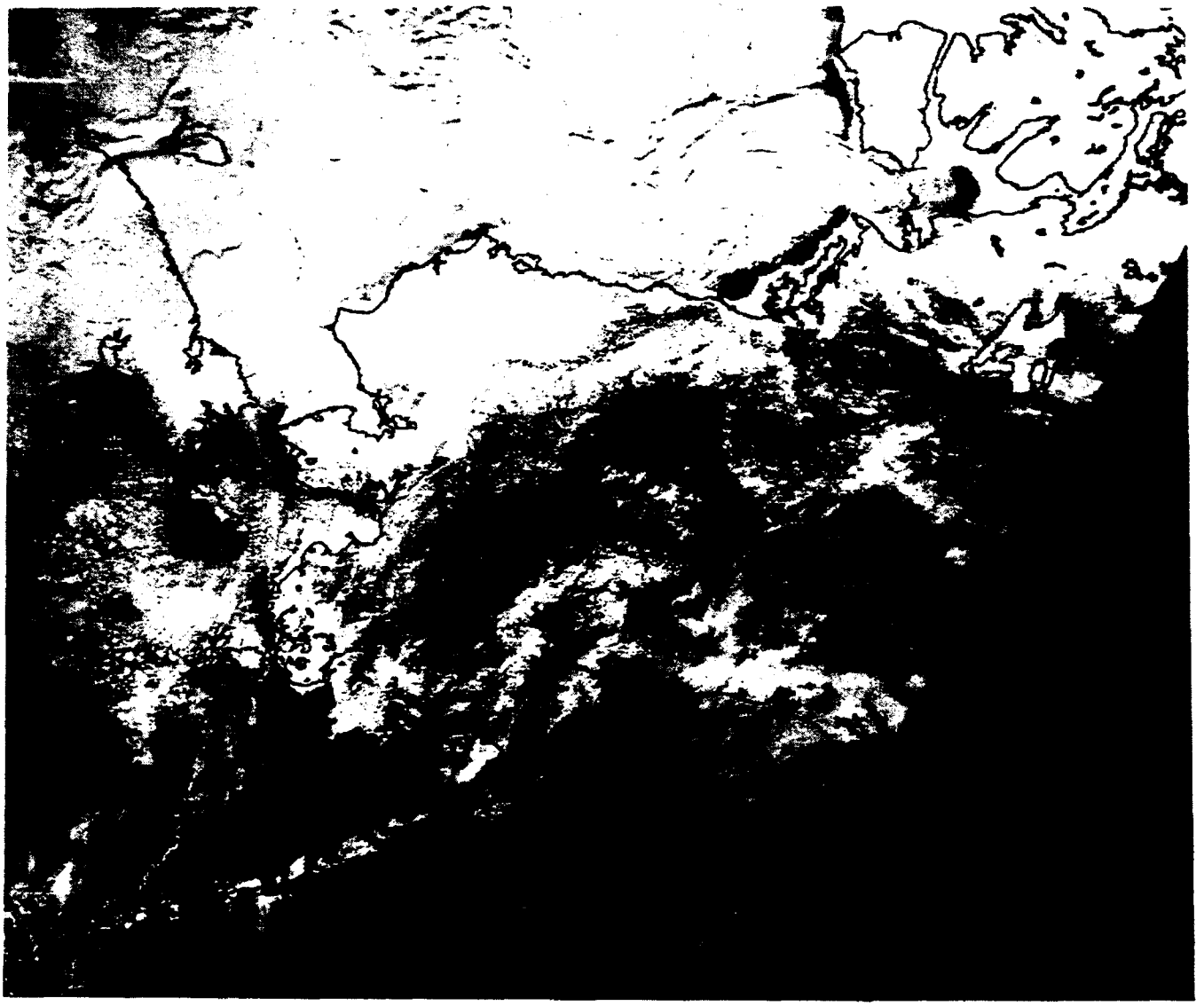


19 Apr 92 1800Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. The visible depiction shows details of cloud top topography.

19 Apr 92 1800Z
NOAA AVHRR CH 1 VIS
Notable Features:

1. Note increased detail in ice/water boundary area.

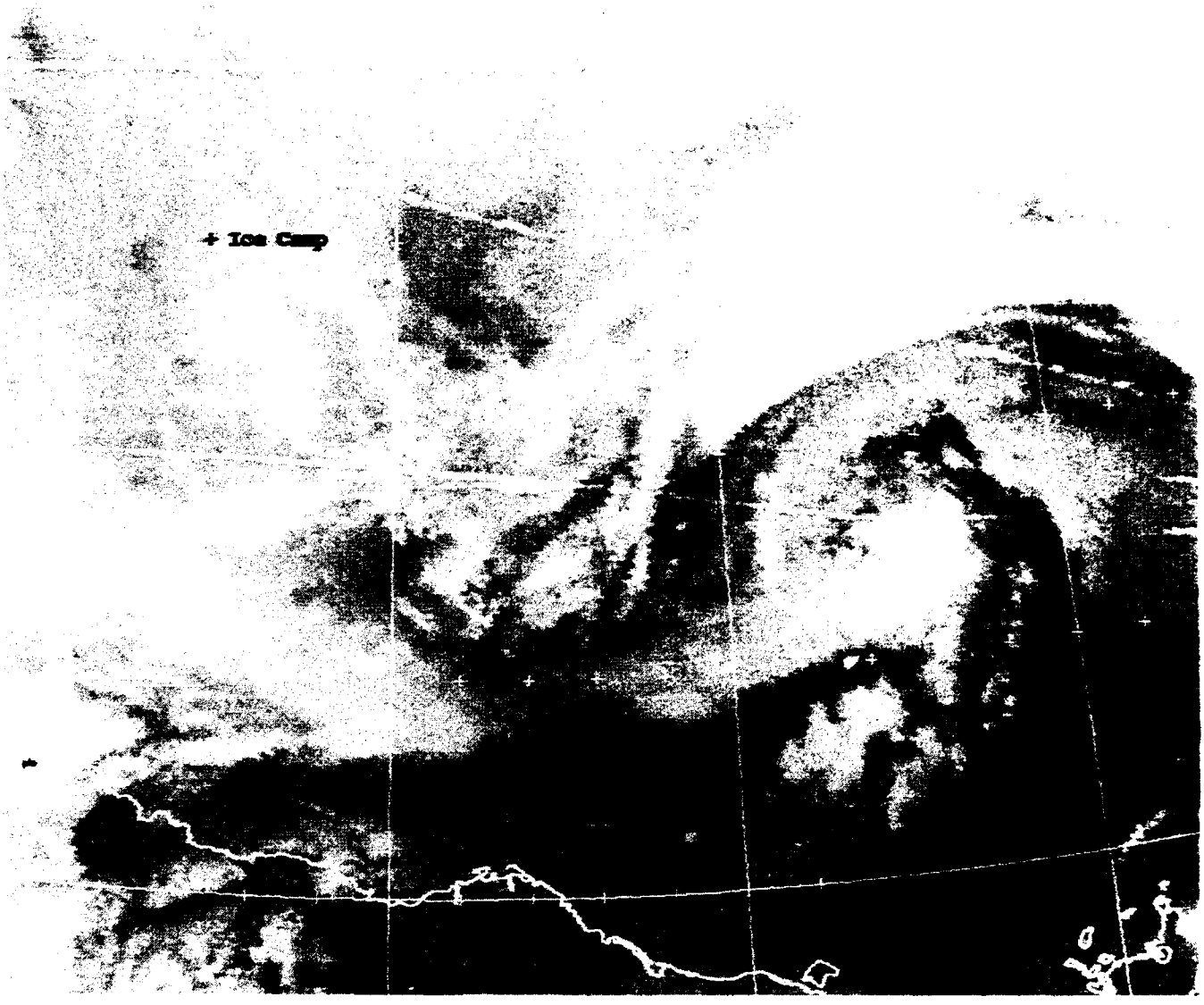


19 Apr 92 2029Z
DMSP OLS VIS
Notable Features:

1. This larger scale view provides a welcome perspective.
2. A large vortex is now seen developing north of the Mackenzie River Delta.
3. Secondary vortices are suggested near the ice camp and Barrow with a major vortex well to the NNW. Frontal band connections are suggested and are not illogical.

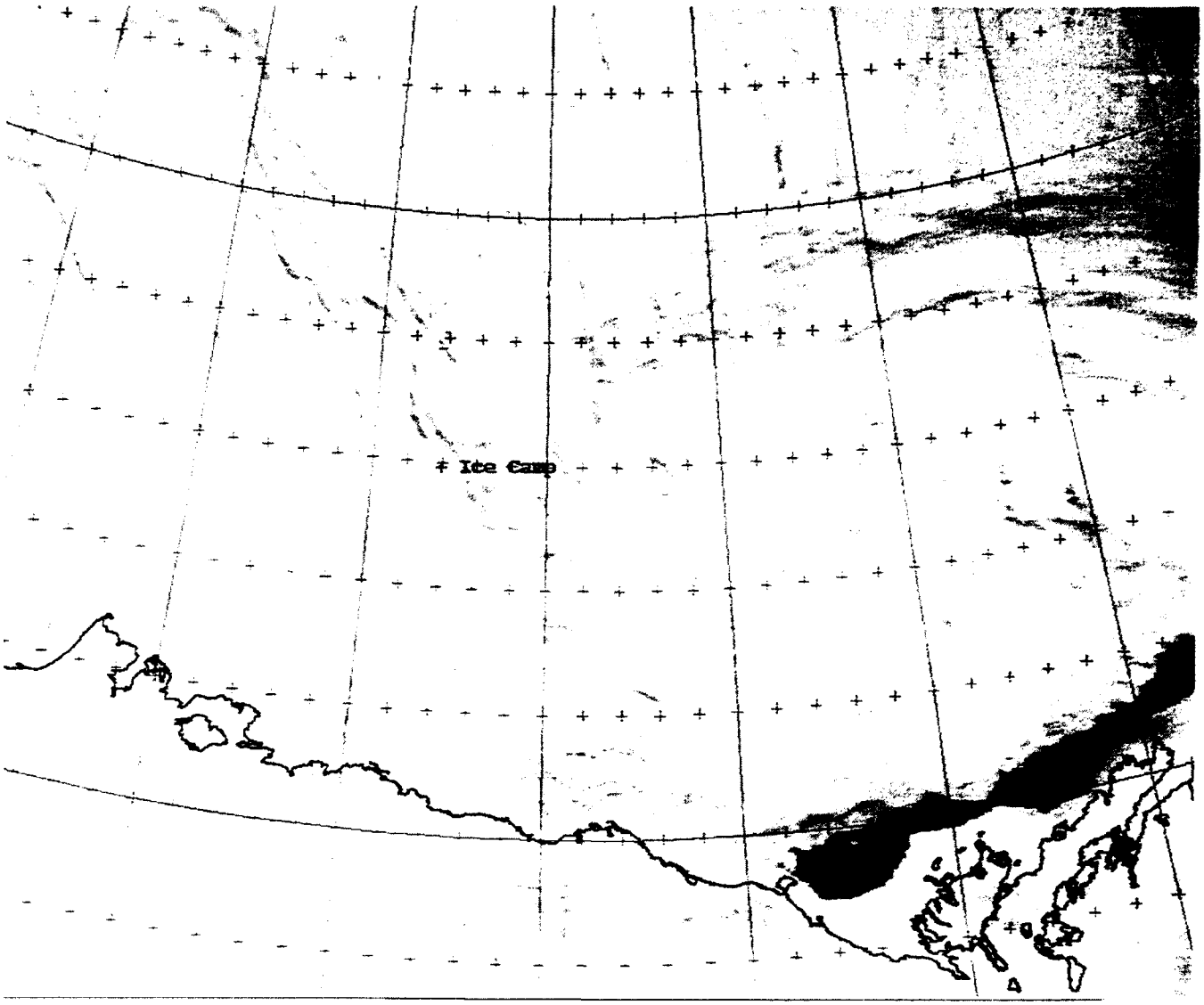
19 Apr 92 2029z
DMSP OLS IR
Notable Features:

1. The companion IR large scale view reveals the pronounced high level <u>anticyclonically</u> curved cloud band surrounding the low level vortex.



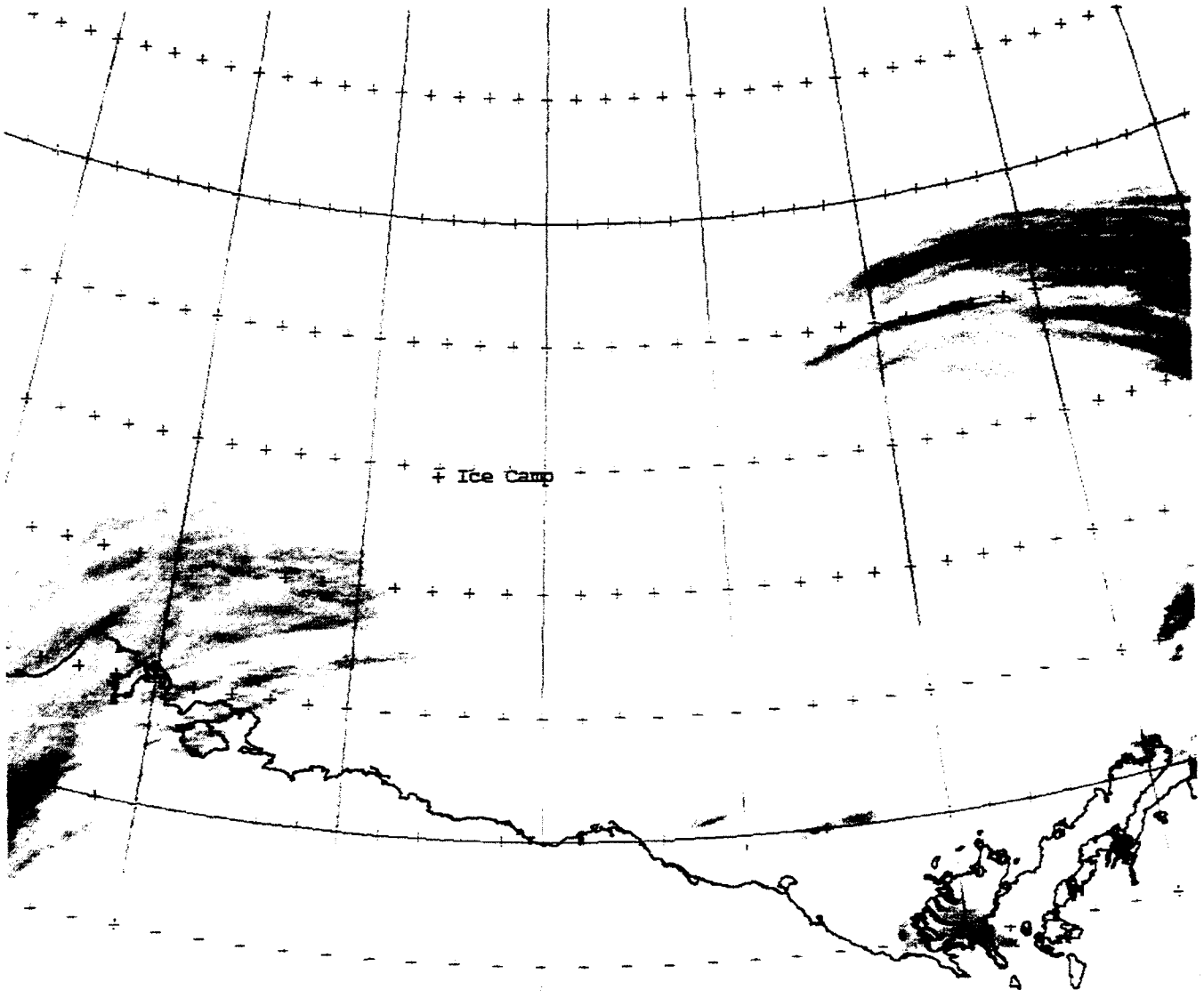
19 Apr 92 2030Z
DMSP OLS IR
Notable Features:

1. An enlarged depiction of the vortex area is useful in providing additional detail which helps reveal a small cyclonic cloud region just south of the ice camp.
2. A NORAPS cross-section should provide additional significant details.



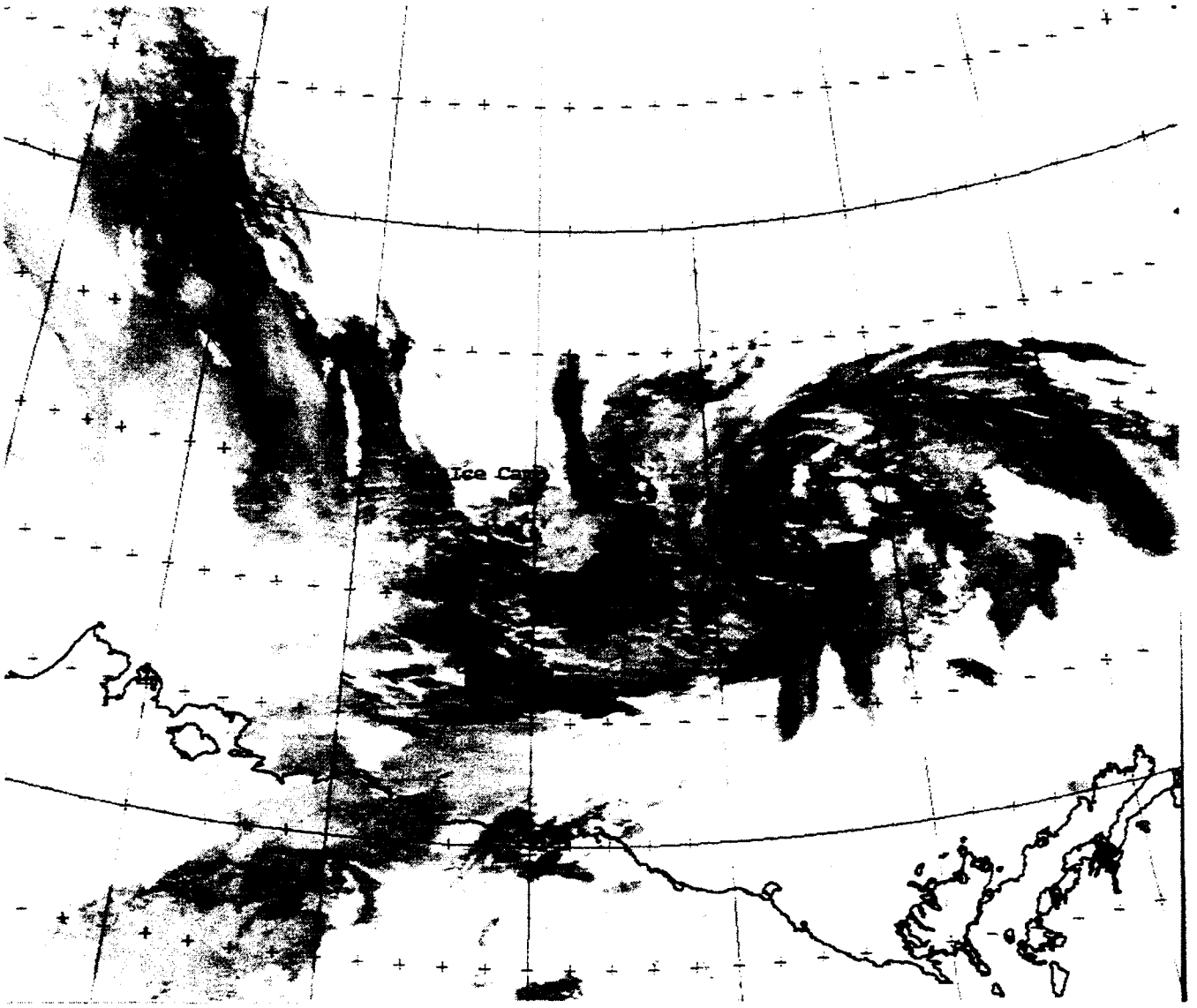
20 Apr 92 0033Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. The vortex system has evolved so that 2 separate centers apear east of the ice camp - one near 73N, 142W, and the other near 72.5N, 137W.
2. The easternmost vortex is strongest while the one to the west appears to be a weaker mirror image.



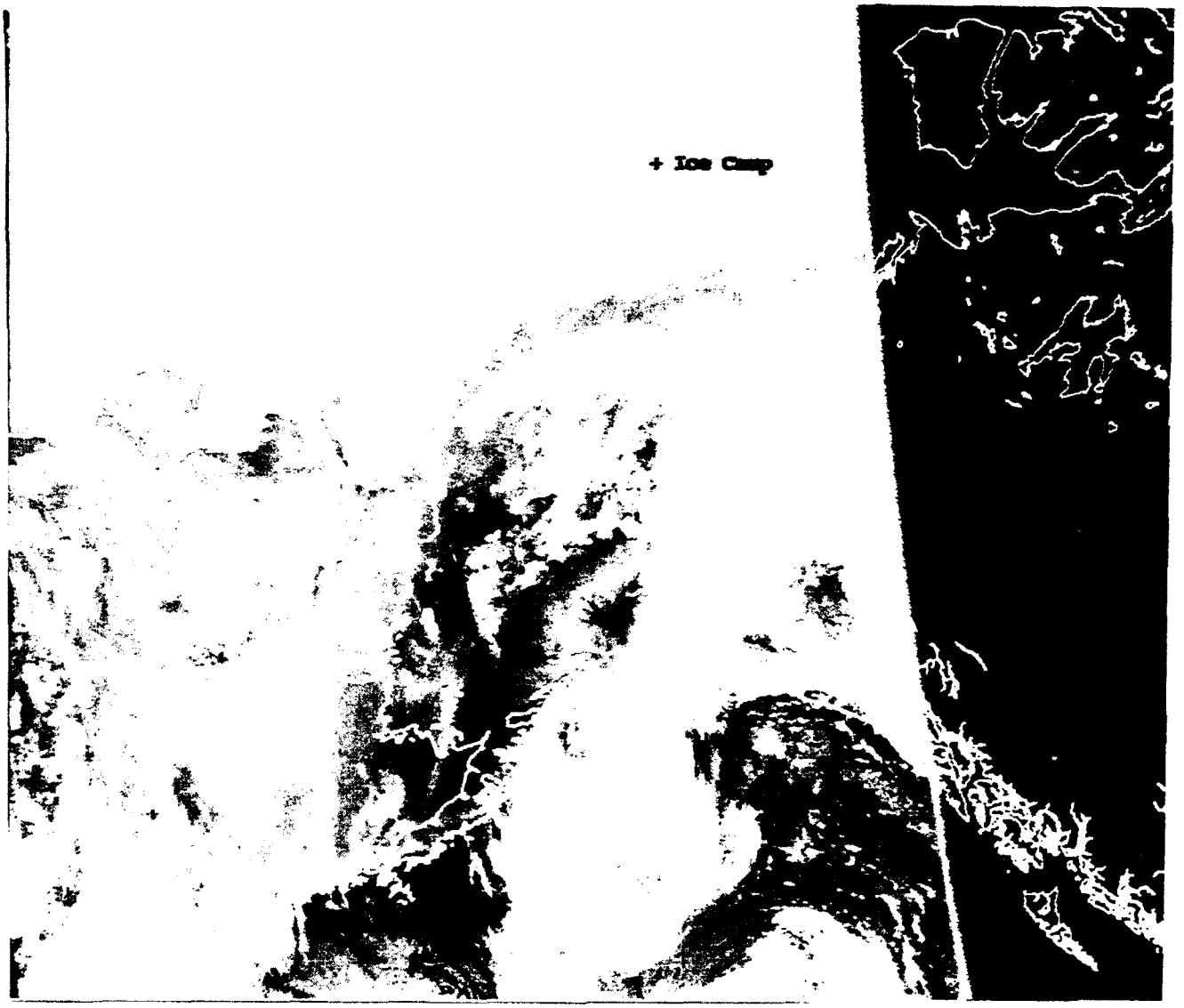
20 Apr 92 0033Z
NOAA AVHRR CH 4 IR
Notable Features:

1. This is an inverse IR image. Darker clouds are coldest.
2. Note the tight vortex center near 72.9N, 141.8W.



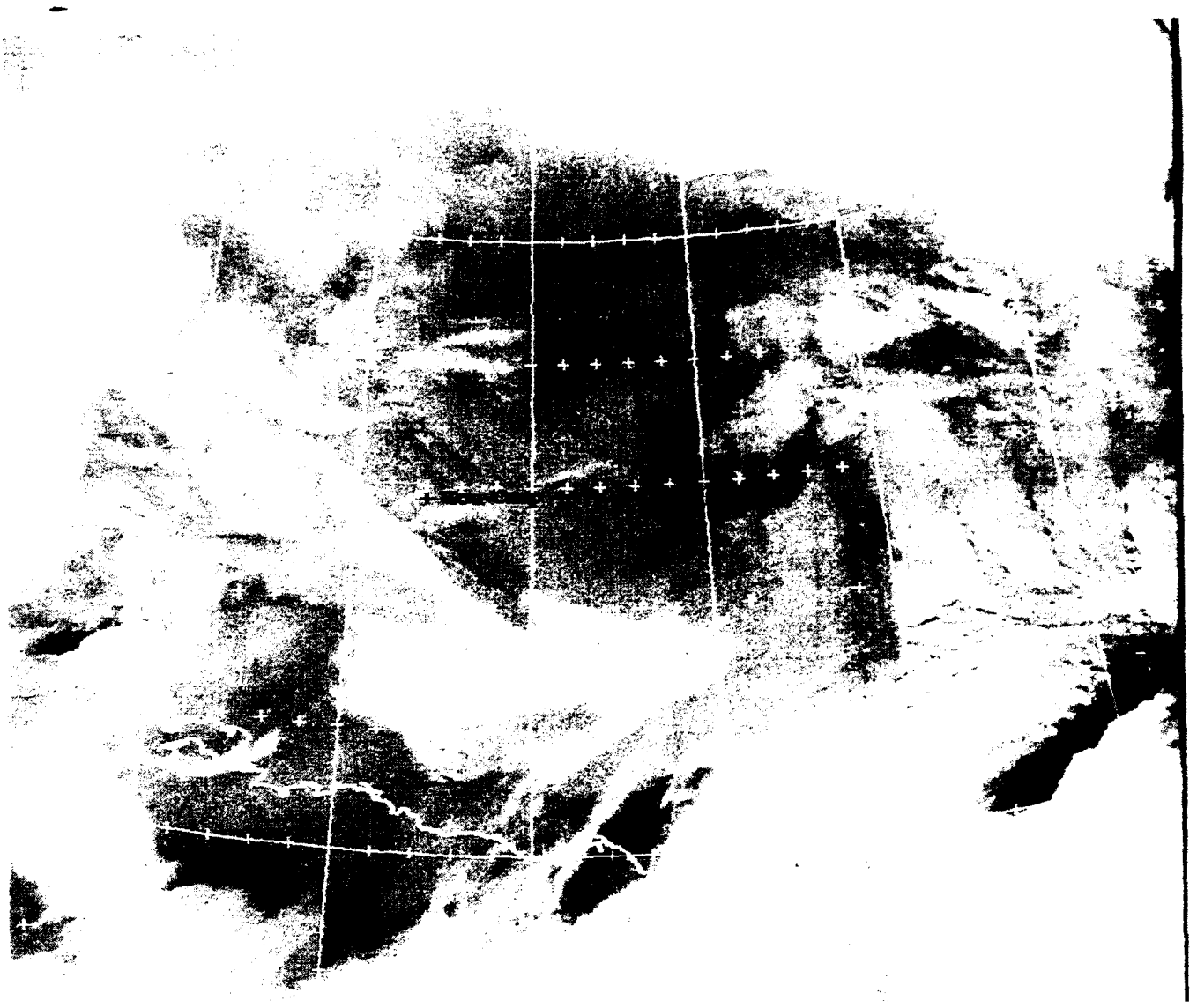
20 Apr 92 0033Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The channel 3 image clearly reveals the two systems. (Compare with the channel 2 view).



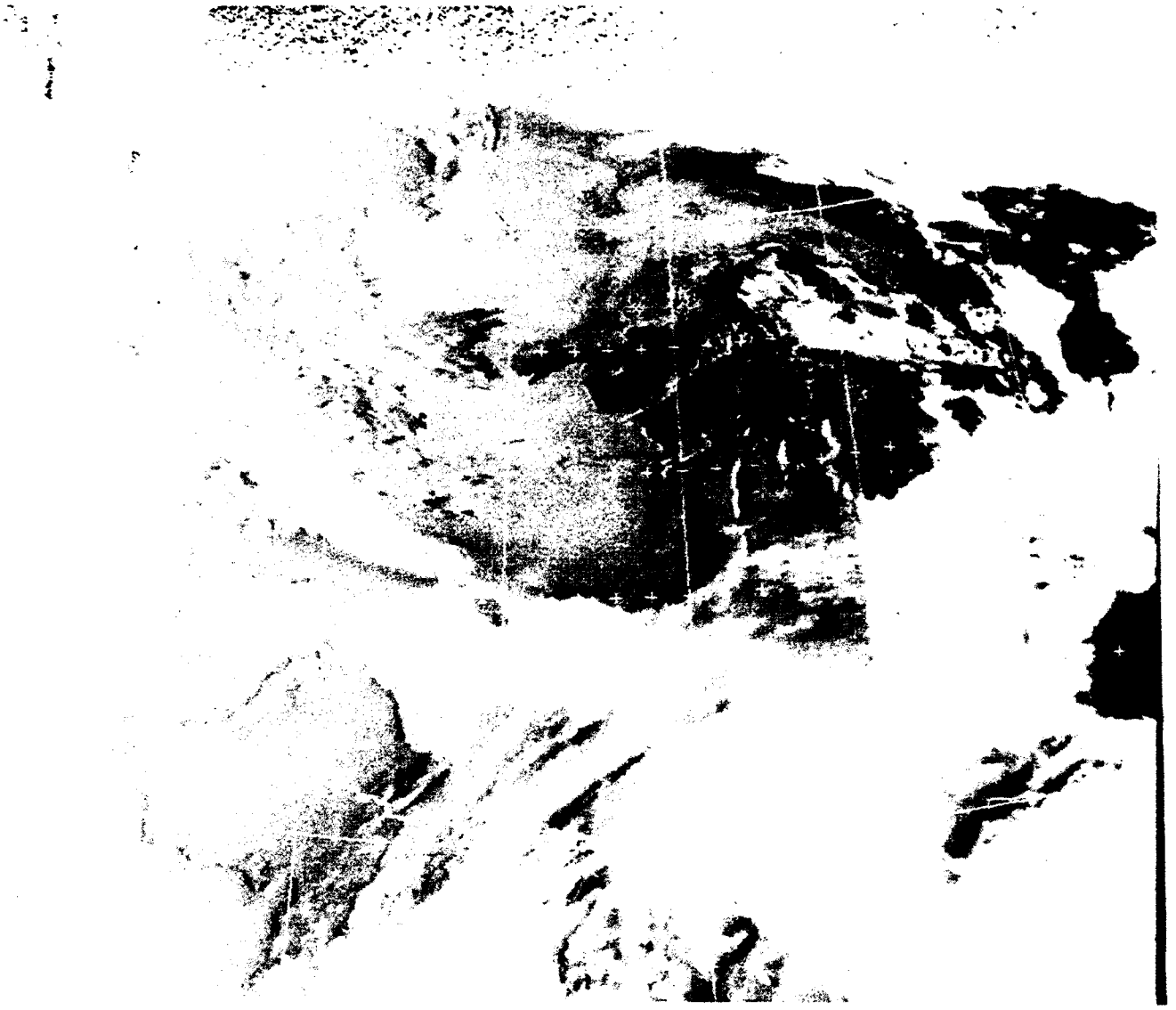
20 Apr 92 0621Z
DMSP OLS IR
Notable Features:

1. This image shcws that coldest temperatures are associated with the easternmost vortex.
2. Note that low ill-defined cloud masses cover most of the E. Siberian, Chukchi, and Beaufort Seas.



