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INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No. 1823

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ANNUAL MEETING - JUNE 1967

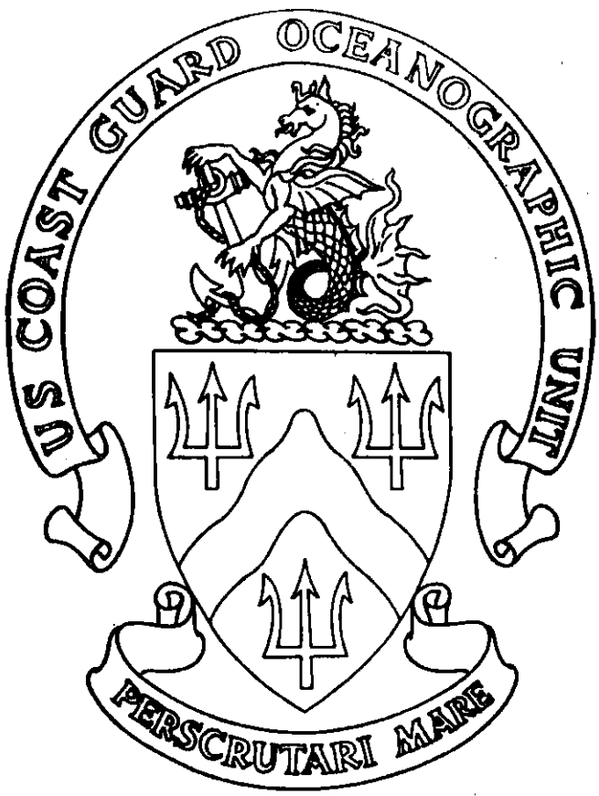
Description of oceanographic analysis and forecast charts for International Ice Patrol, North Atlantic Area

by U.S. Coast Guard Oceanographic Unit
Washington, D.C.

DESCRIPTION OF OCEANOGRAPHIC ANALYSIS AND FORECAST CHARTS FOR

INTERNATIONAL ICE PATROL NORTH ATLANTIC AREA

COMPUTER PRODUCTS PROVIDED BY U.S. NAVAL FLEET NUMERICAL WEATHER FACILITY MONTEREY, CALIFORNIA



U.S. COAST GUARD OCEANOGRAPHIC UNIT WASHINGTON, D.C.

DESCRIPTION OF OCEANOGRAPHIC ANALYSIS & FORECAST CHARTS FOR INTERNATIONAL ICE PATROL NORTH ATLANTIC AREA

1 April 1967

For many years the International Ice Patrol operated by the United States Coast Guard has utilized sea surface temperature and other oceanographic analyses as an aid in predicting the occurence, drift and deterioration of sea ice and icebergs in the North Atlantic Ocean. Charts of these parameters have been constructed from reports of merchant and other ships and from the cruises of an oceanographic vessel assigned to the Patrol.

Recently the work of the United States Naval Fleet Numerical Weather Facility (FNWF) at Monterey, California has been utilized by the International Ice Patrol as a further aid in its operation. The FNWF has established a computer network system which produces various types of analytic and prognostic environmental parameter products. These products result from a long series of steps commencing with the collection of raw data from numerous ships throughout the world. The data received at Monterey are converted into a form acceptable by the particular computer program to which it applies. These computer programs transform the randomly spaced raw data array by interpolation into a grid system, so that the product, a computer printout sheet, displays symmetrically spaced information points. The grid of interest to the International Ice Patrol is "Area B", bounded by latitude lines 37°N and 68°N and longitude 20°W and 65°W. The grid spacing is 40 nautical miles.

The United States Coast Guard Oceanographic Unit which conducts the oceanographic work of the International Ice Patrol receives by data link several types of computer printouts from FNWF for Area B including Sea Surface Temperature (SST), Ocean Fronts (GG), Stream Function (CS), Sea Surface Small Scale Anomaly (SD SEA), Total Heat Exchange (QN), and Latent and Sensible Heat Exchange (QH). These outputs can be received as direct computer printouts displaying discrete grid points, however, since the information is readily acceptable by a digital x-y plotter system, the output can be converted into a more meaningful chart form delineating contours of isolines. Examples of these charts are shown on the following pages and are exactly as received on the automatic x-y plotter, except for the addition of a geographical overlay aligned to the "benchmark" on the center of each chart.

Inasmuch as the computer programs do not account for the continental boundaries, the isopleths produced cross coastlines. This does not reflect on the validity of the product in the maritime regions.

The attached charts are described as follows:

CHART NO. 1

1. Sea Surface Analysis (SST)

   A. Inputs

      (1) 12 hour previous SST Analysis

      (2) SST observations over the past 3-1/2 days including ship sea injection temperatures, bucket temperatures and bathythermograph temperatures.

   B. Outputs

      (1) 12 hourly sea surface temperature (SST) Analysis printed in 2°C isothermal contours with high and lows depicted to the nearest 0.1°C. SST is defined as the average temperature of the surface mixed layer at a defined position and time, and may vary from 1 meter to 200 meters.

2. Ocean Fronts (GG)

   A. Inputs

      (1) Any scalar field produced at FNWF, in this case, the SST field.

B. Output

(1) Isolines of GG (second derivative of the temperature distribution) whose axes of relative maximum may delineate high boundary conditions of strongest temperature gradient, or warm core of a current. The method and interpretation require refinement; however, in the example, the current boundary between Labrador Current and North Atlantic Current can be reasonably demonstrated. Units presented on the contour chart are non-dimensional, since they merely indicate relative highs and lows. The primary purpose of the chart is to delineate boundary conditions and warm cores rather than to assign values to the conditions observed.

3. Stream Function (CS)

A. Inputs

(1) Sea Surface Temperature Analysis

(2) Surface wind analysis for the past 24 hours and prognosis for the next 24 hours.

B. Outputs

(1) Current Stream Function Analysis and 24 hour prognosis in cm^2/sec. The 00 Stream Function drawn on the representative chart is meaningless by itself, but because of difficulties experienced, the complete chart has not been produced. Theoretically there would be several Stream Function contours drawn on each chart, and these would indicate the general direction and velocity of currents in the area.

4. Sea Surface Small Scale Anomaly (SD SEA)

A. Input

(1) Sea Surface Temperature Field

B. Output

(1) Small scale disturbance component of the original field. The small scale anamoly contours (drawn in one degree centigrade isothermal lines, i.e., 01 = 1°C may outline areas of strong current boundary. Ioslated highs (warm spots) show recent net heat additions or stable meanders, and cold spots probably indicate wind mixing and/or upwelling.

