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EASTERN—WESTERN ARCTIC SEA ICE ANALYSES 1989

PREPARED BY
NAVAL POLAR OCEANOGRAPHY CENTER
SUITLAND, MD

A-1

91-01433

PREPARED UNDER AUTHORITY OF
COMMANDER, NAVAL OCEANOGRAPHY COMMAND
STENNIS SPACE CENTER, MS 39529-5000

FOREWORD

The U.S. Navy has a long and eventful history of polar exploration from Robert E. Peary in the Arctic to Richard E. Byrd in the Antarctic. In recent years the strategic importance and expanded research pursuits in these areas have resulted in greater national and international requirements for environmental information. Since 1976, the National Oceanic and Atmospheric Administration (NOAA) and the Navy have worked together at the Joint Ice Center (JIC) in Suitland, Maryland. By combining the Navy's experience in observing and recording sea ice data, and NOAA's expertise in satellite data collection and interpretation, the JIC has been able to keep pace with that demand in both polar regions.

This publication is the 16th edition of the Arctic sea ice atlases prepared by the JIC. The atlas contains weekly charts depicting Northern Hemisphere and Great Lakes ice conditions and extent. The significant use of high resolution satellite imagery, combined with valuable ice reconnaissance data from various sources, has greatly improved the accuracy of these analyses.

The purpose of this atlas is to provide the user with reliable weekly hemispheric ice analyses. Both Navy and NOAA personnel with considerable experience in sea ice analysis prepare the analyses. The following procedures have been developed to ensure the quality of the final products:

a. Conventional shore station, ship and aerial ice reconnaissance observations are plotted and evaluated.

b. Satellite data from different sensors is compared and analyzed for ice information content. Table I, located on the inside back cover, summarizes satellite data availability for 1989.

c. A final product results from a. and b. However, where insufficient data is available, an estimated boundary will be depicted. Meteorological data and computer generated ice drift vectors are utilized to determine the estimated ice edge position.

NAVY / NOAA Joint Ice Center
Naval Polar Oceanography Center
4301 Suitland Road
Washington, DC 20395-5180

1989 Annual Ice Analysis Atlas Jan-Dec 1989

Eastern-Western Arctic Sea Ice Analysis 1989

Joint Ice Center, Naval Polar Oceanography Center
FOB No. 4, 4301 Suitland Rd
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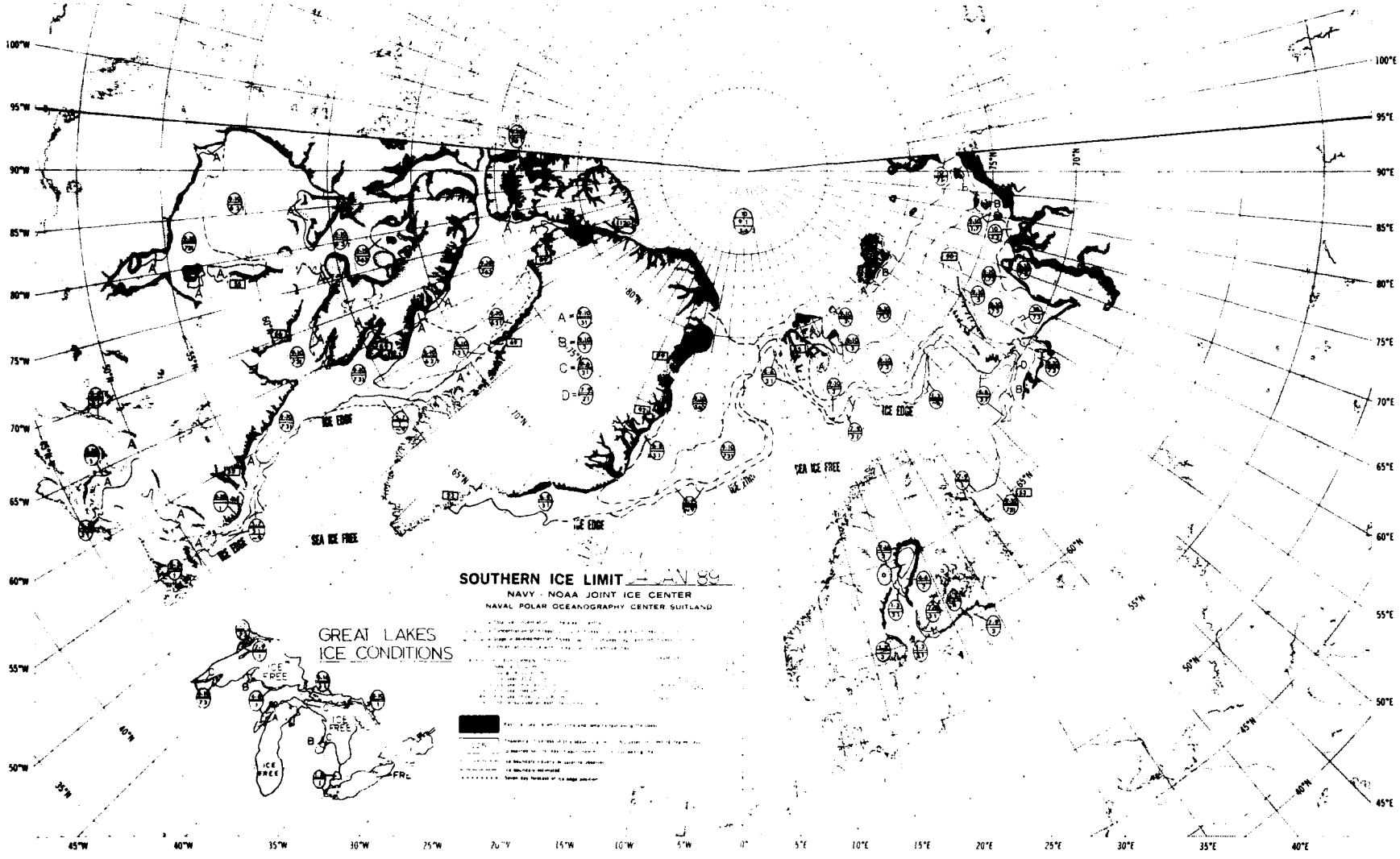
Compilation of the weekly sea ice analyses produced by the Navy/NOAA Joint Ice Center. The Eastern-Western Sea Ice Analysis is produced every year by June or July.

