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A Bering Sea Forecast from Oceanographic Monthly Summary (OMS) Data

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A BERING SEA FORECAST FROM OCEANOGRAPHIC MONTHLY SUMMARY (OMS) DATA

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On June 6, 1984, The Environmental Acoustic Research Group was asked if the SST in the Bering Sea for the remainder of June-July would be anomalous. An answer was desired within a few hours. No recent observations were available. However, a newly published article by Niebauer (1984) had established a 25%-30% probability that surface air temperature in the Pribiloff Island area would be higher some 12 months after an ENSO event (ENSO is an El Nino index). Considering this probability and that there was an ENSO event in 1982-83, an anomalously warm 1984 summer was indicated.

The best data to serve as a basis for a forecast were in the OMS. Since 1981, the OMS had included SST anomalies for the Bering Sea. Some of the OMS utilized values directly observed while others were based on remotely sensed data. The most recent of the publications was that containing April observations. So the observed values and their trends were used from April 1981-1984 to indicate what might be expected in June and July. Each April of 1981-1984, the contours were studied to determine the largest and smallest anomaly in the Bering Sea. These values for the respective years were then plotted against time to illustrate the size and range of the anomalies and the trends in the values (Figure 1 on page 13). From 1981-1983, similar values for May are also shown.

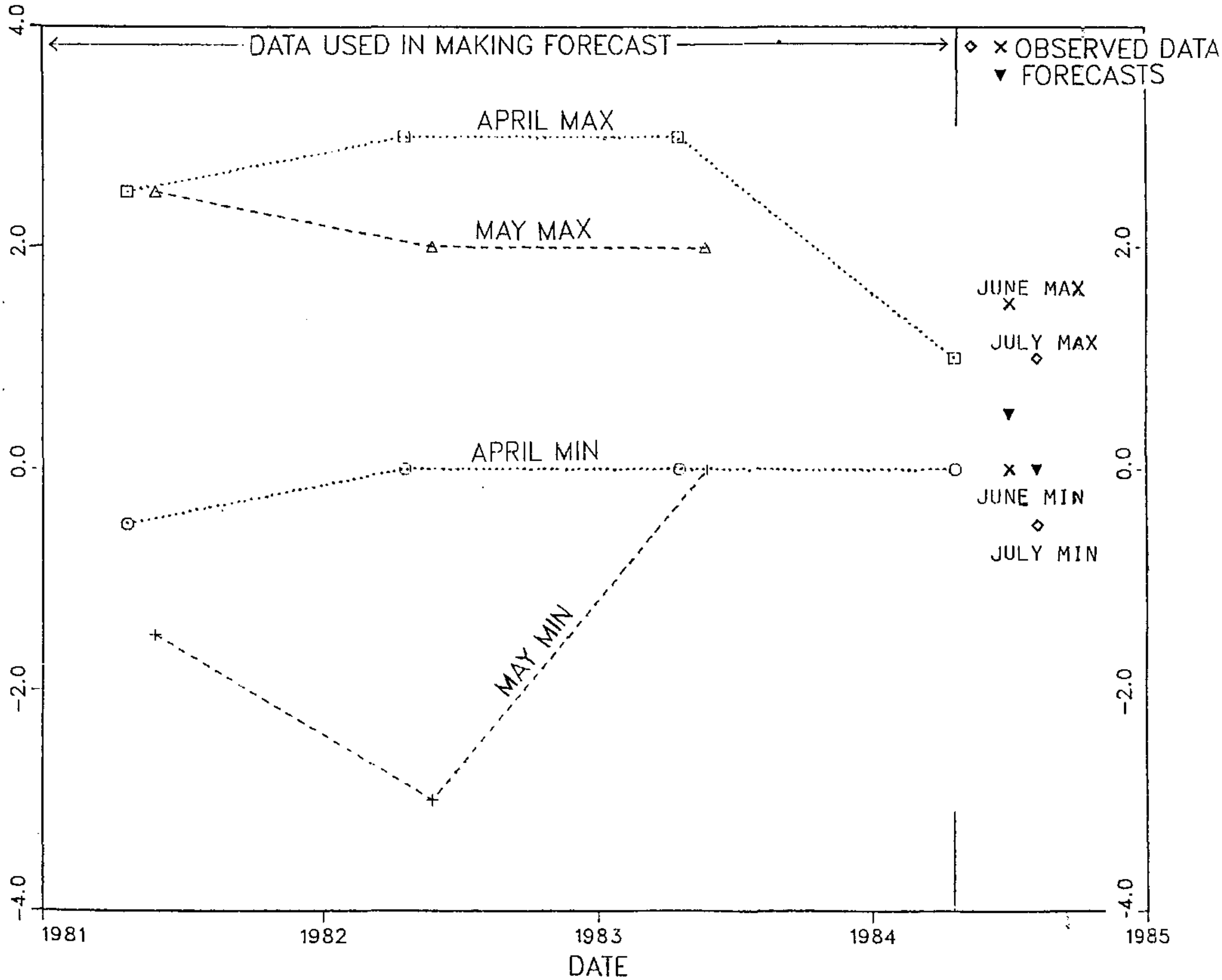
Anomaly extremes for other months and extreme values for the monthly average SSTs were also studied. But the data shown in Figure 1 were the most useful. They showed larger ranges of anomalies from 1981-1983 (average of 3°C for April) decreasing to a smaller anomaly range of 1°C in April 1984, the most recent observation available at forecast time. May 1981-1983 data show a similar trend overall. Figure 1 also shows that from 1981-1984 the anomalies for April and May were decreasing toward the mean, i.e., the earlier years were considerably more anomalous than 1984.