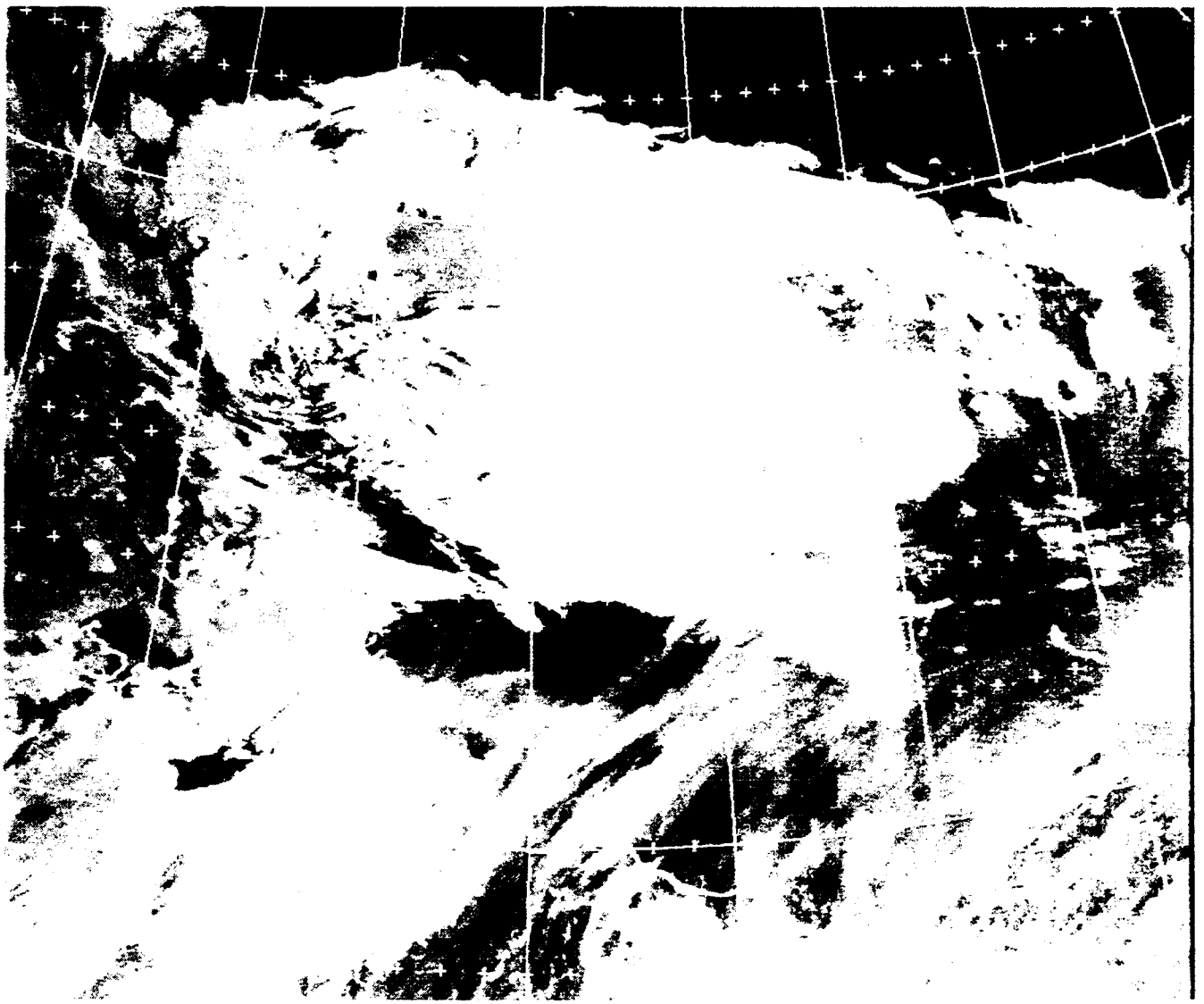
20 Apr 92 1418Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The two systems are hard to find in this view but one is now located NW of the ice camp; the other NE.
2. NORAPS shows E-W troughing at 925 and 700 mbs through the ice camp region.



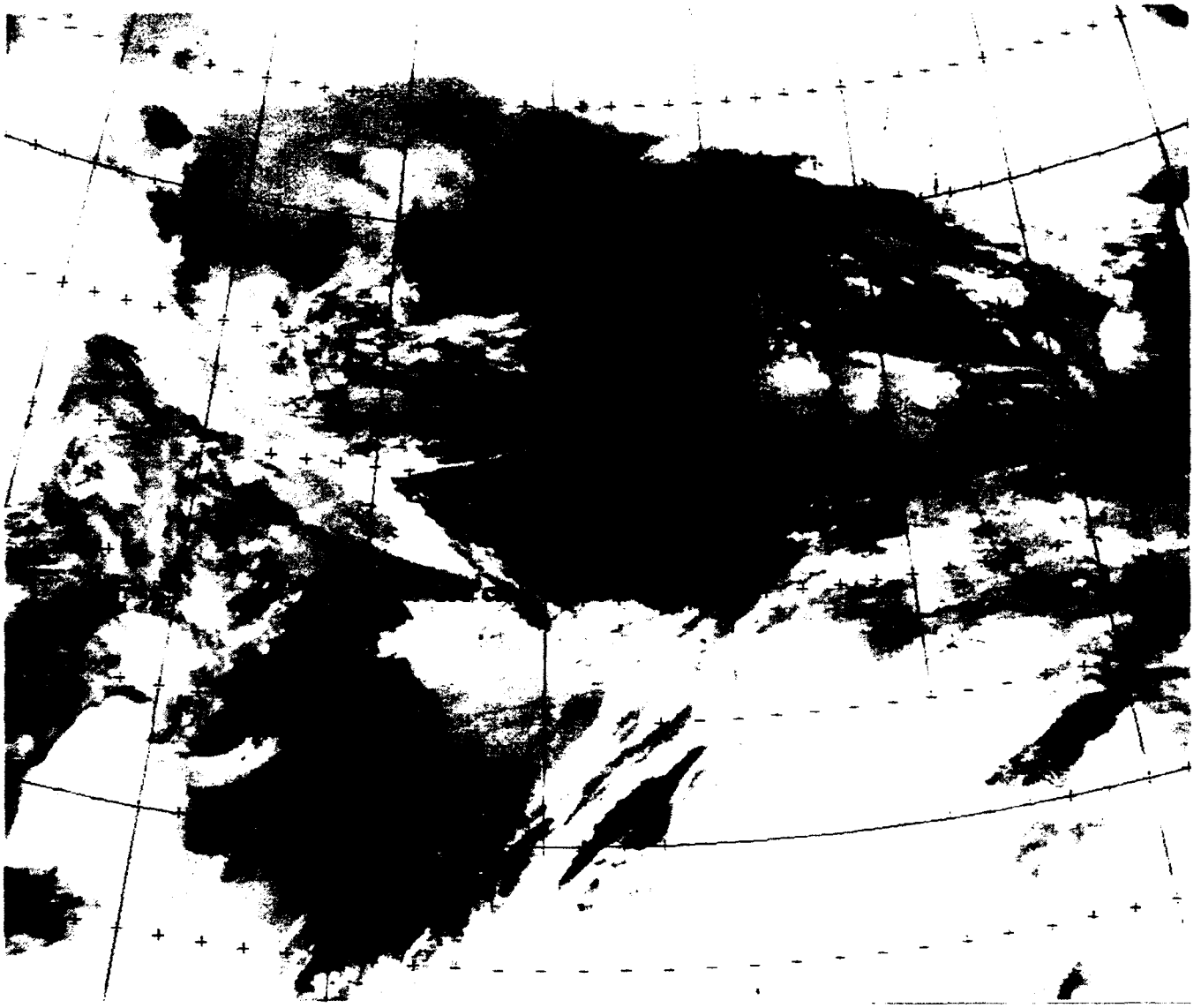
20 Apr 92 1558Z
NOAA AVHRR CH 3 IR
Notable Features:

1. A channel 3 negative (cold clouds are darker) view reveals the vortices north of the ice camp.



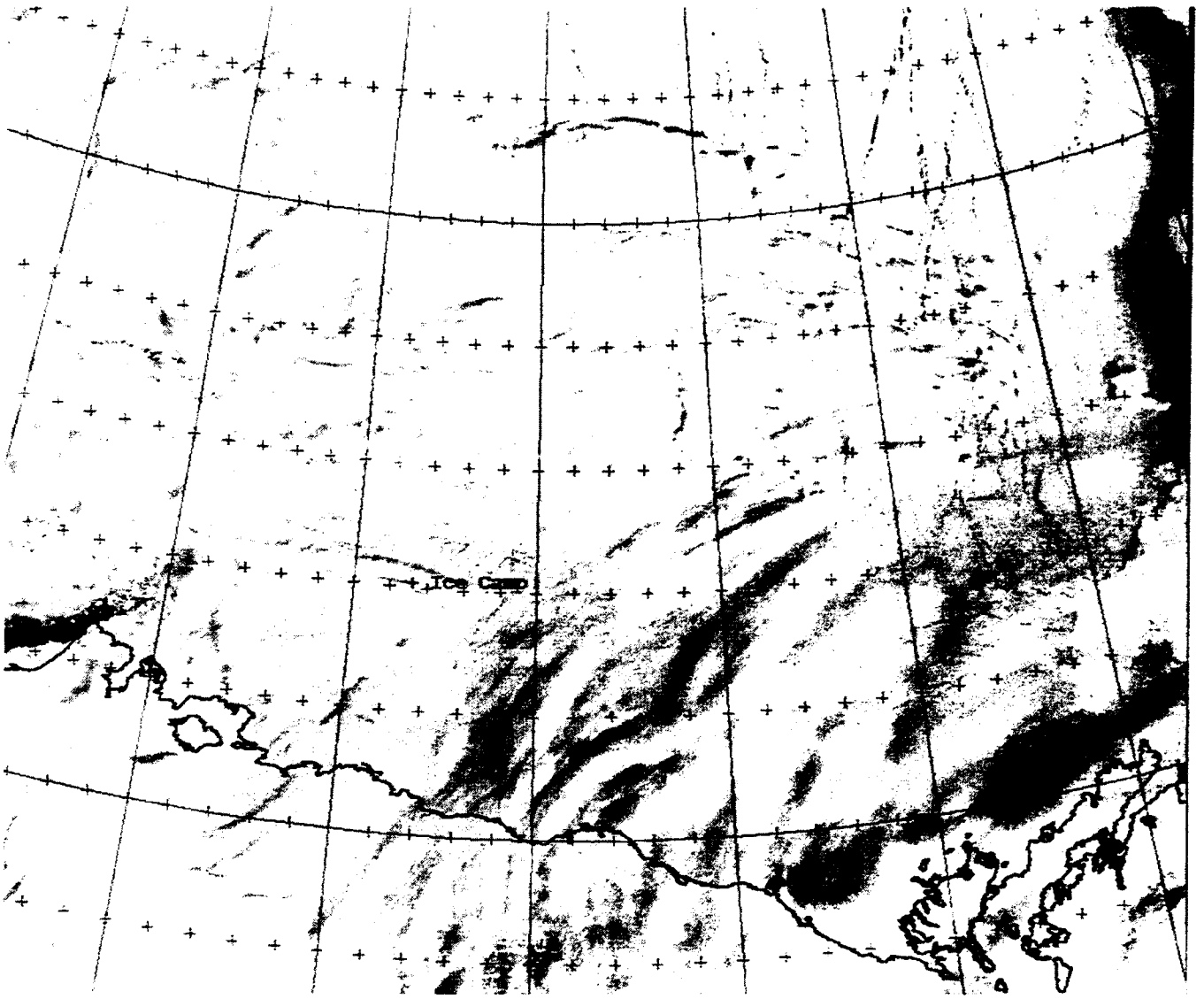
20 Apr 92 1558Z
NOAA AVHRR CH 3 IR
Notable Features:

1. A channel 3 positive (cold clouds are lighter) view is shown for comparison.



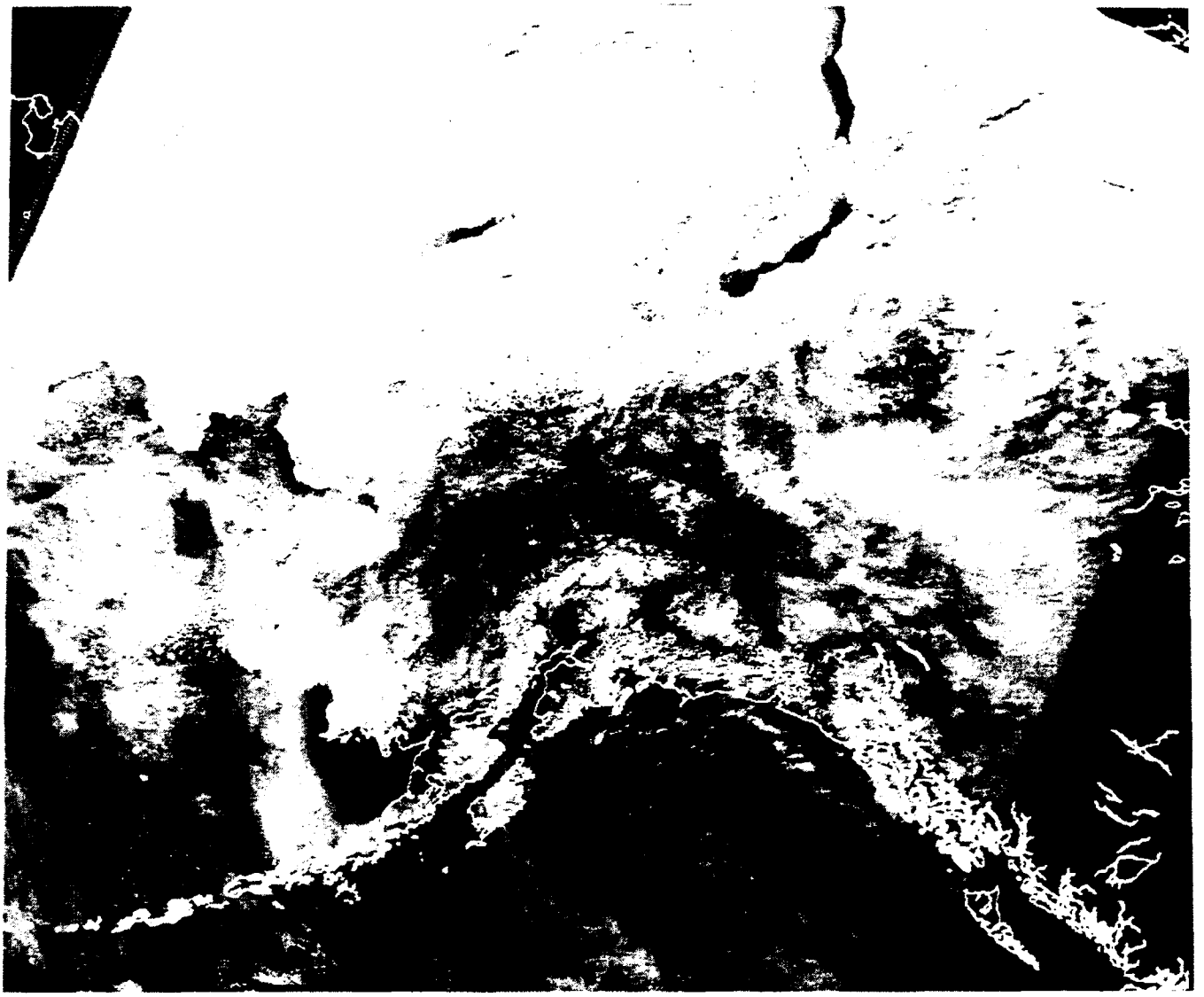
20 Apr 92 1558Z
NOAA AVHRR CH 5 IR
Notable Features:

1. For completness a NOAA channel 5 view is shown. Increased contrast is evident which aids in delineating the clear area SE of the ice camp.



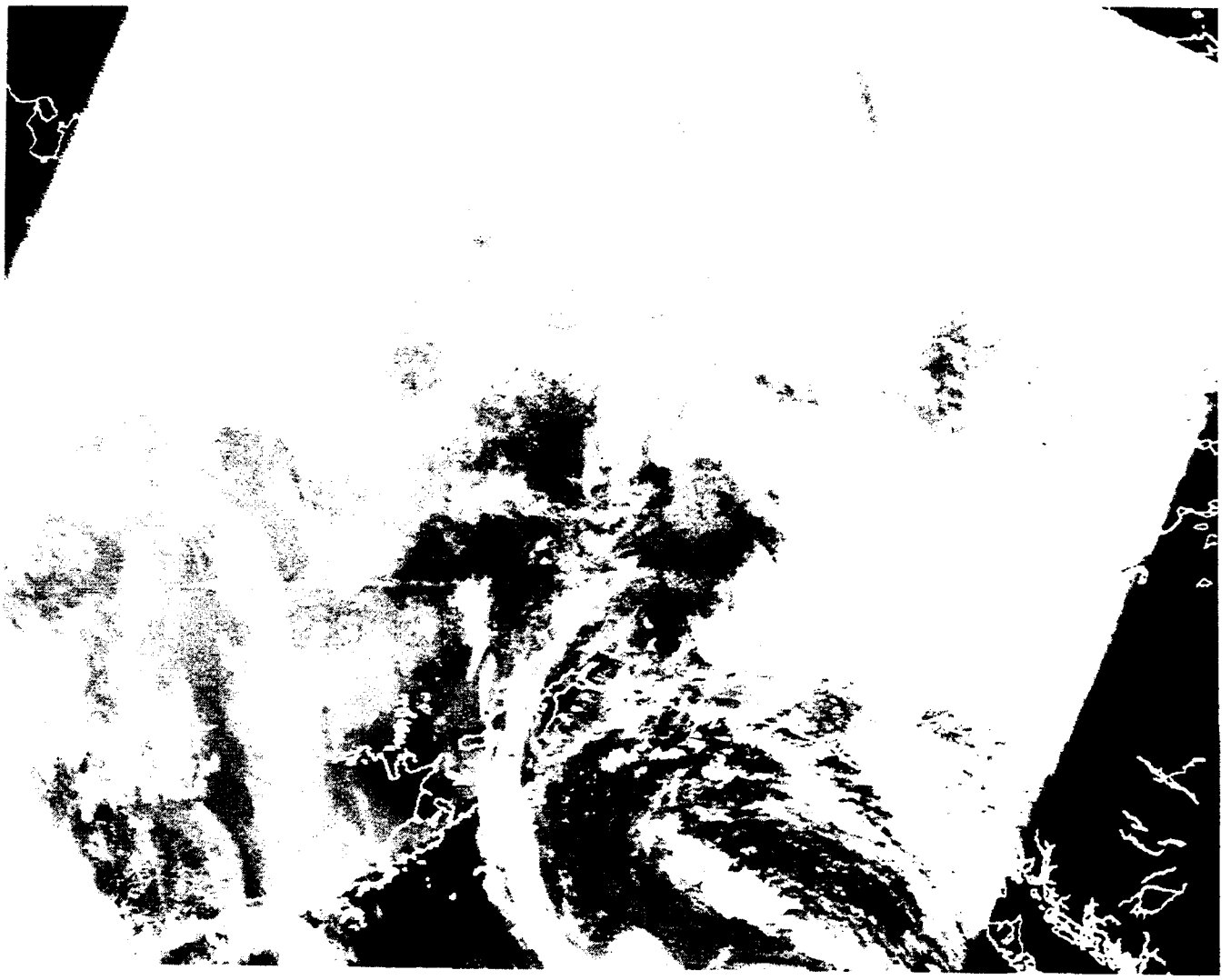
20 Apr 92 1823Z
DMSP OLS VIS
Notable Features:

1. A vortex appears between Barrow and the ice camp (This was also revealed in the previous IR view). This is the region of troughing evident on the NORAPS analyses.
2. The other two vortices are well to the north of the ice camp at this time.



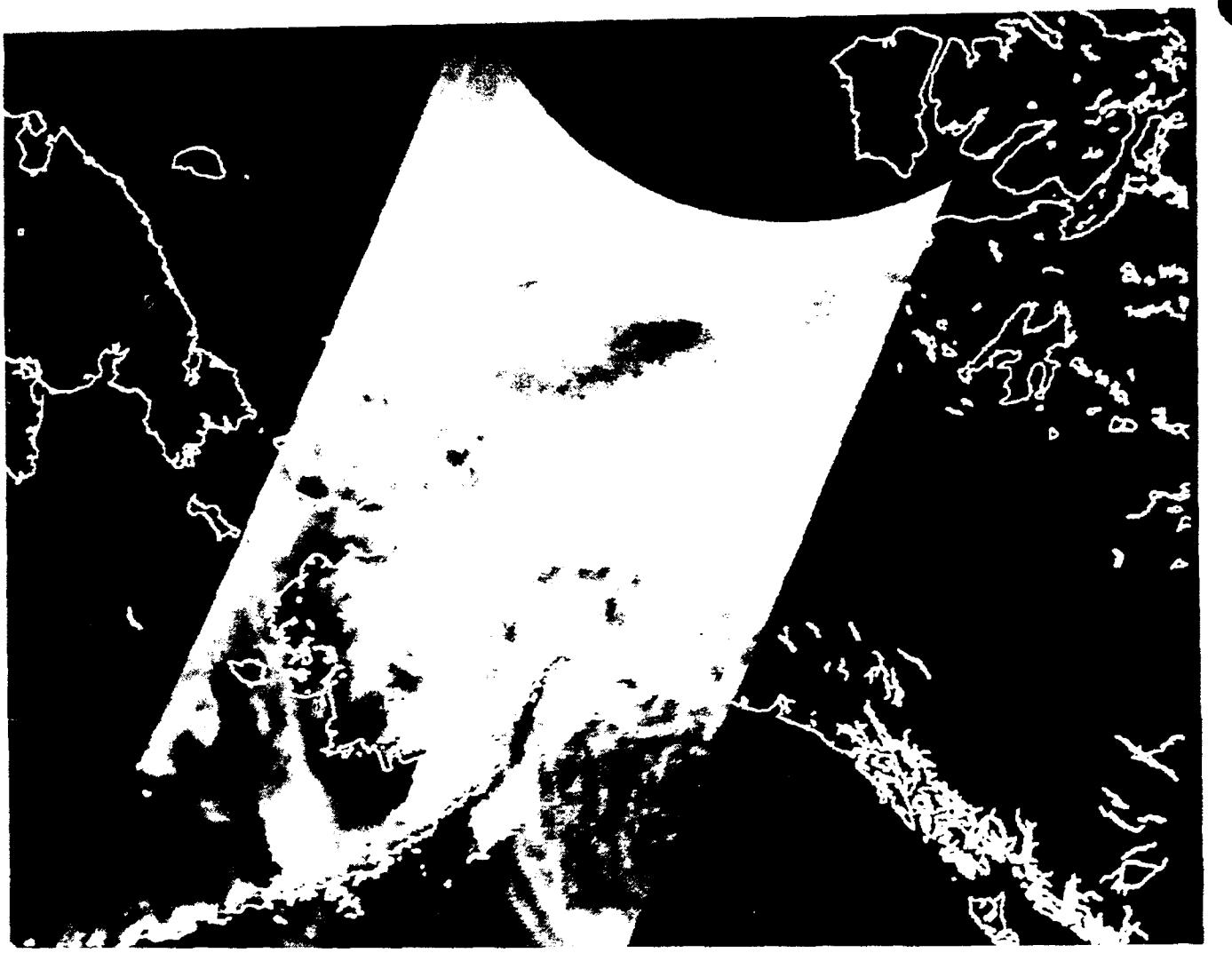
20 Apr 92 1959Z
DMSP OLS VIS
Notable Features:

1. The vortex north of Barrow and those north of the ice camp are only weakly suggested in this large scale image.
2. Note "apparent" large polynyi adjacent to Banks Island; north of the Tuktoyaktuk Peninsula; WSW of Barrow; south of St. Lawrence Island; and along the SW coast of the Seward Peninsula.
3. A stratus cloud deck extends from the Aleutian Island chain northward past Nunivak toward St. Lawrence Island.



20 Apr 92 1959Z
DMSP OLS IR
Notable Features:

1. A companion IR view showing almost total overcast conditions over the Beaufort Sea.
2. The IR view tends to indicate a much thinner polynya adjacent to the west coast of Banks Island implying that this area is more ice-covered than suggested by the visible data.
3. Higher cloud effects prevent detection of the Tuktoyaktuk lead in the IR whereas the feature was clearly evident in the visible data.
3. "Apparent" open water areas SW of Barrow and along the SW coast of the Seward Peninsula noted in the visible data are not apparent in the simultaneous IR view.

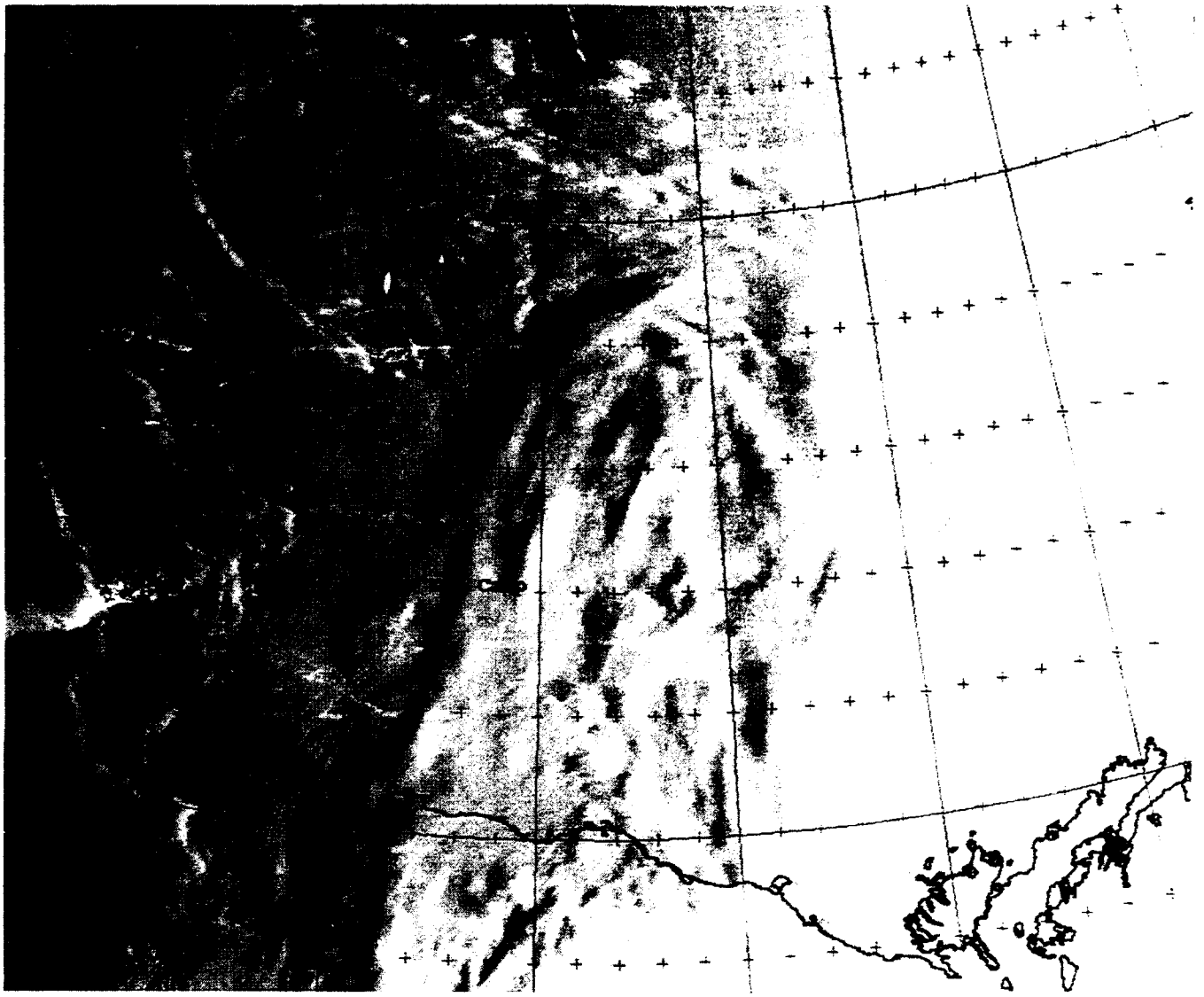


20 Apr 92 1959Z
DMSP 85H SSMI
Notable Features:

1. The open lead areas west of Barrow and north of the Mackenzie River Delta are evident.
2. The northern land area of Alaska is differentiated from the fast ice.
3. A clear distinction between older ice to the north and that within a few degrees of the coast is shown.
4. Stratus clouds between Nunivak and the Aleutian chain are revealed in this SSMI depiction as are non-cirrus clouds in the Gulf of Alaska.
5. Note ice weakness south of the Seward Peninsula and along the south coast of Norton Sound.

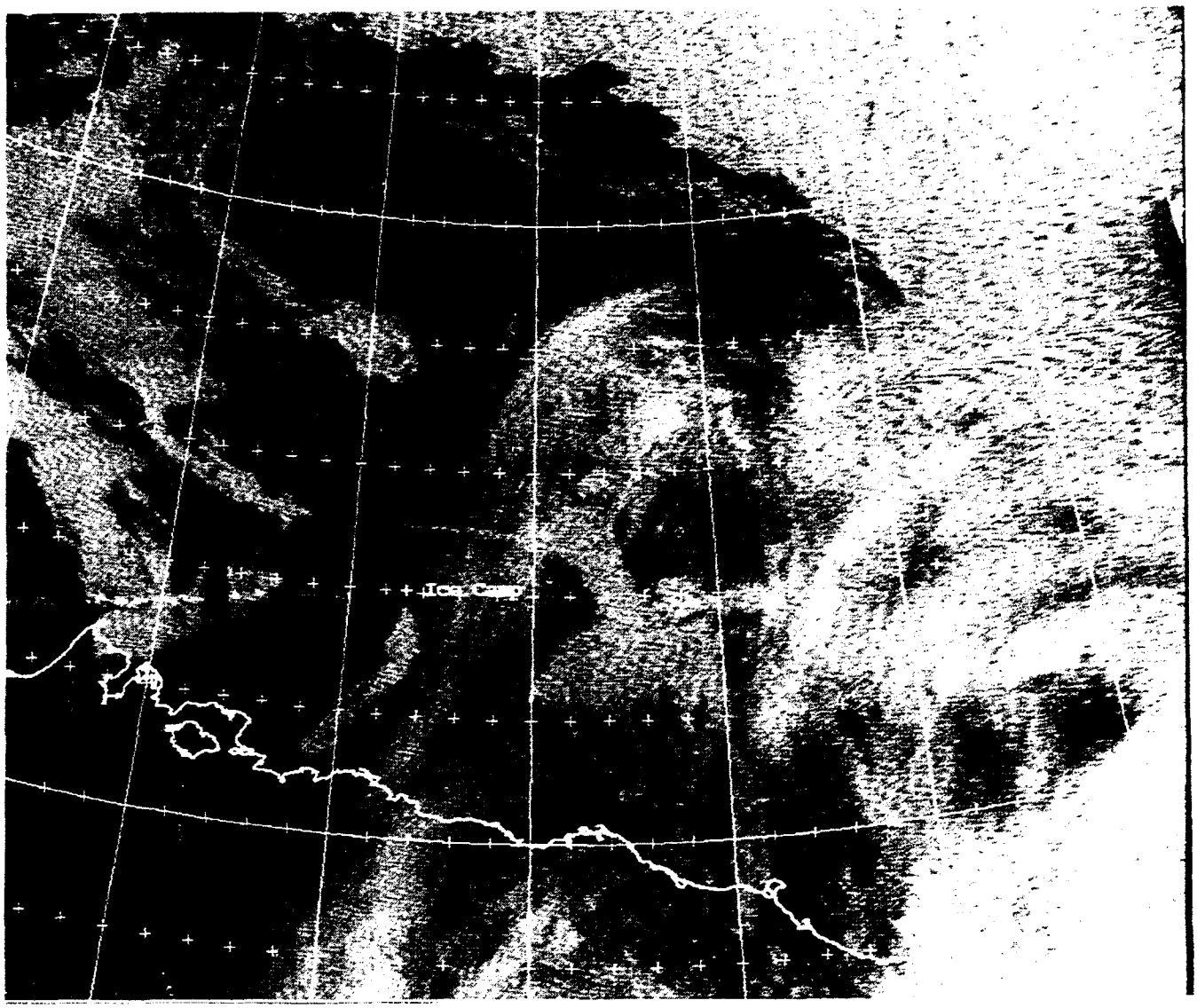
20 Apr 92 1959Z
DMSP 85V SSMI
Notable Features:

1. Distinction between land vs ice north of the N. Slope.
2. Distinction between older ice to the north and that within 1-3 degrees of the N. Slope.
3. Note that leads do not show as well on the vertically polarized SSMI data.
4. Stratus clouds between Nunivak and the Aleutians are apparent and in the Gulf of Alaska, but less well than in the horizontally polarized data.
5. The dark appearance of Nunivak and the Alaskan mainland to the east may possibly be a heavy snow effect.