Unclassified Unclassified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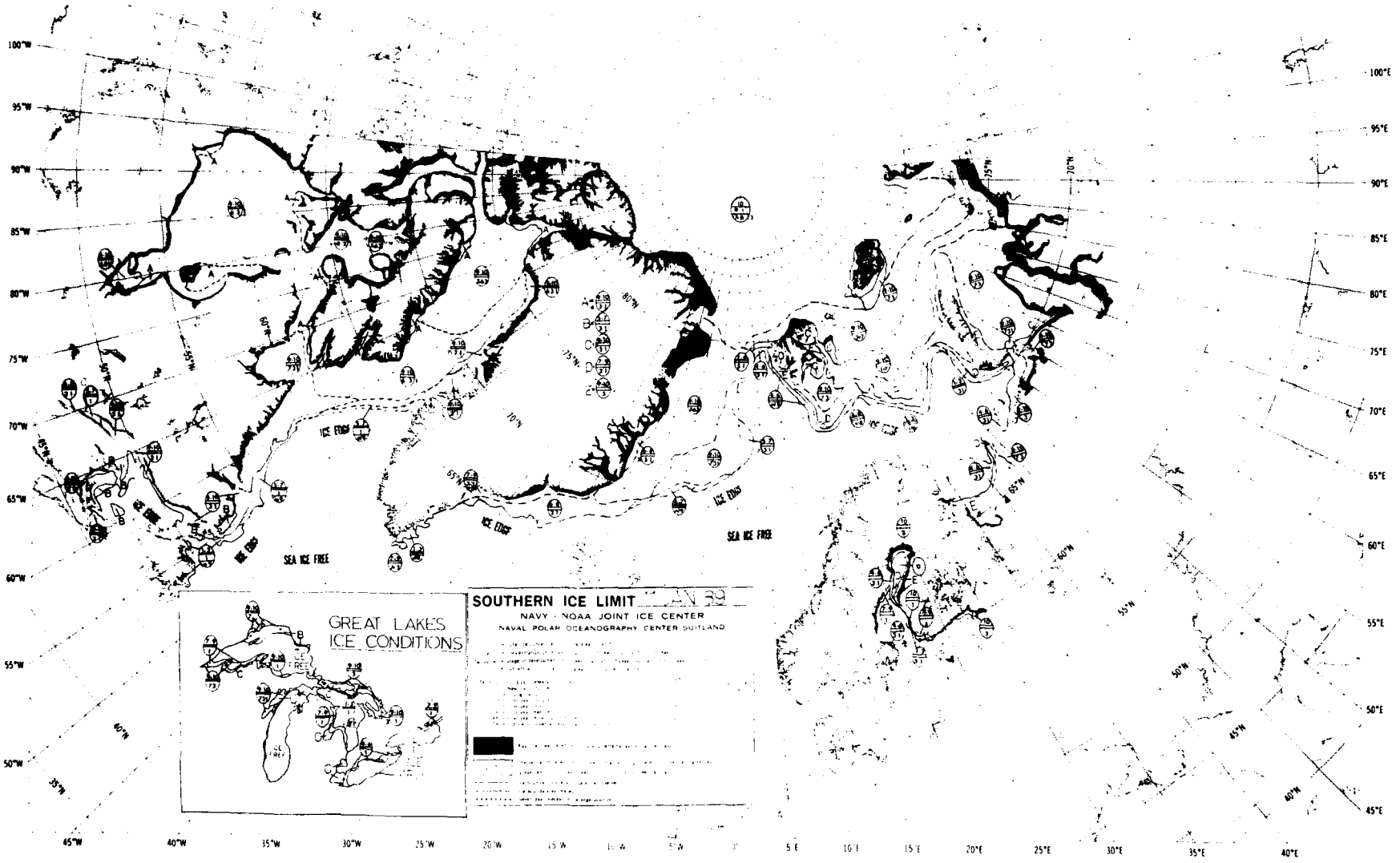
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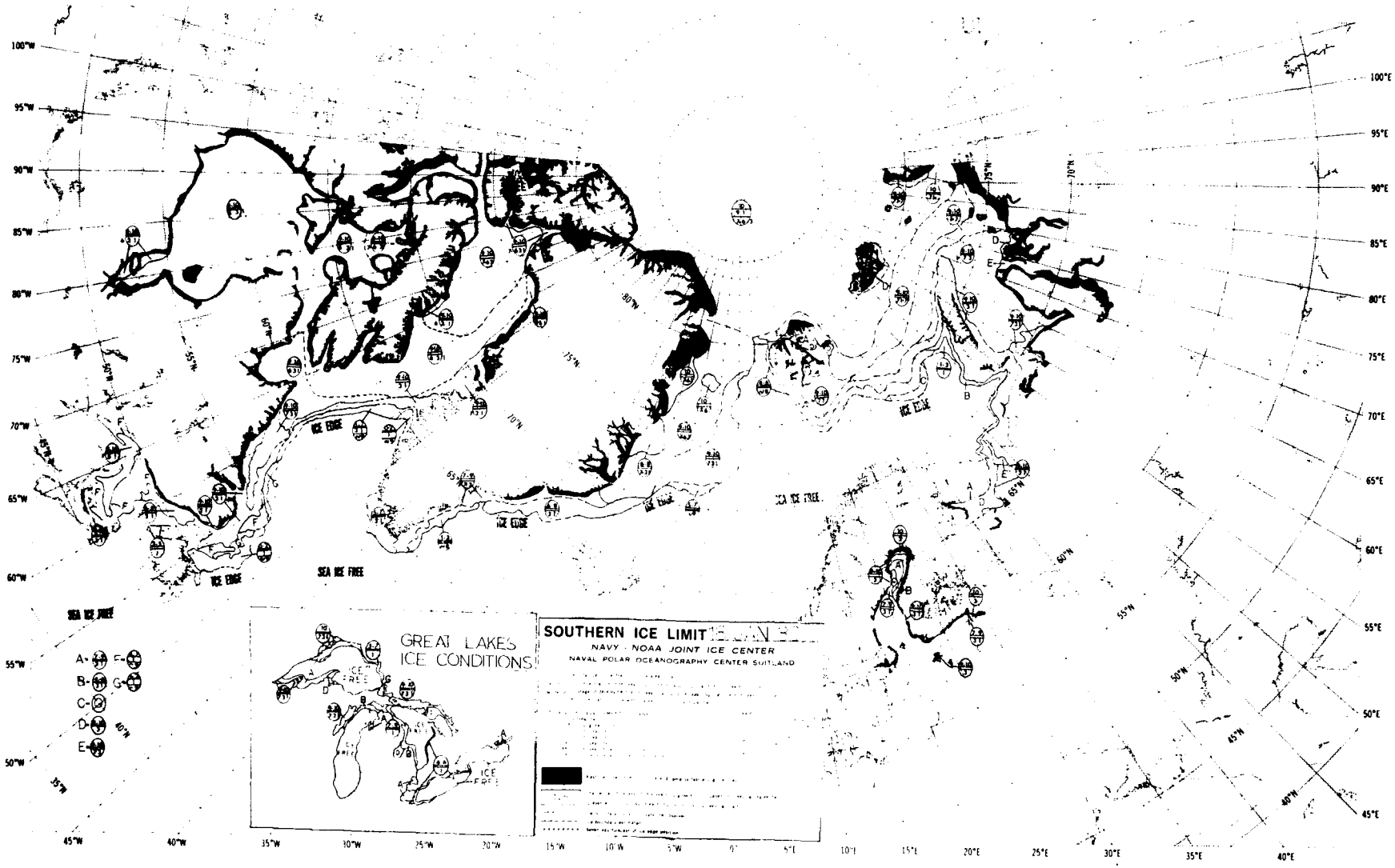
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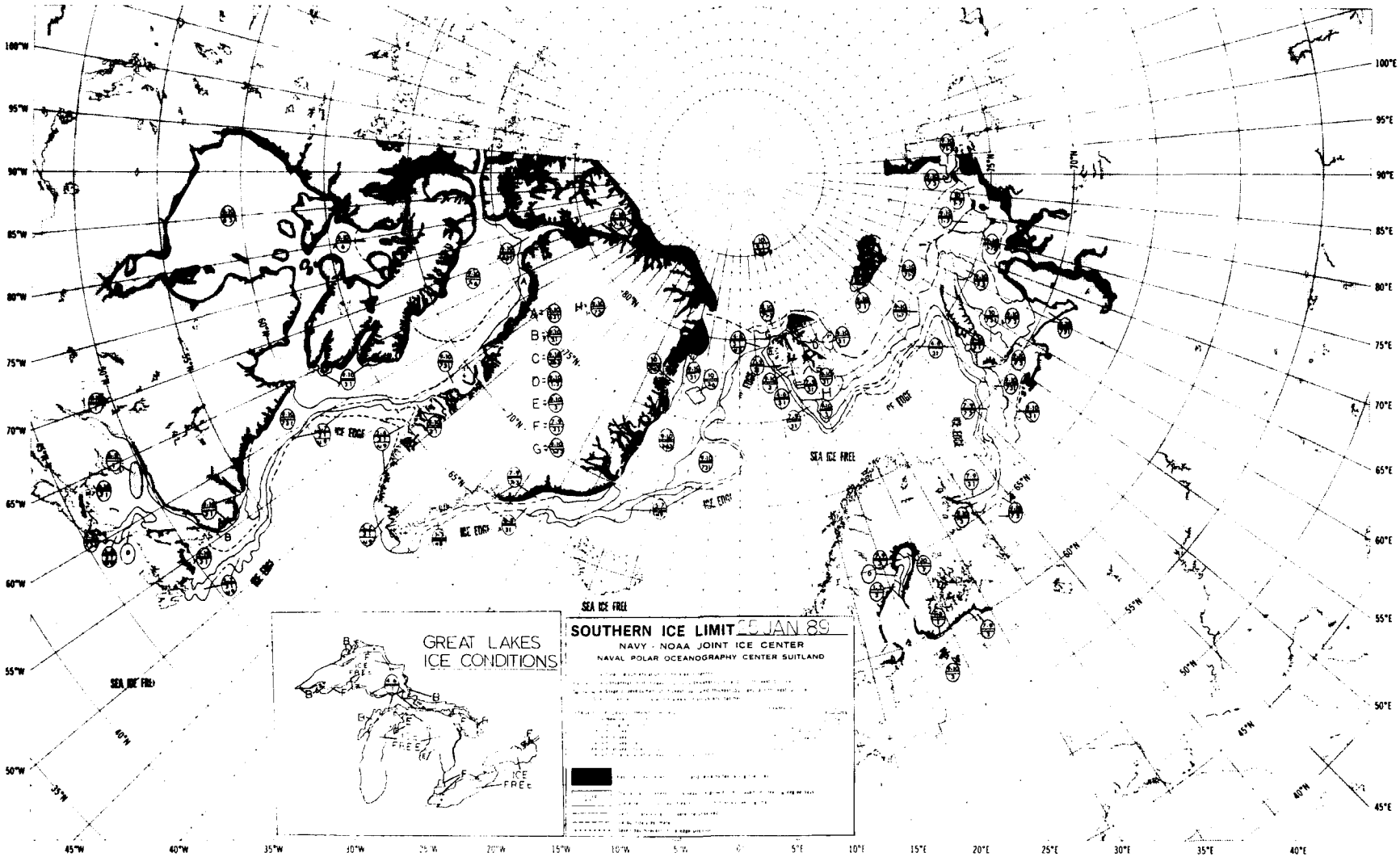