5. Total Heat Exchange (QN)

A. Inputs

(1) Sea Surface Temperature Analysis

(2) Air Temperature Analysis

(3) Water Vapor Pressure Analysis

(4) Cloud Cover analysis for low, middle and high clouds

(5) U, V component analyses of 1000-mb geostrophic wind.

B. Output

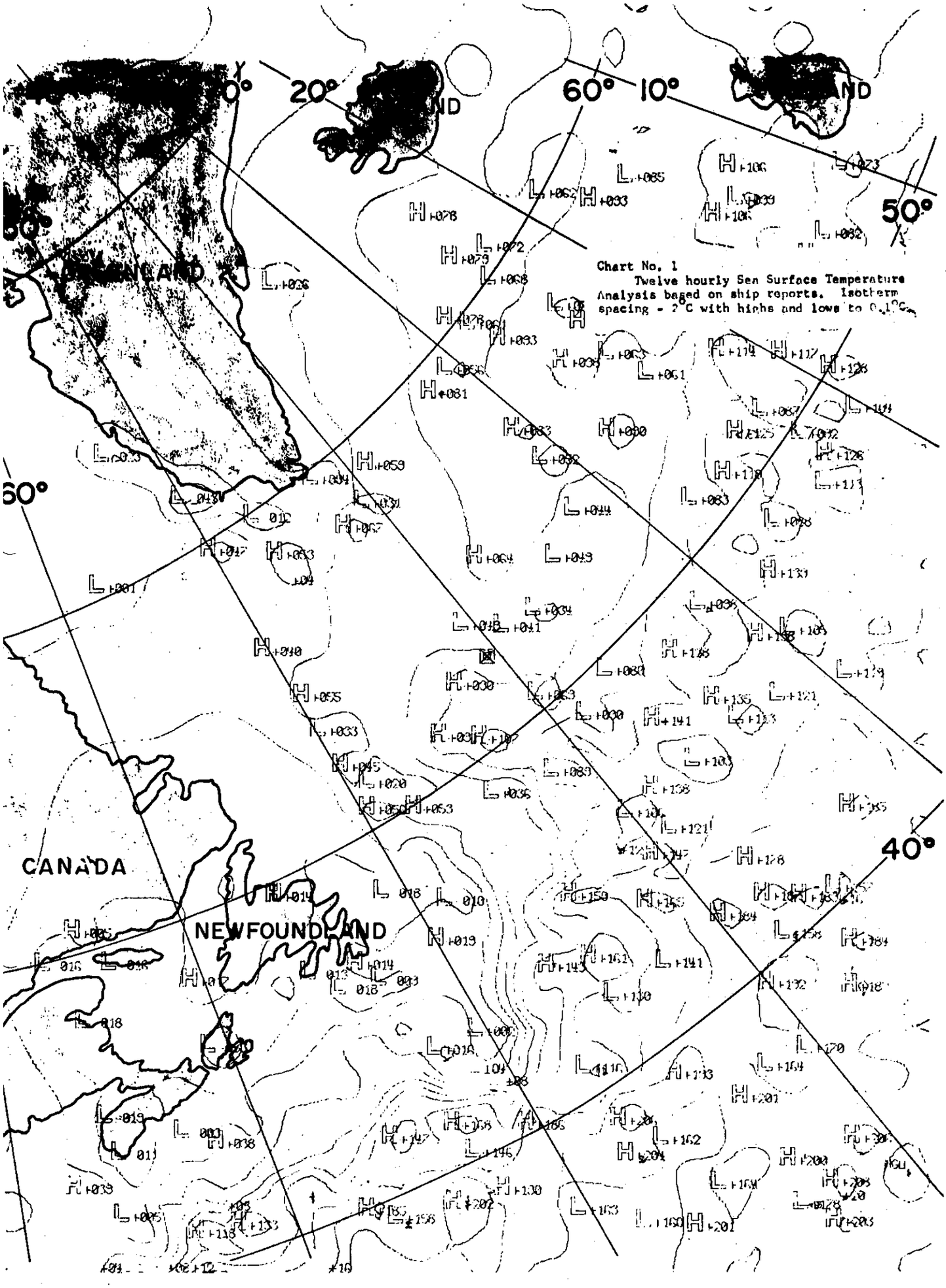
(1) Total Heat Exchange analysis in $gm\text{-}cal/cm^2$ day contoured in intervals where the true value can be obtained by multiplying contour values by 100. A positive sign indicates that the sea gains heat, and a negative sign that the sea loses heat.

6. Latent and Sensible Heat Exchange Analysis (QH)

A. Inputs (same as QN)

B. Output

(1) Latent and Sensible Heat Exchange analysis in $gm\text{-}cal/cm^2$ day, contoured as above, however in this case, a positive sign indicates that the sea loses heat and a negative sign that the sea gains heat.



