OCEANOGRAPHIC Monthly Summary

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National Ocean Service

OCEANOGRAPHIC
Monthly Summary

Oceanographic Monthly Summary is published by the National Weather Service (NWS), the National Environmental Satellite, Data, and Information Service (NESDIS), and the National Ocean Service (NOS). *Oceanographic Monthly Summary* contains sea surface temperature (SST) analyses on both regional and ocean basin scales for the Atlantic, Pacific, and Indian Oceans. The ocean basin analyses are based on a "blend" of *in situ* and satellite data, in which *in situ* data are used to define "benchmark" temperature values in regions of frequent observations and satellite data are used to define the "shape" of the field between these points.[1]

An ocean basin SST anomaly is derived from the "blended" SST analysis[1] and the improved global SST.[2] The regional SST analyses are based upon a combination of *in situ* and satellite data measurements. The regional SST anomalies are calculated from the Robinson-Bauer Climatology.[3,4] *Oceanographic Monthly Summary* also contains Alaskan sea ice information and ocean feature information for contiguous U.S. ocean regions

Oceanographic Monthly Summary welcomes articles containing information of interest to its readers, such as news on operational oceanography, unusual ocean feature phenomena, etc. Contributions should be sent to the editor (address below). Accepted material will appear in the OceaNotes section of *Oceanographic Monthly Summary*. Contributions can be published as quickly as the next monthly issue.

If you are interested in receiving *Oceanographic Monthly Summary* regularly, please refer to the back cover for subscription information.

[1]Reynolds, R. W., 1988: A Real-Time Global Sea Surface Temperature Analysis. *Journal of Climate*, 1, 75-86.

[2]Reynolds, R. W., and L. Roberts, 1987: A Global Sea Surface Temperature Climatology From *In Situ*, Satellite and Ice Data. *Tropical Ocean-Atmosphere Newsletter*, 37, 15-17. Available from Rosentiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149, USA.

[3]Robinson, M.K., 1976: Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer. *NavOcean Ref. Pub. 2.*

[4]Robinson, M.K., R. A. Bauer, and E. H. Schroeder, 1979. Atlas of North Atlantic-Indian Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOcean Ref. Pub. 18.*

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OceaNotes

Cooling of Coastal and Shelf Waters by Wind-Driven Upwelling off the U.S. Northeast --- Summer 1988

by

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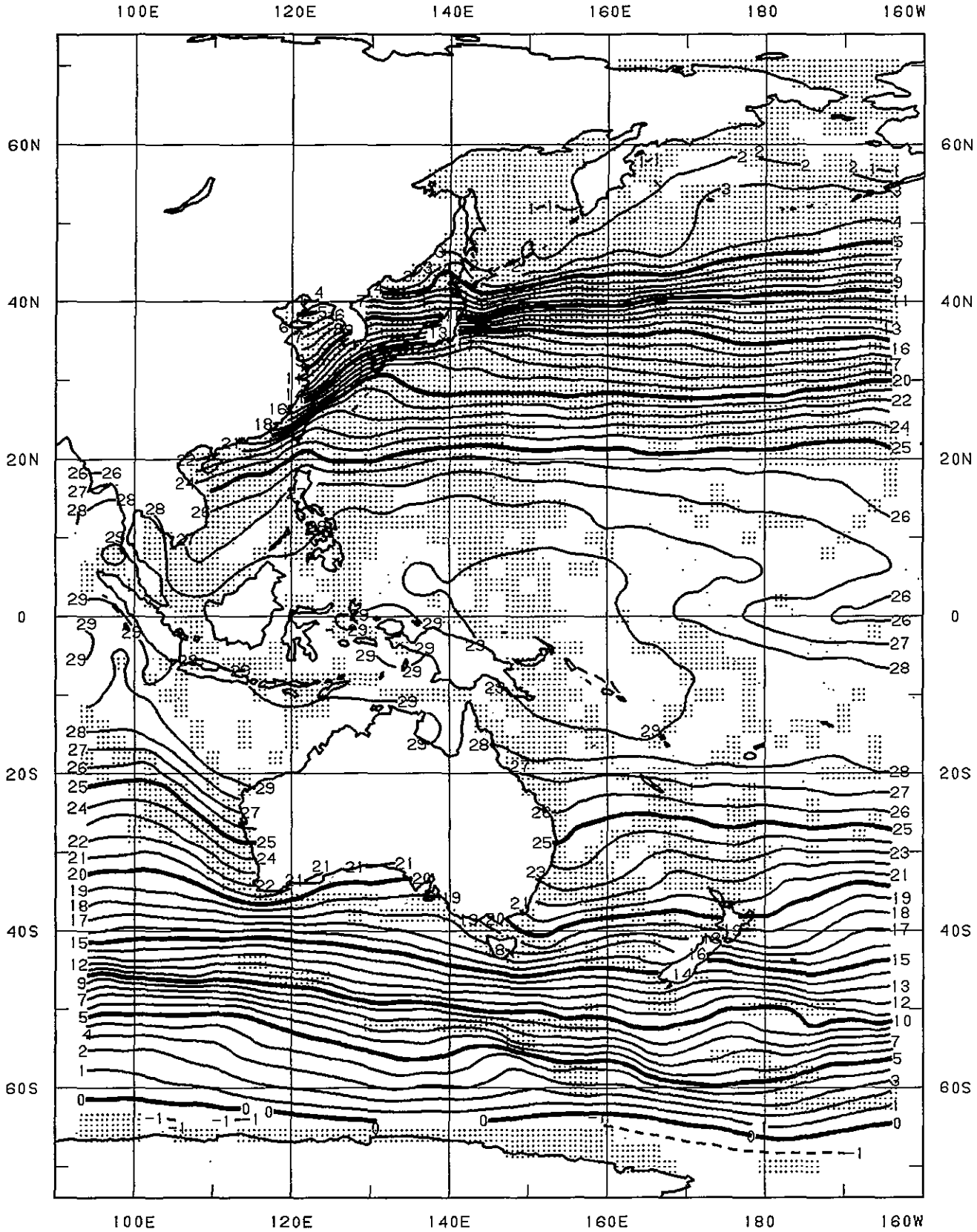
During the summer of 1988, fishermen and bathers at locations ranging from northern New Jersey to southern Delmarva Peninsula reported instances of unusually cool water appearing along the beaches and in coastal waters. During these periods of cool water temperatures, record and near record high air temperatures occurred throughout the area. Ingham and Eberwine (1984) described similar events of cooling of beach waters at Atlantic City, NJ during the summer of 1981 and related the cooling events to coastal upwelling from persistent southwest winds. Water temperatures dropped about 5° C, or less, during each of the events in 1981.

Jim Eberwine, a meteorologist with the National Weather Service, used sea surface temperature values measured at a pier in Atlantic City, NJ to detail cooling events at the coast during the summer of 1988. He reported a number of such events during June through August, with two major events when beach waters declined about 7° C in late July, and 14° C (from about 26° C to 12° C) over about 10 days in early August. In addition, Eberwine has relayed reports from recreational fishermen that in July they had to go 20-25 miles offshore from Atlantic City to find water temperatures and pelagic fish which would normally be found nearshore.

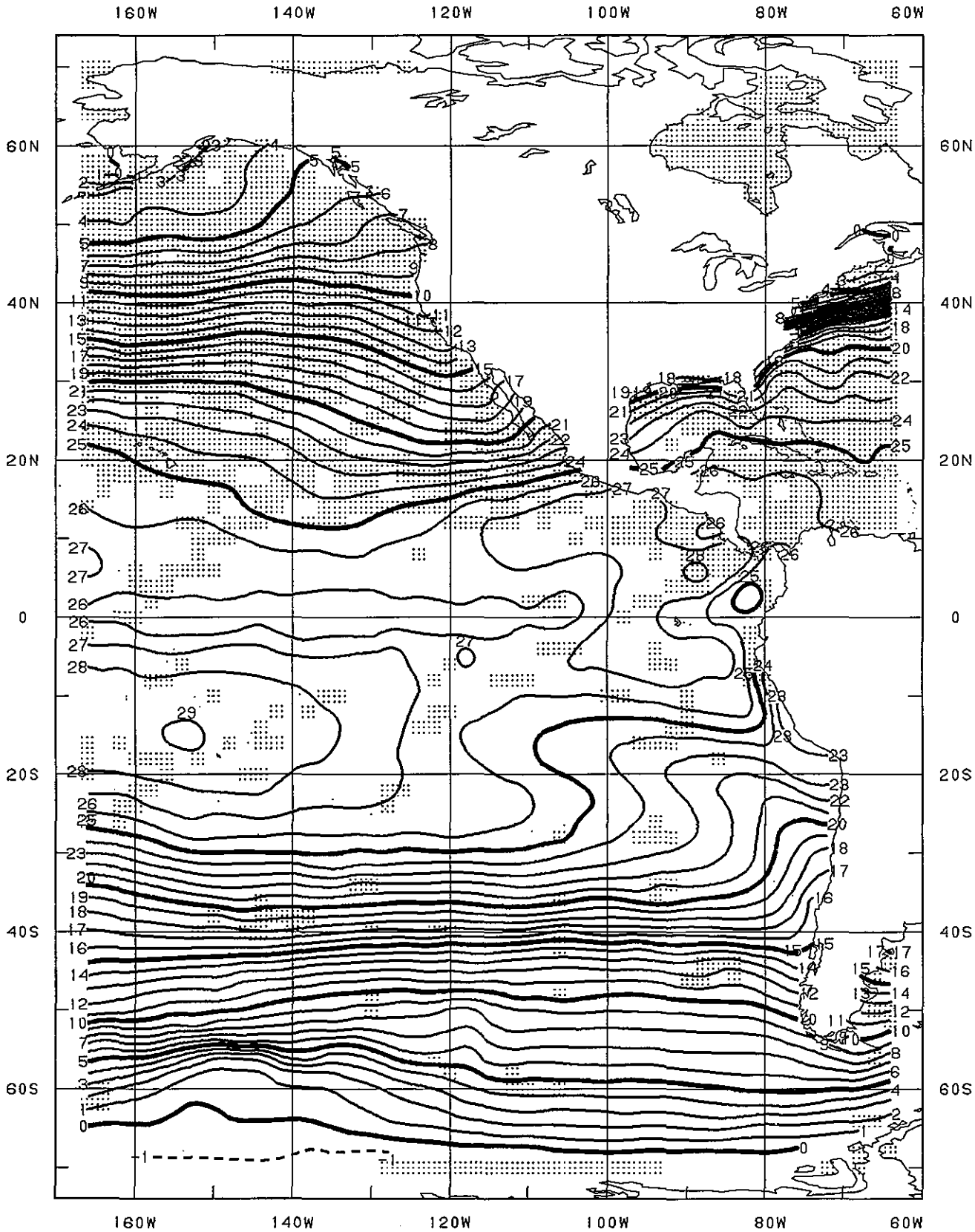
To define cooling events in 1988 and to assess their causes, wind and sea surface temperature (SST) data for the summer were acquired from a NOAA environmental data buoy, moored about 30 miles off Cape Henlopen, Delaware (38.5° N latitude, 74.6° longitude). The SST data in Figure 1a displayed five distinct periods of cooling during June - August (numbered 1-5 in figure 1). The strongest cooling, during early August (#5), amounted to a more than 6°C drop in water temperature, from 25°C to less than 19°C in about 12 days; this corresponded to the event reported by Eberwine (above) when SST fell about 14° near the beach.

Throughout each of the periods of reduced water temperature, winds persisted at speeds over about 10 knots. Also, except for the cooling event in early June (#1), the times when sea surface temperatures were dropping corresponded to periods when the southwest component of the winds exceeded about 8 knots (Fig. 1c), with the magnitude of the temperature decline relating to both the strength and the duration of the southwest wind component. Southwest winds, blowing parallel to the coast, would cause upwelling of cooler, subsurface water along the coast, as the wind effects drive surface waters offshore, as

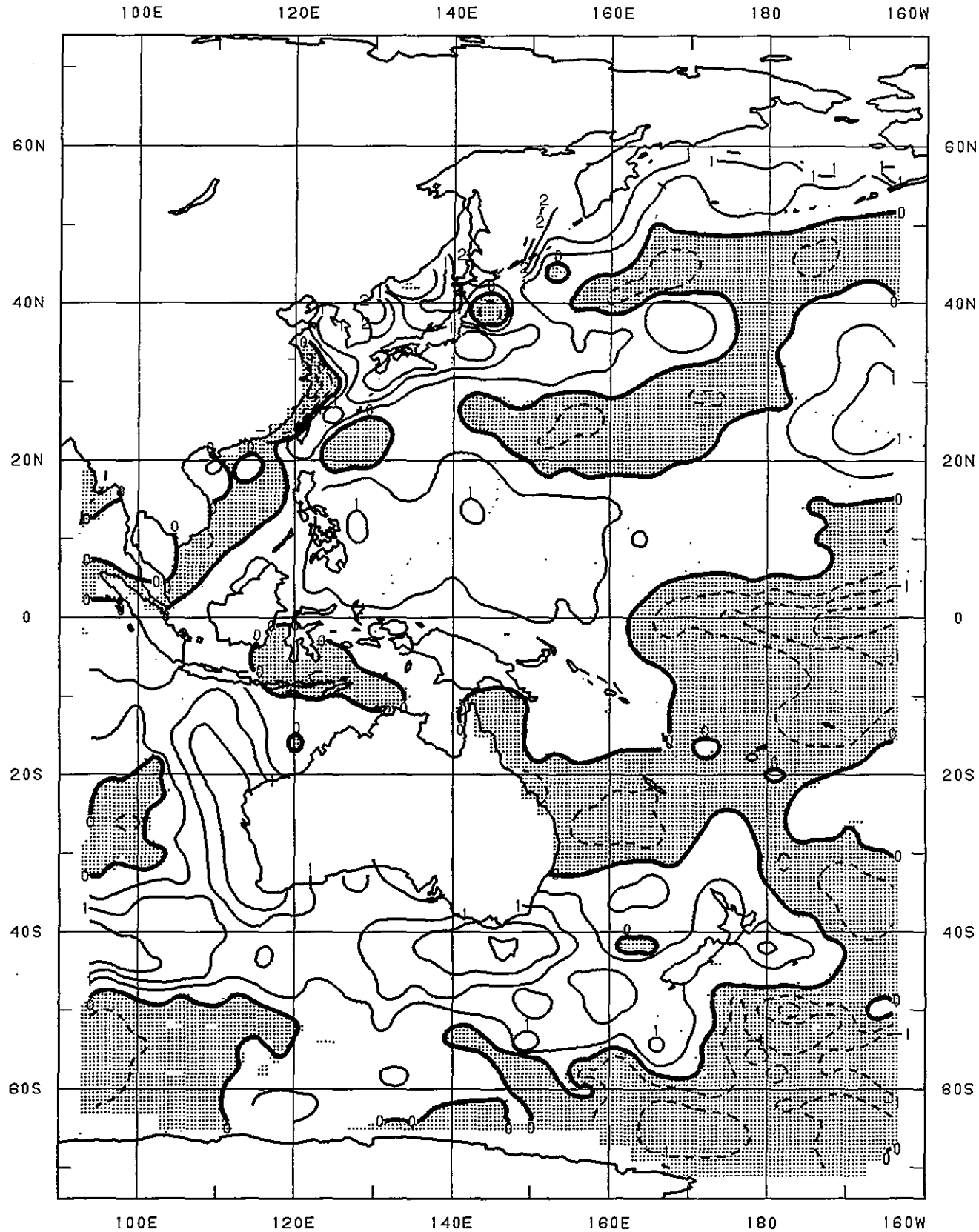
(text continued on page 12)



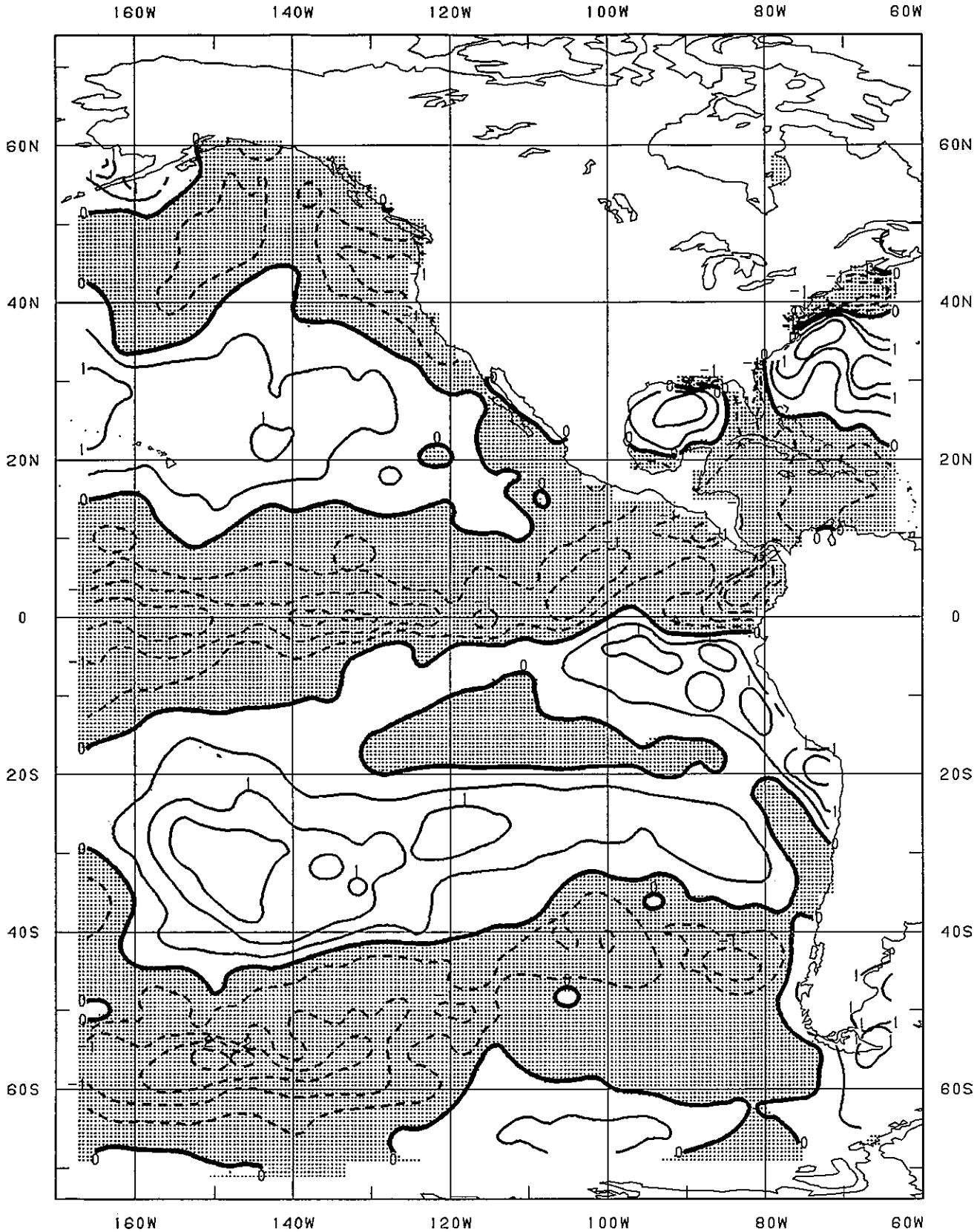
MARCH 1989 WESTERN PACIFIC OCEAN SST--MONTHLY MEAN (C)--MONTHLY mean SST is the mean of in situ (ship, buoy) and satellite data within two-degree quadrangles. Contour line interval is 1.0 C. The stippling indicates where the analysis was fixed by the in situ data; contours are not shown in areas without data.



MARCH 1989 EASTERN PACIFIC OCEAN SST--MONTHLY MEAN (C)--Monthly mean SST is the mean of in situ (ship, buoy) and satellite data within two-degree quadrangles. Contour line interval is 1.0.C. The stippling indicates where the analysis was fixed by the in situ data; contours are not shown in areas without data.



MARCH 1989 WESTERN PACIFIC OCEAN SST--MONTHLY ANOMALY (C)--Monthly anomaly is the difference between the monthly mean SST and the climatological monthly mean value. Contour line interval is 0.5 C. The stippling indicates where the monthly mean is colder than climatology; contours are not shown in areas without monthly or climatological data.



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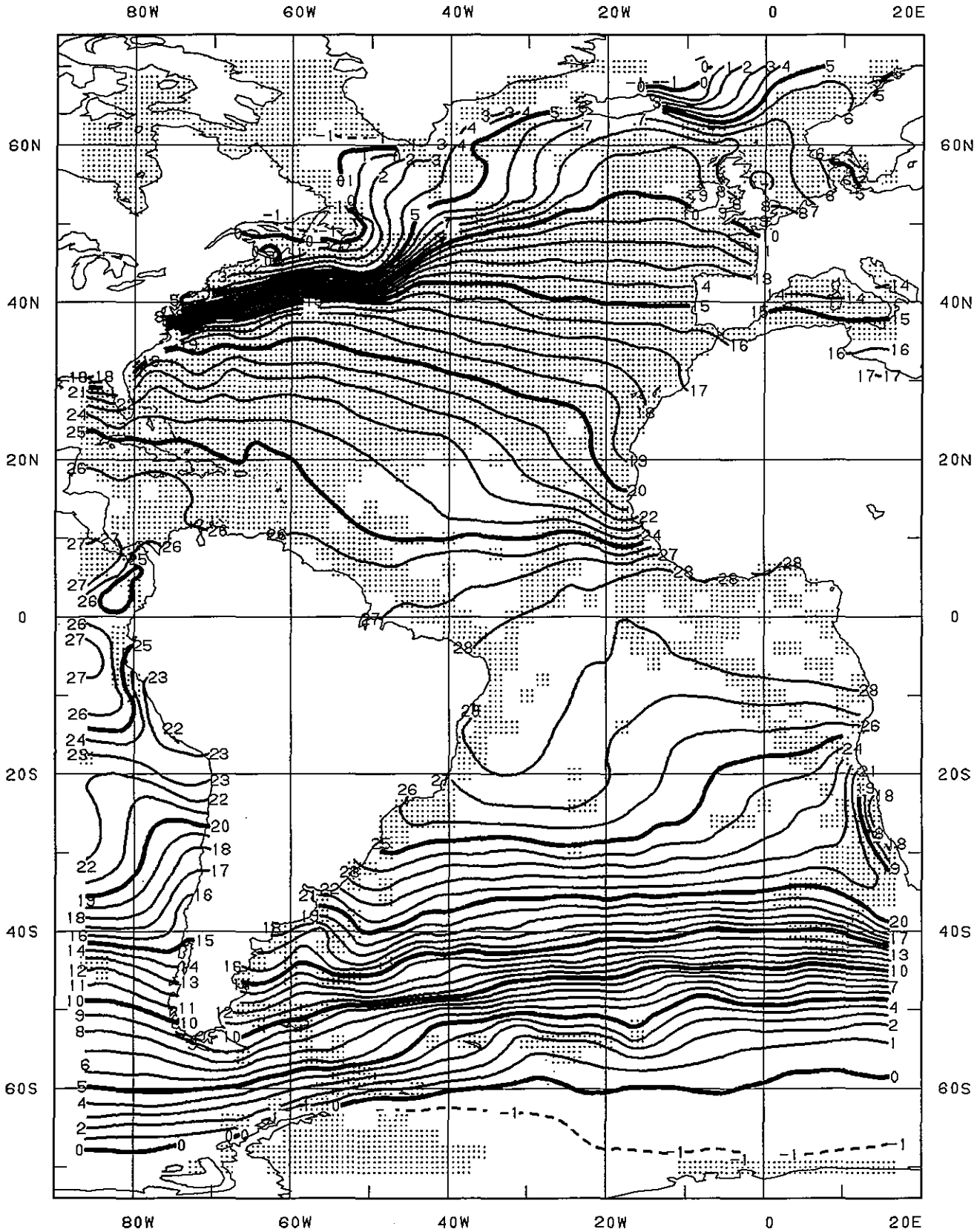
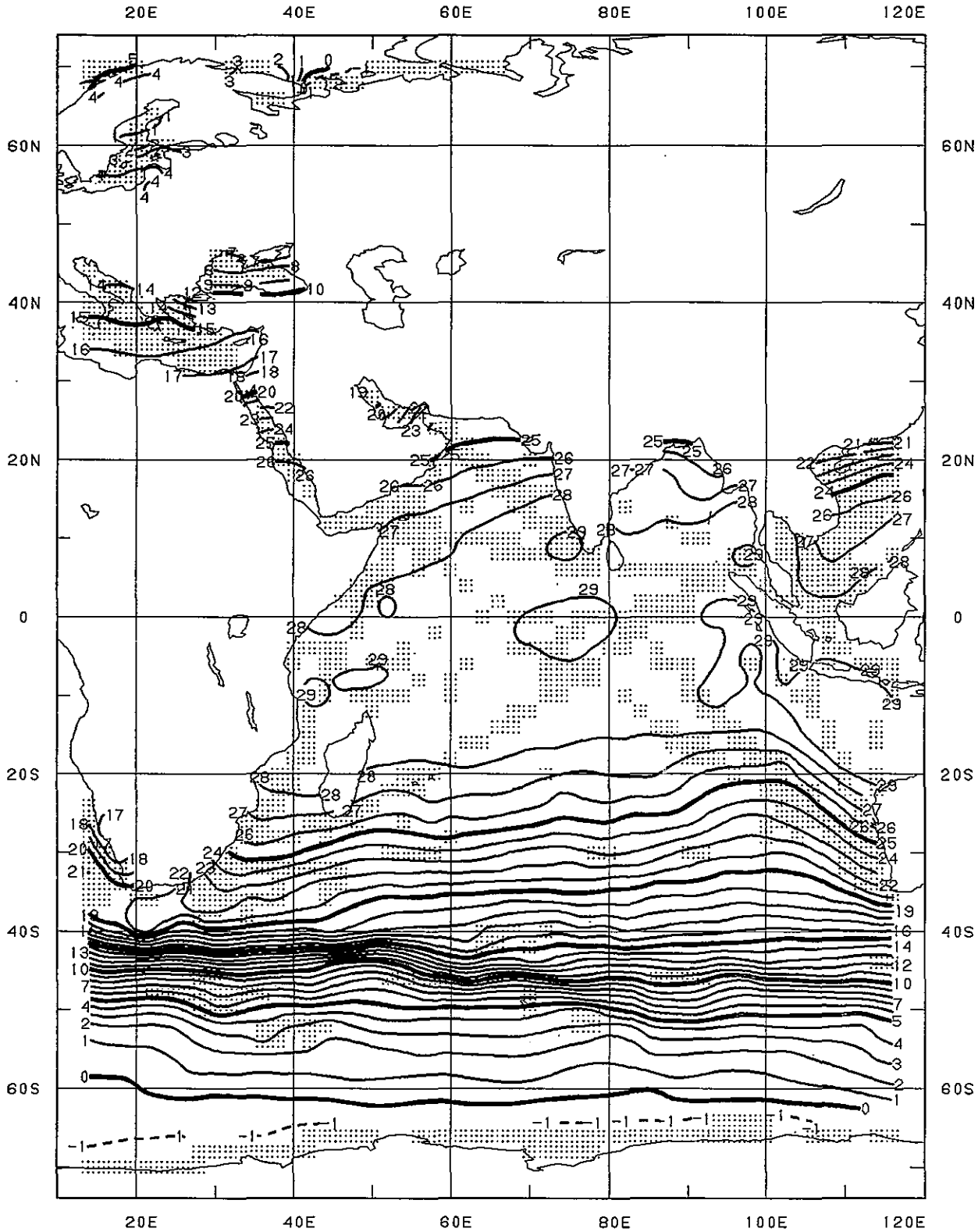
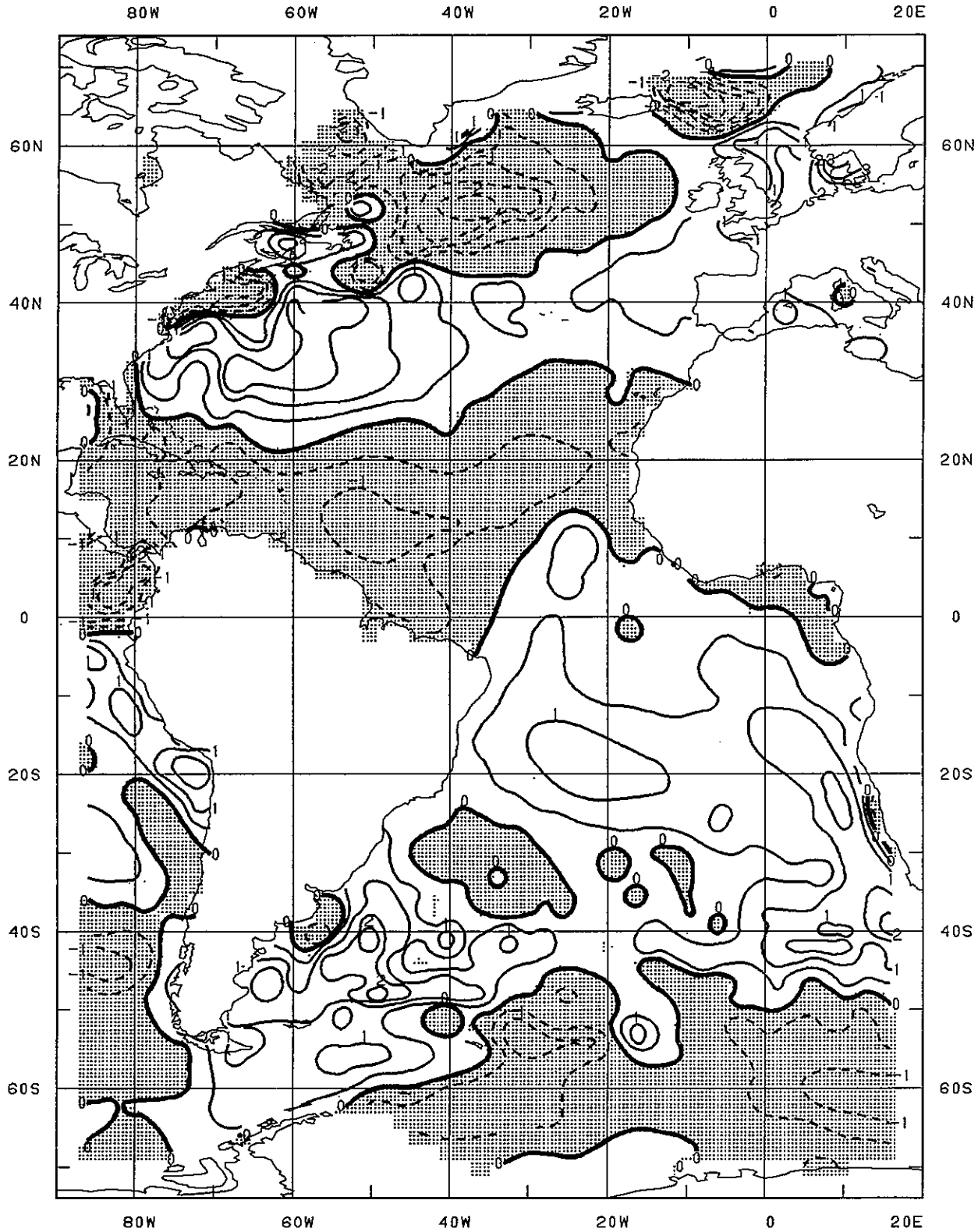


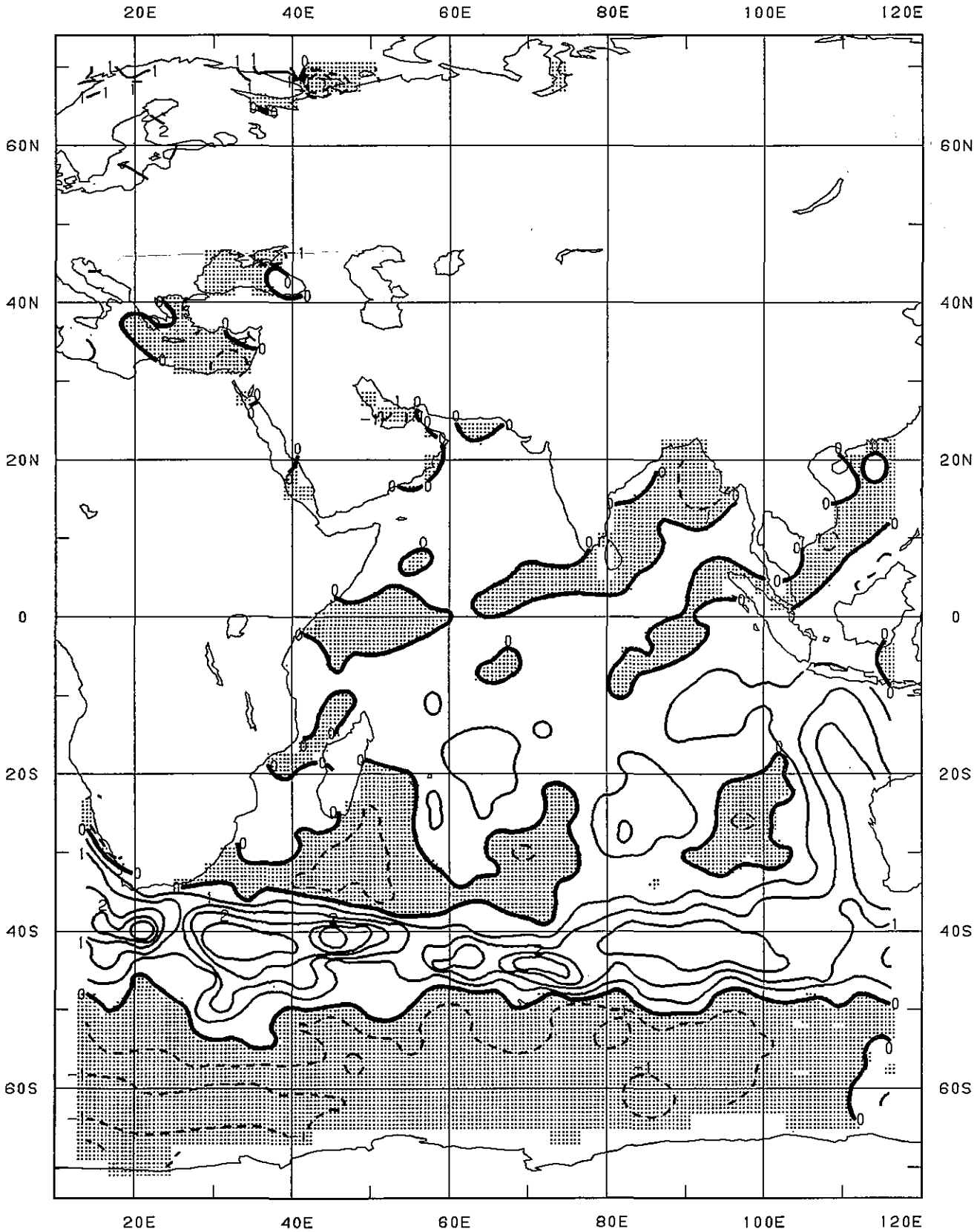
MARCH 1989 ATLANTIC OCEAN SST--MONTHLY MEAN (C)--Monthly mean SST is the mean of in situ (ship, buoy) and satellite data within two-degree quadrangles. Contour line interval is 1.0 C. The stippling indicates where the analysis was fixed by the in situ data; contours are not shown in areas without data.



MARCH 1989 INDIAN OCEAN SST--MONTHLY MEAN (C)--Monthly mean SST is the mean of in situ (ship, buoy) and satellite data within two-degree quadrangles. Contour line interval is 1.0.c. The stippling indicates where the analysis was fixed by the situ data; contours are not shown in areas without data.