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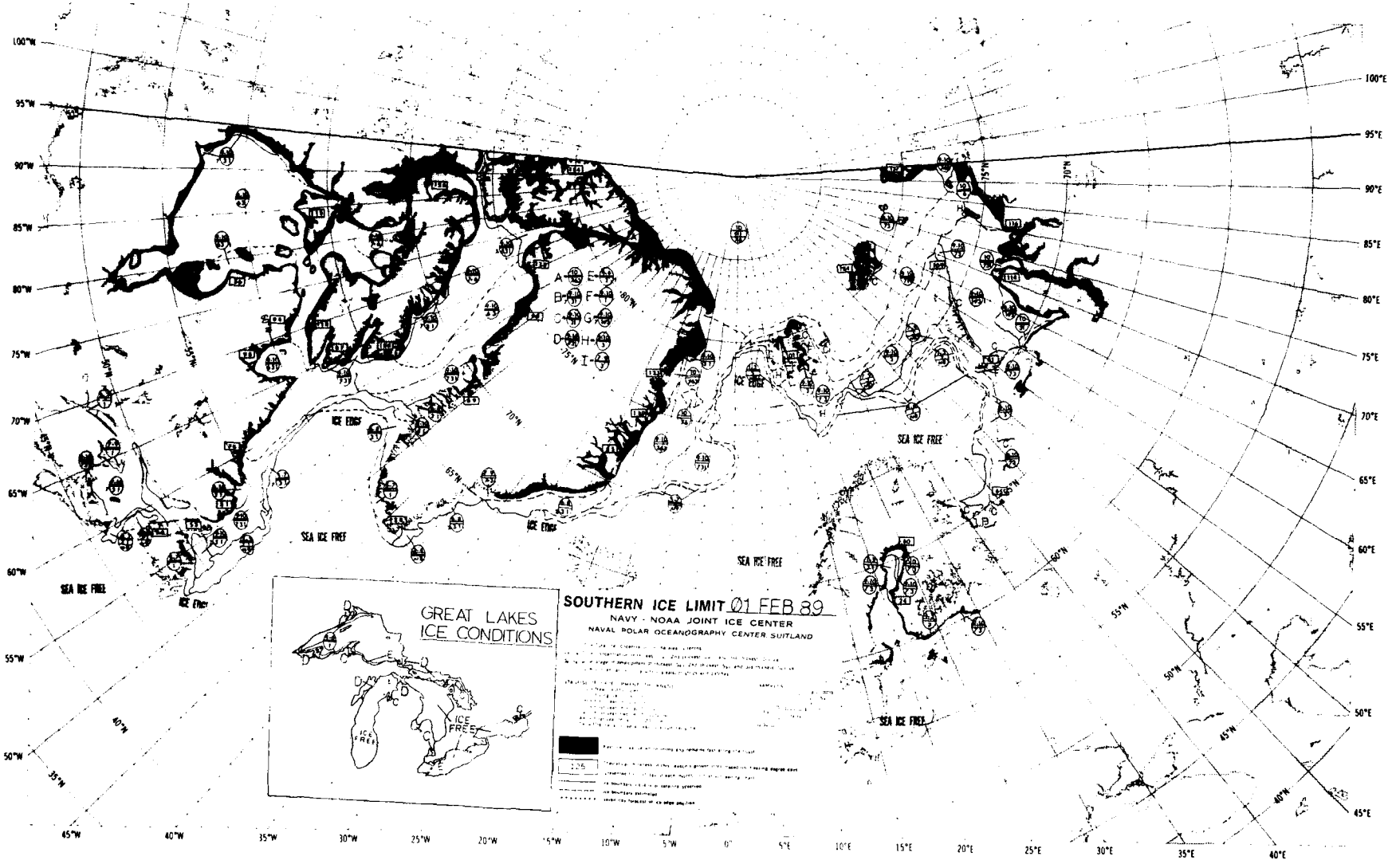
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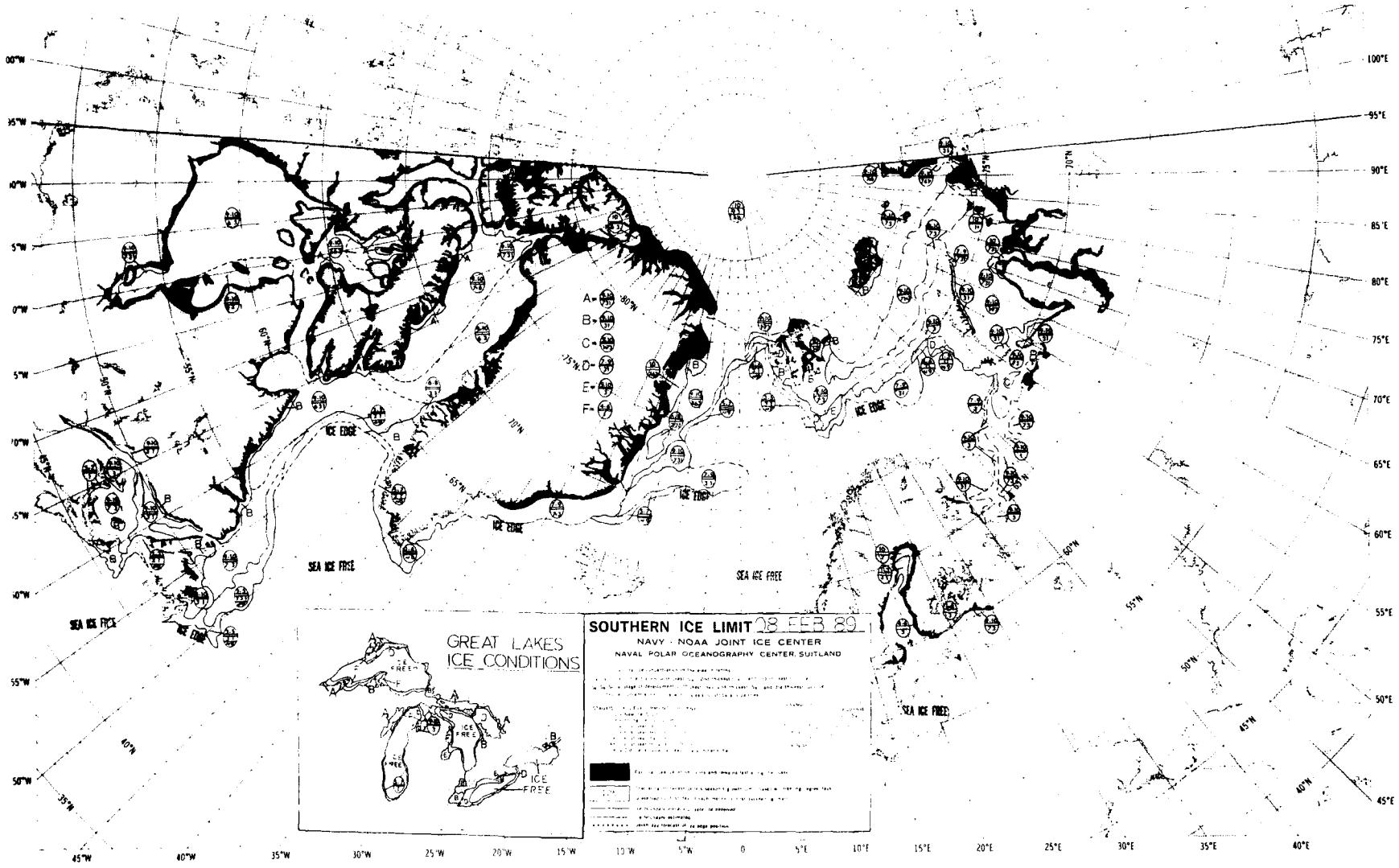
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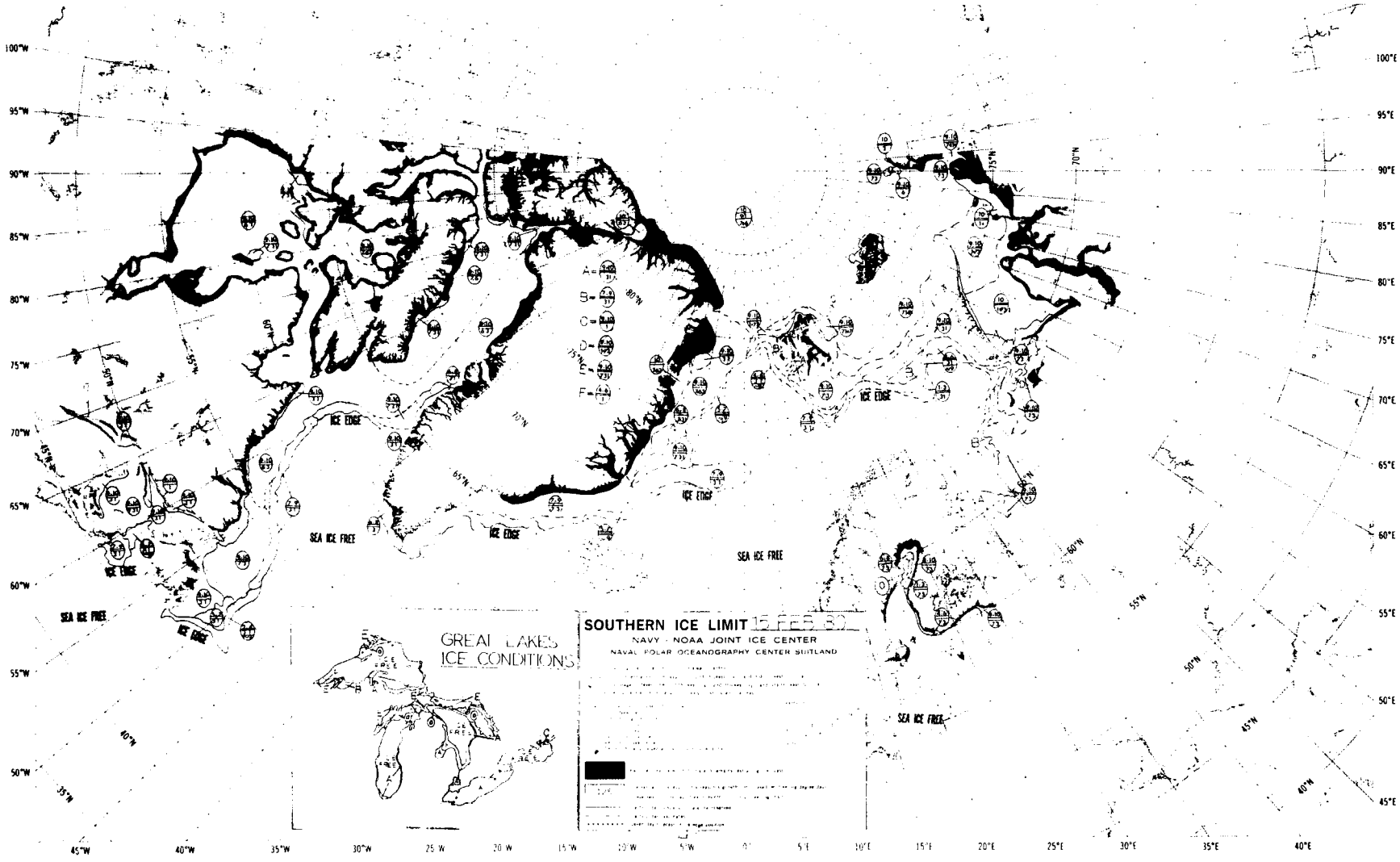
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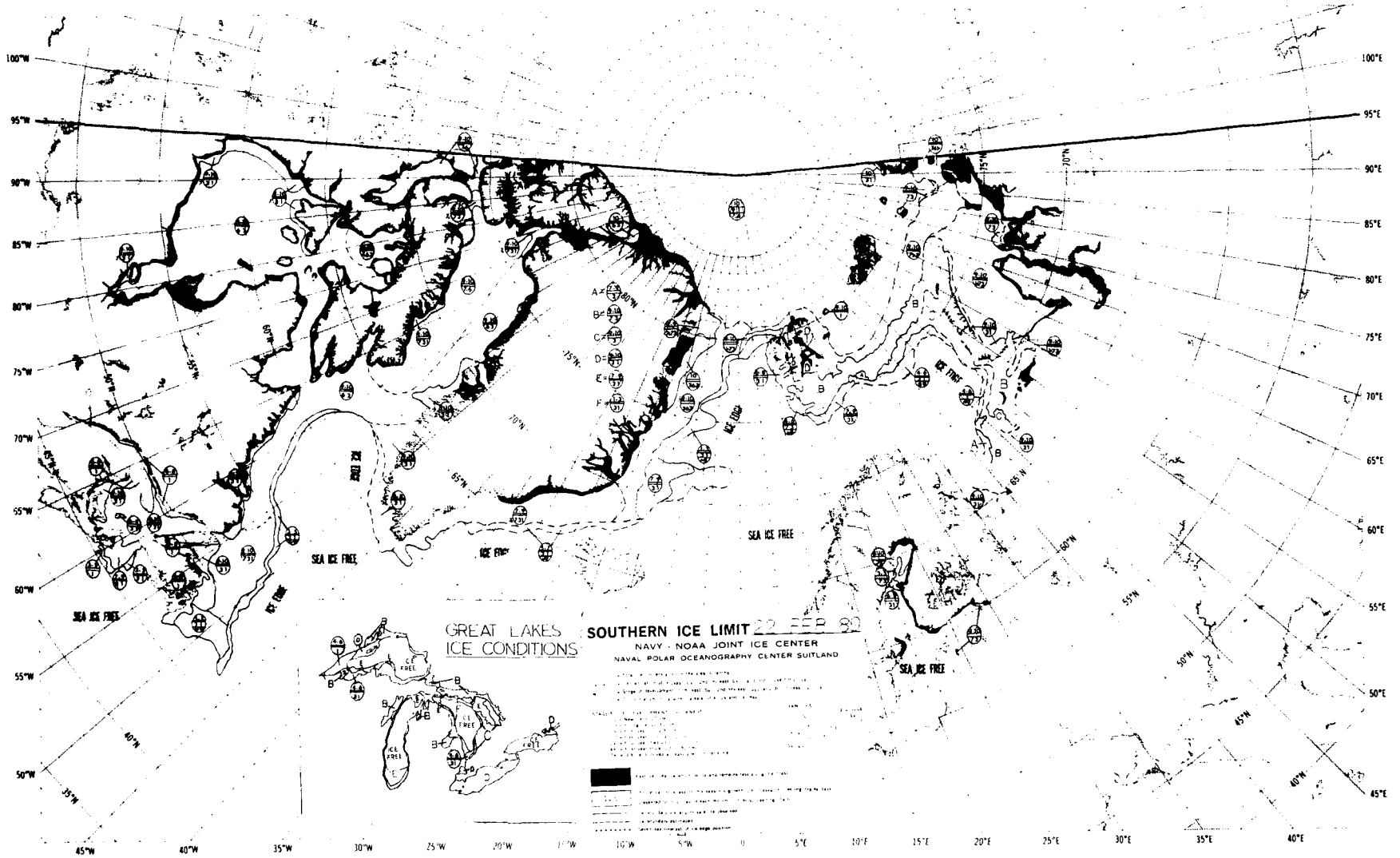
