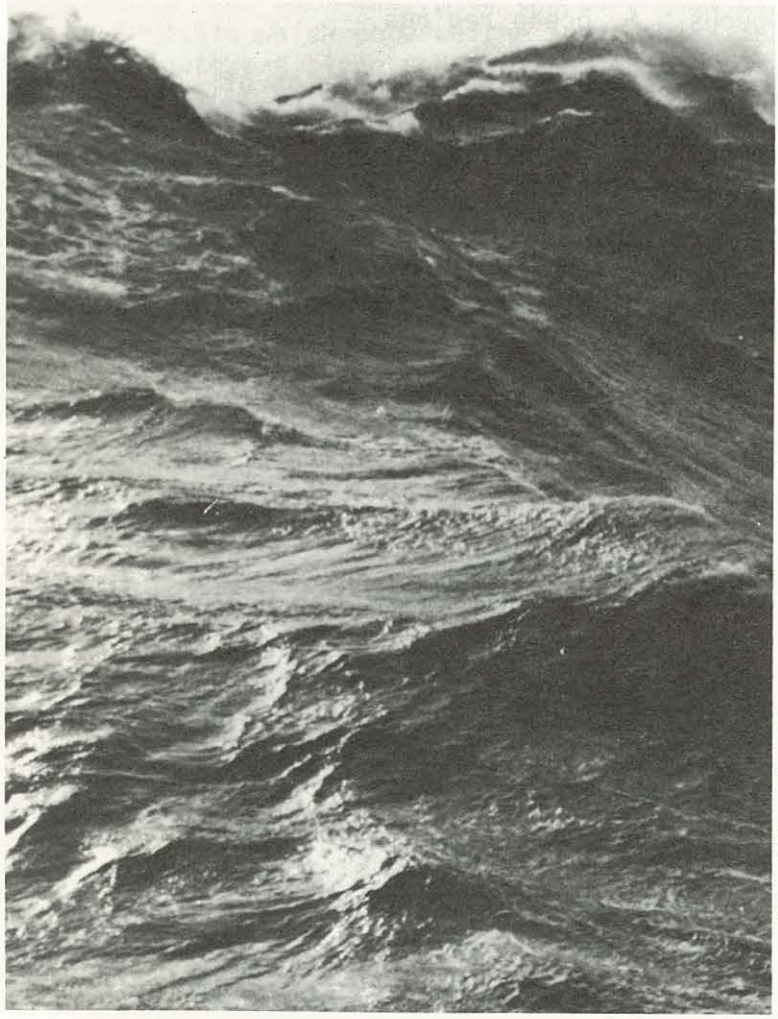
3 MAR 1986

OCEANOGRAPHIC Monthly Summary

NOAA Library, E/AI216
7600 Sand Point Way N.E.
Bin C-15700
Seattle, WA 98115

NOAA LISD SEATTLE

Volume VI Number 1 January 1986



Contents

3 Satellite IMAGE of the Month
4 Pacific SST - monthly mean
6 Pacific SST - anomaly
8 Atlantic/Indian SST - monthly mean
10 Atlantic/Indian SST - anomaly
12 OceaNotes
14 Bering Sea/North Slope ICE, with text
15 West Coast OCEAN FEATURES, with text
16 West Coast SST - monthly mean
17 West Coast SST - anomaly
18 East Coast OCEAN FEATURES, with text
20 East Coast SST - monthly mean
22 East Coast SST - anomaly
24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

Oceanographic Monthly Summary is published by the National Weather Service (NWS) and the National Environmental Satellite, Data, and Information Service (NESDIS). *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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31*.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2*.
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; *NavOceano Ref. Pub. 18*.

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

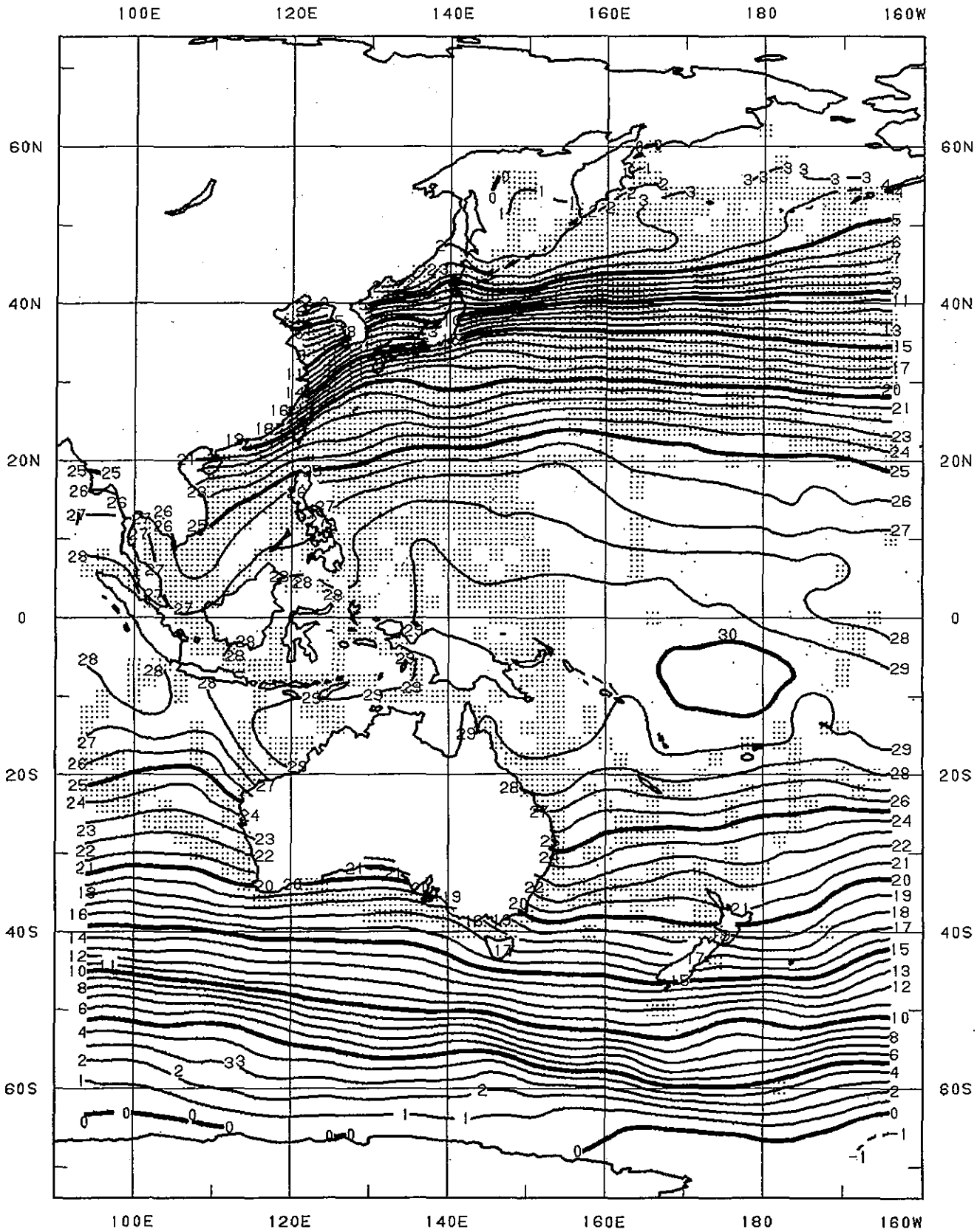
Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

SATELLITE IMAGE OF THE MONTH

Marcia L. Weaks
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

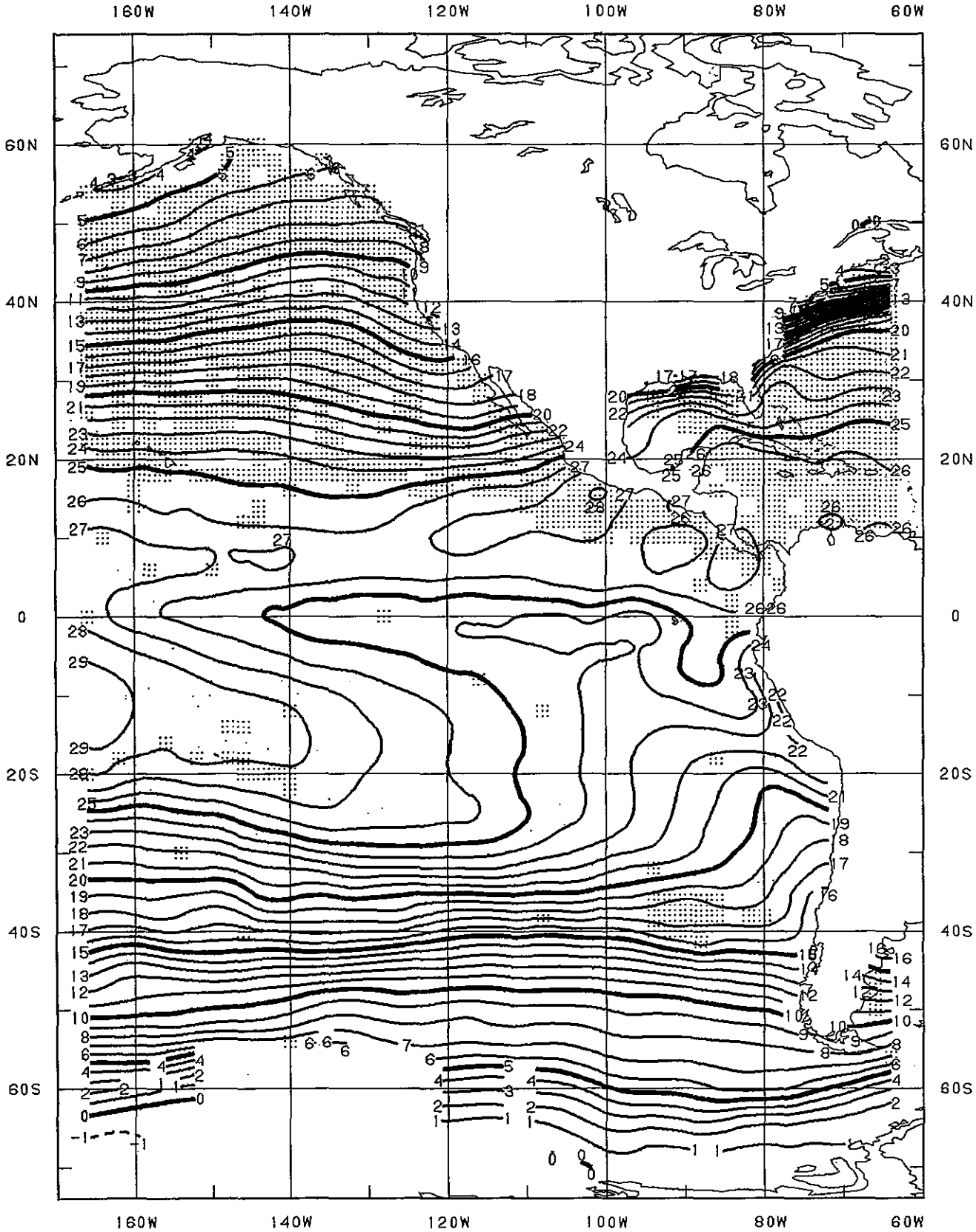
SST STRUCTURE IN THE EAST CHINA SEA

This NOAA-9 infrared image from January 7, 1986, shows the SST structure in the East China Sea. Shanghai, China is indicated by the "S" and the Yangtze (Changjiang) River is marked by the "Y". The island of Taiwan is also identified. Light gray shades correspond to cool SSTs, while dark gray shades correspond to warm SSTs. The SST patterns illustrate the circulation dynamics within the region. The Kuroshio Current flows northeastward from the Philippine Sea. In this image, the Kuroshio has a large meander (lower two arrows). A warm eddy is also present to the north (identified as "WE"). The sharp thermal gradient offshore of China is formed by the confluence of the warmer waters offshore and the cold coastal current. The warm waters to the southwest of Taiwan may be a small branch of the Kuroshio which entered the South China Sea south of Taiwan. The coastal current flows southward along the coast of China. Near Shanghai a small branch splits off and flows to the east. In this image, the southern limit of the eastward branch of the coastal current is located by the upper two arrows. The SST pattern can be quite different in summer, when the discharge from the Yangtze River is large enough to extend 600 km offshore and the flow of the Kuroshio Current increases also.



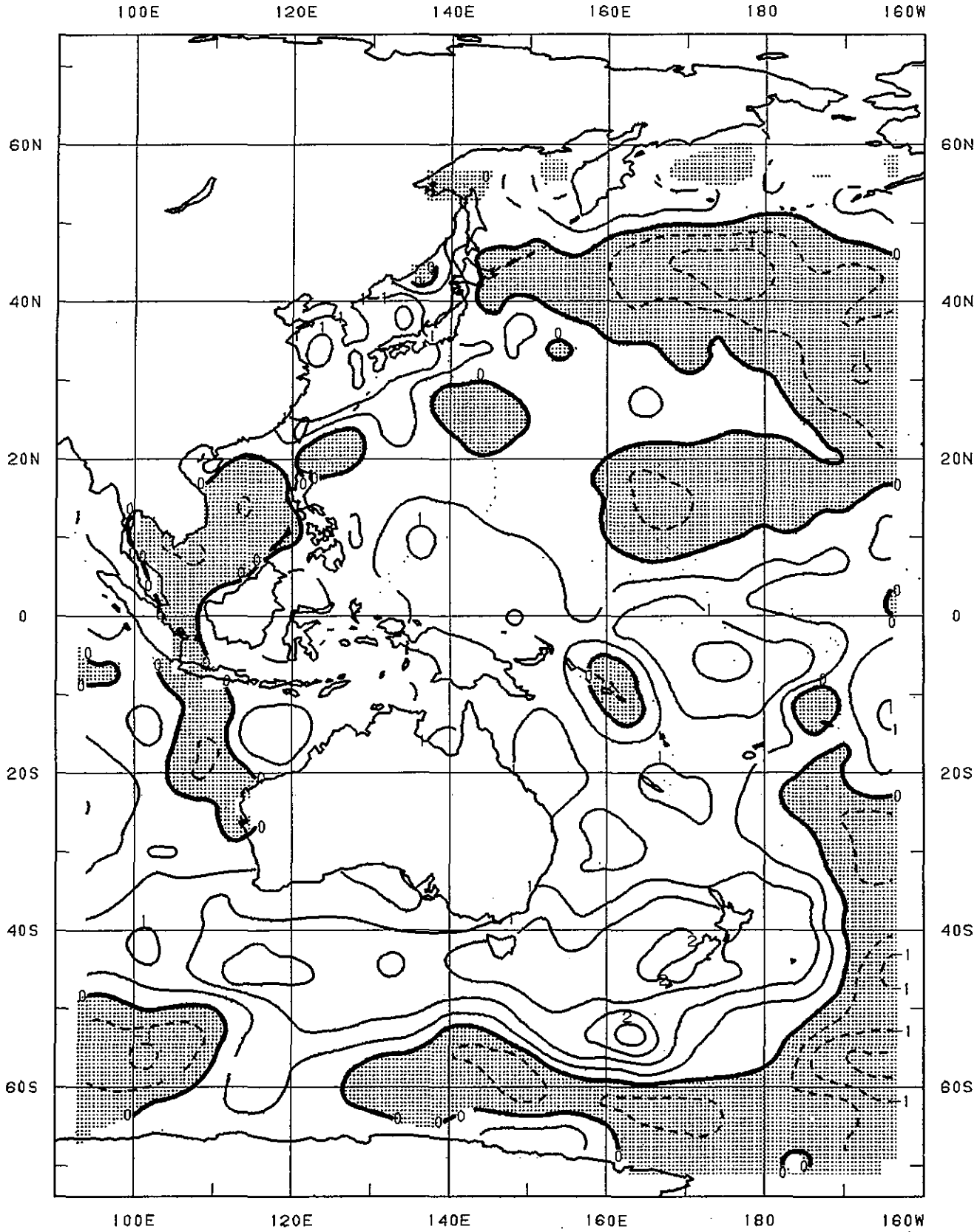
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



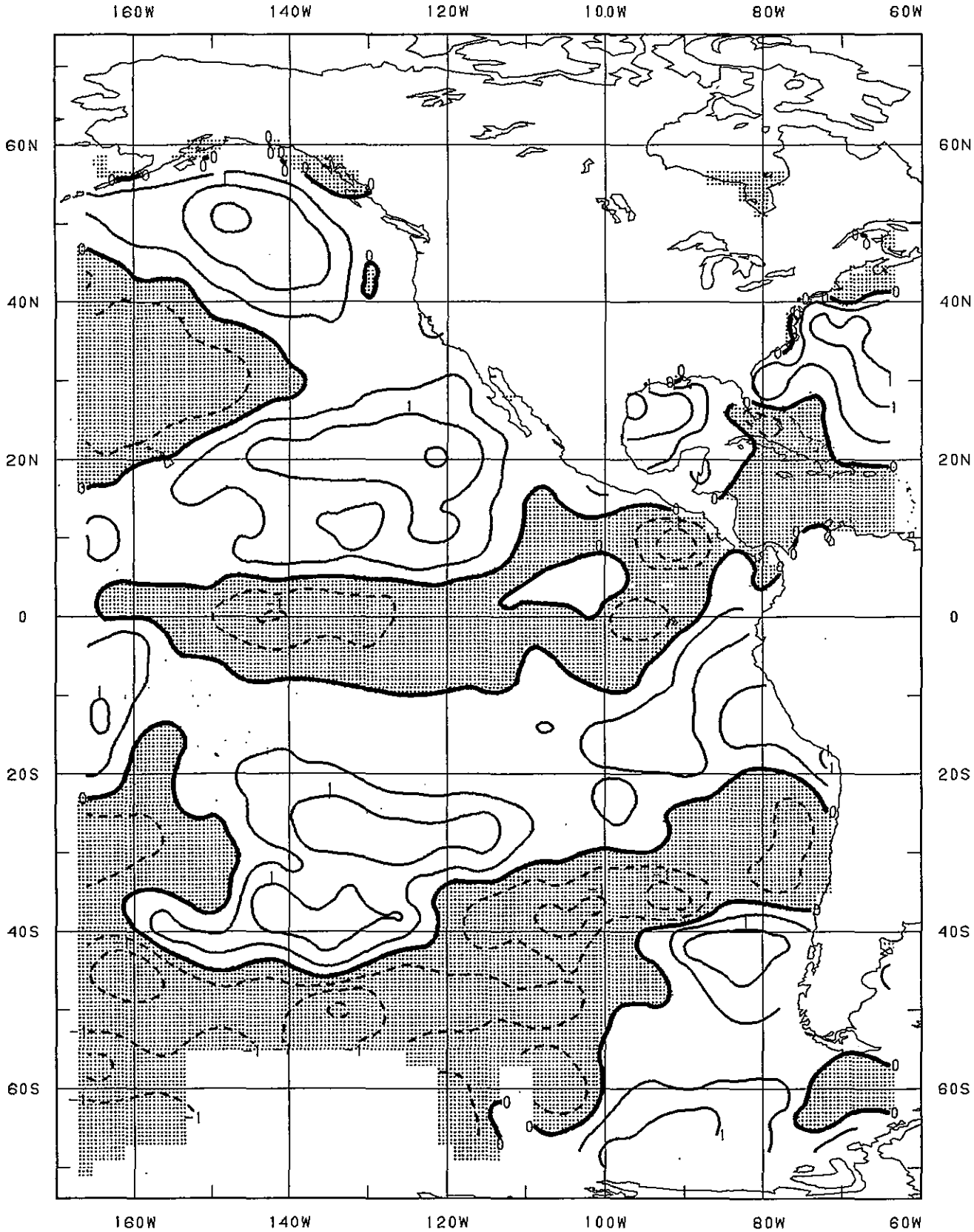
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



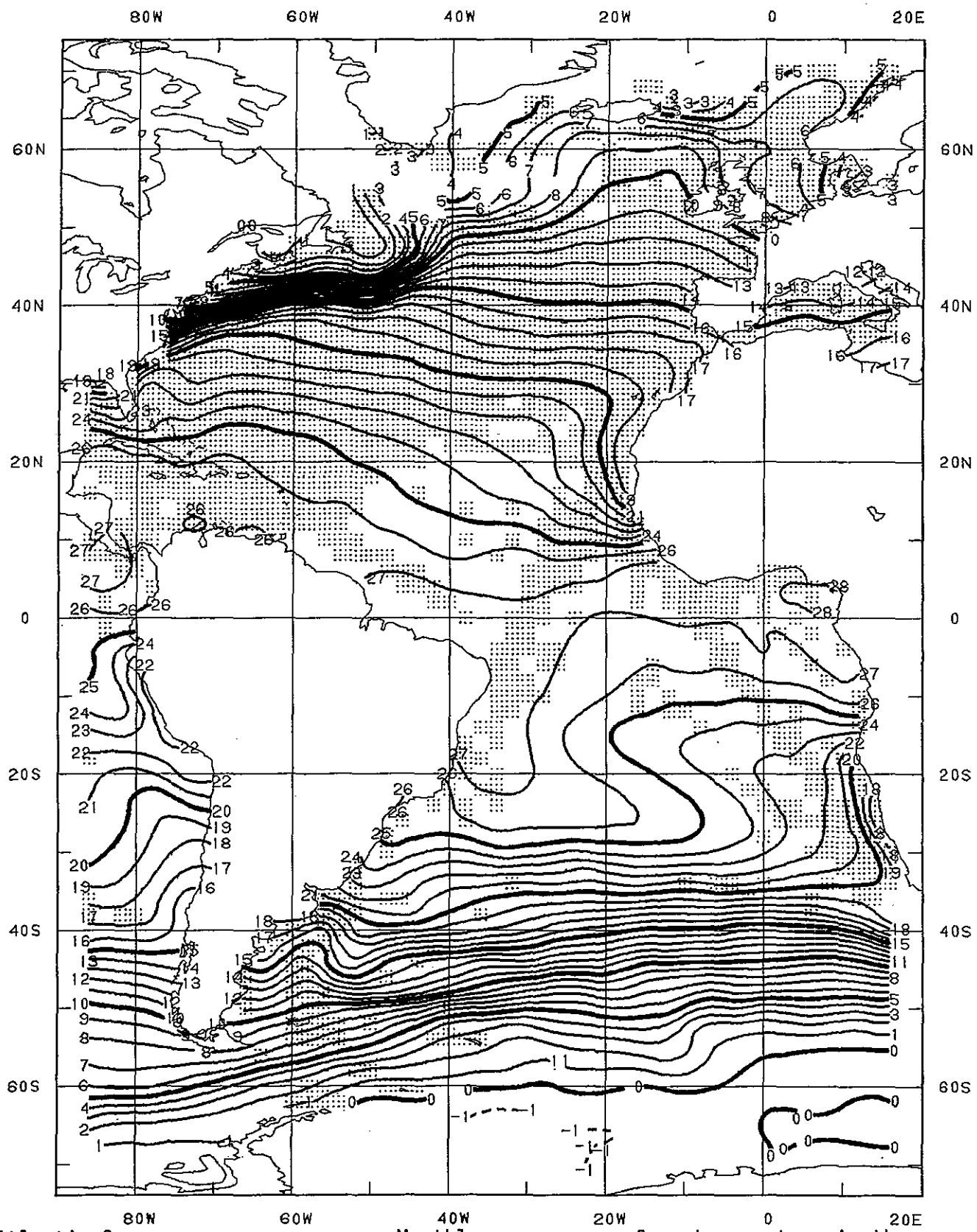
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



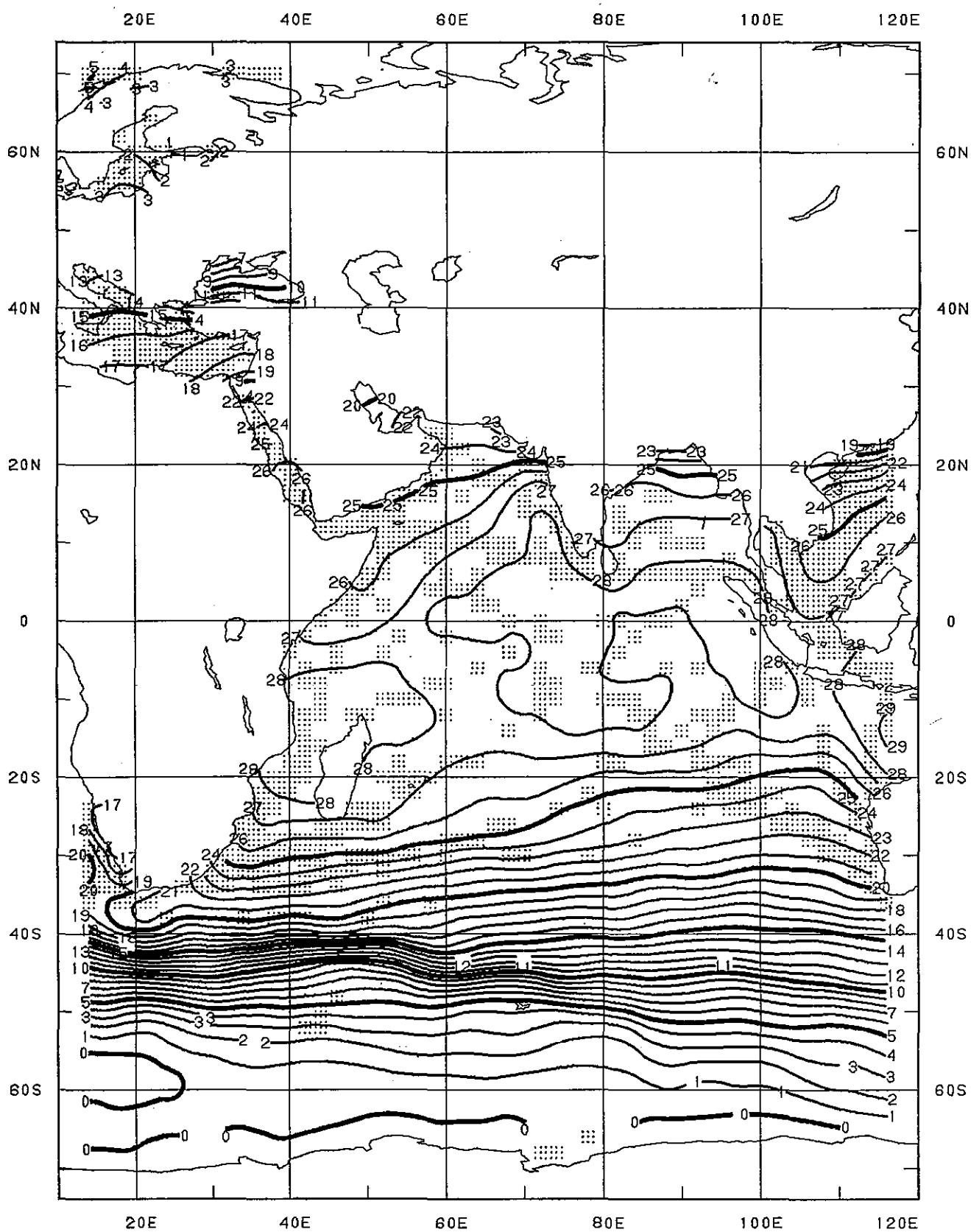
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly anomaly is the difference between the of monthly mean sea surface temperature 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.



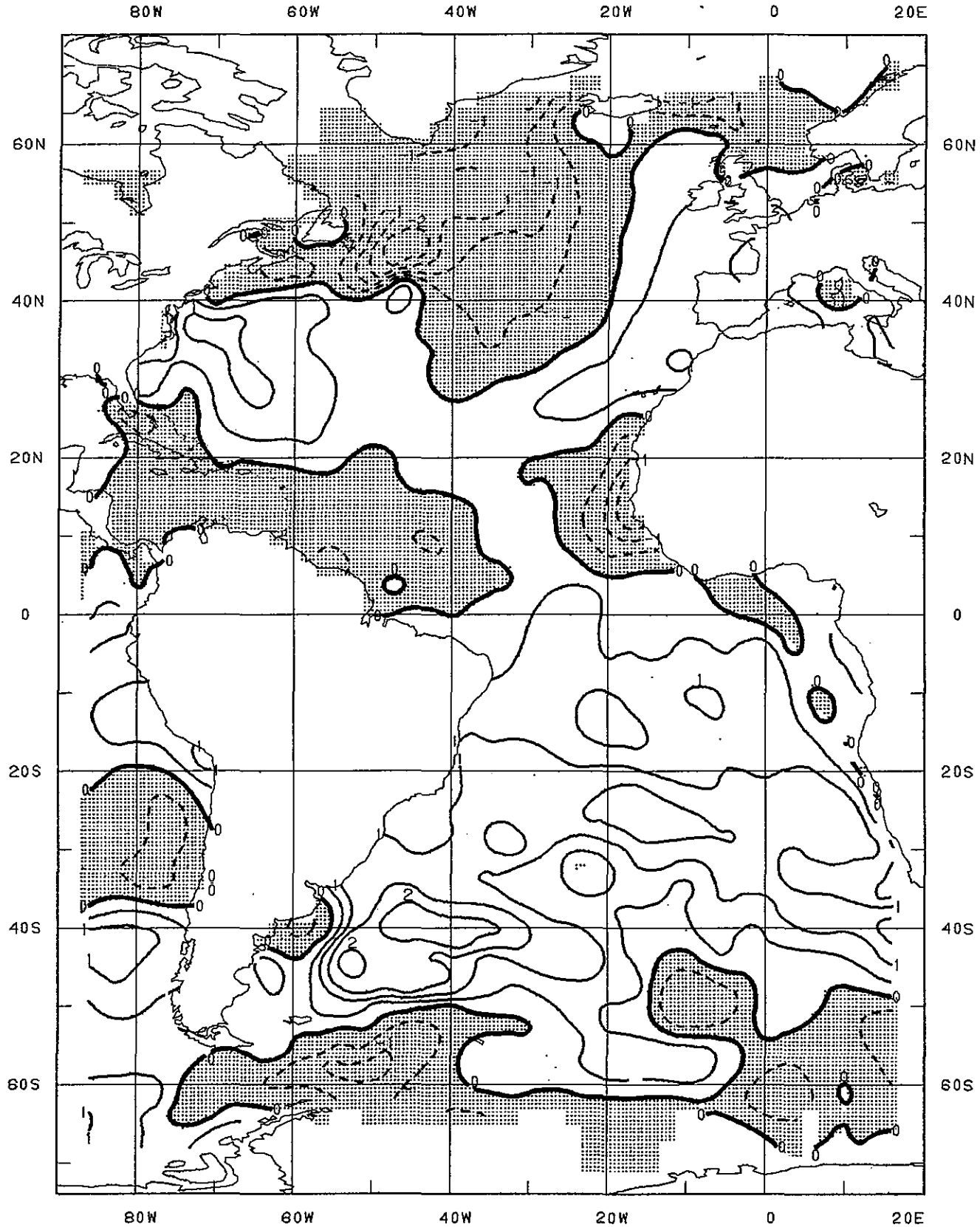
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



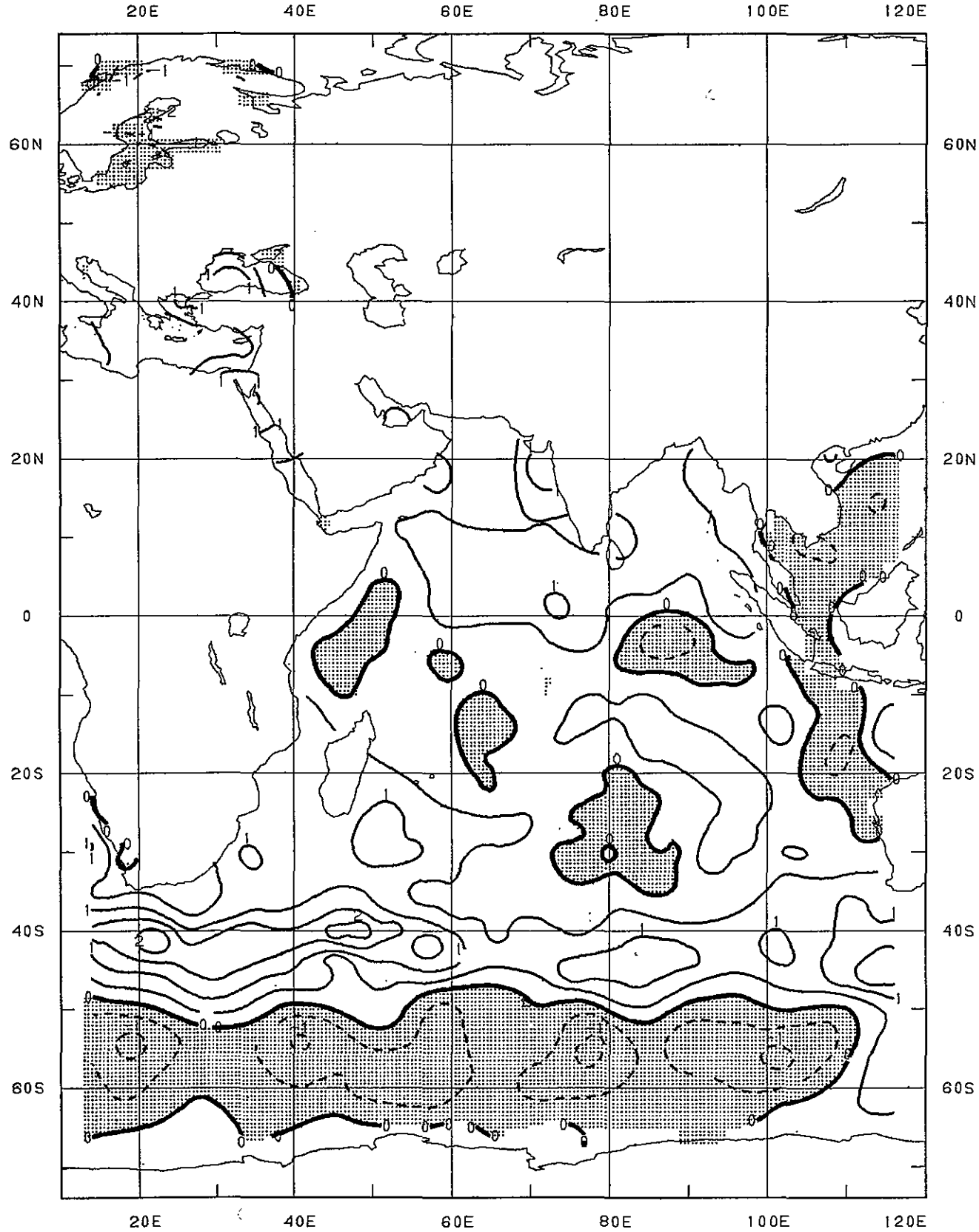
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
JANUARY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

A COMMENT ON SATELLITE FLOW IMAGERY NORTHWEST OF CUBA DURING OCTOBER 1985

by Frank Chew

Atlantic Oceanographic and Meteorological Laboratory
NOAA
Miami, FL 33149

Compared to the segment of the Gulf Stream System downstream (north) of Miami, Florida, few comprehensive *in-situ* data studies are available in the upstream segment north of Cuba to support the shape of the Gulf Stream there as revealed in satellite imagery. The October 1985 satellite imagery for the Gulf of Mexico is an exception; for it shows a feature that was first observed by means of free drifting drogues in August 1971 (Chew, 1974). The October *Oceanographic Monthly Summary* report on the Gulf Stream System correctly denoted little change in the Loop Current amplitude since the previous month, but the report overlooked the important change in the shape of the Stream segment northwest of Cuba. Figure 1 shows the September 24-25 Stream position and Figure 2 shows the October 15-21 position; both positions are from satellite imagery analysis. If the flow south of 25°N is assumed to follow the edge of the current, the September Loop Current (Fig. 1) is seen to enter the Florida Strait along a loose cyclonic path swinging far to the south. In contrast, the October Loop Current south of 25°N (Fig. 2) proceeds farther west before making a tight cyclonic turn near 24°N 86°W and enters the Florida Strait in an initially anticyclonic flow. The tight turn, its location, and the trough following the wave crest all bear a remarkable resemblance to the drogue observations shown in Figure 3. The triangles in Figure 3 indicate the 6 hourly position changes of 3 drogues during August 26-31, 1971. Initially deployed near 23.5°N 86°W the drogues were set at a nominally fixed 40 m depth, and their successive locations are indicated by the vertices in each triangle. The considerable understanding of the kinematical and dynamical properties that can be gained from measurements in such a flow are applied and elaborated in Chew, *et. al.* (1985). For example, the vertical motion and the meander translation are interrelated with the cyclonic and anticyclonic parts of a meander. In particular, the skewness in the strength of the meandering flow can be related to the upwelling and downwelling that tends to restore the thermal wind balance while moving the cold dome meander downstream. These properties can also be discerned in the work of Rossby, *et. al.* (1985) who reported on the Gulf Stream east of Cape Hatteras. Understanding the nature of such a flow is fundamental to the study of the Gulf Stream System.

References:

Chew, F., J.M. Bane, Jr., and D.A. Brooks, 1985. On vertical motion, divergence, and the thermal wind balance in cold-dome meanders: A diagnostic study. *J. Geophys. Res.*, 90, 3173-83.

Chew, F., 1974. The turning process in meandering currents: A case study. *J. Phys. Oceanogr.*, 4, 27-57.

Rossby, A.S., A.S. Bower, and P.T. Shaw, 1985. Particle Pathways in the Gulf Stream. *Bull. Amer. Meteor. Soc.*, 66, 1106-10.

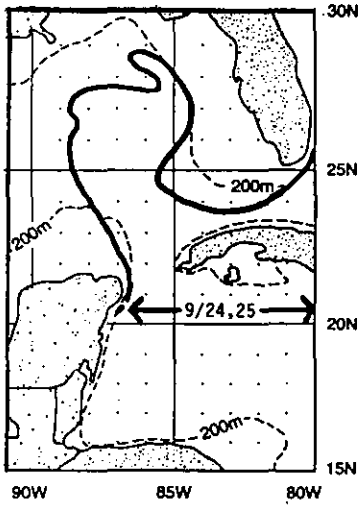


Figure 1. The Loop Current position for September 24-25, 1985.

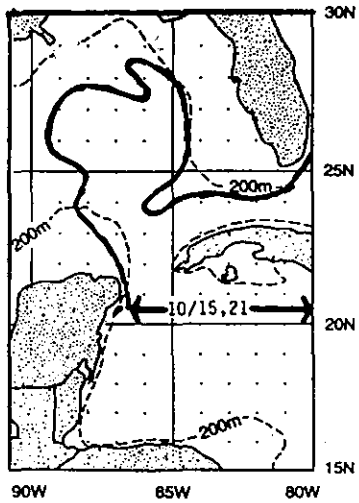


Figure 2. The Loop Current position for October 15-21, 1985.

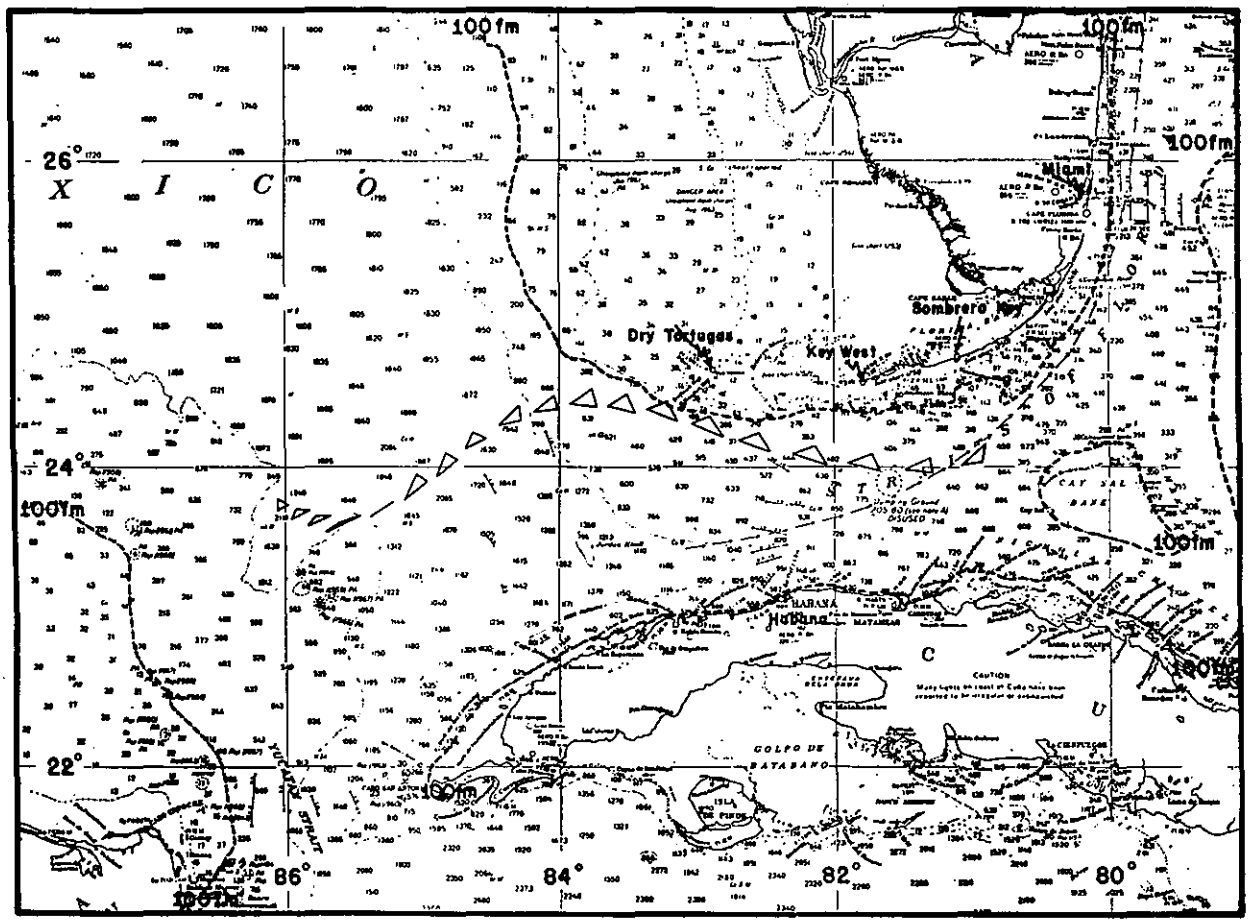
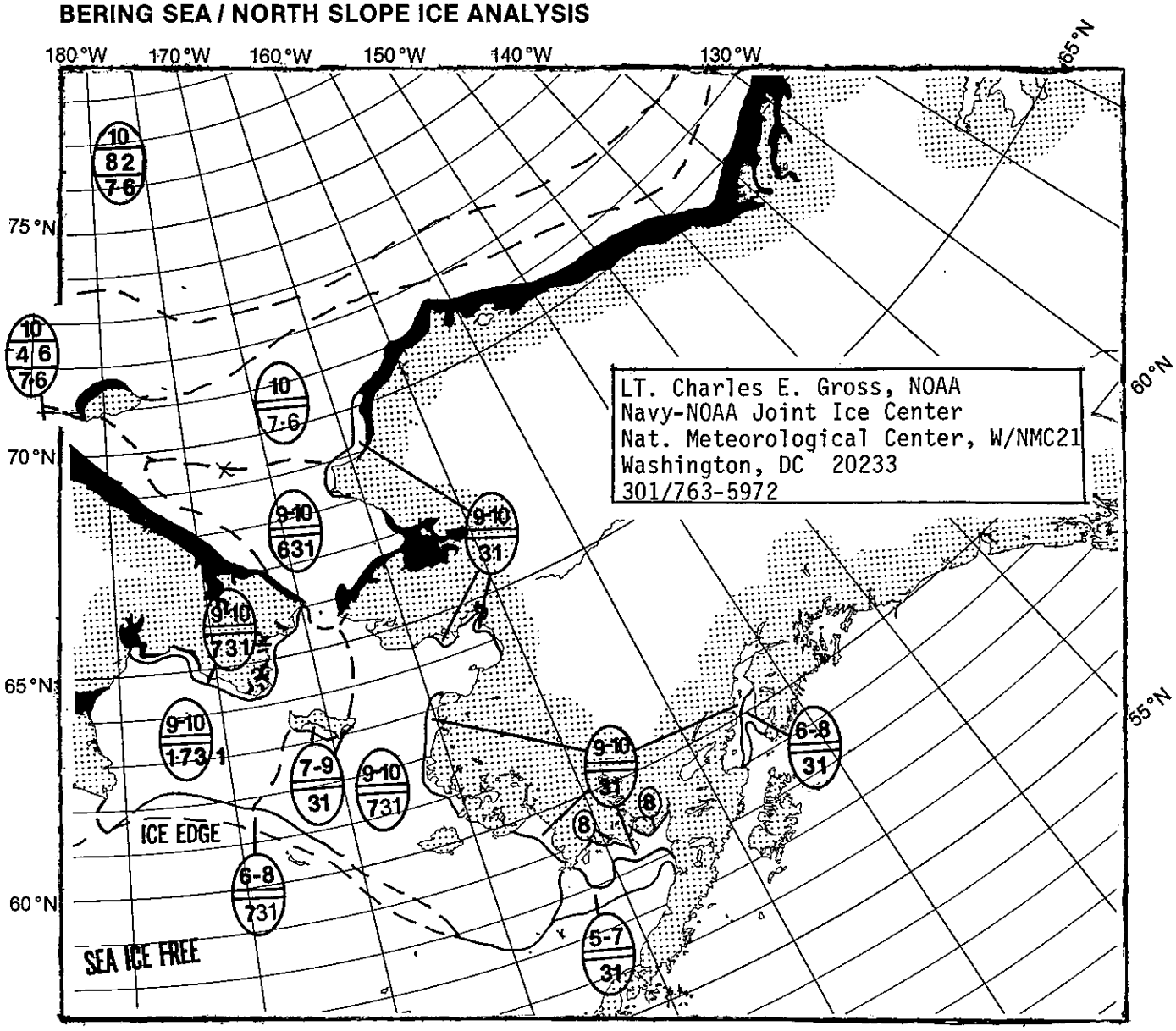


Figure 3. The triangles represent the 6 hourly locations of 3 drifting drogues during August 26-31, 1971. The drogues were initially deployed 200 km north of the Yucatan Strait at a 40 m depth (fixed). (Source: Chew (1974).)

BERING SEA / NORTH SLOPE ICE ANALYSIS



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.

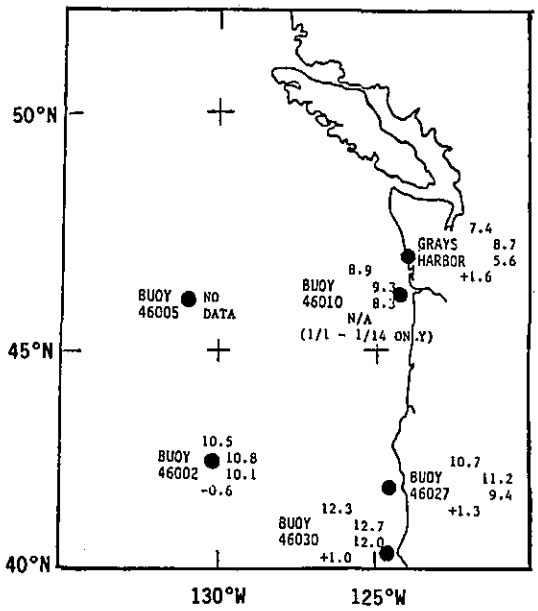
Ice boundary visually or satellite observed.

Ice boundary estimated.

JANUARY 1986

The monthly mean sea level pressure circulation depicts a 987 mb low centered in the northeast Pacific Ocean near 54°N 152°W. Monthly mean geostrophic winds are east-northeasterly throughout the Alaskan Bering Sea waters. During January, the low pressure systems tracked south of the Aleutian Islands. This contributed to the normal to below normal surface air temperatures in the Bering Sea, which contrasts with the above normal temperatures of December. Off-pack winds prevailed in the eastern Bering Sea. Monthly mean air temperatures are normal at Nome (65°N 165°W), normal at King Salmon (59°N 156°W), and below normal at Cold Bay (55°N 163°W). Theoretical ice thickness is below the climatological minimum at Bukhta Provideniya, U.S.S.R. (64°N 173°W) and below the climatological normal at Nome. The current ice edge position is climatologically normal east of 168°W, but is climatologically less than normal west of 168°W.

WEST COAST OCEAN FEATURES



JANUARY 1986

Unlike last month, the dominant weather pattern during January in the North Panel area was marked by the passage of numerous weather frontal systems, persistent cloud cover, and prevailing southerly winds. Oceanographically, this inhibited the seasonal cooling overall, and even resulted in mean monthly SST increases at some locations, particularly in nearshore waters. The predominance of negative SST anomalies observed over the past several months has given way to SSTs near or slightly avove normal over the much of the area. The persistent cloud cover severely limited the use of infrared satellite imagery for detecting ocean thermal patterns. Little thermal structure was observed during the occasional glimpses through the clouds, except for the continued presence of cold freshwater flowing northward along the Washington coast (seen in the imagery taken on January 4 and 6).

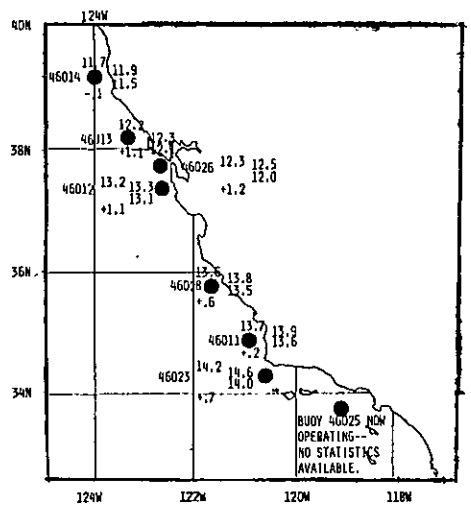
KEY:

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

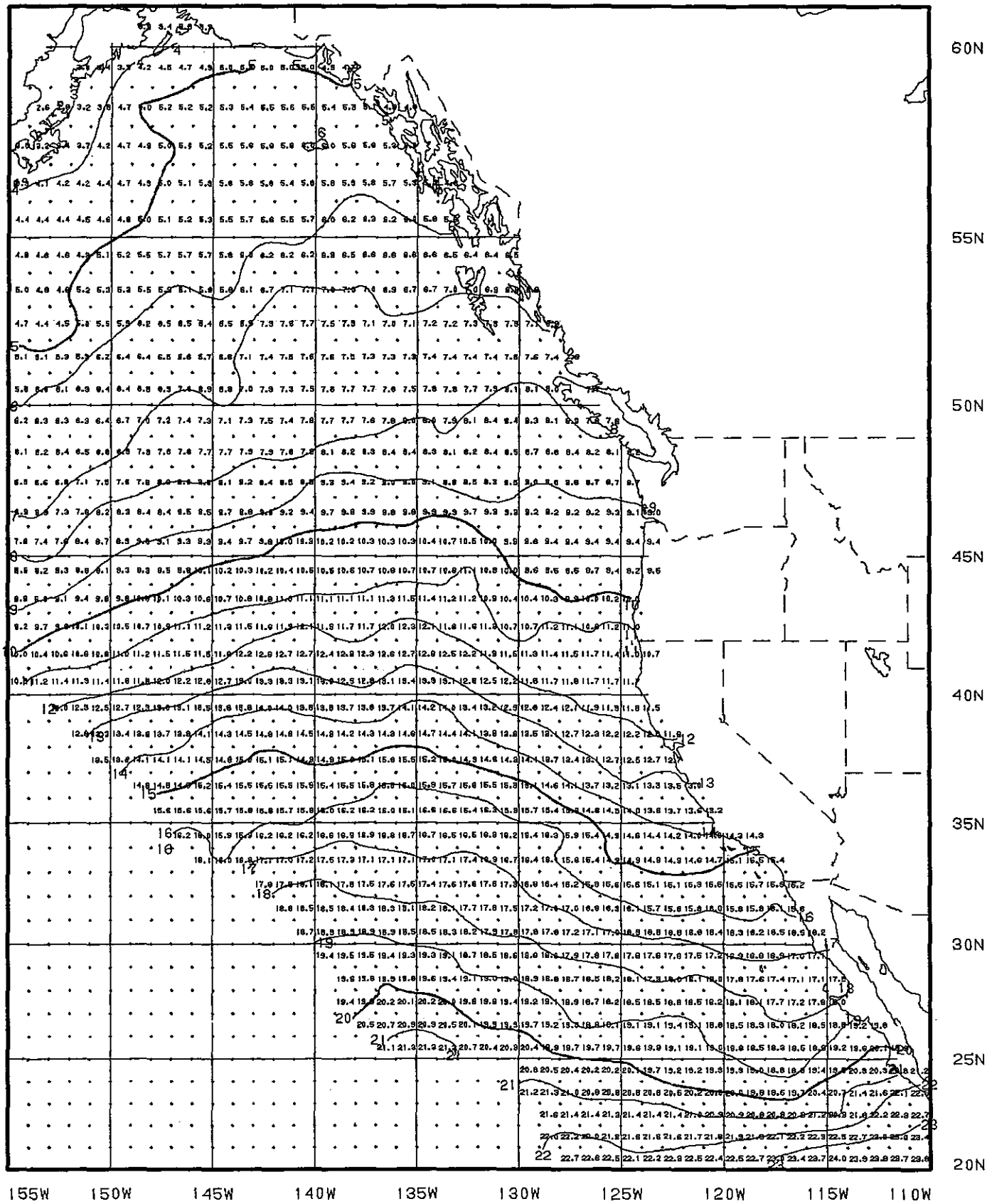
● Denotes station position.

North Panel
Kent Short
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, Wa 98115
(206) 526-6604
FTS 392-6604

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

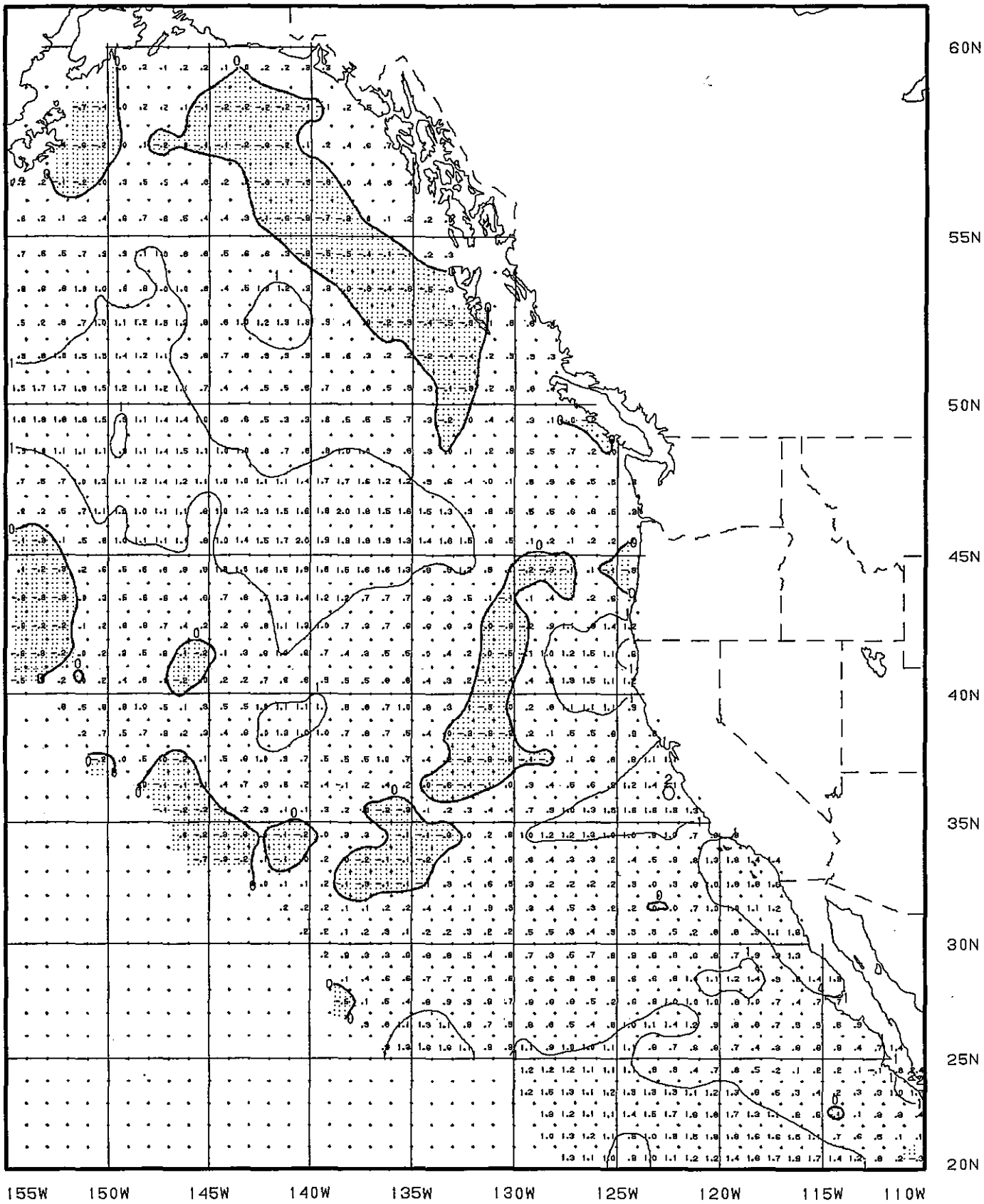


All nine SST analyses during the month indicated above normal SSTs. The normal overall mean SST for January in the South Panel area is 14.7°C, but this month averaged 0.8°C above normal--15.5°C. A very slight cooling trend occurred in the middle of the month, but even then the overall mean SST was 15.3°C. Only the area near 37°N 132°W shows a cool anomaly (about 0.4°C). The remainder of the South Panel area is generally from 0.5°-1.0°C above normal with the maximum anomaly nearshore from San Francisco Bay to San Diego. Normally the SSTs will continue to cool during January, but not this month. Waters warmed along the entire California coastline except for the one buoy at Pt. Arena which cooled by a mere 0.1°C from the previous month. This warming trend seems to agree with the weather pattern which caused above normal air temperatures due to consistent southerly flow. In fact, the city of San Francisco established a new record for the warmest January!



West Coast
SST--MONTHLY MEAN (°C)
January 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
January 1986

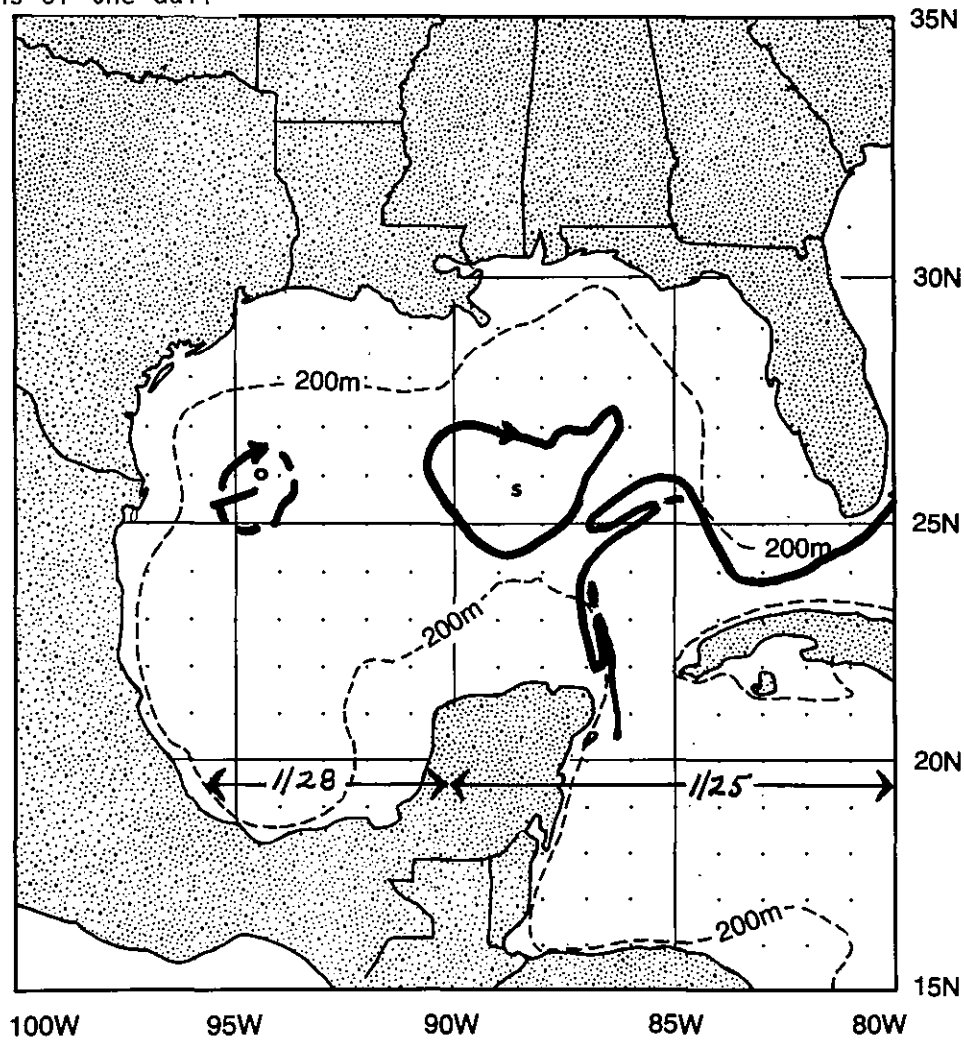
Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf

EAST COAST OCEAN FEATURES

Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

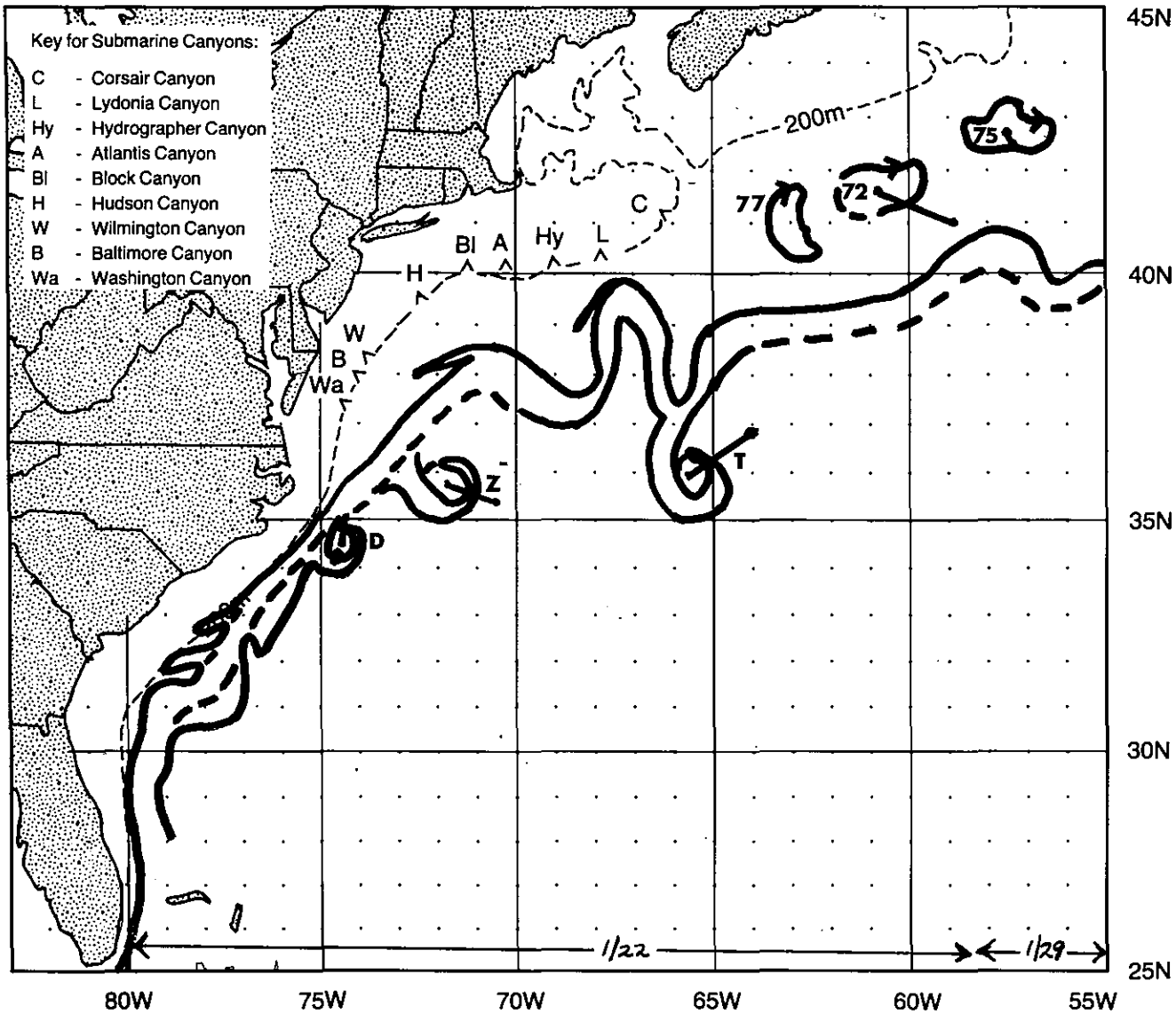
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

JANUARY 1986

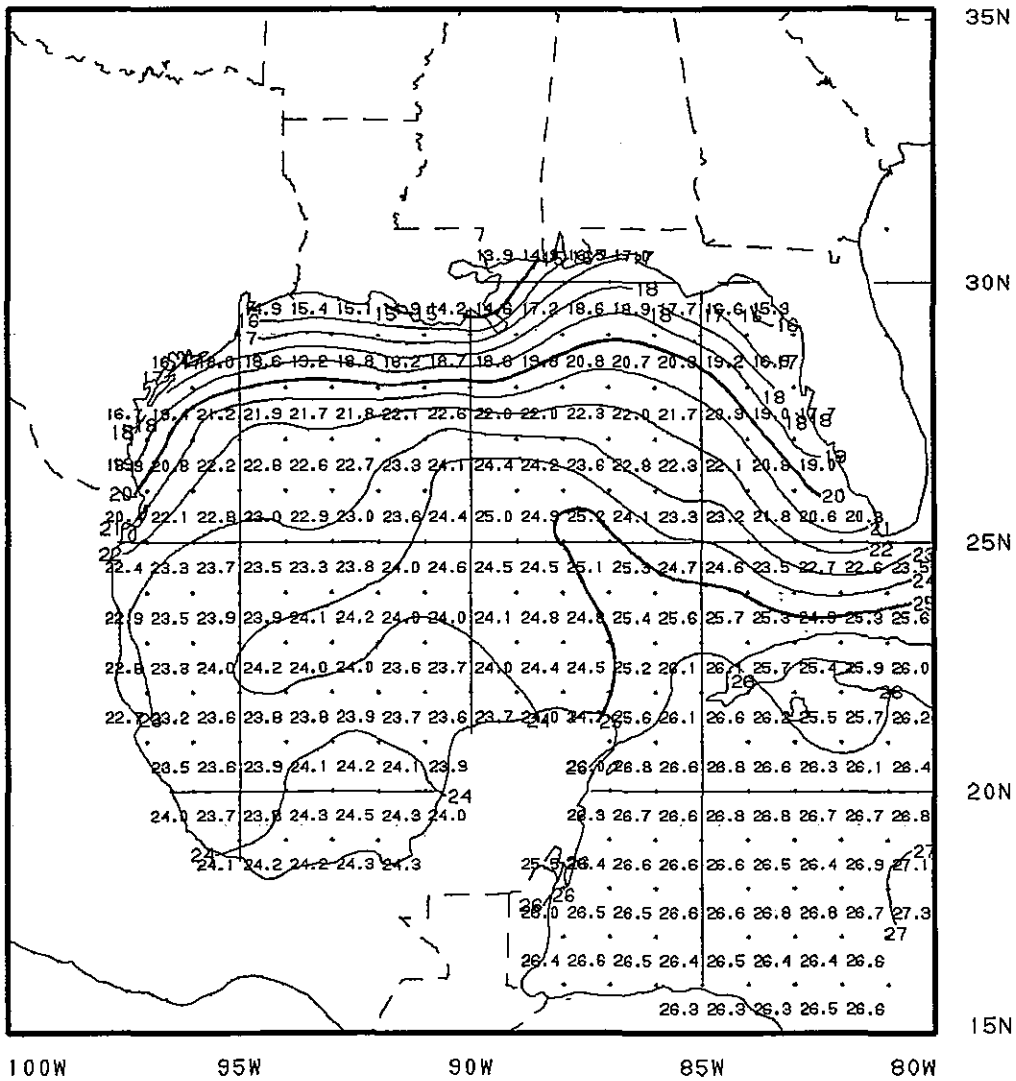
The end-of-January amplitude of the Loop Current decreased about 330 km compared to the end-of-December position. This dramatic decrease is due to the formation of anticyclonic eddy s on January 14. Eddy o translated 80 km ENE. Eddy p apparently dissipated around January 28 near 27°N 95°W.



During January one anticyclonic eddy was presumably absorbed by the Gulf Stream, one anticyclonic eddy formed, and one anticyclonic eddy was newly detected. Short lived eddy 78 was first detected near 40°N 68°W on January 10. It was apparently absorbed by a Gulf Stream meander on January 22. Eddy 72 apparently interacted with the Gulf Stream near 41°30N 60°W on January 10. By January 19 eddy 72 had pinched off from the Gulf Stream also near 41°30N 60°W. Eddy 72 translated 185 km NW. Eddy 77 formed from a Gulf Stream aneurism near 40°N 63°W on January 5. The term aneurism describes that part of a Gulf Stream meander that is rapidly dilating. When an eddy forms from the pinching off of an aneurism the rest of the Gulf Stream meander remains. This differs from the other case in which the entire meander pinches off and forms an eddy. Eddy 75 translated 30 km NNW.

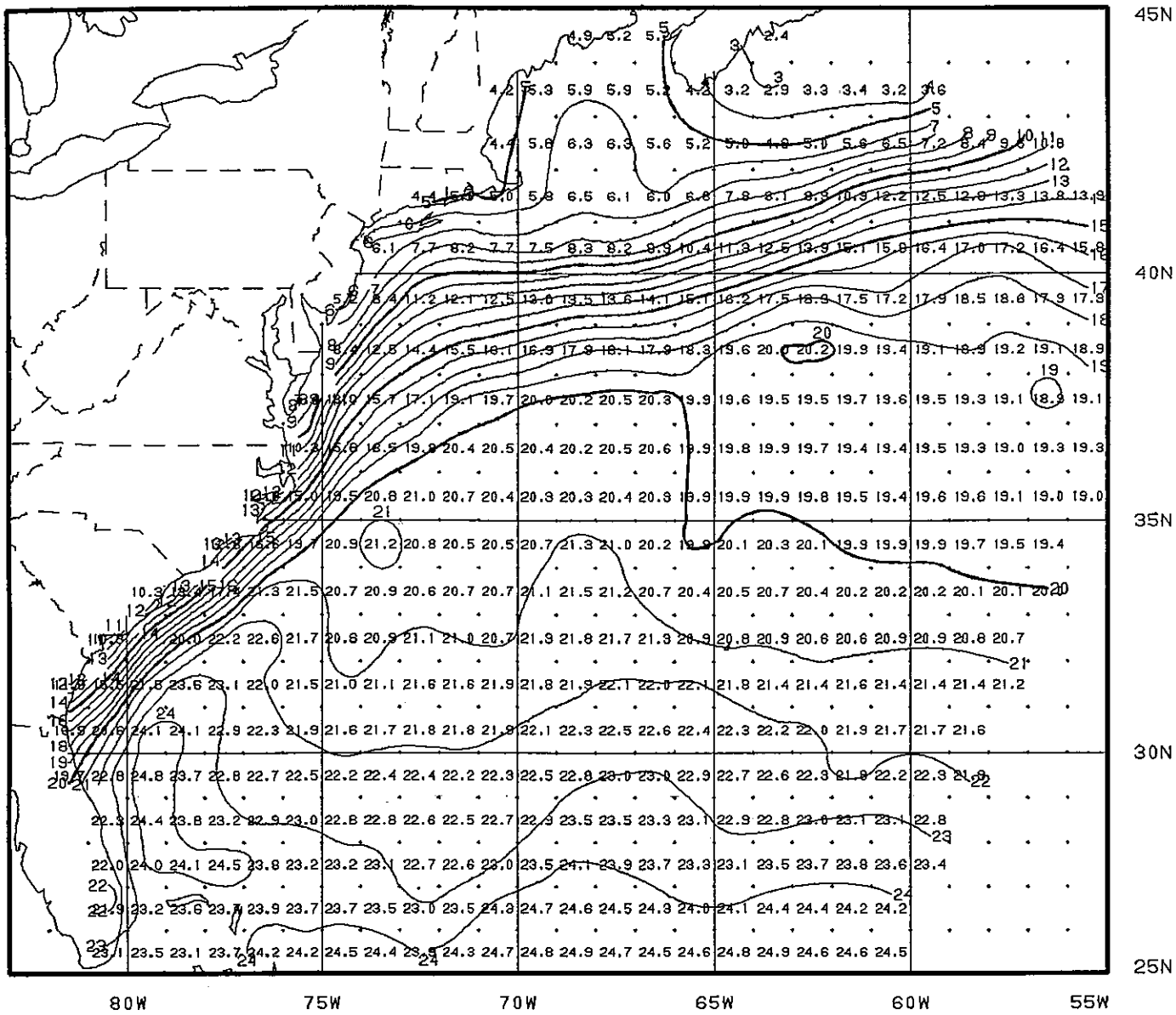
Presumably, the Gulf Stream did not form nor absorb any cyclonic eddies during January. However satellite thermal infrared imagery was contaminated by extensive cloud cover south of the Gulf Stream throughout January. Cyclonic eddy D translated 45 km S. Eddy Z traveled 120 km WNW. Eddy T moved 175 km SW.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
January 1986

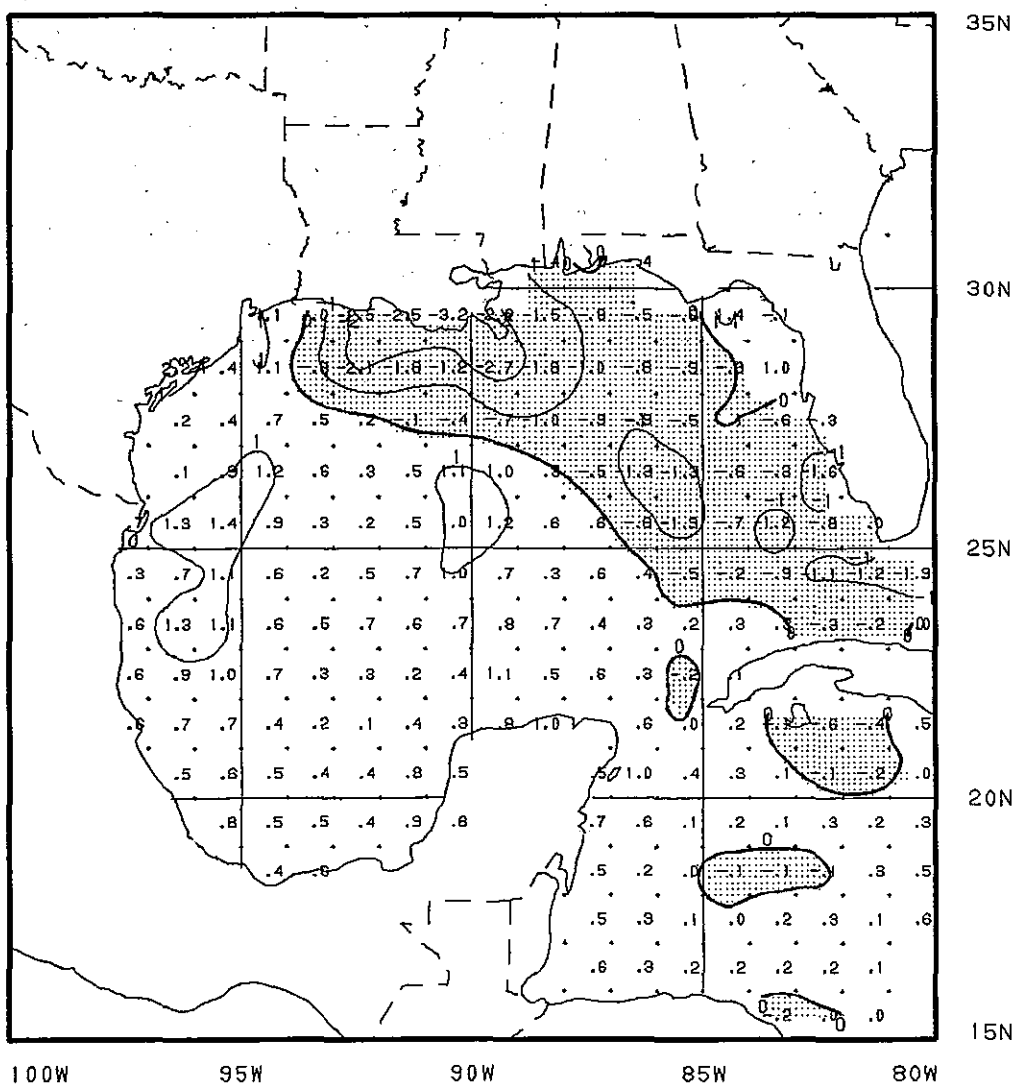
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
January 1986

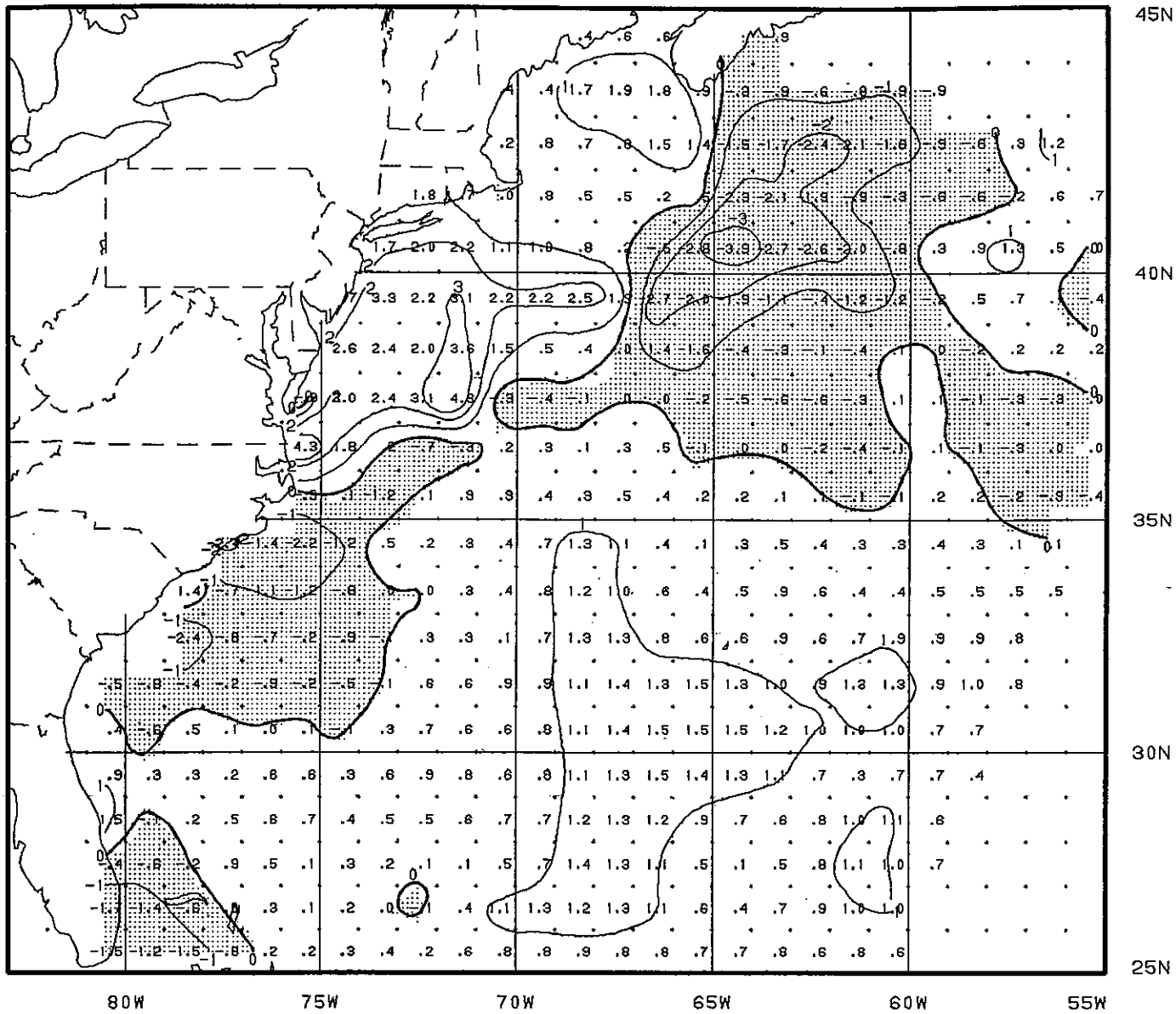
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
January 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

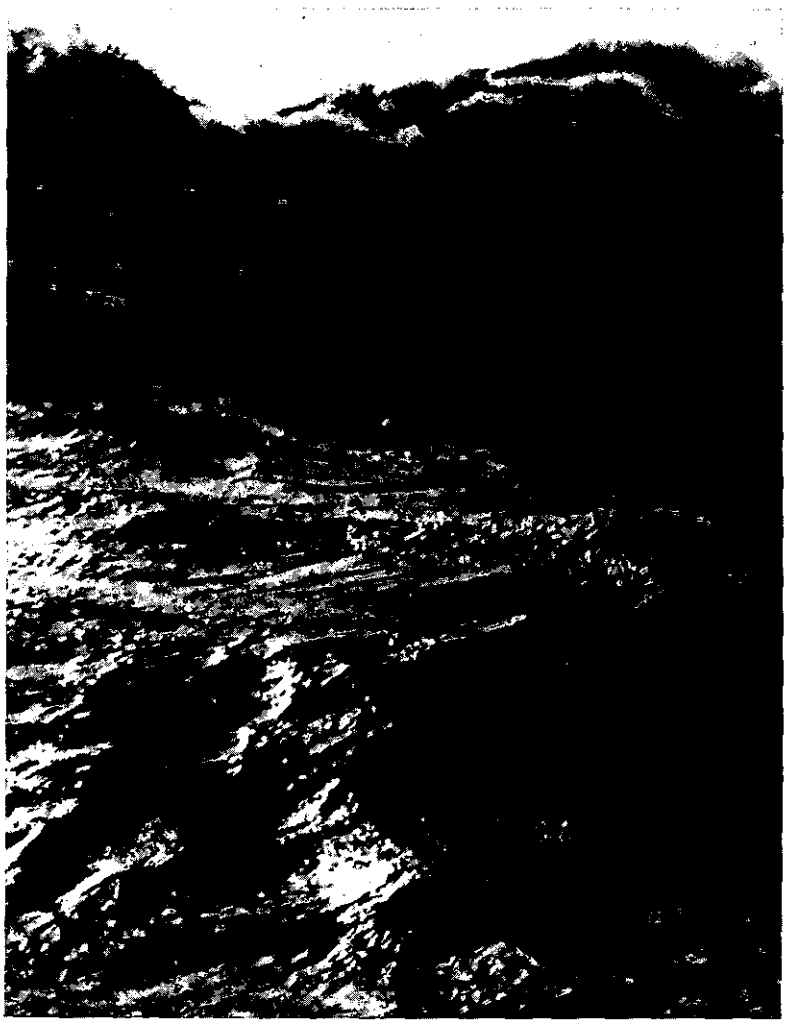


NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
January 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 2 February 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

Oceanographic Monthly Summary is published by the National Weather Service (NWS) and the National Environmental Satellite, Data, and Information Service (NESDIS). *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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31*.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2*.
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; *NavOceano Ref. Pub. 18*.

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

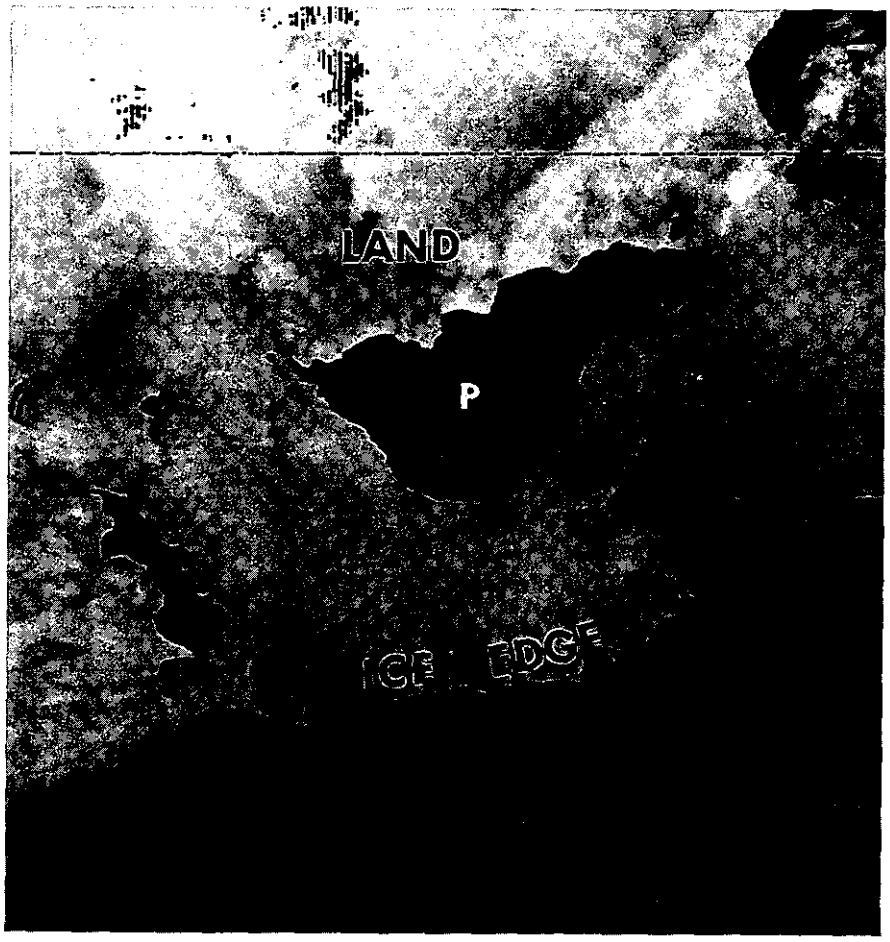
Typing: Damita Johnson

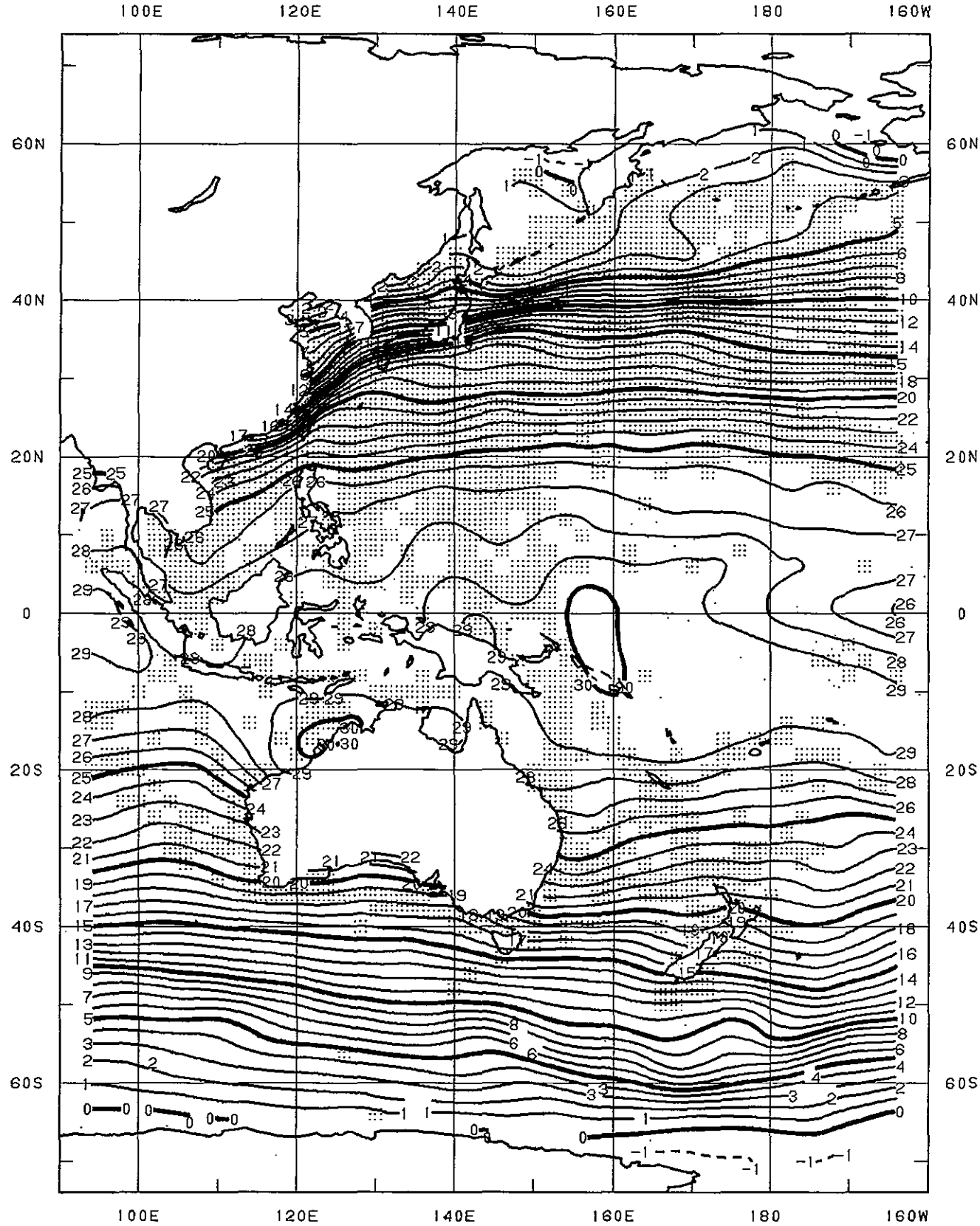
SATELLITE IMAGE OF THE MONTH

Marcia L. Weaks
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

ICE IN THE ADMUNDSEN SEA

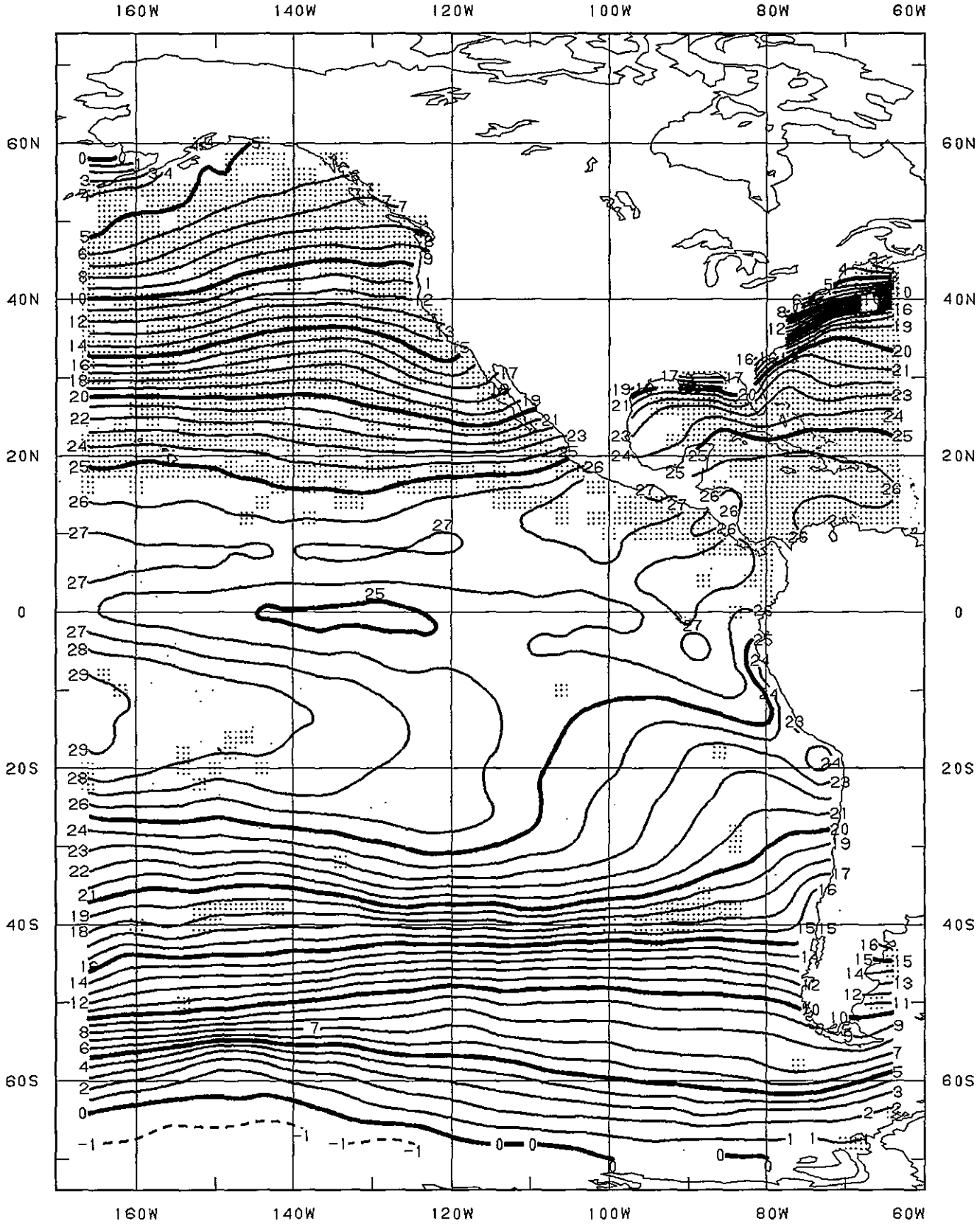
This infrared image was taken in the Admundsen Sea, which is adjacent to the Antarctic Continent, on February 21, 1986. A relatively ice-free area is seen next to the coast centered about 120°W (denoted by "P"). This feature is often termed a "flaw lead" or a "shore polynya", which is defined as an area of open water surrounded by ice. In this image, some relatively thin ice is present within the polynya. Since the ice-free region is warmer than the surrounding ice, it appears darker in this infrared image. Relatively warm katabatic winds that are channeled through mountain passes are believed to push the ice offshore, creating the polynya. Subsurface convection is also thought to contribute to the polynya. The offshore ice edge is indicated by the abrupt change in the gray shades, again due to the difference in temperature between ice and open water in this infrared image. Currently, the University of Southern California is sponsoring an experiment along the ice edges in this region and in the Bellingshausen and Weddell seas. The NOAA/Navy Joint Ice Center is supporting the Antarctic Marine Ecosystem Research at the Ice Edge Project (AMERIEZ) by providing ice edge positions, inner pack concentrations, and ice edge forecasts.





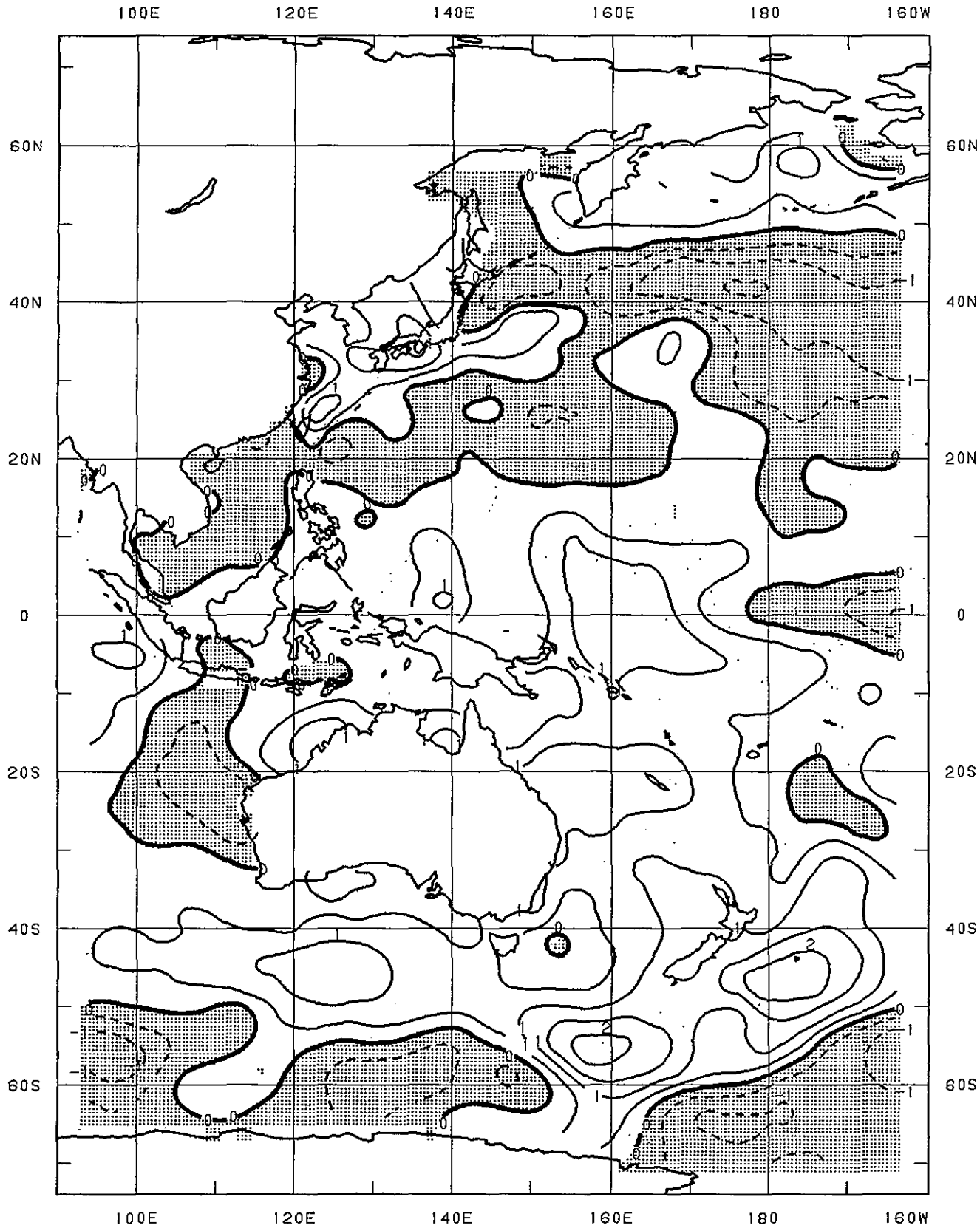
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



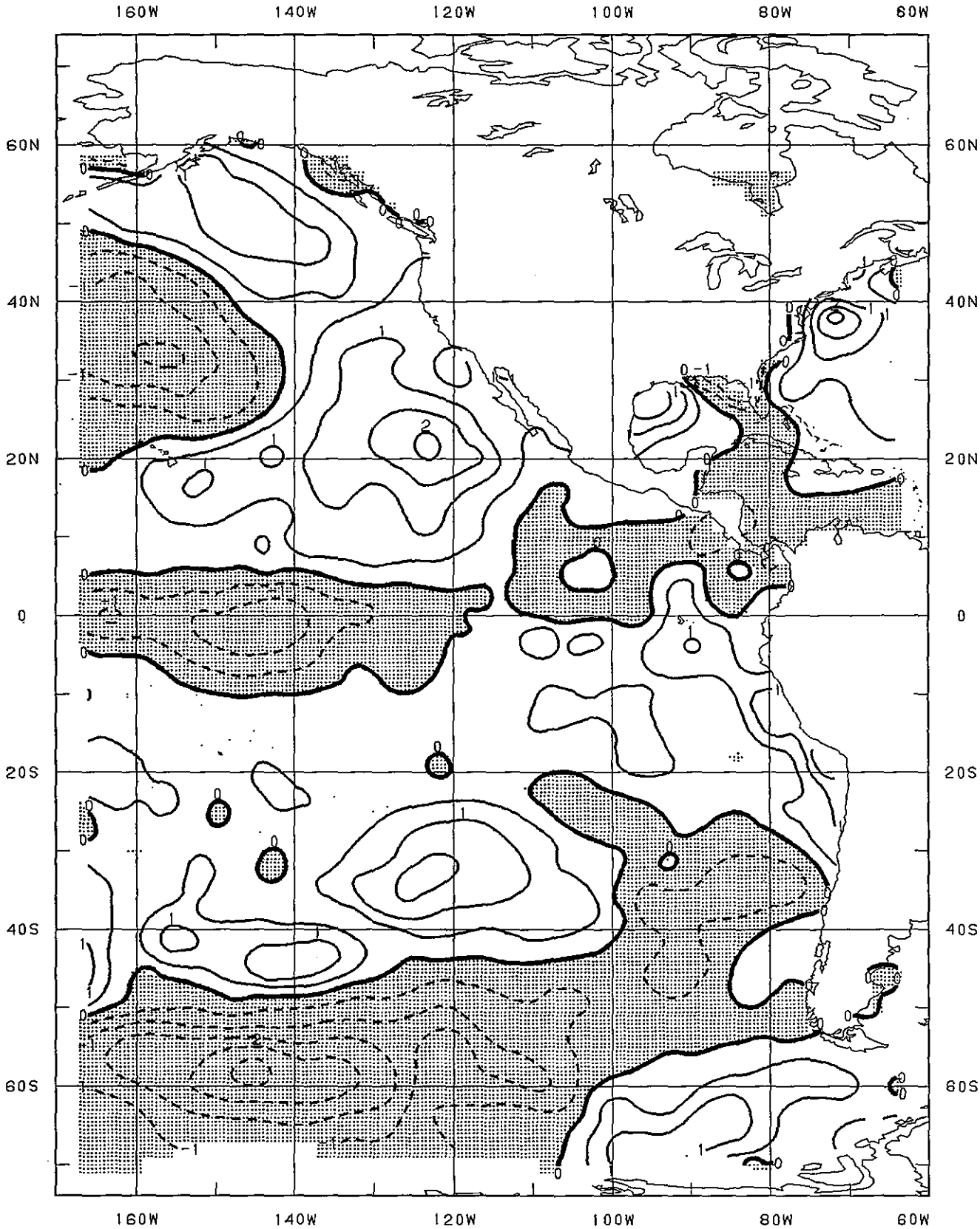
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



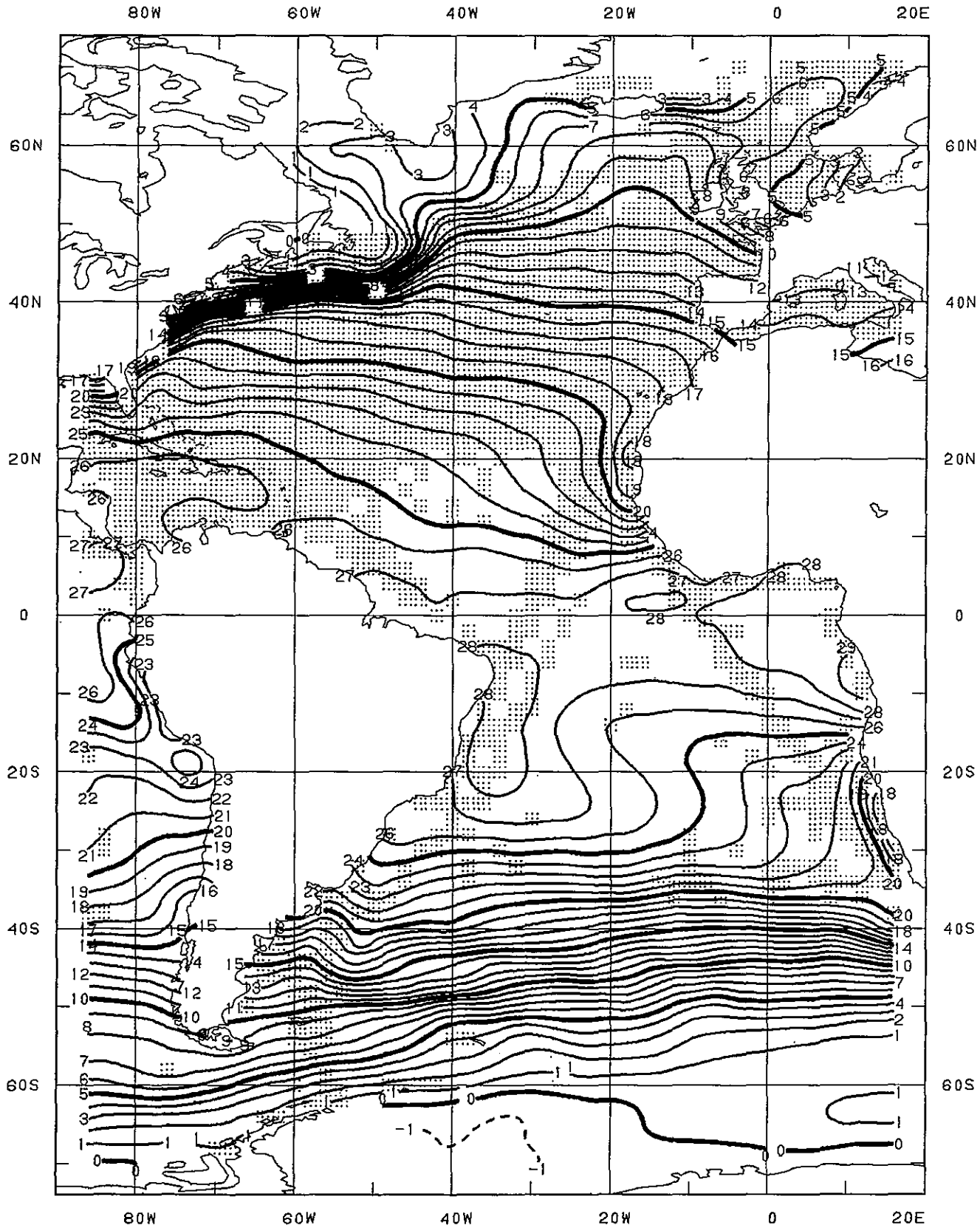
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



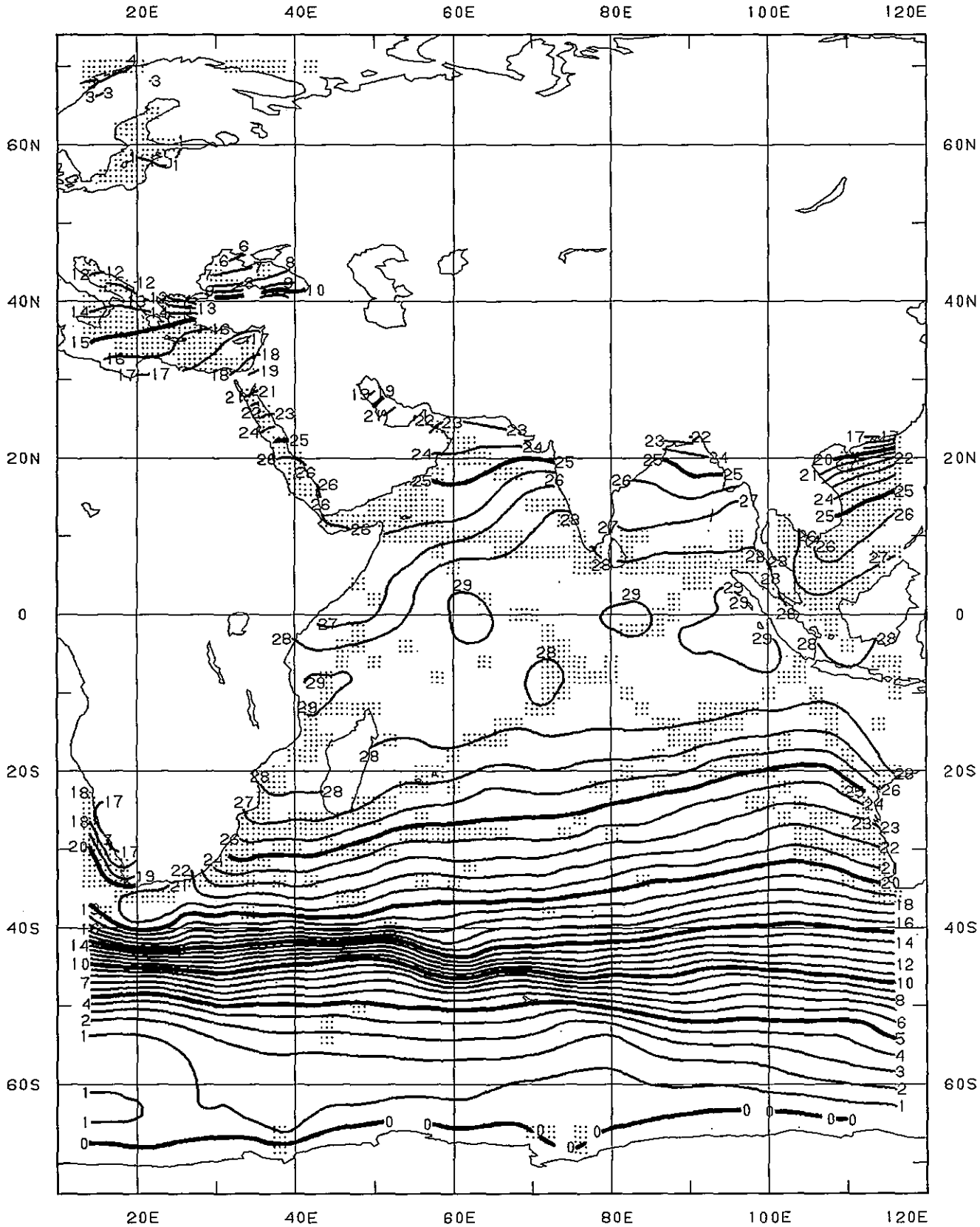
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly anomaly is the difference between the of monthly mean sea surface temperature 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.



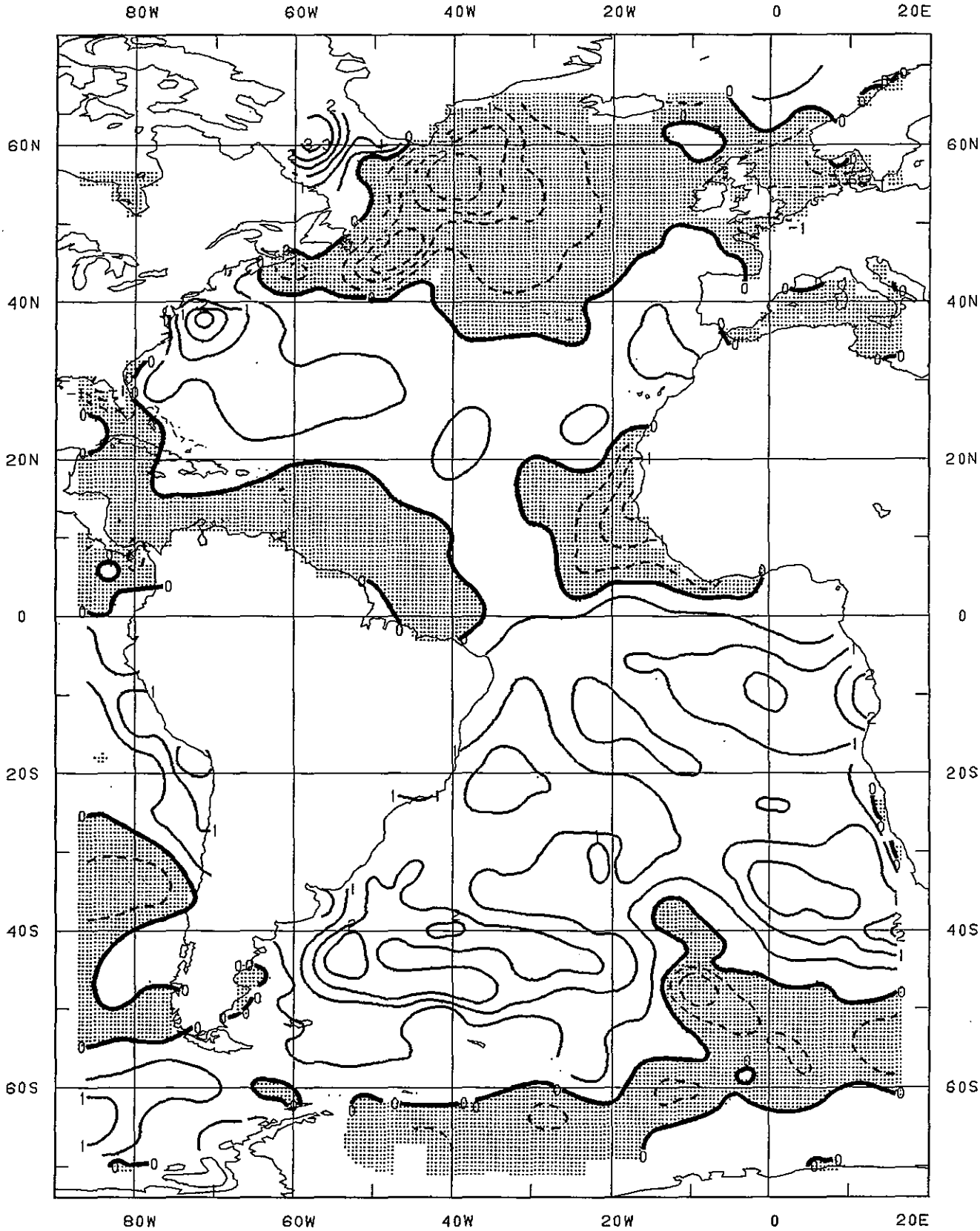
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



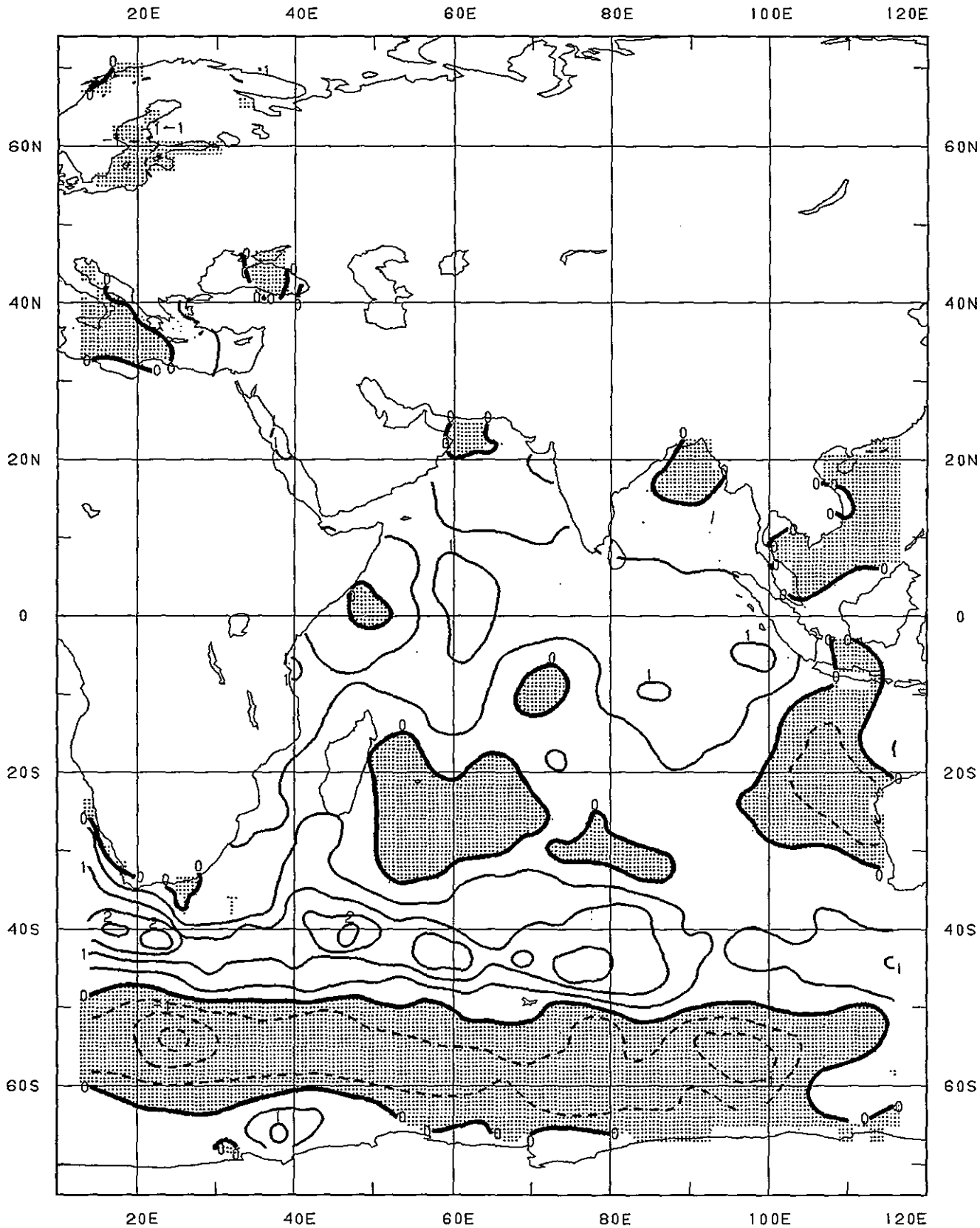
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
FEBRUARY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

AN OPERATIONAL SHIP SUPERSTRUCTURE ICING FORECAST SYSTEM

by David M. Feit

NOAA/NWS, Ocean Products Center, Washington, DC 20233

Ship superstructure ice accretion is a serious hazard to ships navigating in Alaskan waters. The Marine Products Branch at NMC has developed an automated objective guidance system for use in issuing ice accretion forecasts. For marine purposes ice accretion may be defined as the accumulation of ice formed 1) on exposed structural components of ships or 2) on structures above the water surface either on the coast or at sea. Safety considerations are the prime reasons for advising marine interests of the existence and expected location and intensity of ice accretion. The accumulation of ice on vessels such as fishing trawlers has the potential of causing serious handling problems leading to instability and capsizing. The extra weight of ice on masts and rigging not only makes the vessel top heavy but also increases its "sail area" and hence the adverse affects of the wind. This causes difficulties in handling the vessel. While larger ships have less of a problem with instability, the accumulation of ice on antennae makes radio communication difficult and impedes the effectiveness of radar.

Although there are several causes of superstructure ice accretion, such as freezing rain and supercooled fog, it is most frequently caused by freezing spray. Freezing spray results from either the action of the wind on the water or the impact of the ship against the waves. Wise and Comisky (1980), using an empirical approach, developed a nomogram (Fig. 1) to determine the expected rate of ice accretion from freezing spray. The nomogram is based on data from fishing trawlers and requires the input of sea surface temperature, air temperature and wind speed. The nomogram was not previously used for forecasts but rather as an aid to evaluate the current icing potential in a rather localized area. It was recognized that by applying the nomogram at a large number of locations and by using forecast input as well as analyses it is possible to evaluate and quantify the possibility of icing under present conditions and to alert the forecaster to future potential icing situations. In addition instead of evaluating conditions at a single point, the areal extent of icing can be defined and the movement of the ice accretion area can be determined. It should be noted that the quantitative aspects of this evaluation are affected by vessel type.

The approach used in the ice accretion forecast system is to apply the Wise and Comisky nomogram at each of the NMC spectral model grid points in the Gulf of Alaska and adjacent areas bounded by 47°N to 64°N and 125°W to 170°E. Input parameters are the analyzed and forecast spectral model 1000 mb air temperature and wind fields and the sea surface temperature based on an NMC 2-day composite ship/satellite analysis. The result is a contoured chart of grid point values (Fig. 2). A series of charts such as these can indicate to the forecaster the areal extent, movement, and rate of accretion of the icing.

Reference:

Wise, J.L. and A.L. Comisky, 1980. Superstructure Icing in Alaskan Waters, NOAA Special Report, Pacific Marine Environmental Laboratories, Seattle, Washington.

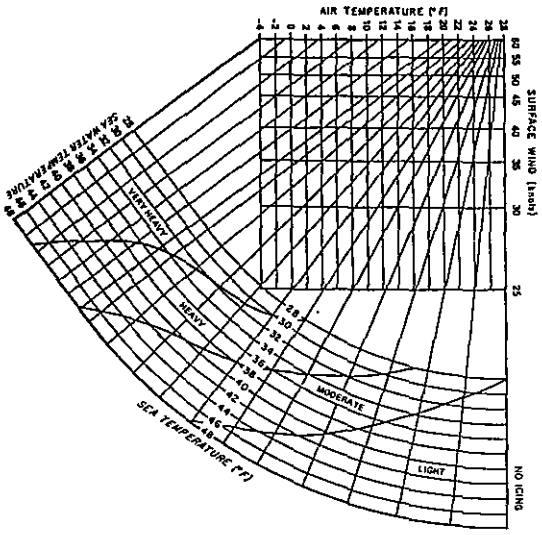


Figure 1. A nomogram developed by Wise and Comisky (1980) determining the expected ice accretion rate for the given wind speed, sea temperature, and air temperature. The curves correspond to the prescribed ice accretion rates of very very heavy, heavy, moderate, and light.