MARCH 1989 ATLANTIC OCEAN SST--MONTHLY ANOMALY (C)--Monthly anomaly is the difference between the monthly mean SST and the climatological monthly mean value. Contour line interval is 0.5 C. The stippling indicates where the monthly mean is colder than climatology; contours are not shown in areas without monthly or climatological data.



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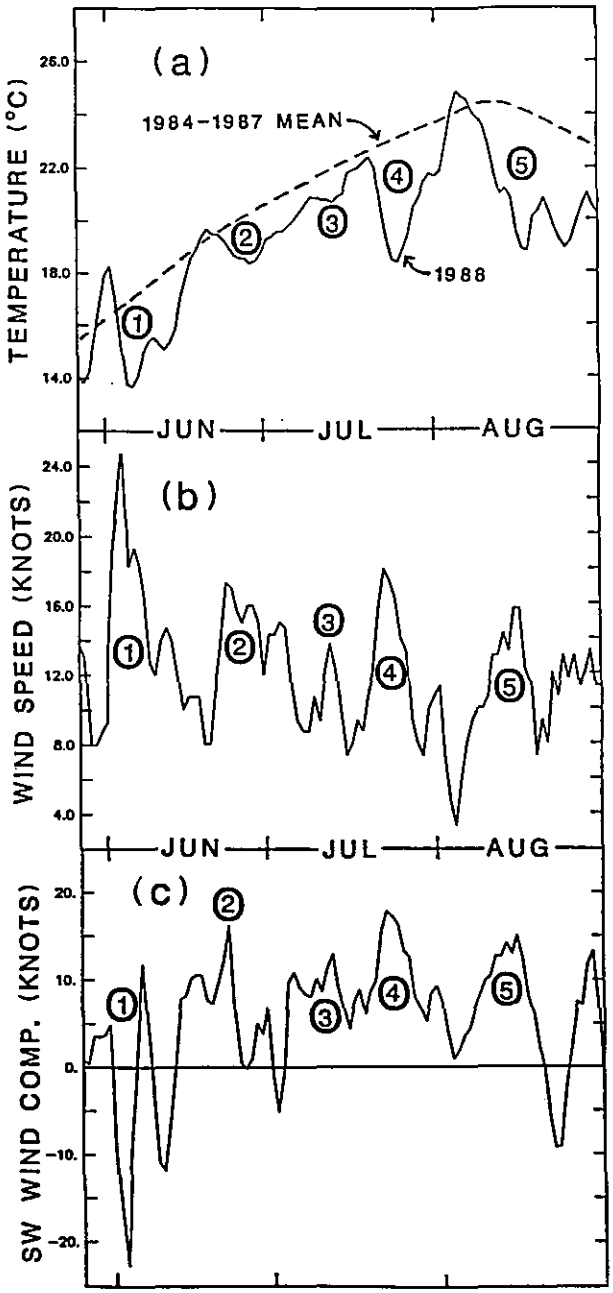
described for this area by Ingham and Eberwine (1984).

During cooling event #1, in early June, the strongest winds (about 25 knots) were from the northeast, a direction contrary to establishing upwelling. During this time of year, however, vertical thermal stratification is relatively weak and it is surmised that the cooling resulted from mechanical mixing of the warming surface waters with cooler, subsurface water because of the persistently strong winds. Following each of the cooling events, and after relaxation of the winds, SST's returned to near-normal values (1984-1987 average in Figure 1a).



The extent and effect of the largest cooling event in 1988 (cooling event #5 in August) is illustrated by comparing the SST patterns in Figure 2, derived from data of the infrared sensor aboard the NOAA 9 polar orbiting satellite. At the time of the satellite pass on 11 August, upwelling near the coast was just beginning, with coastal waters at temperatures near 24°C and, generally, about 26°C across the continental shelf. Six days later, on 17 August, nearshore temperatures had dropped to less than 16°C off New Jersey and were at least 1°C cooler across most of the shelf from Chesapeake Bay to eastern Long Island.

A cursory examination of SST's for previous summers indicates that cooling of coastal and nearshore waters from wind-driven effects is not unusual, but rarely of the magnitudes that occurred in 1988. Moreover, the total time of reduced SST's in 1988 in the buoy records of Figure 1a amounted to about 75% of the June-August season.

Reference cited:

Ingham, M.C. and J. Eberwine. 1984. Evidence of nearshore summer upwelling off Atlantic City, New Jersey. NOAA Tech. Memo. NMFS-F/NEC-31, 10 pp.

Figure 1. Water temperature and winds for 26 May-30 August, 1988 from NOAA buoy 44009 (38.5°N, 74.6°W). (a) Sea surface temperature in 1988 and smoothed, four-year (1984-1987) mean; (b) wind speed in 1988; (c) component of wind along southwest-northeast direction in 1988 (positive values are winds from the southwest).

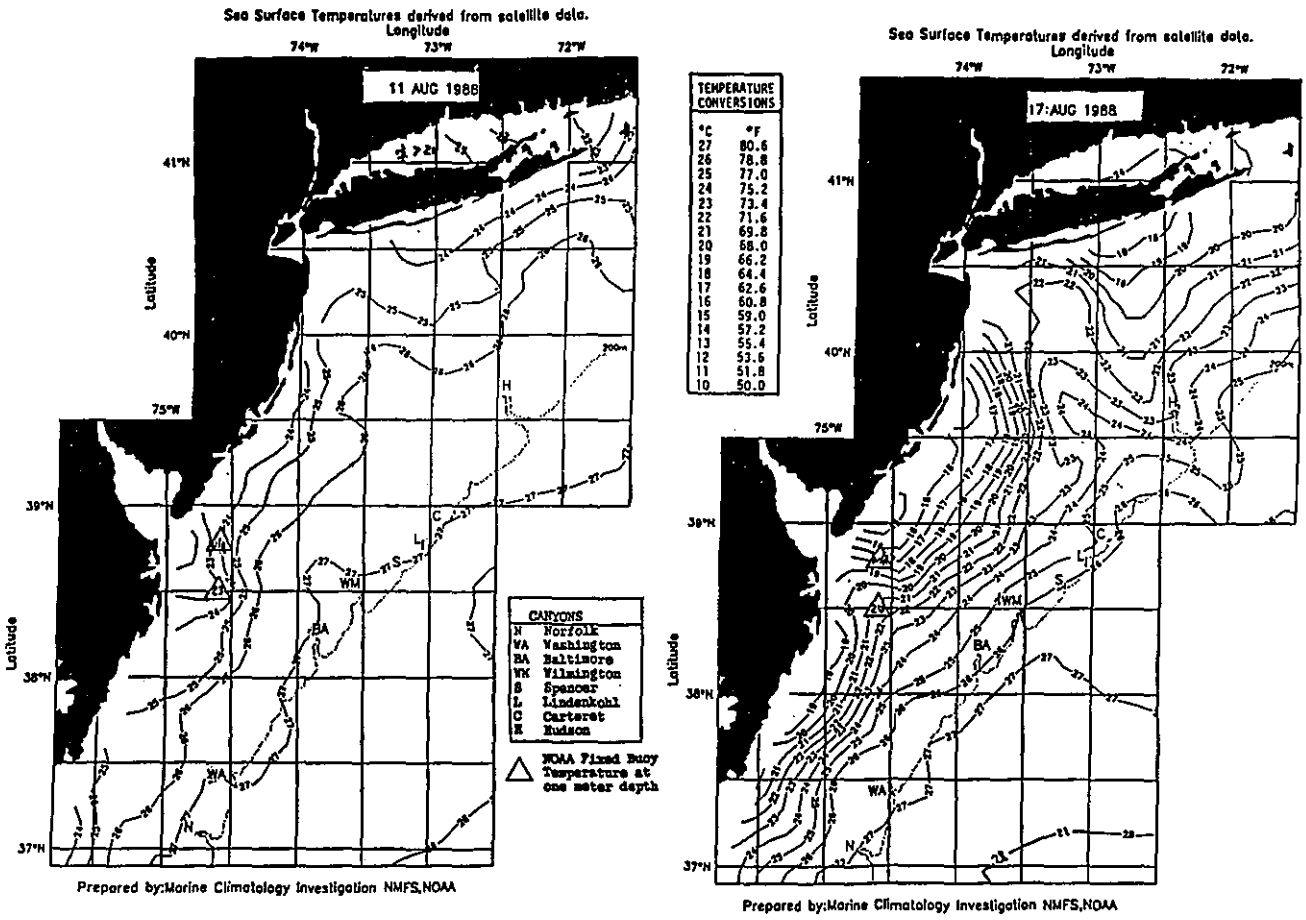
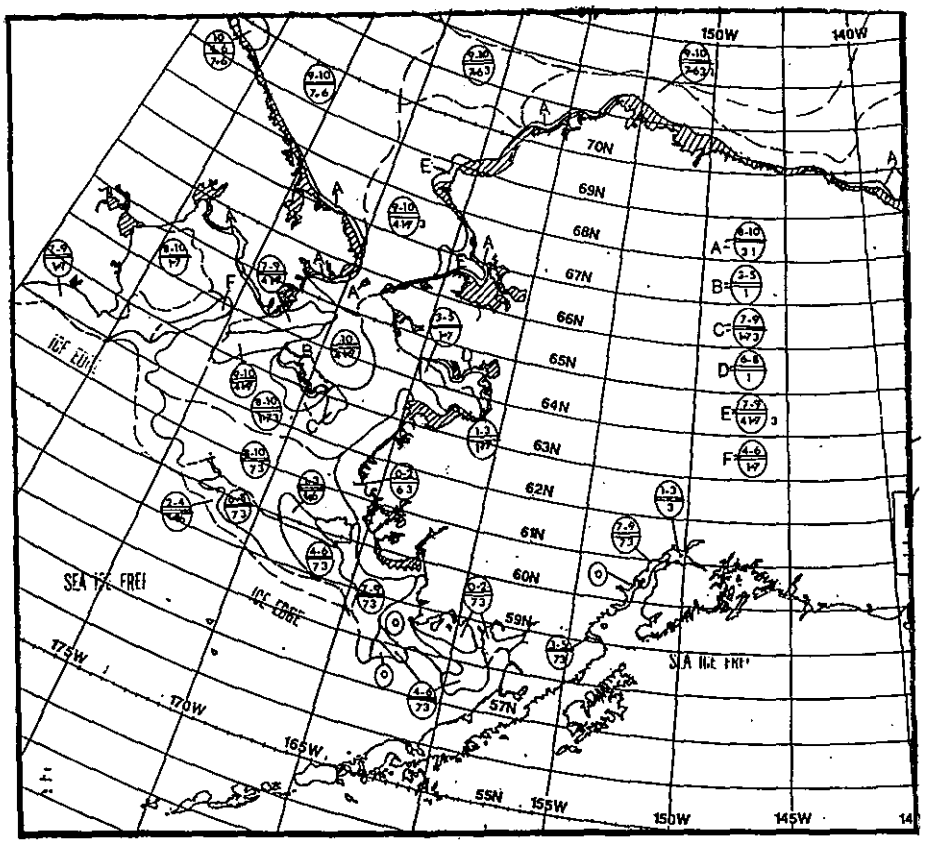


Figure 2. Sea surface temperature (°C) on August 11 and 17, 1988 from NOAA-9 satellite. Data was processed using the facilities of the Oceanographic Remote Sensing Laboratory, University of Rhode Island.



BERING SEA / NORTH SLOPE ICE ANALYSIS

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C = Total ice concentration in the area in tenths.

C_a, C_b, C_c = Concentration of thickest (C_a), 2nd thickest (C_b), and 3rd thickest (C_c) ice

S_a, S_b, S_c = Stage of development of thickest (S_a), 2nd thickest (S_b), and 3rd thickest (S_c) ice.

-C = Concentration of ice within area(s) of strips and patches.

STAGE(S) OF DEVELOPMENT (THICKNESS)

1 = New ice (0-10 cm)
3 = Young ice (10-30 cm)
6 = First year (30-200 cm)
7 = First year thin (30-70 cm)
1. = First year medium (70-120 cm)
4. = First year thick (120-200 cm)
7. = OLD ice (survived at least one summer's melt)

EXAMPLES

125 Theoretical thickness of this season's growth (cm).

Fast ice. Sea ice which forms and remains fast along the coast

Ice boundary visually or satellite observed

Ice boundary estimated.

March began with the sea ice edge in the Bering Sea at its most northern position for the entire modern period of record, i.e., since 1972. The situation changed during the first week as the sea ice edge expanded southward under the influence of colder air from Alaska's interior. The ice edge in the central and eastern Bering Sea fluctuated during the next three weeks and was only slightly north of its average position by month's end. Further west, the Gulf of Anadyr experienced record minimum ice extent during early March. A cold outbreak during the last week of March caused an expansion of 180 nautical miles to bring the edge within 60 nm of its average position. Along the North Slope, where extensive areas of fast ice were swept to sea during February, a return to more seasonal weather allowed a new band of fast ice to form, incorporating older floes, and extend 10 to 20 miles out to sea.

WEST COAST OCEAN FEATURES

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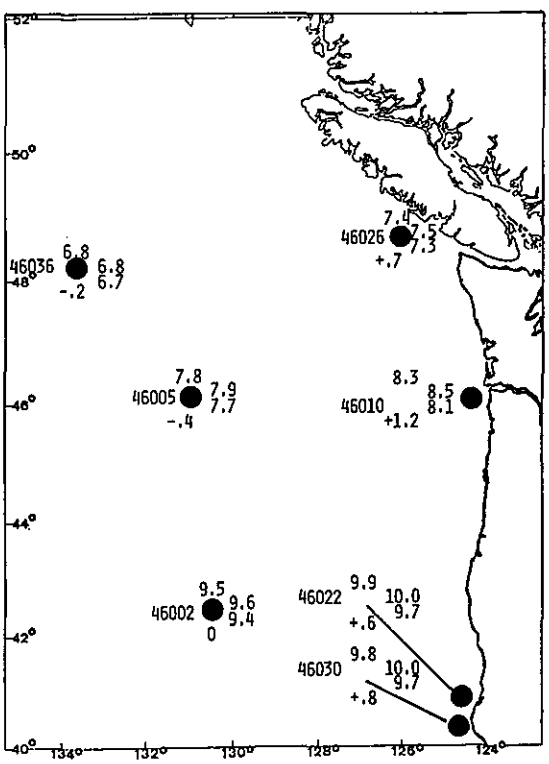
FTS 470-9122

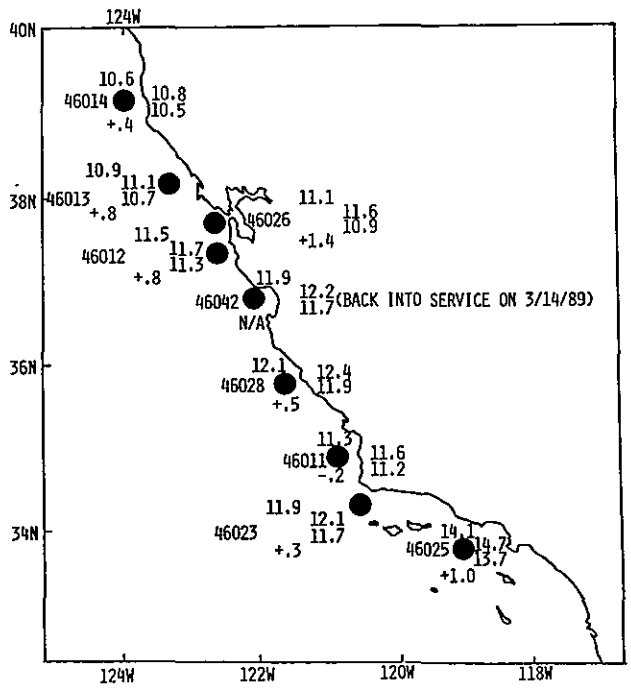
MARCH 1989

Water temperatures along the U.S. West Coast were very close to normal during March. In the North Panel, SST's averaged slightly below normal and those in the South Panel were a little above normal. Climatology dictates that the overall mean water temperature in the North Panel be about 8.3°C; however, the computed mean for the month was 8.0°C. The mean for the South Panel is 14.4°C; the actual observed mean was 14.6°C. Statistics generated from the 3-hourly buoy reports support the following conclusions drawn from the eight analyses produced during the same period:

Of the 14 evenly-spaced locations within the North Panel that are used to compute both the monthly departures and the changes from the previous month, only two had temperatures near or above normal. All the rest were cooler than climatology. The greatest cool anomalies of about 0.5°C were observed from Cape St. James in Canada, to Cape Flattery at the Straits of Juan de Fuca. The only location warmer than climatology (0.4°C) was centered at 41N 128W. Nearshore waters showed an increase in surface temperatures, whereas offshore waters decreased. The positive anomalies were generally around 0.1° to 0.3°C. The cool anomalies were about 0.5°C, with the greatest observed departure of 0.7°C centered at 45N 132W.



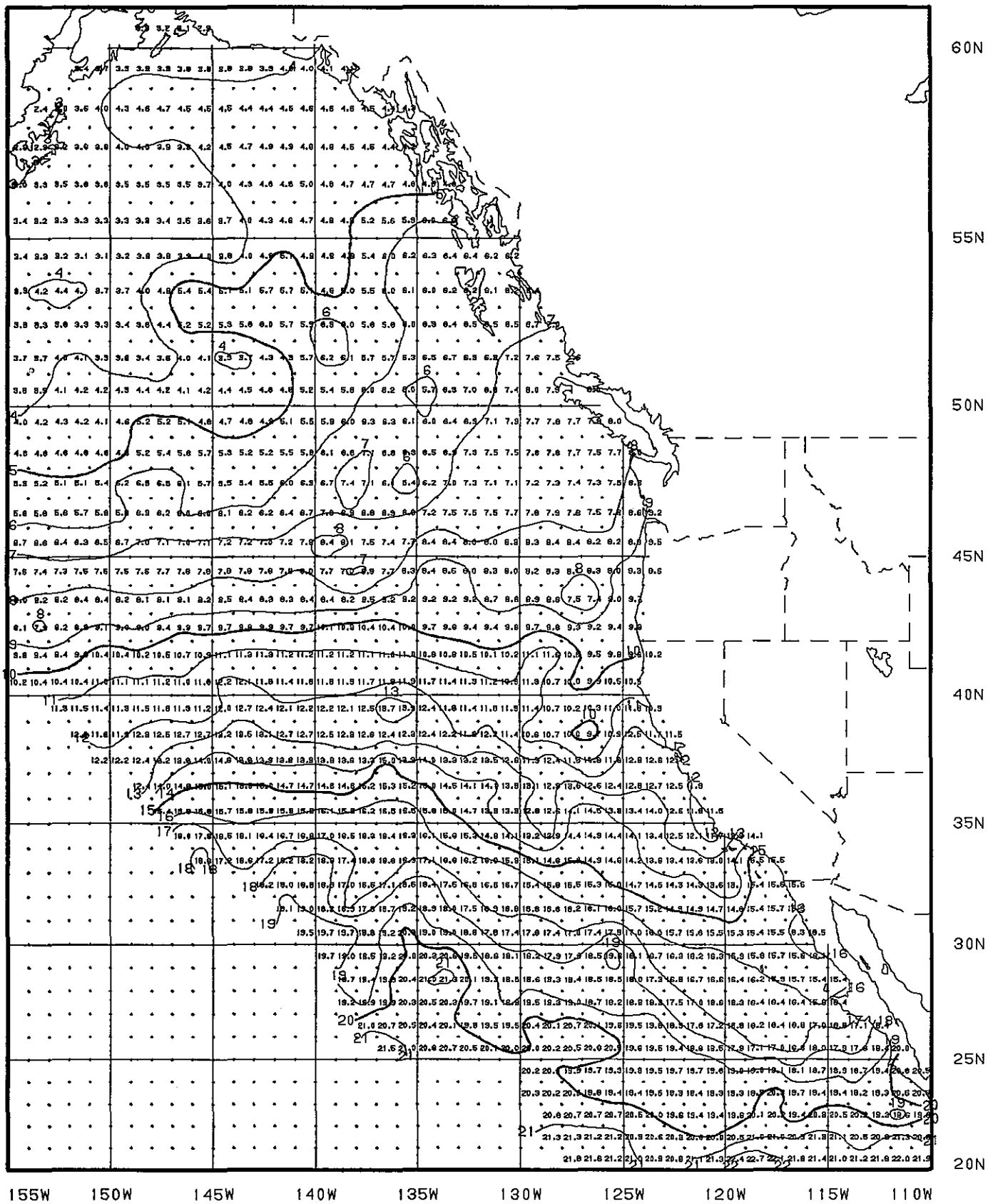
Of the 19 evenly-spaced locations that have been chosen in the South Panel to compute the monthly SST anomalies and the changes from the previous month, only one was exactly normal and four averaged below normal. The remaining 14 locations were slightly warmer than climatology. The greatest positive anomaly (0.6°C) was observed in the south central portion of the chart



KEY:

12.1 ← Monthly mean
LOCATION 13.5 ← Maximum daily mean
NAME 10.2 ← Minimum daily mean
-1.5 ← Change from previous month

● Denotes station position.



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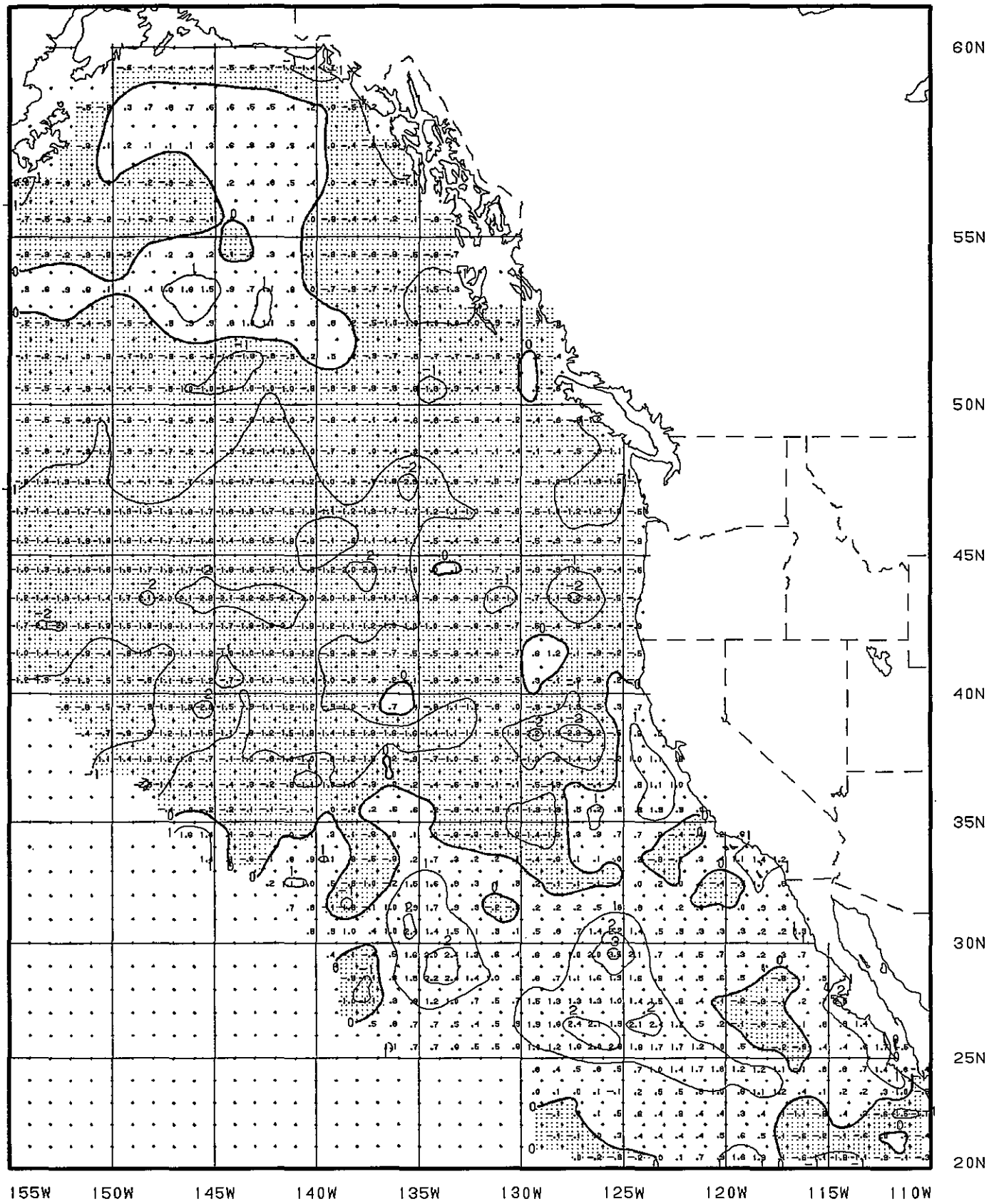

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EAST COAST OCEAN FEATURES

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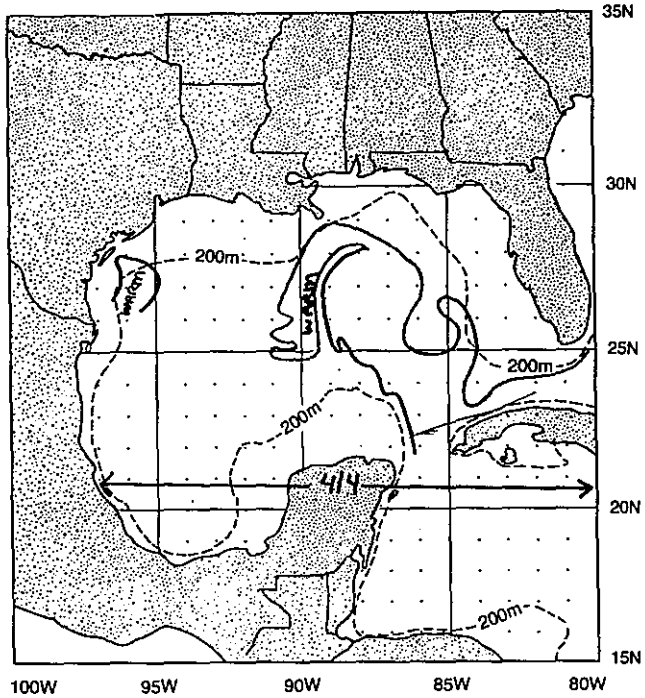
MARCH 1989

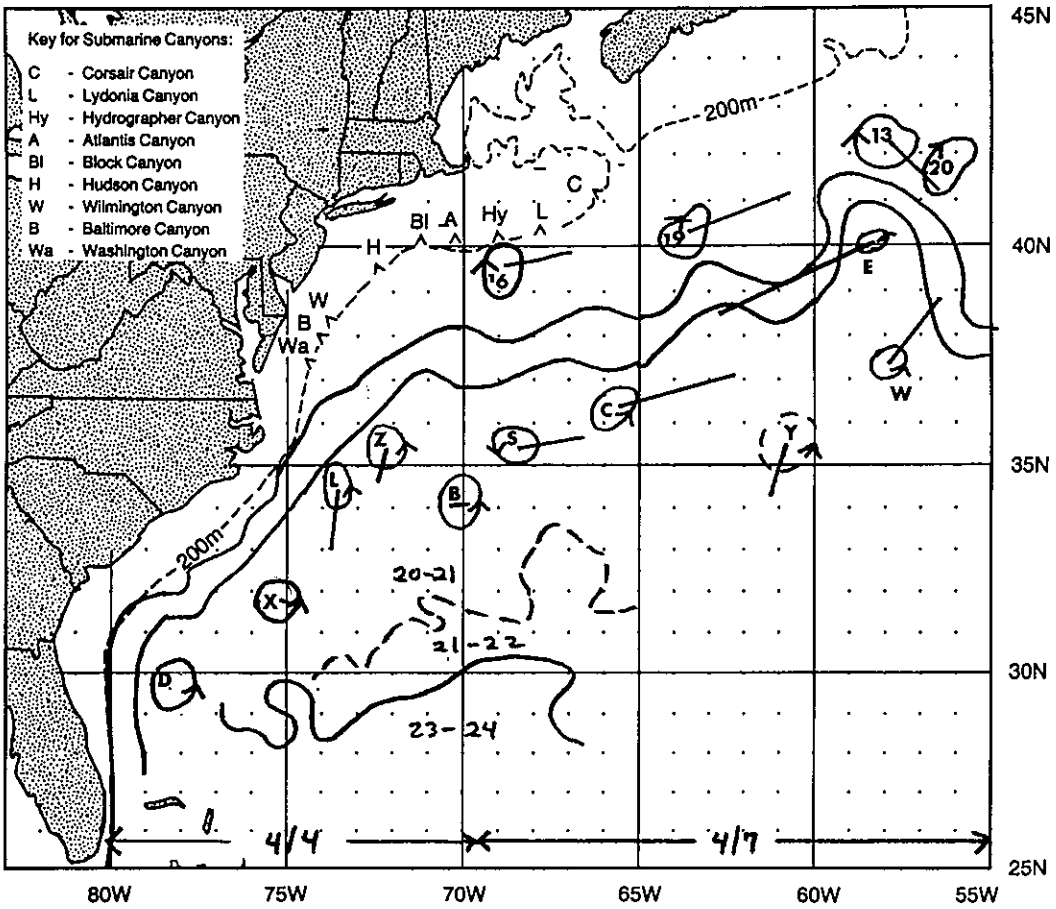
The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the Northwest Atlantic. Cyclonic eddies are labeled A-Z. Arrows on eddies indicate direction of circulation. Warm-core or anticyclonic eddies rotate clockwise; cold-core or cyclonic eddies rotate counterclockwise. The line to the eddy center shows the net translation since last month or since last observed. The edge of continental shelf at 200 m is shown as a dashed line. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart or are indicated by "dot-dashed" lines. The long arrows at the bottom of the chart indicate the dates of data used.

Data used in this analysis include:
Infrared imagery from NOAA satellite - NESDIS
Bathythermograph data from National Meteorological Center of National Weather Service
Oceanographic Analysis -- A daily detailed analysis issued by National Weather Service
(Data accuracy is 1-2C and 5-10 nautical miles)



GULF OF MEXICO

The Loop current intruded 35 km N into the Gulf of Mexico during March. One anticyclonic eddy seemingly formed from an aneurism in the Loop near 28N 91W around March 14. Attaching to the north-western part of the Loop this eddy appeared to merge with the long warm filament which extends from 29N 89W to 25N 90W. A warm feature was also observed near 27N 96W on April 4.



NORTHWEST ATLANTIC OCEAN

One anticyclonic eddy formed and one was absorbed during March. Eddy 20 formed from a Gulf Stream aneurism near 41N 56W on March 29. Eddy 17 was absorbed by the Gulf Stream near 37N 74W around March 15.

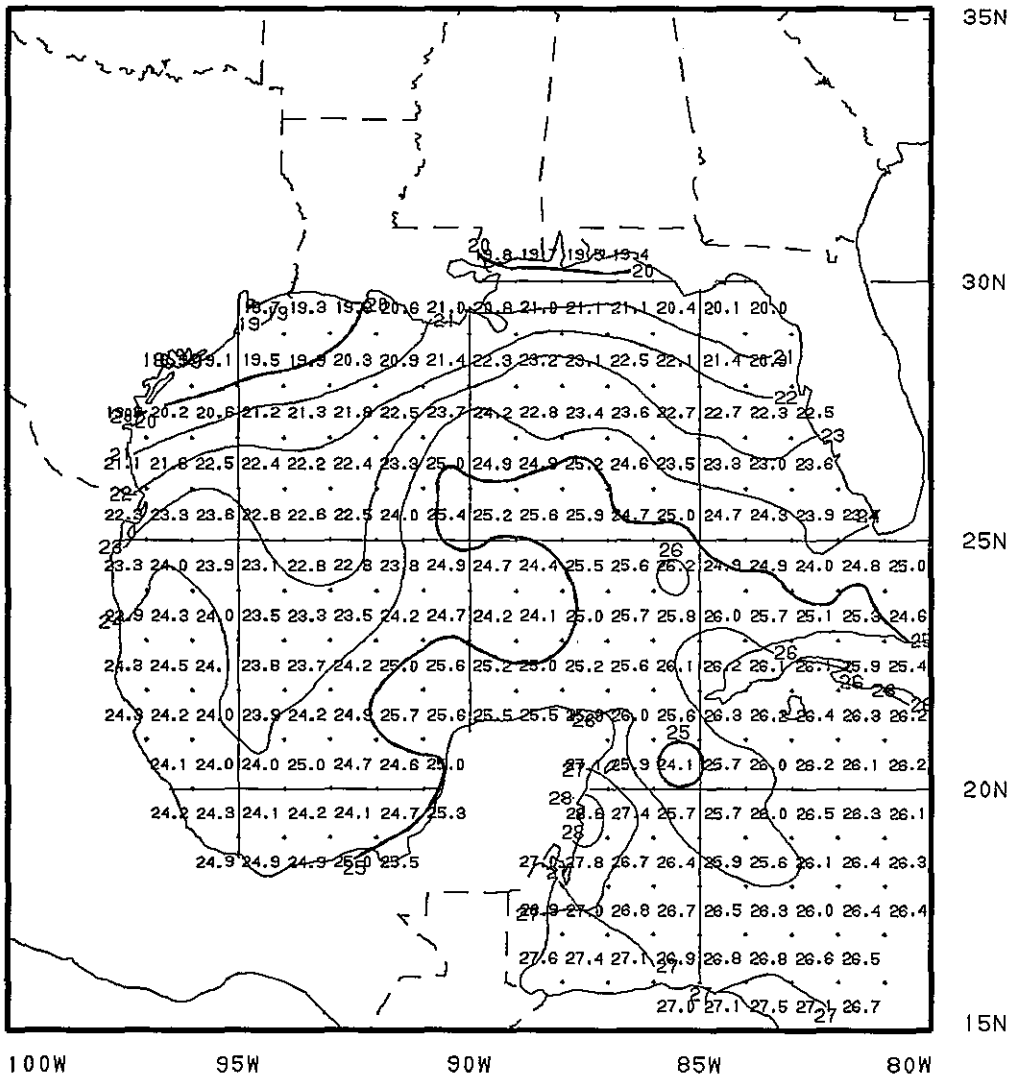
Eddy 16 translated 165 km WSW while eddy 13 translated 165 km NW. Eddy 19 drifted 260 km SW. Eddy 19 interacted with the Gulf Stream on March 20, but it maintained its identity.

Two cyclonic eddies were newly observed during March. An eddy-like feature commonly observed near 30N 78W appeared again on March 14. This feature seems to appear each spring and may be a permanent feature. Since the feature was newly observed this month, it is named eddy D. Eddy E was newly observed near 38.5N 63W on March 17. Its origin is not known. Eddy E was apparently advected downstream very quickly by the Gulf Stream. It traveled 370 km NE.