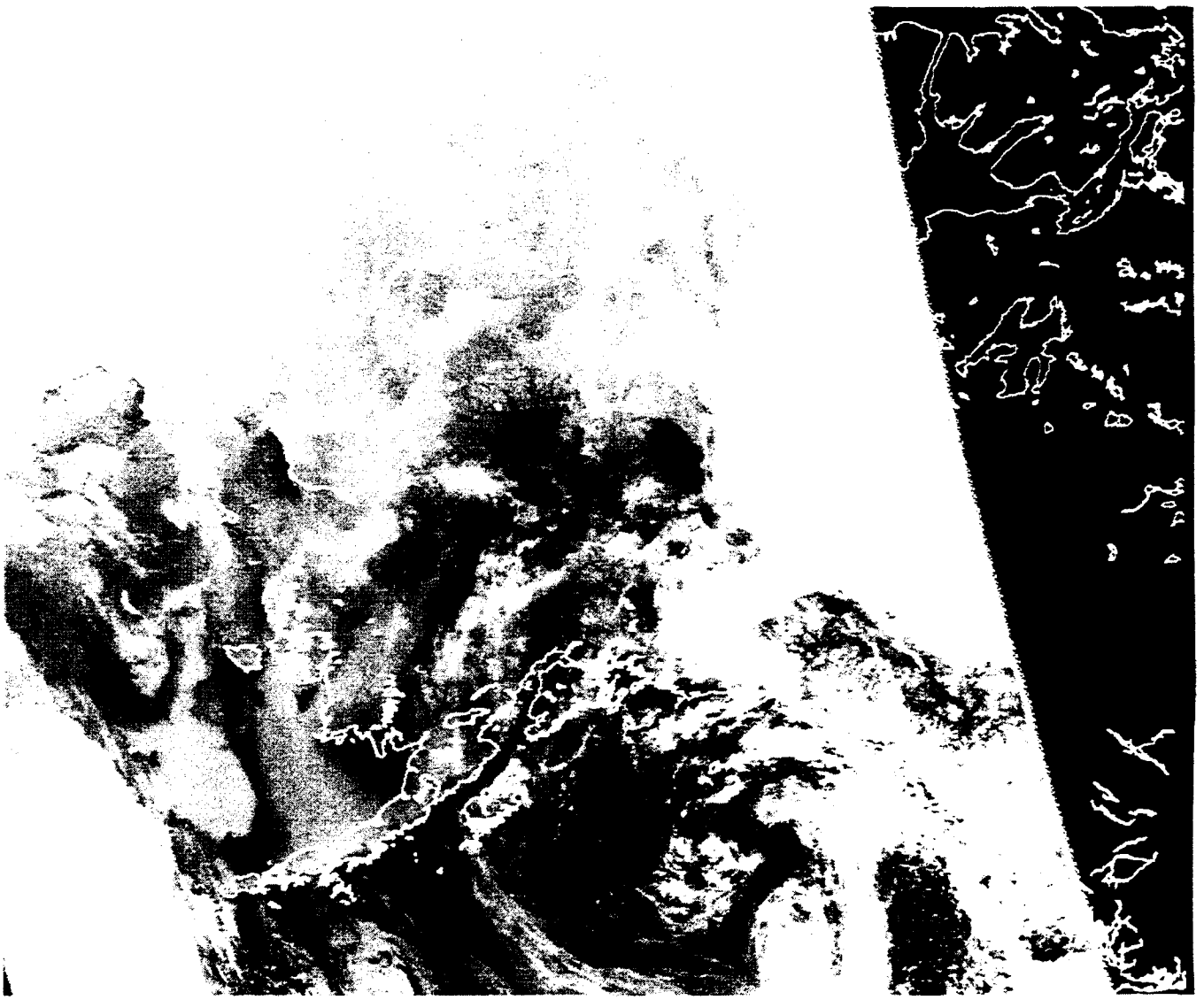
21 Apr 92 0334Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. The vortex north of Barrow has moved northward west of the ice camp toward a second vortex further north. NORAPS shows a closed cyclonic circulation at 925 mb west of the ice camp.
2. Sunglint appears off a polynya area north of Barrow.
3. Clouds east of the ice camp are associated with a large disturbance inland to the south.



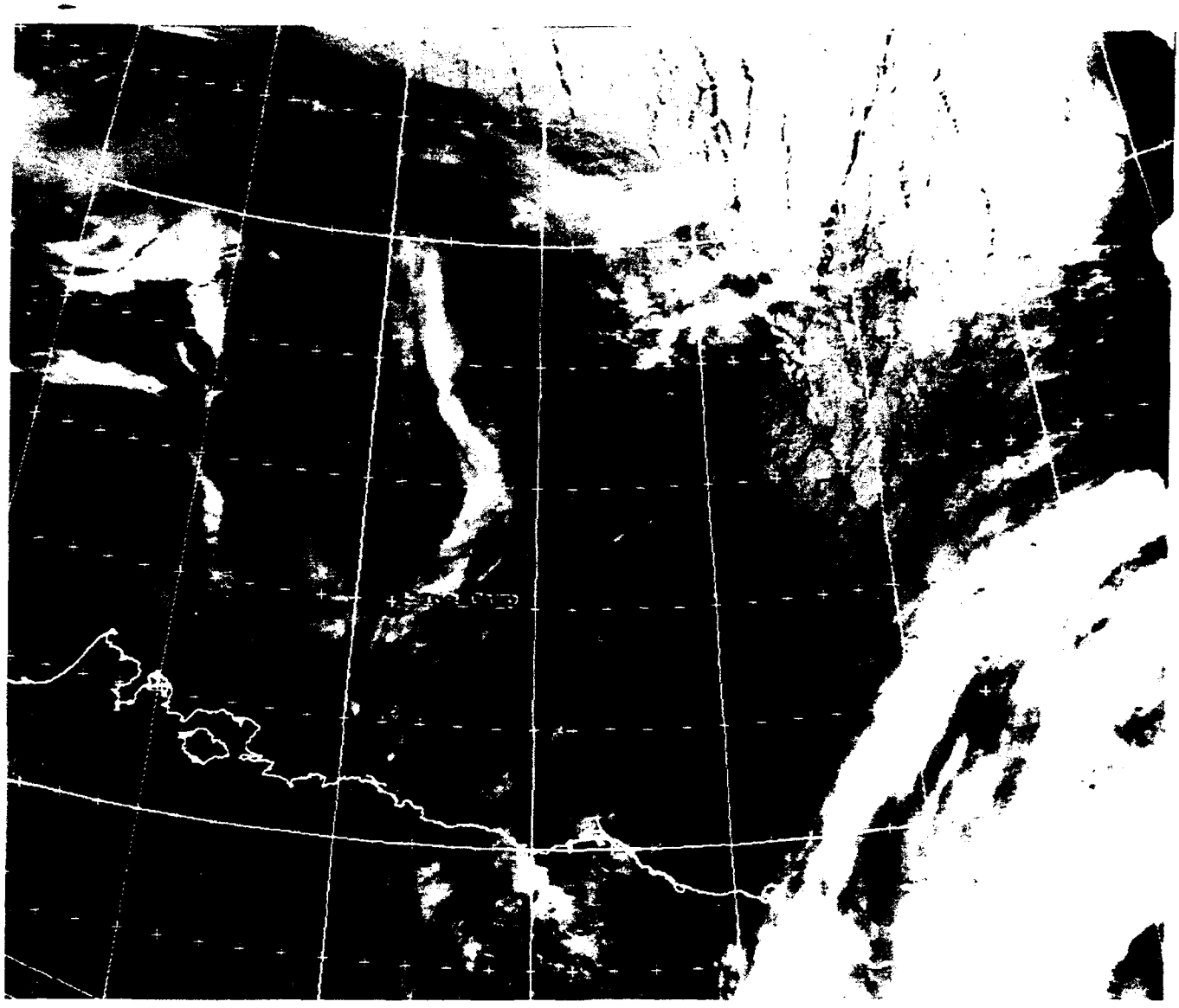
21 Apr 92 0334Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The channel 3 view clearly delineates low clouds associated with features north and west of the ice camp.



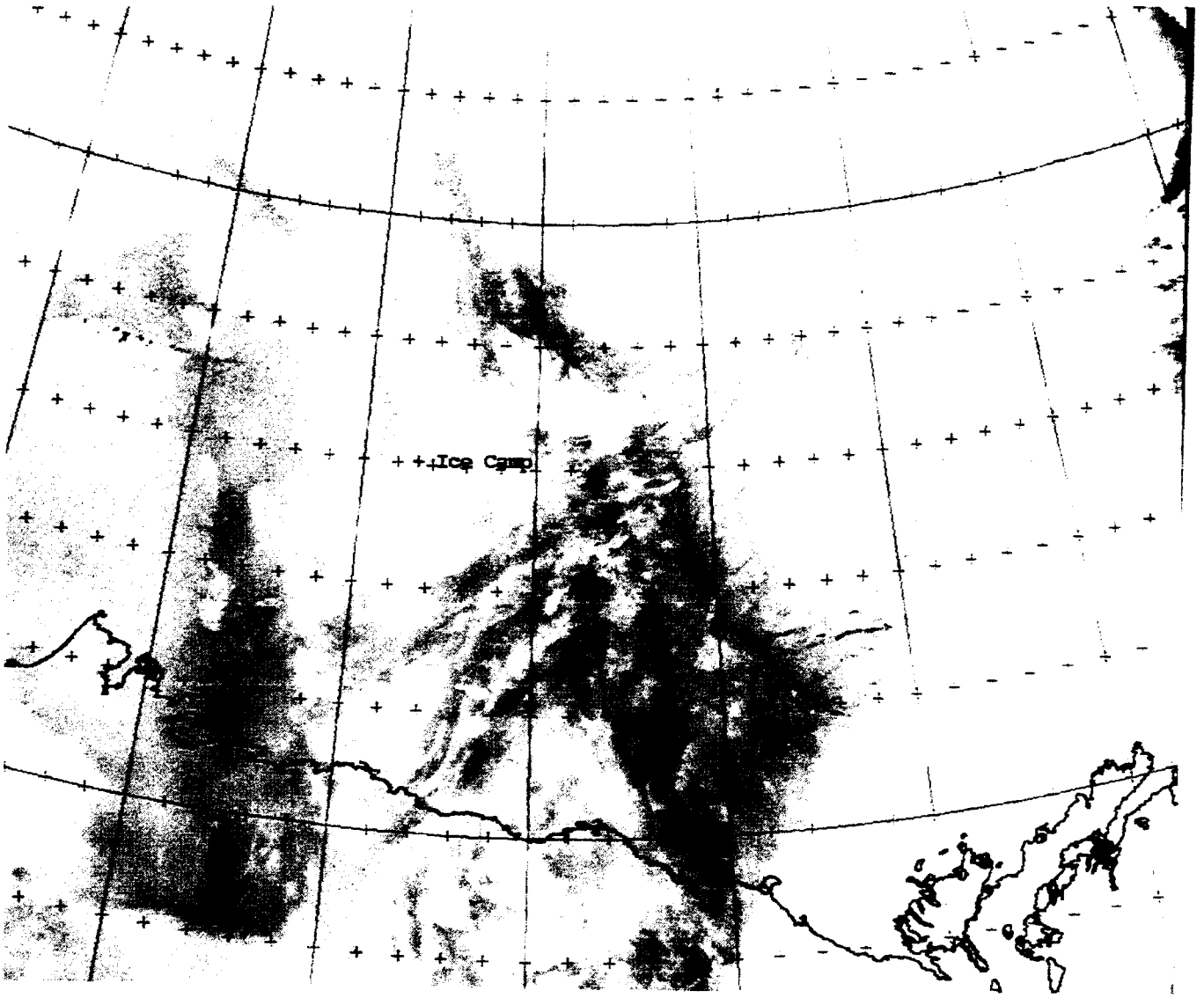
21 Apr 92 0549Z
DMSP OLS IR
Notable Features:

1. This large scale view shows the heavy cloudiness over the NW Territories.
2. Cloud systems over the Beaufort are ill-defined.



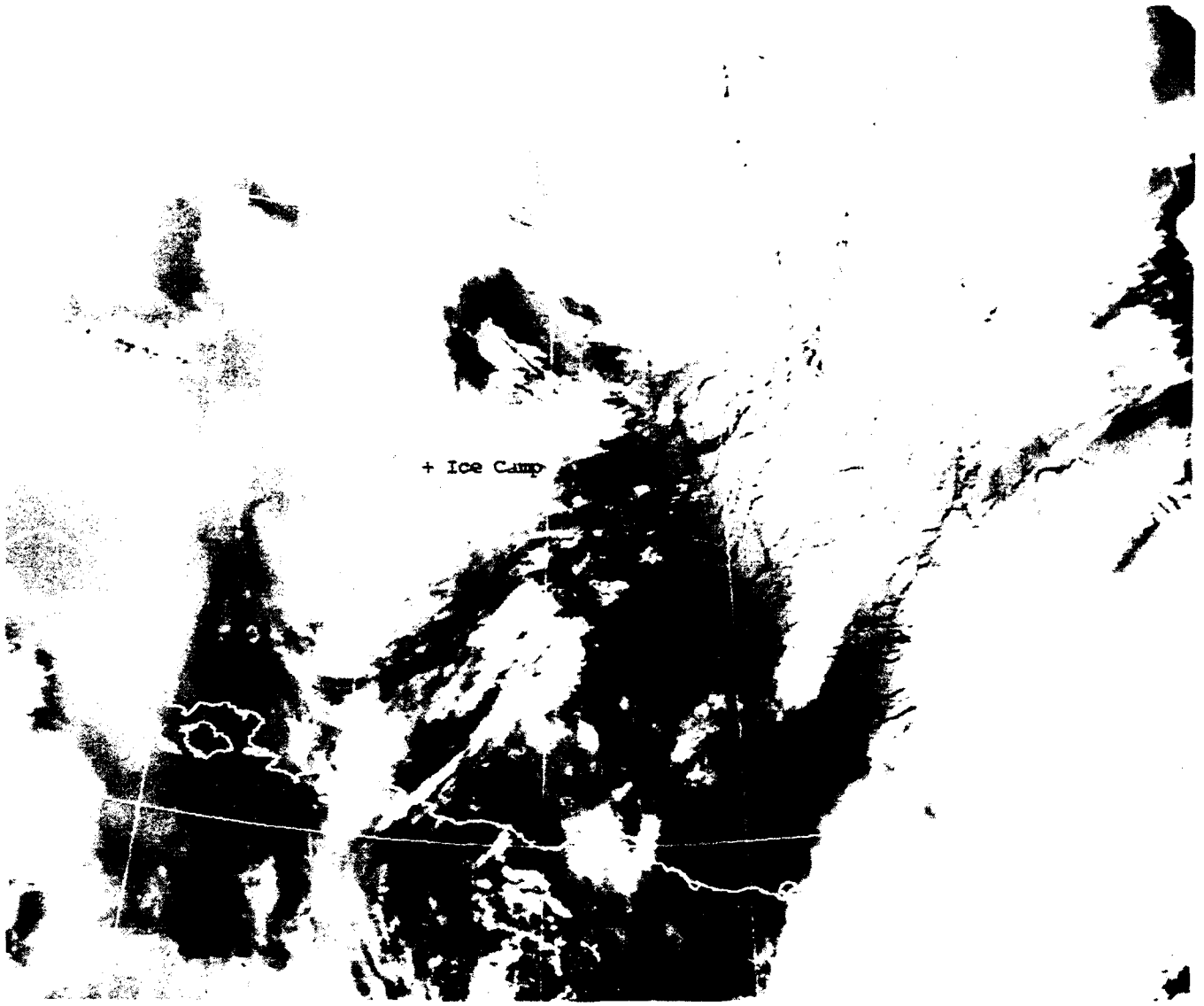
21 Apr 92 1406Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The channel 4 image shows that only the NE Beaufort is clear.



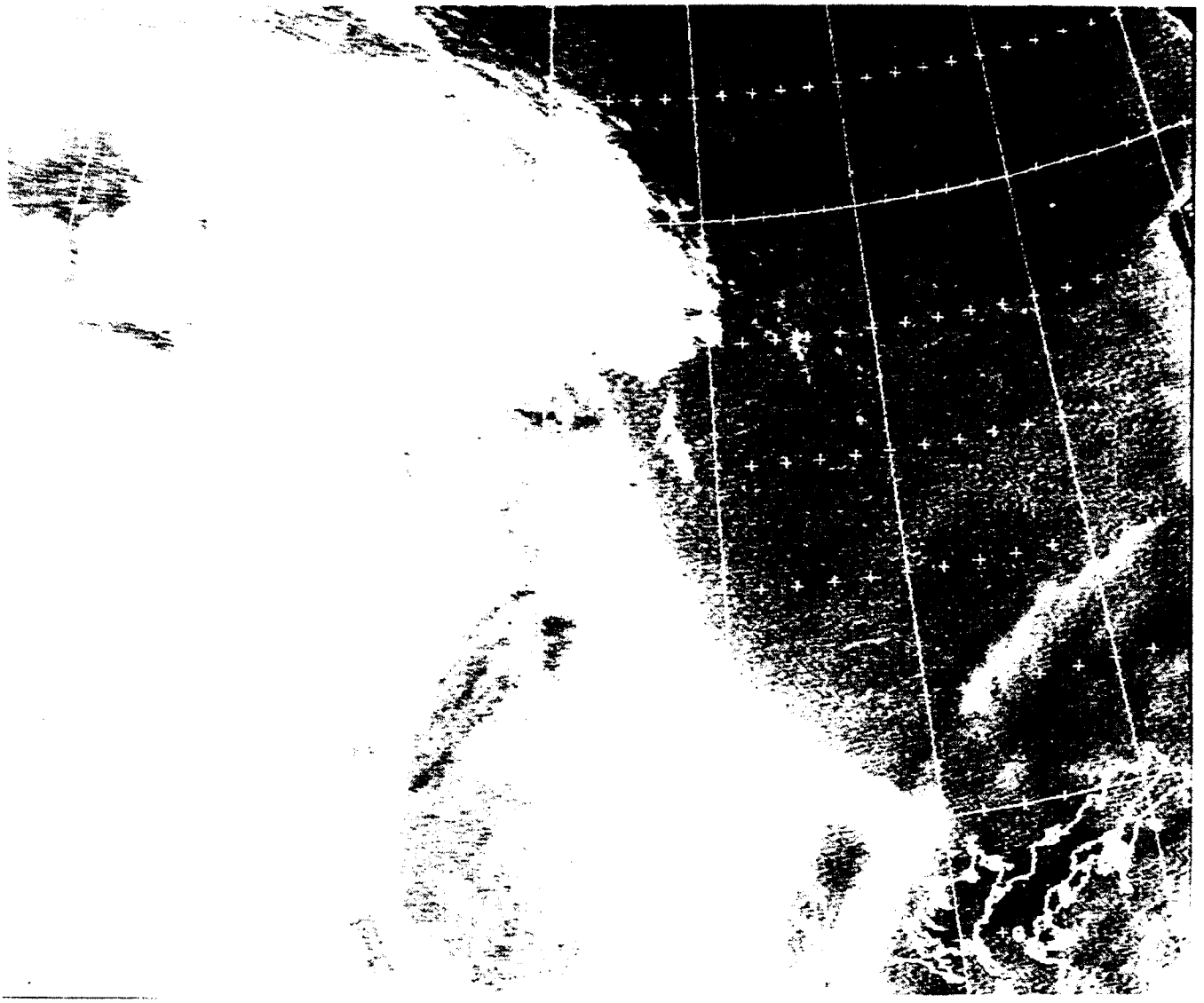
21 Apr 92 1546Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The band of cloudiness extending past the ice camp is beginning to show signs of organization. Note sharp edge to the SE.



21 Apr 92 1712Z
NOAA AVHRR CH 5 IR
Notable Features:

1. NORAPS shows a closed cyclonic circulation just east of the ice camp.
2. The sharp eastern boundary is located along an axis of deformation at 10 m (Winds turn cyclonically southward at the southern end of the edge and anticyclonically northward at the northern end).

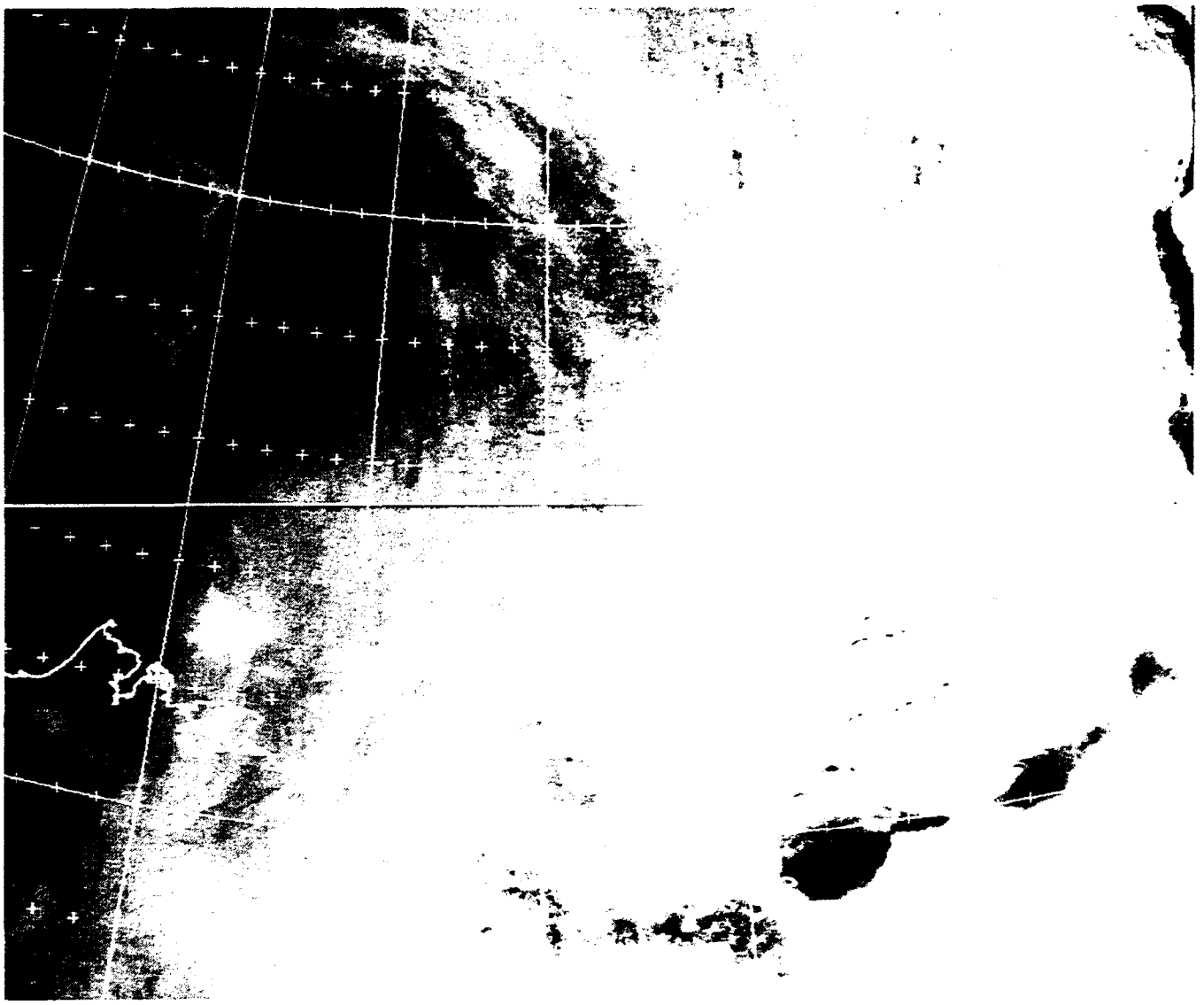


21 Apr 92 1712Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The channel 3 view emphasizes the extremely sharp eastern edge of the band. Such sharp features are normally associated with axes of deformation.

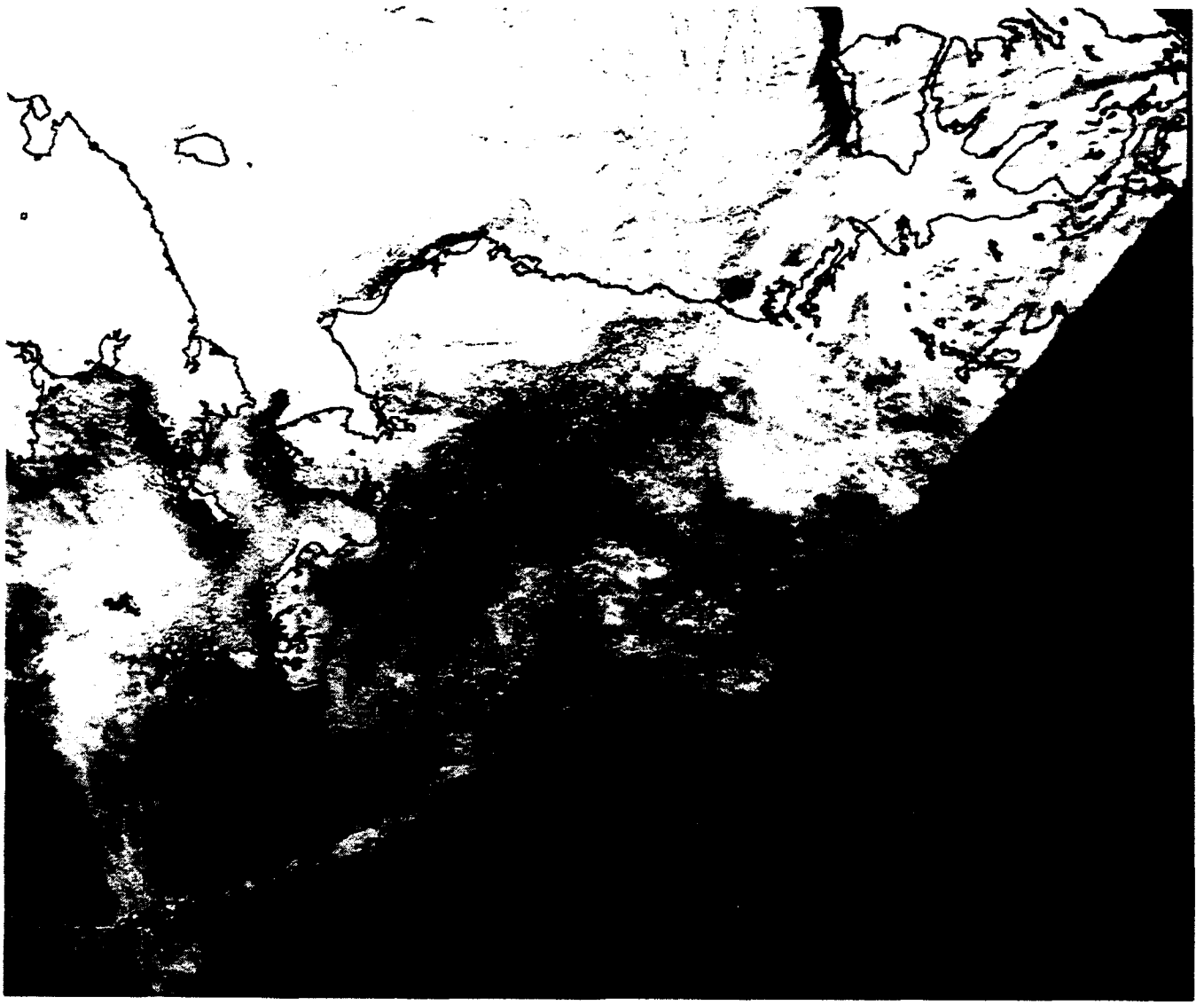
21 Apr 92 1712Z
NOAA AVHRR CH3-CH4 DIF
Notable Features:

1. The difference pattern between channels 3 and 4 provides increased detail of features within the band.
2. A water cloud east of Deadhorse appears enhanced in this depiction.



21 Apr 92 1712Z
NOAA AVHRR CH1-CH2 DIF
Notable Features:

1. Note delineation of ice age effects surrounding the western shore region near Banks Island.
2. Discrimination of flaw lead is suggested east of Barrow and past Deadhorse to Barter Island.

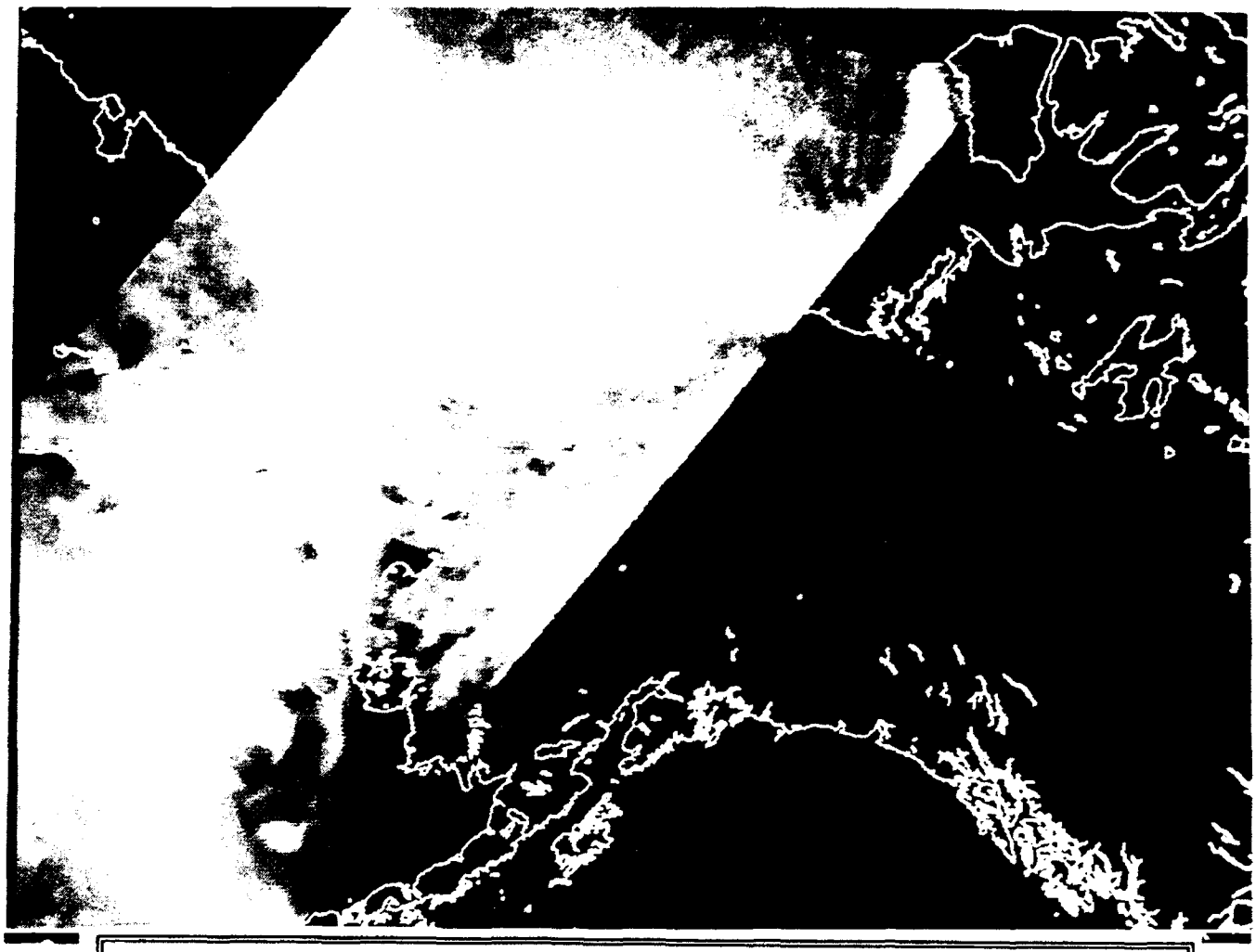


21 Apr 92 2107Z
DMSP OLS VIS
Notable Features:

1. This large scale visible image appears to verify the existence of the flaw lead noticeable just north and east of Barrow. The suggestion is that the Ch1-CH2 difference patterns will be useful in delineating leads not otherwise apparent.
2. Large scale vortices are noticeable north and north-northwest of Barrow.