On the basis of the trends and values shown in Figure 1, it was concluded that the small range shown for April 1984 would continue through June and July 1984. The value of the anomalies would stay near zero, i.e., there would be no significant positive SSTs anomaly in the Bering Sea in June or July 1984. The forecast on June 6, using only the data from the OMS from April 1981-1984 was as follows:

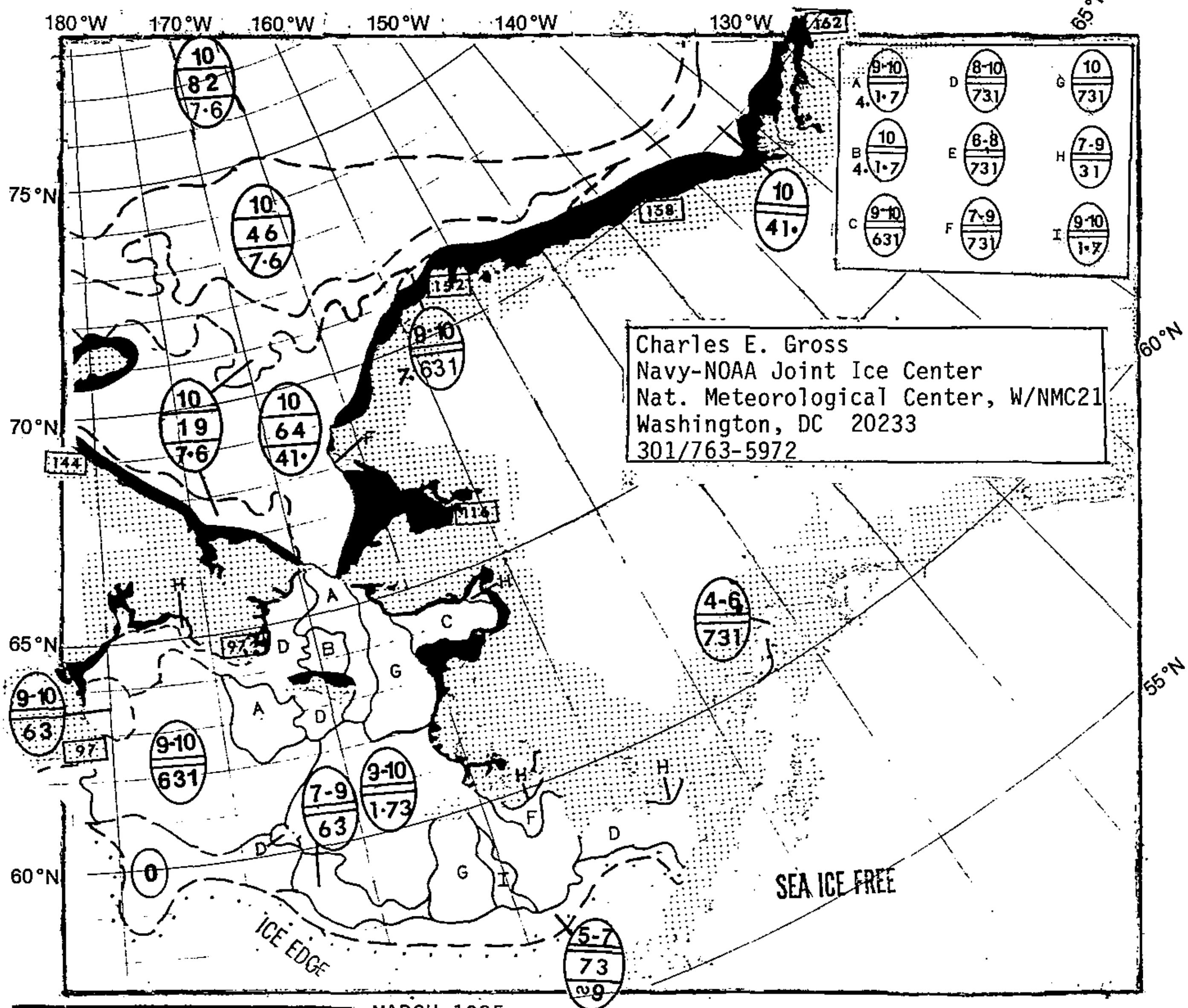
> "June and July 1982 were below normal. During the next year both recovered and went slightly above normal. Meanwhile, April was considerably above normal in 1982 and 1983 but was trending back toward a smaller anomaly. This trend continued into 1984 when April remained about 0.5°C above normal. If the trends for April 1984 are also taken to indicate the yearly trends for June and July, it might be expected that June 1984 would be about 0.5°C above normal and July would be near the normal."

The values forecast and the values later obtained when the observed data were published are shown in Figure 1. The verification is good.

FIGURE 1. ANOMALIES FROM BERING SEA MONTHLY MEAN SST



BERING SEA / NORTH SLOPE ICE ANALYSIS



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C = Total ice concentration in the area in tenths.

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

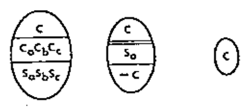
S_a, S_b, S_c = Stage of development of thickest (S_a), 2nd thickest (S_b), and 3rd thickest (S_c) ice.

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

STAGE(S) OF DEVELOPMENT (THICKNESS)

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

EXAMPLES



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

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

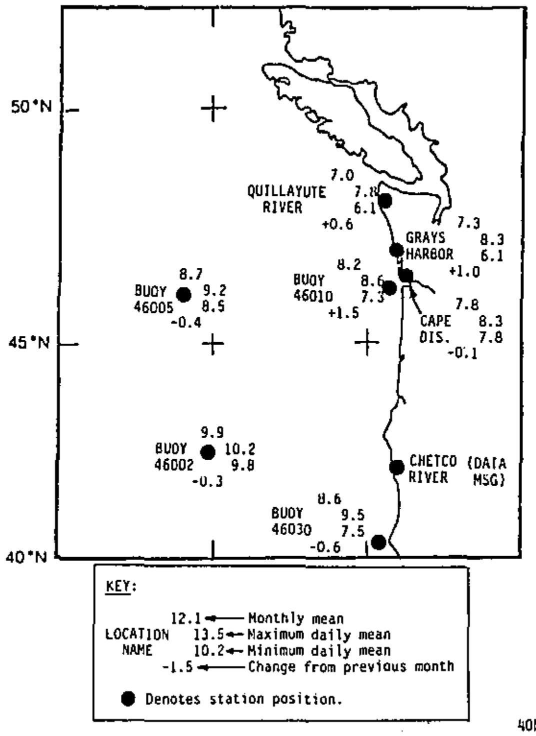
Ice boundary visually or satellite observed.

