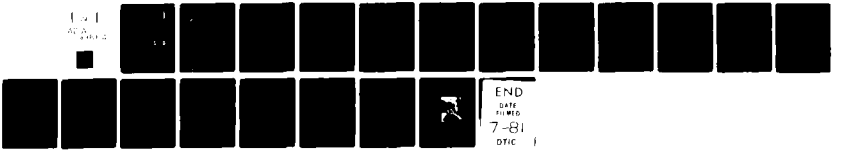
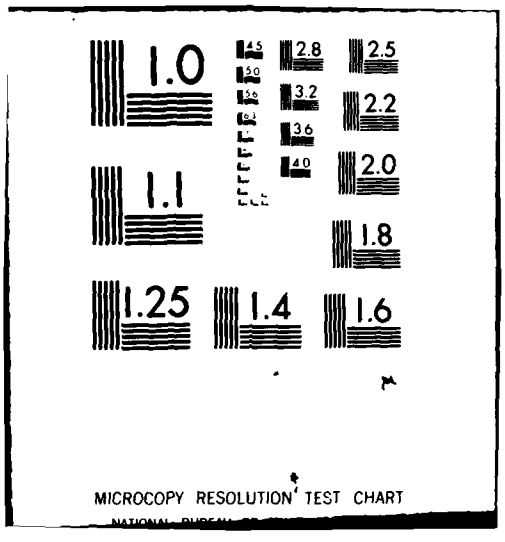
AD-A099 664 AIR FORCE ENVIRONMENTAL TECHNICAL APPLICATIONS CENTER--ETC F/G 4/2
A CLIMATOLOGY OF MONTHLY MEAN SEA SURFACE TEMPERATURES FOR THE --ETC(U)
JAN 78 A J BALTZ

UNCLASSIFIED USAFETAC-PR-78-001 SBIE-AD-E850 056 NL



END
DATE FILMED
7-81
DTIC

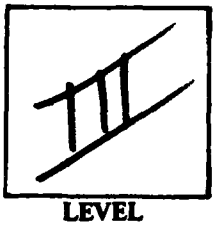

1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART

PHOTOGRAPH THIS SHEET

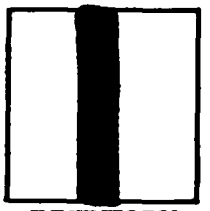
AD-E850 056

AD A099664

DTIC ACCESSION NUMBER



LEVEL



INVENTORY

Rept. No. USAFETAC-PR-78-001

DOCUMENT IDENTIFICATION

Jan. 78

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

DISTRIBUTION STATEMENT

ACCESSION FOR	
NTIS GRA&I	☒
DTIC TAB	☐
UNANNOUNCED	☐
JUSTIFICATION	
BY	
DISTRIBUTION /	
AVAILABILITY CODES	
DIST	AVAIL AND/OR SPECIAL
A	

DISTRIBUTION STAMP

DTIC
ELECTE
S JUN 3 1981 D
D

DATE ACCESSIONED

DATE RECEIVED IN DTIC

PHOTOGRAPH THIS SHEET AND RETURN TO DTIC-DDA-2

DTIC FORM OCT 79 70A

DOCUMENT PROCESSING SHEET

UNITED STATES AIR FORCE
AIR WEATHER SERVICE (MAC)

USAF ENVIRONMENTAL
TECHNICAL APPLICATIONS CENTER

SCOTT AIR FORCE BASE, ILLINOIS 62225

USAFETAC-PR-78-001

A Climatology of Monthly Mean Sea Surface Temperatures for the Gulf of Mexico

by

Anthony J. Baltz, SSgt, USAF

January 1978

Review and Approval Statement

This report is approved for public release. There is no objection to unlimited distribution of this report to the public at large, or by DDC to the National Technical Information Service (NTIS).

This technical report has been reviewed and is approved for publication.

Anthony J. Baltz
ANTHONY J. BALTZ
SSgt, USAF

Calvin C. Naegelin
CALVIN C. NAEGELIN
Capt, USAF
Reviewing Officer

FOR THE COMMANDER

Walter S. Burgmann
WALTER S. BURGMANN
Scientific & Technical Information
Officer (STINFO)

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) 04/02

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER USAFETAC-PR-78-001	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A CLIMATOLOGY OF MONTHLY MEAN SEA SURFACE TEMPERATURES FOR THE GULF OF MEXICO.		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Anthony J. Baltz, SSgt, USAF		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Air Force Environmental Technical Applications Center Scott AFB, IL 62225		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Project 150600
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Air Force Environmental Technical Applications Center Scott AFB, IL 62225		12. REPORT DATE January 1978 13. NUMBER OF PAGES 15
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

oceanography
* marine meteorology

surface temperature
ocean
mexico gulf
* gulf of mexico

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Climatology
Sea Surface Temperature
Gulf of Mexico
Oceanograpghy
Marine Meteorology
Sea Surface Temperature Anomalies
Loop Current

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents monthly mean sea surface temperatures for the Gulf of Mexico in one degree quadrangles. It also includes a short discussion of the temperature data and the ocean currents in the Gulf of Mexico.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Preface

USAFETAC prepared this report on monthly mean sea-surface temperatures in response to a request from Detachment 9, 12 Weather Squadron, at Tyndall AFB, FL. Detachment 9 is interested in determining the feasibility of forecasting the occurrence of fog and stratus conditions less than 1000 feet and/or three miles, based on monthly mean sea surface temperatures in the Gulf of Mexico. Data were requested in the form of mean monthly values for not greater than one degree quadrangles. A survey of available data revealed that completed reports contained only isothermal analyses with no values plotted for individual quadrangles. The data from the National Climatic Center at Asheville, N.C. were used for this report because they are based on the largest number of observations. These data are also readily usable because the mean values have already been computer calculated and plotted on worksheets.

This report answers a specific request and is not expected to have application beyond that request. Further questions on this problem or related problems should be referred to USAFETAC for consultation and study.

If the requester or any other agency incorporates this report, in whole or in part, into another report, we request that USAFETAC be given proper credit and be furnished a copy of the new report if possible.

A Climatology of Monthly Mean Sea Surface Temperature for the Gulf of Mexico

Introduction

This report presents charts of monthly mean sea-surface temperatures in unanalyzed form for the Gulf of Mexico. The National Climatic Center at Asheville, North Carolina, provided the data in the form of computer produced worksheets which had been used in preparing the U.S. Navy Marine Climatic Atlas of the World, Volume One, North Atlantic Ocean (Dec 1974). Each chart (Figures 1-12) is a Mercator projection covering the area 18°N-31°N and 79°W-98°W. The plotted values represent the mean sea-surface temperature in degrees Celsius and an observation count indicator for the one degree quadrangles in which the temperatures are plotted.

Discussion

This climatology is based on observations taken from commercial and military ships during a period from 1854 to 1973. Each monthly chart represents approximately 85,000 observations. The observation count, which ranges from none in some areas to over 3,000 per one degree quadrangle in heavily traveled shipping lanes, is categorized as follows:

Number of Observations	Category
0-9	A
10-99	B
100-999	C
1000-1999	D
2000-2999	E
$\geq$3000	F

The mean temperatures for category A were deleted because less than 10 observations were not considered enough to compute a meaningful average.

According to Rivas (1968) and Saur (1963) the accuracy of the data is controlled by two factors. First, diurnal variations can be as great as 1.2°C for any given location. Second, the accuracy of temperature observations made by commercial and military ships vary in quality.