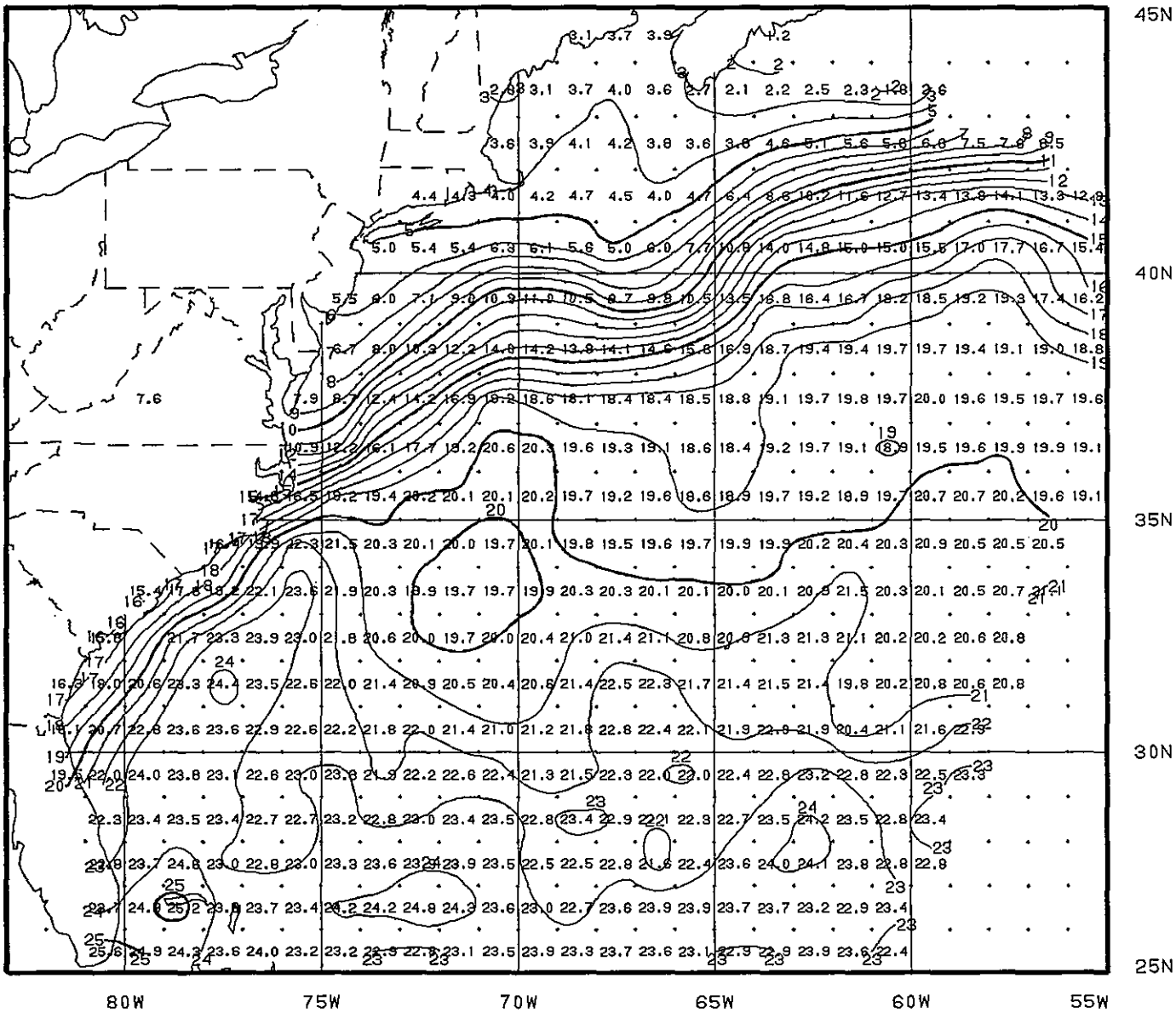
Eddy X moved 55 km WNW. Eddies L and Z translated 160 km N and 75 km NNE, respectively. Eddy B apparently drifted 35 km E, although its position is not certain. Eddy S traveled 185 km WSW while eddy C traveled 270 km SW. Eddy Y, last observed on March 17, had drifted 150 km NNE. Eddy W translated 200 km SW.

Two fronts in the vicinity of the Subtropical Convergence were observed during March. These fronts were farther north than the two fronts that were observed during February. The most recently observed front was located from 29N 77W to 29N 67W on March 30. On March 16 another front was observed north of the recent front from 30N 74W to 31N 65W. The SSTs north of this second front were 20-21C while the SSTs between the fronts were 21-22C. SSTs south of the front were 23-24C.

EAST COAST SST - MONTHLY MEAN

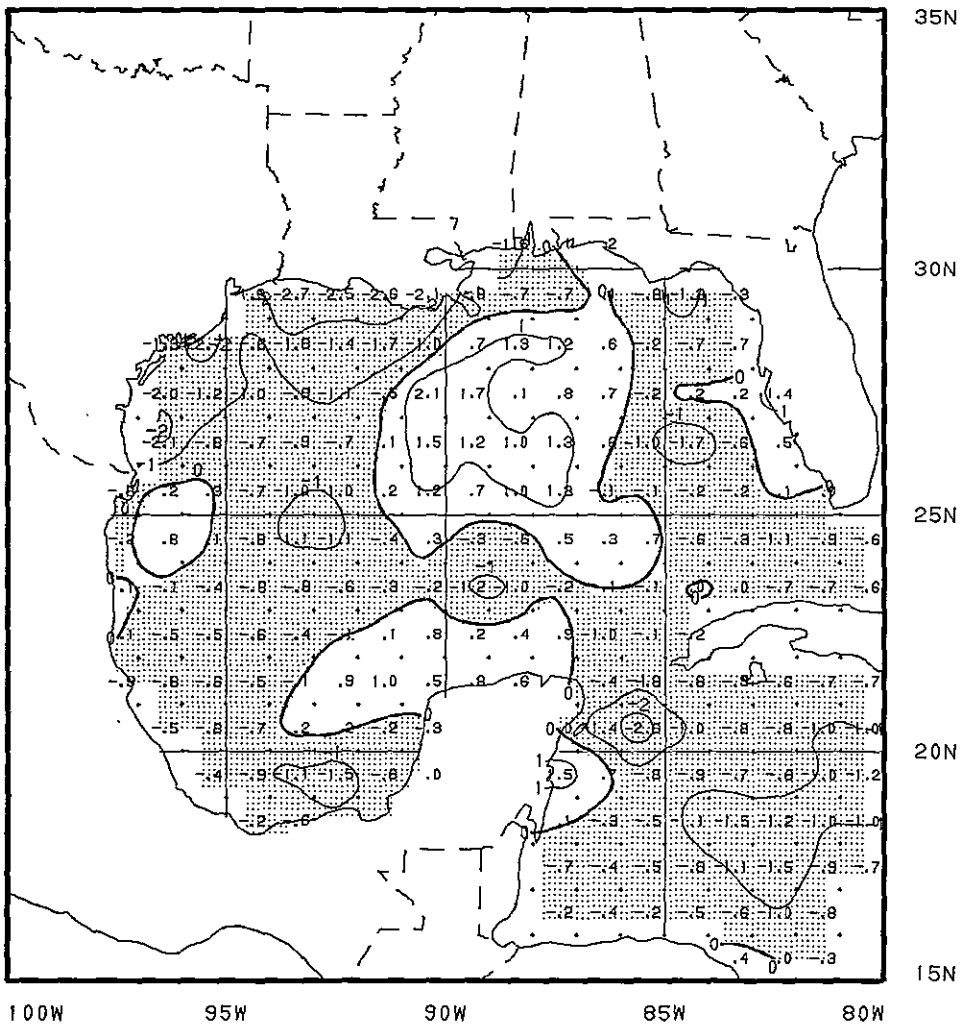


MARCH 1989 GULF OF MEXICO SST-MONTHLY MEAN (C)--Monthly mean SST is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0C.



MARCH 1989 U.S. EAST COAST SST--MONTHLY MEAN (C)--Monthly mean SST is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0C.

EAST COAST SST - ANOMALY



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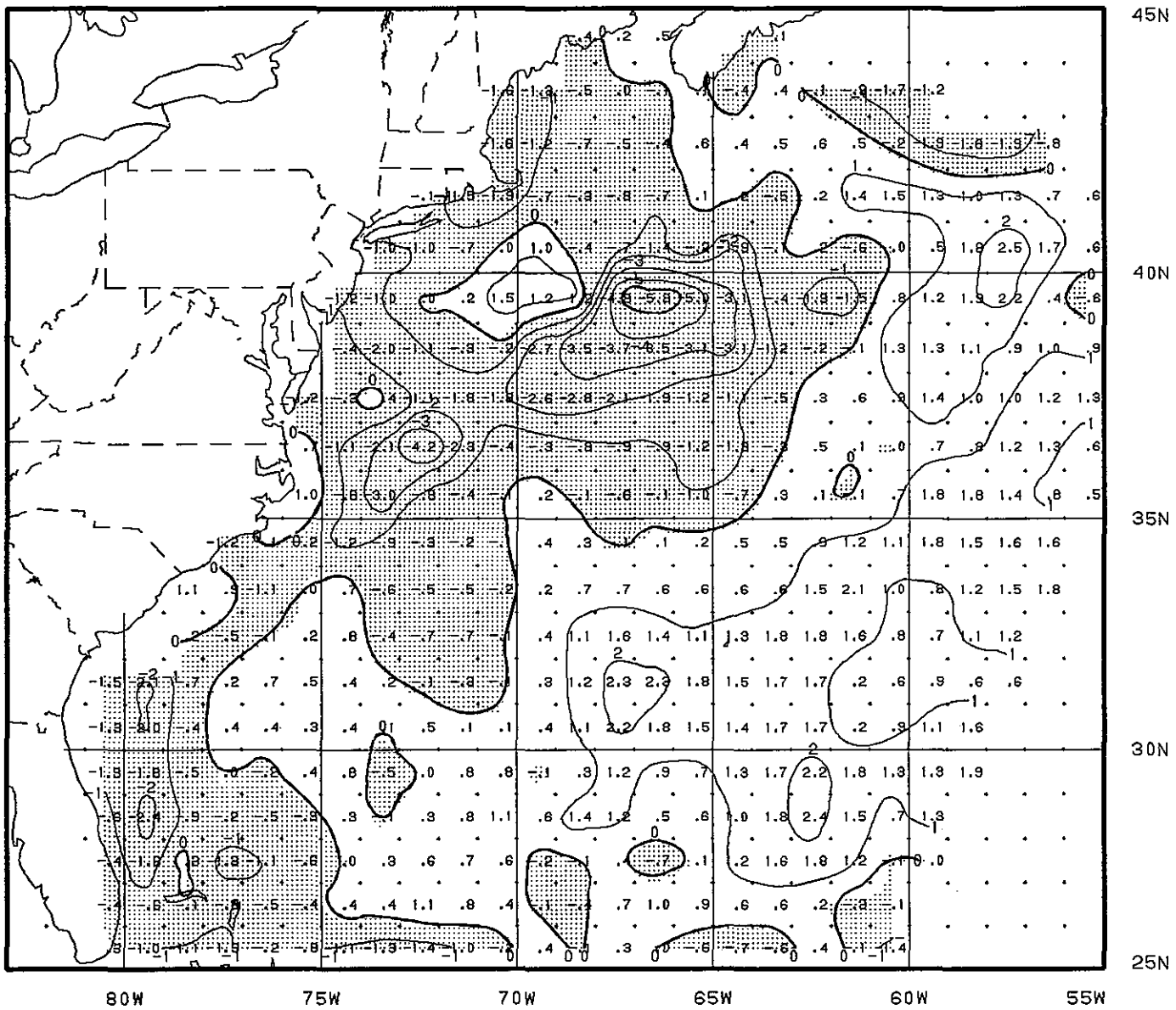

MARCH 1989 U.S. EAST COAST SST--MONTHLY ANOMALY (C)--Monthly anomaly is the difference between the monthly mean SST and the climatological monthly mean value--shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0C.

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OCEANOGRAPHIC Monthly Summary

Volume IX Number 8 August 1989

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National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

OCEANOGRAPHIC
Monthly Summary

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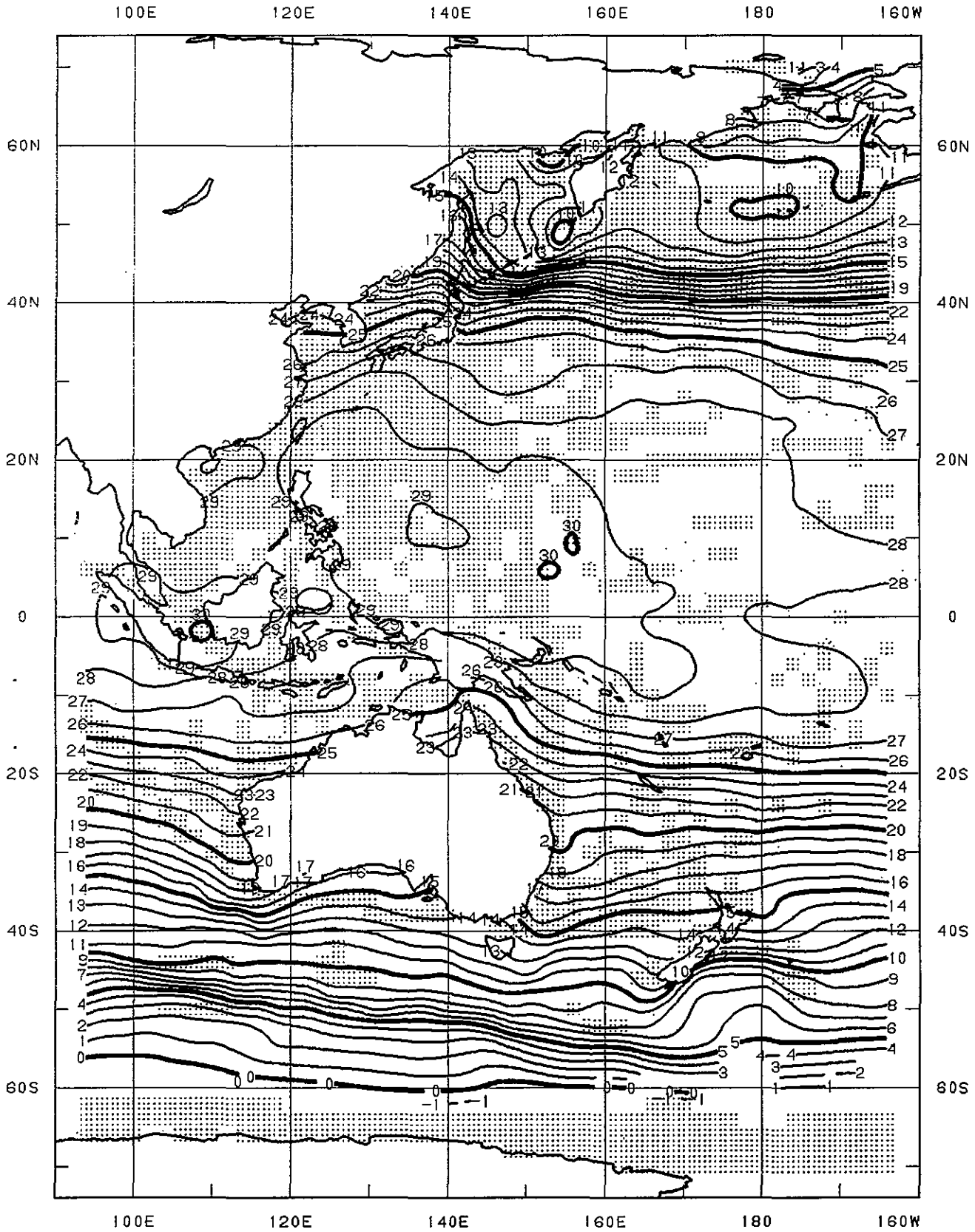

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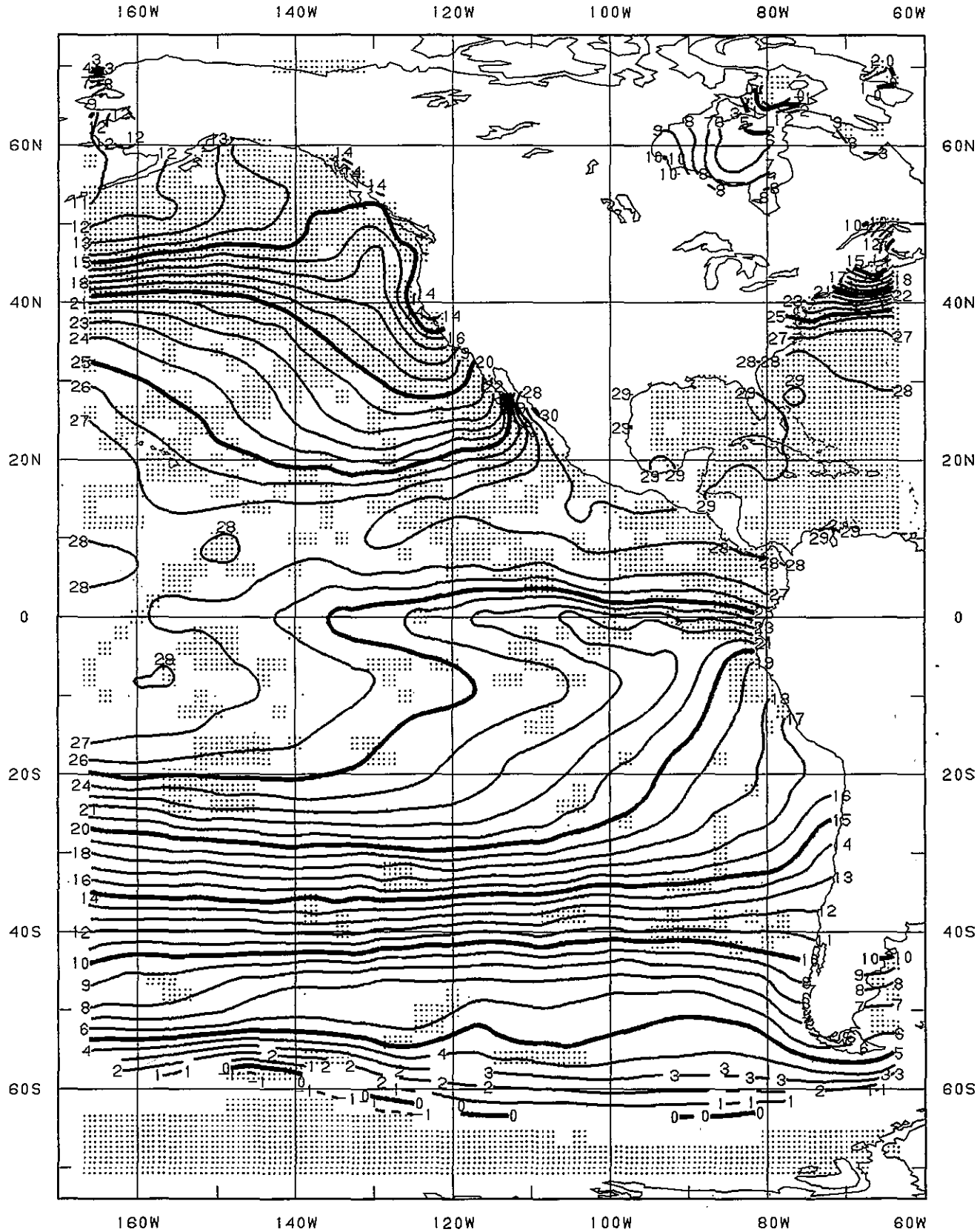

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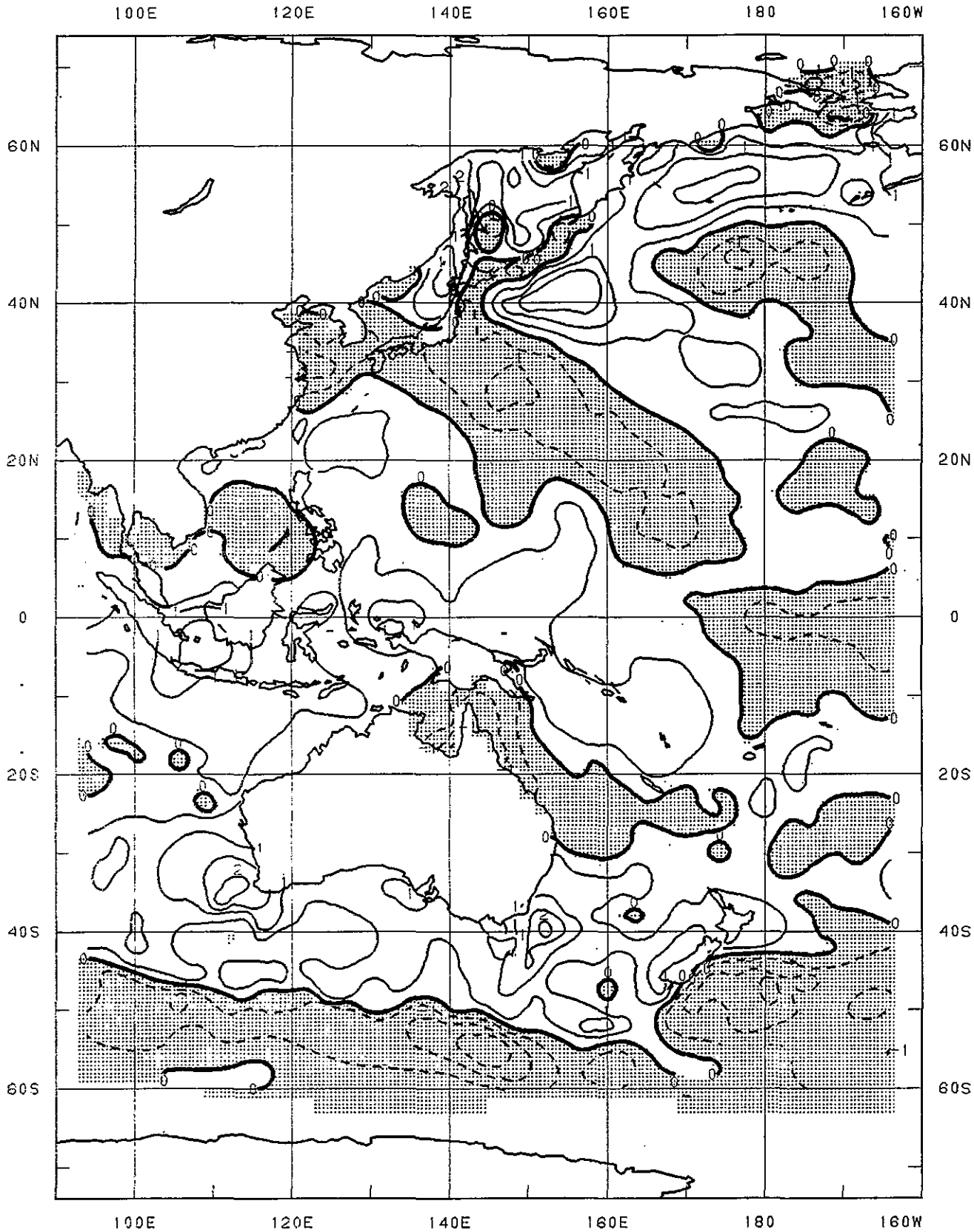

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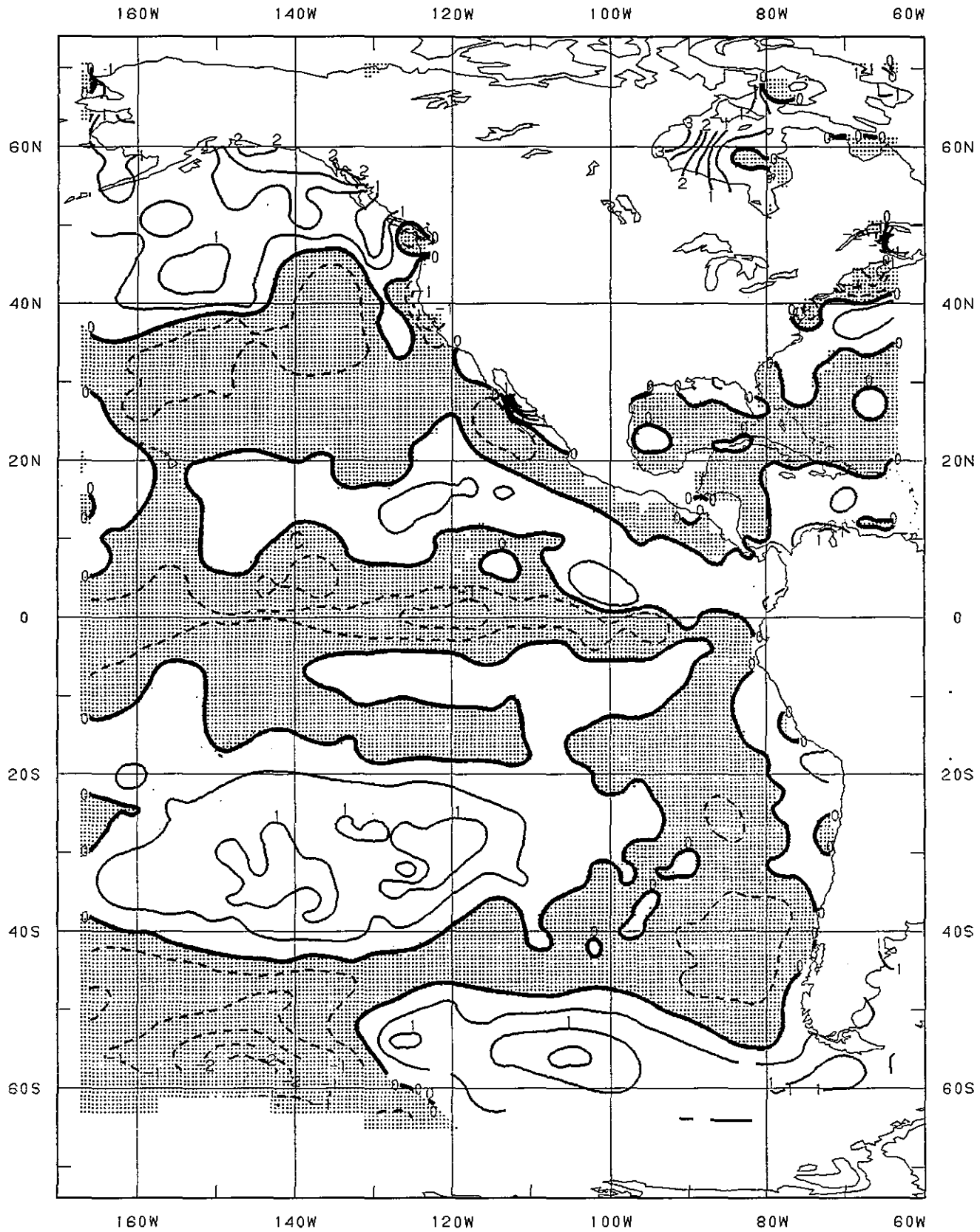

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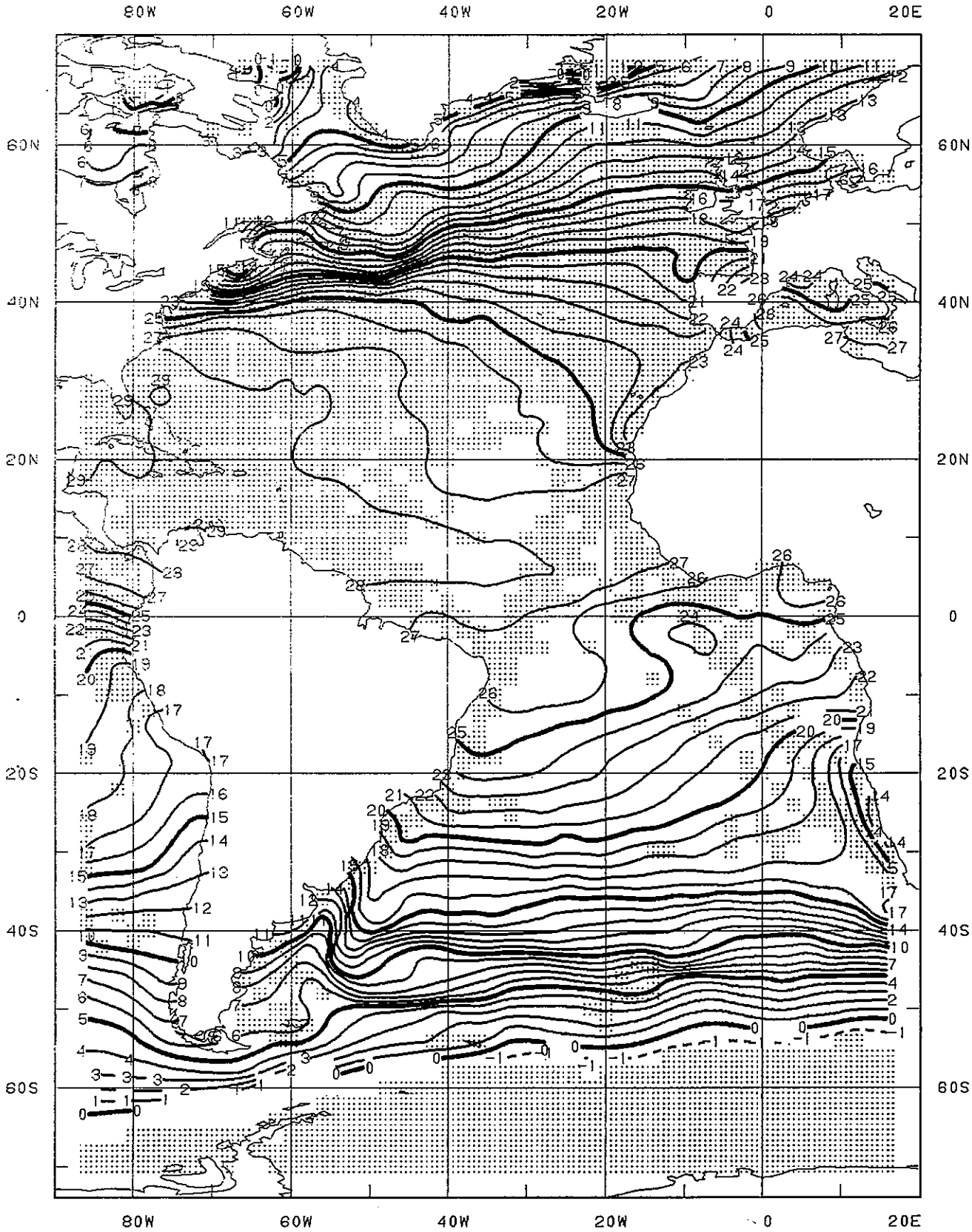

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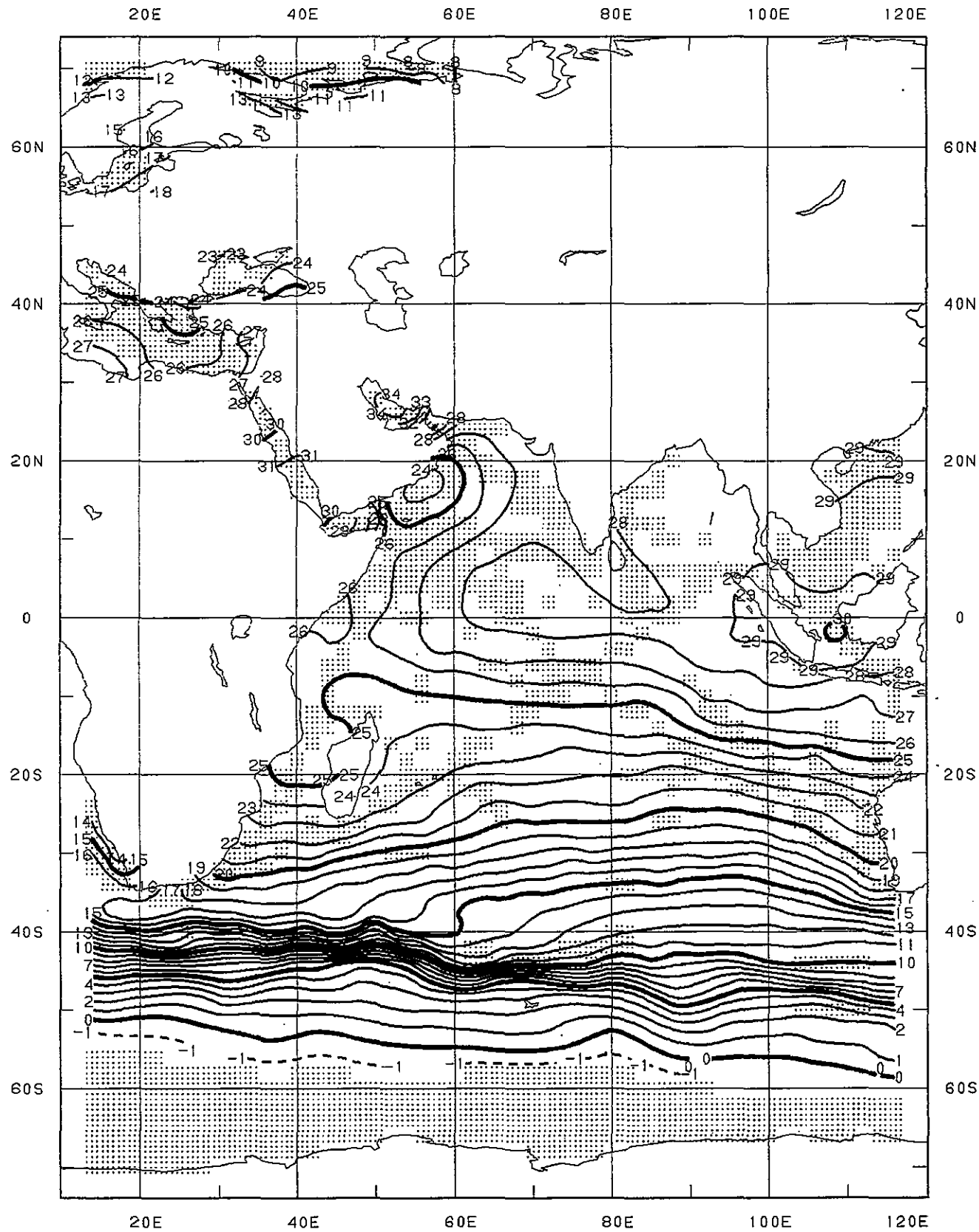

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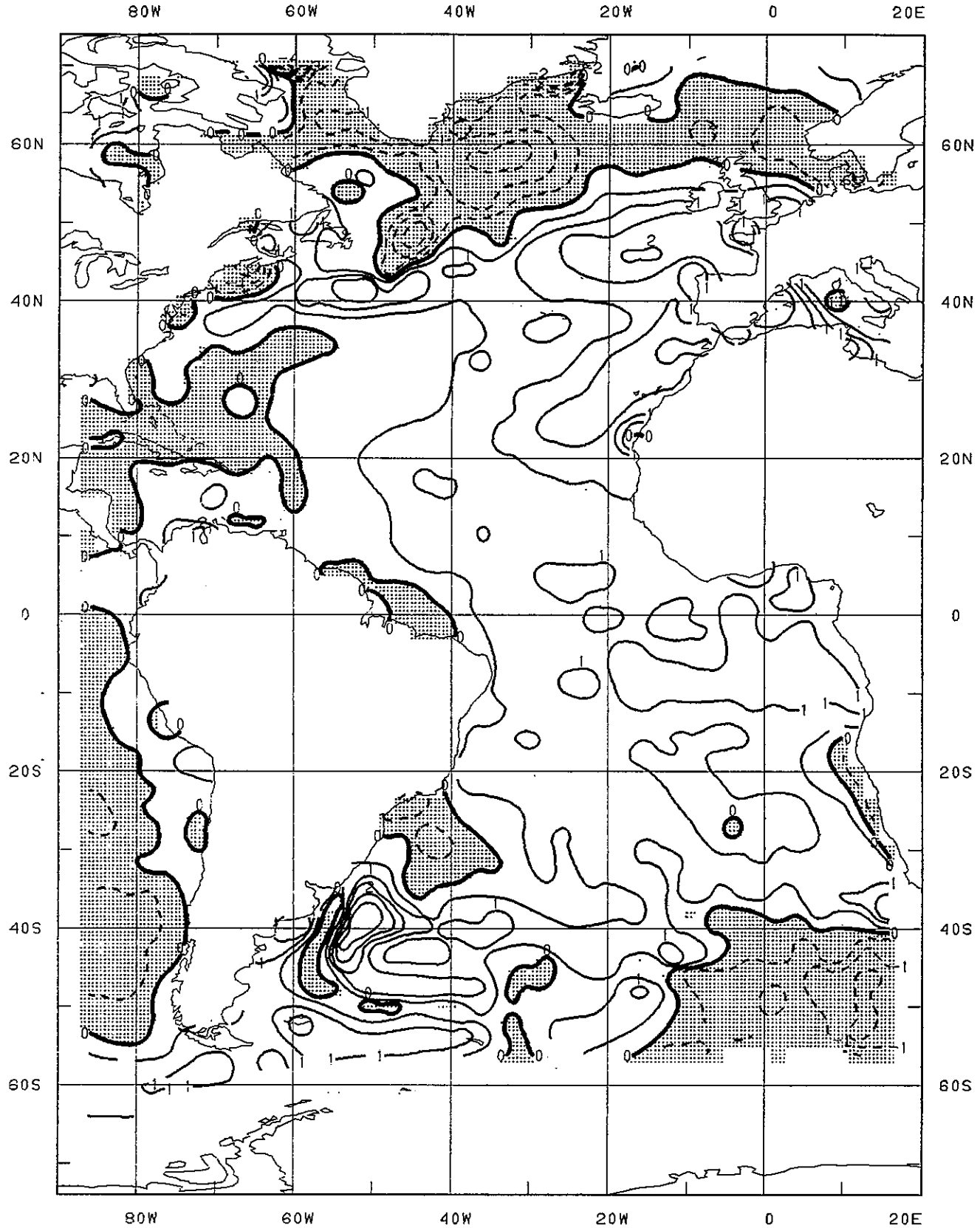