Ice boundary estimated.

MARCH 1985

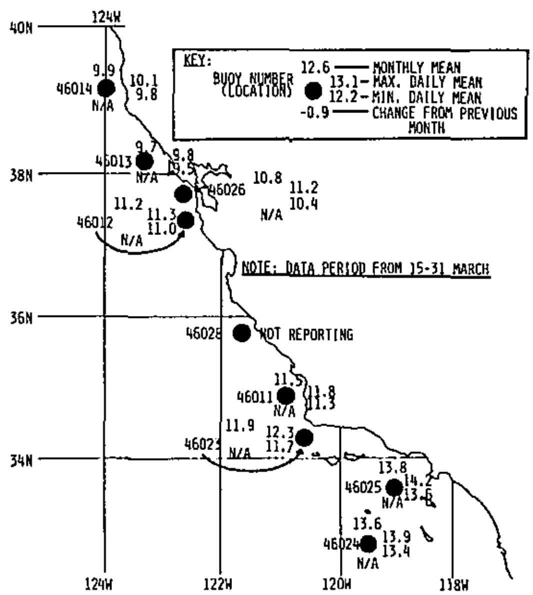
The monthly mean sea level pressure circulation depicts a 1002 mb low centered near Bristol Bay 58°N 160°W and reflects the tracks of a succession of low pressure systems transiting across the southern Bering Sea and the Alaskan peninsula. Geostrophic winds during the period were predominantly east-northeasterly although during the first week of the month southwesterly on-pack winds caused recession of the ice edge in the western and central Bering Sea. A north-northeasterly windflow pattern beginning the second week of the month caused ice edge expansion west of 165°W. Mean surface air temperatures recorded at Nome (65°N 165°W) and King Salmon (59°N 157°W) were normal. Theoretical ice thickness at Nome was slightly less than the 16 year minimum (91 cm vs. 93 cm) and at Bukhta Providenya, USSR (64°N 173°W) less than the 15 year normal ice thickness (93 cm vs. 104 cm). The ice edge position is between the median and minimum east of 163°W and close to the median throughout the remainder of the Bering Sea.

WEST COAST OCEAN FEATURES



MARCH 1985

Coastal SSTs north of the Columbia River showed increases from very low values seen in February. South of the Columbia River, coastal SSTs reached their annual minimum values. Offshore SSTs likewise reached their lows for the year. All coastal SSTs remained below normal for March, with anomalies ranging from -0.6°C to -1.4°C. Except for this nearshore region, the North Panel area was characterized by weak warm anomaly, generally less than 1°C. Most offshore and coastal stations began the month with cool SSTs, exhibited a weak warming trend which reached its peak during March 18-23, then cooled again during the last week of the month. The only exceptions to this were Oregon coastal stations, which continued slowly warming through the end of the month. The warming episode during March 18-23 was due to a series of weather fronts moving through the region, accompanied by moderate to strong southerly winds.