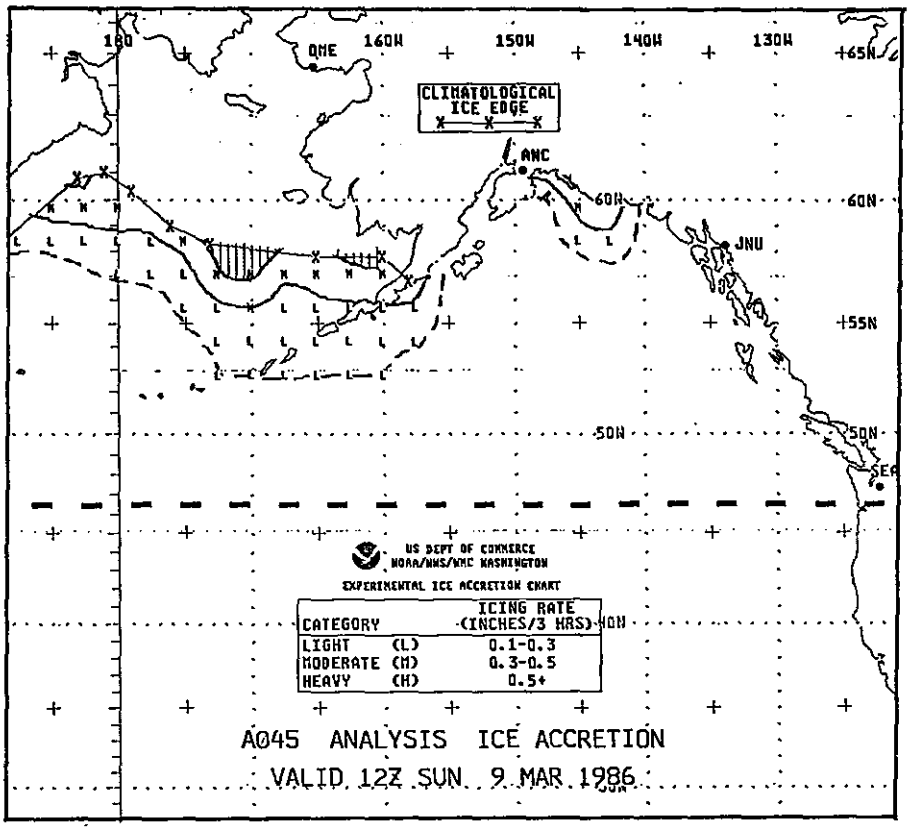
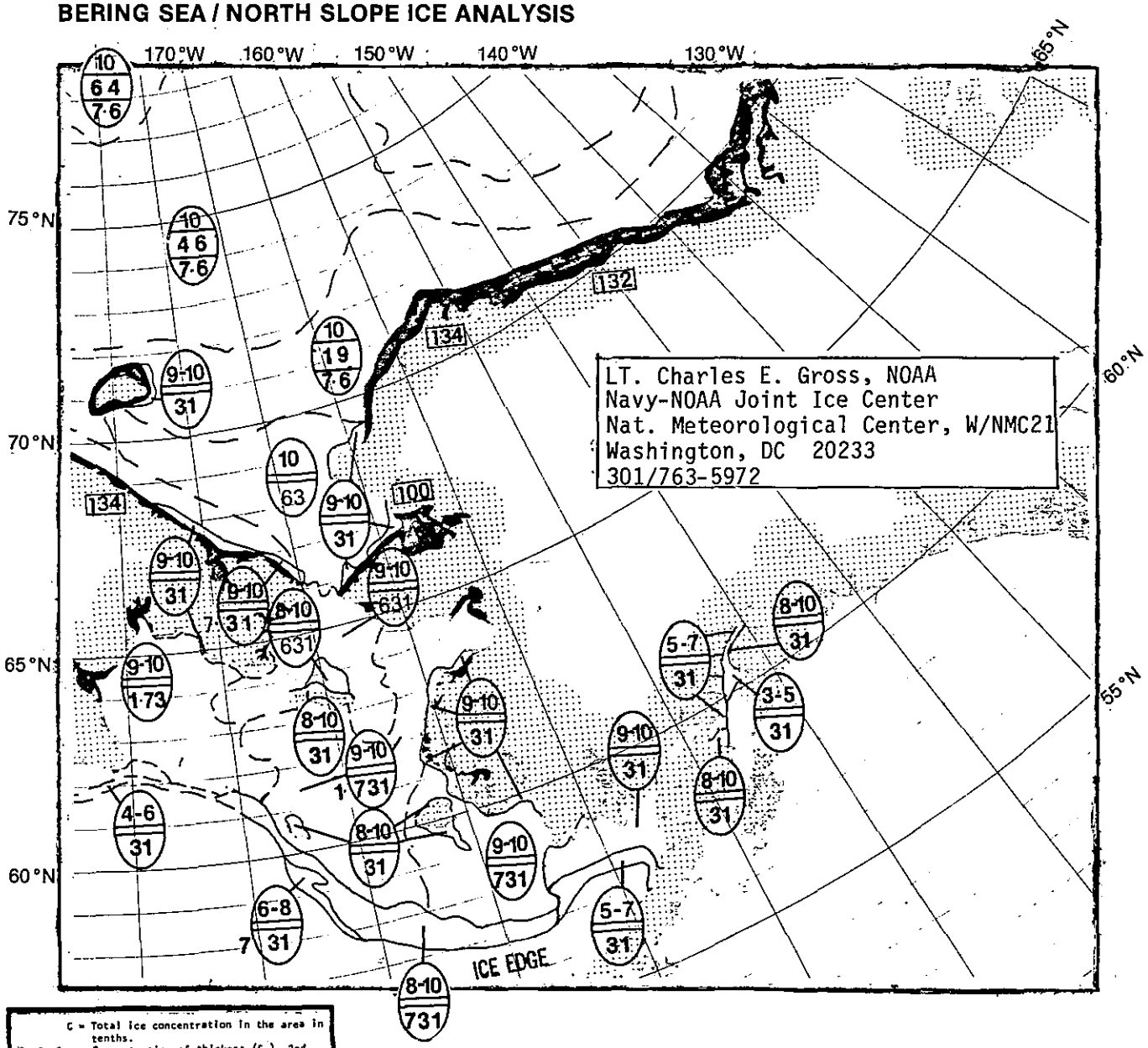


Figure 2. A sample of the NMC ice accretion forecast system chart which is currently being disseminated to the National Weather Service's Alaskan forecast offices.

BERING SEA / NORTH SLOPE ICE ANALYSIS



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.

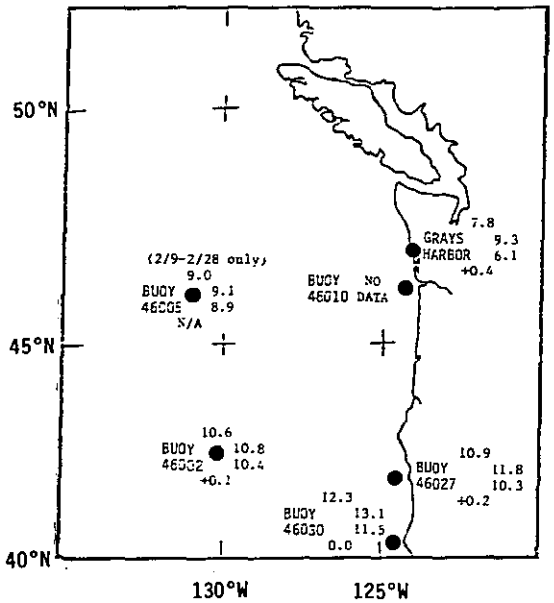
Ice boundary visually or satellite observed.

Ice boundary estimated.

FEBRUARY 1986

The monthly mean sea level pressure circulation depicts a 990 mb low centered at 44°N 164°W in the northern Pacific Ocean. Monthly mean geostrophic winds are easterly throughout the Bering Sea. During the first two weeks of the month a series of low pressure systems transiting north of the Aleutian Islands caused southeasterly winds and above normal air temperatures in the eastern Bering Sea, but during the latter half of the month a northeasterly windflow pattern caused below normal temperatures and resulted in slightly above normal monthly mean air temperatures at King Salmon (59°N 157°W) and near normal air temperatures at Cold Bay (60°N 162°W). Theoretical ice thicknesses are slightly below the 15 year average at Bukhta Providenya, U.S.S.R. (64°N 162°W) (91 cm vrs. 94 cm) and at Nome (96 cm vrs. 97 cm). The Bering Sea ice edge position is between the median and the maximum climatological position in the east and near the median in the west.

WEST COAST OCEAN FEATURES



FEBRUARY 1986

This is an uneventful month for ocean features in the North Panel area. SST stations over the entire area recorded virtually no overall change from January values. Since SSTs normally continue to seasonally decrease during February, the net result in this case is SSTs warmer than normal throughout the area. Positive anomalies over the majority of the area ranged from 1.0 to 1.5°C. Persistent cloudiness restricted the use of satellite imagery in observing ocean thermal features. Occasional cloud-free views of the ocean surface revealed very little surface thermal structure, which is the normal wintertime condition. Only one satellite image on February 13 showed a faint indication of the Columbia River plume, and cold freshwater flowing northward along the Washington and Vancouver Island coasts.

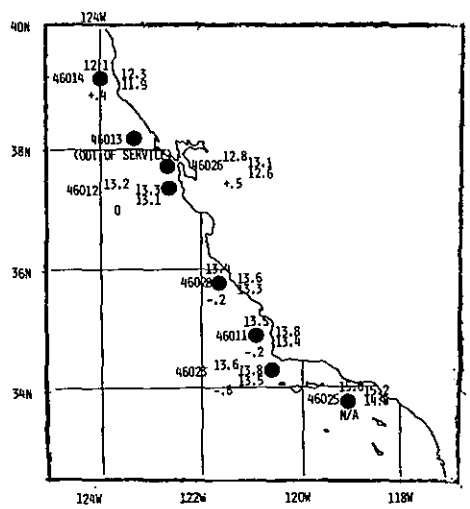
KEY:

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

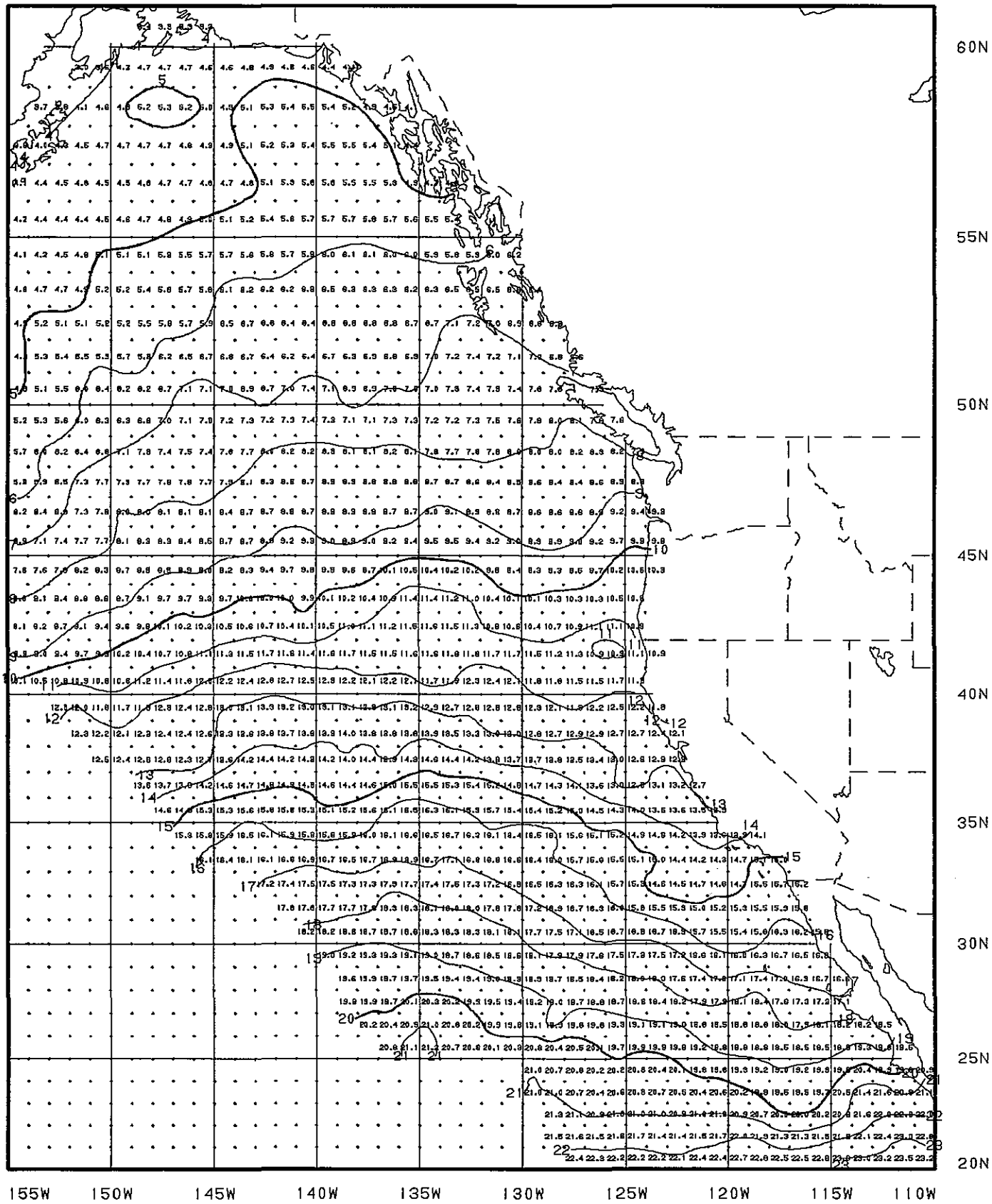
● Denotes station position.

North Panel
Kent Short
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, Wa 98115
(206) 526-6604
FTS 392-6604

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

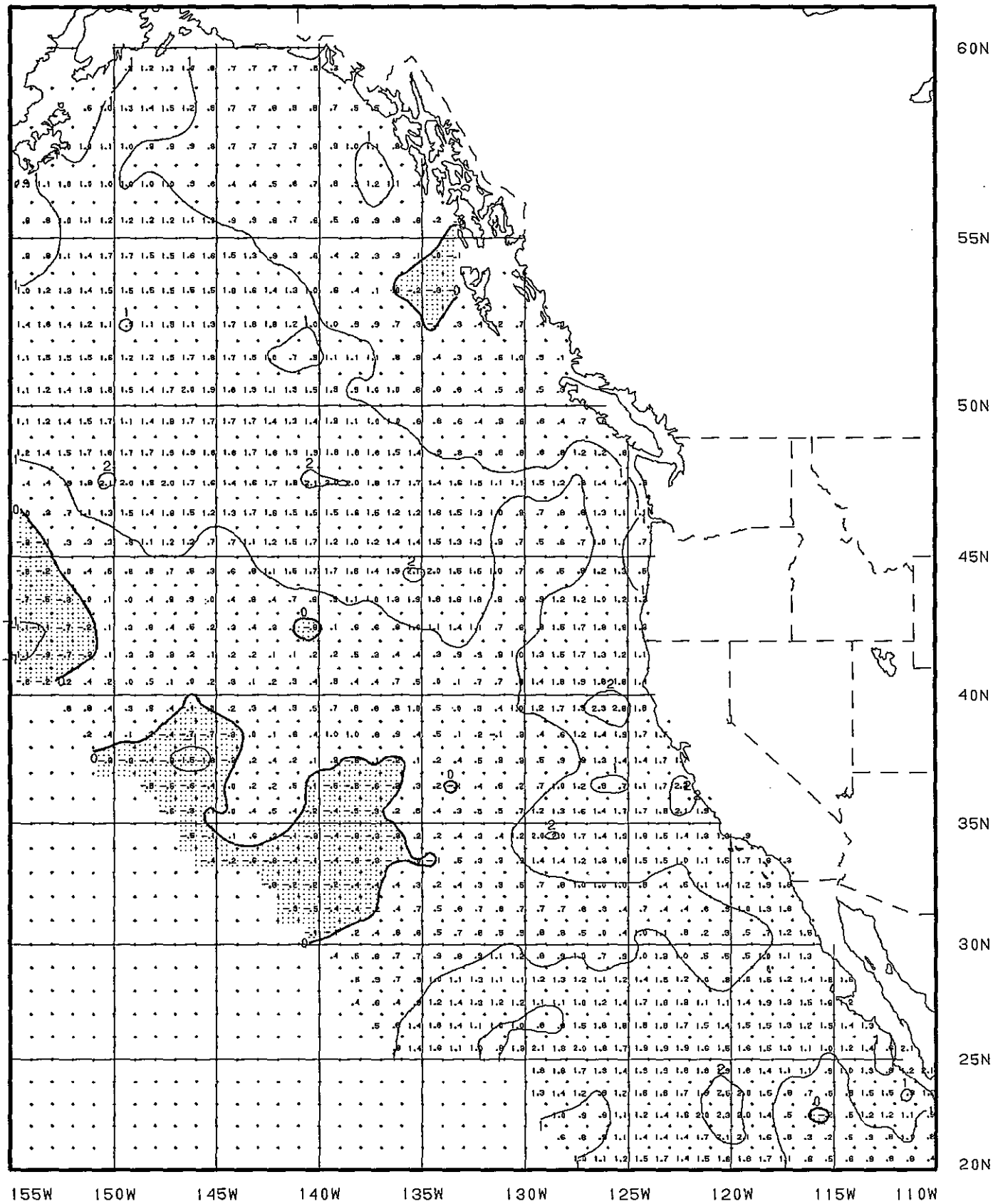


February SSTs, like January's, averaged much above normal. The climatological monthly mean SST value for the South Panel is 14.5°C, but this month's value is 15.7°C -- 1.2°C above normal. The maximum warm SST anomalies of 1.7° -2.0°C are found along the coast with less warming farther offshore. Only the western edge of the chart near 35°N 135°W is near normal. No cool SST anomalies are found. Fixed buoy statistics, when compared to the previous month, show warming on the north coast and cooling on the central coast. The major weather feature throughout February was a persistent southerly flow, again very much like January, which advected warm water toward the West Coast. A very slight cooling trend was observed between February 7-14. The period of February 18-28 showed an overall warming of SSTs. This was most likely in response to the strong subtropical jet position through central California which also caused extremely heavy precipitation and extensive flooding in the state.



West Coast
SST--MONTHLY MEAN (°C)
February 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

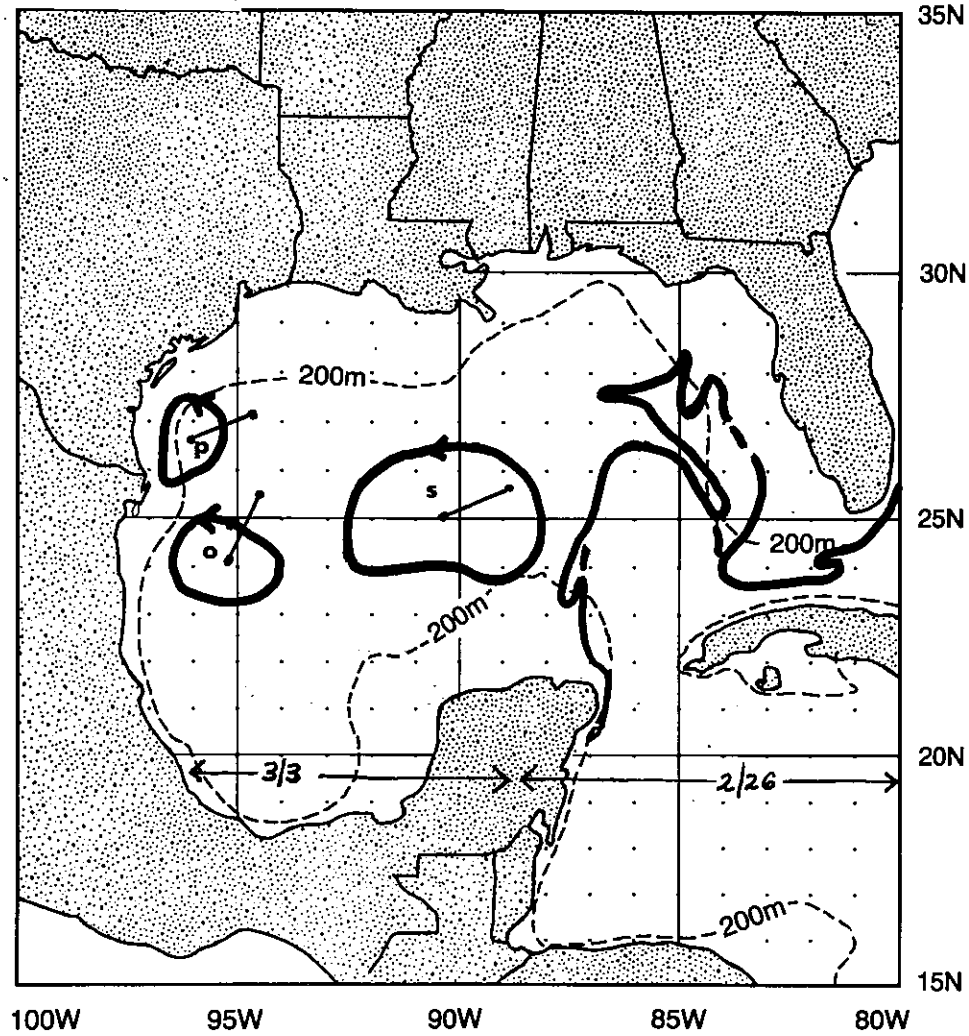


West Coast
SST--MONTHLY ANOMALY (°C)
February 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

FEBRUARY 1986

The end-of-February amplitude of the Loop Current shows an increase of about 120 km compared to the end-of-January position. Anticyclonic eddy s translated 165 km SW. Eddy o traveled 165 km SSW. Eddy p, which was assumed to have dissipated around January 28, was clearly detected again on March 3 near 26°30N 96°W. Thus eddy p has moved 140 km WSW since December 25, 1985.

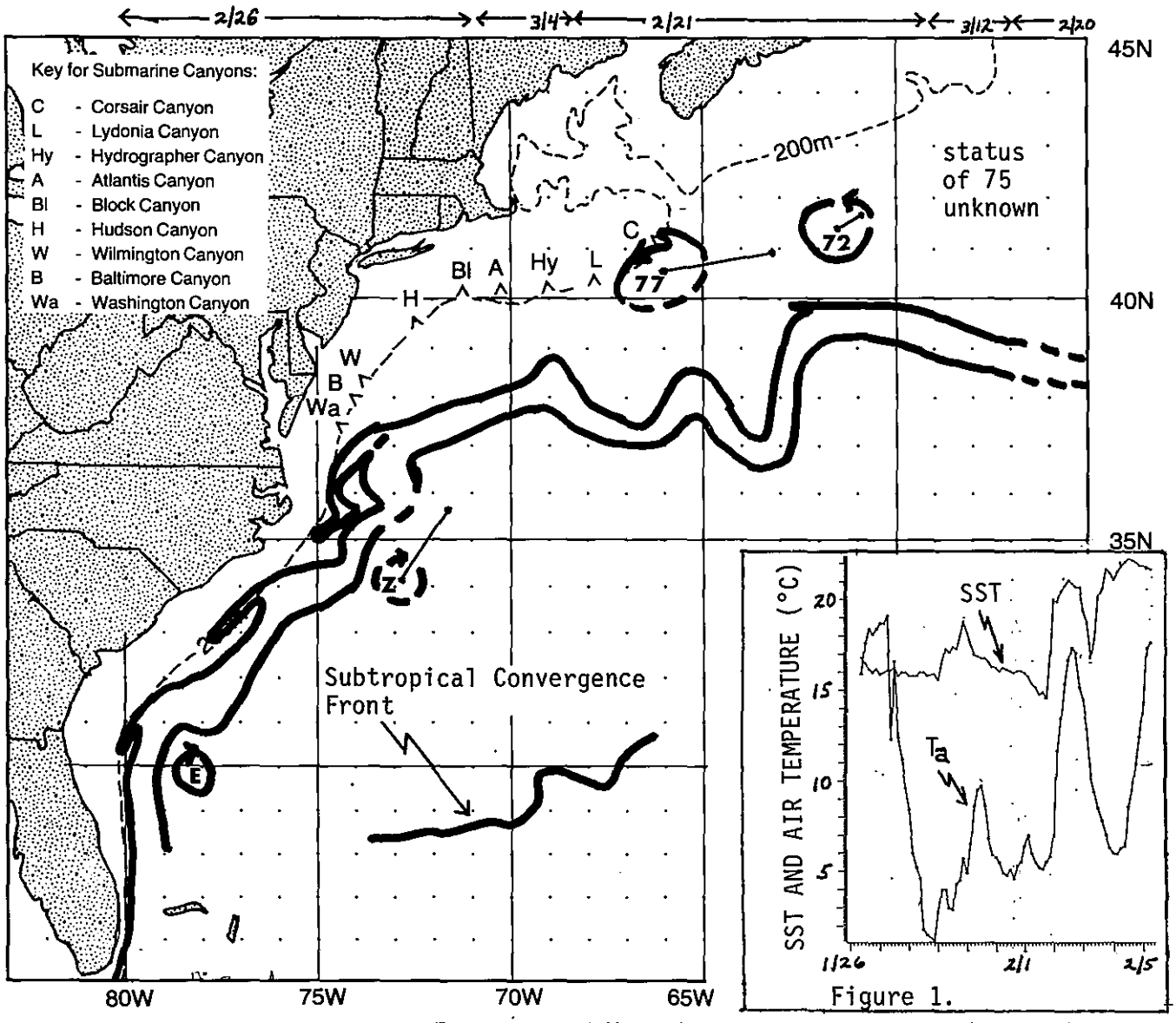


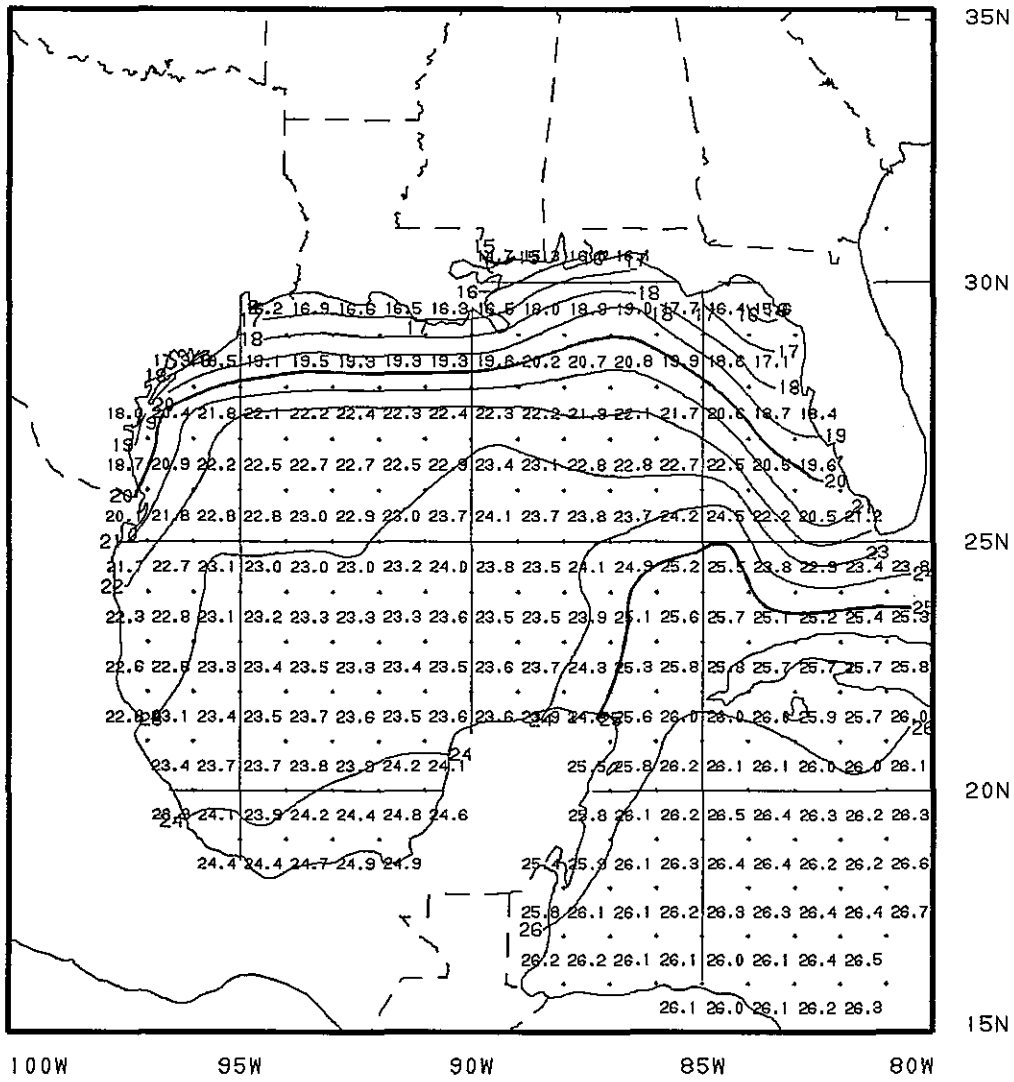
Figure 1.

Persistent cloud cover during February inhibited the tracking of anticyclonic and cyclonic eddies in the NW Atlantic Ocean. Anticyclonic eddy 75 was not observed by satellite imagery due to clouds, but it probably still exists. An anticyclonic eddy was detected at 40.5°N 66°W on February 21. Assuming this is eddy 77, it has translated 240 km WSW. Eddy 72 traveled 65 km SW.

Cyclonic eddies T and D were also not observed owing to cloud cover. New eddy E was observed near 30°N 78°W on February 21. Eddy Z apparently rapidly translated 210 km SW from January 22 to February 7, when it was last observed. The Subtropical Convergence Front was last discerned on February 17 between 28°N 73°W and 31°N 66°W.

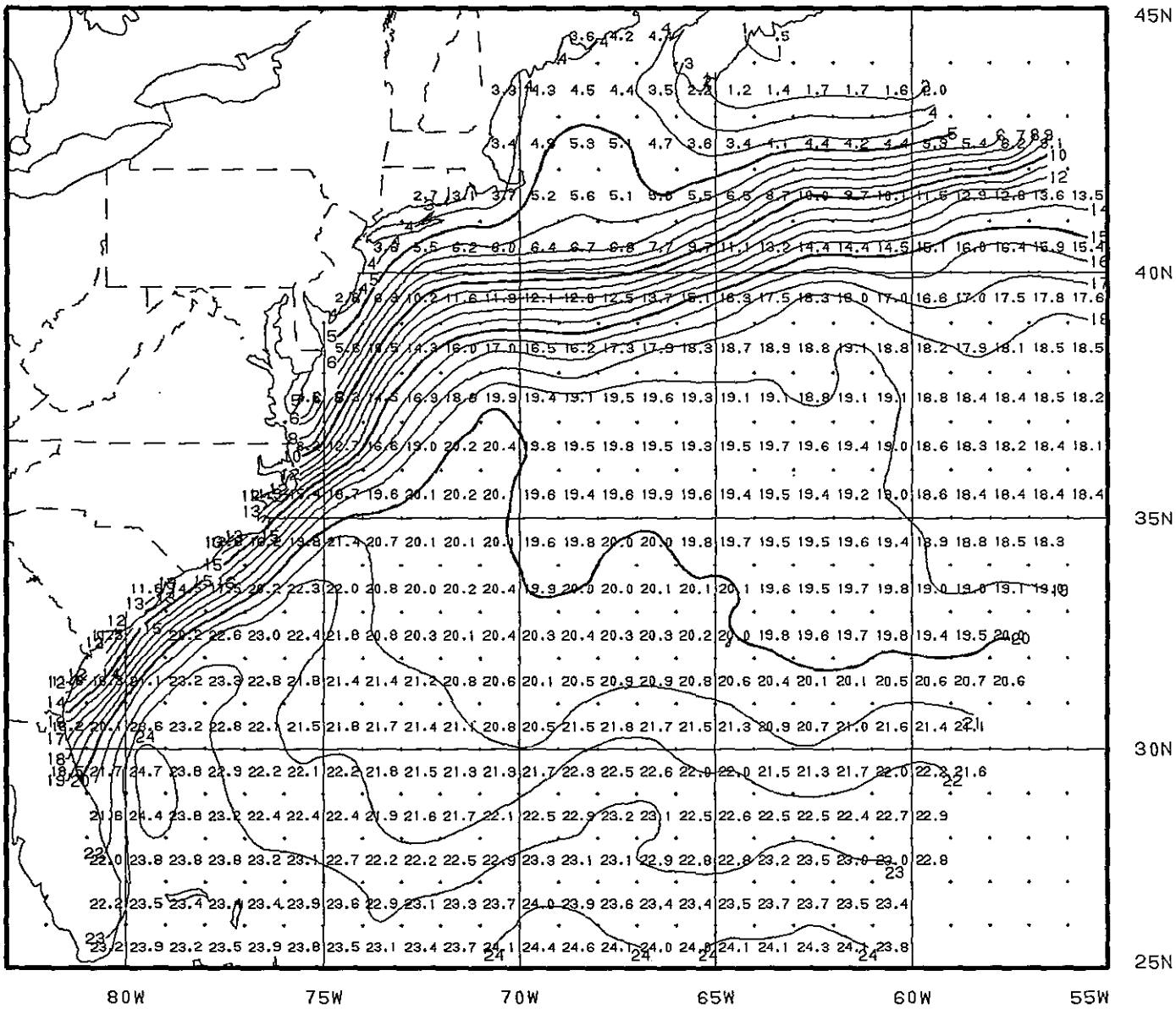
The Gulf Stream meander seen along 69°W on the above end-of-February analysis translated past data buoy 44004 (38.5°N 70.7°W) during the first half of February. Figure 1 (seen in the lower right corner of the above analysis) is a plot of the SSTs and air temperatures (T_a) recorded by the buoy during January 26 - February 5. On January 29-30 the buoy apparently encountered a warm filament attached to the Gulf Stream according to satellite imagery causing a temporary rise in SST from 16°C to 19°C. The SST dramatically increased from 15°C to 21°C on February 2 as imagery revealed that the meander's edge had just moved over the buoy's location. A temporary drop in SST occurred on February 3 when the meander presumably moved just south of the buoy. The buoy SSTs remained steady near 21°C until February 13 when the meander finally translated eastward past the buoy's location.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
February 1986

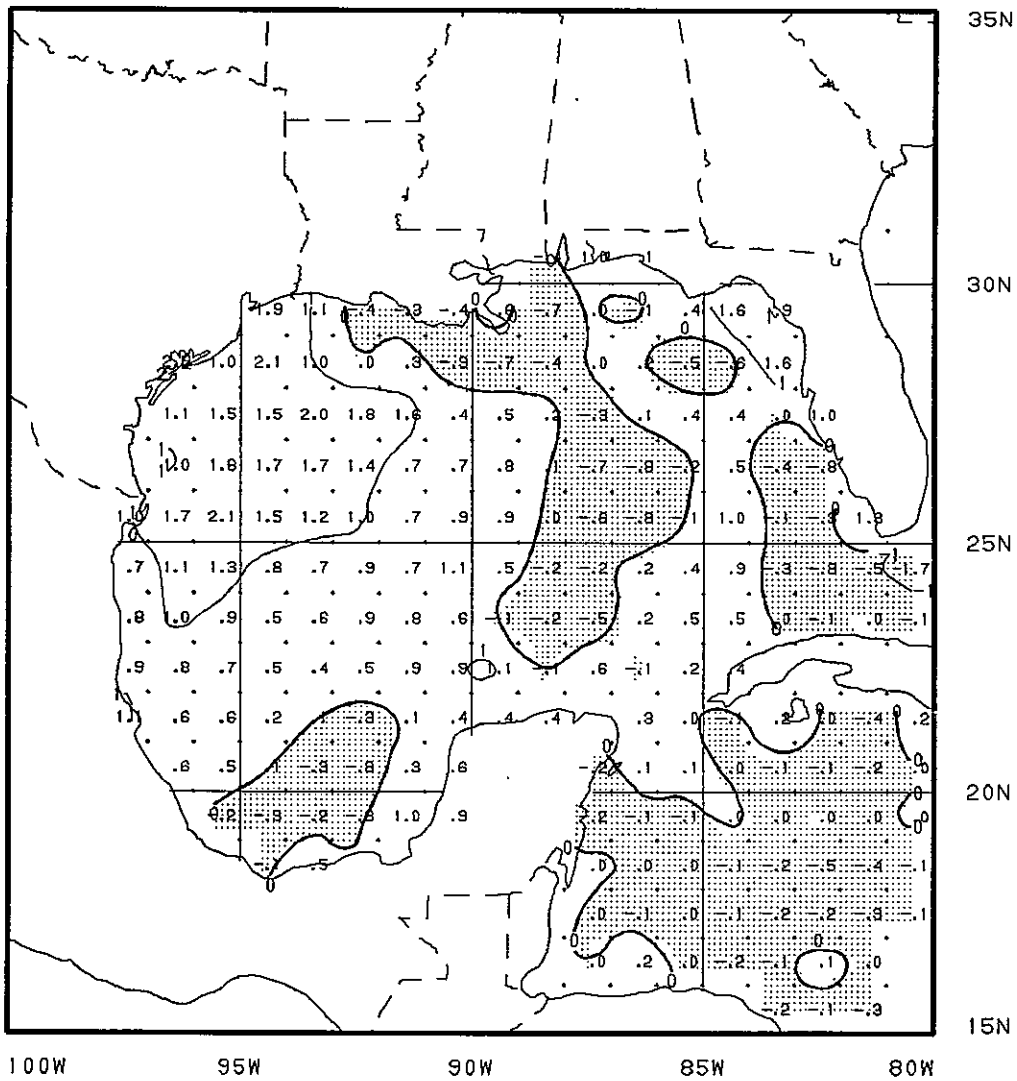
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
February 1986

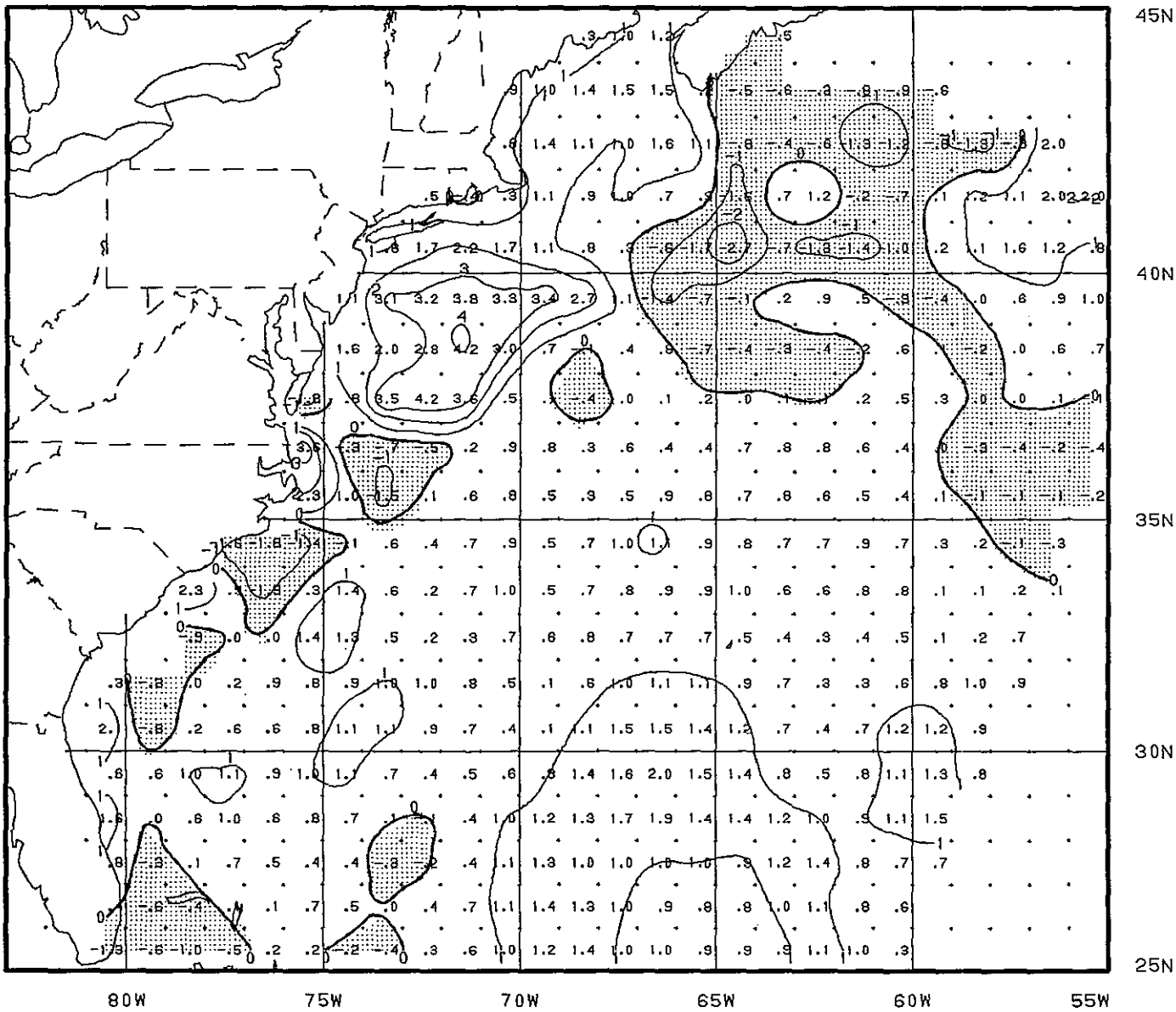
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
February 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
February 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE WA 98115-0070

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

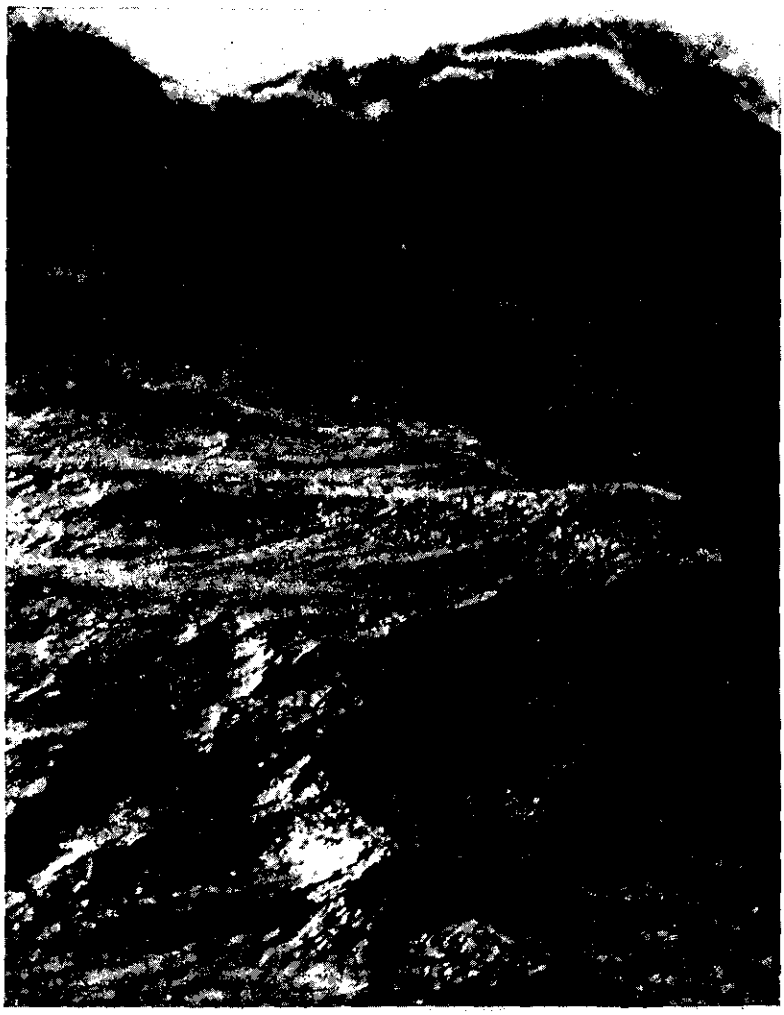
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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, 1986.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 3 March 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31.*
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2.*
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; *NavOceano Ref. Pub. 18.*

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

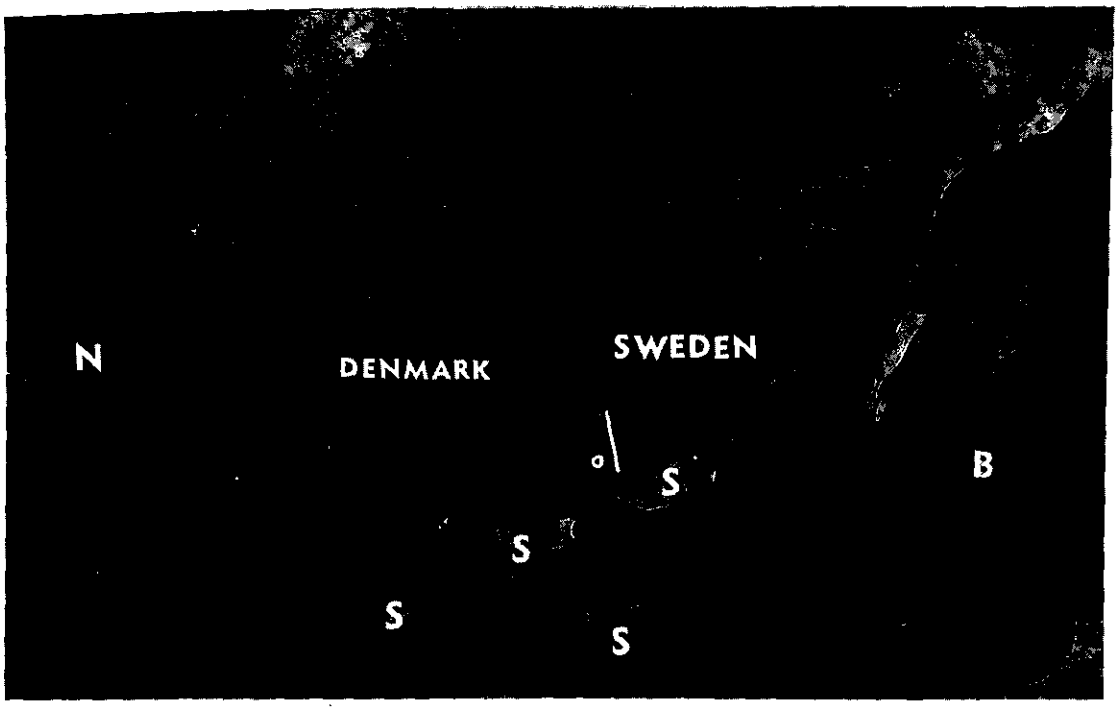
Typing: Damita Johnson

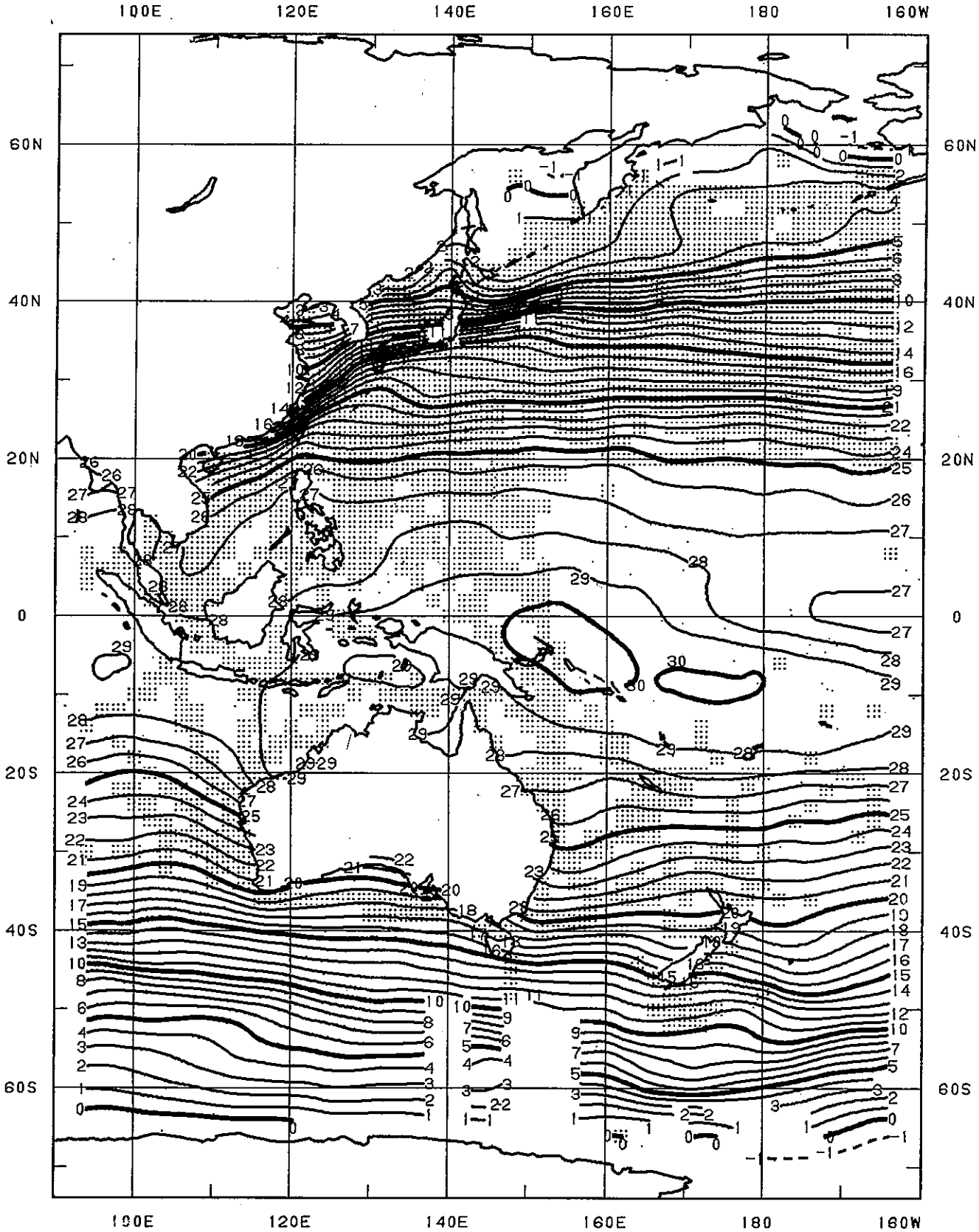
SATELLITE IMAGE OF THE MONTH

Marcia L. Weaks
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

ICE IN THE BALTIC SEA

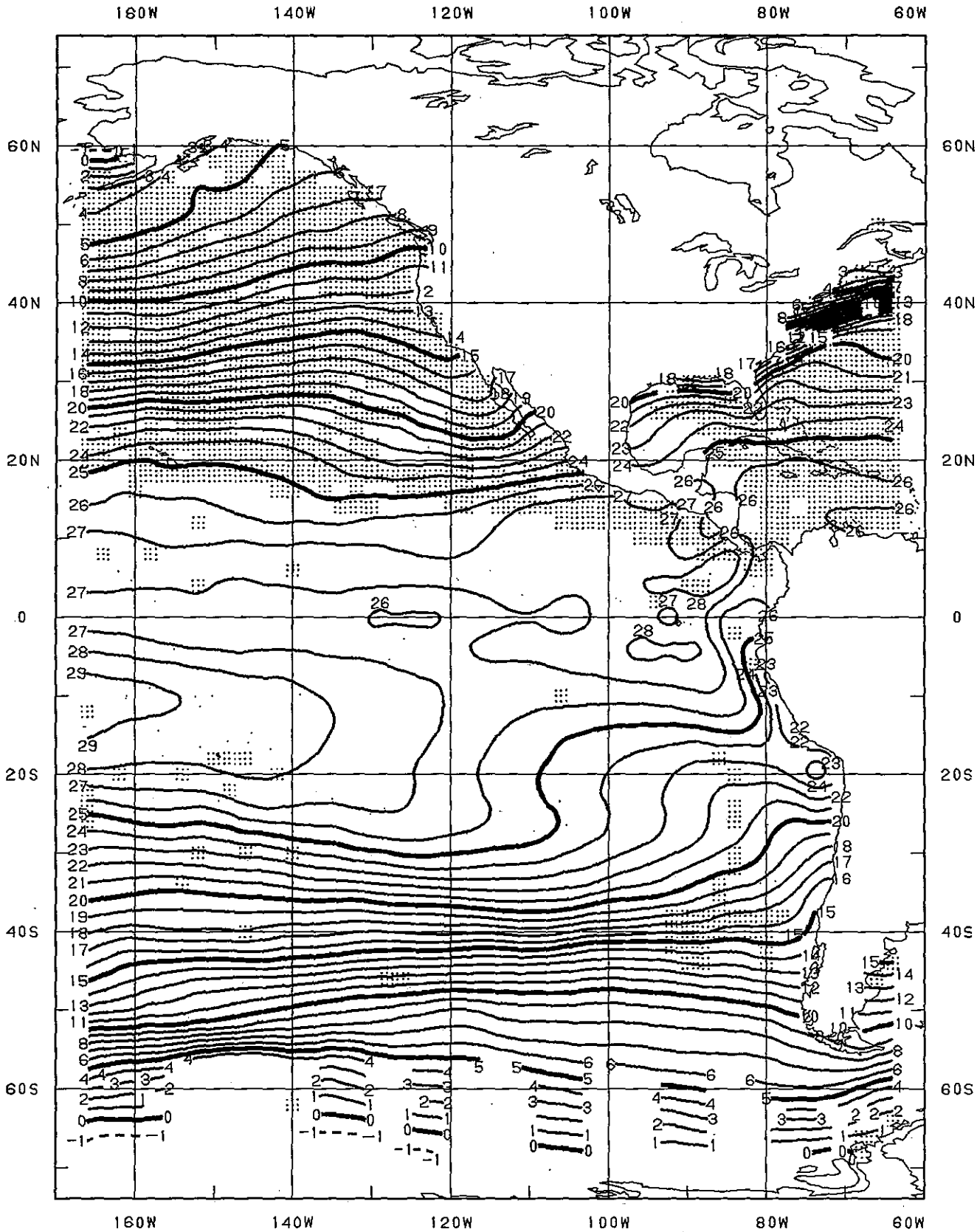
Ice conditions are depicted in this visible image of the eastern North Sea (N) and Baltic Sea (B) on March 3, 1986. A thin strip of ice along the southwest coast of Denmark is the only ice present in the imaged portion of the North Sea. A relatively thin ice (0-3 cm thick) layer covers a large portion of the water between Denmark and Sweden. This thin ice does not have a high reflectivity, therefore it appears on the image as a dull grey shade. This thin ice makes the passageway to the Baltic Sea a bit hazardous for those ships without ice breaking capabilities. The passageway is indicated on the image by a thin white line. For reference, Copenhagen, Denmark is demarked by the small white circle. Thin ice is also seen south of Denmark and Sweden, but it appears brighter (has a higher reflectivity) due to a recent snowfall covering. Similarly, snow covered land areas (S) are easily located as very bright (white) areas that correspond to terrain features. As of April 1, only small portions of thin ice remained along the southeastern Swedish coast. The ice conditions in this region have been normal this year as the ice season usually extends from early November to April or May.





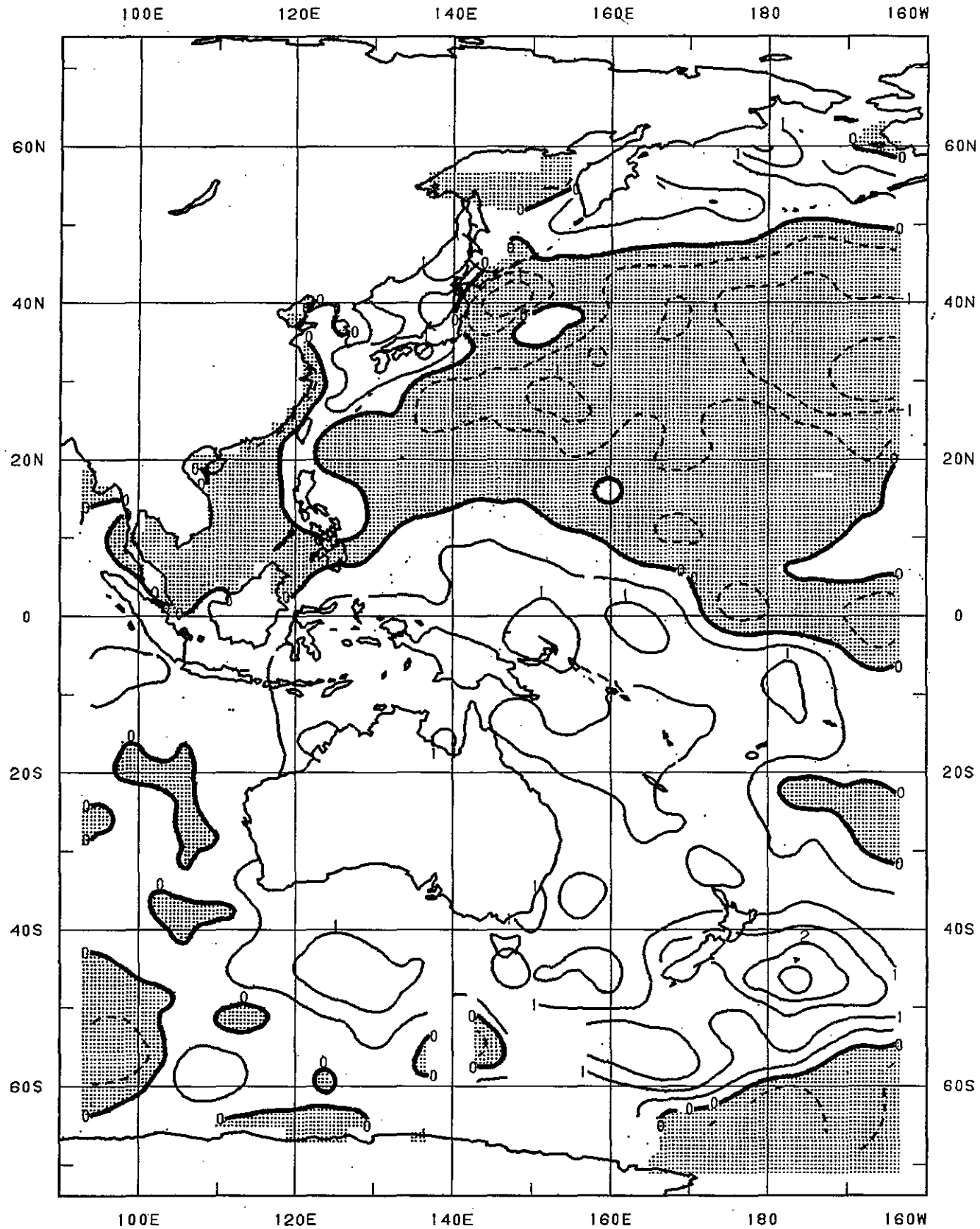
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



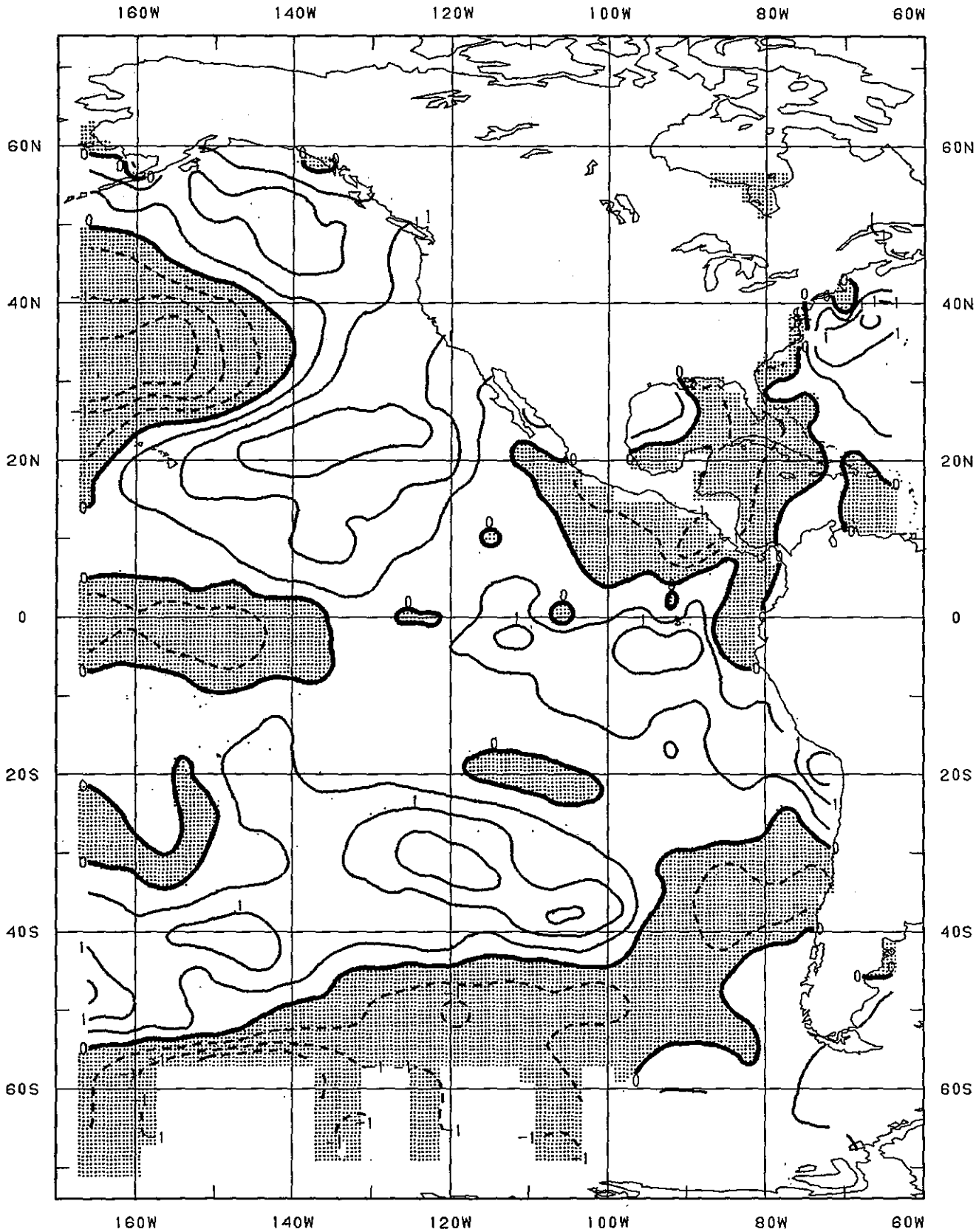
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



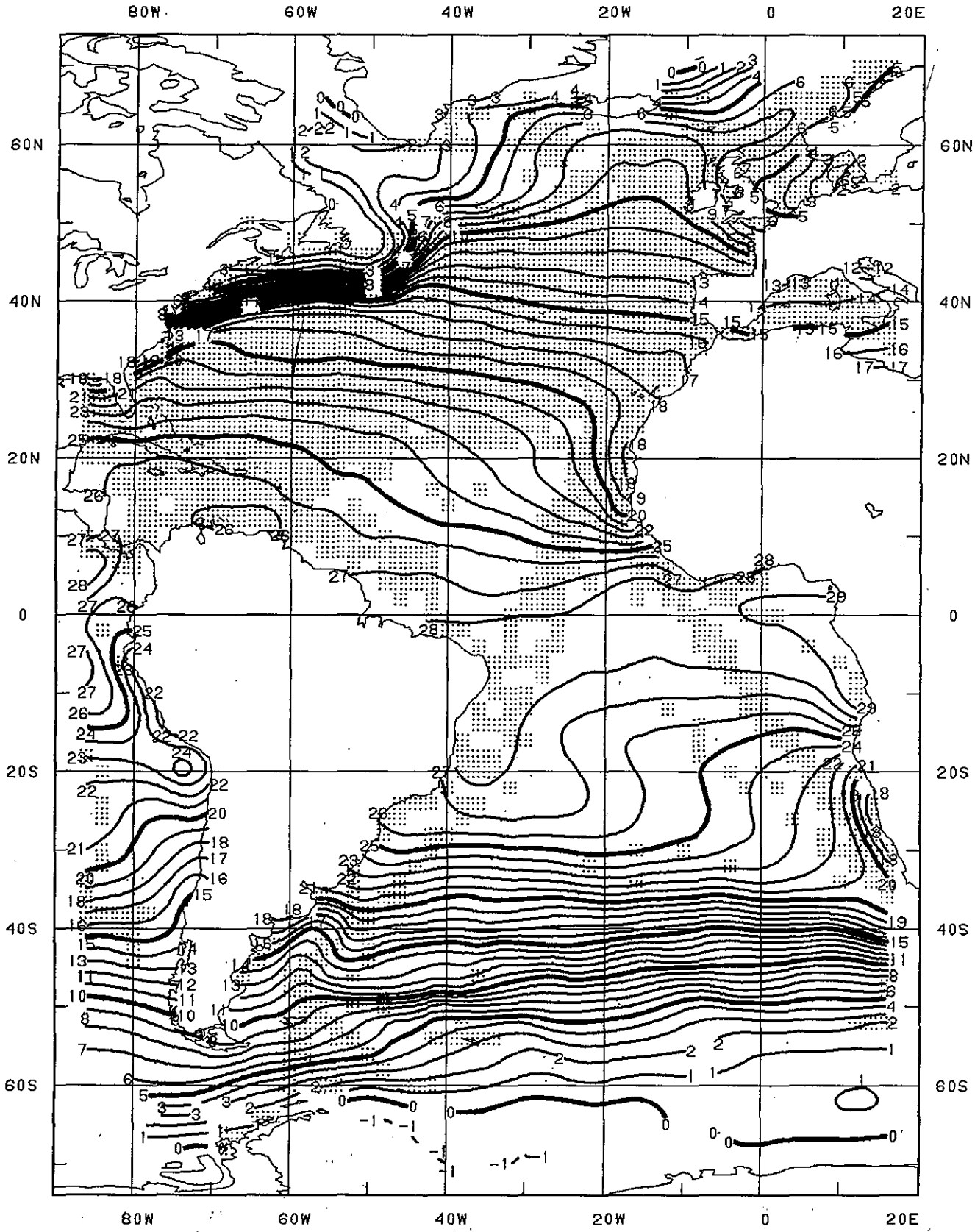
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



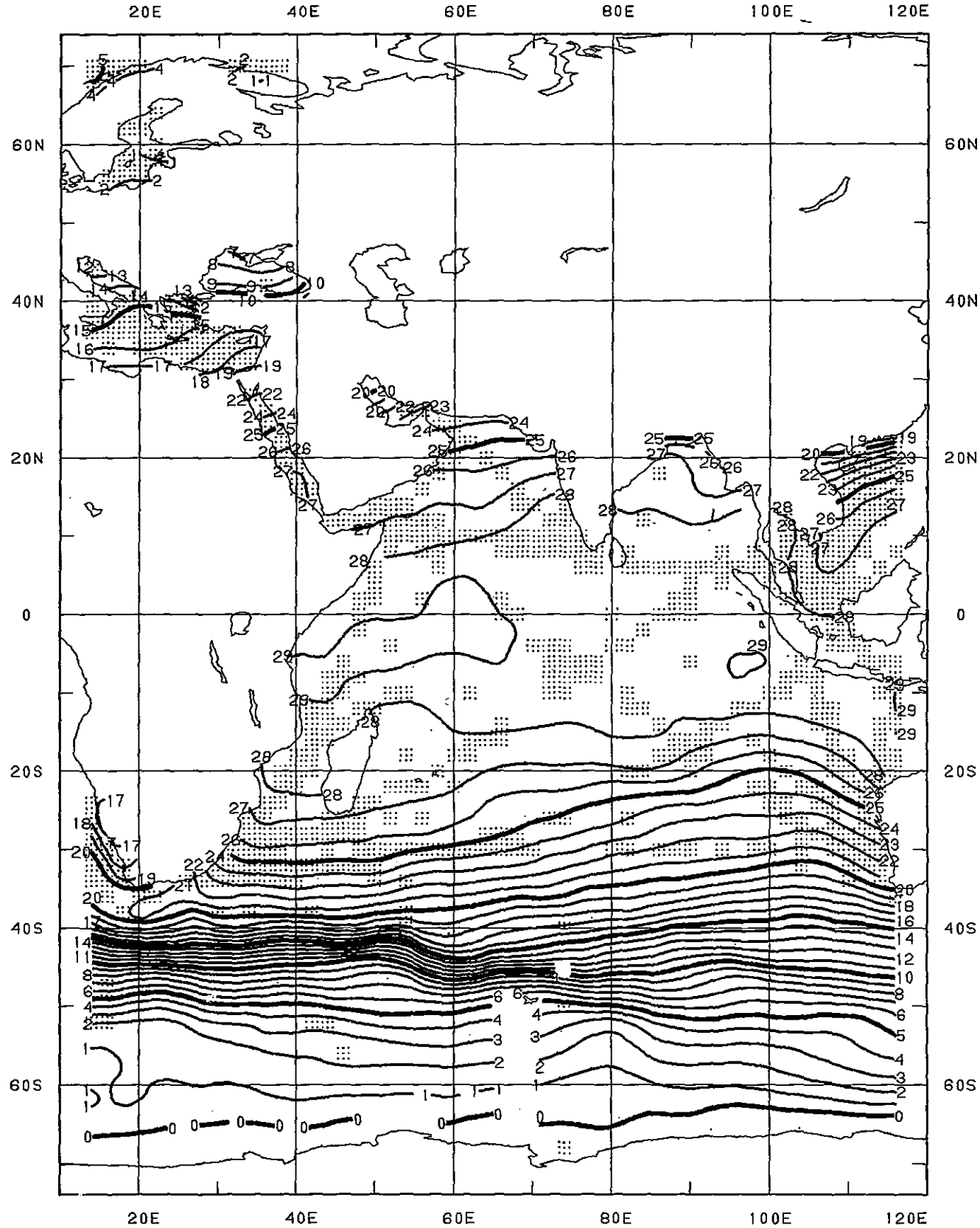
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly anomaly is the difference between the of monthly mean sea surface temperature 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.



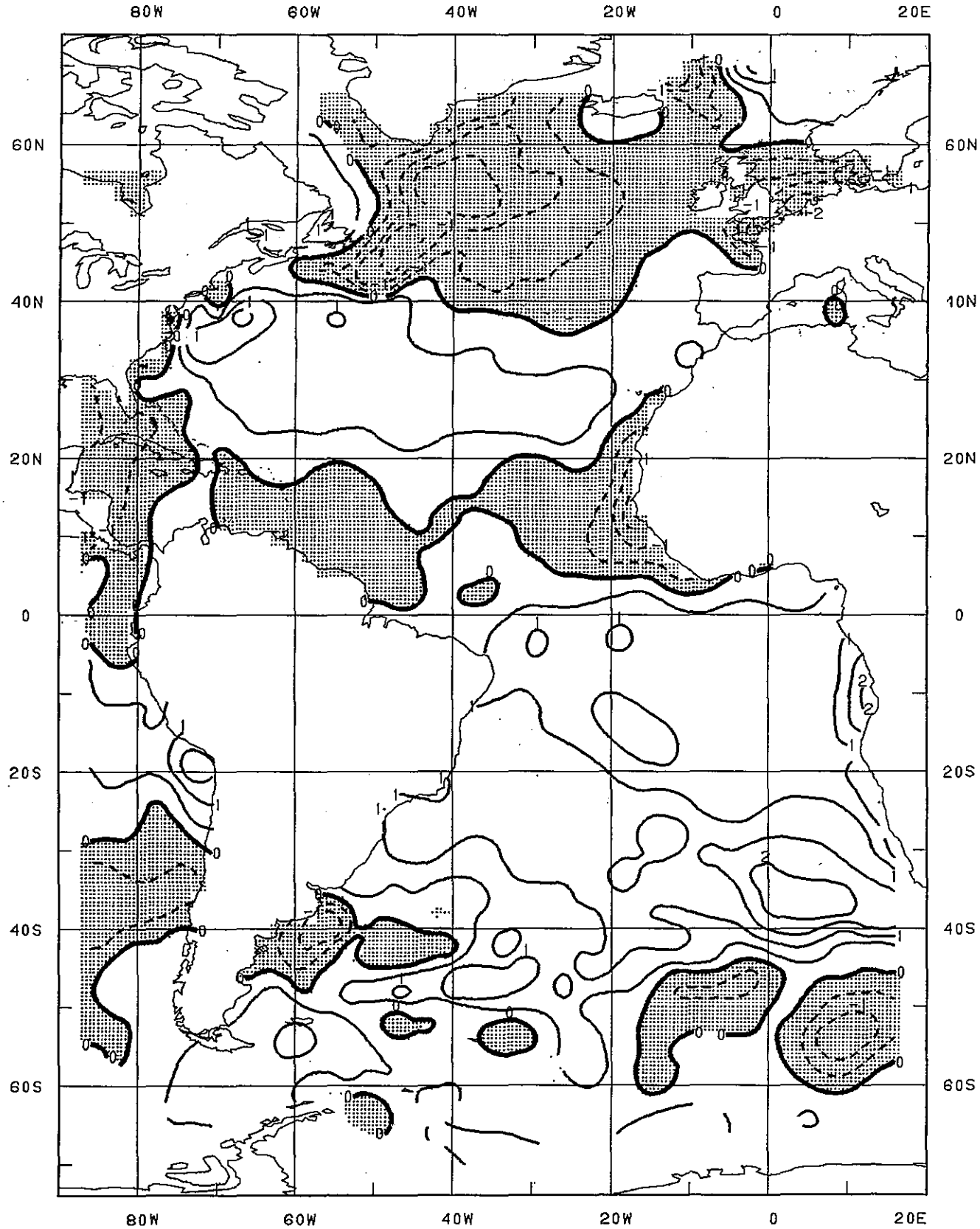
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



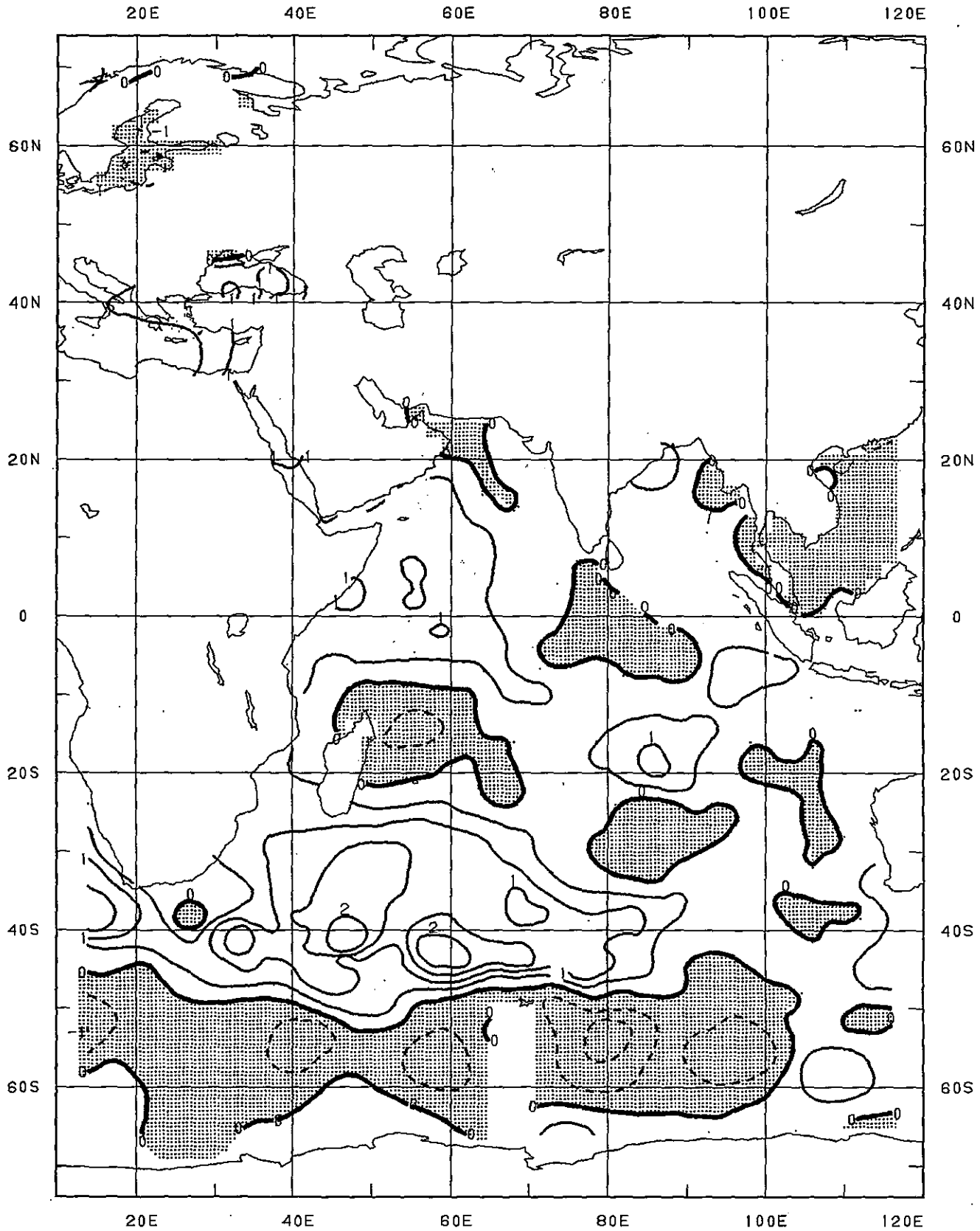
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
MARCH 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

EL NINO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC ADVISORY

Climate Analysis Center, National Meteorological Center
National Weather Service, Washington, D.C. 20233
(301) 763-8227

Routine monitoring of climatic conditions in the tropical Pacific shows that the pattern of SST anomalies in the eastern tropical Pacific is evolving in a manner resembling the incipient stage of an El Nino event. El Nino is an anomalous warming of the eastern equatorial Pacific that takes place at irregular intervals of 2-7 years and lasts for 1-2 years. Specifically, ship and satellite observations over the waters west of Peru indicate that SSTs in that region have gradually changed from below normal values in late 1985 to above normal in January and February, 1986. In February, this region of above normal SSTs expanded northward, then westward along the equator to around 120°W. Rainfall was also above normal over the region of above normal SST south of the equator. While the SST anomalies are still relatively small (see p. 7), their rate of increase in magnitude and extent during the past few months is worthy of note. Figure 1 shows that a sharp upward anomaly trend between October and the following February (also seen this year) along the shipping lane which parallels the Peru coast is characteristic of El Nino years. The northern Peruvian coastal station at Talara (4.6°S) showed an SST change from near normal in January to 2.4°C above normal in February. At coastal stations farther south, SSTs remained near or below normal. Although periods of heavy rainfall have been observed over the southern interior during the past two months, the typical El Nino pattern of recurrent heavy rains in the desert regions of northwest Peru had not developed by the end of February.

These changes in eastern Pacific SST reflect a slow but consistent evolution of the SST pattern across the entire equatorial Pacific during the past 2 years. Viewed on an even larger scale, the associated global Southern Oscillation surface seesaw in pressure between the Australian-Indonesian region and the southeast Pacific also swayed during February in a direction consistent with the development of an ENSO episode (i.e., an increase in the pressure gradient driving westerly wind anomalies). At Darwin, Australia, which is representative of the western end of the pressure seesaw, surface pressure averaged above normal during February. At the opposite end, the key southeast Pacific index station at Tahiti, French Polynesia, showed a sharp fall in pressure. The above normal pressure at Darwin was accompanied by below normal rainfall over large portions of Australia, western Indonesia, and Malaysia.

In the western equatorial Pacific between 150°-170°E, anomalously high SSTs have developed during the past few months. Ocean surface temperatures in this region are normally quite high, but current SSTs (30°C, more than 1°C above normal) are rarely exceeded. There are indications that this area of positive SST anomalies has migrated slowly and irregularly eastward during the past few months. As this took place, anomalous westerly surface winds developed to the west of the area of warmest water.

While these developments are positive indicators of an event, other important oceanic features often associated with the initial stages of an ENSO episode are not yet in evidence. In particular, the subsurface thermal structure and sea-level slope across the equatorial Pacific do not appear to be far from normal at this time.

A major ENSO episode, such as that which occurred during 1982/83, leads to massive dislocations of the rainfall regimes of the tropics, bringing drought to vast areas and torrential rains to otherwise arid regions. The related atmospheric circulation anomalies extend deep into the extratropics, where they are associated with unusual wintertime conditions over regions as far apart as the United States and New Zealand. Because ENSO is global in nature, a strong occurrence leads to the nearly simultaneous appearance of severe climatic conditions over a variety of regions around the world, as well as major disruptions of the marine ecosystems along the west coast of South and sometimes North America. Should the present conditions develop into an ENSO episode, it seems highly unlikely that it would approach the magnitude of the 1982/83 event, the strongest of the century. Although most ENSO episodes follow a generally similar evolution, each occurrence has a personality of its own, differing in both strength and behavior.

Since the disastrous effects of the 1982/83 ENSO, a number of climate researchers have developed experimental prediction techniques. Some of these now indicate the development of an ENSO episode this year, others give more ambiguous results. Therefore, no strong consensus yet exists in the U.S. scientific community on the likelihood of a 1986 ENSO episode. The developing pattern of climate anomalies in the tropical Pacific is in many ways consistent with the early stages of an ENSO episode. Therefore, it seems prudent to call attention to the possibility of such a development during 1986. The situation should be clarified during the next 2-4 months. During this period the Climate Analysis Center will continue to closely monitor conditions in the equatorial Pacific and to provide early dissemination of information on the evolving anomaly patterns.

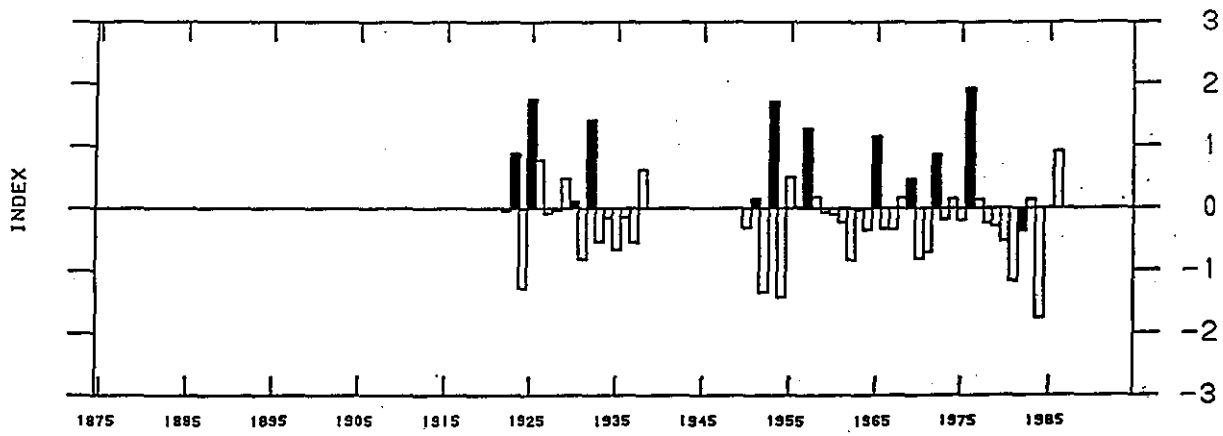
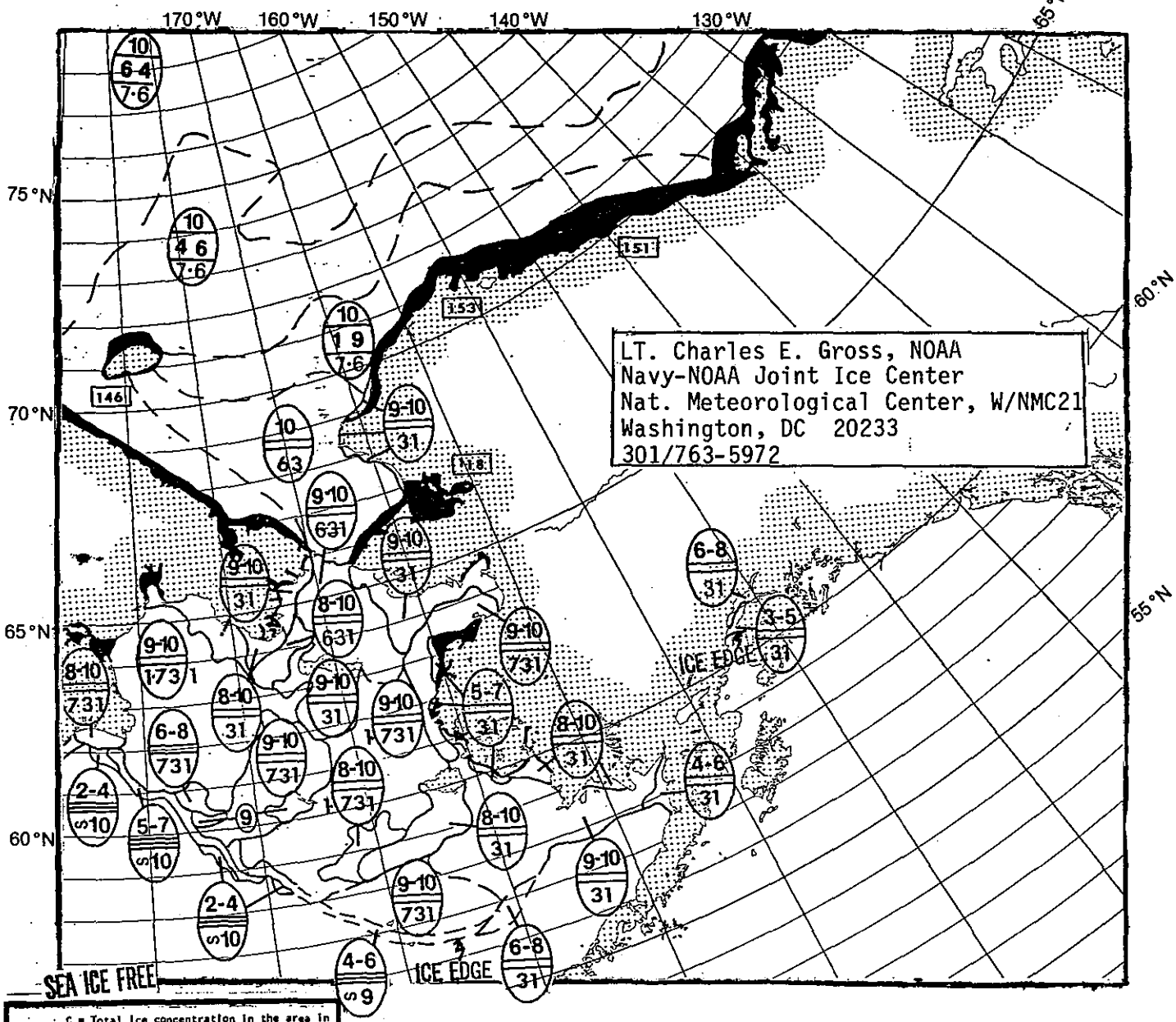


Figure 1. Differences between the anomalies of SST for January/February and the previous November/December periods along the shipping route which parallels the Peru coast between 4°-12°S. The plotted values are standardized anomalies, i.e., the actual values have been divided by their standard deviation. Solid bars are El Nino years. All years in which the index values equaled or exceeded the 1986 value were El Nino years.

BERING SEA / NORTH SLOPE ICE ANALYSIS



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).

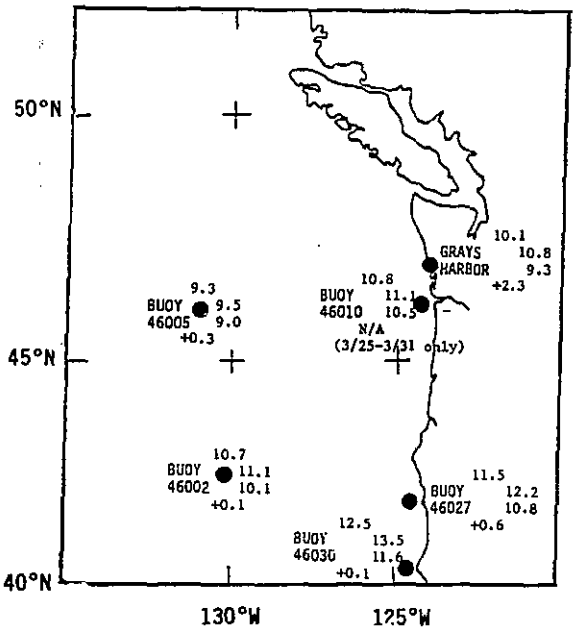
Fast ice. Sea ice which forms and remains fast along the coast.

Ice boundary visually or satellite observed.

Ice boundary estimated.

MARCH 1986

The monthly mean sea level pressure circulation depicts a 999 mb low centered in the Gulf of Alaska at 54°N 145°W and a 1021 mb high in the East Siberian Sea at 70°N 170°E. Geostrophic winds during the period are predominantly east-northeasterly. An analysis of the tracks of low pressure systems transiting the area indicates that most tracked parallel and south of the Aleutian Islands terminating in the Gulf of Alaska. This pattern results in a northeasterly windflow pattern in the Bering Sea and is related to the more extensive ice conditions in March. Mean surface air temperatures recorded at Nome (65°N 165°W) and King Salmon (59°N 157°W) are normal. The ice edge position is near the median in Bristol Bay, between the median and maximum in the eastern Bering Sea, and between the median and minimum in the western Bering Sea.



MARCH 1986

SSTs over the entire North Panel area average warmer than normal, continuing the trend of February. The southeastern corner of the region contains the largest positive anomalies, 2.0°C to 2.5°C, while most of the rest of the area has anomalies of 1.0°C to 1.5°C. No seasonal cooling is observed at any reporting station. This is an abnormal occurrence for March, during which SSTs normally decrease to their annual minimum values over most of the North Panel area. Persistent cloud cover during the month allowed only two clear glimpses of the ocean surface by satellite on March 16 and 19. Very little organized surface thermal structure is visible, although the Columbia River plume curving to the northwest is faintly discernable on the March 16 satellite image.

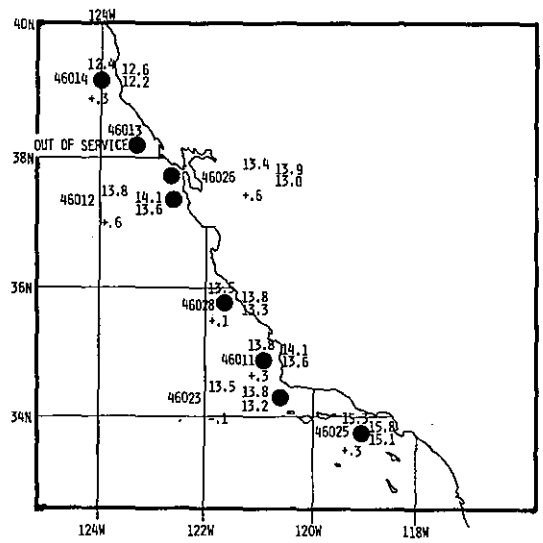
KEY:

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

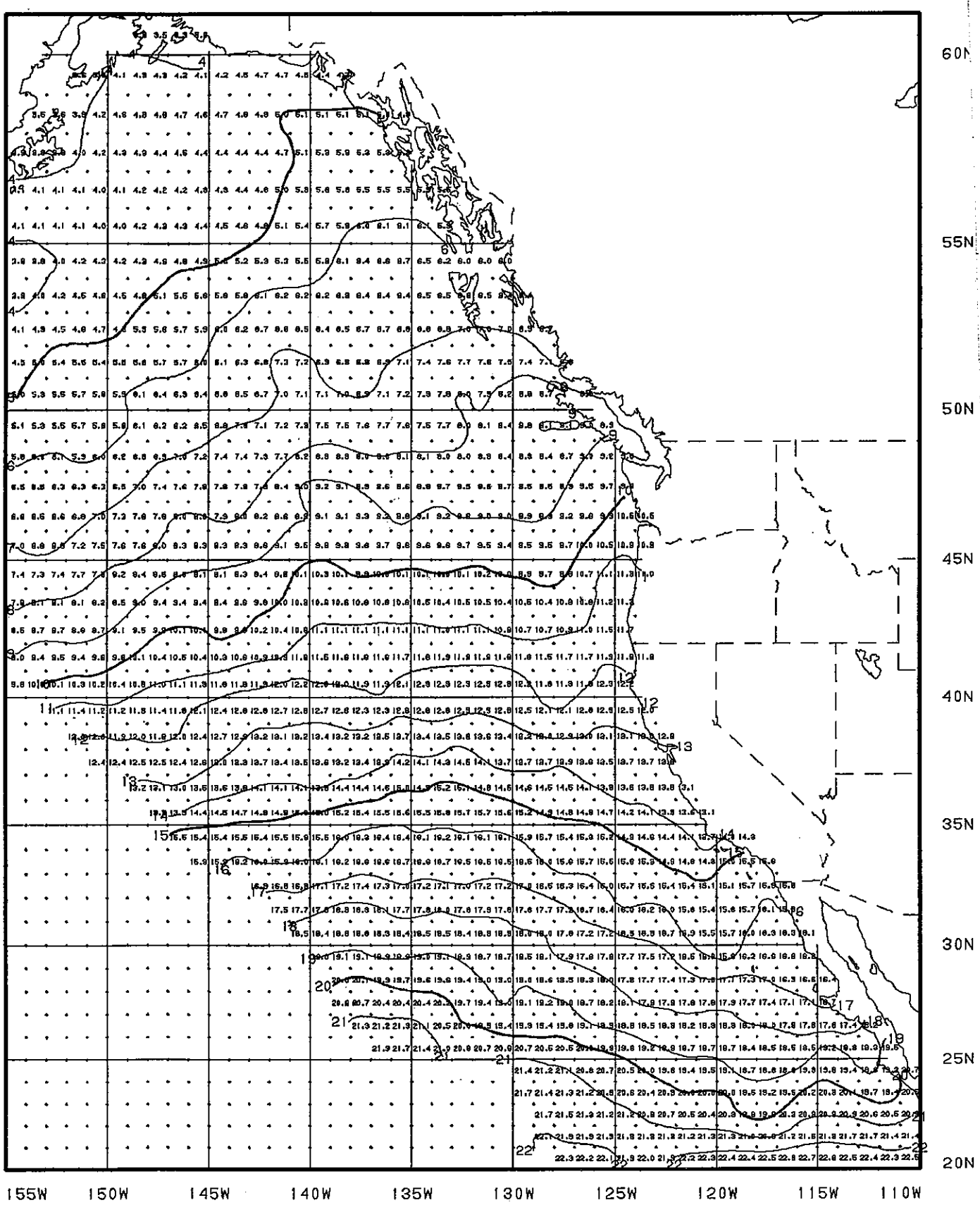
● Denotes station position..

North Panel
Kent Short
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, Wa 98115
(206) 526-6604
FTS 392-6604

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

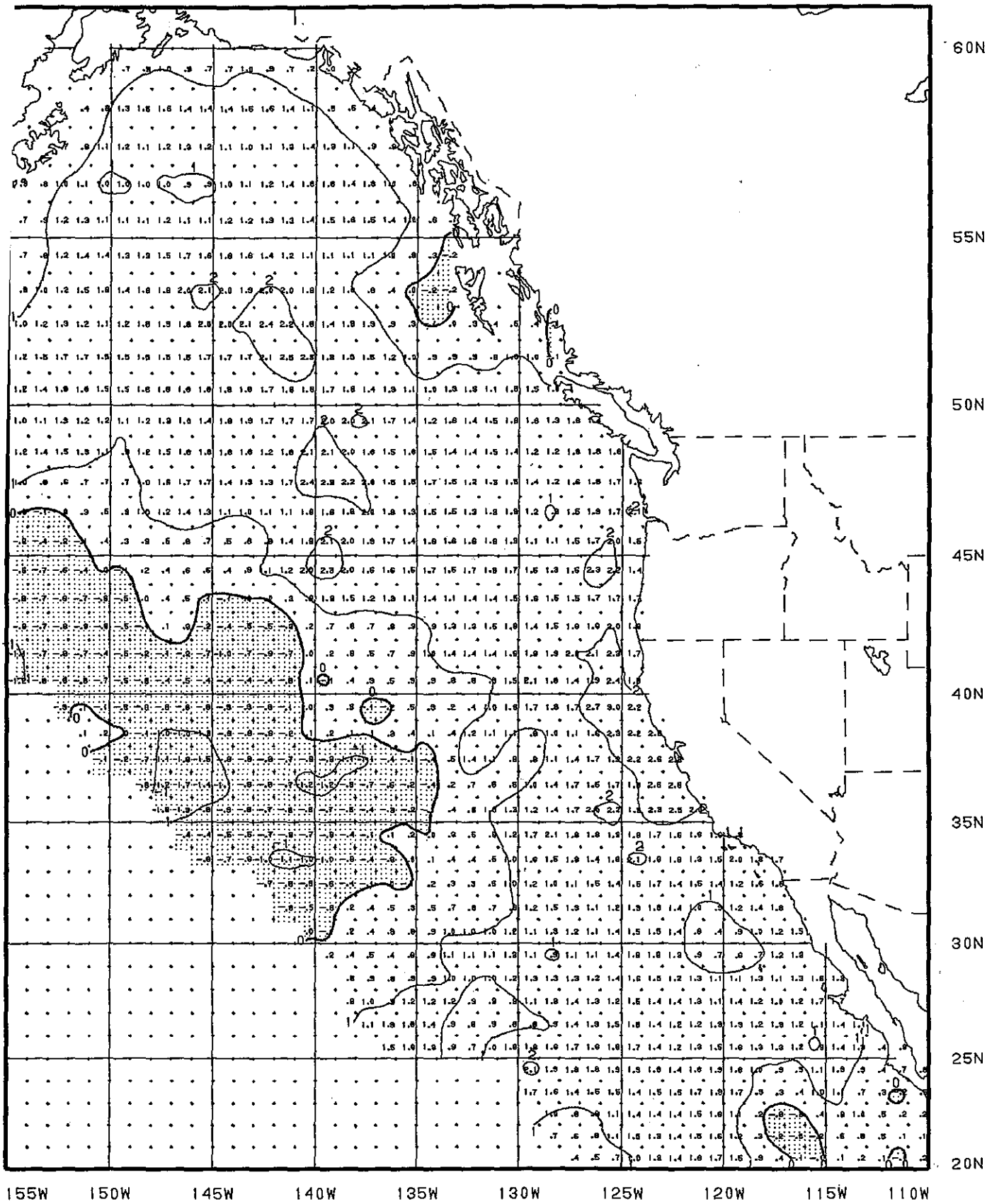


Like the two previous months, SSTs continue to remain much above normal. The normal March climatological mean SST for the South Panel is 14.4°C, but this March's value is 1.4°C higher or 15.8°C. The anomalies are strongest in nearshore areas particularly alongshore from 35°N to 40°N where warm anomalies over 2.0°C are observed. The anomalies became less pronounced farther offshore; in fact, on the extreme western portion of the chart, SSTs are only 0.2°C above climatology. The March monthly SST changes from the February mean SSTs indicate that no single area cooled or warmed more than 0.5°C; so for all practical purposes, not much change occurred. All buoys except for buoy #46023 near Point Conception showed some warming from the previous month.



West Coast
SST--MONTHLY MEAN (°C)
March 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

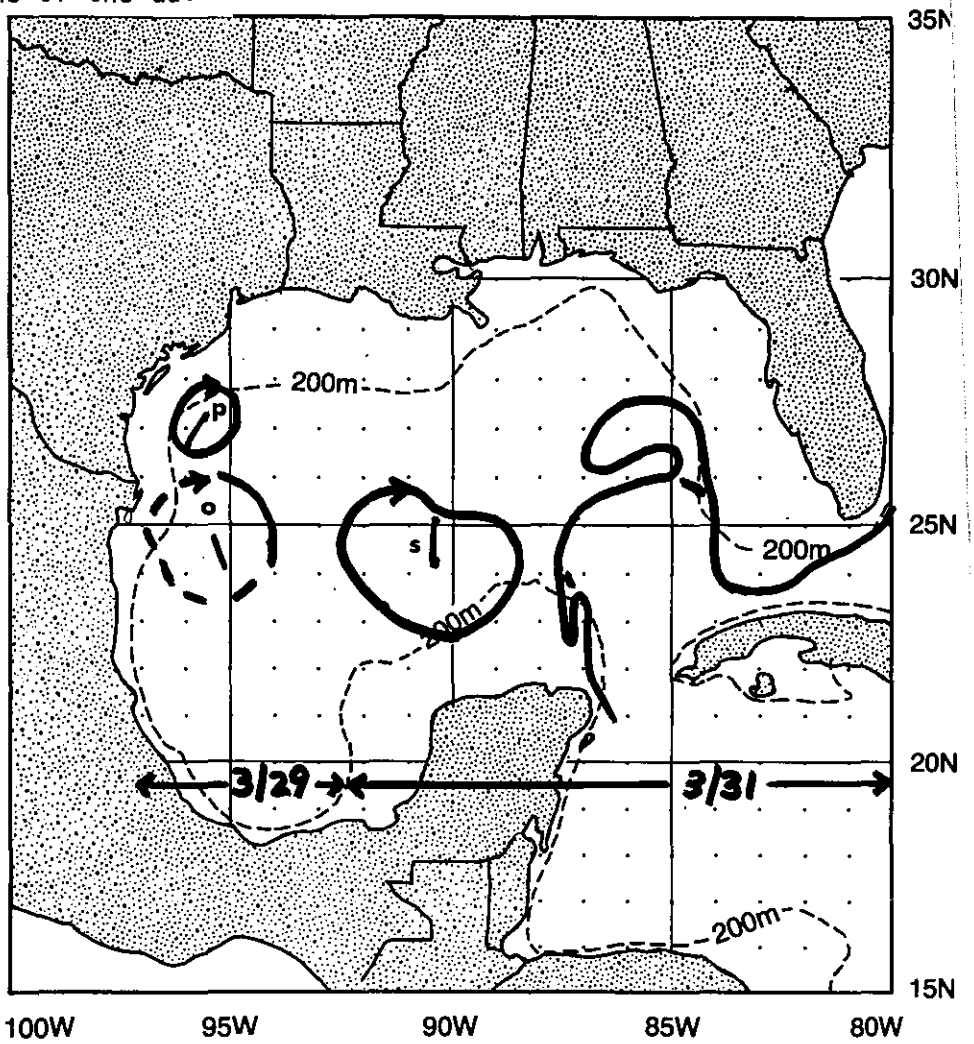


West Coast
SST--MONTHLY ANOMALY (°C)
March 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

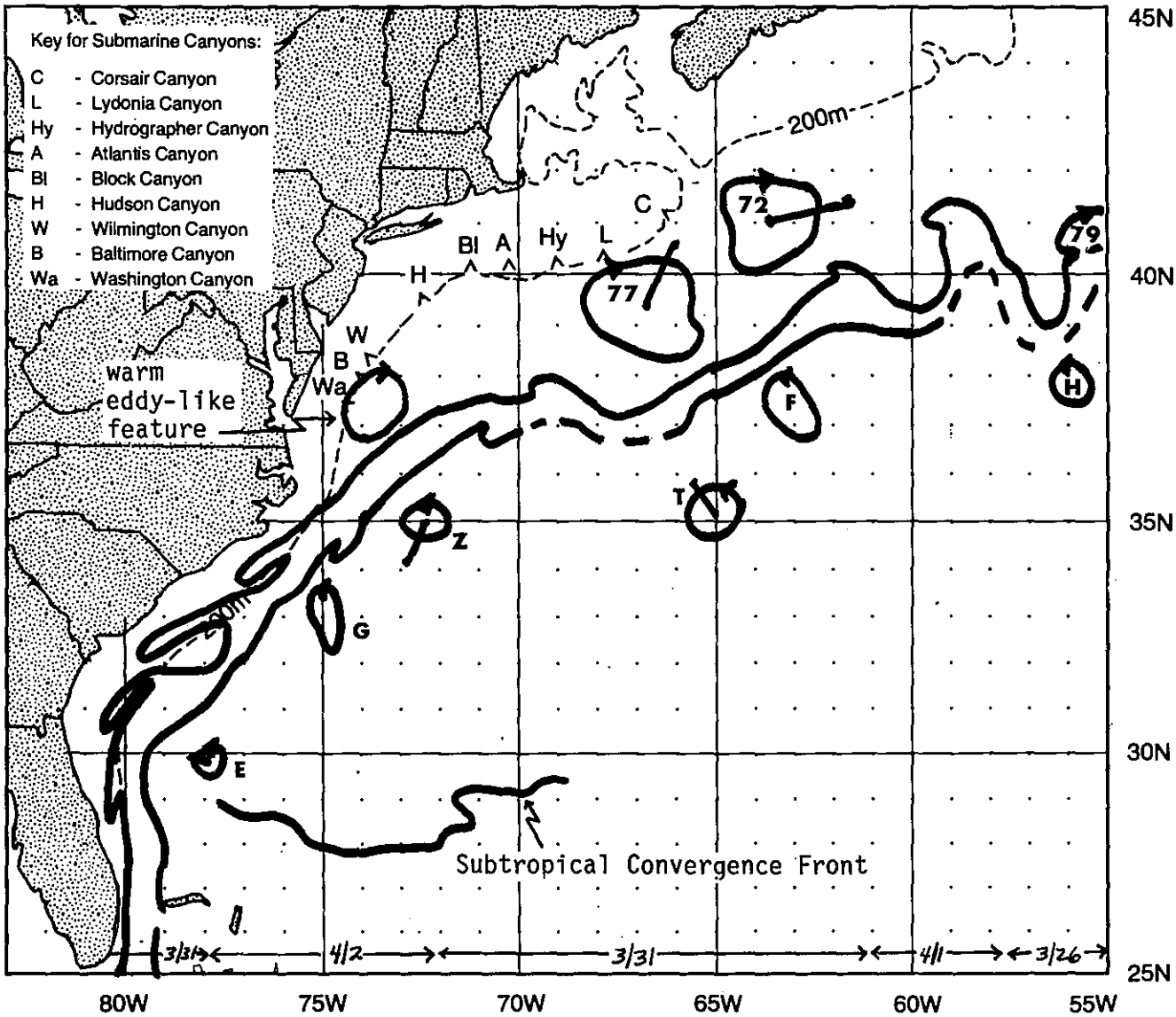
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

MARCH 1986

The end-of-March amplitude of the Loop Current shows a decrease of 75 km compared to the end-of-February position. Anticyclonic eddy s translated 85 km S. Eddy o traveled 65 km NNW. Eddy p moved 85 km NE and appears to be dissipating.

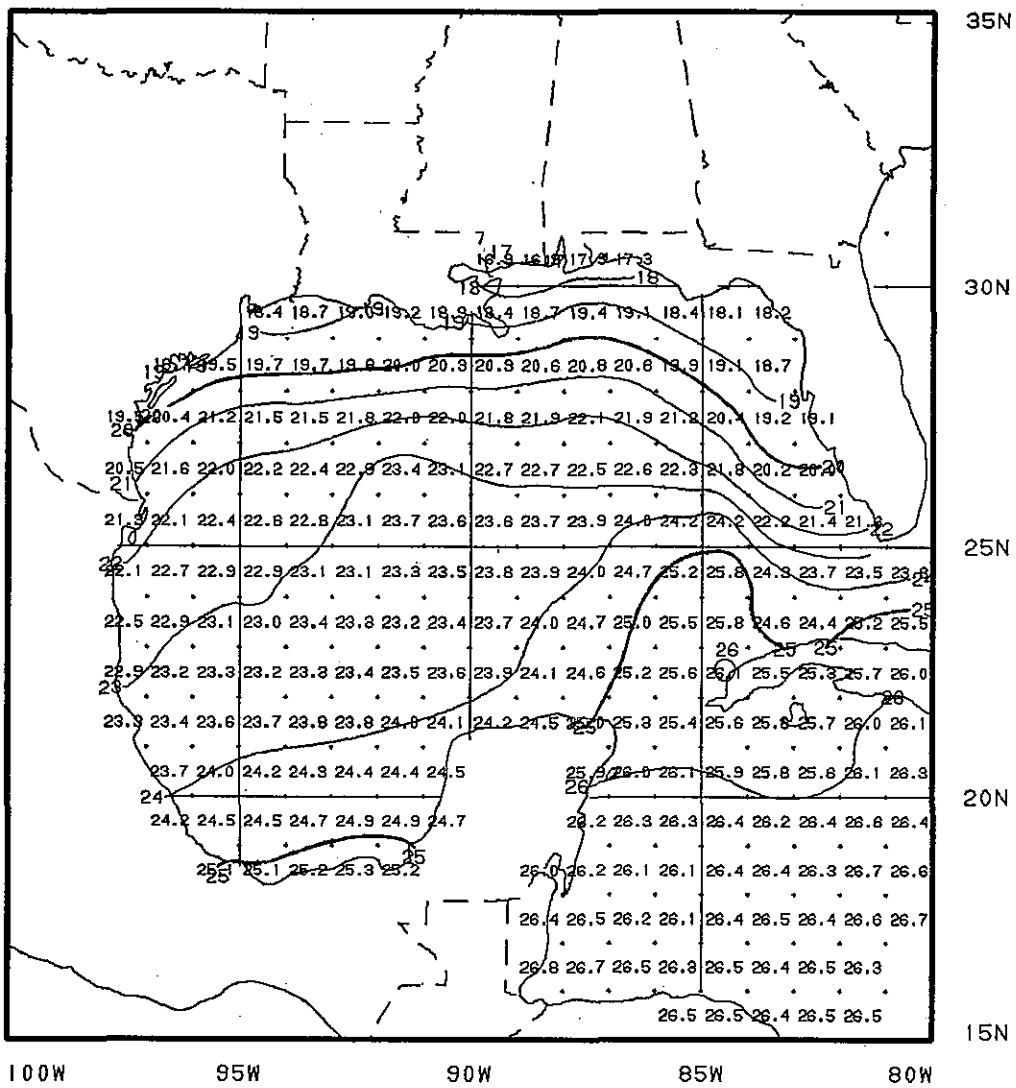


One anticyclonic eddy was newly detected during March. Eddy 78 was first observed on March 3 near 41°N 58°W. Around March 14 Eddy 78 began interacting with a Gulf Stream meander and it was apparently absorbed by that meander on March 26. A warm eddy-like feature formed near 37°N 74°W about March 10 presumably from a long filament of warm Gulf Stream water that extended from 35°N 75°W to 37°N 74°W. This feature has persisted through March and appears to have some circulation associated with it. Eddy 77 translated 140 km SW while Eddy 72 translated 175 km WSW. Eddy 79 was first observed near 41°N 51°W on August 12, 1985. Eddy 79 has since moved about 330 km W and now appears to be interacting with a Gulf Stream meander.

Three cyclonic eddies were newly detected in March. Eddy F apparently formed from a Gulf Steam meander near 37°N 63°W about March 11. Eddy G was newly observed near 33°N 75°W about March 19. Its origin is not known. Eddy H was detected near 38°N 56°W on March 26. Its origin is also not known. Eddy E translated 45 km ESE. Eddy Z traveled 90 km NE. Eddy T, last observed January 22, was detected again on March 19 having translated 75 km SE.

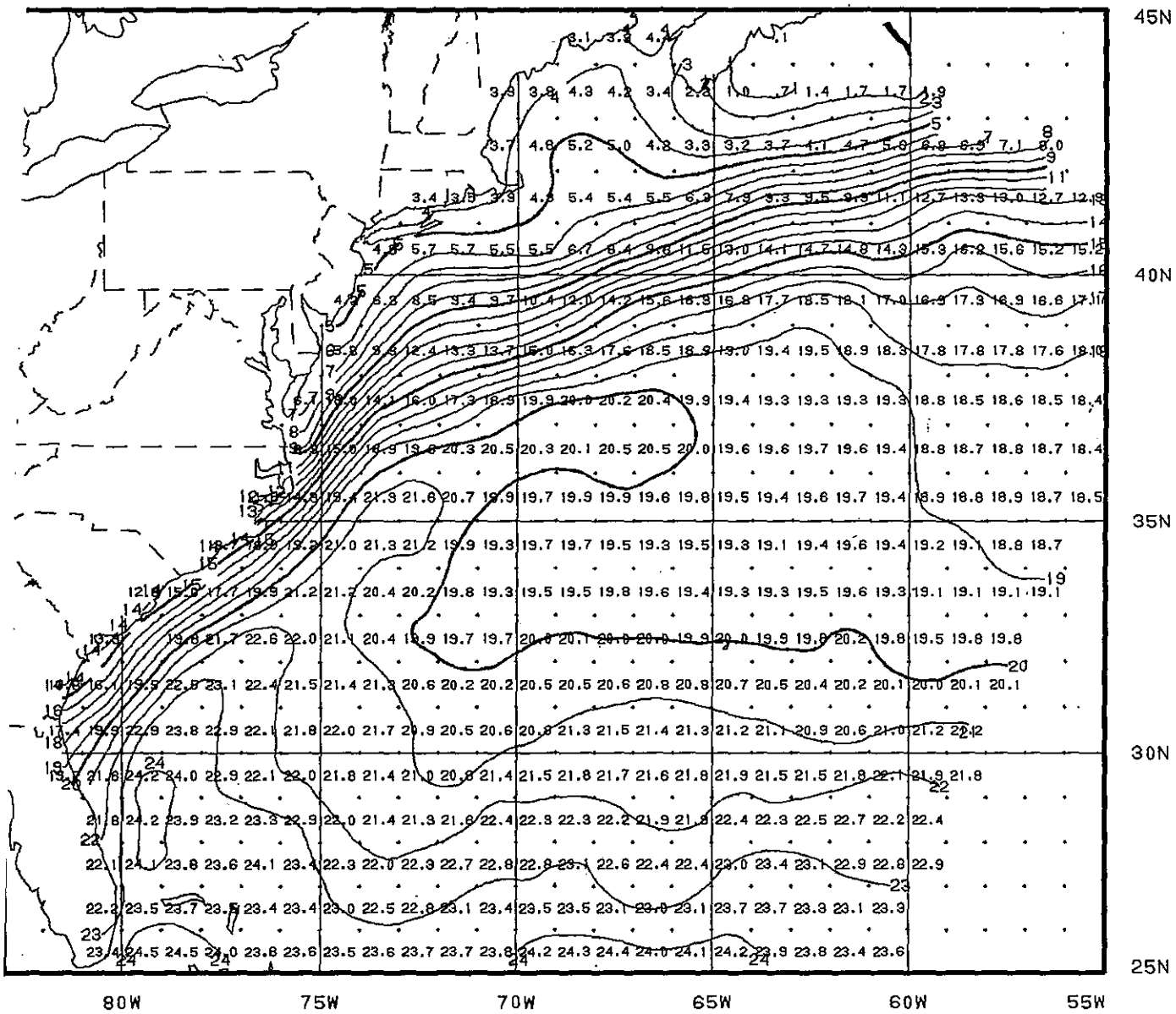
The Subtropical Convergence Front was last discerned on March 19 between 29°N 78°W and 29°N 69°W.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
March 1986

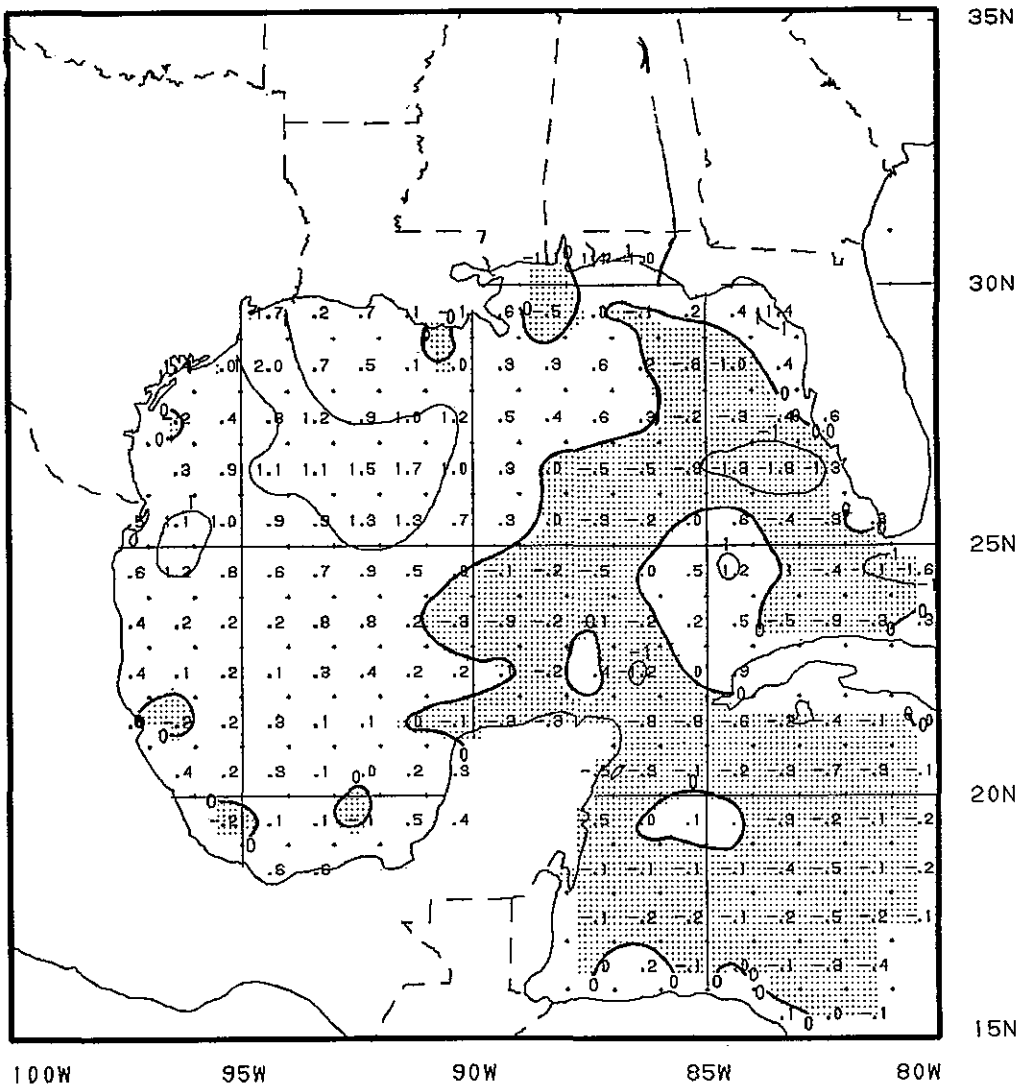
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
March 1986

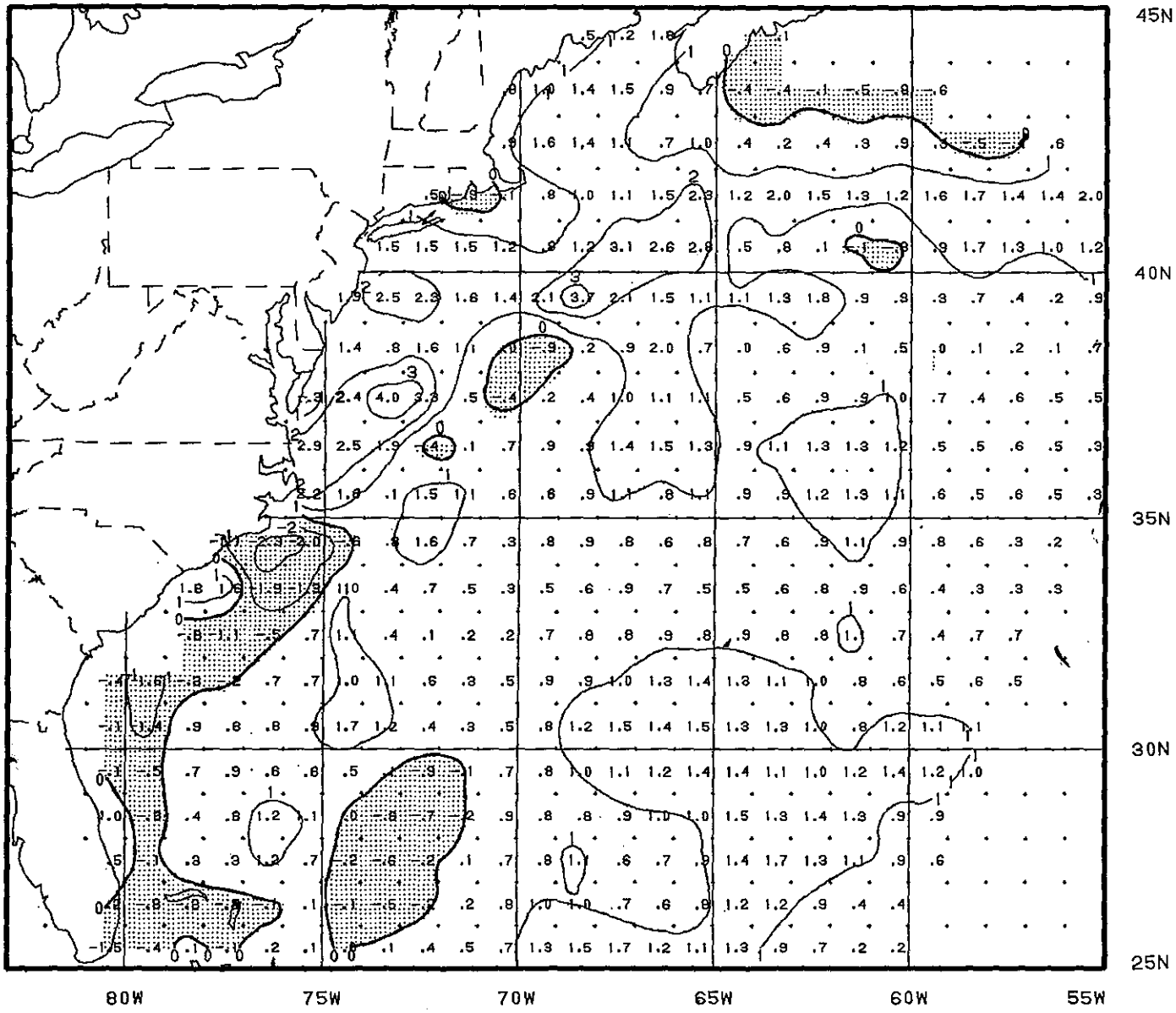
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
March 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
March 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE WA 98115-0070

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

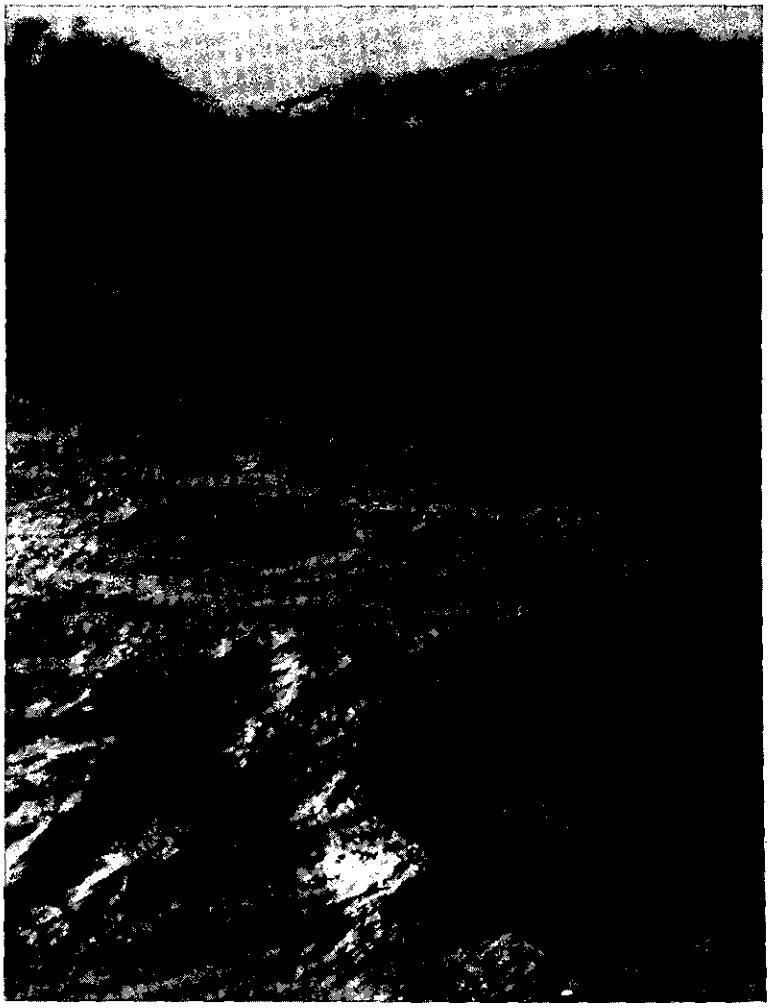
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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 September 30, 1986.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 4 April 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31*.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2*.
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; *NavOceano Ref. Pub. 18*.