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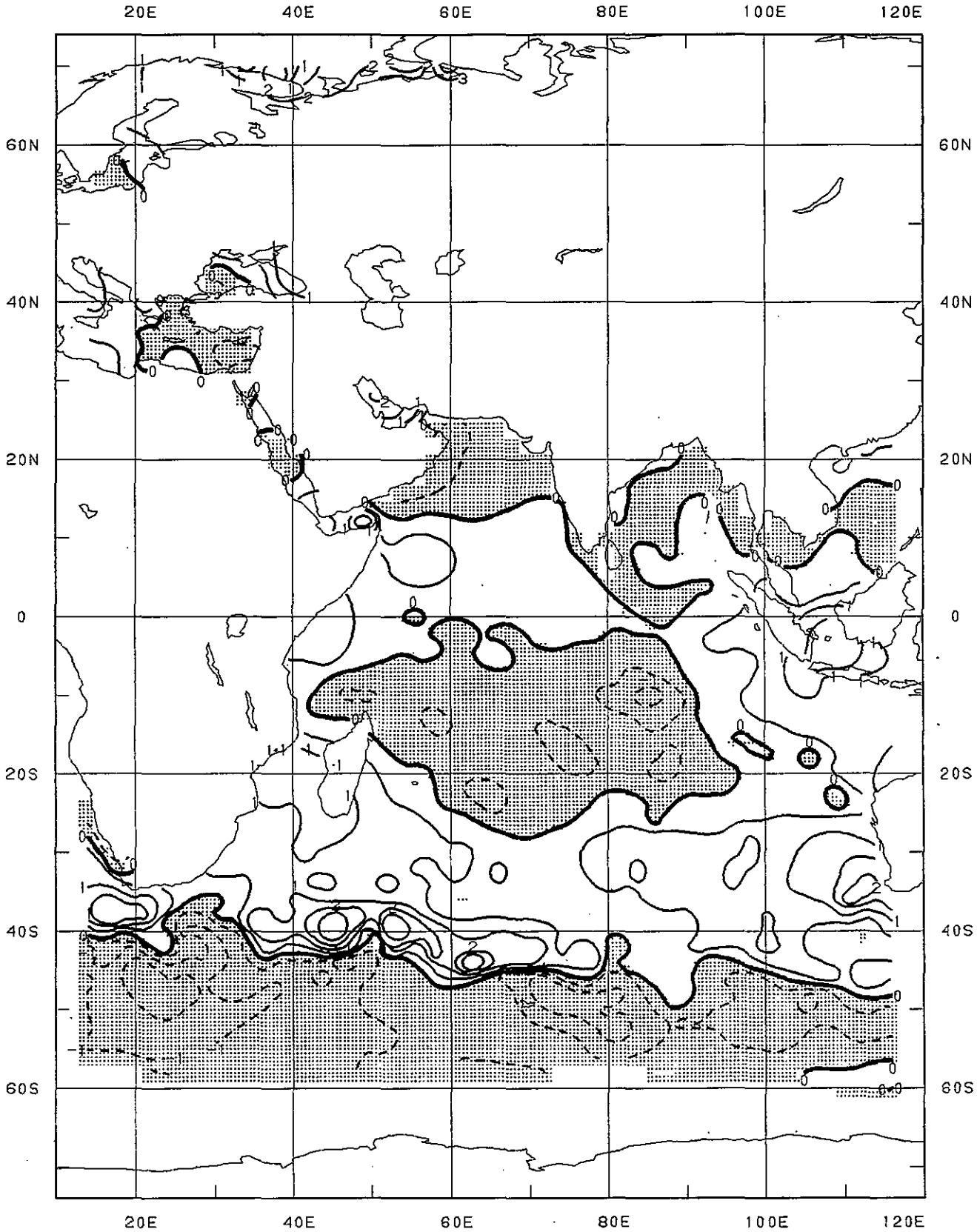

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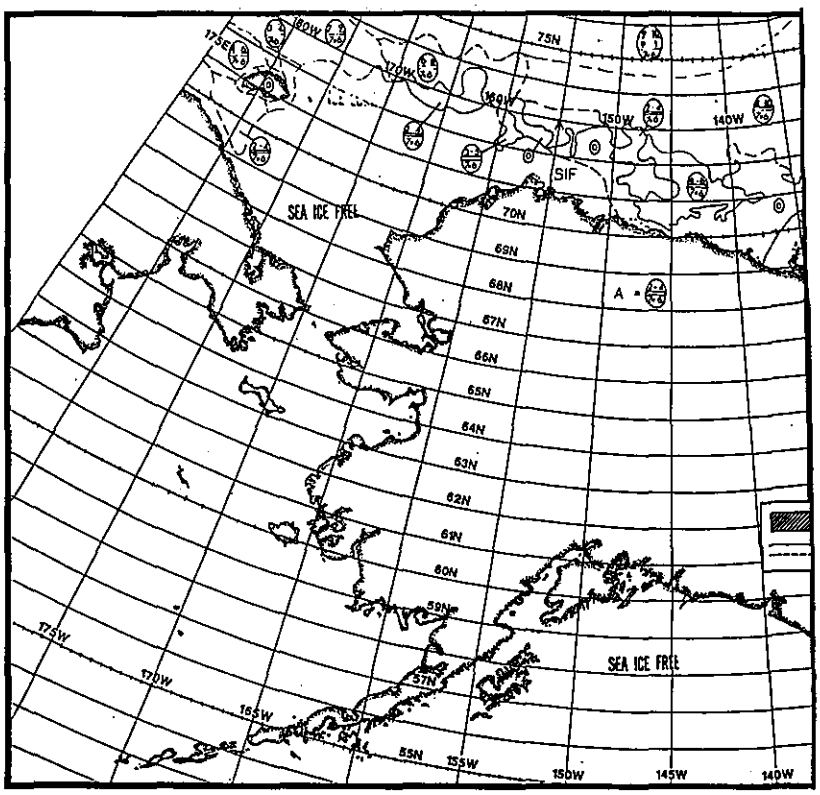

C = Total ice concentration in the area in tenths.

C_a, C_b, C_c = Concentration of thickest (C_a), 2nd thickest (C_b), and 3rd thickest (C_c) ice

S_a, S_b, S_c = Stage of development of thickest (S_a), 2nd thickest (S_b), and 3rd thickest (S_c) ice.

-C = Concentration of ice within area(s) of stripe and patches.

STAGE(S) OF DEVELOPMENT (THICKNESS)

1 = New ice (0-10 cm)
3 = Young ice (10-30 cm)
6 = First year (30-200 cm)
7 = First year thin (30-70 cm)
1. = First year medium (70-120 cm)
4. = First year thick (120-200 cm)
7. = Old ice (survived at least one summer's melt)

EXAMPLES

125 Theoretical thickness of this season's growth (cm).

Fast ice. Sea ice which forms and remains fast along the coast

Ice boundary visually or satellite observed

Ice boundary estimated

BERING SEA / NORTH SLOPE ICE ANALYSIS

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Navy-NOAA Joint Ice Center
National Meteorological Center, W/NMC21
(301) 763-5972

AUGUST 1989

Very warm temperatures persisted along the North Slope during August as they had during July. At the same time, however, sea ice from the northern Chukchi Sea was slowly working toward the southeast and the southern Beaufort Sea retained substantial quantities of sea ice due to a lack of southerly winds. The combined effect was to keep the shipping lane along the coastline nearly sea ice free from Barrow to Barter Island for most of the month but with substantial sea ice lurking only some 30 to 60 nautical miles offshore. By the end of the month, as shown in the accompanying figure, the eastern half of the route had been reduced to "Open Water" as small amounts of sea ice drifted toward shore. The chukchi Sea retained a large area of "sea-ice-free/open-water" conditions that may inhibit the inception of freeze-up as temperatures drop late in September.

WEST COAST OCEAN FEATURES

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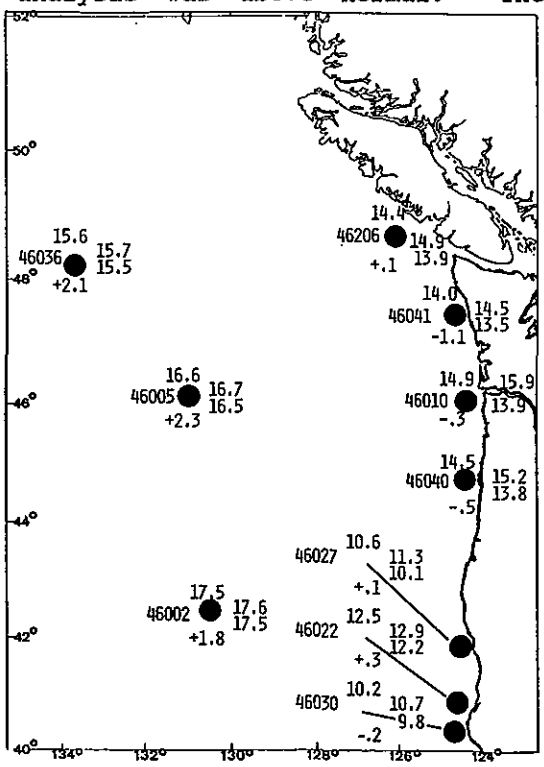
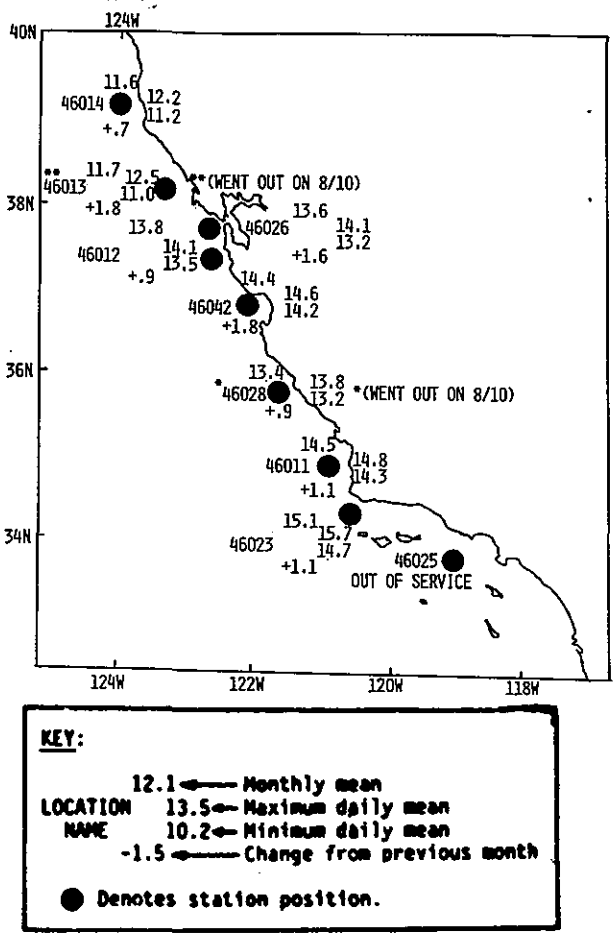
AUGUST 1989

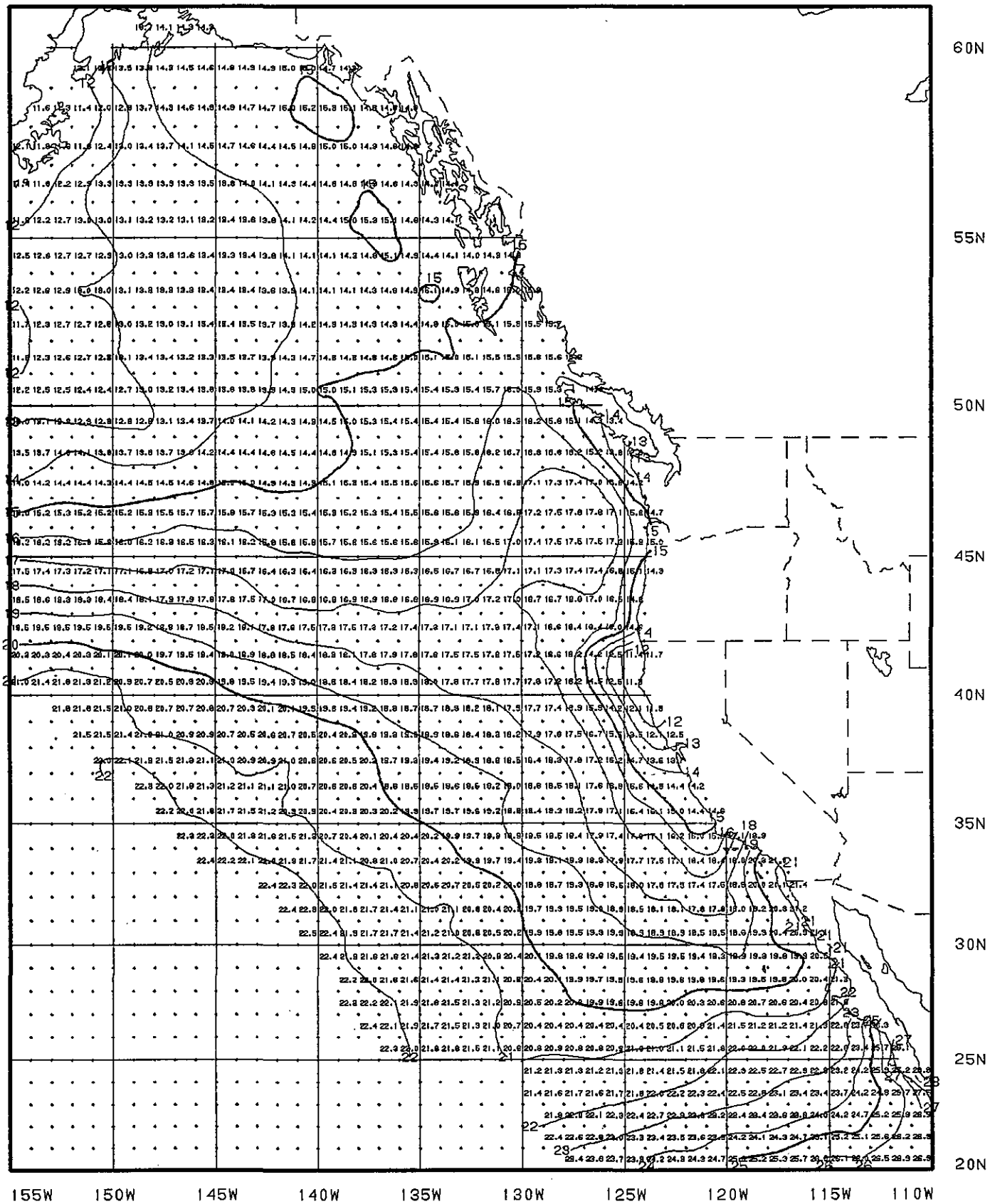
Sea surface temperatures along the U.S. West Coast averaged very close to normal during the month. In the North Panel, two areas averaged cooler than climatology (≤0.5°C). One of the areas was confined to the southwest corner of the chart and the other location was along the central coast of Washington. The remainder of the analysis averaged warmer than normal. The greatest positive anomalies found were +1.5°C near the northwest tip of Vancouver Island and the other was +1.1°C to the west of Cape Blanco, Oregon. There was an obvious warming trend of SST's since the previous month. Values over the entire chart ranged from +0.9°C to +2.0°C. The least warming was again along Washington state and the maximum was analyzed between 44°N and 48°N and west of 130°W.

In the South Panel, SST's north of 36°N and west of 128°W were below normal; the remainder of the analysis was above normal. The greatest cool anomaly (-0.9°C) was found at 34°N/135°W; the least (-0.1°C) was near Pt. Arena, California. Warm anomalies ranged from +0.3°C to +1.9°C. The most warming observed was from just south of the Los Angeles Bight to the northern Baja peninsula. Comparing August to July, there was warming over most of the South Panel ranging from +0.2°C to 1.8°C. Only a small area in the southwest corner of the analysis cooled by a mere 0.1°C.

Fixed buoy statistics showed warming in the offshore areas of the North Panel and throughout the South Panel. The warming in the entire South Panel was the result of weak upwelling activity in the coastal regions. However, in the North Panel as the month progressed, upwelling migrated northward and as a result, the buoy temperatures in Washington and Northern Oregon cooled. There were 8 analyses produced during August in both Panels.







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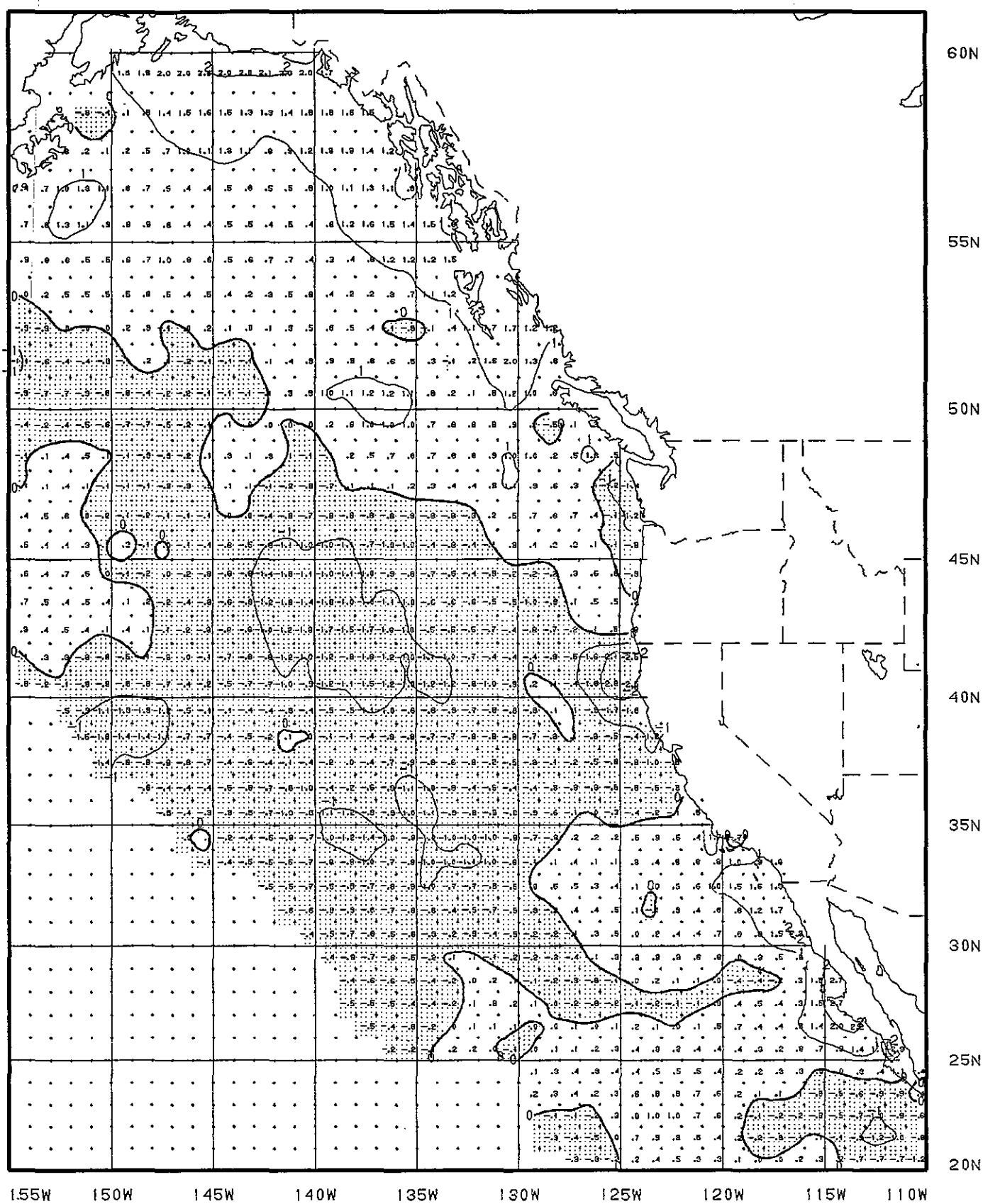

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EAST COAST OCEAN FEATURES

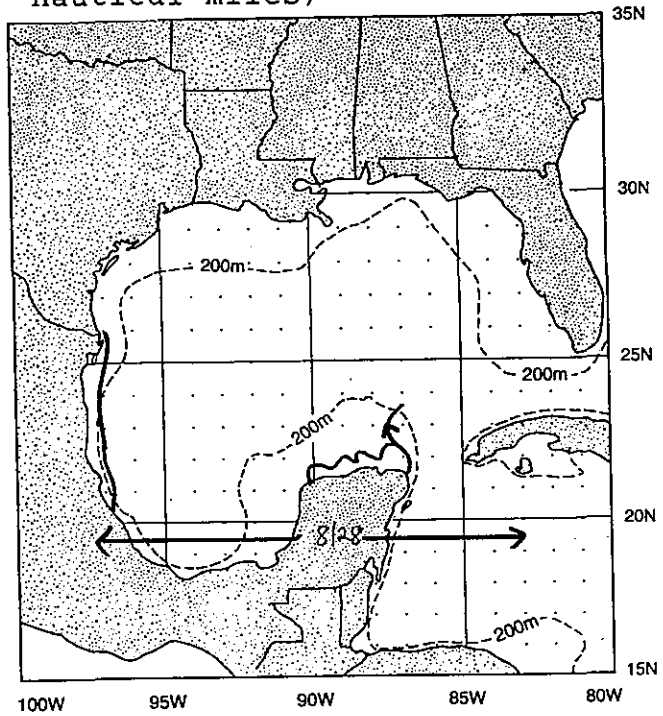
Jenifer Clark
NOAA/NOS

Camp Springs, MD 20746
(301) 763-8294

August 1989

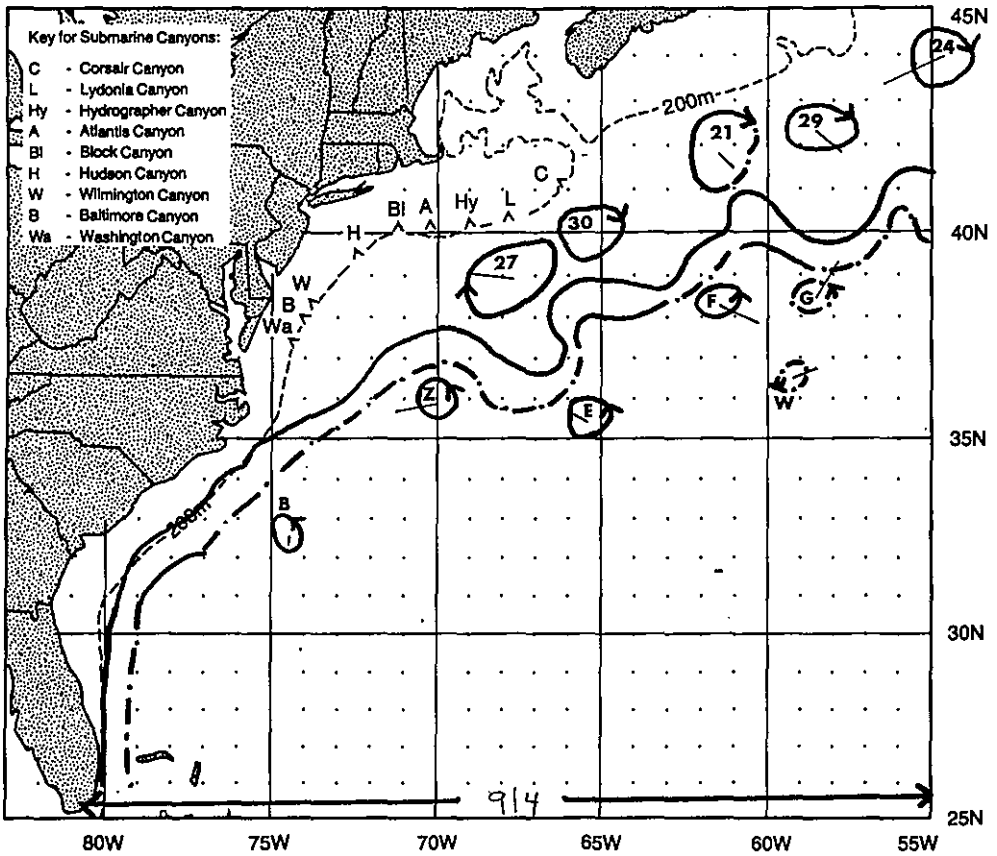
The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the Northwest Atlantic. Cyclonic eddies are labeled A-Z. Arrows on eddies indicate direction of circulation. Warm-core or anticyclonic eddies rotate clockwise; cold-core or cyclonic eddies rotate counterclockwise. The line to the eddy center shows the net translation since last month or since last observed. The edge of continental shelf at 200 m is shown as a dashed line. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart or are indicated by "dot-dashed" lines. The long arrows at the bottom of the chart indicate the dates of data used.

Data used in this analysis include:
Infrared imagery from NOAA satellite - NESDIS
Bathythermograph data from National Meteorological Center of National Weather Service
Oceanographic Analysis -- A daily detailed analysis issued by National Weather Service
(Data accuracy is 1-2C and 5-10 nautical miles)



GULF OF MEXICO

Due to continued seasonly high sea surface temperatures (SSTs), not many features were discernible in the Gulf of Mexico. However, on August 29 a possible Loop Current edge was faintly detected from about 21.5°N 87.0°W to 23.5°N 87°W. SSTs were 30-31°C east of this boundary and 29-30°C west of it. Two areas of upwelling were noted north of Yucatan from 21°N 90°W to 22°N 87°W and along Mexico from 26°N 97°W to 20°N 97°W. SSTs in both upwelled areas were about 27°W while SSTs in the remainder of the Gulf of Mexico ranged from 28-31°C.



NORTHWEST ATLANTIC

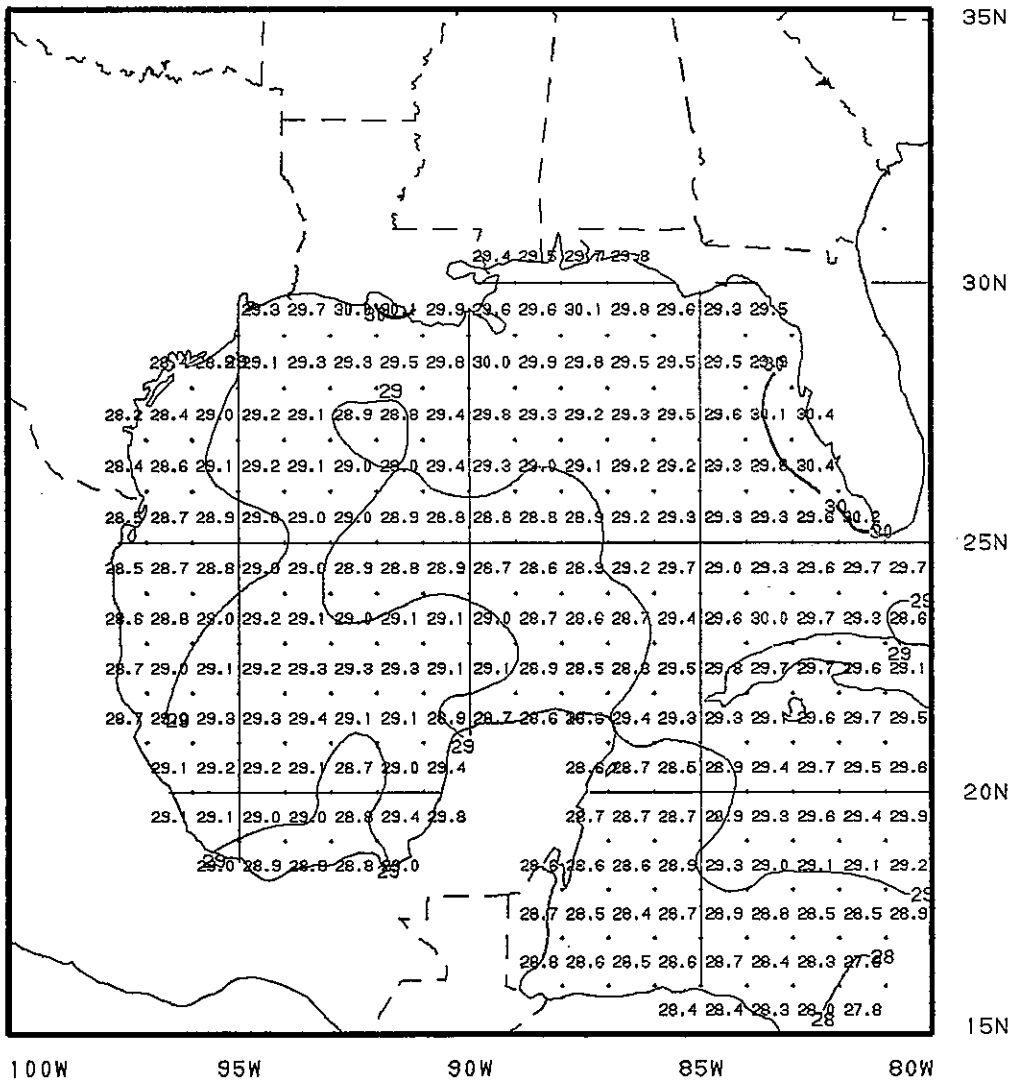
One new anticyclonic eddy formed during August. Eddy 30 detached from a Gulf Stream meander near 40°N 65°W on August 14. Two warm (anticyclonic) eddies were apparently absorbed during August. Eddy 28 was absorbed by a meander near 40°N 67°W around August 28. Eddy 22 moved 110 km NW where it was absorbed by eddy 30 around September 1.

Eddy 27 interacted with a Gulf Stream meander on August 28 but maintained its identity. It was pushed 110 km ESE by this meander. Eddy 21 drifted 65 km NW while Eddy 29 drifted 90 km NW. Eddy 24 translated 165 km NE.

One new cyclonic eddy formed during August. However, it was not named since it only lasted one week. A Gulf Stream trough pinched off a cold eddy near 36°N 67°W on August 21. By August 28, this eddy was resorbed by the same meander. Eddy H, previously observed near 34°N 66°W, was deleted from the analysis since it was not observed during the month.

Eddy B moved only 25 km NNE. Eddy Z traveled 110 km E and eddy E traveled 55 km SE. Eddy F drifted 140 km NW. Eddy W, last observed on August 11, translated 110 km WSW. Eddy G apparently drifted 110 km SW.