North Panel
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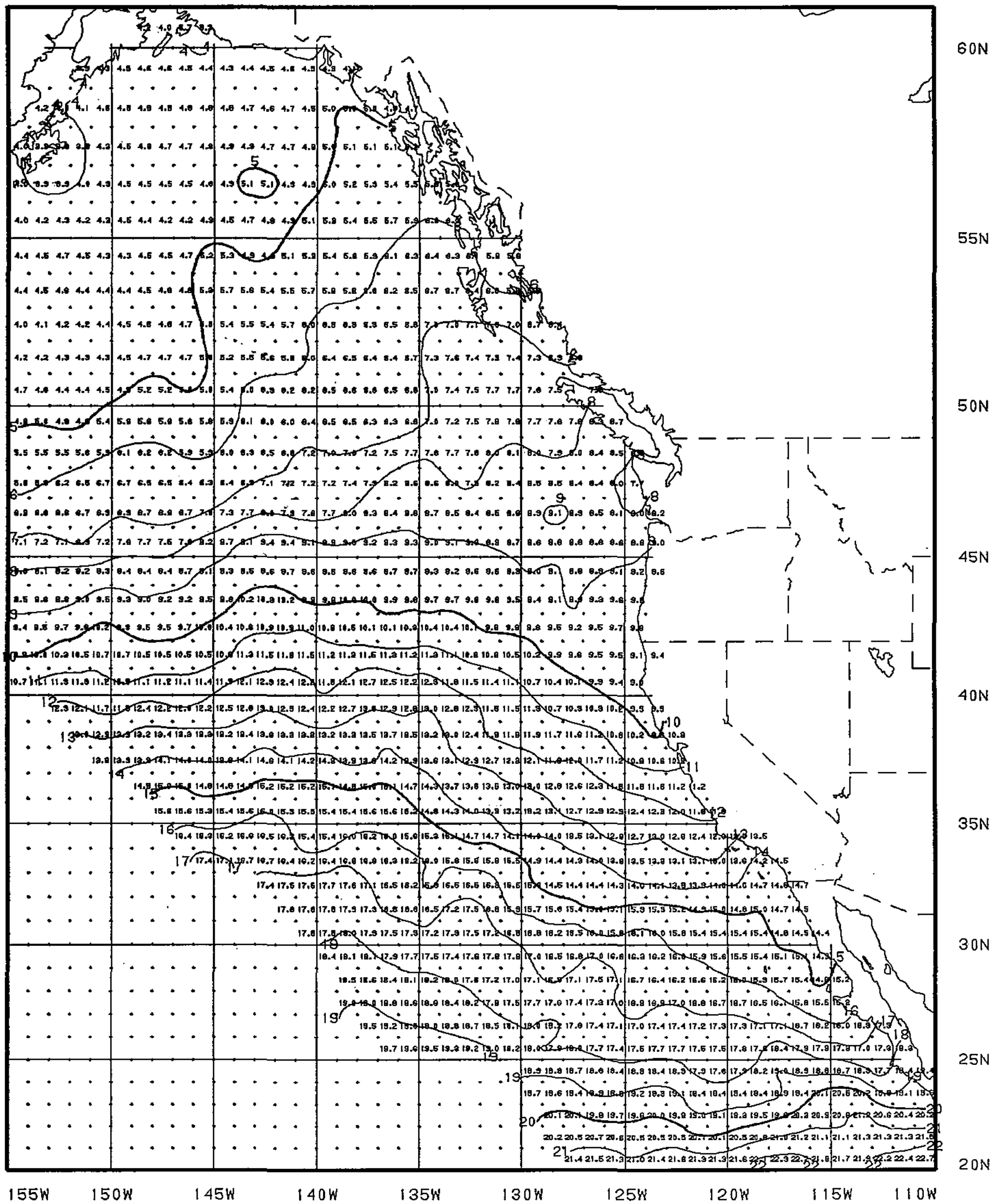
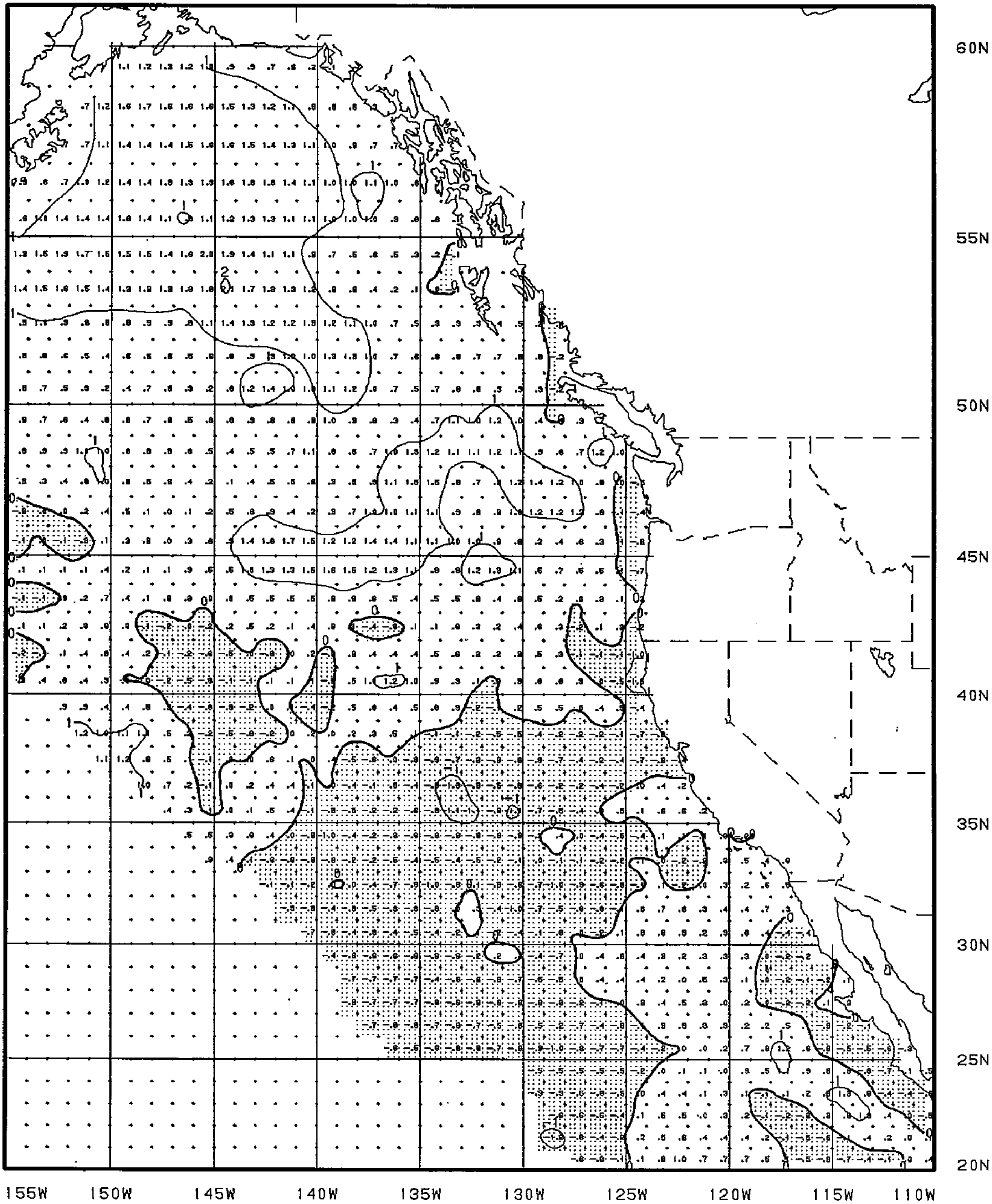
Nearly the entire South Panel region showed continued seasonal cooling with the exception of two locations which warmed by 0.1°C; one in the extreme northwest and the other in the extreme southeast portion of the chart. When compared to the previous month, the area of maximum cooling of 1.0°C was nearshore and north of the Golden Gate. March is when the overall mean temperature of the analysis area reaches its seasonal minimum of 13.9°C; the computed mean was 13.7°C or 0.2°C cooler than normal. SSTs alongshore and south of Monterey Bay were all slightly warmer (0.3°C) than climatology. The only other anomalously warm area was in the extreme northwest part of the South Panel with a 0.8°C calculated. More than 65 percent of the locations averaged cooler than climatology with a -1.1°C minimum near 30°N 130°W. Buoy statistics during the second half of March revealed that nearshore SSTs were cooler on March 31 than they were on March 15.