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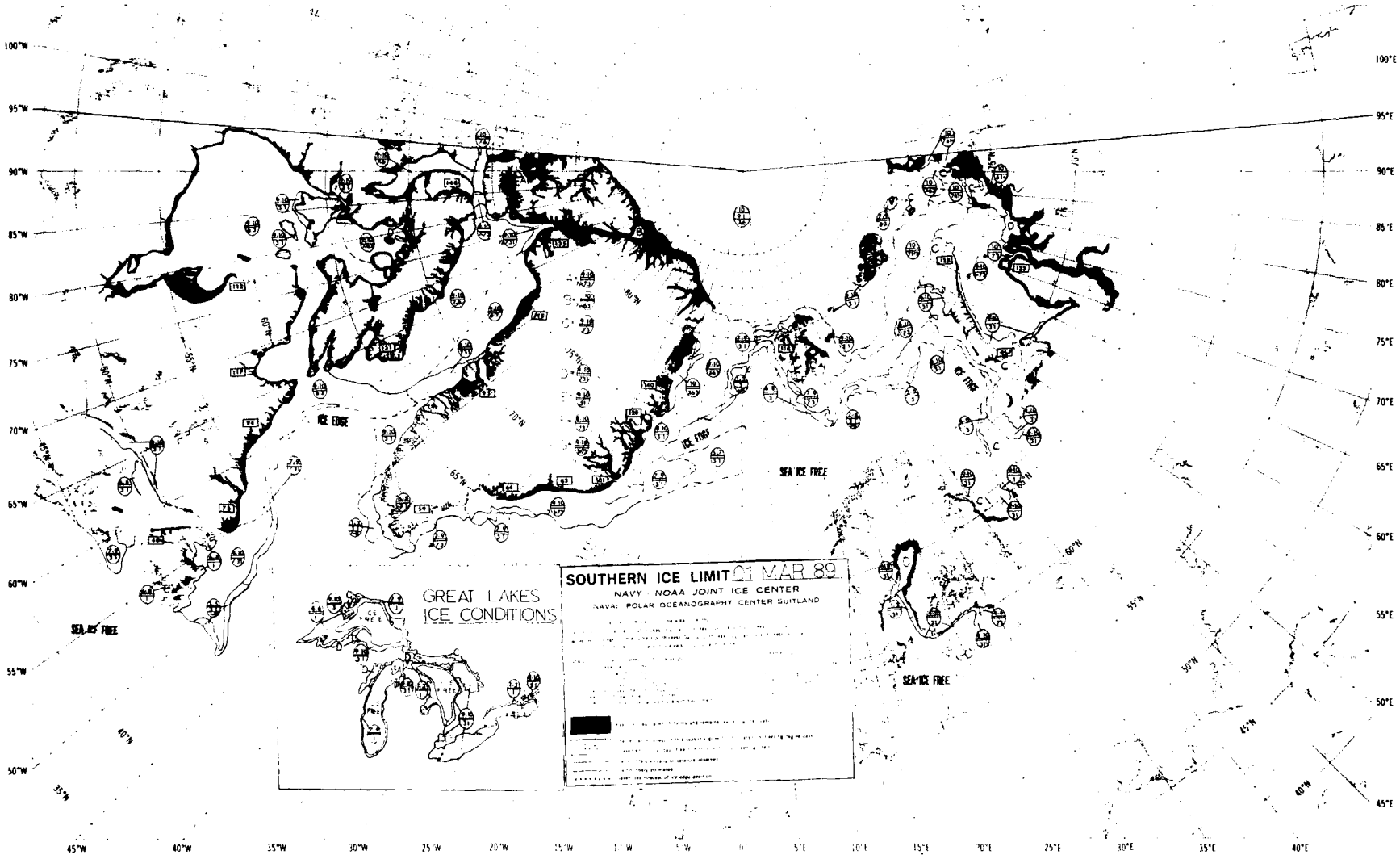
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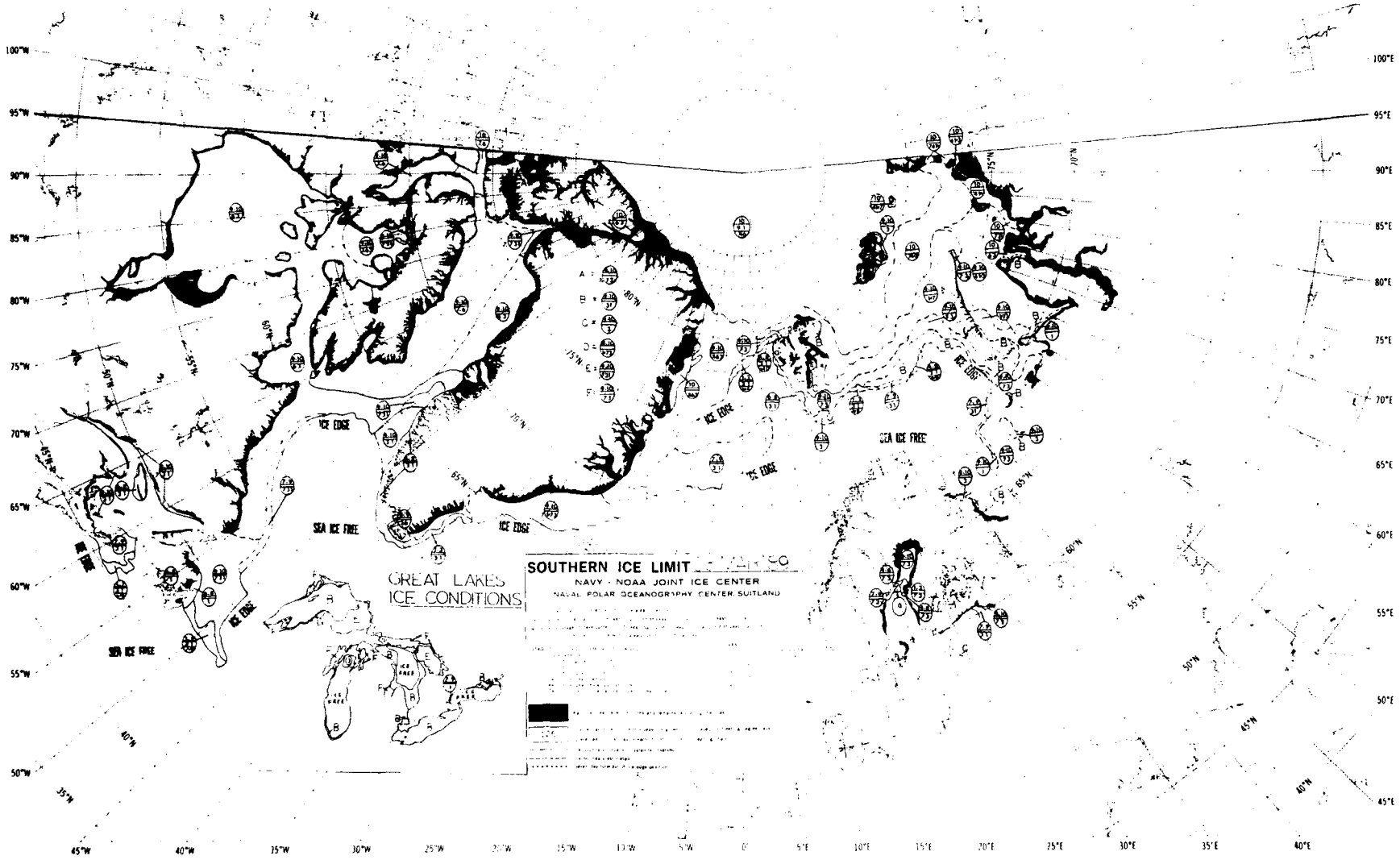
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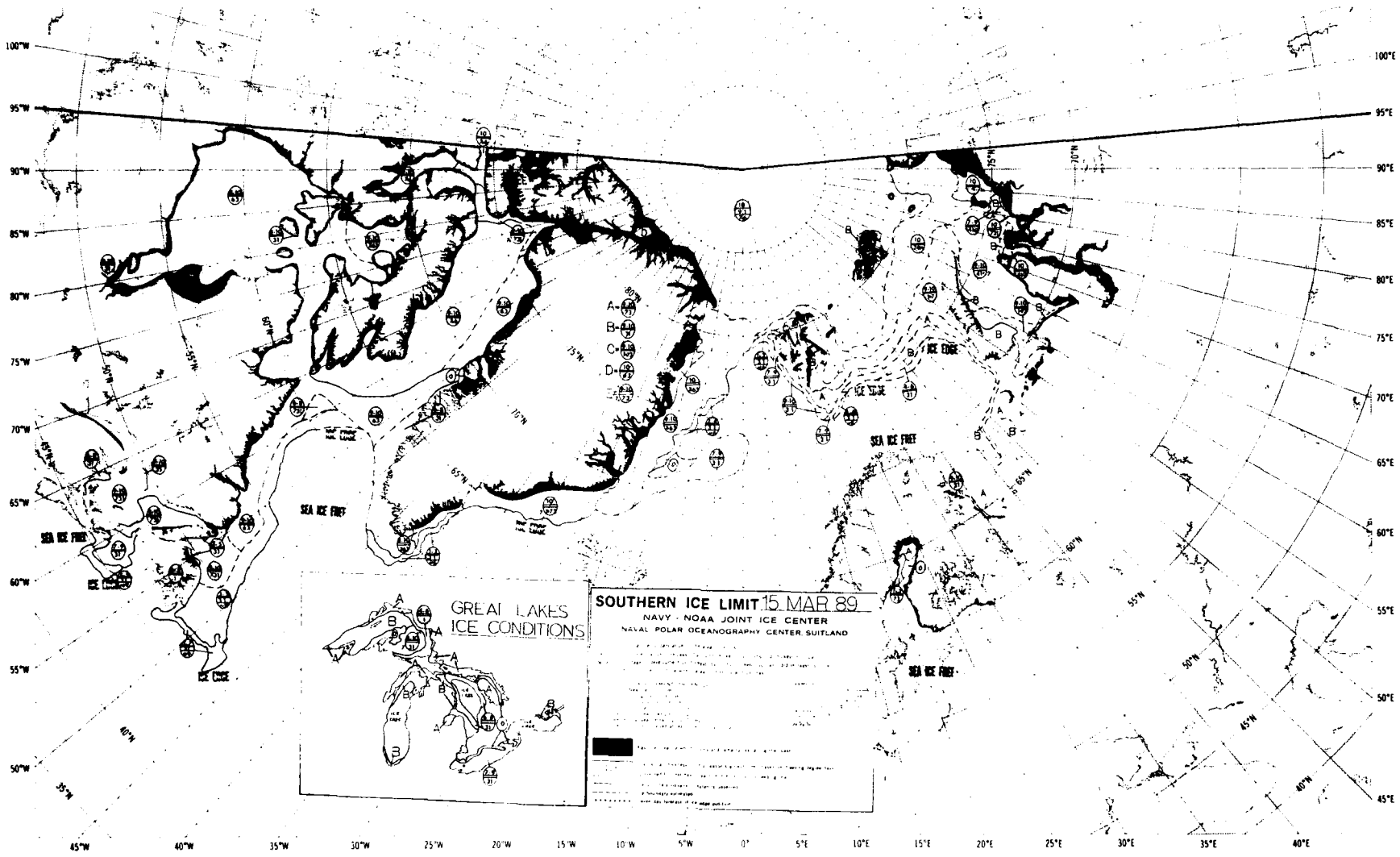