0 12Z 28 MAR 67 CG STB SST SEA AREA B

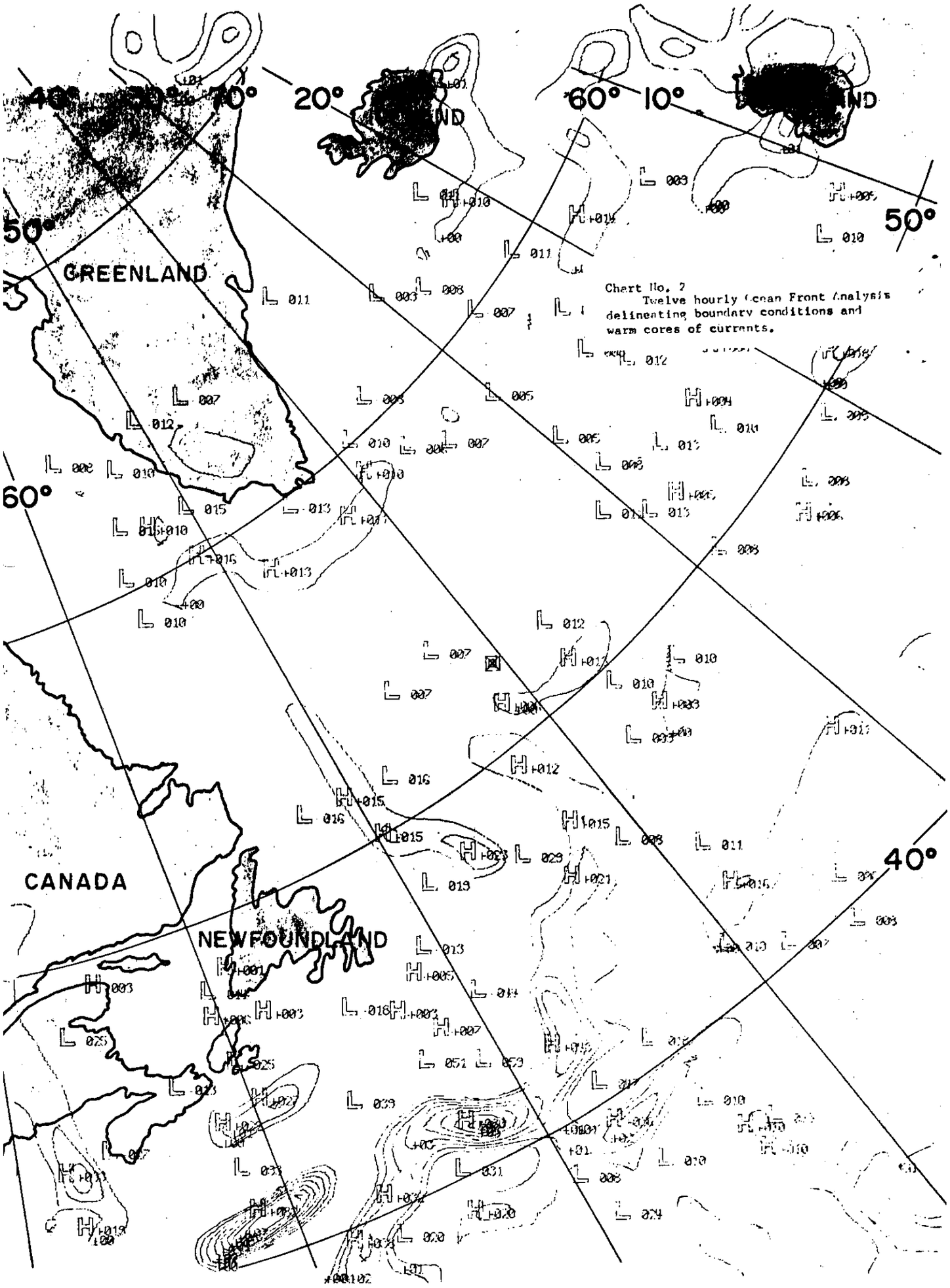


Chart No. 7
Twelve hourly Ocean Front Analysis delineating