West Coast
SST--MONTHLY MEAN (°C)
March 1985

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 1985

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

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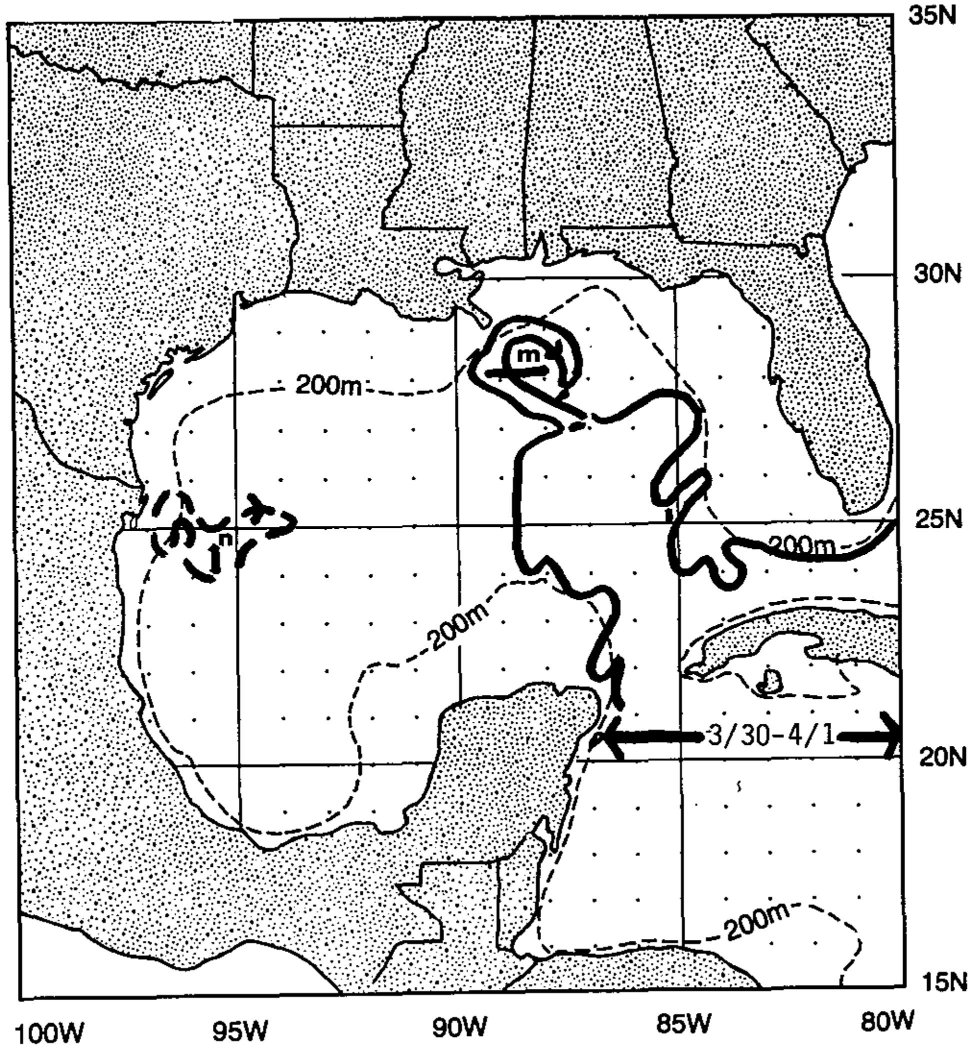
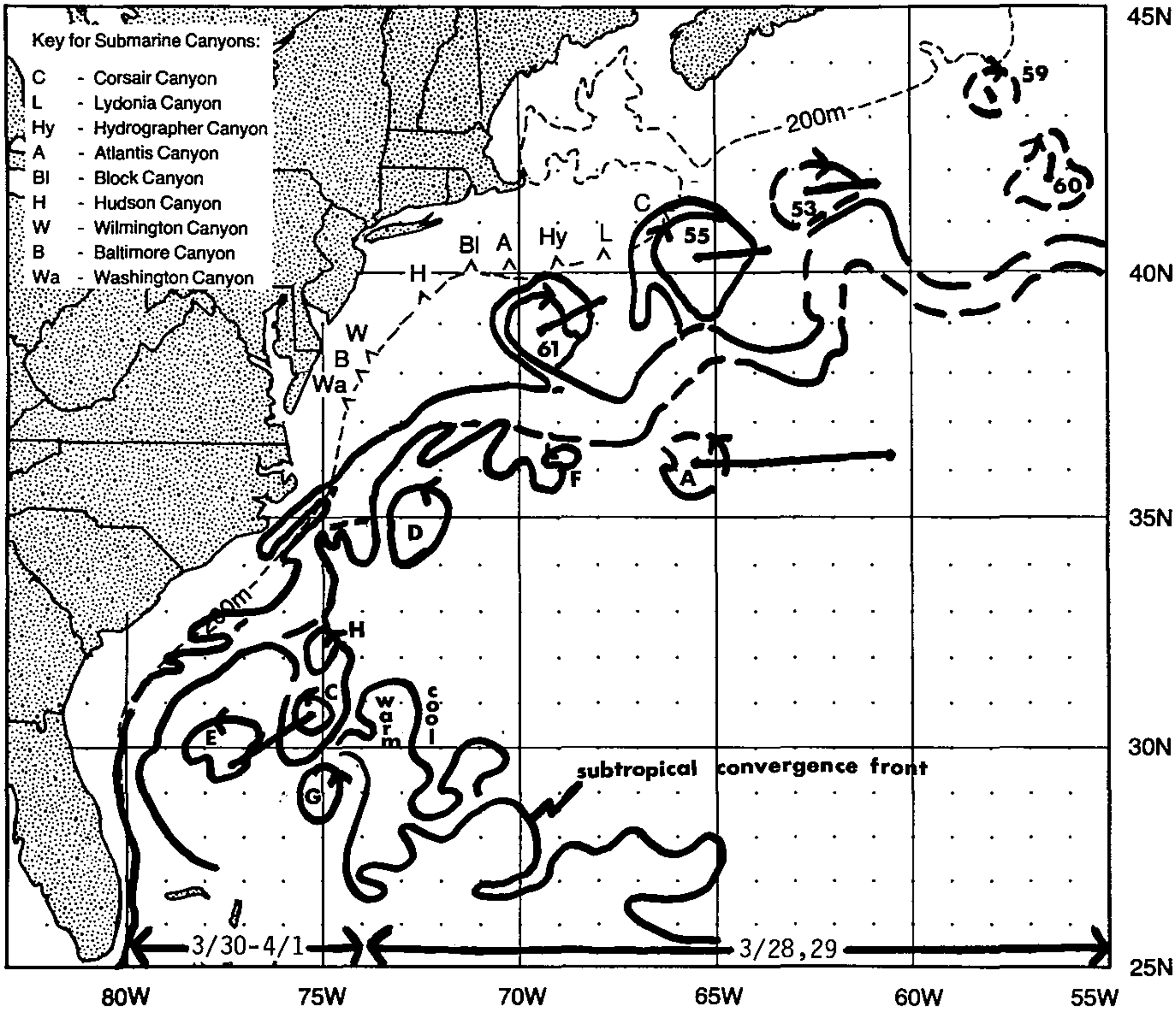