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

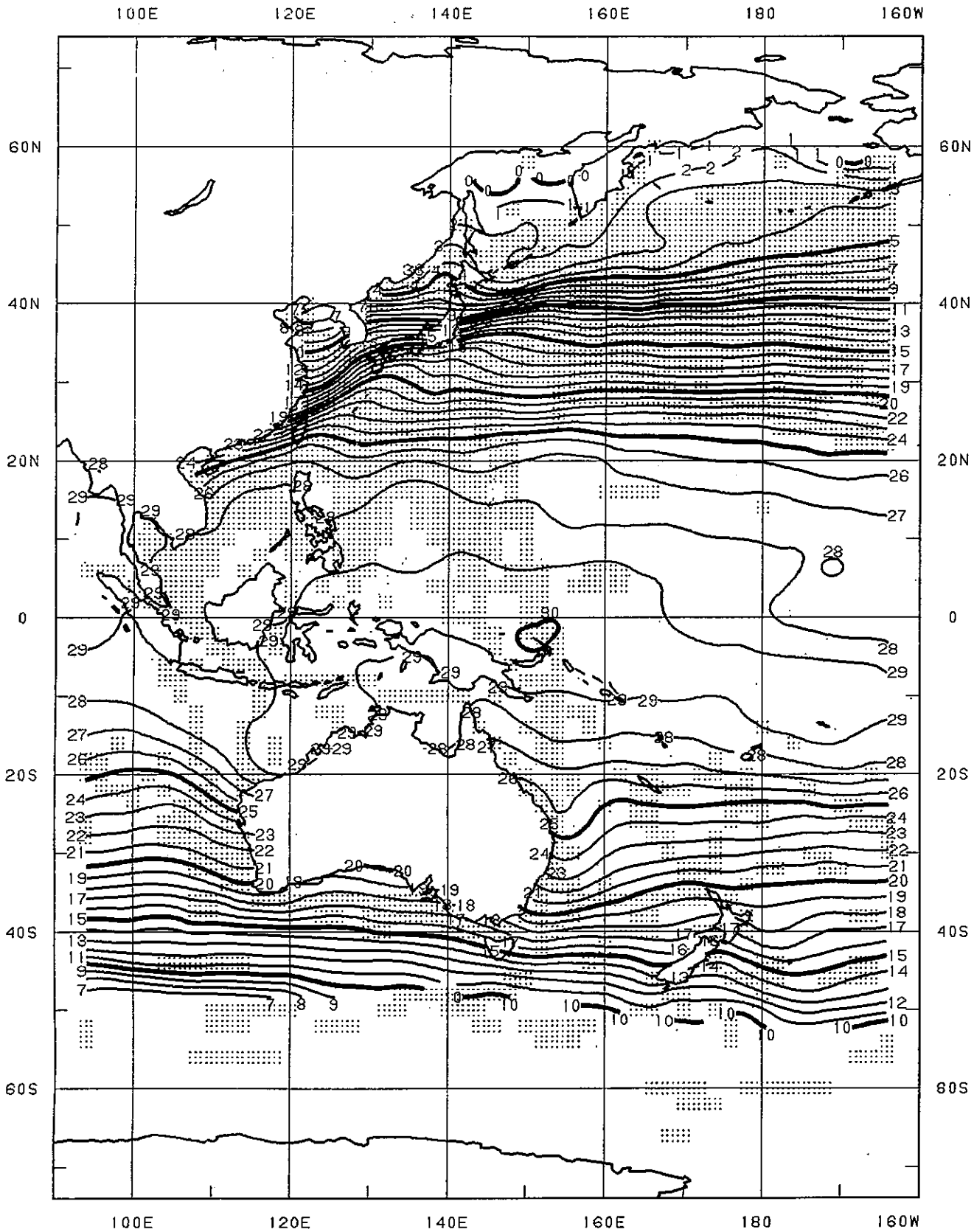
Typing: Damita Johnson

SATELLITE IMAGE OF THE MONTH

Marcia L. Weaks
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

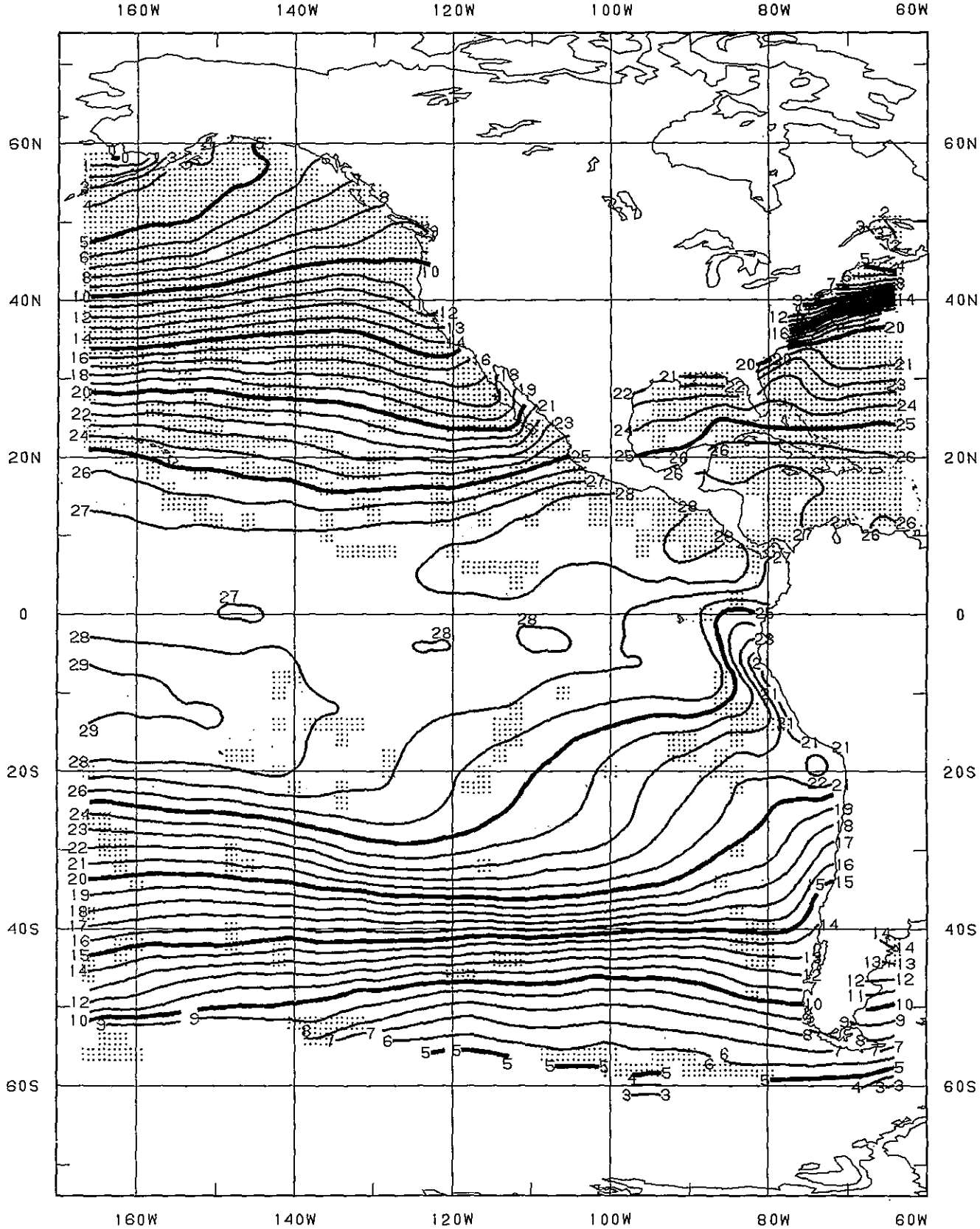
THE GULF STREAM

Ths sinuous path of the southern portion of the Gulf Stream is shown in this infrared image taken on April 2, 1986. Florida is the landmass shown in the left portion of the image. It is black because the gray scale enhancement "blacks out" temperatures above 30°C. Warm Gulf Stream waters are outlined by a dark gray shade (GS), while cooler shelf waters are a light gray (S). As indicated by the gradual transition in gray shades seaward of the Stream, the boundary between the Gulf Stream water and the Sargasso Sea water is not always clear cut. In contrast, a sharp transition usually exists from the shelf to the Stream in both surface and subsurface temperature and salinity patterns. Biologically speaking, the boundary between the shelf and the Stream waters is a very productive area; thus it is a prime area for fishing. The large Gulf Stream meander off the South Carolina coast (see arrows) is a persistent feature caused by the "Charleston Bump" a topographic feature on the continental slope that also triggers instabilities (waves) in the Gulf Stream which primarily propagate downstream.



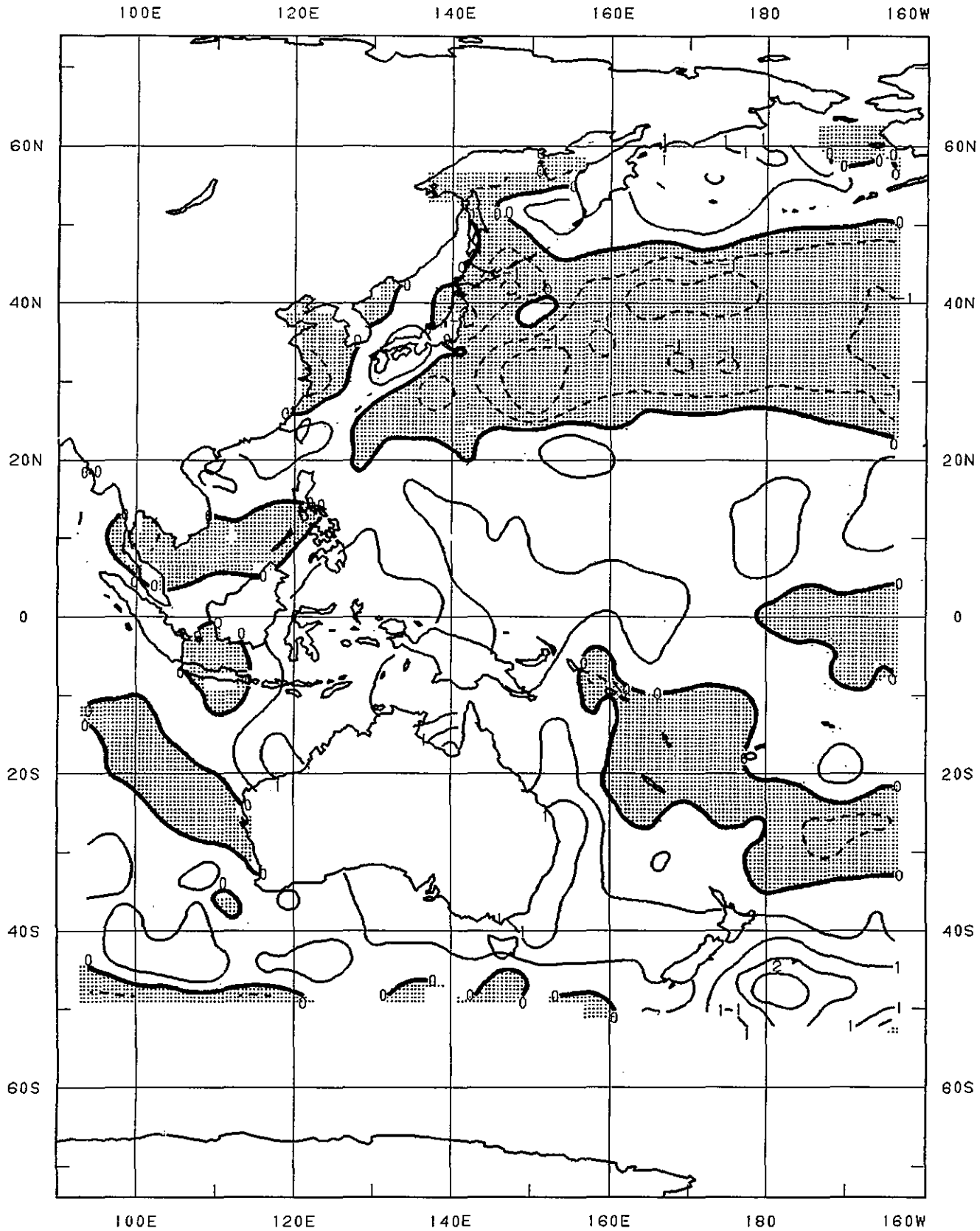
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
APRIL 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



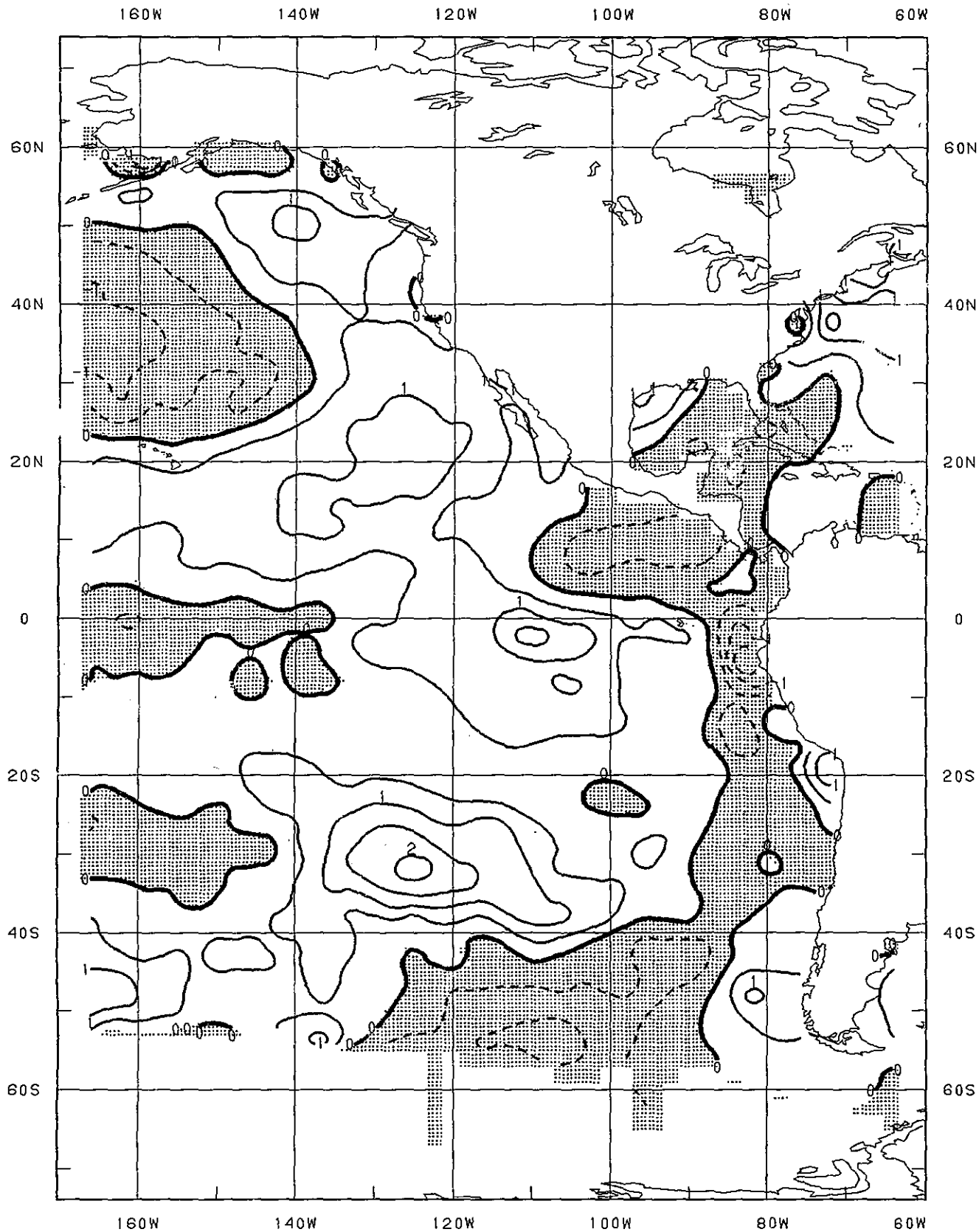
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUCY, AND SATELLITE DATA
APRIL 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



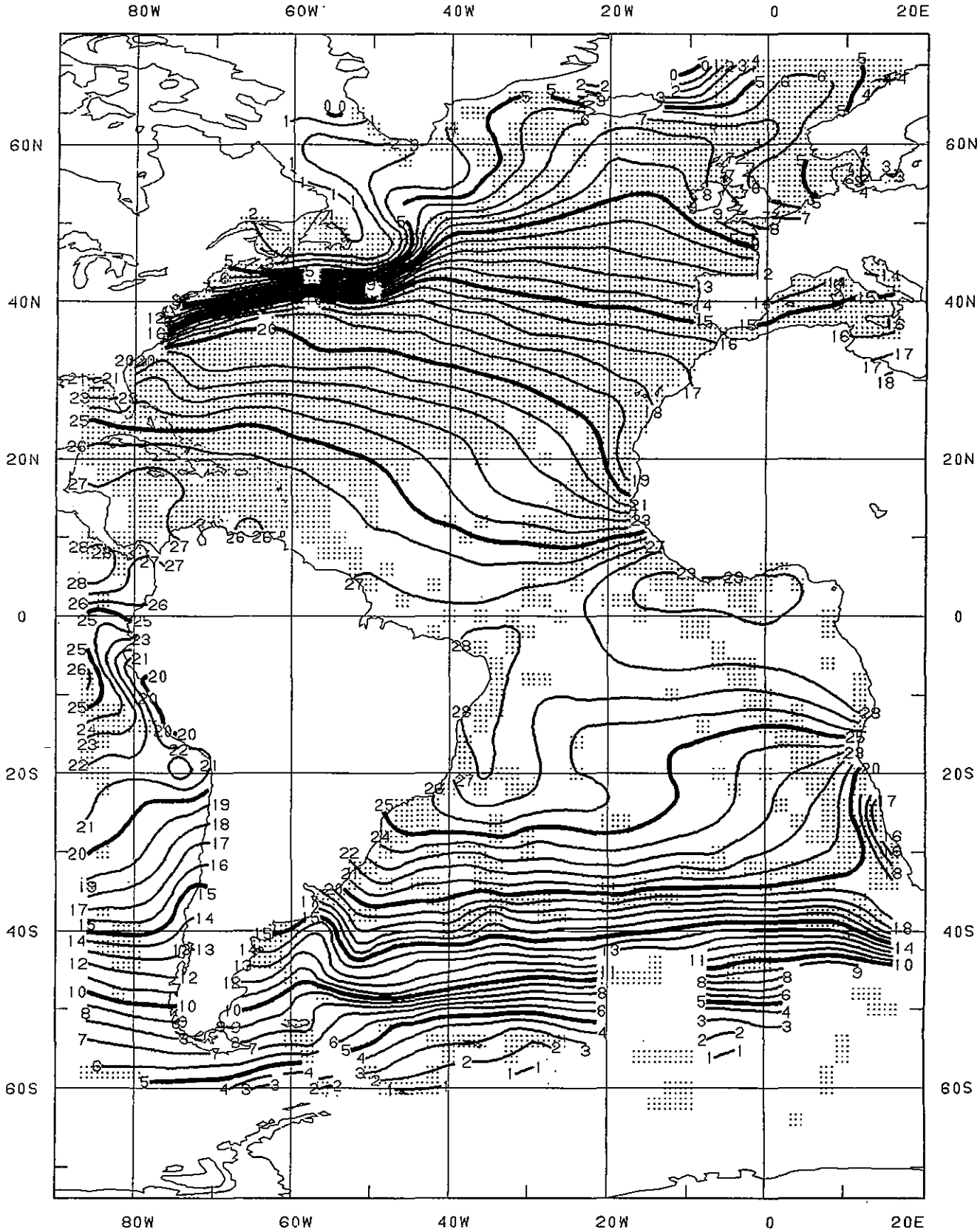
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
APRIL 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



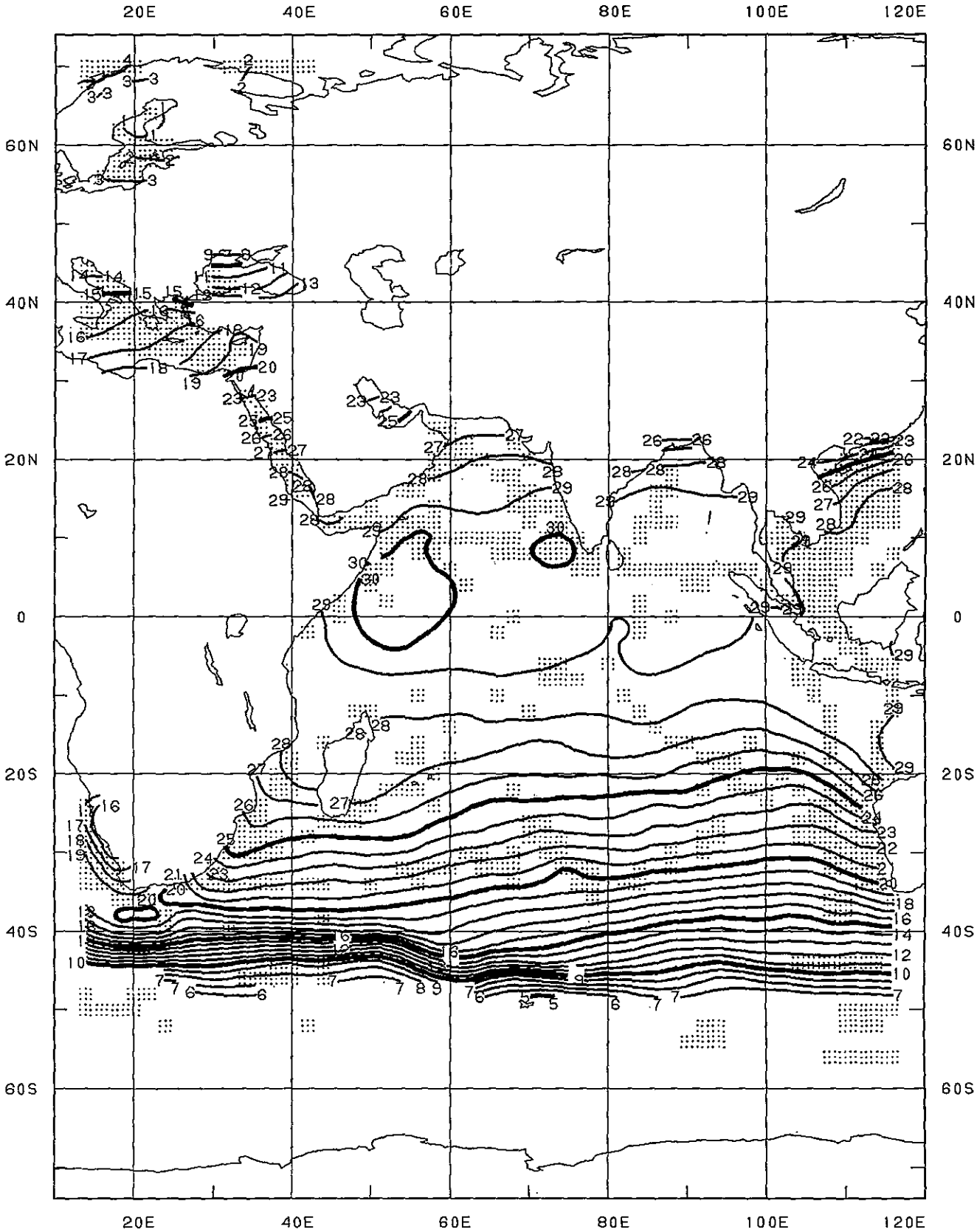
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
APRIL 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



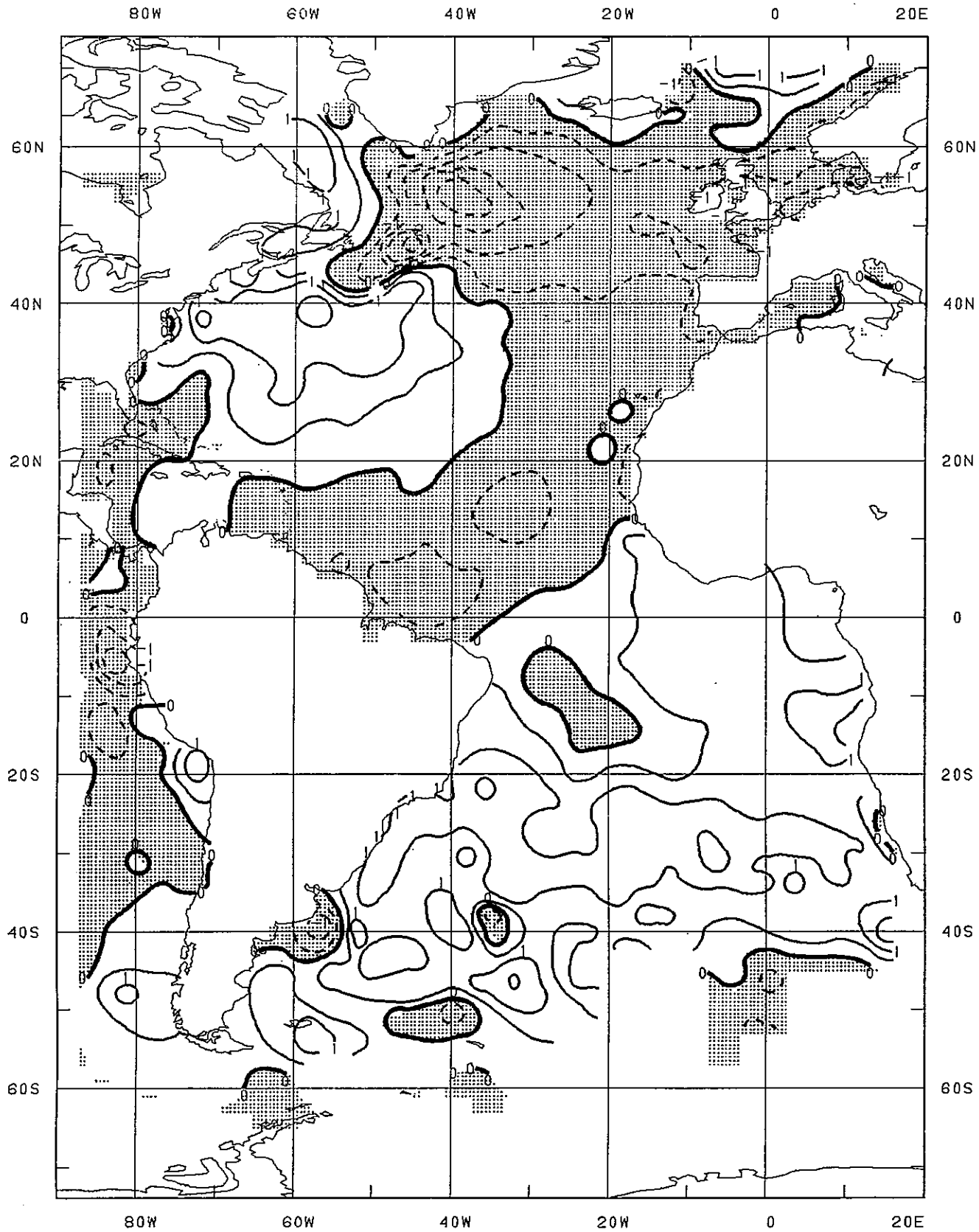
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
APRIL 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



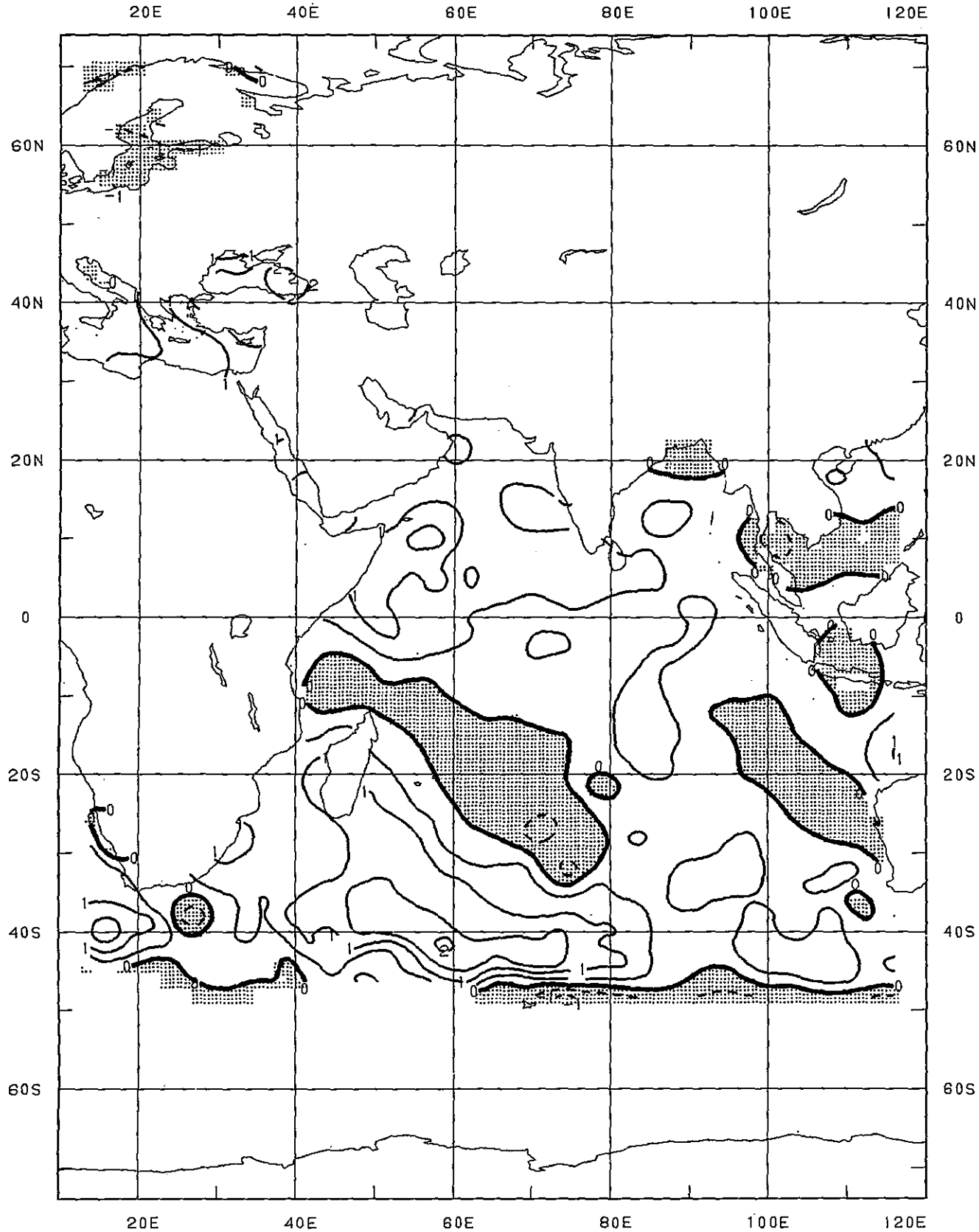
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
APRIL 1986

Monthly mean sea surface temperature is the mean of in situ 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
APRIL 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
APRIL 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

DATA RESOURCES OF THE NATIONAL OCEANOGRAPHIC DATA CENTER

by Richard J. Abram
National Oceanographic Data Center
NOAA/NESDIS, E/OC22
Washington, DC 20235

The National Oceanographic Data Center (NODC) -- which this year is celebrating its 25th anniversary -- is the U.S. national repository and dissemination facility for global oceanographic data. Established in 1961 as an interagency facility under the management of the Naval Hydrographic (now Oceanographic) Office, the NODC has been part of NOAA since NOAA was created in 1970. Today the NODC operates within the NOAA National Environmental Satellite, Data, and Information Service (NESDIS). The environmental data files of the NODC and its sister centers -- the National Geophysical Data Center (NGDC), Boulder, CO, and the National Climatic Data Center (NCDC), Asheville, NC -- are installed on a central NESDIS computer facility located at the NCDC in Asheville.

Through the NODC, researchers have access to data from government agencies, universities and research institutions, industry, and foreign agencies and organizations. Foreign data are acquired through bilateral and multilateral exchanges. Since 1962 the U.S. NODC has operated World Data Center A for Oceanography, one of the U.S. components of a global network that facilitates international data exchange. The NODC receives data from dozens of other countries including the U.S.S.R. and other eastern-bloc nations and the People's Republic of China.

NODC's primary data resources are its archive data files. Data received by NODC that are processable into standard formats enter its data processing/quality control system and are merged into the appropriate data files. Data in these files can be selectively retrieved (either by cruise or by geographic area and time period) and provided to customers in a variety of media and forms. Besides printouts and magnetic tape copies of selected data, the NODC provides a wide selection of customized data summaries, analyses, and graphic plots. All NODC data products are provided at cost. Standard charges are imposed for some relatively simple products; cost estimates are provided for more complex jobs.

For certain standard types of ocean data such as hydrographic stations and bathythermograph temperature profiles, NODC data files have worldwide coverage. NODC holds other types of physical, chemical, and biological data primarily for U.S. offshore and outer continental shelf areas. For example, the NODC receives and archives wind and wave data from automated buoys operated by the NOAA National Data Buoy Center. NODC's physical/chemical data files (Table 1) include ocean temperature and circulation data that are finding increased application to climate studies. A computerized data inventory system enables NODC personnel to respond quickly to customer inquiries about the quantity of available data meeting specified selection criteria.

In addition to its archive files, NODC also provides copies of special data sets held in originator formats. For example, NODC holds data tapes prepared by S. Levitus, NOAA/GFDL, in conjunction with the Climatological Atlas of the World Ocean. These tapes include global objective analyses of major ocean parameters on a one-degree grid.

From the NOAA Ocean Products Center (OPC) the NODC is receiving quality controlled marine data products. Global Blended Sea Surface Temperature analyses (which combine in situ and satellite data prepared in support of the Tropical Ocean - Global Atmosphere (TOGA) program) are now available at NODC. The initial data were received in December 1985. NODC is also receiving and archiving monthly IGOSS data tapes. These data are received at NODC within several working days after the end of each month.

Detailed information about NODC's data holdings, products, and services is provided in the NODC Users Guide, which is available free. Customers orders and inquiries should be directed to:

National Oceanographic Data Center, User Services Branch
NOAA/NESDIS E/OC21, Washington, DC 20235

Telephone: 202-634-7500 or FTS 634-7500

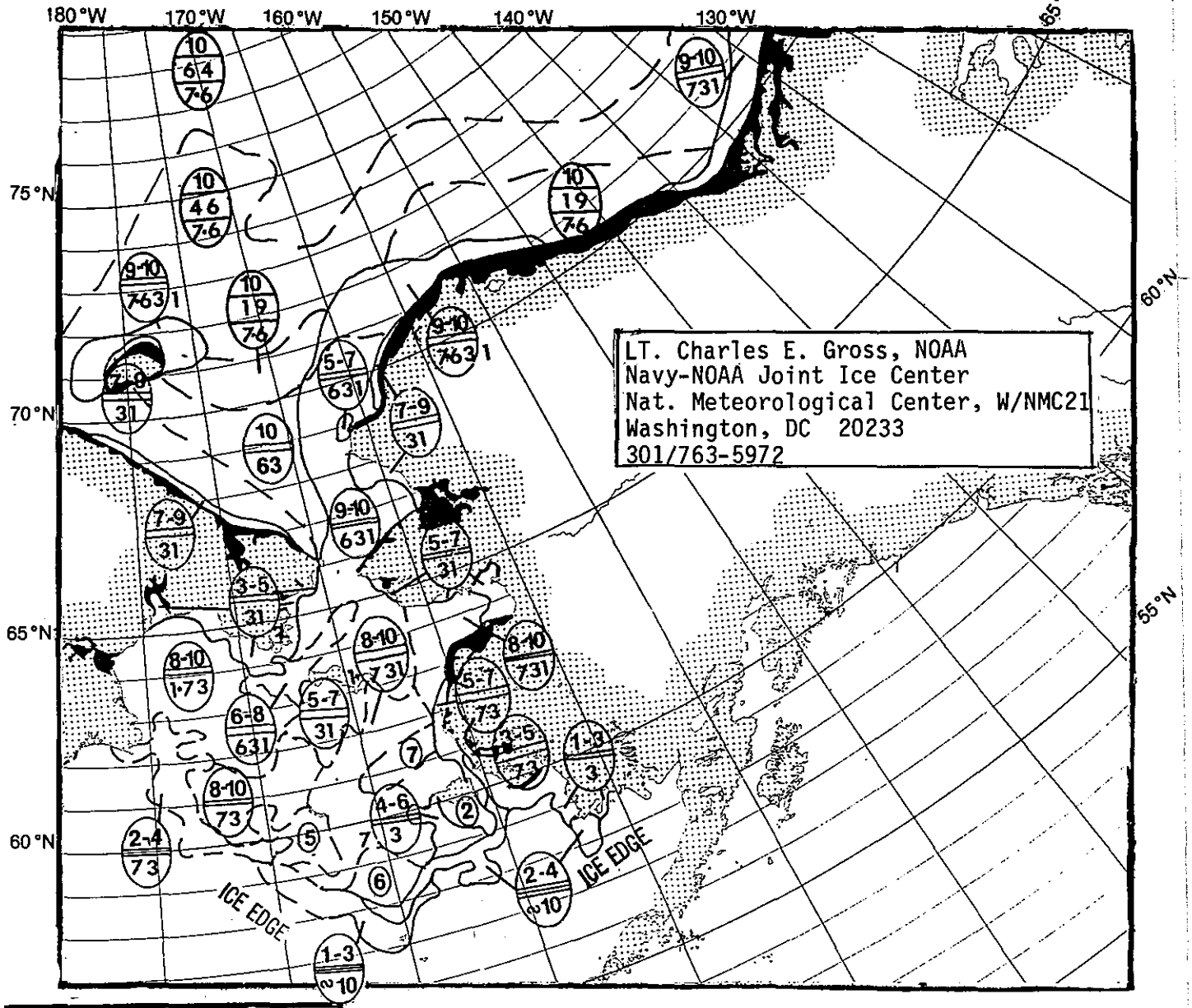
Telemail: Mailbox "NODC.WDCA"

Table 1. Major NODC Physical/Chemical Data Files

Data Type	Volume (as of April 1986)
Oceanographic Stations	713,268 stations
Mechanical BT data	980,222 stations
Expendable BT data	531,799 stations
CTD/STD data (high resolution)	38,176 stations
CTD/STD data (low resolution)	36,368 stations
Surface current (ship drift) data	4,175,000 stations
Current meter data	17,292 obs.-months*
Lagrangian current measurements	1,258 obs.-months*
Coastal wave data	51 obs.-months*
NDBC buoy data	6,043 obs.-months*
Pressure gauge data	473 obs.-months*
Water physics and chemistry	71,538 stations
Marine toxic substances and pollutants	11,159 stations

*Time series data are reported as observation-months, i.e., measured parameters recorded for a period of one month.

BERING SEA / NORTH SLOPE ICE ANALYSIS



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.

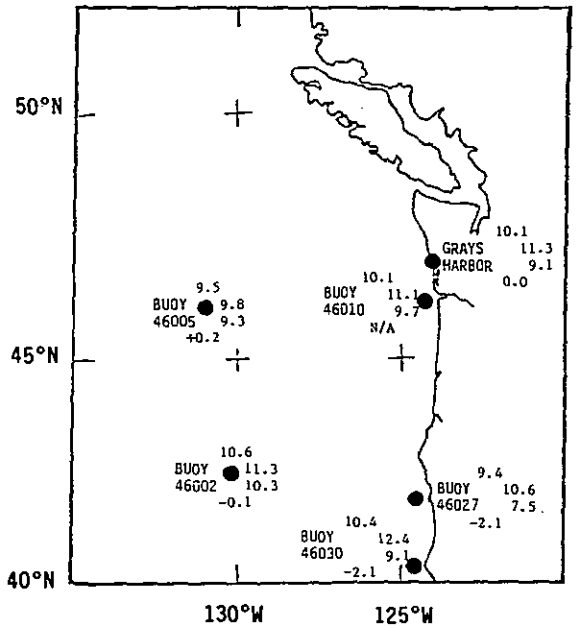
Ice boundary estimated.

APRIL 1986

The monthly mean sea level pressure circulation depicts a 1007 mb low centered in the Gulf of Alaska near 57°N 145°W. Geostrophic winds during the period are predominantly east-northeasterly throughout the Bering Sea. Mean surface air temperatures at King Salmon (59°N 157°W) and Nome (65°N 165°W) are below normal for the month. These conditions combined in reducing the overall recession of the ice edge to be less than 60 km. Small concentrations of belts and strips in the vicinity of Cape Newenham are the only ice covered areas remaining in Bristol Bay. The ice edge position is between the median and the maximum in the eastern and central Bering Sea and is near the minimum in the extreme western Bering Sea.

WEST COAST OCEAN FEATURES

APRIL 1986



The most significant aspect of ocean features in the North Panel area this month is the continuance of a widespread warm SST anomaly. Warmer than normal SSTs are observed over the entire area, although the magnitudes of the anomalies are generally less than in March. Climatologically, SSTs normally begin seasonal warming during April. Offshore SSTs this April, however, show no indication of any warming trend as the April mean SSTs are virtually identical to the March values. Coastal SSTs along Washington and northern Oregon also show little or no change. However, coastal SSTs from mid-Oregon southward show distinct cooling, with monthly mean decreases of 1 to 2°C. This coastal SST decrease is attributed to two distinct cooling episodes during April 9-12 and April 21-24. In both cases, SSTs apparently responded to brief periods of upwelling-favorable northwesterly winds. Confirmation of these possible early spring upwelling events through the use of satellite imagery was not possible due to a persistent cloud cover.

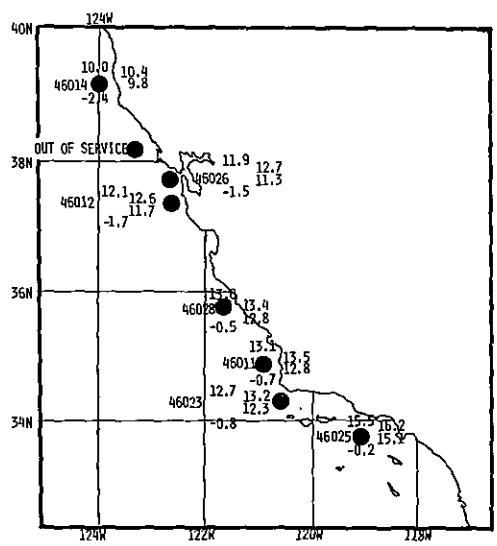
KEY:

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

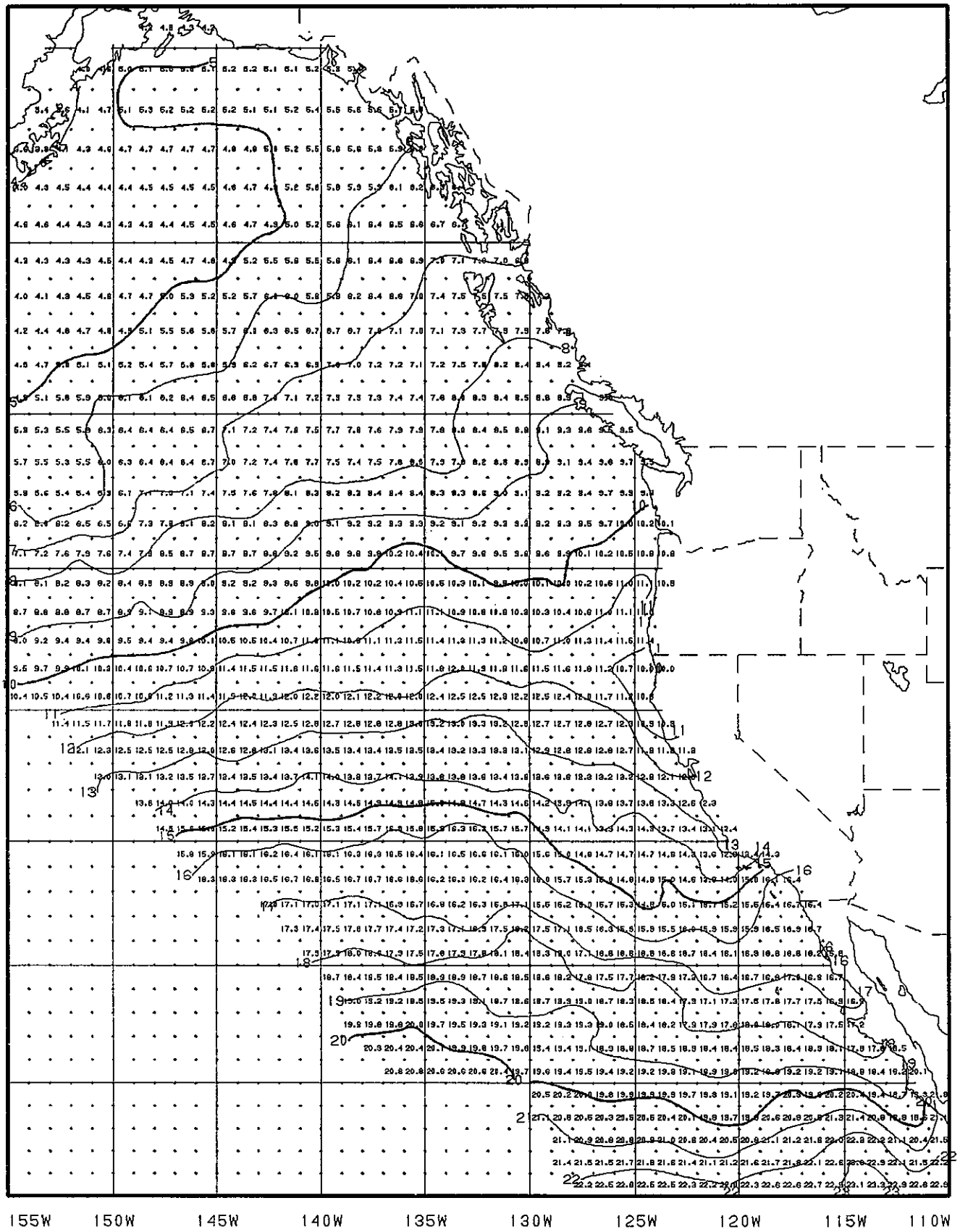
● Denotes station position.

North Panel
Kent Short
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, Wa 98115
(206) 526-6604
FTS 392-6604

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

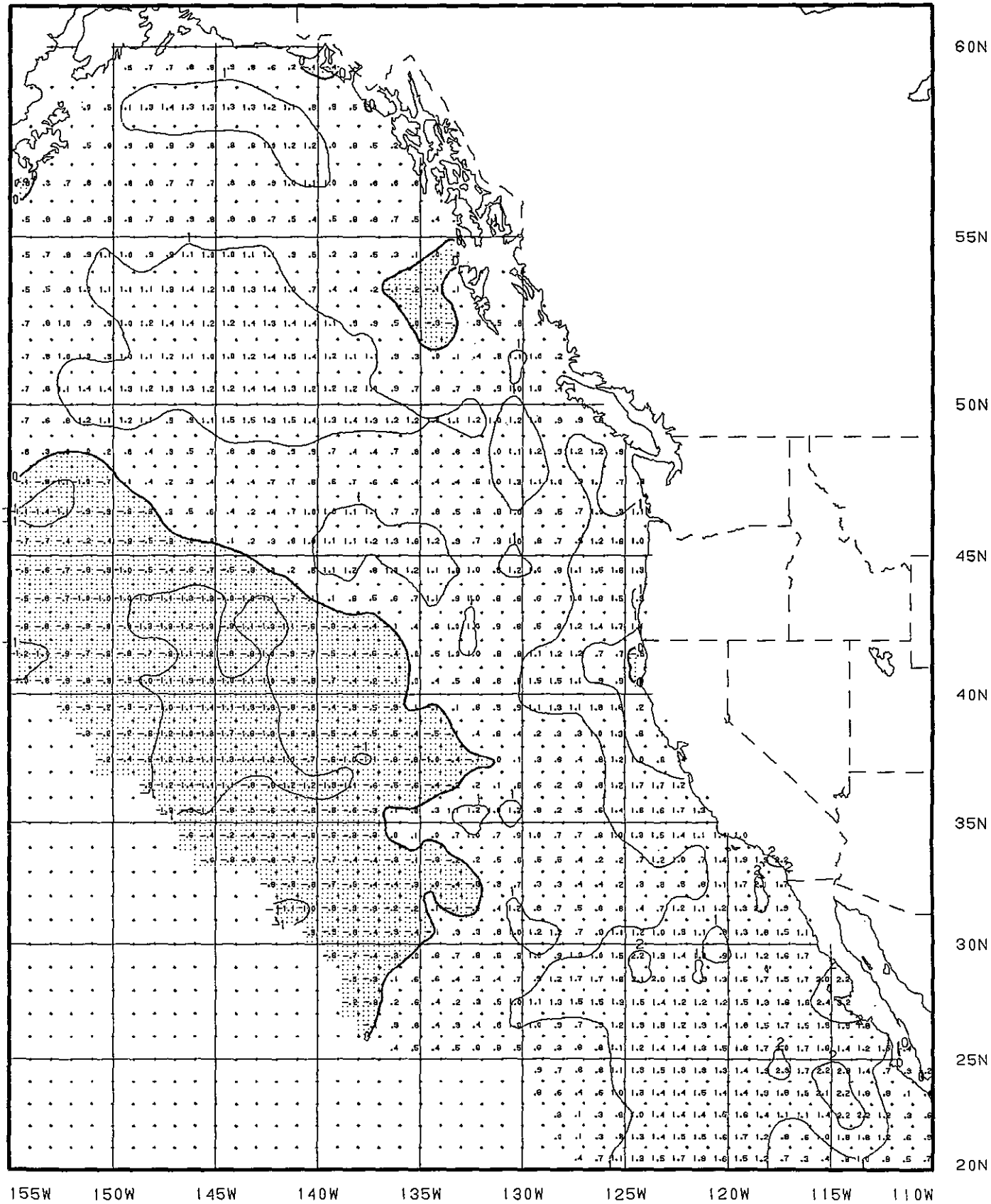


April mean sea surface temperatures for the South Panel are 0.8°C above the normal climatological mean value of 15.6°C. The area between 115°-126°W has a warm anomaly of 1°C or greater. West of 126°W, SSTs have positive anomalies of less than 1°C. On the western edge of the chart, north of 33°N, temperatures average slightly below normal. Compared to March, water temperatures cooled between 0.1° - 5.0°C nearly throughout the South Panel. Only two minor exceptions are observed along the Baja coast (+0.1°C) and near 37.5N 132.5°W (+0.2°C). The buoy statistics reveal significant cooling compared with the previous month, especially north of Monterey Bay. In looking at the daily averages of buoy reports, it is remarkable to see how quickly the strong northwesterly winds during April 24-30 brought cooled upwelled water to the surface. By April 30, SSTs had dropped to 9°C on the north coast (buoy #46014) and to 12°C at Pt. Conception (buoy # 46023), the coldest temperatures observed since last year!



West Coast
SST--MONTHLY MEAN (°C)
April 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

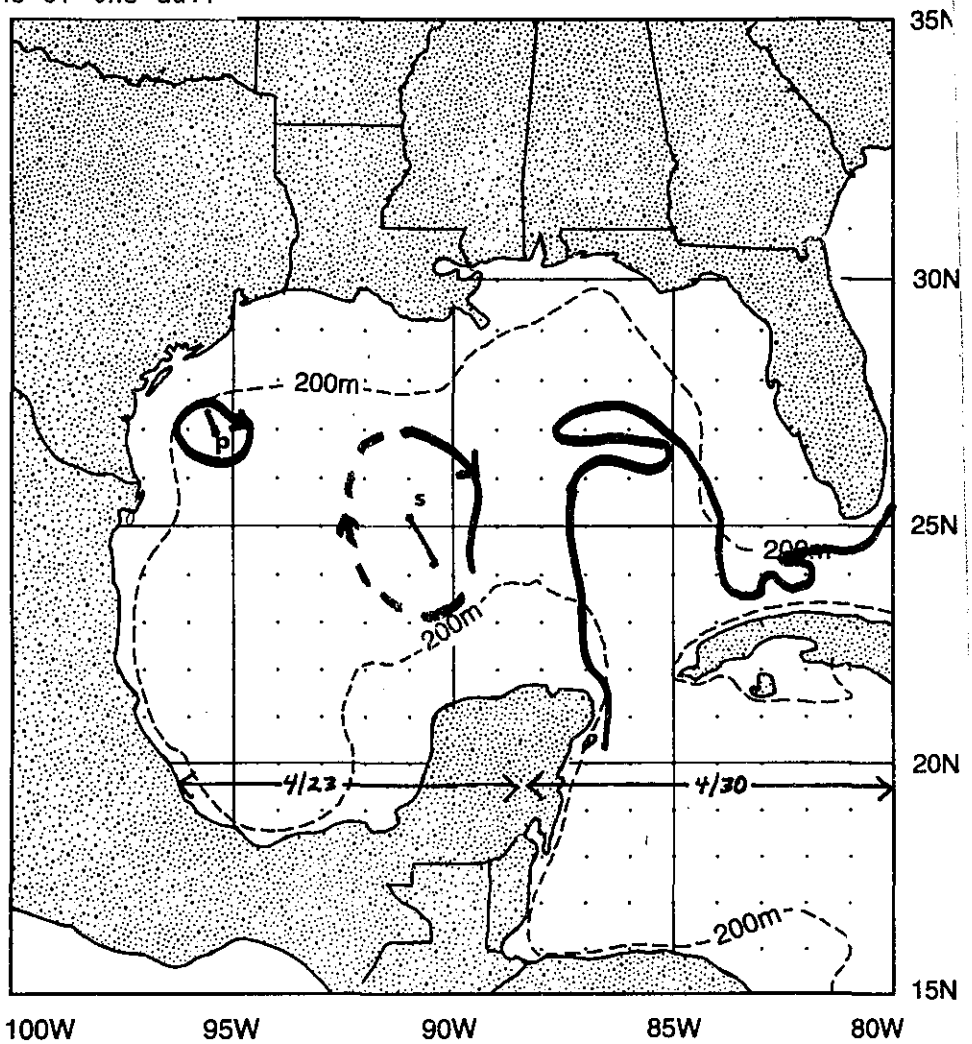


West Coast
SST--MONTHLY ANOMALY (°C)
April 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

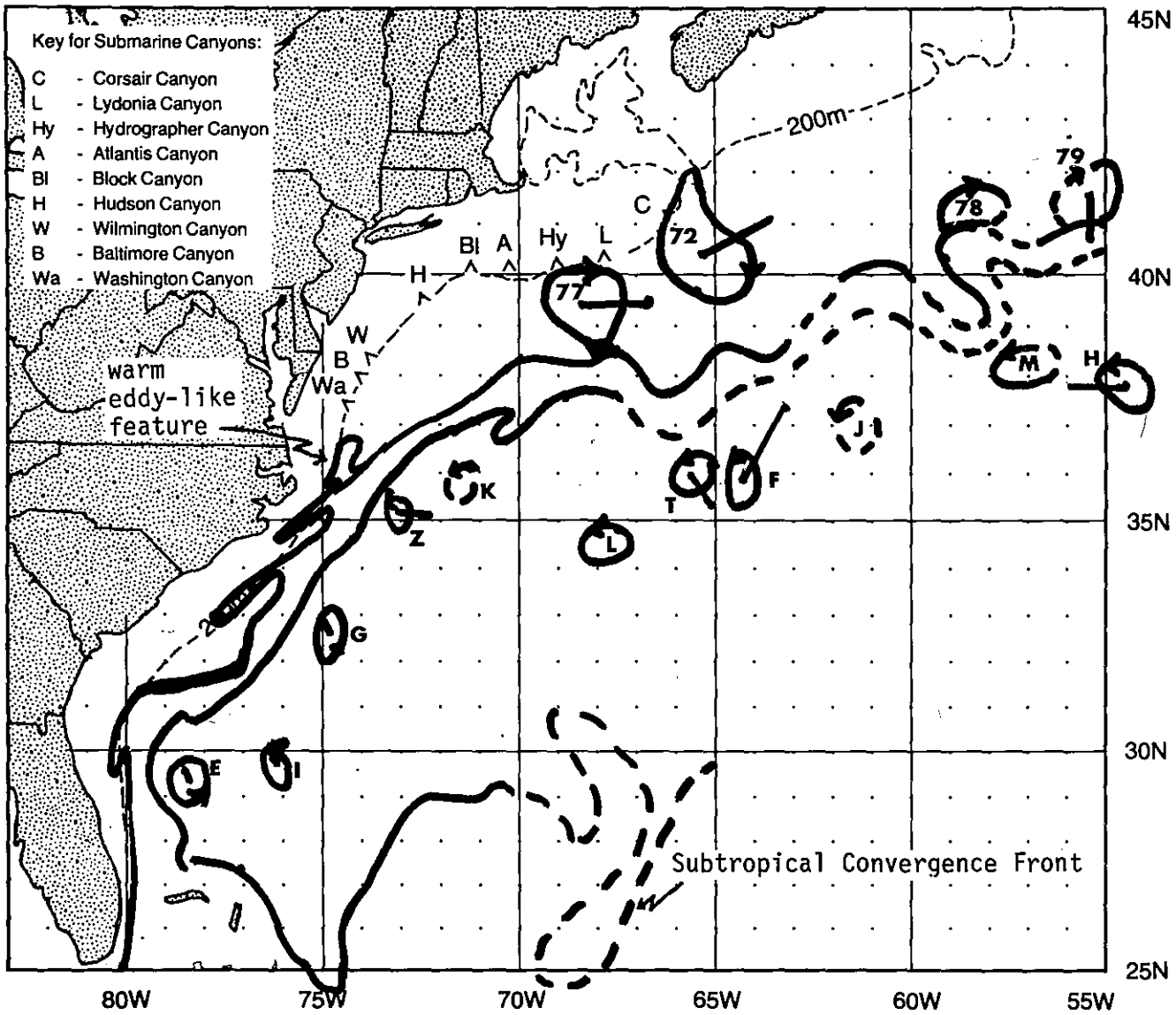
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

APRIL 1986

The end-of-April amplitude of the Loop Current increased by 35 km compared to the end-of-March position. Anticyclonic eddy s translated 110 km NW. Eddy p moved 45 km SE. The status of eddy o is uncertain as it was not observed during April.

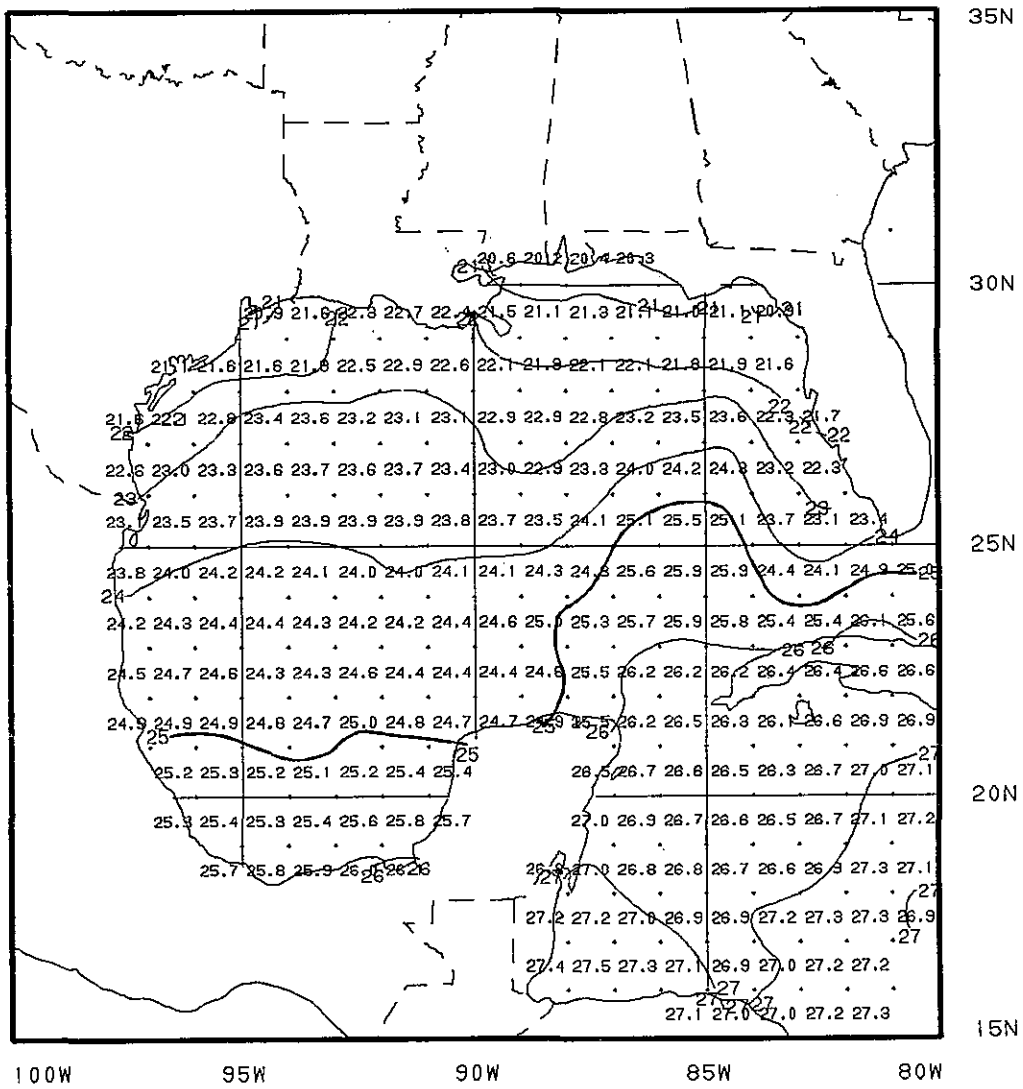


One anticyclonic eddy reformed during April. Eddy 78, apparently absorbed by a Gulf Stream meander on March 26, reemerged from the Gulf Stream around April 4. It was last discerned on April 29 near 41°N 58°30W. A warm eddy-like feature, which was observed near 37°30N 74°W last month, translated 130 km SW during April and it is now being absorbed by the Gulf Stream. Eddy 77 traveled 140 km W. Eddy 72 moved 150 km SW. Eddy 79 translated 85 km N.

Due to cloud free conditions and the seasonally high thermal contrast, five cyclonic eddies were newly detected in April. Eddy I was newly observed near 29°30N 76°W about April 3. Eddy J was detected on April 5 near 37°N 61°30W. Eddy K was discerned near 36°N 71°30W on April 15. Eddy L was newly detected on April 15 near 34°30N 68°W. The origins of eddies I, J, K, and L are unknown. Eddy M apparently formed from a Gulf Stream meander near 38°N 57°W in late April. Eddy E translated 55 km SE. Eddy G traveled 45 km SSE. Eddy Z apparently translated 75 km WNW. Eddy T moved 85 km NW while eddy F traveled 195 km SW. Eddy H translated 140 km E.

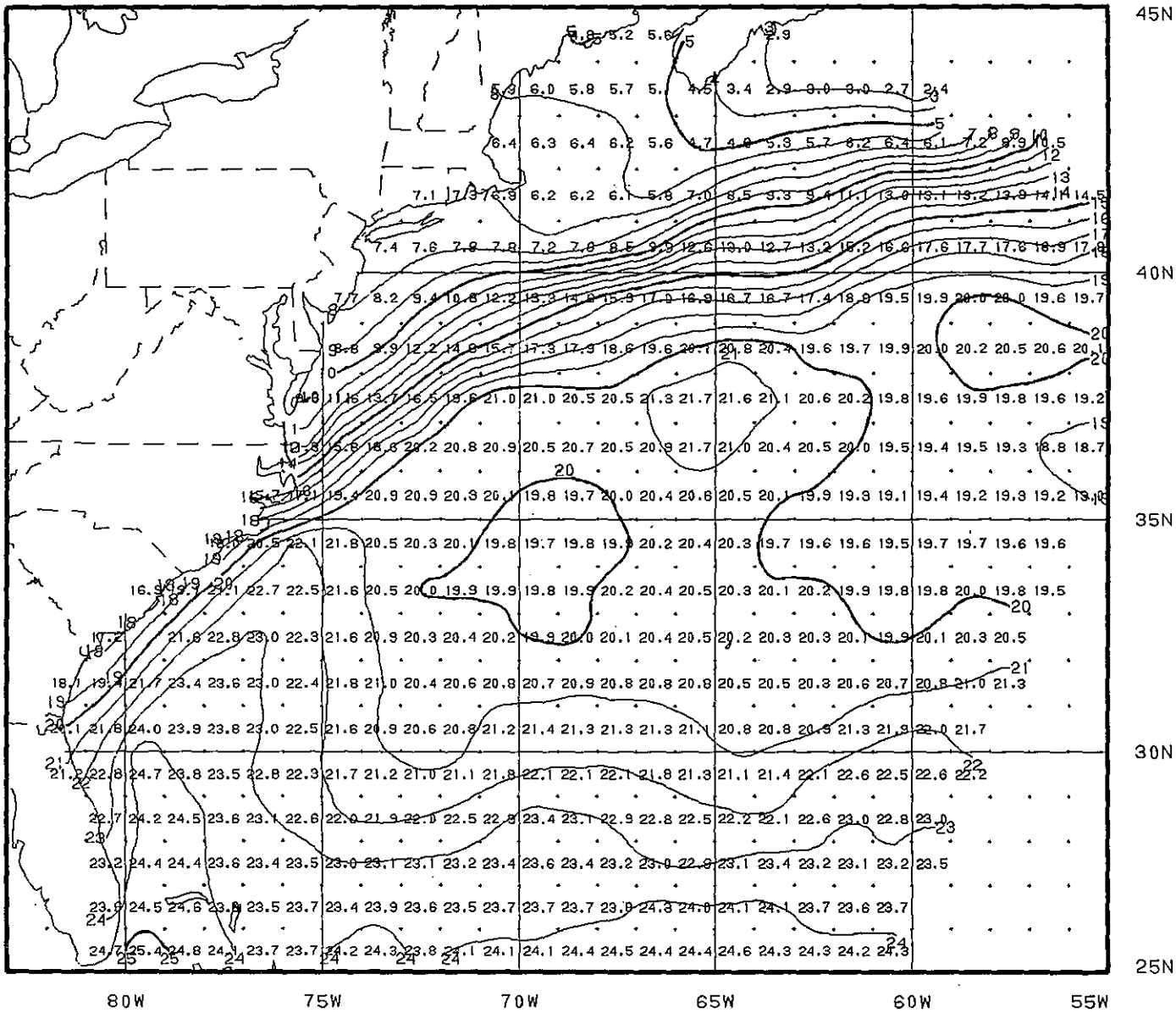
The Subtropical Convergence Front was twice detected during the month on April 30 between 27°N 78°W and 29°N 71°W and on April 16 between 29°N 71°W and 29°30N 65°W.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
April 1986

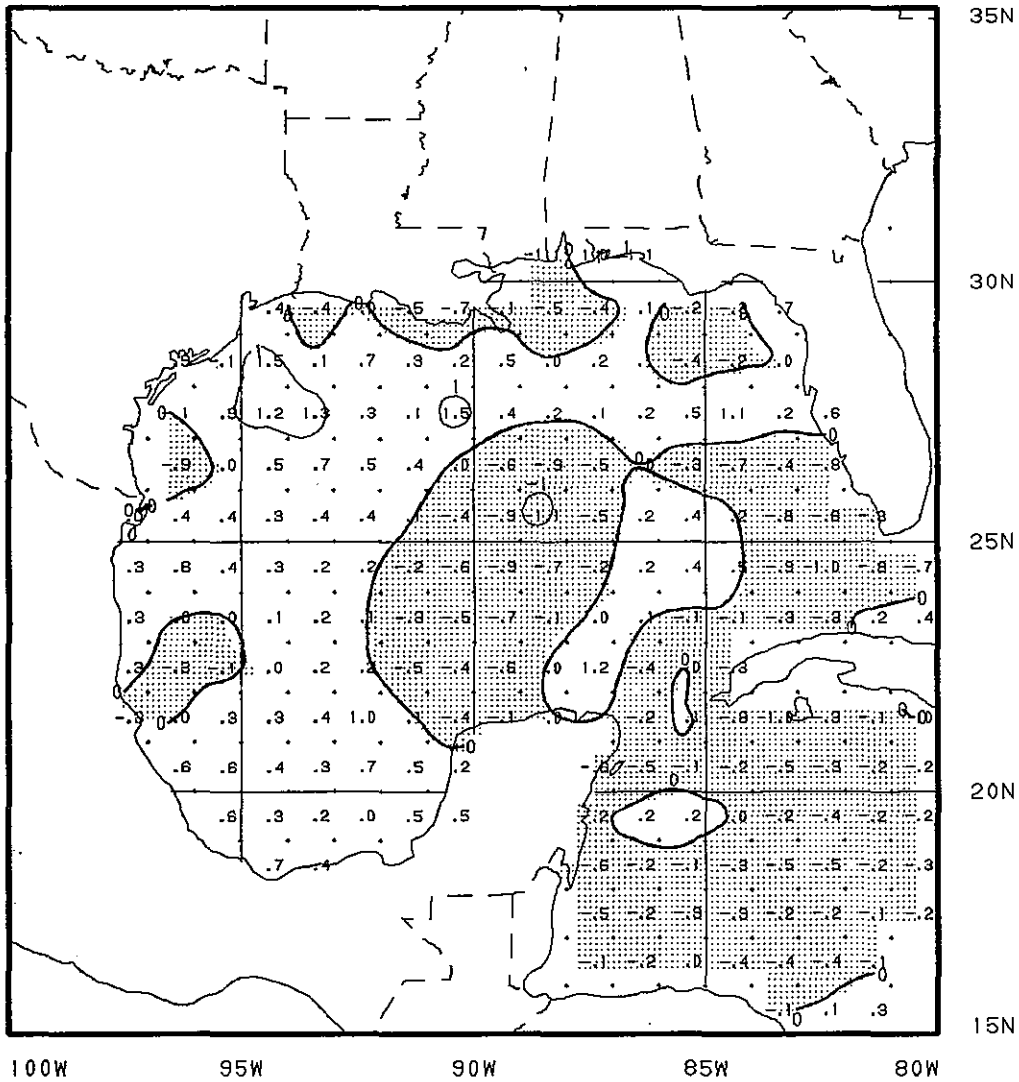
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
April 1986

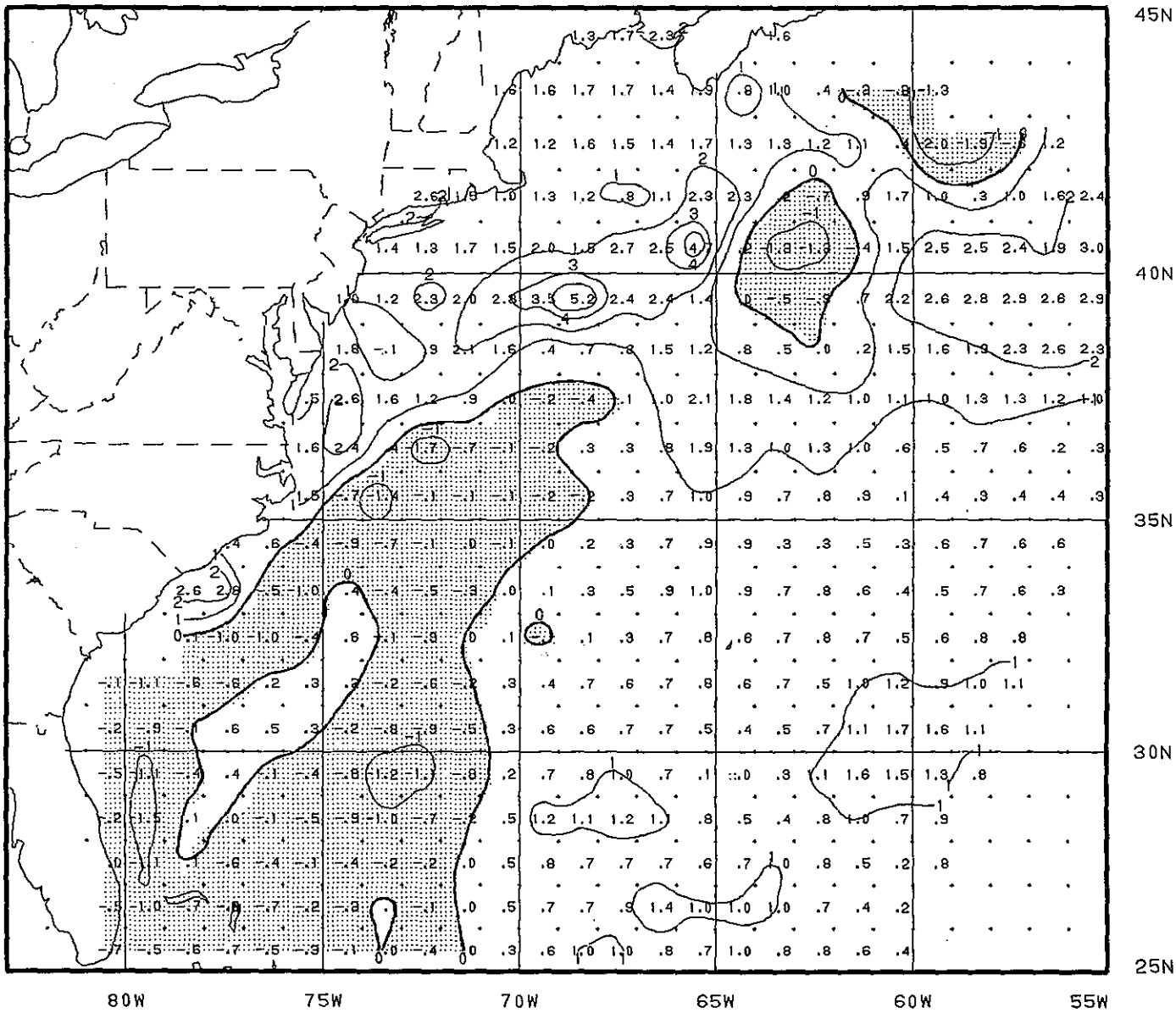
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
April 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
April 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N. E.
SEATTLE WA 98115-0070

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

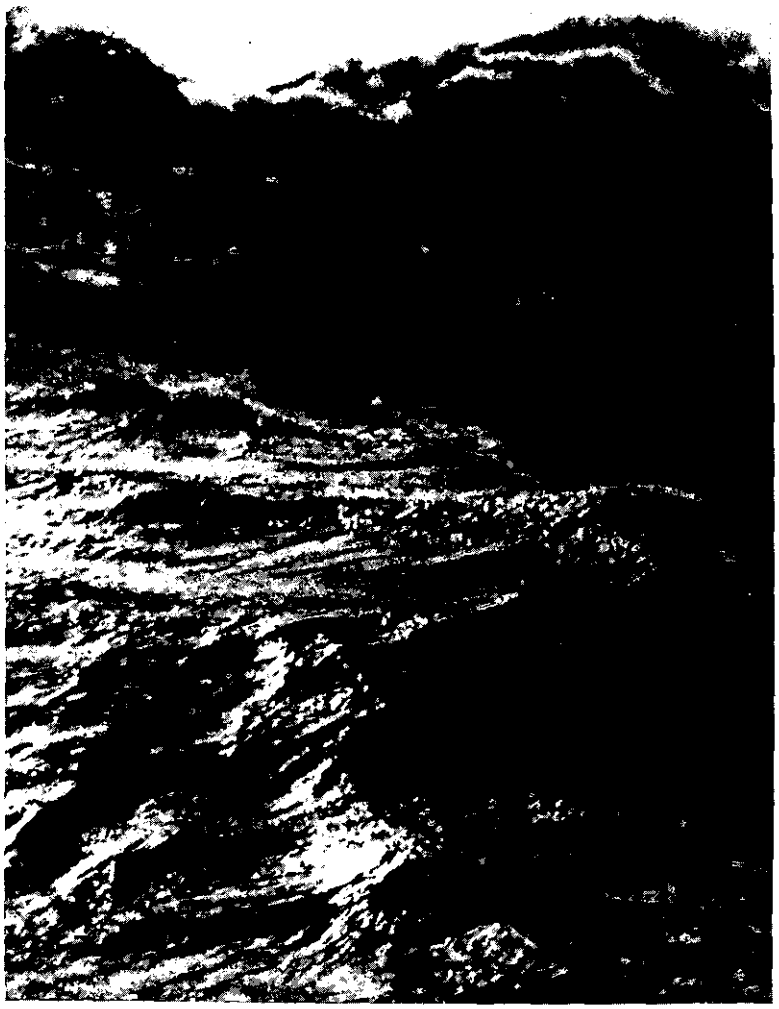
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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 September 30, 1986.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 5 May 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31*.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2*.
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; *NavOceano Ref. Pub. 18*.

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

Typing: Damita Johnson

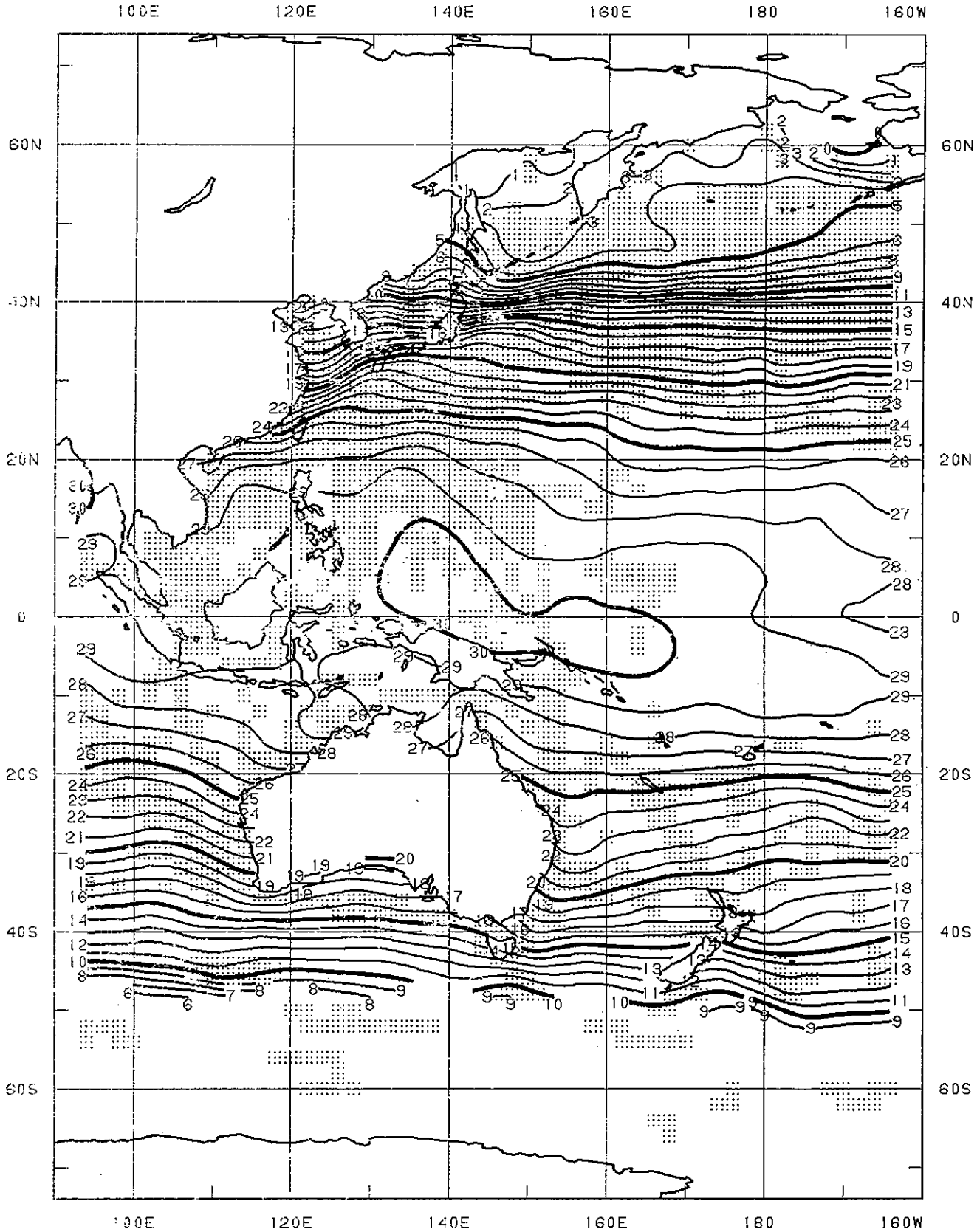
SATELLITE IMAGE OF THE MONTH

Marcia L. Weaks
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

ALASKAN NORTH SLOPE ICE

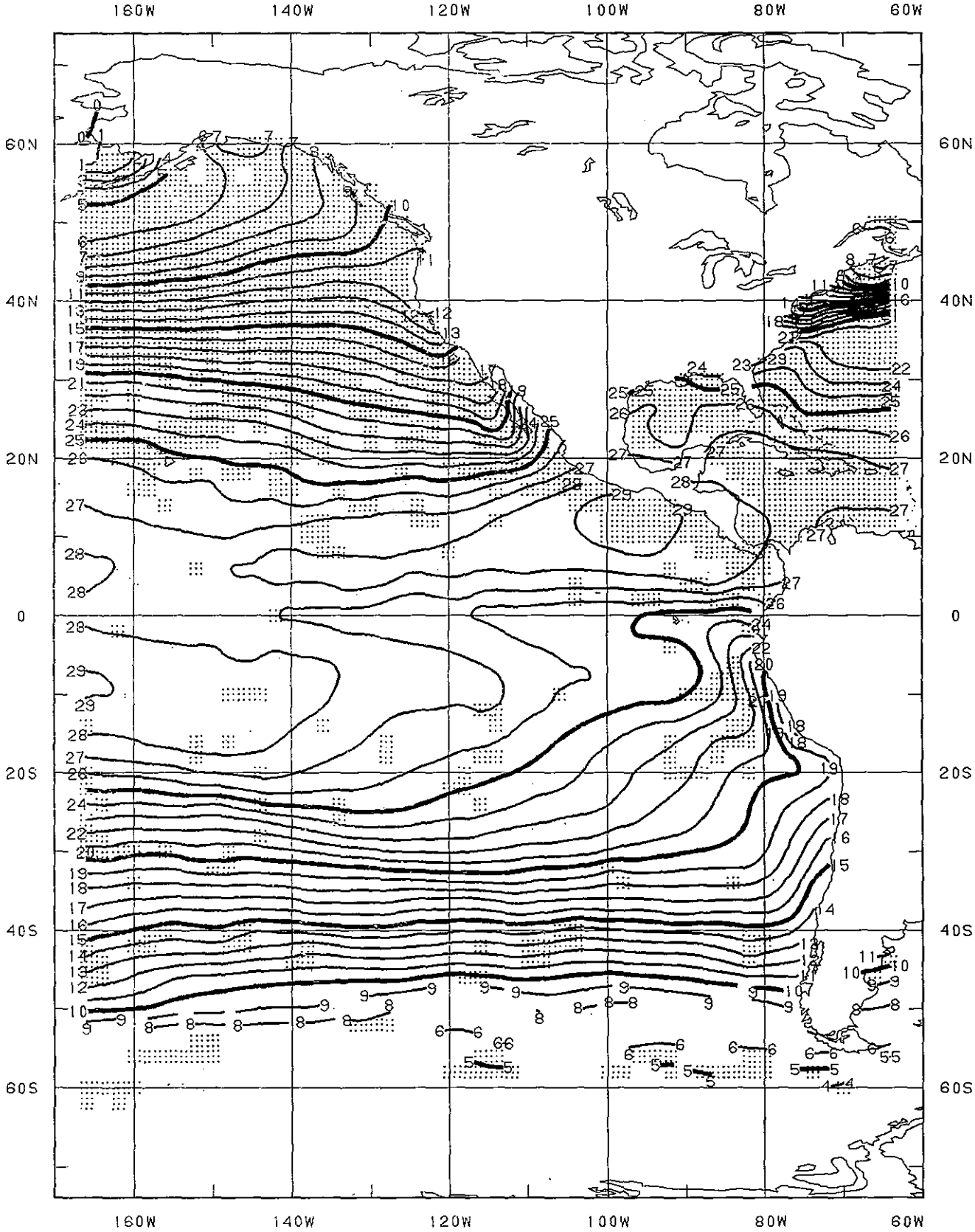
Ice conditions along the North Slope of Alaska are depicted in this NOAA-9 visible image from May 6, 1986. The image extends from the Kotzebue Sound (K) in the Bering Strait to east of Point Barrow (B). In visible imagery, ice and clouds generally appear as light gray shades, while thinner ice and open water appear as dark gray shades. Surface wind conditions, air temperature, and proximity to sources of warmer water (such as river runoff or currents from the Bering Sea) determine ice formation and dissipation in the Alaskan region.

Fast ice, ice which forms and remains along the coast, is found along the Alaskan coast from Cape Lisburne (L) eastward. It is the presence of this ice, along with the thickness and location of the pack ice, which determine the length of the shipping season. Forecasters from the Navy-NOAA Joint Ice Center believe this year will be a relatively mild year, and therefore shipping could begin in late July and last for 1-2 months. The dark area located from Point Hope (H) to east of Icy Cape (I) may look like an open water lead, but it actually contains up to 50% areal coverage of first year thin or young ice (10-70 cm thick). This kind of lead is known as a "restricted flaw lead". North of the lead, areas of cloudiness are indicated among 60-80% coverage (FY8) and 90-100% coverage (FY9) of first year and young ice (10-200 cm thick). One criterion used by ice analysts to determine percentages of areal coverage is the amount of open water around ice floes and "floebergs". East of the lead, the slightly lighter gray shade indicates a combination of thin cloud cover and greater ice concentrations within the lead (up to 80% areal coverage). South of Point Hope in the Bering Strait, ice concentrations are 70-90% in first year and young ice (10-200 cm thick).



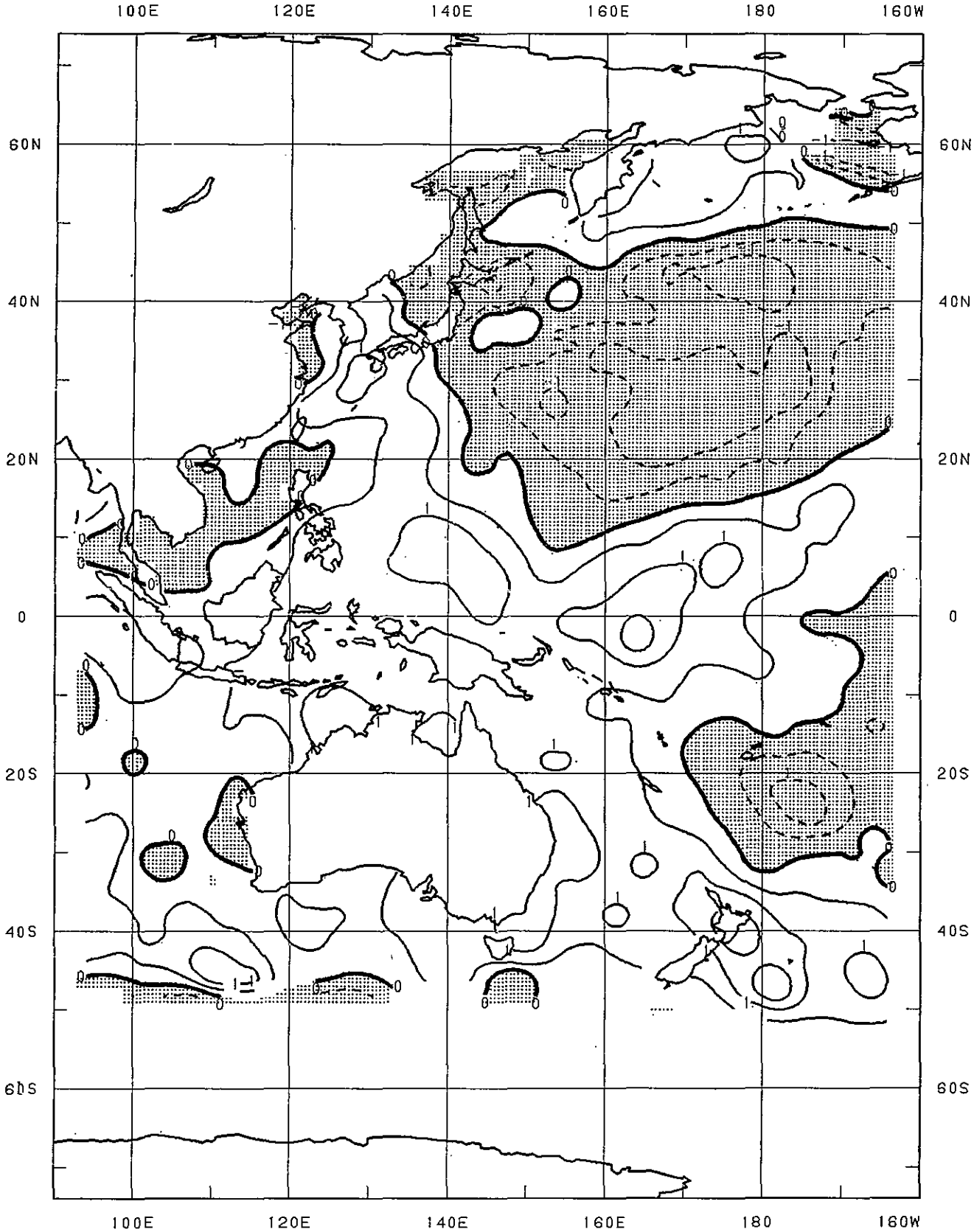
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
MAY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



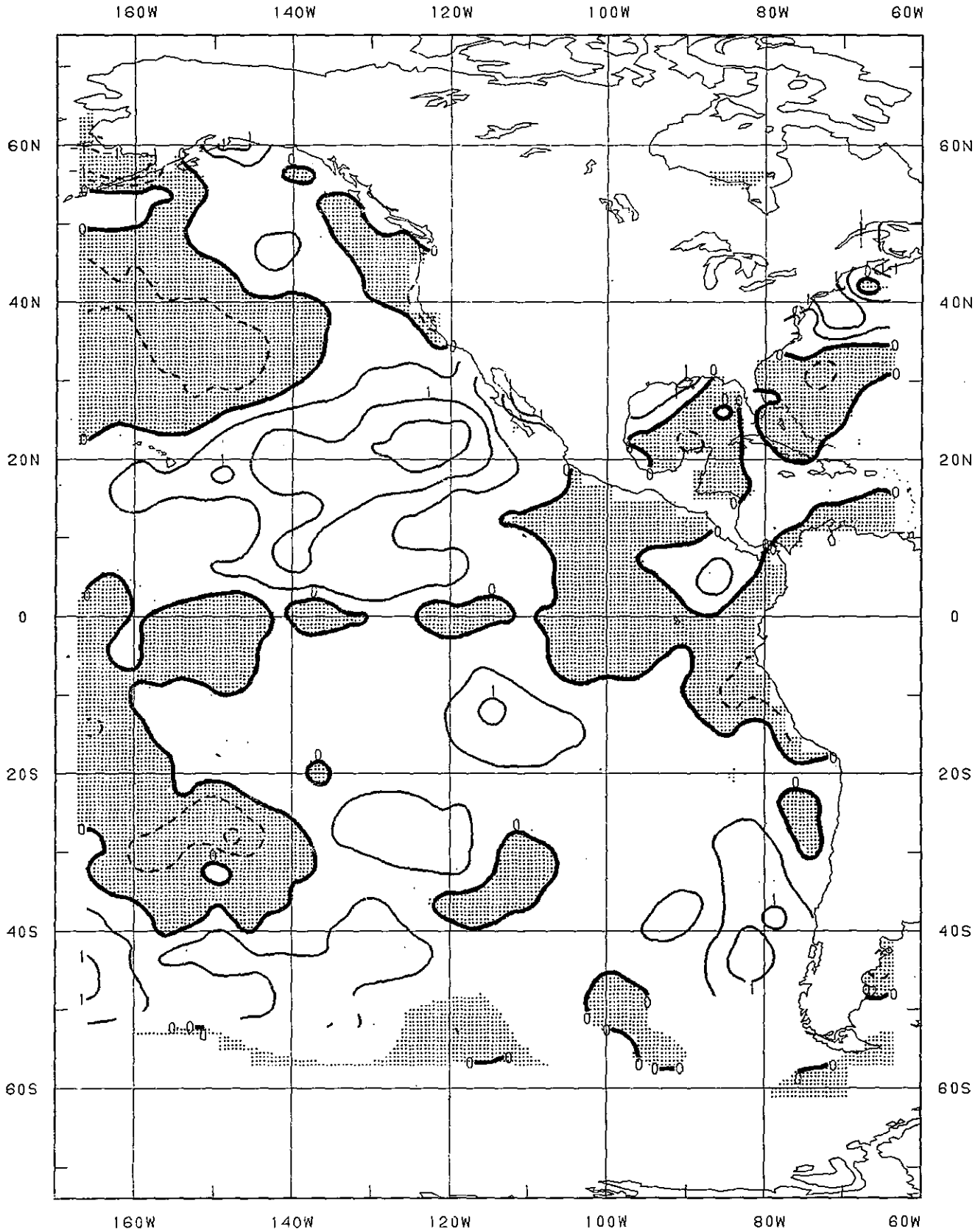
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
MAY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



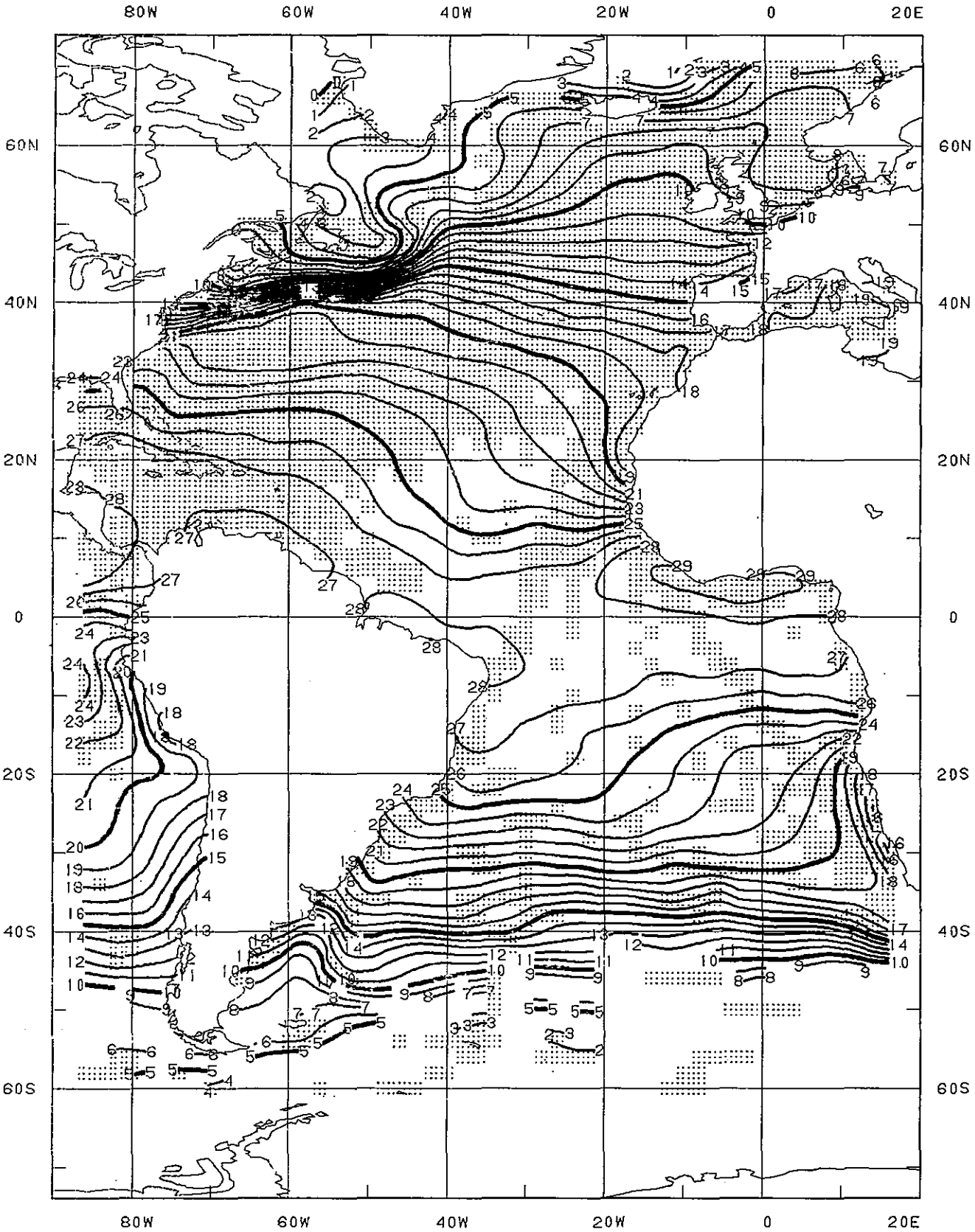
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
MAY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



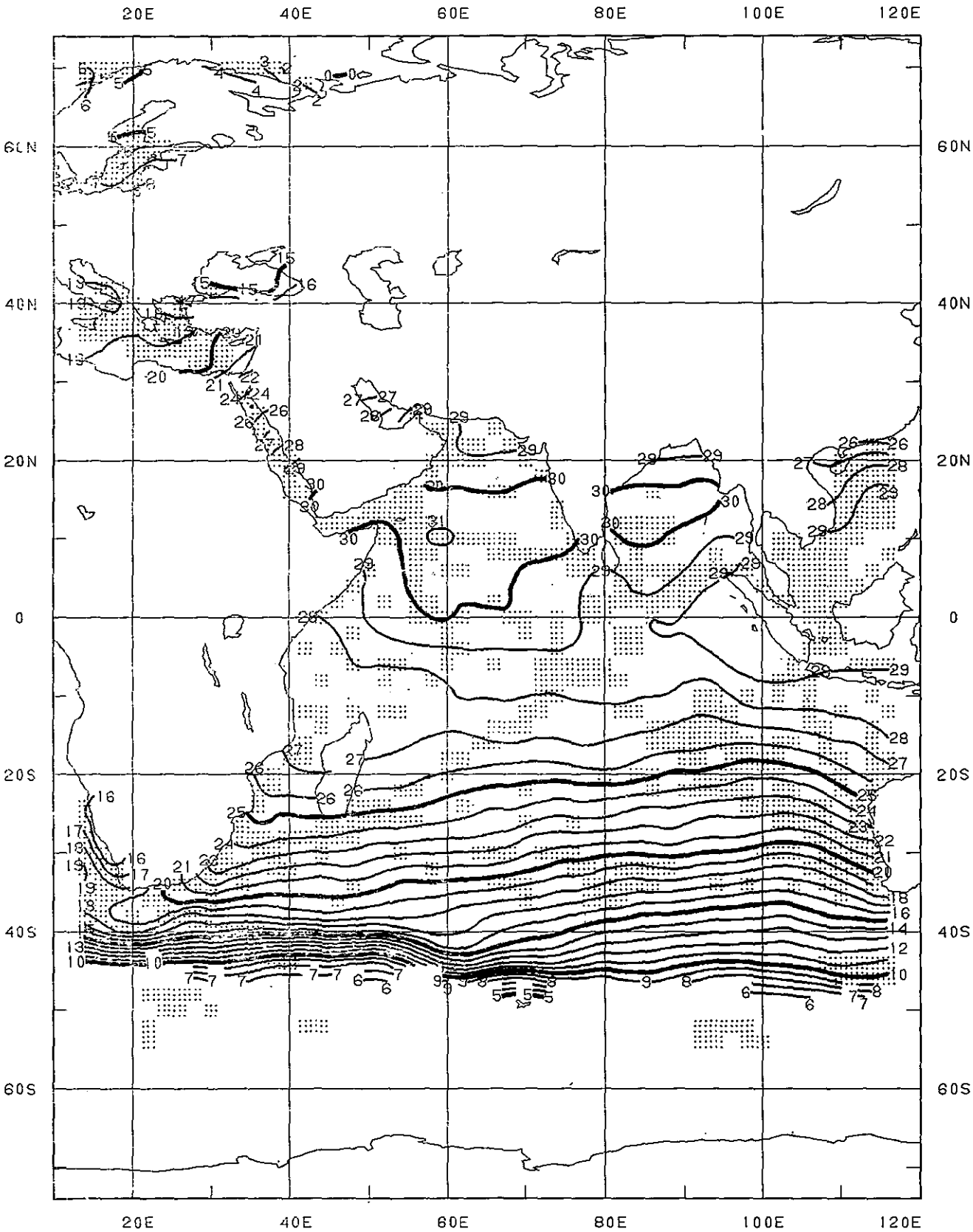
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
MAY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



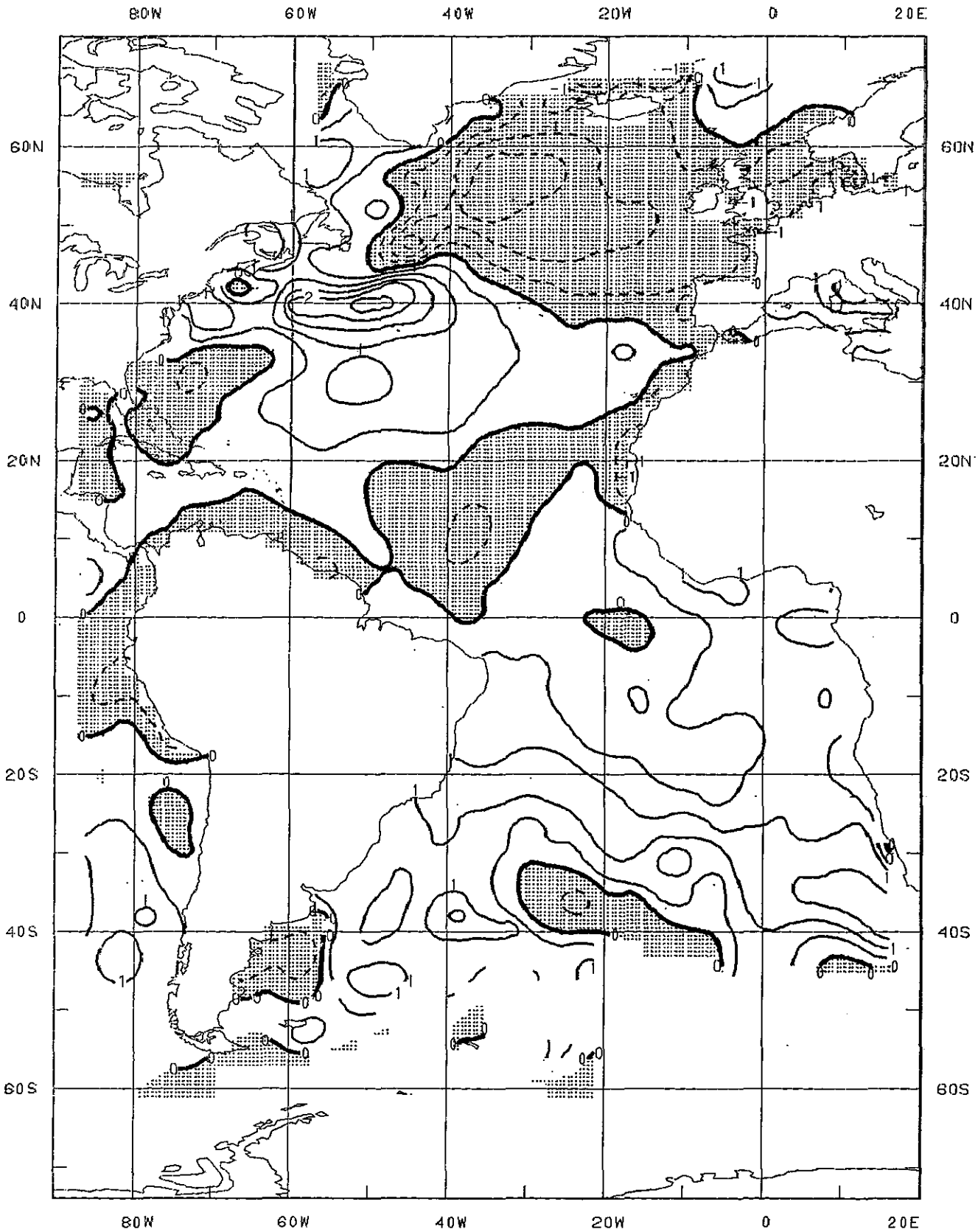
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE
DATA
MAY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



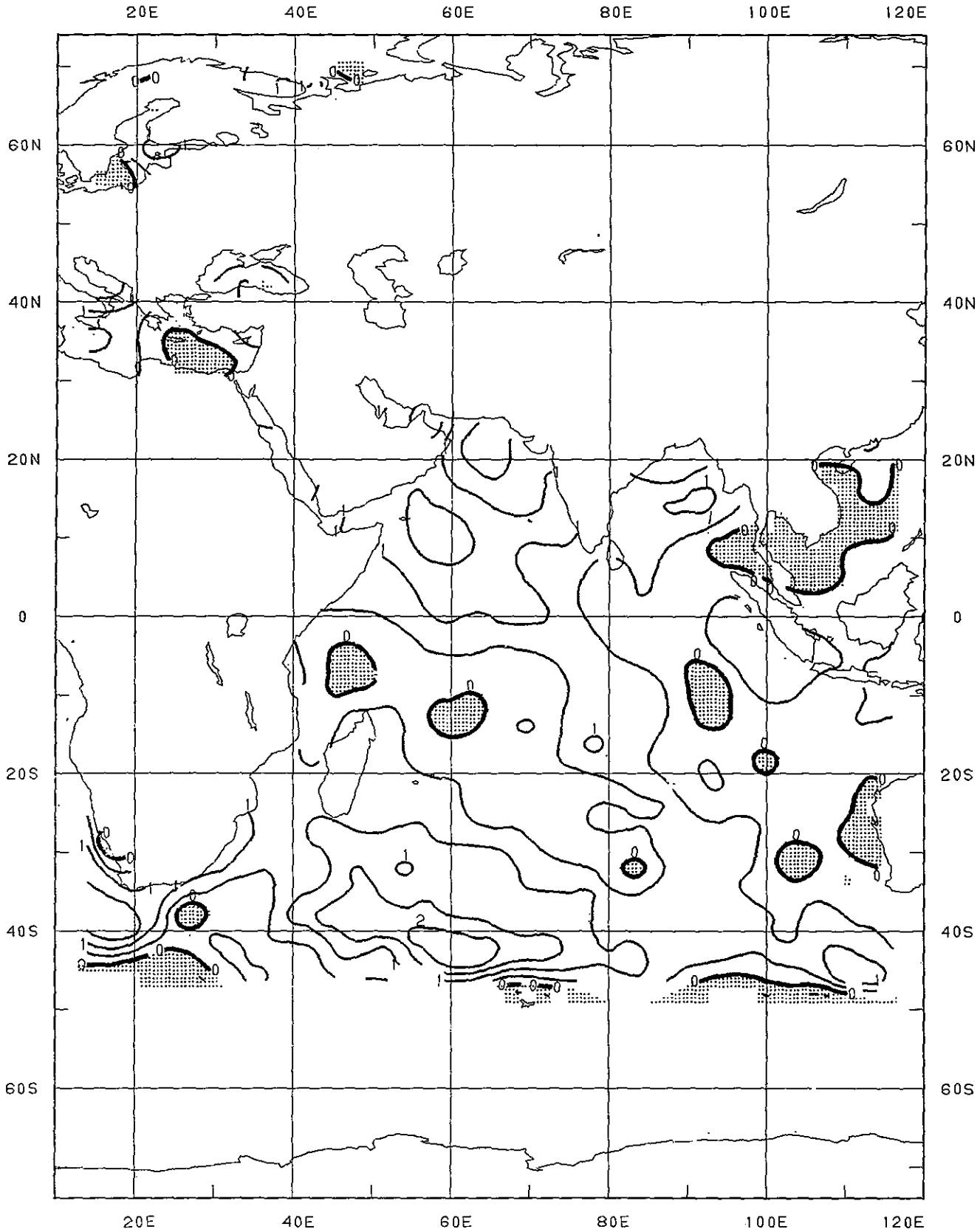
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
MAY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (C°)
SHIP, BUOY, AND SATELLITE DATA
MAY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
MAY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

THE EFFECT OF HURRICANE GLORIA ON SEA SURFACE TEMPERATURE PATTERNS

CDR Craig S. Nelson[1], William G. Pichel[2], Robert A. Warner[2], Barbara A. Banks[2]
National Meteorological Center, NWS[1]
National Environmental Satellite, Data, and Information Service[2]
NOAA, Washington, D. C.

Operational SST analyses, which use satellite data, are now of sufficient accuracy and resolution that they can be used to monitor the detailed effects of a hurricane passage on SST patterns. In the wake of hurricane Gloria, one of the largest storms of the twentieth century, it is probable that significant upwelling and mixing cooled the surface waters by as much as 4°C. The maximum cooling occurred 50-100 km to the east of the storm track, associated with the maximum surface winds in the northeast quadrant of the storm. These SST effects are readily observable in 14 km analyses of satellite-derived multi-channel SST (MCSST) observations.

On September 27, 1985, the center of hurricane Gloria passed over Hatteras Island, North Carolina, then moved just offshore, skirting the coasts of Virginia, Maryland, Delaware, and New Jersey (Fig. 1). Thus the strongest winds (43-46 m/s), associated with the northeast quadrant of the hurricane, remained over open water. Wind speeds observed at land stations and at coastal meteorological buoys were not as high. For example, at Cape Point, North Carolina, maximum sustained winds were approximately 33 m/s and reported hourly observations from the NDBC buoys 41001, 44009, and CHLV2 did not exceed 35 m/s. However the automated station at Diamond Shoals Light reported sustained winds greater than 40 m/s. Lower SST were recorded at each of the coastal buoys after Gloria moved through the area. Although the absolute change in SST at each buoy was not large, rapid decreases in SST (0.5-1.0°C in 6 hours) were observed at three of the four buoys after Gloria passed (Fig. 2).

Patterns of SST in the Middle Atlantic Bight prior to Gloria's passage are shown Figure 3. The warm surface manifestation of the Gulf Stream can be seen east of Cape Hatteras as 27°C water located at approximately 36°N 74°W. Surface thermal gradients north of the Gulf Stream are not notably strong; however, the SST's decrease steadily to the north, reaching a minimum of 20°C just to the south of Long Island. The hurricane's passage significantly altered the SST patterns, which can be seen by comparing the SST patterns after Gloria's Passage (Fig. 4) with those before (Fig. 3). An elongated pool of relatively cool, 18°C water appears east of Gloria's central track, in the region of maximum winds associated with the northeast quadrant of the storm. In a strip parallel to and 50-100 km east of Gloria's central track, the surface temperature decreased by as much as 4°C. A comparison of the analyzed SST field (Fig. 4) with the observed coastal buoy temperatures (Fig. 2) shows reasonable agreement (i.e., differences of approximately 0.5°C) which suggests that the cold tongue and strong thermal gradients are real features induced by the passage of hurricane Gloria and not artifices of the MCSST retrieval algorithms or the analysis procedures. Further supporting evidence may be found in the few available expendable bathythermograph (XBT) profiles taken in this region before and after Gloria. These data (not shown) not only show a 3°C decrease in SST, but also suggest that the entire water column from the surface to about 40 m cooled by as much as 2°C. The SST pattern which became evident after Gloria's passage is not substantially different from that seen during Octobers of previous years. However in previous years, the SST decrease was spread out over a much longer period.

Studies of other hurricanes show similar SST effects Leipper (1967) found a 1-5°C decrease in SST in the Gulf of Mexico due to upwelling and mixing after hurricane Hilda in 1964. Bates and Smith (1985) found a 1-3°C decrease in SST to the right of the storm track in the Gulf of Mexico with the passage of hurricane Alicia in

1983. Our results are further corroborated by Stramma and Cornillon (1986, in press) who studied 13 hurricanes in the western North Atlantic between 1981 and 1984, and found maximum cooling (up to 3.5°C) well to the right of the storm track (approximately 70 km).

REFERENCES

Bates, J.J., and W.L. Smith, 1985: Sea Surface Temperature; Observations from Geostationary Satellites. J. Geophys. Res., 90, 11609-11618.

Lawrence, M. B., 1985: Preliminary Report: Hurricane Gloria, 16-27 September 1985. Internal report, National Hurricane Center, NWS, NOAA Coral Gables, Florida, 12pp.

Leipper, D.F., 1967: Observed Ocean Conditions and Hurricane Hilda, 1964. J. Atmos. Sci., 24, 182-196.

Stramma, L., and P. Cornillon, 1986: Satellite Observations of Sea Surface Cooling by Hurricanes. J. Geophys. Res., in press.

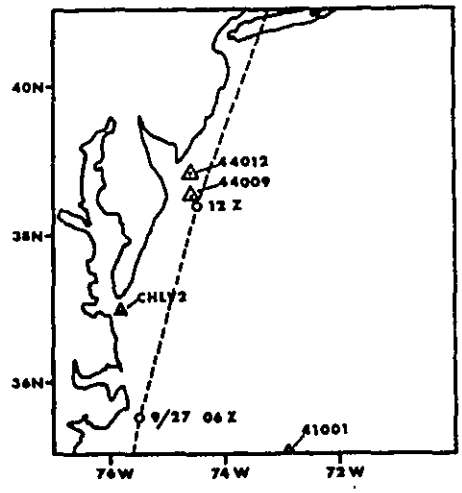


Figure 1. Track of hurricane Gloria.

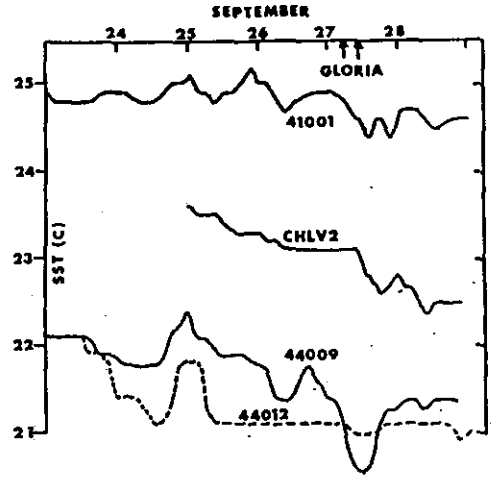


Figure 2. SST time series at in situ stations.

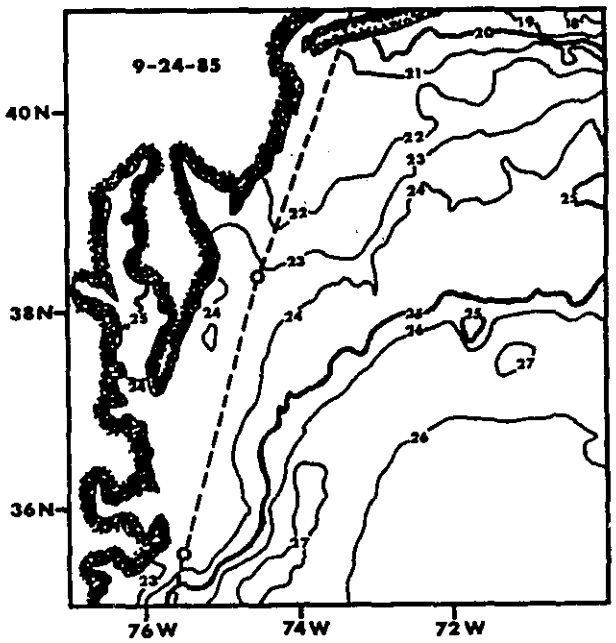


Figure 3. SST analysis for September 24, 1985.

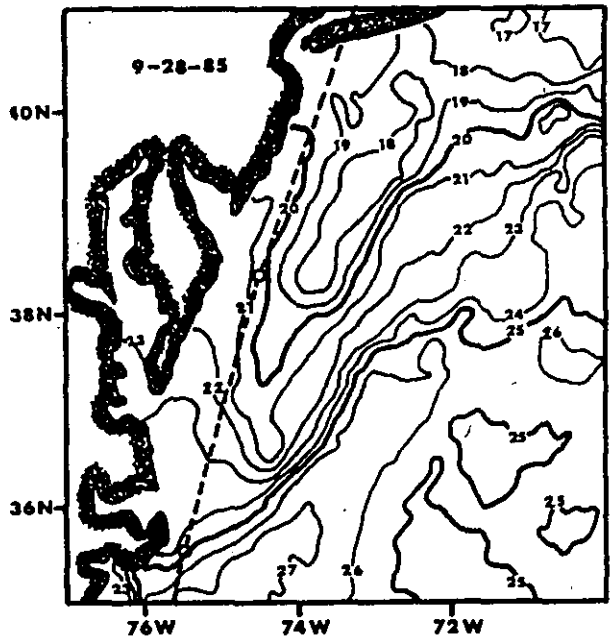
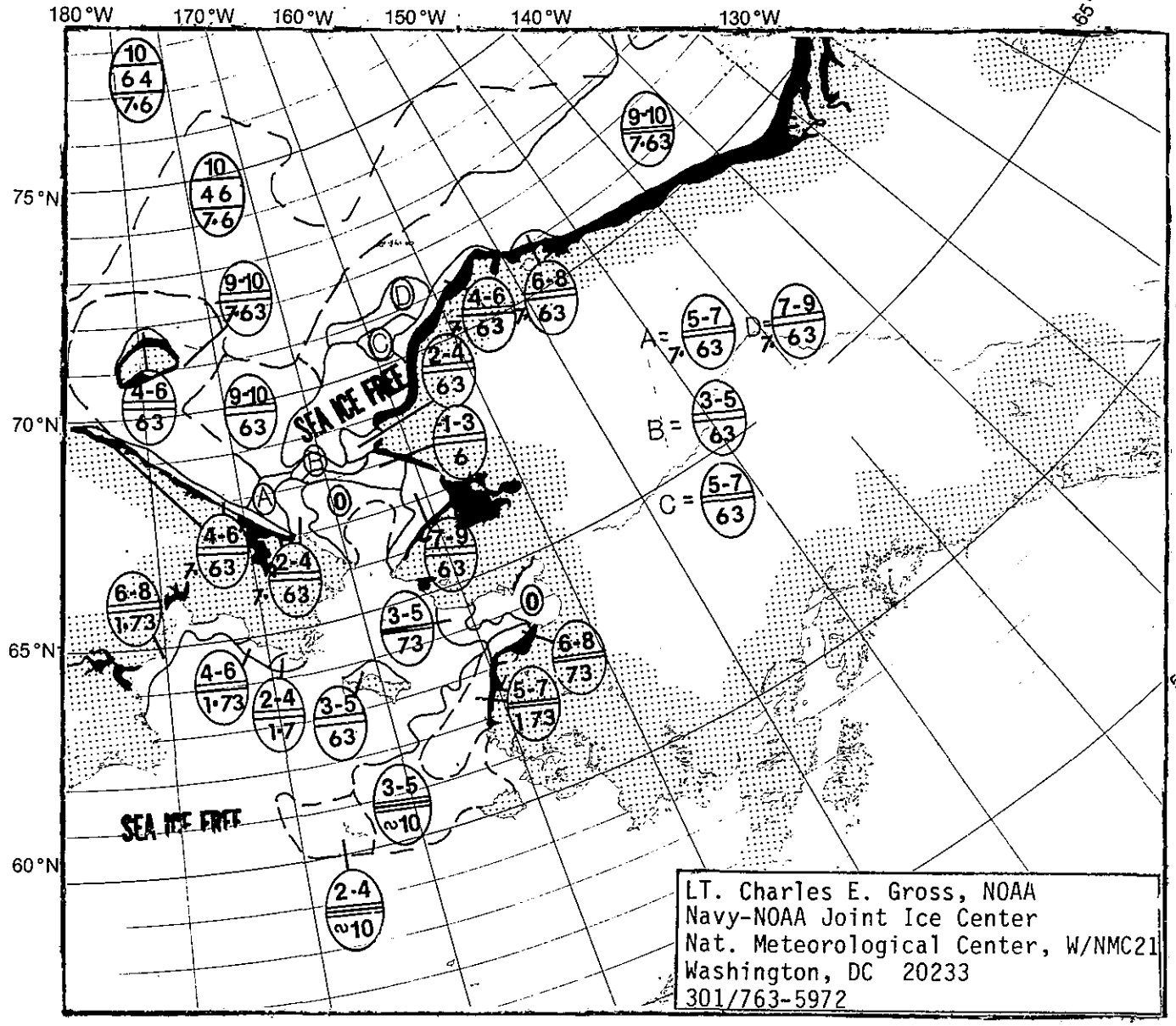


Figure 4. SST analysis for September 28, 1985.