EAST COAST SST – MONTHLY MEAN



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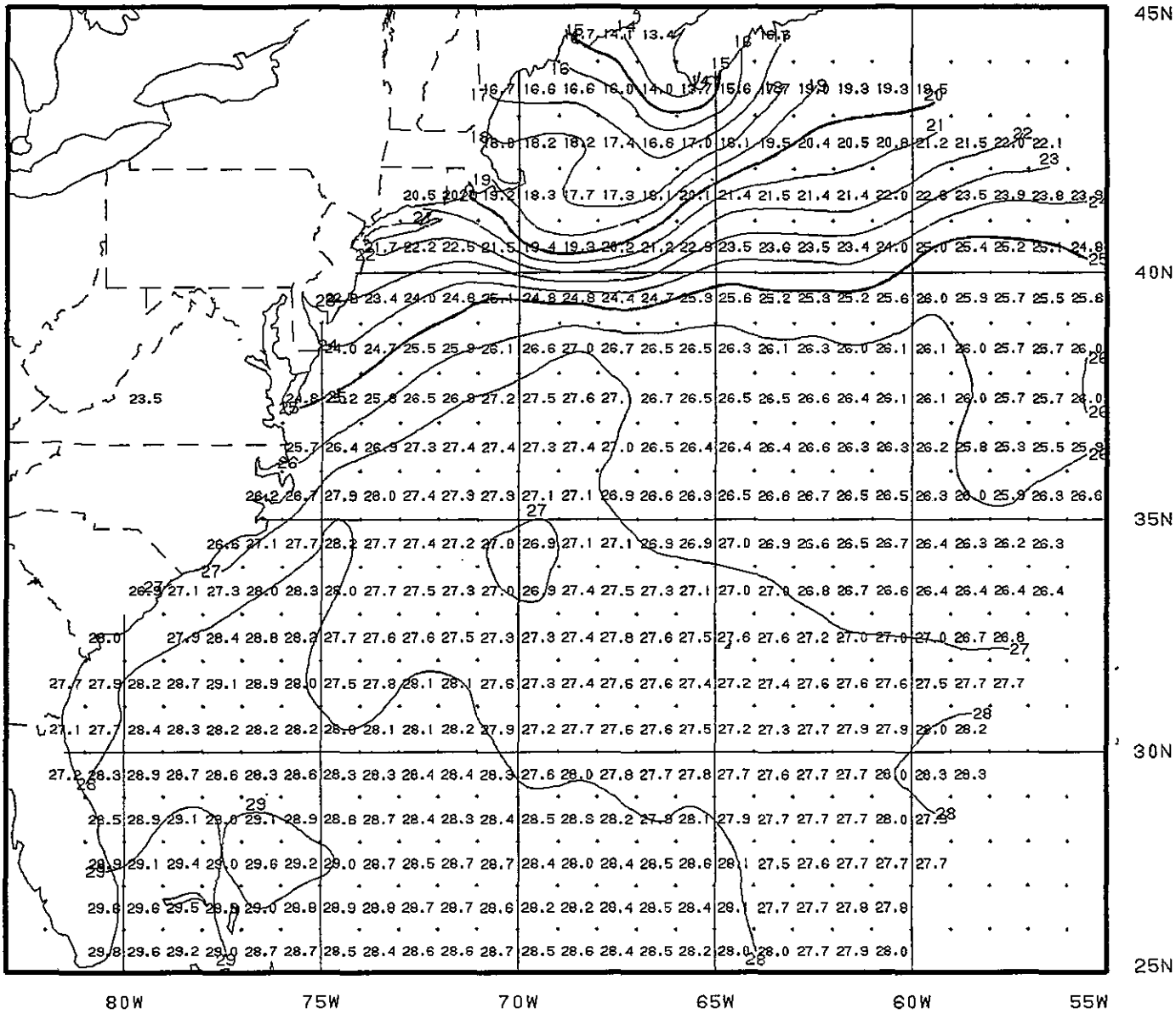

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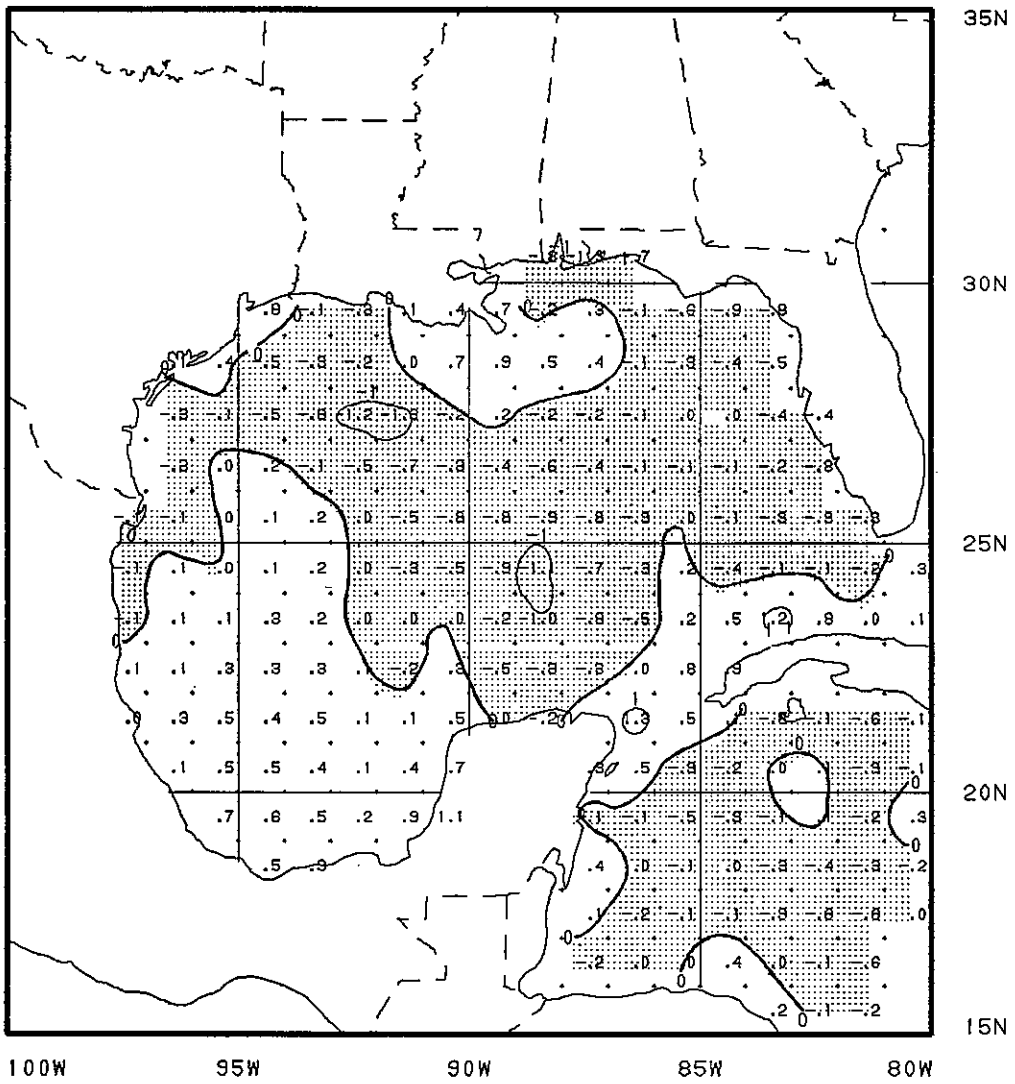

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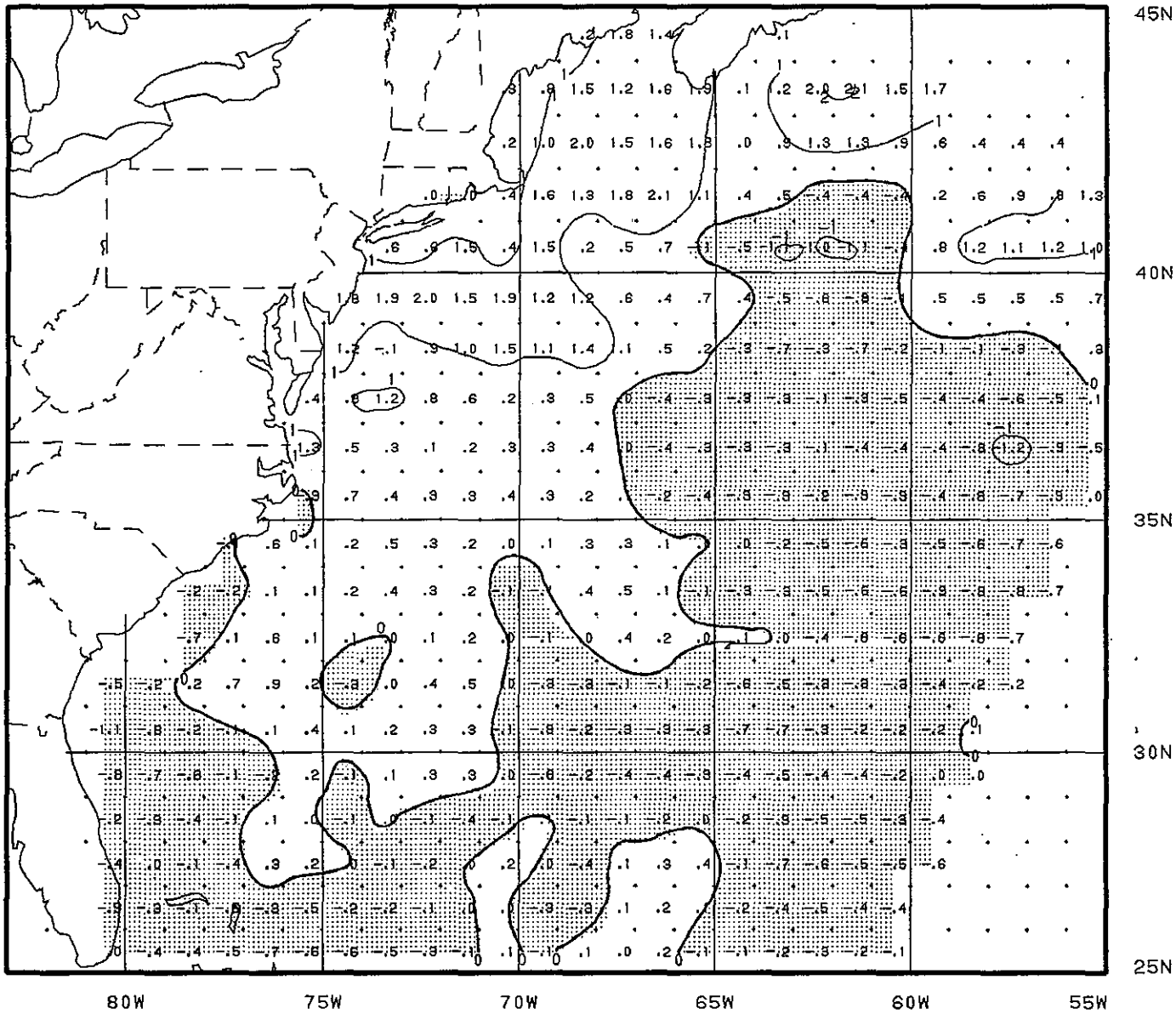

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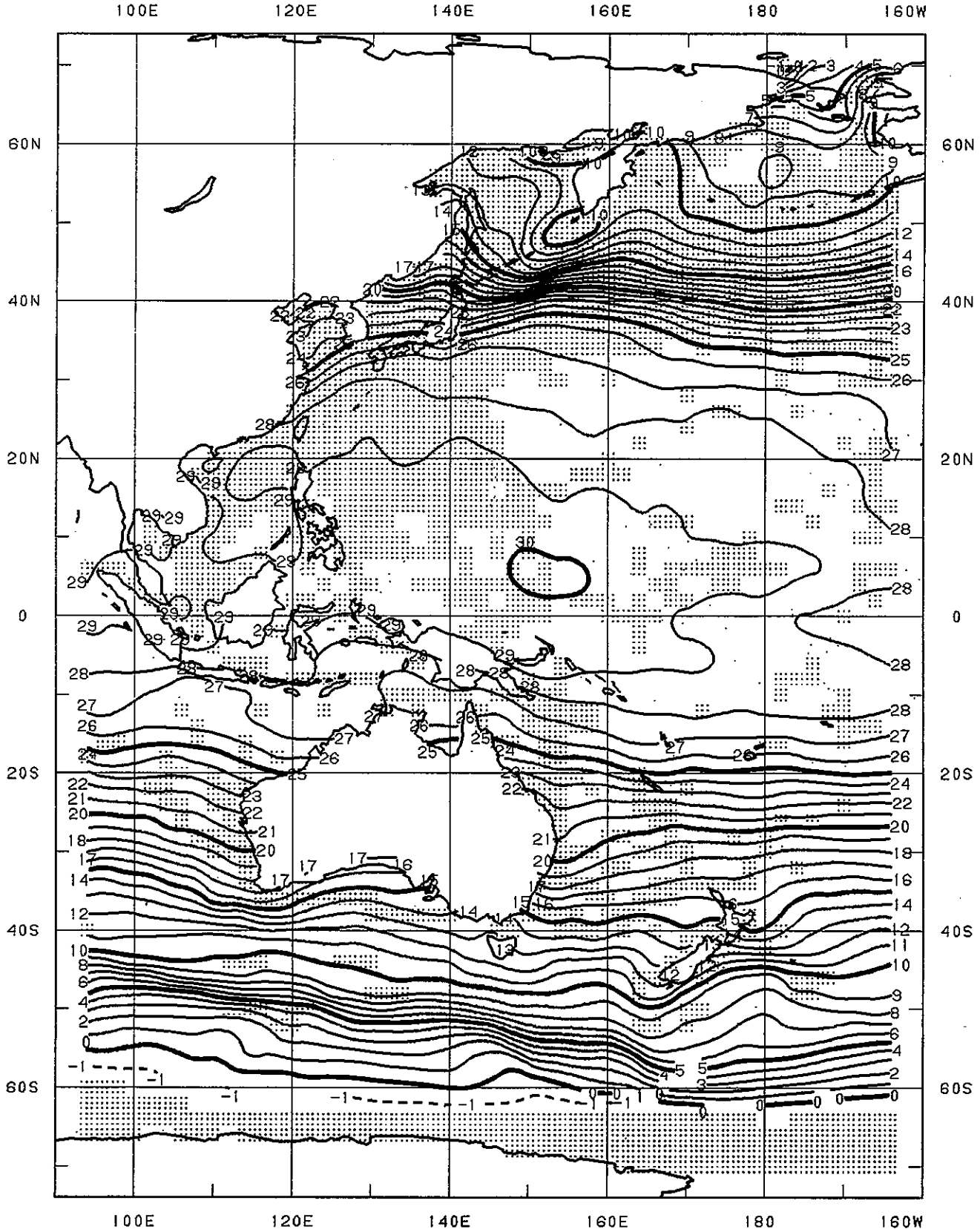

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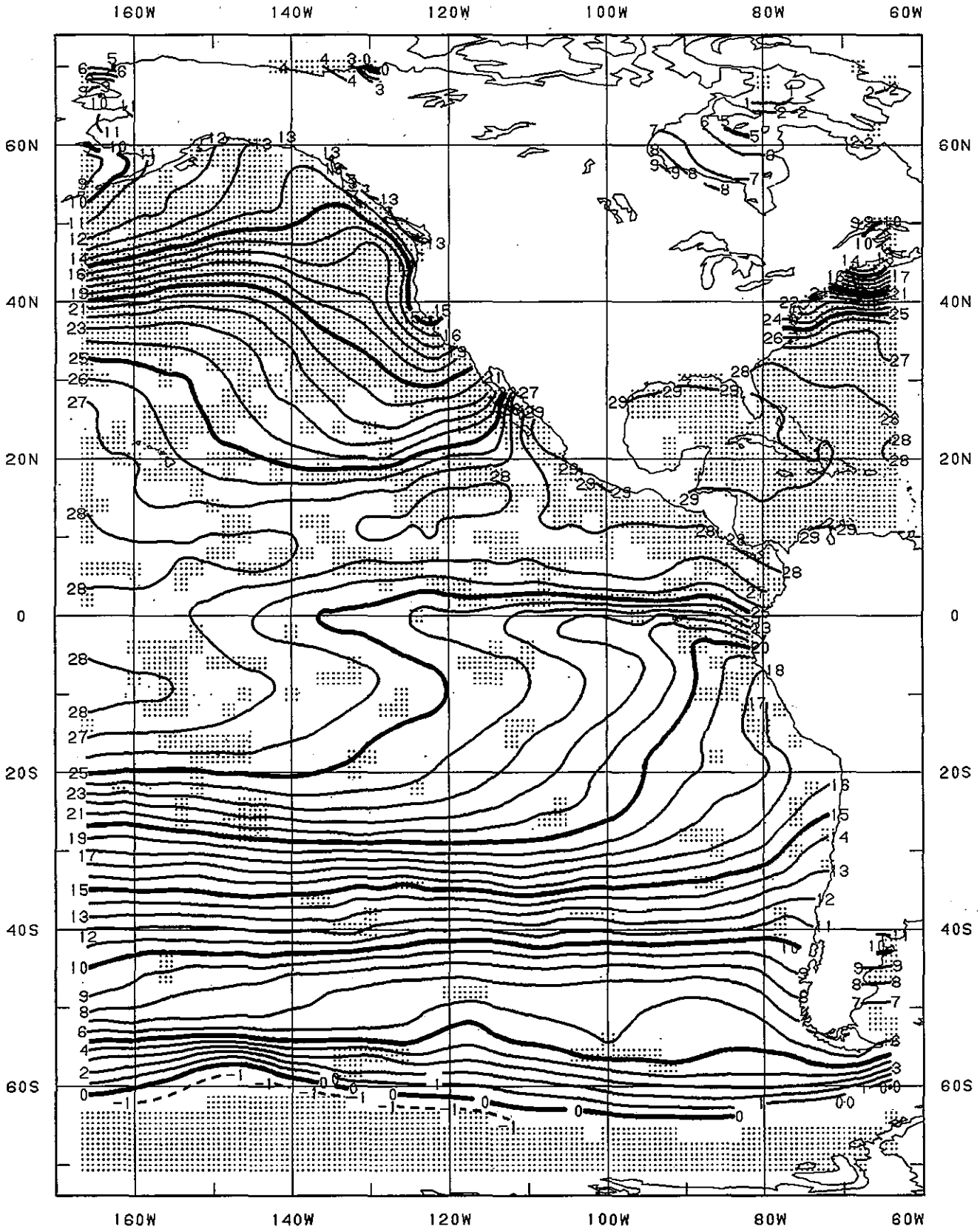

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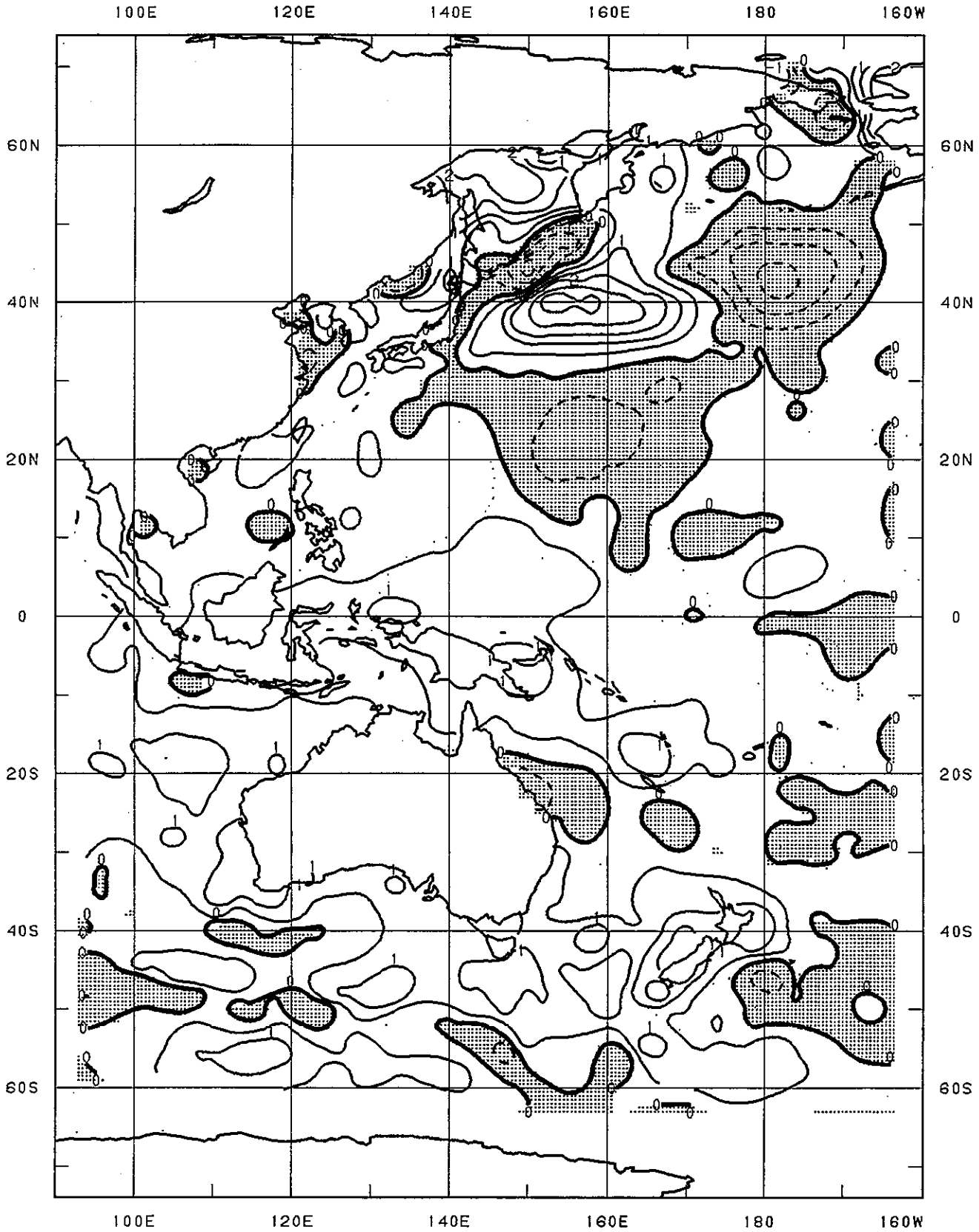

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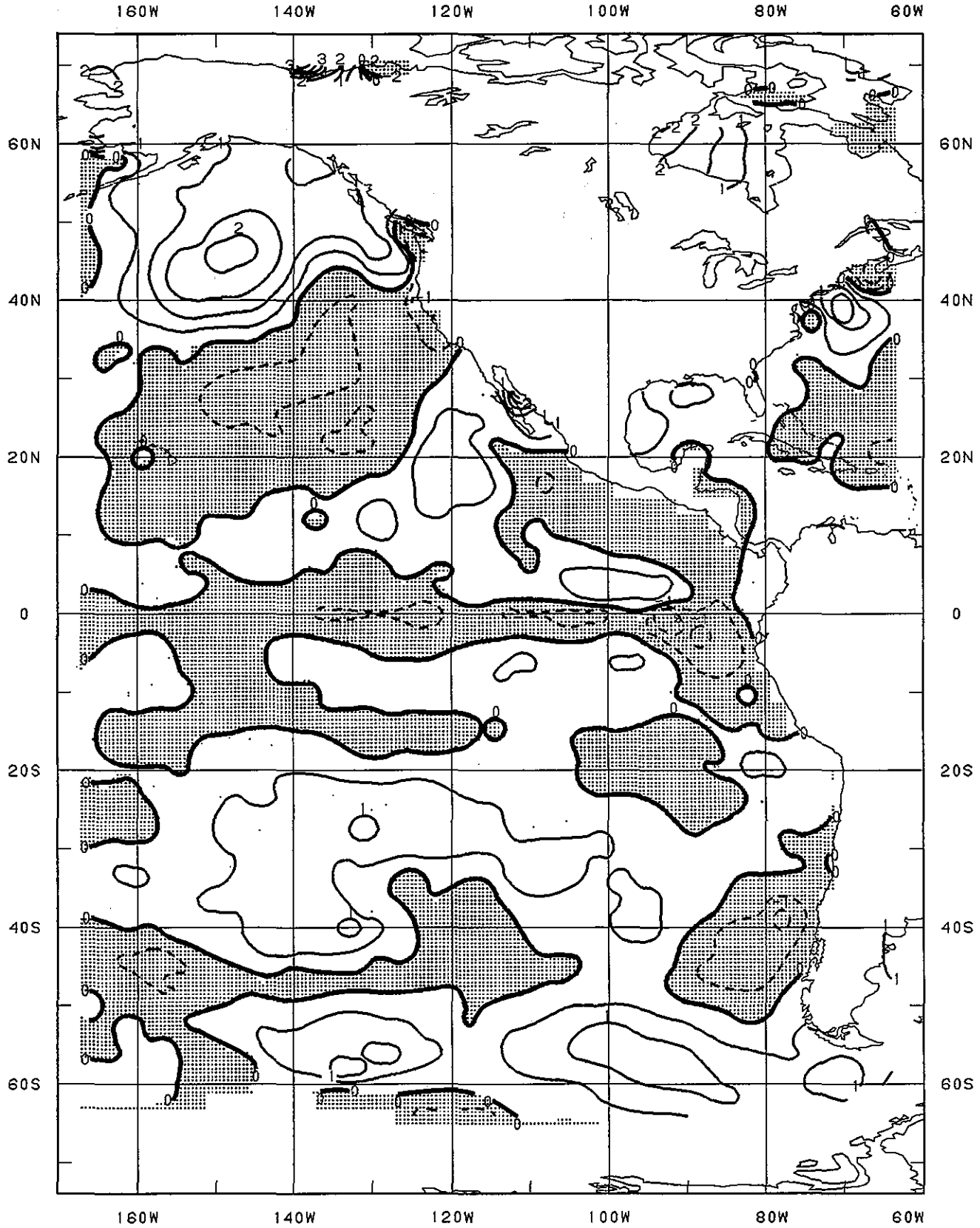

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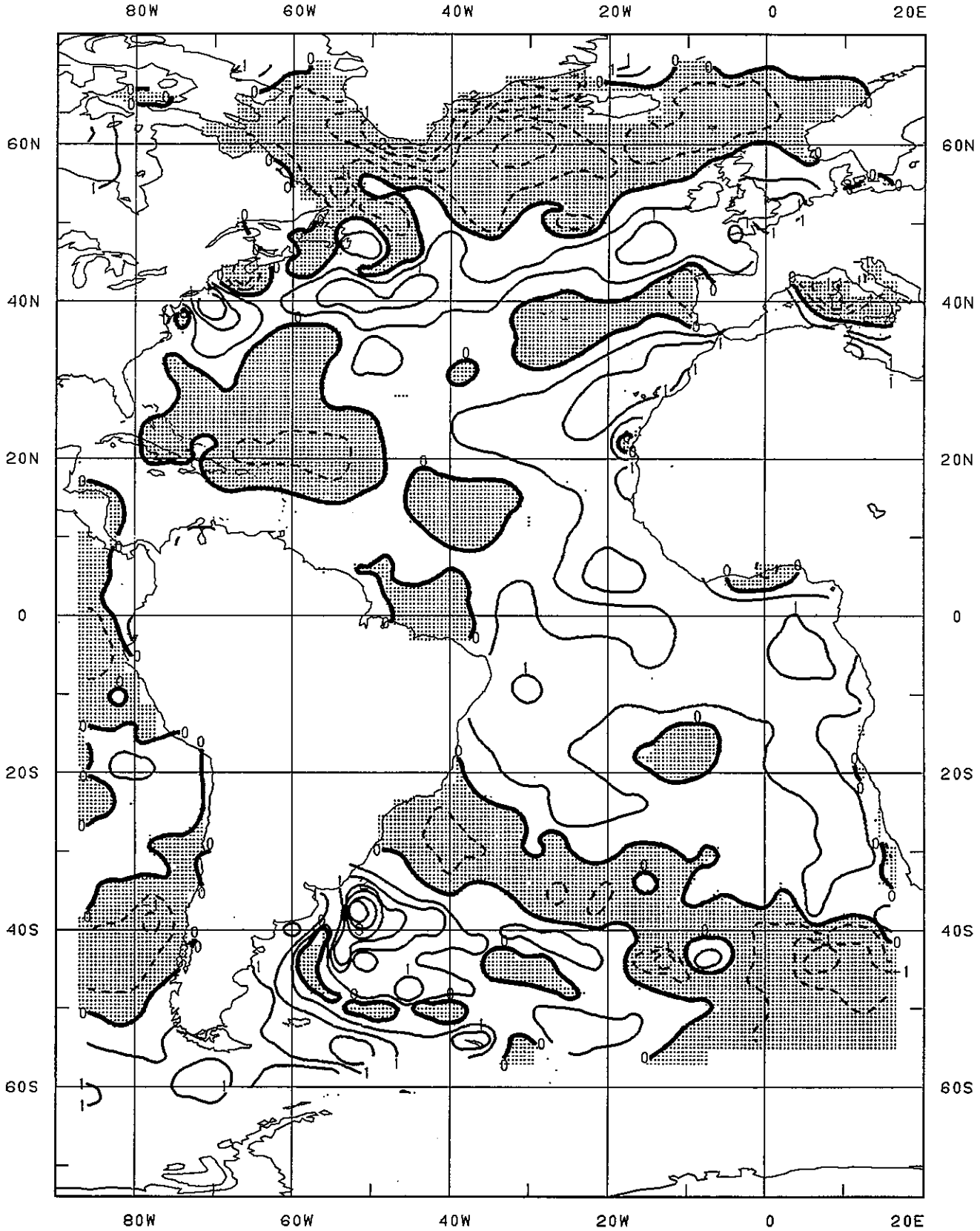

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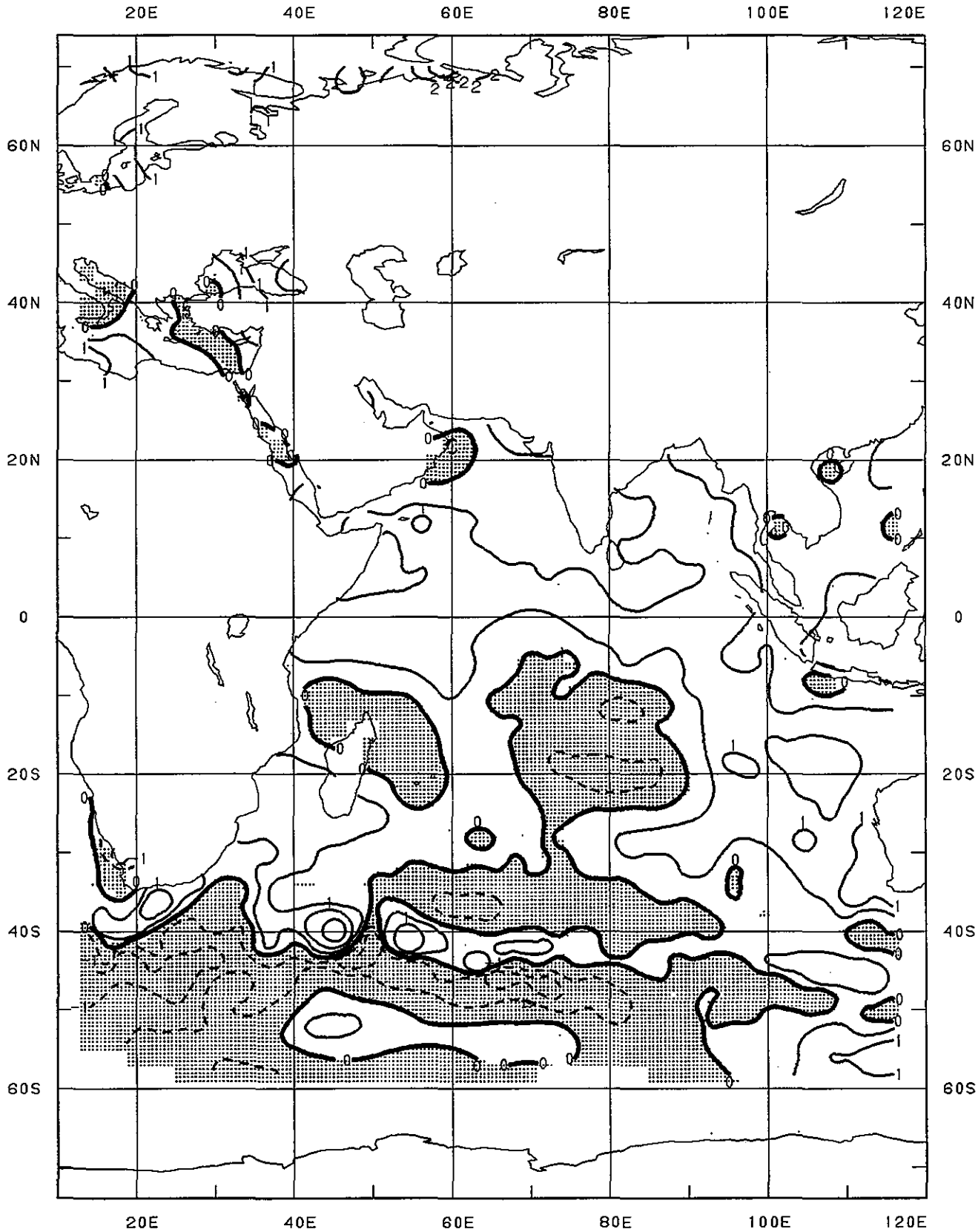

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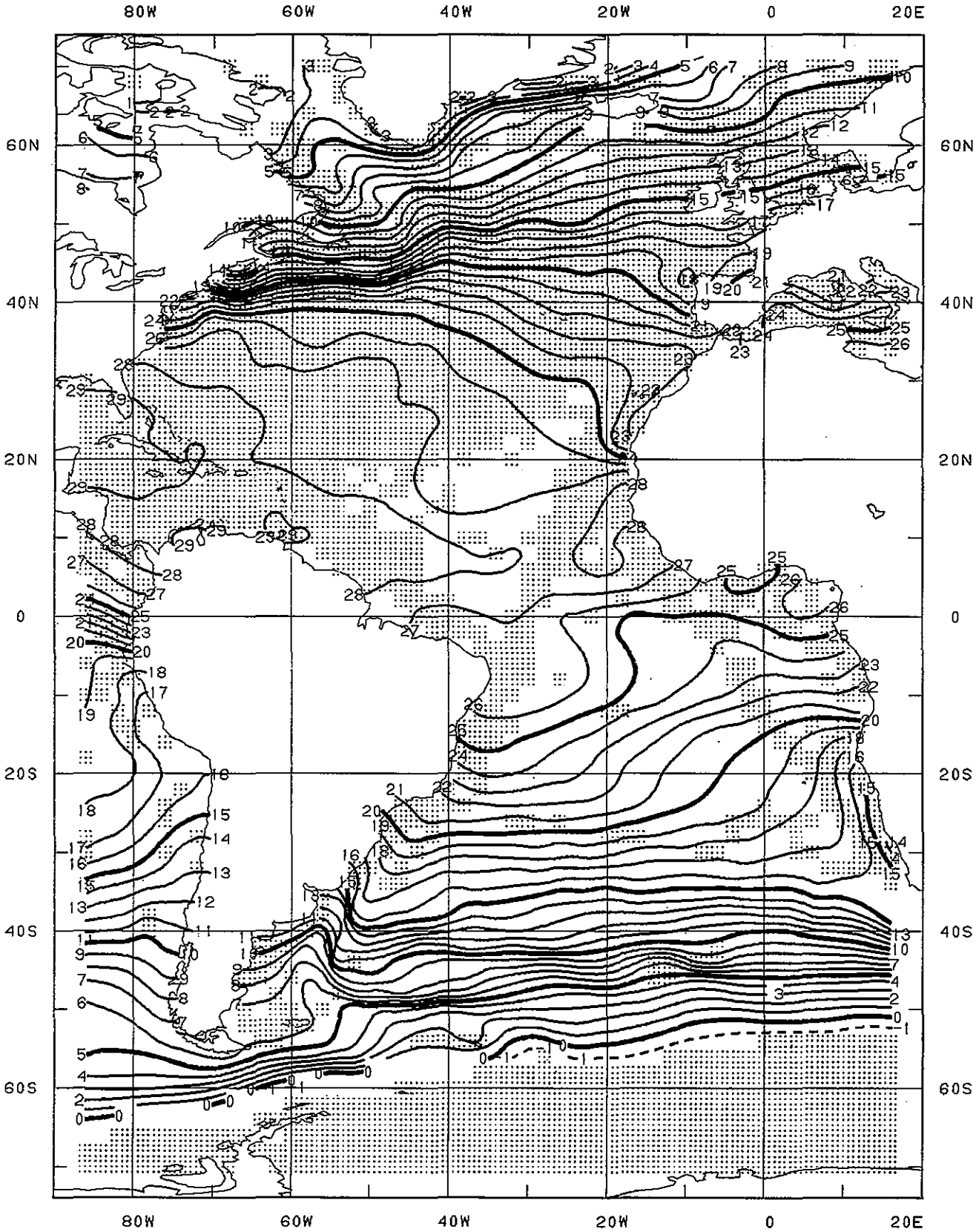

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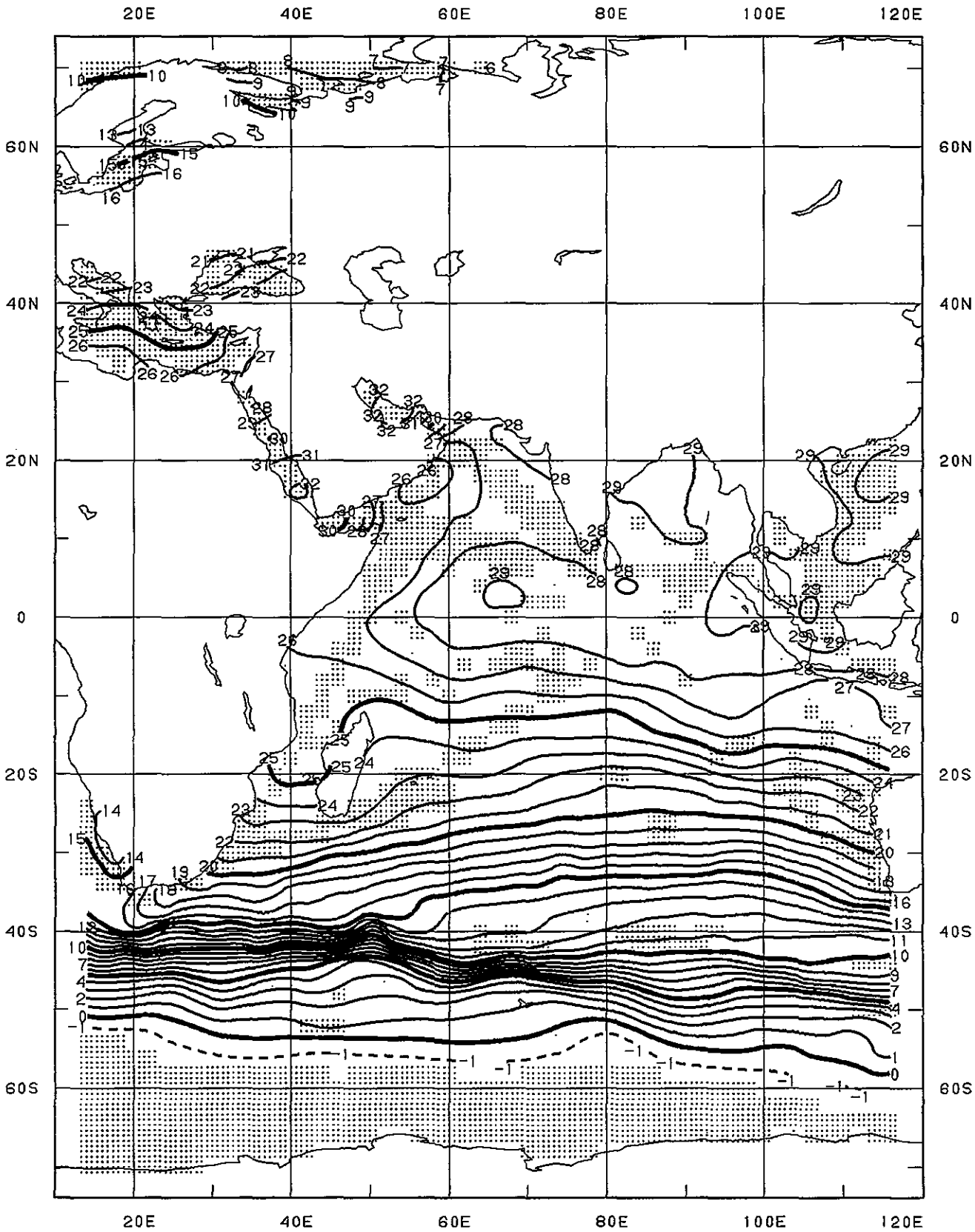

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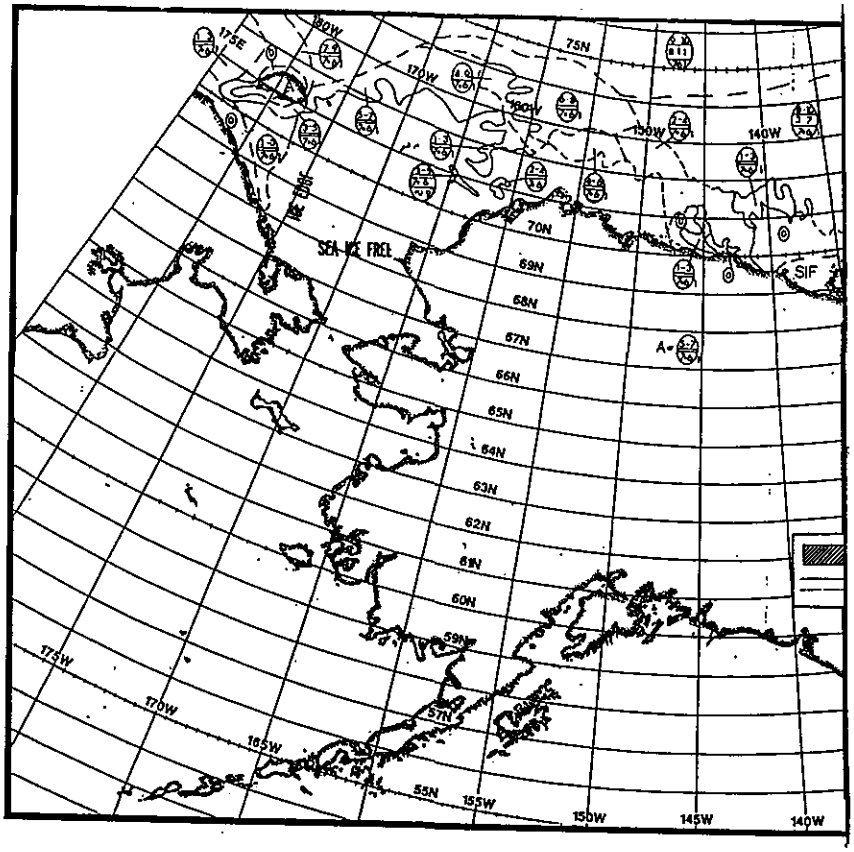

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EXAMPLES

125 Theoretical thickness of this season's growth (cm).

Fast ice Sea ice which forms and remains fast along the coast

Ice boundary visually or satellite observed

Ice boundary estimated.