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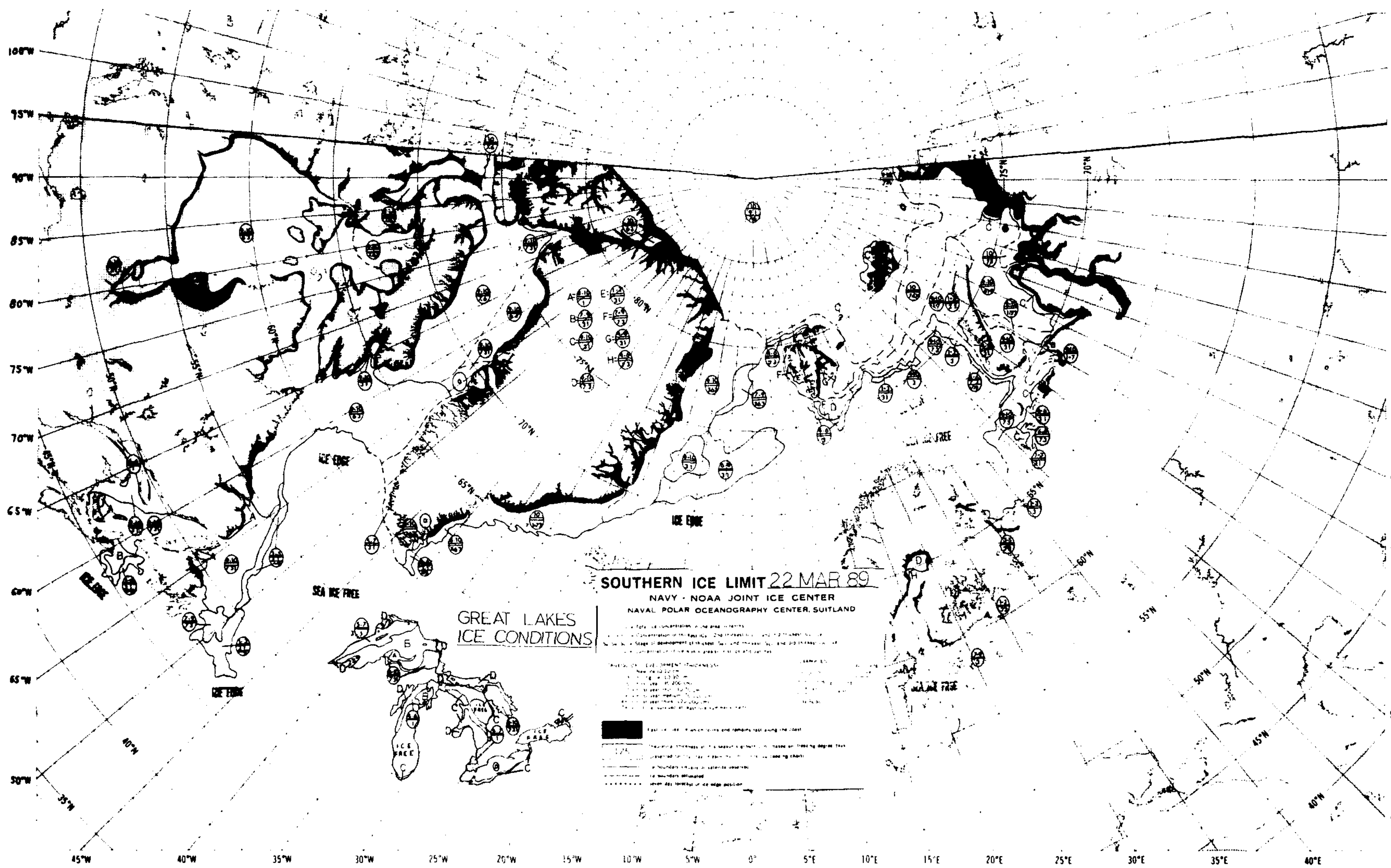
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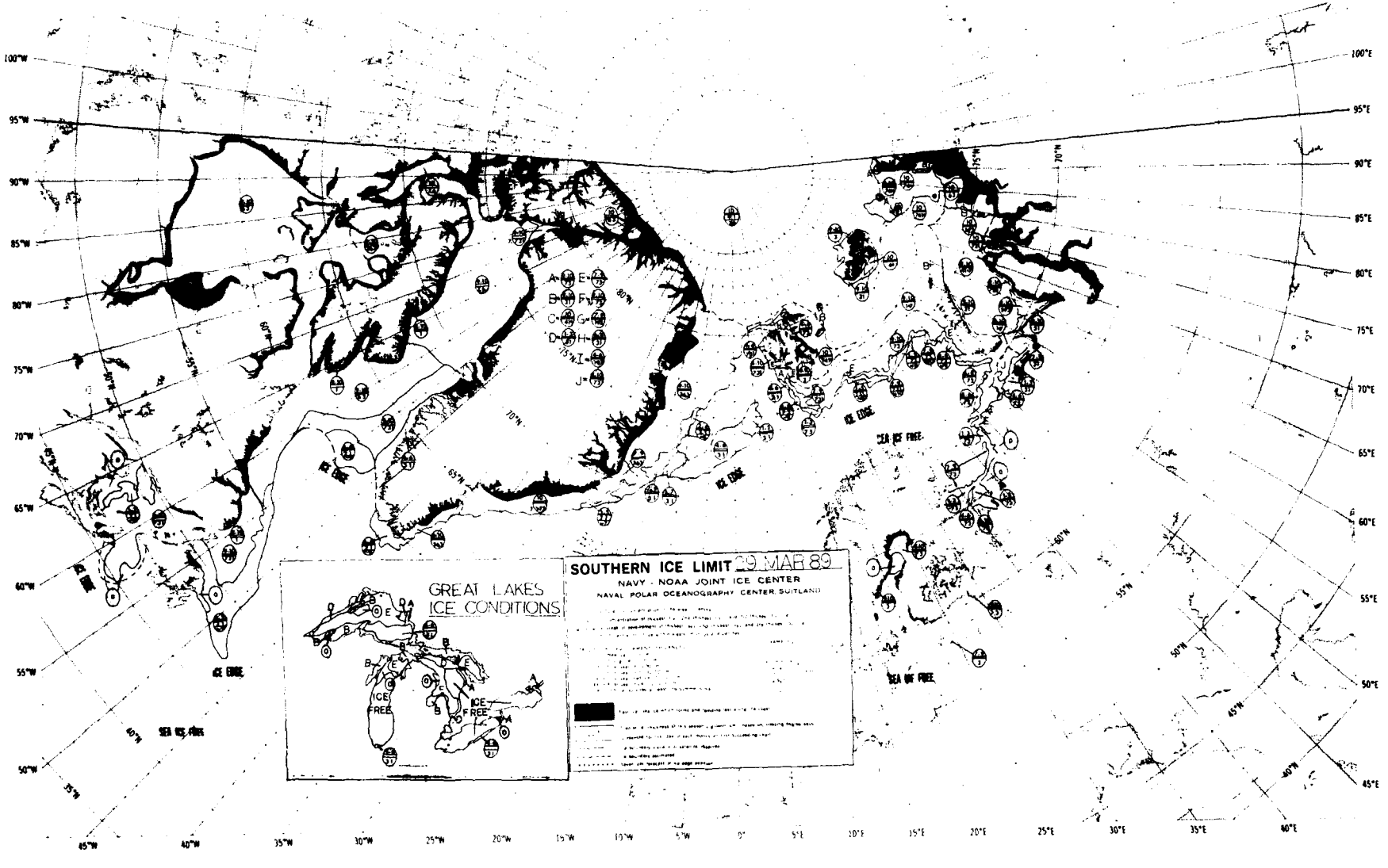
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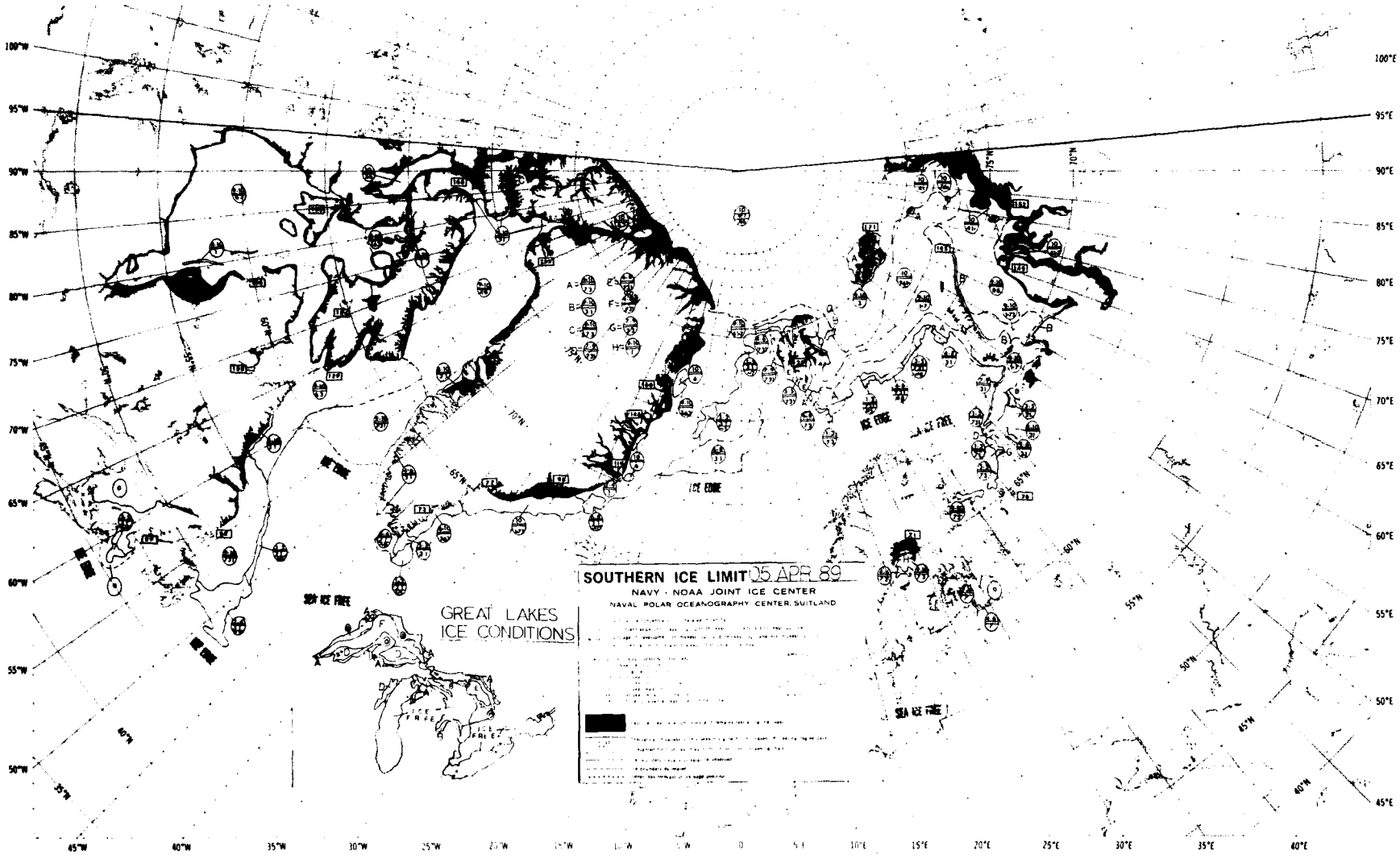
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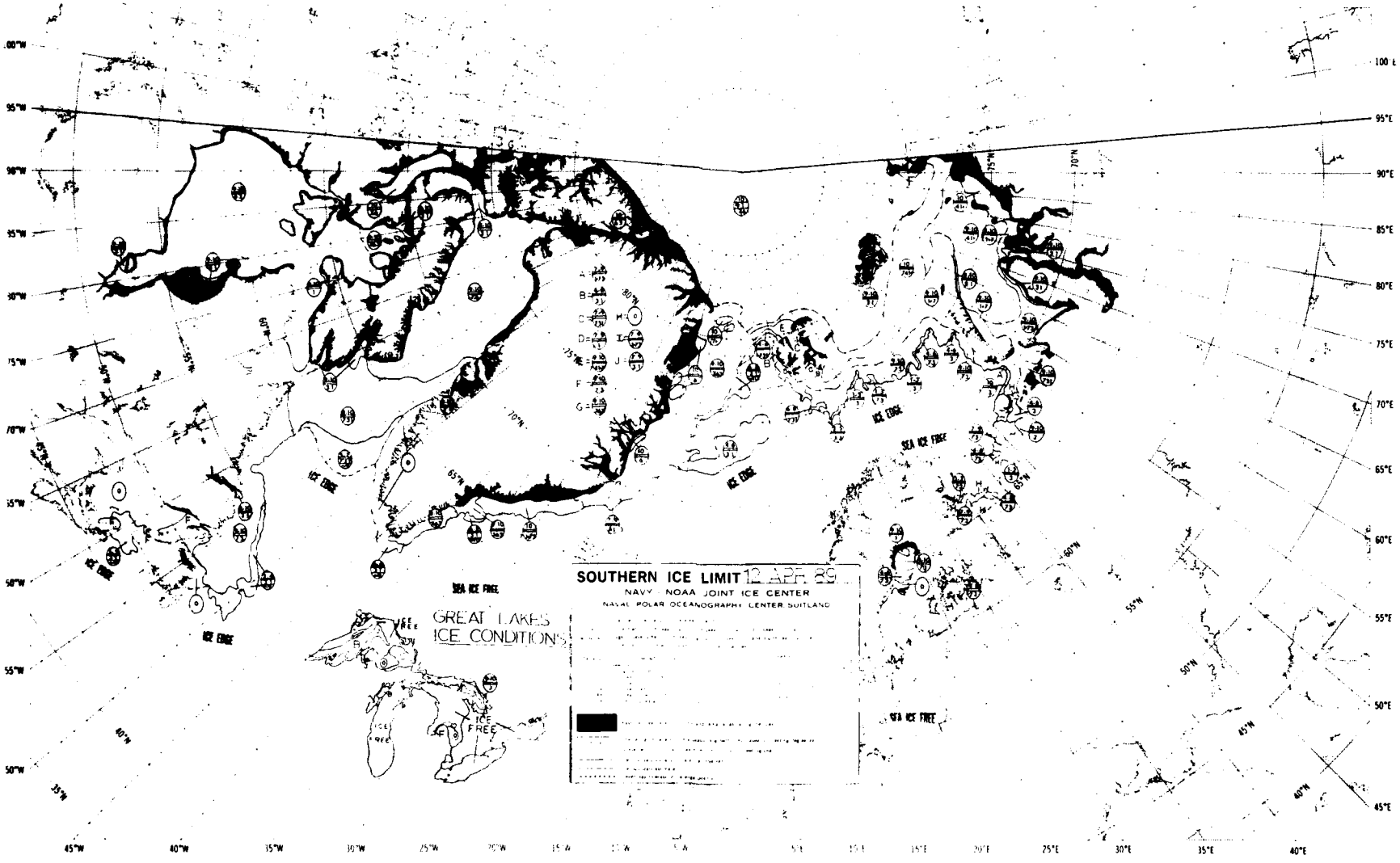