BERING SEA / NORTH SLOPE ICE ANALYSIS



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

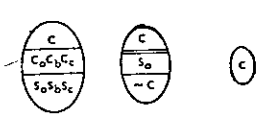
S_a, S_b, S_c = Stage of development of thickest (S_a), 2nd thickest (S_b), and 3rd thickest (S_c) ice.

-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).

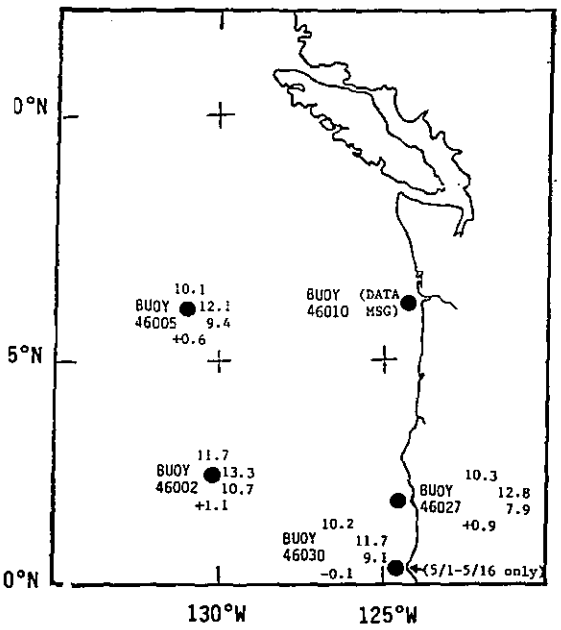
Fast ice. Sea ice which forms and remains fast along the coast.

Ice boundary visually or satellite observed.

Ice boundary estimated.

MAY 1986

The monthly mean sea level pressure circulation depicts a 1008 mb low centered in the Gulf of Alaska near 56°N 145°W providing weak easterly and northeasterly surface geostrophic winds in the Chukchi and Bering Seas. Monthly mean surface air temperatures are normal at Barrow (71°N 157°W) and slightly below normal at Nome (65°N 165°W). Extensive melting of sea ice is observed in the Bering and Chukchi Seas. Sea ice recession ranges from 60-370 km in the Bering Sea. An extensive sea ice free area extends from the southwestern coast of the Seward Peninsula to south of St. Lawrence Island and isolates a large amount of sea ice to the south. Sea ice free areas are observed along the northwestern Alaskan coast near Pt. Hope. The current ice edge position is near the minimum in the Gulf of Anadyr (Anadyrskiy Zaliv) and between the maximum and median in the central Bering Sea.



MAY 1986

The onset of seasonal warming, the return to near normal SSTs over the majority of the area, and the clear indication of periodic upwelling events are the three important developments in the North Panel area this month. The widespread warm anomaly, which was a dominant feature for several months, has given way to SSTs only slightly above or below normal. In offshore waters, SSTs began a slow, steady increase ending the month 2.0-2.5°C higher than at the beginning. Coastal SSTs also warmed slightly overall, although this warming was punctuated by two significant coastal upwelling episodes on May 14-16 and May 26-30. Coastal SSTs as low as 8-9°C between Cape Blanco and Cape Mendocino were observed during the May 14-16 event. During both events, satellite imagery detected weak thermal boundaries between cool upwelled water nearshore and warmer water offshore. There is as yet no indication of any start to upwelling north of the mid-Oregon coast.

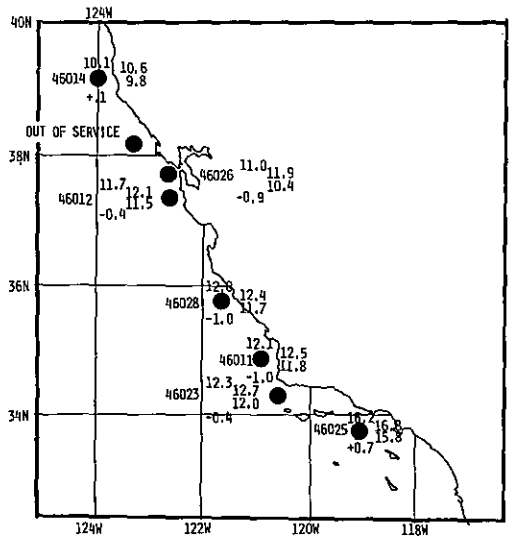
KEY:

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

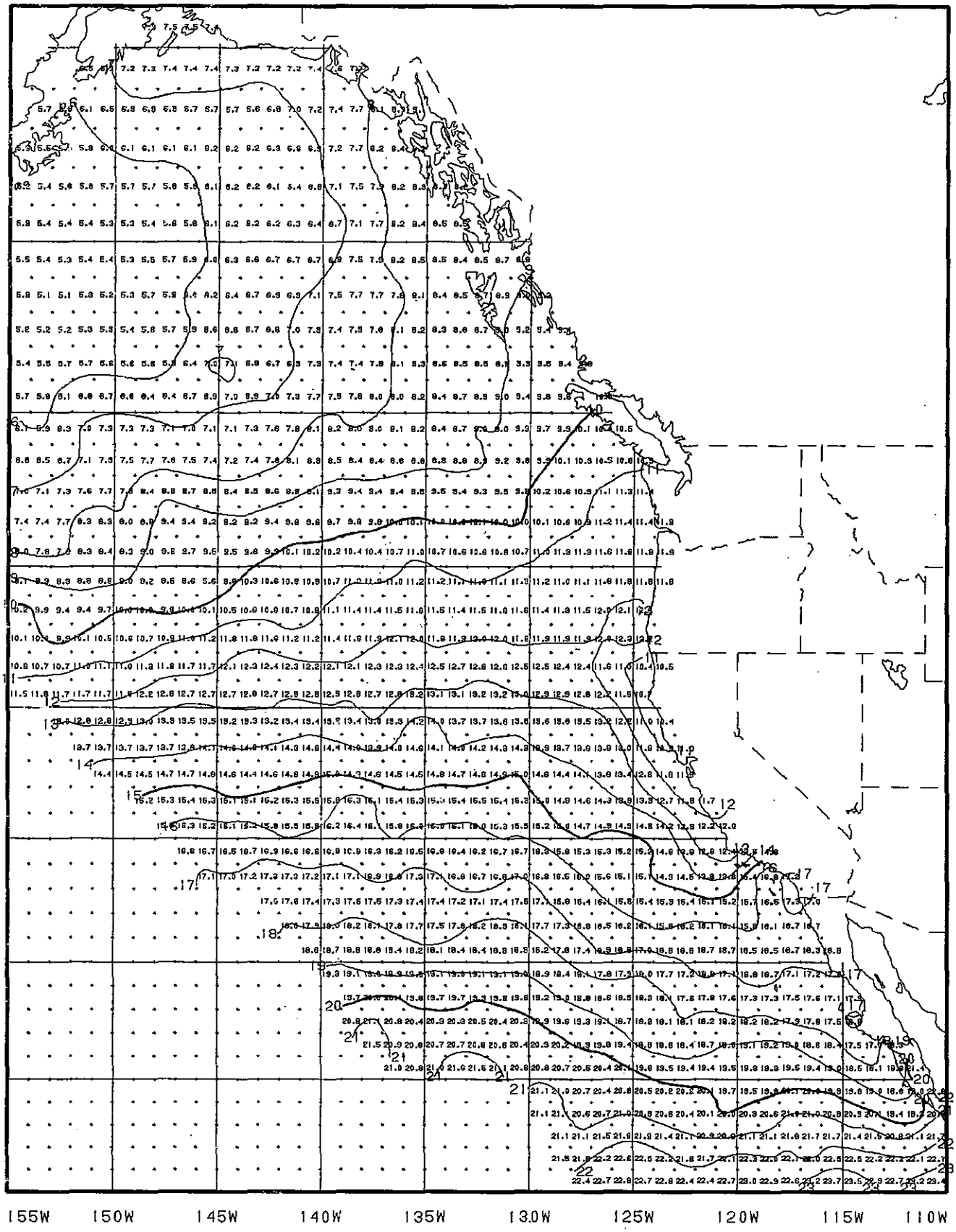
● Denotes station position.

North Panel
Kent Short
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, Wa 98115
(206) 526-6604
FTS 392-6604

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

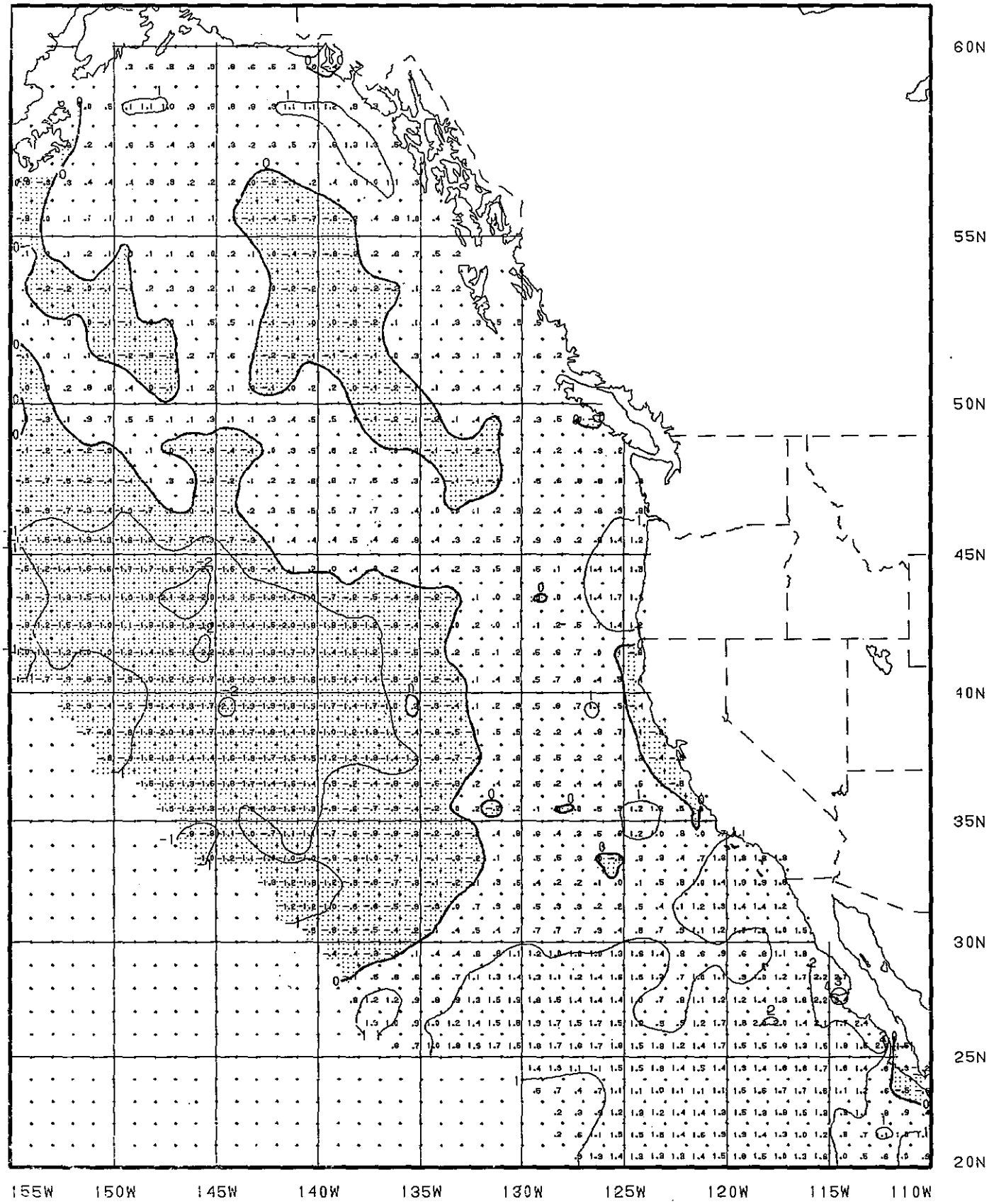


The South Panel's May mean sea surface temperature (15.7°C) shows an overall warm anomaly (0.5°C) when compared to the climatological mean value (15.2°C). This positive anomaly has continued in the South Panel area since the first of the year. Offshore waters east of 130°W and south of 35°N showed positive anomalies of 0.5°-1.5°C. The only offshore cool anomaly exists (-0.5°C) in the northwestern corner of the South Panel. When compared to the previous month, slight SST warming (0.1°-0.5°C) occurred in most locations except those adjacent to the coast. This nearshore cooling can be attributed to a nearly continuous upwelling event that occurred May 8-23. This upwelling episode was in response to a fairly strong north-northwesterly air flow as confirmed by meteorological station observations and high resolution infrared satellite data.



West Coast
SST--MONTHLY MEAN (°C)
May 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
May 1986

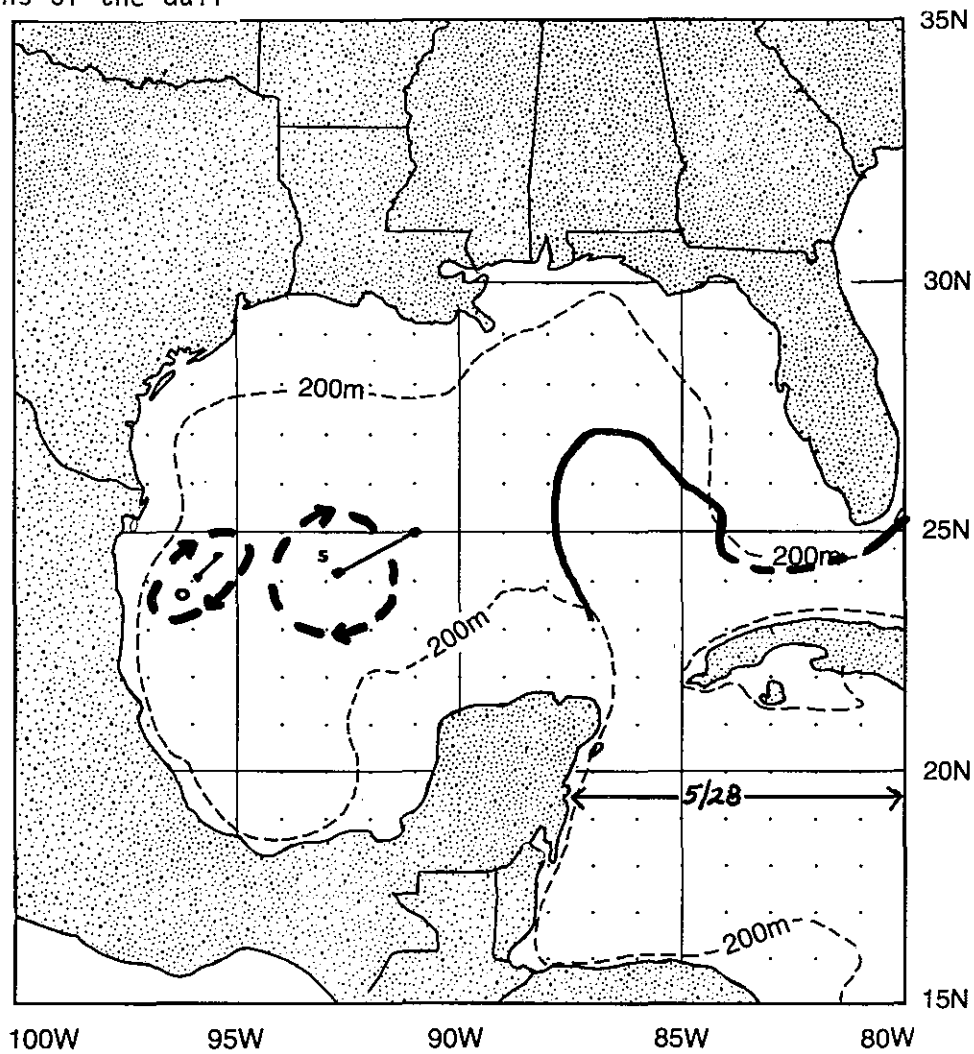
Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf

EAST COAST OCEAN FEATURES

Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

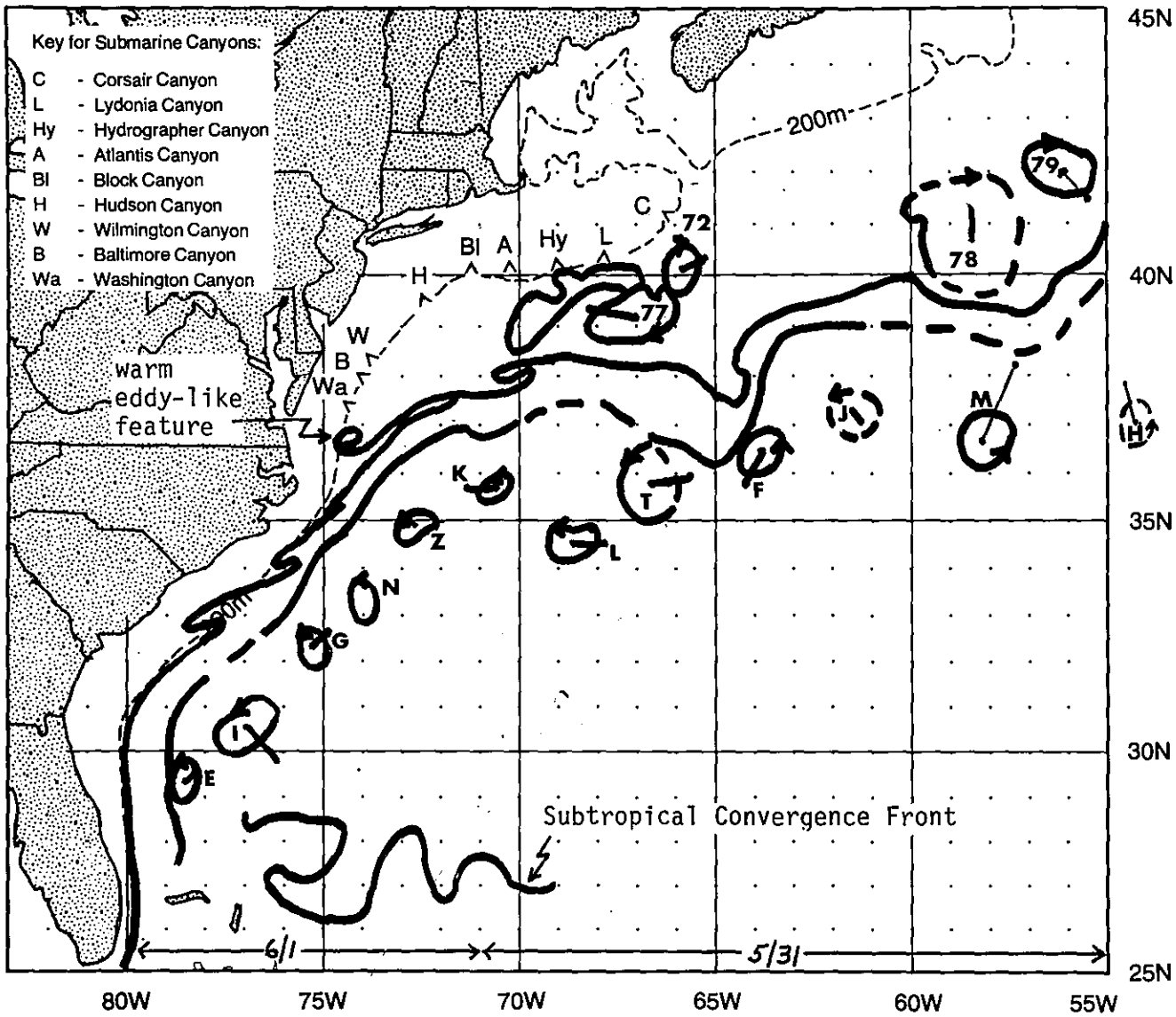
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

MAY 1986

The end-of-May amplitude of the Loop Current increased by 85 km compared to the end-of-April position. Due to near isothermal conditions in the Gulf of Mexico anticyclonic eddies p, s, and o were not observed on satellite infrared imagery during May. However the position of eddy s was periodically estimated from drifting buoy data and eddy s apparently translated 195 km SW. Also the position of eddy o was estimated from XBT data taken on May 6 by Texas A & M University and the Mexican Navy. Eddy o apparently translated 55 km SW.

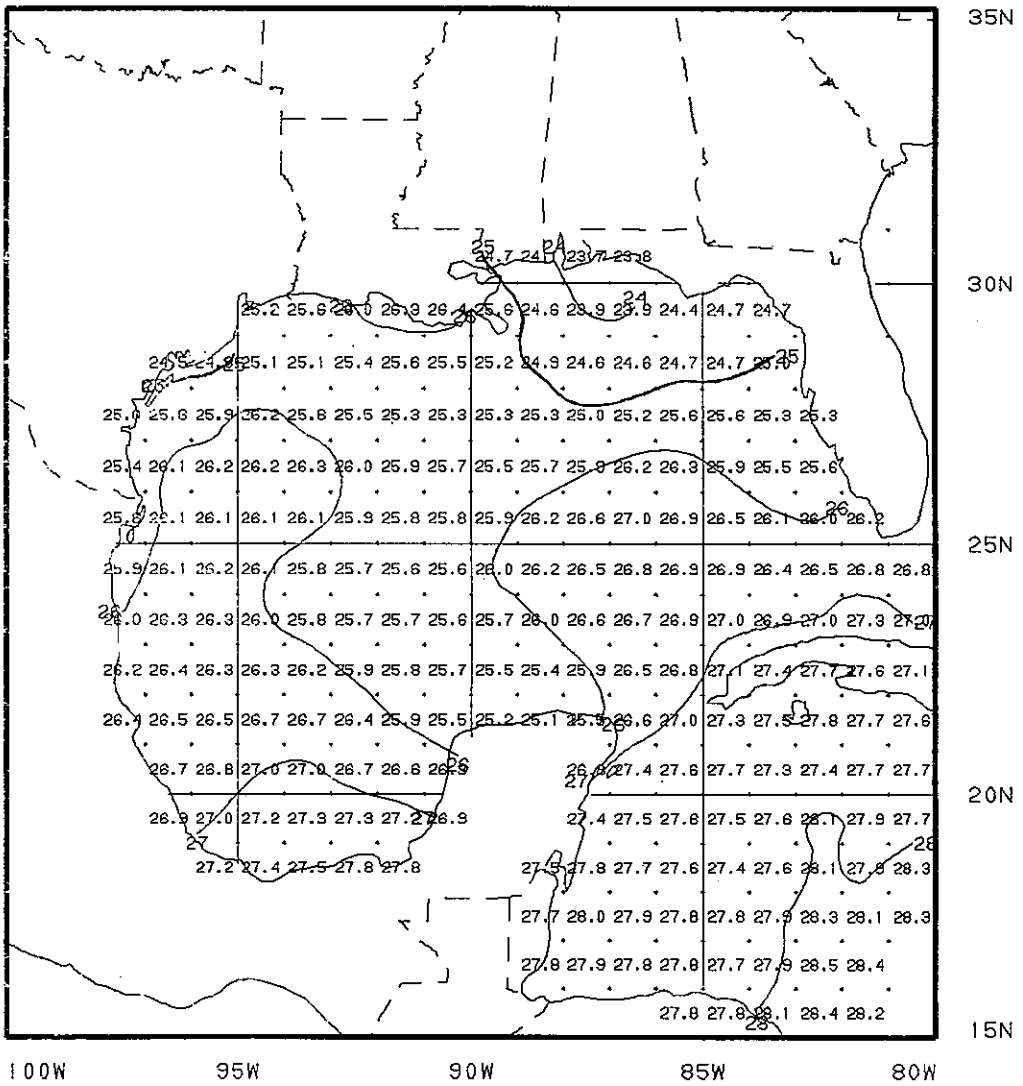


Anticyclonic eddy 77 traveled 110 km E. There is an elongated warm area from 39°N 70°W to 40°N 67°W near eddy 77. This area may have some circulation associated with it. Eddy 72 moved 55 km SW and appears to be interacting with eddy 77. Eddy 78 translated 65 km S while eddy 79 translated 85 km NW. Remnants of the warm eddy-like feature are still discerned near 37°N 74°W.

New cyclonic eddy N was first detected near 33°30N 74°W on May 11. Its origin is unknown. Eddy E moved 25 km SW. Eddy I traveled 120 km NW. Eddy G translated 55 km SW. Eddies Z and K translated 45 km SE and 75 km E, respectively. Eddy L moved 75 km W. Eddy T traveled 90 km W. Eddy F translated 85 km NE. Eddy J, last observed on May 18, traveled 25 km NW. Eddy M moved 175 km SW. Eddy H, last discerned on May 19, translated 85 km SSE.

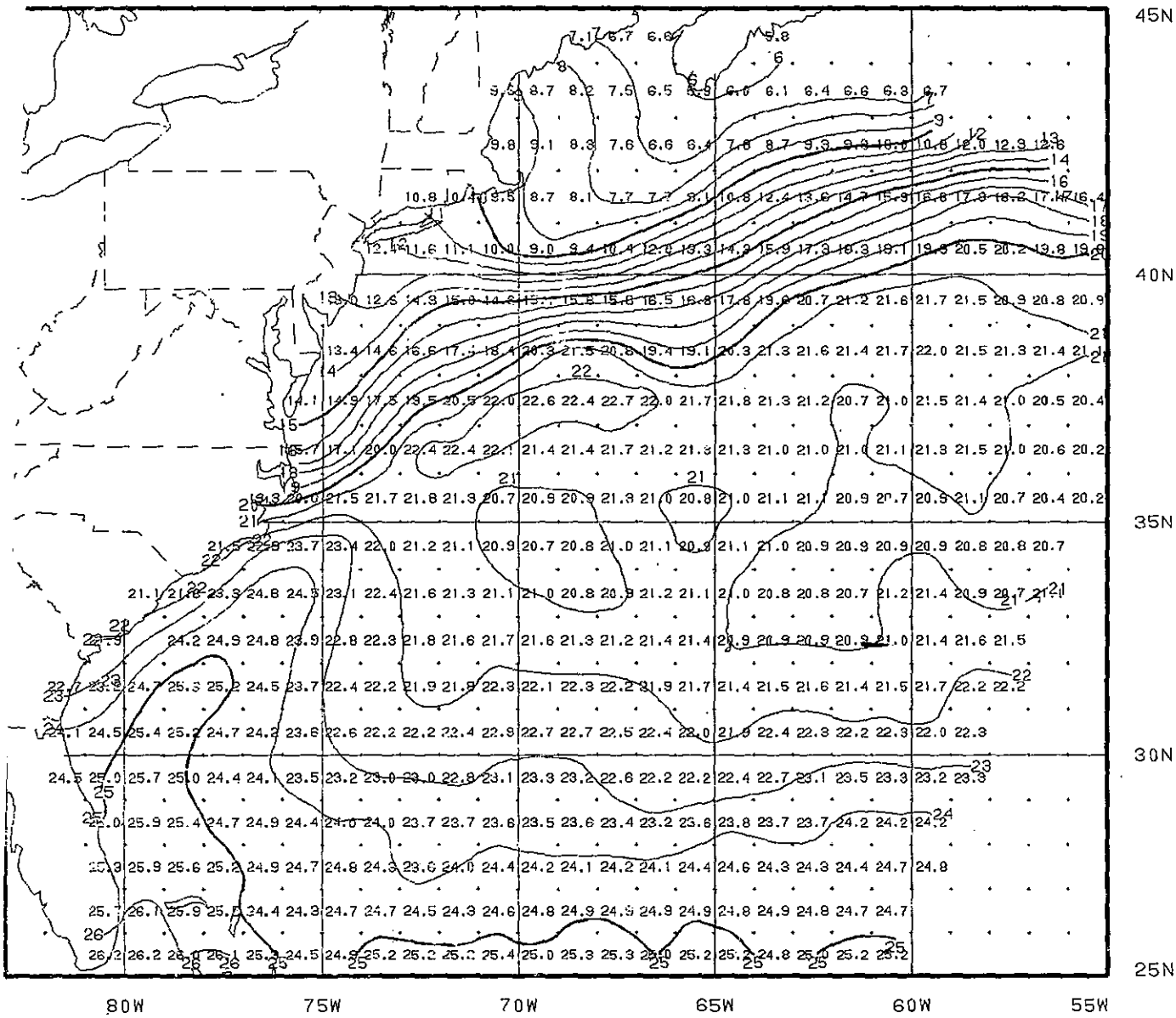
The Subtropical Convergence Front was detected on May 29 between 28°N 77°W and 27°N 70°W.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
May 1986

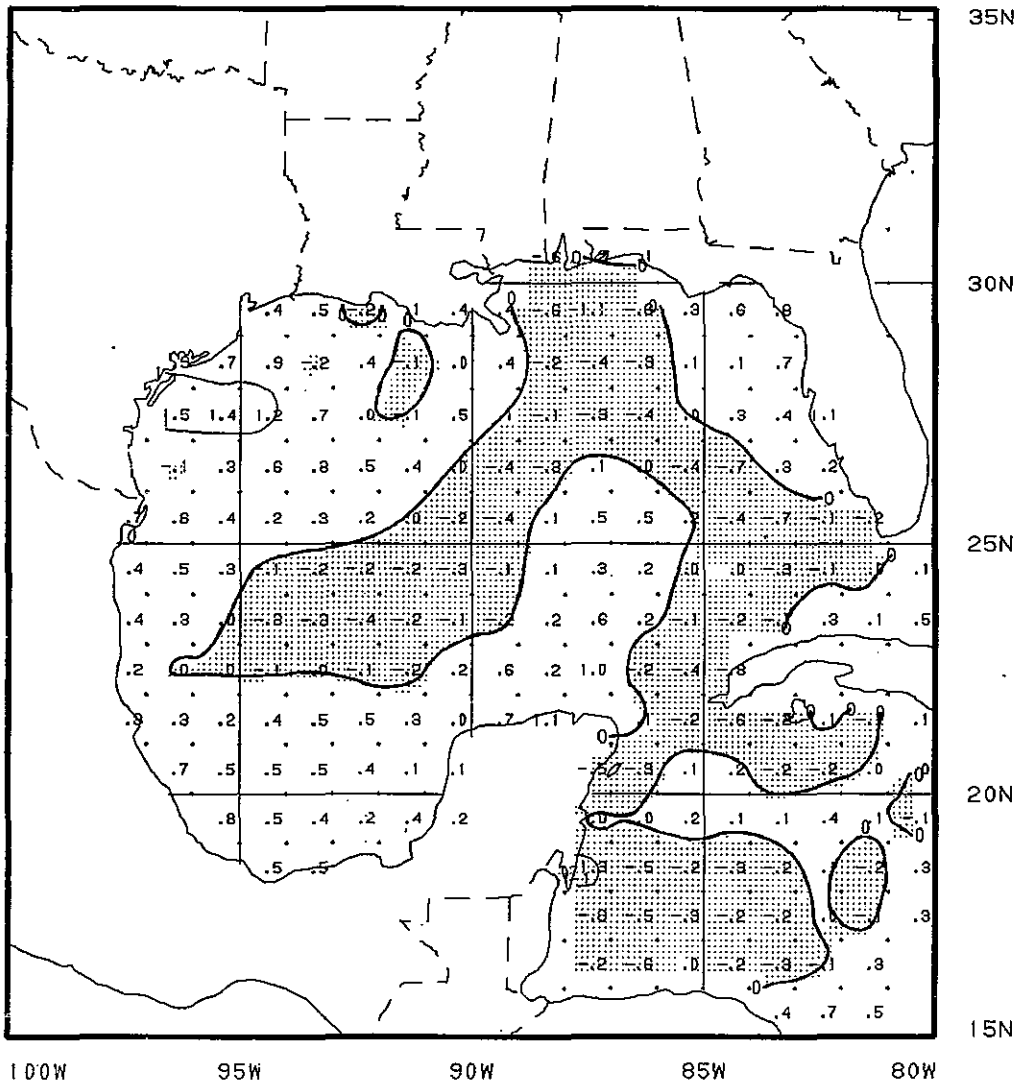
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
May 1986

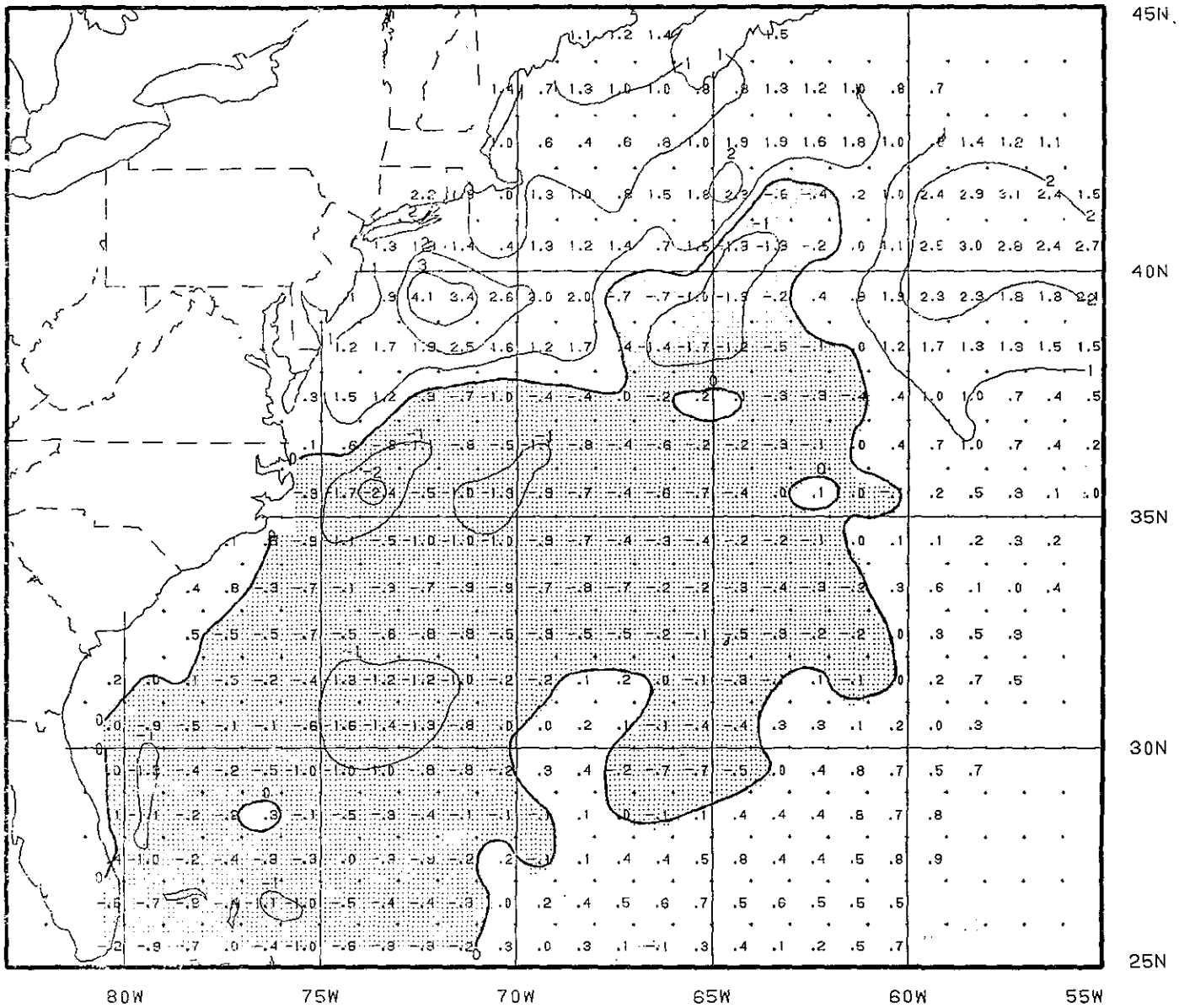
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
May 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
May 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE WA 98115-0070

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

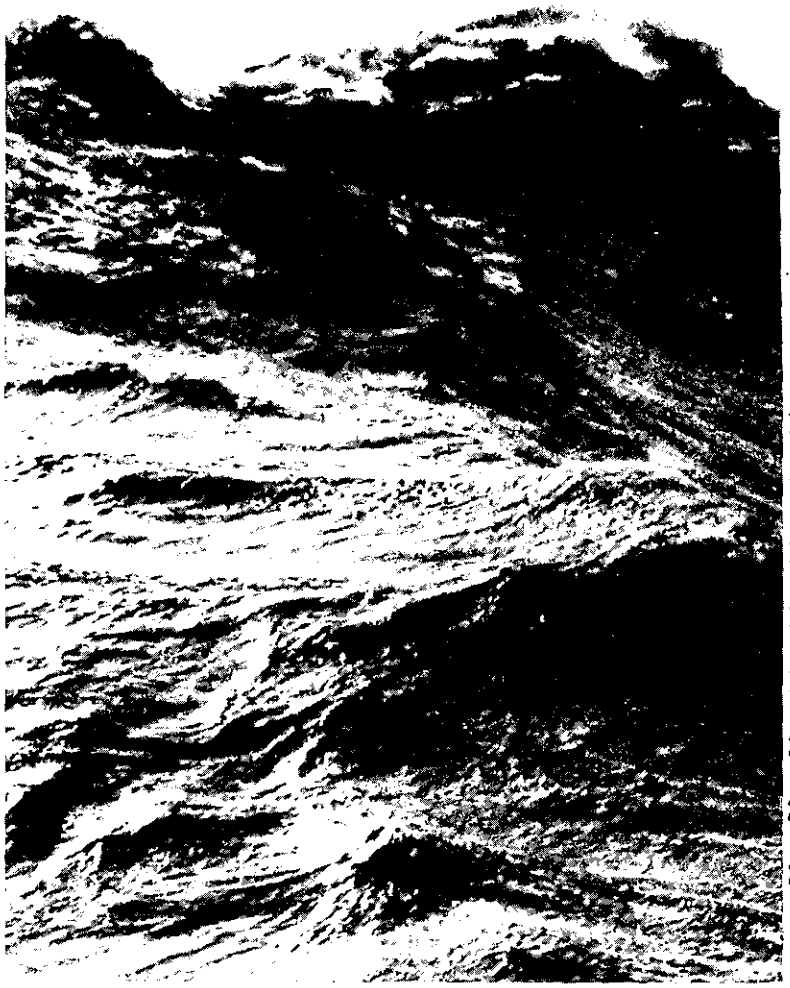
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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 September 30, 1986.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 6 June 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31*.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2*.
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; *NavOceano Ref. Pub. 18*.

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

Typing: Damita Johnson

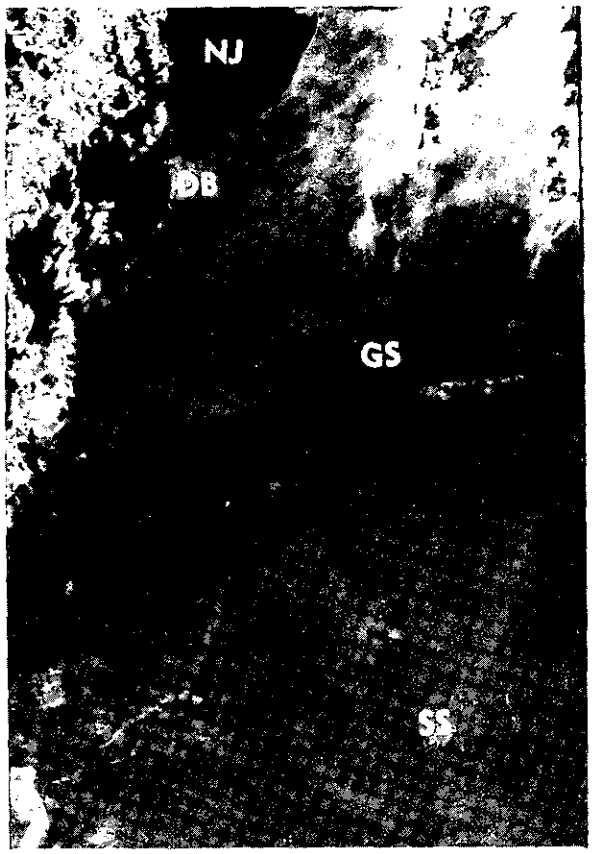
SATELLITE IMAGE OF THE MONTH

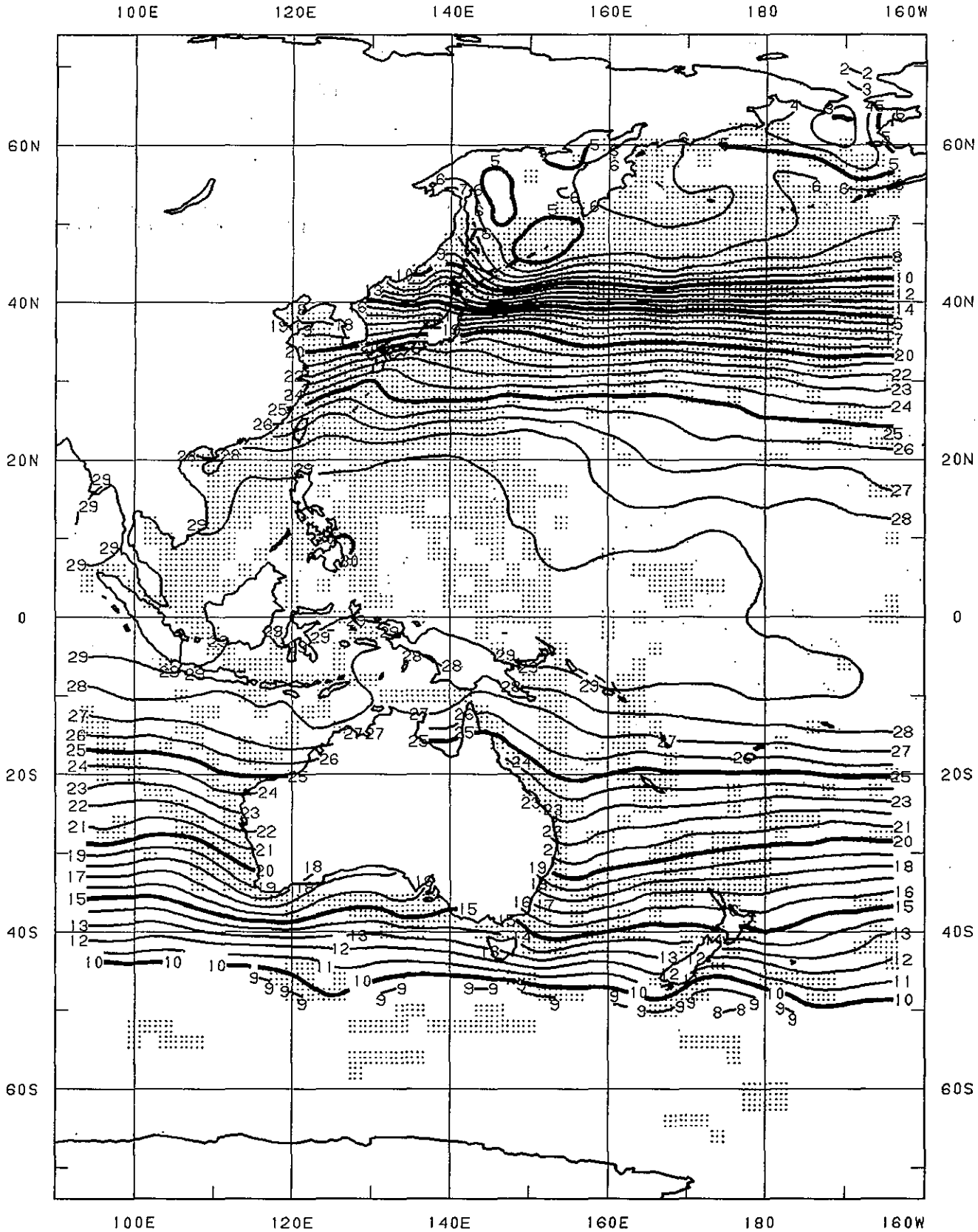
Kim Buttleman
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

SST AND OCEAN FEATURE DELINEATION USING MULTICHANNEL TECHNIQUES

The two infrared images below illustrate improvements to ocean features delineation and SST resolution which are possible through the use of multichannel techniques. Both images are from NOAA-9 on June 10, 1986, and show an area of the Gulf Stream (GS) and northwestern Sargasso Sea (SS) off the central East Coast of the United States. New Jersey (NJ) and the mouth of the Delaware Bay (DB) are found in the upper left portion of the images.

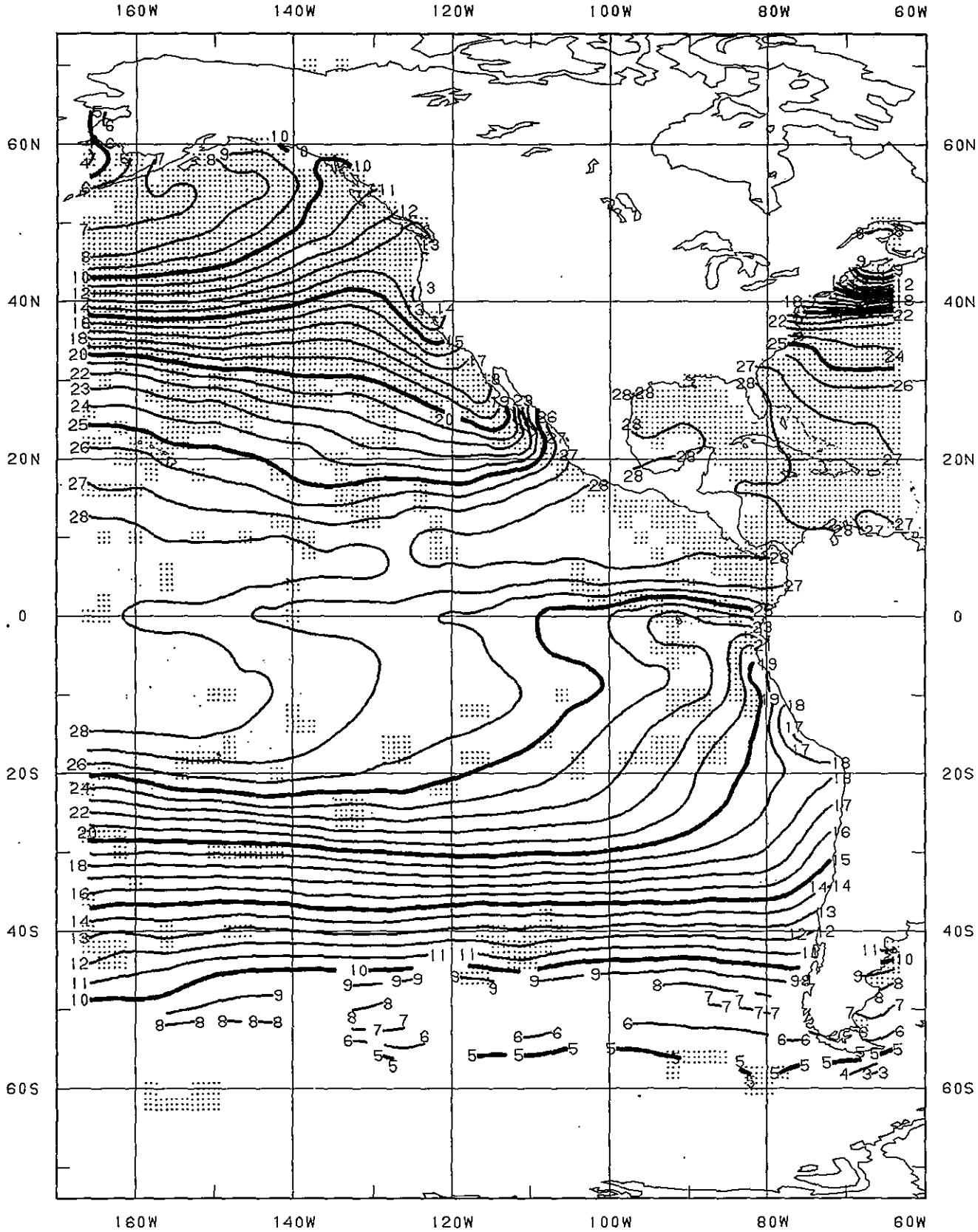
The image on the left was processed using a single infrared channel standard enhancement table for East Coast polar satellite passes. This general purpose enhancement table is used to delineate cloud structure for the meteorologist, land features for the environmentalist, and mid-latitude oceanographic features for the oceanographer. While some improvement to ocean feature and SST resolution is possible using other enhancement tables, many of the more subtle features remain obscured due to atmospheric absorption and scattering. Water vapor is the primary contributor to this atmospheric effect. The image at right was processed using a multichannel SST technique (MCSST). This technique uses an algorithm which has been previously derived from a regression relationship between in situ SSTs and satellite infrared black body temperatures. Since the algorithm is based on global sets of SST and radiosonde profiles, it effectively removes the attenuating and scattering effects of atmospheric moisture for most synoptic conditions. In areas of extreme thermal gradients, such as the North Wall of the Gulf Stream, the MCSST processing only slightly increases the boundary definition. However, in areas of weak temperature gradients and fine structure, such as the Sargasso Sea, the boundary definition is often greatly improved.





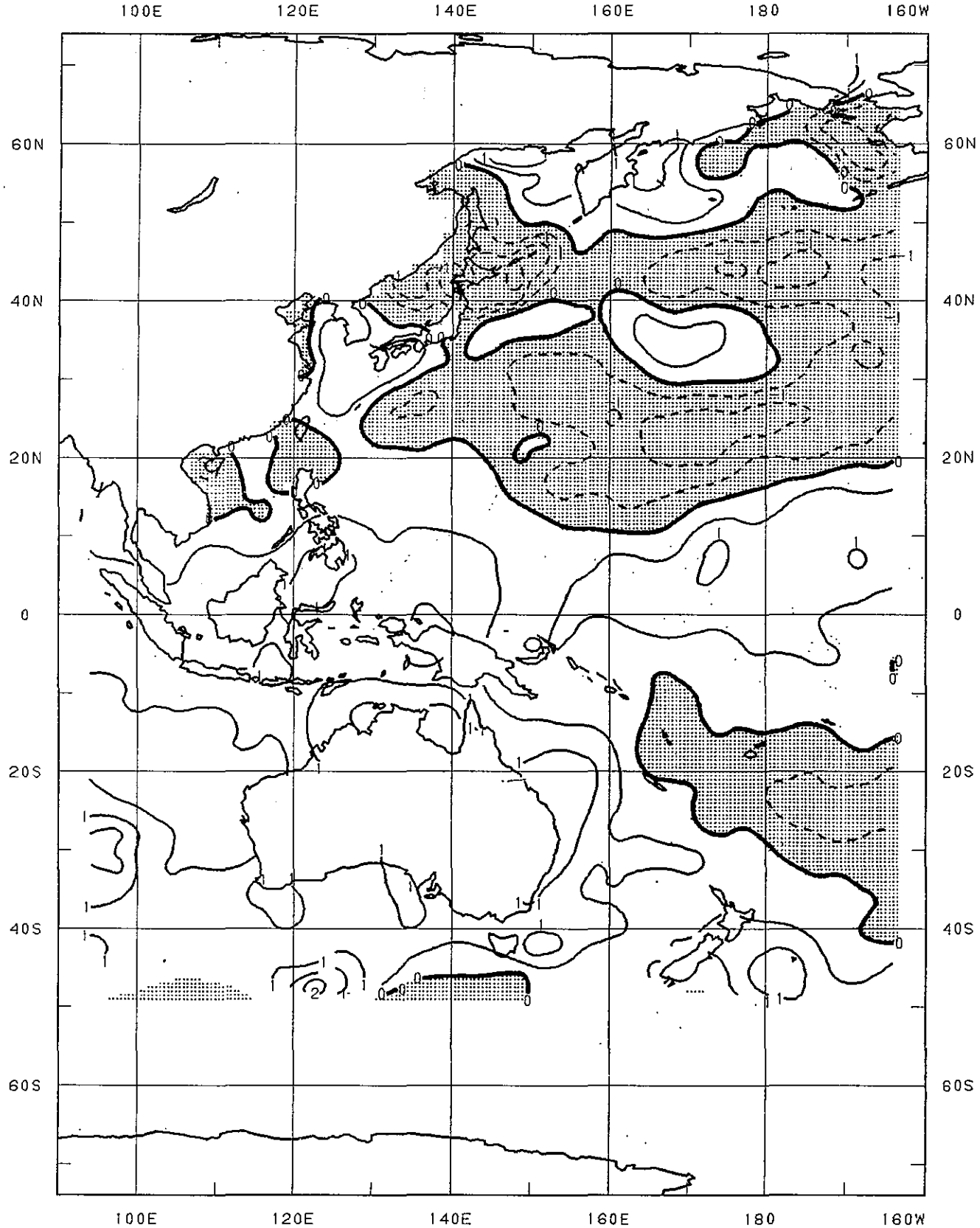
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



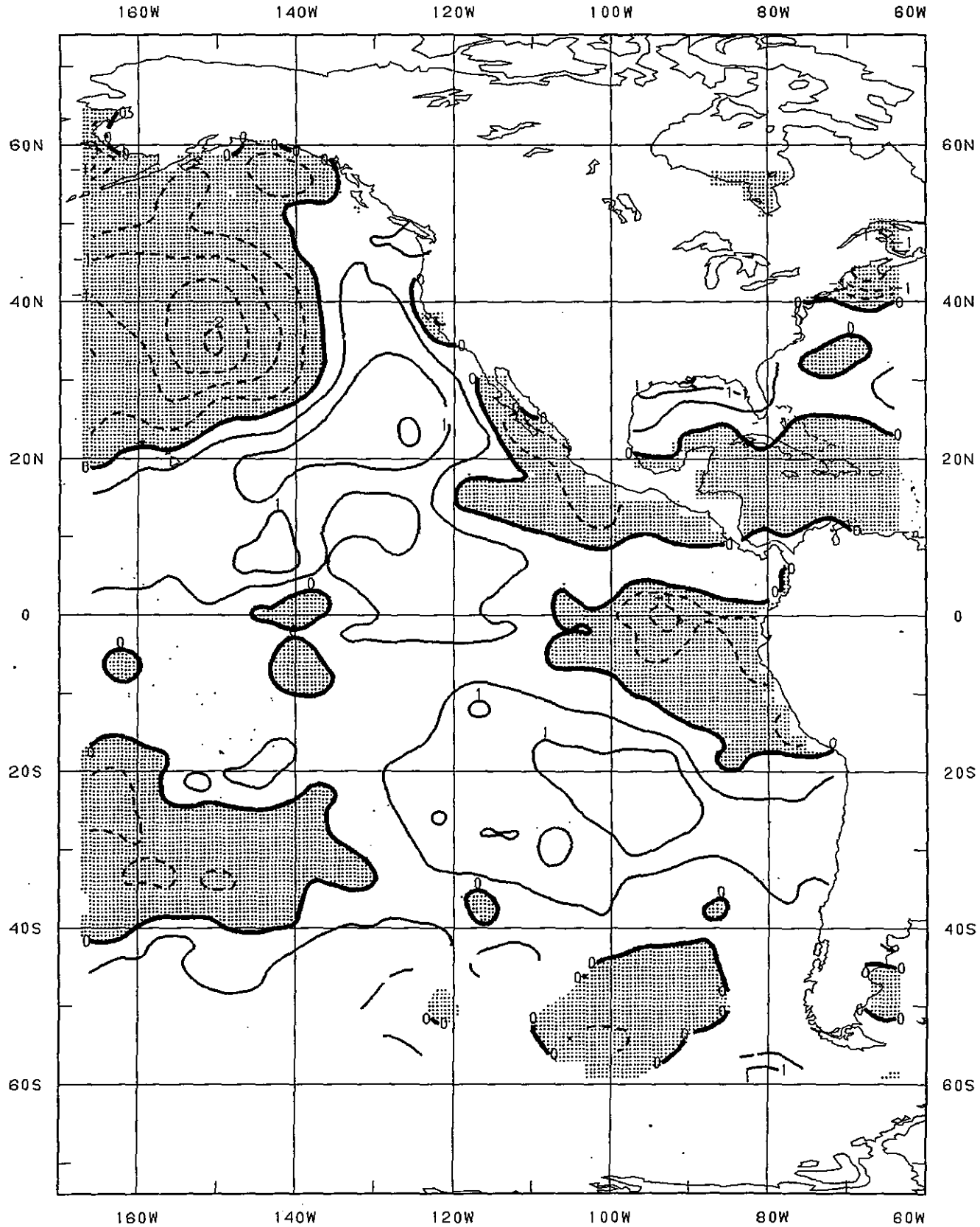
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



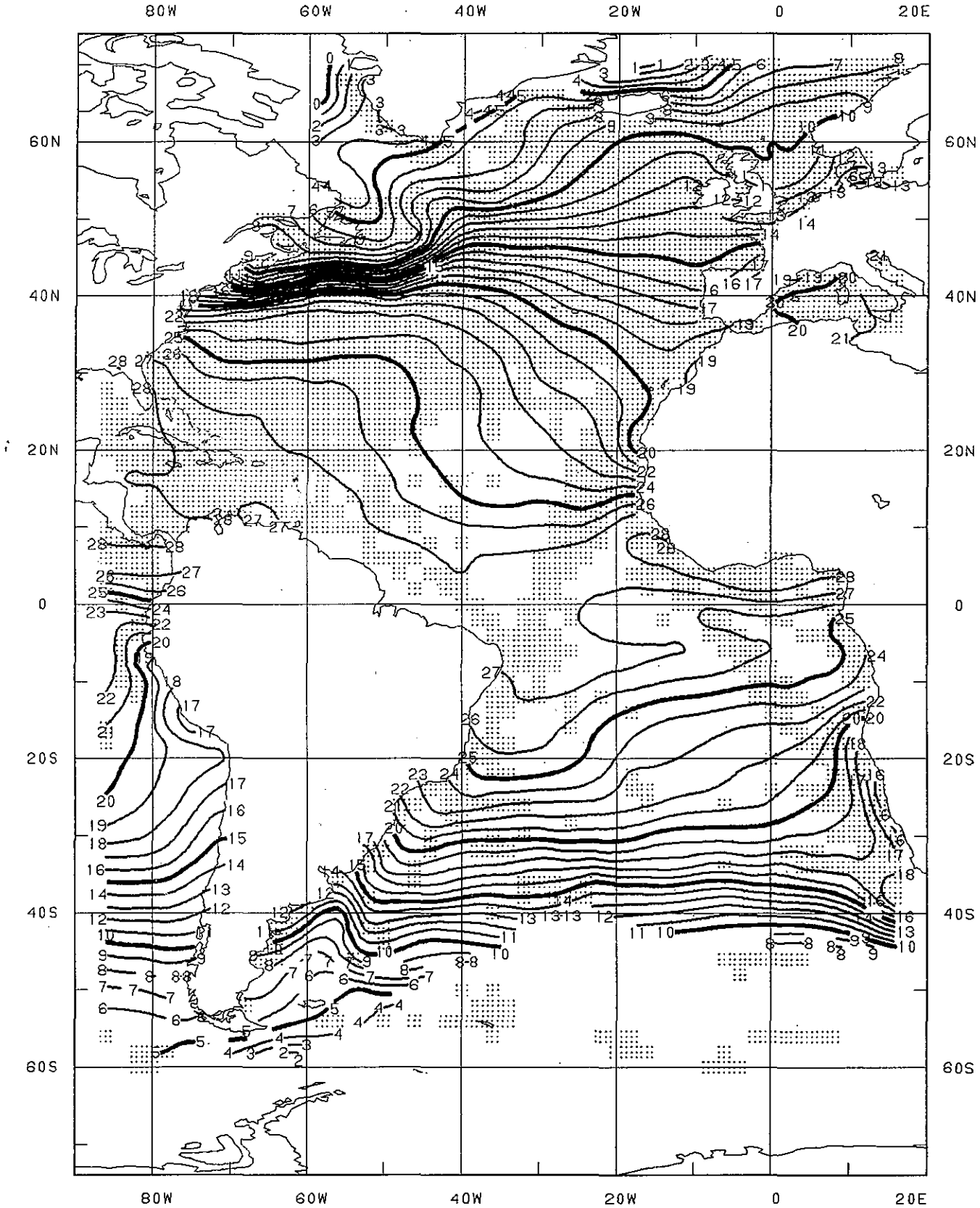
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



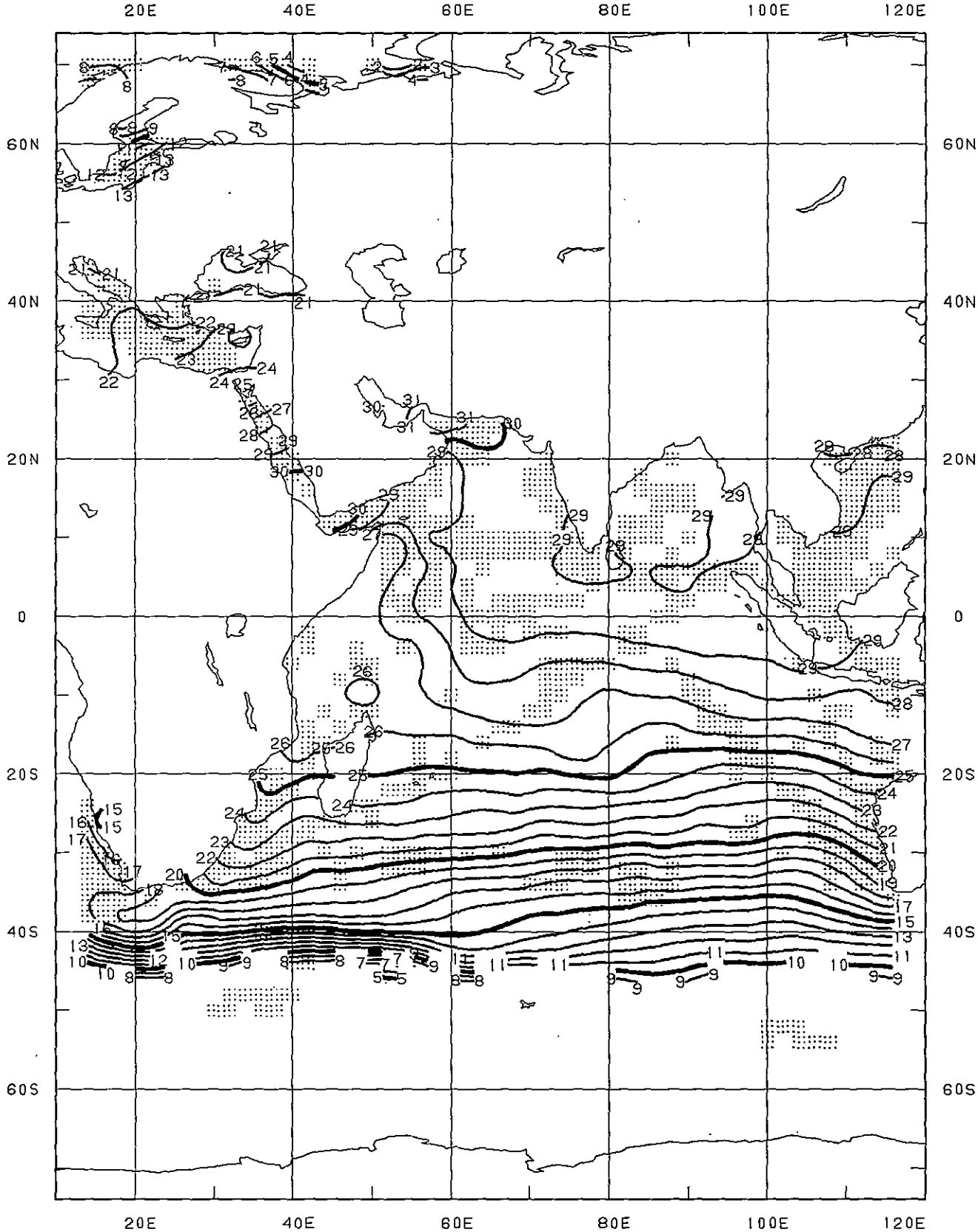
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



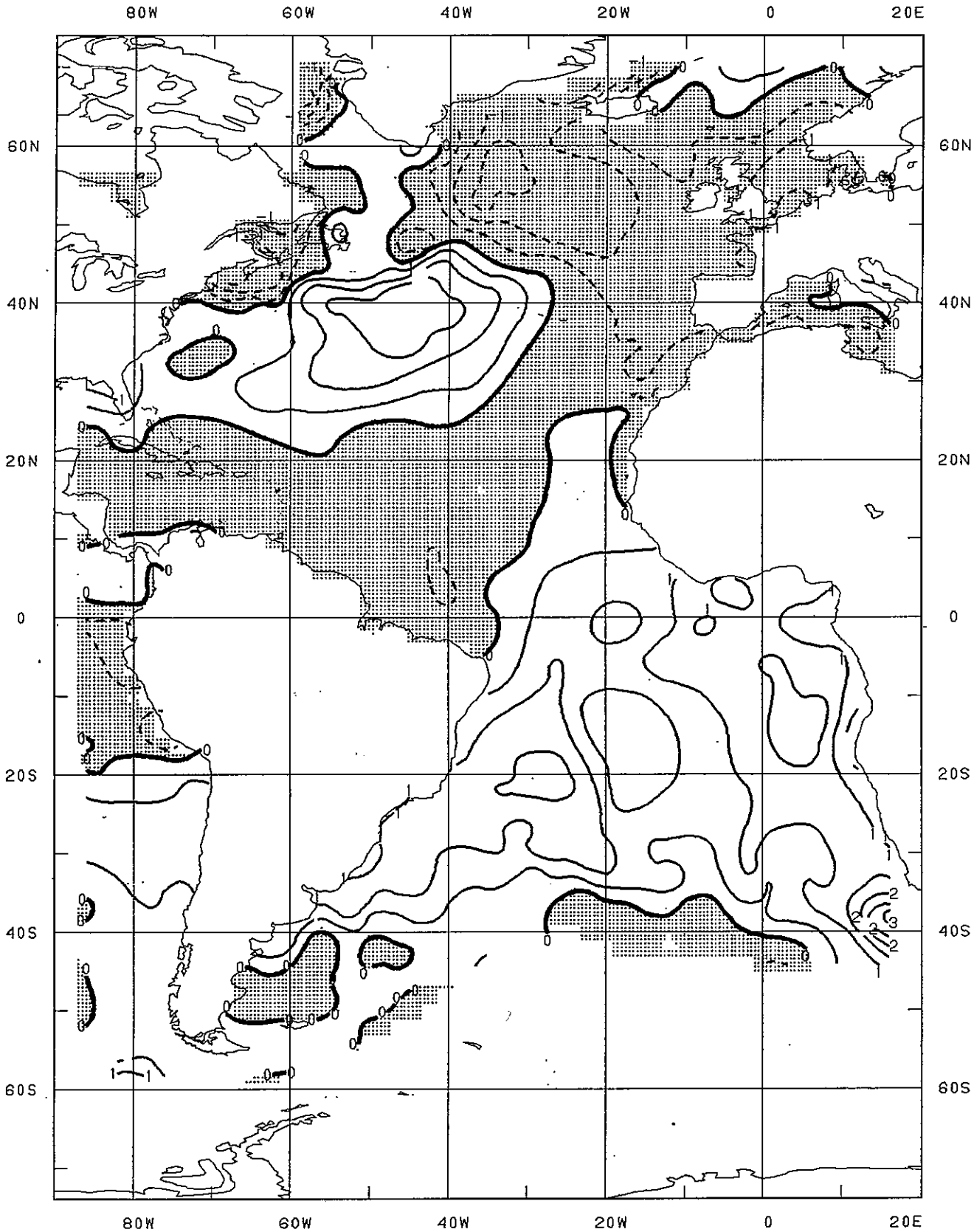
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



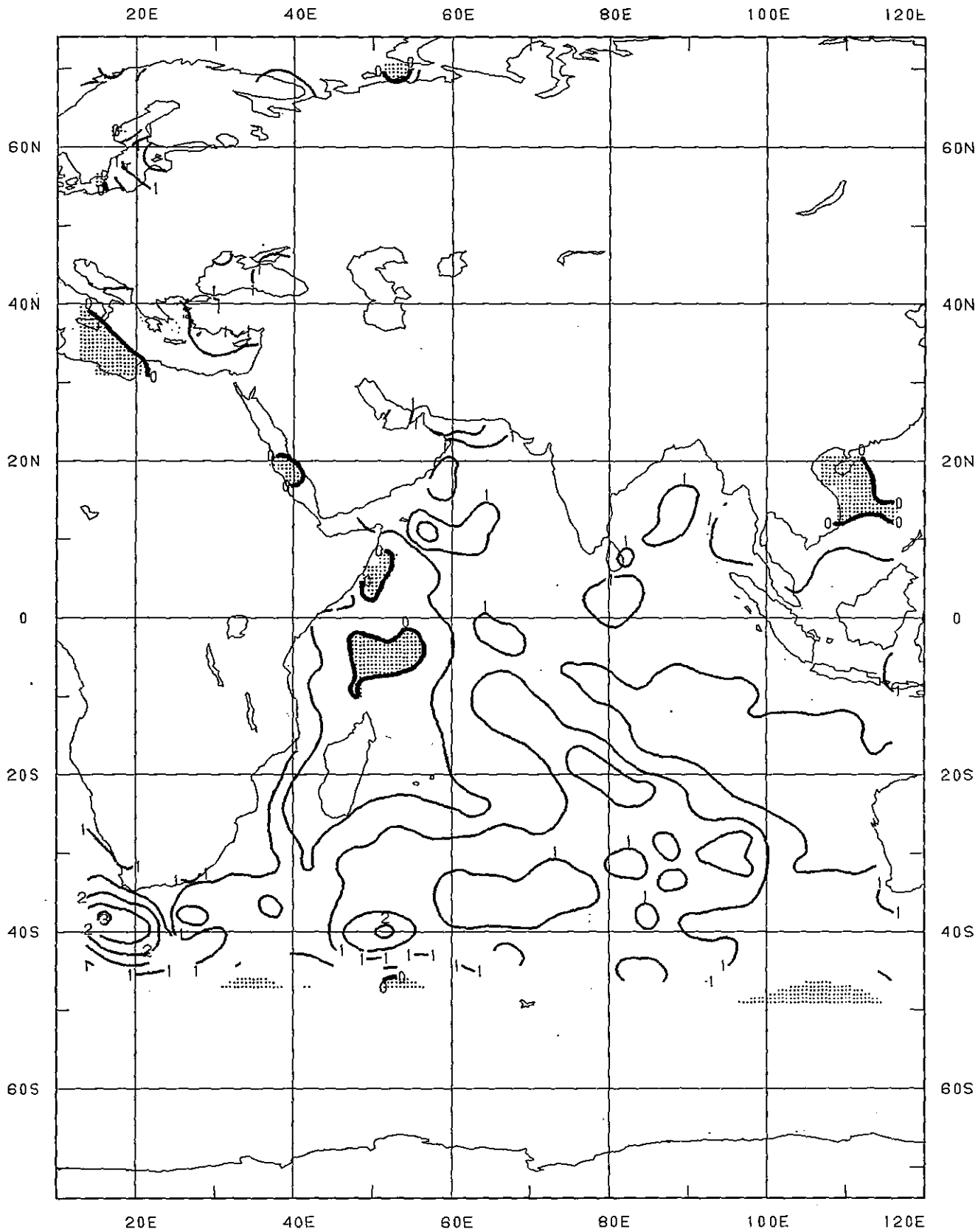
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
JUNE 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

SATELLITE - DERIVED MULTICHANNEL SST PRODUCTS

Barbara A. Banks, William G. Pichel, Robert A. Warner
National Environmental Satellite, Data, and Information Service
NOAA, Suitland, Maryland, 20233

In the last few years a number of satellite-derived objectively analyzed SST fields have been developed. These fields are produced by automatically analyzing multichannel SST observations derived with data from the Advanced Very High Resolution Radiometer (AVHRR) carried on board the TIROS-N series of NOAA polar-orbiting environmental satellites. The AVHRR measures reflected or emitted radiation in five spectral bands; two in the visible portion of the electromagnetic spectrum which are used for cloud detection during the day, and three in the infrared (IR) portion of the spectrum which are used for cloud detection at night and SST calculation day and night. The AVHRR provides twice daily global coverage at 4 km resolution.

Observations of SST at particular locations and times are derived on an orbit-by-orbit basis from AVHRR data using the multichannel SST (MCSST) algorithm. Approximately 75,000 daytime and 25,000 nighttime observations are calculated daily, each with a resolution of 8 km in the coastal regions of the U.S., every 15 km in the Eastern North Pacific and Western North Atlantic, and every 25 km elsewhere. Every 6 hours, all SST observations are placed in a user-accessible geographically organized database. One observation from every 2½° latitude-longitude square is transmitted twice each day in an alphanumeric bulletin on the Global Telecommunications System.

Satellite SST observations are objectively analyzed at a number of spatial and temporal scales to produce gridpoint fields of SST. The same basic analysis technique is used at all grid scales and for all compositing intervals. A search area is first defined for each gridpoint, the size of which is a function of the SST gradient. All observations in the search area are given weights which are inversely proportional to the square of the distance from the gridpoint. To update the gridpoint temperature, a weighted average is formed of all observations in the search area and then used to modify or replace the previous temperature for that gridpoint. A global analysis is produced daily with a 1° grid spacing. Regional analyses for the waters adjacent to the U.S. at ½° grid spacing are produced weekly and local analyses in the coastal areas of the U.S. at 1/8° are currently produced twice weekly (Figure 1).

Recent SST comparisons (Strong, 1986, personal communication) indicate that when satellite observations are available to update the field, root mean square differences between buoys and the nearest analyzed field gridpoints have the same 0.5-0.7°C range as do the direct matches between individual satellite observations and buoys.

Satellite MCSST observations and objectively analyzed SST fields are available digitally within NOAA to users of the National Weather Service Computer Operations Division NAS 9000 computers. Digital archives of these products are available to all users. Also available are yearly subscriptions to the SST charts detailed in Table 1. For information contact:

NOAA/NESDIS/NCC
Satellite Data Services Division
World Weather Building, Room 100
Washington, D.C. 20233
Phone: (301) 763-8106

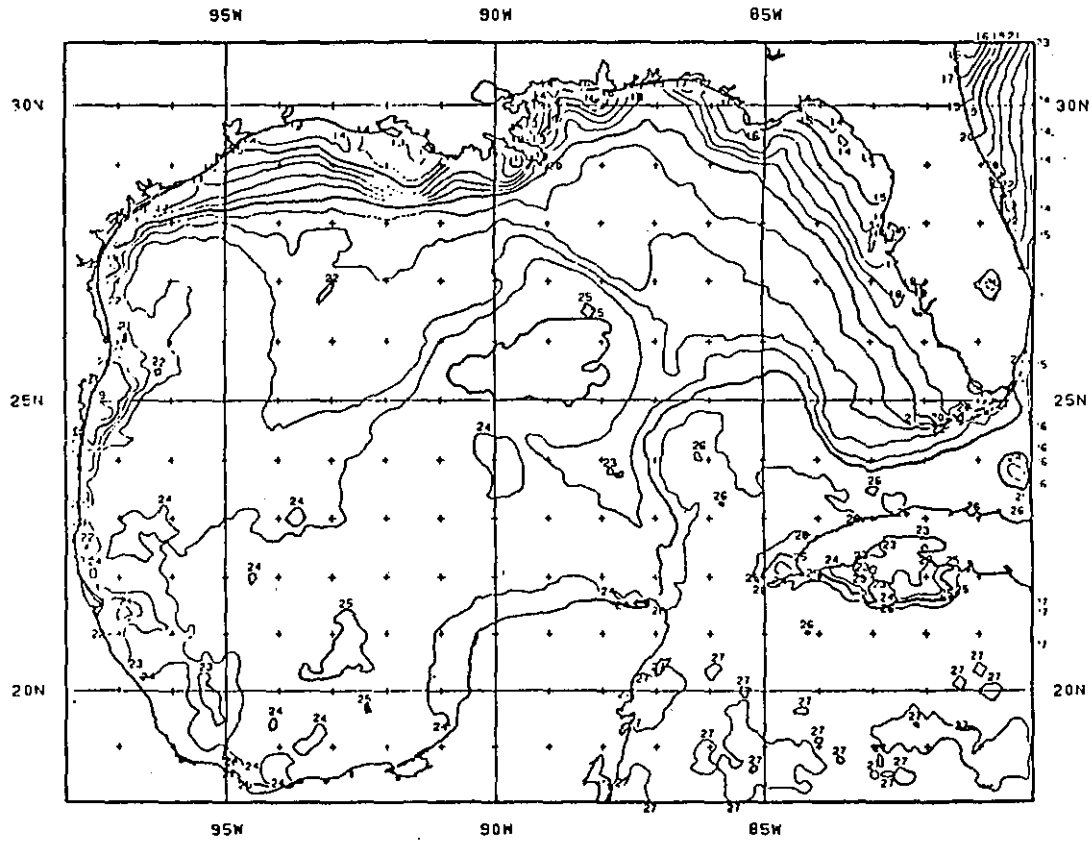
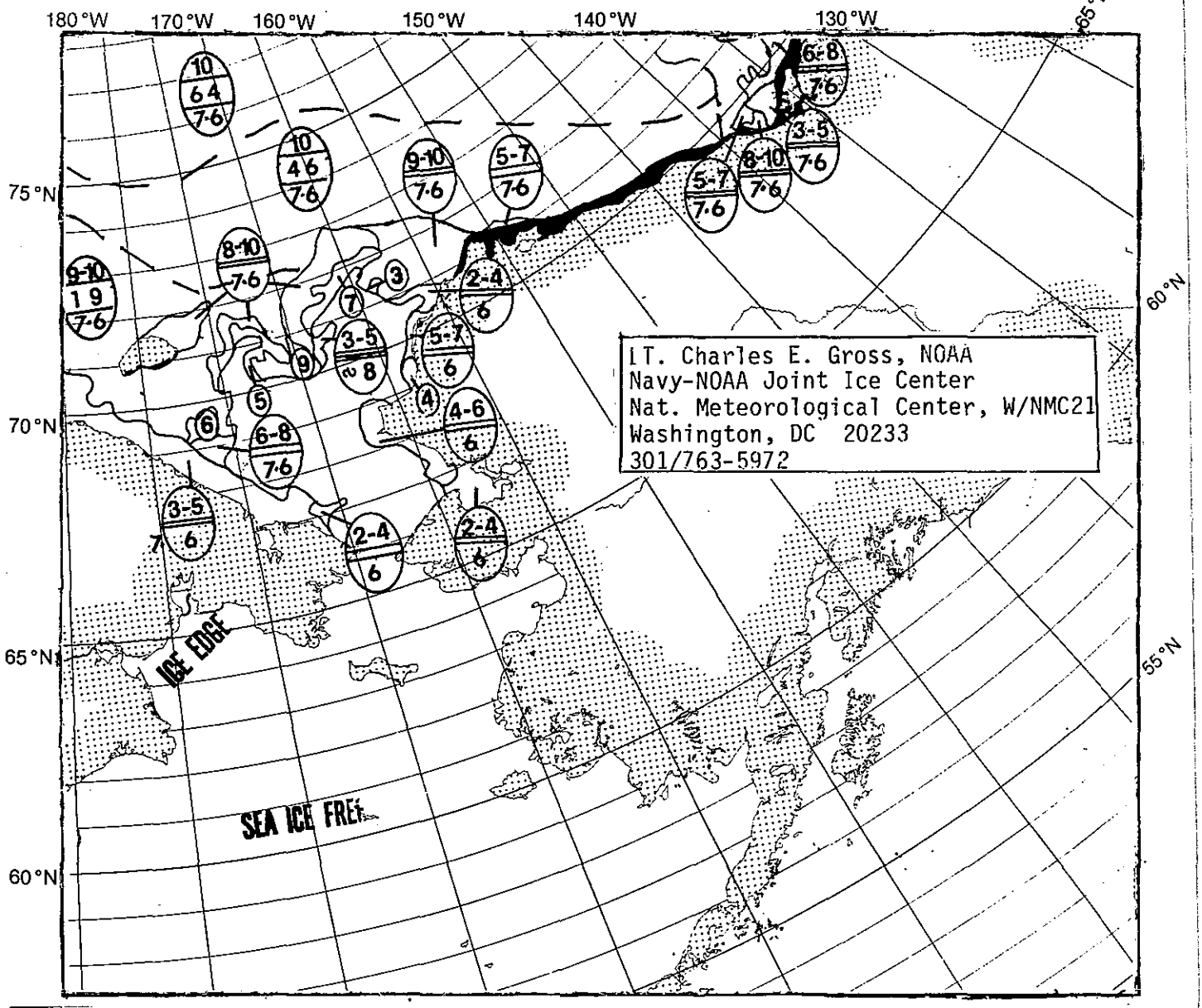


Figure 1. A 14 km SST Chart of the Gulf of Mexico for January 18, 1986.

Table 1. Current satellite-only SST products.

Product	Resolution	Coverage	Production Frequency
Global Analysis	1°	70°S-70°N	Weekly
Regional Analyses	1/2°		Weekly
Atlantic Coast		5-53°N, 52-100°W	
Pacific Coast		15-63°N, 97-145°W	
Hawaii/Alaska		15-63°N, 142°W-170°E	
EPOCS (Eastern Tropical Pacific)		35°S-20°N, 70-150°W	
Pacific Islands		35°S-20°N, 145°W-155°E	
Local Analyses	1/8°		Twice Weekly
Northeast Atlantic Coast		30°N-46°N, 82°W-60°W	
Southeast Atlantic Coast		18°N-32°N, 85°W-70°W	
Gulf of Mexico		18°N-31°N, 80°W-98°W	
Southwest Pacific Coast		28°N-41°N, 114°W-136°W	
Northwest Pacific Coast		39°N-52°N, 123°W-136°W	
Gulf of Alaska		50°N-62°N, 126°W-160°W	
Bering Sea		50°N-70°N, 157°W-180°W	
Gulf of California		20°N-32°N, 105°W-136°W	

BERING SEA / NORTH SLOPE ICE ANALYSIS



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 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).

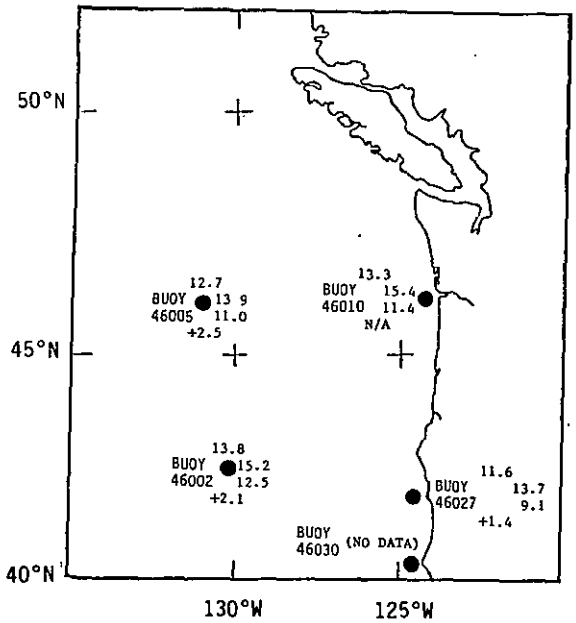
Fast ice. Sea ice which forms and remains fast along the coast.

Ice boundary visually or satellite observed.

Ice boundary estimated.

JUNE 1986

The monthly mean sea level pressure circulation depicts a 1016 mb high in the Beaufort Sea near 74°N 140°W and a 1003 mb low in the Bering Sea near 57°N 177°W. Weak southeasterly geostrophic winds are observed in the northern Bering Sea and southern Chukchi Sea with easterly winds observed along the Alaskan North Slope. Monthly mean surface air temperatures are above normal at Barrow (71°N 157°W) and Nome (65°N 165°W). By the end of June, the Bering Sea was free of sea ice, with the exception of a small area in the Gulf of Anadyr. Warmer temperatures and prevailing on-pack winds combined to recess the ice edge significantly with a large ice free area extending from the Bering Strait over 750 km into the Chukchi Sea. The current ice edge position is at a new minimum in the northern Chukchi Sea and near the minimum throughout the remainder of the Chukchi Sea.



JUNE 1986

Near normal conditions prevail in the North Panel area. Monthly mean SSTs over most of the region are only slightly above normal, except for a small area centered about 240 km off the mid-Oregon coast which exhibits warm SST anomalies of 1.5-2.0°C. Offshore SSTs show a steady seasonal warming trend during the month, resulting in means 2.0-3.0°C warmer than for May. Two distinct coastal upwelling events, during June 7-12 and 22-25, are evident in wind observations and coastal SSTs along Oregon and Washington. The lowest coastal SSTs reported during the month (about 9°C) were recorded at Buoy #46027 on June 10 and 24. Satellite imagery shows weak thermal boundaries associated with these upwelling events. A pronounced warming of coastal waters occurred in the period between the two upwelling events. This is exemplified by an increase in daily mean SST at Buoy #46010 of over 3°C (from 12.3°C to 15.4°C) between June 13 and 22.

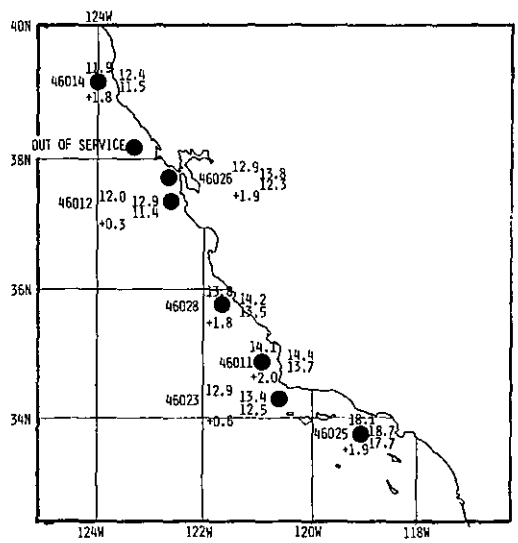
KEY:

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

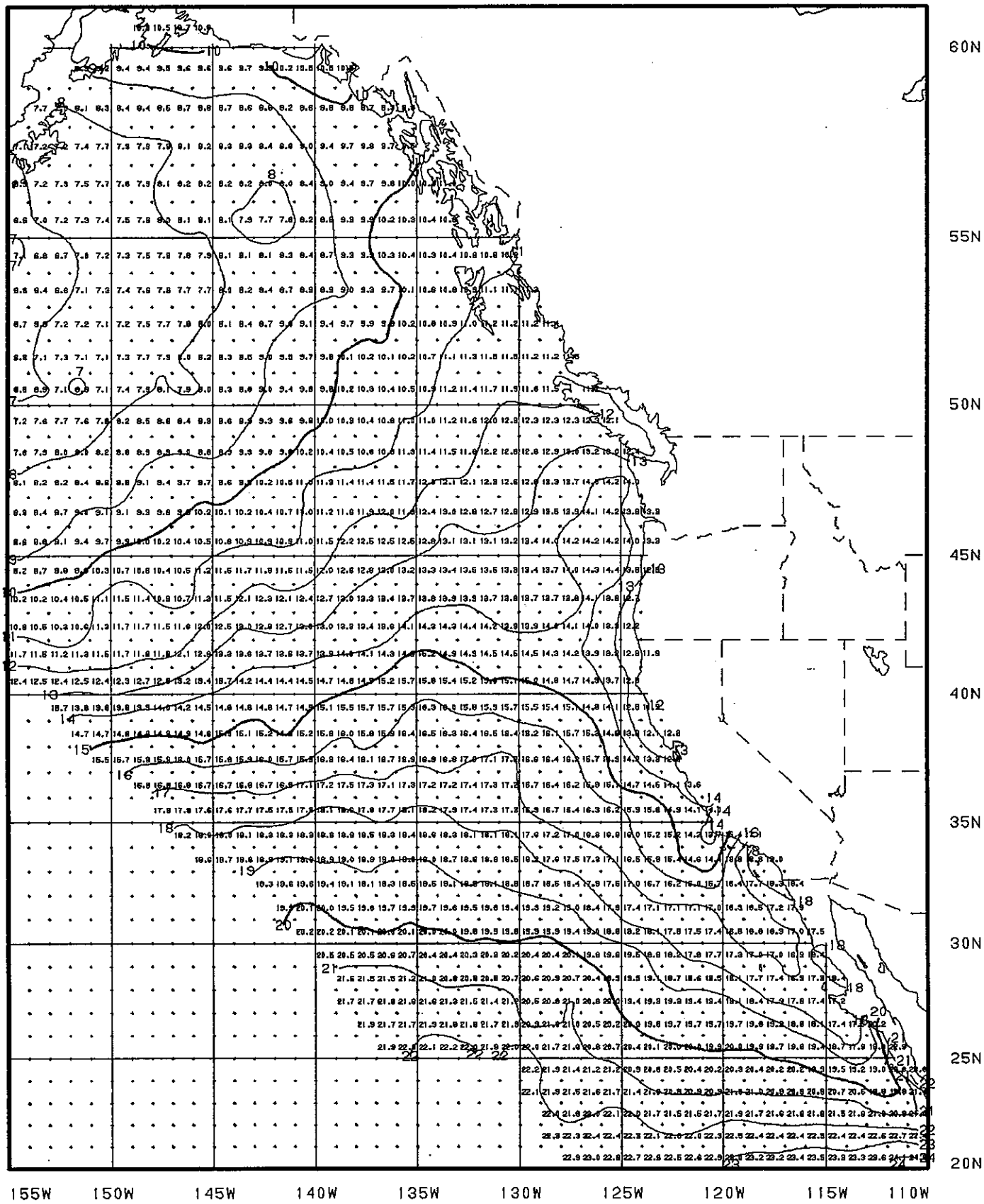
● Denotes station position.

North Panel
Kent Short
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, Wa 98115
(206) 526-6604
FTS 392-6604

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

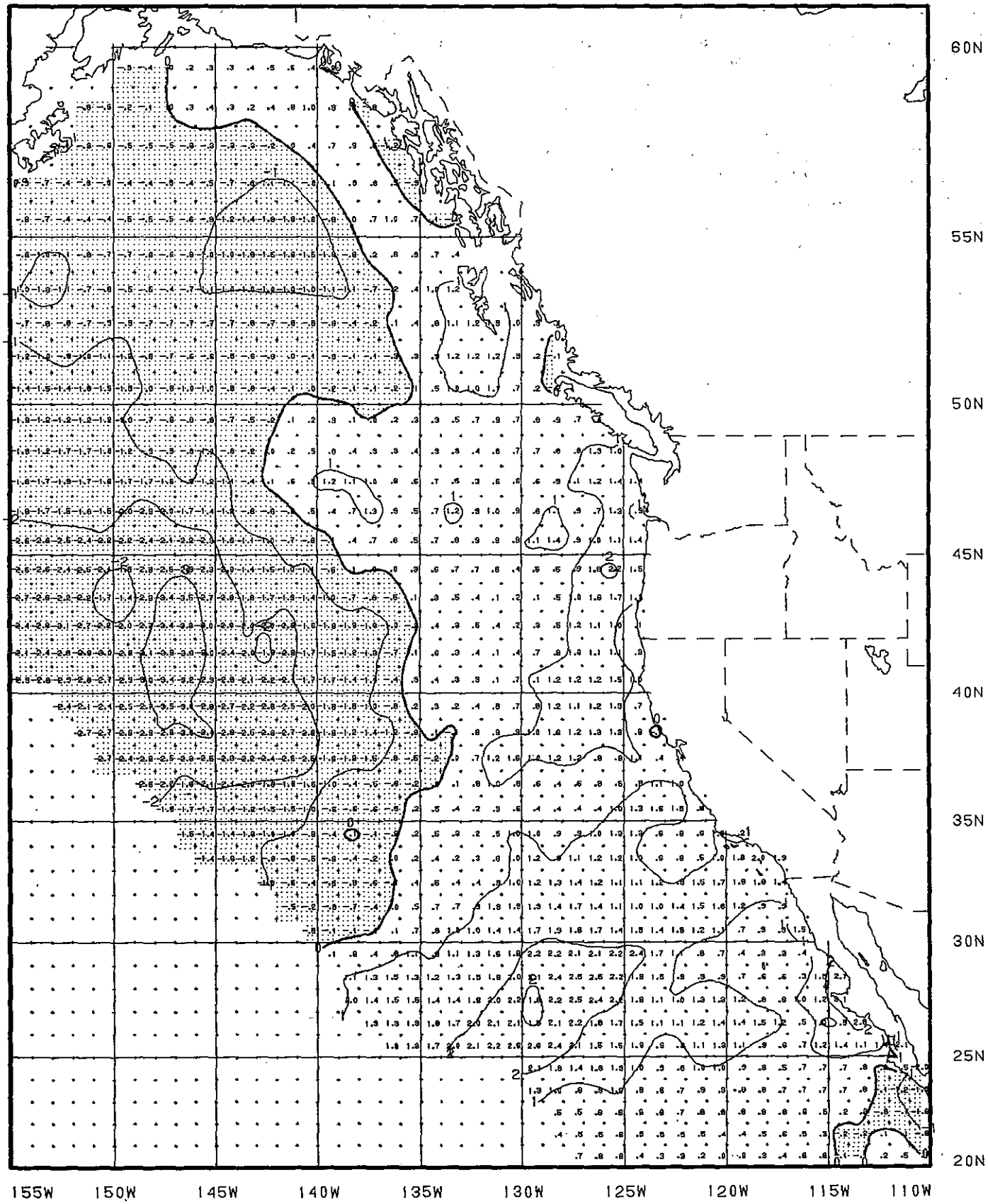


June continues the previous 6 month pattern of above normal SSTs in the South Panel. The South Panel's June mean SST (17.4°C) is 1.2°C higher than the climatological mean SST (16.2°C). Only the northwest corner of the South Panel is cooler than climatology. Warm anomalies of up to 2.5°C are seen along the Baja peninsula and near 30°N 130°W. During June the SSTs warmed from 0.5°C around Pt. Conception to 2.3°C over a broad region in the western part of the South Panel. Two major upwelling periods were observed during the month on June 10 and June 20. Both upwelling episodes were observed by infrared satellite imagery. Between these upwelling events, southwesterly winds prevailed and nearshore temperatures warmed. Buoy SSTs show that seasonal warming was consistent along the coast of California.



West Coast
SST--MONTHLY MEAN (°C)
June 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
June 1986

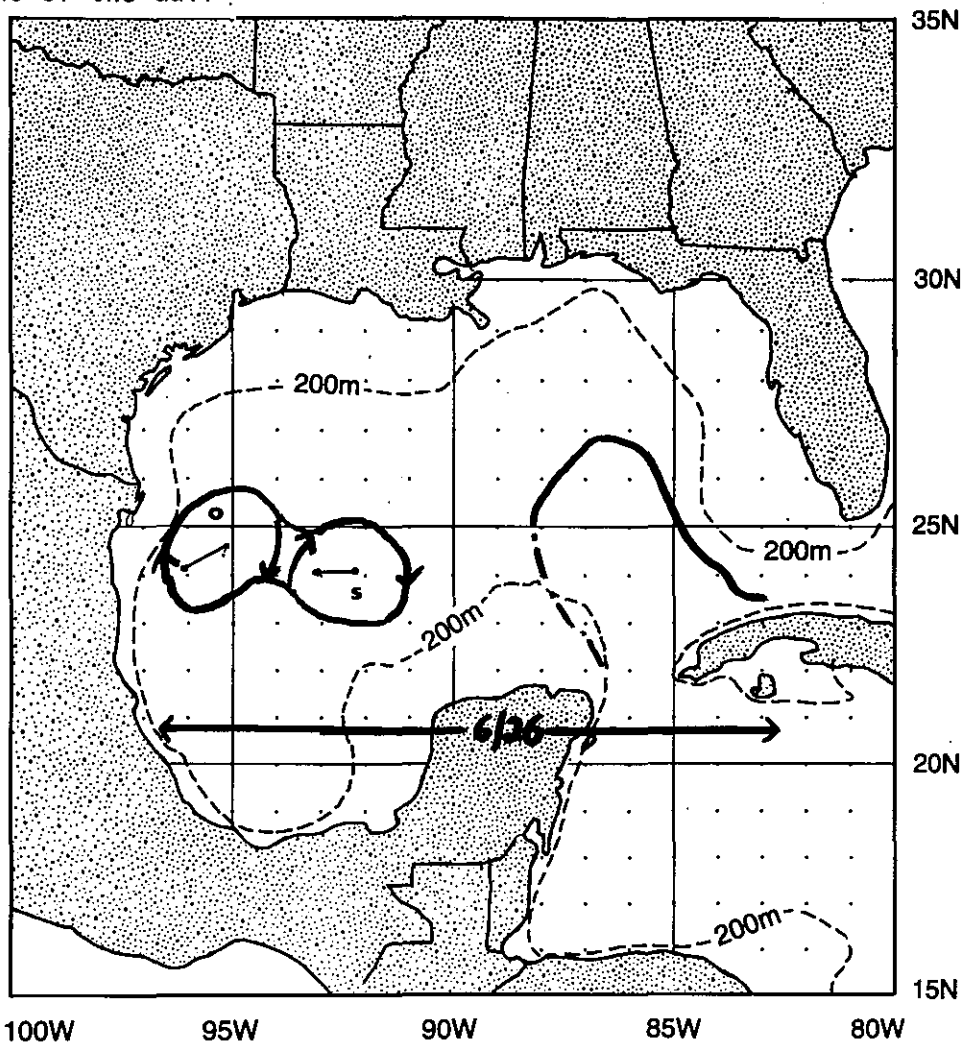
Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf

EAST COAST OCEAN FEATURES

Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

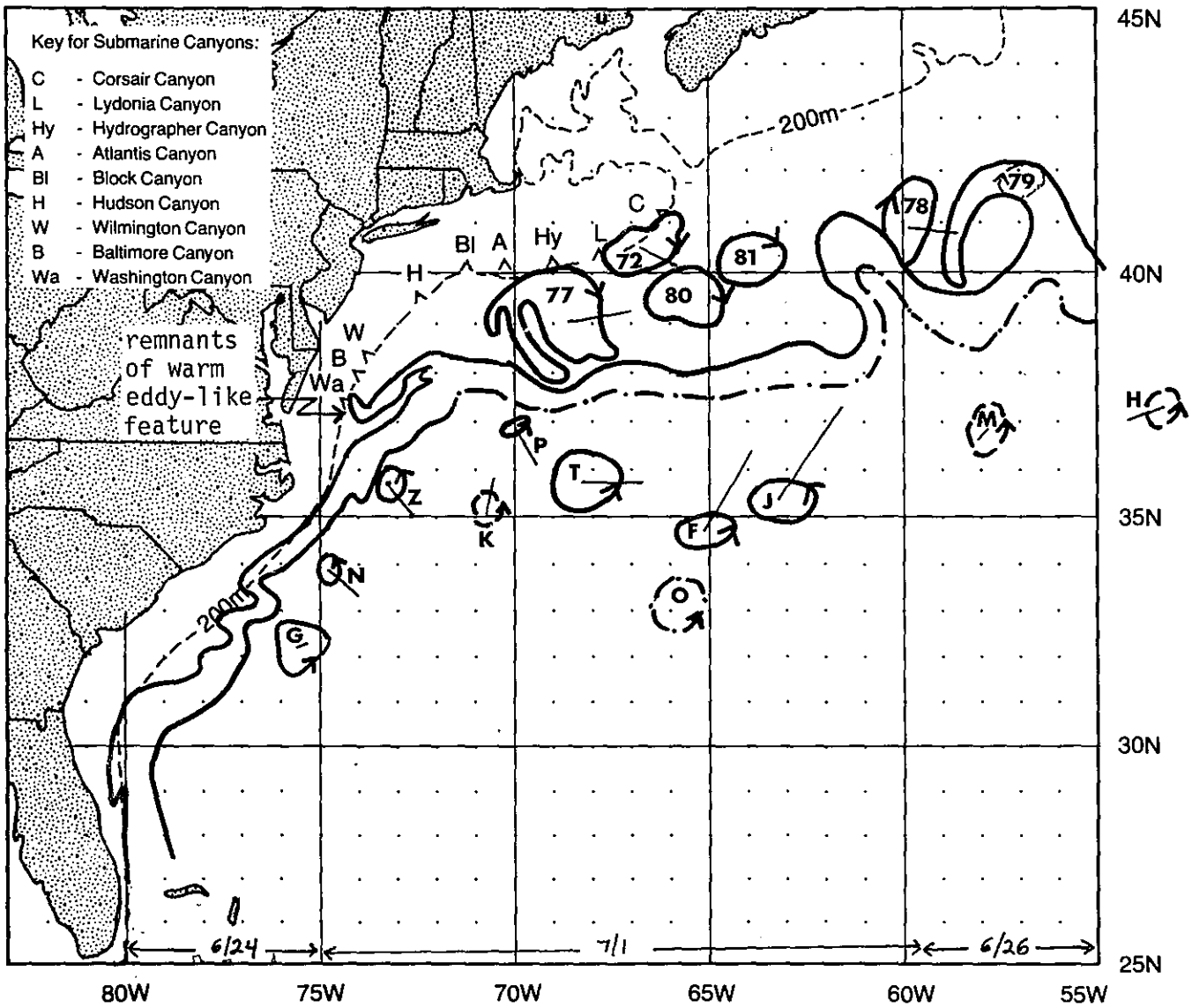
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

JUNE 1986

Due to near isothermal SST conditions in the Gulf of Mexico during June, ocean features were not discernible on satellite imagery. According to drifting buoy data, the end-of-June amplitude of the Loop Current decreased by 55 km compared to the end-of- May position. The positions of anticyclonic eddies o and s were also estimated by drifting buoy data. Eddy o apparently translated 110 km ENE, and eddy s apparently moved 85 km E. According to the Slidell Satellite Field Service Station, eddies o and s are interacting with each other.

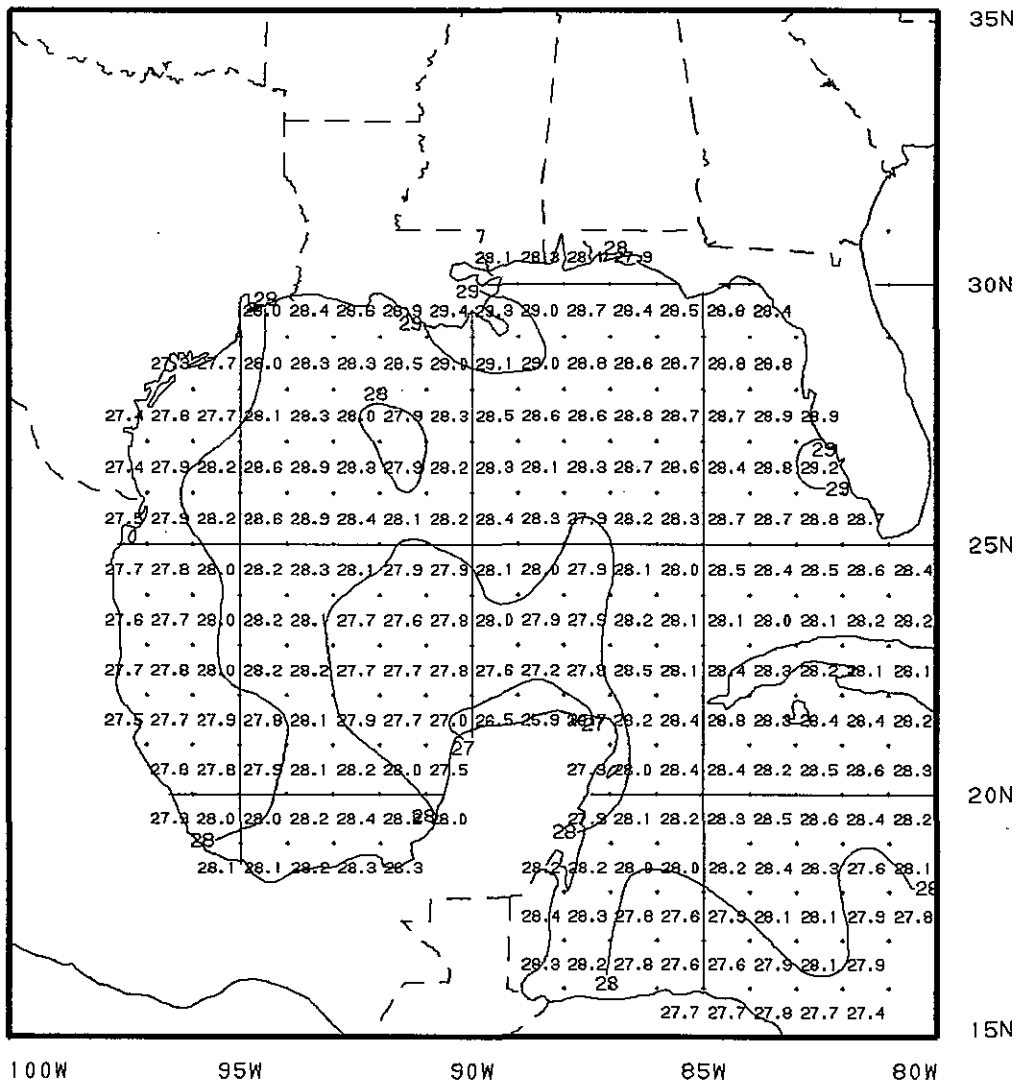


Two new anticylonic eddies formed during June. Eddies 80 and 81 both formed from Gulf Stream meanders near 40°N 64°W. Eddy 80 formed on June 15, and eddy 81 formed around July 1. Eddy 77 traveled 140 km W while eddy 72 translated 85 km NW. Eddy 78 moved 120 km W. Eddy 79 moved 85 km SW and is interacting with a Gulf Stream meander near 42°N 57°W. Remnants of a warm eddy-like feature are still discernible near 37°N 74°W.

Two cyclonic eddies were newly observed during June. Eddy O was detected in XBT data from the Ship OLEANDER on June 8. Eddy P was newly observed in satellite imagery on June 2. By June 20 eddy P had translated 110 km NW. The origins are unknown for eddies O and P. Eddy G translated 25 km W. Eddies N and Z both traveled 90 km NW. Eddy K moved 75 km SSW when it was last observed on June 11. Eddy T translated 130 km W. Eddies F and J translated 195 km SW and 240 km SW, respectively. Eddy M, last detected on June 6, traveled 35 km NE. Eddy H translated 85 km ENE when it was last observed on June 17. Eddies E, I, and L were not observed during June.

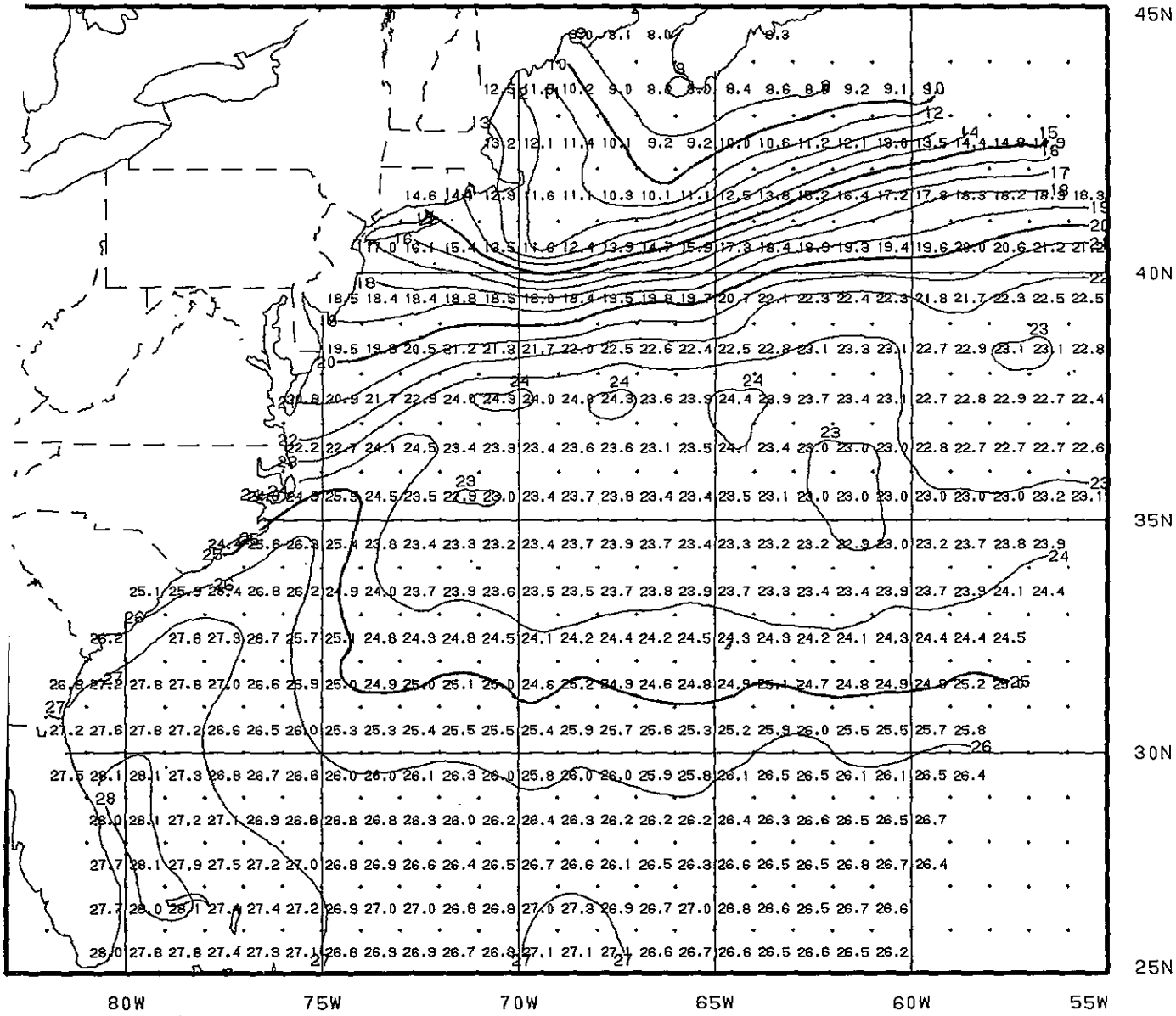
The Subtropical Convergence Front was not observed during June due to isothermal SST conditions and clouds.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
June 1986

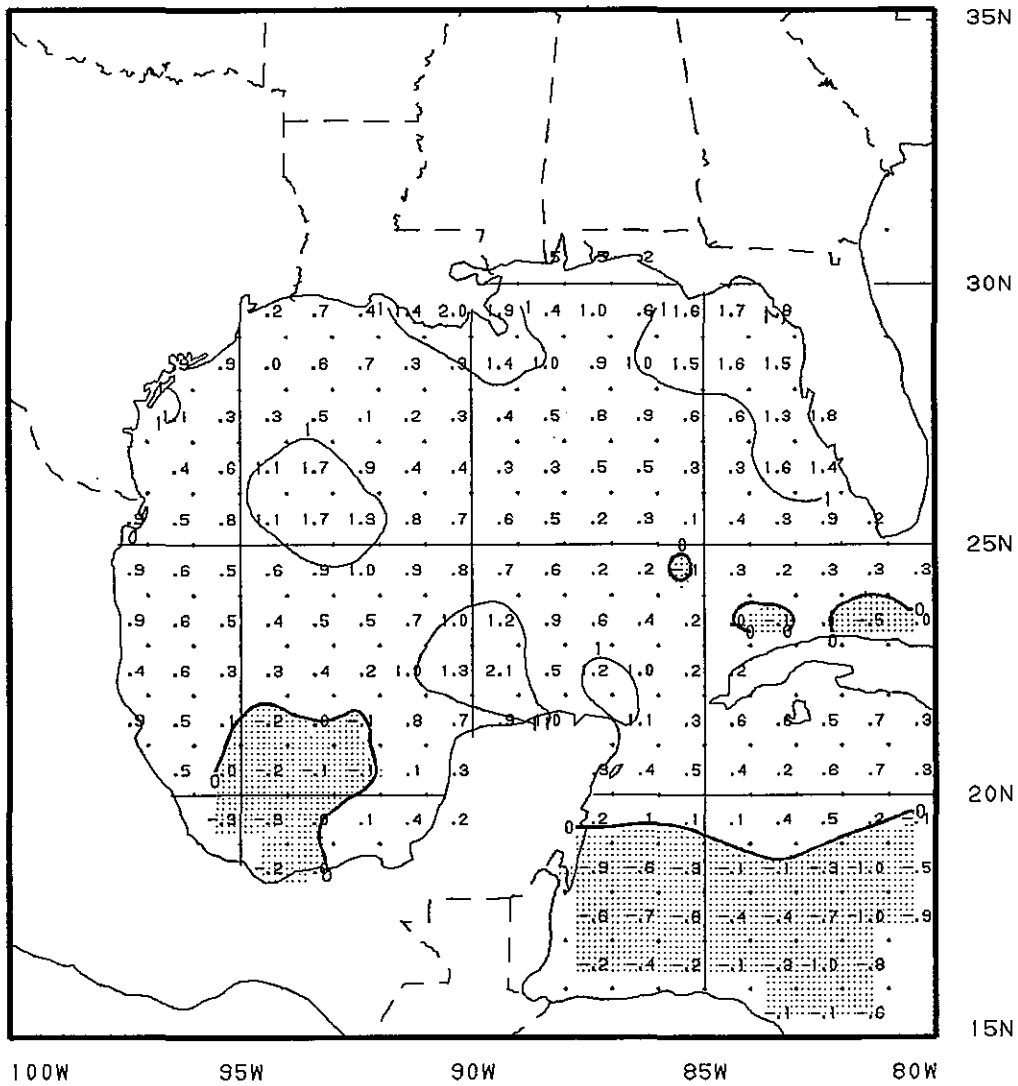
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
June 1986

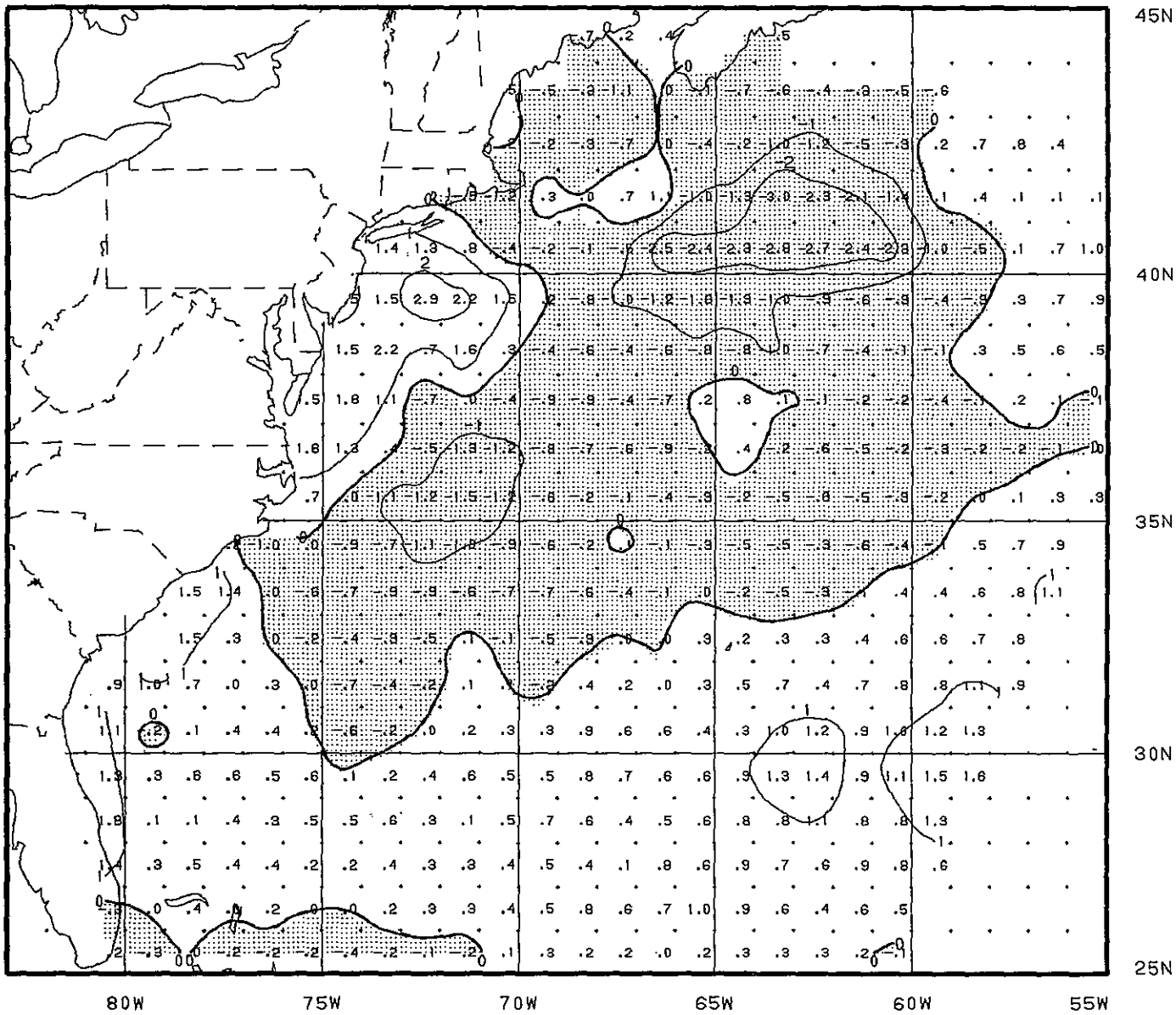
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
June 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
June 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

Sidney Stillwaugh
NOAA Info. Center

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE WA 98115-0070

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

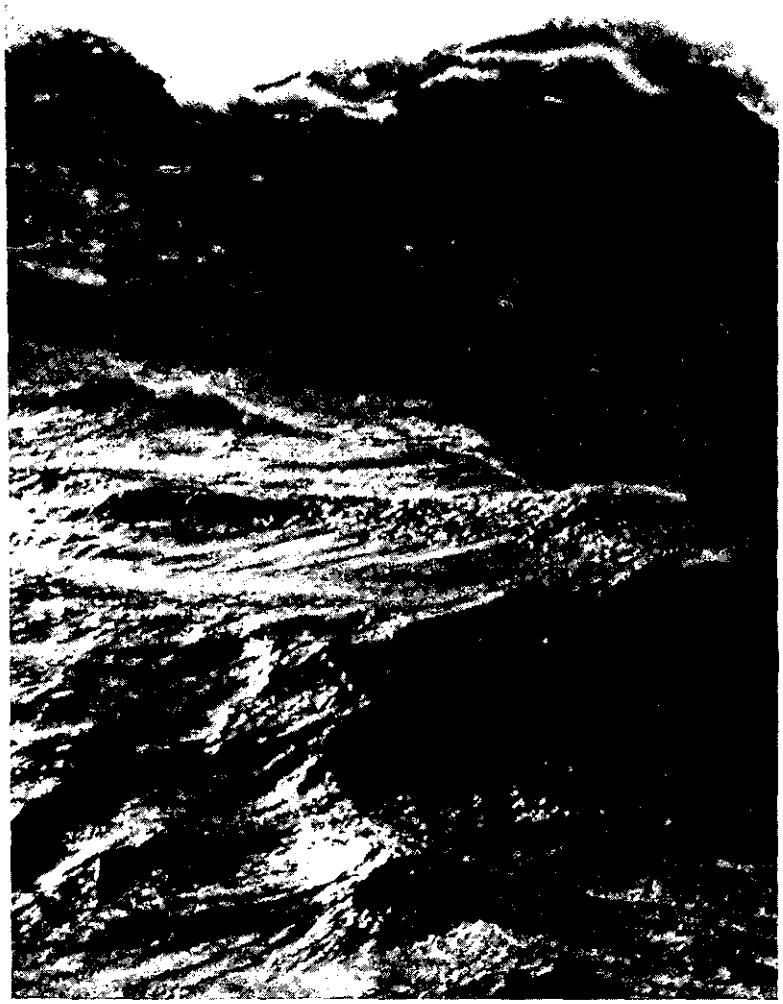
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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 September 30, 1986.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 7 July 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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.