BERING SEA / NORTH SLOPE ICE ANALYSIS

Gary M. Wohl, NOAA
Navy-NOAA Joint Ice Center
National Meteorological Center, W/NMC21
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SEPTEMBER 1989

After two record warm months the North Slope area returned to more normal conditions during September. However, sea ice conditions were more varied than the temperature regime might indicate. This month's sea ice condition chart was prepared on September 20 and was based, in part, on airborne RADAR reports gathered in support of exploratory operations in the Chukchi Sea. Several patches of sea ice were identified well south of the edge of the polar ice pack despite the abnormally warm temperatures. Similarly, some very light concentrations of ice persisted in the Barter Island area, about 80 to 100 nm south of the polar pack ice edge. By month's end the patches in the Chukchi Sea had vanished, most of the ice near Barter Island had ablated, and the pack remained about 60 nm north of Point Barrow.

WEST COAST OCEAN FEATURES

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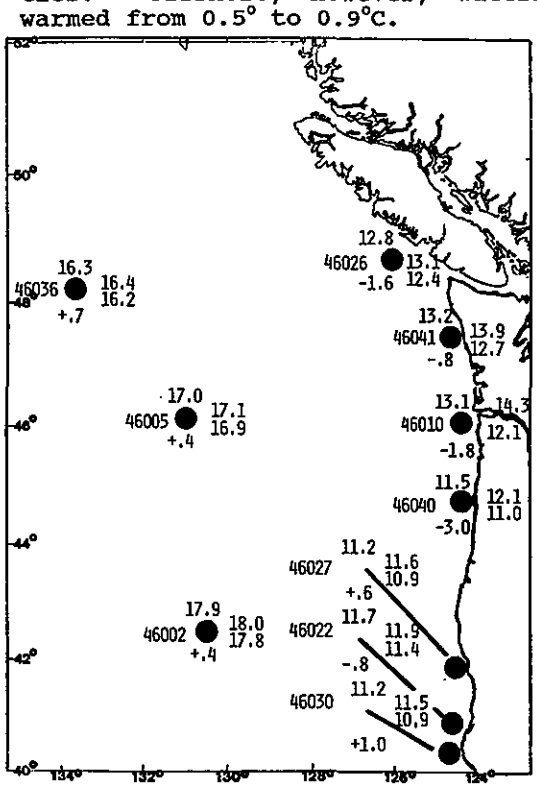
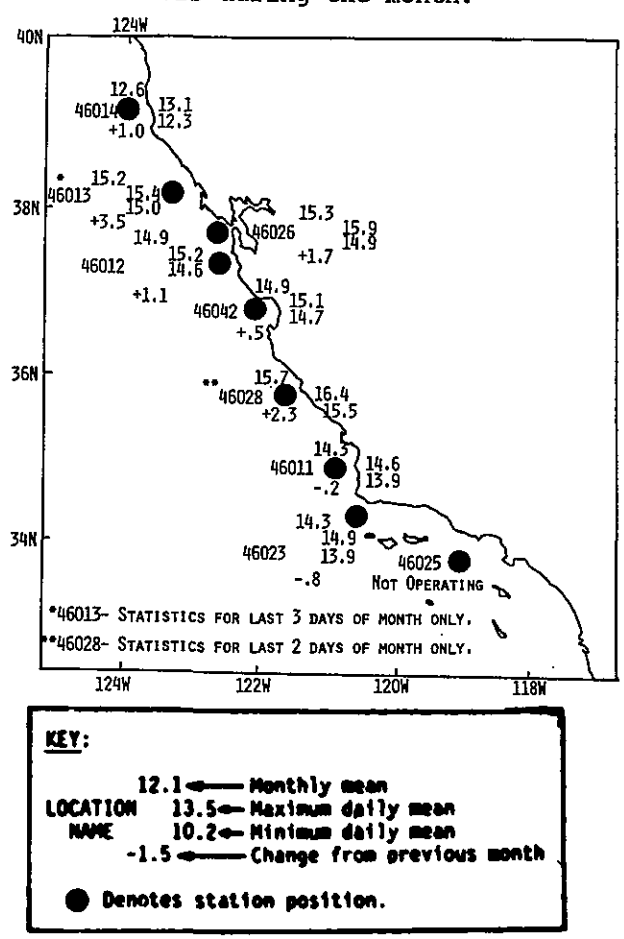
SEPTEMBER 1989

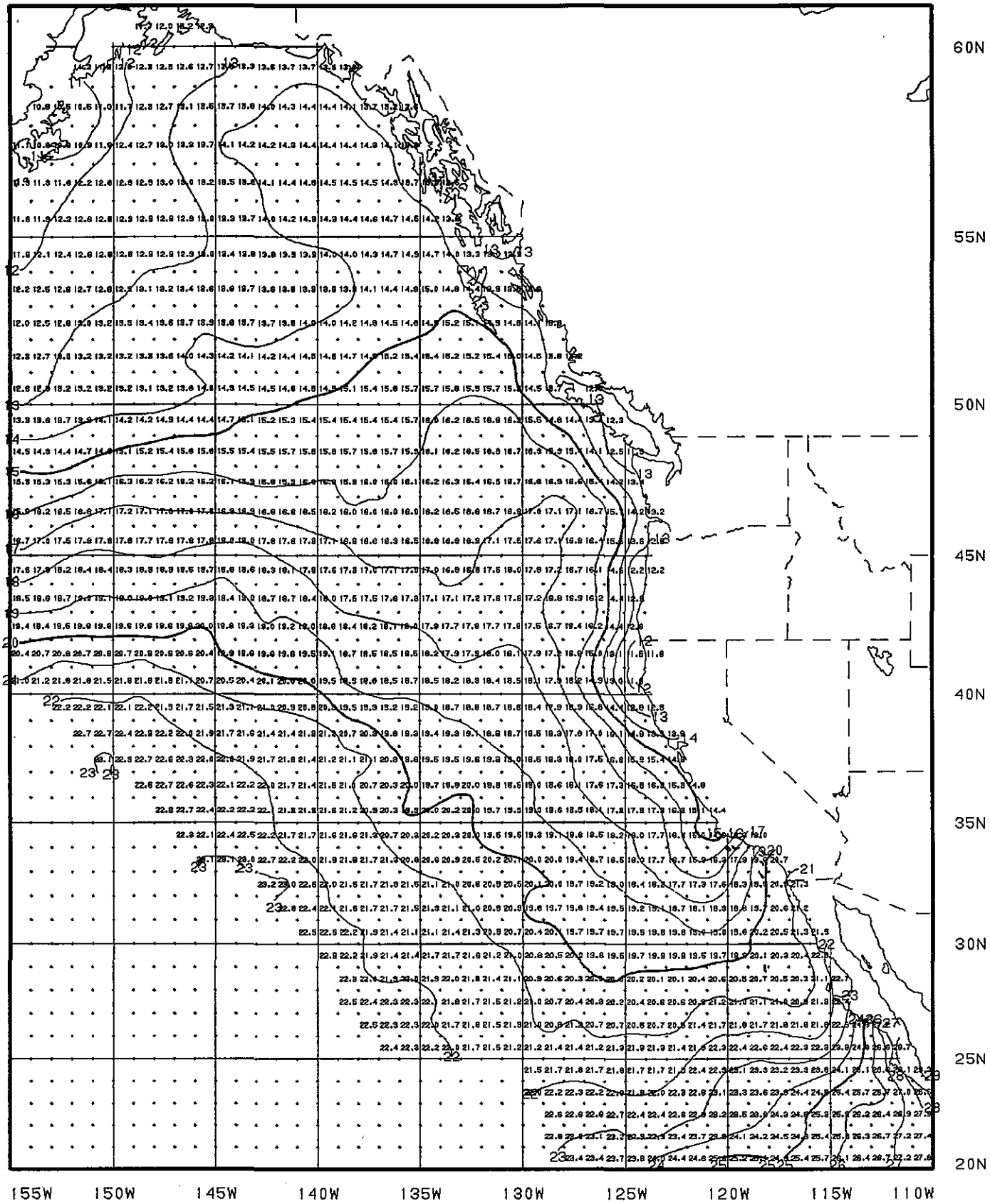
Sea surface temperatures in September averaged slightly above normal in both the North and South Panels. The overall mean temperature for the North Panel was computed to be 16.8°C, 0.3°C above the climatological mean; the South Panel was 19.2°C, 0.1°C above the mean.

In general, nearshore waters in the North Panel were below normal and offshore waters above normal. The greatest negative anomaly observed (-0.8°C) was analyzed to the west of Cape Blanco, Oregon. The highest positive anomaly (+1.2°C) was found in the northwest quadrant of the chart. Water temperatures along the 40th parallel averaged near normal. As a result of continuous upwelling activity on the coast. In fact, temperatures dropped between 0.9°C and 1.2°C in the four coastal locations used to produce the statistics. Offshore, however, waters warmed from 0.5° to 0.9°C.



In the South Panel, offshore waters averaged below normal and nearshore waters above normal. The negative anomalies (from 0.1° to 0.8°C) were observed west of 128°W. The greatest positive anomalies were found at 35°N/117°W (+1.0°C) and 31°N/117°W (+1.8°C). All other positive values were between +0.1° and +0.7°C. Comparing this month to last, SST's warmed throughout the analysis area except for one location in the Los Angeles Bight; here, the temperature dropped a mere 0.1°C since August. The greatest warming (+1.2°C) was observed just south of the San Francisco Bay or at 37°N/123°W. All other locations warmed between 0.1° and 0.9°C. The warming that occurred in the nearshore was the result of a relaxation in the upwelling activity. As the upwelling season (April to October) progresses, the upwelling activity moves farther north. The statistics generated from the 3-hourly buoy reports (see graphics) also verify the findings from the eight analyses produced in each of the Panels during the month.





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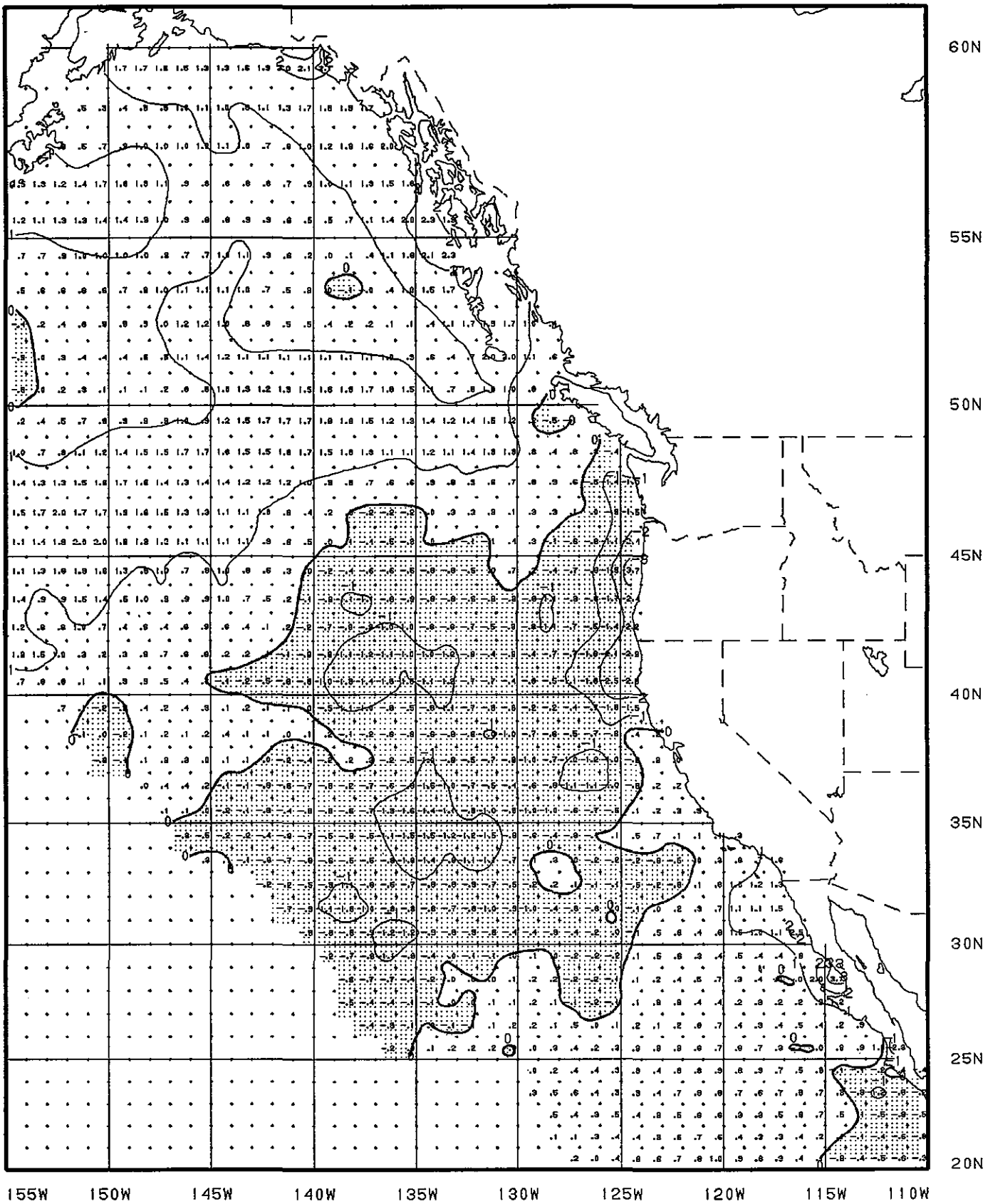

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EAST COAST OCEAN FEATURES

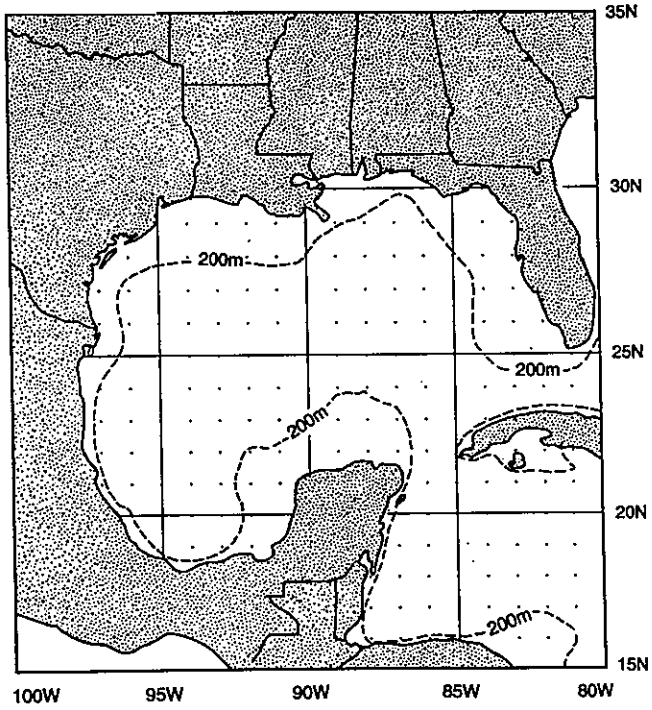
Jenifer Clark
NOAA/NOS

Camp Springs, MD 20746
(301) 763-8294

SEPTEMBER 1989

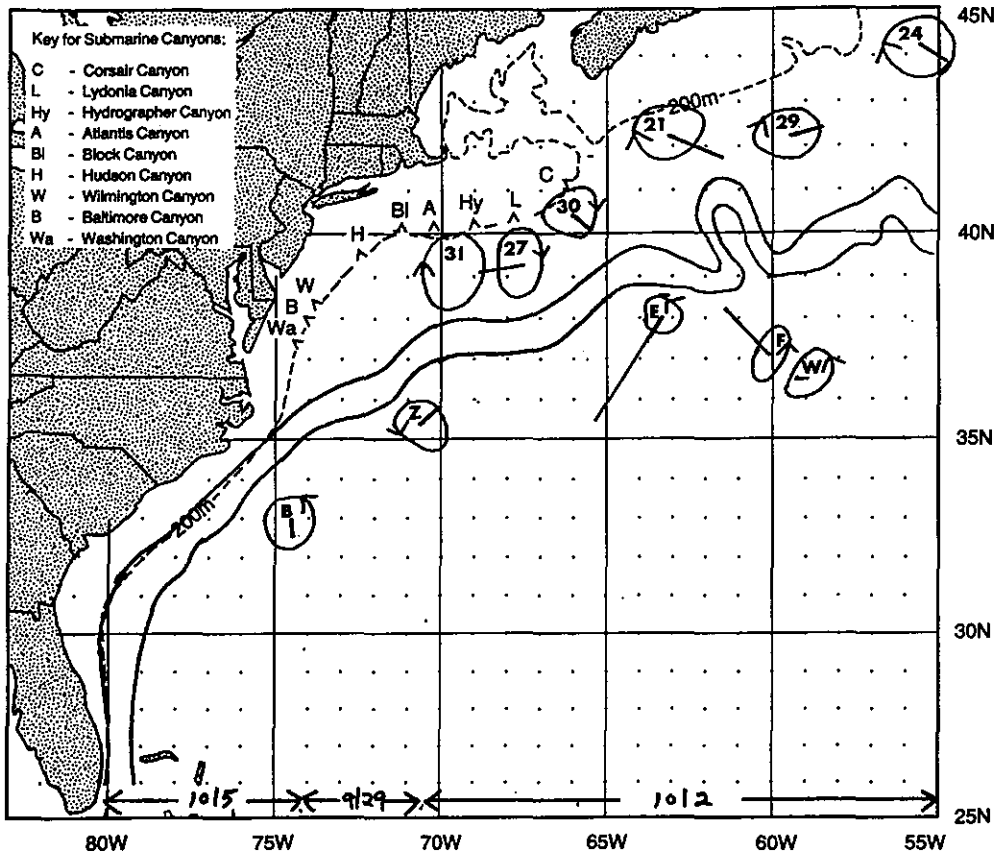
The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the Northwest Atlantic. Cyclonic eddies are labeled A-Z. Arrows on eddies indicate direction of circulation. Warm-core or anticyclonic eddies rotate clockwise; cold-core or cyclonic eddies rotate counterclockwise. The line to the eddy center shows the net translation since last month or since last observed. The edge of continental shelf at 200 m is shown as a dashed line. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart or are indicated by "dot-dashed" lines. The long arrows at the bottom of the chart indicate the dates of data used.

Data used in this analysis include:
Infrared imagery from NOAA satellite - NESDIS
Bathythermograph data from National Meteorological Center of National Weather Service
Oceanographic Analysis -- A daily detailed analysis issued by National Weather Service
(Data accuracy is 1-2C and 5-10 nautical miles)



GULF OF MEXICO

During September, the Loop Current in the Gulf of Mexico was not observed. This was due to near isothermal conditions and clouds. Sea surface temperatures ranged from 27°C near shore to 30°C in the central Gulf.

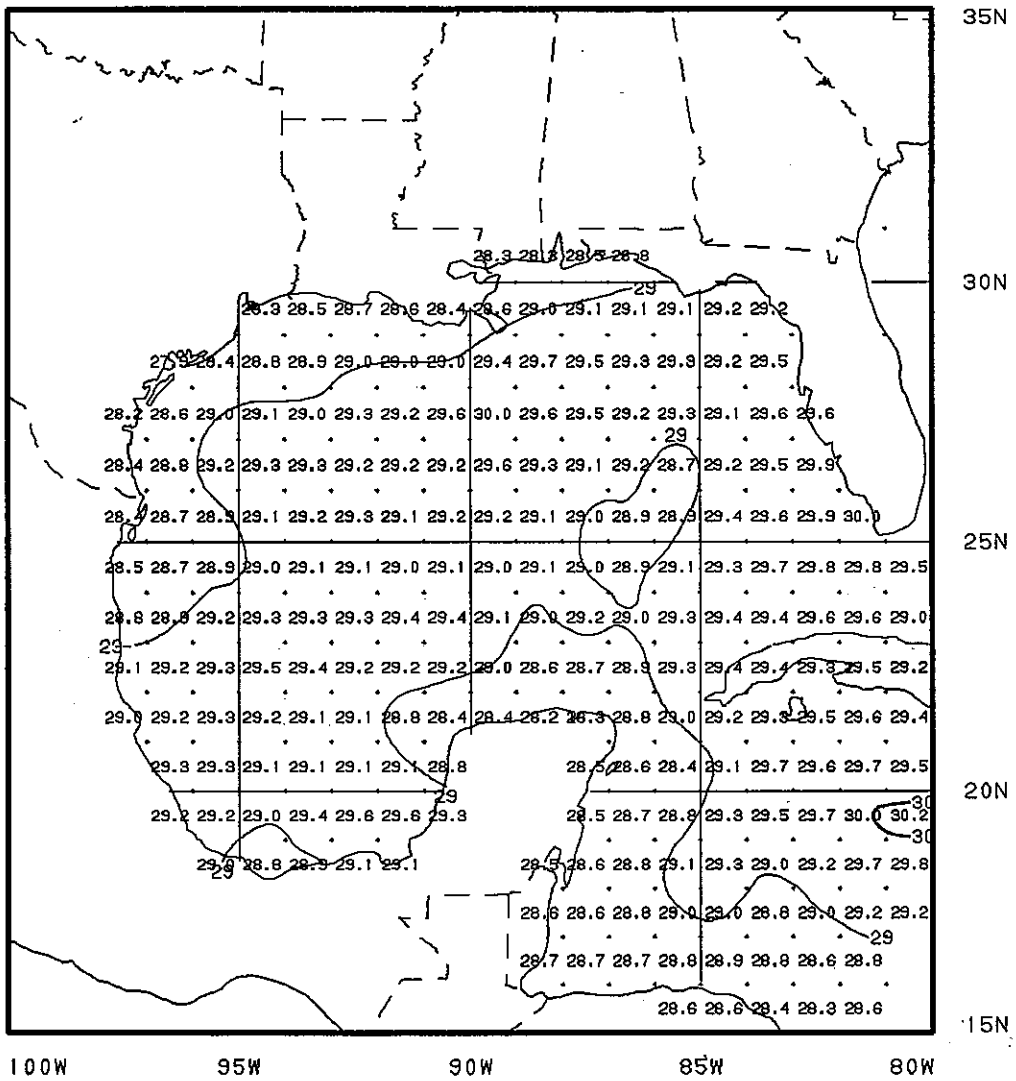


NORTHWEST ATLANTIC

One anticyclonic eddy formed during September. Eddy 27 had an extensive filament of warm water attached to the northern eddy edge from 40°N 67°W to 39°N 72°W. Around September 11, eddy 27 elongated in an east-west orientation and interacted with this warm filament. On September 20, elongated eddy 27 split into two separate eddies (labeled eddy 30 and 27) centered near 39.3°N 69.3°W and 39.6°N 67.0°W, respectively. The resultant translation of eddy 27 was 140 km E. Eddy 30 traveled 100 km NW while eddy 21 traveled 165 km NW. Eddy 29 drifted 75 km W. Eddy 24 moved 85 km NW.

No new cyclonic eddies formed during September. Eddy G was not observed, so it was eliminated from the analysis. Eddy B drifted 55 km N while eddy Z drifted 85 km SW. Eddy E was pushed 340 km NE by a Gulf Stream meander. Eddy F translated 185 km SE. Eddy W drifted only 35 km E.

EAST COAST SST – MONTHLY MEAN



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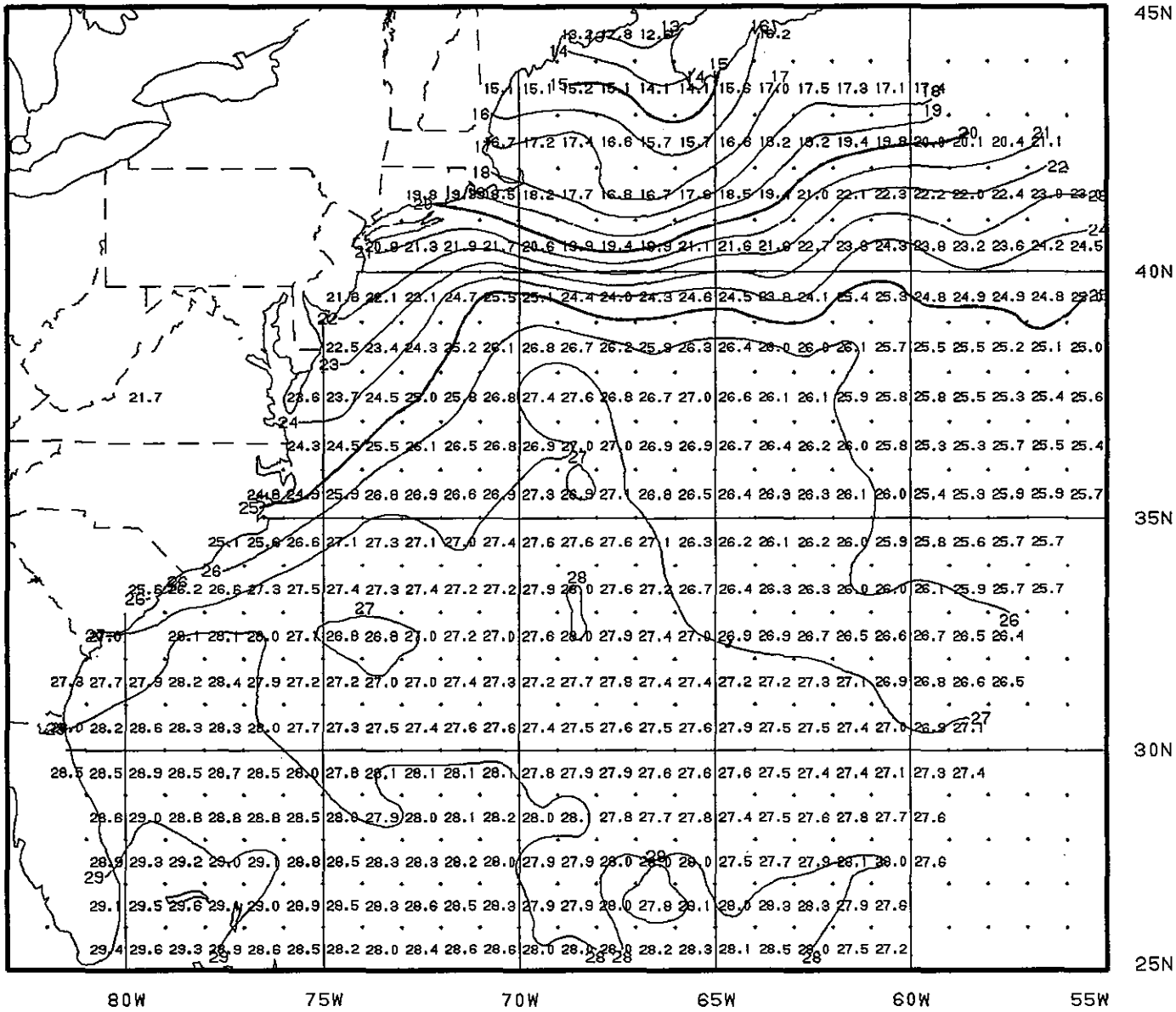

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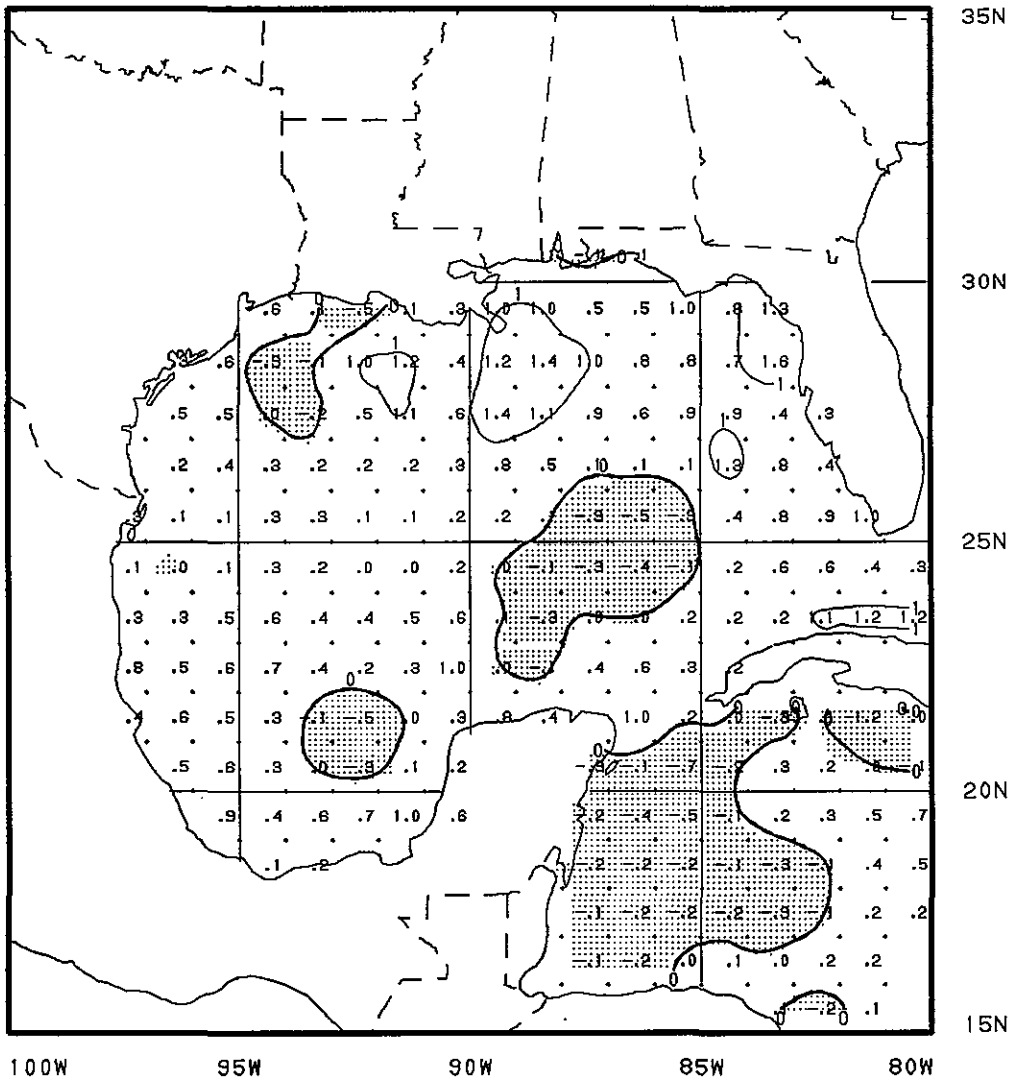
EAST COAST SST – ANOMALY



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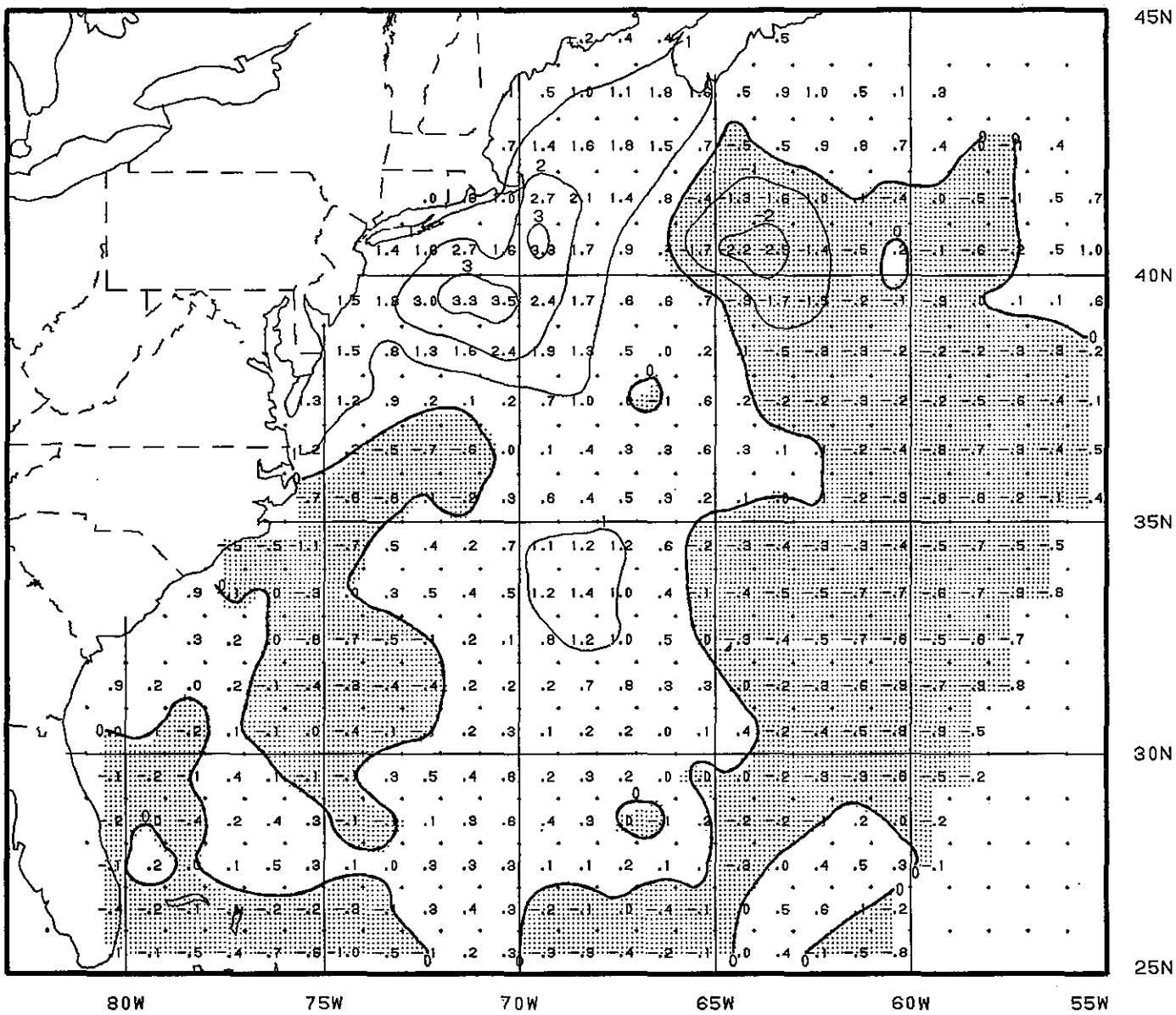

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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through April 1, 1990.