boundary conditions and warm cores of currents.

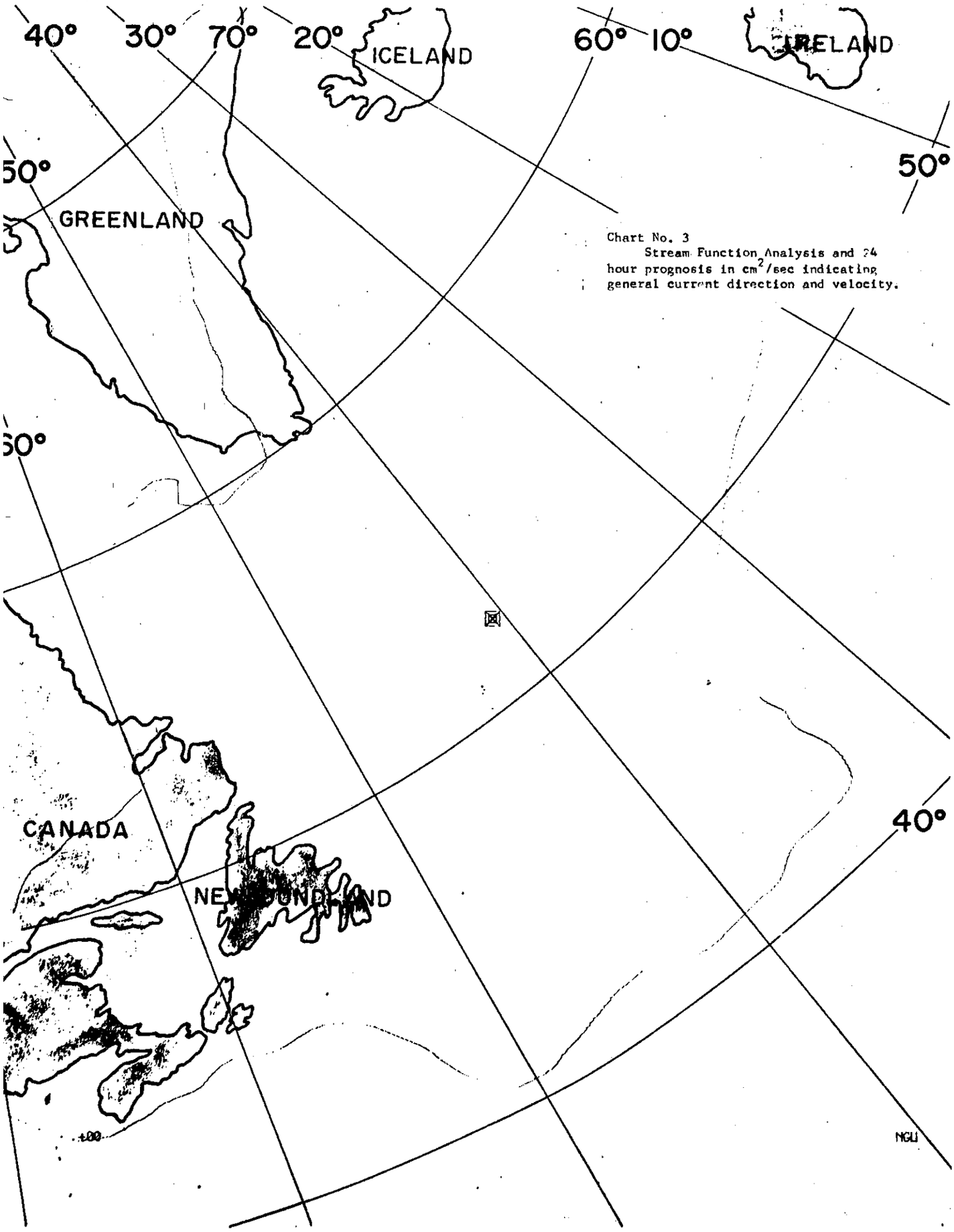
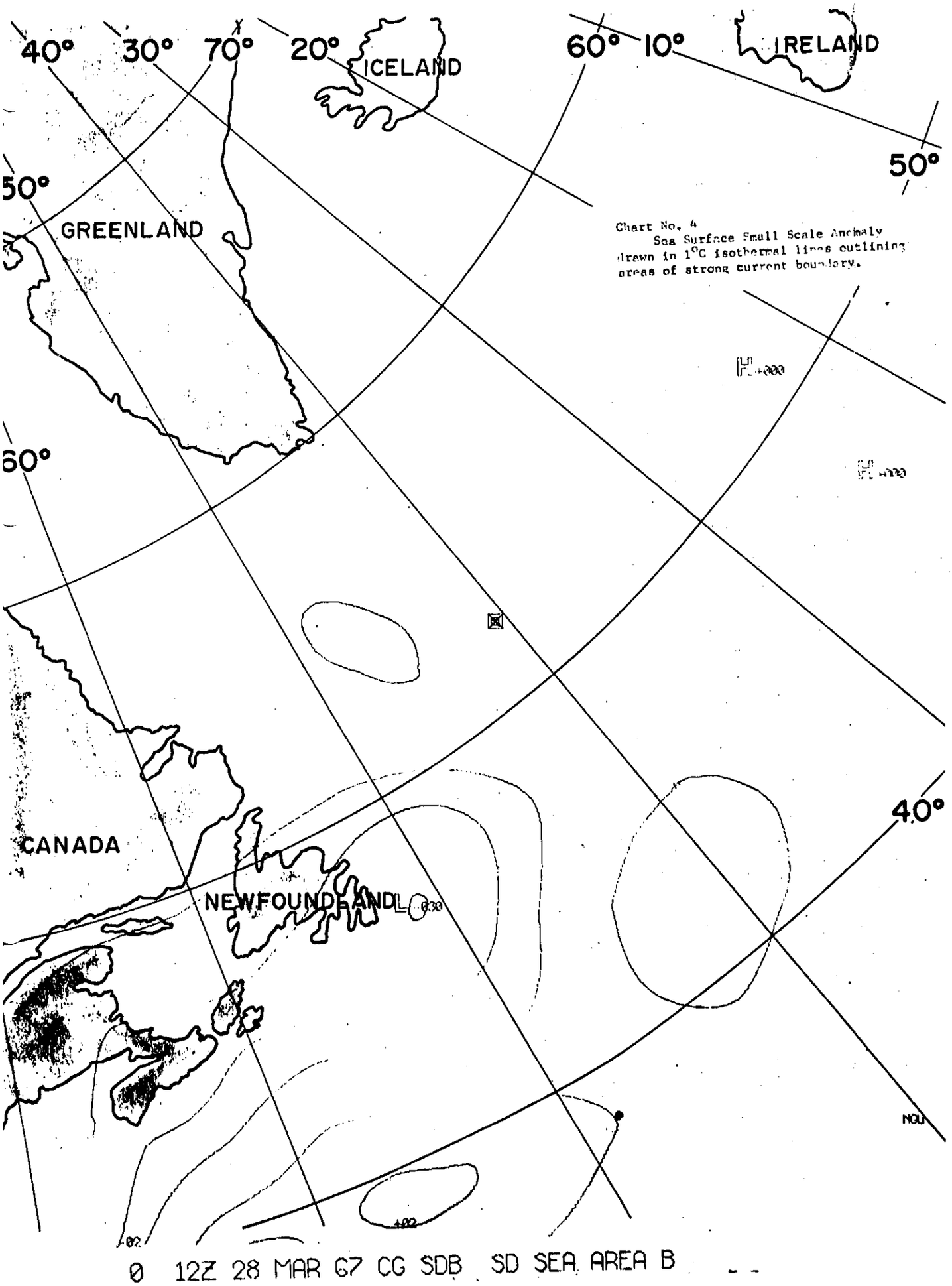