Sea water temperatures are most commonly read from thermometers located in the sea water intakes in ships' engine rooms. These temperatures are generally known as "injection temperatures." The size, length, and location of the intake pipe and the location of the thermometer in the pipe differ from ship to ship. In some cases, the intake pipes may be located behind overboard discharge pipes; also the ship's load will affect the intake pipe depth. The thermometer may be mounted near the hull or some distance inboard. Incrustation and poor exposure of the thermometer well, combined with coarsely calibrated (sometimes 5°F increments) and incorrectly calibrated thermometers, add to the inaccuracy of observations. Even reporting procedures can cause errors when there is a time lag between recording temperatures on the engine room logs and reporting them on the weather observation.

Other methods of obtaining sea-surface temperatures include bathythermograph observations and bucket observations. The bathythermograph is a recording thermometer for determining both surface and subsurface water temperatures. Bucket observations are made with a thermometer mounted in an insulated container that is dipped into the water. While these temperatures are more precise than injection temperatures, Stevenson (1964) demonstrates that both water and air temperatures are modified in the immediate vicinity of a vessel either anchored or in motion. Rivas (1968) suggests that observational anomalies tend to offset each other when there is a large number of observations taken over a long period of record. However, a U.S. Department of Commerce report (1973) does indicate that daily surface water temperatures may deviate substantially from the means. Some causes of these deviations are hurricane and winter frontal passages, river runoff and ocean currents.

The Loop Current is the primary current in the Gulf of Mexico. Leipper (1970) shows that this current generally follows an annual cycle but it experiences much year to year variability (Figure 13). Its suggested seasonal pattern begins in spring with

a small loop in the southeastern Gulf. The current enters through the Yucatan Strait and curves around Cuba, exiting through the Florida Straits. It penetrates northward in spring, with the rapid northward growth known as the spring intrusion. In summer the current spreads westward with two possible patterns occurring. In one case the entire Loop Current moves westward to the 90°W meridian. In the second case a portion of the loop breaks off from its feeder current and shifts westward. The spreading continues into fall. The loop's intensity weakens such that in winter the primary current is again found in the southeastern Gulf.

Upwelling produces another seasonal effect on Gulf sea-surface temperatures. The only place that significant upwelling occurs is along the northern coast of the Yucatan Peninsula. Upwelling is primarily a summertime phenomena detectable from May through October.

Maul (1976) best describes the entire problem of temperature fluctuations and current variability by suggesting " . . . the entire ocean is dominated by change with a broad spectrum of temporal and spatial scales. Indeed the mean picture of the oceans - the atlas image - may be largely a figment of our mathematics; one should not expect to encounter mean conditions at any given time."

BIBLIOGRAPHY and REFERENCES

Arnold, J. E., et al.: "Statistical Evaluations of Sea Surface Temperature Distributions Based on Nimbus Satellite HRIR Data," Texas A and M Research Foundation, Contract E - 162-69(N), 1971, 111 p.

Ichiye, T., et al.: "Assessment of Currents and Hydrography of the Eastern Gulf of Mexico," Texas A and M University, Dept. of Oceanography, 1973, 391 p.

Leipper, D. F.: "A Sequence of Current Patterns in the Gulf of Mexico," Journal of Geophysical Research, Oceans and Atmospheres, Vol. 75, No. 3, Jan 20, 1970, pp 637-658.

Maul, G. A.: "Variability in the Gulfstream System," Gulfstream, Vol. 2, No. 10, Oct 1976, 7 p.

Molinari, R. L.: "Synoptic and Mean Monthly 20°C Topographies in the Eastern Gulf of Mexico," NOAA Technical Memorandum ERL AOML-27, Atlantic Oceanographic and Meteorological Laboratories, Jun 1977, 33 p.

Rivas, L. R.: "Fishermen's Atlas of Monthly Sea Surface Temperatures for the Gulf of Mexico," U. S. Dept of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, 1968, 33 p.

Robinson, M. K.: "Atlas of Monthly Sea Surface and Subsurface Temperature and Depth of the Top of the Thermocline Gulf of Mexico and Caribbean Sea," Scripps Institution of Oceanography, University of California, San Diego, 1973, 12 p and 93 Figures.

Saur, J. F. : "A Study of the Quality of Sea Water Temperatures Reported in Logs of Ships' Weather Observations," Journal of Applied Meteorology, Vol. 2, No. 3, Jun 1963, pp 417-425.

Stevenson, R. E.: "The Influence of a Ship on the Surrounding Air and Water Temperatures," Journal of Applied Meteorology, Vol. 3, No. 1, Feb 1964, pp 115-118.

U.S. Dept. of Commerce: "Environmental Conditions Within Specified Geographical Regions Offshore East and West Coasts of the United States and in the Gulf of Mexico," NOAA National Data Buoy Center, 1973, 735 p.

U.S. Naval Oceanographic Office: "Oceanographic Atlas of the North Atlantic Ocean," Pub. No. 700 Series, Section 2, Physical Properties, U. S. Naval Oceanographic Office, Washington, D. C., 1967, 300 p.

U.S. Navy: "Marine Climatic Atlas of the World, Vol. 1, North Atlantic Ocean," U.S. Government Printing Office, Washington, D. C., Nov 1955, 275 p.

U.S. Navy: "Marine Climatic Atlas of the World, Vol. 1, North Atlantic Ocean," U.S. Government Printing Office, Washington, D. C., Dec 1974, 371 p.