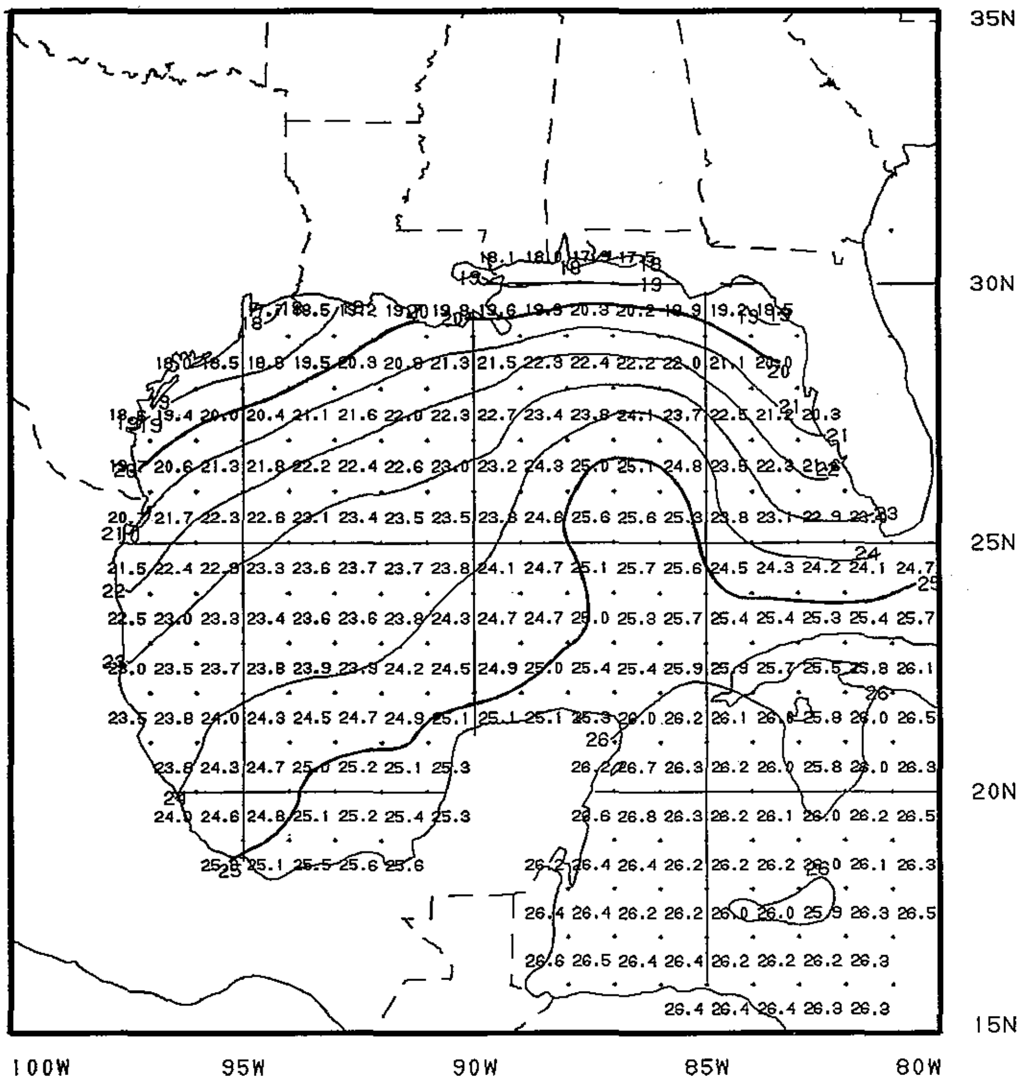
MARCH 1985

The warm eddylike feature detected near 24°N 95°30W on February 16 has been labeled eddy n. Eddy n traveled 55 km N when it was last observed on March 4. A long filament protrudes from the northwestern side of the Loop Current to anticyclonic eddy m. Eddy m translated 110 km E.