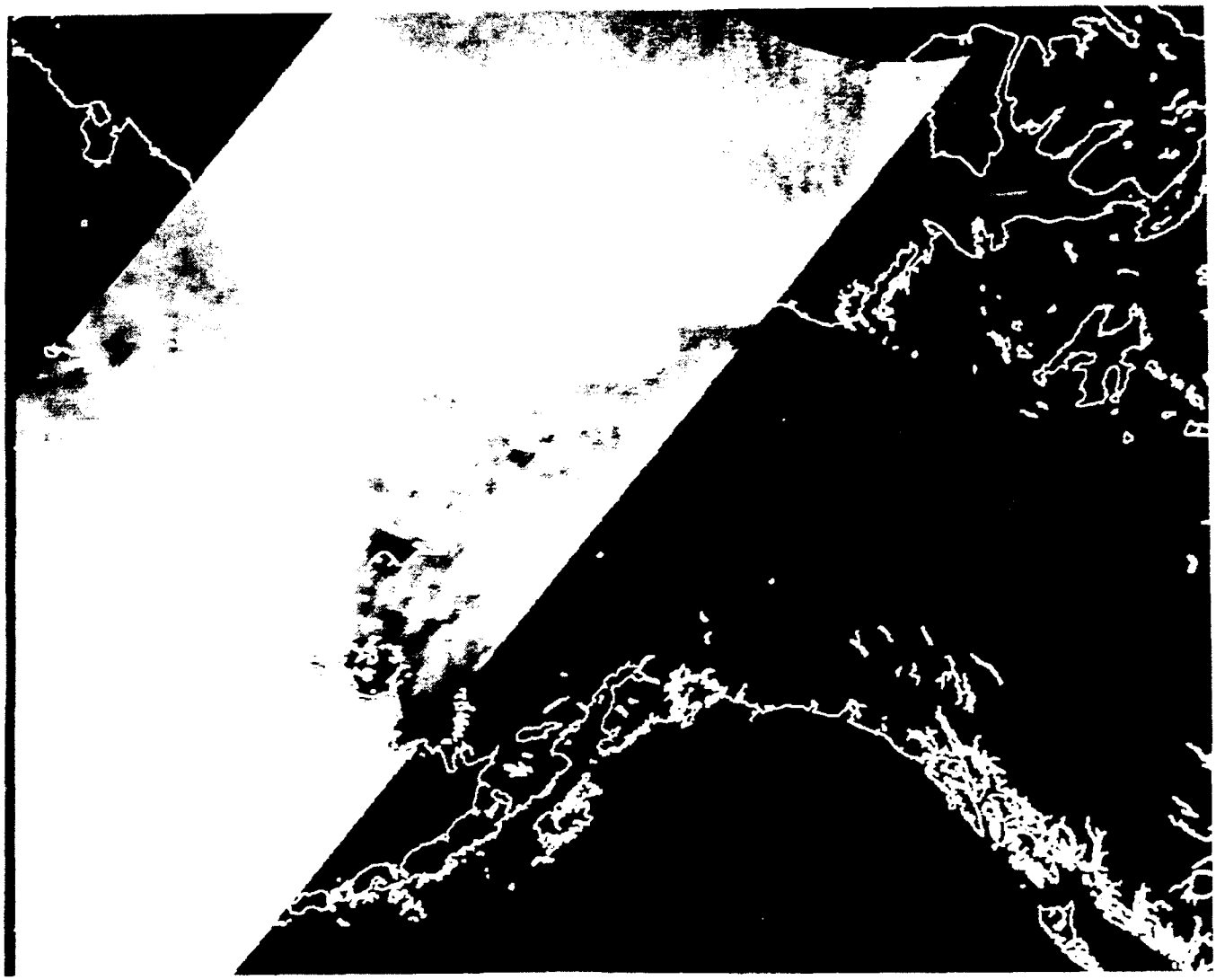
21 Apr 92 2107Z
DMSP OLS IR
Notable Features:

1. The simultaneous IR view shows another series of vortices extending eastward from Cape Lisburne toward Wrangle Island.
2. A strong frontal band extends over the Mackenzie River Delta toward Banks.



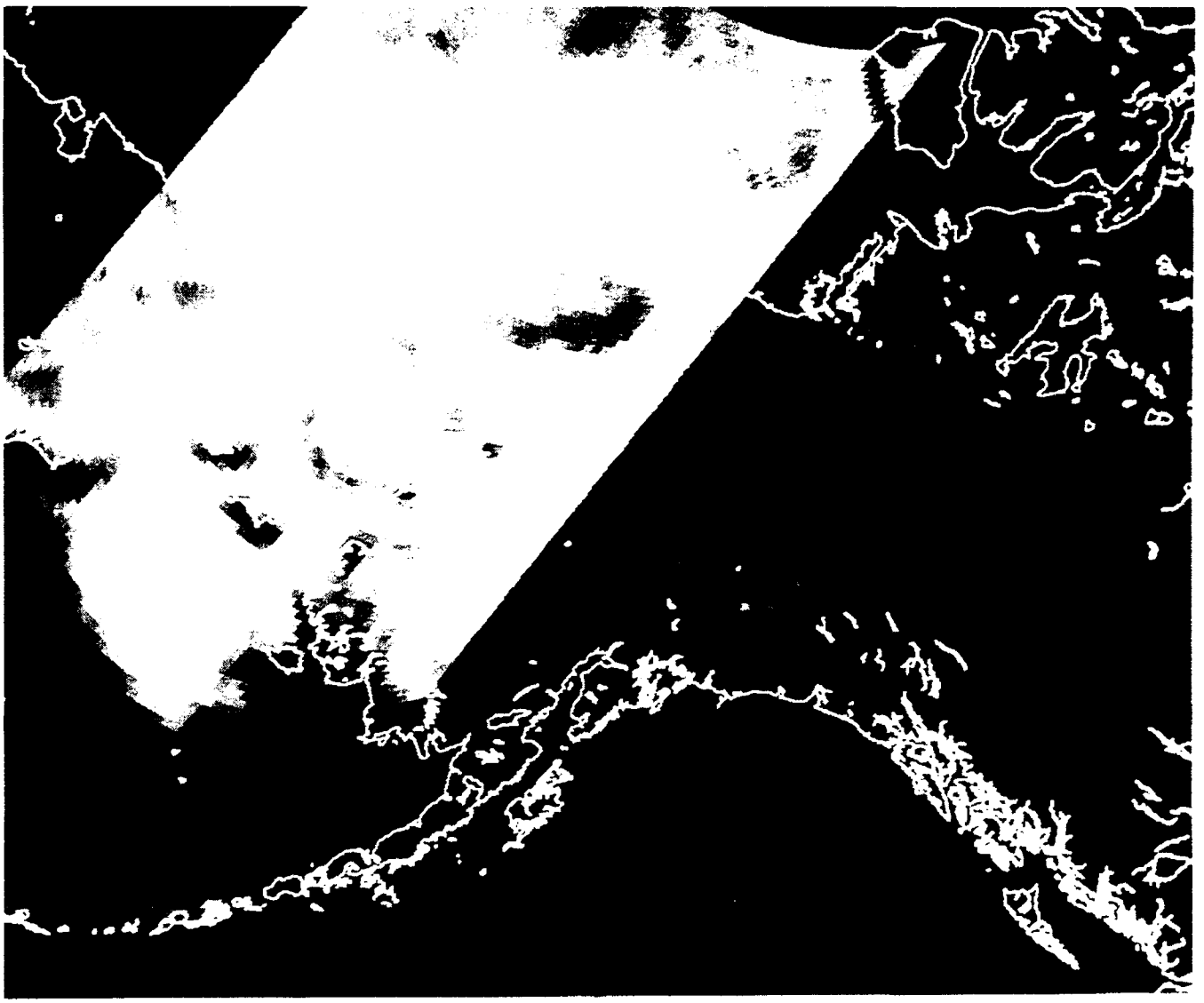
21 Apr 92 2107Z
DMSP 85H SSMI
Notable Features:

1. The lead or polynya feature extending SW from Barrow is again prominent.
2. The thinner ice region west of Banks Island appears very bright while the open water adjacent to Banks is dark (See 21 Apr 1712Z CH1-Ch2 difference pattern). From this it can be inferred that thinner ice regions exist immediately north of the N. Slope and NW of Barrow.
3. Darker multiyear ice is etched by adjacent lighter (thinner) ice regions in the N. Beaufort, Chukchi, and E. Siberian Sea regions.
4. Note dark areas on the eastern end of St. Lawrence Island and north of the Yukon Delta. The St. Lawrence effects seem to be thin ice or open water, but the Yukon offshore feature is fast ice (See 2107Z vis data).



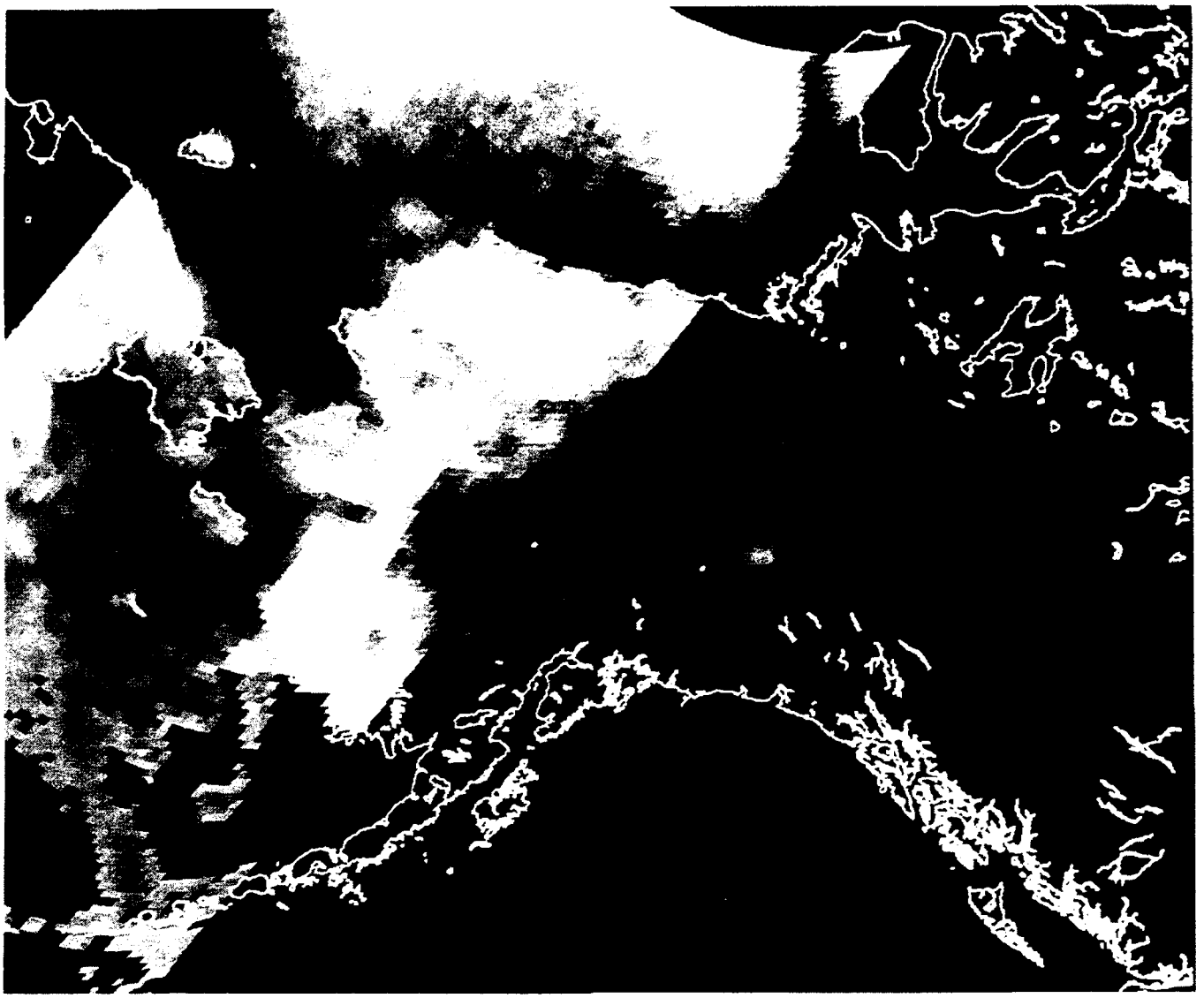
21 Apr 92 2107Z
DMSP 85V SSMI
Notable Features:

1. The vertically polarized SSMI channel seems more sensitive to thin ice and more clearly delineates the exact areas of open water. Compare again the 21 Apr 1712Z CH1-CH2 difference pattern and one can see that the open water is restricted to an area close to the Banks coastline. Note also that the "open lead" SW of Barrow is represented by a very fine dark line indicating some ice in the lead which appears much broader in other channels.
2. The fast ice in Norton Sound surrounding the Yukon Delta gives the darkest return in the image (Compare with the simultaneous visible view).



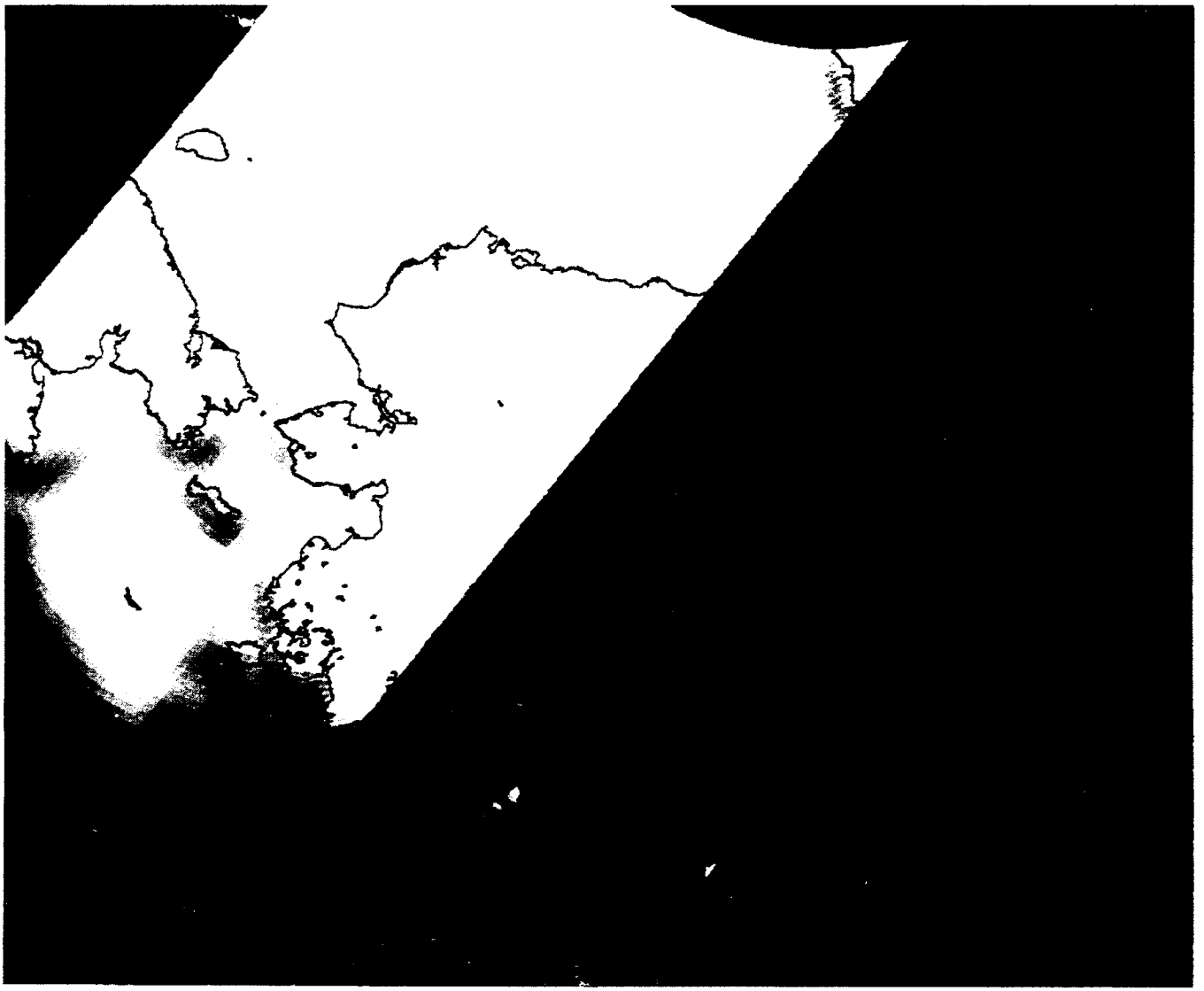
21 Apr 92 2107Z
DMSP FIRSTICE SSMI
Notable Fea ures:

1. This depiction appears to be very sensitive to open water or very thinnly covered ice regions. Note polynya effects off of St. Lawrence Island, the Chukchi Peninsula, the Bering Strait region, as well as Banks Island.
2. Deep snow areas are also apparently revealed as shown, for example, on the northern slopes of the Brooks Range, which appears darker than in the 85V and 85H channels.



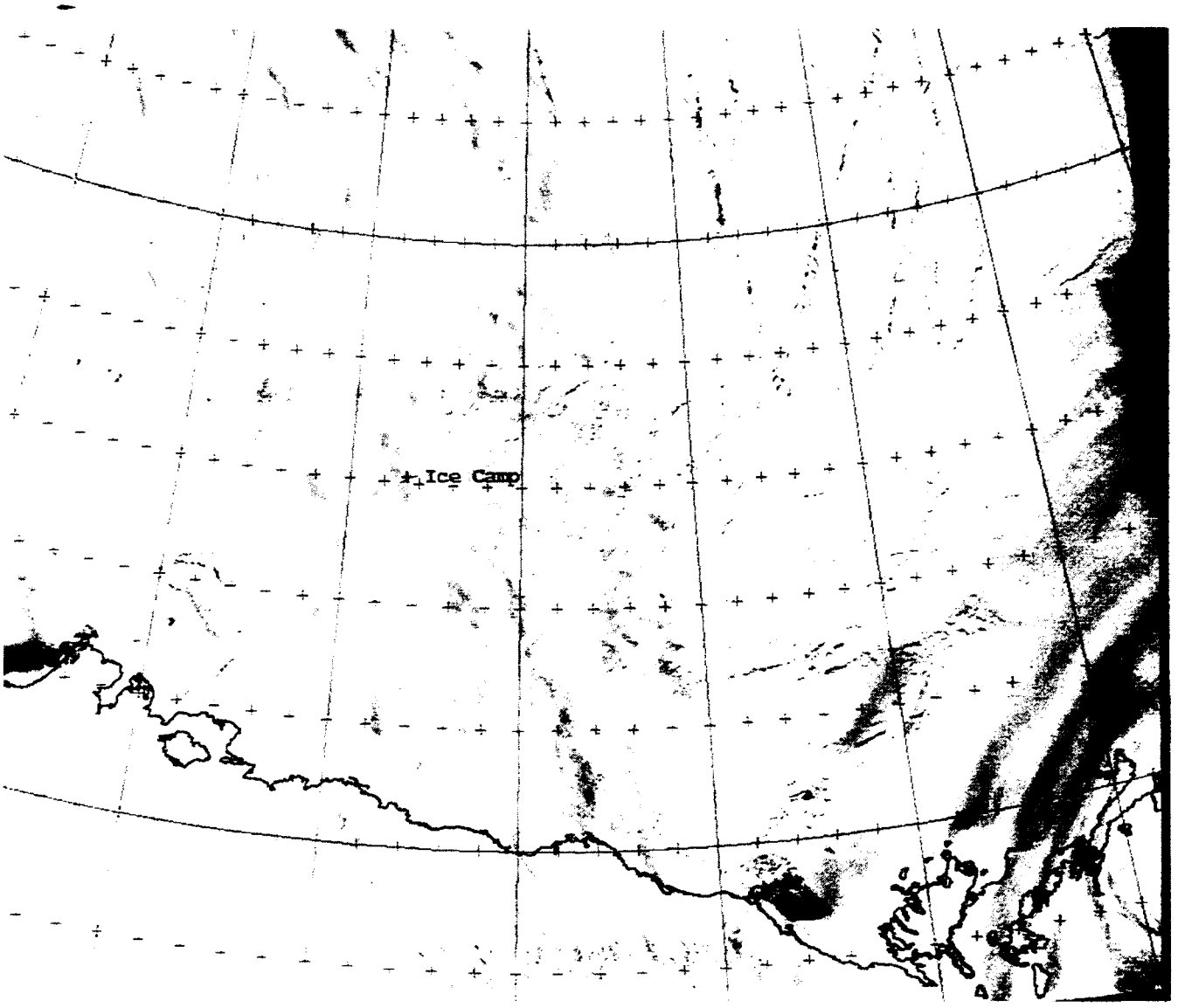
21 Apr 92 2107Z
DMSP MULTIICE SSMI
Notable Features:

1. This algorithm appears to give an almost inverse image compared to the FIRSTICE depiction. For example, the St. Lawrence Island polynya appears bright in this image whereas it was dark in the FIRSTICE depiction. The snowy Brooks Range slope similarly has reversed to a bright tone.
2. Additional cloud details are revealed southward toward the Aleutian Islands e.g. Note a cloud line effect extending southward from Nunivak Island and northward from the central Aleutians.



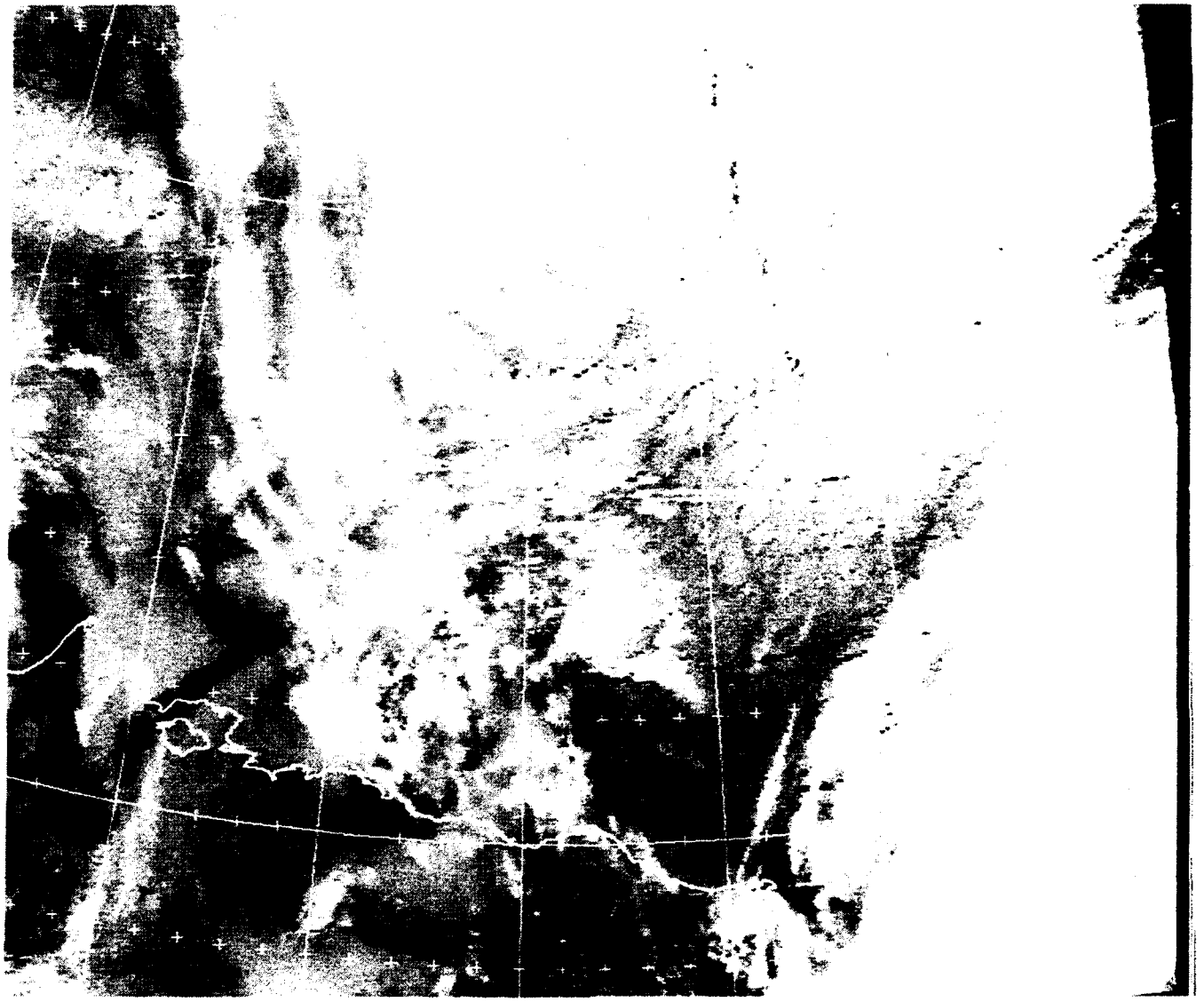
21 Apr 92 2107Z
DMSP TOTICE
Notable Features:

1. The TOTICE algorithm shows apparent ice free polynya areas near Banks; SW of Barrow; in the Bering Strait; and south of the Chukchi Peninsula.
2. Note the cloud line extending south of Nunivak Island.



22 Apr 92 0233Z
DMSP OLS VIS
Notable Features:

1. A cyclonic shear region exists north of Barrow while a ridge line protrudes SE'ward into the eastern Beaufort Sea (which appears clear in the satellite image).
2. Large polynyi are seen east of Herschel Island; SW of Barrow; and along the west coast of Banks Island.
3. Anticyclonic cirrus streaks cover the Mackenzie River Delta area.



22 Apr 92 0233Z
DMSP OLS IR
Notable Features:

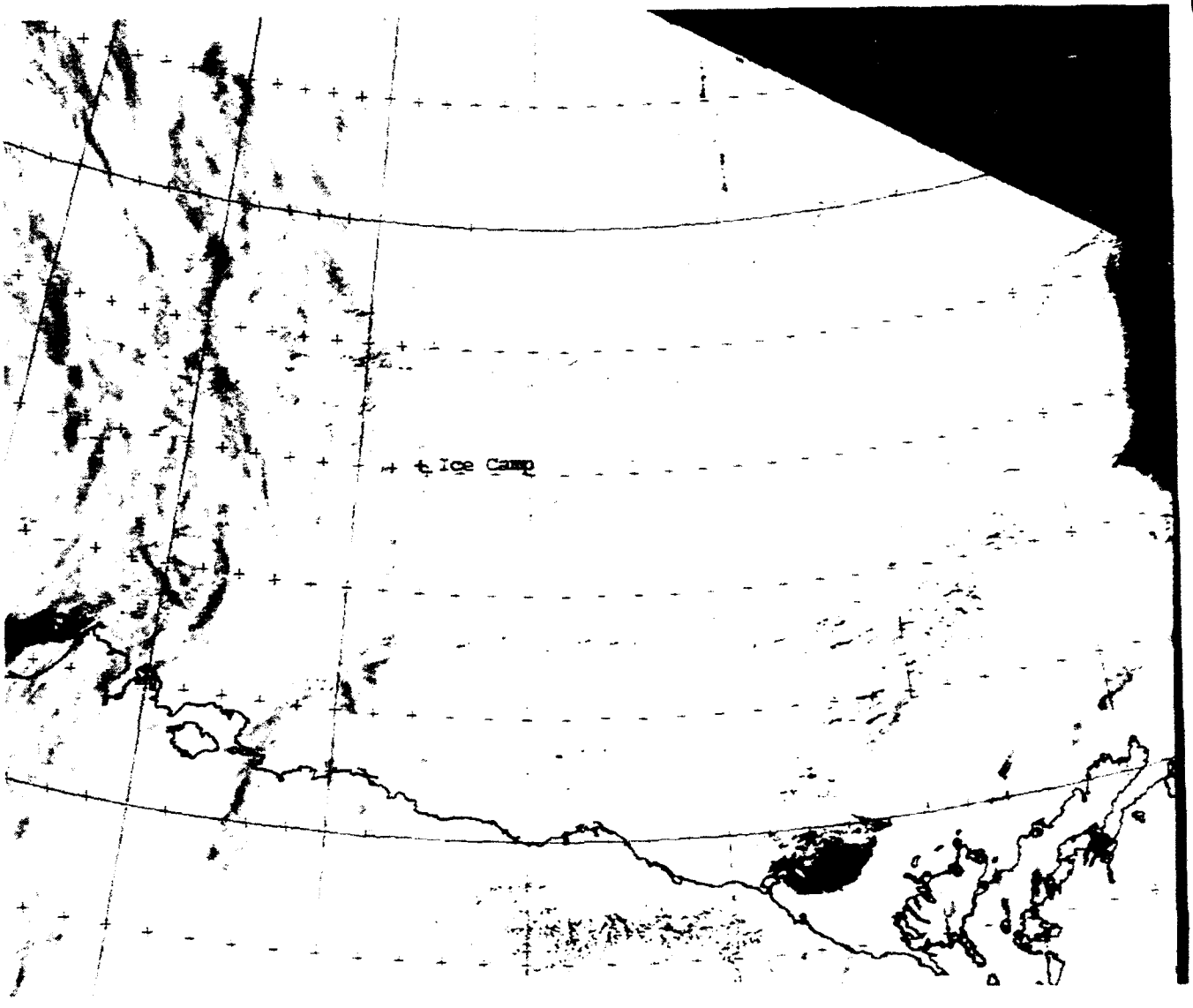
1. Middle and high clouds NE of Barrow coincide with a low level convergence zone with easterly flow meeting westerly flow just west of the ice camp.
2. Low pressure was developing south of Banks Island.

22 Apr 92 0310Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The fast ice boundary passing just north of Barter and Herschel Islands is well revealed in this depiction.
2. The light area in the NW corner of the image is clear.
3. A vortex is suggested near 72N, 153W.

22 Apr 92 1354Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The polynya and thin ice area west of Banks is notable as is the polynya NE of Herschel Island.