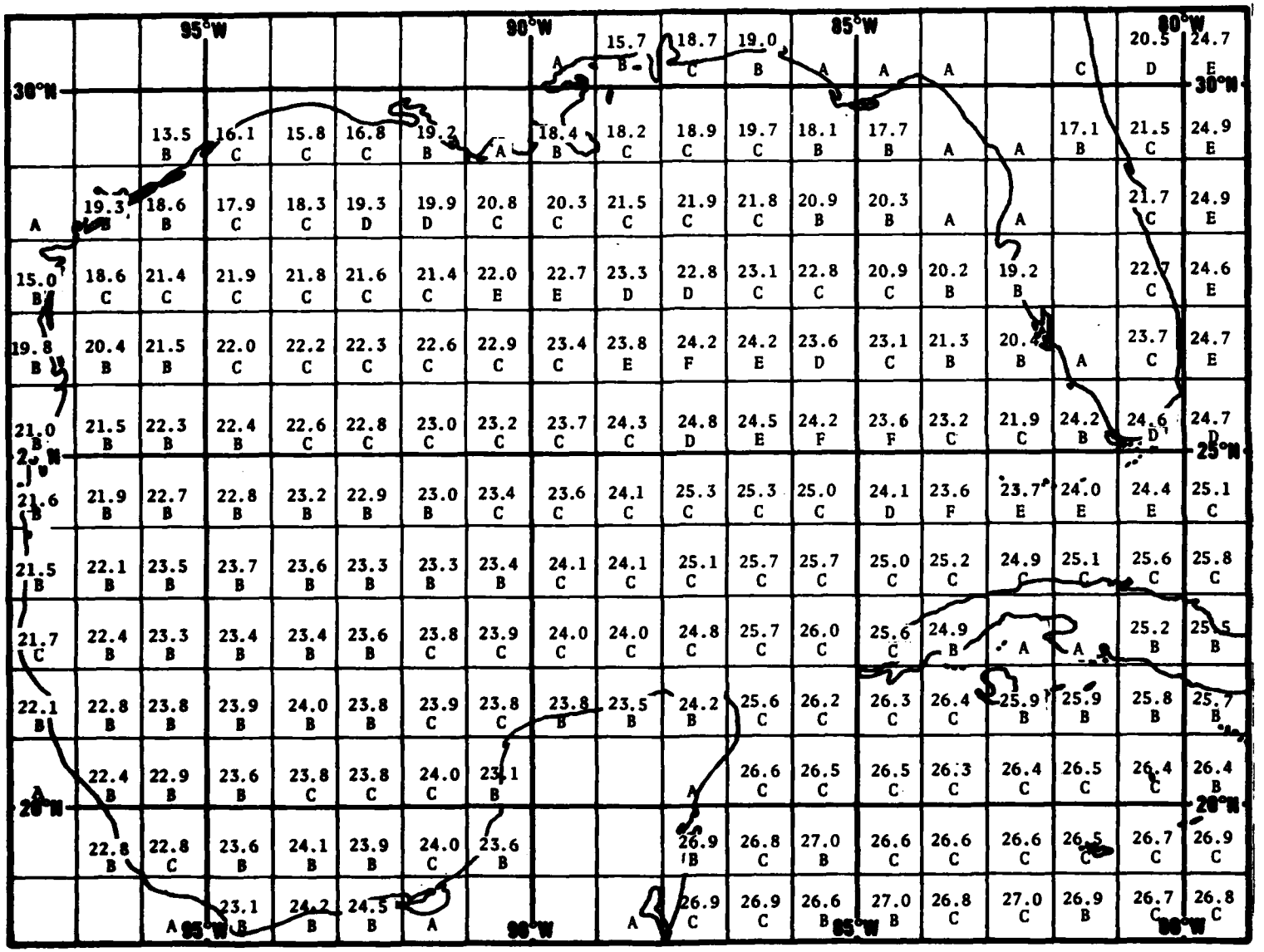


Figure 1. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for January.

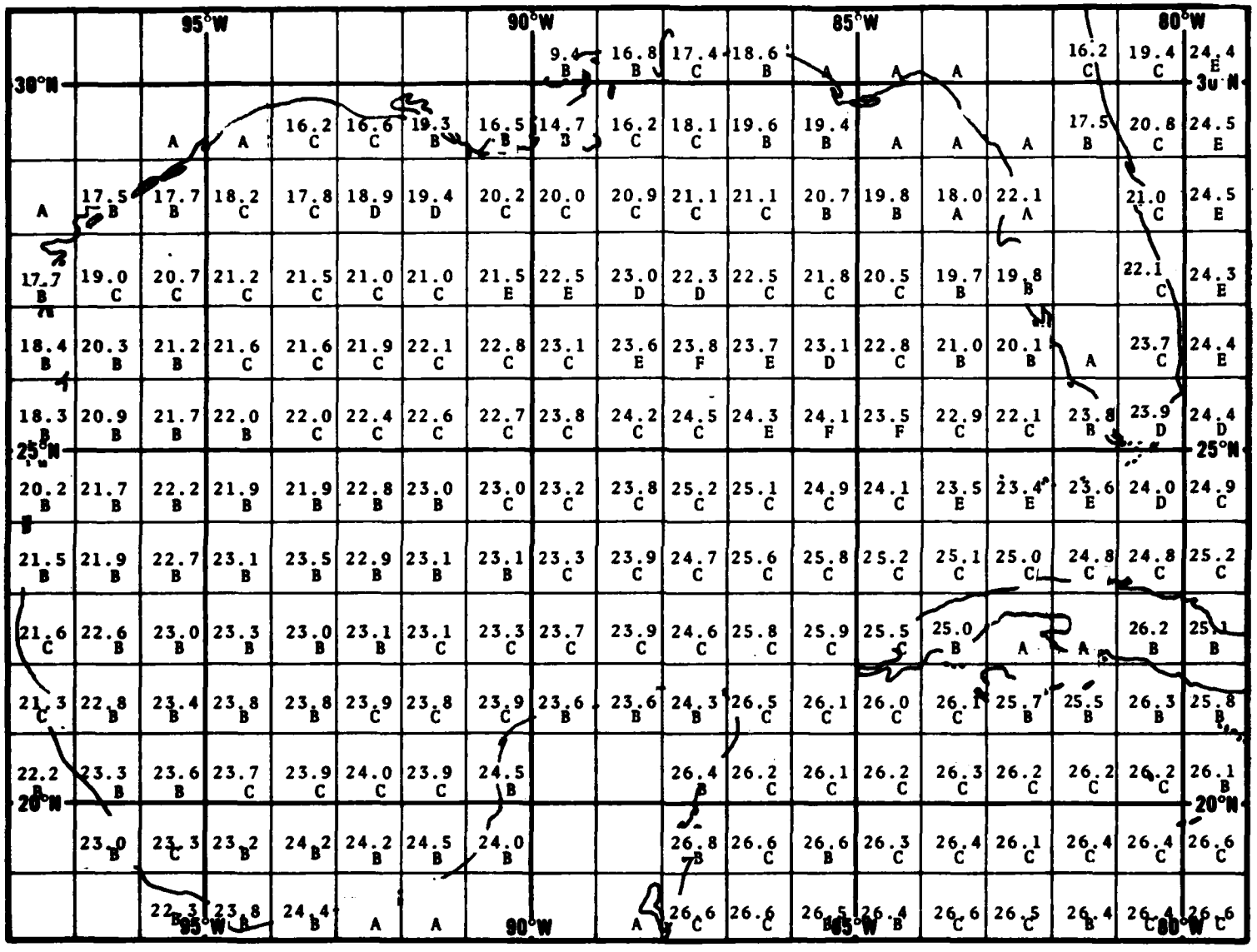


Figure 2. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for February.