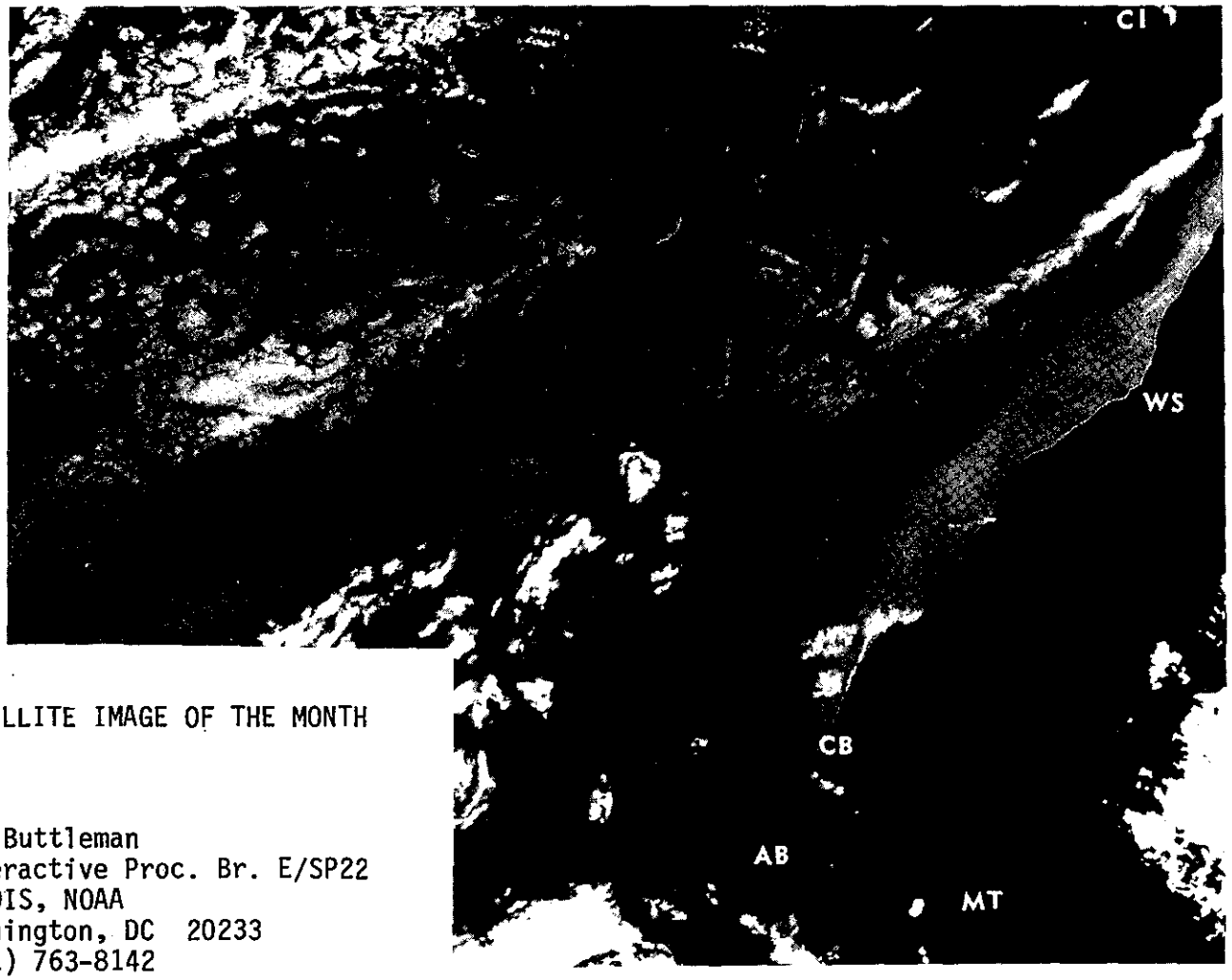
[1]Reynolds, R.W. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31*.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2*.
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; *NavOceano Ref. Pub. 18*.

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

Typing: Damita Johnson



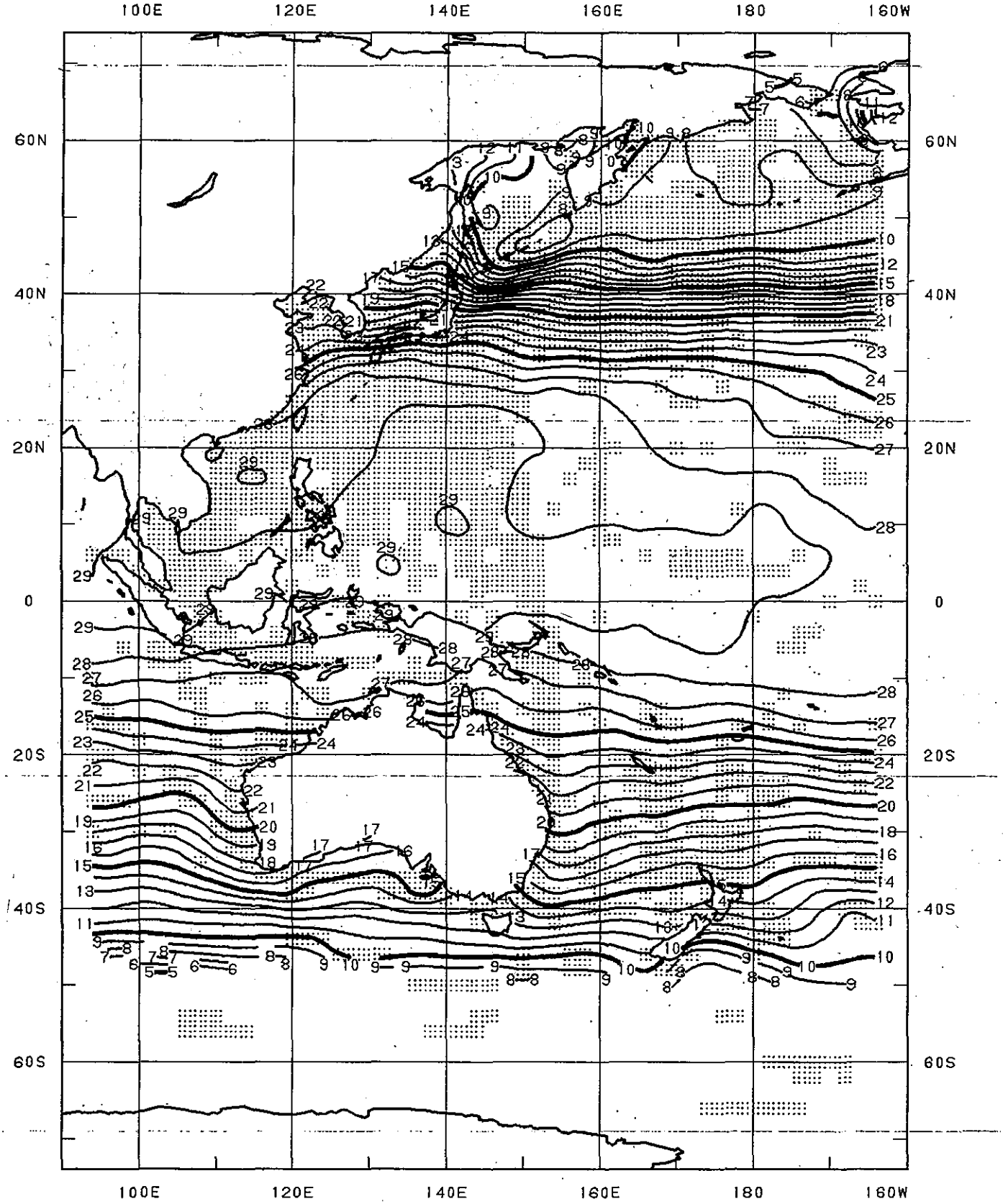
SATELLITE IMAGE OF THE MONTH

Kim Buttleman
Interactive Proc. Br. E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

THE RAFT OF THE MEDUSA

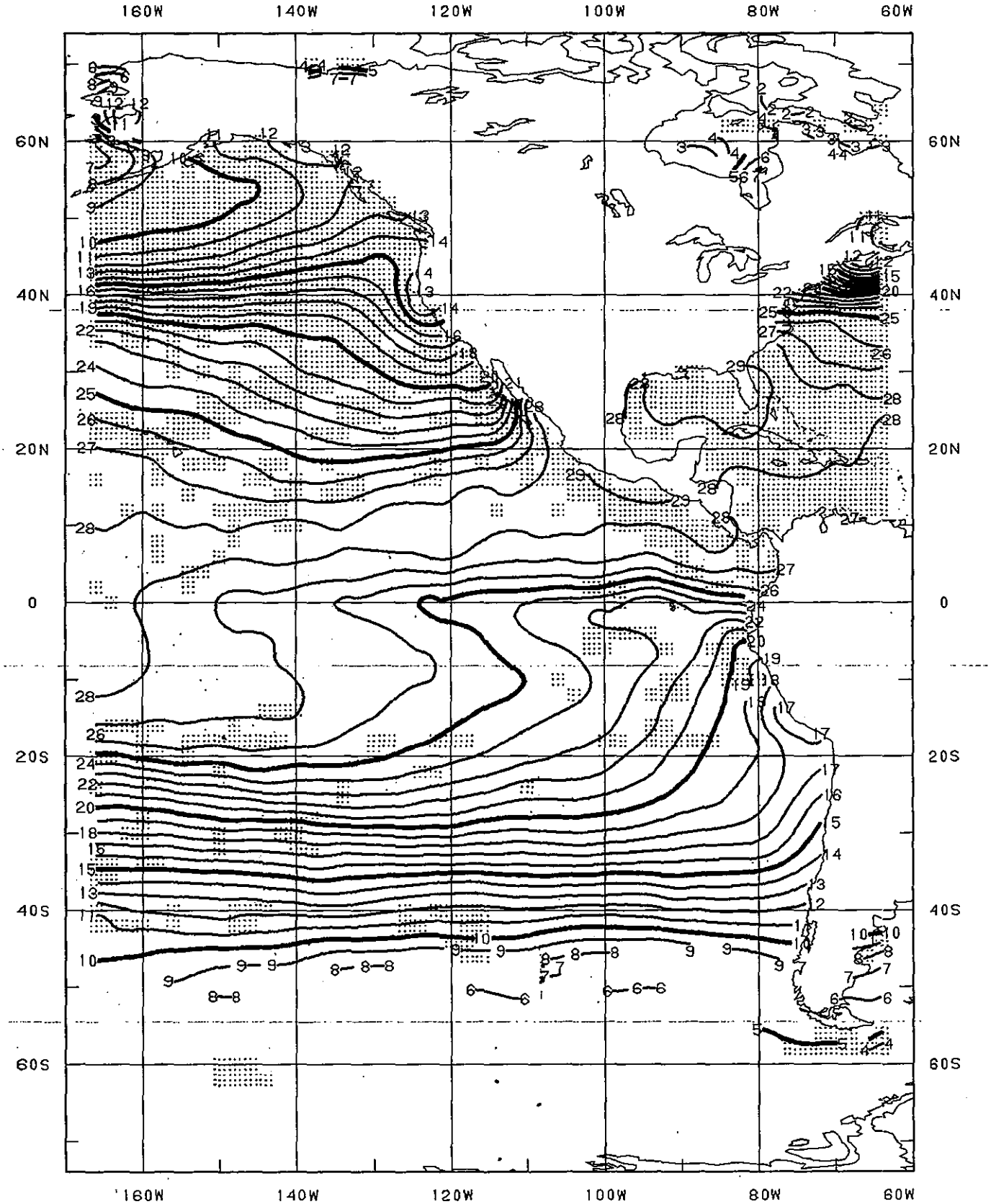
This NOAA-9 image from July 26, 1986, shows the Canary Islands (CI), and the coasts of W. Sahara (WS) and Mauritania (MT). A number of physical phenomena are apparent. Most pronounced are several sets of atmospheric von Karman vortex streets, the large cloud spirals extending WSW from the islands. These form downstream from barriers (islands) under conditions of steady flow (NE trades) and stratification of the fluid. Also apparent are several oceanographic phenomena. There is extensive upwelling along the coast as evidenced by the lighter (colder) water. This is predominantly geostrophically induced with a seasonal (trade-wind) component. There is substantial turbulence downstream of the Canaries, which block the Canary Current also flowing to the WSW. Numerous eddies are also apparent off Cap Blanc (CB). This area is a backwater of the divergence of the Canary Current into the Guinea and N. Atlantic Equatorial Currents. The substantial sediment load carried by the coastal currents is dropped here resulting in the Arguin Banks (AB).

In July 1816 the French frigate Medusa ran aground on the Banks approximately 60 miles SW of Cape Blanc. The ship was abandoned, with 238 people in six boats and 150 on a raft made of the ship's masts and spars. After towing the raft for several hours, the boats deserted it. By sailing with the sea breezes, the boats reached the coast with a loss of only six people. Caught in the eddies, the raft drifted for two weeks, often within sight of land. It was found less than 120 miles from its original position with only 15 survivors. This incident was the inspiration for Gericault's painting The Raft of the Medusa, now in the Louvre.



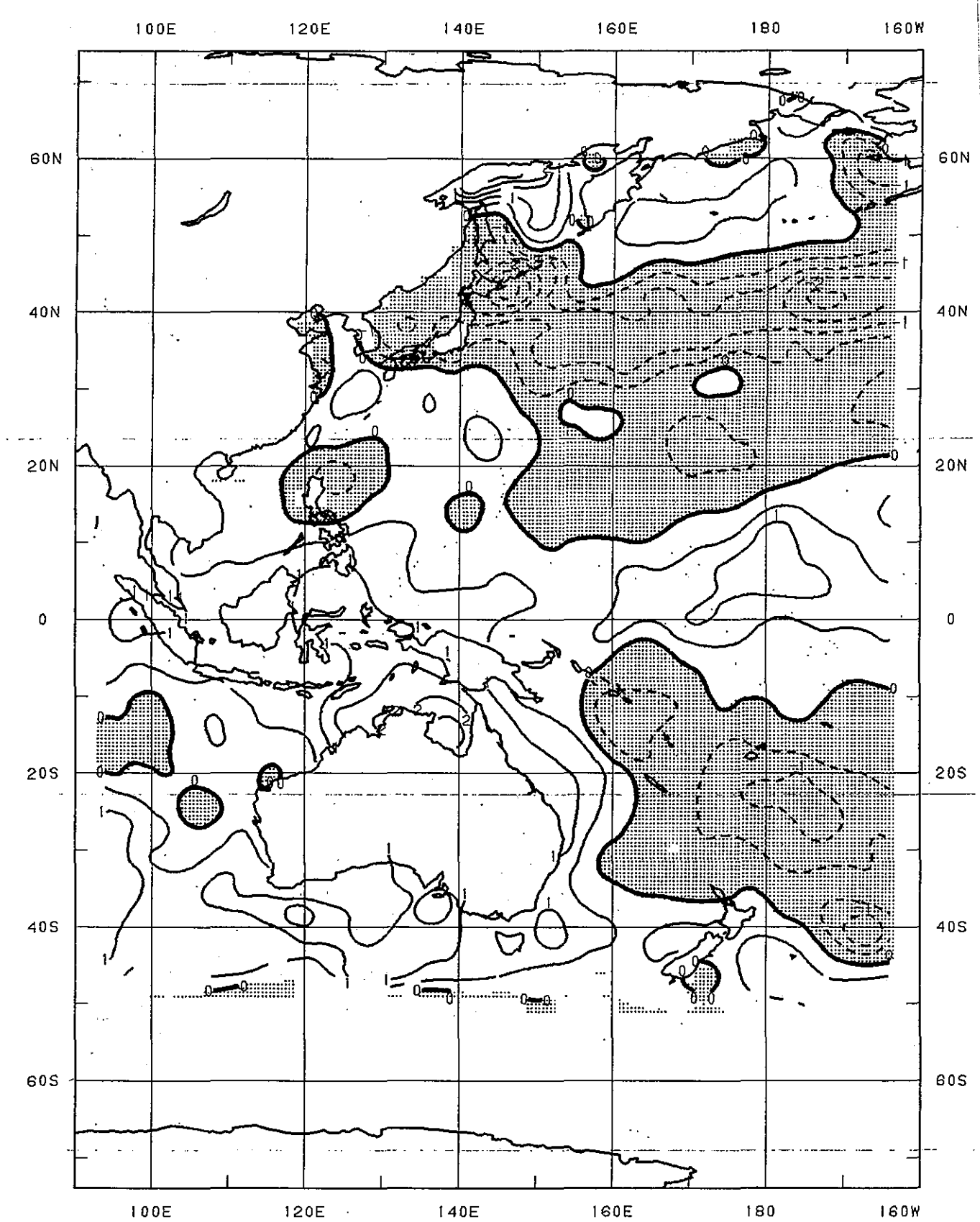
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JULY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



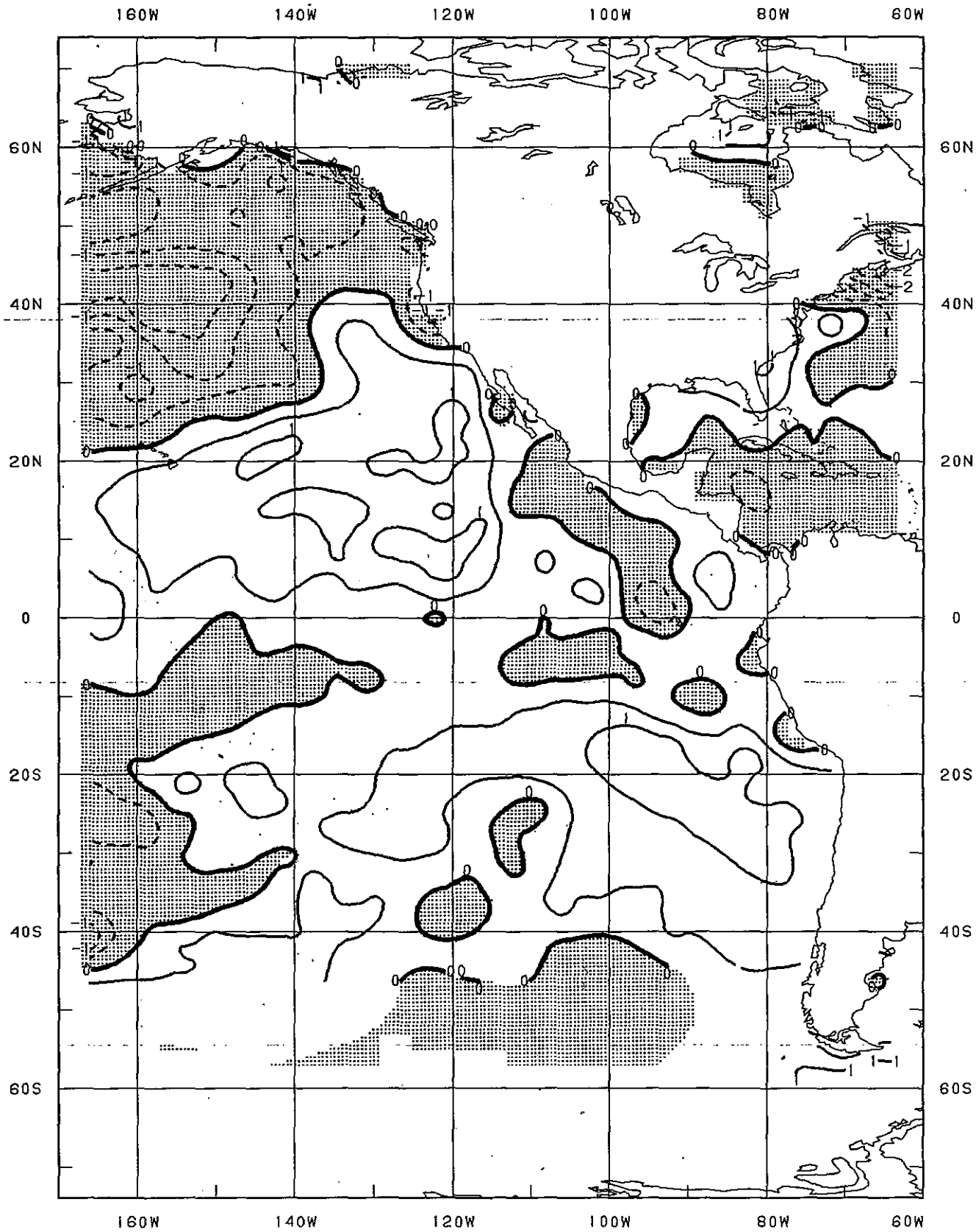
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JULY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



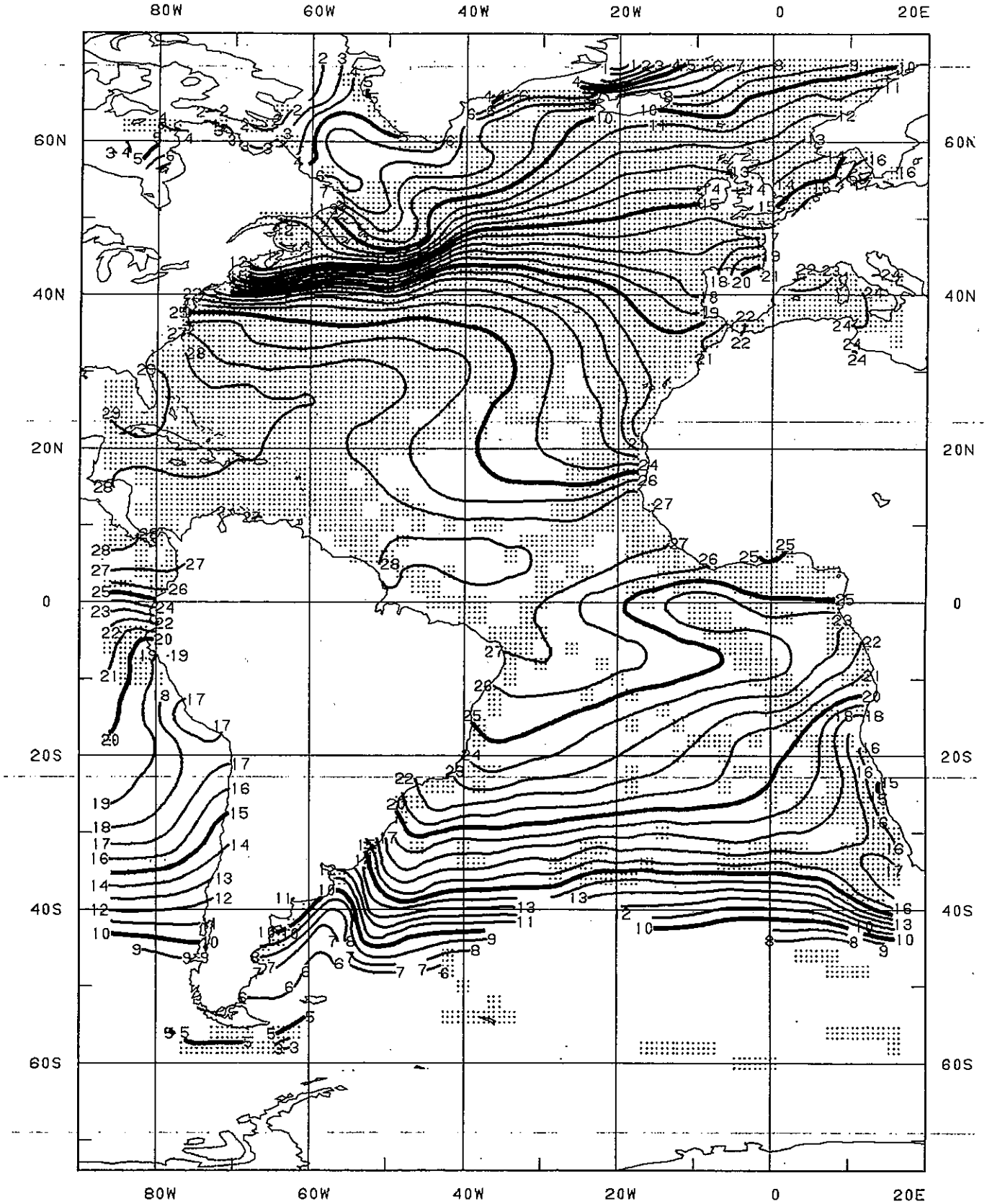
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
JULY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



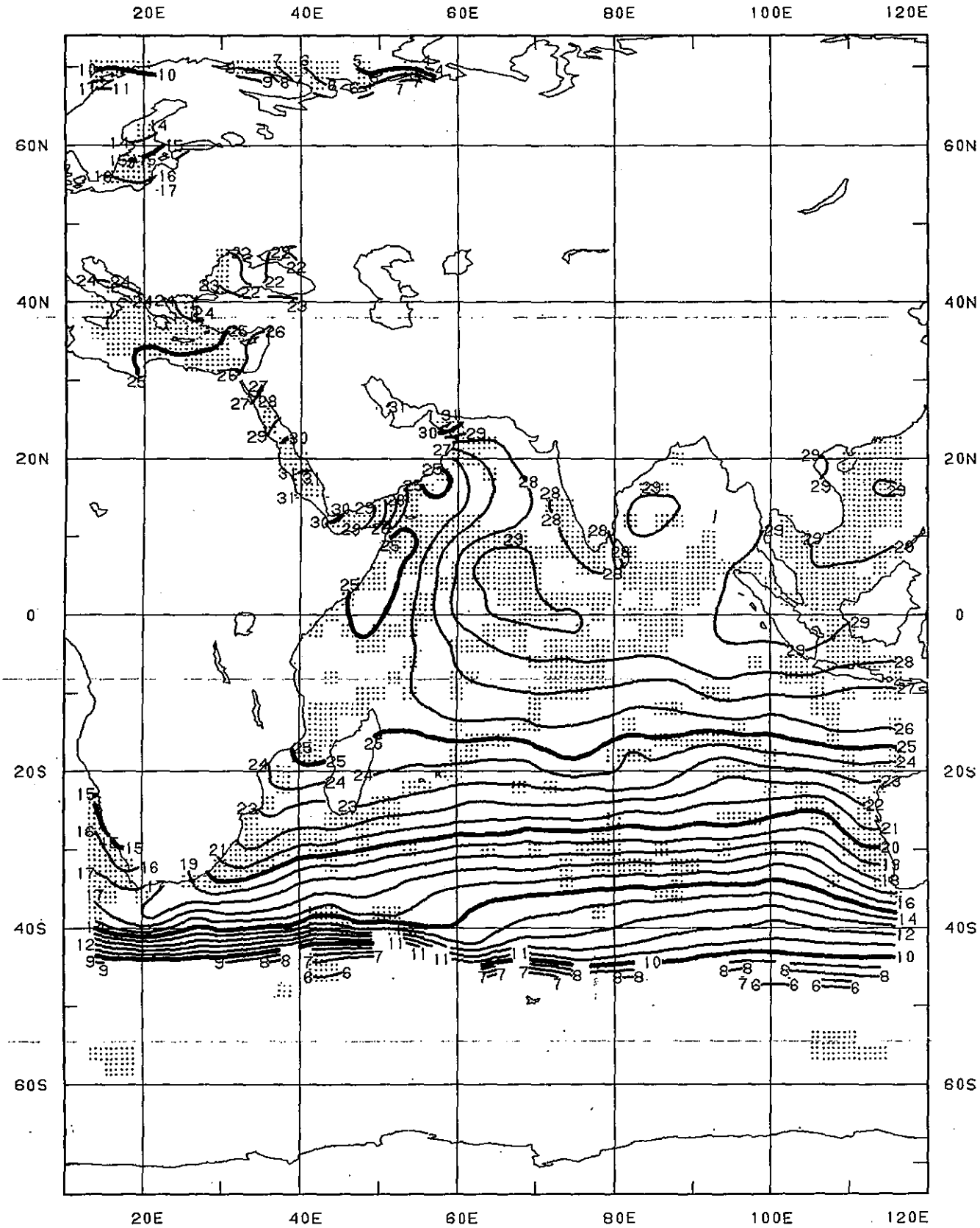
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA.
JULY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



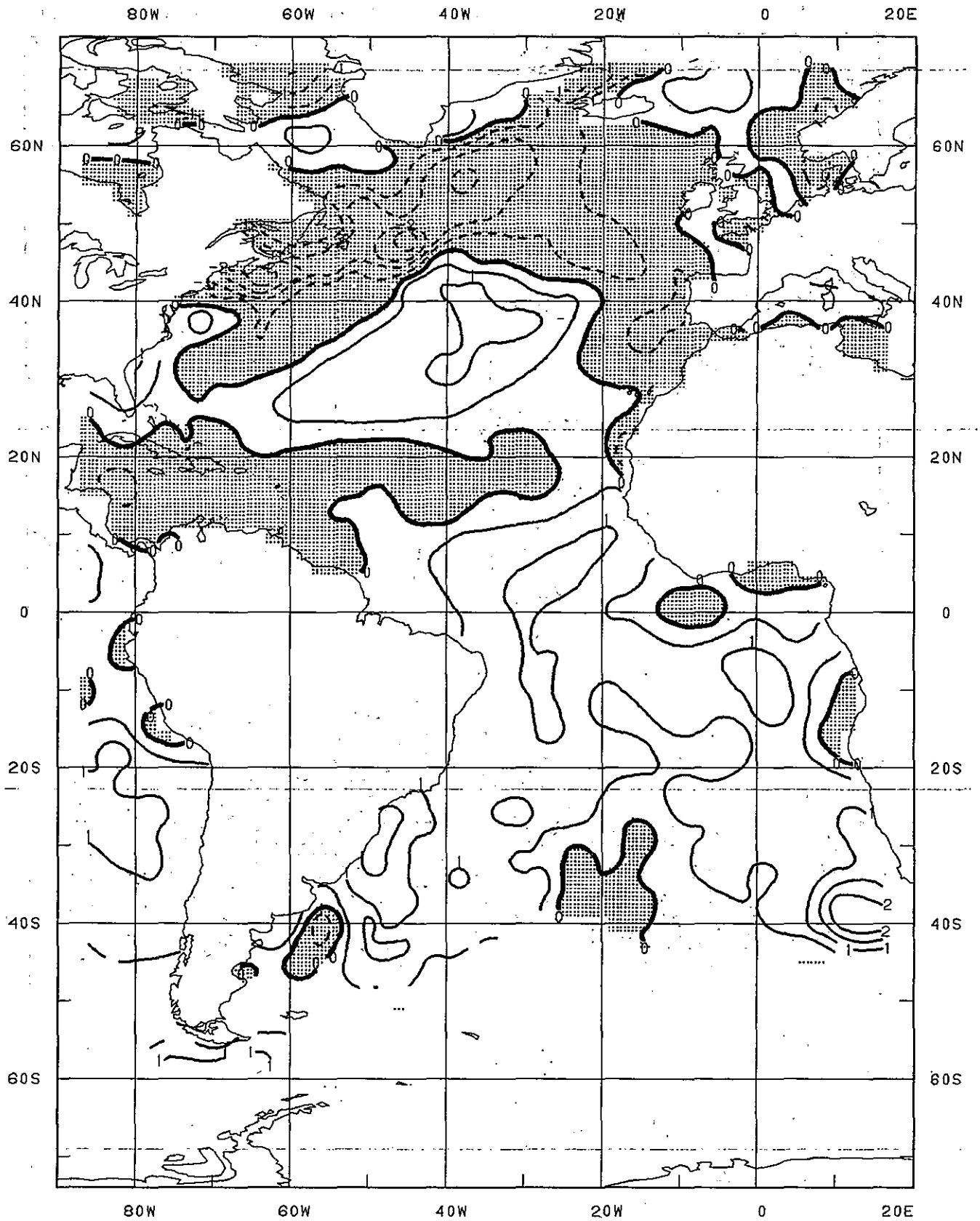
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JULY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



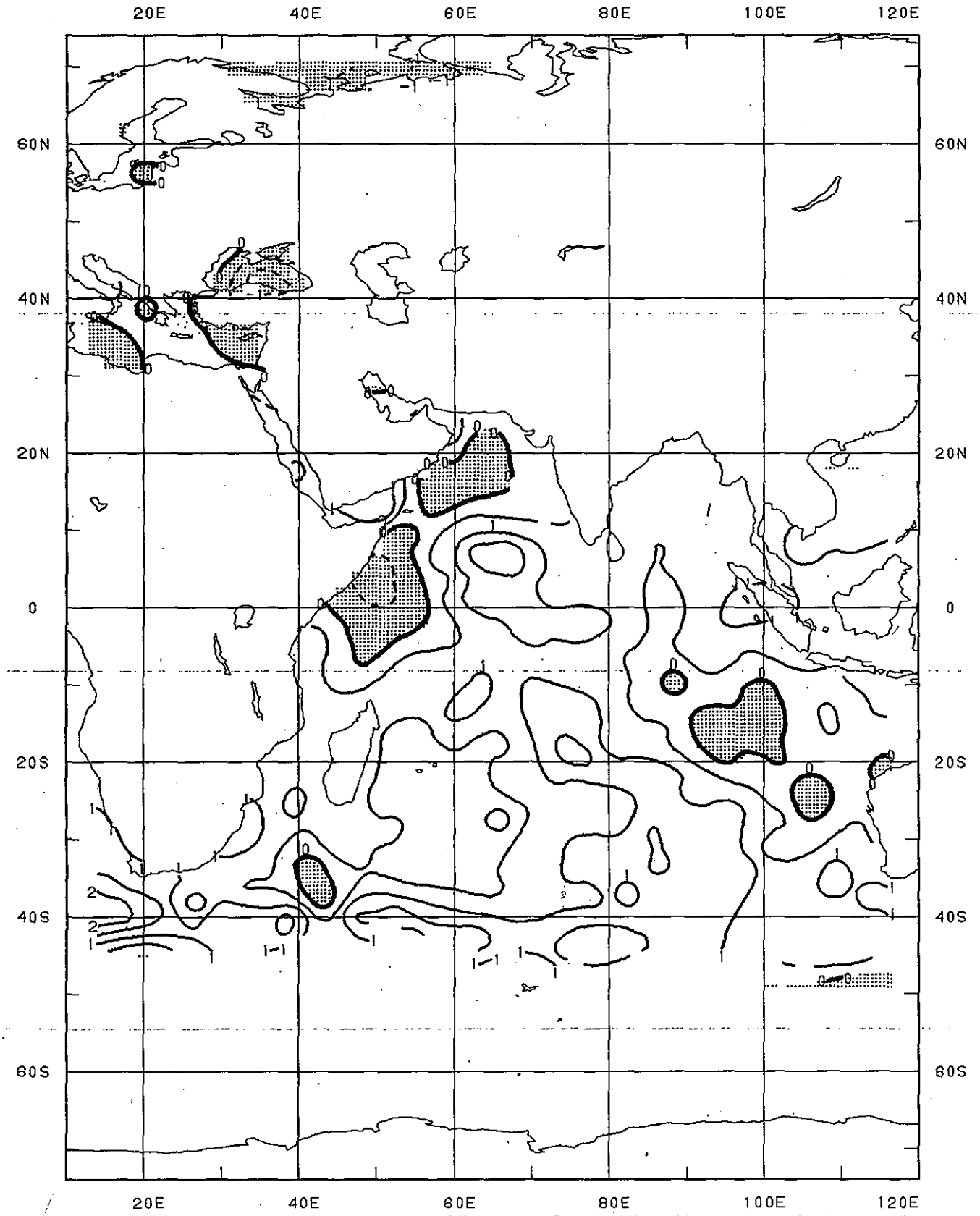
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
JULY 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
JULY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
JULY 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

SUMMERTIME IN SITU OBSERVATIONS OF THE LOOP CURRENT

Michael K. Burdette
National Weather Service Forecast Office
Regional Satellite & Ocean Services Unit
Slidell, LA

Summertime SST conditions in the Gulf of Mexico normally preclude delineation of oceanographic features using standard infrared satellite data or even special processing techniques used in conjunction with multichannel data due to near isothermal conditions that exist in the Gulf. In the absence of a major tropical storm moving thru the area, or the occurrence of an upwelling event, mapping ocean features from satellite data becomes a near impossibility.

During late June and early July, an opportunity presented itself to map the Loop Current in moderate detail utilizing data types other than satellite imagery. ARGOS drifting buoy #42501 (deployed by the Minerals Management Service, Dept. of Interior) made its way into the southeastern Gulf and was entrained in the outer edge of the Loop Current on June 19. The buoy continued to stay with the Loop until about July 4, delineating its outer boundary during that period. Additionally, a very detailed XBT transect was made across the Loop Current on June 25 and 26 by the MV EDGAR M. QUEENY.

Figure 1 shows the trajectory of drifting buoy #42501 from June 11 to July 4 and 24+ hour velocity estimates noted for various sections of the path. Also on Figure 1, note the XBT transect and the reference to particular station numbers which correspond well with the drifter data. Of particular interest is the fact that the drifter was outfitted with a variey of sensors including SST, a 200 meter thermistor string, air temperature, barometric pressure, and a very accurate positioning capability.

Figure 2 shows a time series plot of the SST, the 20 m depth temperature, the 30 m depth temperature, and the 24+ hour average computed velocity. The Loop entrainment event is clearly seen in this figure through the characteristic jump in temperature at various depths. It is also interesting to note the velocity averages prior to and during entrainment.

Figure 3 shows the isotherm contours along the XBT transect. The relatively rapid isotherm displacements are characteristic of the edges of the Loop. Also for comparison, note the boundaries indicated on the XBT transect relative to the track of the drifter.

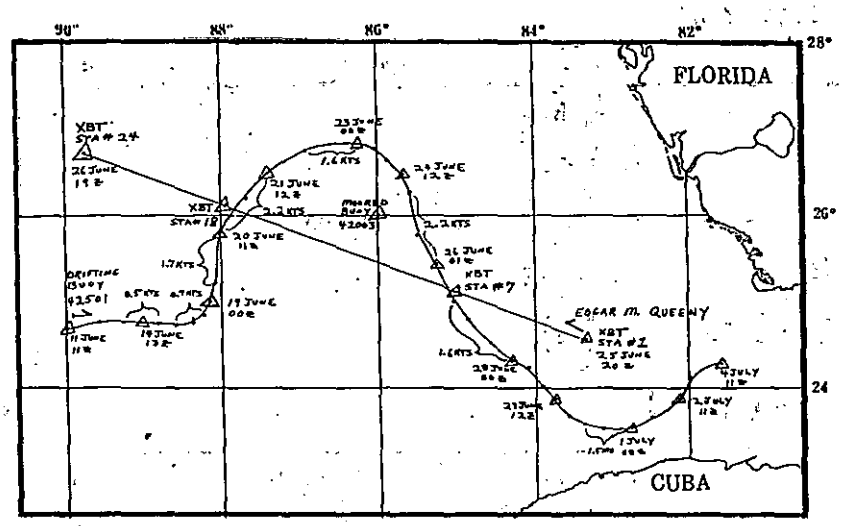


Figure 1. Trajectory of drifting data buoy #42501 during June 11 - July 4, 1986. The estimated current speeds of the buoy are given. Also shown are 4 of 24 station locations along the straight line XBT transect of the E. M. QUEENY on June 24-25, 1986.

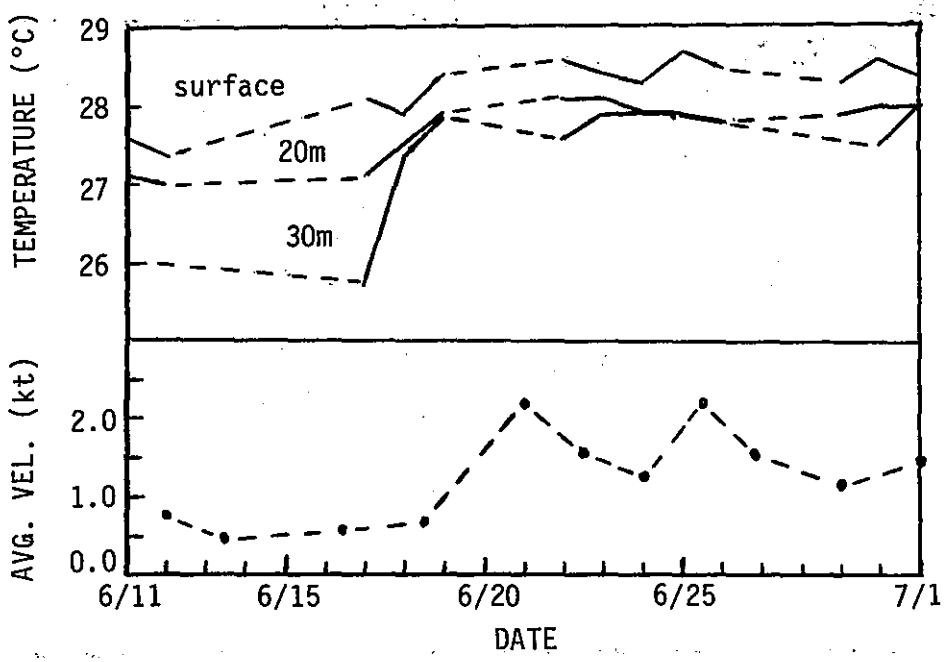


Figure 2. Time series of temperature data (at 3 depths) and the computed 24+ hour average velocity of drifting buoy #42501.

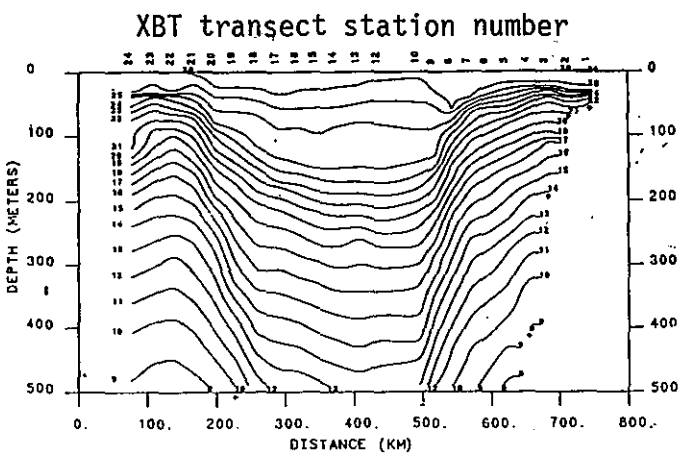
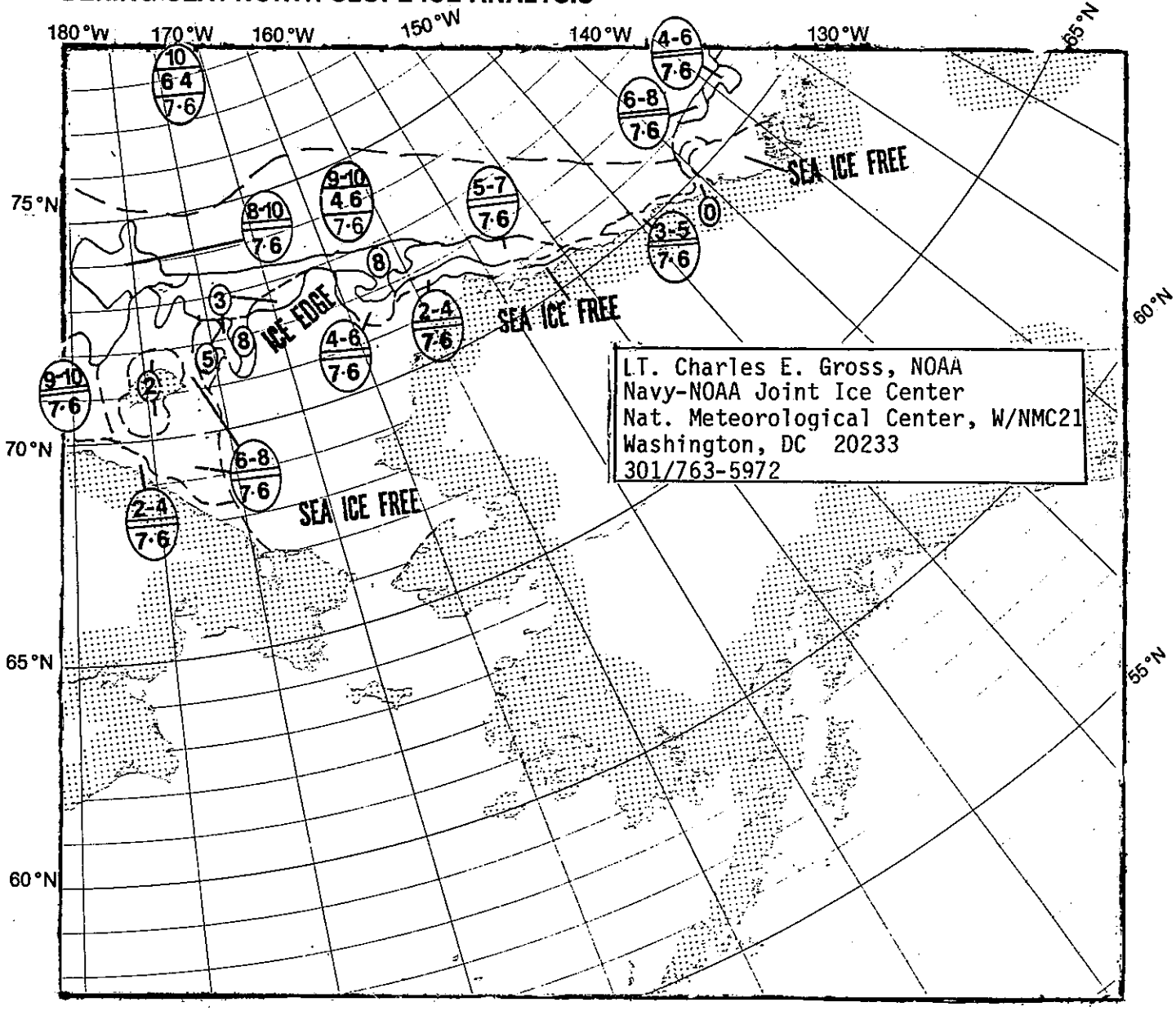


Figure 3. Temperature section of the Loop Current from XBT data of E. M. QUEENY on June 25-26, 1986. (Data courtesy of the Marine Climatology Investigation, NMFS).

BERING SEA / NORTH SLOPE ICE ANALYSIS



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

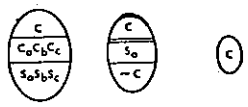
S_a, S_b, S_c = Stage of development of thickest (S_a), 2nd thickest (S_b), and 3rd thickest (S_c) Ice.

-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).

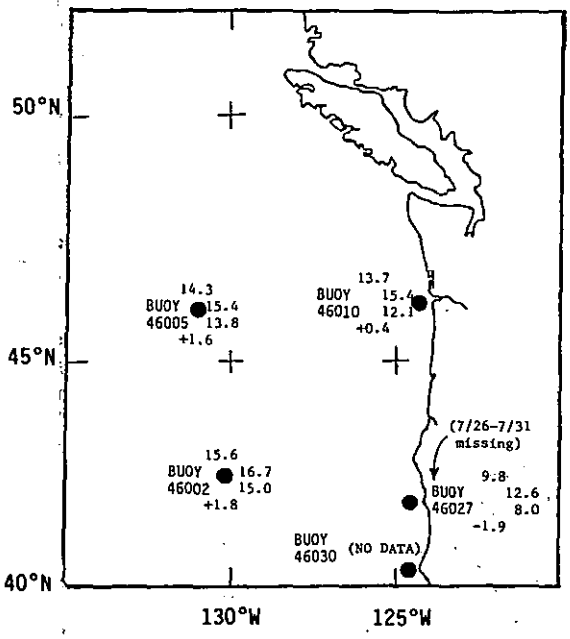
Fast ice. Sea ice which forms and remains fast along the coast.

Ice boundary visually or satellite observed.

Ice boundary estimated.

JULY 1986

The monthly mean sea level pressure circulation depicts a 1028 mb high in the northeastern Pacific near 38°N 143°W and a 1016 mb high in the Beaufort Sea near 73°N 135°W. Mean surface geostrophic winds are southwesterly south of Point Lay (70°N 163°W) and light and variable on the Alaskan North Slope. Monthly mean surface air temperatures are above normal at Barrow (71°N 157°W) and Nome 65°N 165°W). A coastal lead extending as far east as Dease Inlet (71°N 155°W) developed late in the month; however, reduced concentrations (3-5 tenths) of old and first year ice remained along the coast from 153°W to 155°W and from 143°W to 148°W. The current ice edge position is between the median and the minimum throughout the Chukchi Sea.



JULY 1986

Steady warming in offshore waters and periodic warming and cooling episodes in coastal waters resulting from fluctuations in upwelling intensity characterize the North Panel area. Offshore SSTs average 1.5 - 2.0°C higher than June. Coastal SSTs, when averaged along the entire coast, show little change from June, as increased seasonal heating is offset by more persistent coastal upwelling. The strongest upwelling events occurred near the middle and end of the month, and showed the normal latitudinal variation being strongest along the southern portion of the coast and weakest in the north. Thermal boundaries associated with upwelling are evident on several satellite images. The most complex of these boundaries, exhibiting several wavelike plumes and filaments of cool upwelled water from the mid-Oregon coast southward, are seen on imagery from July 17. The SSTs in the North Panel area are near normal, the vast majority being within plus or minus 1°C of climatological means.

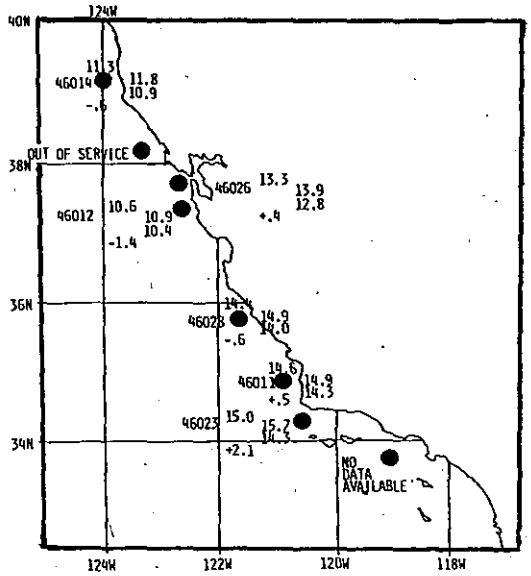
KEY:

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

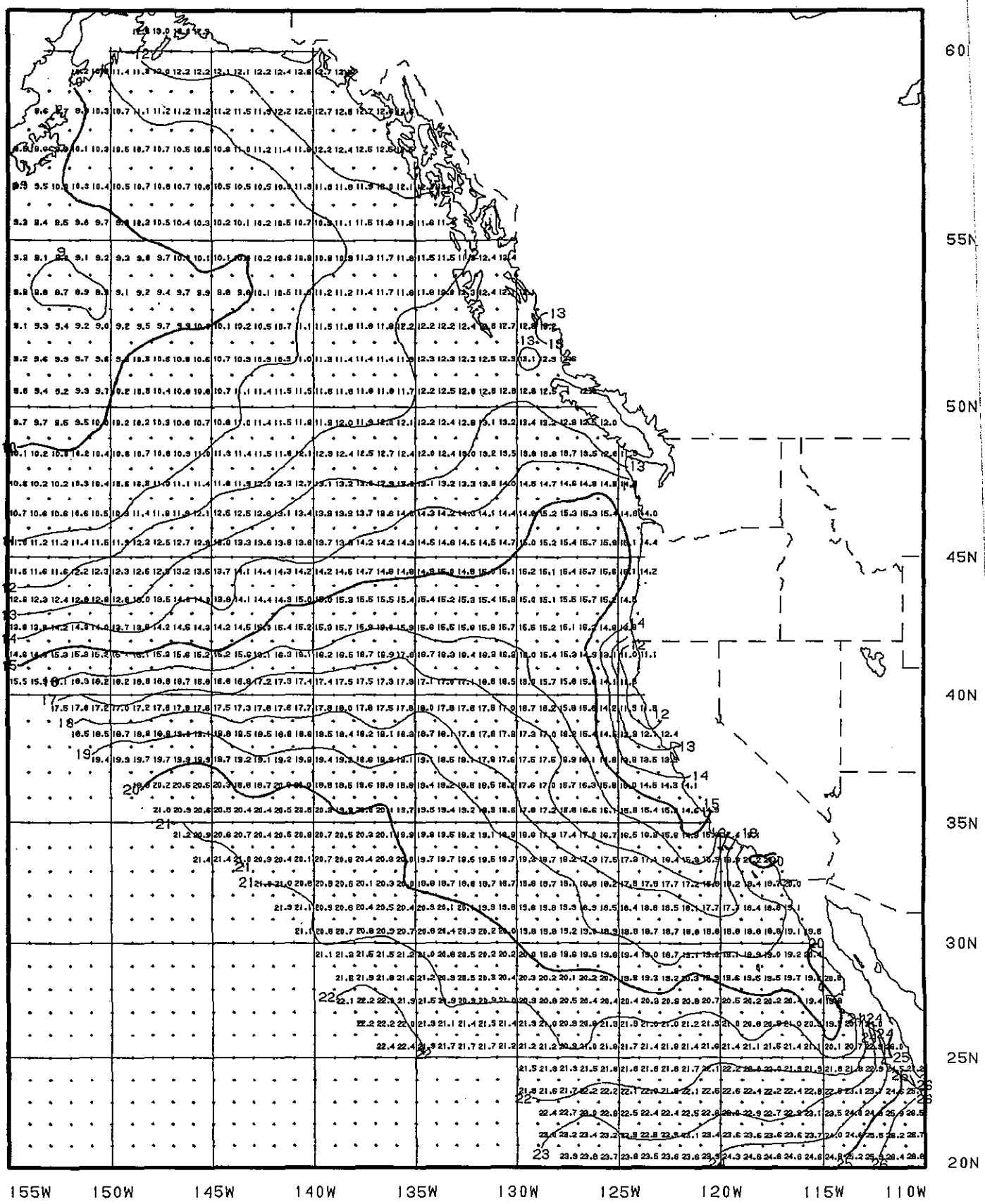
● Denotes station position.

North Panel
Kent Short
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, Wa 98115
(206) 526-6604
FTS 392-6604

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

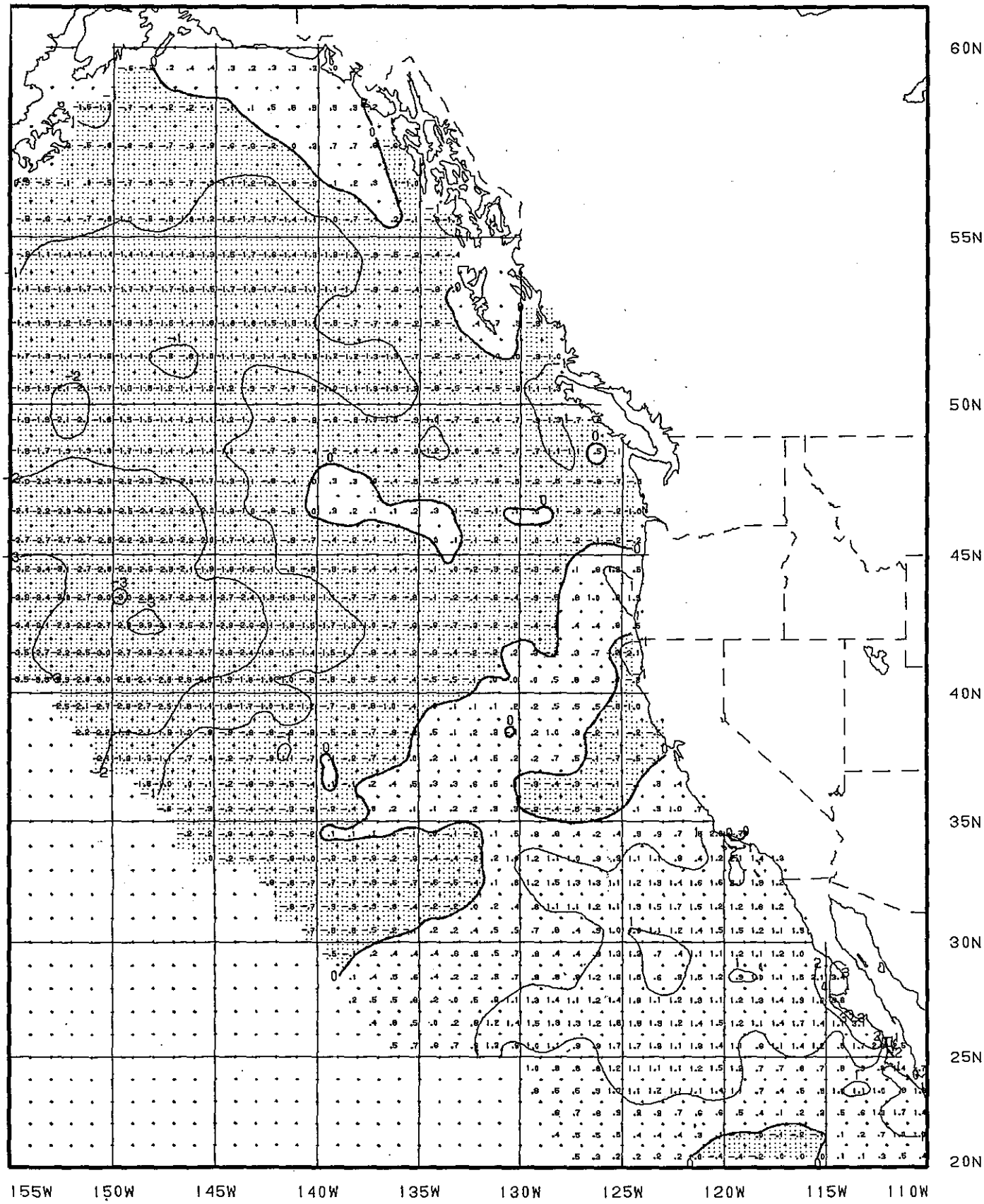


Both nearshore and offshore SSTs continue to be above normal. The largest warm anomaly observed was over 2.0°C along the Southern California and Northern Baja Coasts. Near Pt. Arena (39°N 125°W) the SSTs averaged 0.4°C below normal; this was most likely due to the continuous upwelling activity in that vicinity. The South Panel had normal climatological warming. The largest warming (2.3°C) during July was in the Los Angeles Bight. The area near Pt. Arena was the only location that cooled (0.4°) when compared to June. Fixed buoy statistics showed a mixture of warming and cooling. Those along the north and central coast cooled in response to upwelling. The only exception was buoy #46026 which was influenced by the warm tidal outflow from the San Francisco Bay. For the first 3 weeks of July, coastal upwelling boundaries could be seen on satellite infrared imagery. These clear images were due in part to the offshore flow which pushed the fog and low clouds seaward.



West Coast
SST--MONTHLY MEAN (°C)
July 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



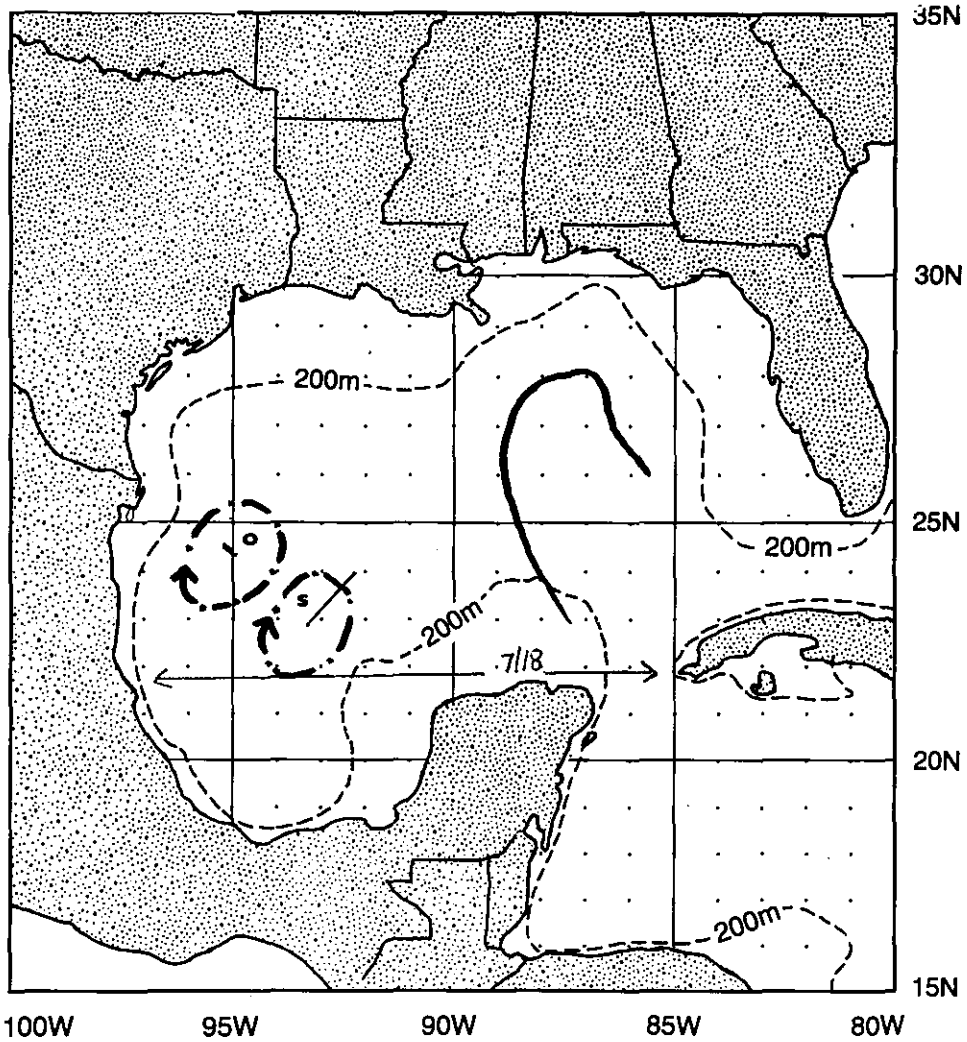
West Coast
SST--MONTHLY ANOMALY (°C)
July 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

EAST COAST OCEAN FEATURES

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 NW 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. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

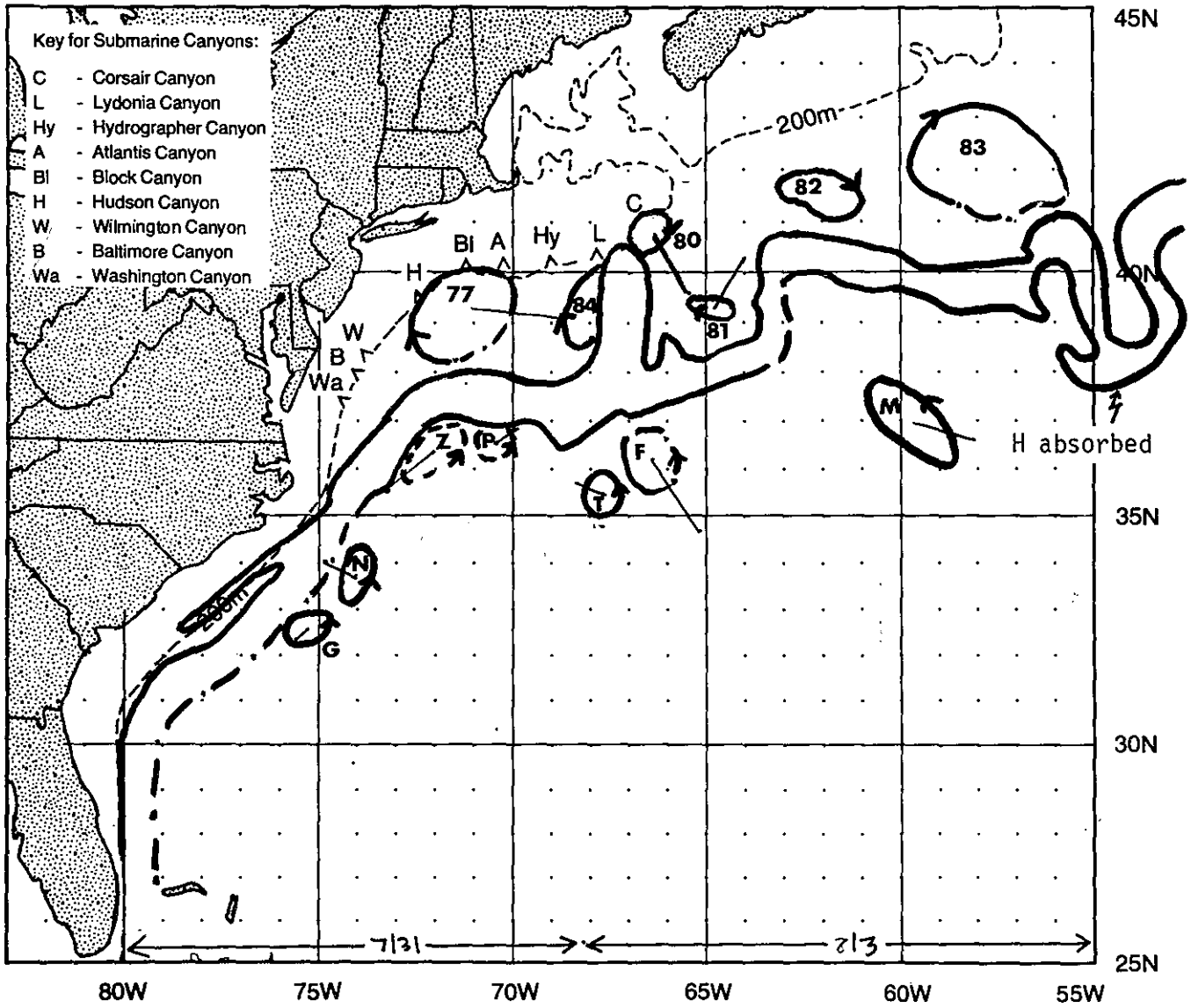
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

JULY 1986

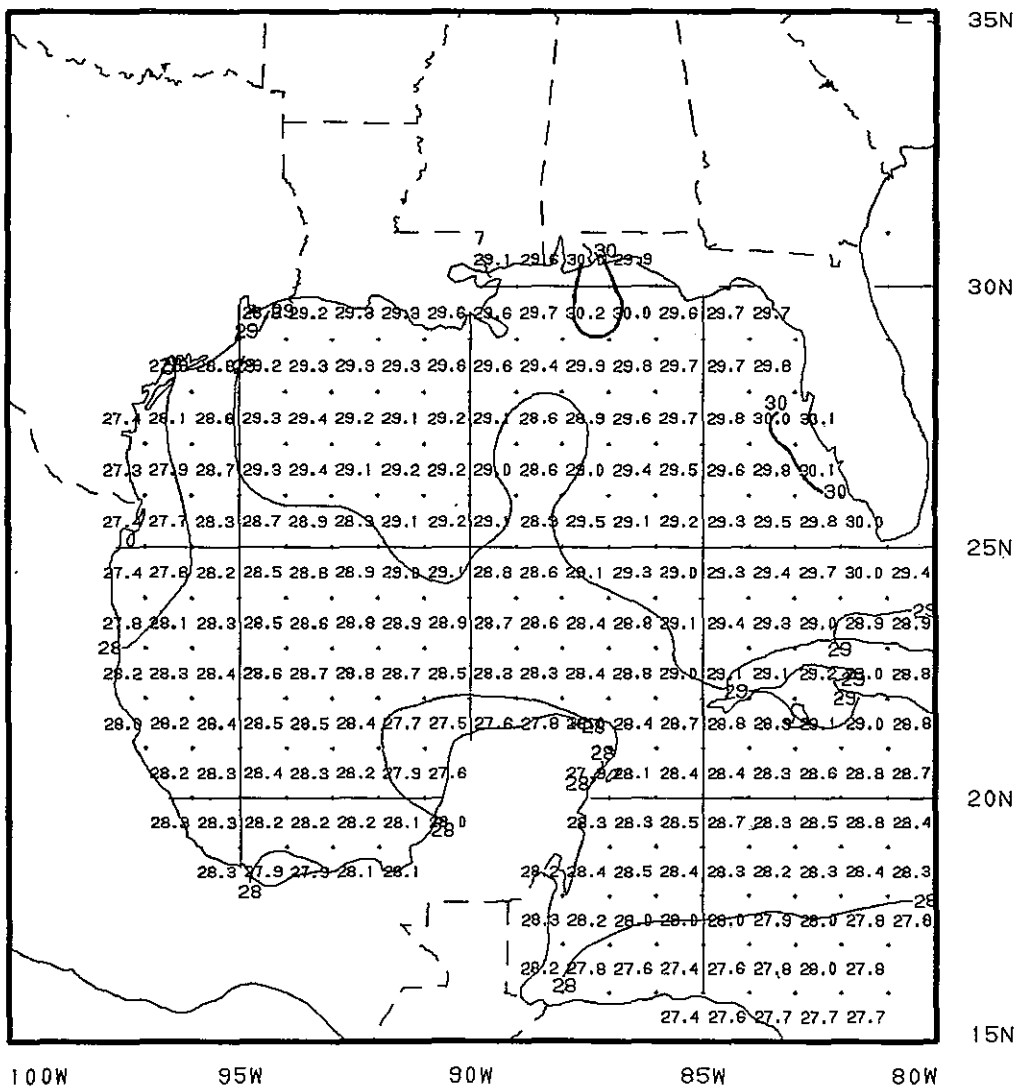
On July 18 the Loop Current in the Gulf of Mexico was partially discernible according to thermal infrared satellite imagery. Usually the Loop Current is warmer than the surrounding Gulf of Mexico water. However due to the intense surface heating of the surrounding Gulf of Mexico water, the Loop Current appeared slightly cooler. The amplitude of the Loop Current had increased 140 km by July 18 compared to the end-of-June northernmost penetration. The positions of eddies o and s were estimated by drifting buoy data. By July 18 eddy s apparently translated 165 km SW and eddy o apparently translated 25 km SE.



Three new anticyclonic eddies formed and three anticyclonic eddies were absorbed during July. Eddy 82 formed from a Gulf Stream meander near 41°N 62°W around July 9. Eddy 83 formed from an aneurism of a meander near 42°N 58°W around July 23. Eddy 84 formed from an aneurism of a meander near 40°N 68°30W around July 25. Eddy 72 was apparently absorbed by eddy 80 around July 18. Eddy 78 was last observed around July 10. Its current status is unknown. Eddy 79 was absorbed by a Gulf Stream meander near 42°N 57°W around July 7. Eddy 77 traveled 210 km WNW. Eddies 80 and 81 apparently translated 150 km NW and 130 km SW, respectively.

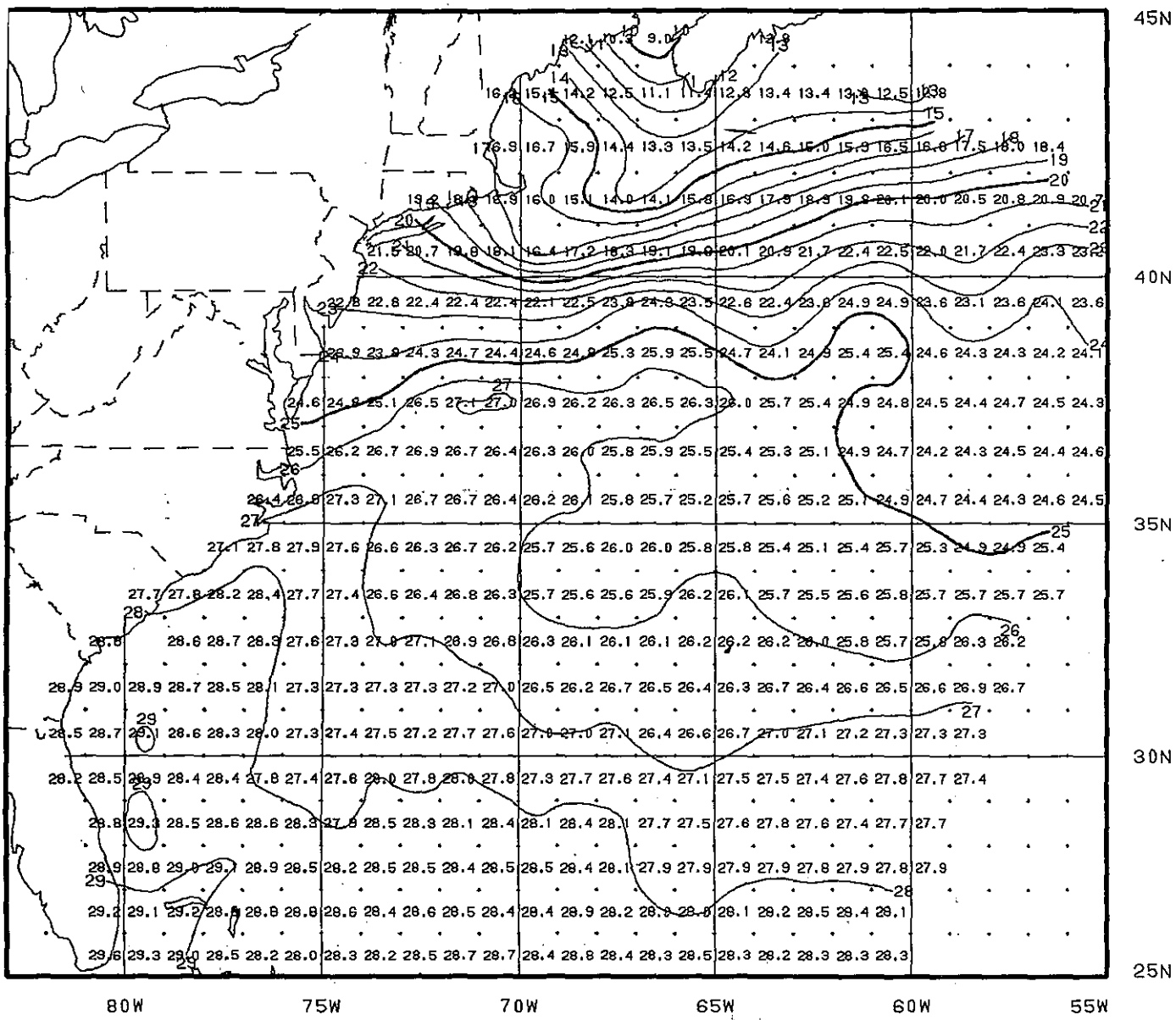
Cyclonic eddy H was absorbed by a Gulf Stream meander near 39°N 54°W around August 4. Eddy G moved 55 km NE. Eddy N translated 65 km SE. Eddy Z moved 140 km NE and eddy P moved 35 km SW when they were last observed on July 9. Eddy T traveled 65 km ESE by July 19. Eddy F translated 195 km NW. Eddy M traveled 140 km WNW. Eddies K, O, and J were not observed during July.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
July 1986

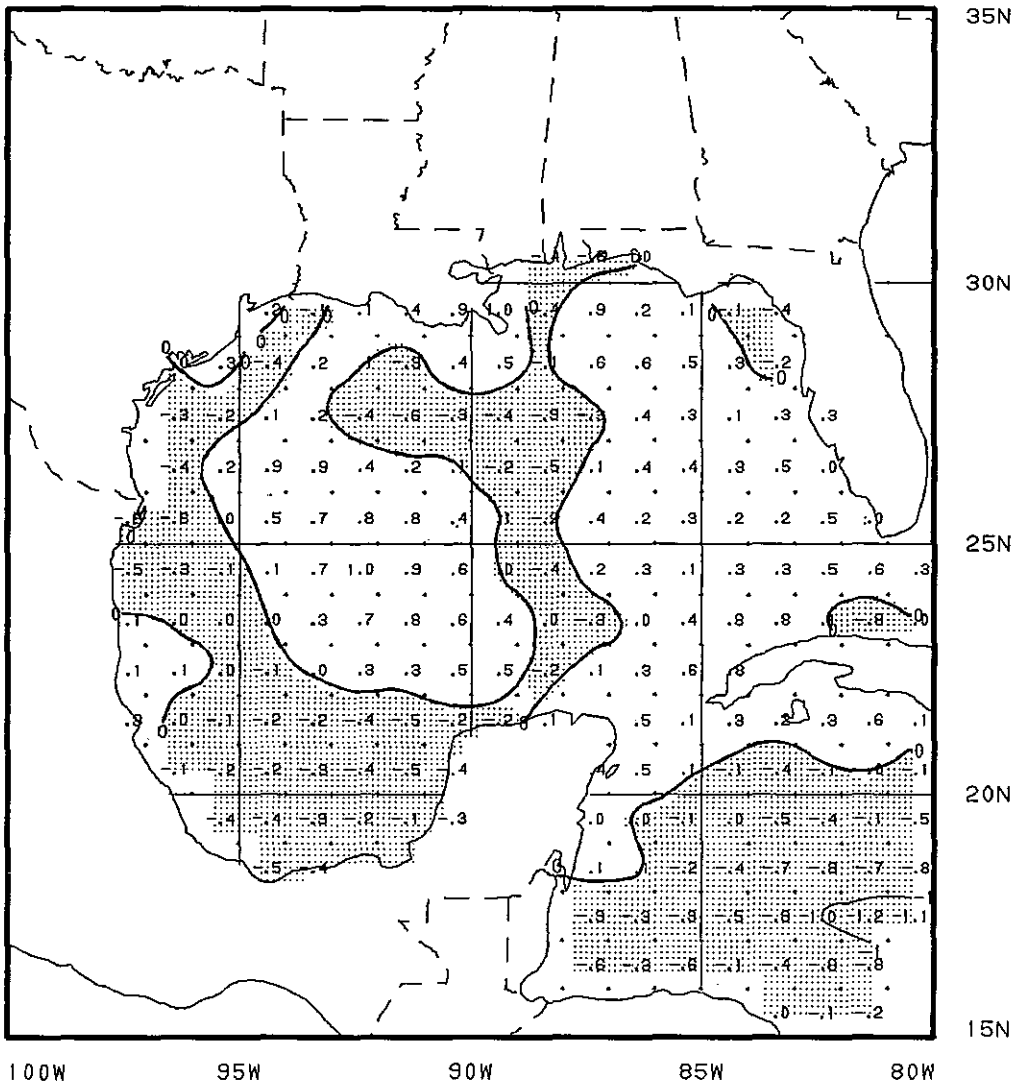
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
July 1986

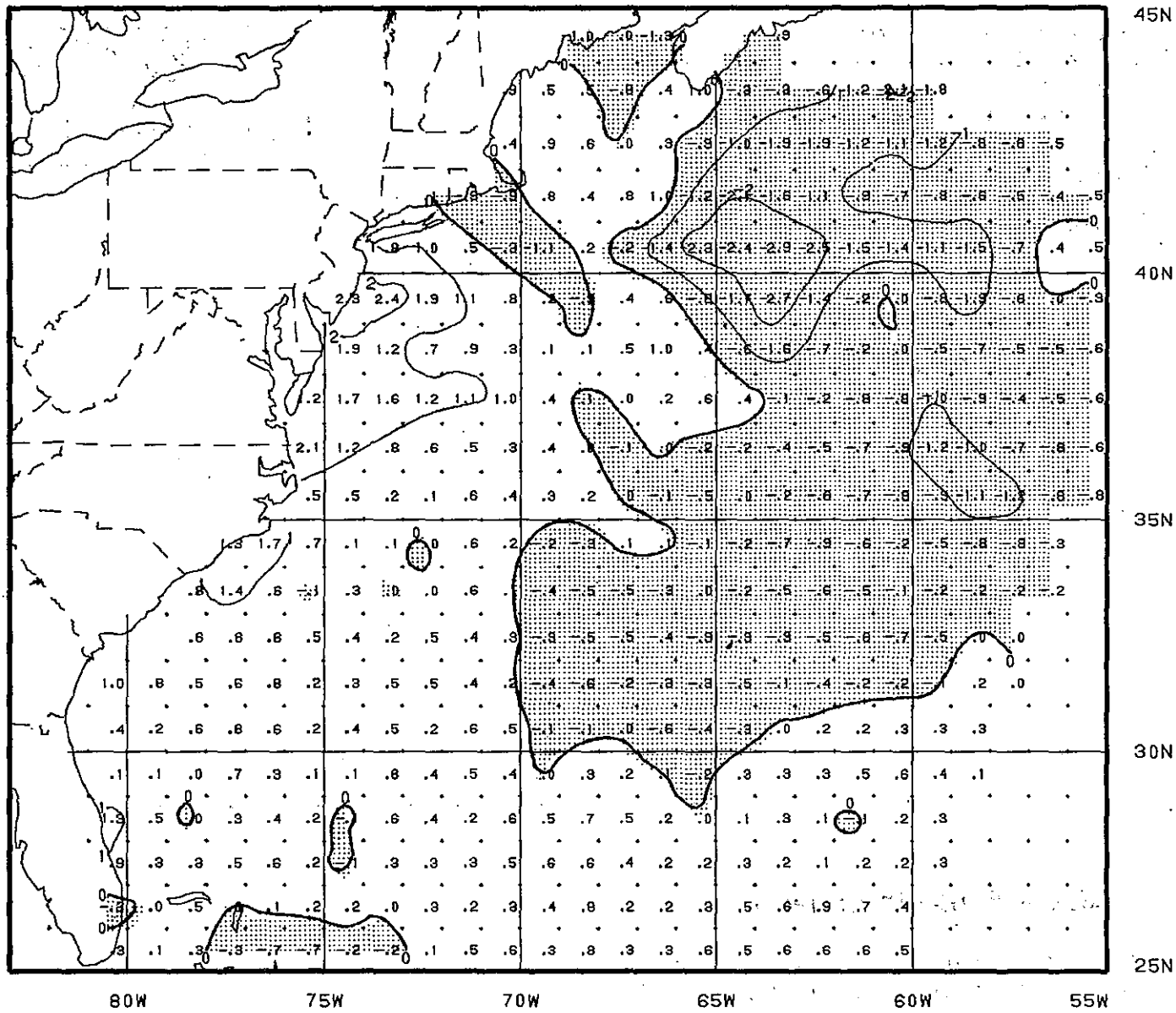
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
July 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
July 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE WA 98115-0070

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

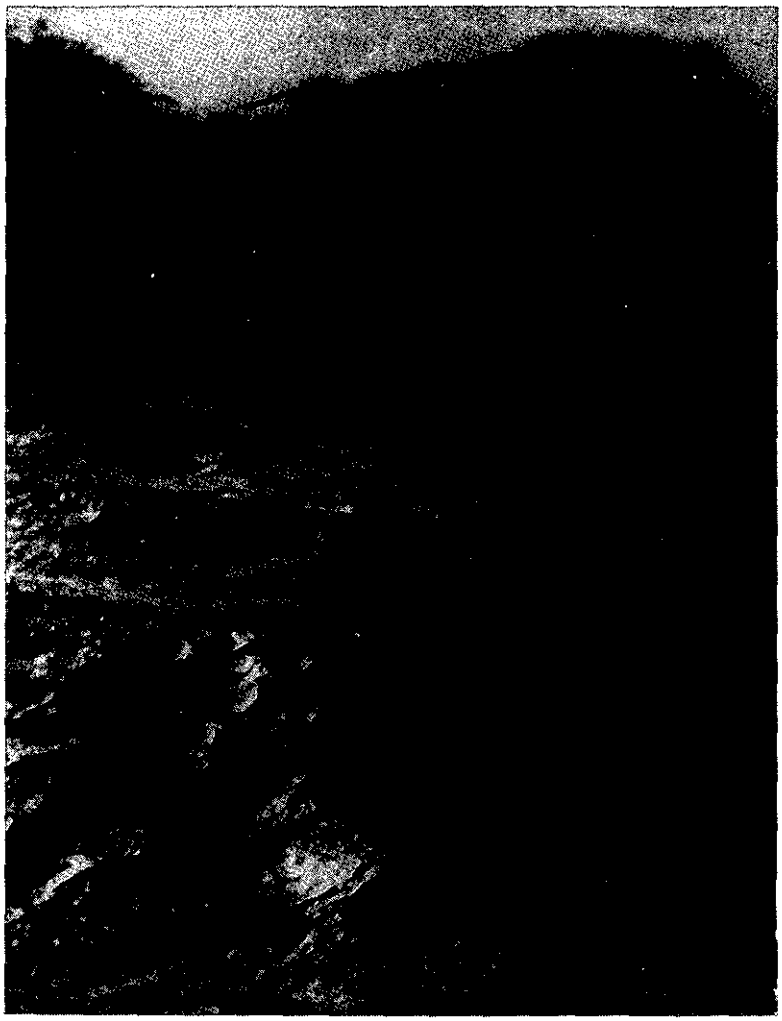
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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 September 30, 1986.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 8 August 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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 and the Climate Analysis Center (CAC) 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] *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 *Oceanographic Monthly Summary* 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.

Reynolds, R.W. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.

[2]Reynolds, R.W., 1982. A Monthly Averaged Climatology of Sea Surface Temperatures; *NOAA Technical Report NWS 31*.

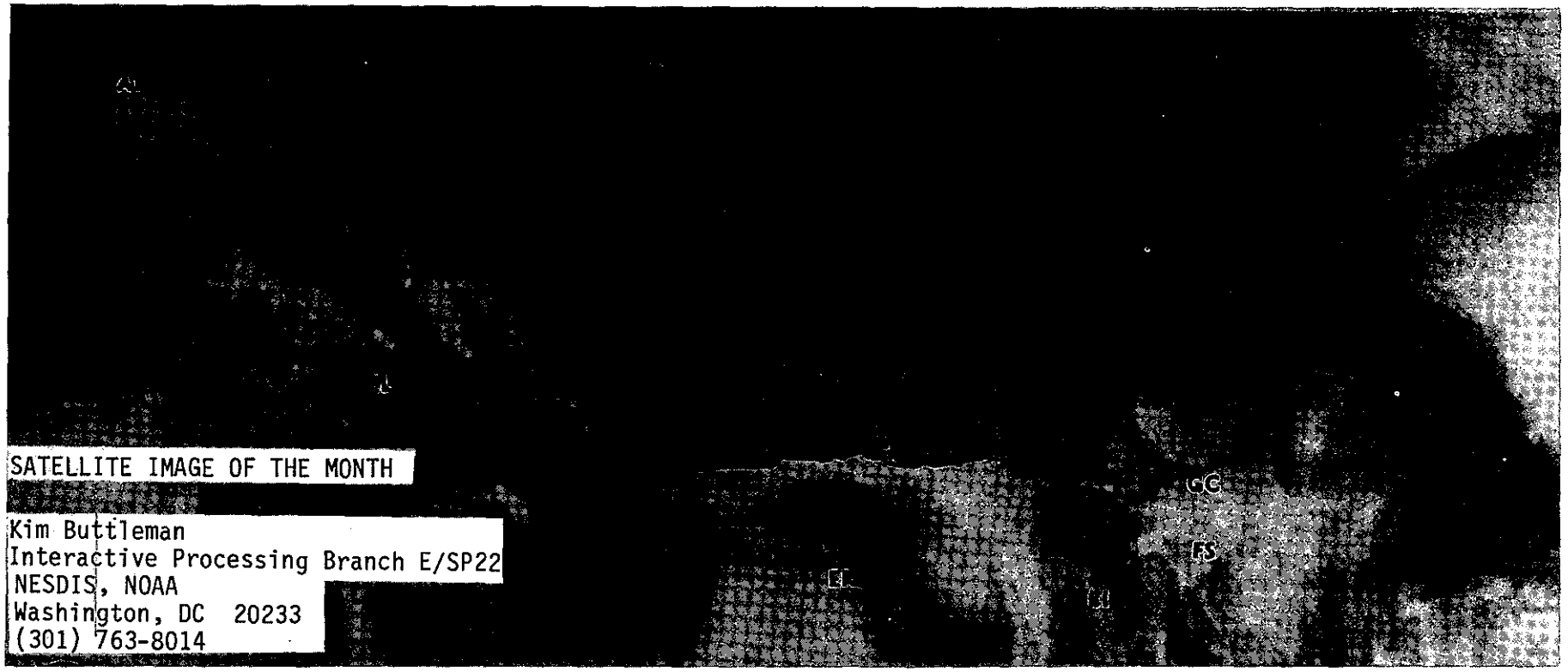
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2*.
Robinson, M.K., R.A. Bauer, and E.H. Schroeder, 1979. Atlas of North Atlantic-Indian Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 18*.

Oceanographic Monthly Summary

Editor: Steve Auer
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

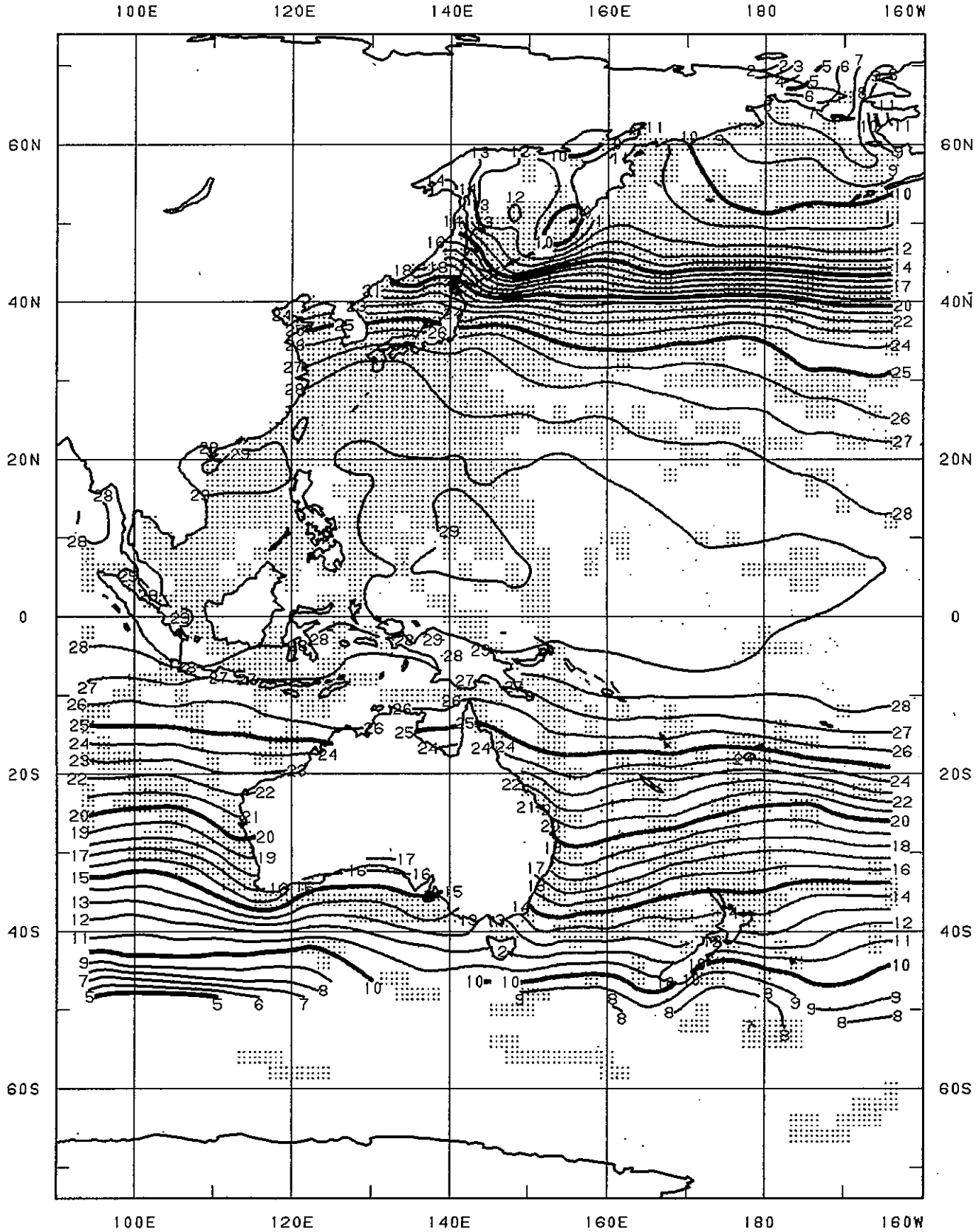
Typing: Damita Johnson



THE GRAND CHASM

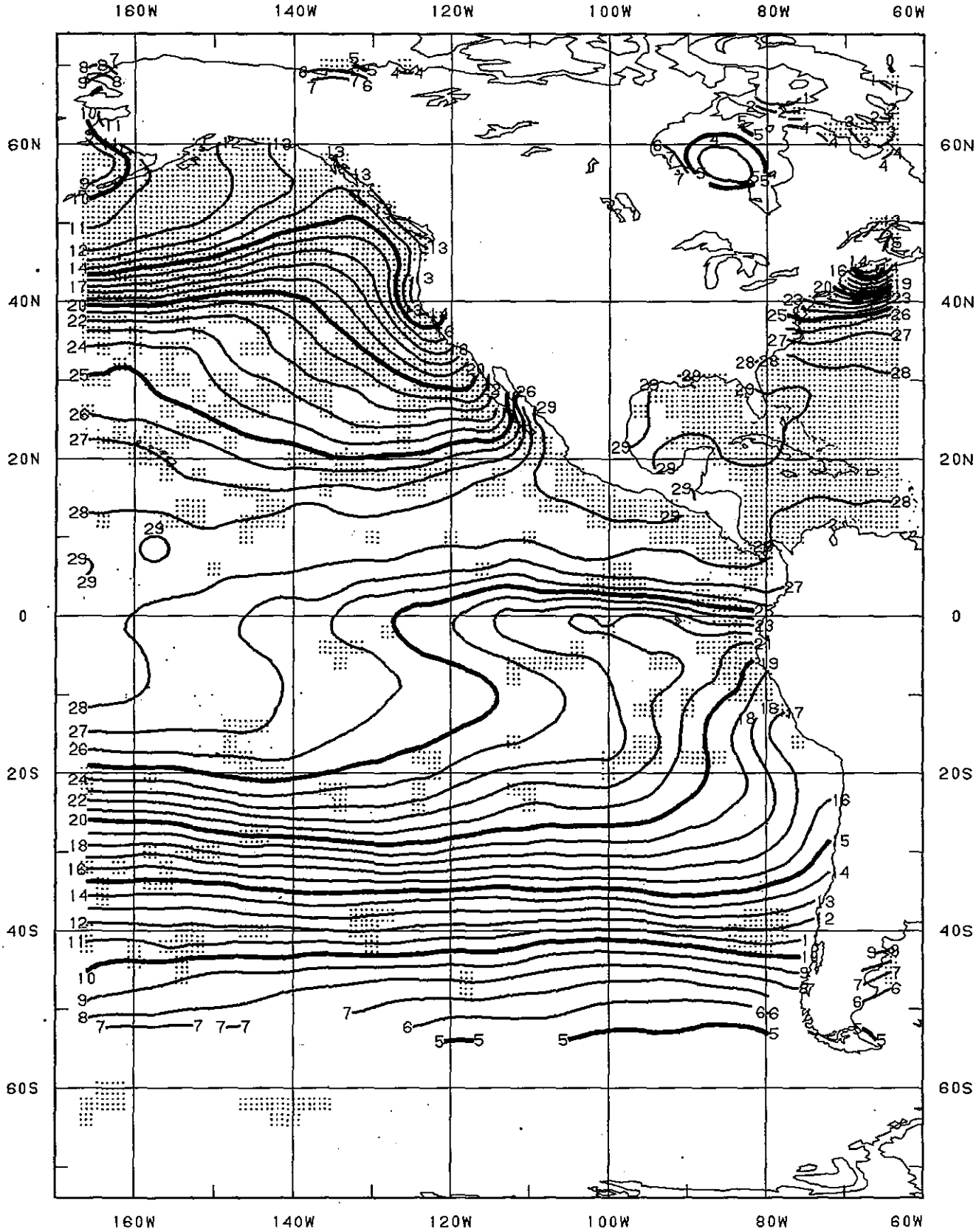
This image (NOAA-9, AVHRR ch 4) from July 23, 1986 (3:52 GMT) shows the coast of Antarctica from approximately 30°W to 60°W. Included are the Weddell Sea (WS), the Antarctic Peninsula (AP), Ellsworth Land (EL), Coats Land (CL), Berkner Island (BI), and the Edith Ronne and Filchner Ice Shelves (ERS and FS). At the north end of the Filchner Ice Shelf is the remants of the crevasse called the Grand Chasm (GC).

This area was first explored in 1955 to 1958 by the British Commonwealth Transarctic Expedition. The crevasse was then described as being approximately 100 km long, from 400 m to 5 km wide, and up to 53 m deep. It slowly enlarged until recently, when, apparently in June, the rupture was completed. An area approximately 90 km x 210 km broke off, generating three major and a number of smaller ice islands. Included are the sites of the old Ellsworth Station (U.S.) and Druzhnaya (U.S.S.R.). The ice thickness at the ice front has been measured at 230 m and at 510 m near the break. Some motion has subsequently occurred. The bergs can be expected to move in a clockwise arc across the Weddell Sea and up the east coast of the Antarctic Peninsula. Should they ground along the way, their life expectancy is indefinite. If they do not ground, they may be carried into the southern South Pacific and Indian Oceans, and may survive two years or longer.



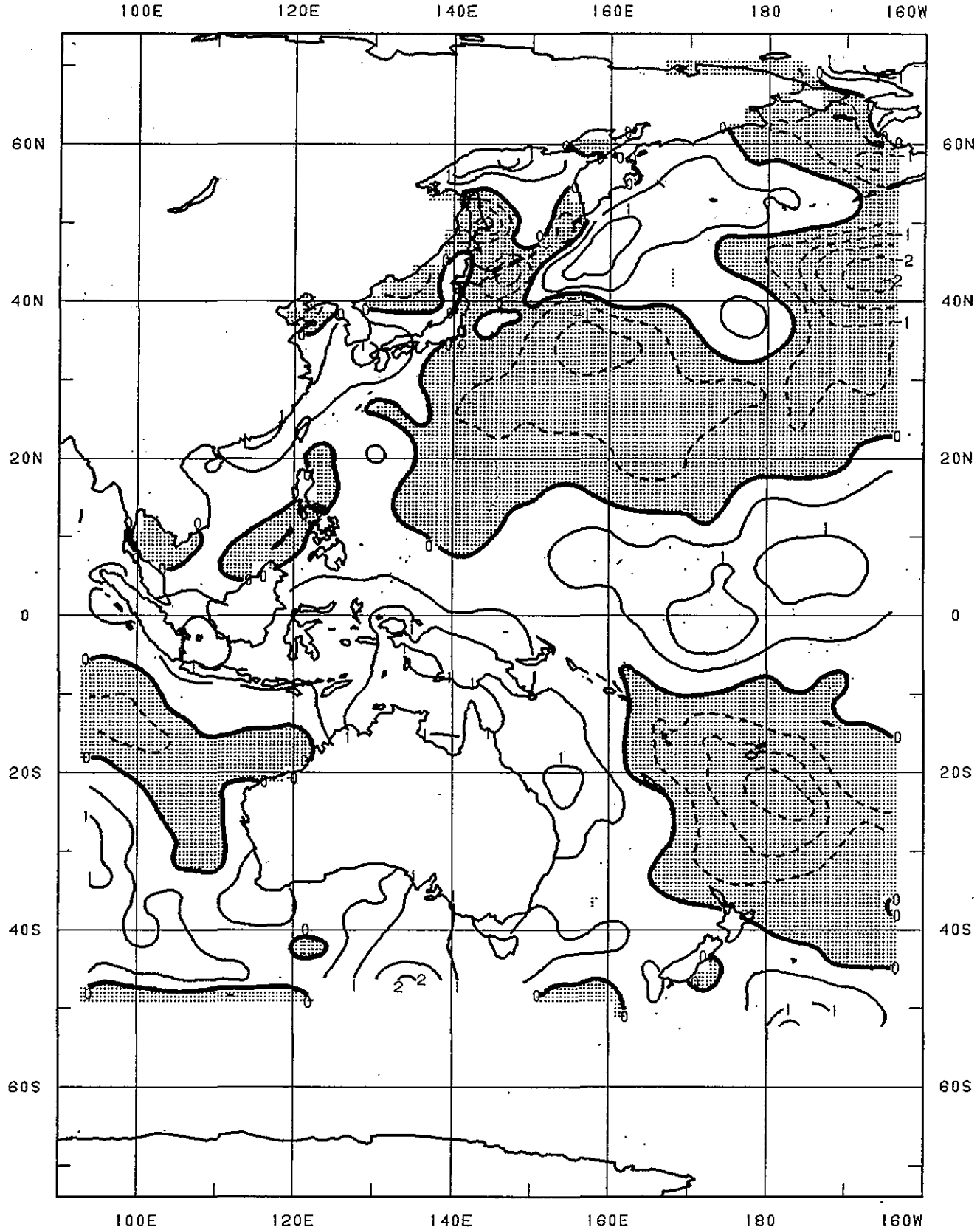
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



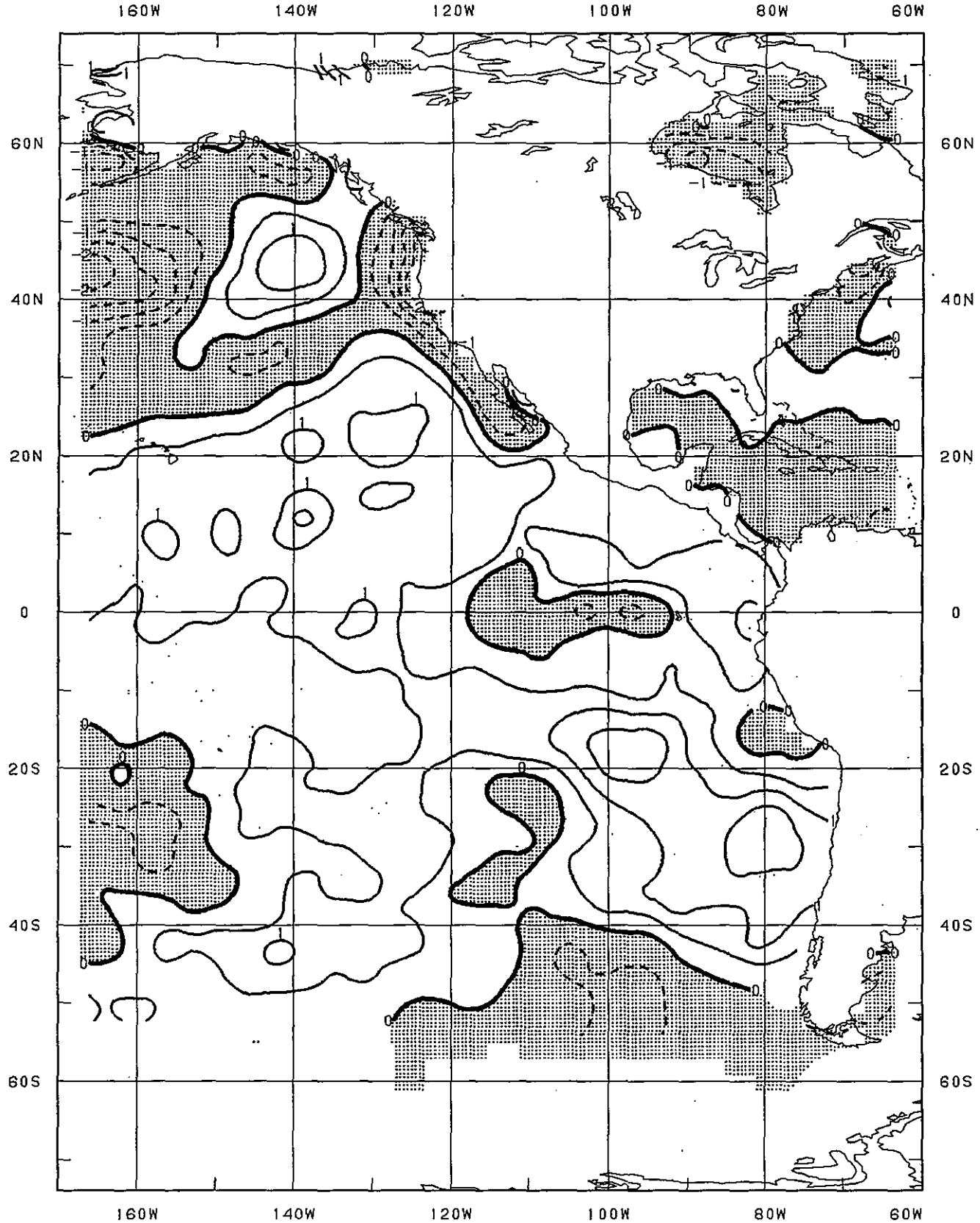
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



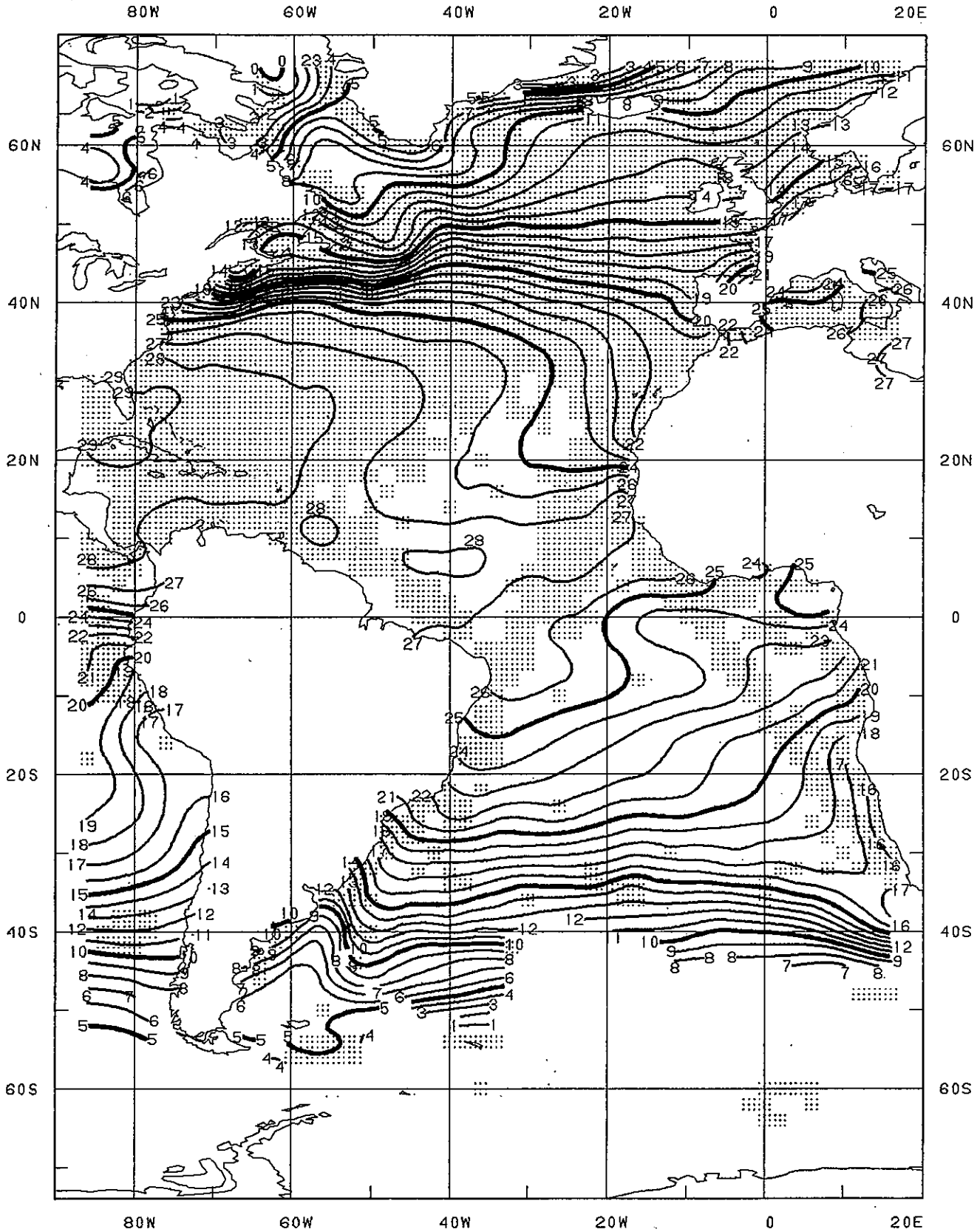
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



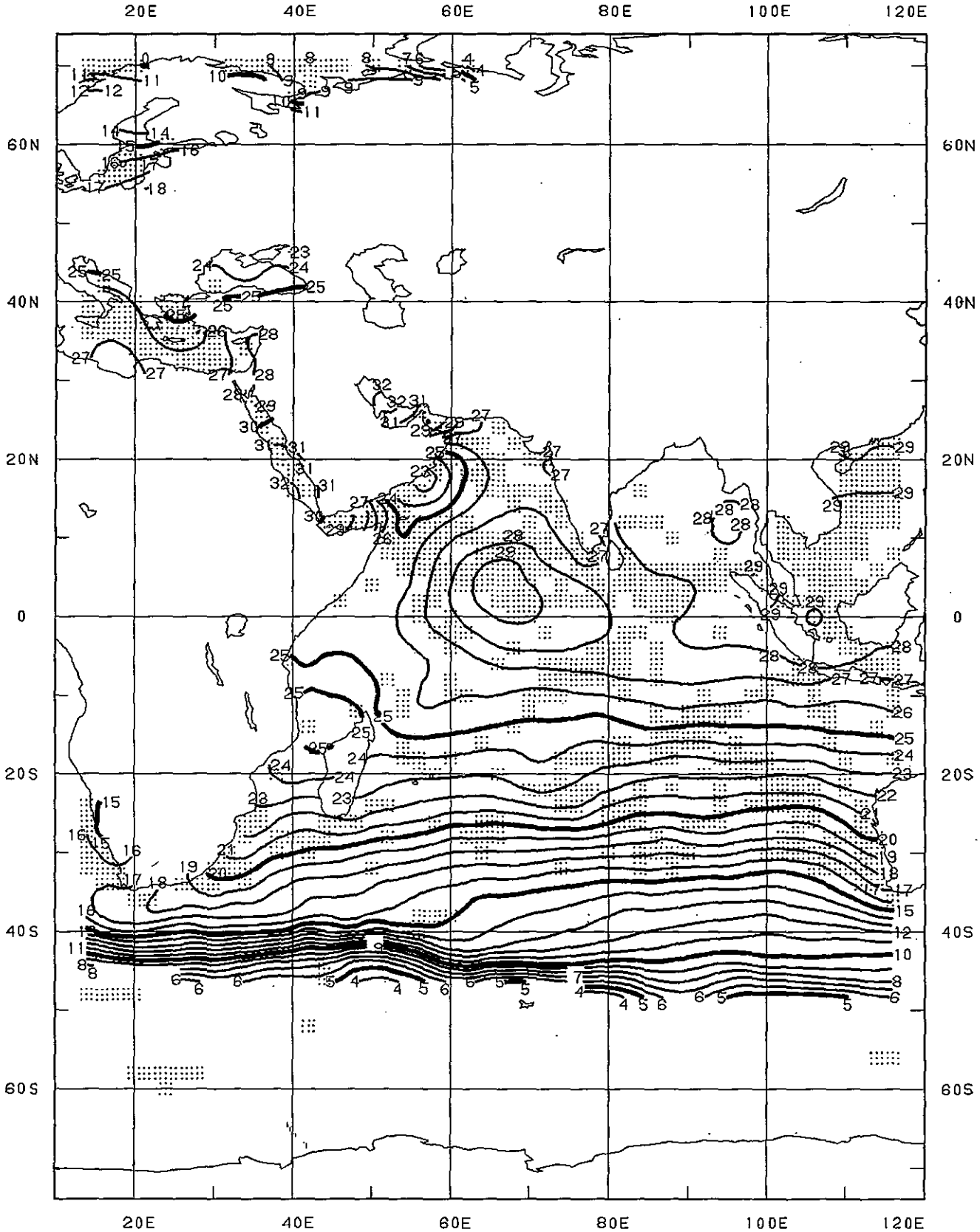
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



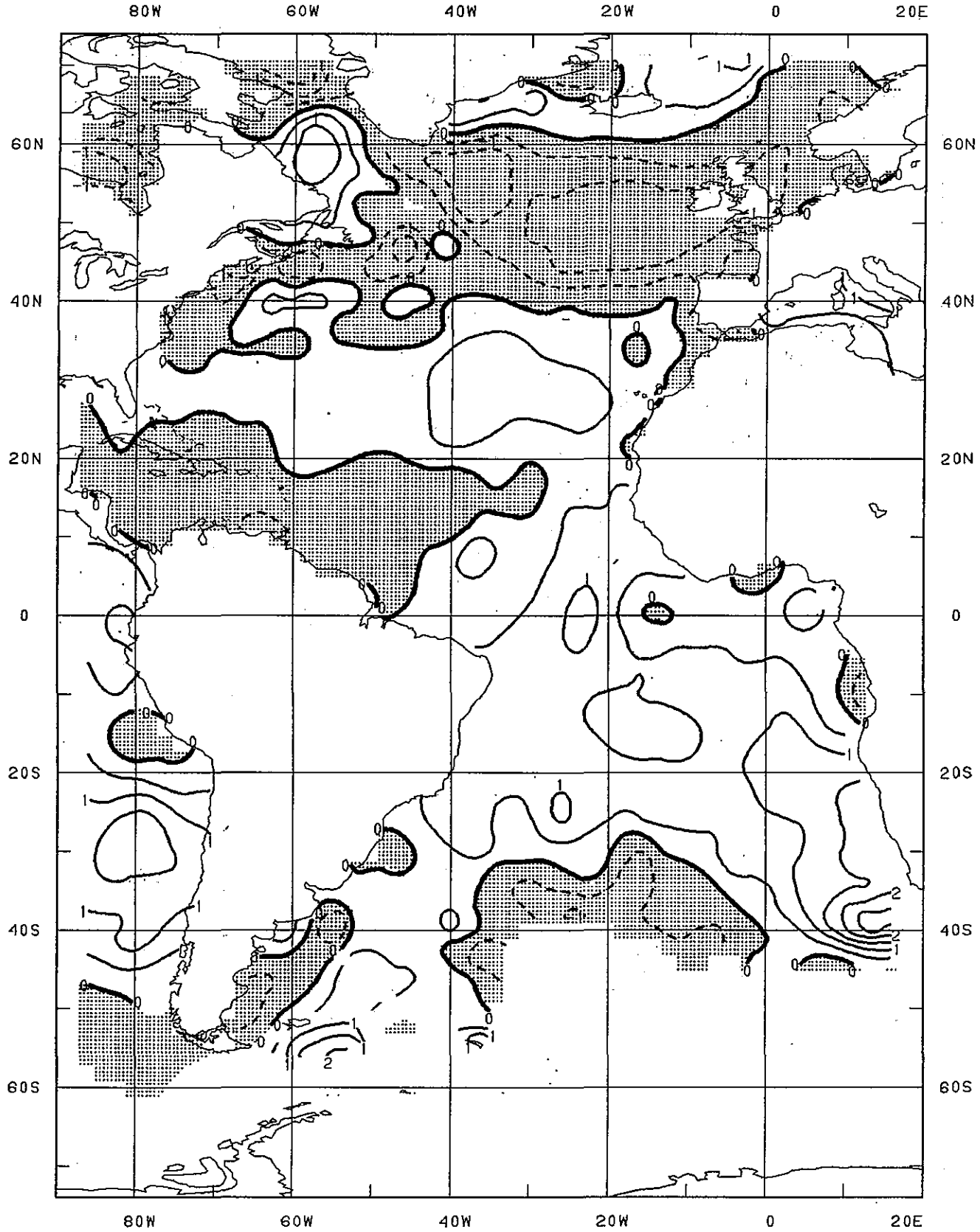
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



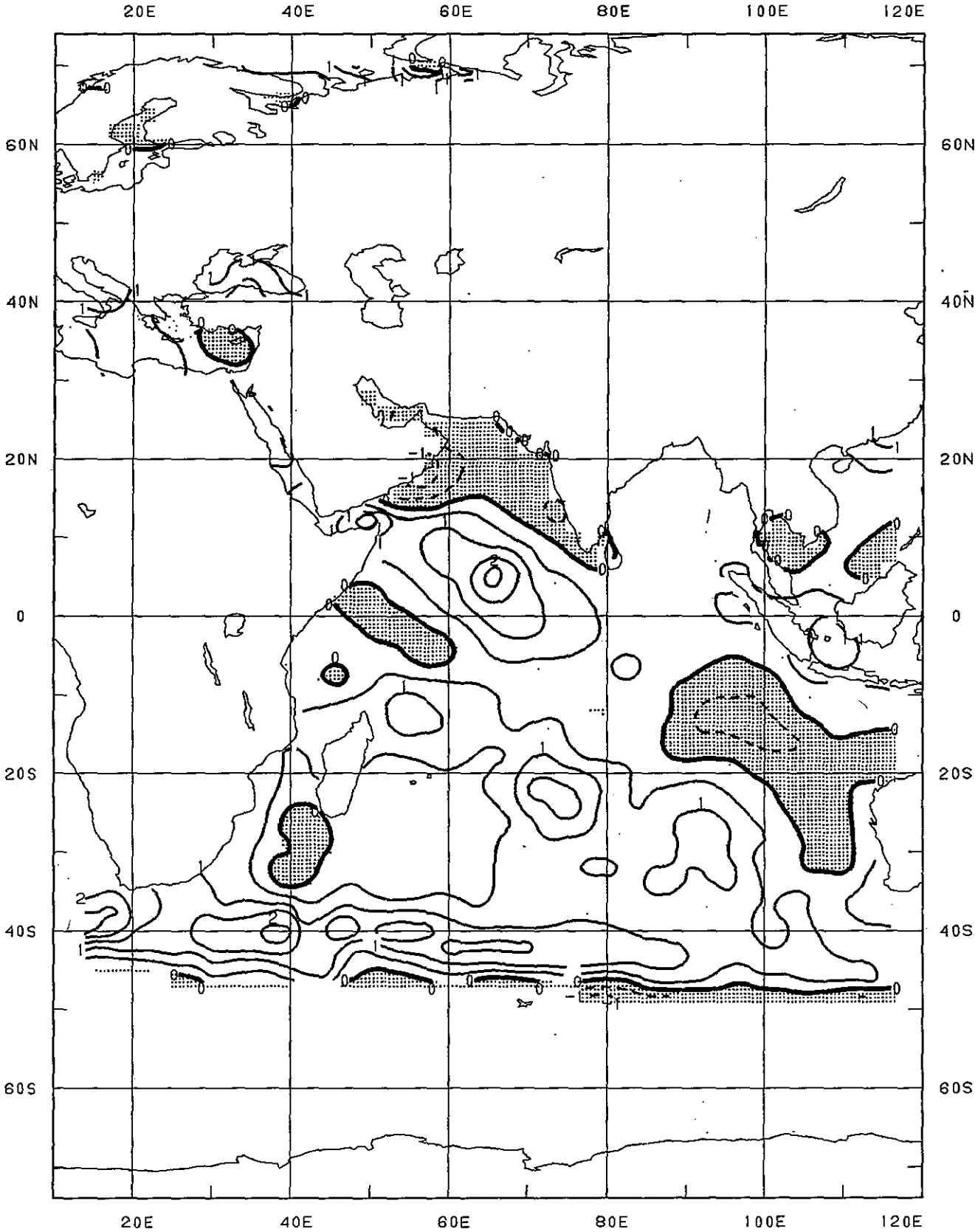
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
AUGUST 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

SLAR and AVHRR Imagery of Ocean Frontal Features East of the Grand Banks

Neal B. Thayer and Donald L. Murphy
U.S. Coast Guard, International Ice Patrol
Groton, Connecticut 06340

Side-Looking Airborne Radar (SLAR), a real aperture imaging radar, has been used by the U.S. Coast Guard's International Ice Patrol (IIP) since 1983 as its main method of iceberg reconnaissance. The geographical area of responsibility of IIP is centered around The Grand Banks of Newfoundland, an area of complex hydrodynamics containing the Labrador Current and the North Atlantic Current (Gulf Stream). With its all-weather capabilities, SLAR has proven to be a very useful iceberg reconnaissance tool for the foggy waters of the Grand Banks.

Imaging satellite and airborne radars have long been known to have the capability to detect ocean features (fronts, eddies, and internal waves) which modulate the short gravity portion of the surface wave spectrum. Imaging radars are able to map the surface wave field through their sensitivity to the amount of energy contained in a small portion of the surface wave spectrum. Through a resonance phenomenon called Bragg scattering, each radar achieves maximum backscatter (return signal) from a specific surface wavelength. The critical wavelength is a function of the wavelength of the incoming radiation and the incidence angle. For the range of incidence angle encountered in IIP SLAR, the critical surface wavelength ranges from 2 to 30 cm.

The active microwave SLAR and the passive infrared AVHRR (Advanced Very High Resolution Radiometer) offer complimentary mapping capability for ocean features like fronts and eddies. SLAR is unaffected by clouds and offers greater detail and positioning accuracy than AVHRR, but is spatially limited (area of approximately 70,000 sq. km). AVHRR is able to map a much larger area, putting SLAR imagery of ocean features in context, but is unable to penetrate cloud cover and cannot resolve features that are below mesoscale (10 km) in size.

Figures 1 and 2 show an IIP SLAR image and NOAA-9 infrared AVHRR satellite image of the ocean area near 45°N 48°W, taken within eight hours of one another on May 17, 1986. The AVHRR shows the general detail of a large ocean area containing the North Atlantic Current (NAC), the Labrador Current water (LAC), and a warm eddy (WE). The SLAR exhibits great detail of the boundary between the southern edge of the warm eddy and the cold Labrador Current water being entrained around the eddy. Both images show a complex interleaving of warm water (dark in both images) and cold Labrador Current water (the light cusp-like features).

KENT SHORT LEAVES OMS STAFF

The Oceanographic Monthly Summary staff extends their best regards to Kent Short who has left the NOAA/Northwest Ocean Service Center to pursue a career in private industry. Kent has reported on the monthly conditions in the North Panel section of the West Coast (p. 15) since the OMS began in January 1981. We also wish to welcome Lee Morgan who is assuming charge of this regular feature.

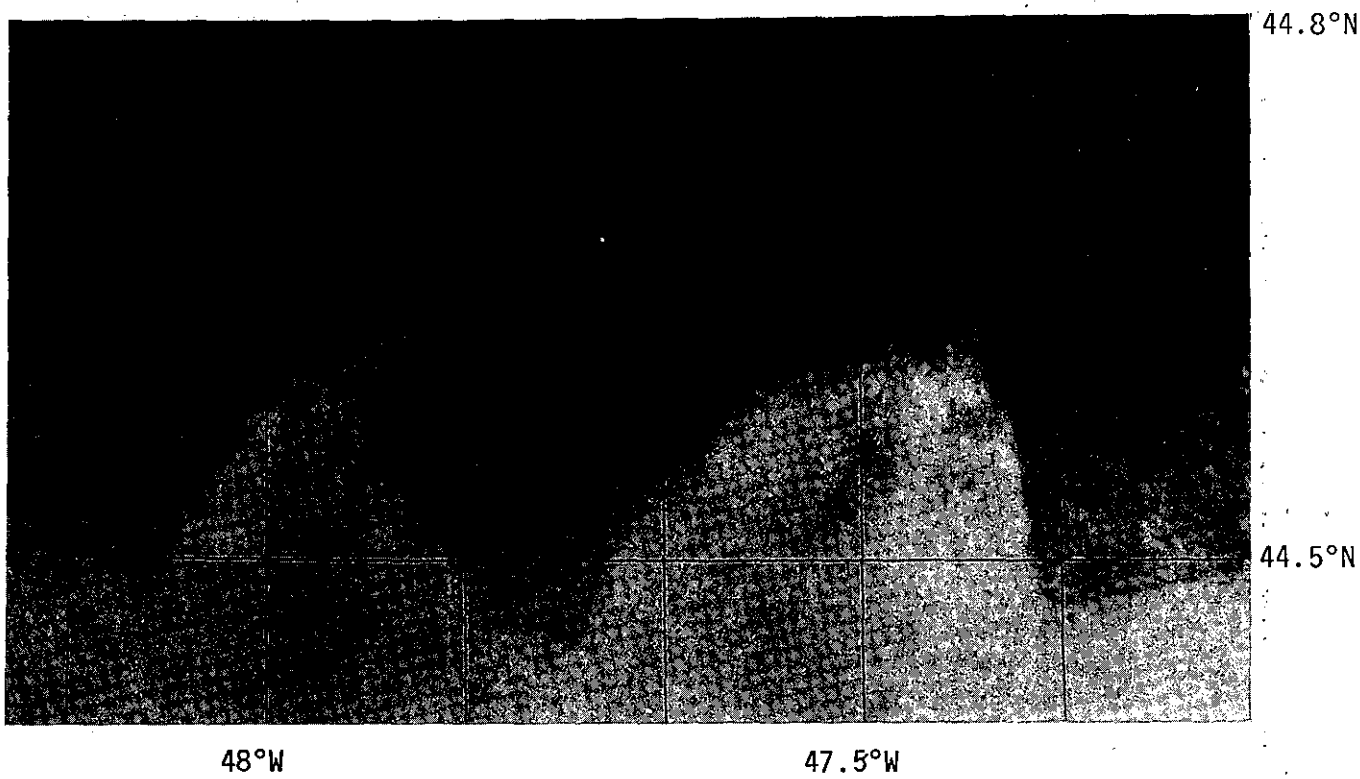


Figure 1. NOAA-9 infrared AVHRR (Advanced Very High Resolution Radiometer) satellite image from May 17, 1986.