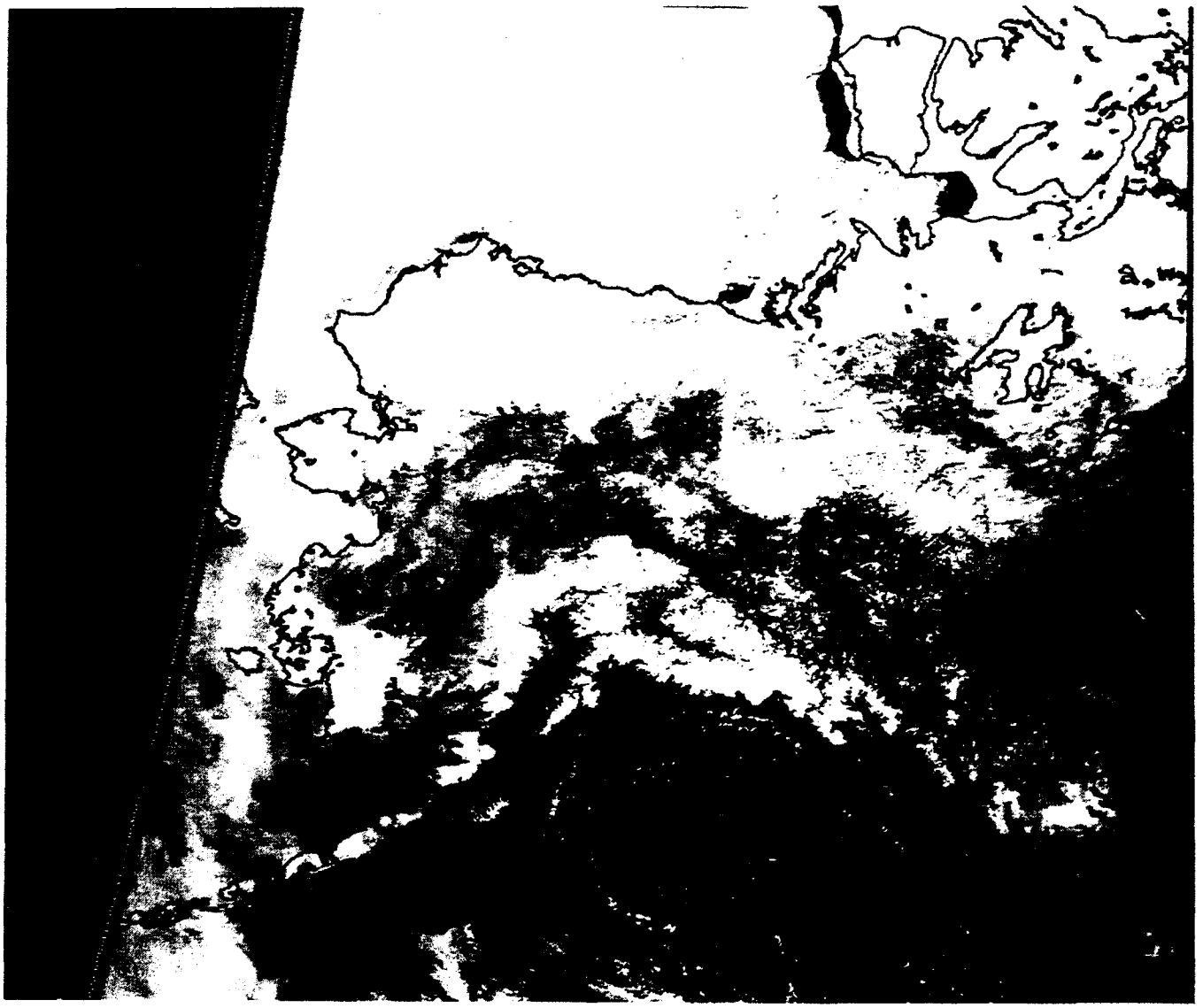


22 Apr 92 1618Z
DMSP OLS VIS
Notable Features:

1. Ridging is suggested by the clear region through the eastern Beaufort Sea with cyclonic activity north of Barrow and SE of the Tuktoyaktuk Peninisula.

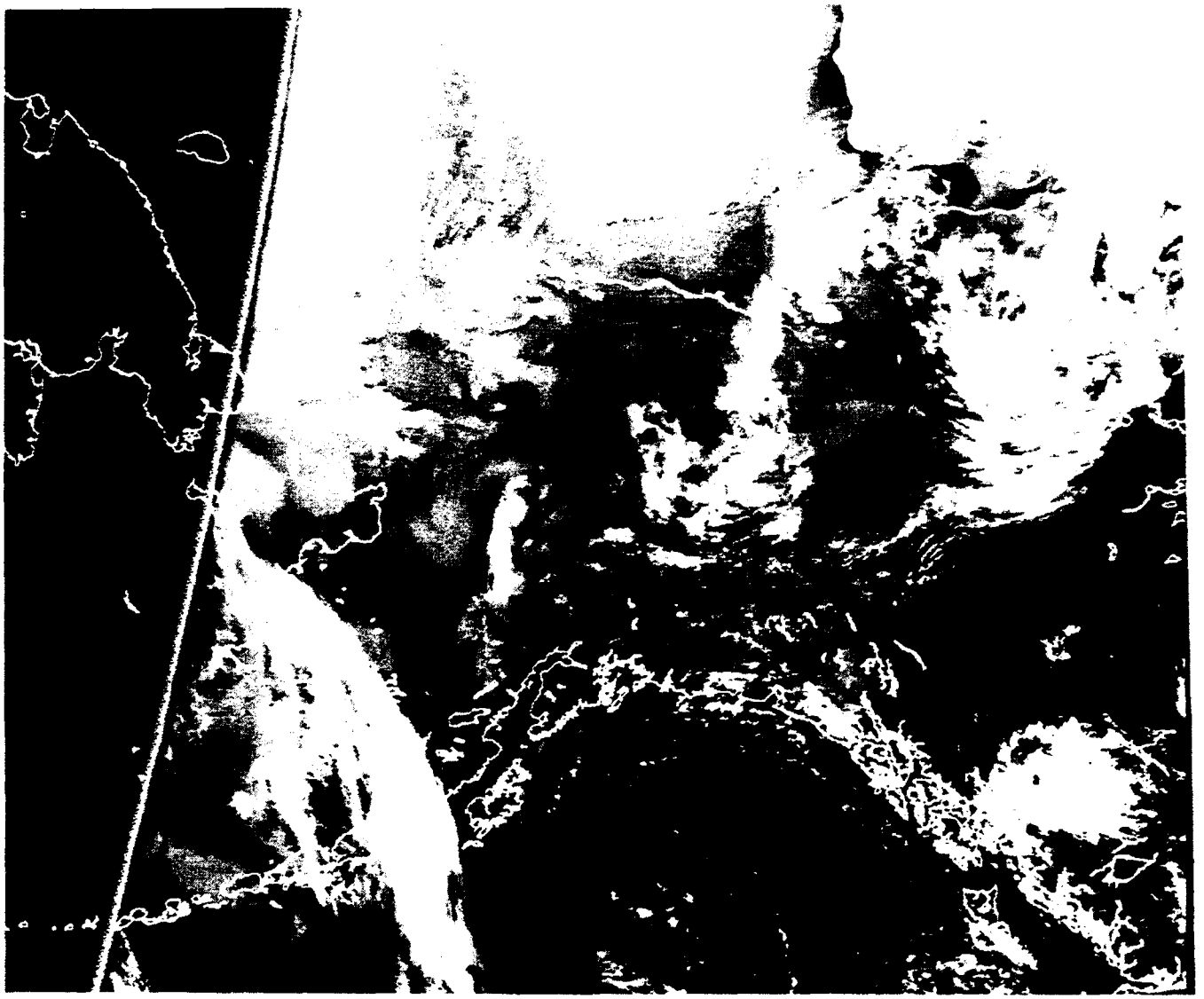
22 Apr 92 1618Z
DMSP OLS IR
Notable Features:

1. Anticyclonically-turning cirrus striations are evident over the Mackenzie Delta.
2. Much of the lower coudiness north of Barrow appears to be low or mid-level.



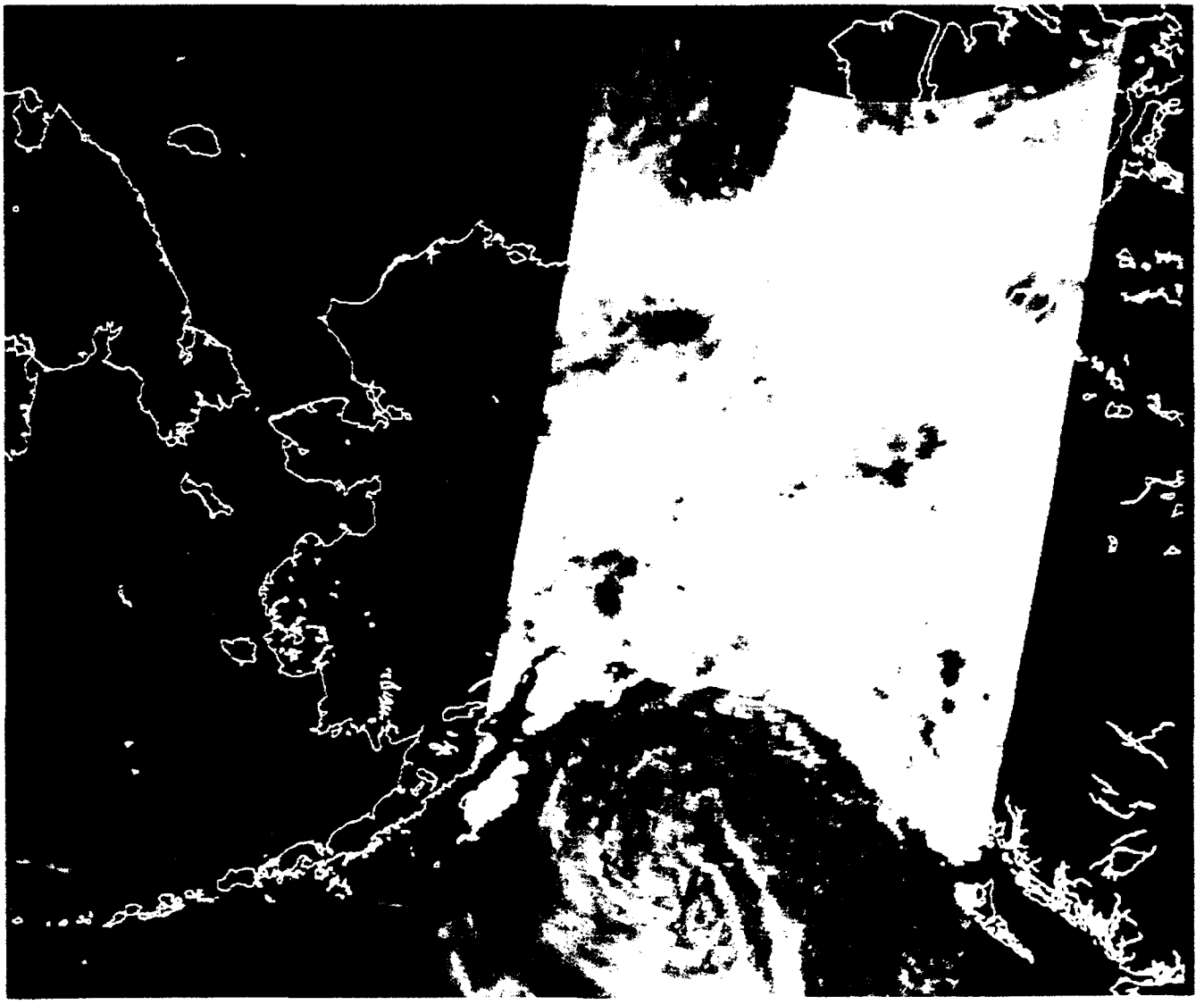
22 Apr 92 1857Z
DMSP OLS VIS
Notable Features:

1. This large scale visible view shows much of central and southern Alaska apparently in the clear.



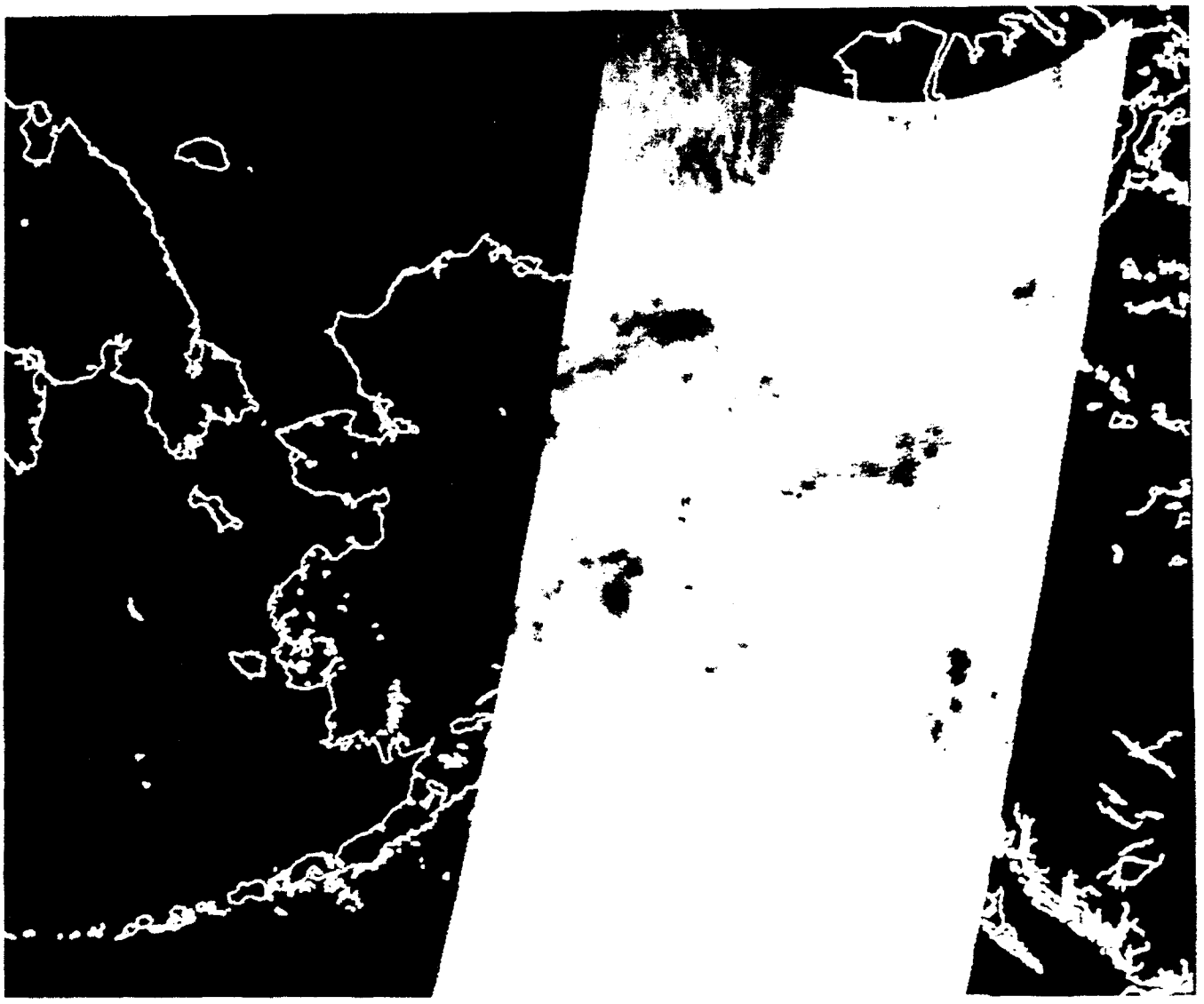
22 Apr 92 1857Z
DMSP OLS IR
Notable Features:

1. The IR view gives a much better assessment of total cloudiness - much of which is transparent to the visible sensor.
2. Note especially cloudiness extending southward from the Tuktoyaktuk Peninsula; the storm SE of this feature; and the cirrus covering SW Alaska and the Alaska Peninsula. There is really an amazing difference between the visible and IR views.



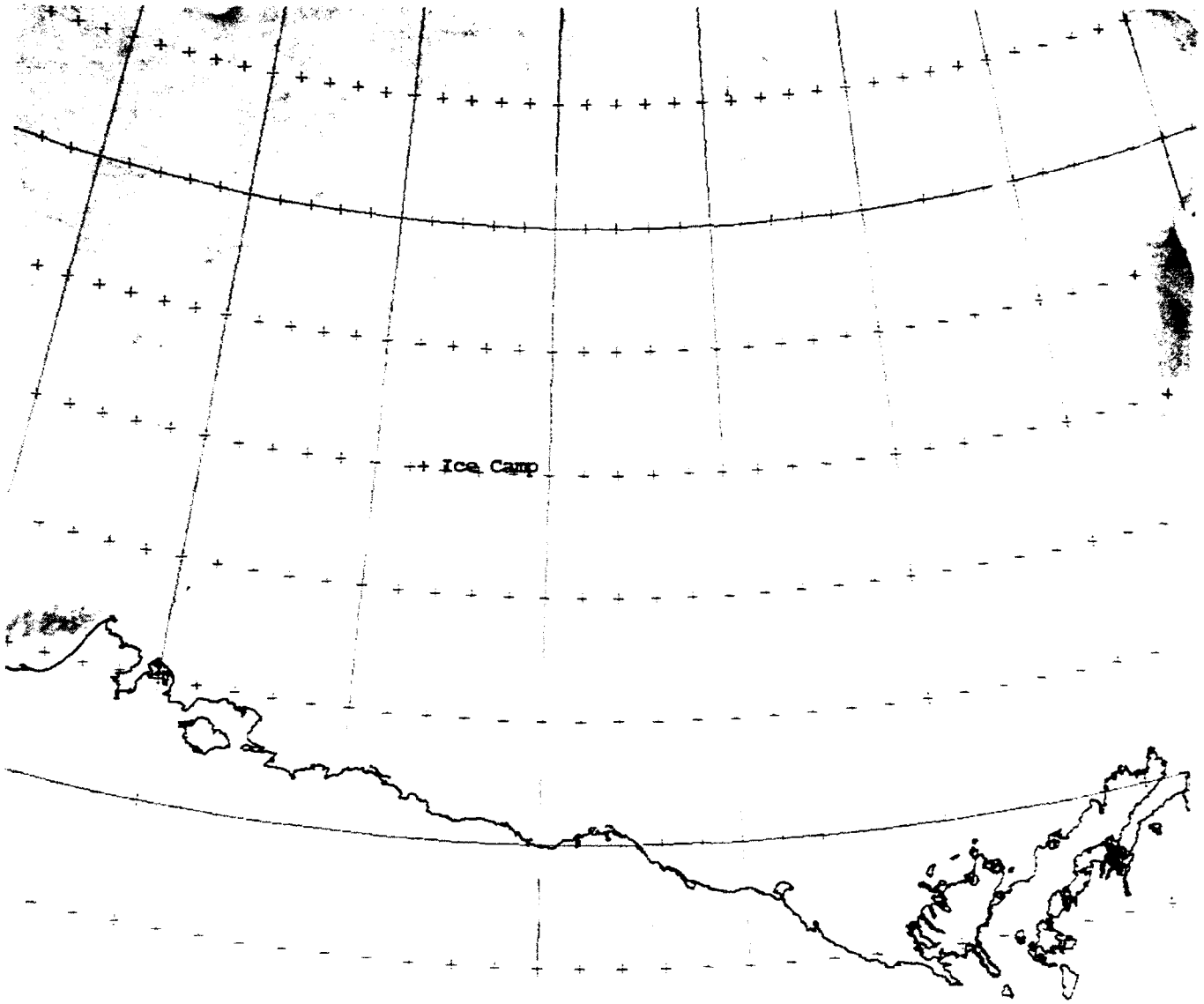
22 Apr 92 1856Z
DMSP 85H SSMI
Notable Features:

1. The wide gray area adjacent to Banks Island coincides closely to what appears to be open water in the visible data. The brighter outlying region is thin and possibly "wet" ice.
2. Note that the crescent-shaped area in Amundson Gulf is smaller than it appears in the visible data, indicating more ice in the region than is suggested by the visible data.



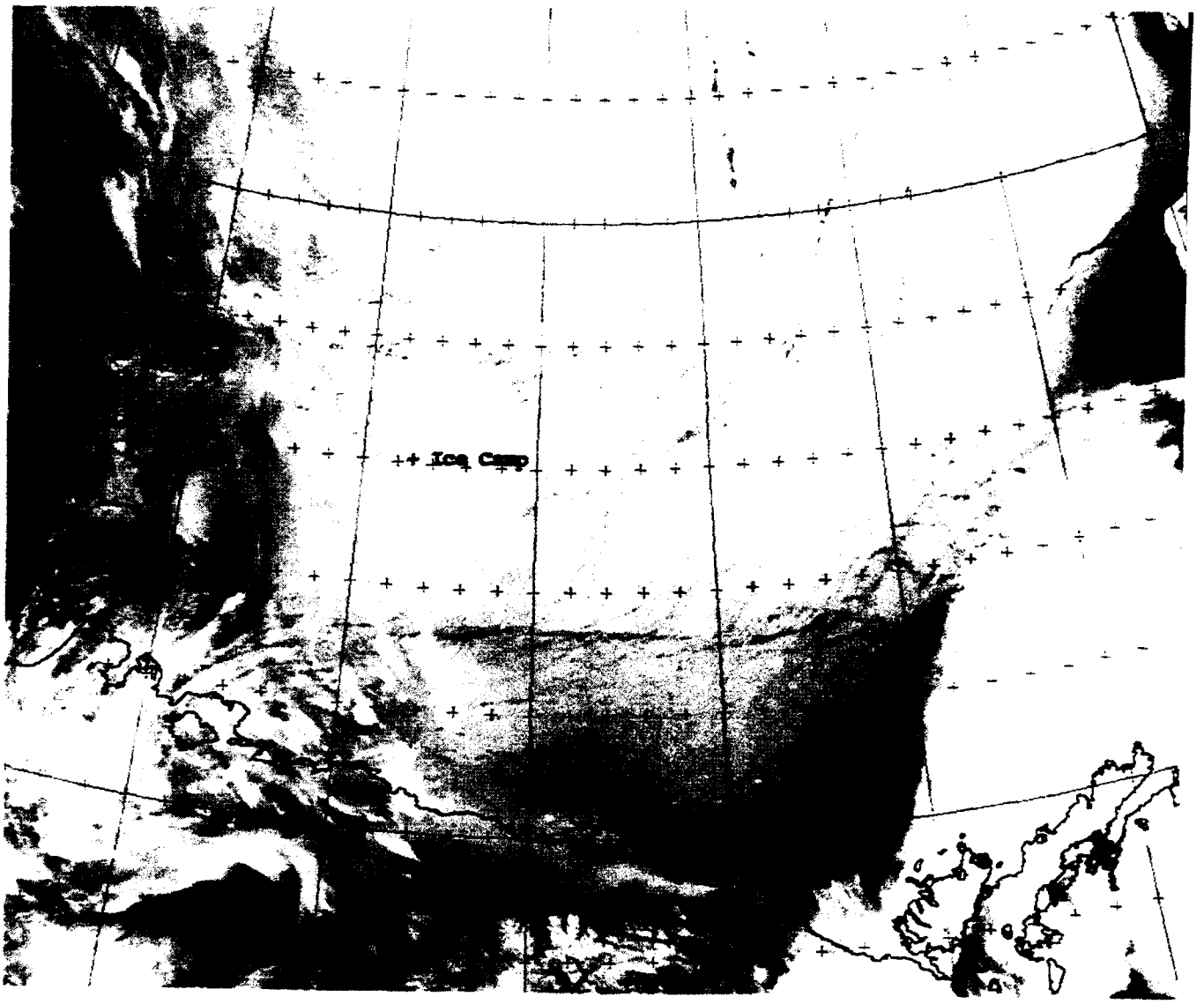
22 Apr 92 1856Z
DMSP 85V SSMI
Notable Features:

1. The vertically polarized SSMI data are even more restrictive in delineating only a small region adjacent to Banks Island as open water.
2. The "crescent-shaped" area in Amundson Gulf almost disappears in these data suggesting that this area is not really open water.



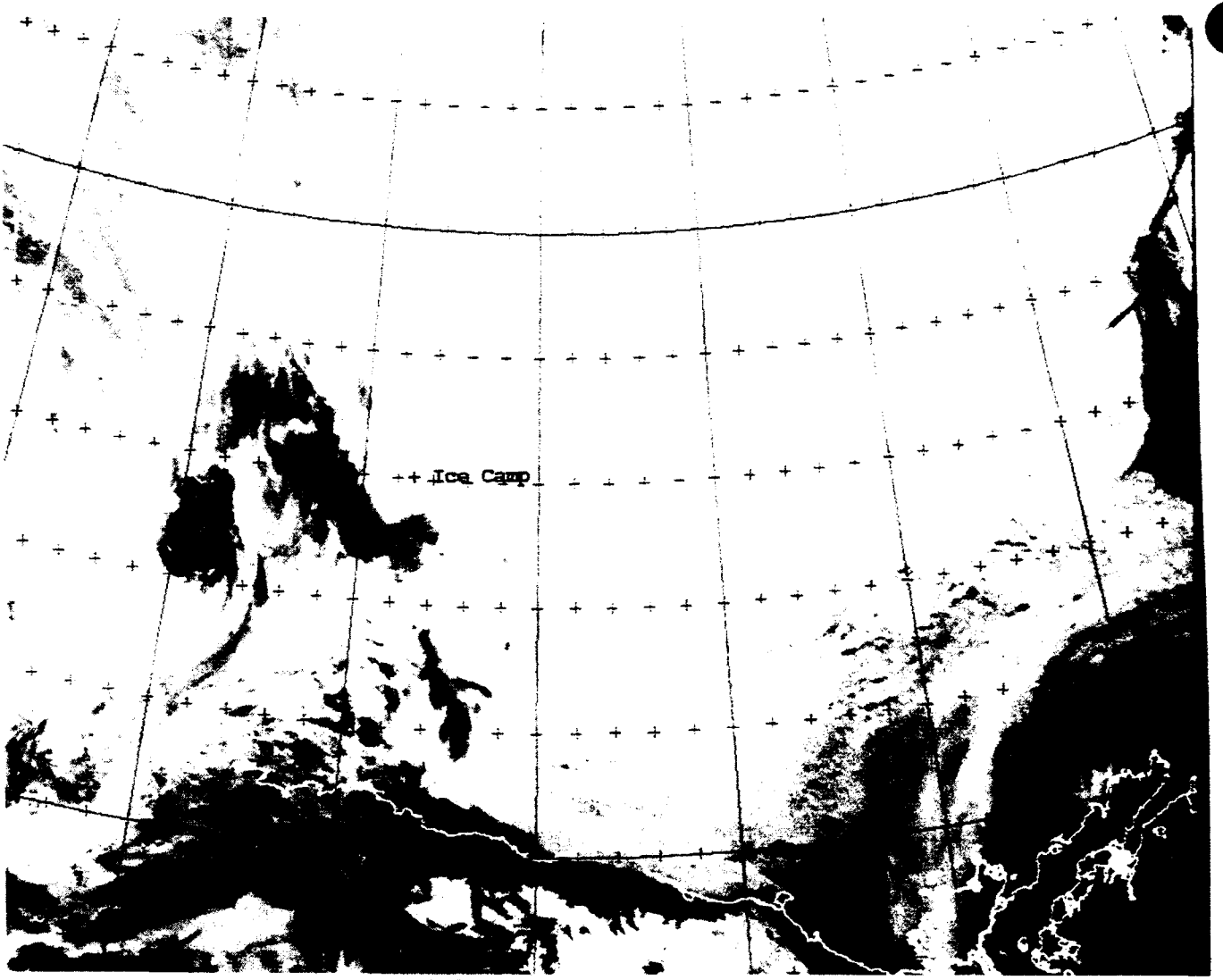
22 Apr 92 2006Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. Cyclonic activity continues to be suggested north of Barrow and to the SE.
2. Channel 2, being highly absorbed by any water shows the broad thin ice region west of Banks with only a hint of open water immediately adjacent to the coastline.



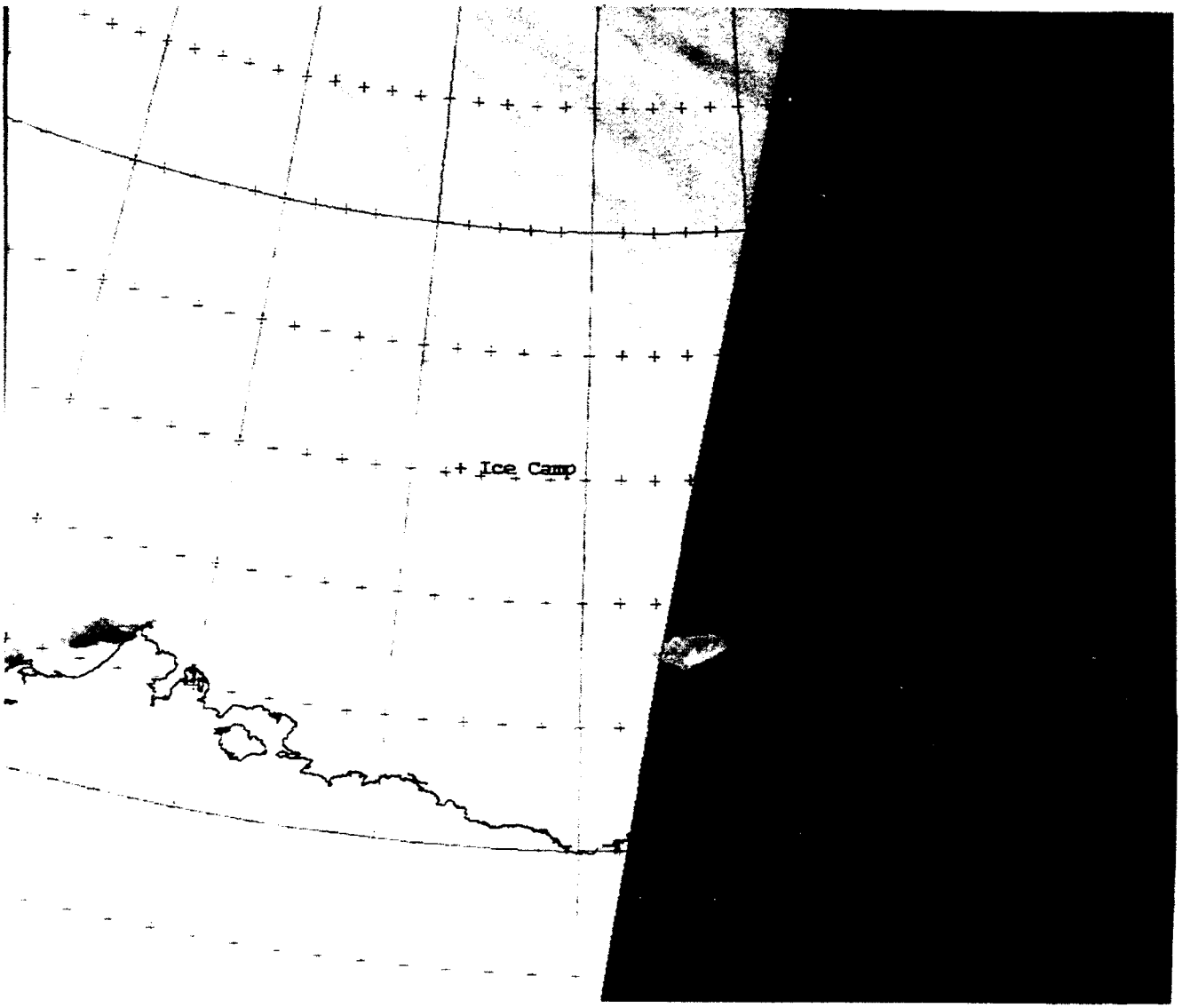
22 Apr 92 2008Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Channel 4 reveals a much broader area of thin ice than channel 2. The darkest return suggests open water but this possibilty is dispelled by the channel 2 data.