OCEANOGRAPHIC Monthly Summary

Volume IX Number 10 October 1989

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U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
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National Ocean Service

OCEANOGRAPHIC
Monthly Summary

Oceanographic Monthly Summary is published by the National Weather Service (NWS), the National Environmental Satellite, Data, and Information Service (NESDIS), and the National Ocean Service (NOS). *Oceanographic Monthly Summary* contains sea surface temperature (SST) analyses on both regional and ocean basin scales for the Atlantic, Pacific, and Indian Oceans. The ocean basin analyses are based on a "blend" of *in situ* and satellite data, in which *in situ* data are used to define "benchmark" temperature values in regions of frequent observations and satellite data are used to define the "shape" of the field between these points.[1]

An ocean basin SST anomaly is derived from the "blended" SST analysis[1] and the improved global SST climatology.[2] The regional SST analyses are based upon a combination of in situ and satellite data measurements. The regional SST anomalies are calculated from the Robinson-Bauer Climatology.[3,4] *Oceanographic Monthly Summary* also contains Alaskan sea ice information and ocean feature information for contiguous U.S. ocean regions

Oceanographic Monthly Summary welcomes articles containing information of interest to its readers, such as news on operational oceanography, unusual ocean feature phenomena, etc. Contributions should be sent to the editor (address below). Accepted material will appear in the OceaNotes section of *Oceanographic Monthly Summary*. Contributions can be published as quickly as the next monthly issue.

If you are interested in receiving *Oceanographic Monthly Summary* regularly, please refer to the back cover for subscription information.

[1]Reynolds, R. W., 1988: A Real-Time Global Sea Surface Temperature Analysis. *Journal of Climate*, 1, 75-86.

[2]Reynolds, R. W., and L. Roberts, 1987: A Global Sea Surface Temperature Climatology From *In Situ*, Satellite and Ice Data. *Tropical Ocean-Atmosphere Newsletter*, 37, 15-17. Available from Rosentiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149, USA.

[3]Robinson, M.K., 1976: Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer. *NavOcean Ref. Pub. 2.*

[4]Robinson, M.K., R. A. Bauer, and E. H. Schroeder, 1979. Atlas of North Atlantic-Indian Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOcean Ref. Pub. 18.*

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Stephen Hogan
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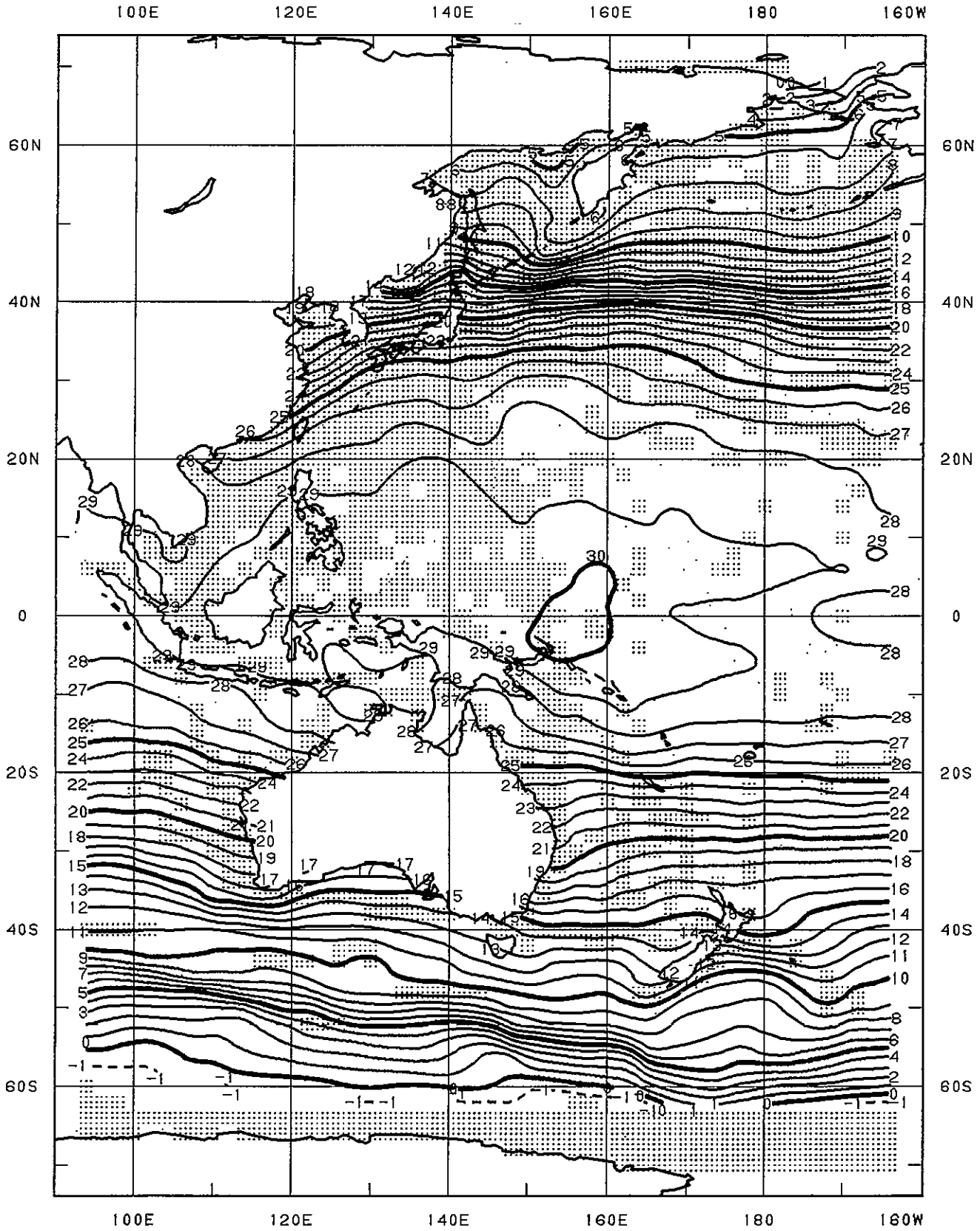

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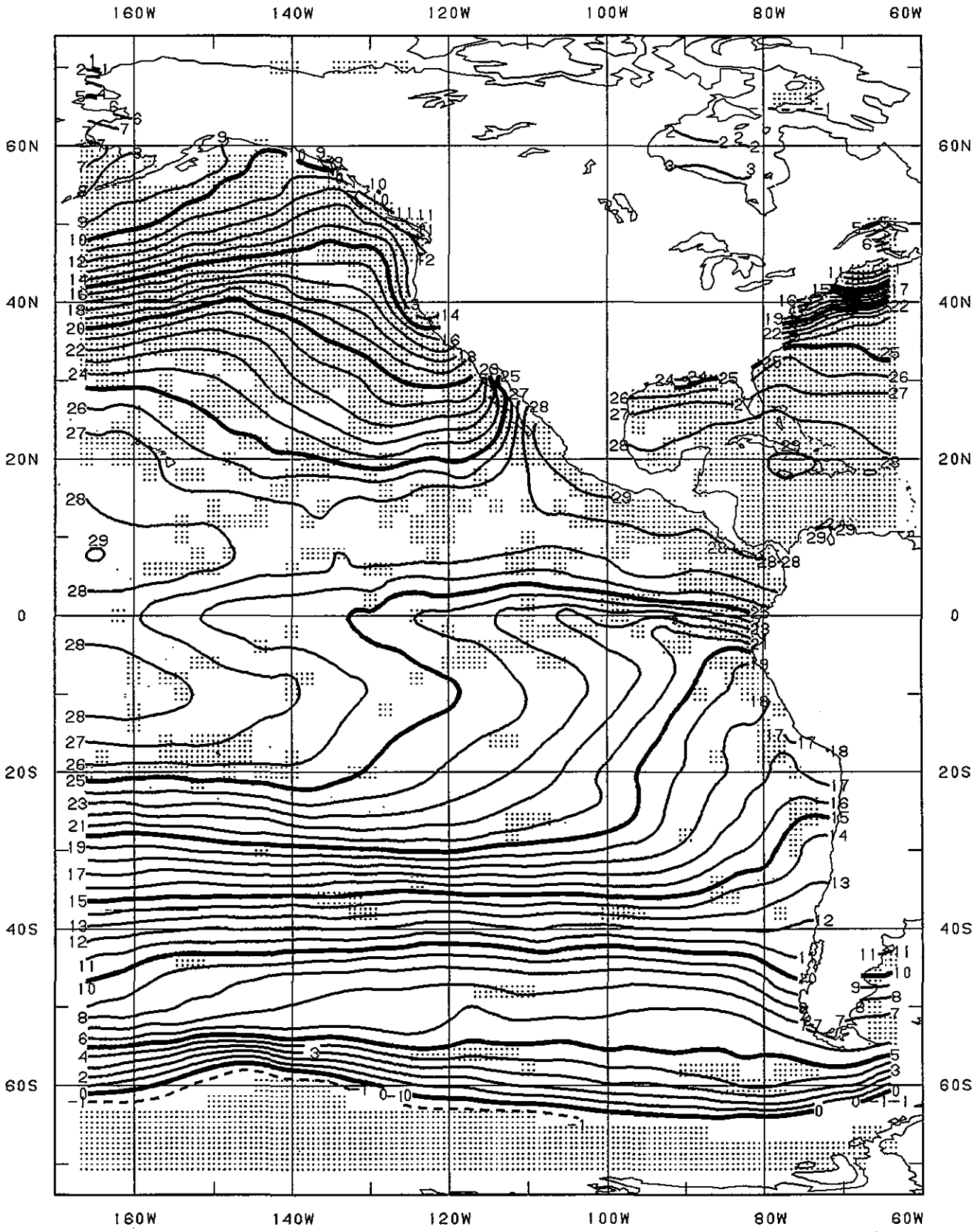

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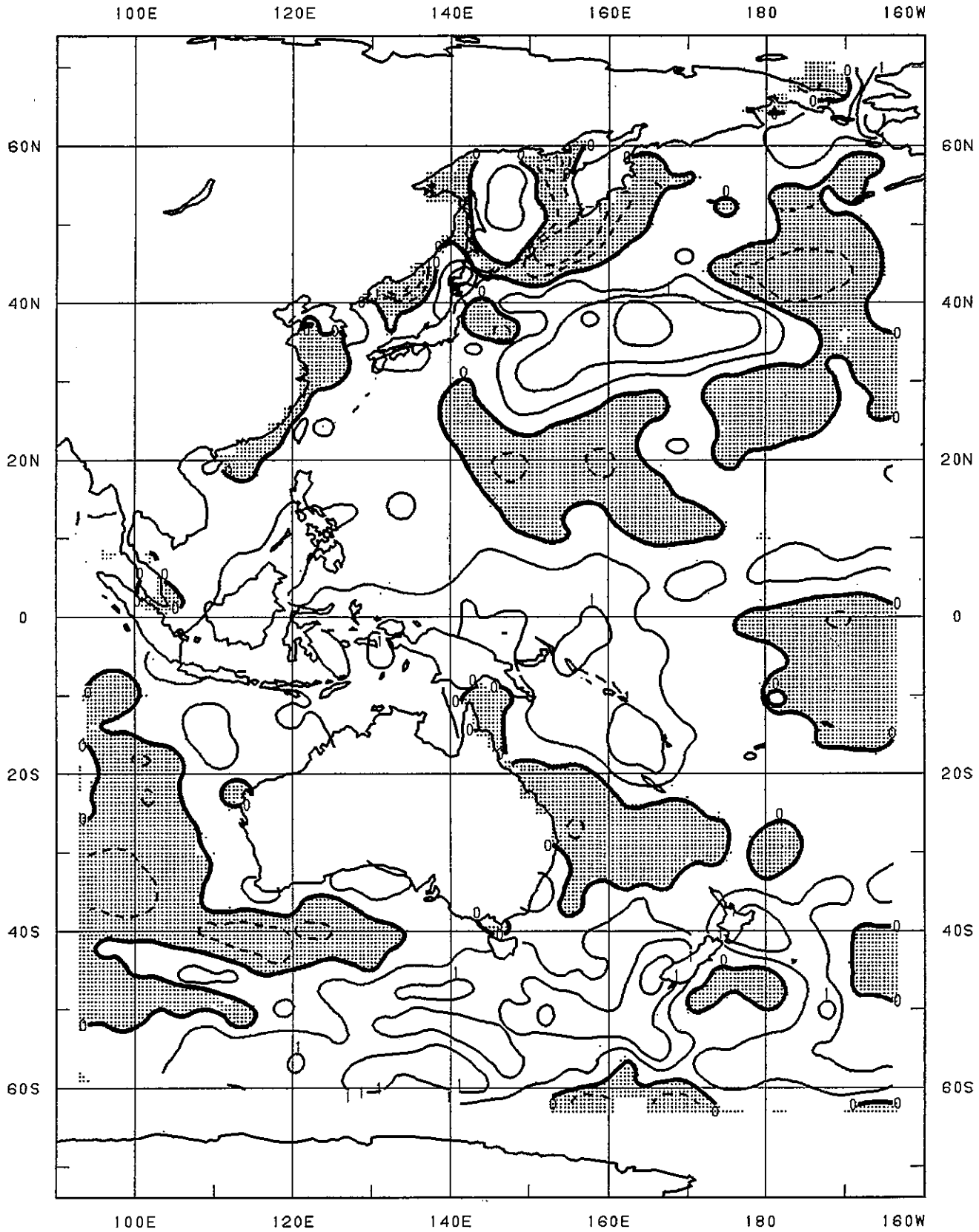

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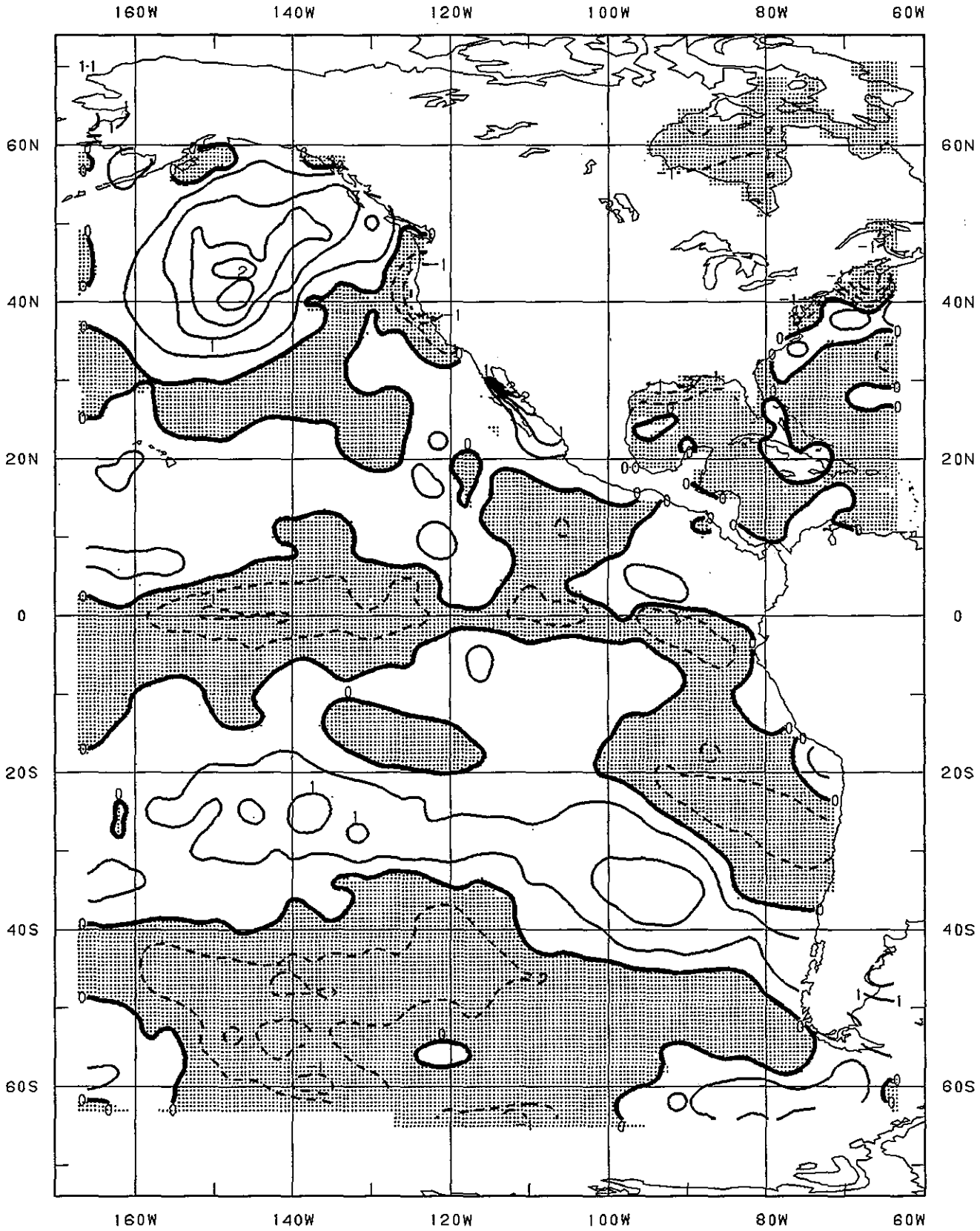

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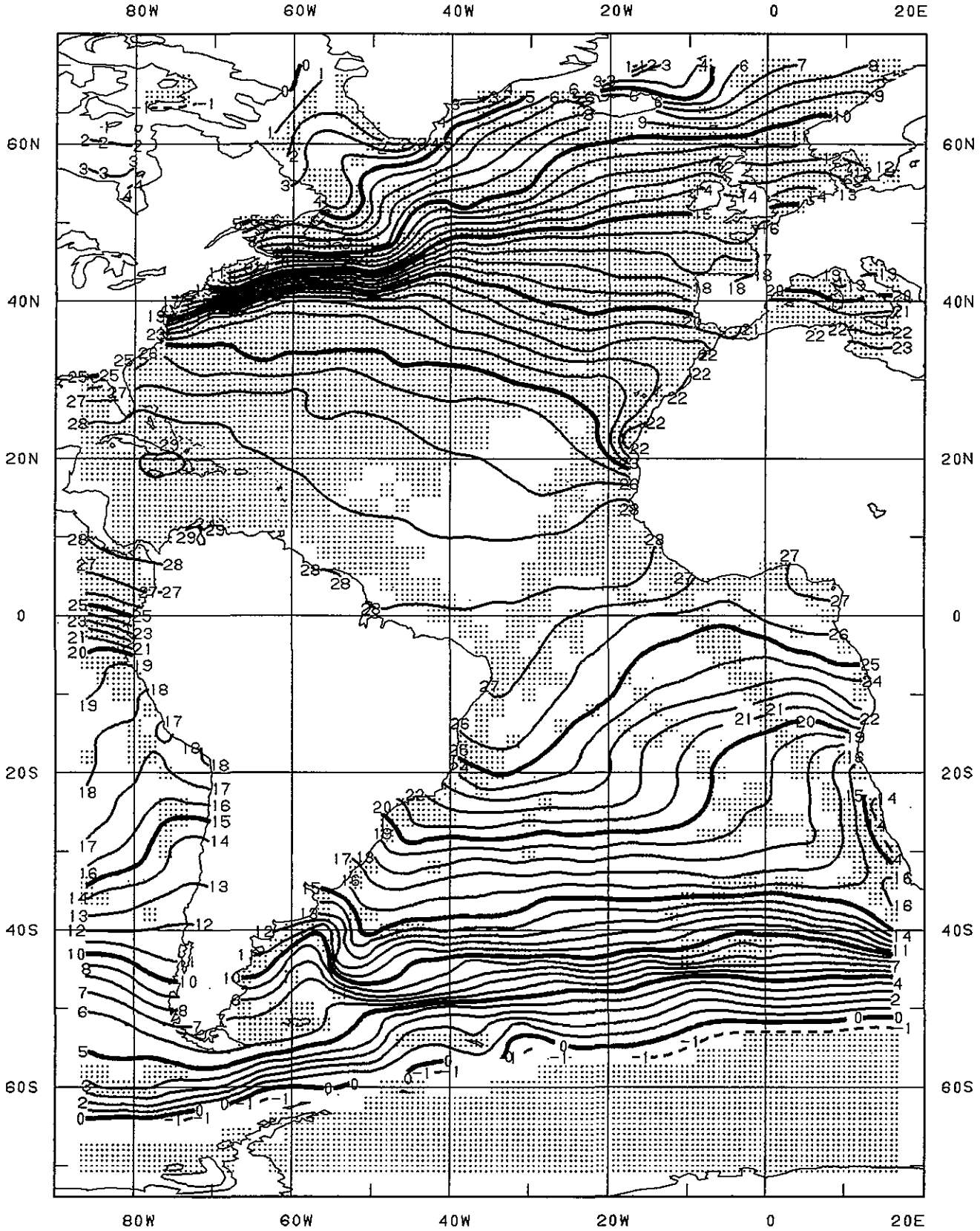

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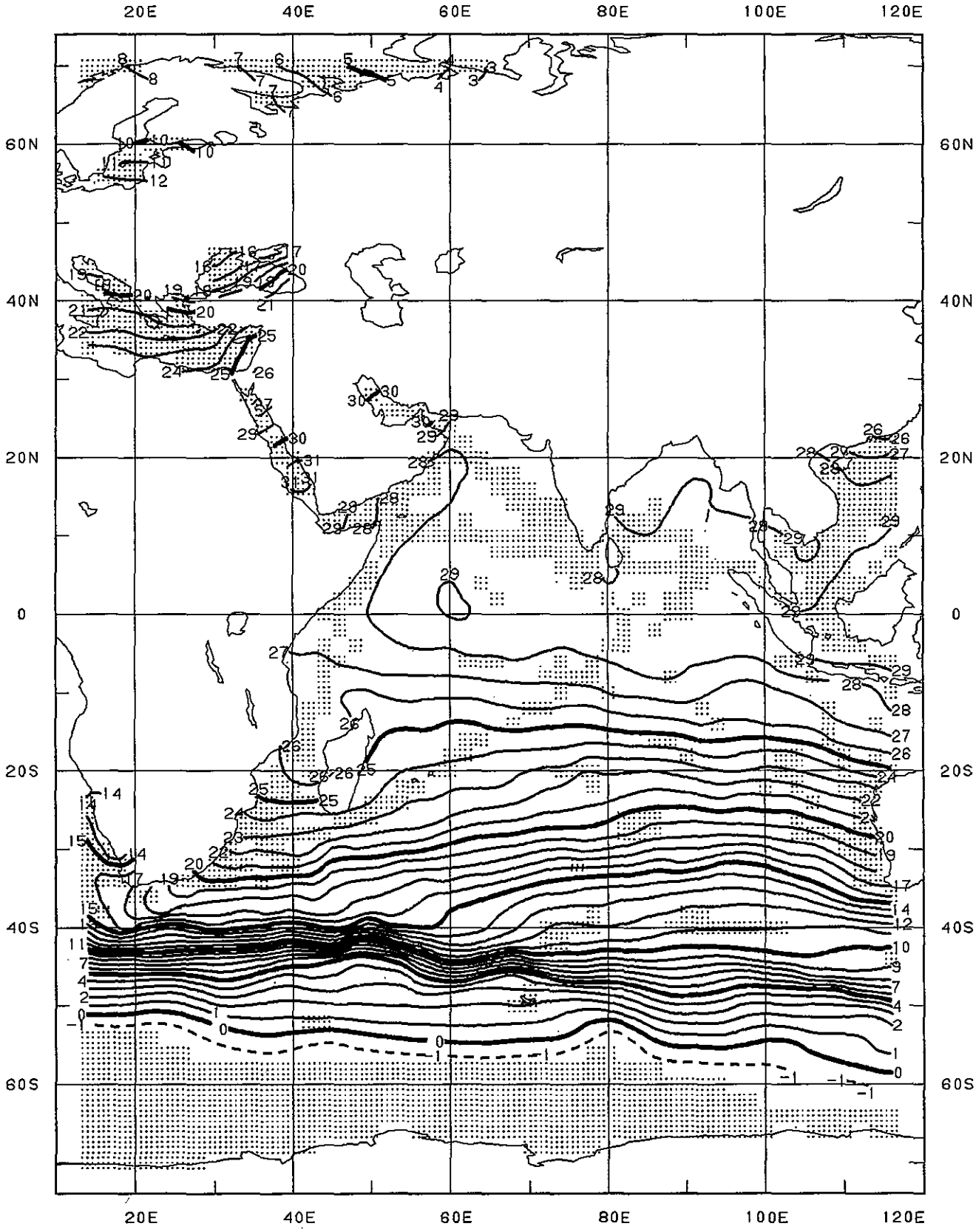

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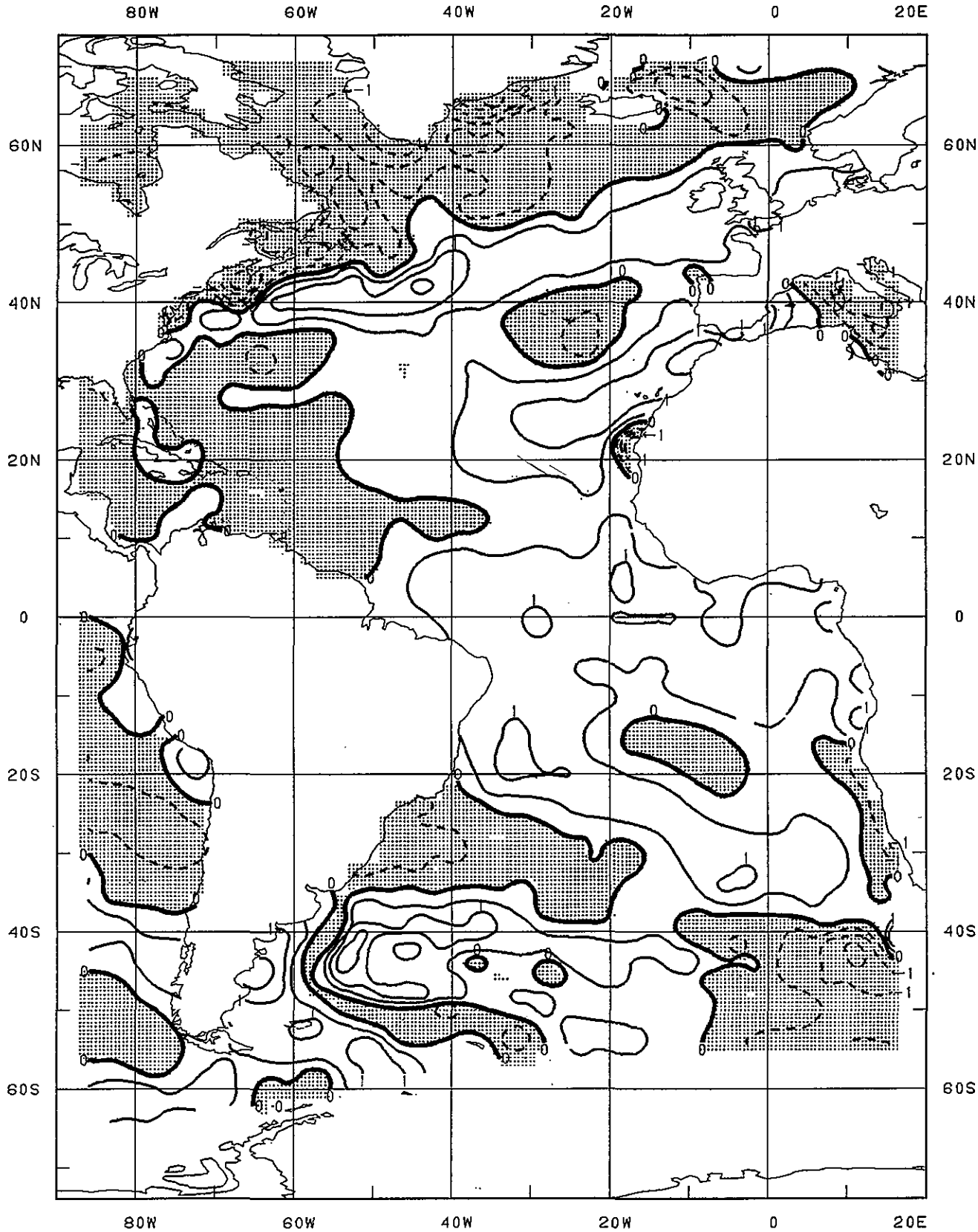

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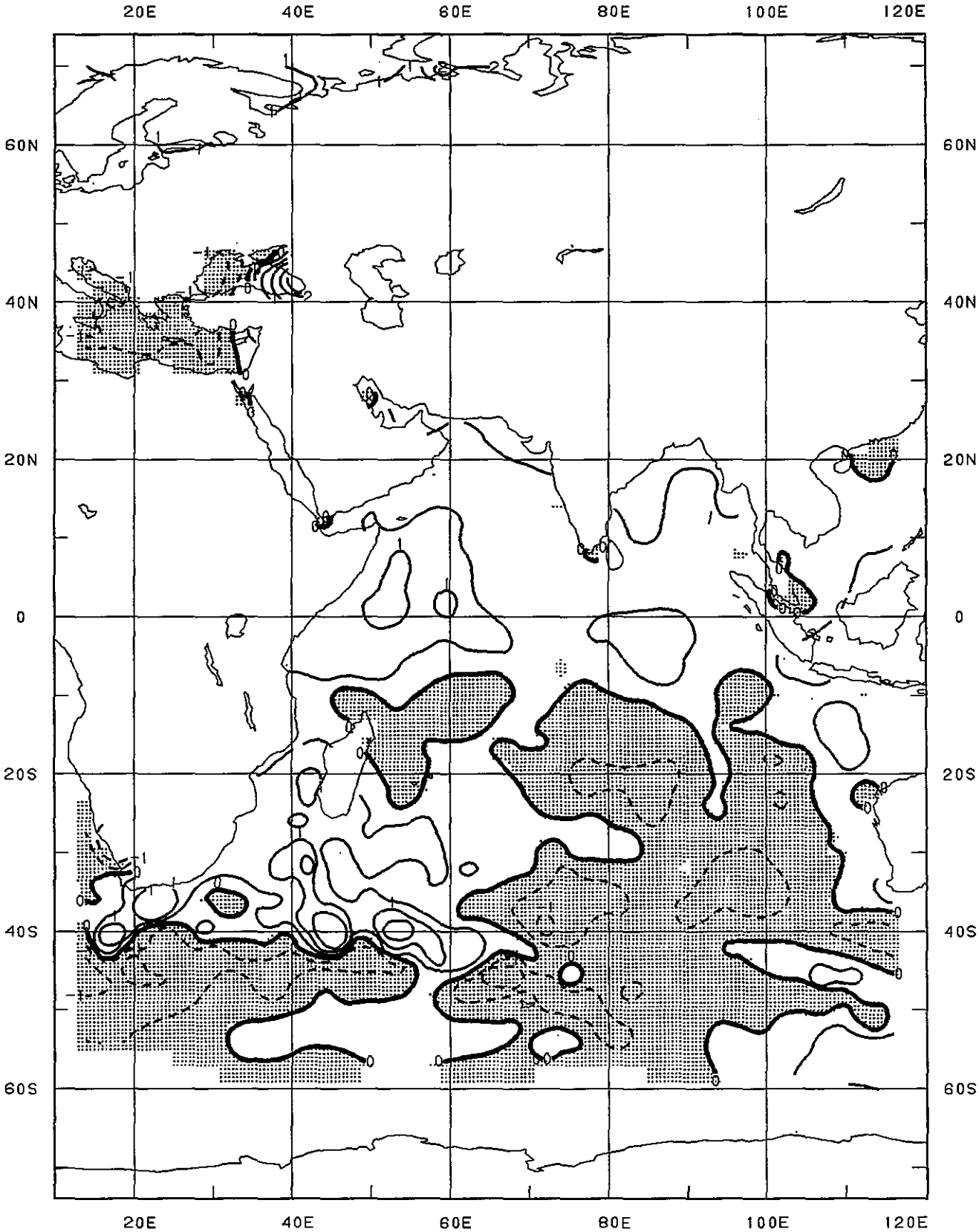

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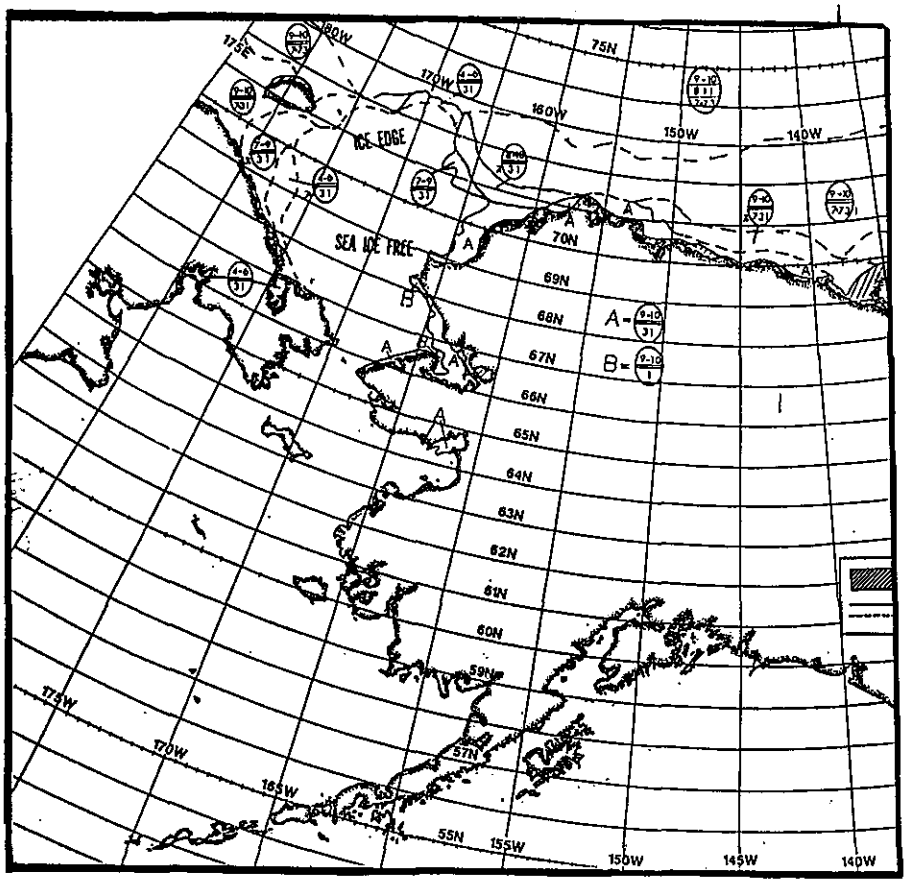

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EXAMPLES

125 Theoretical thickness of this season's growth (cm).

Fast ice Sea ice which forms and remains fast along the coast

Ice boundary visually or satellite observed

Ice boundary estimated.