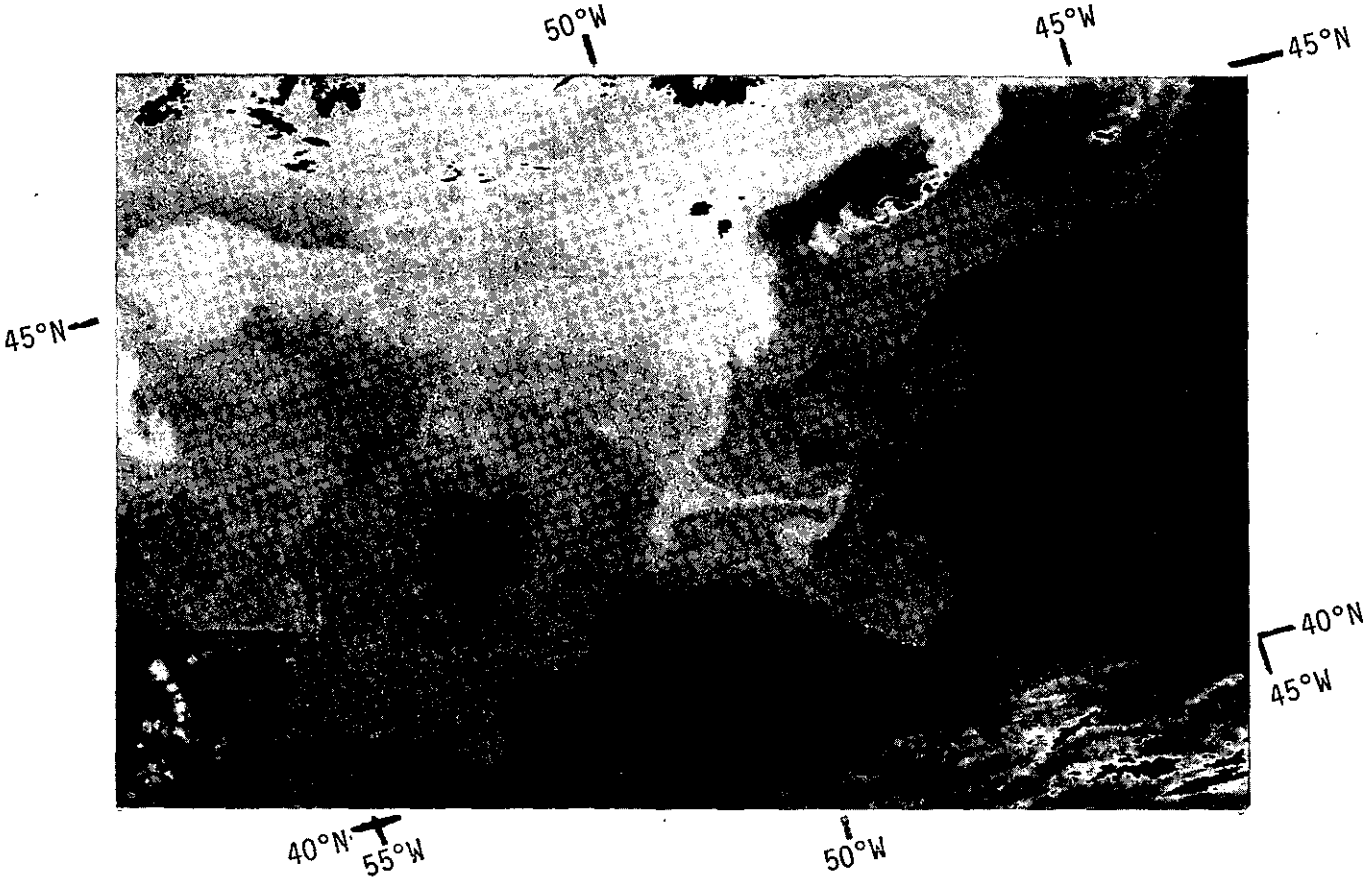
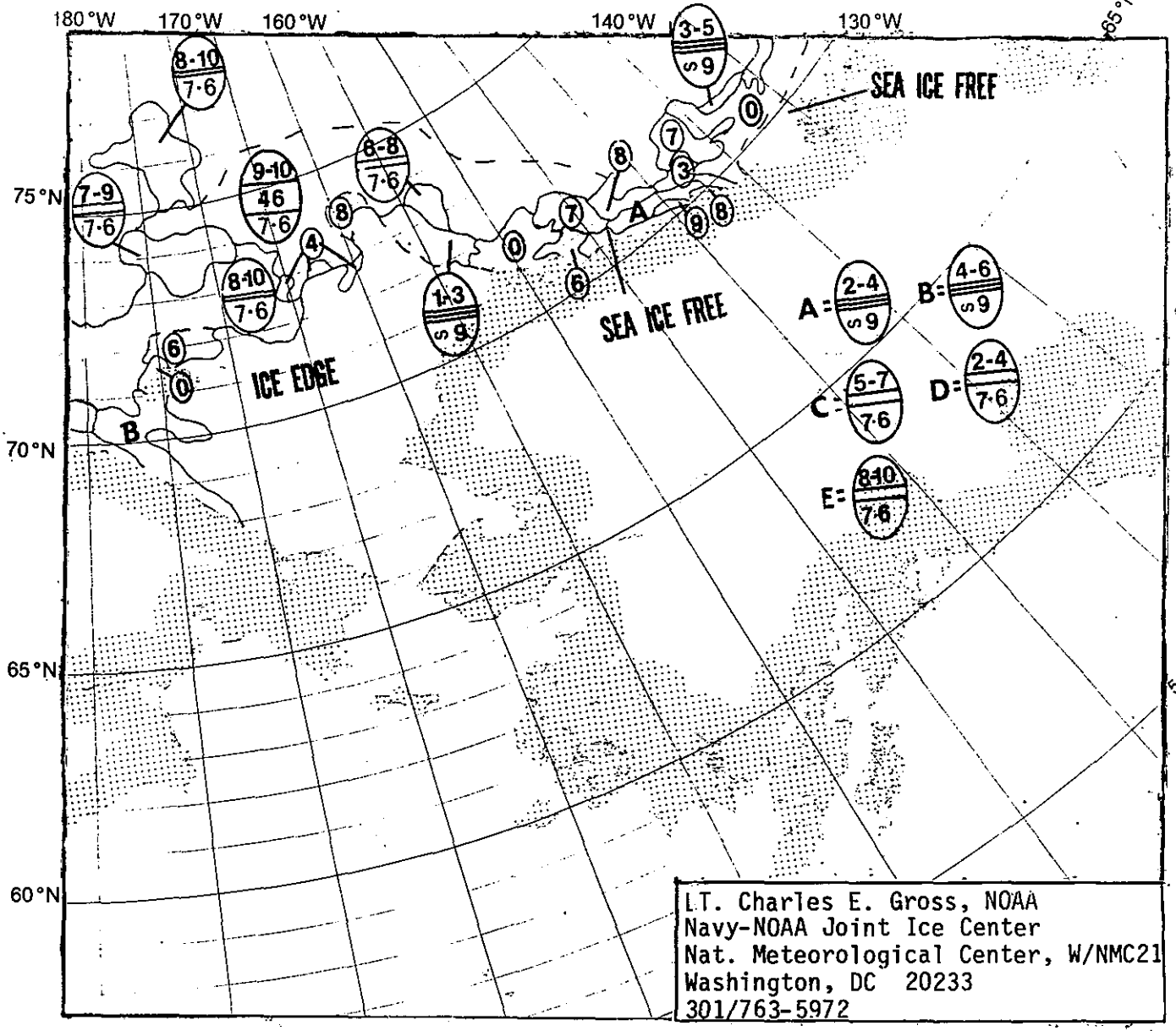


Figure 2. Side-Looking Airborne Radar (SLAR) image from May 17, 1986.

BERING SEA / NORTH SLOPE ICE ANALYSIS



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

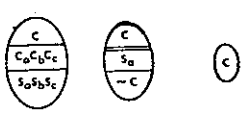
S_a, S_b, S_c = Stage of development of thickest (S_a), 2nd thickest (S_b), and 3rd thickest (S_c) ice.

~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).

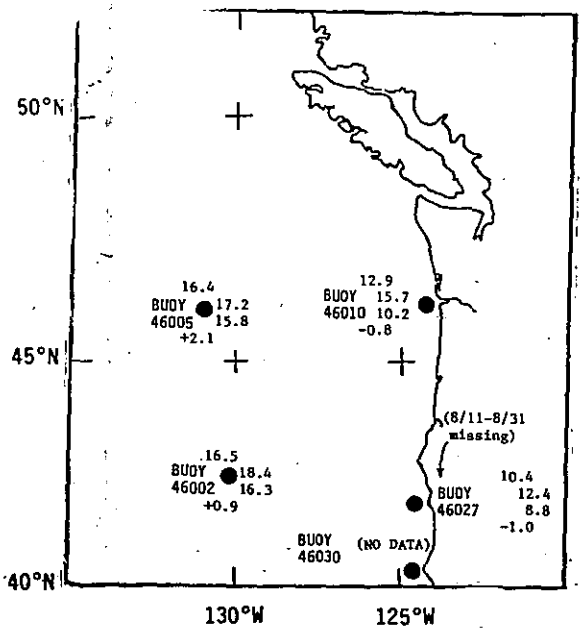
Fast ice. Sea ice which forms and remains fast along the coast.

Ice boundary visually or satellite observed.

Ice boundary estimated.

AUGUST 1986

Early August ice conditions in the Alaskan region indicated more open water and ice free areas than normal. Barge traffic was able to enter Prudhoe Bay early in the month, slightly earlier than average due to the favorable ice conditions. During the month, the sea ice edge retreat slowed west of Prudhoe Bay and the edge advanced to the south in the area east of Prudhoe Bay due to northerly winds. End of the month conditions are depicted on the accompanying ice chart. The monthly mean sea level pressure circulation indicates a storm track through the Bering and Chukchi Seas and a high pressure area in the western Canadian Archipelago. This pattern created onshore winds east of Prudhoe Bay which caused the ice edge advance. Air temperatures remained close to normal at Barrow (71°N 157°W) under the influence of the storm track.



AUGUST 1986

Continued warming of offshore waters and two intense coastal upwelling events characterize the North Panel area. Offshore SSTs averaged 0.9 - 2.1°C warmer than July temperatures and continued to increase throughout the month. Coastal upwelling during August 3-5 was very strong south of Cape Blanco and moderate to strong along the Washington and Oregon coast north of Cape Blanco. Thermal boundaries from the Columbia River to Cape Mendocino resulting from the upwelling were observed on satellite imagery of August 4. A less intense upwelling event occurred during August 19-22. The two intense upwelling events helped drive coastal SSTs 2.3 - 3.3°C below monthly normals and about 1.0°C cooler than the July coastal SSTs. Satellite imagery also showed thermal boundaries associated with upwelling off the west coast of Vancouver Island. Coastal upwelling diminished during the last nine days of the month.

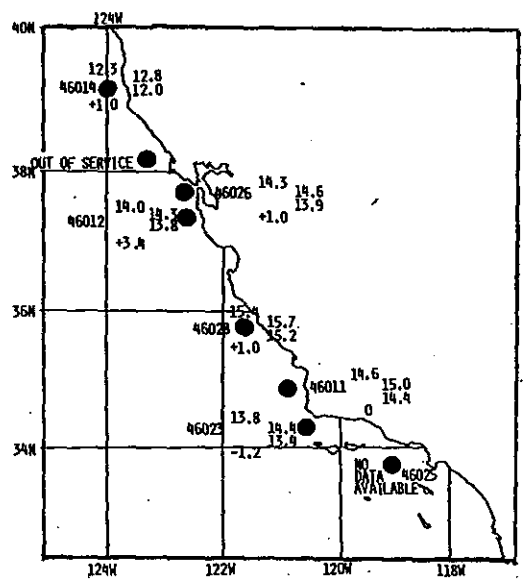
KEY:

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

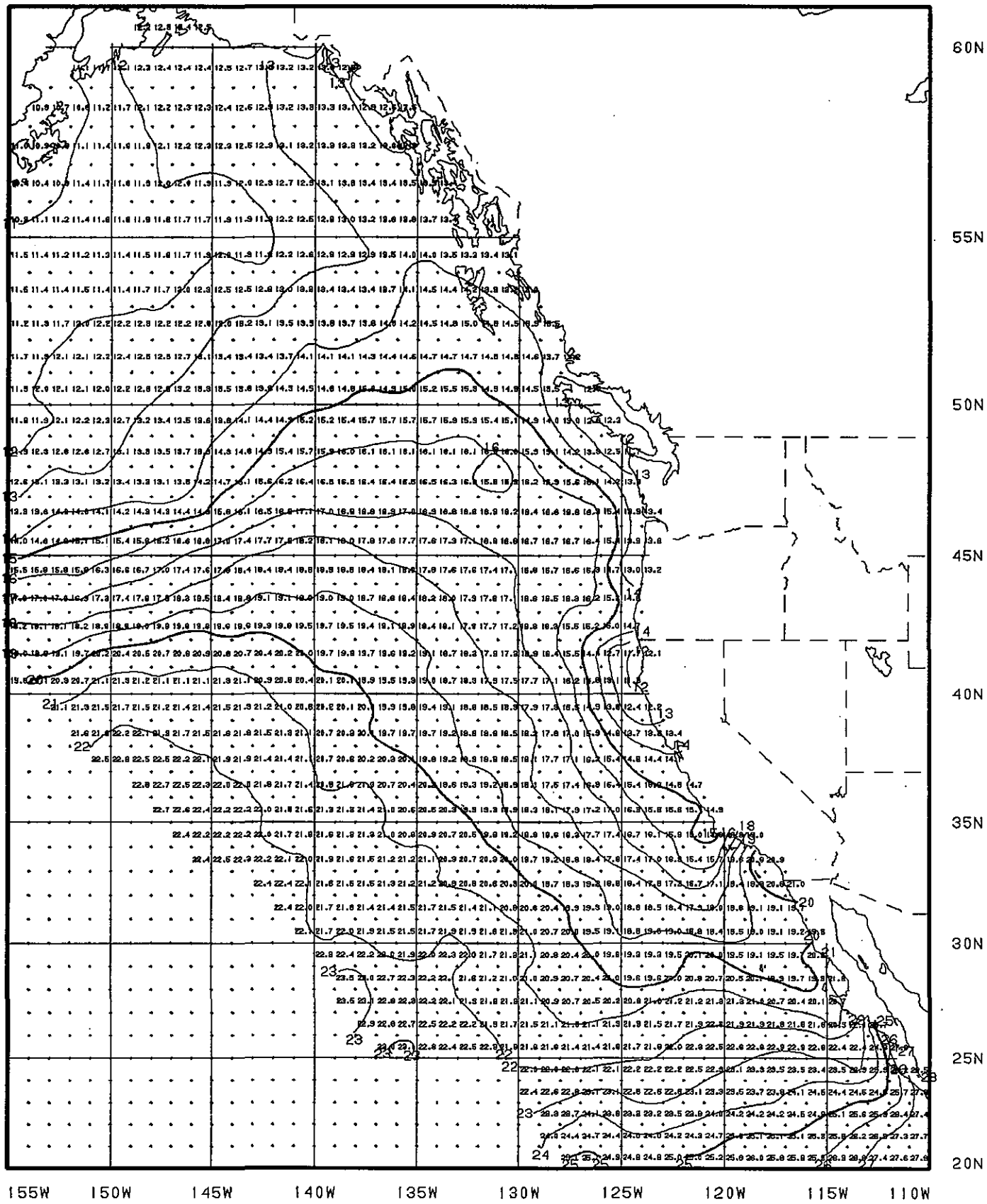
● Denotes station position.

North Panel
Lee Morgan
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, WA 98115
(206) 526-6606
FTS 392-6606

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

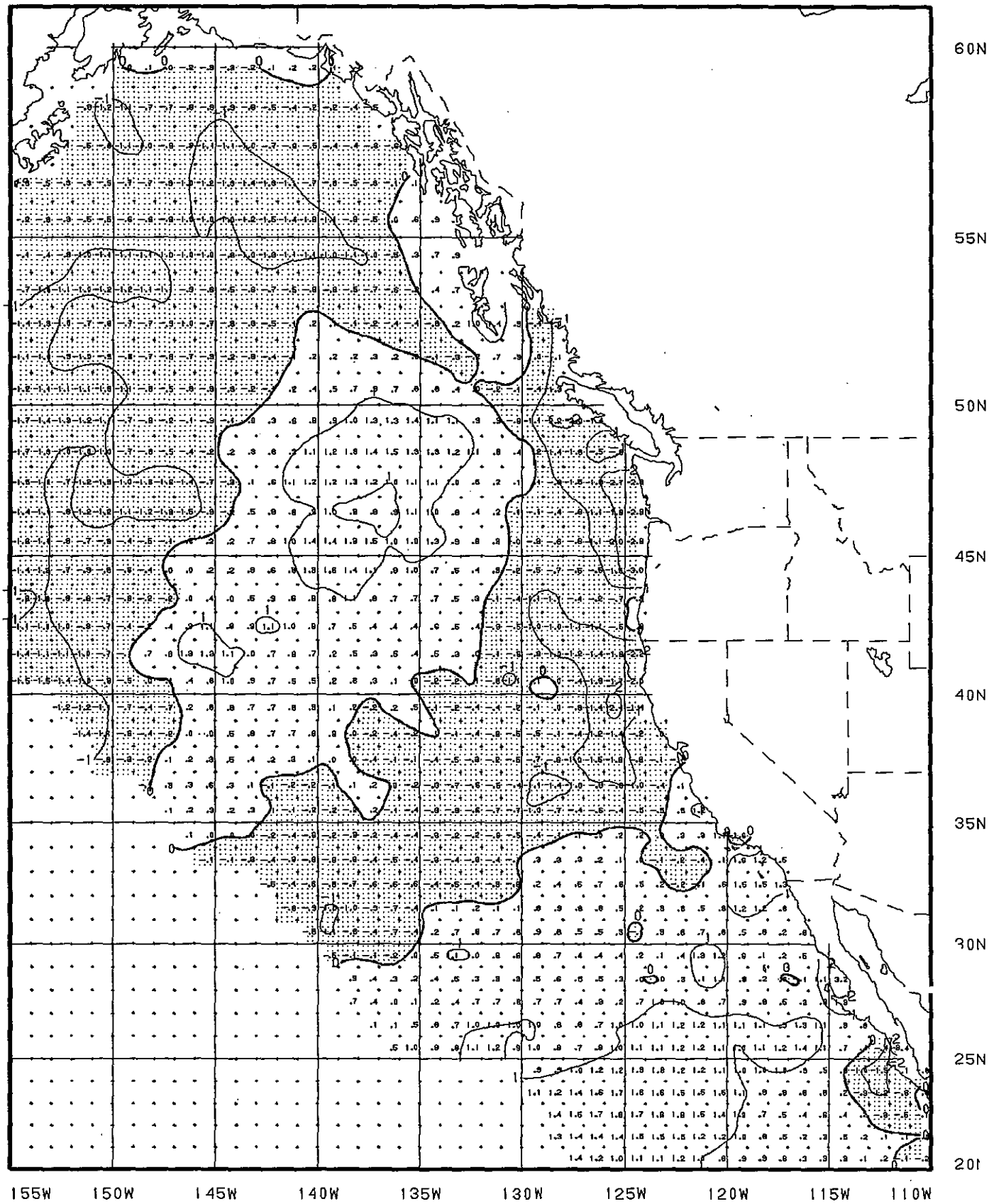


SSTs for the month of August show cool anomalies in the area north of 37°N and seaward of the coast, and in the western third of the South Panel south to 31°N. The monthly mean SST value for the South Panel is only 0.3°C above the normal average of 18.6°C. The maximum cool anomaly of -1.9°C is located just west of Pt. Arena, and the warmest anomaly is nearshore at 35°N 121°W. A comparison of the August and July mean SSTs indicates that all areas experienced warming, except for Pt. Conception and Pt. Arena. The maximum area of warming (+1.6°C) occurred in the extreme northwestern corner of the panel. Fixed buoy statistics revealed that 5 of the 7 buoys warmed since July, with buoy #46012 showing a value of +3.4°C. Continuous low clouds and fog throughout the South Panel precluded the use of AVHRR analog data for observing upwelling boundaries or any SST surface structure.



West Coast
SST--MONTHLY MEAN (°C)
August 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
August 1986

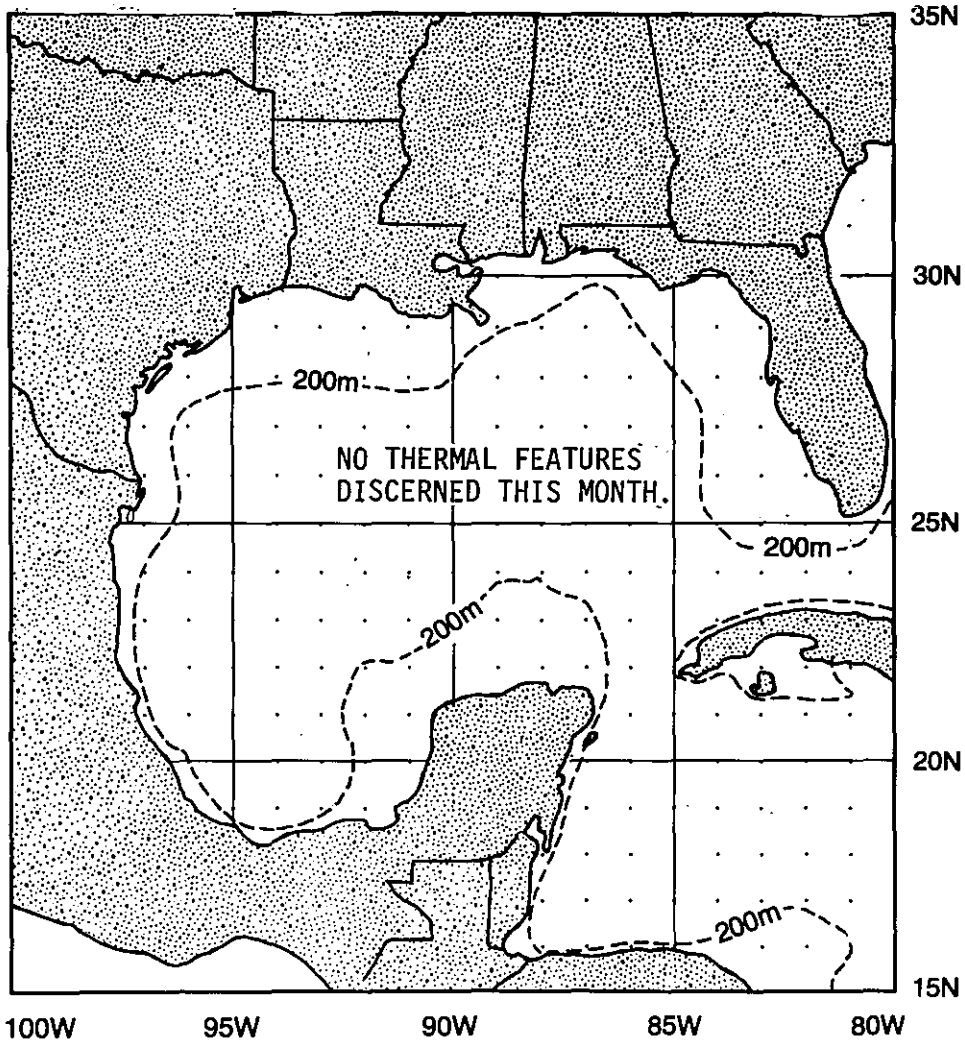
Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf

EAST COAST OCEAN FEATURES

Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

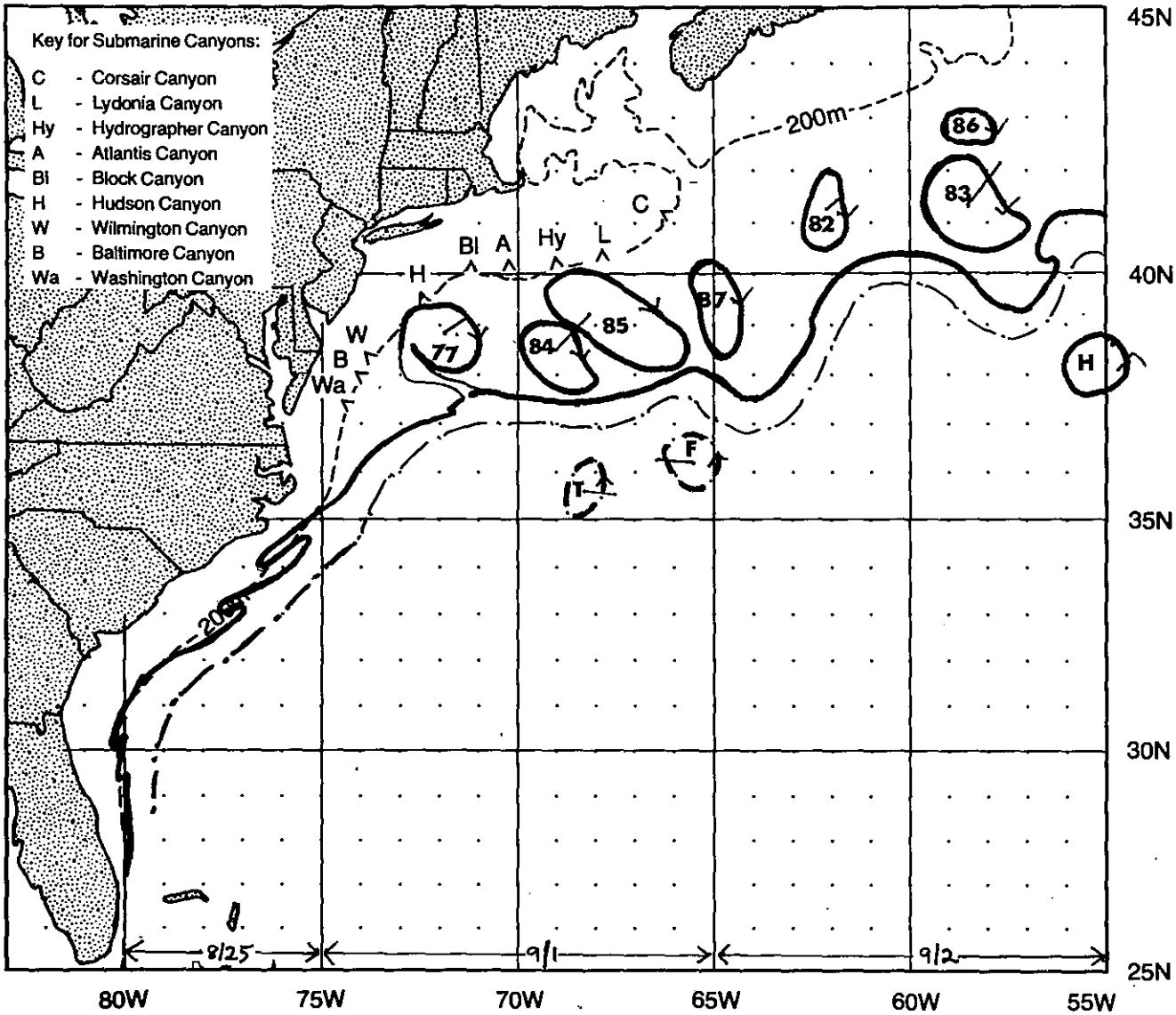
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

AUGUST 1986

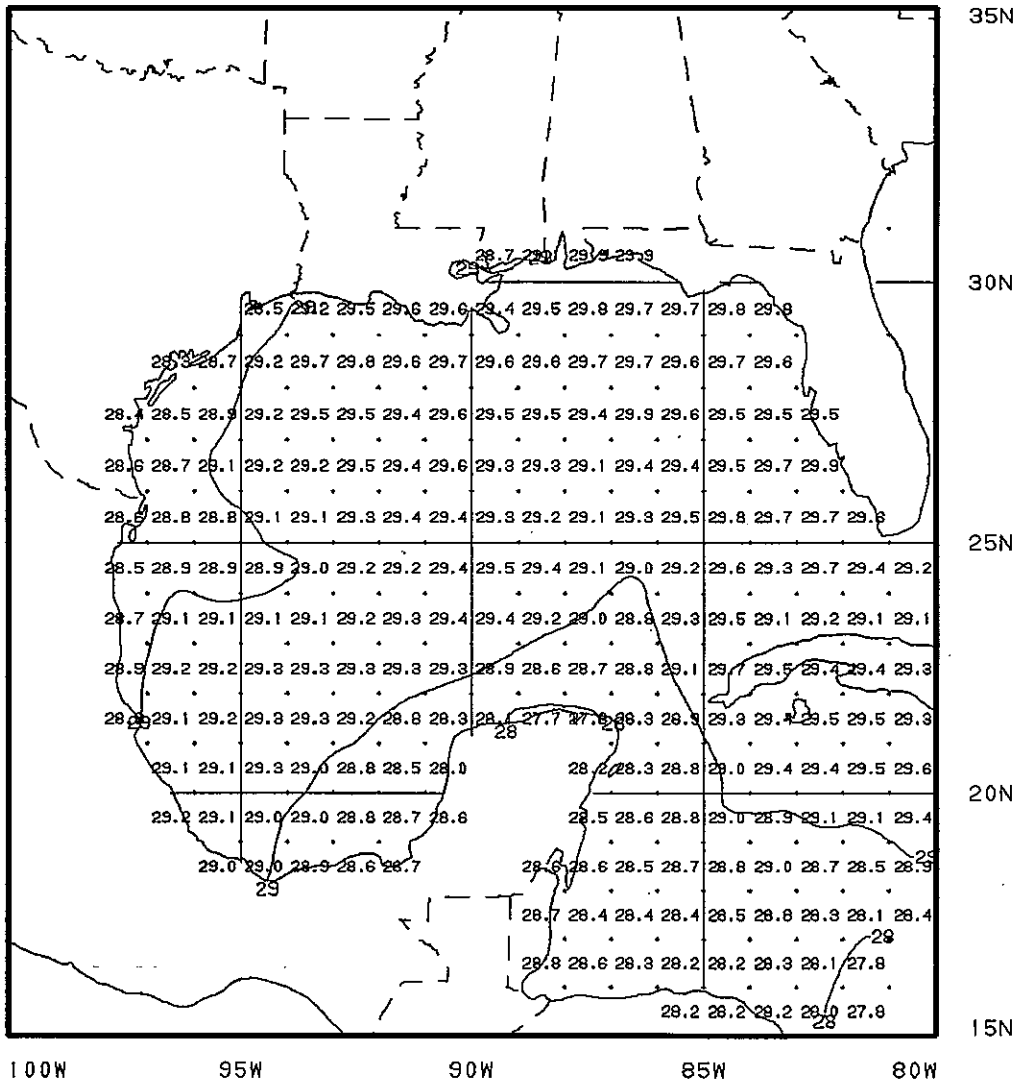
The Loop Current in the Gulf of Mexico was not discernible in thermal infrared satellite imagery due to near isothermal conditions at the surface. Anticyclonic eddies o and s were also not detected during August.



Three new anticyclonic eddies formed and two anticyclonic eddies were absorbed during August. Eddy 85 formed from a Gulf Stream meander around August 6 near 40°N 68°W. Eddy 86 formed when eddy 83 apparently split around August 8 near 43°N 58°30W. Eddy 87 formed from a Gulf Stream meander near 40°N 65°W on August 15. Eddy 80 was apparently absorbed by eddy 85 around August 25. Eddy 81 was absorbed by the Gulf Stream near 39°N 65°W around August 6. Eddy 77 moved 65 km SW. Eddy 84 translated 110 km SW. Eddy 82 traveled 25 km SW while eddy 83 traveled 110 km SW.

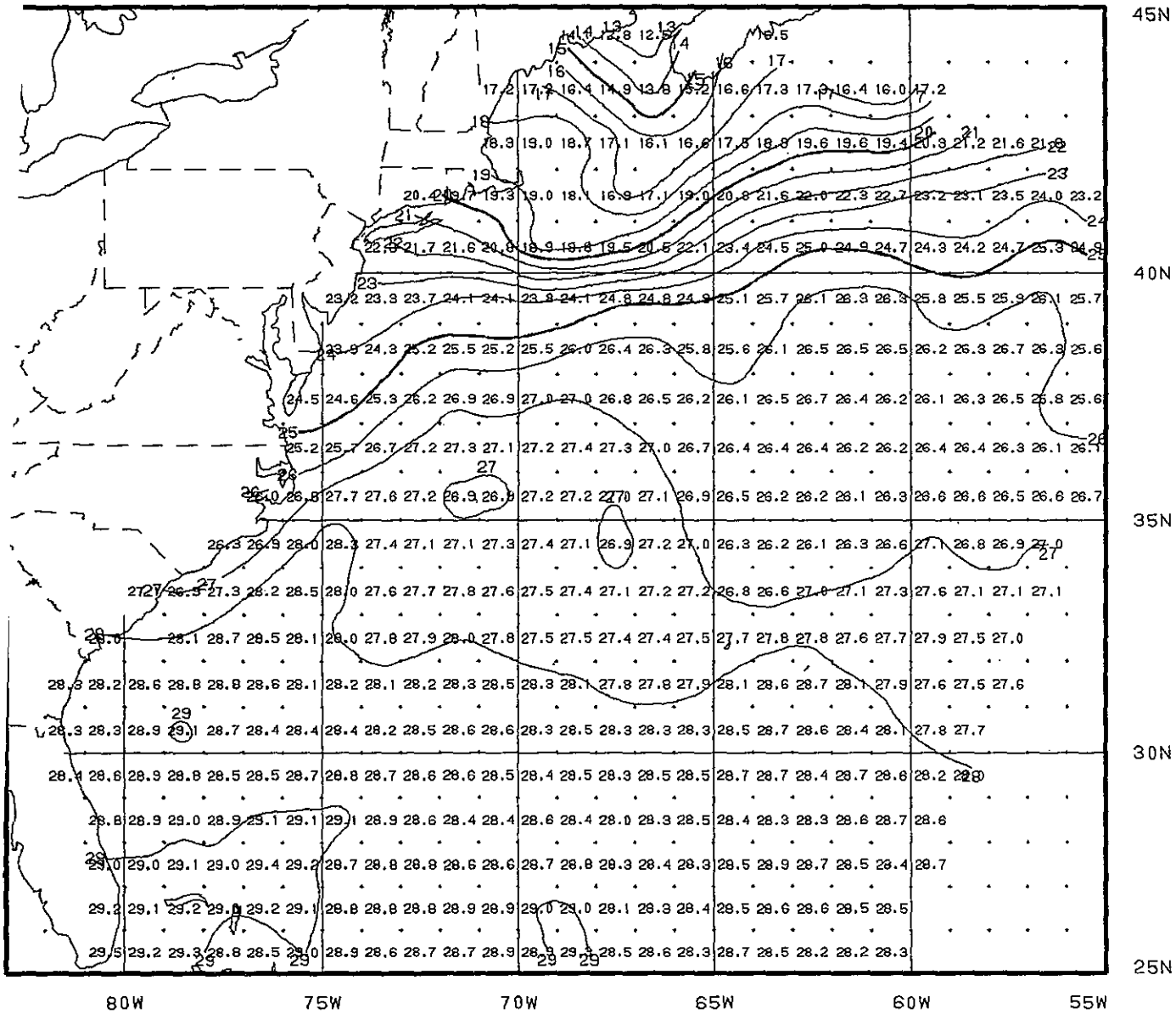
Cyclonic eddy H, absorbed by a Gulf Stream meander near 39°N 54°W around August 4, reformed around August 10. Eddy T moved 65 km WNW when it was last observed on August 8. Eddy F translated 85 km E when it was last detected on August 8. Eddies G, N, Z, P, and M were not observed during August due to seasonal heating and cloudiness.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
August 1986

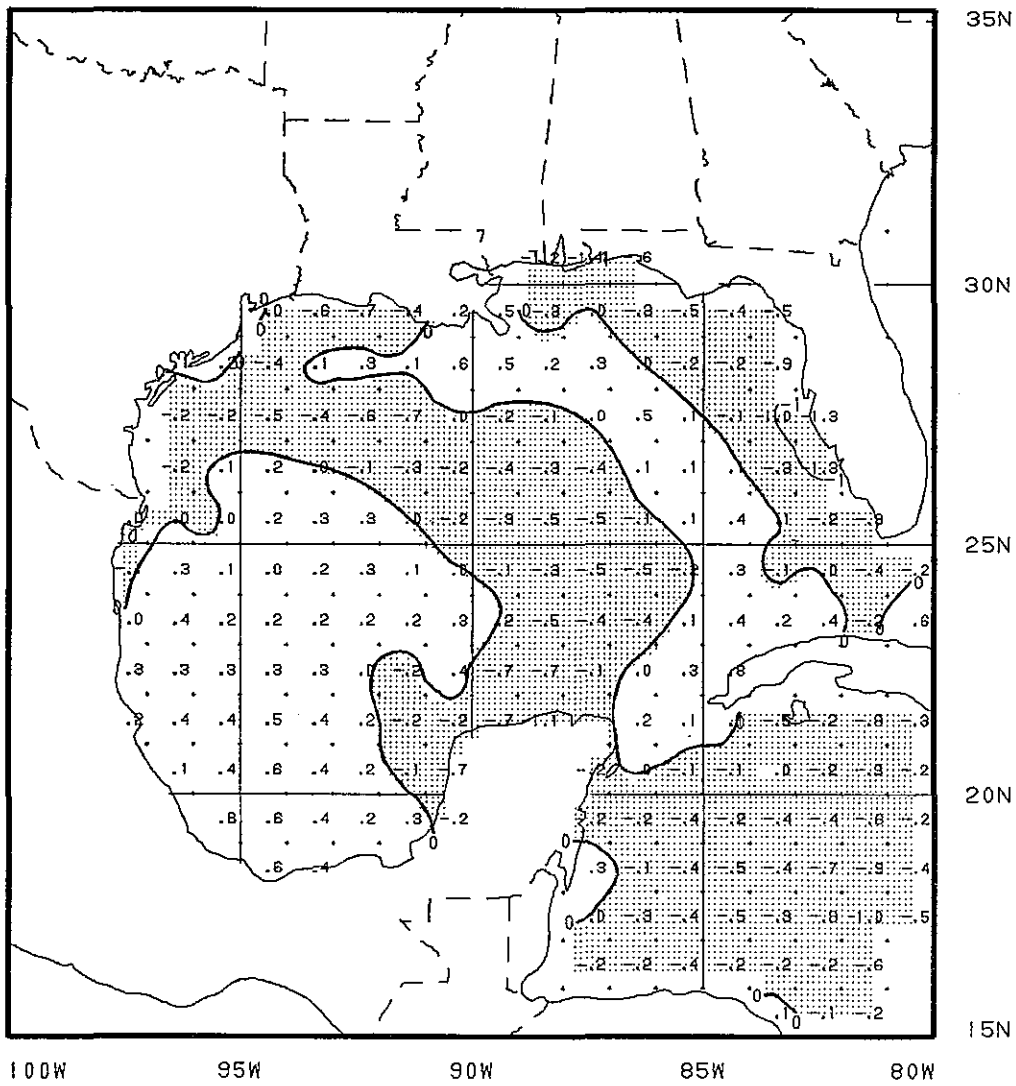
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
August 1986

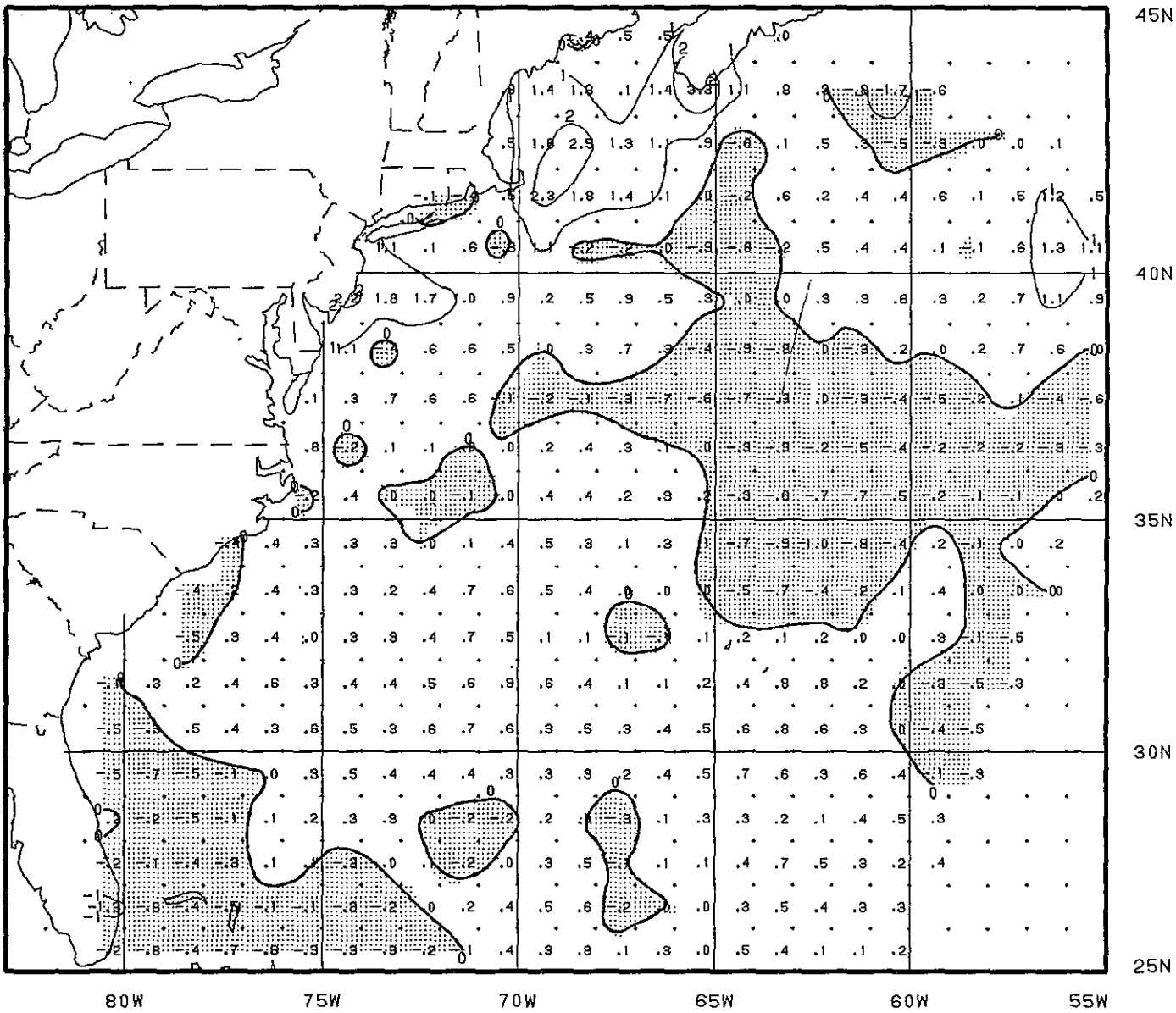
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
August 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
August 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

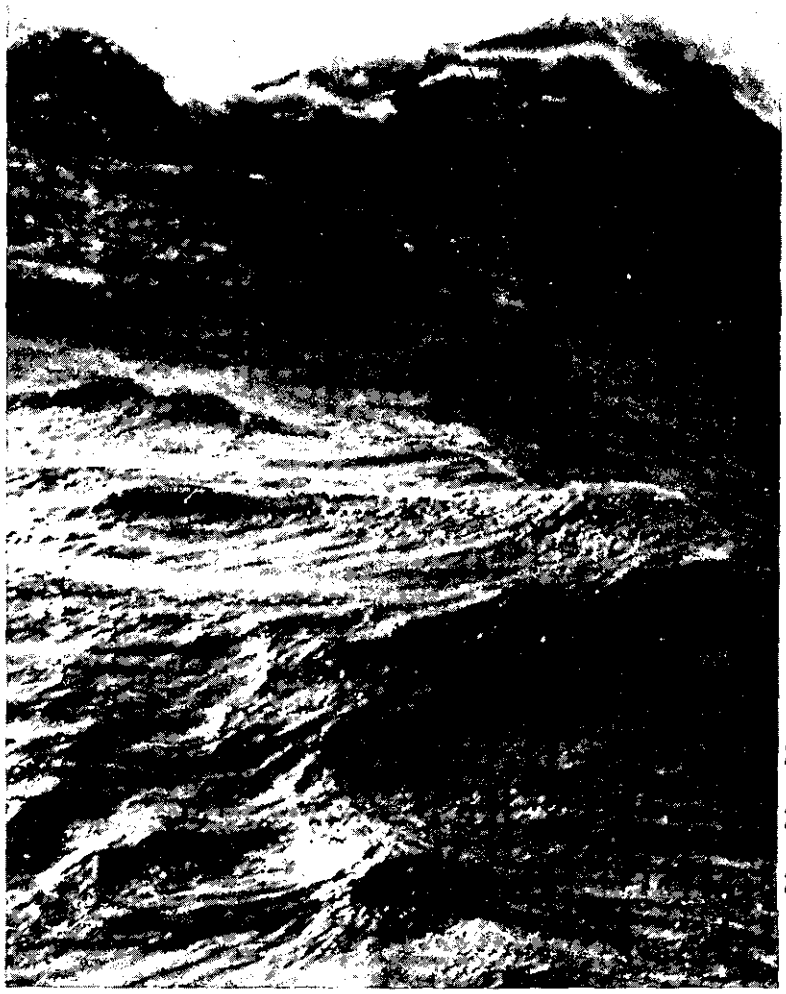
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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, 1987.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 9 September 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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] 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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop,* Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]The climatology is derived from *in situ* data (1950-1979), satellite data (1982-1985) and an ice climatology (for more detail, see Oceanotes).
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2.*
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; *NavOceano Ref. Pub. 18.*

Oceanographic Monthly Summary

Editor: Pat McHugh
NOAA, NWS
National Meteorological Center, W/NMC21
Washington, DC 20233
(Telephone: (301) 763-8133)

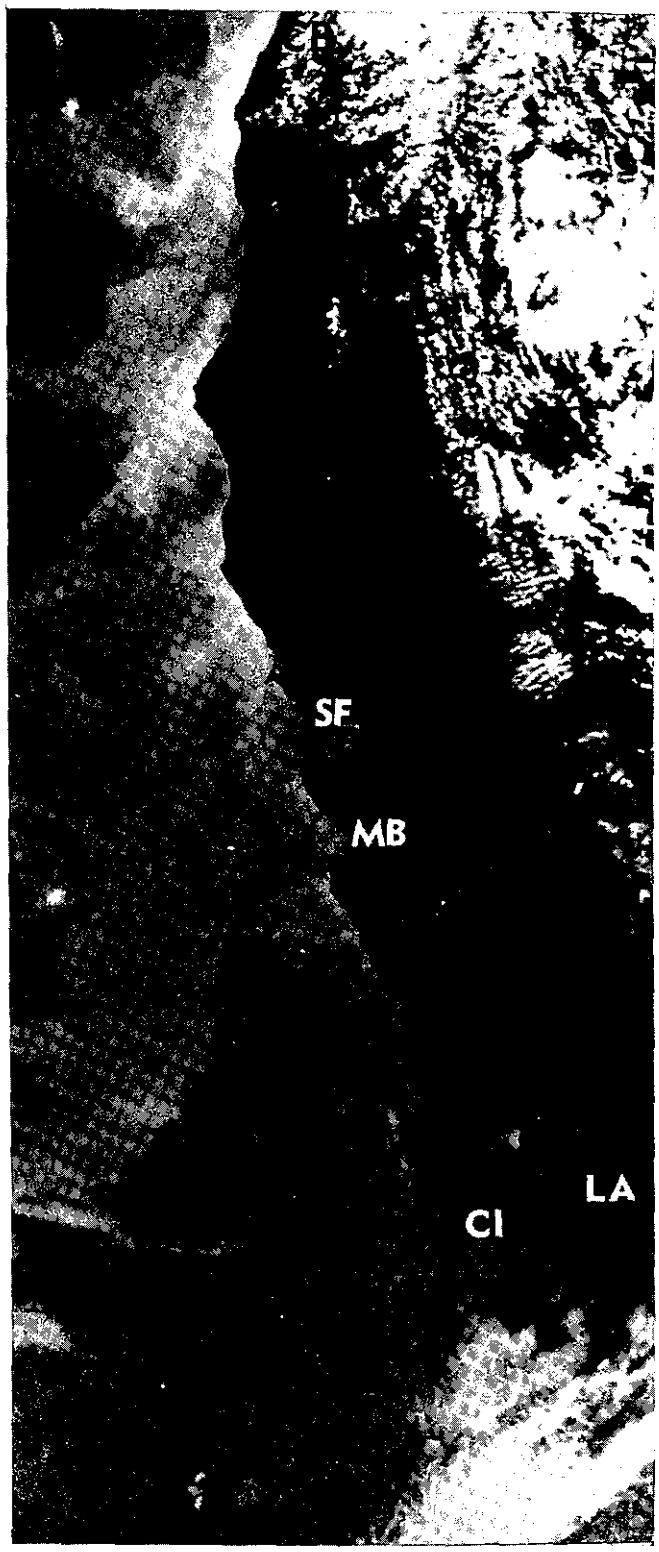
Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239)

Typing: Damita Johnson

SATELLITE IMAGE OF THE MONTH

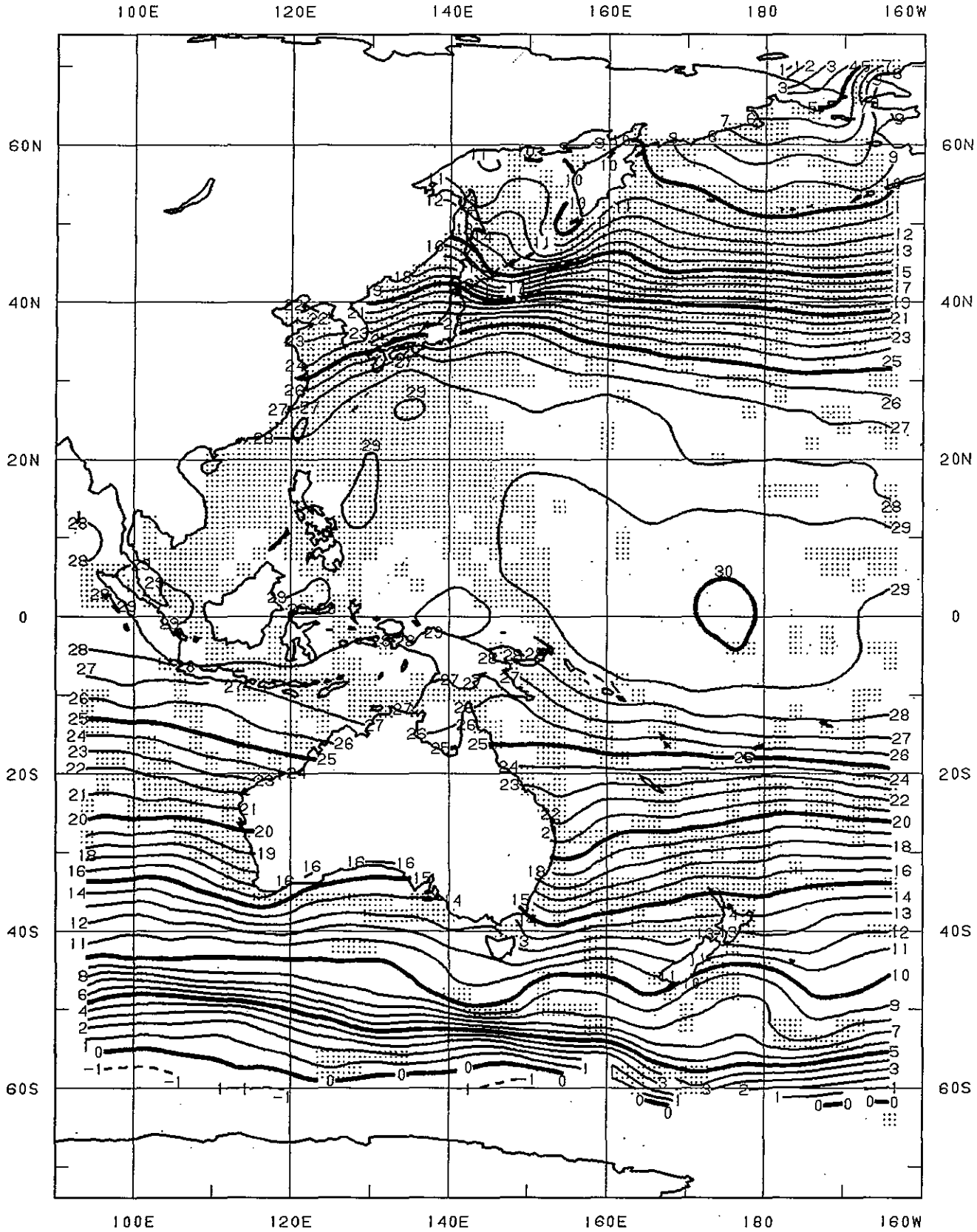
Kim Buttleman
Interactive Processing Branch, E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

U. S. WEST COAST UPWELLING



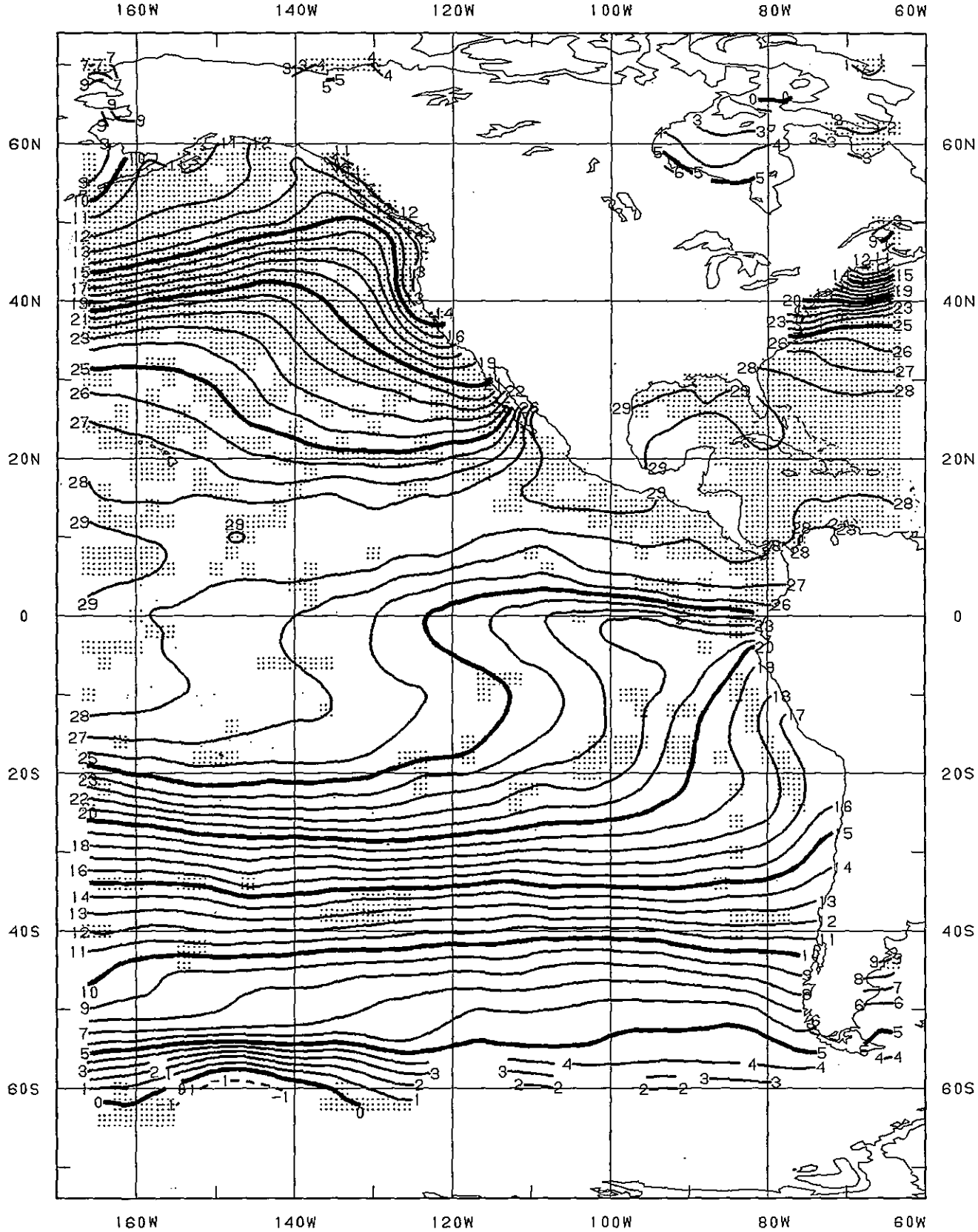
This NOAA-9 infrared image from Sept. 9, 1986, shows the coast of California and Oregon from Los Angeles (LA) to Coos Bay (CB). Also shown are San Francisco (SF), Monterey Bay (MB) and the Channel Islands (CI). This time of year marks the onset of substantial coastal upwelling. This is the result of Ekman transport driven by northerly winds. Temperature differences as great as 10°C between areas of upwelling adjacent to the coast and offshore waters were found at the time of this image. The upwelling nutrients stimulate increased productivity among primary and higher trophic levels. The concentrations of small fish attract warm water pelagic predatory species, such as tuna, where they feed along the thermal fronts.

Both AVHRR and the Coastal Zone Color Scanner have been used to map the upwelling fronts, AVHRR on the basis of temperature differences and CZCS using color differences caused by the pigments in the phytoplankton. By utilizing the maps on an experimental basis fishermen have been able to increase their catch substantially.



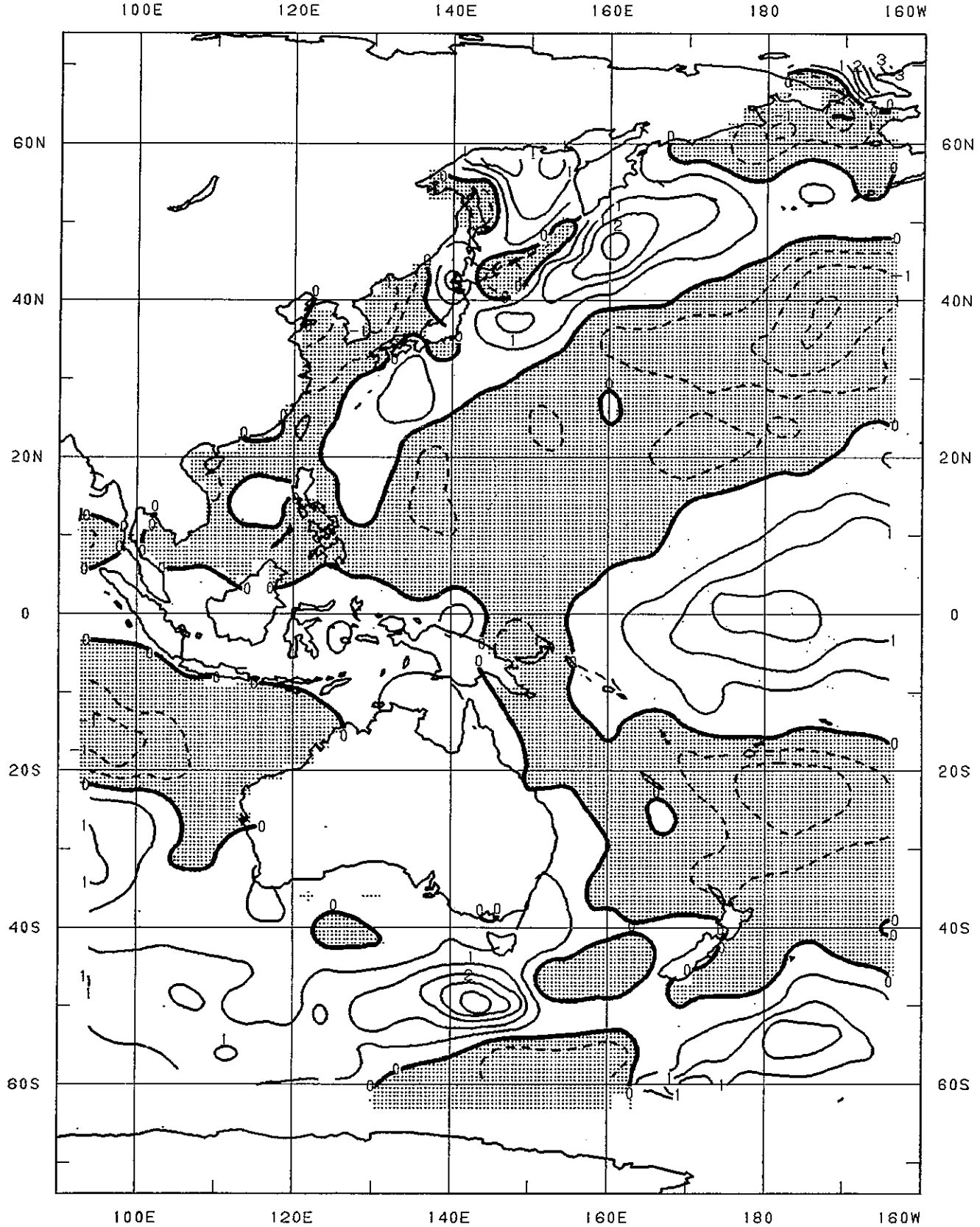
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



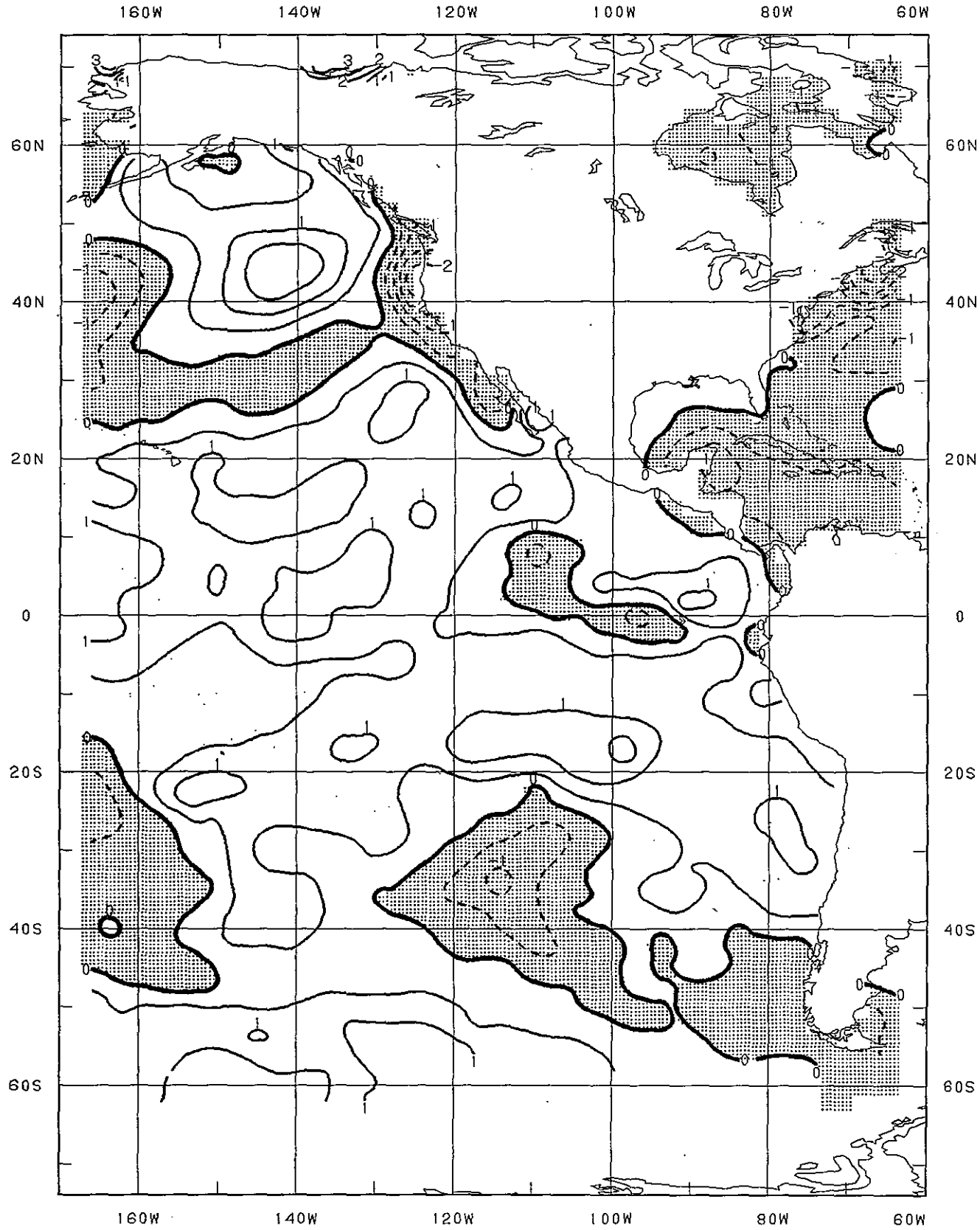
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



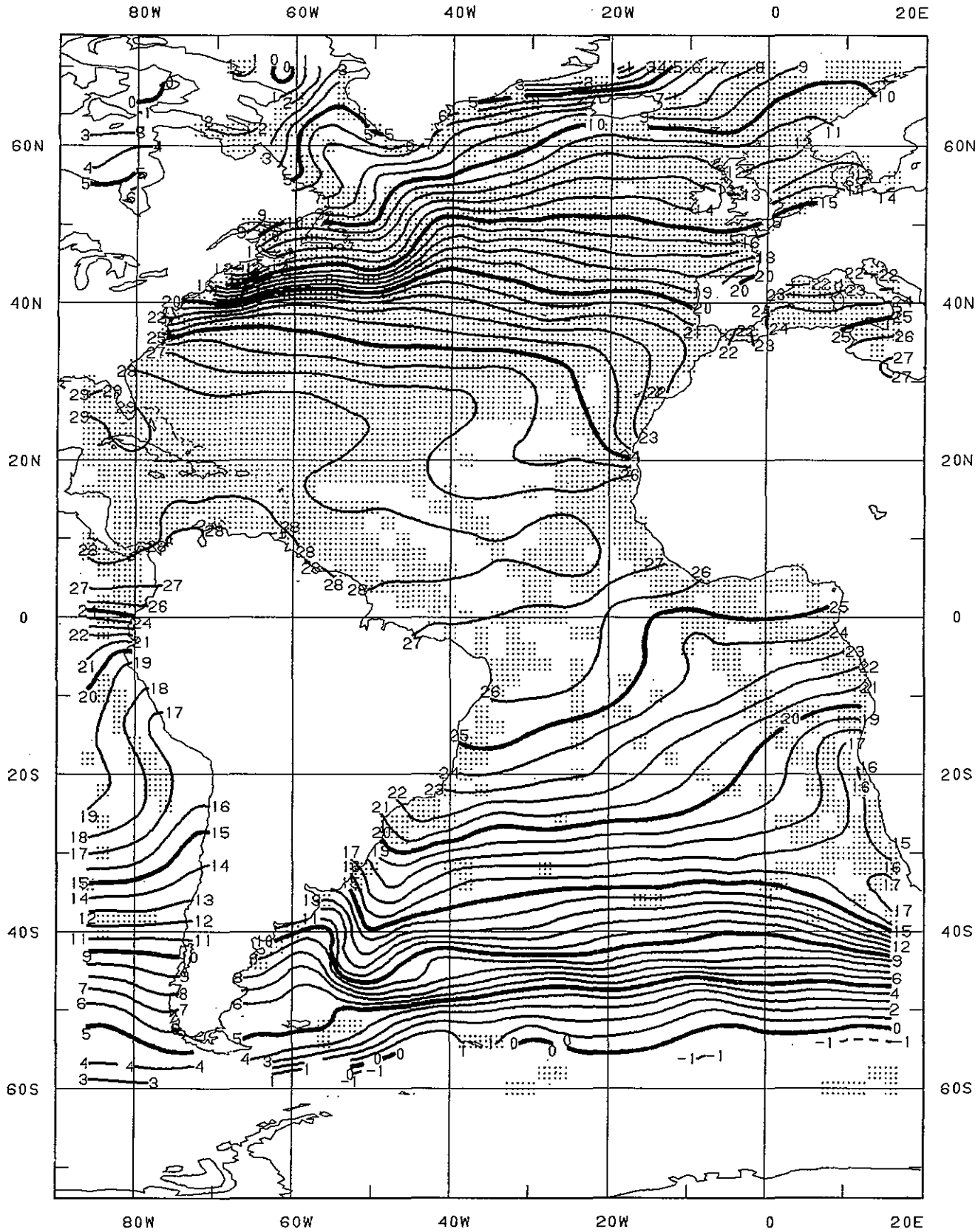
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



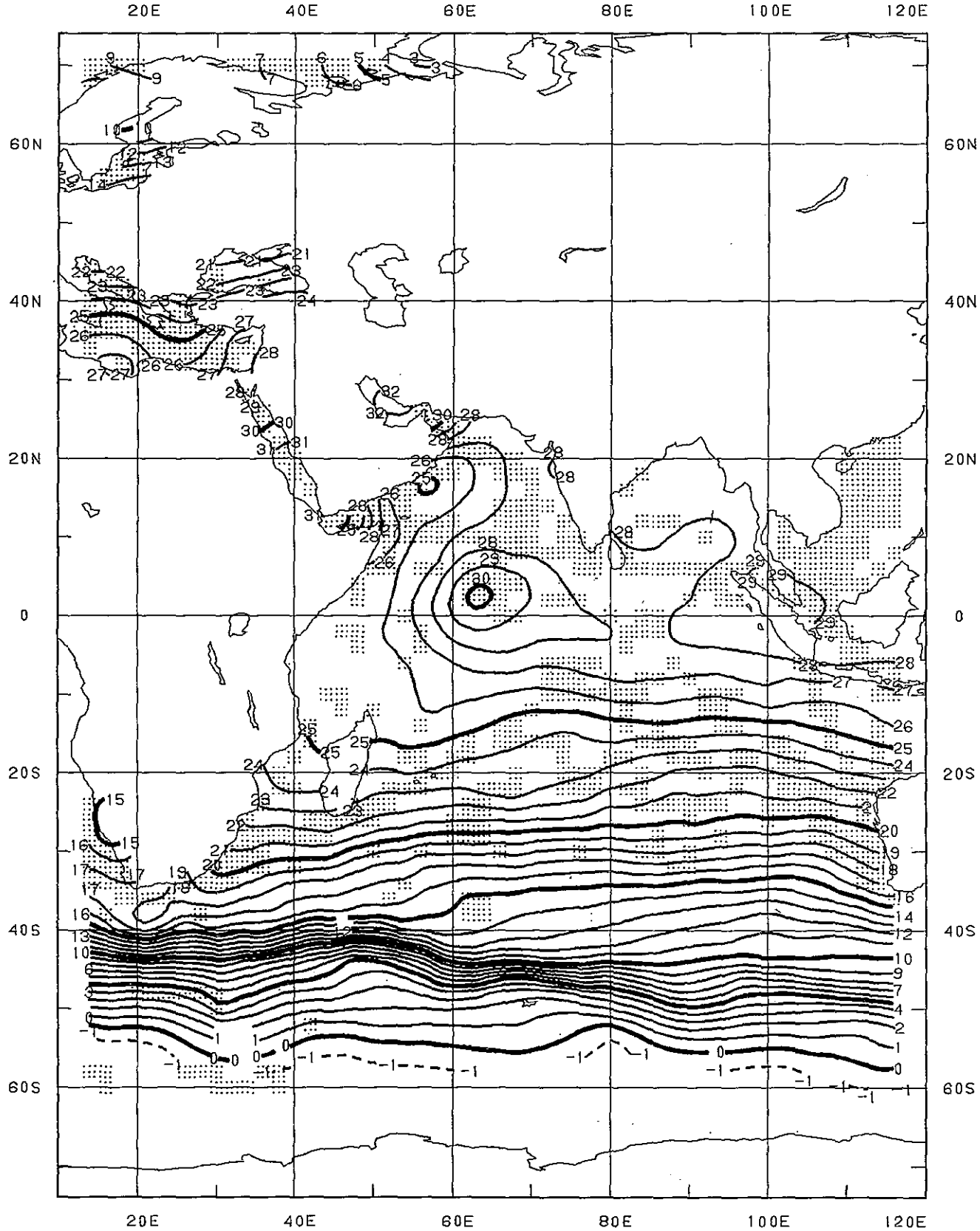
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



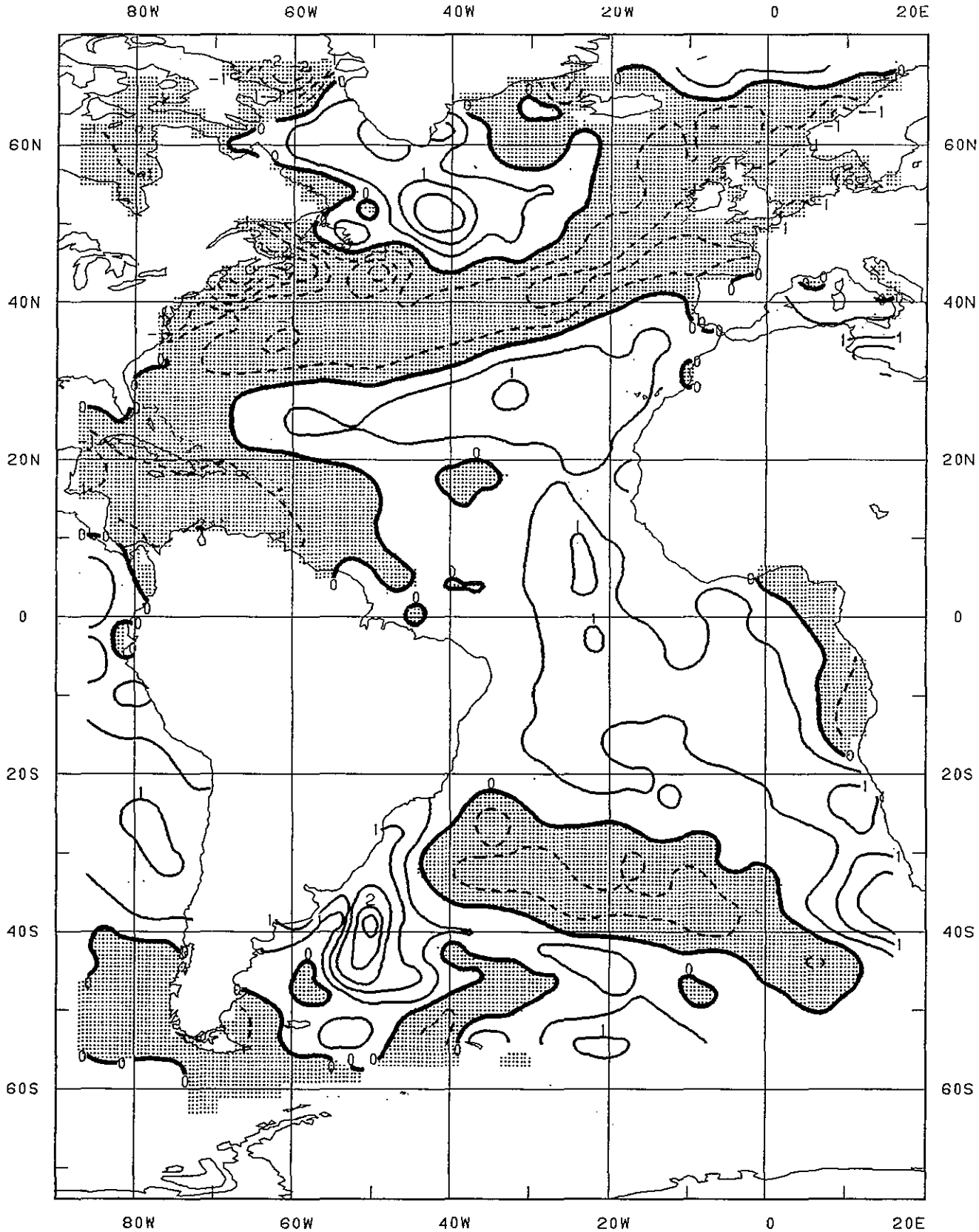
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



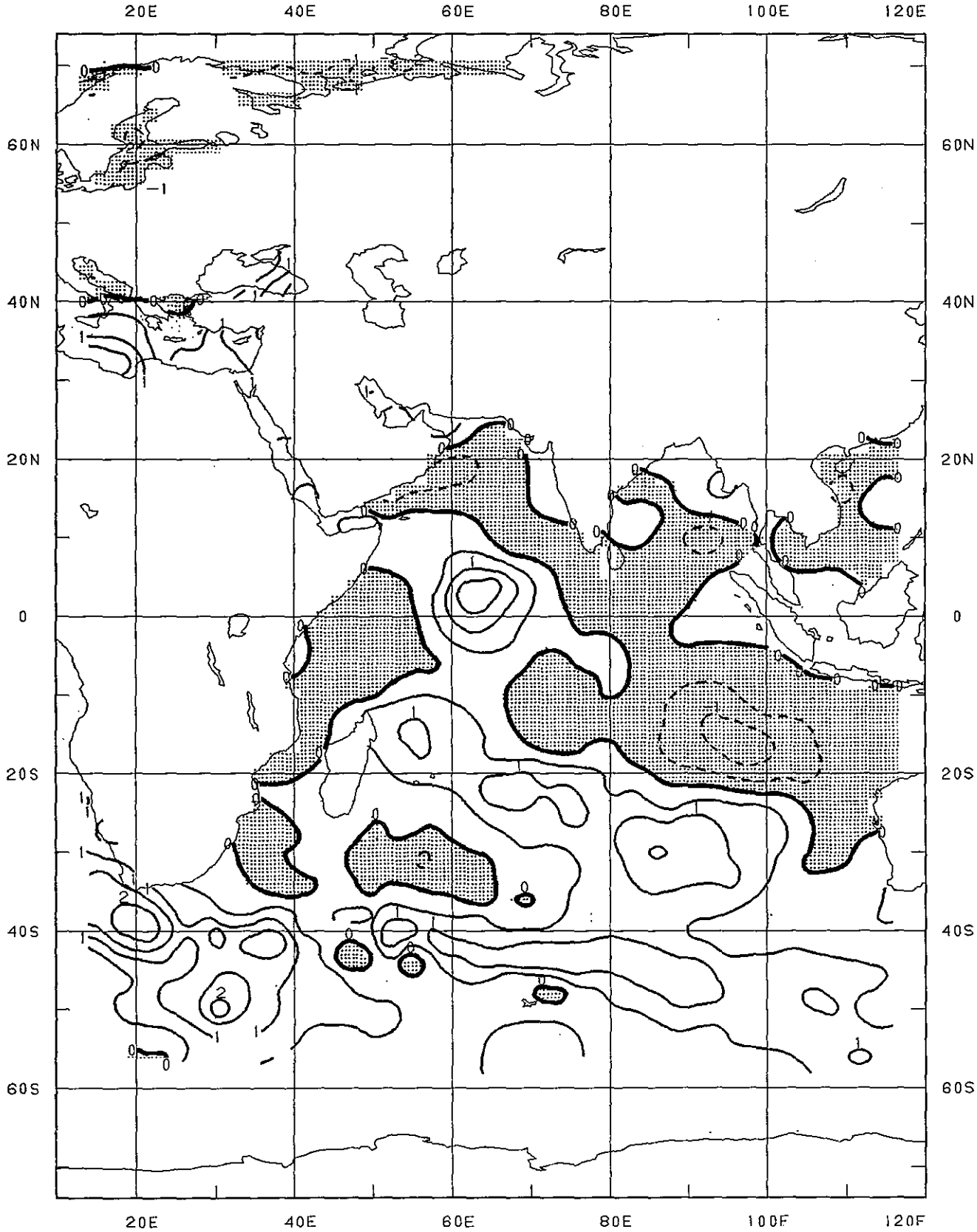
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
SEPTEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

NEW GLOBAL SST CLIMATOLOGY

In the April 1986 Climate Dianostic Bulletin, differences between the CAC (Climate Analysis Center) SST climatology and other SST climatologies were noted. These differences were not primarily due to analysis methods, but due to the use of data from different periods of time. The CAC climatology includes data from the 1850's through 1970's; the other climatologies used no data prior to 1950. During a period which is roughly defined by the decade of the 1940's, bucket temperature SST measurements were gradually replaced by engine intake SST measurements. It has been well documented that this change typically increases the average measurement by several tenths of a degree Celsius.

Since our main purpose is to study departures from climatology, a climatology is needed which minimizes any change in measurement technique and which is consistent with the present SST analysis. Since the present blended analysis technique is heavily influenced by ship intake temperatures and since much of the change from bucket to intake measurements occurred prior to 1950, a new monthly climatology was computed using the 2°C resolution COADS (Comprehensive Ocean - Atmosphere Data Set) data for the period (1950-1979). However in spite of the coarser resolution, the COADS data coverage was not as complete as the original CAC climatology. To improve the coverage, monthly climatological ice limits and monthly satellite climatological SST fields were used. Complete details will be presented in an article to be submitted to Tropical Ocean-Atmosphere Newsletter (published by CIMAS, University of Maimi, 4600 Rickenbacker Causeway, Miami, FL 33149).

Comparisons of the new "COADS/ICE" climatology with the CAC climatology shows that the COADS/ICE fields are generally warmer (approximately 0.25°C) over most of the ocean. The warming is especially evident off the coasts of South America and Australia. In the extreme Southern Hemisphere the COADS/ICE climatology fields are cooler than the CAC climatology. This difference is due to the lack of ice and satellite data in the CAC fields. The main disadvantage in the COADS/ICE climatology results from the lower resolution which reduces the size of coastal and equatorial upwelling areas compared to the CAC climatology. However since the advantages of the COADS/ICE outweigh this disadvantage, the COADS/ICE climatology will henceforth be used to define the SST anomalies.

For more infomration, contact Richard W, Reynolds (Climate Analysis Center, NMC) (301-763-8227) or Leeanne Roberts (Ocean Products Center, NMC) (301-763-8133).

NEW EDITOR

Pat McHugh is the new Oceanographic Monthly Summary Editor. He replaces Steve Auer who has a new job with the National Environmental Satellite, Data, and Information Service. Steve has been editor for the past 9 months and was the first editor 1981-3.

WORLD OCEAN ATLAS DATA TAPES

Global analyses of major ocean variables are provided in a series of data tapes available from the National Oceanographic Data Center (NODC). The data tapes were produced by S. Levitus of the NOAA Geophysical Fluid Dynamics Laboratory in conjunction with his Climatological Atlas of the World Ocean (NOAA Professional Paper No. 13, December 1982). The atlas and associated data tapes present a synthesis of all temperature, salinity, and oxygen data available in NODC's oceanographic station and bathythermograph data files as of 1977-78. The tapes include objective analyses on a one-degree grid at standard depth levels, as well as a statistical analysis of the observed data by five degree squares. The available data sets are:

- Annual Analyses. Gridded fields of temperature, salinity, oxygen, and oxygen saturation; 2 tapes.

- Seasonal Analyses. Gridded fields of temperature and salinity; 4 tapes.

- Monthly Analyses Gridded fields of temperature; 3 tapes.

- Seasonal Five-Degree Square Statistics. Number of observations, means, and standard deviations for temperature, salinity, oxygen, oxygen saturation, potential density, and specific volume; 2 tapes.

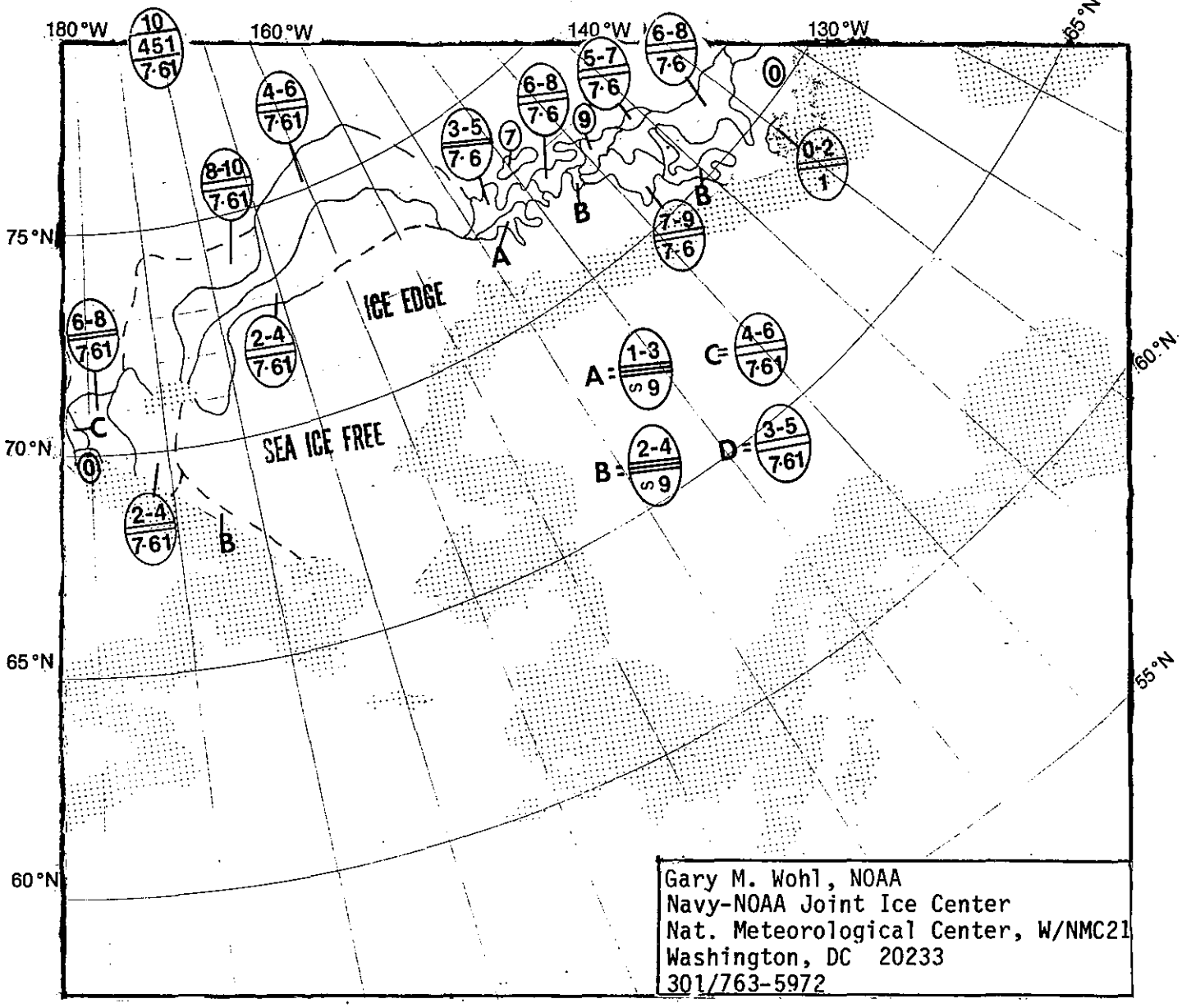
Further details about the data sets are given in a series of three fliers available on request from NODC. These also provide information on costs and payment procedures. Inquiries about these data tapes should be directed to:

National Oceanographic Data Center
User Services Branch
NOAA/NESDIS E/OC21
Washington, DC 20235

Telephone: 202-634-7500 (commercial)
FTS 634-7500

Telemail: Mailbox "NODC.WDCA"

BERING SEA / NORTH SLOPE ICE ANALYSIS



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

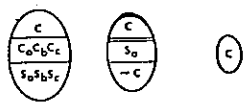
S_a, S_b, S_c = Stage of development of thickest (S_a), 2nd thickest (S_b), and 3rd thickest (S_c) ice.

-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.

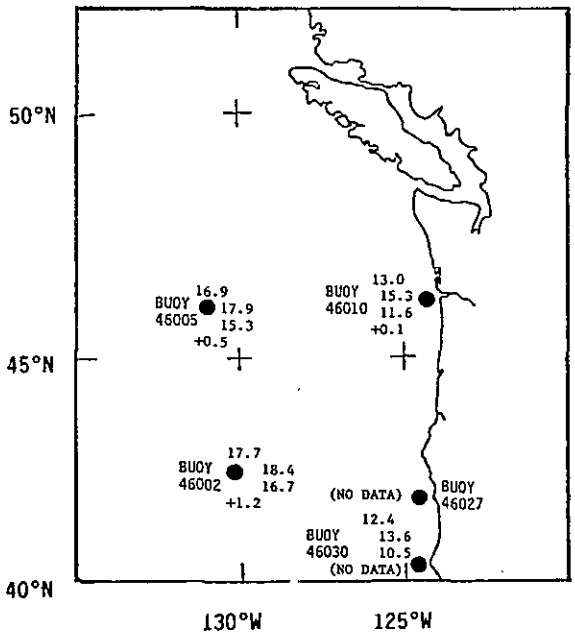
Ice boundary visually or satellite observed.

Ice boundary estimated.

SEPTEMBER 1986

September ice conditions in the Alaskan region continued the generally lighter than normal conditions experienced during the preceding two months. Once again the polar pack ice was held to the north due to favorable wind conditions. Temperatures fell during the latter part of the month as the sun remained above the horizon for fewer hours and brief periods of northerly winds brought in colder air from the high Arctic. Milder than normal conditions persisted, however, due to storm tracks from the Bering Sea and the Siberian side of the Arctic. The mean sea level pressure chart for September clearly shows a blocking high over the Gulf of Alaska and a Bering Sea storm track leading toward the Chukchi and Beaufort Seas. Temperatures at Barrow, Alaska averaged slightly above normal for the month (+6° F) under the influence of warmer air from the south.

WEST COAST OCEAN FEATURES



KEY:

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

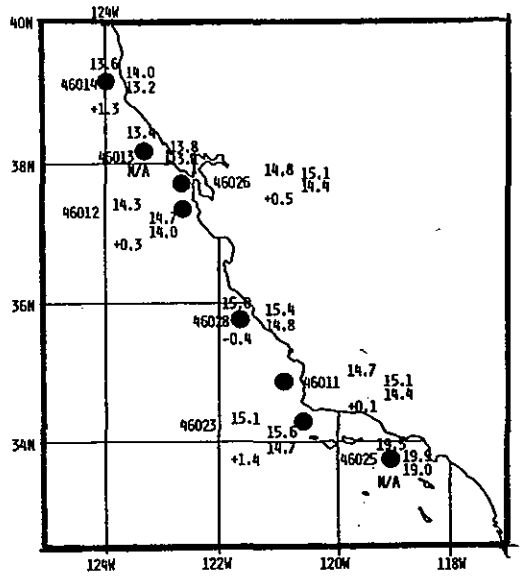
● Denotes station position.

SEPTEMBER 1986

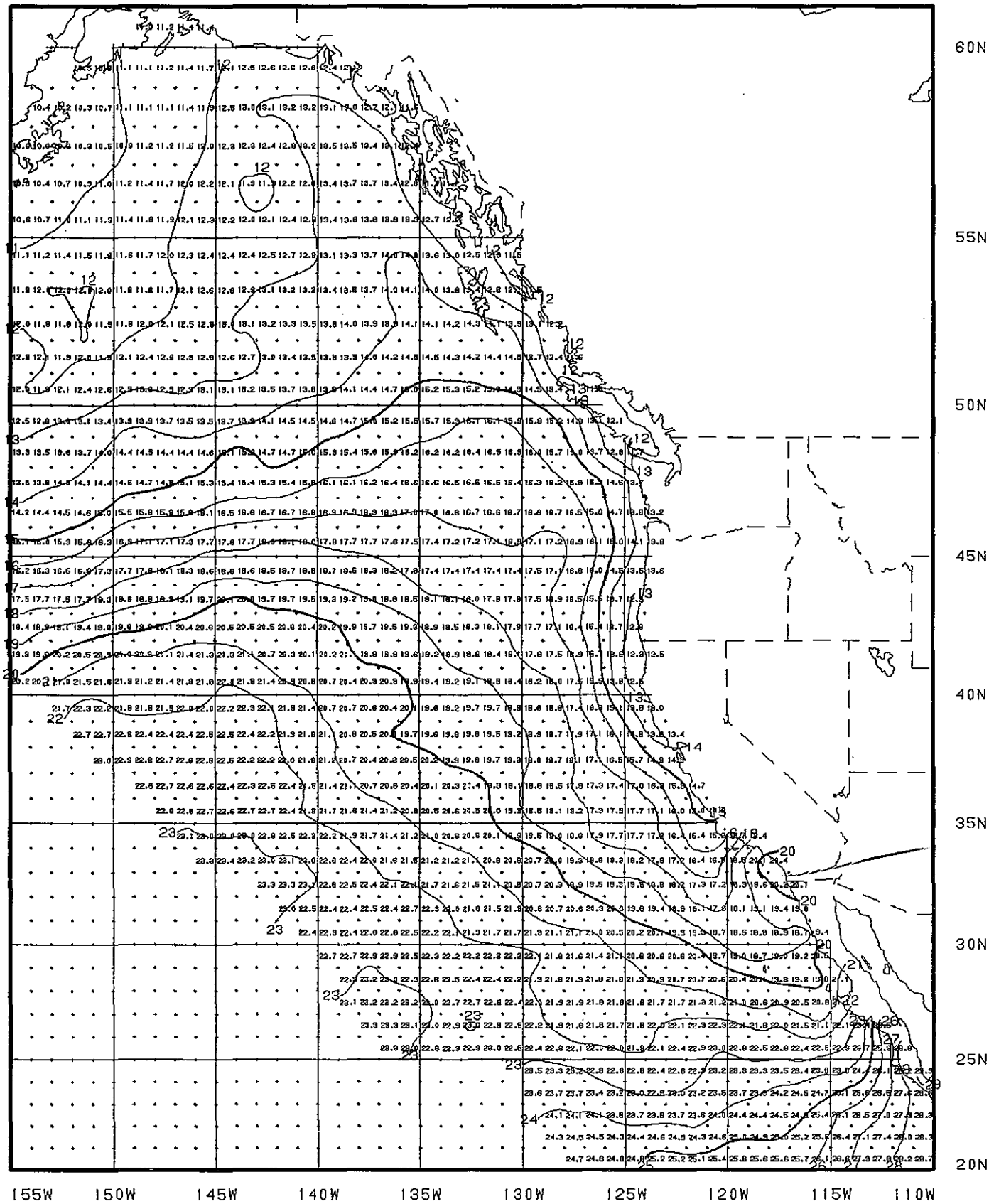
North Panel offshore waters began steady seasonal cooling after reaching their maximum SSTs in mid-September. The monthly mean SST change is +0.6°C since August. The mean monthly coastal SSTs are also slightly warmer than August due to southerly winds associated with several weak weather systems and a strong cyclone during September 23-26. Coastal SSTs show steady warming after mid-September. Complex thermal boundaries associated with upwelling are visible on satellite imagery throughout the month off western Vancouver Island and during the first two weeks off central and southern Oregon. Upwelling was especially strong off southern Oregon during September 1-3. Monthly mean SSTs over most of the area are about normal for September with the large negative anomalies (-1.0 to -1.5°C) occurring in the southeast corner area and the largest positive anomalies (1.0°C) occuring in the west central area. Commercial albacore fisherman reported average daily catches of 100 fish per boat during September 14-20 while fishing in SST waters 16-18°C, 500 miles off the Columbia River.

North Panel
Lee Morgan
NOAA/Northwest Ocean Service Center
7600 Sand Point Way NE
Bin C15700
Seattle, WA 98115
(206) 526-6606
FTS 392-6606

South Panel
Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

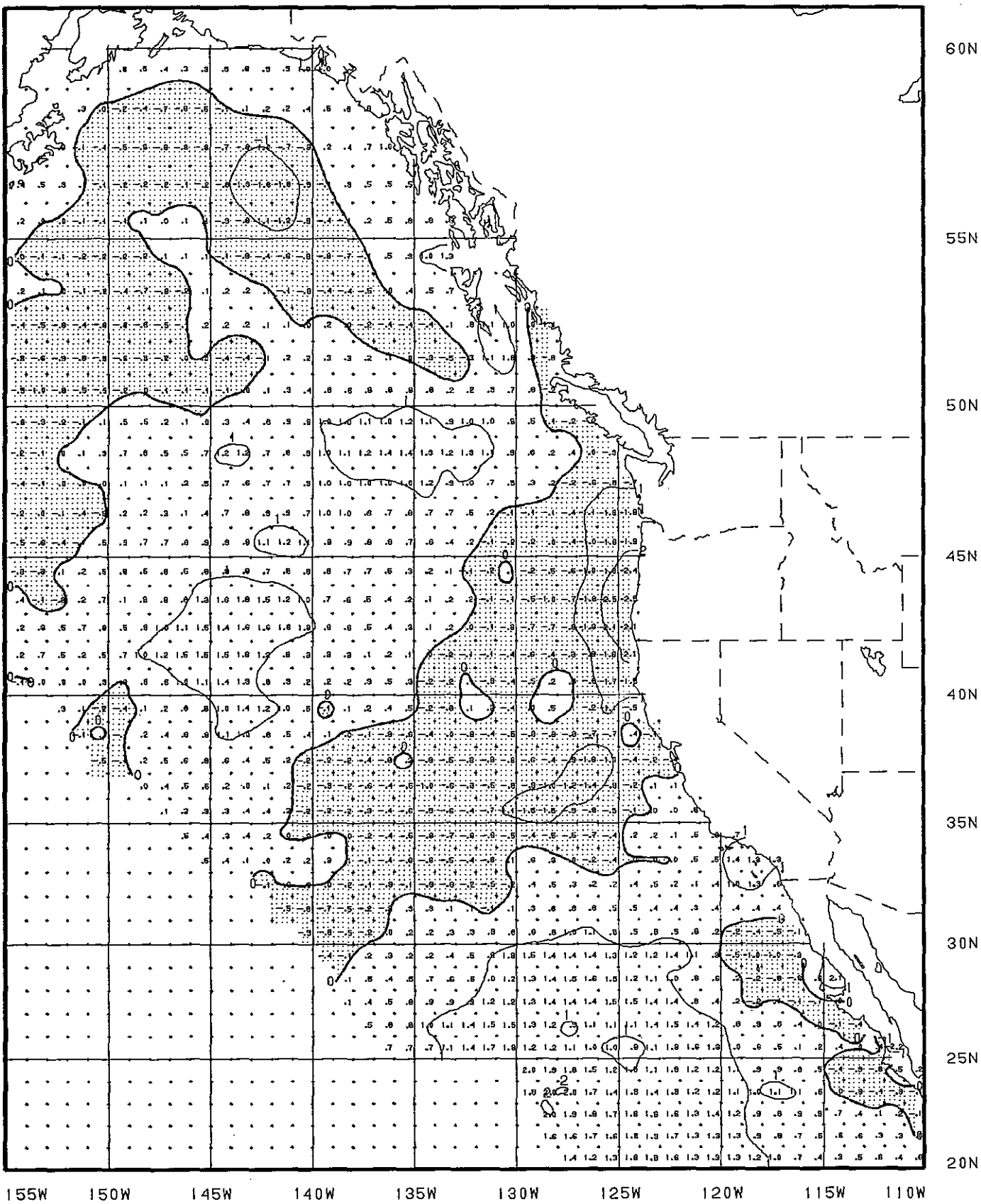


SSTs for the month of September show cool anomalies north of about 36°N and warm anomalies south of 36°N. The maximum cool anomaly (-1.3°C) is in the northwest section of the South Panel. The maximum warm anomaly (+1.4°C) is in the Los Angeles Bight. In contrast to the anomaly pattern, SSTs warmed during September west of 120°W, with maximum cooling (+1.5°C) in the northwest section of the South Panel; SSTs cooled east of 120°W.



West Coast
SST--MONTHLY MEAN (°C)
September 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
September 1986

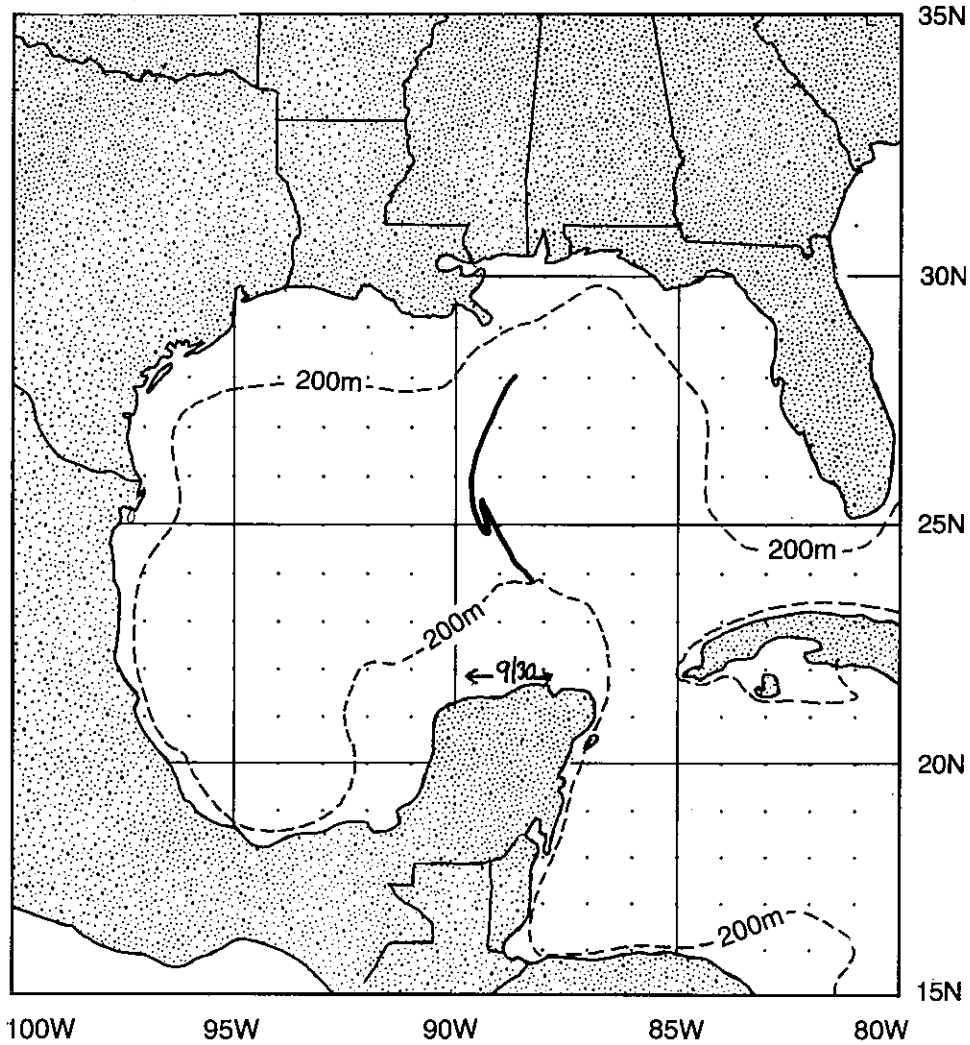
Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

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 NW 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. Eddies or sections of the Gulf

EAST COAST OCEAN FEATURES

Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

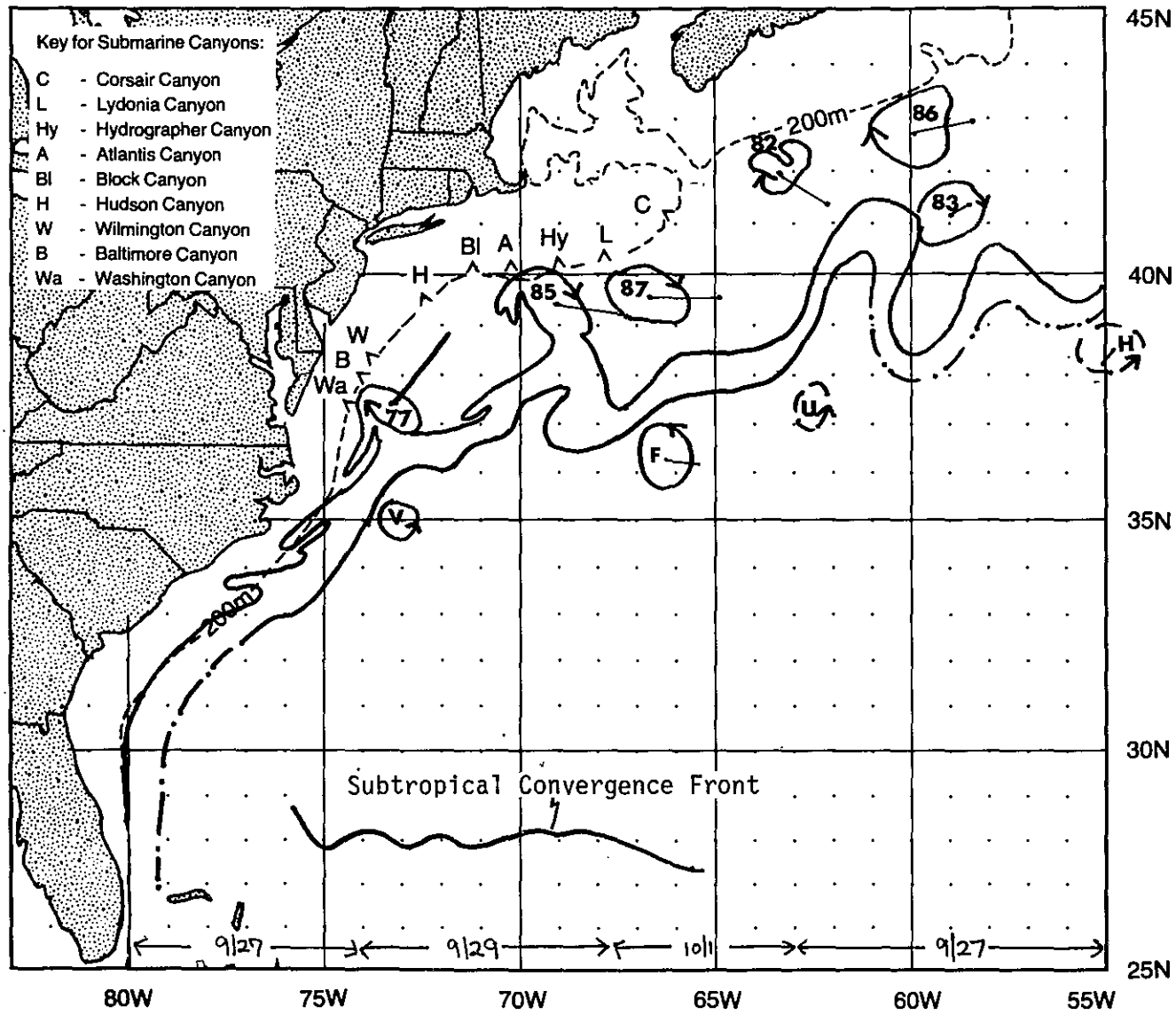
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

SEPTEMBER 1986

Due to near isothermal conditions in the Gulf of Mexico during September, the Loop Current was not discernible until September 30. On September 30, moisture corrected satellite imagery revealed a very subtle gradient along the western side of the Loop Current. It is interesting that the Loop Current water appeared slightly cooler than the Gulf of Mexico water to the west as the Loop Current is normally the warmest feature in the Gulf of Mexico. A similar condition occurred in 1982.

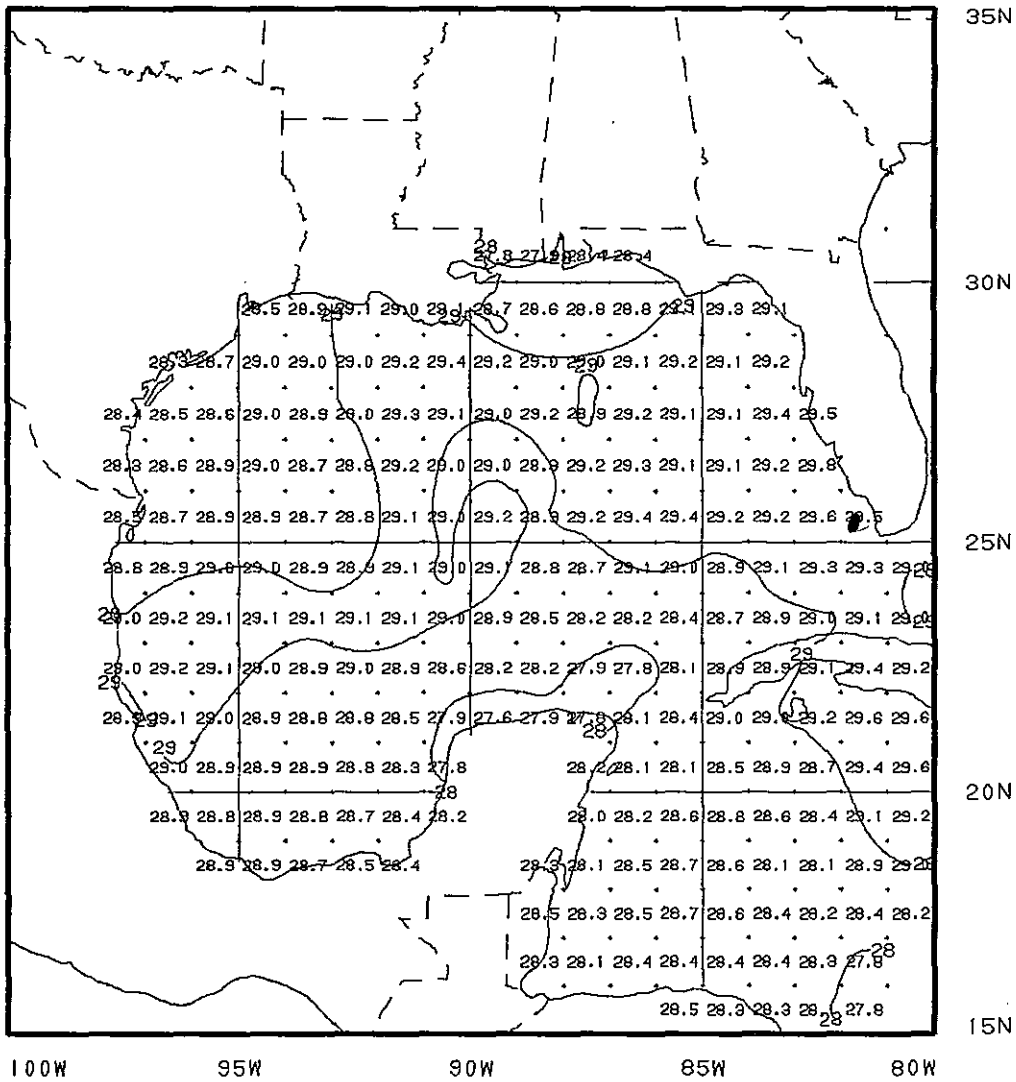


No new anticyclonic eddies were formed during September and one anticyclonic eddy was apparently absorbed. Eddy 84 was apparently absorbed by eddy 85 around September 8. Eddy 77 rapidly translated 195 km SW and is interacting with the Gulf Stream near 37°N 73°W. Eddies 85 and 87 traveled 150 km WNW and 150 km W, respectively. Eddy 85 is interacting with the Gulf Stream near 39°N 69°W. Eddy 85 is interacting with the Gulf Stream near 39° N 69°W. Eddy 82 moved 120 km NW. Eddy 86 traveled 110 km WSW. Eddy 83 translated 45 km SW.

Two cyclonic eddies were newly detected due to cloud free conditions. Eddy U was observed near 37°30N 62°30W on September 12; its origin is unknown. Eddy V was first observed near 35°N 73°W on September 19; it could be a previously identified eddy which has not been observed for over one month. Eddy F translated 75 km W while eddy H translated 35 km NNE when it was last observed on September 13. Eddy T was not observed.

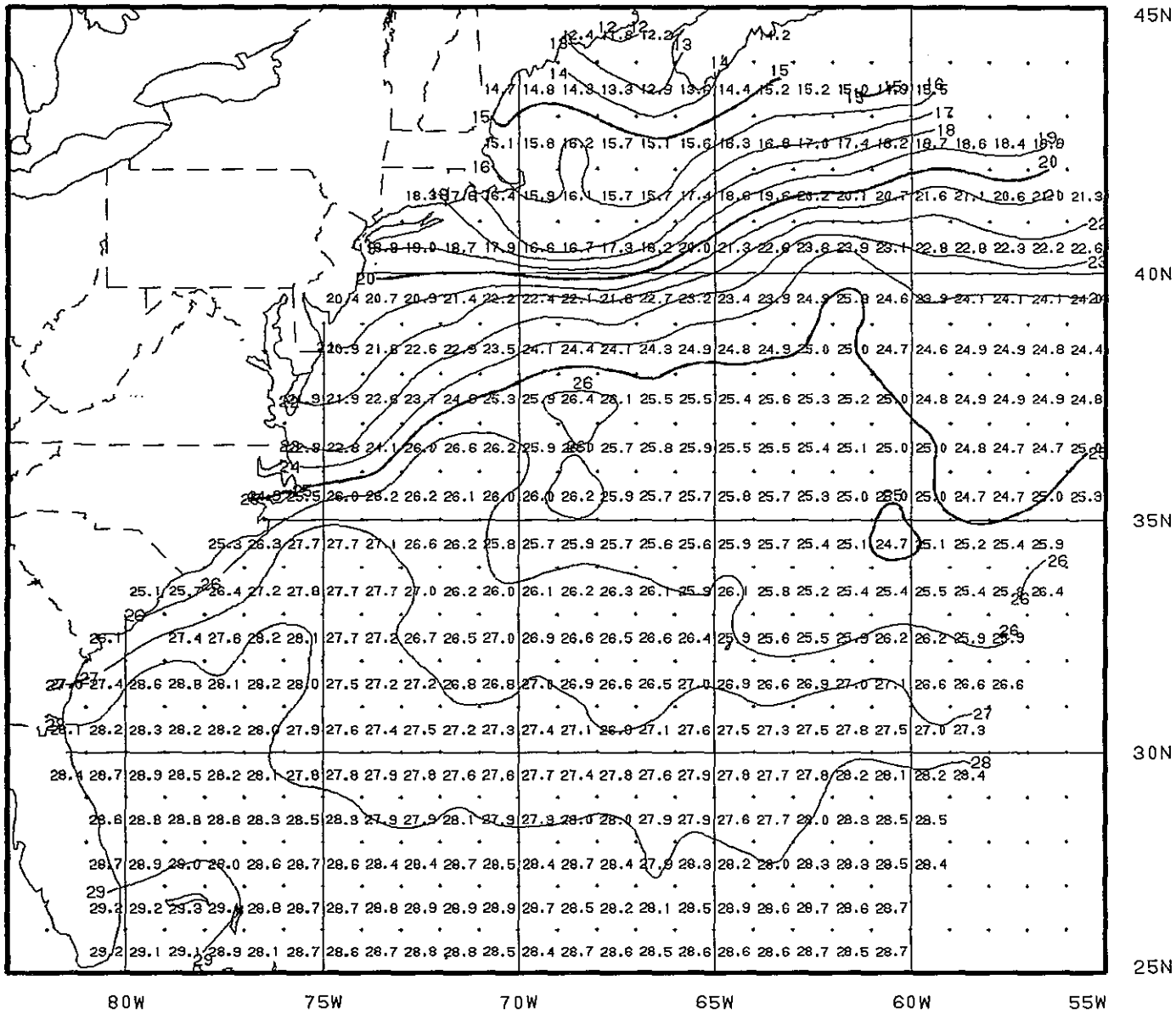
The Subtropical Convergence Front was seemingly discernible in moisture corrected satellite imagery on September 29 from 28°N 75°W to 27°30N 65°30W.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
September 1986

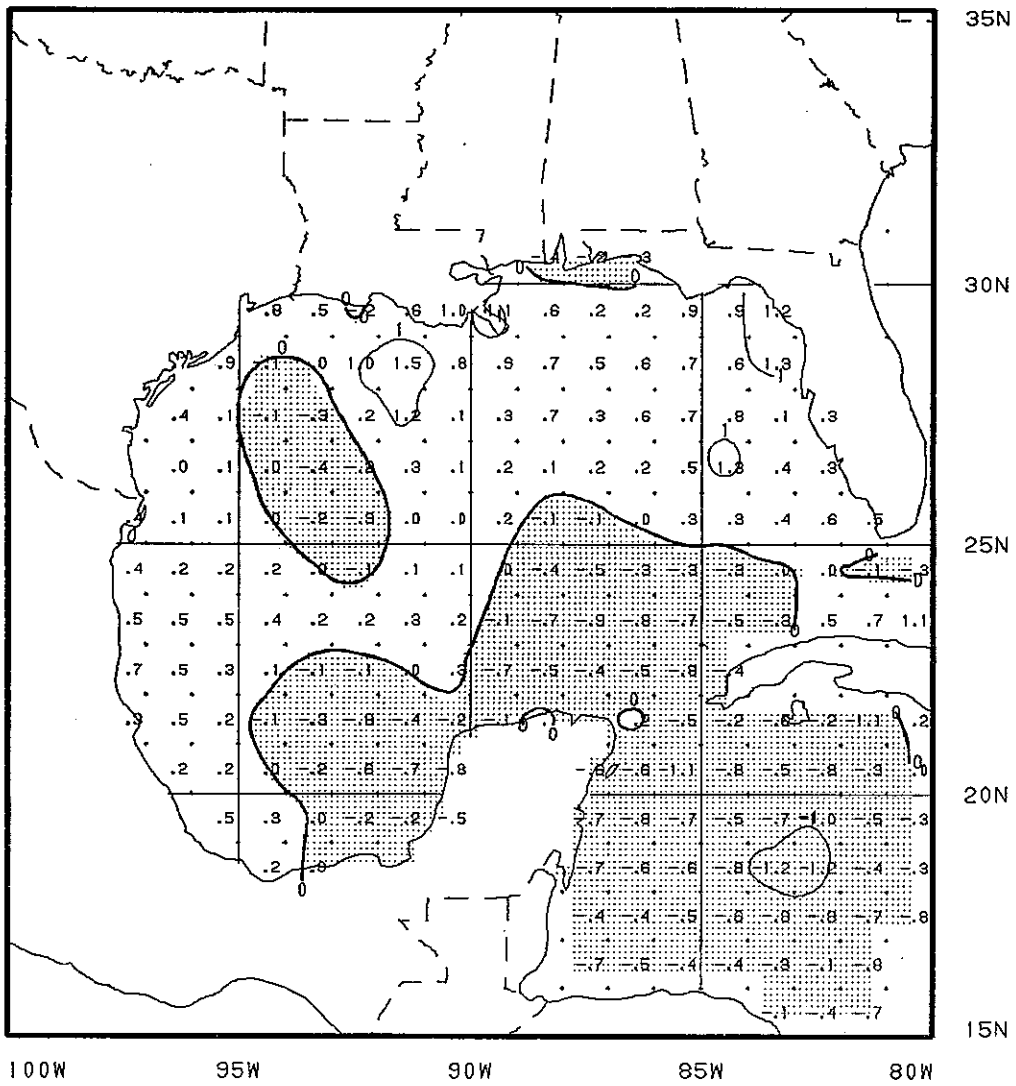
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
September 1986

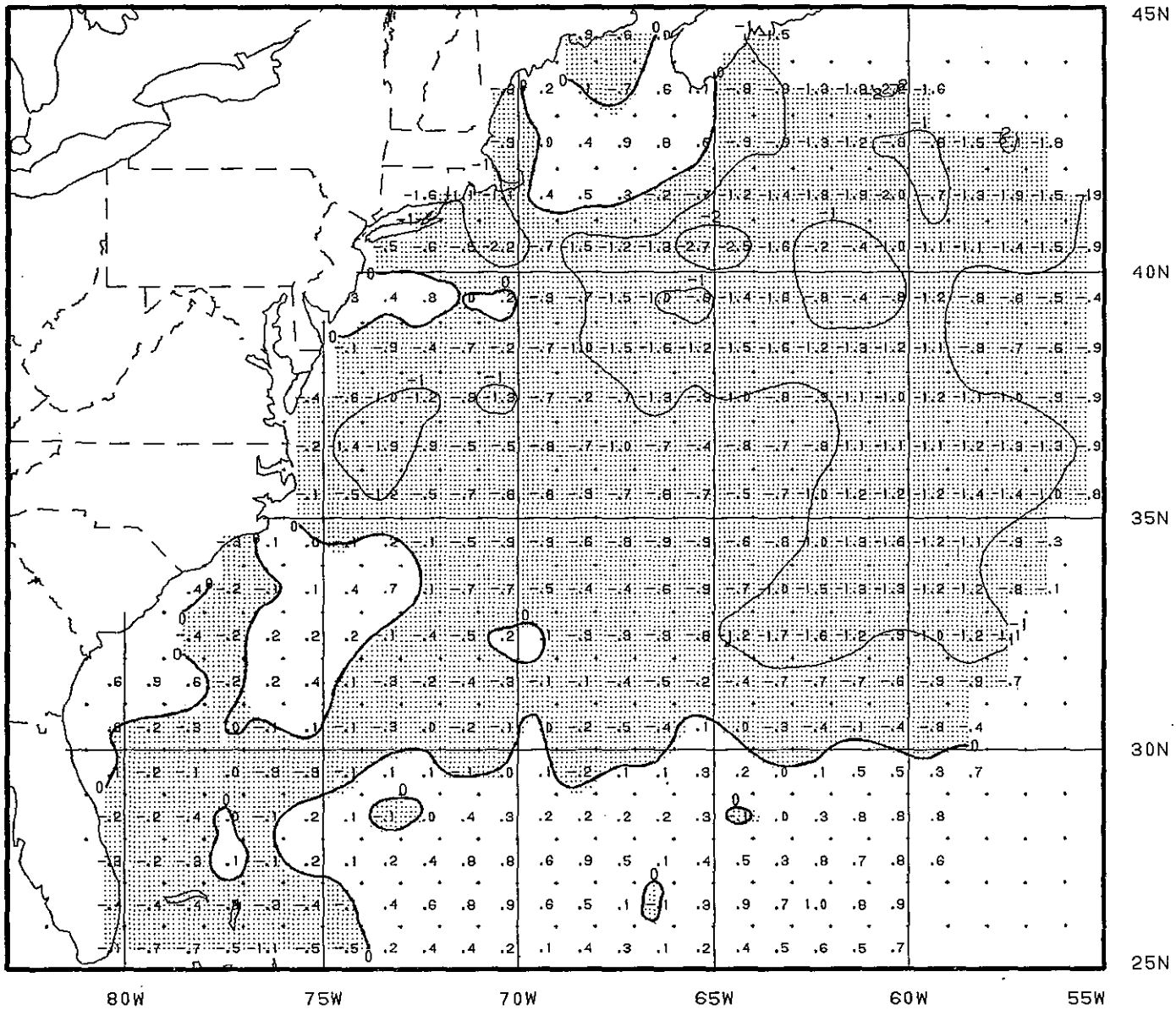
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
September 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
September 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE, WA 98115-0070

17

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

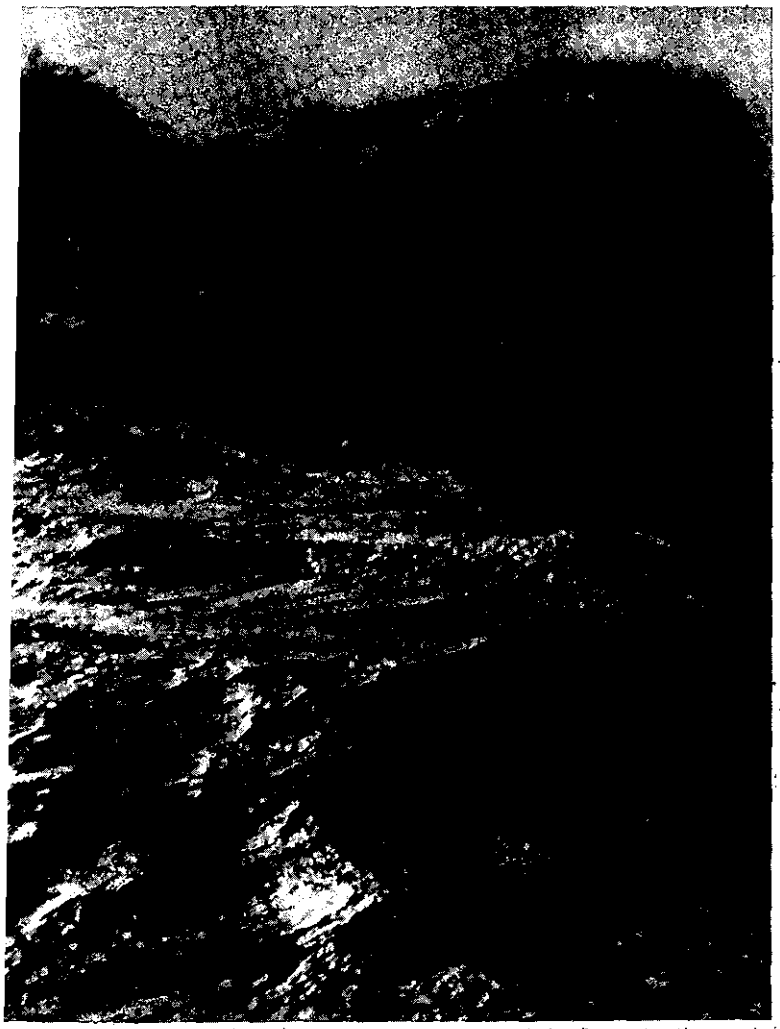
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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, 1987.