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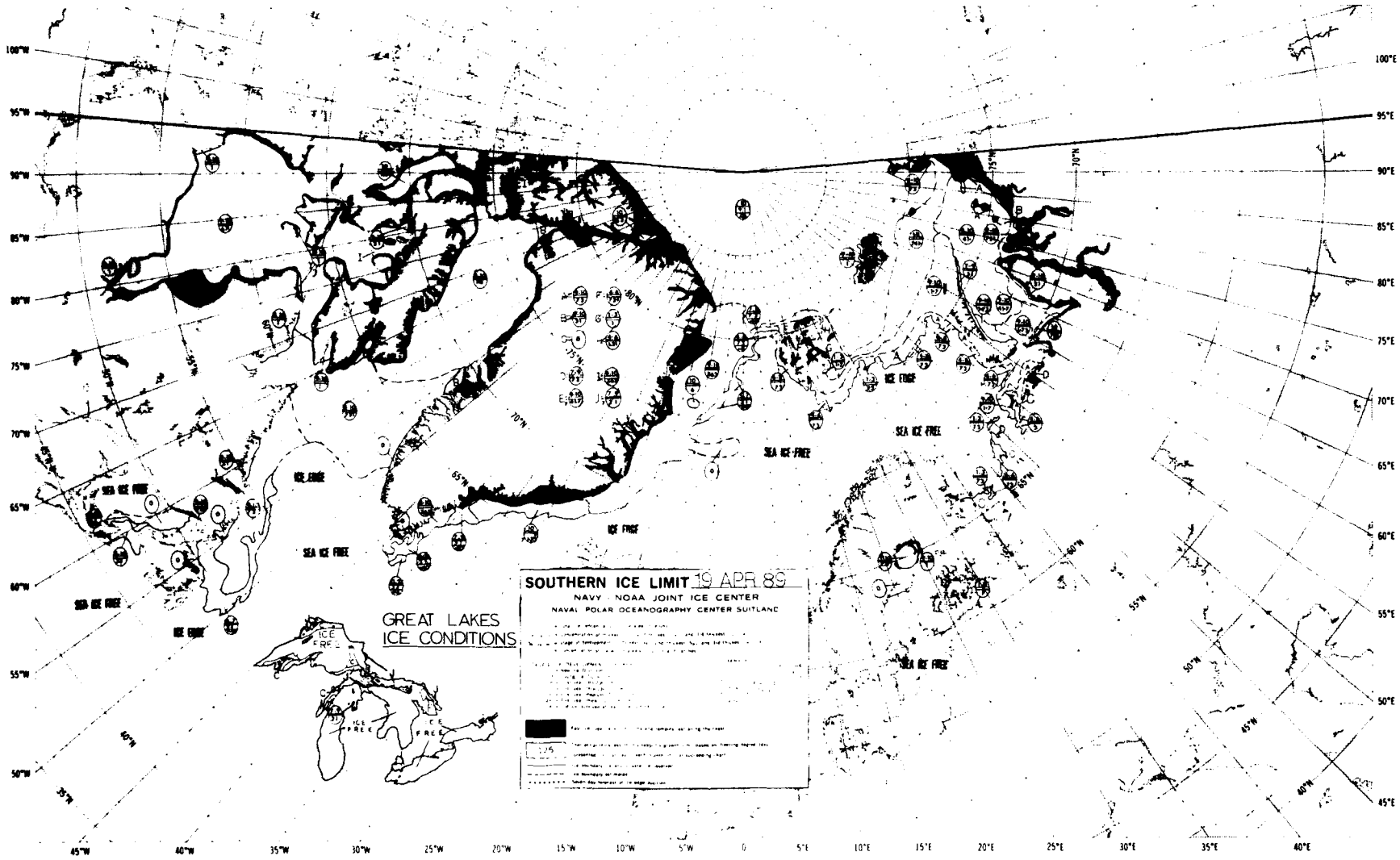
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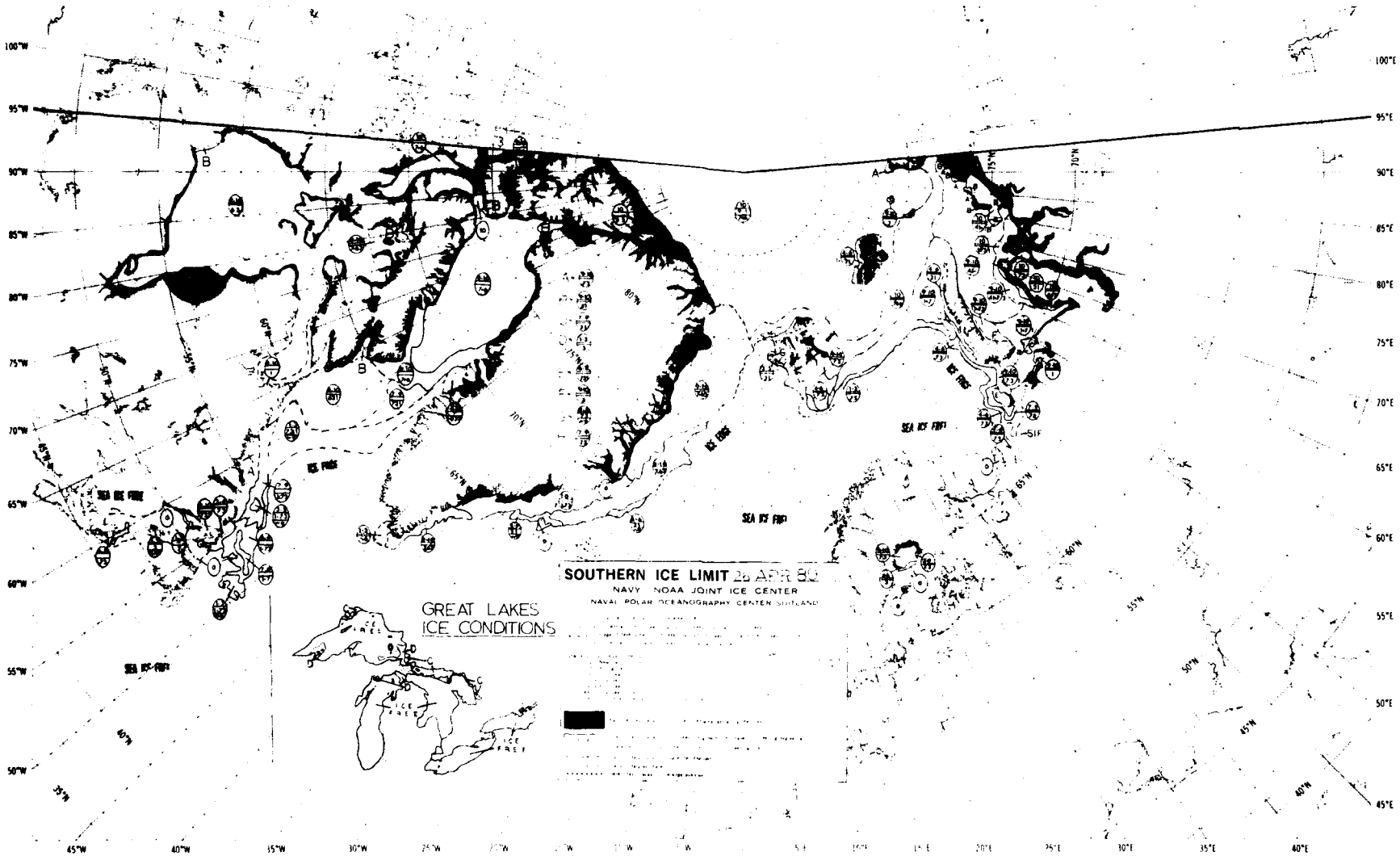
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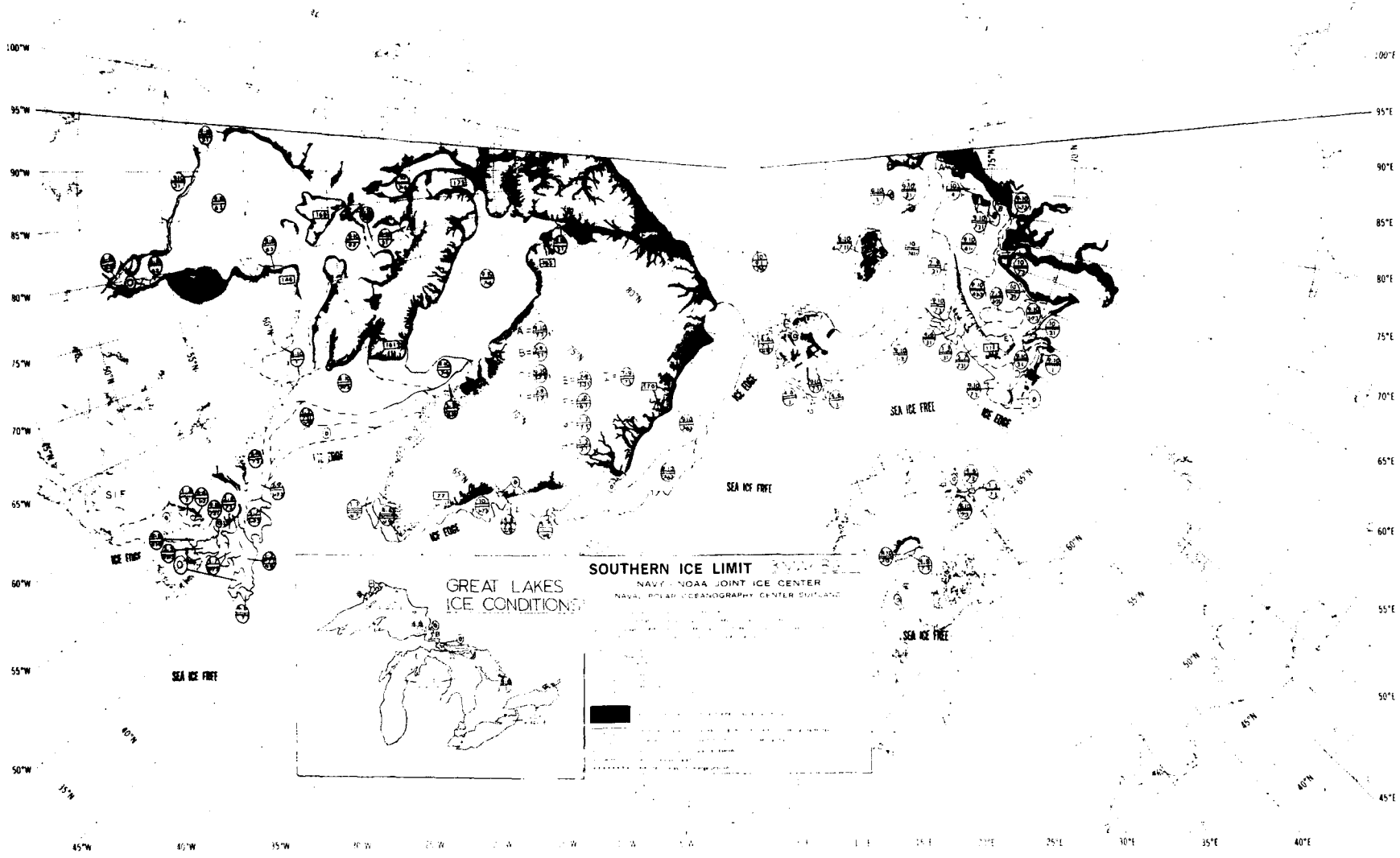