BERING SEA / NORTH SLOPE ICE ANALYSIS

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National Meteorological Center, W/NMC21
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OCTOBER 1989

Sea ice growth and expansion of the ice edge was exceedingly slow during the first half of October as warm temperatures persisted throughout the region. Temperatures began to moderate during the third week and by the fourth week below normal temperatures were recorded at many coastal stations. New ice spread quickly in response to the cold air and occupied coastal waters as far south as eastern Norton Sound. In the central and western Chukchi Sea ice extent remained less than average through the month.

WEST COAST OCEAN FEATURES

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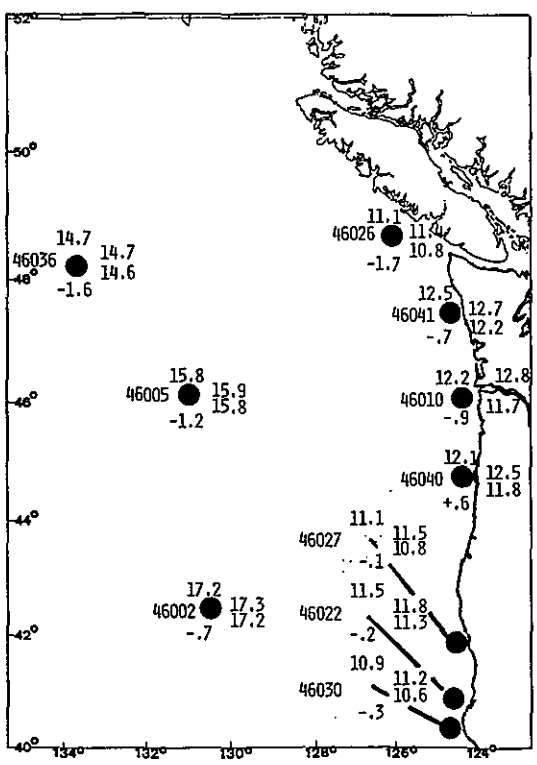
OCTOBER 1989

Sea surface temperatures in the North and South Panels averaged close to normal during October. This month's North Panel's average temperature (15.3°C) was 0.3°C above normal; the South Panel mean (18.7°C) was 0.1°C cooler than normal.

In the North Panel, offshore waters were generally warmer than climatology. Positive anomalies ranged between 0.1°C and 1.0°C. The only exception to warming in the offshore areas was off the Carolina Coast where SST's were approximately 0.5°C cooler than expected. Cool anomalies were also observed near Cape St. James (-0.1°C) in Canada and to the west of Cape Blanco, Oregon (-0.8°C).

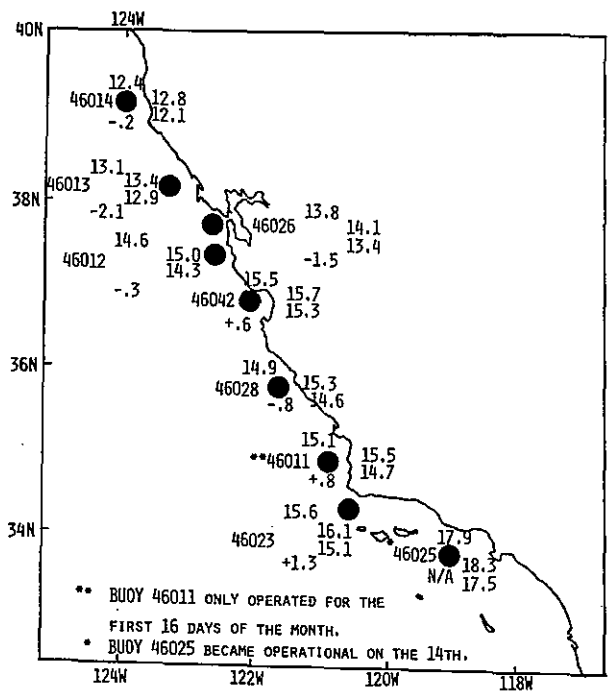
Comparing October to September, all areas cooled by at least 1.0°C. The greatest cooling was observed along the northern boundary of the chart, where water temperatures dropped by 2.2°C at 51N/134W and by 3.1°C at 51N/130W.



In the South Panel, offshore waters averaged below normal and nearshore waters above. Negative anomalies were greatest (between 1.0° and 1.2°C) along 37N and between 134W 126W. In the nearshore, the greatest observed positive anomaly (+1.3°) was along the Baja Peninsula. All other nearshore waters were near normal.

Comparing this month to last, almost all areas of the South Panel showed signs of cooling. The only exception (+0.2°C) was the warming observed in and around Pt. Conception and to the southwest of this location. Cooling was greatest in the northwest corner of the chart (-1.3°C) and less toward the south and east. Cooling was also the rule along the Mexican coast and adjacent waters; values here were around 1.0°C.

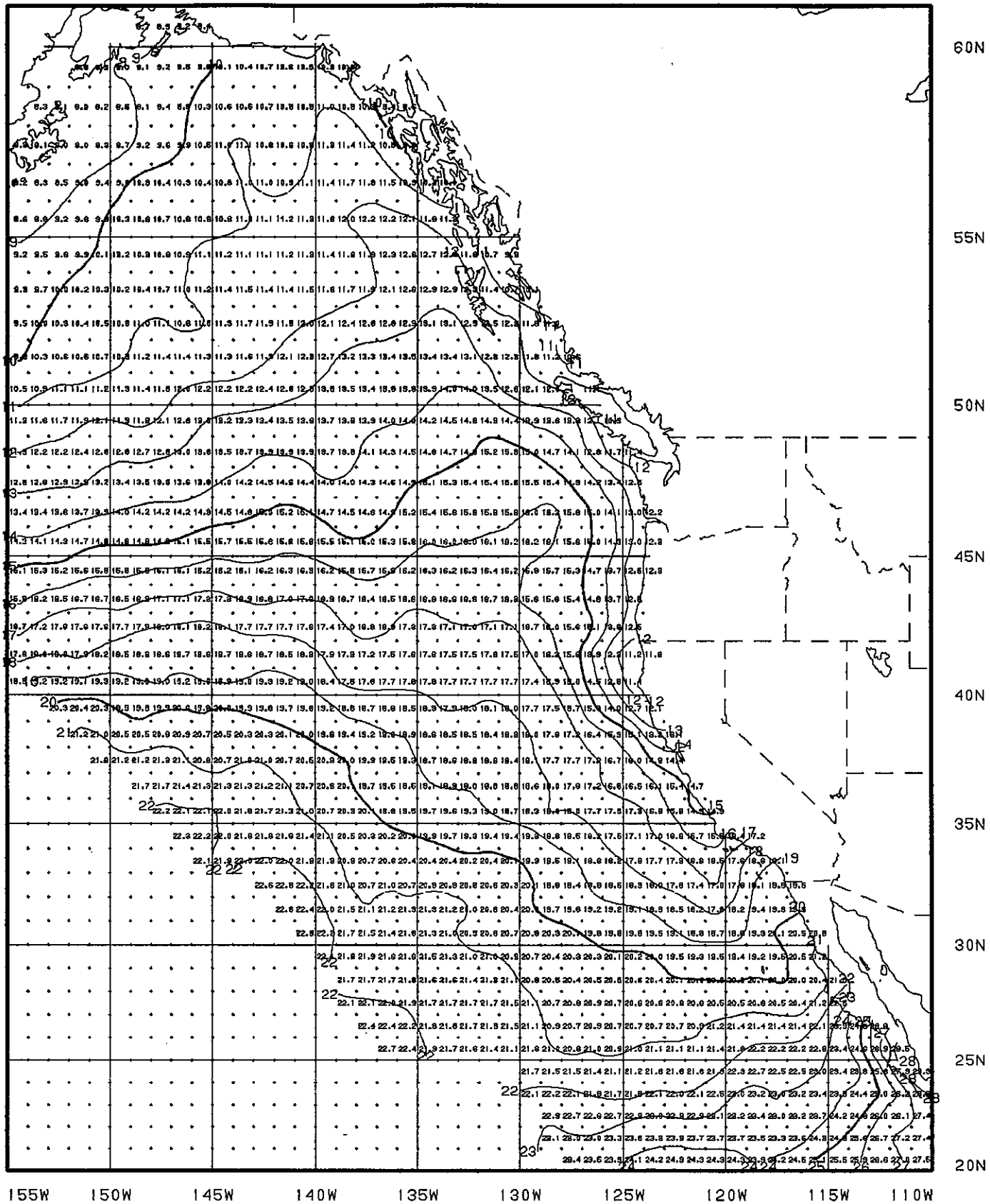
The 3-hourly buoy statistics also showed similar results to the averages observed from the 9 analyses. The only exception was in the warming observed at buoy 46040 in the North Panel due to a relaxation in the upwelling activity.



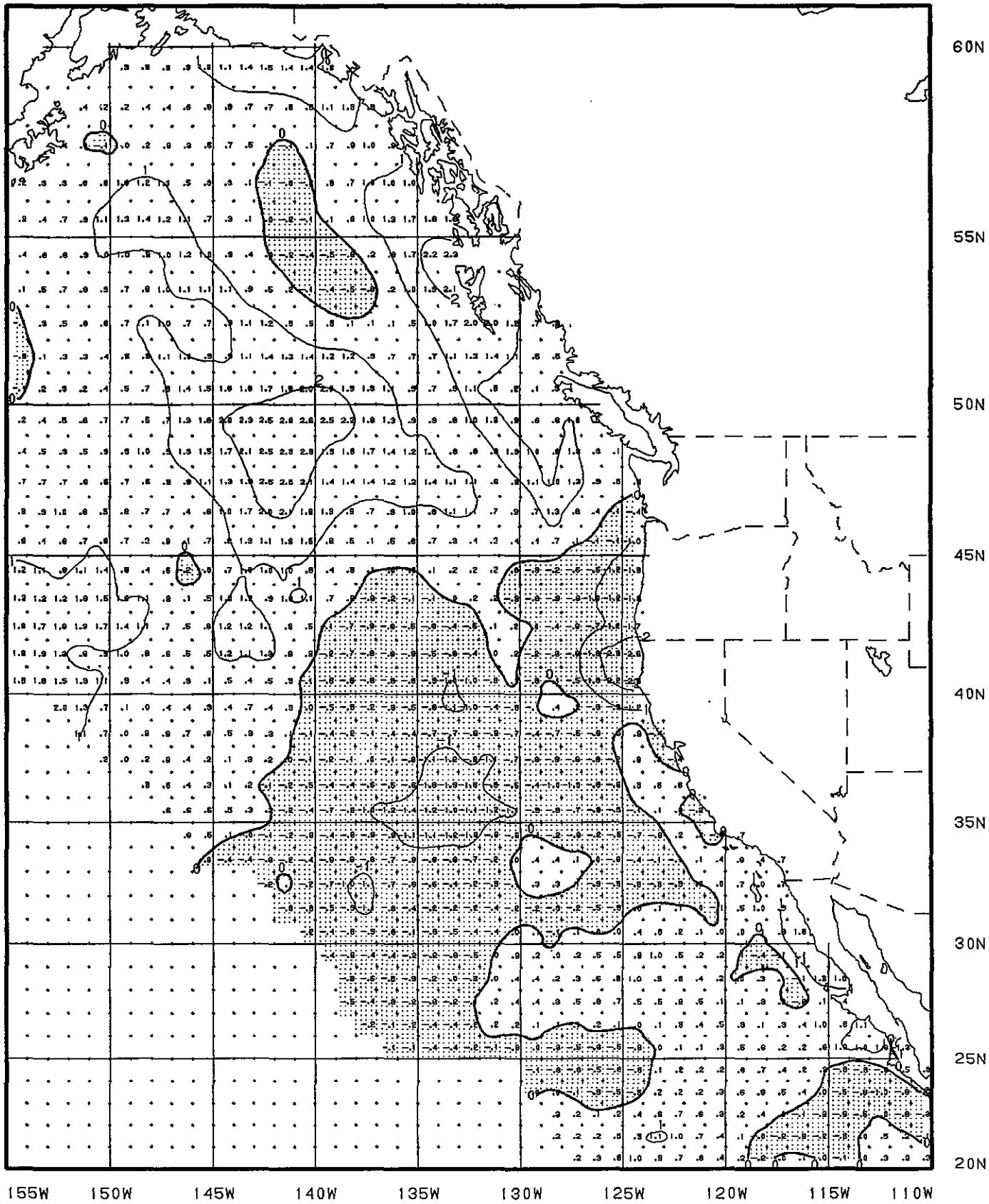
KEY:

12.1 ← Monthly mean
LOCATION 13.5 ← Maximum daily mean
NAME 10.2 ← Minimum daily mean
-1.5 ← Change from previous month

● Denotes station position.



OCTOBER 1989 U.S. WEST COAST SST--MONTHLY MEAN (C)--Monthly mean SST is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0C.



OCTOBER 1989 U.S. WEST COAST SST--MONTHLY ANOMALY (C)--Monthly anomaly is the difference between the monthly mean SST and the climatological monthly mean value--shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0C.

EAST COAST OCEAN FEATURES

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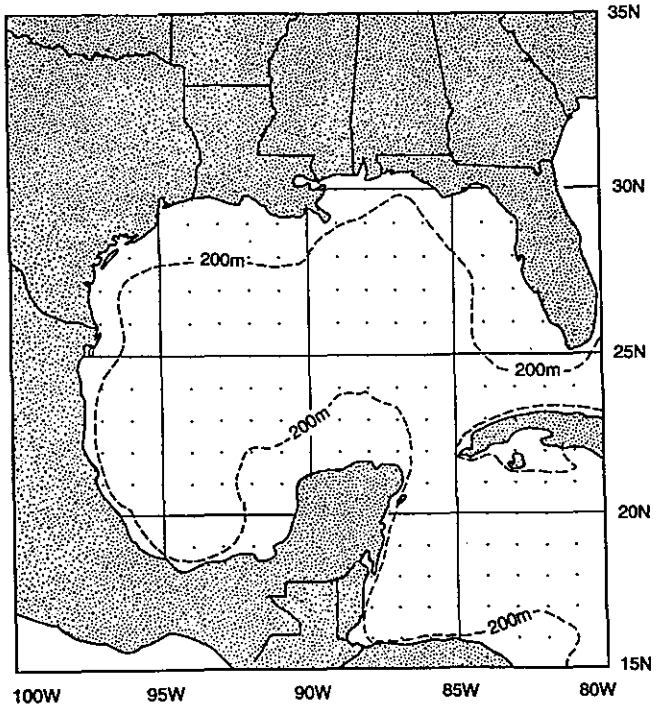
OCTOBER 1989

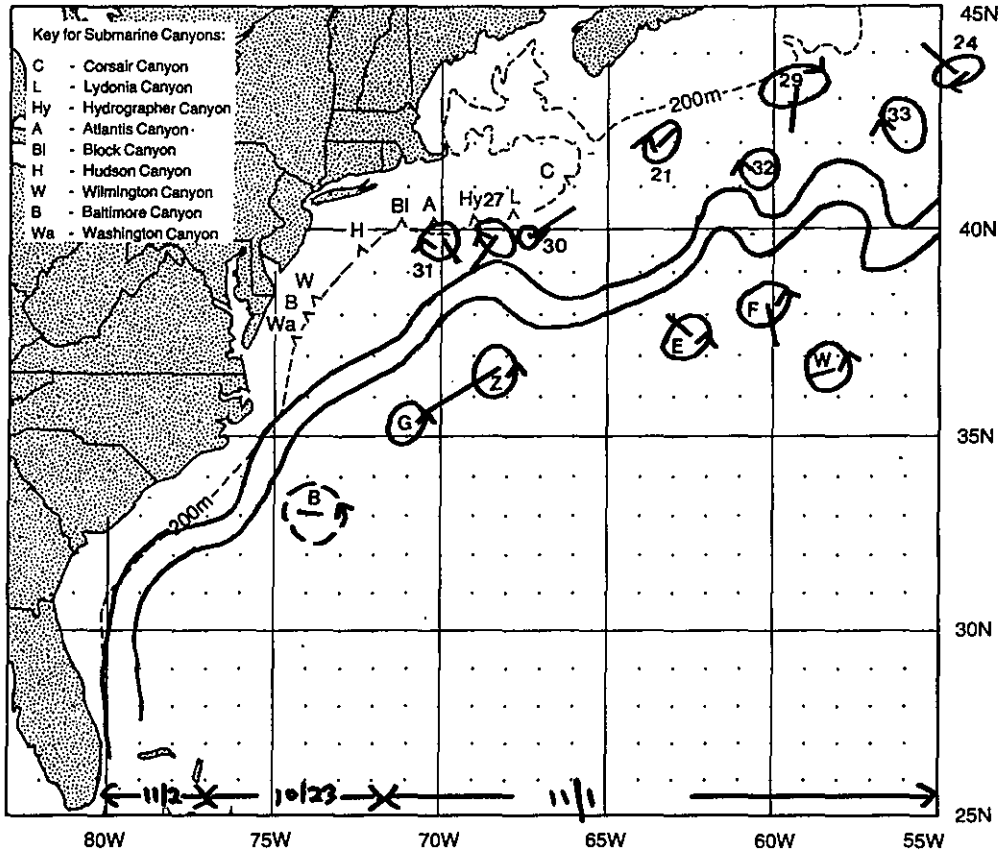
The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the Northwest Atlantic. Cyclonic eddies are labeled A-Z. Arrows on eddies indicate direction of circulation. Warm-core or anticyclonic eddies rotate clockwise; cold-core or cyclonic eddies rotate counterclockwise. The line to the eddy center shows the net translation since last month or since last observed. The edge of continental shelf at 200 m is shown as a dashed line. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart or are indicated by "dot-dashed" lines. The long arrows at the bottom of the chart indicate the dates of data used.

Data used in this analysis include:
Infrared imagery from NOAA satellite - NESDIS
Bathythermograph data from National Meteorological Center of National Weather Service
Oceanographic Analysis -- A daily detailed analysis issued by National Weather Service
(Data accuracy is 1-2C and 5-10 nautical miles)



GULF OF MEXICO

The Loop Current in the Gulf of Mexico was not discerned during October mostly due to clouds and partly due to near isothermal conditions in the center of the Gulf. Near shore SST's were cool (20-24C) while central Gulf SST's were warm (26-28°).

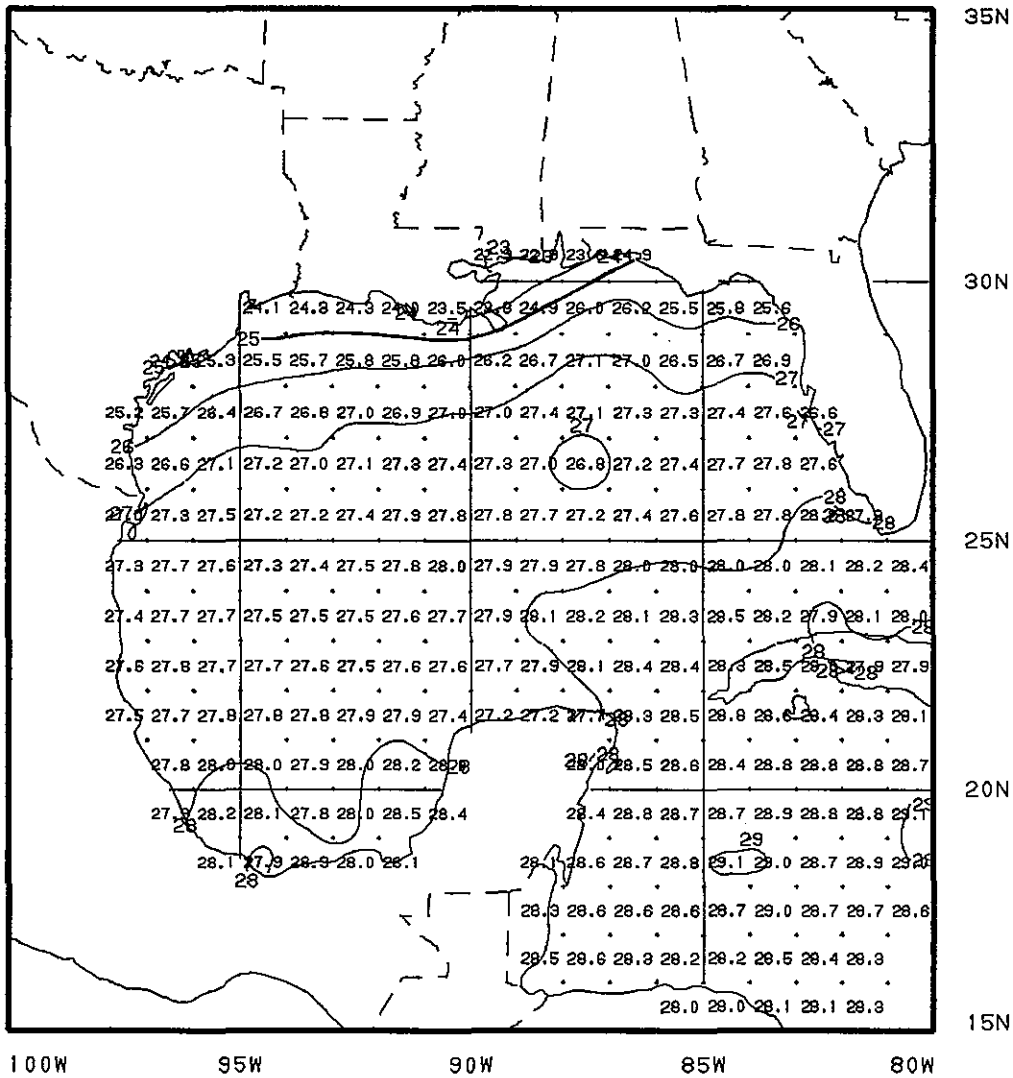


NORTHWEST ATLANTIC

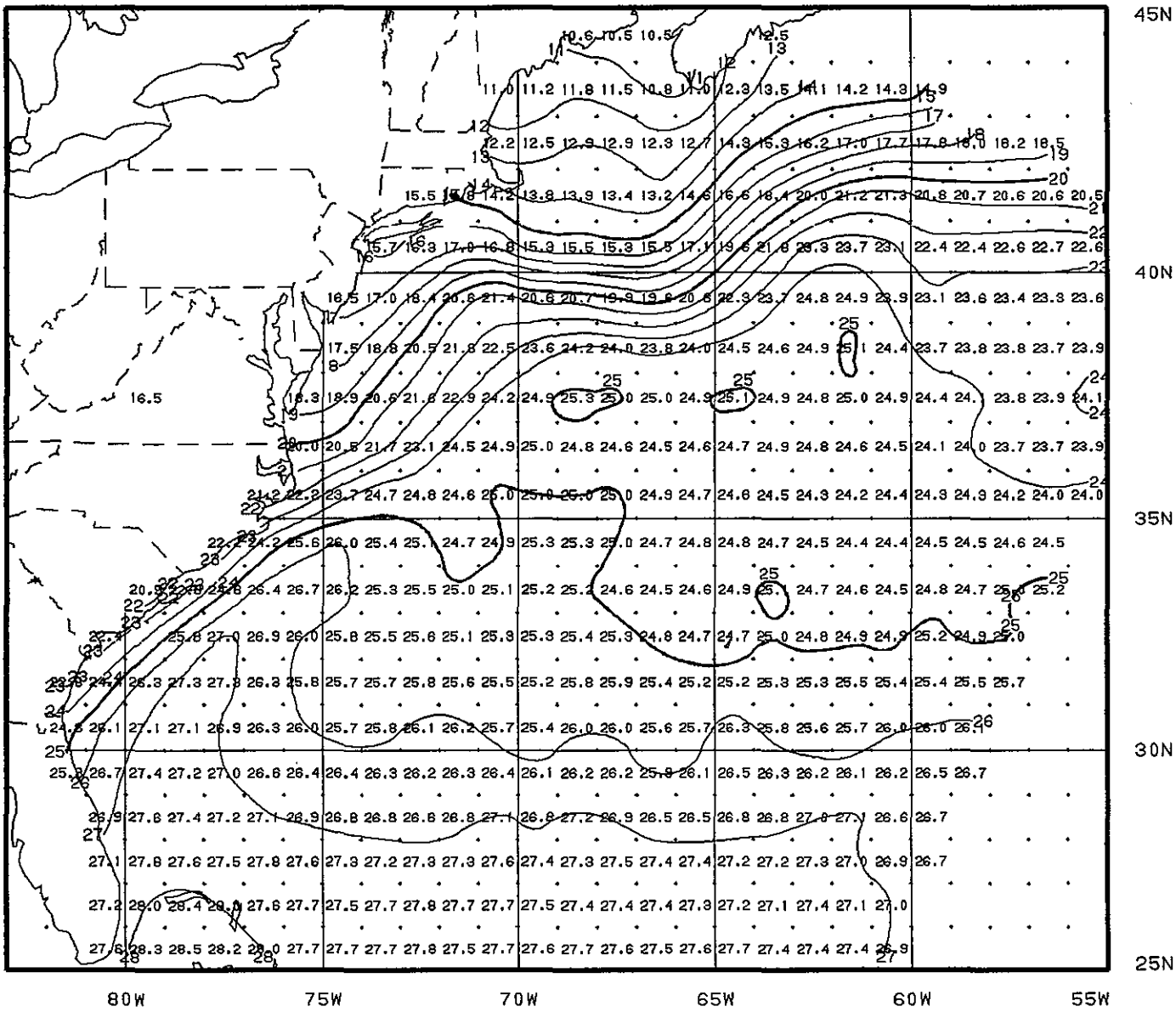
Two anticyclonic eddies were found during October. Eddy 32 formed from a Gulf Stream meander near 41°N 62°W on October 9. Eddy 33 also formed from a Gulf Stream meander on October 16 near 41°N 56°W. Eddy 31 translated 85km NE. Eddy 30 drifted 130km SW and appears to be dissipating. Eddy 21 traveled 55km SW. Eddy 29 moved 130km N and eddy 24 moved 120km NW.

One cyclonic eddy was newly observed during October. Eddy G was first observed on October 11 near 35°N 72°W. Its origin is not known. Eddy B, last observed on October 18, translated 15km E while eddy Z rapidly translated 260km NE. Eddy E drifted 95km SE. Eddies F and G moved 120km N and 75km E, respectively.

EAST COAST SST – MONTHLY MEAN

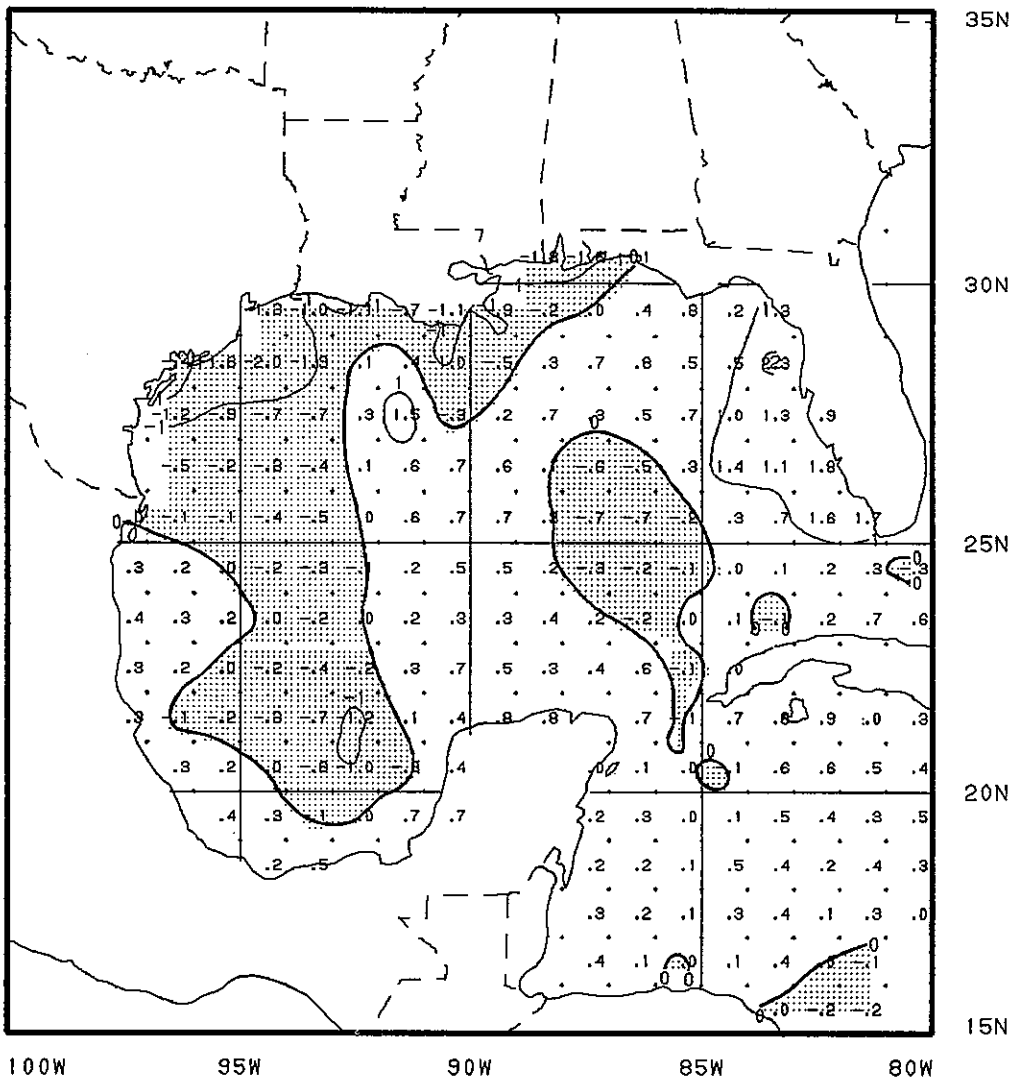


OCTOBER 1989 GULF OF MEXICO SST-MONTHLY MEAN (C)--Monthly mean SST is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0C.

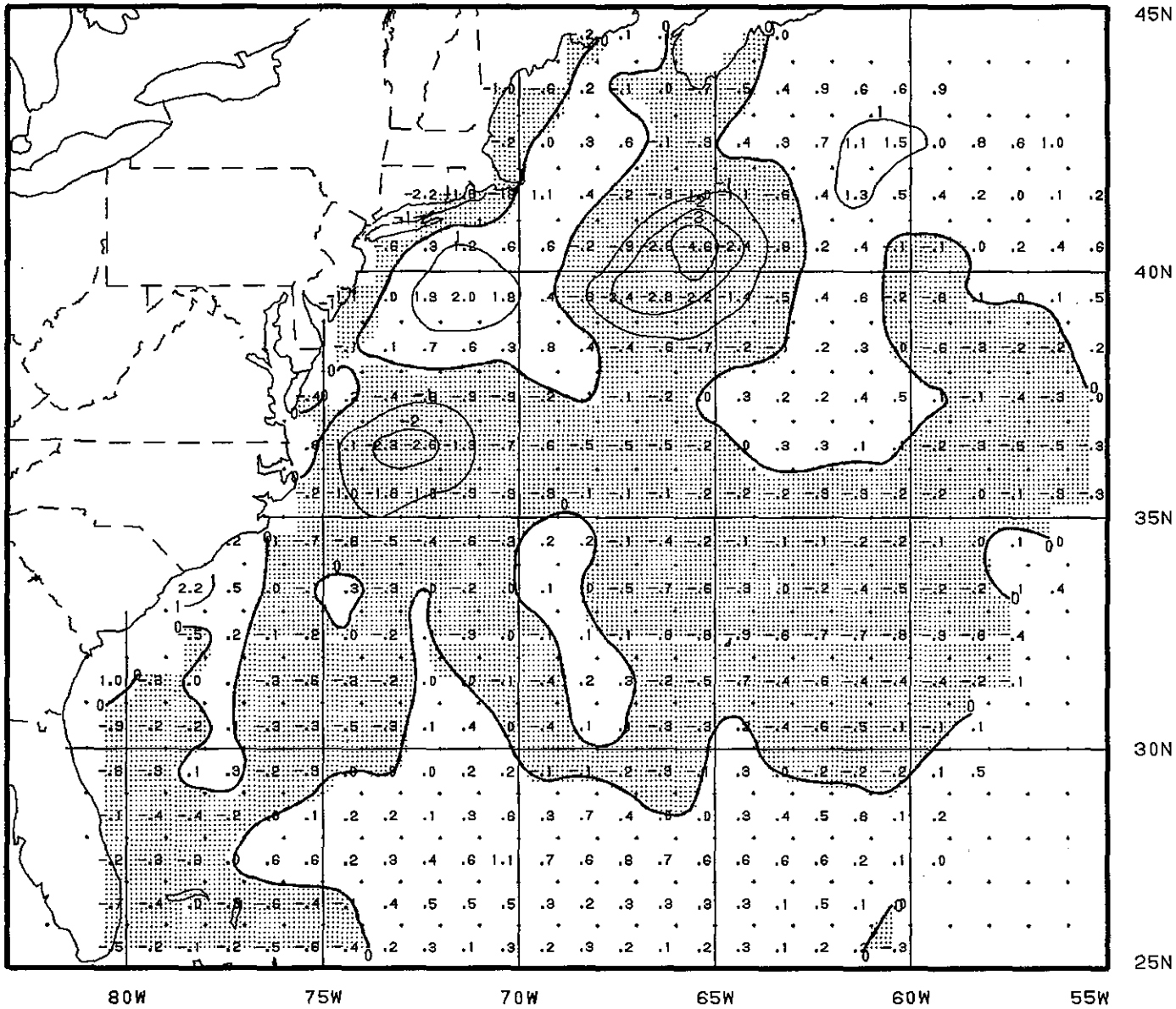


OCTOBER 1989 U.S. EAST COAST SST--MONTHLY MEAN (C)--Monthly mean SST is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0C.

EAST COAST SST – ANOMALY



OCTOBER 1989 **GULF OF MEXICO SST--MONTHLY ANOMALY (C)--Monthly anomaly is the difference between the monthly mean SST and the climatological monthly mean value-shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0C.**



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