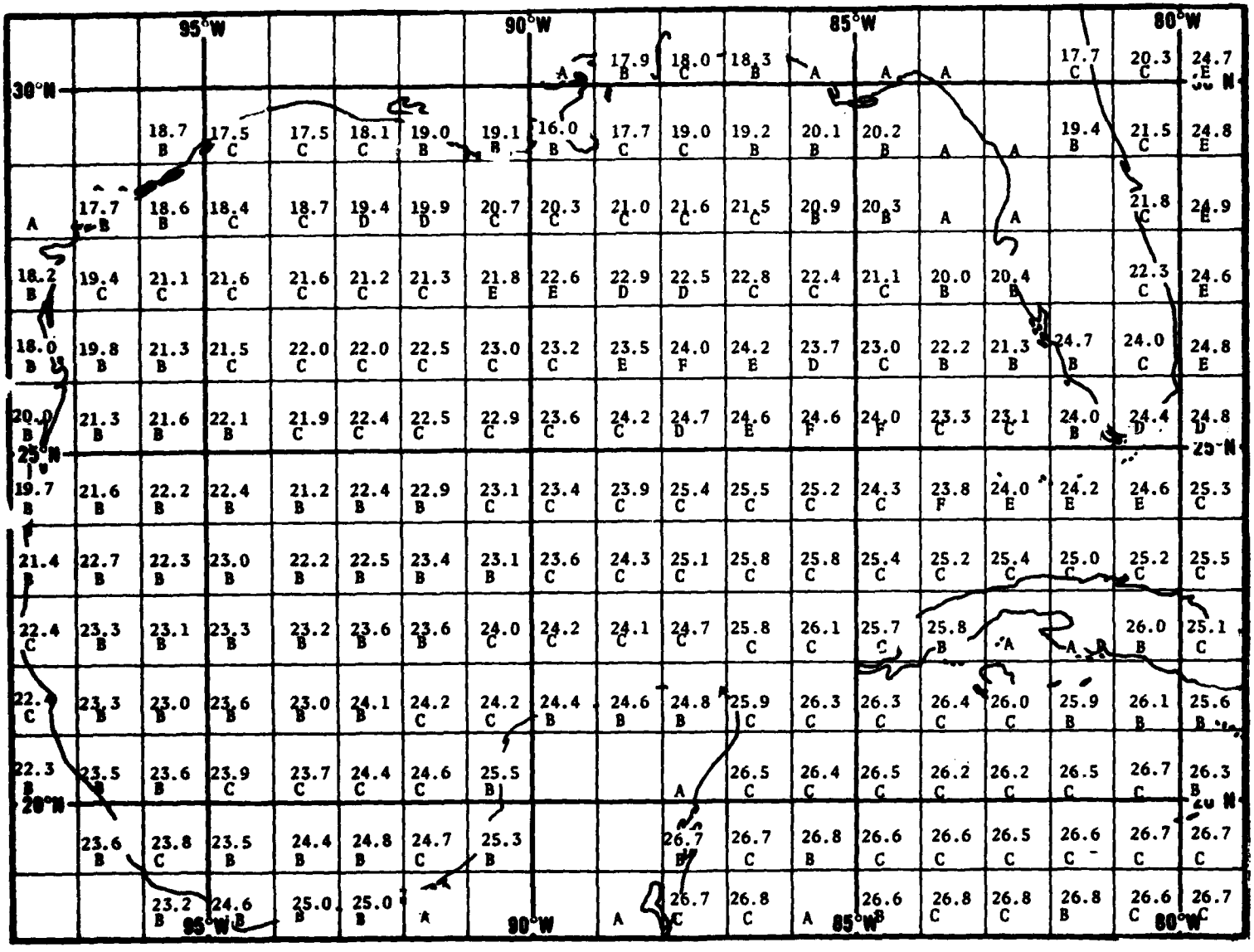


Figure 3. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for March.

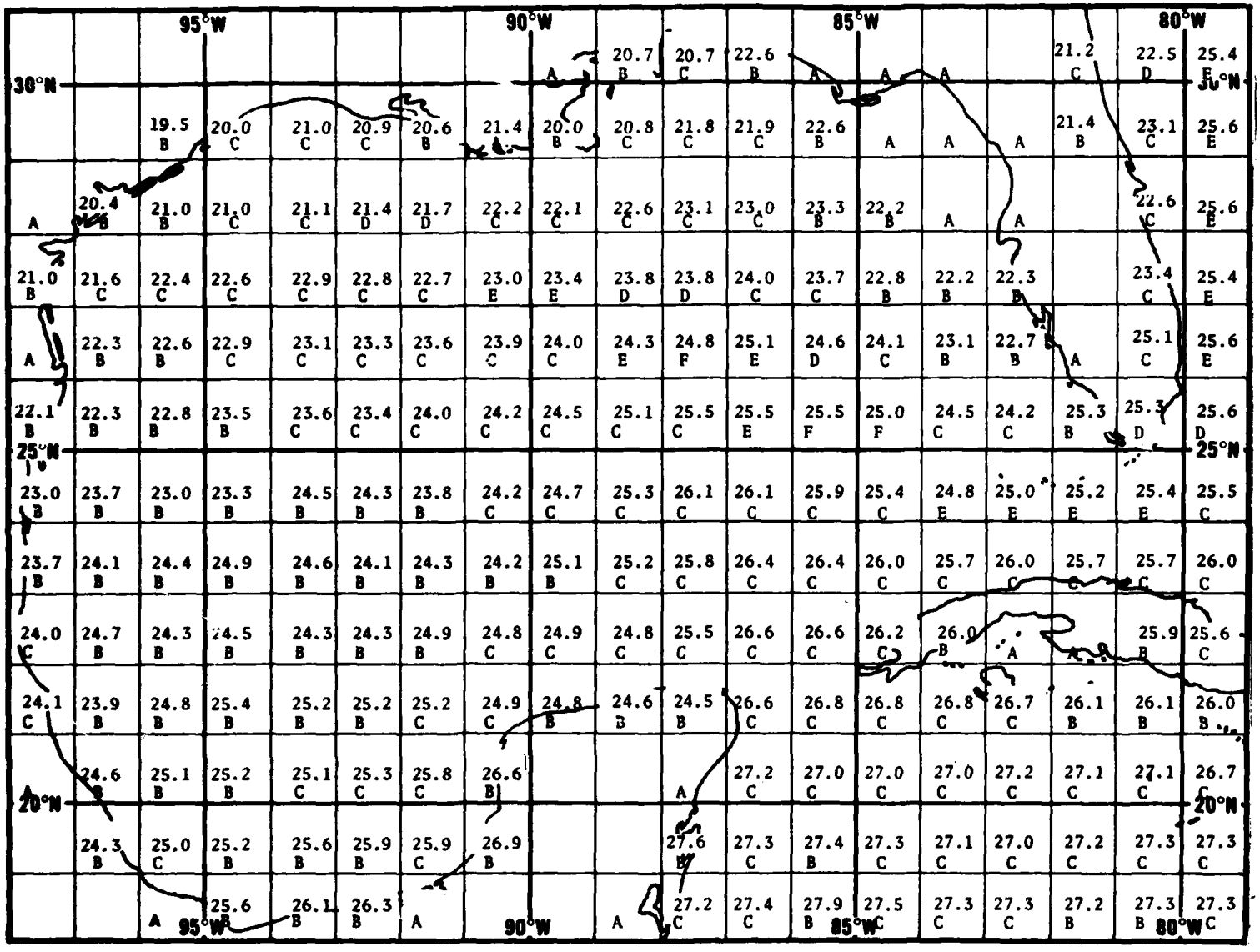


Figure 4. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for April.