Chart No. 3
Stream Function Analysis and 24 hour prognosis in cm^2/sec indicating general current direction and velocity.

0 12Z 28 MAR 67 CG CSB STREAM FUNCTION CG A



0 12Z 28 MAR 67 CG SDB SD SEA AREA B

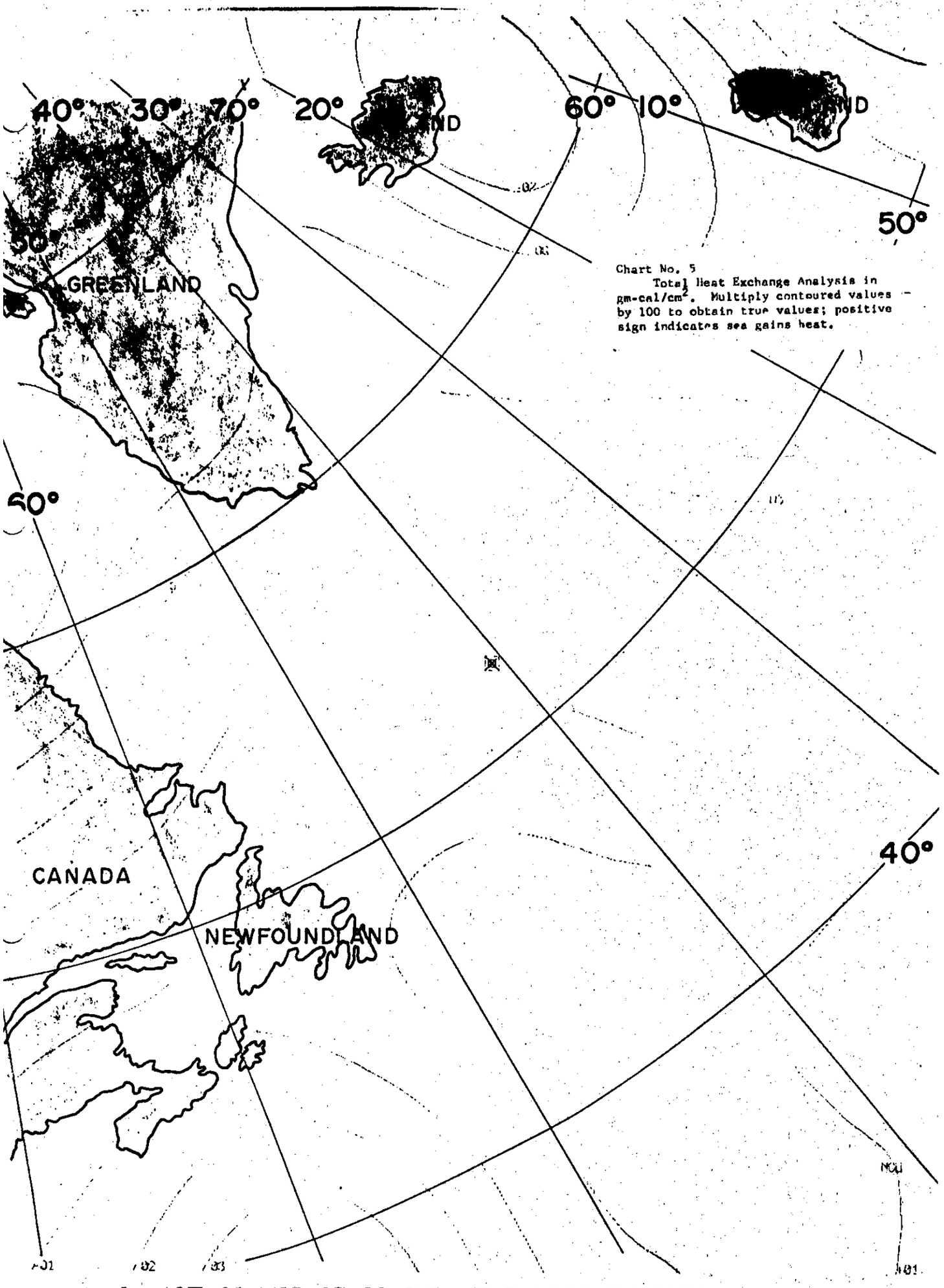
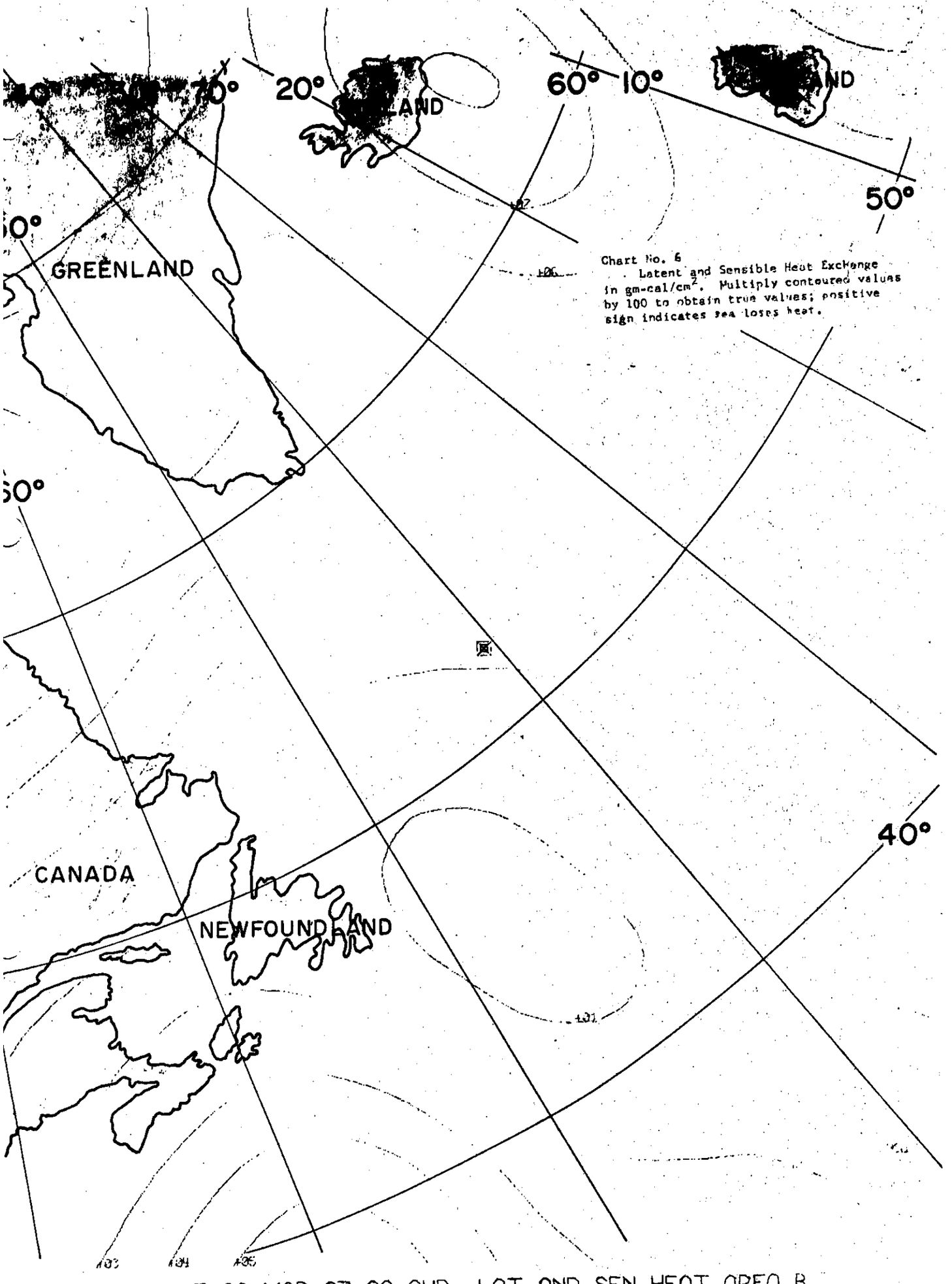


Chart No. 5

Total Heat Exchange Analysis in gm-cal/cm^2. Multiply contoured values by 100 to obtain true values; positive sign indicates sea gains heat.


70°
20°
60°
10°
50°
40°
GREENLAND
CANADA
NEWFOUNDLAND
Chart No. 6
Latent and Sensible Heat Exchange in gm-cal/cm². Multiply contoured values by 100 to obtain true values; positive sign indicates sea loses heat.
0 12Z 28 MAR 67 CG QHB LAT AND SEN HEAT AREA B