OCEANOGRAPHIC Monthly Summary

olume VI Number 10 October 1986



Contents

3 Satellite IMAGE of the Month
4 Pacific SST - monthly mean
6 Pacific SST - anomaly
8 Atlantic/Indian SST - monthly mean
10 Atlantic/Indian SST - anomaly
12 Bering Sea/North Slope ICE, with text
13 West Coast OCEAN FEATURES, with text
14 West Coast SST - monthly mean
15 West Coast SST - anomaly
16 East Coast OCEAN FEATURES, with text
18 East Coast SST - monthly mean
20 East Coast SST - anomaly
22 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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] 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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]The climatology is derived from *in situ* data (1950-1979), satellite data (1982-1985) and an ice climatology.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2.*
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; *NavOceano Ref. Pub. 18.*

Oceanographic Monthly Summary

Editor: Patrick McHugh
NOAA, NOS
Office of Ocean Services, N/OS1
Rockville, MD 20852
Telephone (301) 443-6076

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239

Typing: Damita M. Johnson

SATELLITE IMAGE OF THE MONTH*

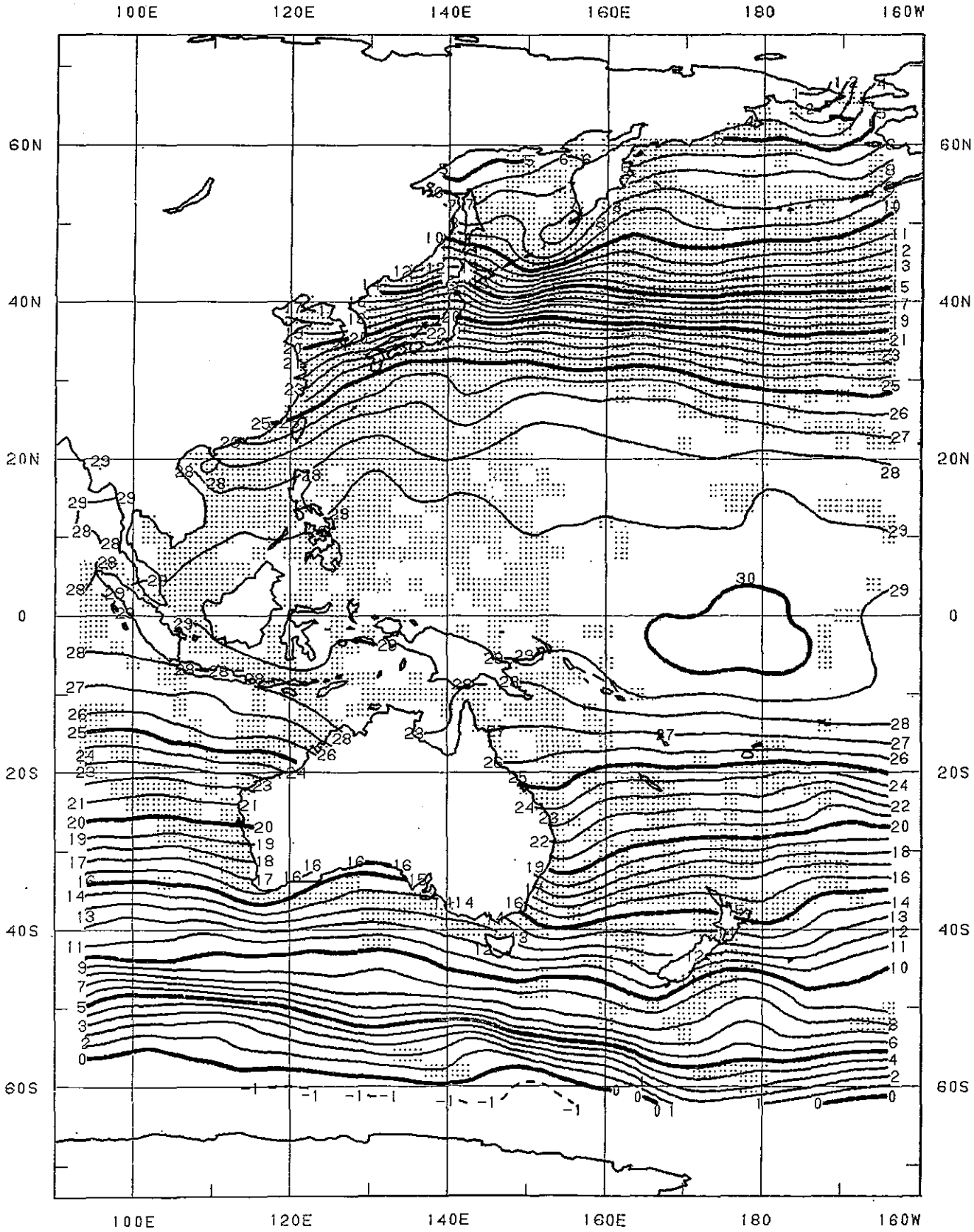
Kim Buttleman
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

THE AGULHAS CURRENT

This image (NOAA-9, AVHRR ch 4, S enhancement table from September 28, 1986 (14:06 GMT)) shows the southwest coast of the Republic of South Africa and the boundary between the Indian Ocean and the South Atlantic Ocean. Included in the land areas are Saint Helen Bay (SHB), Cape Town (CT), and Cape Agulhas (CA). Visible in the ocean areas are the divergence of the terminus of the warm (dark) Agulhas Current (AC) into the northern edge of the cold (light) Antarctic Circumpolar Current (ACC) and the start of the Benguela Current (BC). Several warm loops, remnants of the Agulhas Current, are plainly visible.

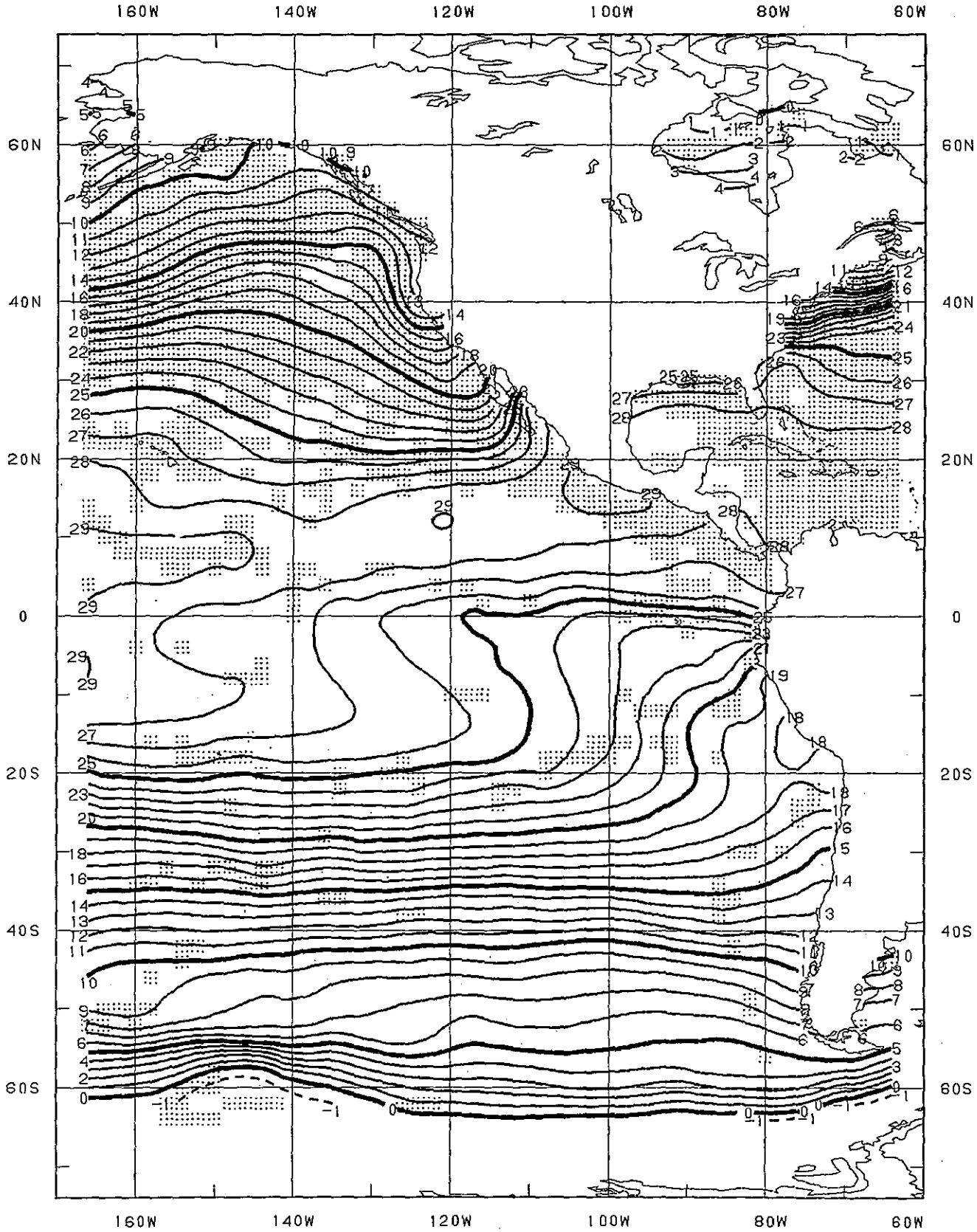
Where it skirts the southeast coast of South Africa (under the clouds), the Agulhas Current is the strongest of the western boundary currents in the southern hemisphere, reaching speeds of five knots. This region can be extremely hazardous to ships. Long-wave storm-generated swells originating in the Antarctic and southern Indian Ocean run counter to the fast moving current, and their interaction can double wave amplitude. Smaller ships can be inundated by the larger waves, and supertankers are vulnerable when the wavelength of the swells is close to the length of the ship. In this case, if the wave height is great enough, the stem and stern of the ship may be supported by the crests of the wave as it passes under the ship, leaving the middle of the ship over the trough, unsupported by water. A number of ships have been known to break in half under these circumstances.

*In last month's issue, the third sentence describing U.S. West Coast Upwelling should have read: This time of year marks the end (not onset) of substantial coastal upwelling.



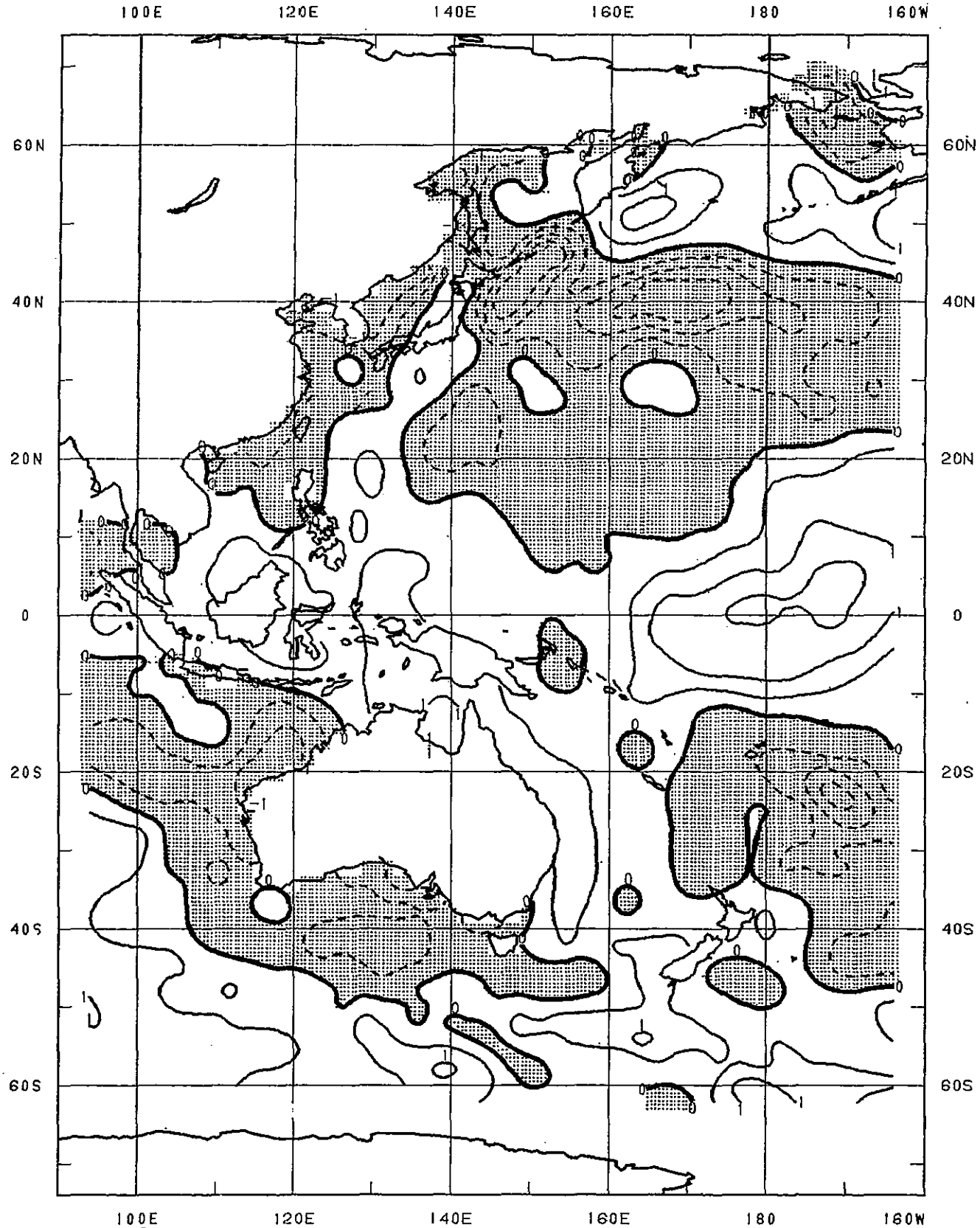
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA

Monthly mean sea surface temperature is the mean of *in situ* 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.



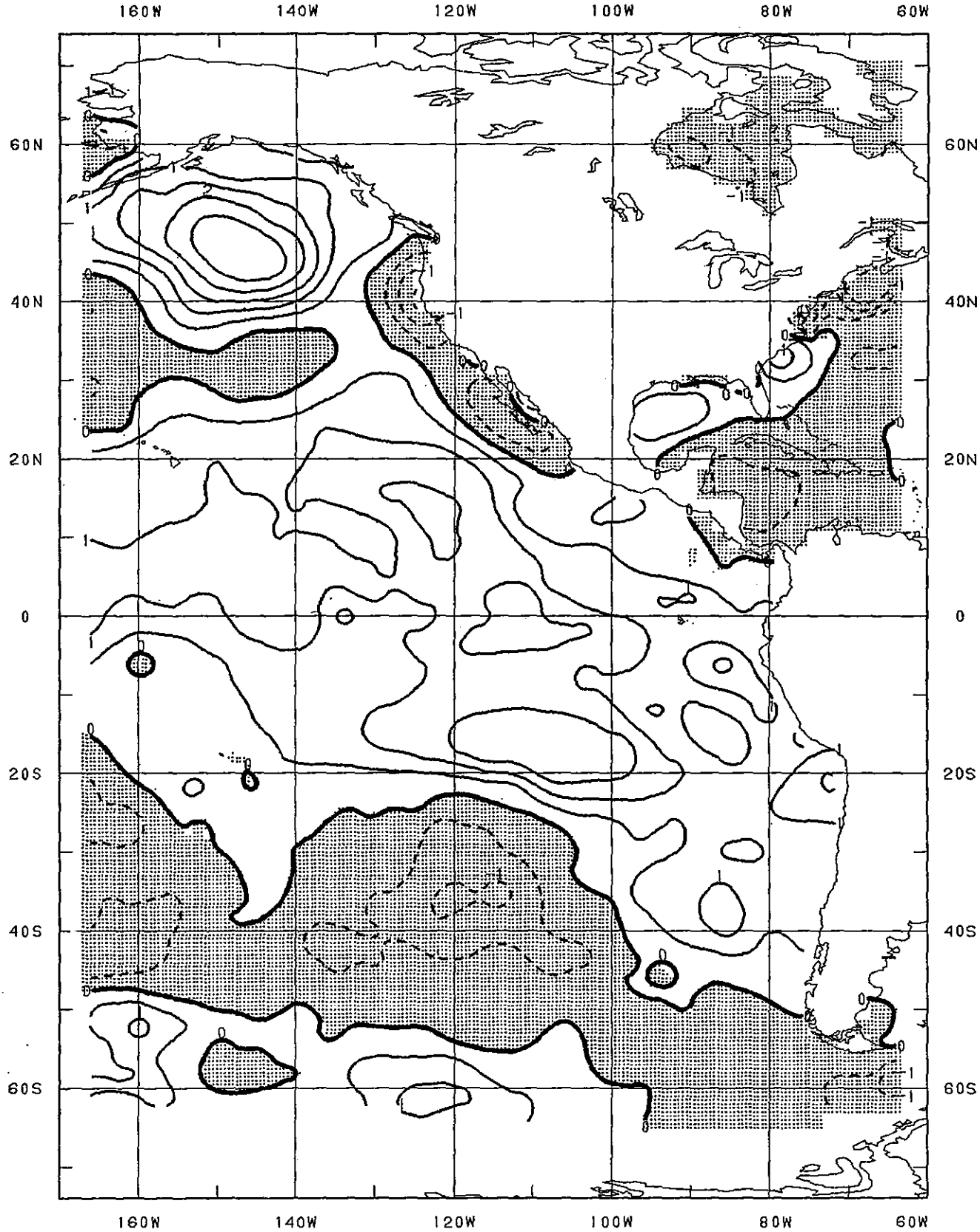
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA

Monthly mean sea surface temperature is the mean of *in situ* 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.



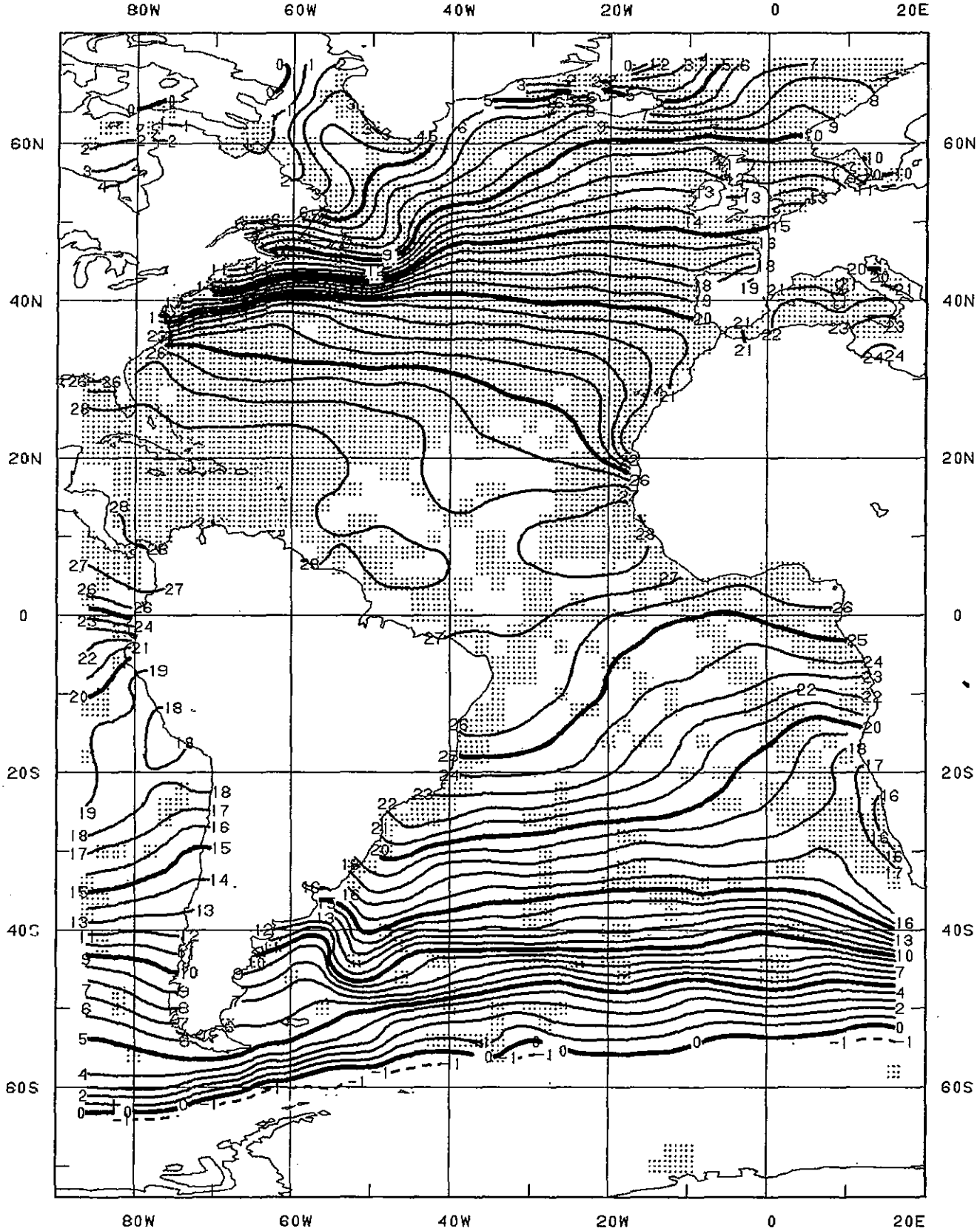
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



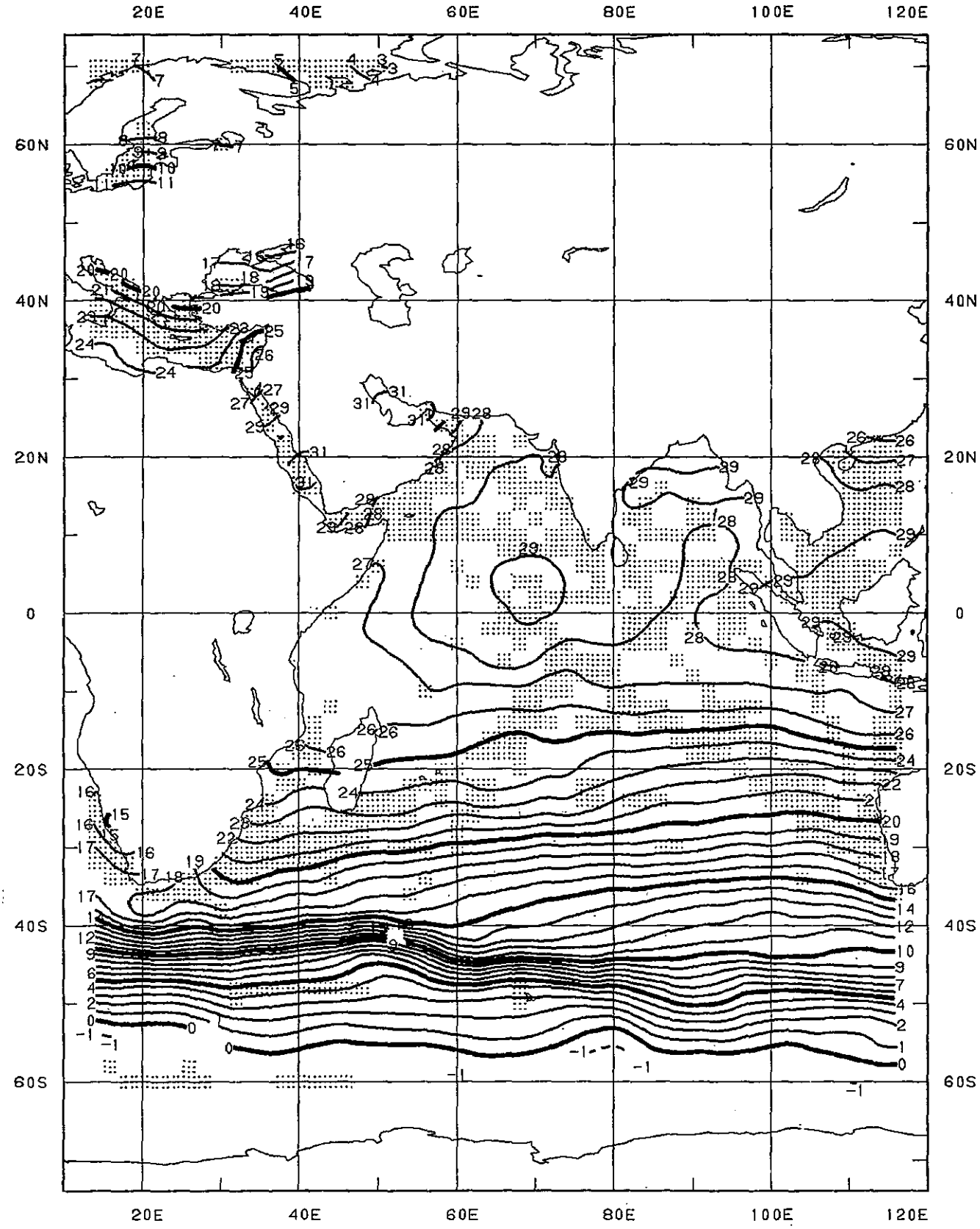
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



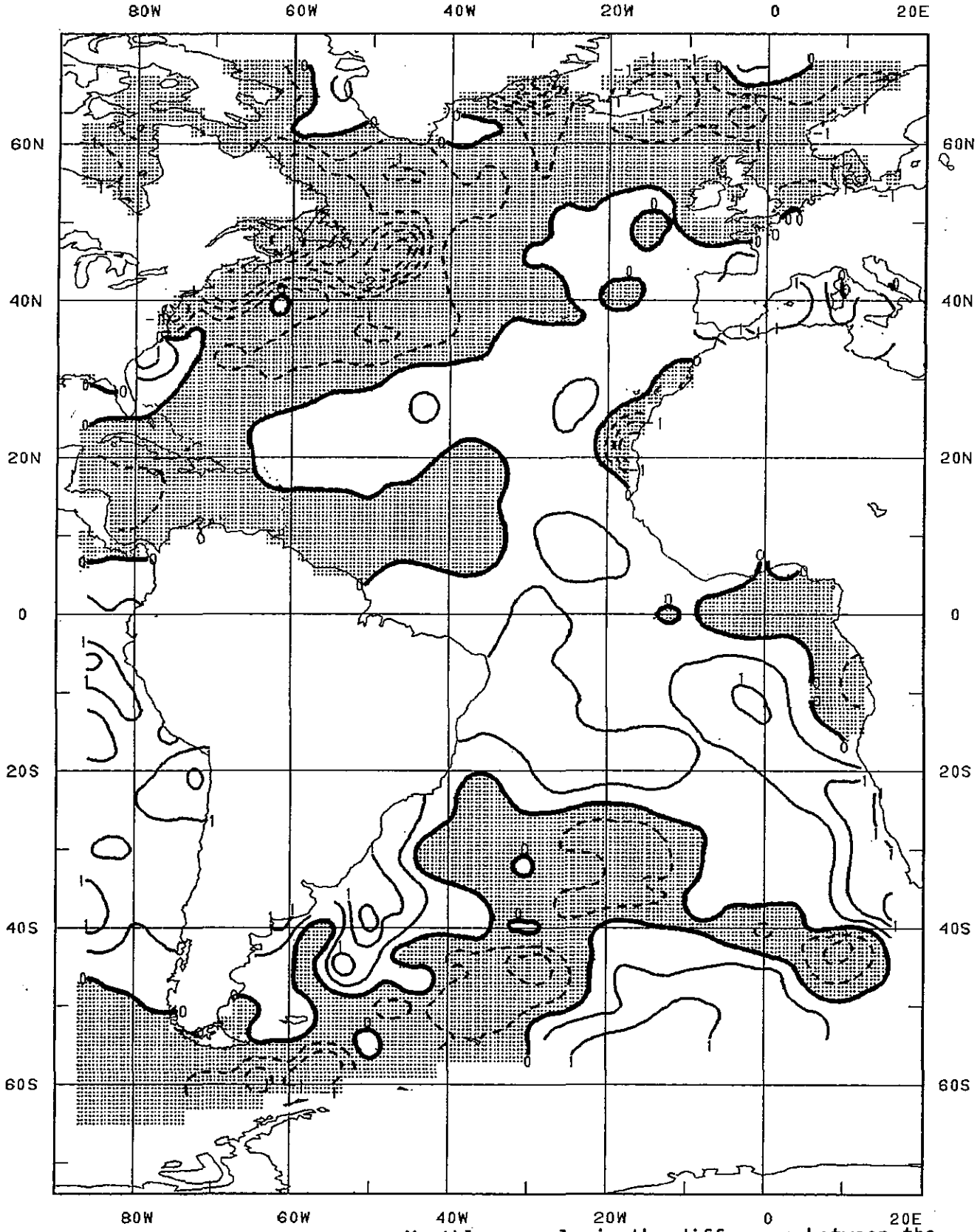
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA

Monthly mean sea surface temperature is the mean of *in situ* 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.



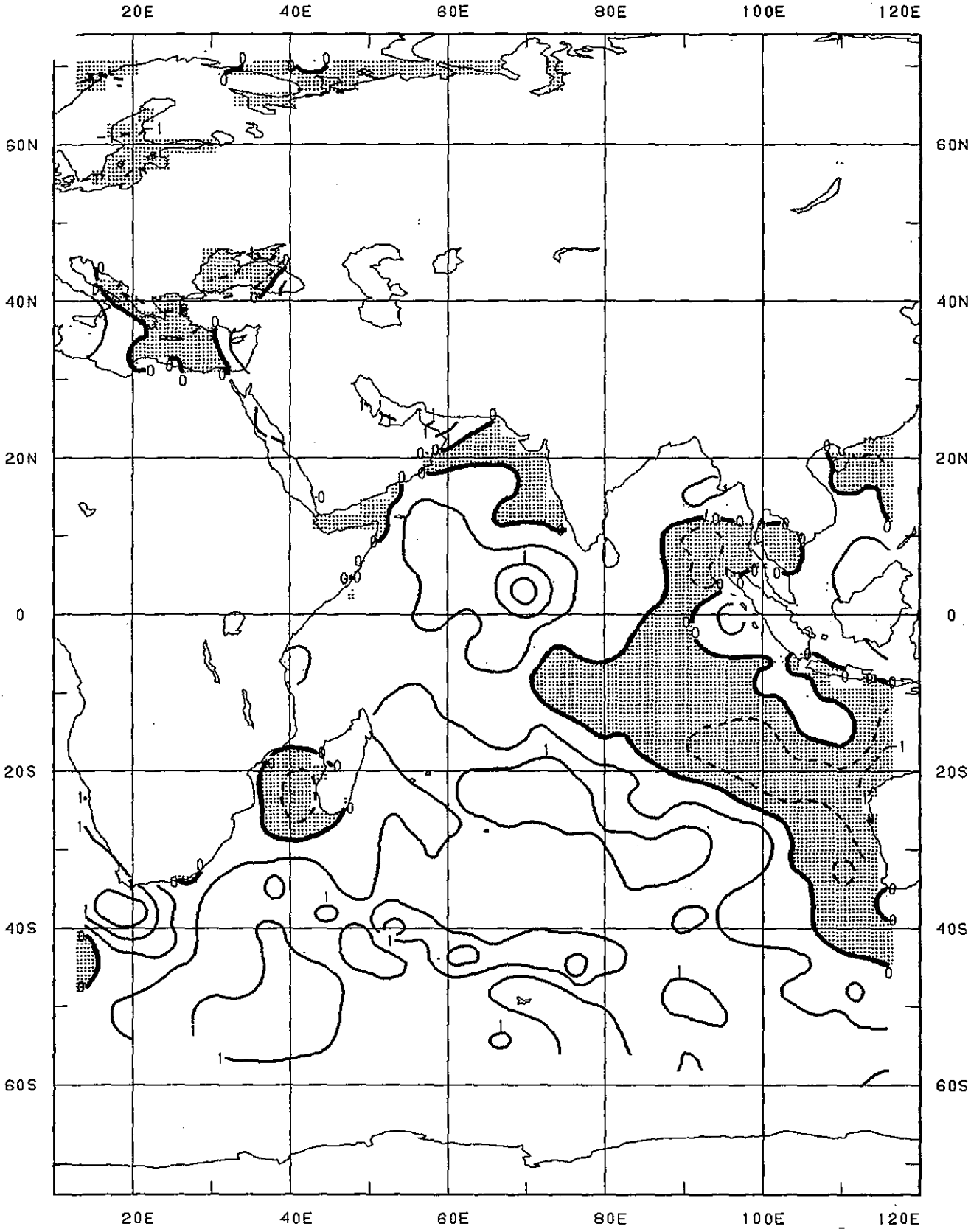
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA

Monthly mean sea surface temperature is the mean of *in situ* 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.



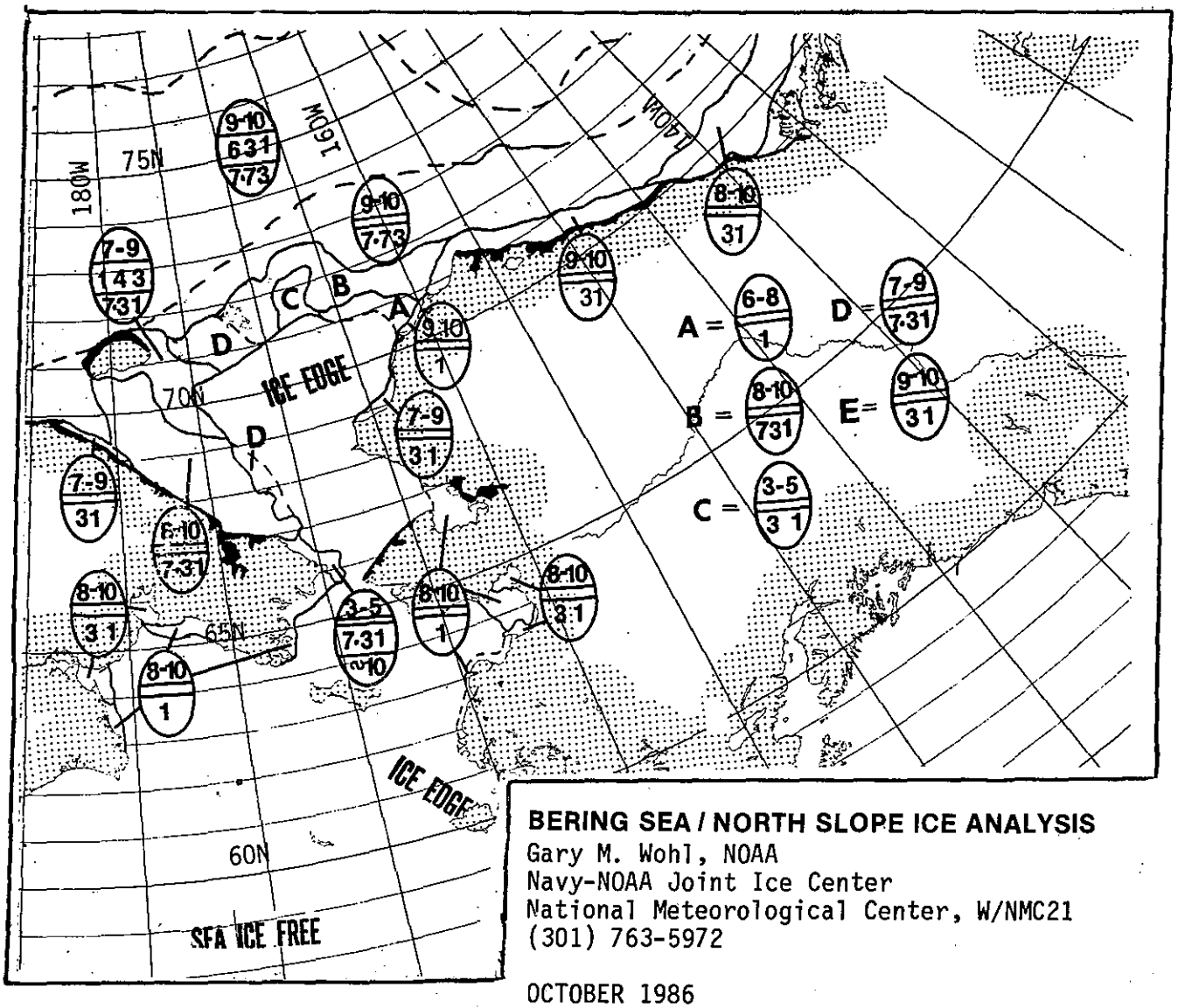
Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA

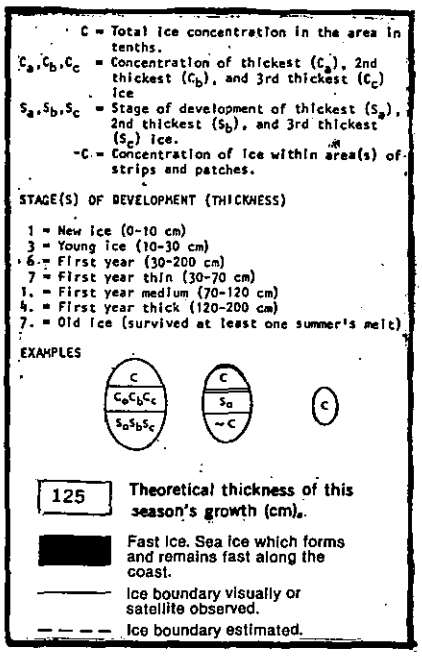
Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value. Contour line interval is 0.5°C. The stippling indicates where the monthly mean is colder than climatology; contours are not shown in areas without monthly or climatological data.



BERING SEA / NORTH SLOPE ICE ANALYSIS

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

OCTOBER 1986



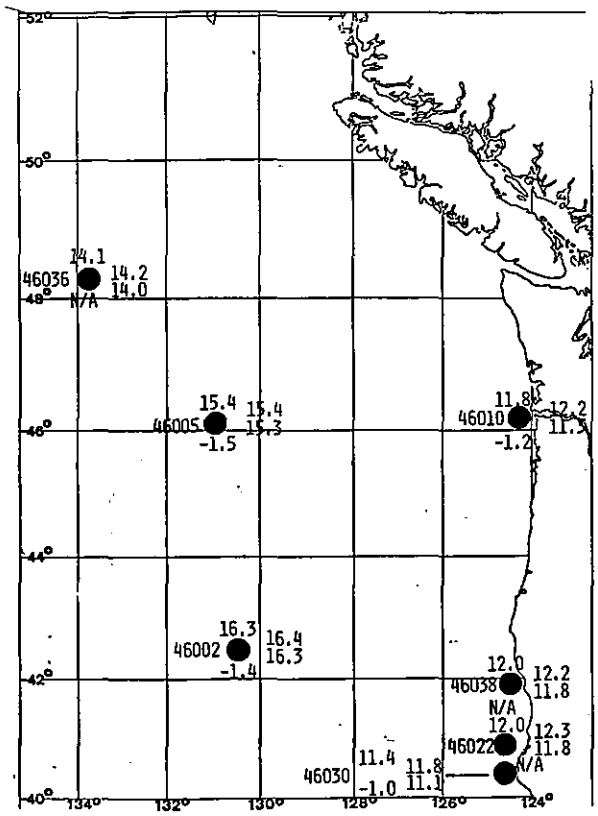
October brought a marked change in the sea ice conditions for the Alaskan area. The open water areas off the North Slope disappeared as the polar drift ice moved toward the south and new ice grew seaward from protected coastal waters. New sea ice also grew along the Alaskan coast of the Chuckchi Sea and, toward the end of the month, in the protected areas of Norton Sound in the northern Bering Sea. This moderate ice growth pattern was supported by the atmospheric circulation as shown by the mean sea level pressure distribution for October. A storm track leading toward the Gulf of Alaska maintained a flow from the interior of the state toward the Chuckchi Sea. Average temperatures for the month were slightly below normal at the coastal station of Kotzebue, slightly above normal at Barrow, and about seven degrees above normal at Nome. New sea ice was also observed along the Siberian coastline of the Bering Sea, and some old ice approached the Bering Strait from the northwest.

WEST COAST OCEAN FEATURES

Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

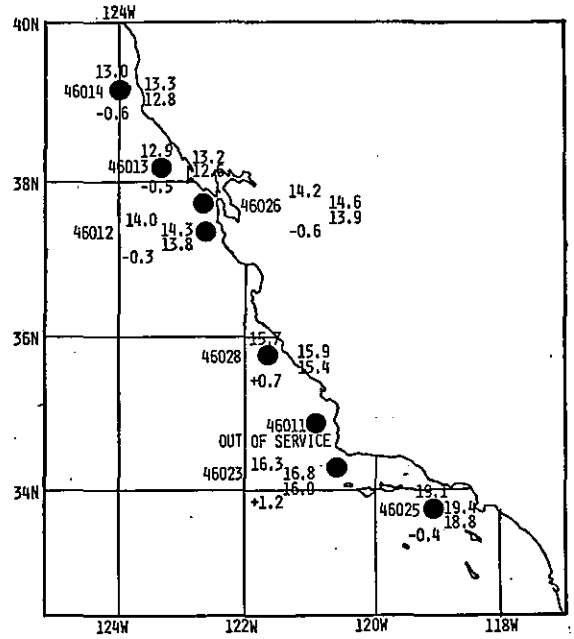
OCTOBER 1986

During October, statistics from 13 of the 15 fixed-buoys in the North and South panels showed the expected seasonal cooling. Only buoys 46011 and 46023 along the Central



California coast indicated some warming. Infrared satellite data on more than one occasion revealed warm water near these buoys. A possible explanation for this intrusion could be the surface manifestation of the Davidson Current. This current, a nearshore countercurrent to the California Current, usually appears when the fall upwelling activity relaxes and can sometimes maintain itself on the surface through January. Detailed statistics over the South panel, in addition to the fixed-buoy information, are routinely produced. Starting in the next issue of the OMS, similar statistics will be available for the discussion of the North panel.

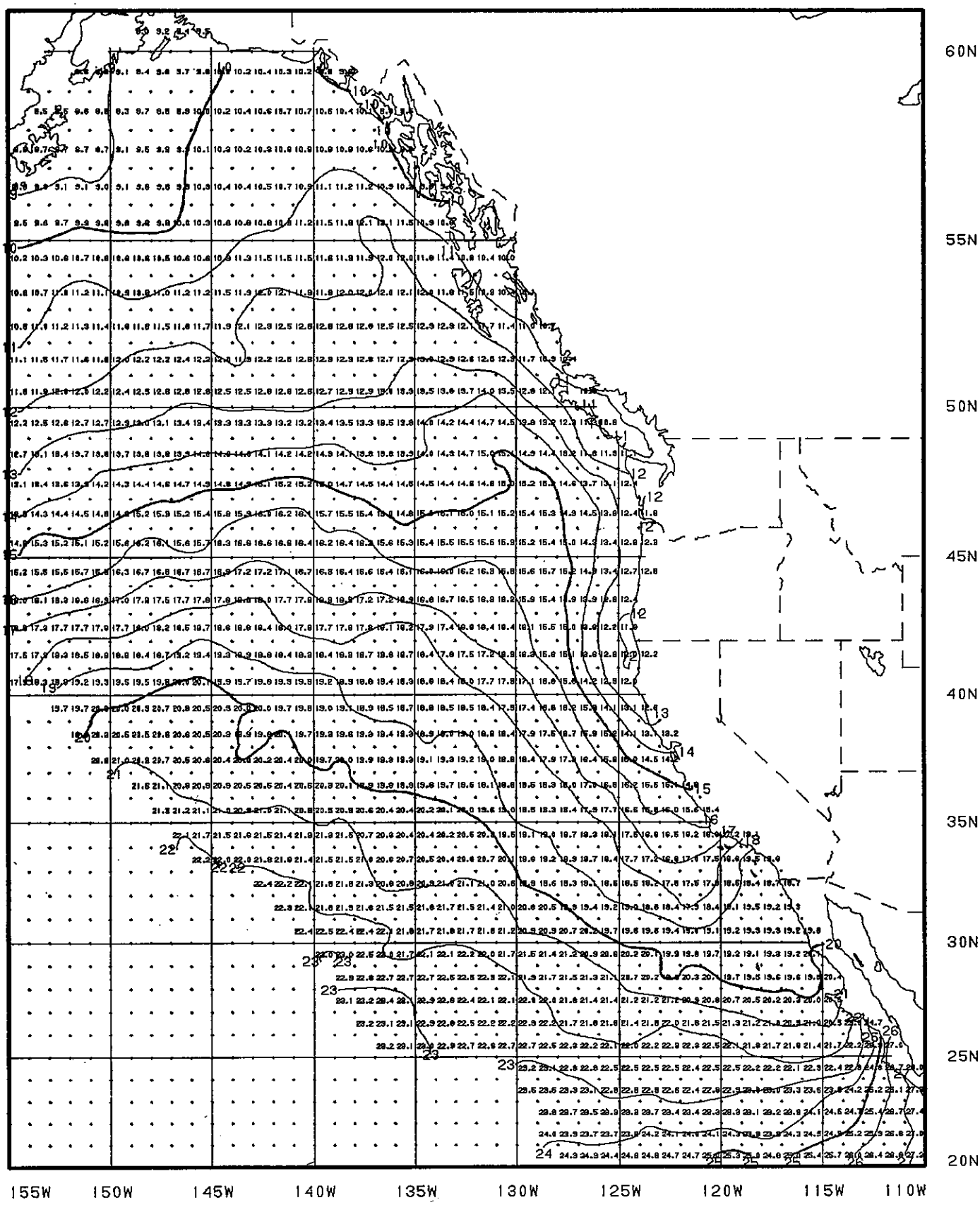
Sea surface temperatures over the entire South panel averaged +0.3°C above the climatological mean value of 18.8°C. Fifty percent of the analysis area averaged above normal and the other half below. The warmest anomaly (+1.1°C) was in the Los Angeles Bight; the coolest anomaly was centered near 36.5°N 127.5°W. Comparing October to September, all statistical locations cooled except for the two areas near Pt. Conception at 35°N 122°W and 33°N 120°W. Again, this warming is in agreement with those findings in the fixed-buoy statistics. The northern and western portions of the South Panel cooled the most with values between 0.5°C and 1.1°C.



KEY:

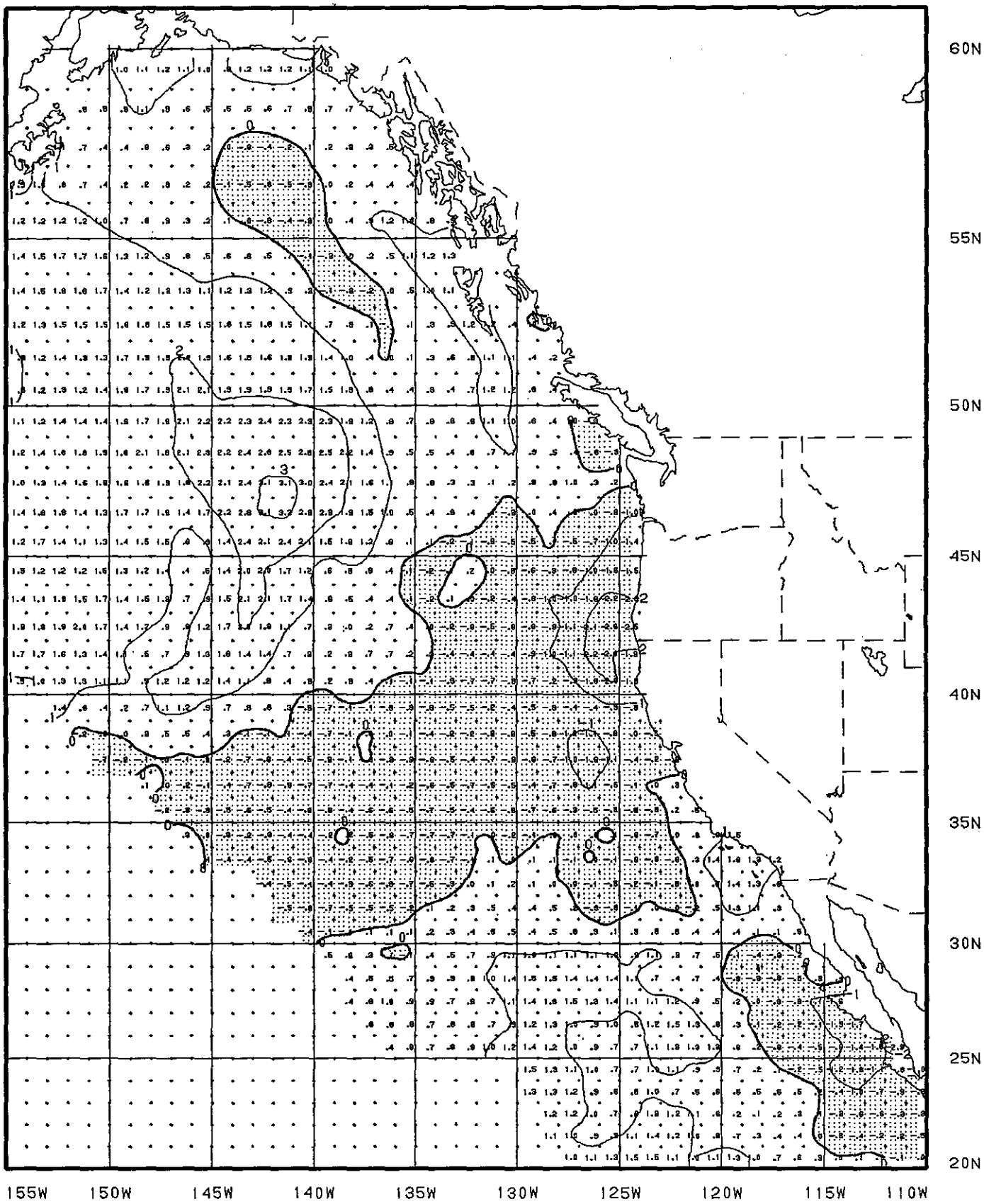
12.1 ← Monthly mean
LOCATION 13.5 ← Maximum daily mean
NAME 10.2 ← Minimum daily mean
-1.5 ← Change from previous month

● Denotes station position.



West Coast
SST--MONTHLY MEAN (°C)
October 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
October 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

EAST COAST OCEAN FEATURES

Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

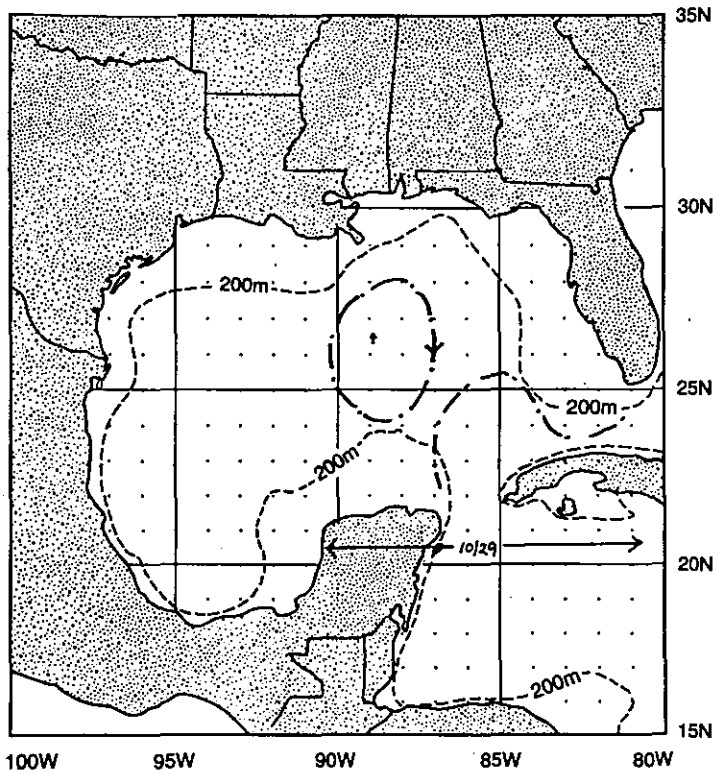
The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the NW 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. Eddies or sections of the Gulf Stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the date of data used.

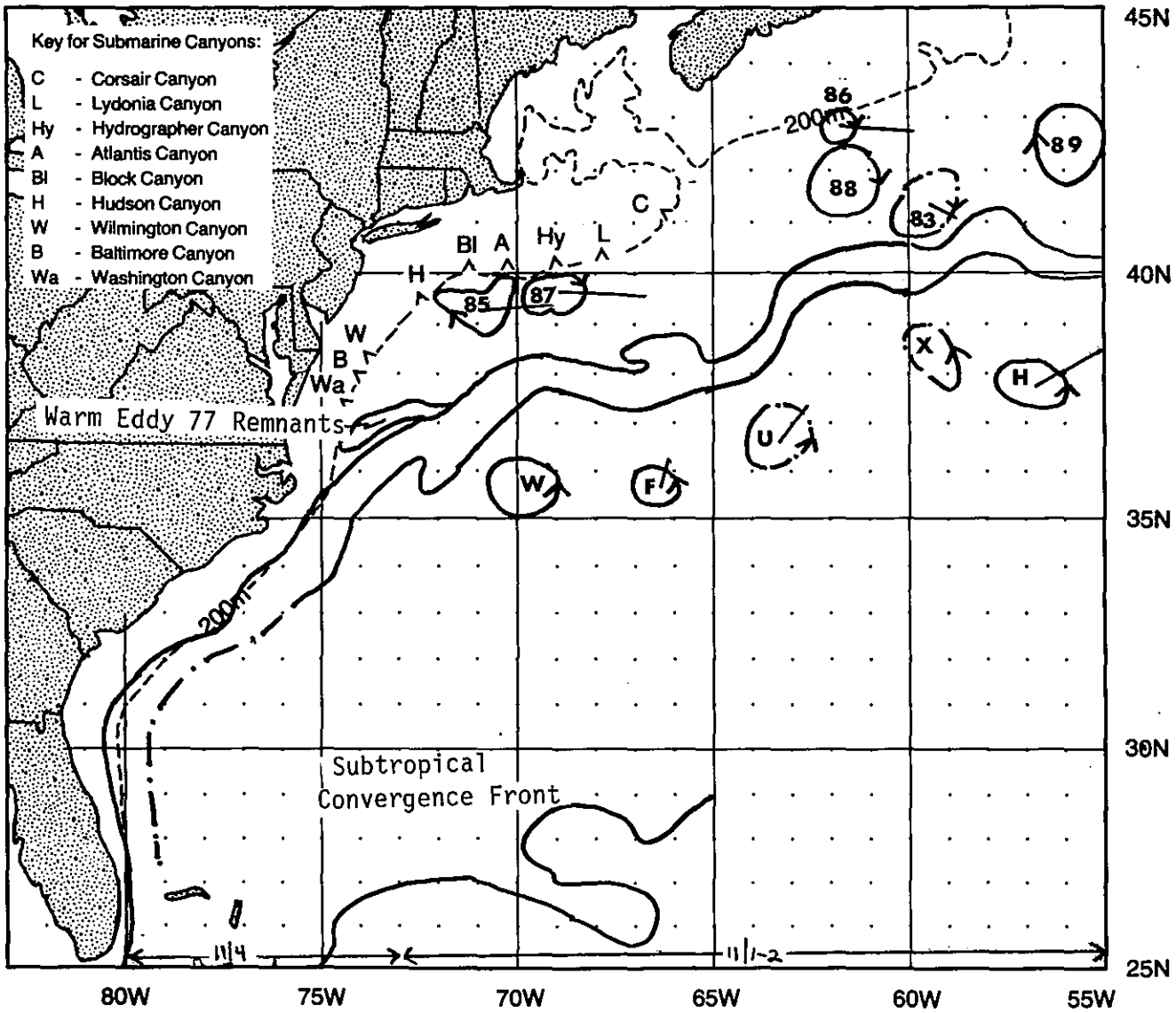
Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center
- of National Weather Service Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS

OCTOBER 1986

Near isothermal conditions still prevail in the Gulf of Mexico during October. The position of the Loop Current is estimated from Navy XBT data supplied by Mike Burdette from the National Weather Service in Slidell, Louisiana. The position of newly detected anticyclonic eddy t is also estimated from the Navy XBT data. A subtle gradient was mentioned in the September OMS near 24°N 88°W to 28°N 89°W. This gradient was mistakenly identified as the western edge of the Loop Current. Apparently the gradient was really the western edge of warm eddy t.

One new anticyclonic eddy formed and one translated into the analysis area west of 55°W during October. Eddy 88 formed from a Gulf Stream meander near 42°N 62°W around October 22. Eddy 89 was first detected on May 19 near 43°N 53°W. Its origin is unkown. By October 10 Eddy 89 translated into the analysis area near 43°N 56°W.



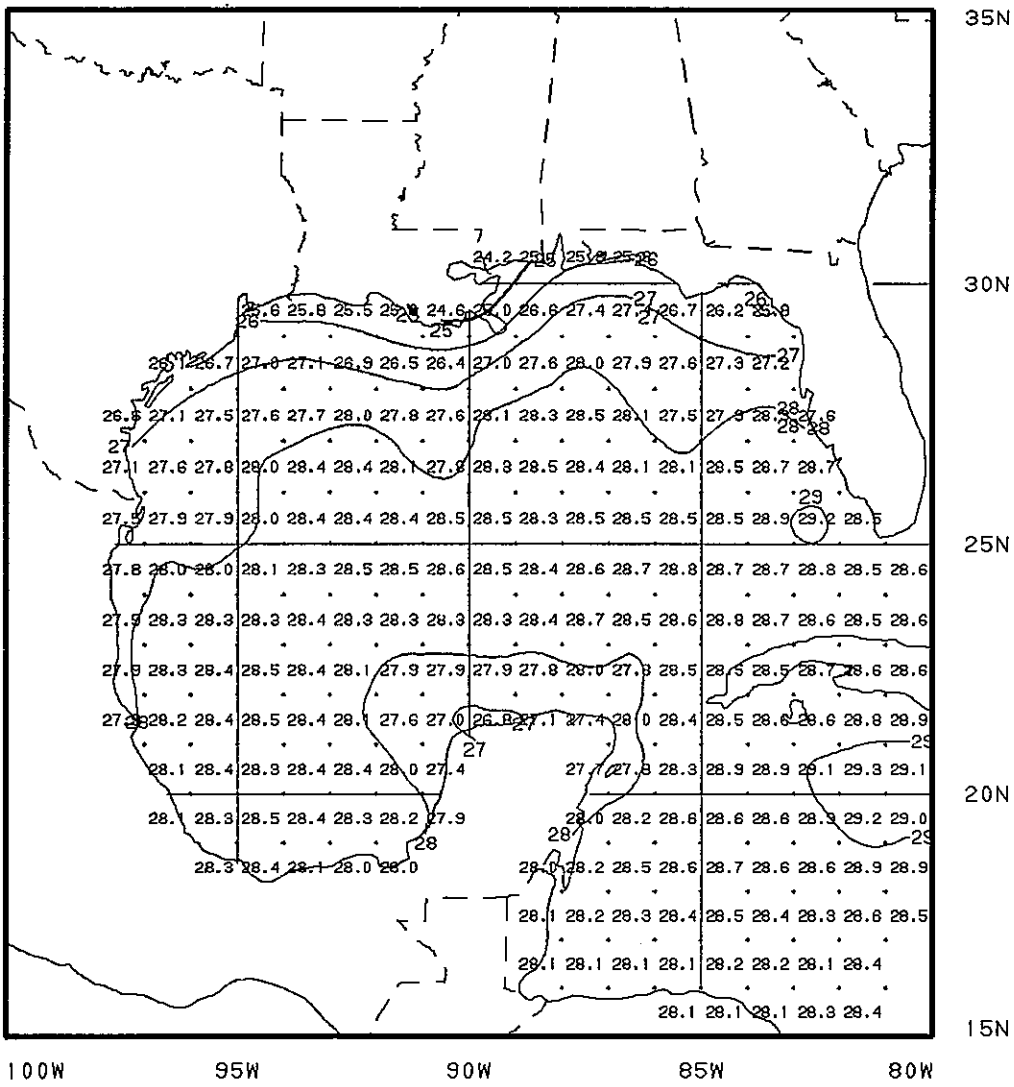


One anticyclonic eddy was absorbed and one apparently dissipated during October. Eddy 77 traveled 85 km SW by October 28 where it is being absorbed by the Gulf Stream near 37°N 74°W. Eddy 82 seemingly dissipated near 42°N 63°30W. Eddy 85 moved 140 km W while eddy 87 moved 200 km W. Eddy 86 translated 155 km WNW where it is interacting with eddy 88. Eddy 83 traveled 55 Km NW.

Two cyclonic eddies were newly detected in October. Eddy W was detected around October 3 near 36°N 70°W. Its origin is unknown. Eddy X formed from a Gulf Stream meander near 38°N 59°W about October 20. Eddy F translated 75 km SSW. Eddy U traveled 110 km SW. Eddy H moved 175 km SW. Eddy V was not observed.

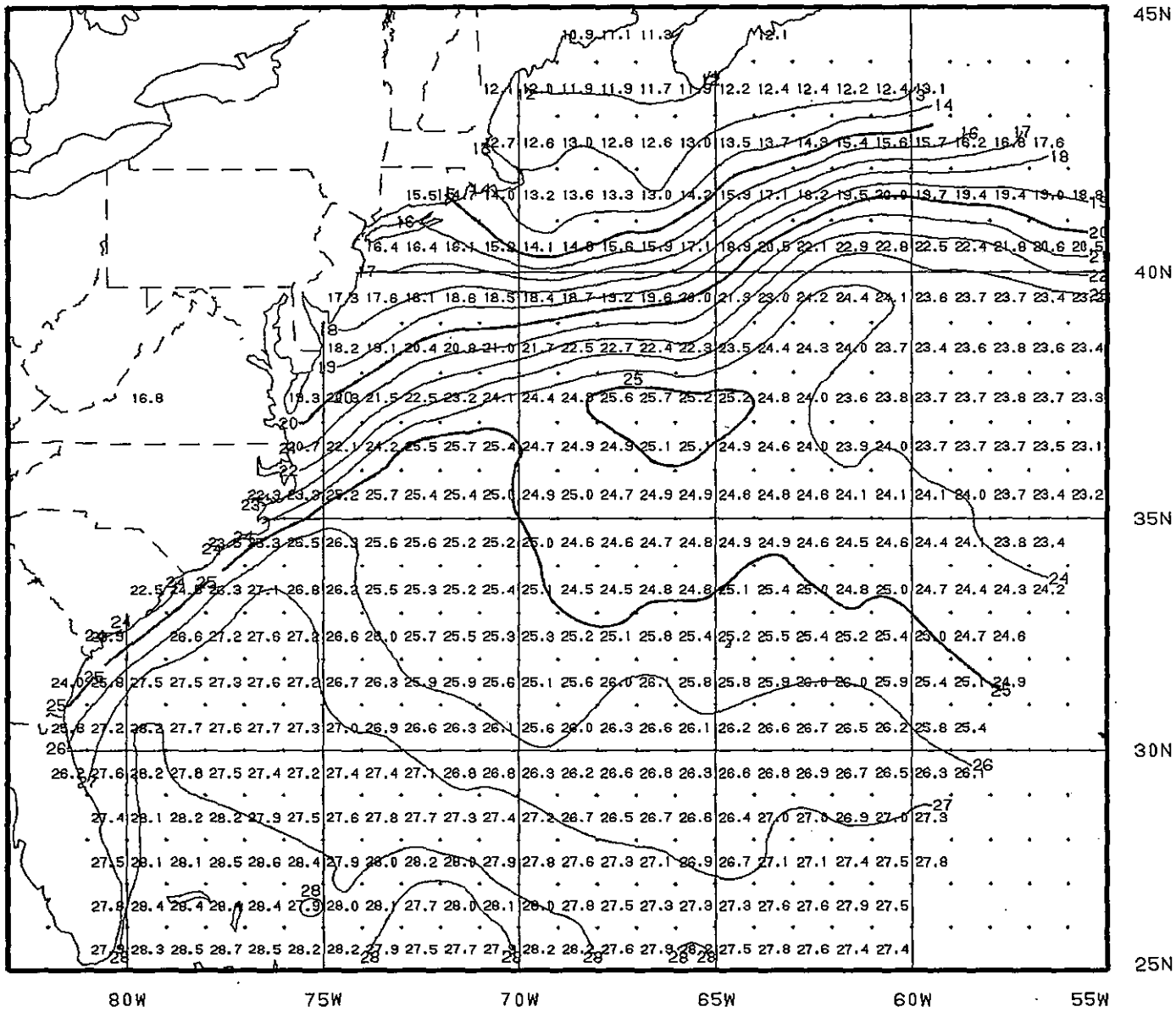
The Subtropical Convergence Front (STC) was observed on October 28 from 25°N 75°W to 29°N 65°W.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
October 1986

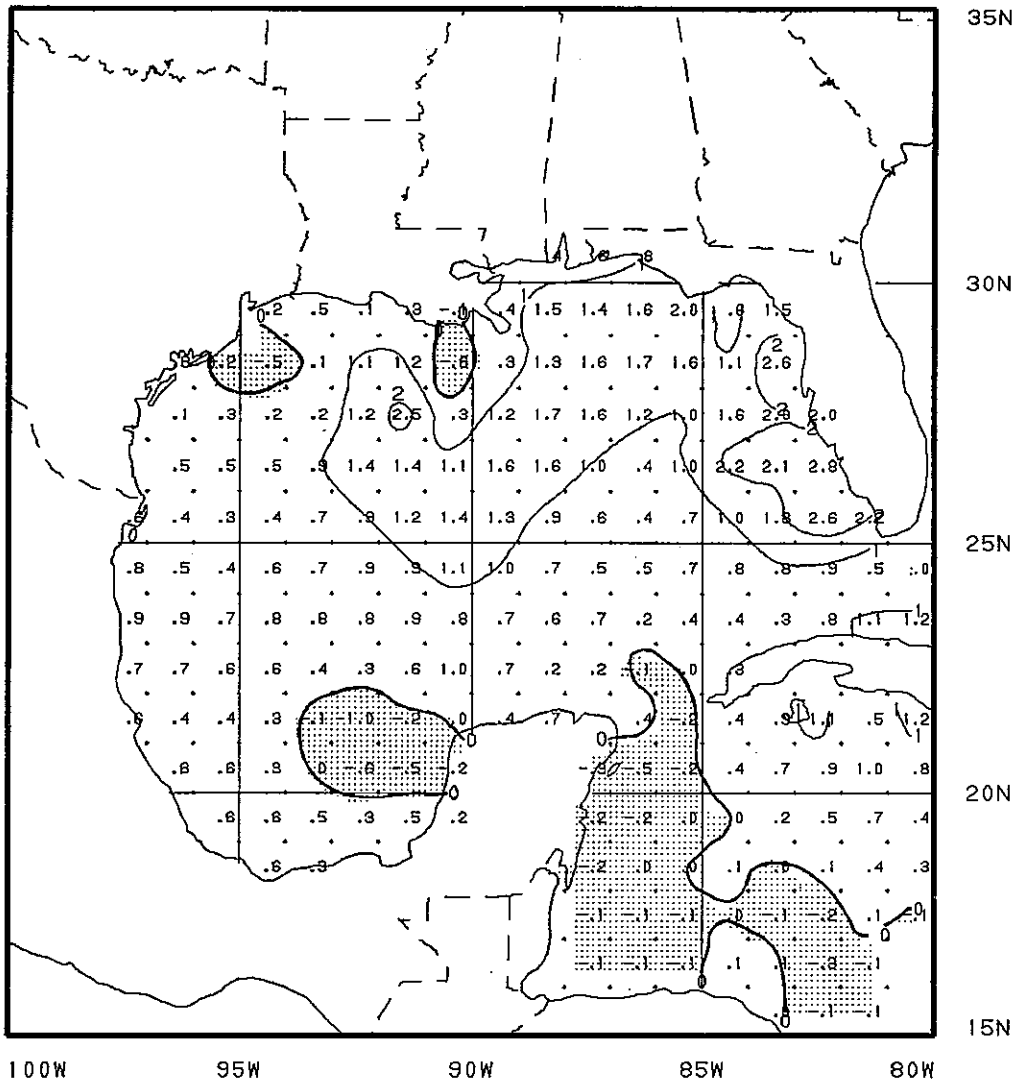
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
October 1986

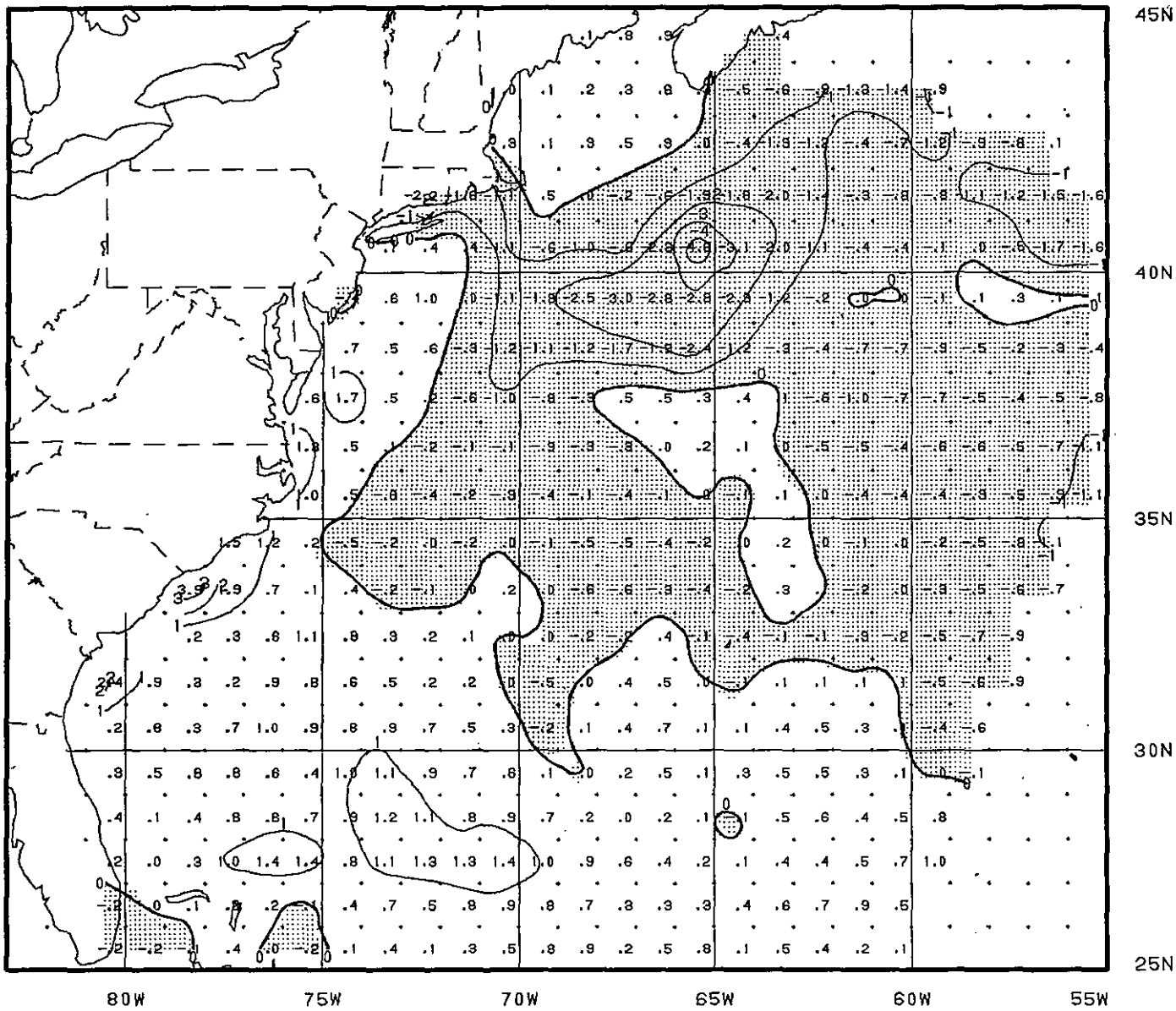
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
October 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
October 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

This page is left blank intentionly

This page is left blank intentionly

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE, WA 98115-0070

17

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

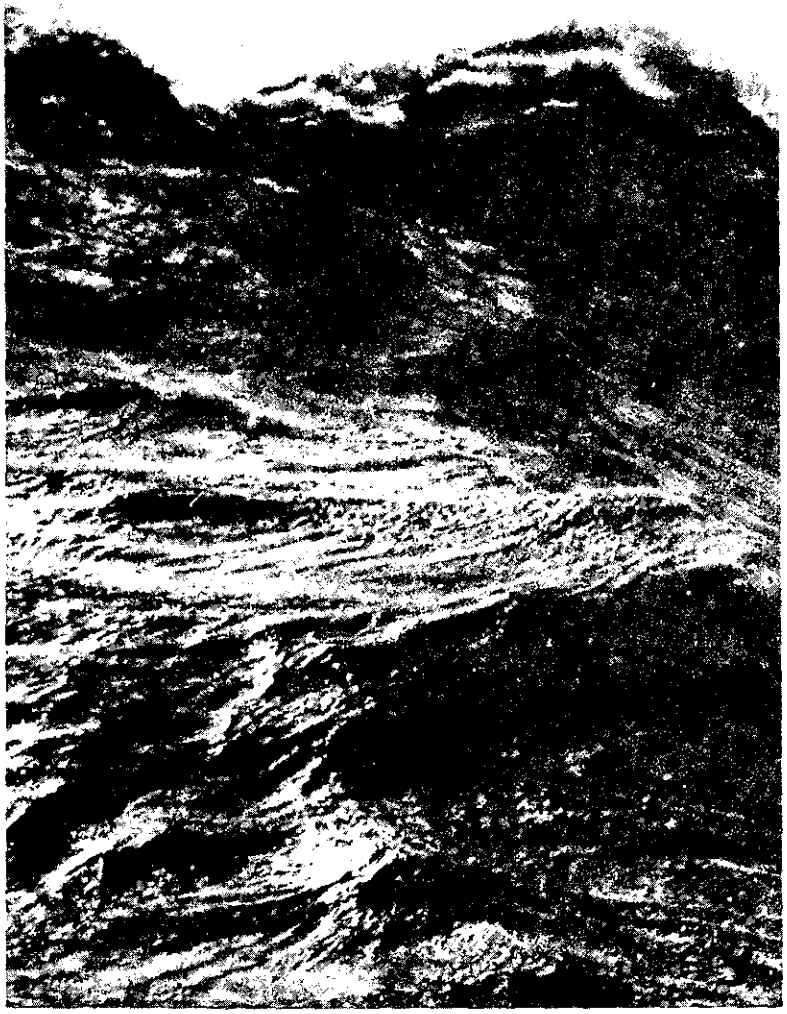
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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, 1987.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 11 November 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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] 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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]The climatology is derived from *in situ* data (1950-1979), satellite data (1982-1985) and an ice climatology.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2.*
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; *NavOceano Ref. Pub. 18.*

Oceanographic Monthly Summary

Editor: Patrick McHugh
NOAA, NOS
Office of Ocean Services, N/OS1
Rockville, MD 20852
Telephone (301) 443-6076

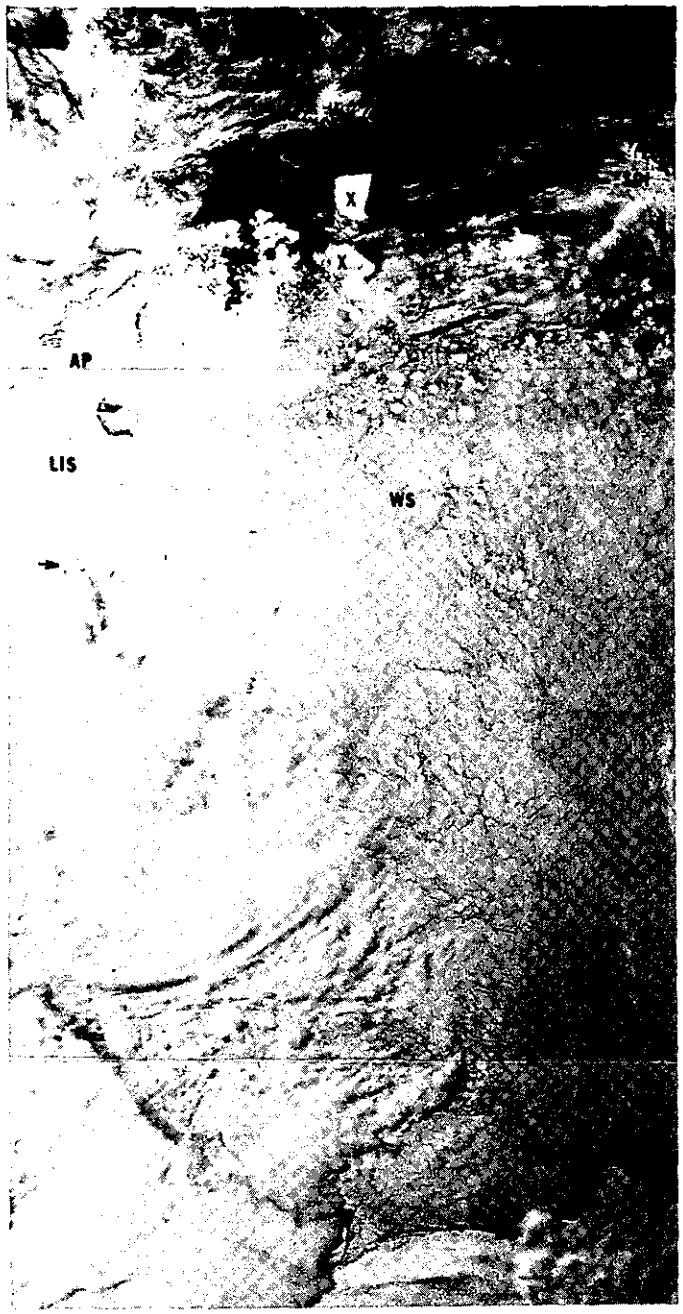
Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239

Typing: Damita M. Johnson

SATELLITE IMAGE OF THE MONTH*

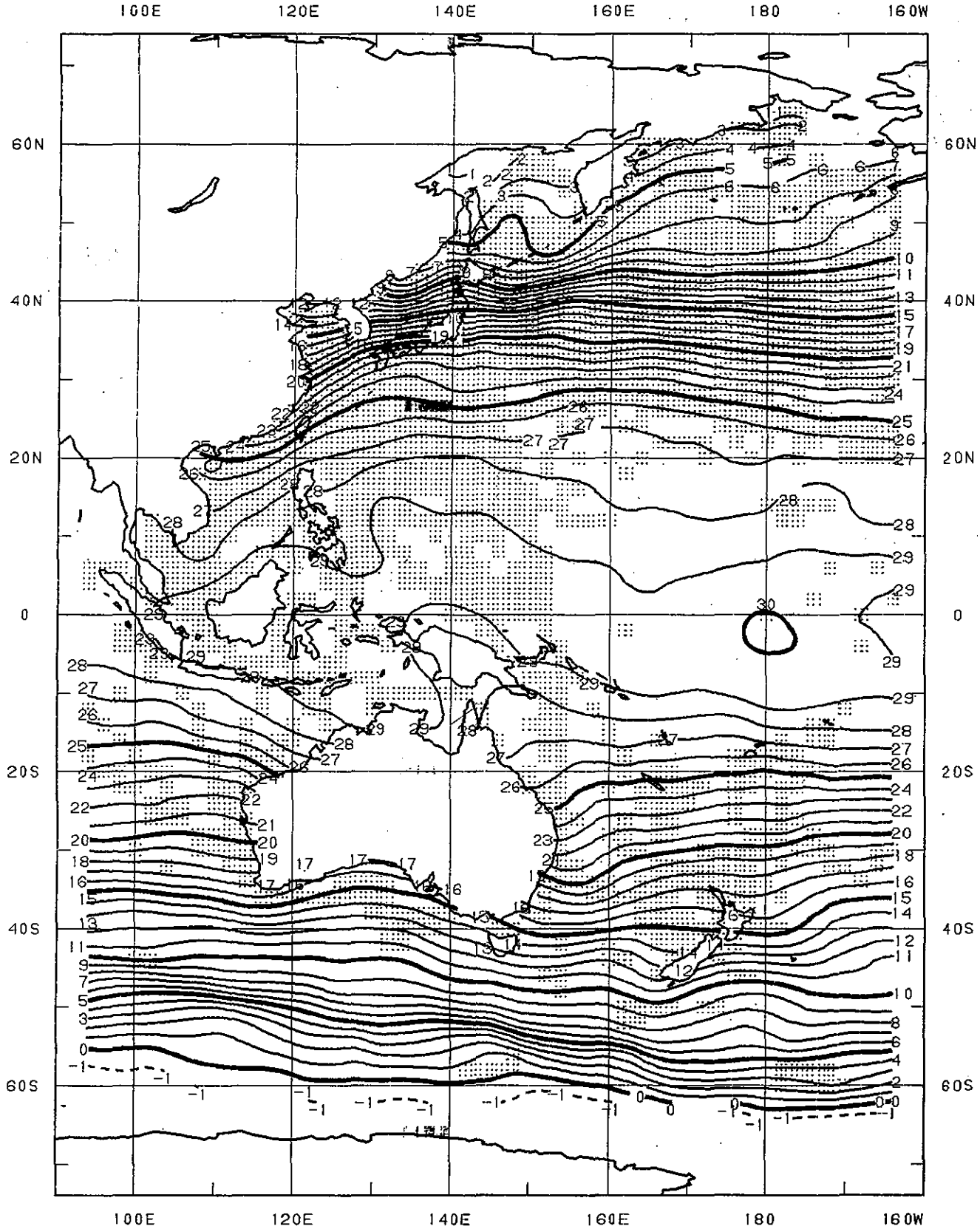
Kim Buttleman
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

This image (NOAA-9, AVHRR channel 1) from November 13, 1986 (19:17 GMT) extends from approximately 58°S to 70°S. It shows the extreme south Atlantic, the northern portion of the Weddell Sea (WS), and the Antarctic Peninsula (AP), with the Larsen Ice Shelf (LIS) extending east from the peninsula. Pack ice covers the Weddell Sea. In the open water of the south Atlantic, cloud wakes from the South Orkney Islands (SOI) and Clarence and Elephant Islands (CEI) are visible. Also visible are two very large tabular icebergs (both marked by X) off the tip of the Antarctic Peninsula.



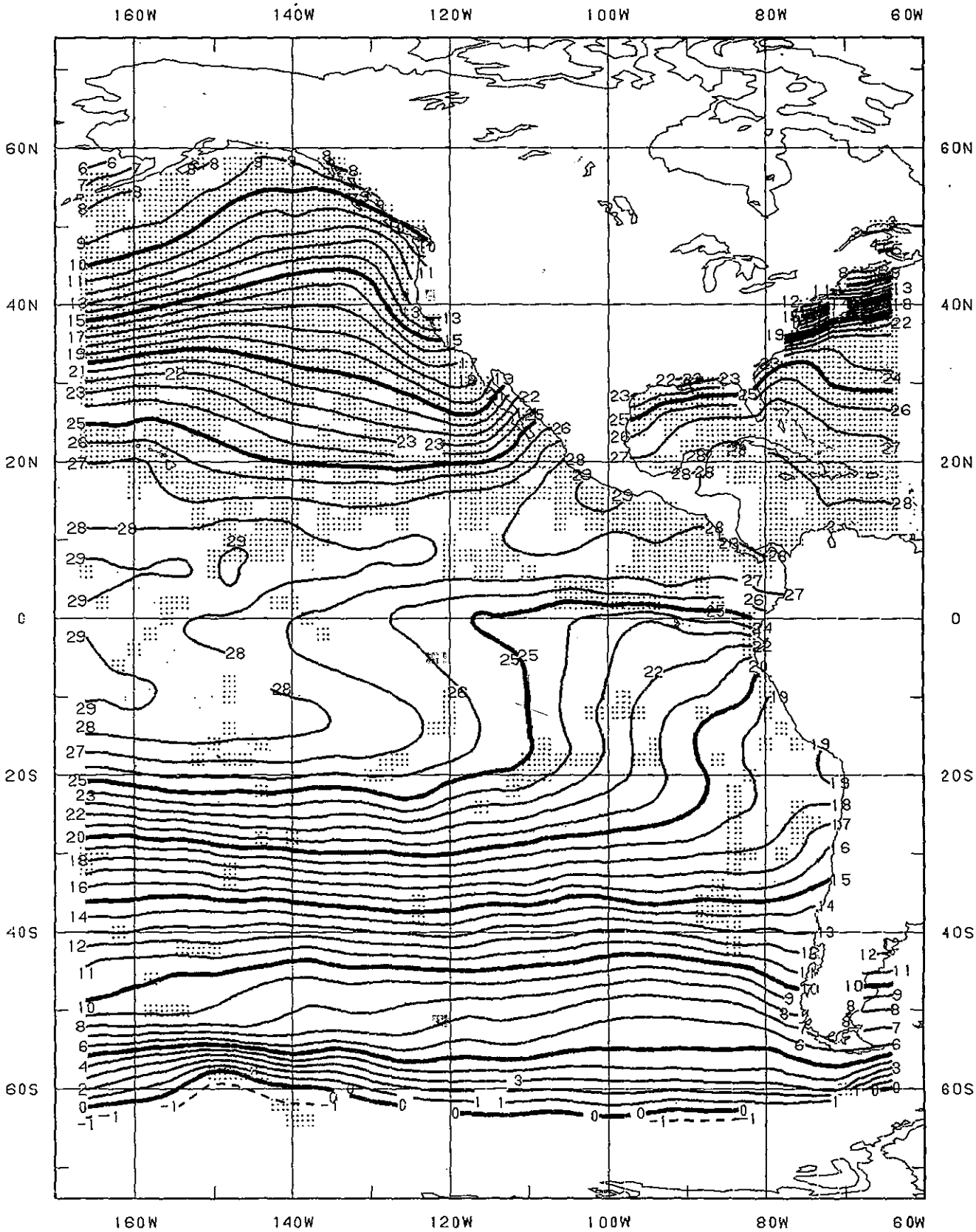
These two bergs broke off the Larsen Ice Shelf, apparently in February 1986, from an ice tongue which extended from the shelf at the spot marked by the arrow. They were originally one berg, approximately 80 x 110 km, but it broke into two approximately equal size pieces between August 8 and September 5. They have drifted northward, carried by the large clockwise gyre in the Weddell Sea, and have thus far covered about 600 km. From their present locations they will probably be carried to the east by the Antarctic Circumpolar Current.

*Follow-up to the August OMS Image of the Month: On October 4, Izvestiya reported the possible loss of the mothballed Druzhnaya I research station on the Filchner Ice Shelf. It was apparently located on one of the bergs which broke off the shelf during the southern winter. On October 26 the newspaper, Sovietskaya Rossiya, announced the departure from Vladivostok of a "rescue" expedition. About 170 people, including helicopter crews, were to attempt to find the station and, if possible, relocate the equipment to a new facility. A concurrent article in Pravda also criticized those in charge for failing to relocate the station before the disappearance. On November 13, it was reported that a helicopter from the West German research ship Polarstern had sighted the apparently intact station on one of the three large bergs that had separated from the Filchner Ice Shelf.



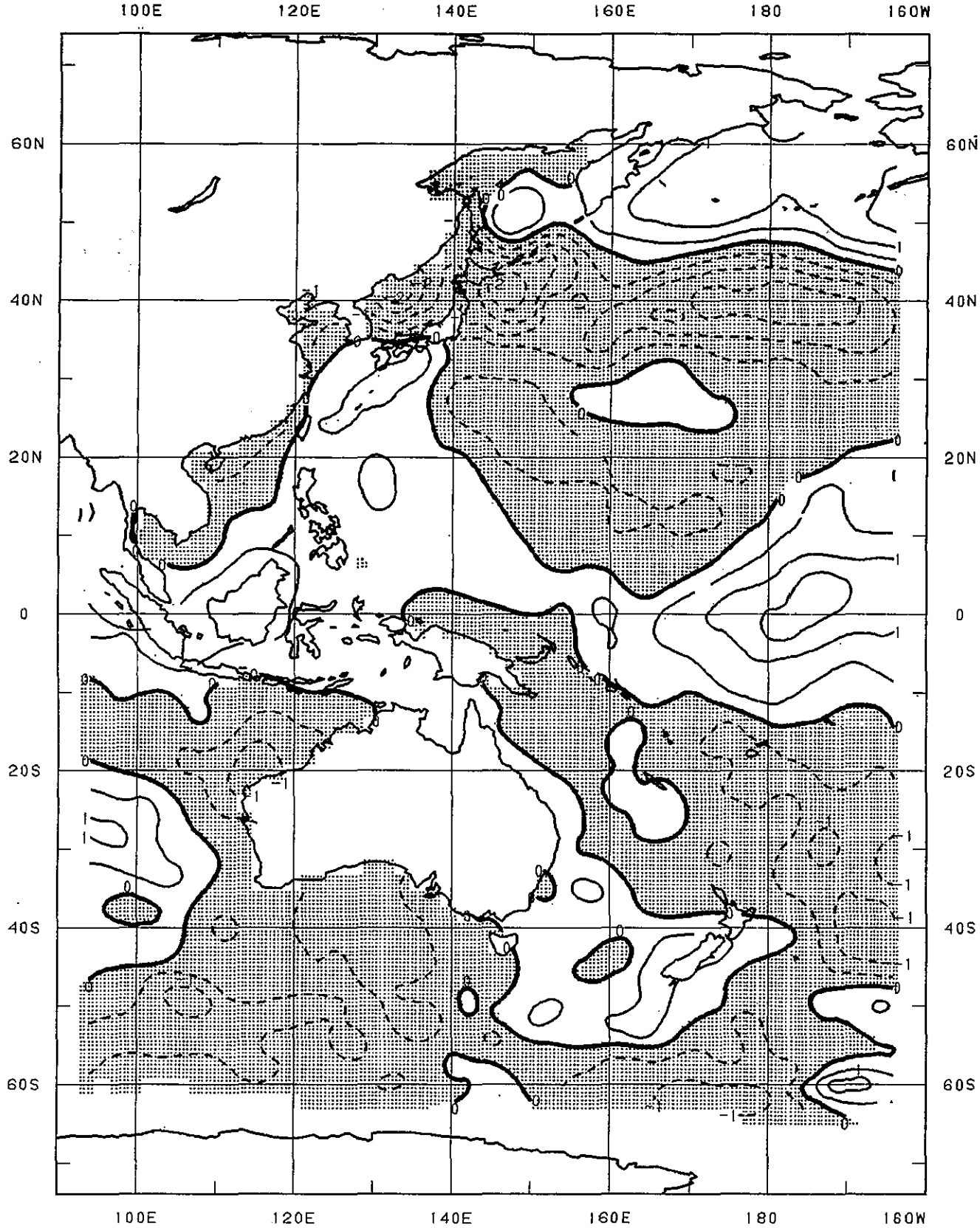
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
NOVEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



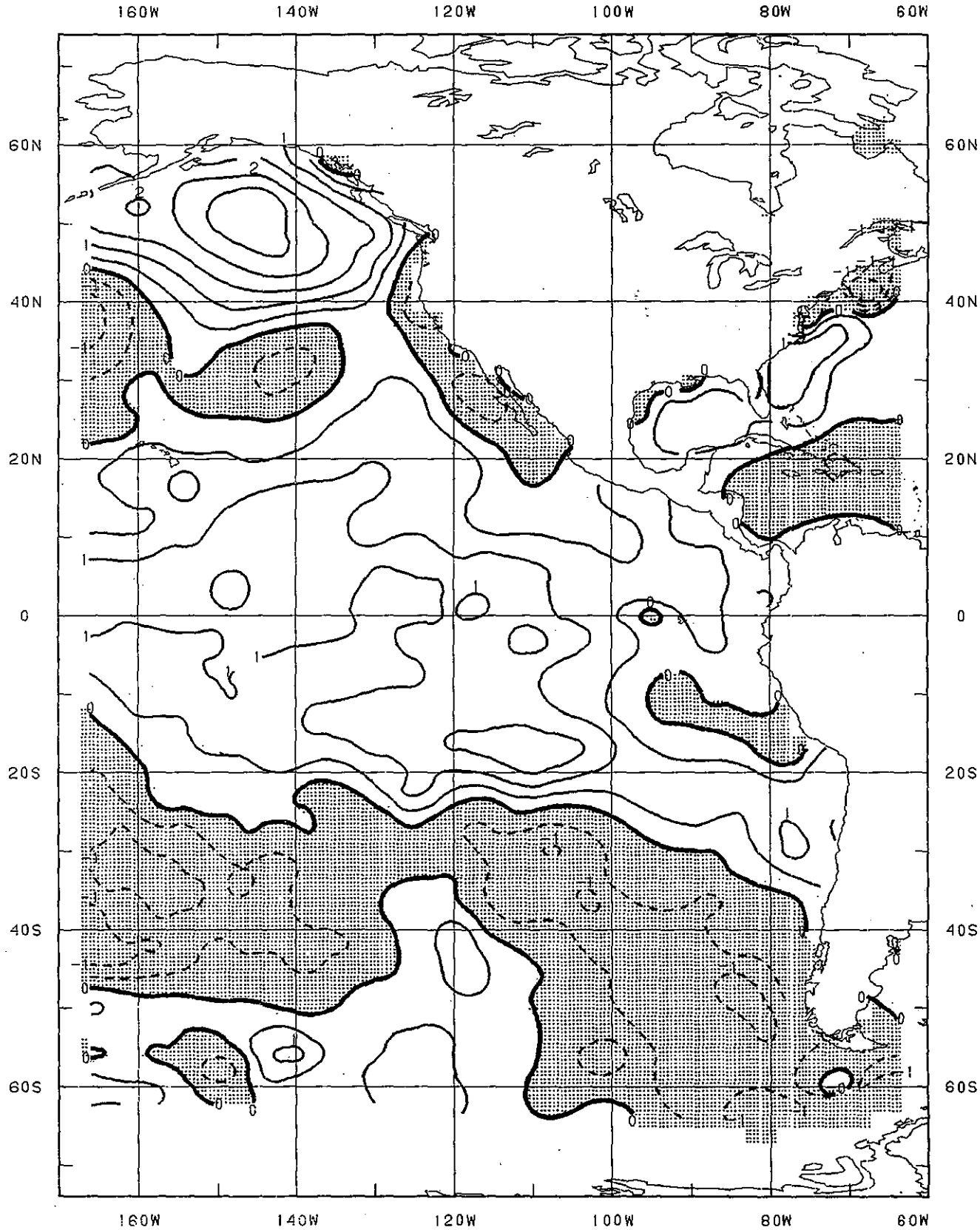
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
NOVEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



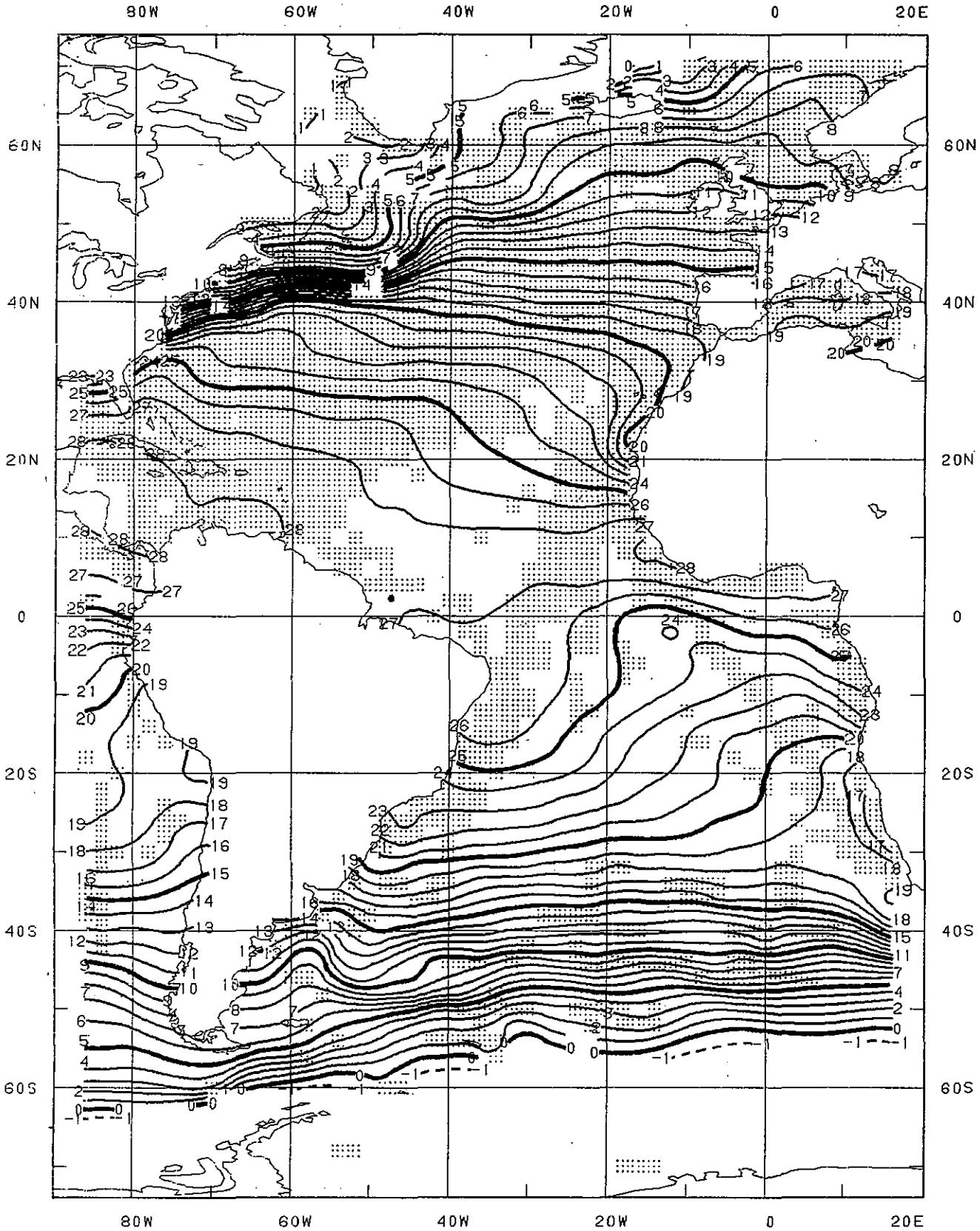
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
NOVEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



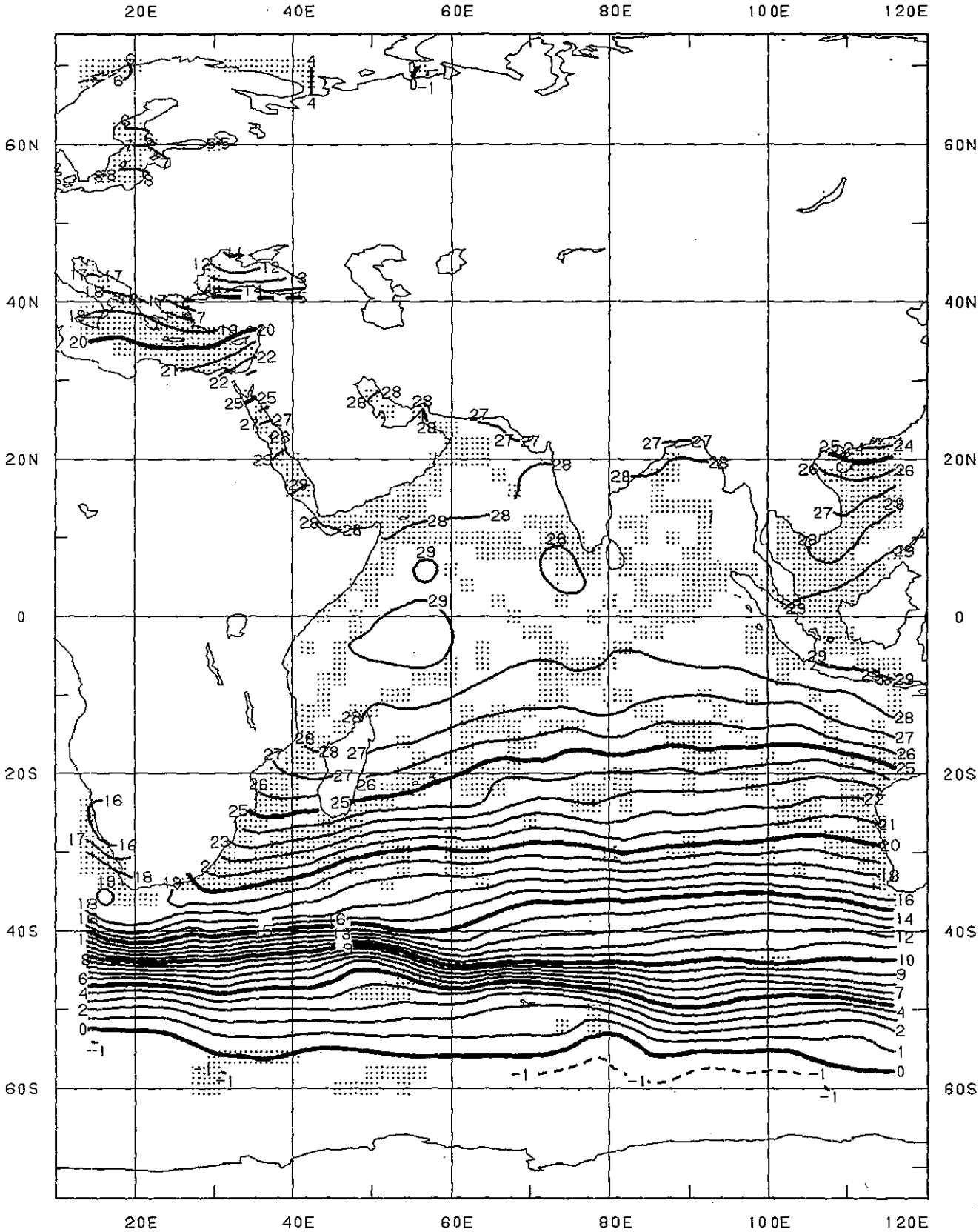
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
NOVEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



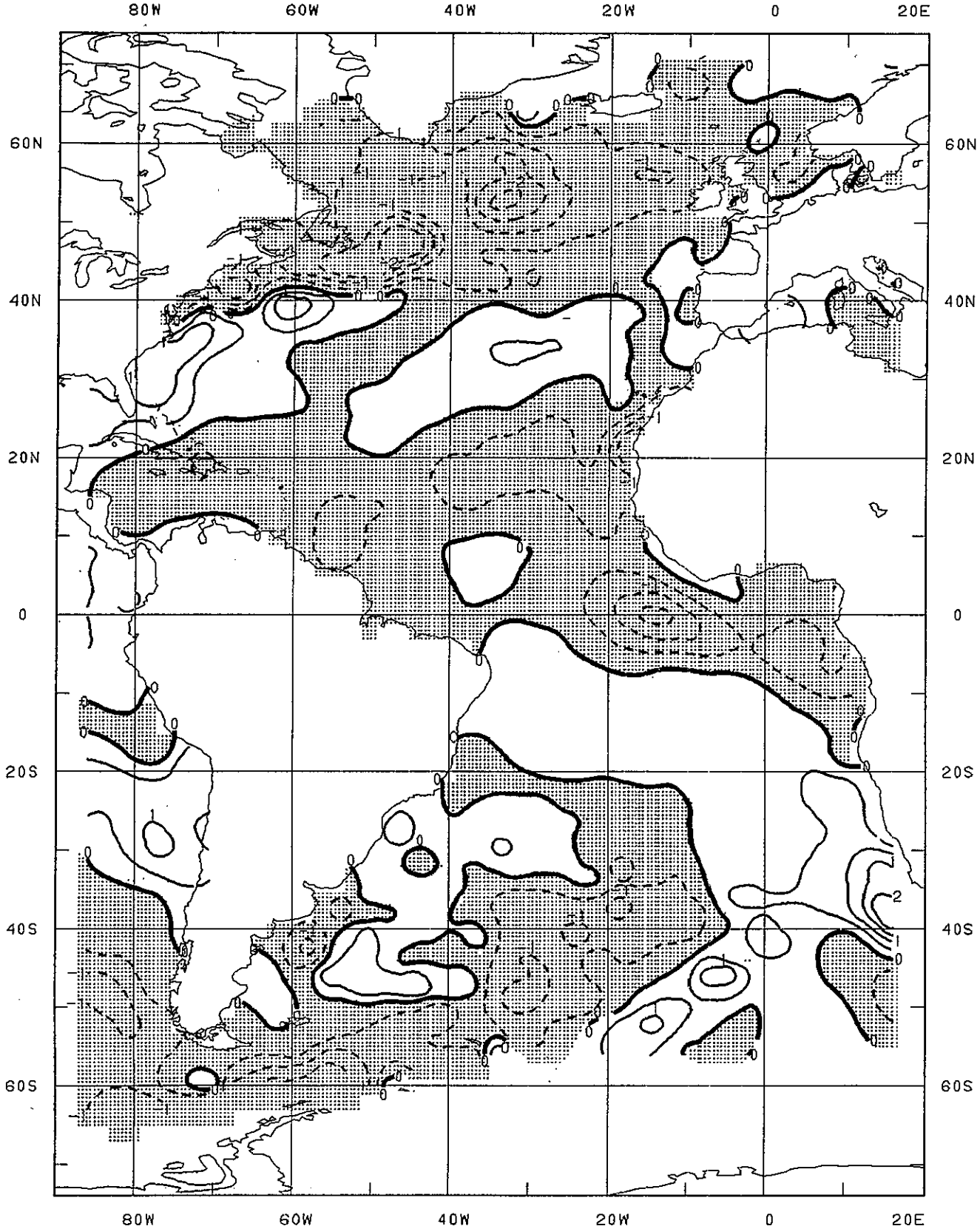
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
NOVEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



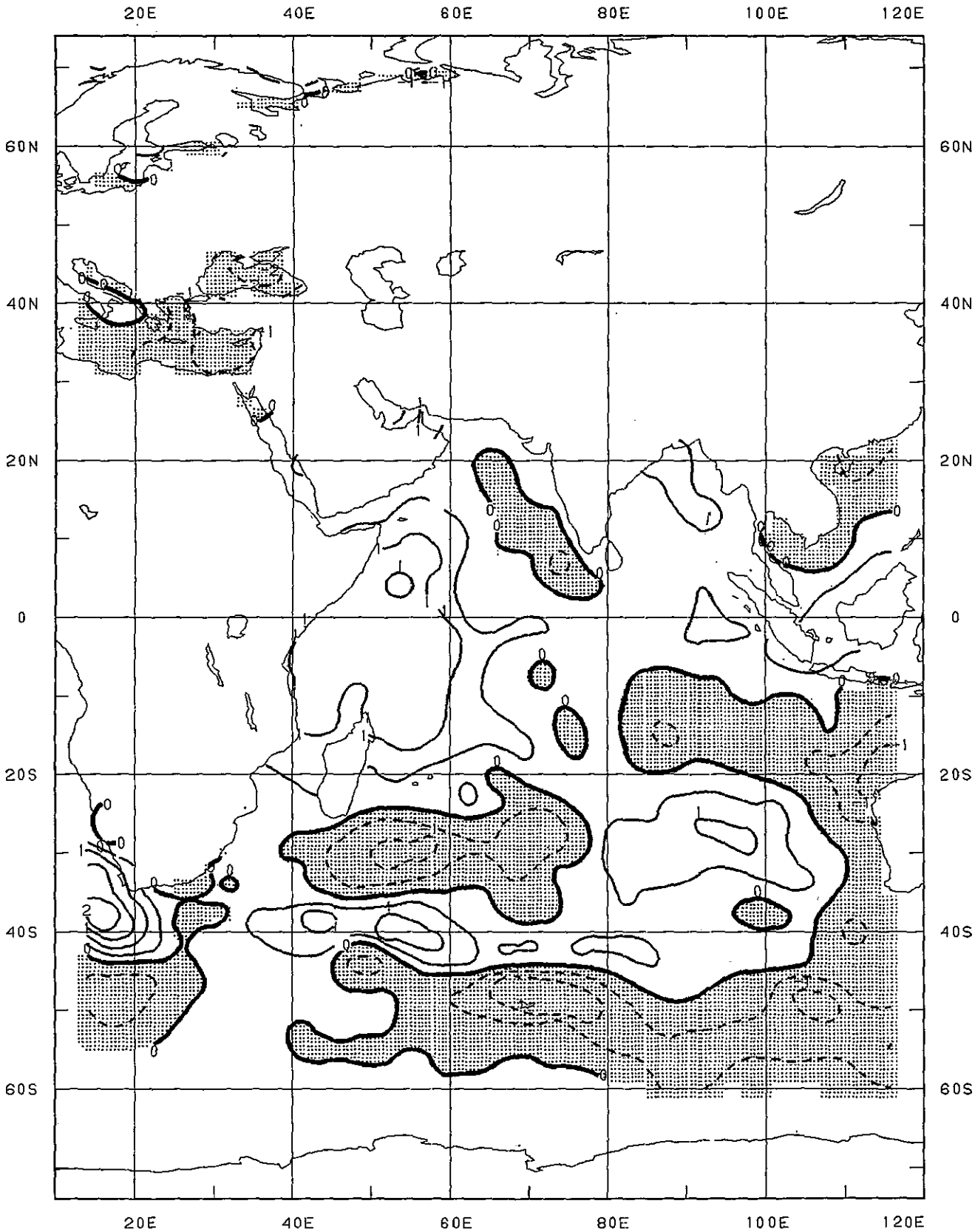
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
NOVEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
NOVEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, and SATELLITE DATA
NOVEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

OceaNotes

Satellite Relayed Ship Reports Use SEAS* To Improve Marine Weather Forecasts

Vincent J. Zegowitz
Data Systems Division
Office of Technical Services
National Weather Service, NOAA
&
Patrick S. McHugh
Ocean Observations Division
Office of Ocean Services
National Ocean Service, NOAA

Until recently, the surface observations necessary for marine forecasts came from a limited number of data buoys, other automated sensor stations such as those in the Coastal Marine Automated Network (CMAN), and voluntary ship observers through the Voluntary Observing Ship Program (VOS) of the World Meteorological Organization. The VOS program, which still provides the majority of marine meteorological observations, relies on visual observations by personnel aboard cooperating vessels. Data are measured and observed at the synoptic hours and transmitted via radio to shore. The potential data return from this network is very great, since there are over 1,600 merchant vessels in the U.S. program and a total of about 7,500 worldwide. However, analysis of the data shows that only a portion of the observations are received in time to be of use in NMC's forecast model runs. All data are certainly useful but timely, accurate data are of the highest value. Less than 100-percent reliable, high-frequency radio communication links between ship and shore operators and the lack of operator availability on an around-the-clock basis combine to limit significantly the number of observations entered into the numerical forecast models. Also, the number of human interventions required in the transmission and data routing process results in a cumulative error problem. The result is data voids in critical areas, particularly in coastal regions, occurring at critical times, such as early morning hours and during storms.

The National Ocean Service, in cooperation with the National Weather Service and the National Environmental Satellite, Data, and Information Service (NESDIS), has developed the capability of delivering both marine meteorological and subsurface temperature data (taken by expendable bathythermograph (XBT) probes) accurately and quickly using a SEAS unit and the Geostationery Operational Environmental Satellite (GOES) system. Information from the SEAS unit is transmitted through the

*Shipboard Environmental (Data) Acquisition System (SEAS)

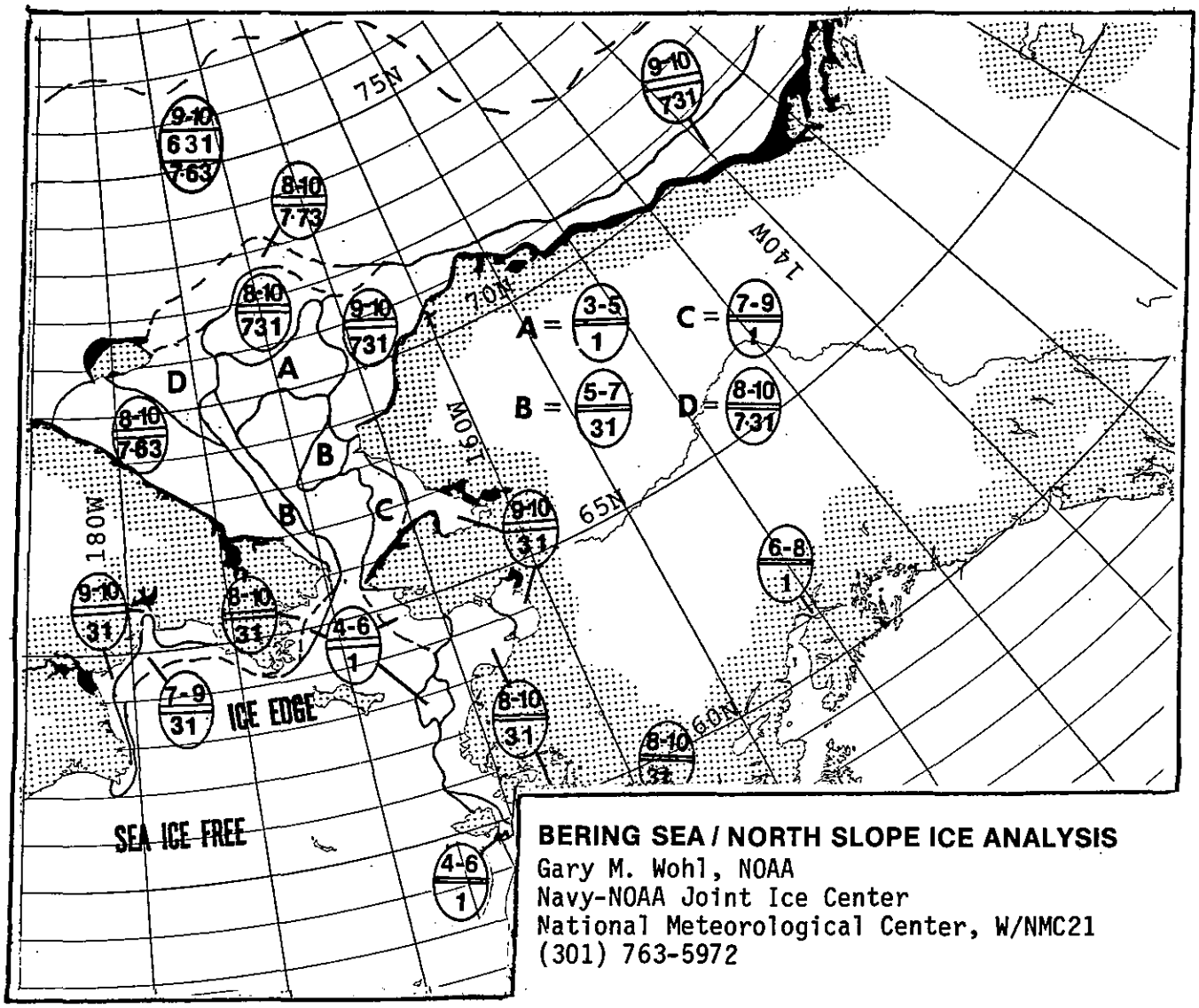
GOES satellite to the receiving station at Wallops Island, Virginia. It takes less than 10 minutes to transmit ship data via satellite to Wallops Island and then to NMC.

Installation of a SEAS unit and instruction of the crew of a participating ship in its operation take only a few hours, causing a minimum of interference to the ship's schedule. Once the SEAS unit is installed and activated, the operator sees a "menu" on the microcomputer's screen. To enter standard shipboard meteorological data, the operator first selects the meteorological option from the menu. Data are entered manually through the microcomputer's keyboard and appear on the screen. Upon completion, the microcomputer automatically arranges the data into the appropriate WMO-coded format and stores the data in a holding "buffer" of the GOES transmitter. These data are automatically transmitted at a predetermined time.

The XBT option is used to store and transmit subsurface temperature data collected by an XBT probe. The operator first enters type of probe, latitude, longitude, launch number, etc. The XBT is launched with a hand-operated launcher. As the probe descends to its maximum depth, the data transmitted from the probe are arranged by the XBT controller in temperature-depth pairs at selected depths where significant temperature changes occur. These pairs of data are stored in the XBT data buffer of the GOES transmitter and are automatically transmitted at a predetermined time. During the launch of the XBT, the signal from the XBT probe is also recorded on a cassette tape or diskette for later processing by the National Oceanographic Data Center. Upon docking, these data and the accompanying log sheets are mailed to the NODC from the NOAA and Voluntary Observing Ships. The data are processed and added to the NODC archives usually within five days of receipt.

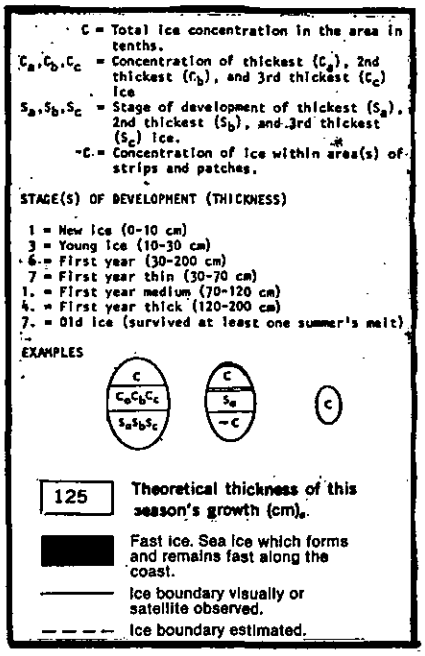
The GOES satellite system uses a total of 266 channels for transmission in the frequency range, 401.7 - 402.1 MHz. Data transmissions from platforms, such as a SEAS-equipped vessel, are scheduled for one or more of the 1,440 1-minute time slots per day available on each channel. The data capacity of each data buffer is 500 characters.