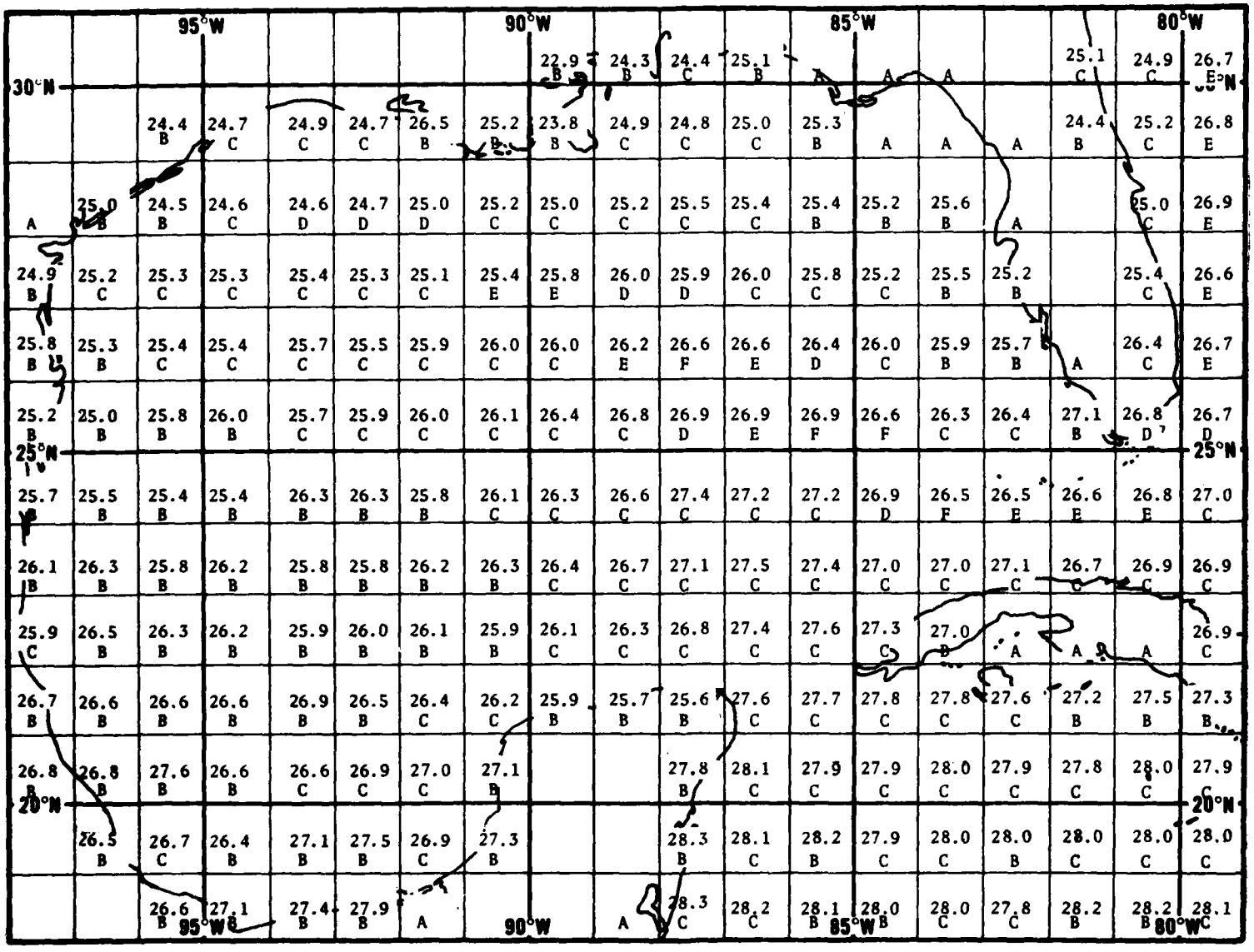


Figure 5. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for May.

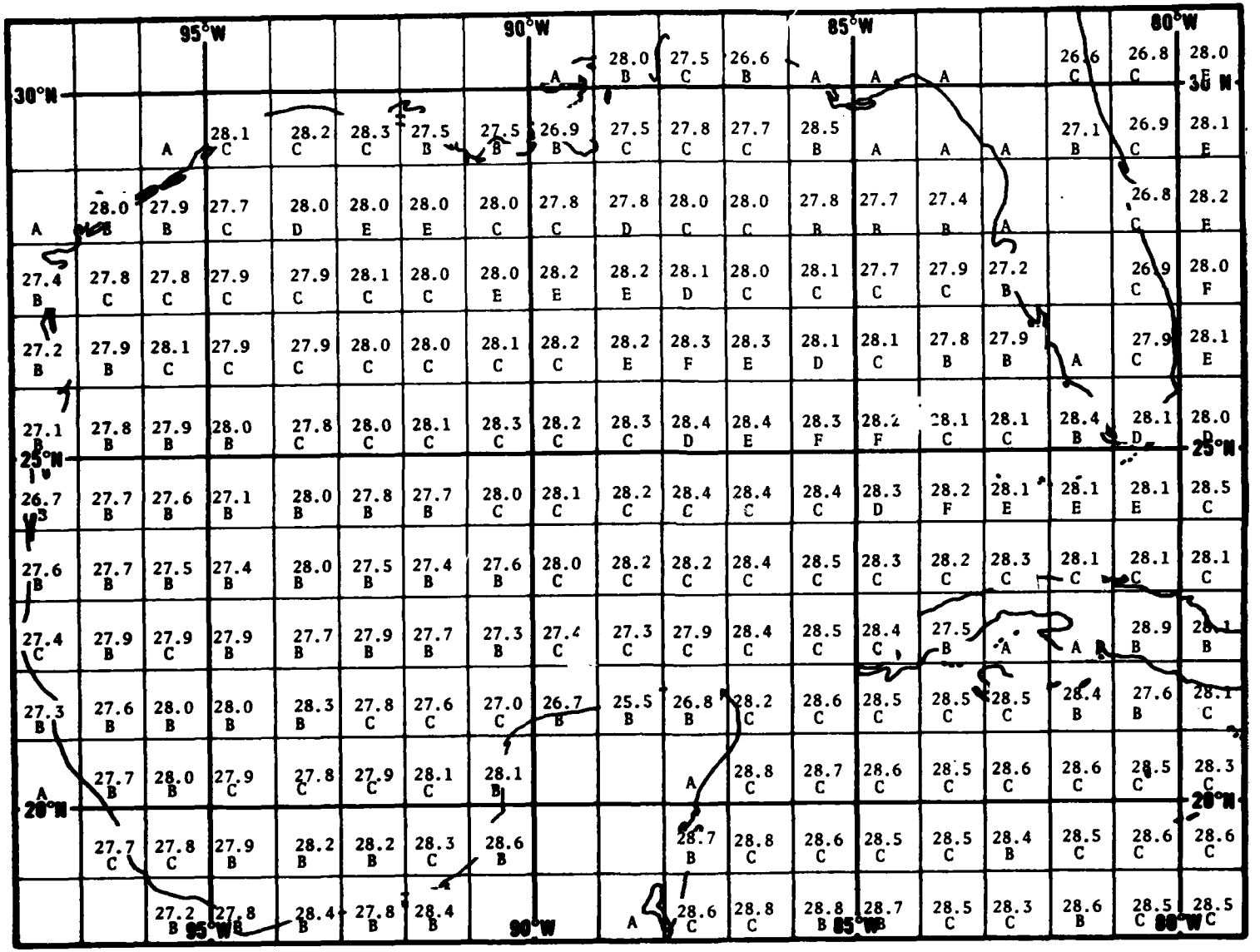


Figure 6. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for June.