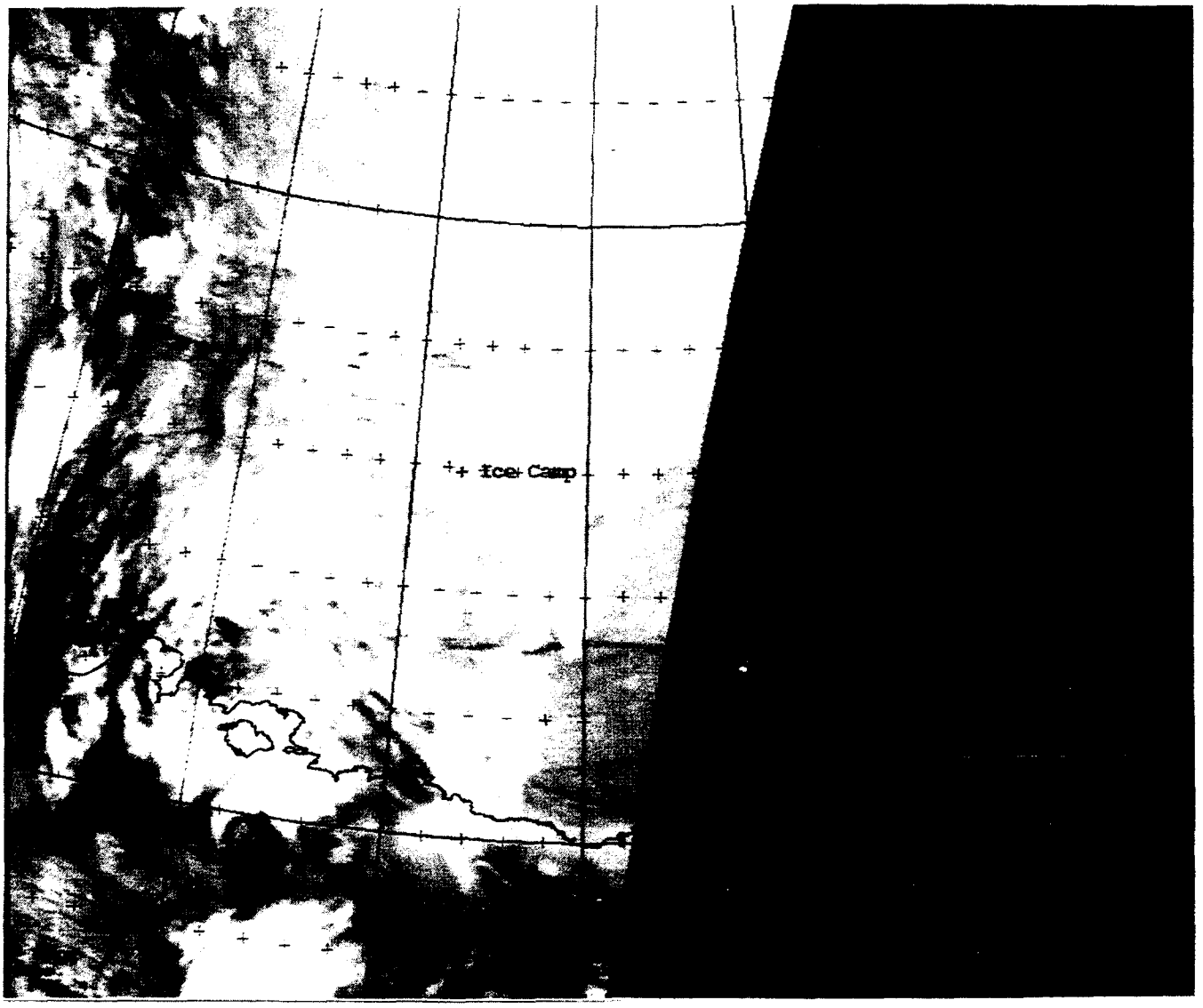
22 Apr 92 2008Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The channel 3 data are very effective in revealing a vortex north of Barrow near 72.5N, 154W.
2. Channel 3 shows ice crystal clouds as black north of the Tuktoyaktuk Peninsula.
3. The thin ice area in channel 3 is similar to the channel 2 rendition.
4. Note the low cloud plume coming off an open crack in the thin ice west of Banks. The crack or lead itself seems to be revealed in the channel 3 data!
5. The edge of shore fast ice is revealed as a bright line extending WNW from Herschel Island.



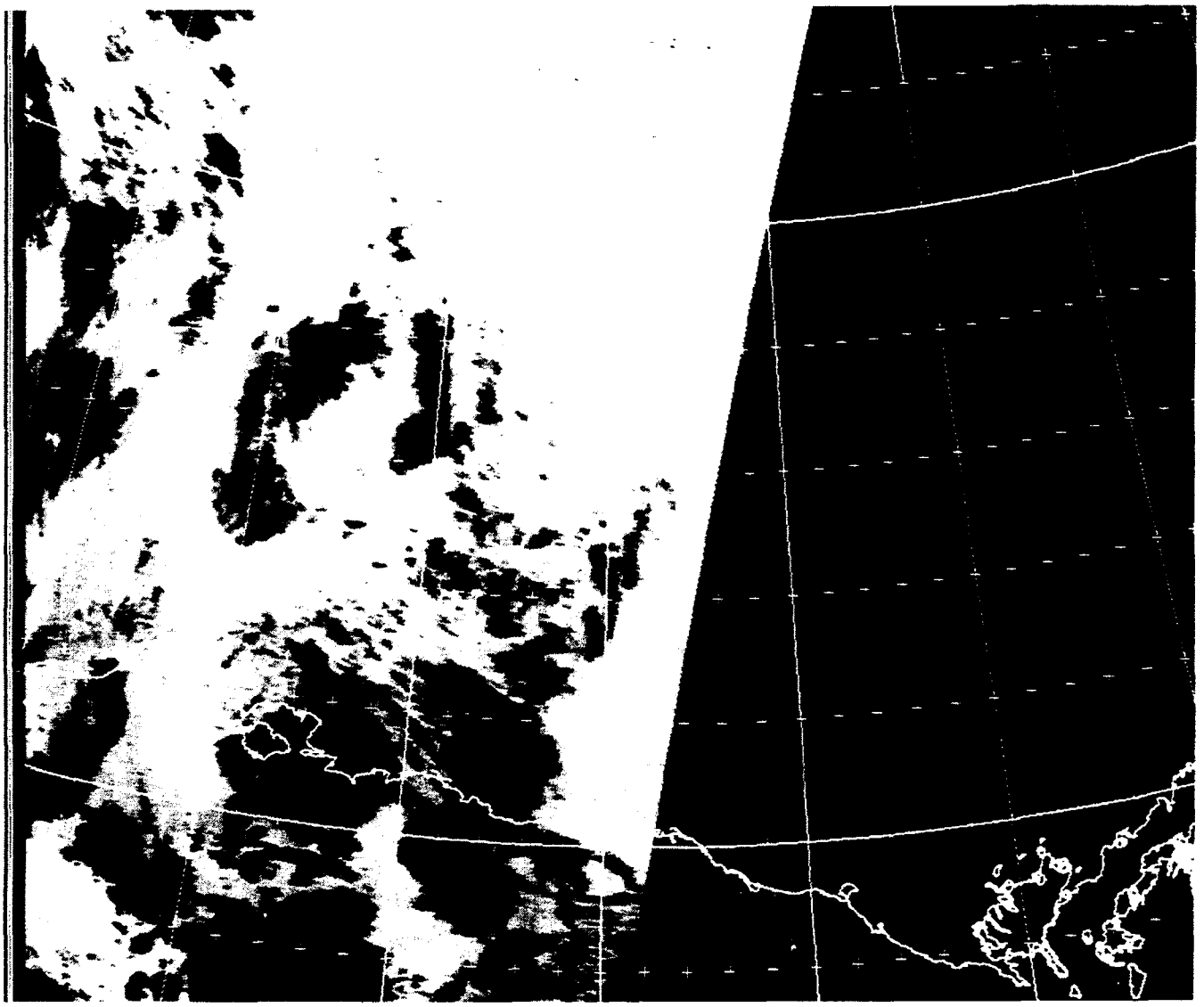
23 Apr 92 0138Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. The vortex north of Barrow has appeared to slip southward to a position near Barrow in this image.



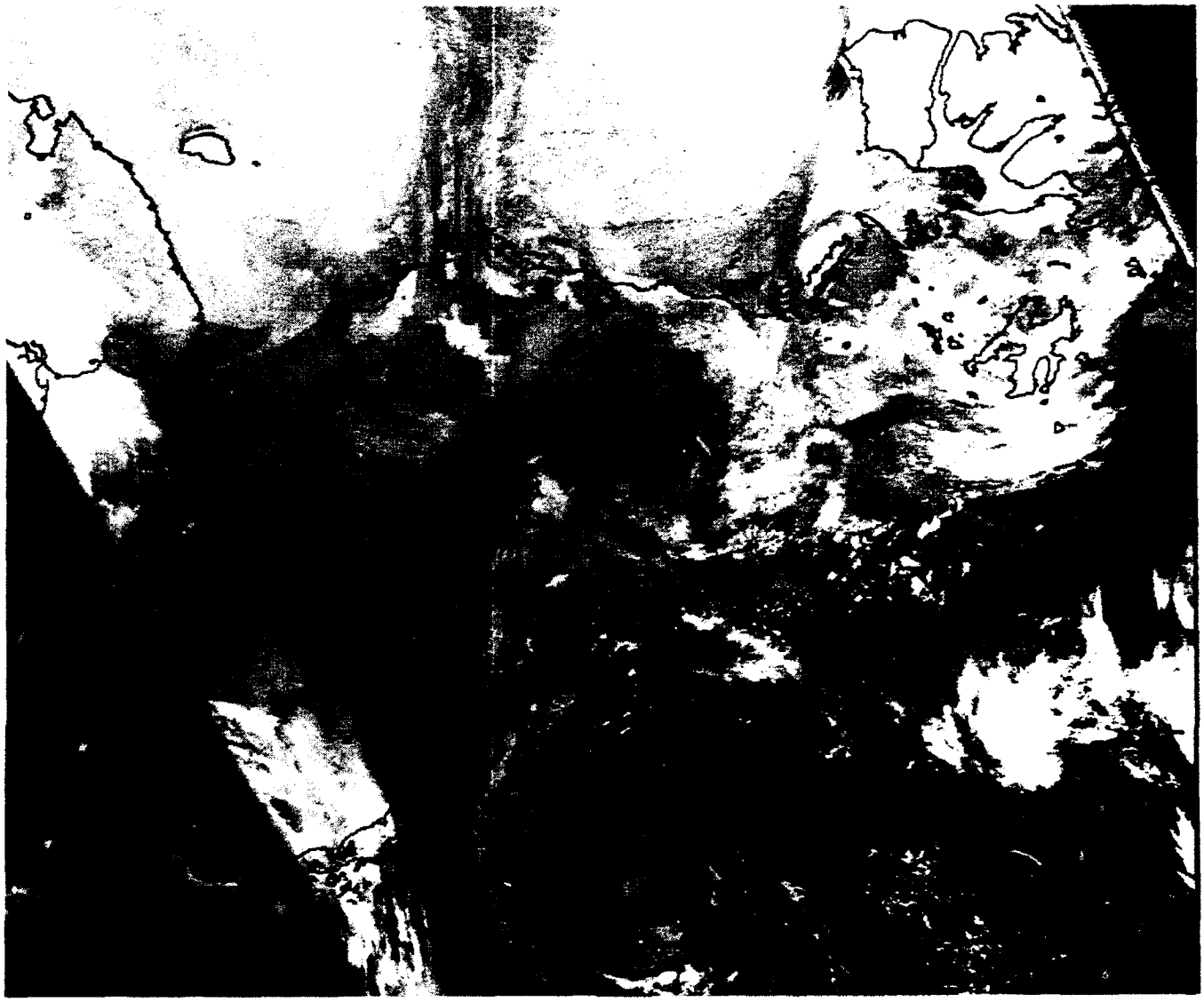
23 Apr 92 0138Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The IR data clearly reveal a vorticle center just east of Dease Inlet.
2. A second center is shown near 75.2N, 152.5W.
3. A possible vortex appears on the northward slope of the Brooks Range.



23 Apr 92 0138Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The channel 3 data do not resolve the vortex near 75N as well as the IR. The suggestion is that this may be an upper level feature. **NOGAPS** does show an upper level low at 500 mb in the area but not centered at that location.
2. Cloud height is difficult to interpret in this image since some black areas represent low clouds while other equally black areas are caused by ice crystal clouds. Compare channels 3 and 4 for insight into this problem.

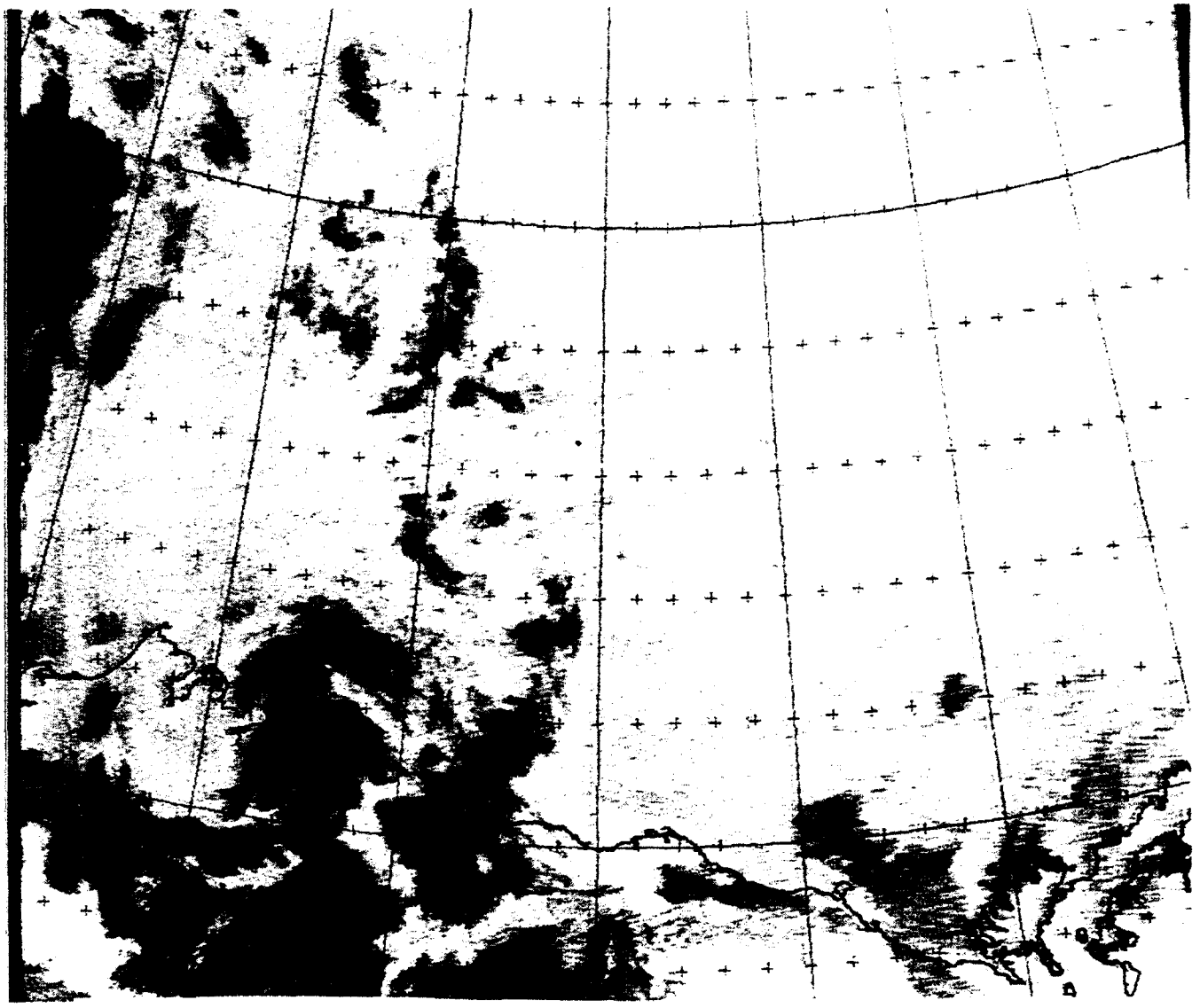


23 Apr 92 0447Z
DMSP OLS IR
Notable Features:

1. This large scale IR image clearly reveals the vortex east of Barrow and the banded sructure to the north.
2. The central and eastern Beaufort are under the influence of high pressure while cyclonic activity is shown near the Tuktoyaktuk Peninsula.

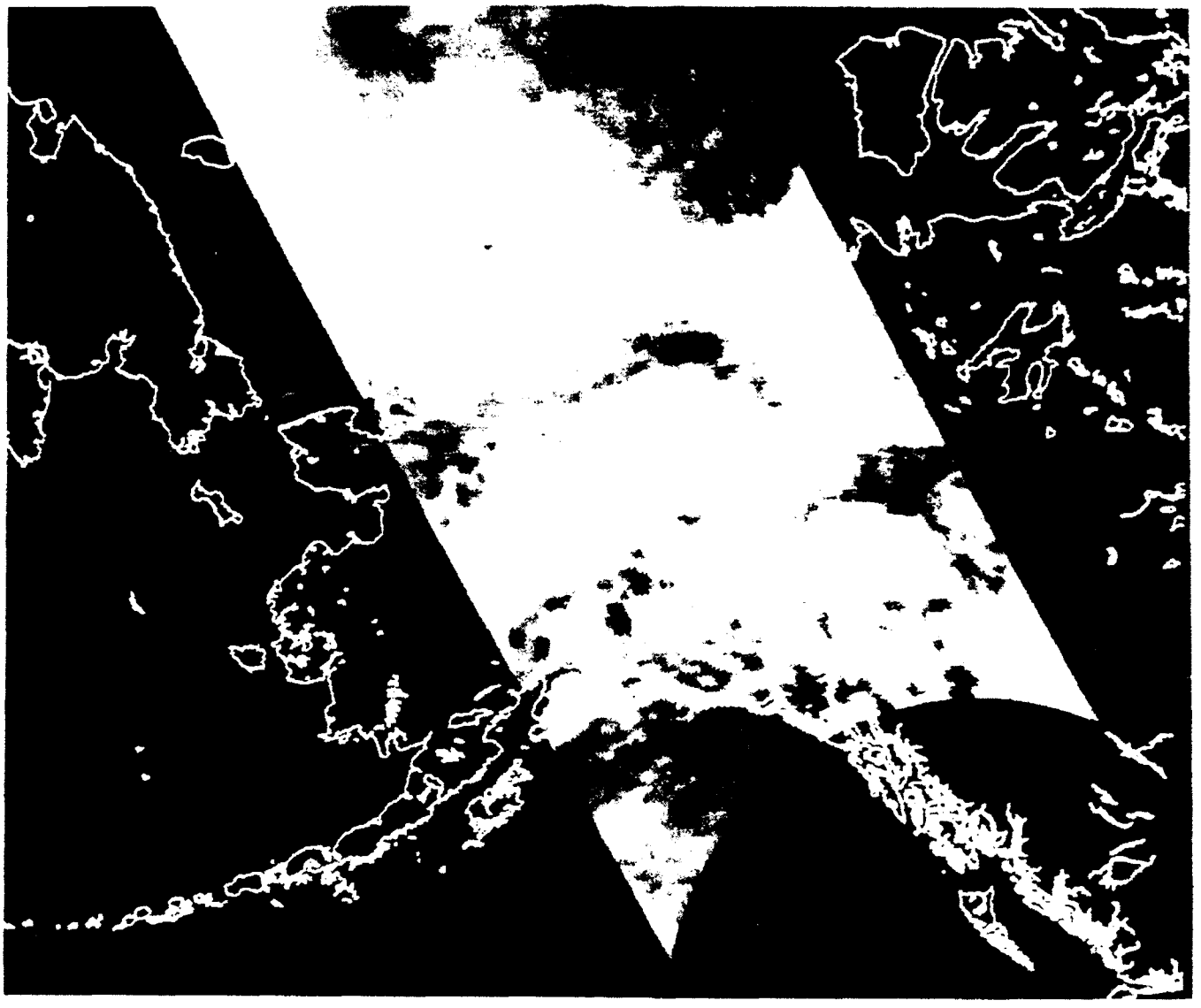
23 Apr 92 0427Z
NOAA AVHRR CH 4 IR
Notable Features:

1. A NOAA view shows the vortex east of Barrow and also suggests the northern vortex noted earlier now positioned near 76N, 153W.
2. Multiyear ice floes appear in the central Beaufort.



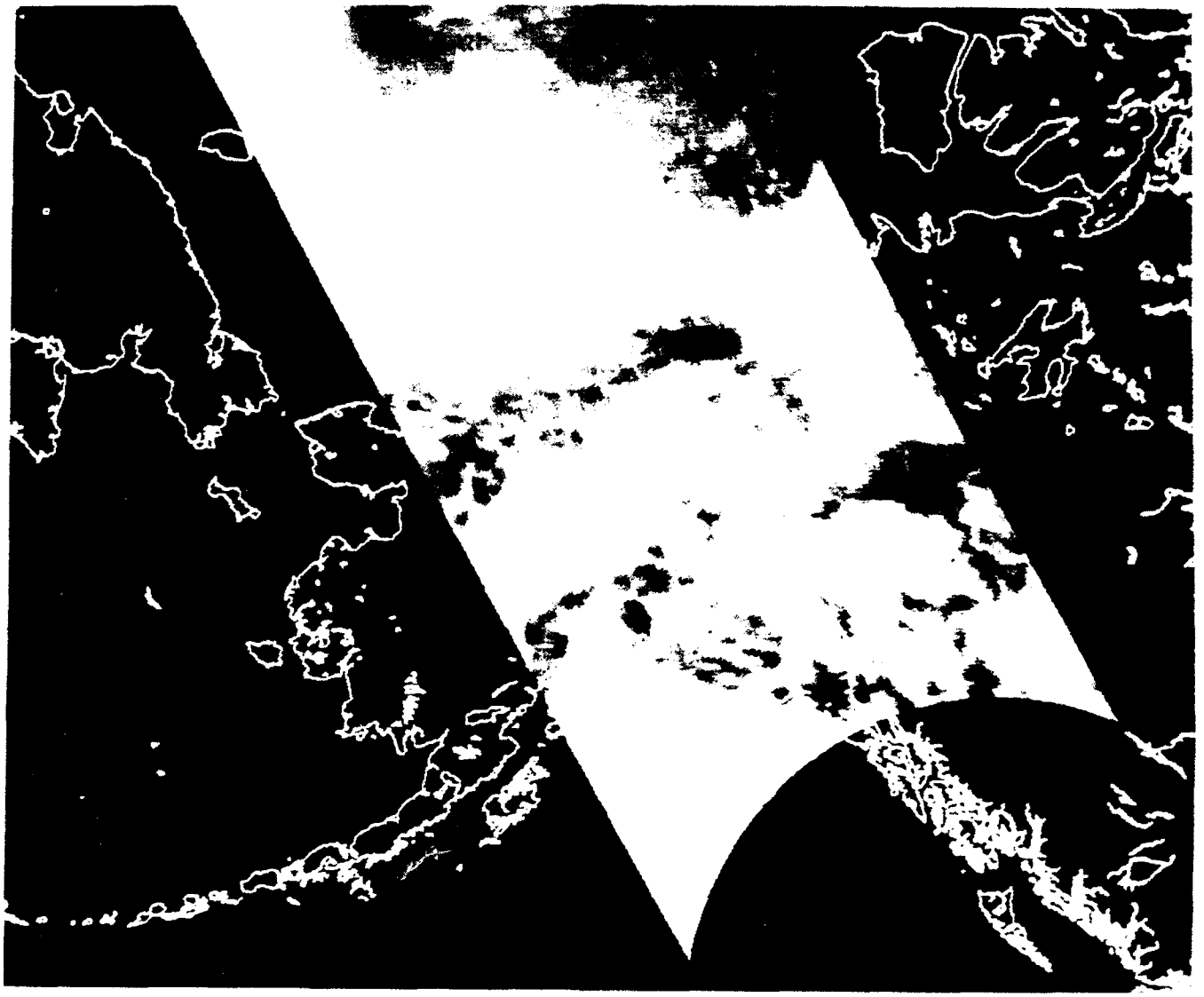
23 Apr 92 0427Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The channel 3 view is easier to interpret at this time. It clearly reveals low clouds wrappping around the vortex center and low clouds to the south over the Brooks Range.
2. Note that much of the cirrus to the north, apparent in channel 4, are not detected in channel 3. The same is true of the heavy cirrus north of the Tuktoyaktuk Peninsula which are barely resolved in the channel 3 data. Low clouds generated from the flaw lead north of Herschel Island and the polynya in the region, however, are clearly shown.



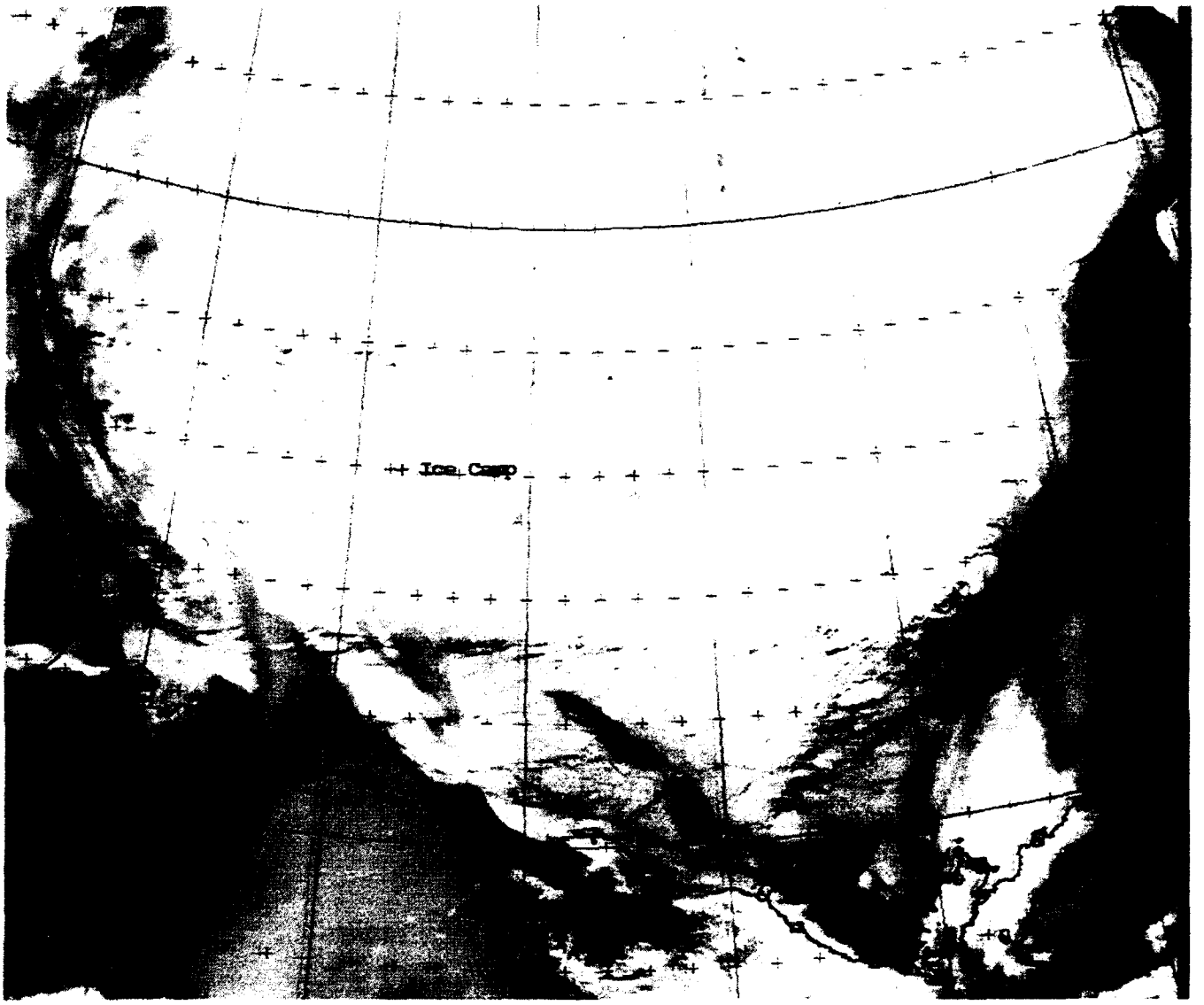
23 Apr 92 0447Z
DMSP 85H SSMI
Notable Features:

1. The two darkest regions in the Arctic Sea represent the "hard-core" areas of multiyear ice. Thinner ice is indicated along the continental boundary and for some distance north of Barrow. Brighter spots and lines in the dark region may be leads and areas of thinner ice.



23 Apr 92 0447Z
DMSP 85V SSMI
Notable Features:

1. The vertically polarized data over the ice are very similar to the horizontally polarized data - however, delineation of bright spots and lines in the dark areas appears crisper in detail.
2. Note that the geographical boundary appears slightly displaced in both of the SSMI images.

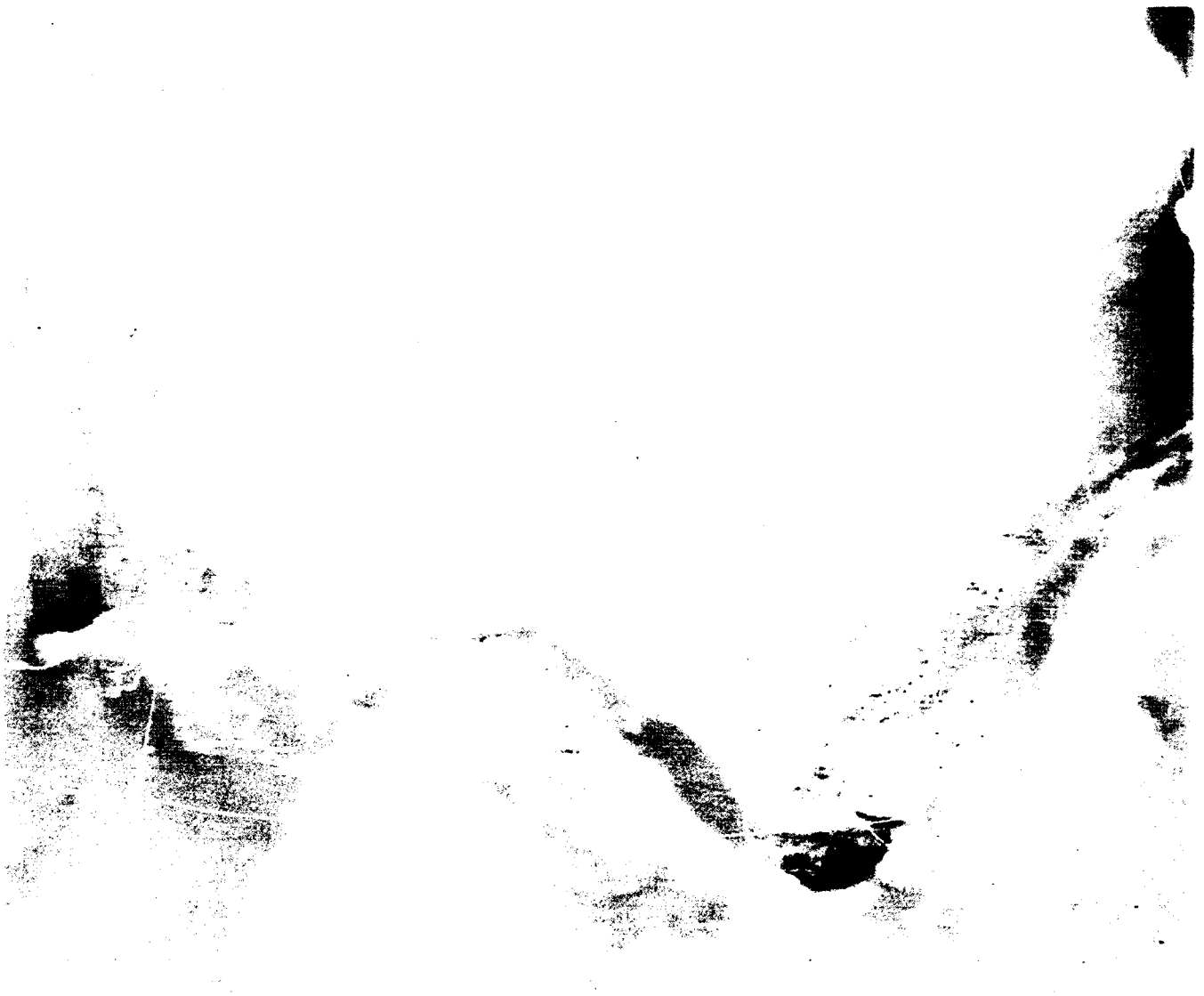


23 Apr 92 1342Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The vortex appears to have moved northward on this image to a position near 72.5N, 154W. Dense low overcast covers Deadhorse and the area to the south. Anchorage forecasters analyzed a frontal zone along the N. Slope connecting the vortex north of Barrow to a second low north of the Tuktoyaktuk Peninsula.