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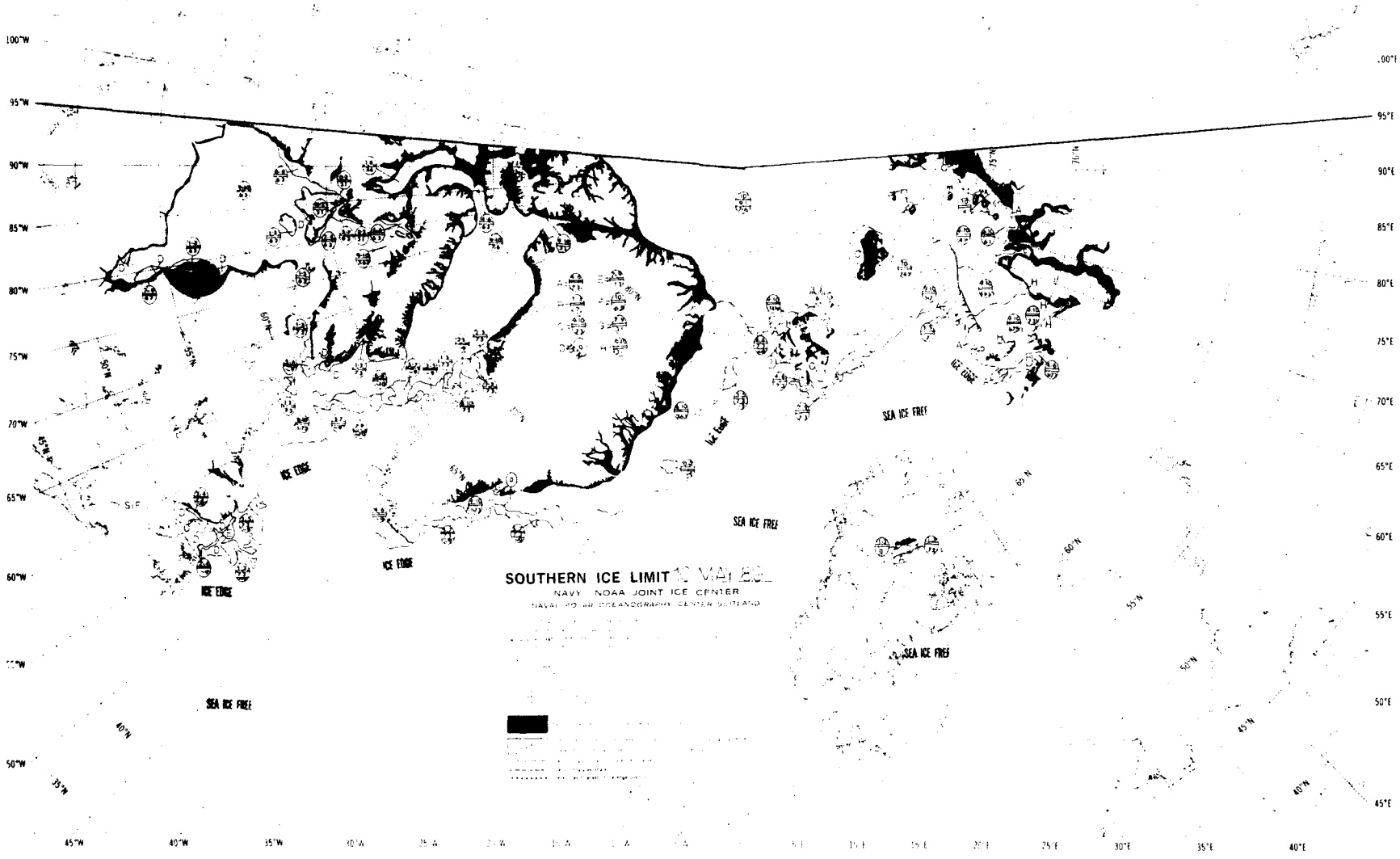
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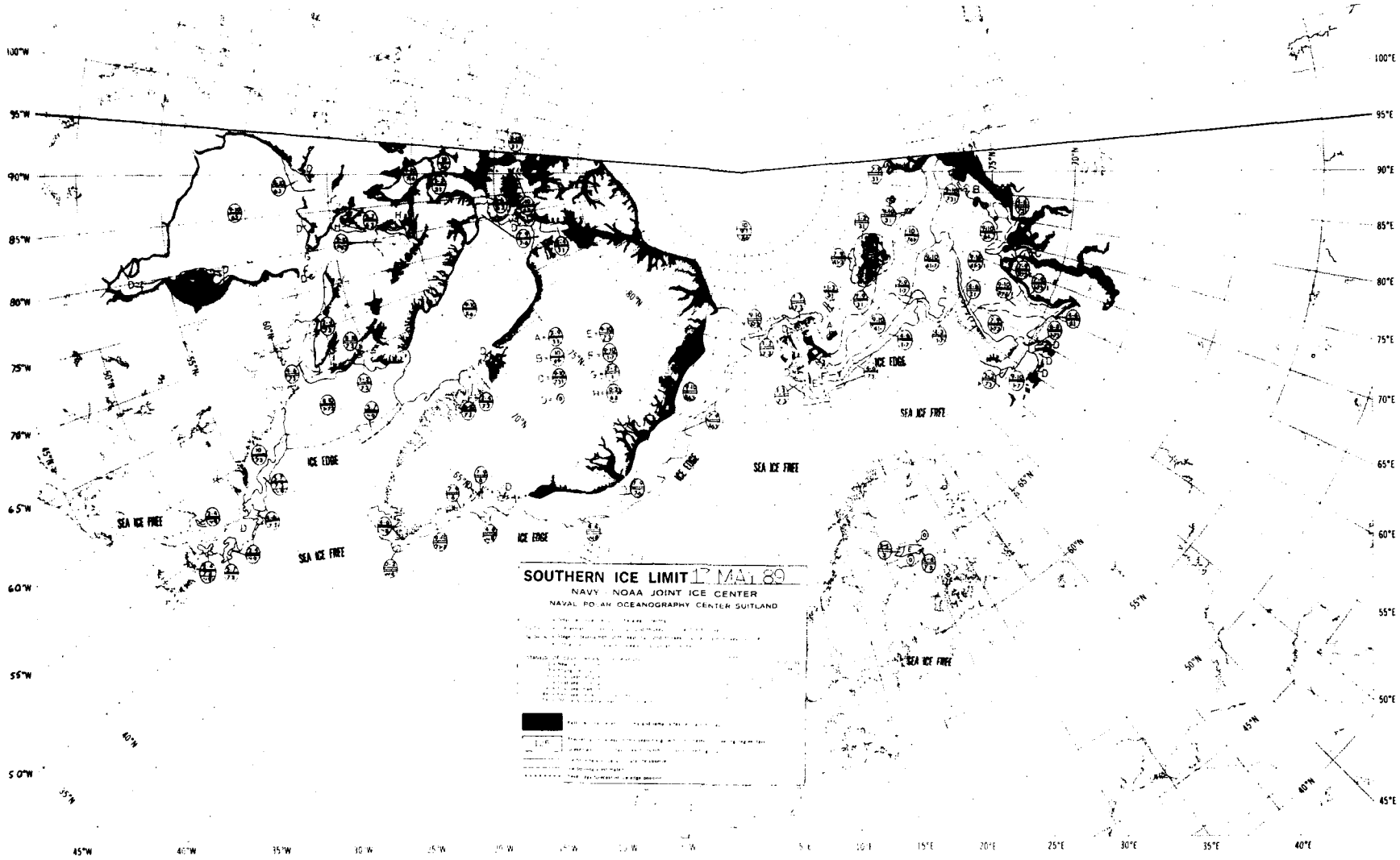
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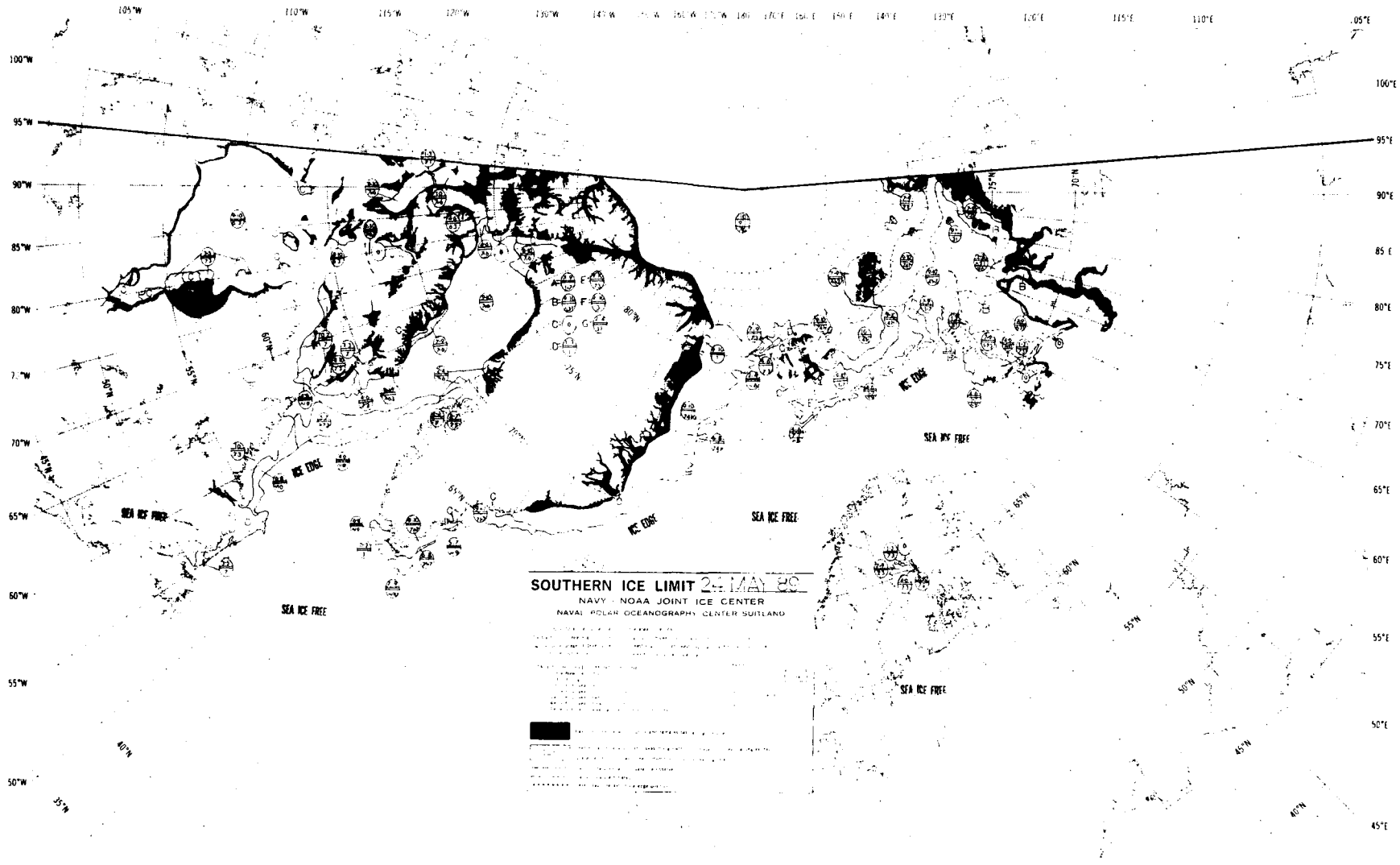
SOUTHERN ICE LIMIT 24 MAY 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