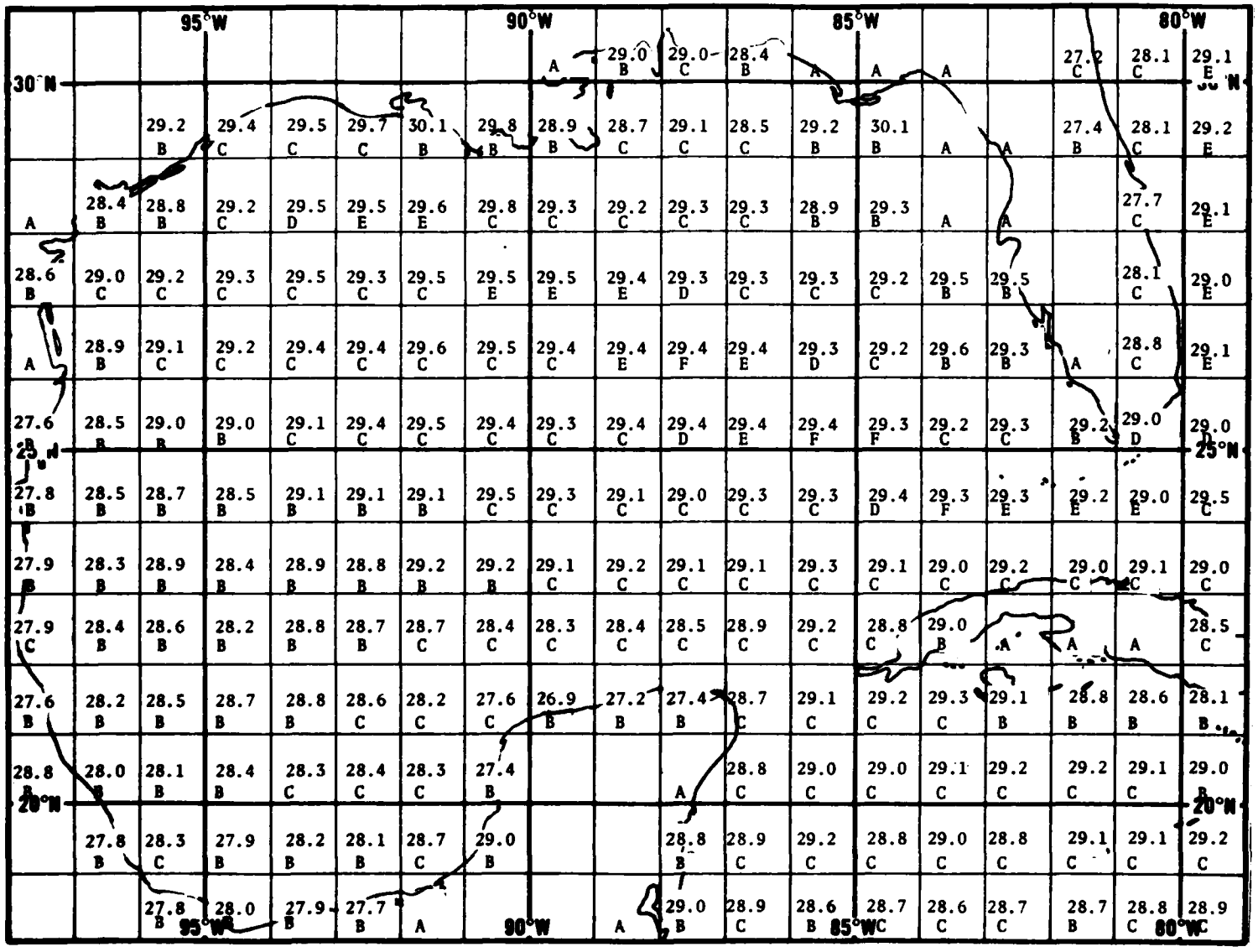


Figure 7. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for July.

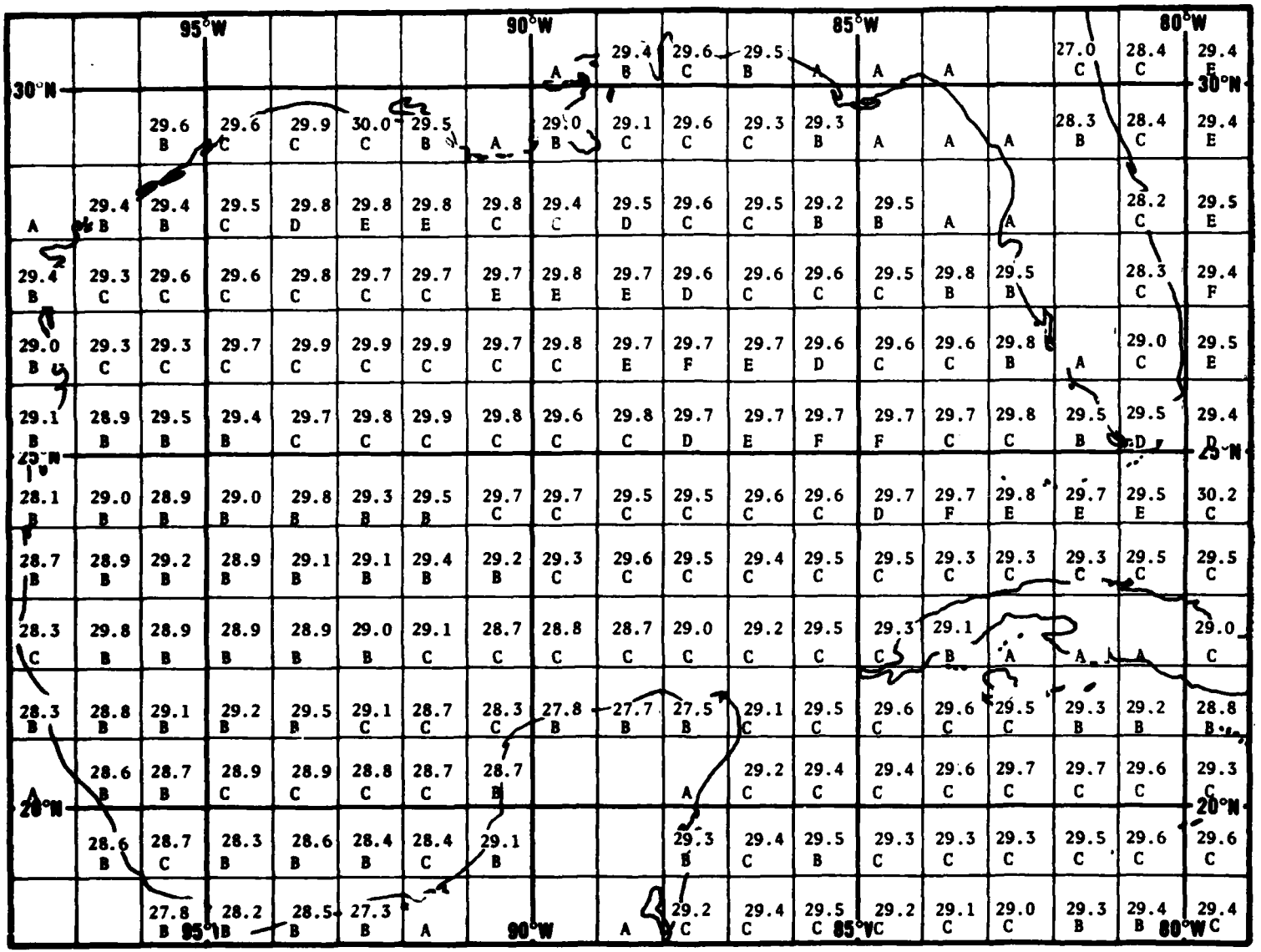


Figure 8. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for August.