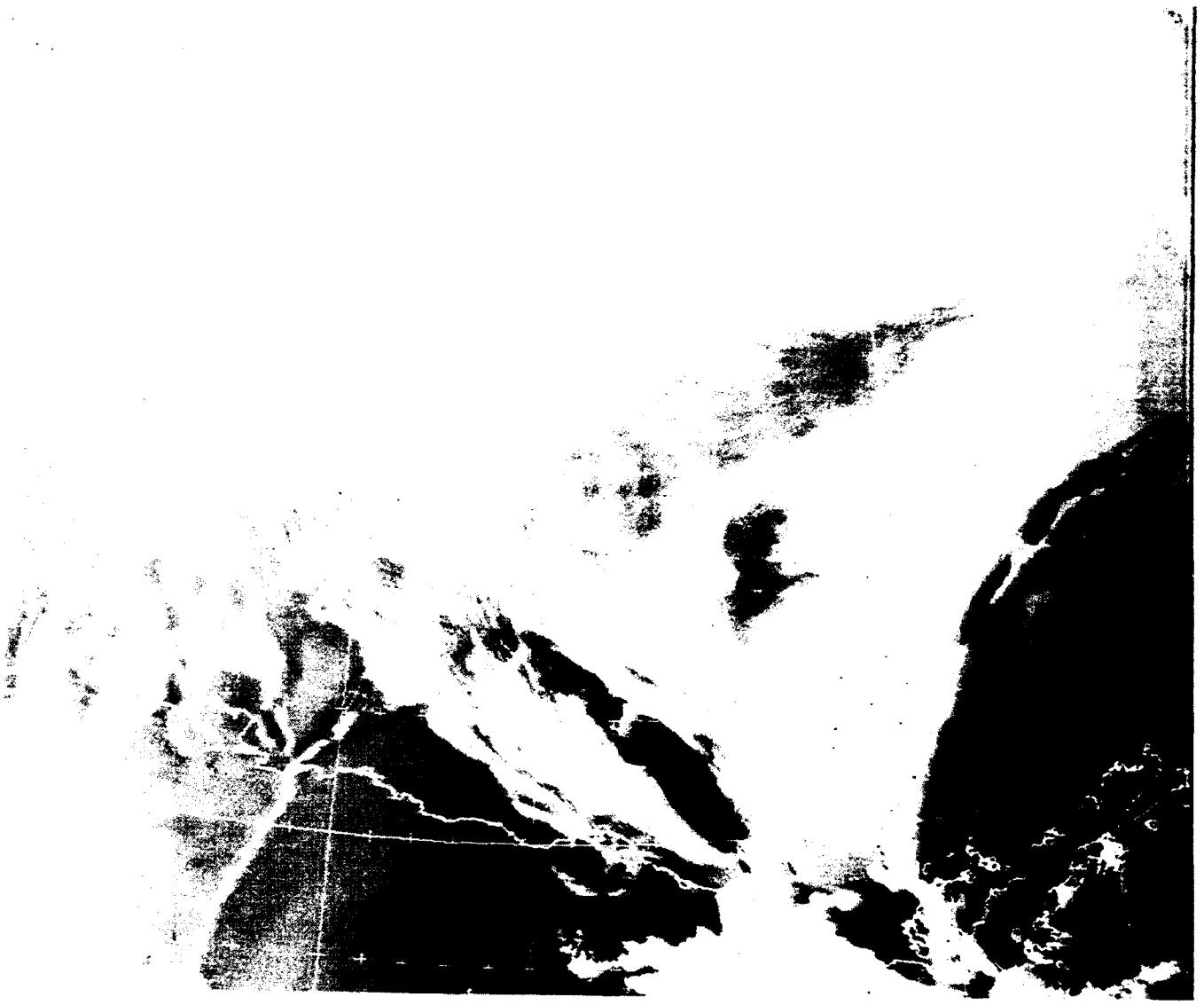
23 Apr 92 1342Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The simultaneous channel 3 data at this time show much more detail over the ice than channel 4. This is rather interesting since the 0427Z channel 3 image revealed <u>less</u> detail. The difference may be associated with light scattering changes with time of day. More research into this problem is required.
2. Note the cloud plume SE of the Herschel Island polynya. This was a plume generated by air-sea interaction under NE wind flow.



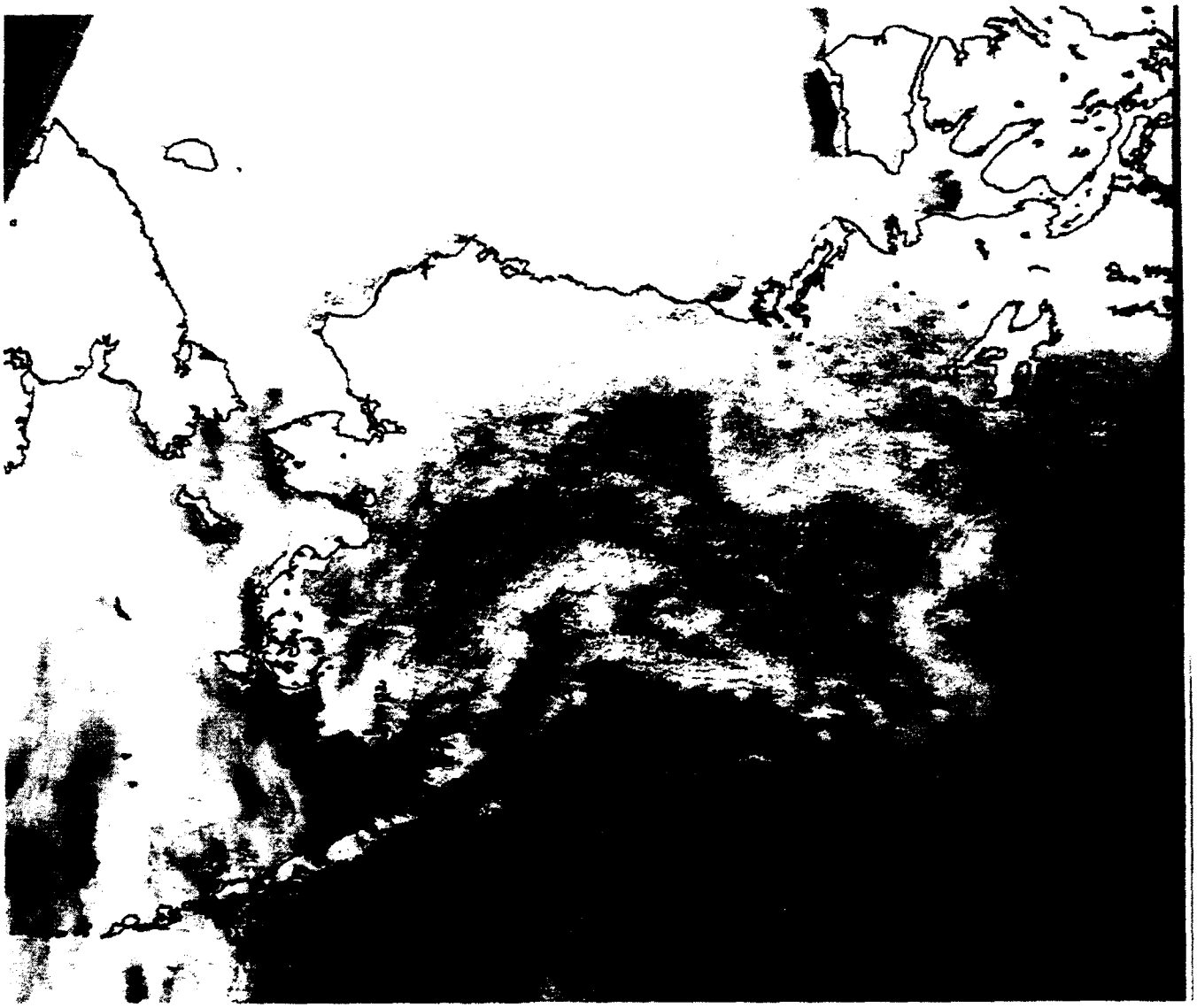
23 Apr 92 1522Z
NOAA AVHRR CH 4 IR
Notable Features:

1. Continued evidence of the two vortex regions and of the Herschel polynya features is shown in this image.



23 Apr 92 1522Z
NOAA AVHRR CH 3 IR
Notable Features:

1. This channel 3 image reveals the low (dark) clouds surrounding the Tuktoyaktuk vortex and brings out details of low clouds (the Herschel polynya plume) over the central Beaufort.
2. Lead detail in this image is degraded in comparison to the channel 3 view at 1342Z.
3. Note cloud shadow effect SSE of Barrow. The light-toned line is a shadow region where visible reflection is reduced thereby decreasing the channel 3 radiation intensity.

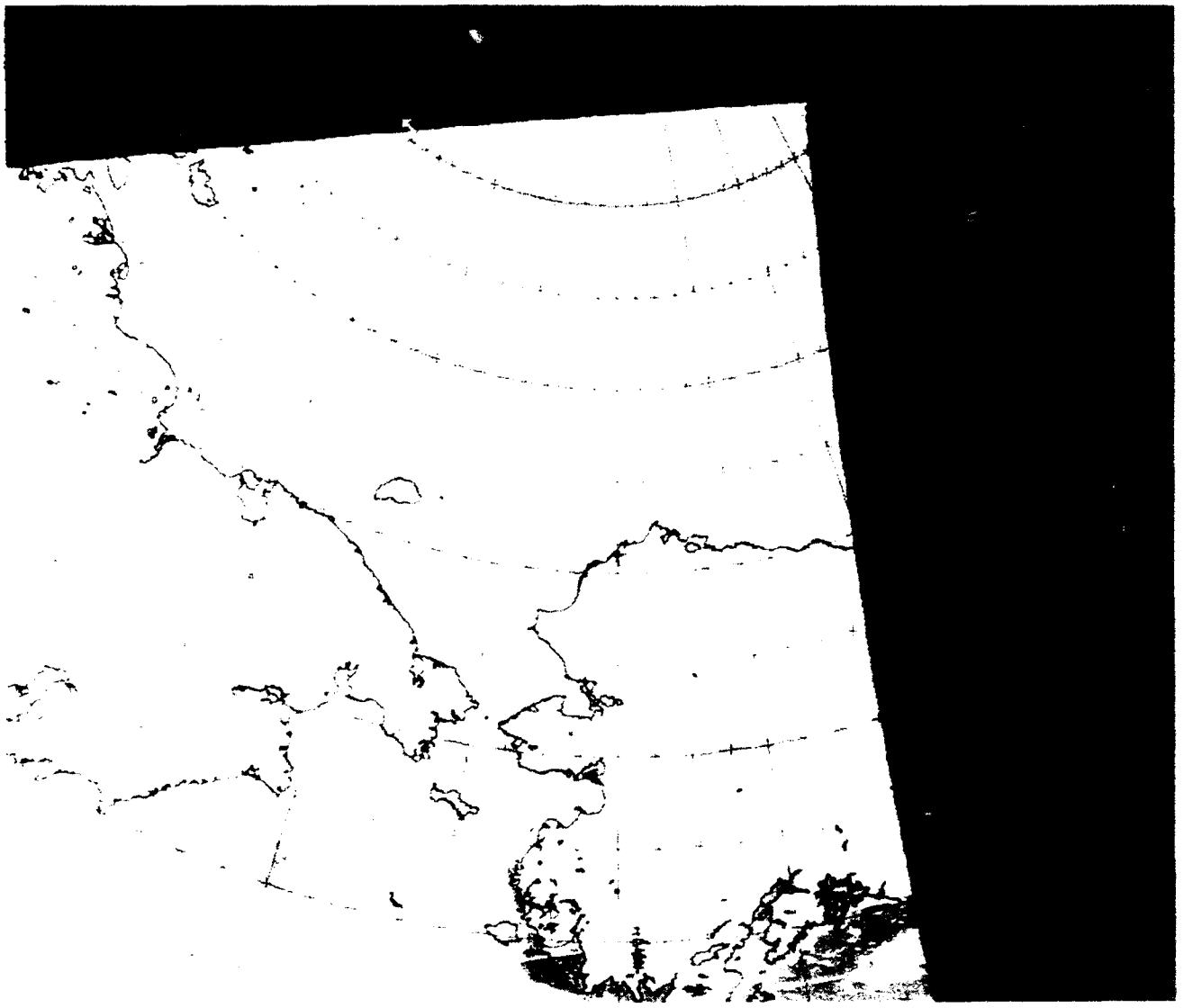


23 Apr 92 2005Z
DMSP OLS VIS
Notable Features:

1. Cloud/ice detail is difficult to resolve in this large scale visible image. Continued activity is evident near the Tuktoyaktuk Peninsula and it looks like the banded cloudiness north of Barrow has shifted eastward with a definate vortex center shown north of Deadhorse.

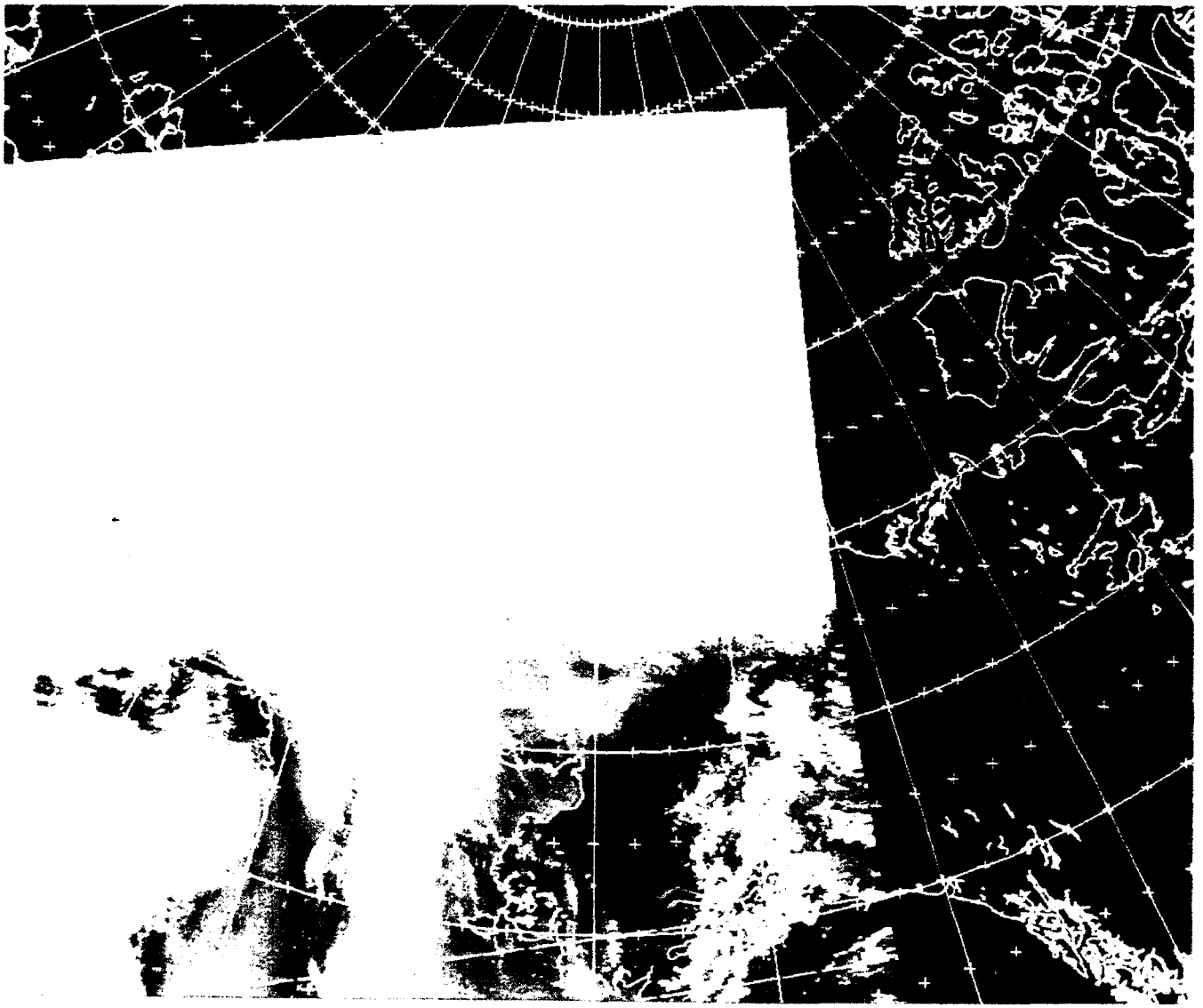
23 Apr 92 2005Z
DMSP OLS IR
Notable Features:

1. The companion large scale IR view has similarly poor contrast. However, vortices SSW of Banks; north of Deadhorse; and north of Cape Lisburne are evident.



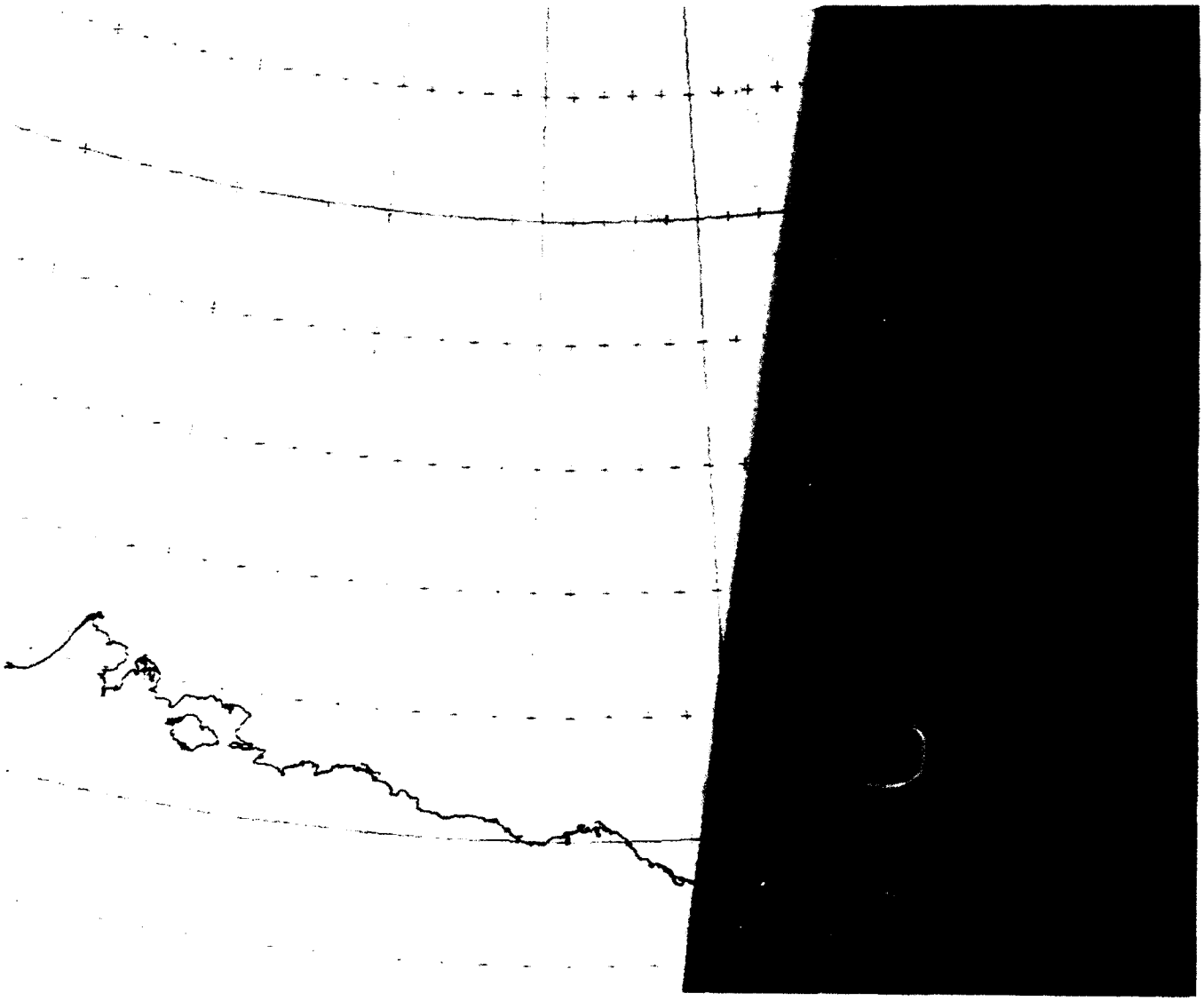
24 Apr 92 0123Z
NOAA AVHRR CH 2 VIS
Notable Features:

1. A P-3 flight was made on this final day, through the Bering Strait. Winds were southerly at low levels turning to southwesterly by 700 mbs in the Strait region.
2. This image shows possible frontal cloudiness stretching N-S through the Strait.



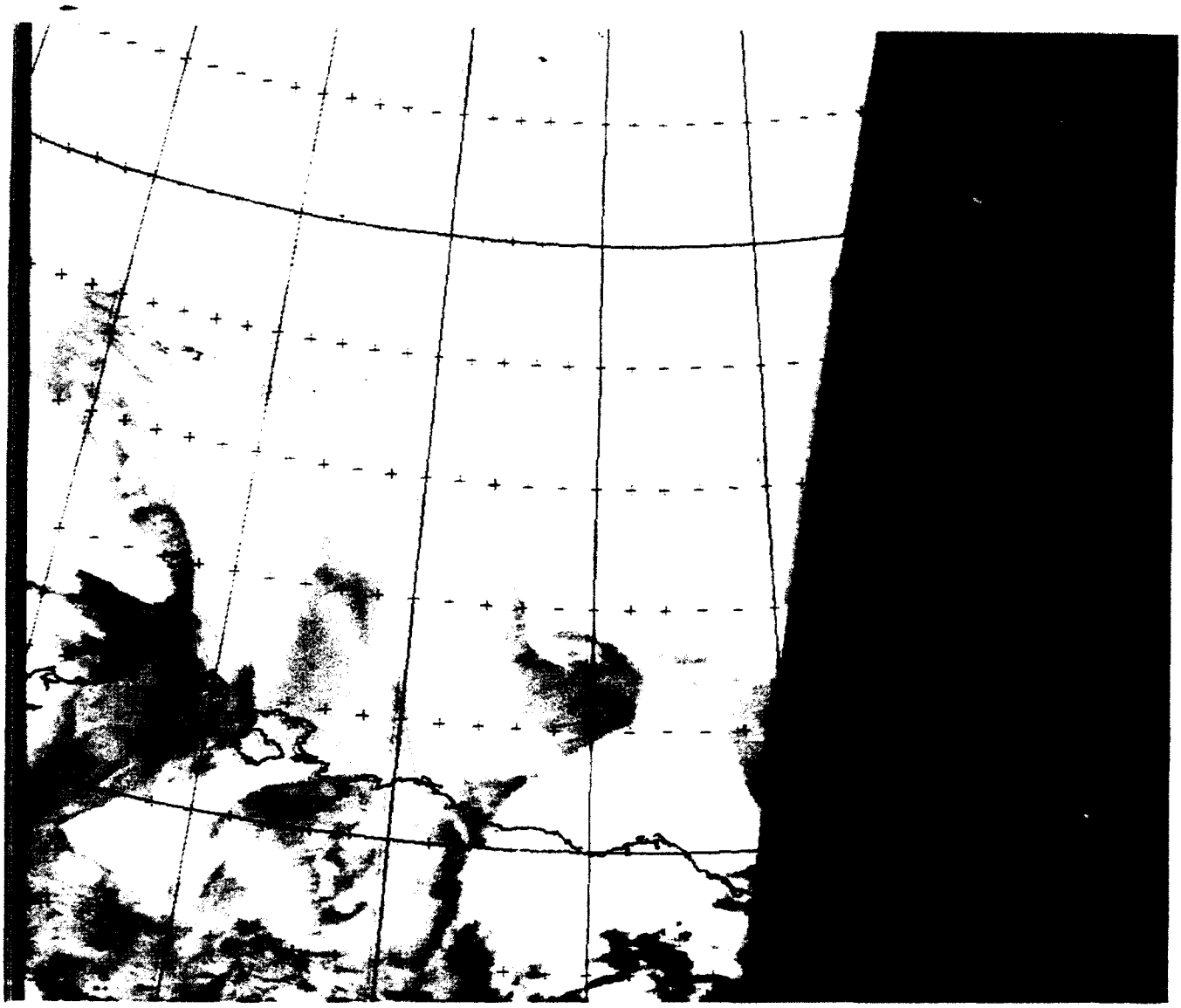
24 Apr 92 0123Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The companion IR view provides increased detail revealing the heavier cloudiness west of the Strait.
2. Note evidence of vortices near Barrow and the westward progression of the vortex north of Deadhorse, now near 72N, 146W.



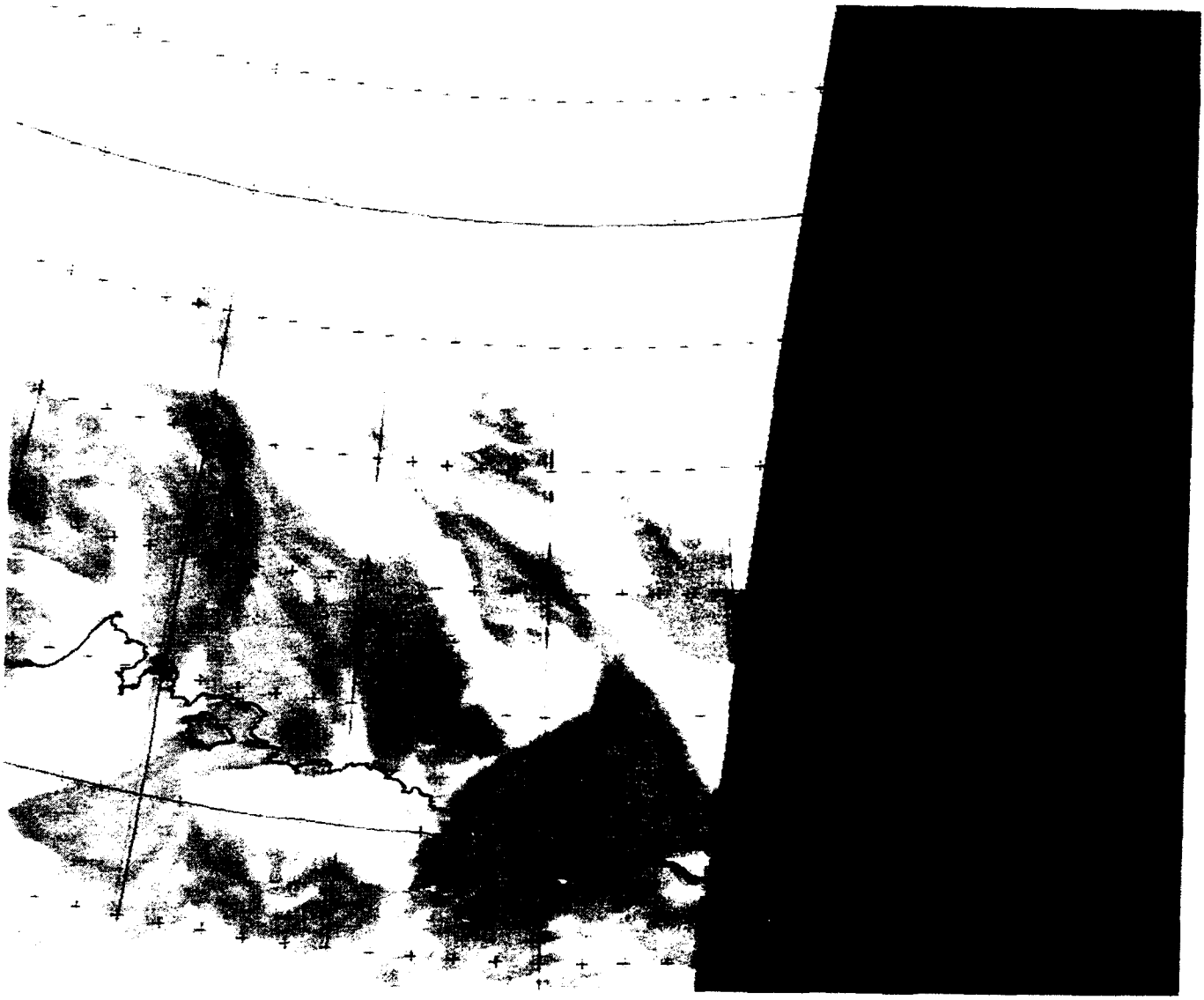
24 Apr 92 0126Z
NOAA AVHRR CH 1 VIS
Notable Features:

1. The smaller scale channel 1 visible view reveals the vortex near 71.8N, 146.5W as well as less defined vortices north of Barrow.



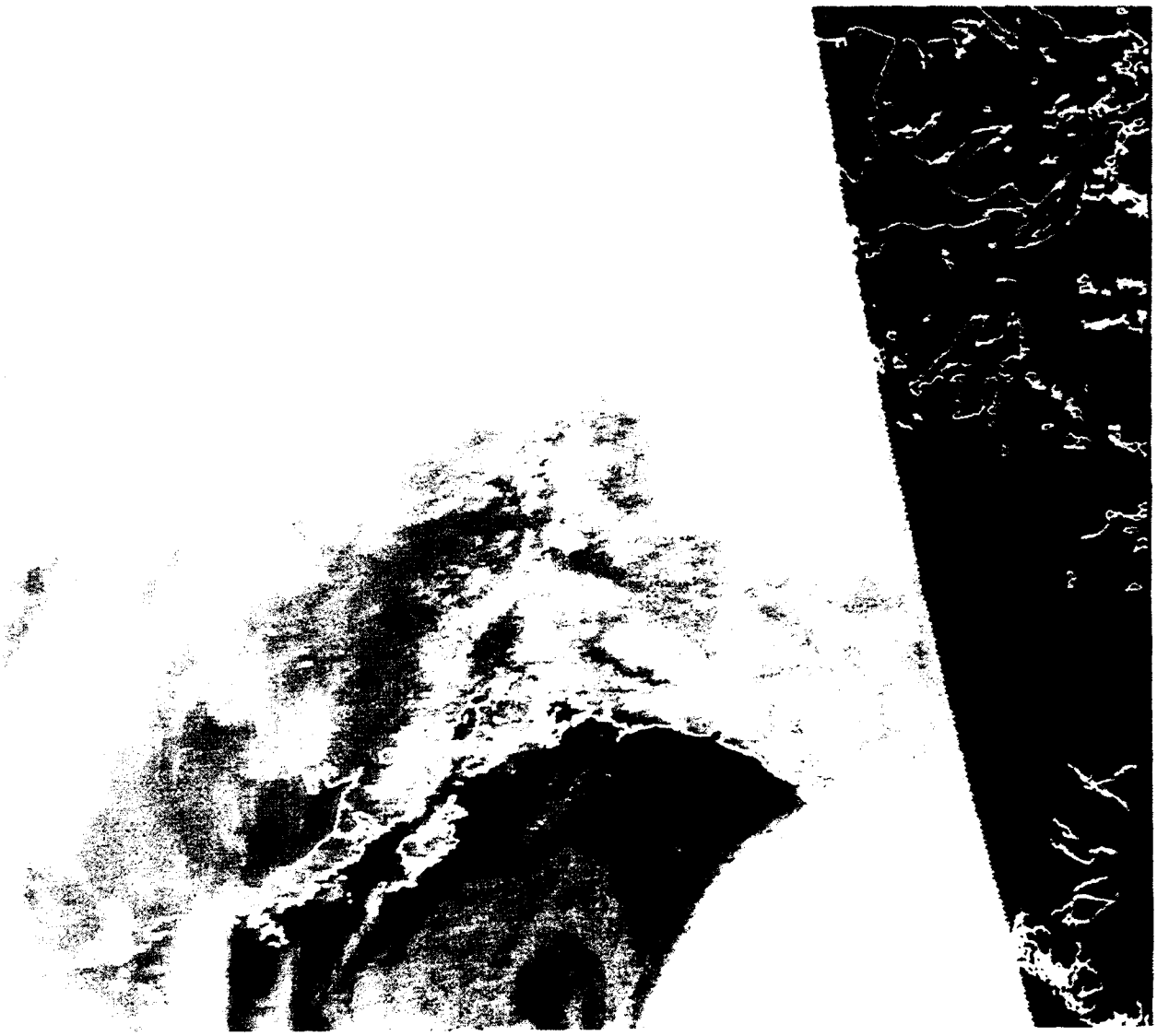
24 Apr 92 0126Z
NOAA AVHRR CH 4 IR
Notable Features:

1. The channel 4 view provides vastly increased detail, not only in revealing the vortex NNW of Deadhorse, but separately revealing vortices on the N. side of the Brooks Range; one NW of Barrrow; and another center near 74N,156W.