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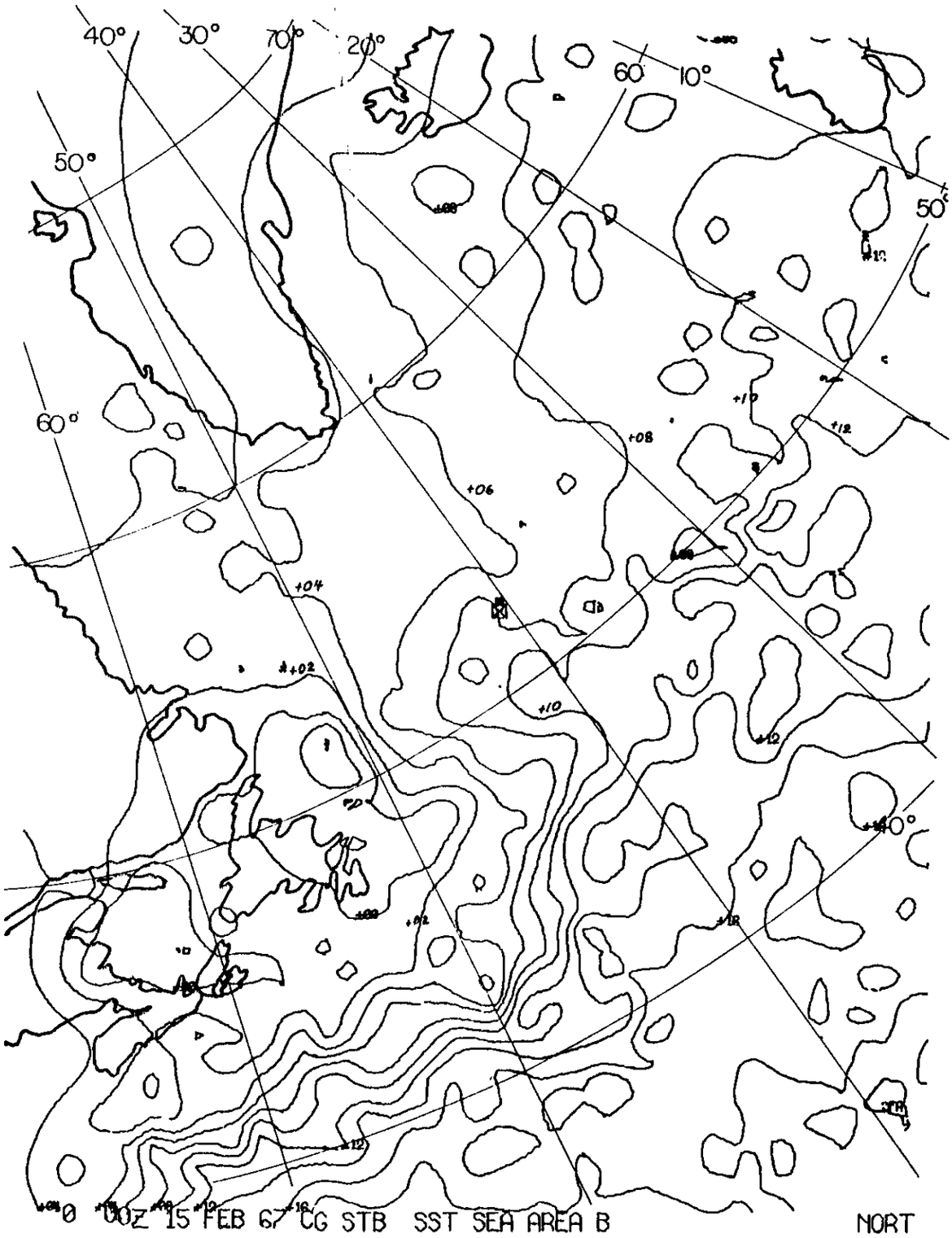
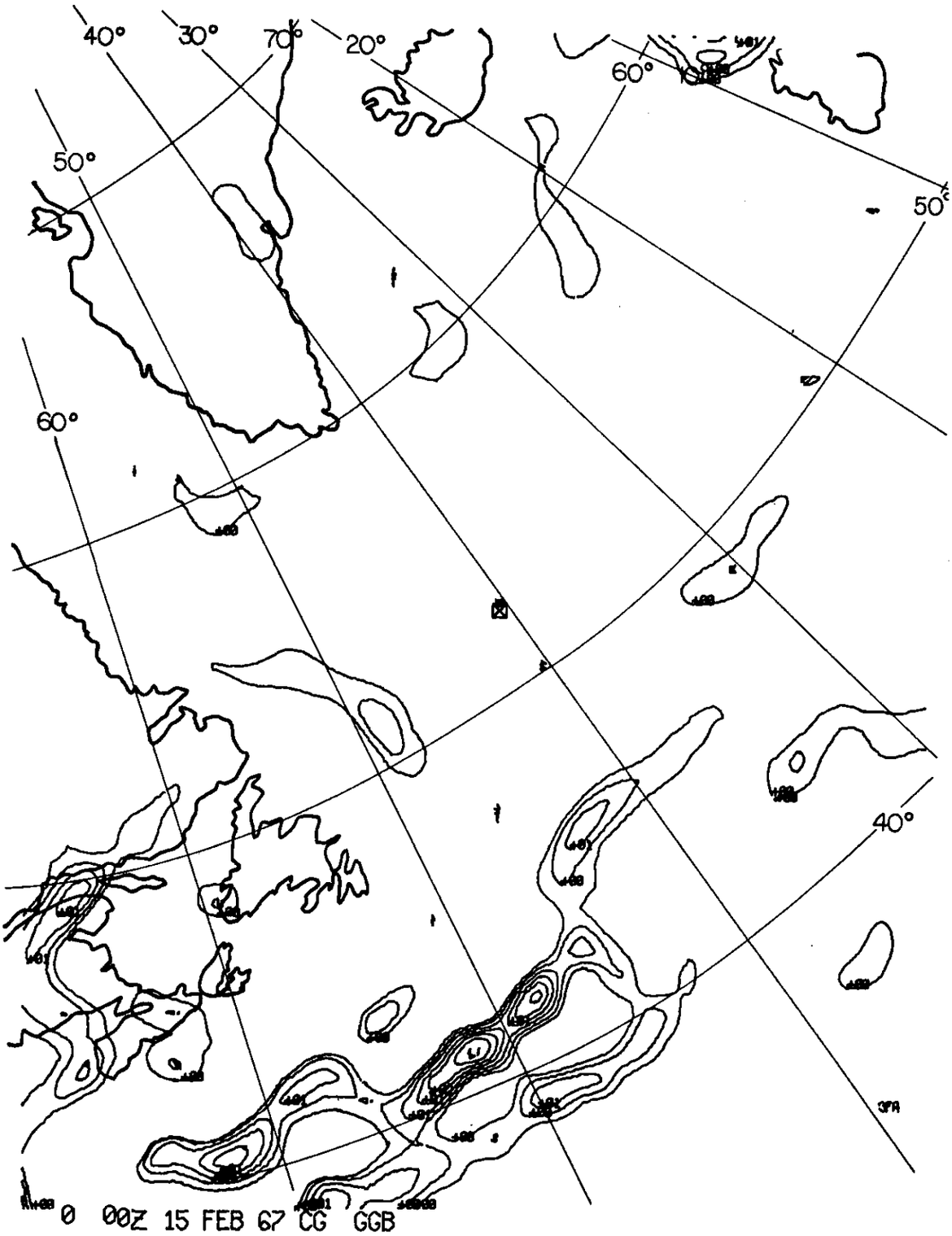
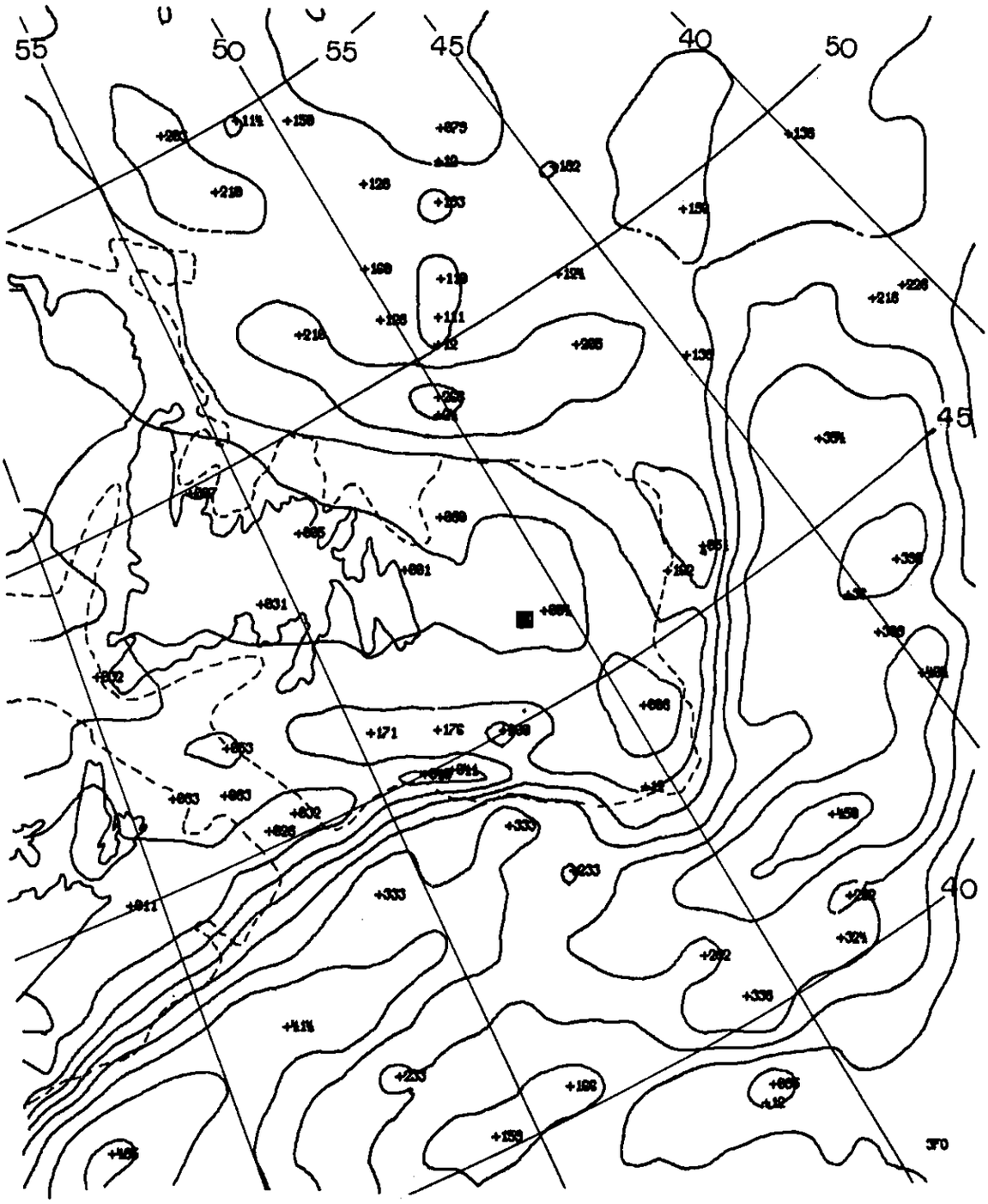
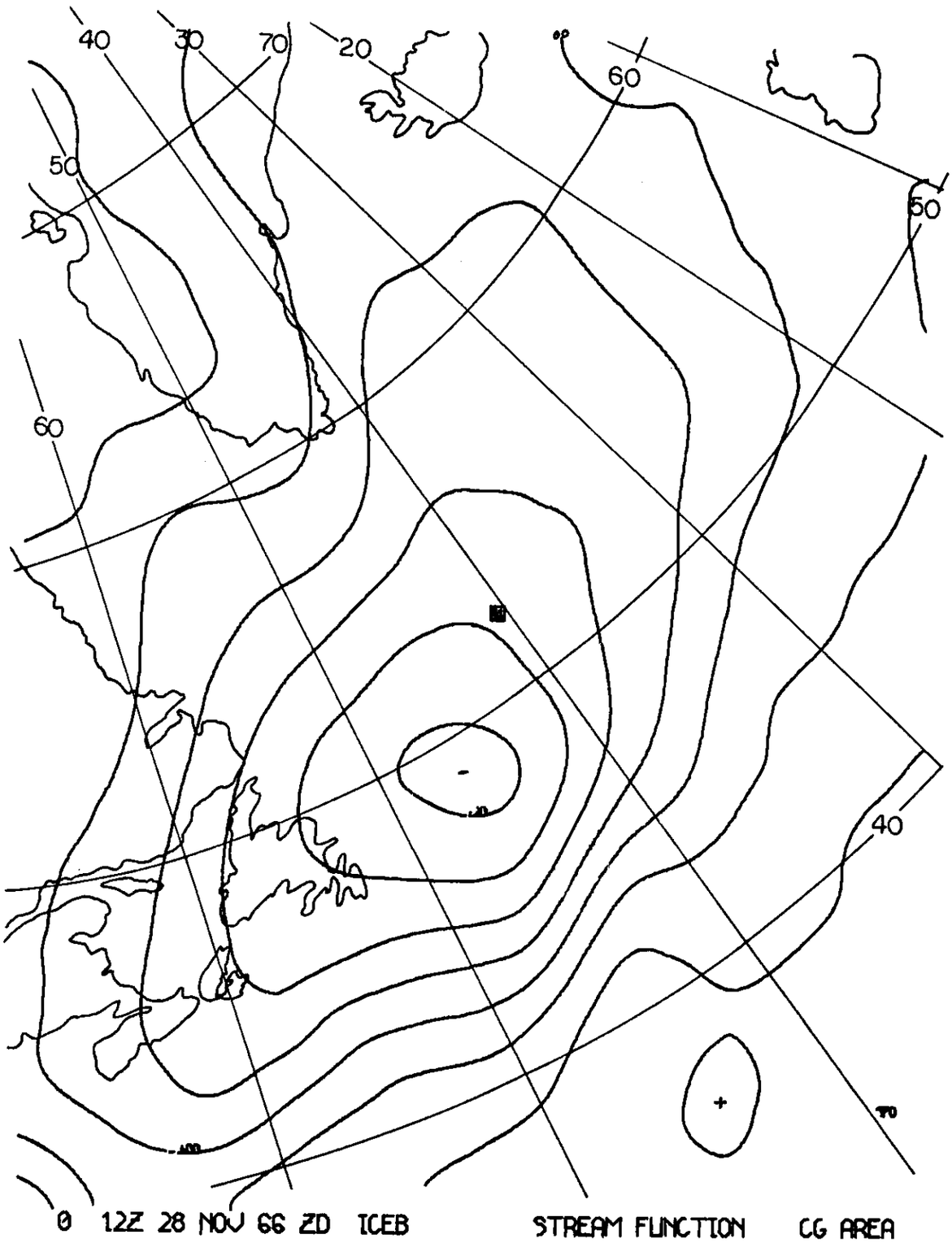
The attached five figures with zoom analyses in NW Atlantic (SST, GG Theta, curr transp, curr stream funct and tot. heat exch.) are for possible replacement of the figures in ICNAF Res. Doc. 67/40 which did not reproduce too well.