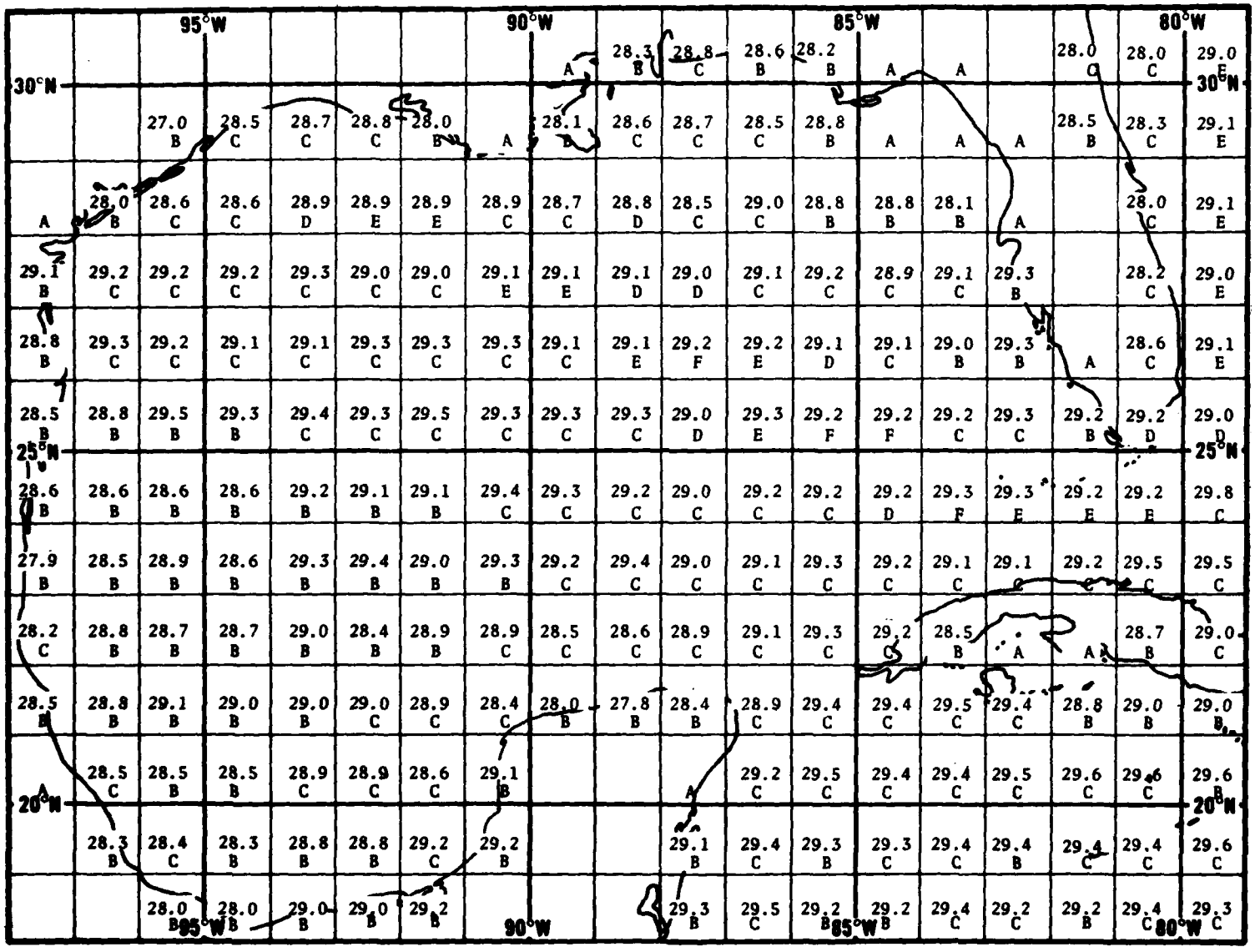


Figure 9. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for September.

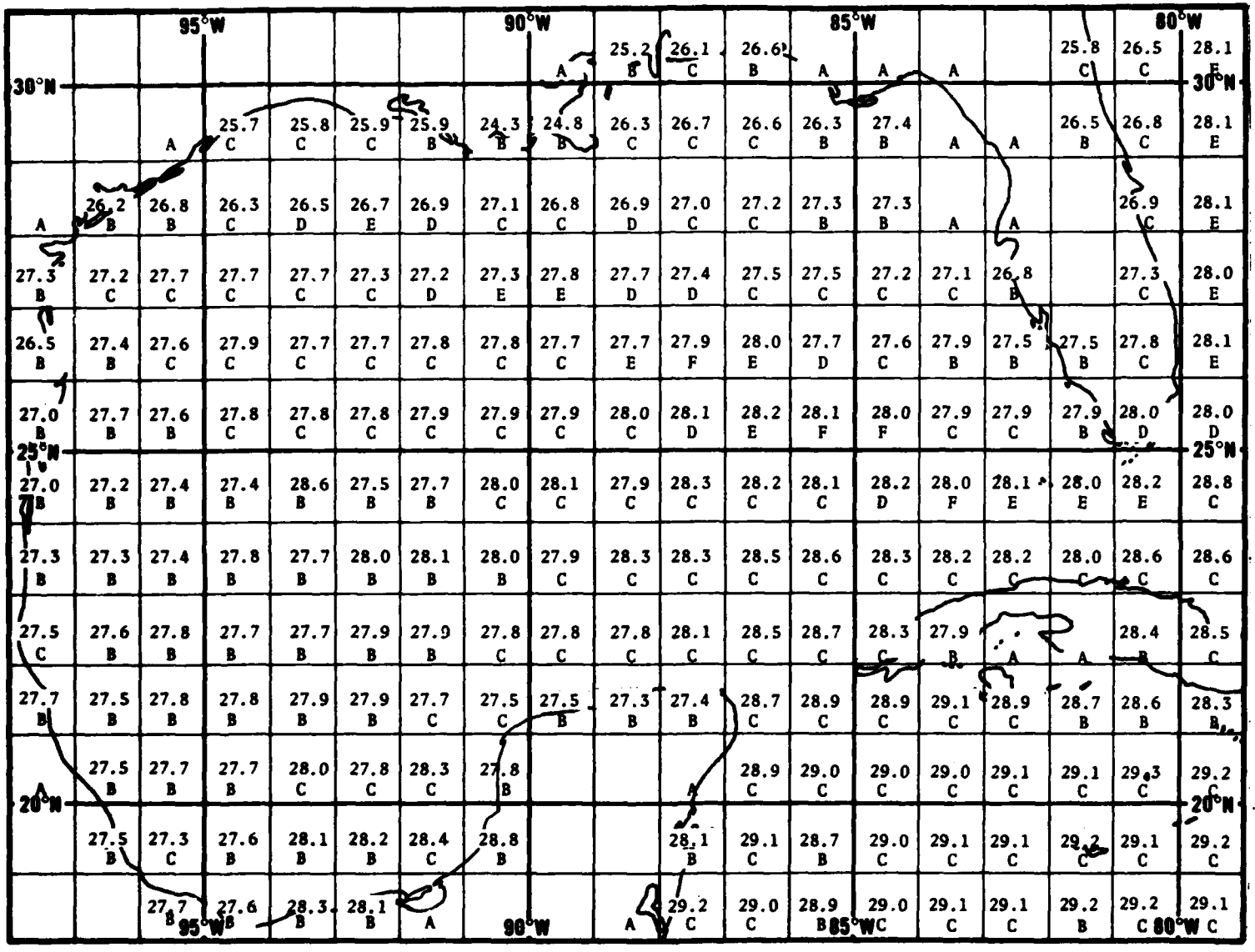


Figure 10. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for October.