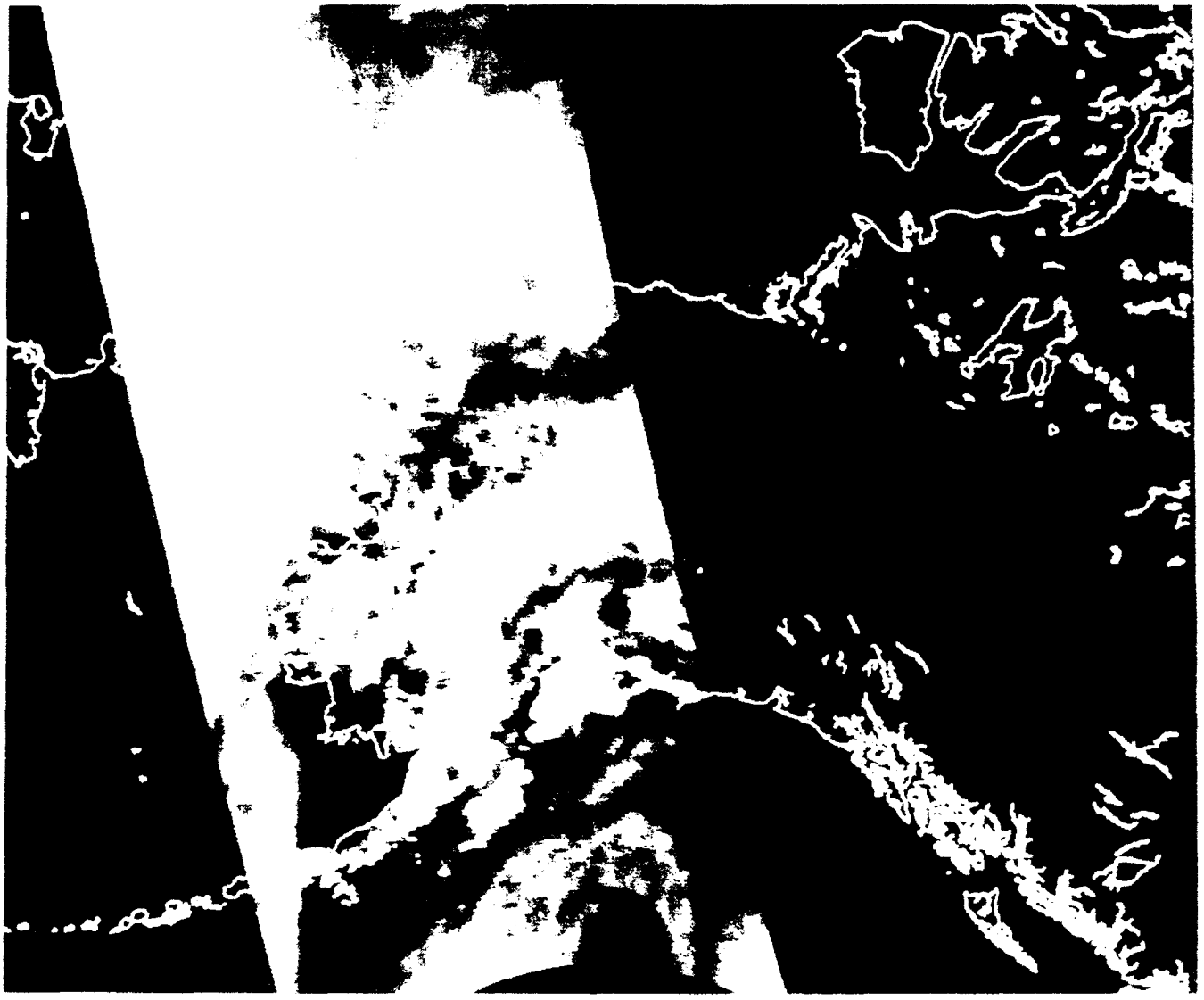
24 Apr 92 0126Z
NOAA AVHRR CH 3 IR
Notable Features:

1. The channel 3 data clarifies exact vortex centers near 71.8N, 146W, 69.5N, 150.5W, and 72N, 158W. A small vortex is also suggested near 74N, 155.5W.



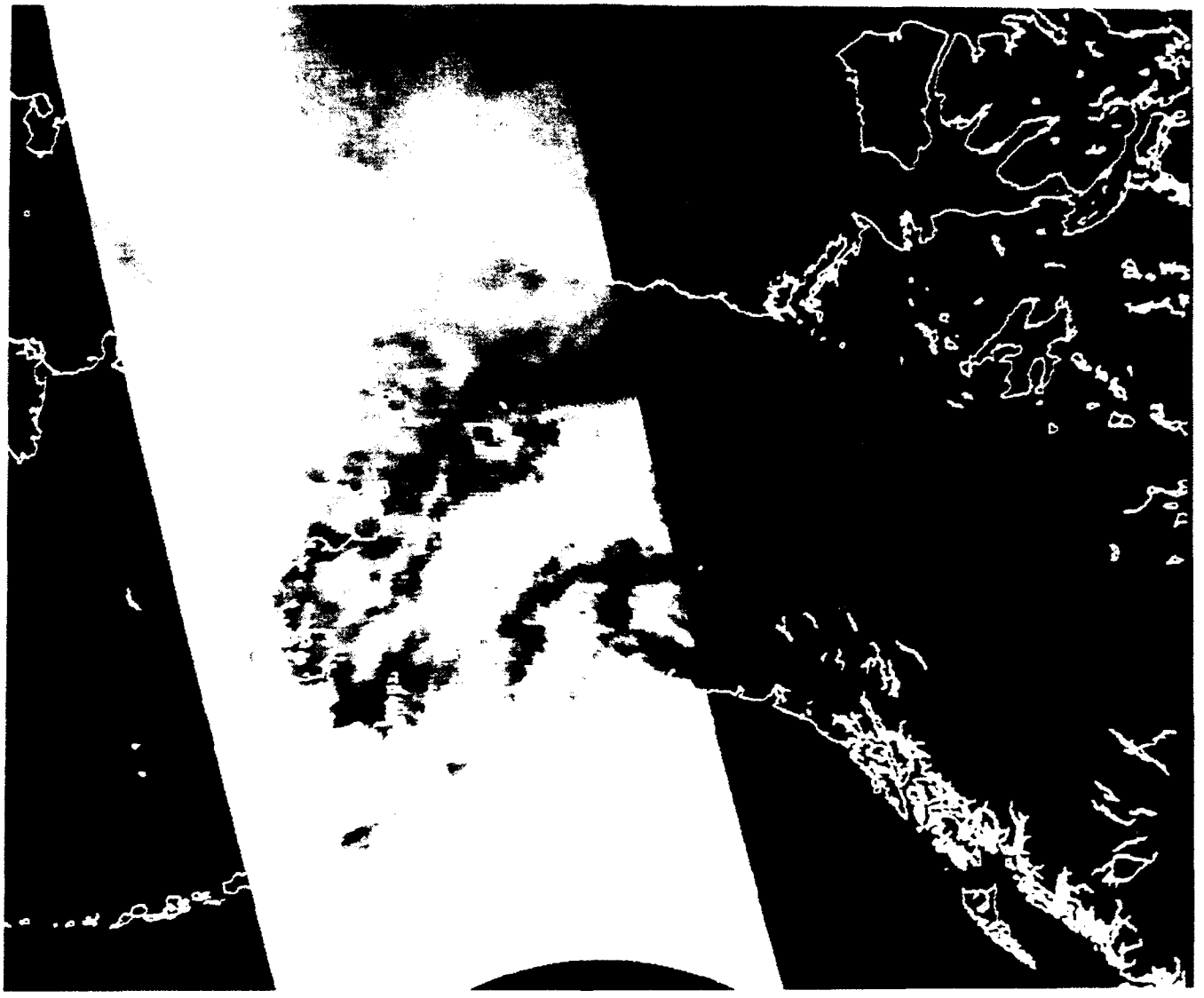
24 Apr 92 0556Z
DMSP OLS IR
Notable Features:

1. Centers are faintly suggested in this large scale IR view, 1) near the Tuktoyaktuk Peninsula, 2) NNE of Deadhorse, 3) 2 vortices north of Barrow, and, 4) a center north of Cape Lisburne.
2. The profusion of vortex centers on this scale is captured somewhat by NORAPS but completely lost in NOGAPS. Conclusion: **NORAPS-scale forecasts are required for any meaningful forecast capability in the Arctic Sea region.**



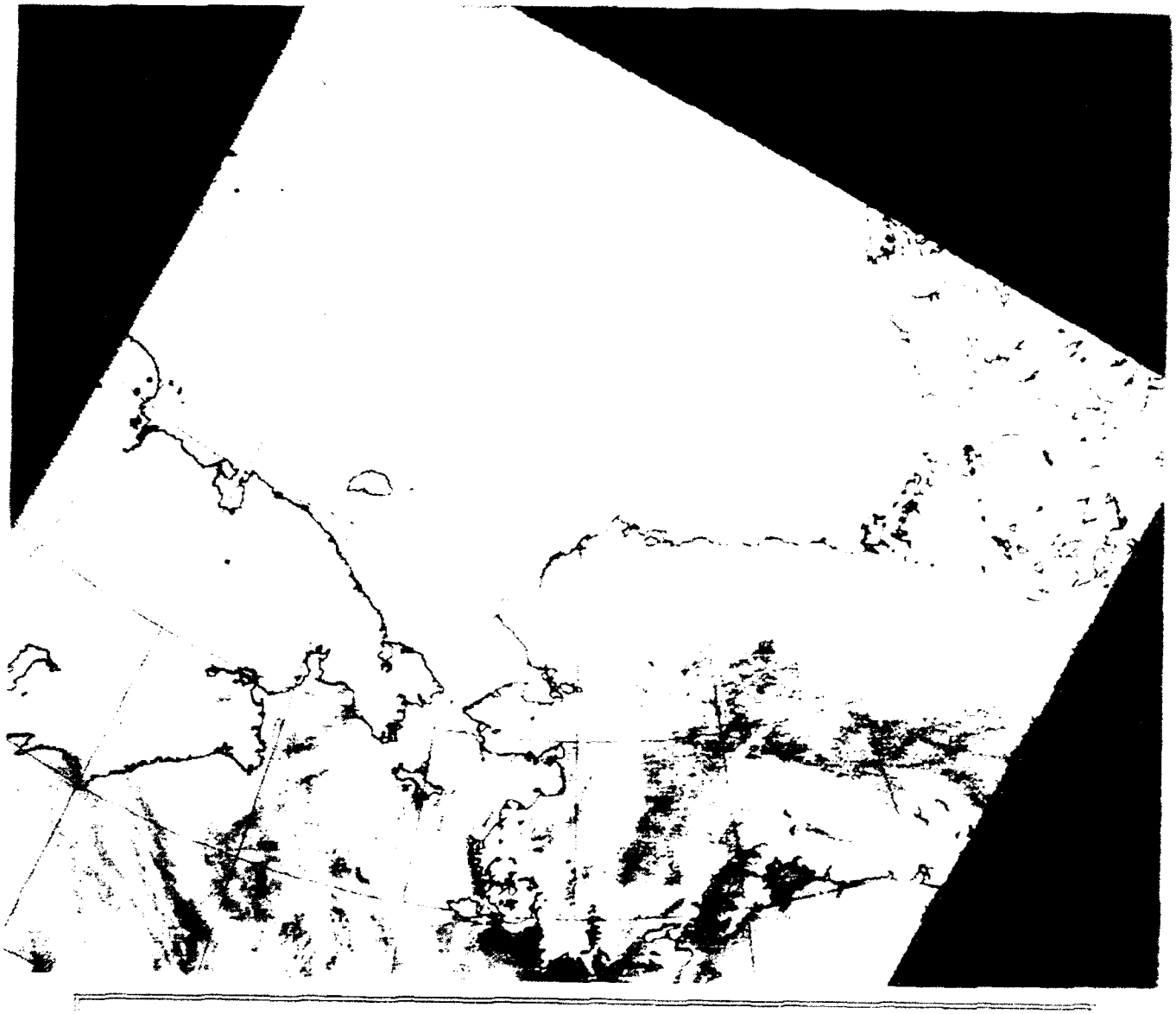
24 Apr 92 0555Z
DMSP OLS 85H SSMI
Notable Features:

1. Lighter ice tones indicates thinner (first year) ice. Darker regions near the coast and islands indicates open or semi-open leads and polynya areas.



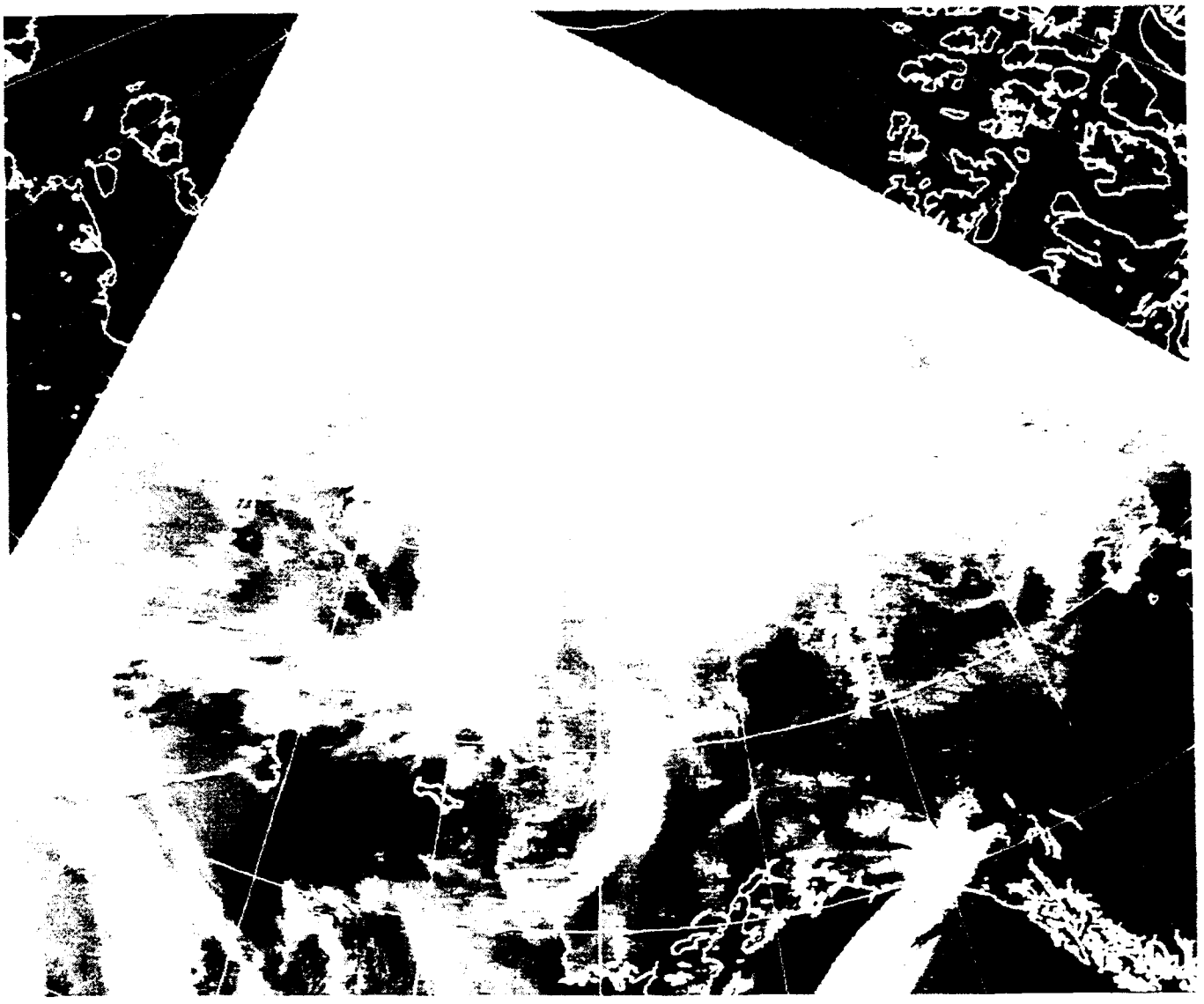
24 Apr 92 0555Z
DMSP OLS 85V SSMI
Notable Features:

1. The vertically polarized data provide increased detail of some features. Note especially the light area "bulge" north of the Bering Sttrait. This "bow-like" feature of crumbled ice pack develops when ice flow through the Strait is from the north.
2. Note also the flaw lead boundary and open water indication south of Point Hope.



24 Apr 92 1732Z
DMSP OLS VIS
Notable Features:

-- A large scale visible view of the region, with excellent contrast, as shown in this image. Faint cirrus patterns of wispiness extending from Banks Island westward toward Wrangel Island are apparent.



24 Apr 92 1732Z
DMSP OLS IR
Notable Features:

1. The companion IR view of the region provides increased detail in locating vortex centers. Only the northern Beaufort and the region NW of Barrow appear clear at this time.

4. SYNTHETIC APERTURE RADAR DATA

Synthetic Aperture Radar (SAR) data were acquired at the Alaska SAR Facility (ASF), Geophysical Institute, University of Alaska, Fairbanks. Selected "quick-look" images were expeditiously shipped to the Leadex Project Office in Anchorage via Mark Air.

One of the first major discoveries was that the larger ice floes and leads apparent in the SAR data could also be seen in the DMSP and NOAA satellite images. Thus, one could use the larger-scale weather satellite data to monitor changes in ice configuration(such as the opening or closing of leads) and then "zero-in" on details of such changes by obtaining the much higher resolution SAR data (about 10 m as opposed to about 800 m).

a. SAR data of 23 March 1992

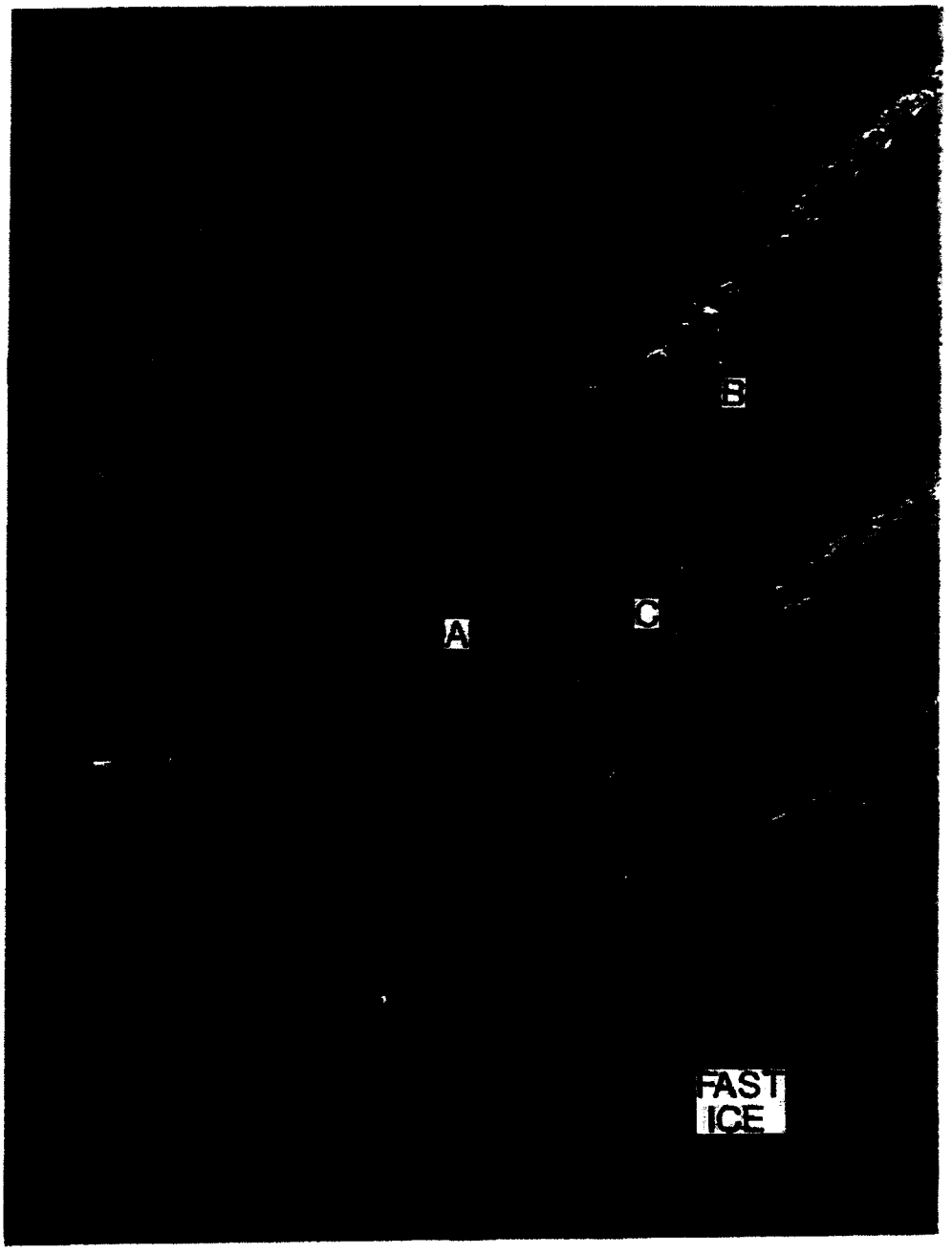
An example of a feature resembling a "tadpole" in appearance in SAR data on 23 March 92 is shown on the opposing page. This feature was located near 73.8N, 146.5W at the start of the experiment, about 75 miles NNW of the ice camp, whose approximate position is also shown on this image. The feature was apparent in DMSP and NOAA data throughout the experiment (see satellite images on 26-29 March 92 for the first views.


TADPOLE
ICE
CAMP

b. **SAR data comparison. 24 versus 30 March 1992.**

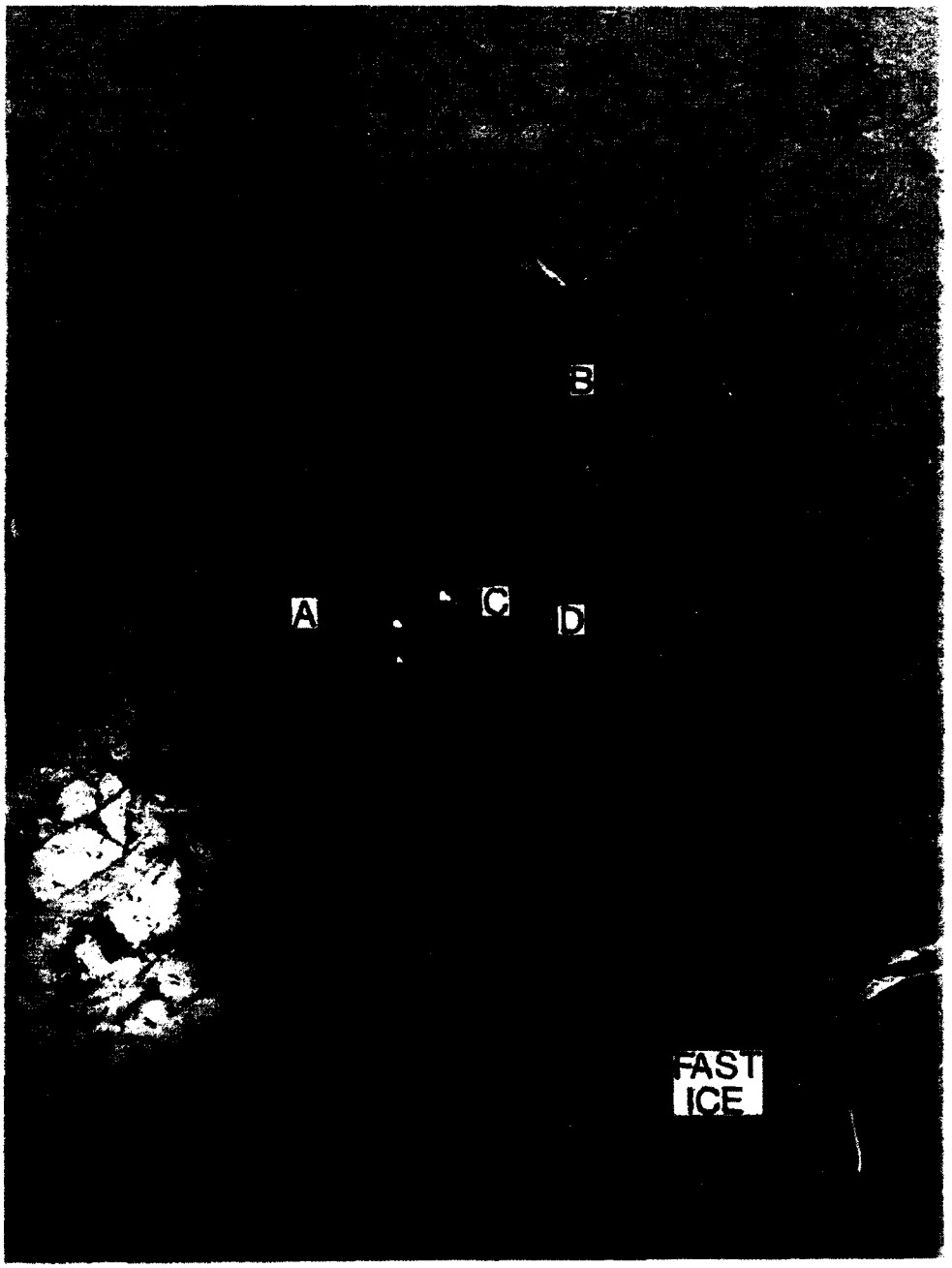
A dramatic closing of leads near the fast ice north of Deadhorse was noted during the period 24-30 March 92. On 24 March (below) bright SAR striated line signals appear along NE-SW oriented lead features just north of the fast ice boundary, whose dark gray shade appears much darker than that of the multiyear floes to the north.

By comparison the 30 March image (opposing page) shows that these leads have closed. Vector relative motions of individual ice floes in the region were obtained through simple overlay comparisons. The comparison showed that ice regions A, B, and C remained stationary, apparently frozen to the bottom. Ice features



to the north of A and B moved southward, closing the lead, while the area south of A, B, and C moved eastward, resulting in a shear line that broke floe C into two parts (labeled C and D on the 30 March image).

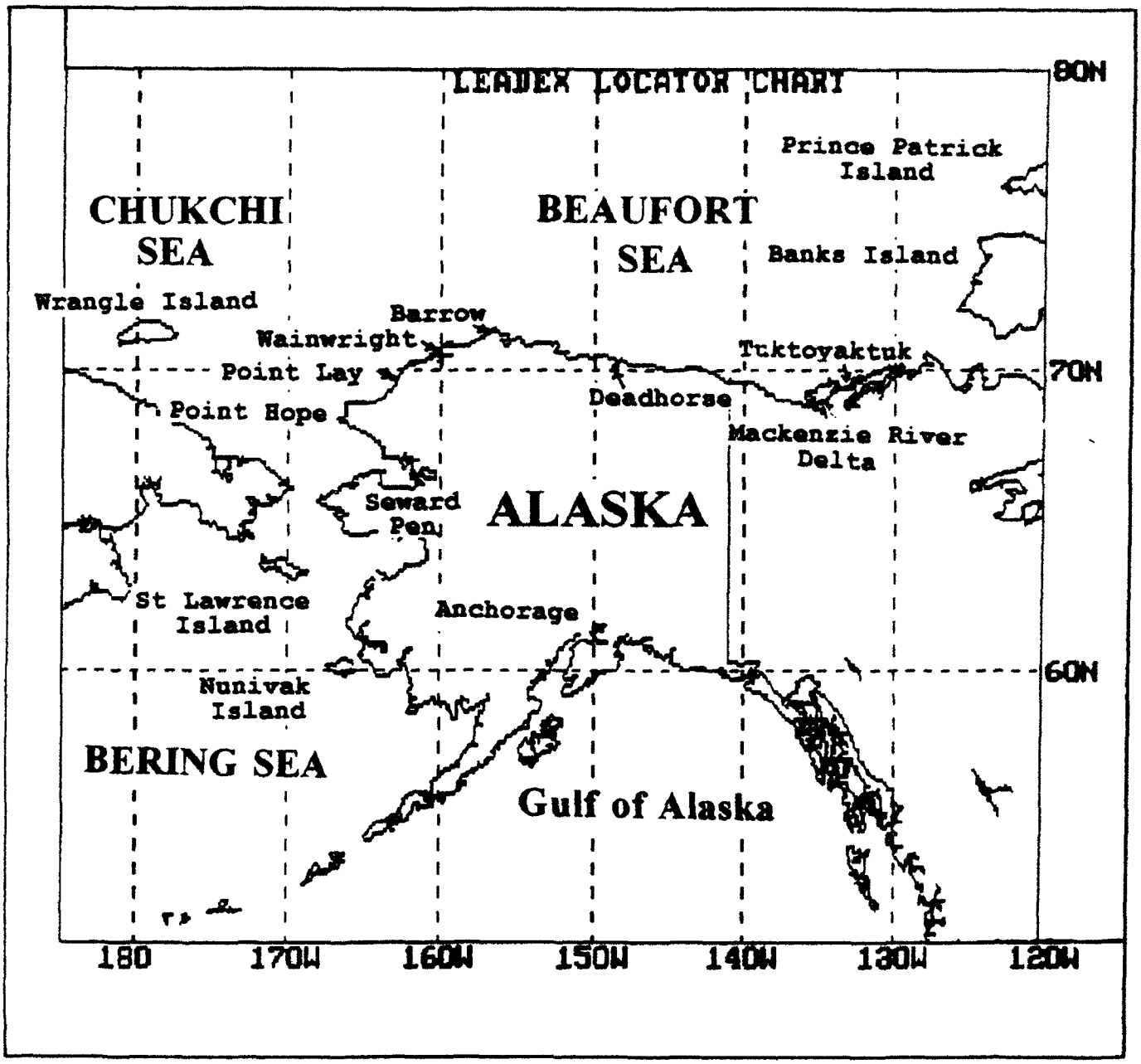
The intriguing aspect of this comparison is that the 24 March bright line depictions apparently signalled the condition of a lead closing under compression forces, creating ridges in the process sensed as bright lines in the SAR data. It will be highly desirable to obtain additional intervening views, if available, and study to relate to surface wind stress, so that forcing functions can be more clearly identified.



c. **SAR data comparison. 18 versus 30 March 92.**

Another even more intriguing data set for comparison exists when comparing 18 March 92 data near 74.6N, 143.4W, with similar data on 30 March 92. The 18 March data shown below appear devoid of particularly special effects. Note, however, the same region on 30 March (opposing page). A series of plume-like structures are evident crossing the image from east to west. On first sight the plumes seem randomly positioned; however, a more careful scrutiny reveals that the plumes have one characteristic in common - they are all linked to dark, first year,ice leads, or fractures.

Frozen lead fractures due to local ice divergence could have sporadically provided open water to serve as a moisture source for plume generation. Why should such plumes appear in SAR data? Moisture fall-out from the plumes could have resulted in frozen frost flowers, notorious for producing a heightened signal in C-band radar - that of the ERS satellite. An alternate explanation has been offered by Bob Onstott, ERIM, who suggested that the features may have been the result of a sudden shear-lead development in the region under heightened wind speed conditions. The strong signal, according to this interpretation, would be caused by SAR signal reflection from capillary waves which formed under the strong winds in the newly opened water region of the shear leads. Further study is obviously required.


LEADEX LOCATOR CHART
80N
70N
60N
CHUKCHI SEA
BEAUFORT SEA
Prince Patrick Island
Banks Island
Wrangle Island
Barrow
Wainwright
Point Lay
Point Hope
Tuktoyaktuk
Deadhorse
Mackenzie River Delta
Seward Pen
ALASKA
St Lawrence Island
Anchorage
Nunivak Island
BERING SEA
Gulf of Alaska
180
170W
160W
150W
140W
130W
120W

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