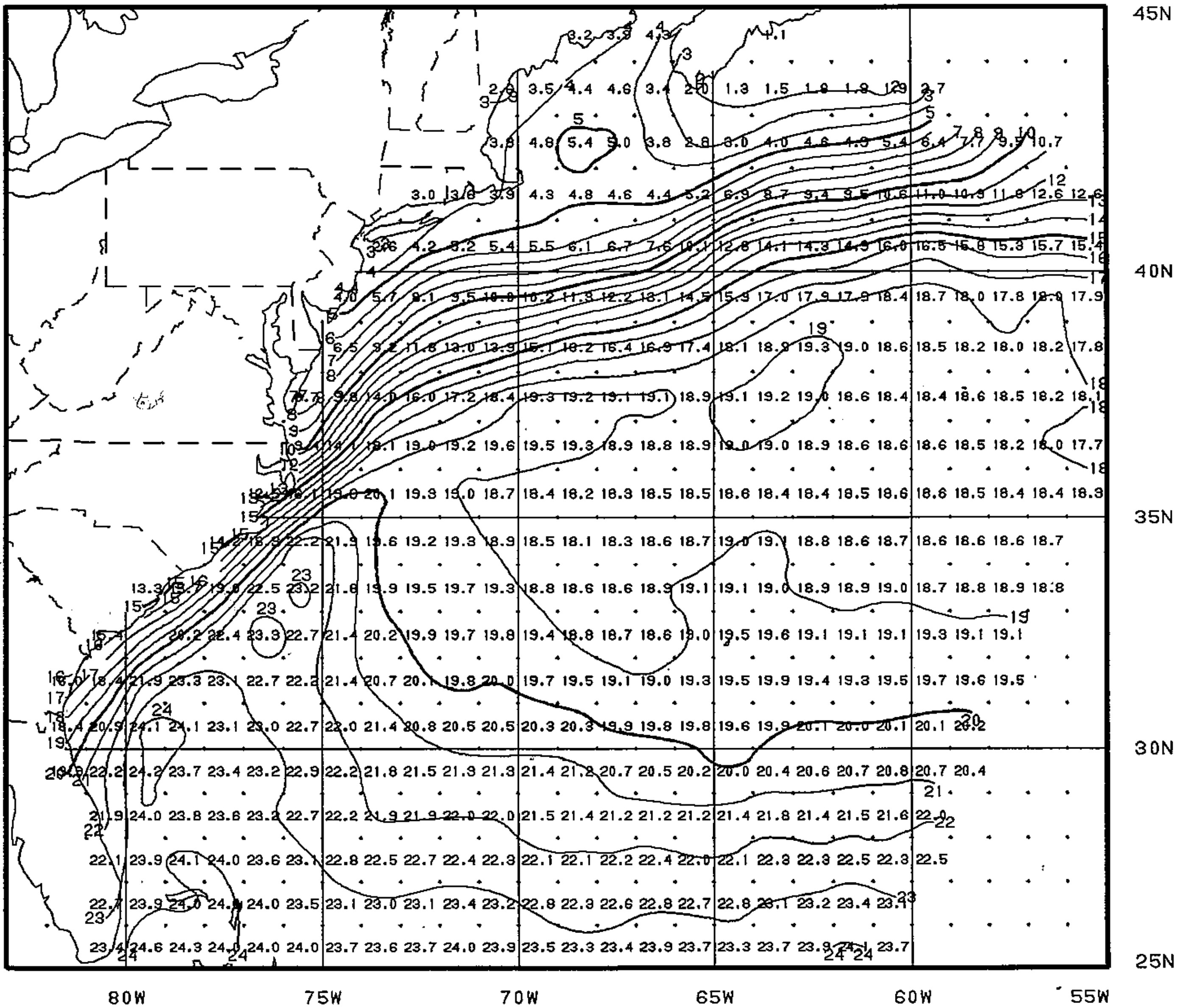
Anticyclonic eddy 61 moved 140 km SW. Eddy 55 traveled 150 km W. Eddy 53 traveled 140 km W. Eddy 59 translated 20 km NNW when it was last observed on March 1. Eddy 60, last detected on March 20, apparently moved 35 km S.

Partially due to cloudfree conditions during March, five cyclonic eddies were newly detected. All five eddies' origins are unknown. Eddy D was first observed near 34°30N 72°30W on March 3. Eddy E was first discerned near 29°N 78°30W on March 6. Eddy F was newly detected near 36°30N 68°30W on March 27. Eddy G was first observed near 29°30N 74°30W on March 24. Eddy H was newly detected near 32°30N 75°W on March 26. Eddy A was last observed near 36°30N 60°30W on January 20. Eddy A was not detected in February due to cloudiness. Since January 20, eddy A apparently translated 415 km W. Eddy C apparently traveled 220 km NE. The Subtropical Convergence Front was observed on March 29. A secondary front was detected along 30°N on March 27.