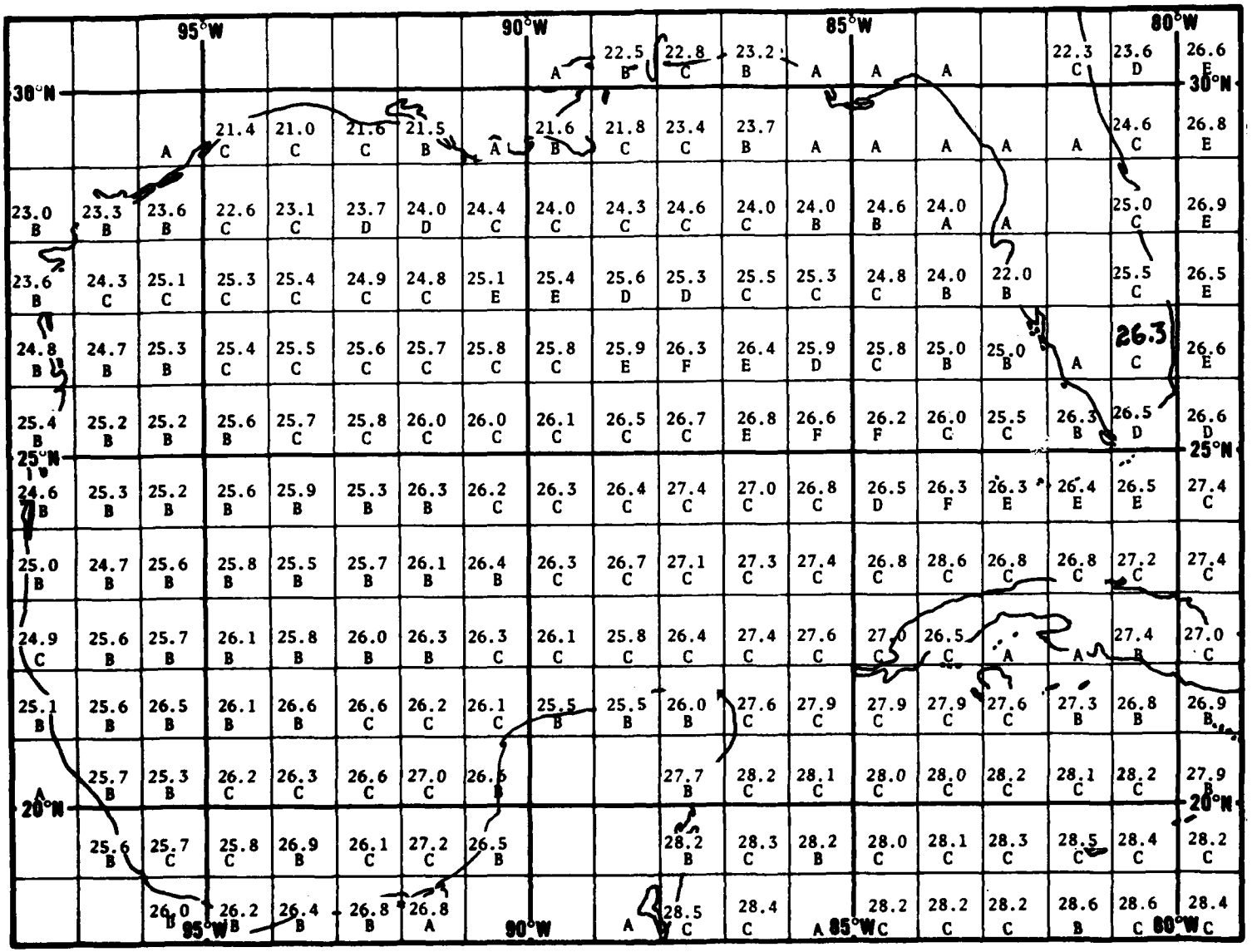


Figure 11. Average Sea Surface Temperatures (Numerical Value) and Observation Count (Letter) for November.

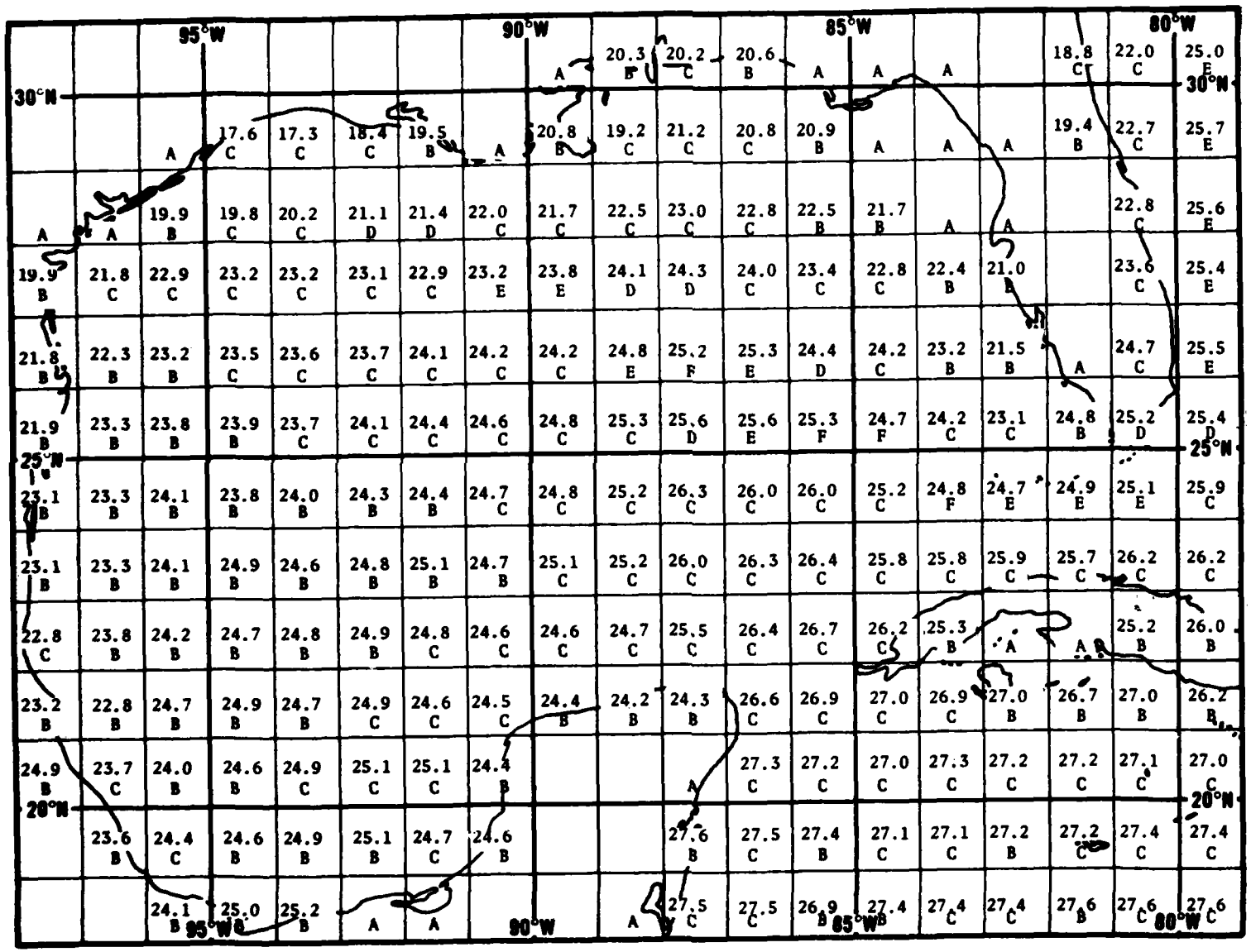


Figure 12. Average Sea Surface Temperatures (Numeri— Value) and Observation Count (Letter) for December.

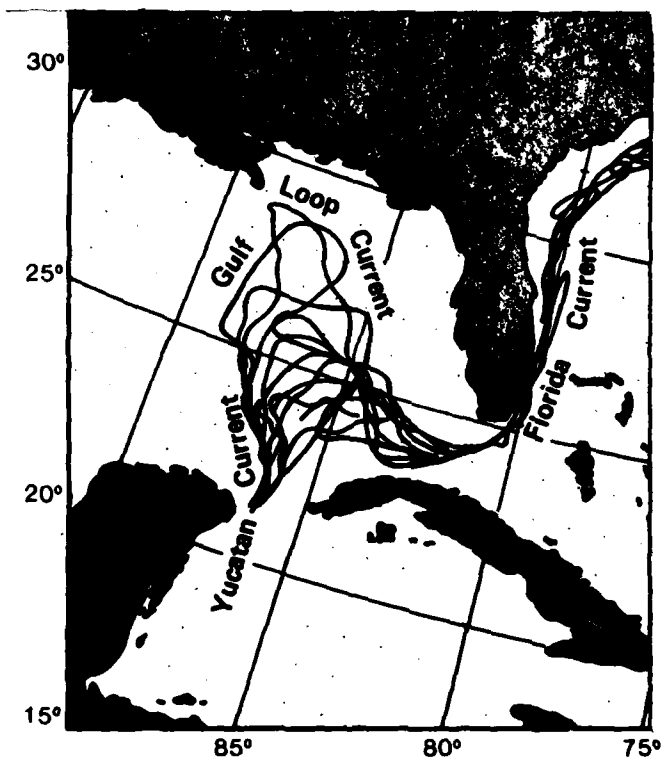


Figure 13. Gulf Loop Current Positions During a Typical Annual Cycle. The Loop Current Intrudes Furthest North Into the Gulf During the Spring of the Year.