Today, the SEAS program is well underway. By the end of 1987 approximately 130 systems will have been deployed on ships of opportunity and the NOAA fleet. To ensure optimum data coverage by SEAS, each ship is evaluated for area of operation, vessel capability, and the vessel operator's desire to incorporate SEAS into the ship routine schedule. The SEAS program will provide an important increase in the number of real-time meteorological and oceanographic observations for input into the marine forecast process.



BERING SEA / NORTH SLOPE ICE ANALYSIS

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



NOVEMBER 1986

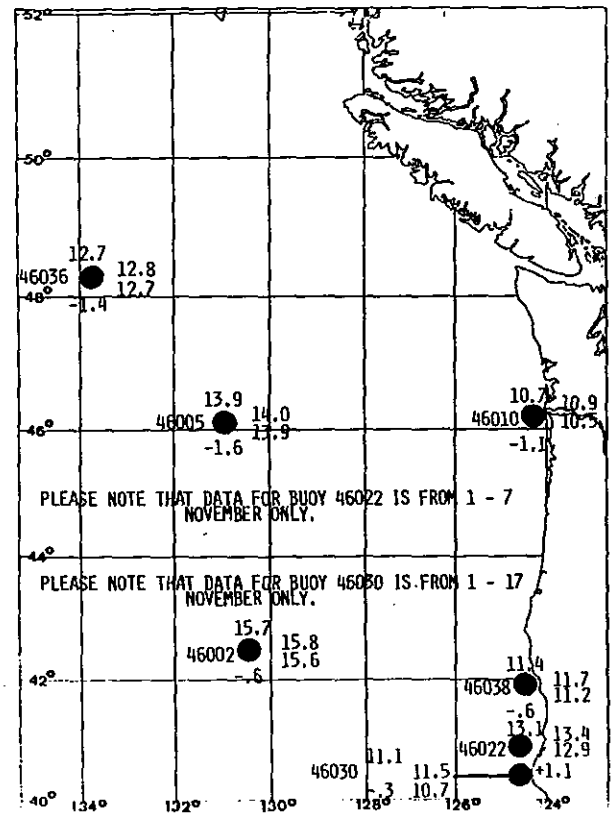
Slow sea ice expansion throughout the Chukchi Sea characterized November conditions in the Alaskan area. New ice also formed in the protected portions of the northern Bering Sea, most notably in Norton Sound. Ice growth and expansion were slow and the accompanying figure shows that portions of the middle Chukchi Sea were still open during the last week of the month. This was caused by a pressure distribution that prevented very cold Siberian air from entering the region. Instead Pacific Maritime air was pumped into the Alaskan region by a series of low pressure systems traversing the southern Bering Sea and a high pressure system to the northeast of Alaska. Temperatures at the shore stations (Kotzebue and Nome) near the ice edge averaged above normal in keeping with the general pattern.

WEST COAST OCEAN FEATURES

Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

NOVEMBER 1986

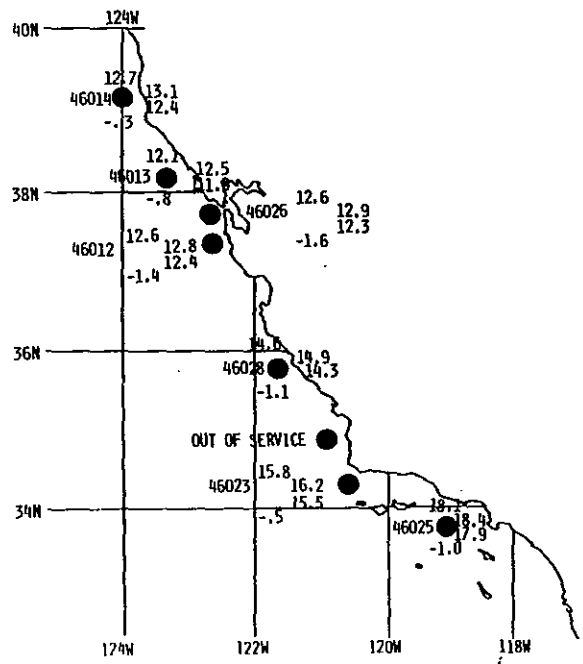
The north panel averaged 0.6°C above the climatological mean value of 12.9°C for that area. The only location on the chart cooler than climatology was nearshore



and south of 45°N. The warmest anomaly of 1.3°C was found at the western edge of the analysis area at 47°N 134°W. Buoy statistics revealed that six of the seven buoys showed some cooling from the previous month. The only exception was buoy 46022 which reported for the first week of November and then went out of service. Most likely, this buoy would have cooled, too, had it continued to work for the remainder of the month.

In the south panel, the climatological mean SST was 17.7°C, but it averaged a mere 0.2°C above normal. Roughly the northern half of the chart was below normal and the southern half above normal. The coolest anomaly of 0.7°C was centered near 37°N 130°W; the warmest anomaly was at 31°N 117°W. Comparing November to the previous month, the entire chart cooled from 0.6 - 1.6°C. The least cooling occurred at 29°N 119°W and the most cooling was around 33°N 124°W. Buoy statistics from the south panel showed that the maximum cooling was along the central California coast.

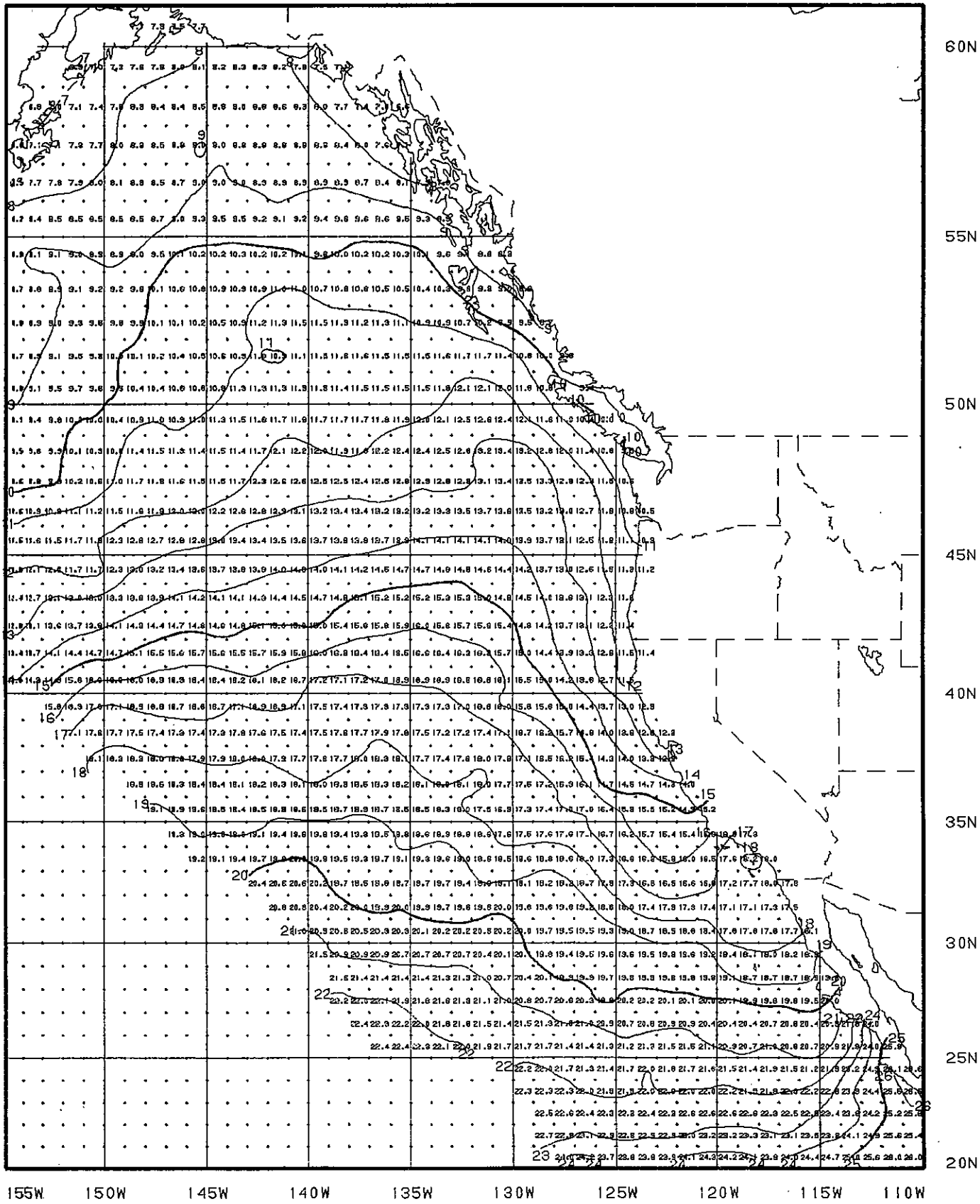
Eight analyses were prepared during the month for both north and south panels.



KEY:

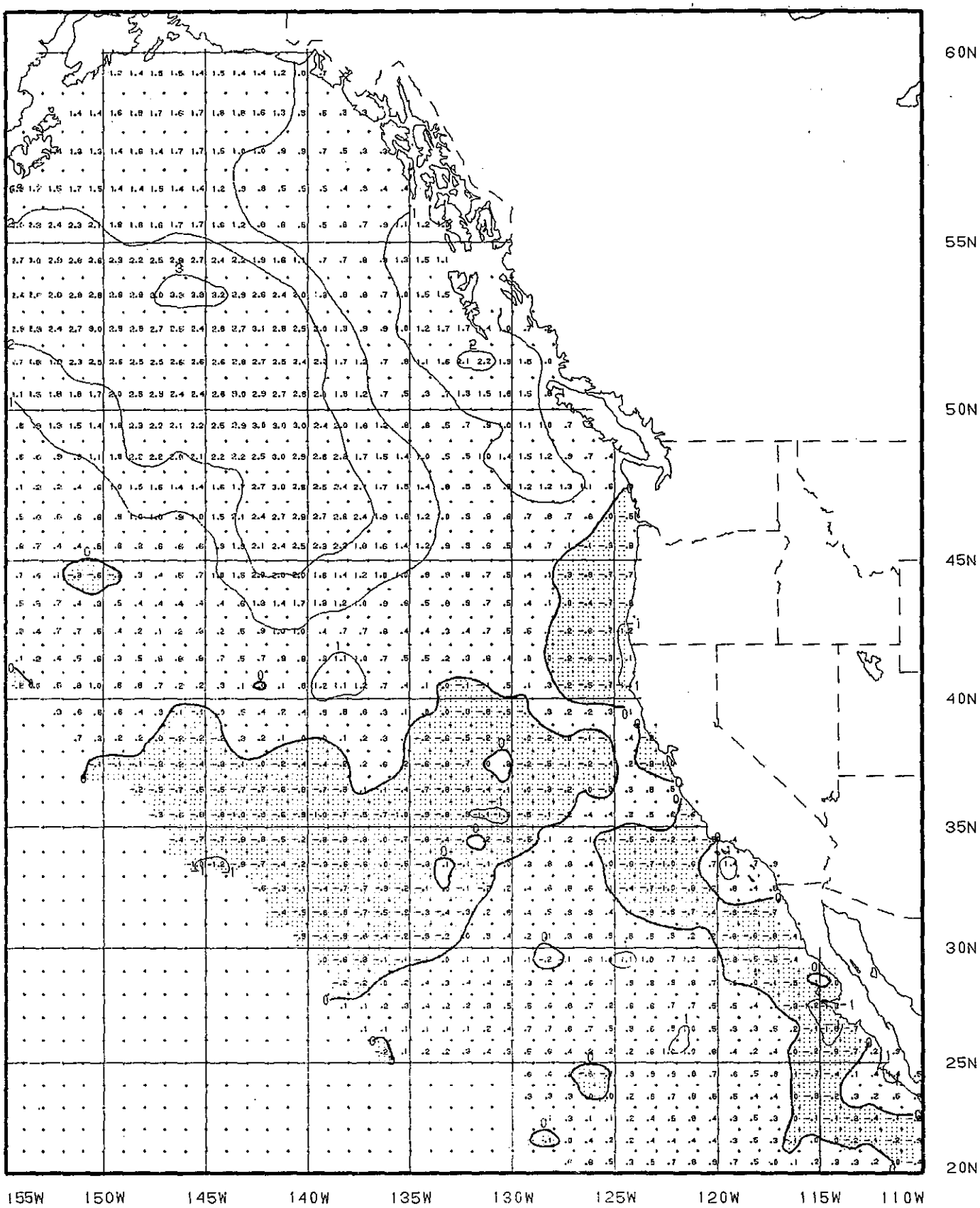
LOCATION NAME
12.1 ← Monthly mean
13.5 ← Maximum daily mean
10.2 ← Minimum daily mean
-1.5 ← Change from previous month

● Denotes station position.



West Coast
SST--MONTHLY MEAN (°C)
November 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
November 1986

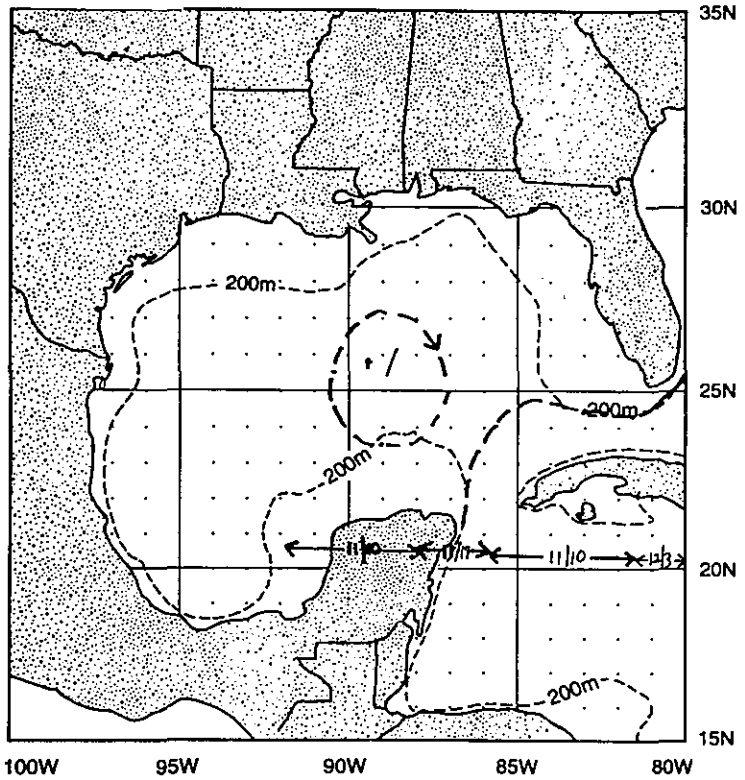
Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

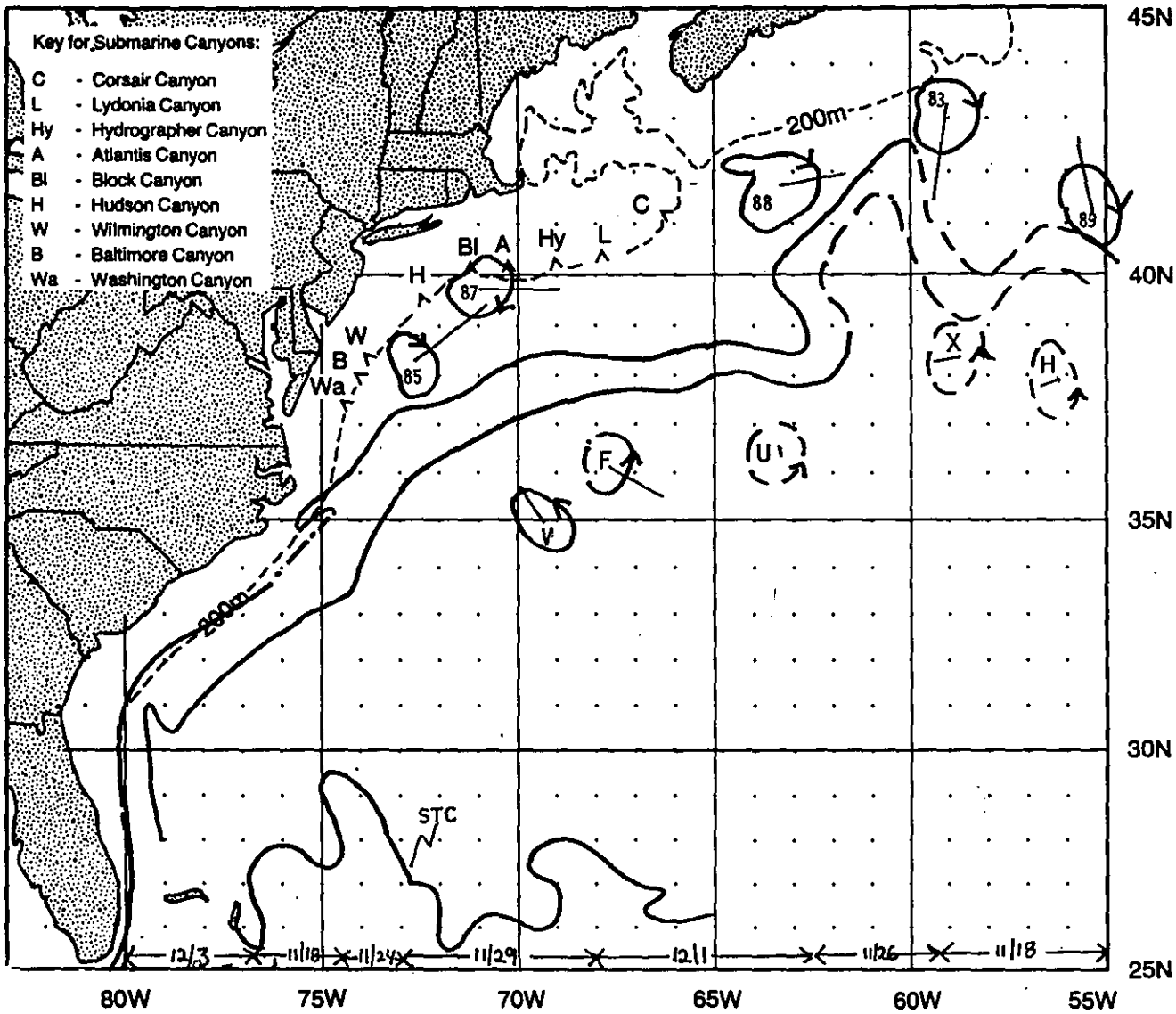
EAST COAST OCEAN FEATURES

Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

Data used in this analysis include:
NOAA satellite infrared imagery,
NESDIS
Bathythermograph data,
National Meteorological Center of
National Weather Service Oceanographic
Analysis,
A daily detailed analysis issued
by National Weather Service/NESDIS

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 NW 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. Eddies or sections of the Gulf stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the data of data used.





NOVEMBER 1986

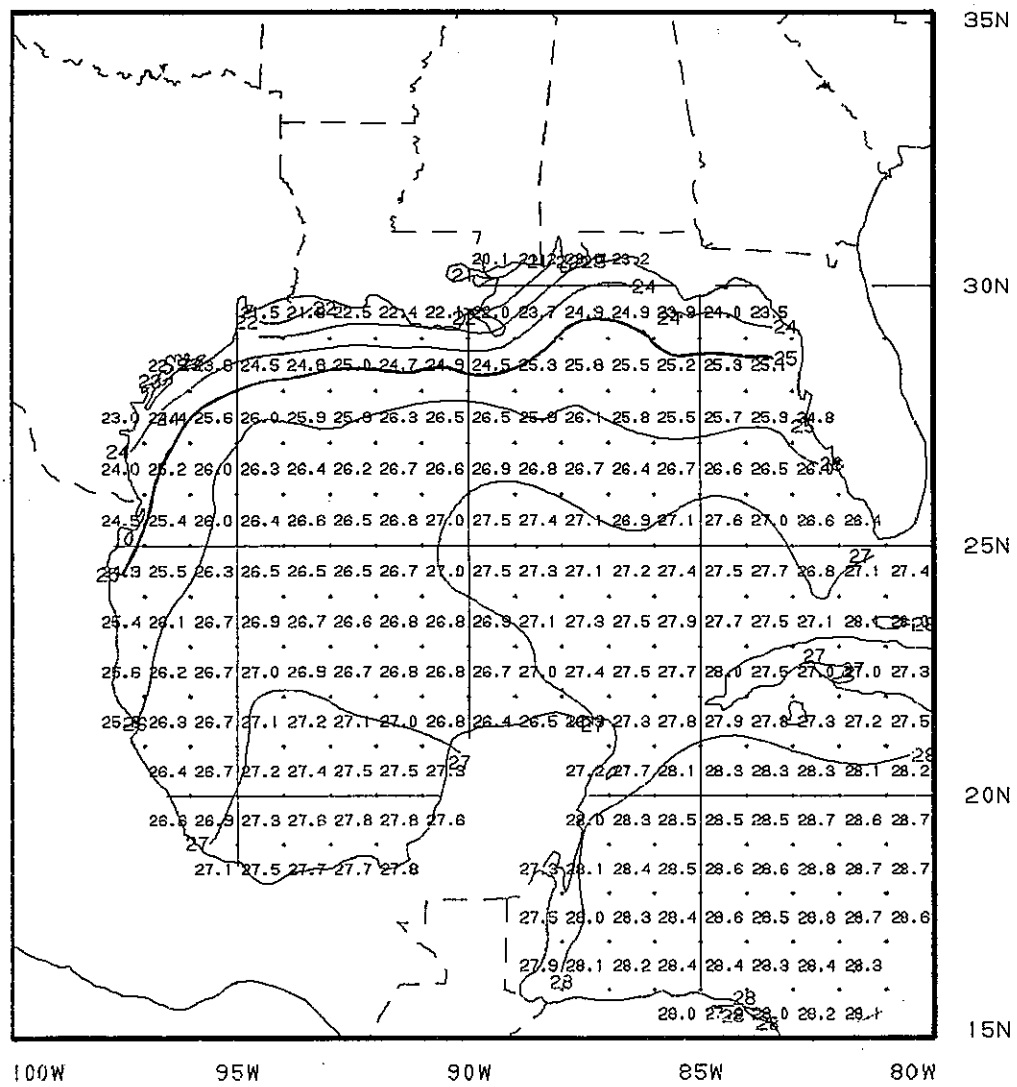
The position of the Loop Current in the Gulf of Mexico was estimated from thermal infrared satellite data from November 10. Anticyclonic eddy t translated 85 km SW where it was last observed on November 10.

One anticyclonic eddy was posssibly absorbed during November. Eddy 86 was apparently absorbed by Eddy 88 near 42°N 63°W around December 1. Eddy 85 traveled 185 km SW while Eddy 87 traveled 165 km W. Eddy 88 moved 130 km WSW. Eddy 83 translated 165 km NNE. Eddy 89 moved 120 km SSE.

Cyclonic eddy W translated 85 km SE. Eddy F moved 140 KM NW. Eddy U traveled only 25 km SE where it was last observed on November 9. Eddy X, last detected on November 18, moved 55 km E. Eddy H translated 35 km ENE where it was last discerned on November 9.

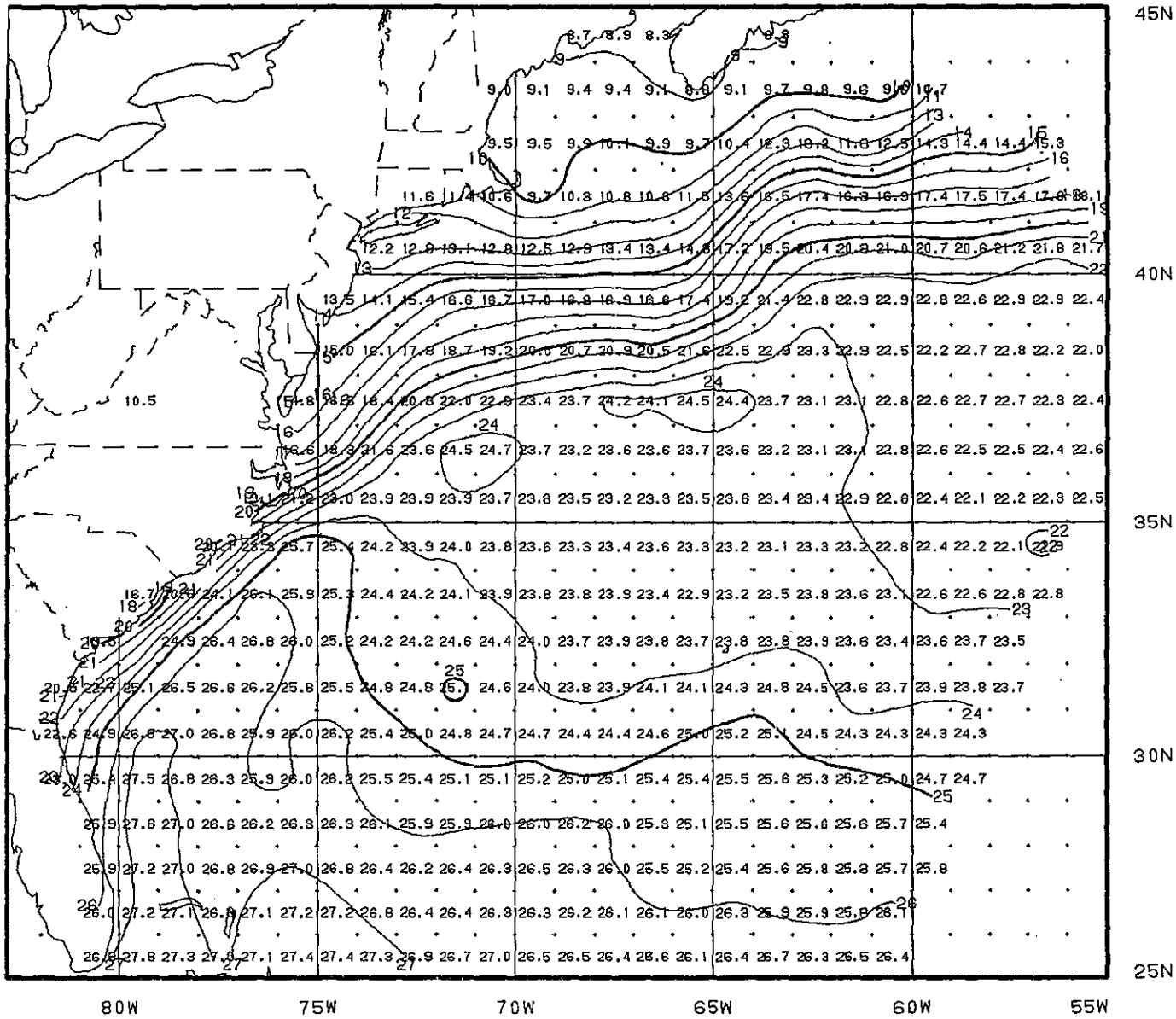
The subtropical Convergence Front (STC) was observed on December 3 in moisture-corrected thermal infrared data. It extended from 26°N 77°W o 26°30N 65°W.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
November 1986

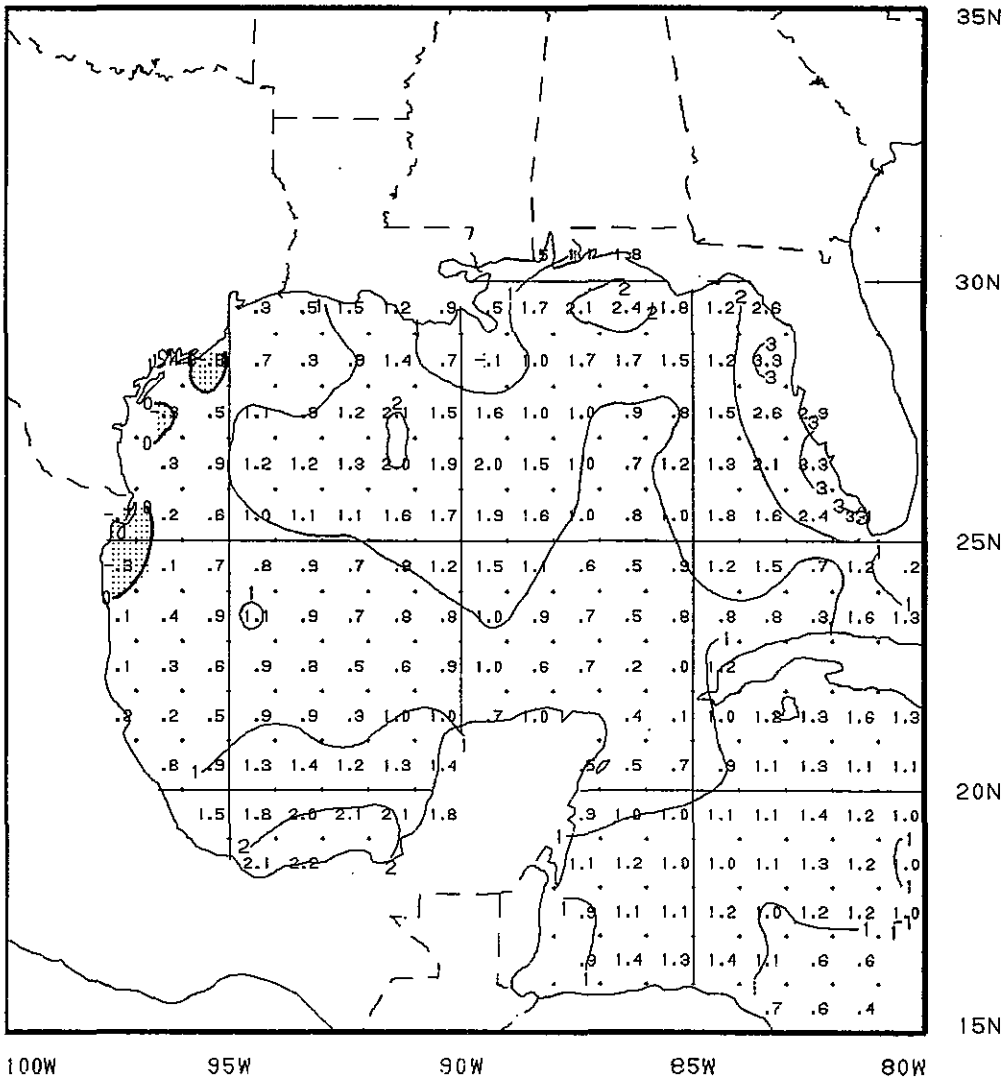
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY MEAN (°C)
November 1986

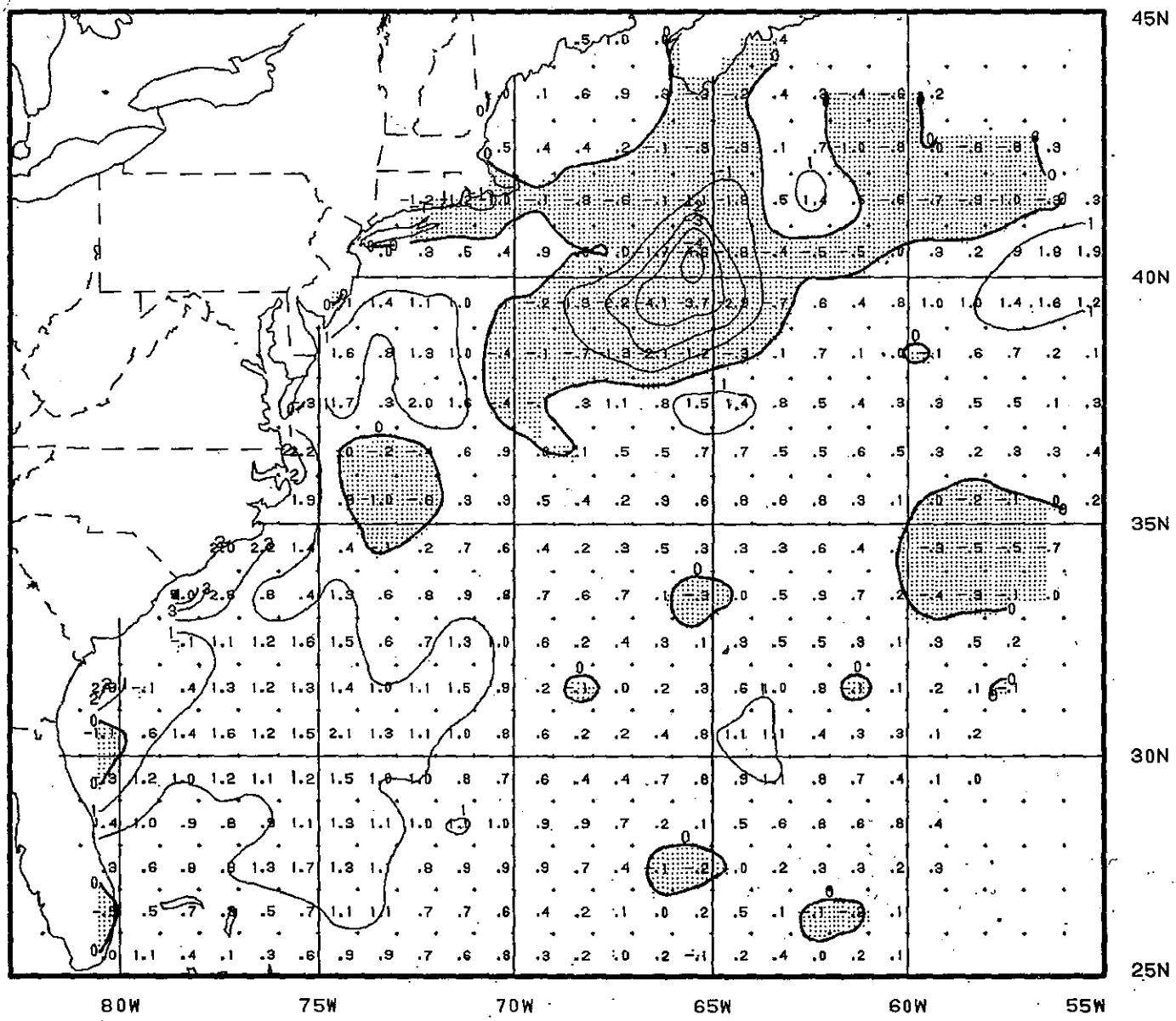
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
November 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
November 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE, WA 98115-0070

17

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

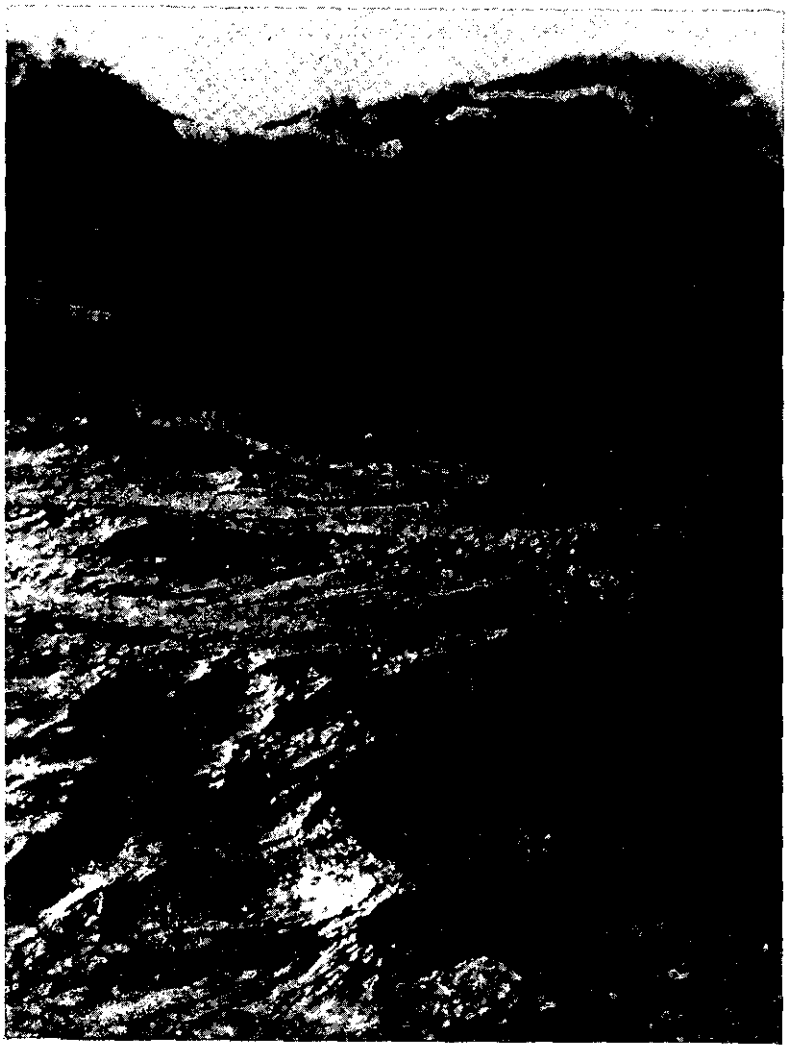
Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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, 1987.

OCEANOGRAPHIC Monthly Summary

Volume VI Number 12 December 1986



Contents

3 Satellite IMAGE of the Month

4 Pacific SST - monthly mean

6 Pacific SST - anomaly

8 Atlantic/Indian SST - monthly mean

10 Atlantic/Indian SST - anomaly

12 OceaNotes

14 Bering Sea/North Slope ICE, with text

15 West Coast OCEAN FEATURES, with text

16 West Coast SST - monthly mean

17 West Coast SST - anomaly

18 East Coast OCEAN FEATURES, with text

20 East Coast SST - monthly mean

22 East Coast SST - anomaly

24 Subscription Information

U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration
National Weather Service
National Environmental Satellite, Data, and Information Service
National Ocean Service

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] 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 *Oceanographic Monthly Summary* 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. and W.H. Gemmill, 1984. A sea surface temperature analysis which blends *in situ* and satellite observations. *Proceedings of the Ninth Climate Diagnostics Workshop*, Corvallis, OR, Oct. 22-26, 1984, pp. 408-416.
[2]The climatology is derived from *in situ* data (1950-1979), satellite data (1982-1985) and an ice climatology.
[3]Robinson, M.K., 1976. Atlas of North Pacific Ocean Monthly Mean Temperatures and Mean Salinities of the Surface Layer; *NavOceano Ref. Pub. 2.*
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; *NavOceano Ref. Pub. 18.*

Oceanographic Monthly Summary

Editor: Patrick McHugh
NOAA, NOS
Office of Ocean Services, N/OS1
Rockville, MD 20852
Telephone (301) 443-6076

Assistant Editor: Jenifer Clark
NOAA, NWS
Washington, DC 20233
(Telephone: (301) 763-8239

Typing: Damita M. Johnson

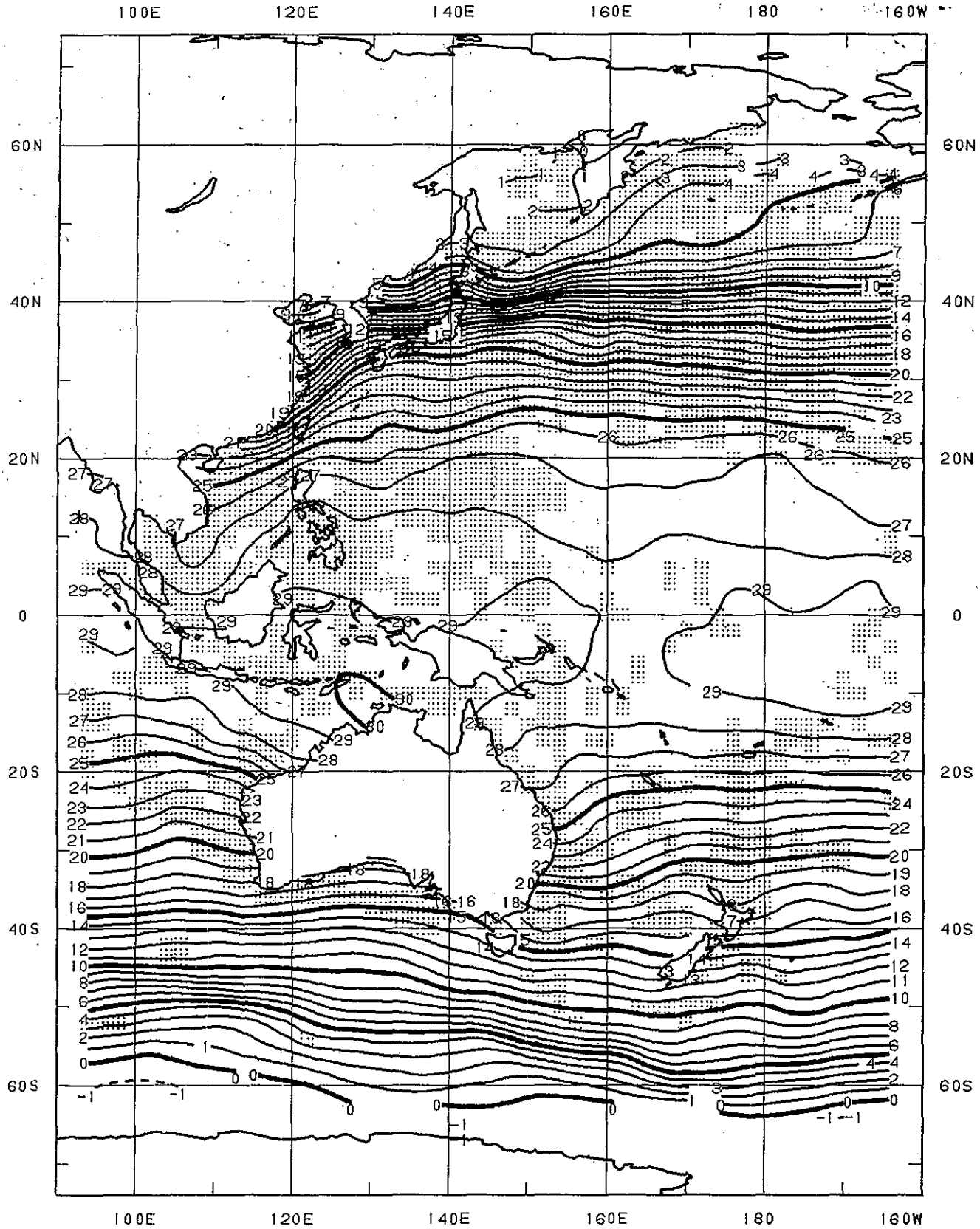
SATELLITE IMAGE OF THE MONTH

Kim Buttleman
Interactive Processing Branch E/SP22
NESDIS, NOAA
Washington, DC 20233
(301) 763-8142

The Brazil-Falkland Convergence

This image (NOAA-9, AVHRR ch 4, S enhancement table) from December 11, 1986 (19:25 GMT) shows the southeast coast of South America and the western South Atlantic. Included in the land areas are Uruguay (UR) and Argentina (AR). Also indicated in the land areas are the locations of the two nations' respective capitals, Montevideo (M) and Buenos Aires (BA). Visible in the ocean areas are the convergence of the southern end of the warm (darker) Brazil Current (BC) and the northern edge of the cold (lighter) Falkland Current (FC). Also indicated are the estuaries of Rio de la Plata (RP) and Bahia Blanca (BB).

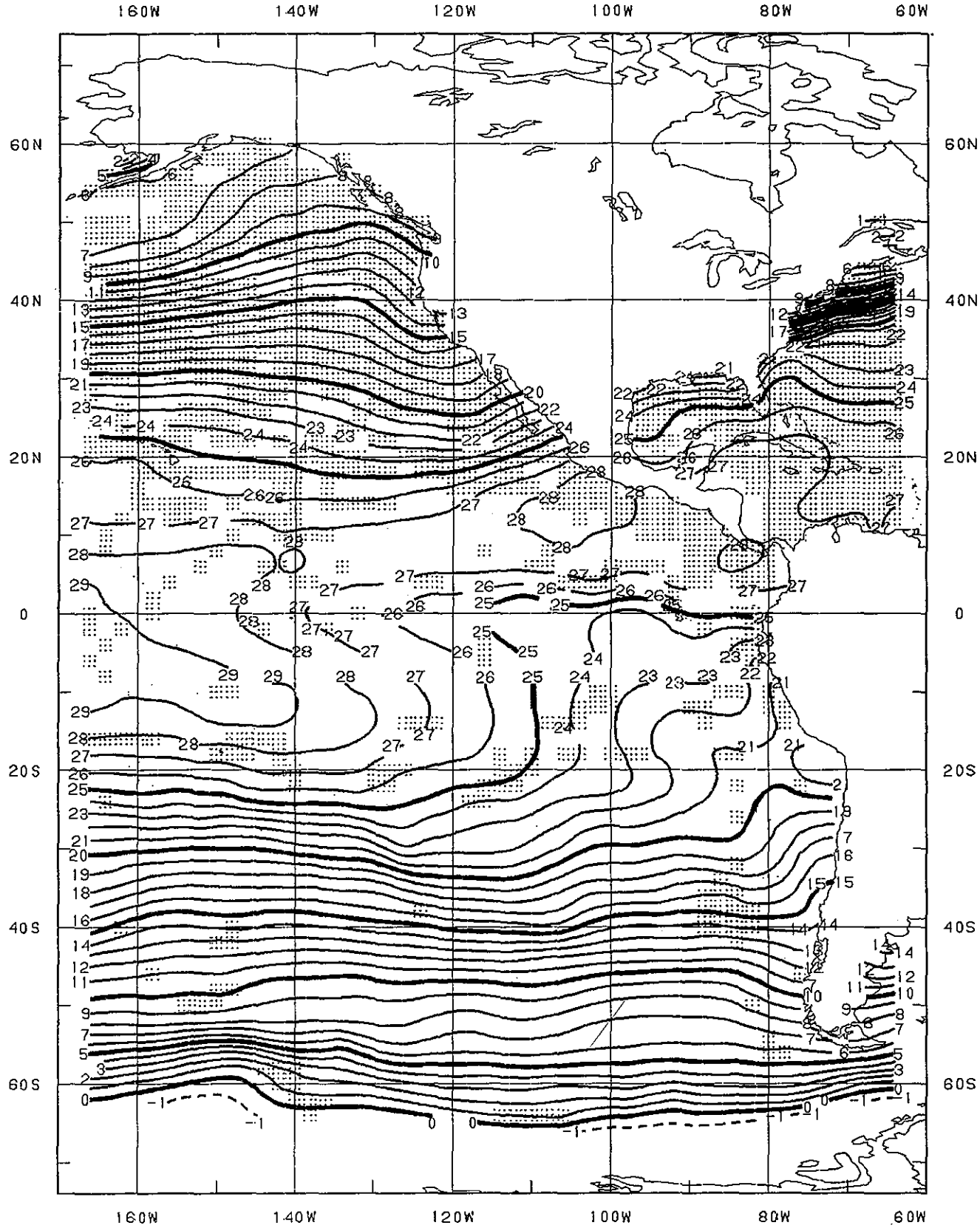
The Brazil Current is one of the slowest and shallowest western boundary currents. The shape of the Brazil coast splits the westward-flowing Atlantic South Equatorial Current into the northwest-flowing Guiana Current and the southwest-flowing Brazil Current, substantially weakening it relative to other western boundary currents. It flows along the Brazilian coast until it meets the Falkland Current. This subtropical convergence varies in latitude seasonally, from approximately 38°S in the southern winter to 46°S in the southern summer. The combined currents then flow east as the South Atlantic Current. In this image a tongue of cold water has penetrated to approximately 36°S. It is flanked on the east by a warm eddy (WE) from the Brazil Current. On the west there are numerous small frontal eddies between the cold water and warm, less saline estuarine water from the Rio de la Plata.



SST MEAN DEC 86

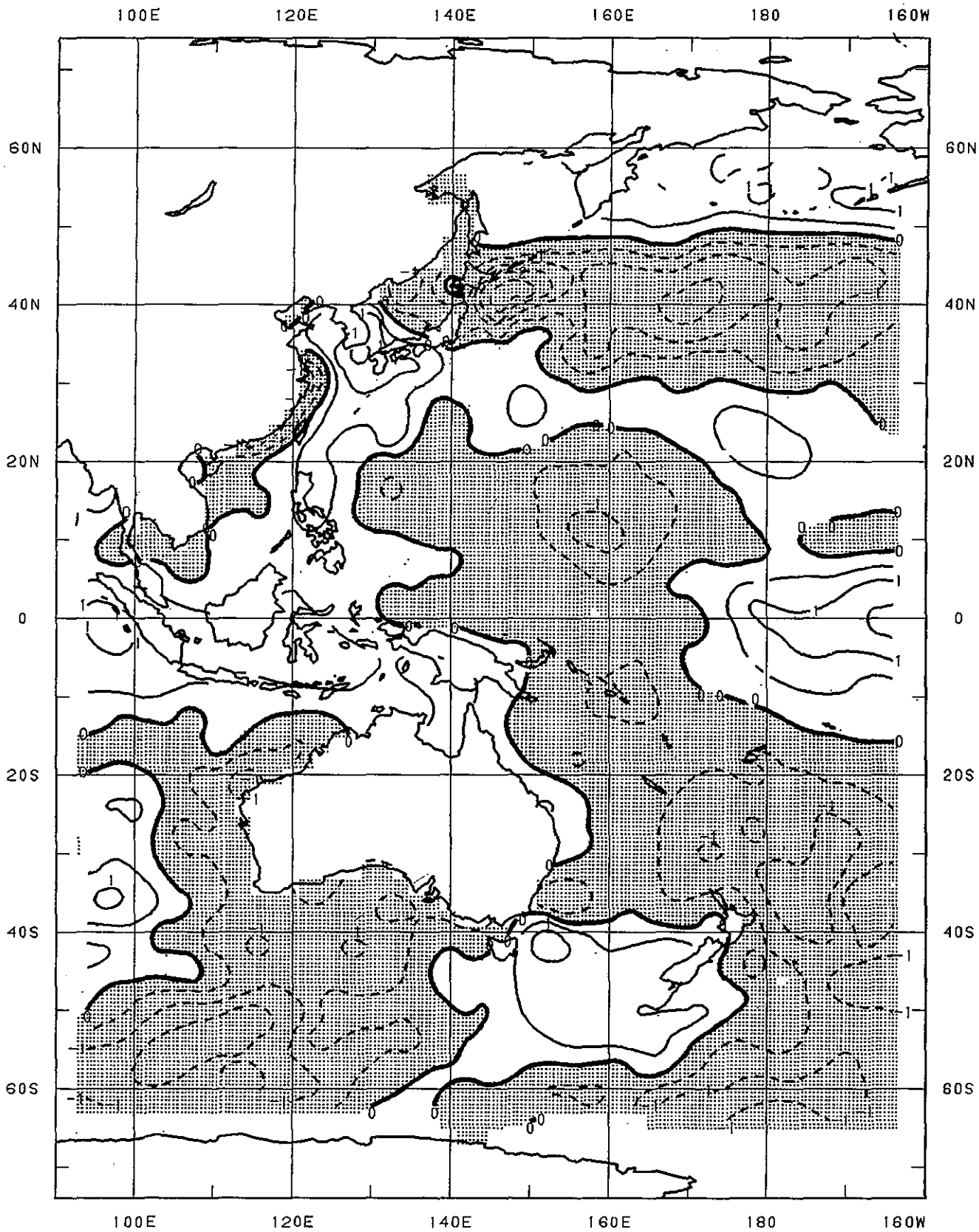
Western Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



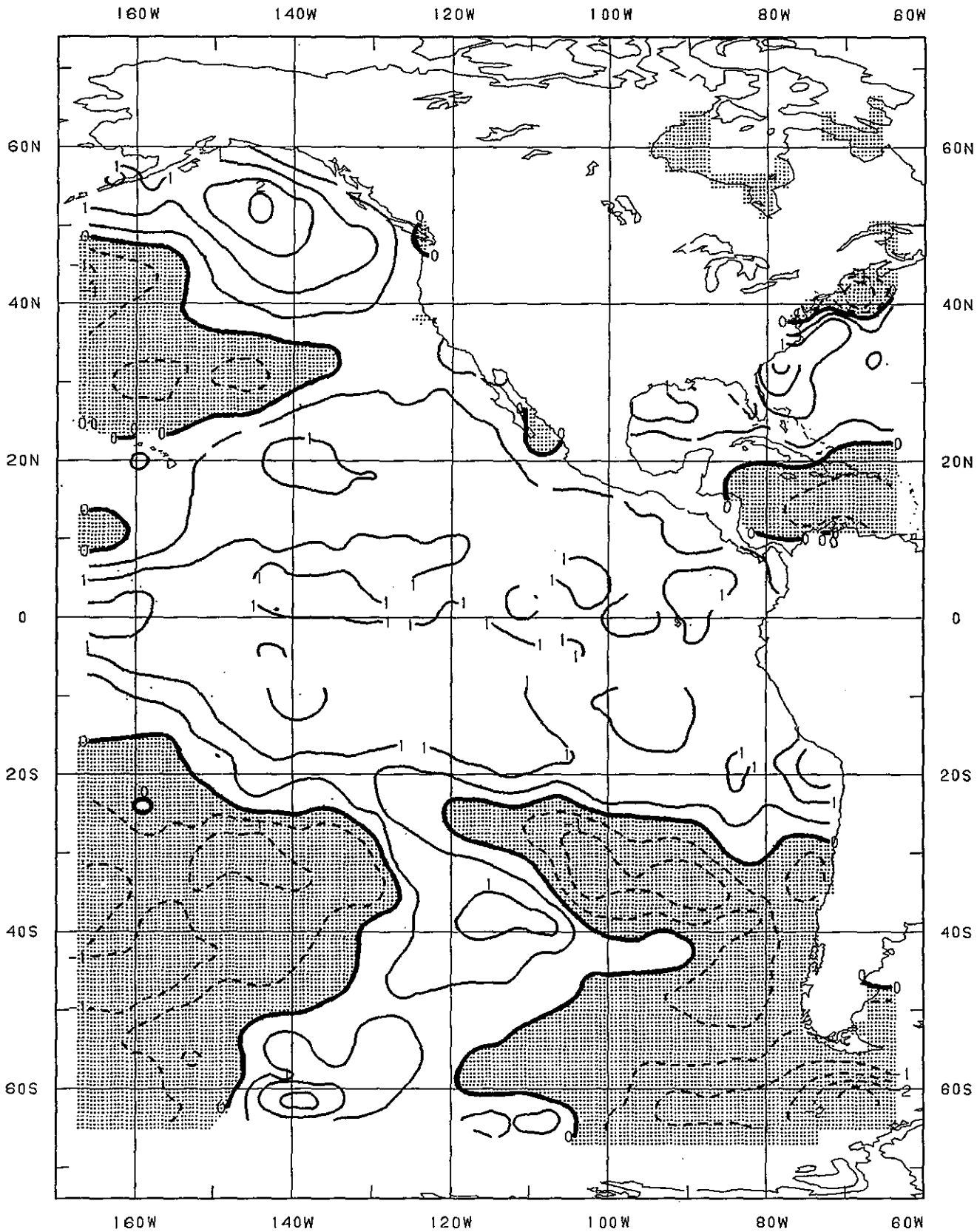
Eastern Pacific Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



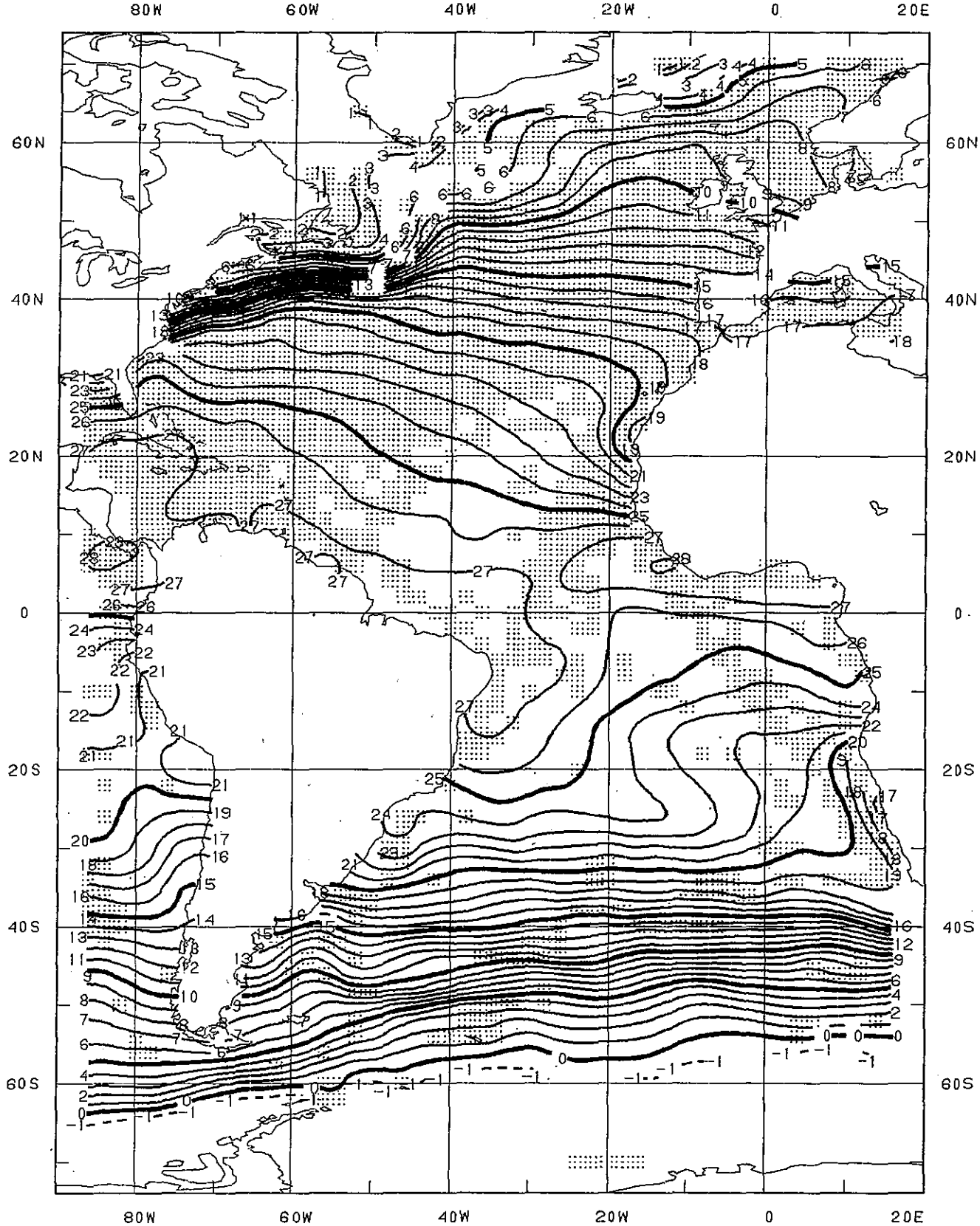
Western Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



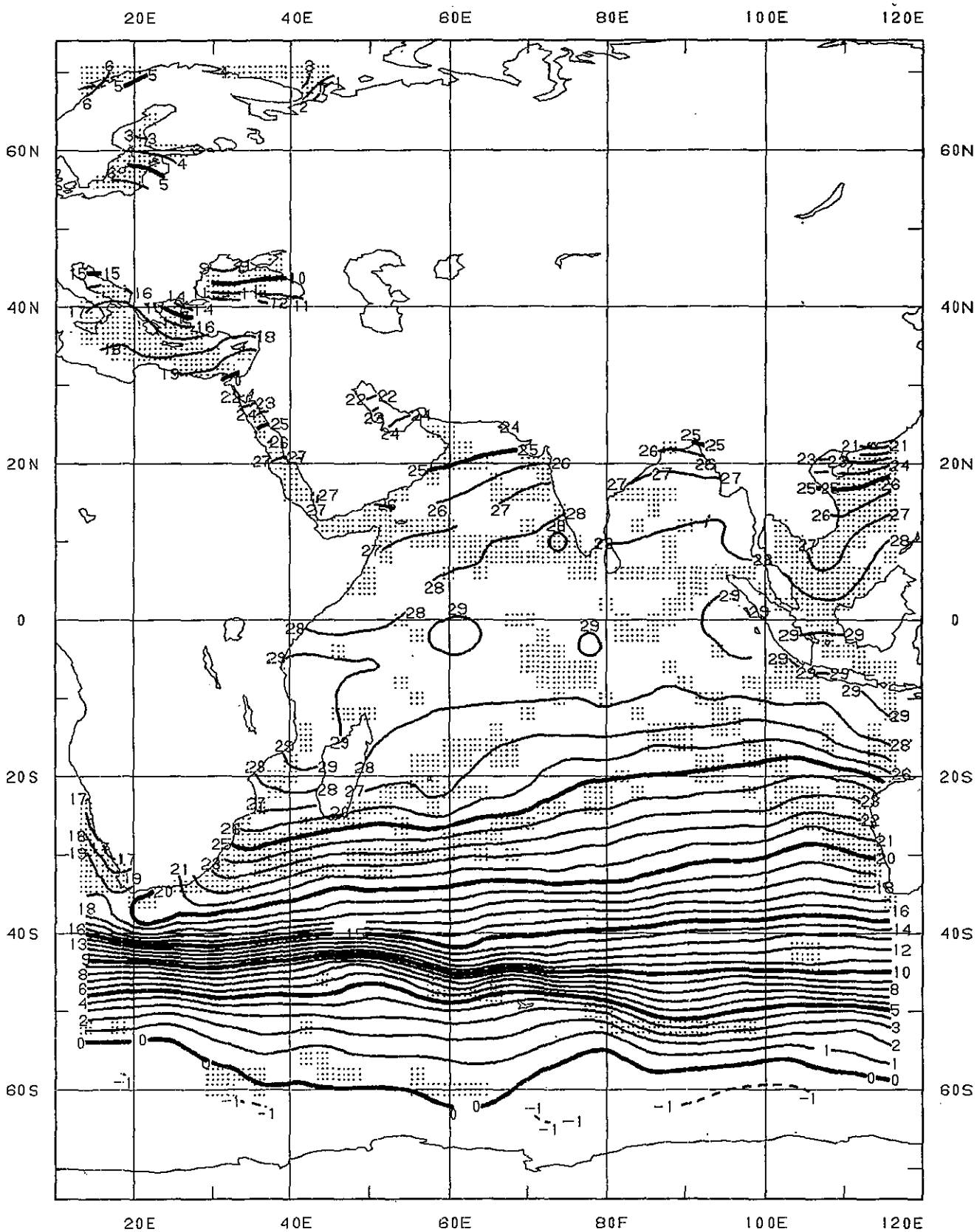
Eastern Pacific Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



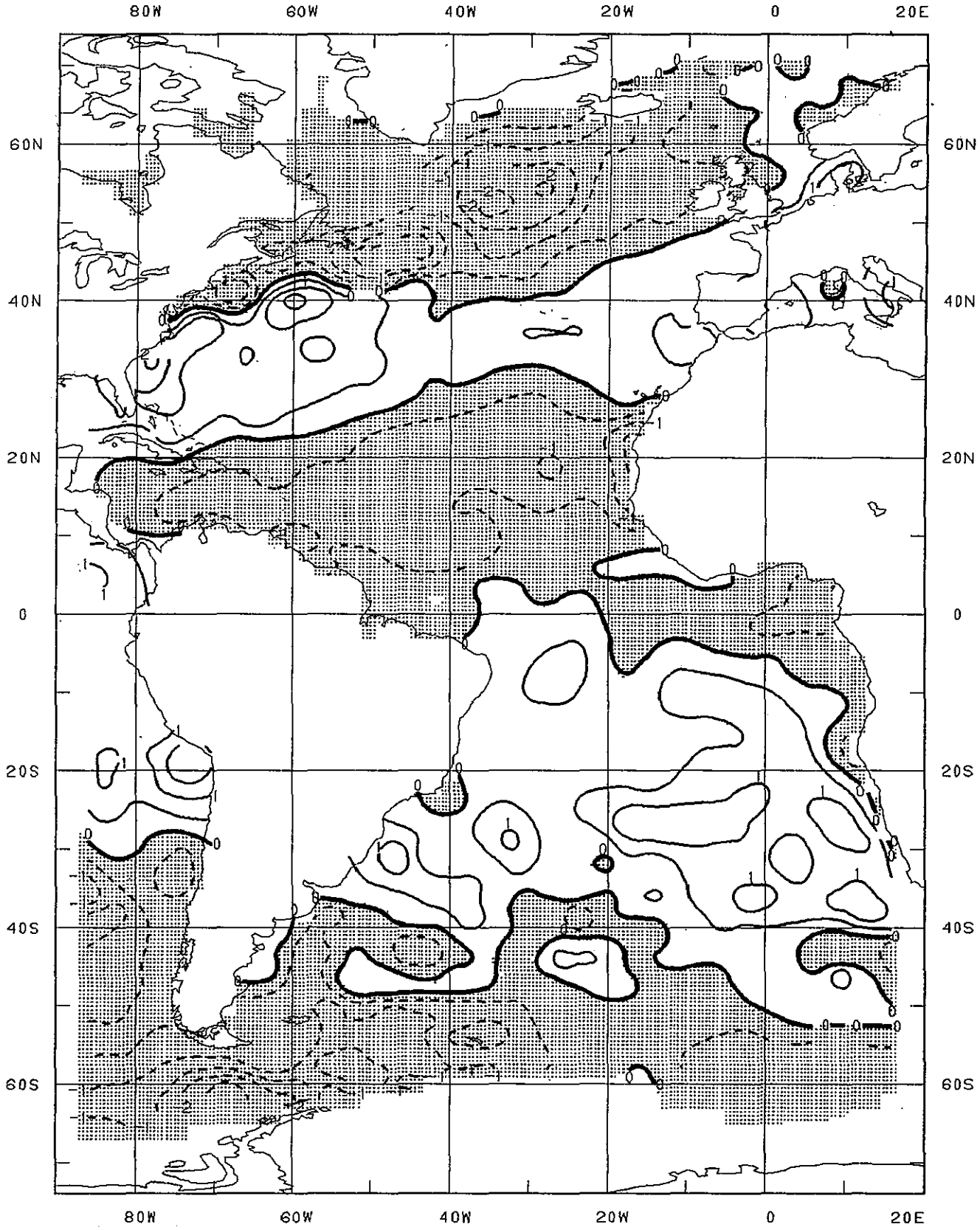
Atlantic Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



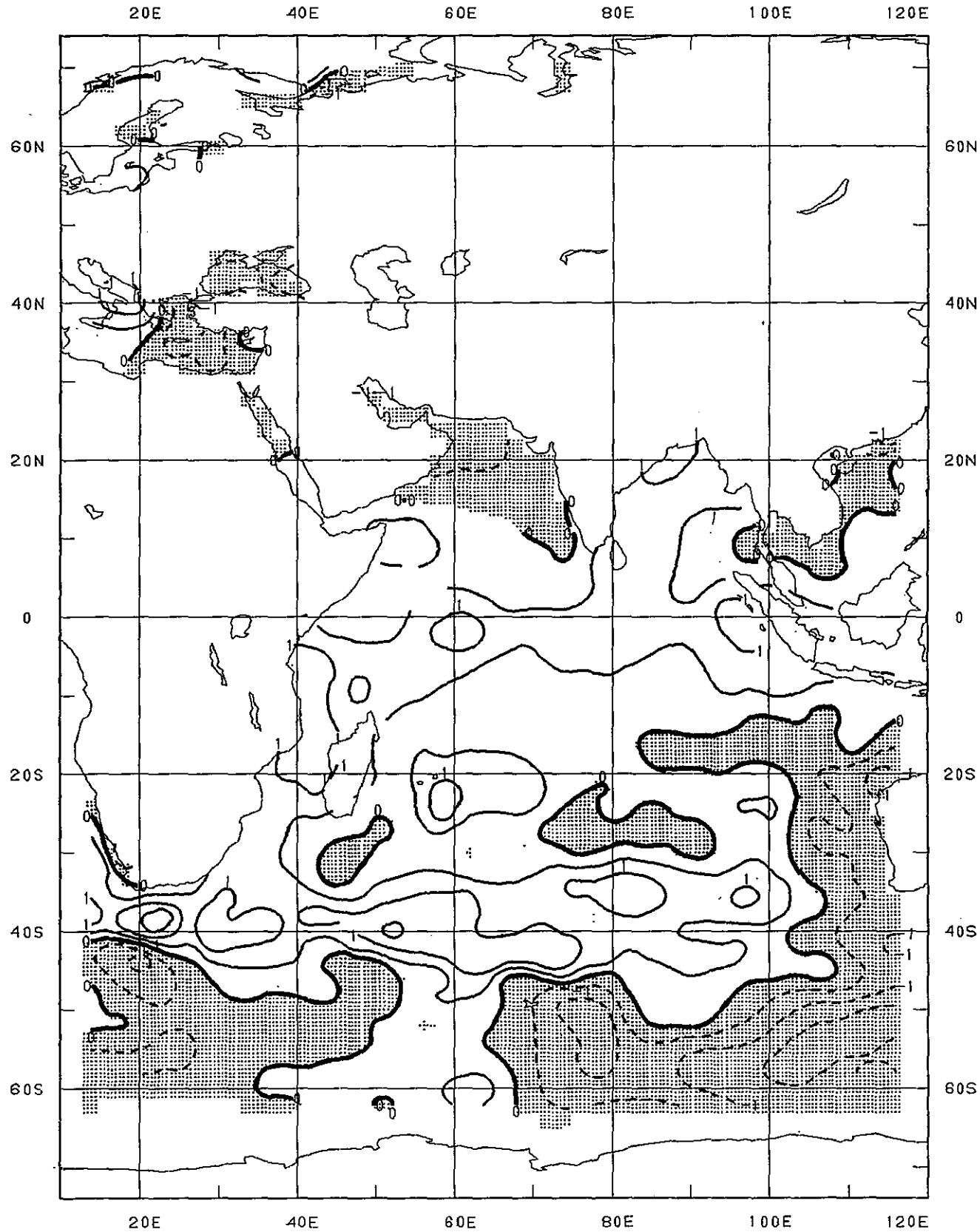
Indian Ocean
SST--MONTHLY MEAN (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly mean sea surface temperature is the mean of *in situ* 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.



Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.



Indian Ocean
SST--MONTHLY ANOMALY (°C)
SHIP, BUOY, AND SATELLITE DATA
DECEMBER 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature 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.

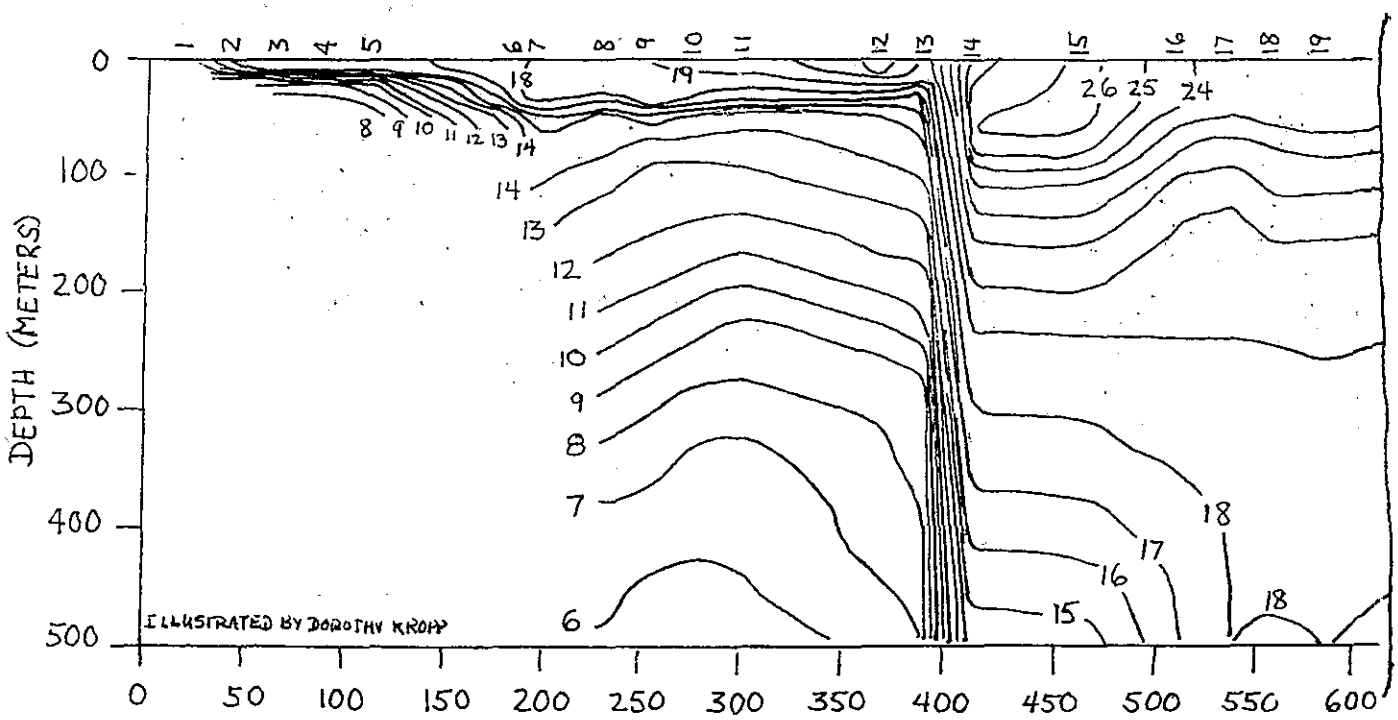
1986 NEWPORT-BERMUDA YACHT RACE TAKES ADVANTAGE OF XBT DATA

Jenifer Clark
NOAA/NWS
&
Dane Clark
Chief, Synoptic Analysis Branch
Satellite Data Services Division
NOAA/NESDIS

On June 13, 1986, 125 yacht racers at Newport, Rhode Island set sail for Bermuda. Prior to their departure, the yacht racers were given an oceanographic and meteorological briefing at the Captains' meeting. Since 1980 Dane and Jenifer Clark have presented the meteorological and oceanographic briefings, respectively. The oceanographic briefing had previously been a series of oceanographic analysis and sea surface thermal analysis charts. These charts show the satellite derived locations of favorable and unfavorable Gulf Stream and eddy currents as well as the sea surface temperatures.

Cyclonic cold eddies form south of the Gulf Stream. Since cold eddies are heavier than the surrounding Sargasso Sea water, then tend to sink and do not always have a surface manifestation. Since the thermal infrared satellite sensors do no penetrate below the surface, sub-surface cold eddies can be a potential hindrance to yacht racers who are trying to avoid unfavorable currents.

Due to the cooperation of Sonny Richardson of the National Ocean Services in Rockville, Maryland, Bob Benway of the National Marine Fisheries Services in Narragansett, Rhode Island, and the Ship OLEANDER, XBT data were made available to aid the racers in detecting subsurface cold eddies. The OLEANDER routinely makes a trip from Newark, New Jersey, to Hamilton, Bermuda, several times a month. XBT's are usually taken from shore to the north wall of the Gulf Stream. On their trip scheduled for June 5-8, 1986, it was requested that they continue the XBT's all the way to Bermuda. On May 6 and 27 the Oceanographic analysis charts showed a very slight gradient of cool water meeting warmer water near 34°N 66°W. Therefore, it was suspected that a subsurface cold eddy might be in that vicinity by June 5-8. The OLEANDER



SATELLITE DATA 05-08 JUN 1986

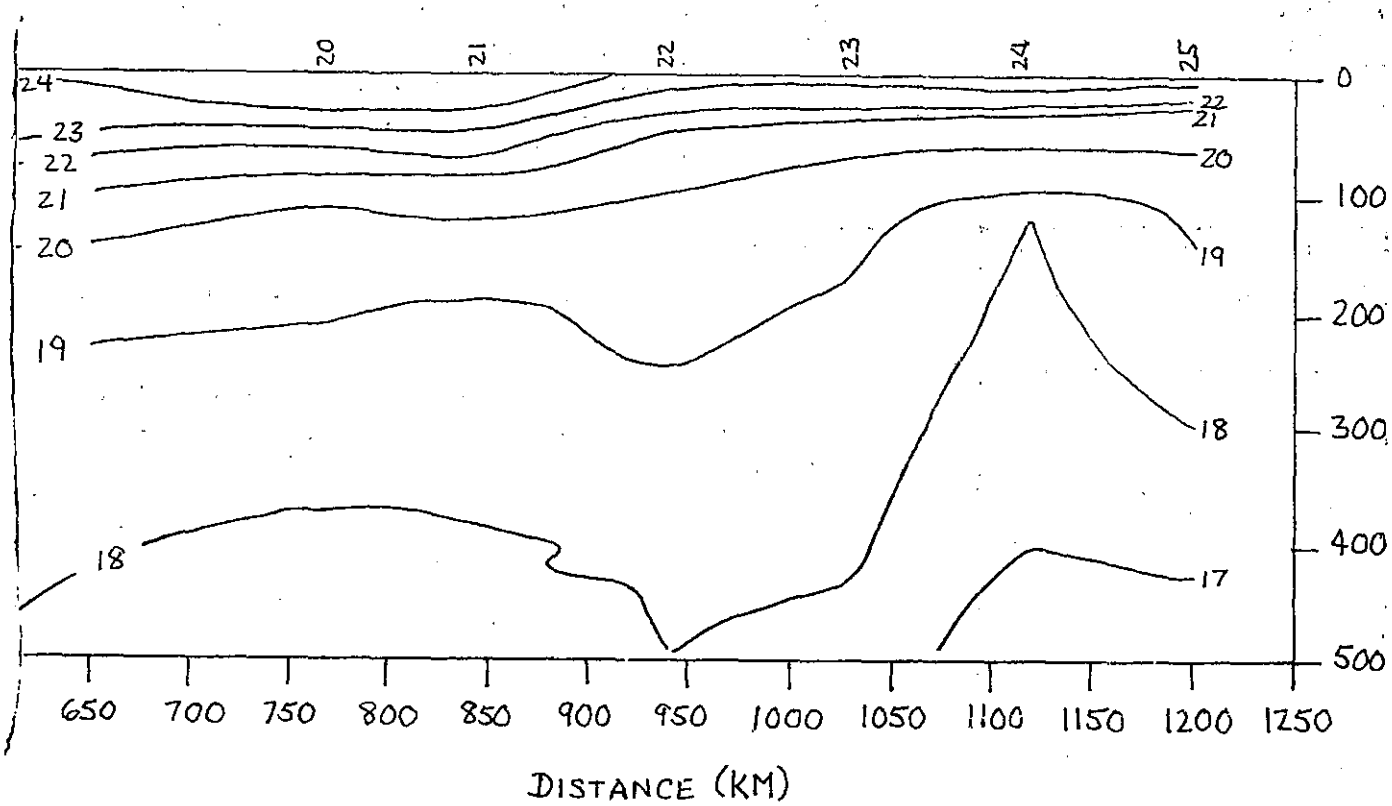
personnel were then requested to concentrate XBT probes near 34°N 66°W.

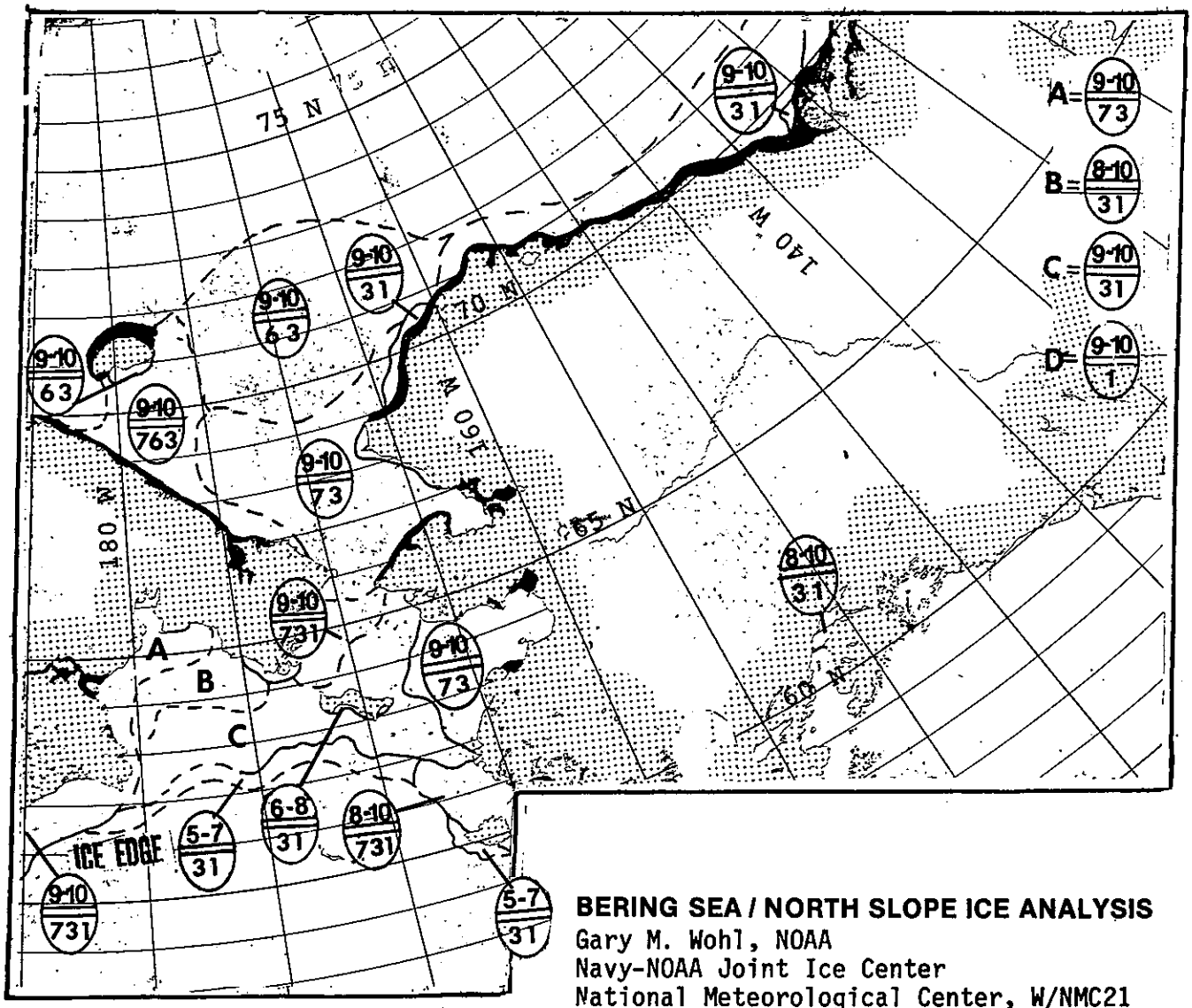
Figure 1 is a cross section of XBT data taken June 5-8, 1986. On the X axis is the distance in kilometer from shore to Bermuda along the track. On the X axis is the water depth from the surface to 500 m. Isotherms are shown in °C. Horizontally along the top of the figure, XBT locations are numbered from 1 to 25.

Two observations were made from figure 1. The north wall of the Gulf Stream is readily detectable between XBT's 13 and 14 (near 400 km from shore). This location correlated well to the location on the oceanographic analysis chart. Cold eddies are characterized by dome shaped isotherms. Near XBT 24 the isotherms are dome shaped below 100 m indicating the possible presence of a subsurface cold eddy. The question was, "Does the circulation actually extend to the surface in the absence of any thermal indication of a cold eddy in the first 100 m?"

Armed with this new possible cold eddy information the Oceanographic Analysis chart was appended to include a possible cold eddy near 33°30N 66°W. 123 log books were received after the race. Many of these included sea surface temperatures as well as current speeds and directions. Most of the sea surface temperatures were reported to be 23-24°C near the possible cold eddy. This compared favorably to the Oceanographic Analysis chart which also showed 23-24°C near the possible cold eddy. A few yacht racers detected ½ -1 knot counterclockwise currents associated with this possible cold eddy while many mentioned that there was no evidence of a cold eddy.

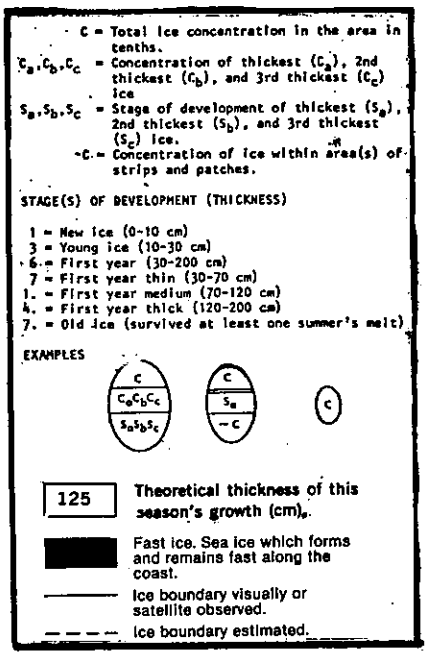
Therefore it was concluded that the possible cold eddy probably has sunk so far below the surface that currents near the sea surface from the eddy were negligible. However, there was a lot more confidence in the appended Oceanographic ANalysis chart for the racers since it appeared that unexpected cold eddy currents were not in the vicinity of the rhumb line south of the Gulf Stream. This conclusion could not have been drawn without the extra XBT probes launched by the OLEANDER.





BERING SEA / NORTH SLOPE ICE ANALYSIS

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



DECEMBER 1986

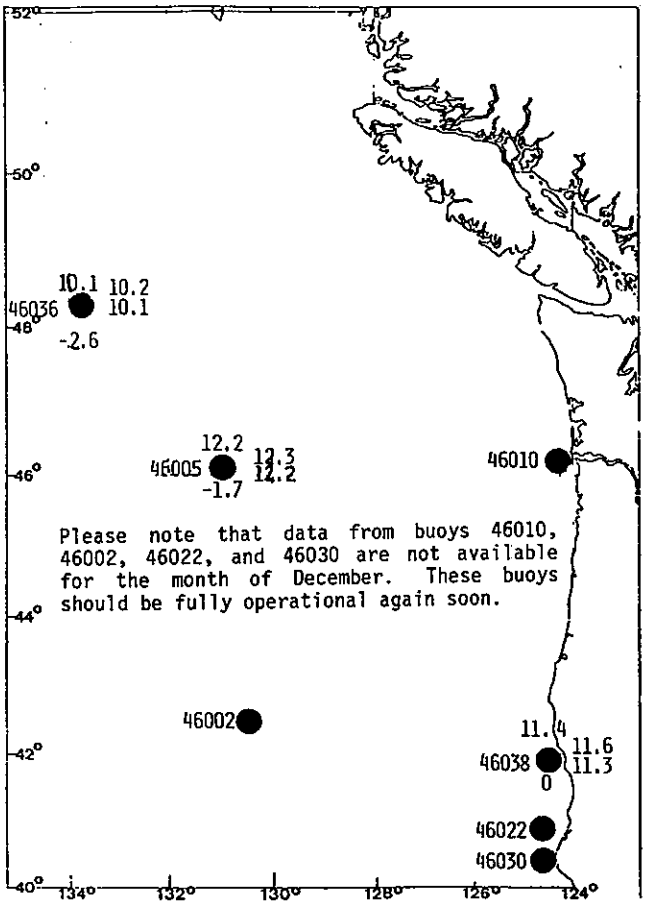
Sea ice expanded through the northern Bering Sea during December, especially late in the month when colder air entered the region from the north. The ice cover on the Beaufort and Chukchi Seas was nearly complete; the remaining openings were near the coastline or near shorefast ice (frozen to the shoreline and/or the sea floor) and in leads caused by strong winds. Shorefast ice expanded seaward along most of the Beaufort and Chukchi Sea coastlines. In the Bering Sea, ice thickness increased rapidly due to ice floes rafting upon one another. Rafting was common in all places where wind speeds were moderate to strong. Sea ice expansion was expected to continue throughout the Bering Sea during January under the influence of northerly winds caused by a storm track south of the Aleutians and an influx of cold, Siberian air.

WEST COAST OCEAN FEATURES

Ernest Daghir
NOAA/NWS
Satellite Field Service Station
660 Price Avenue
Redwood City, CA 94063
(415) 876-9122
FTS 470-9122

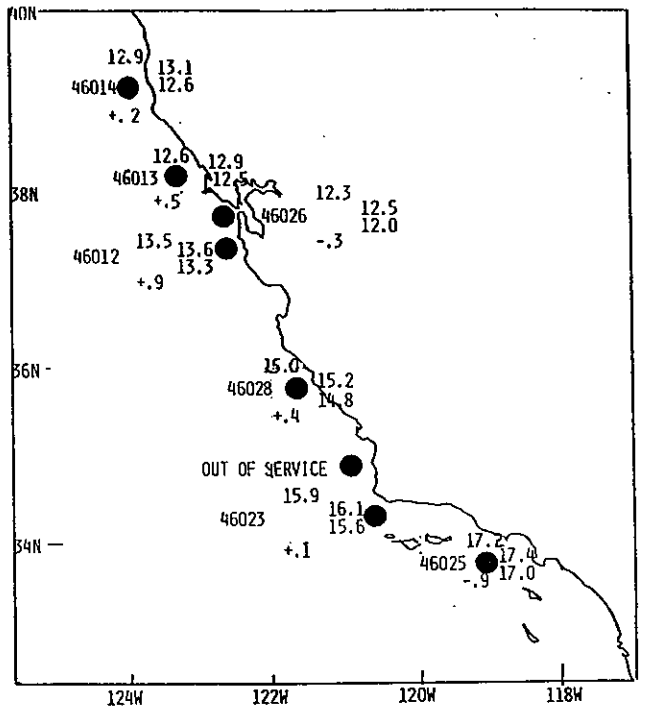
DECEMBER 1986

The monthly mean temperature in the North Panel was computed to be +0.6°C above the climatological normal mean value of



10.9°C. (This warm anomaly over the area is the same as it was in November). Two small areas in the North Panel had temperatures 1.2°C above the climatological mean and they were centered northwest of Vancouver Island and at 46°N 132°W. The least cooling occurred along the coast and also in the extreme northwest corner of the chart. Comparing December to the previous month, it shows considerable cooling of 1.4°C to 2.5°C throughout the analysis area. This cooling is expected at this time of the year. Again, the least cooling was analyzed to be closest to the coast. Statistics from the three operating buoys agree that the majority of cooling was offshore as opposed to nearshore.

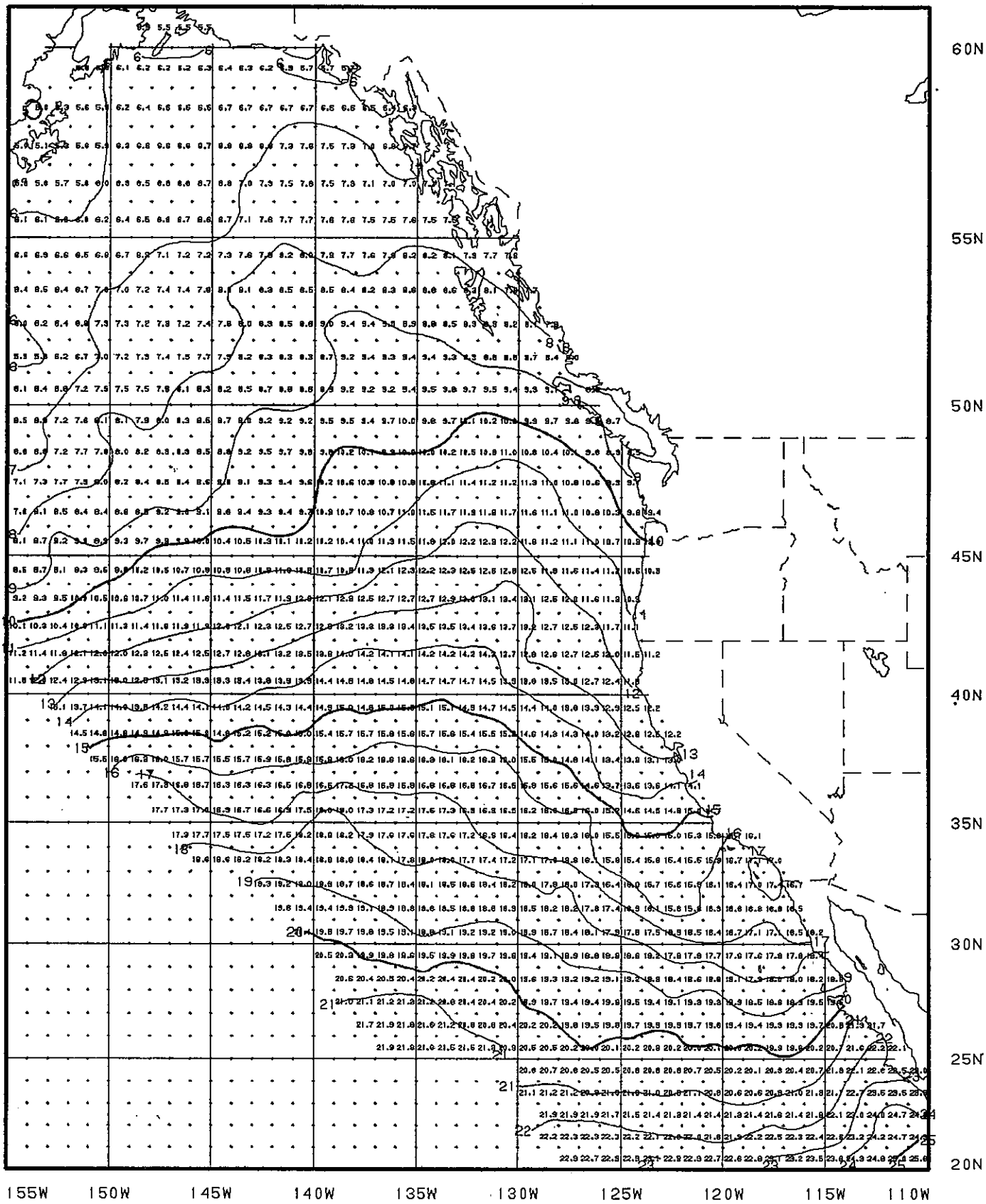
In the South Panel, the monthly mean temperature was 0.4°C above the climatological mean value of 16.3°C. The waters adjacent to the coast had the warmest anomalies of 0.7°C to 1.4°C. Oddly enough, one of the two areas analyzed to be below normal by 0.7°C was within 150 nmi of the warmest anomaly mentioned above. The other cool anomaly was centered at 36.5°N 132.5°W. Comparing this month to November, the least cooling again occurred alongshore. In fact, buoy statistics show warming at five of the seven fixed buoys! Offshore waters cooled on the average of 1.0°C to 1.9°C.



KEY:

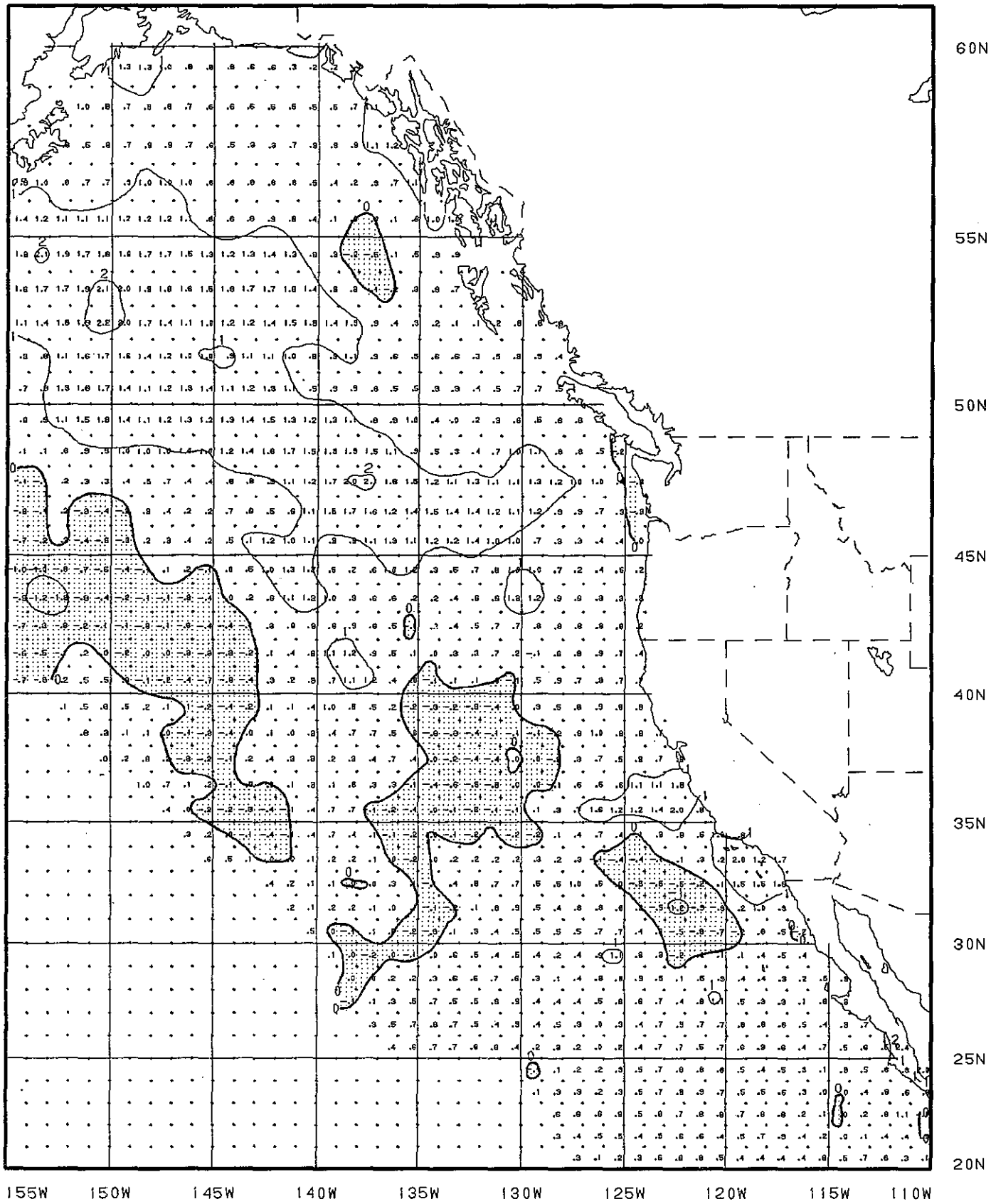
12.1 ← Monthly mean
LOCATION 13.5 ← Maximum daily mean
NAME 10.2 ← Minimum daily mean
-1.5 ← Change from previous month

● Denotes station position.



West Coast
SST--MONTHLY MEAN (°C)
December 1986

Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



West Coast
SST--MONTHLY ANOMALY (°C)
December 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

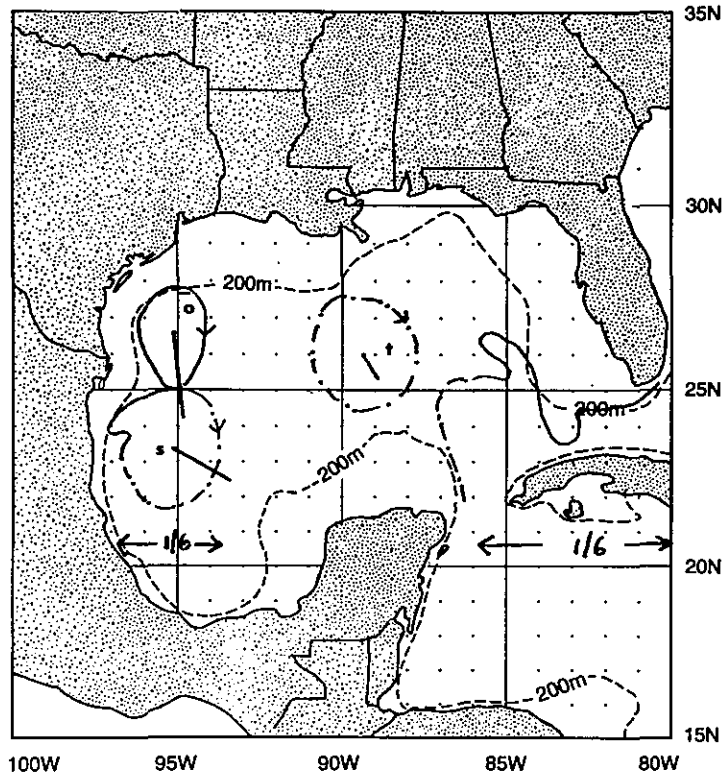
EAST COAST OCEAN FEATURES

Jenifer Clark
NOAA, NWS
Washington, DC 20233
(301) 763-8239

DECEMBER 1986

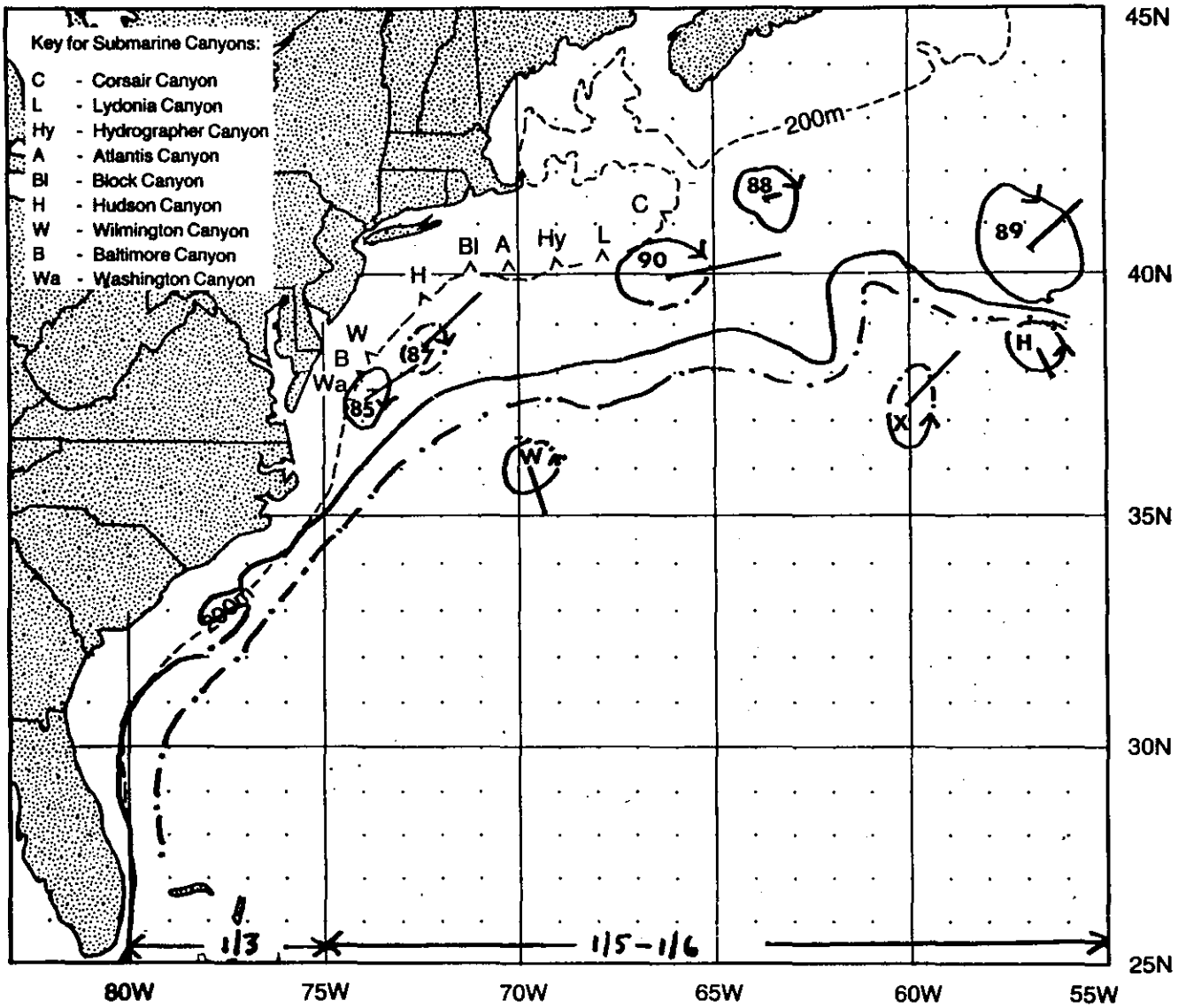
The end of this month's positions of the Gulf Stream System and its associated eddies are shown for the NW Atlantic and the Gulf of Mexico. The Gulf Stream and Loop Current boundaries are located by infrared satellite imagery or XBT (expendable bathythermograph) data. Anticyclonic eddies are labeled a-z in the Gulf of Mexico and 1-99 in the NW 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. Eddies or sections of the Gulf stream System which were not observed during the month are not shown on the analysis chart. The long arrows at the bottom of the chart indicate the data of data used.

Data used in this analysis include:
- NOAA satellite infrared imagery, NESDIS
- Bathythermograph data, National Meteorological Center of National Weather Service
- Oceanographic Analysis, A daily detailed analysis issued by National Weather Service/NESDIS



GULF OF MEXICO

The eastern half of the Loop Current was faintly discernible on January 6, 1987. It has apparently moved about 110 km northward of last month's location observed on November 10, 1986. Anticyclonic eddy t, last observed on December 11, translated 90 km NW. According to the National Weather Service in Slidell, Louisiana, two warm eddies have been detected in the western Gulf of Mexico in data from drifting buoys. It is assumed that these eddies are eddies s and o last observed on July 18, 1986. Eddy s seemingly traveled 195 km NW and eddy o apparently translated 260 km NNW since July 18.



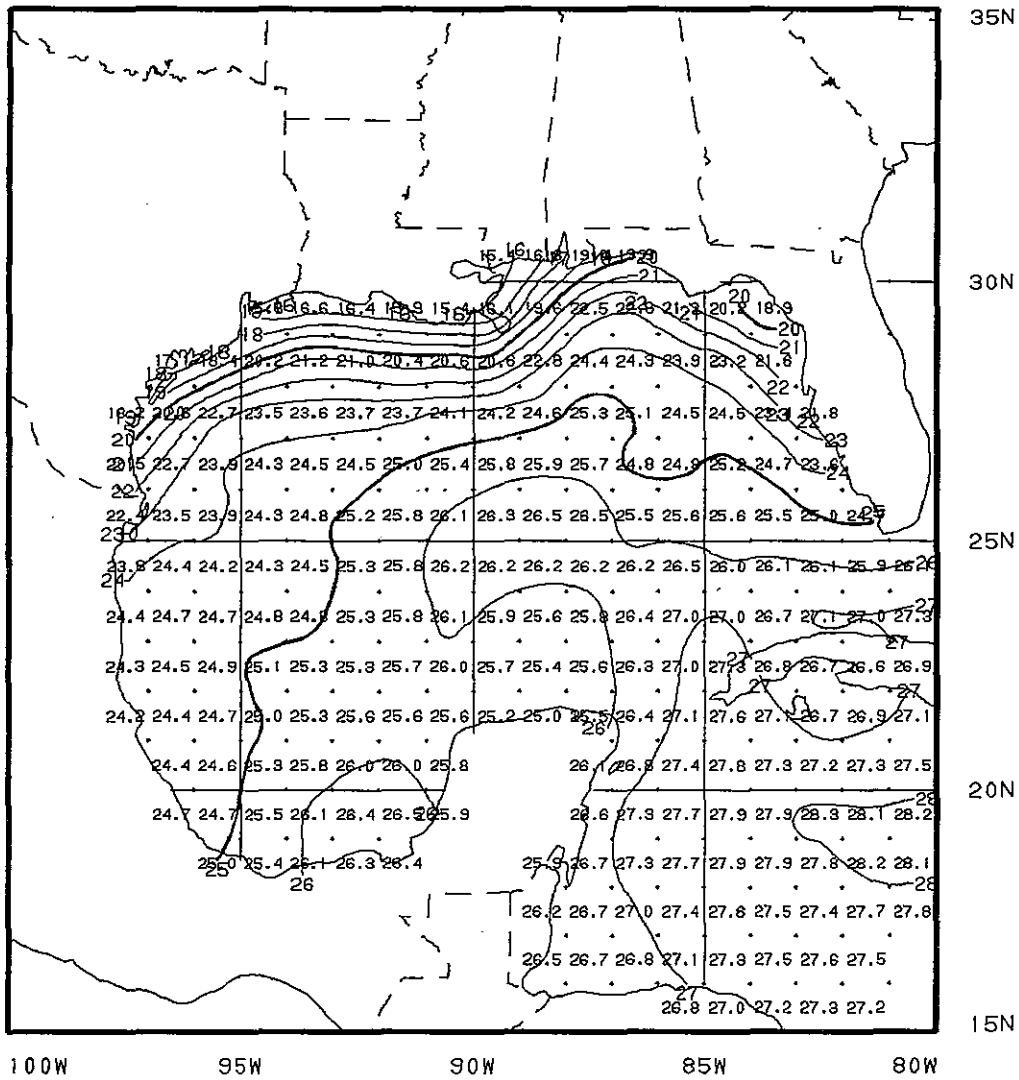
EAST COAST

One anticyclonic eddy formed from an aneurism in the Gulf Stream during December. Eddy 90 formed on December 3 near 40°N 63°W. Eddy 90 has since moved 275 km WSW. Eddy 83 appeared to dissipate near 43°N 61°W some time during the month. Eddy 87 translated 195 km SW when it was last faintly detected near 38°30N 72°30W on December 23. Due to low thermal contrast, the status of eddy 87 is not known. Eddy 88 moved only 35 km W. Eddy 89 traveled 140 km SW.

Cyclonic eddy W translated 110 km NNW while eddy X moved 155 km SW. Eddy H translated 85 km NW. Eddies F and U were not observed.

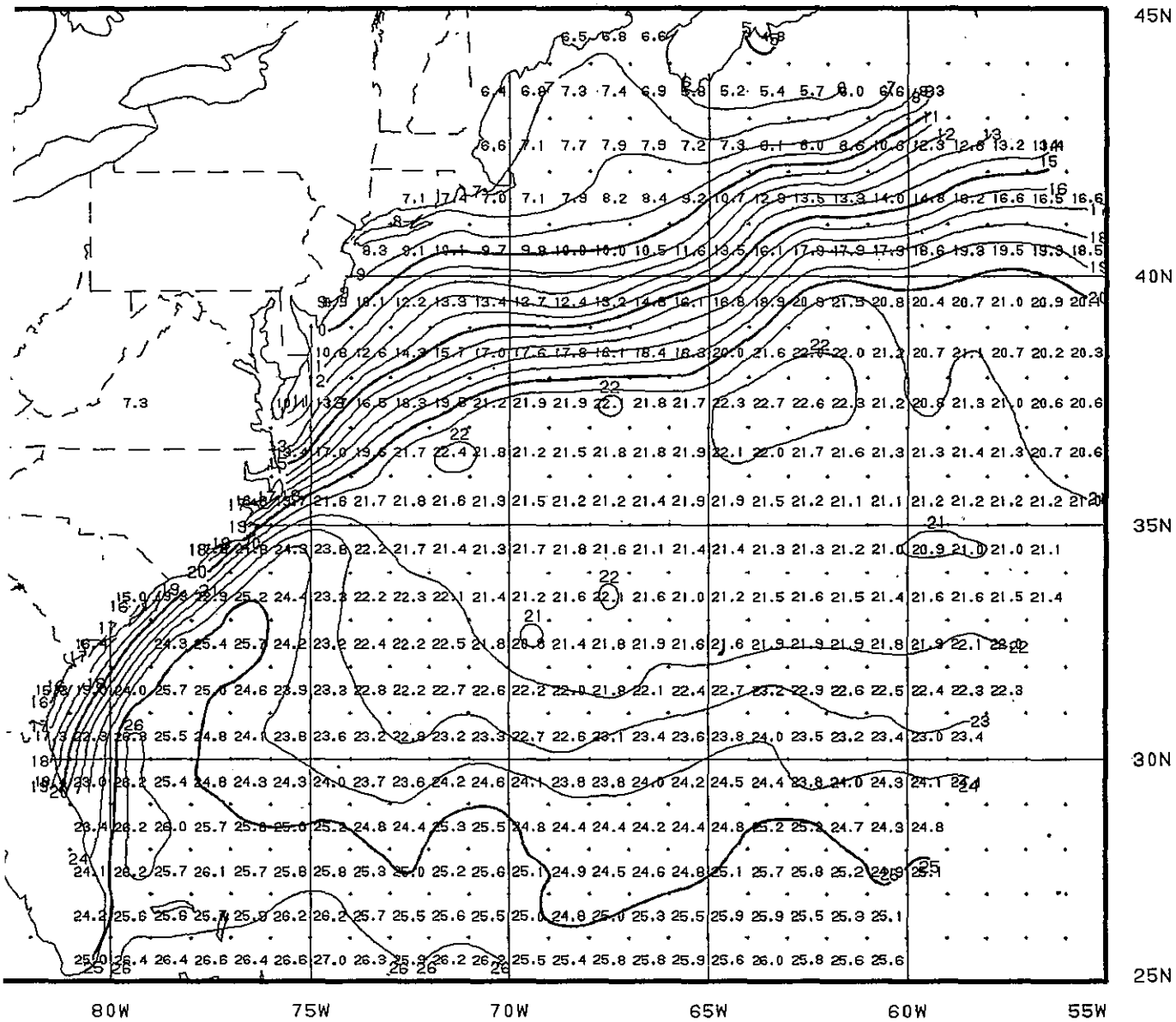
The Subtropical Convergence Front was not observed during December.

EAST COAST SST-
MONTHLY MEAN



Gulf of Mexico
SST--MONTHLY MEAN (°C)
December 1986

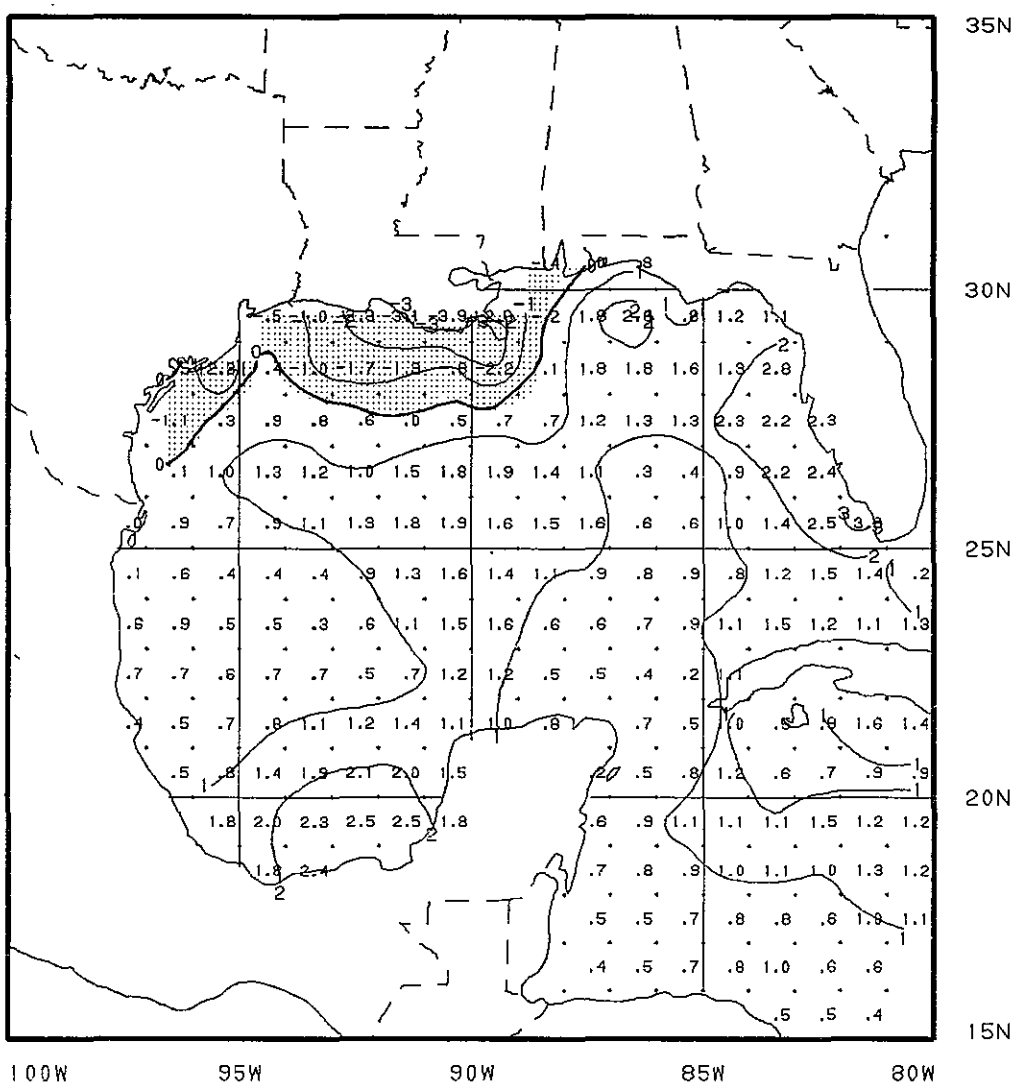
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.



W Atlantic Ocean
ST--MONTHLY MEAN (°C)
ecember 1986

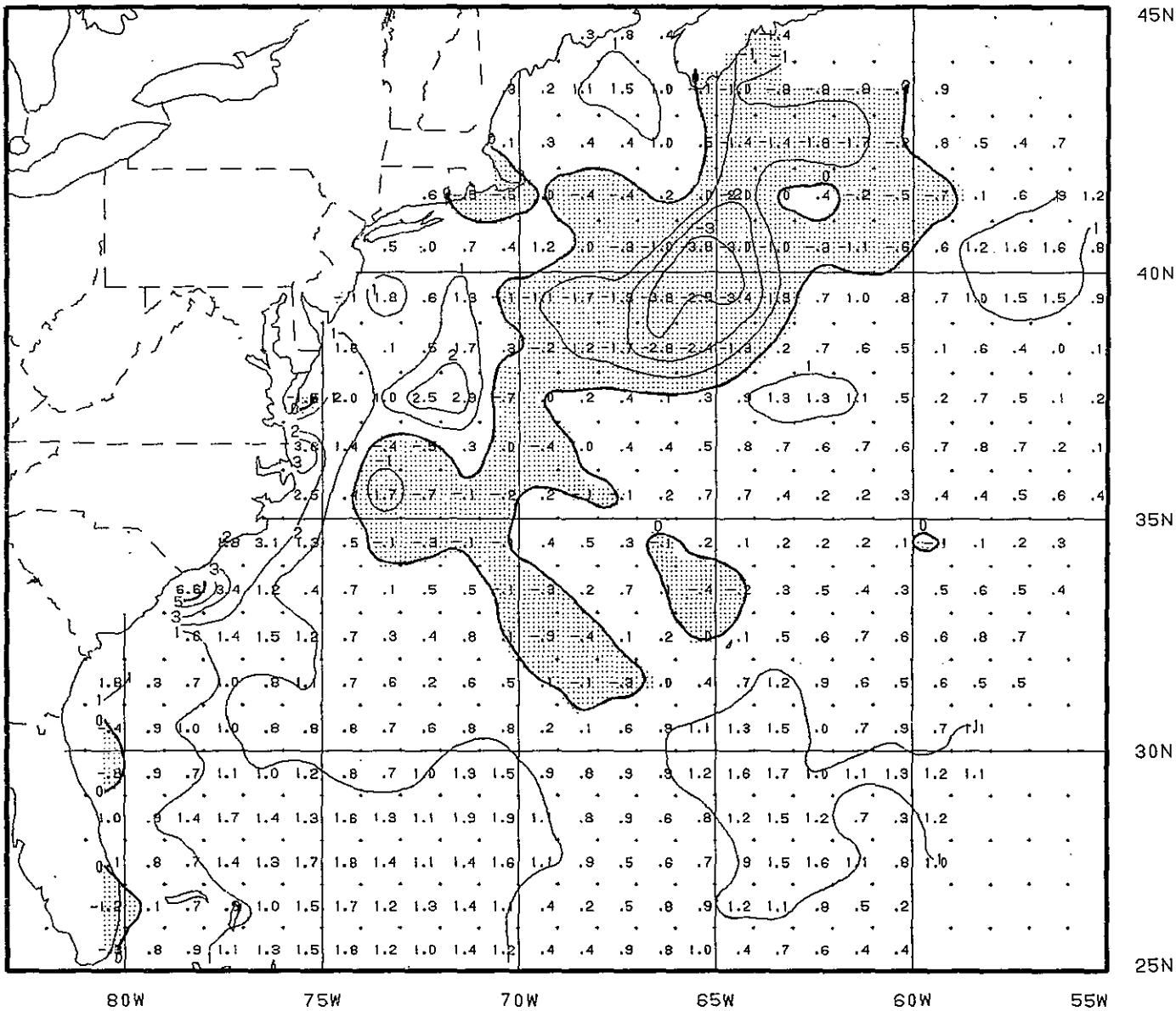
Monthly mean sea surface temperature is the mean of twice-weekly analyses using ship, buoy, and satellite observations. Contour line interval is 1.0°C.

EAST COAST SST-ANOMALY



Gulf of Mexico
SST--MONTHLY ANOMALY (°C)
December 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.



NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
December 1986

Monthly anomaly is the difference between the monthly mean sea surface temperature and the climatological monthly mean value -- shading shows where the monthly mean is colder than climatology. Contour line interval is 1.0°C.

Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, W/NMC21
Oceanographic Monthly Summary
Washington, DC 20233

FIRST-CLASS MAIL
POSTAGE & FEES PAID
NOAA
PERMIT NO. G-19

PRINTED MATTER

NOAA LIAISON OFFICER
BIN C15700
BUILDING 1
7600 SAND POINT WAY, N.E.
SEATTLE, WA 98115-0070

17

Subscription Information

Subscription orders for *Oceanographic Monthly Summary* should be placed with:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Subscription rates are:

Annual --	Domestic	$17.00
	Foreign	$21.25
Single copy --	Domestic	$ 1.75
	Foreign	$ 2.20

Checks should be made payable to *Superintendent of Documents*. Air mail delivery can be obtained (at additional cost) by request.

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, 1987.