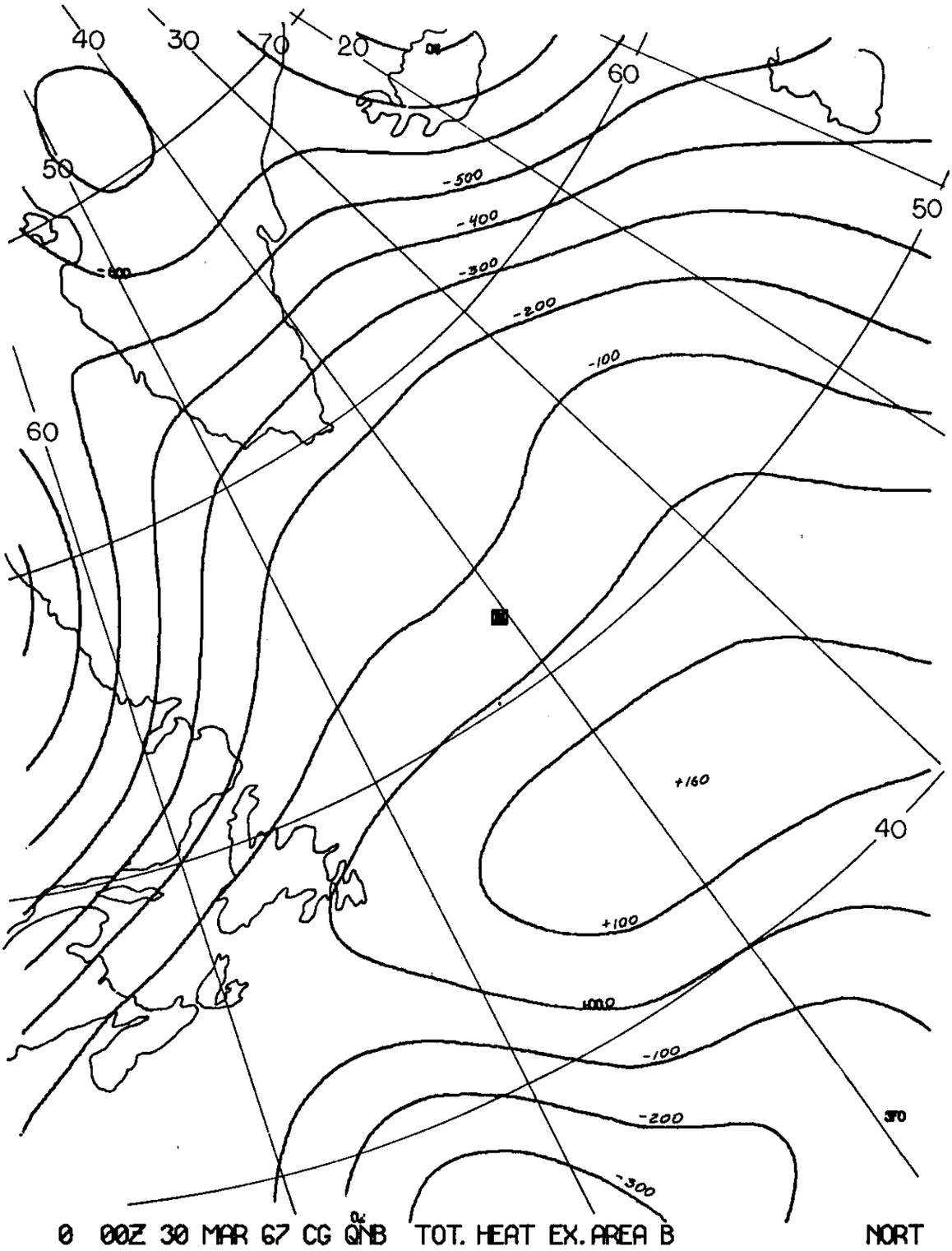

40°
30°
70°
20°
60
10°
50°
50°
60°
+08
+10
+12
+06
+04
+02
+10
+12
40°
+12
0 00Z 15 FEB 67 CG STB SST SEA AREA B
NORT


40°
30°
70°
20°
60°
50°
50°
60°
40°
0 00Z 15 FEB 67 CG GGB



0 12Z 01 DEC 66 ZT ICEACURRENT TRANSPORT NM/DAY CG AREA


40
30
70
20
60
50
50
60
40
0 12Z 28 NOV 66 ZD ICEB
STREAM FUNCTION CG AREA


40
30
70
20
60
50
-500
-400
-300
-200
-100
60
50
+160
40
+100
100.0
-100
-200
-300
0 00Z 30 MAR 67 CG QNB TOT. HEAT EX. AREA B
NORT