Gulf of Mexico
SST--MONTHLY MEAN (°C)
March 1985

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 1985

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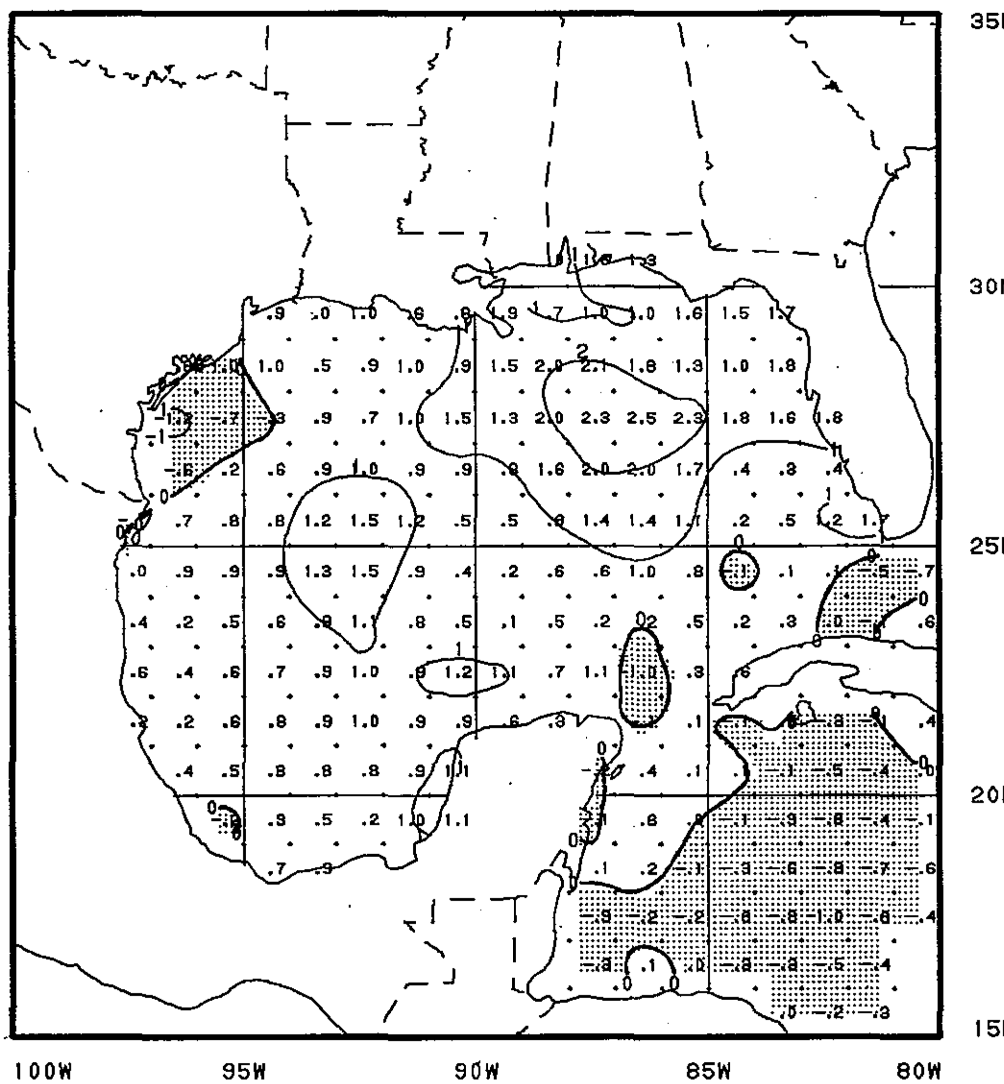
EAST COAST SST-ANOMALY



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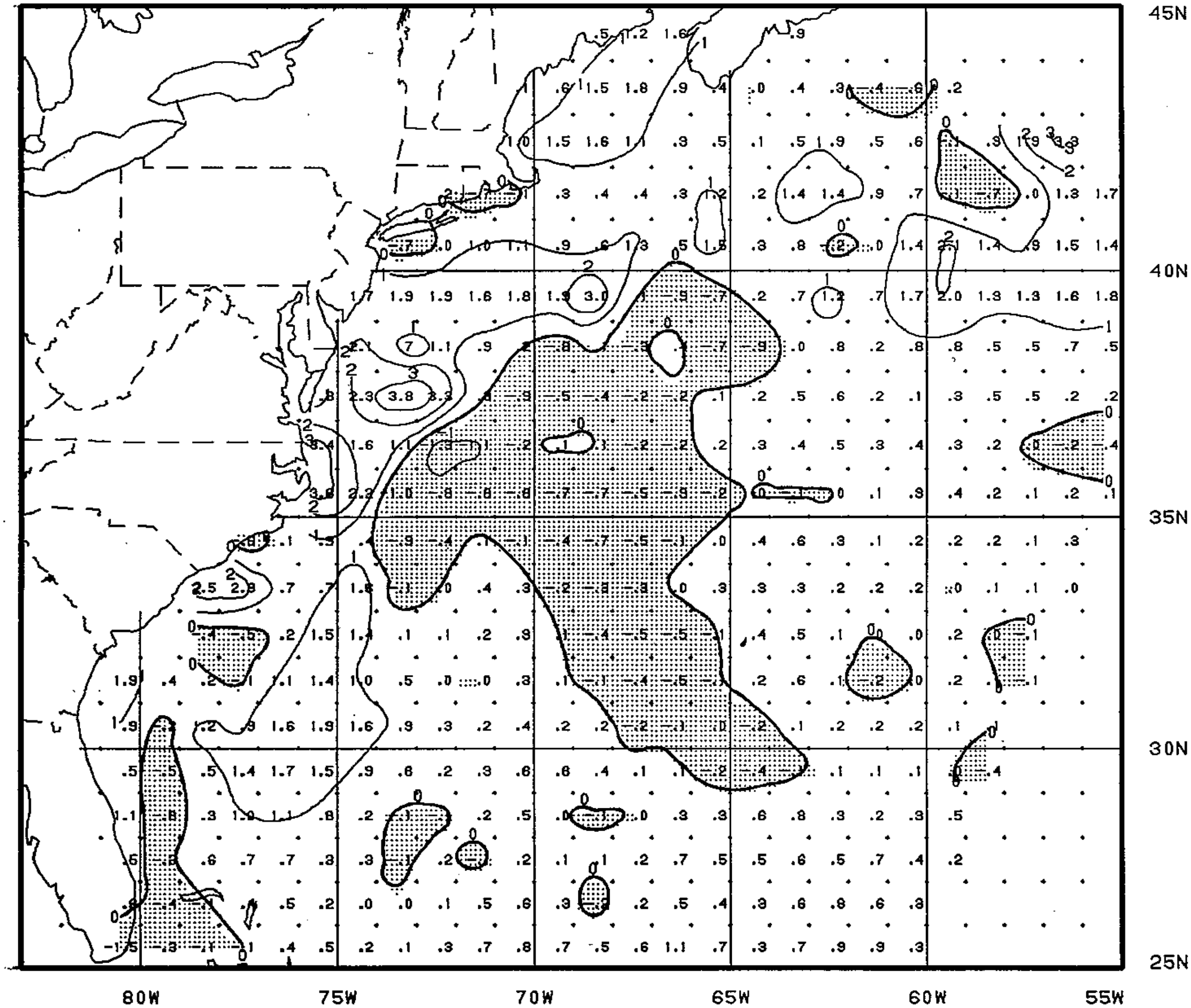

NW Atlantic Ocean
SST--MONTHLY ANOMALY (°C)
March 1985

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.