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SEA ICE FREE
SEA ICE FREE
105°W
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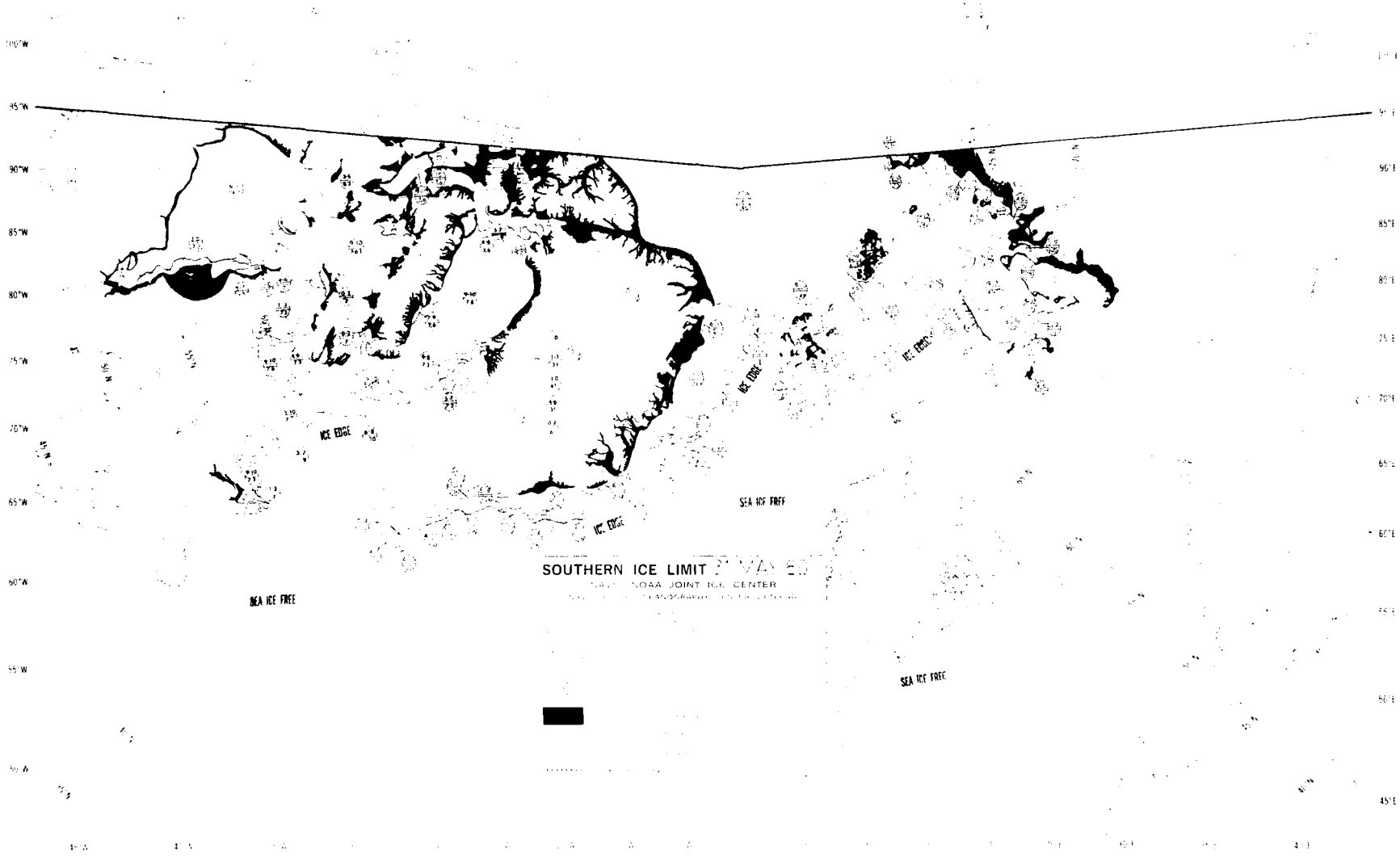
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SEA ICE FREE
SEA ICE FREE
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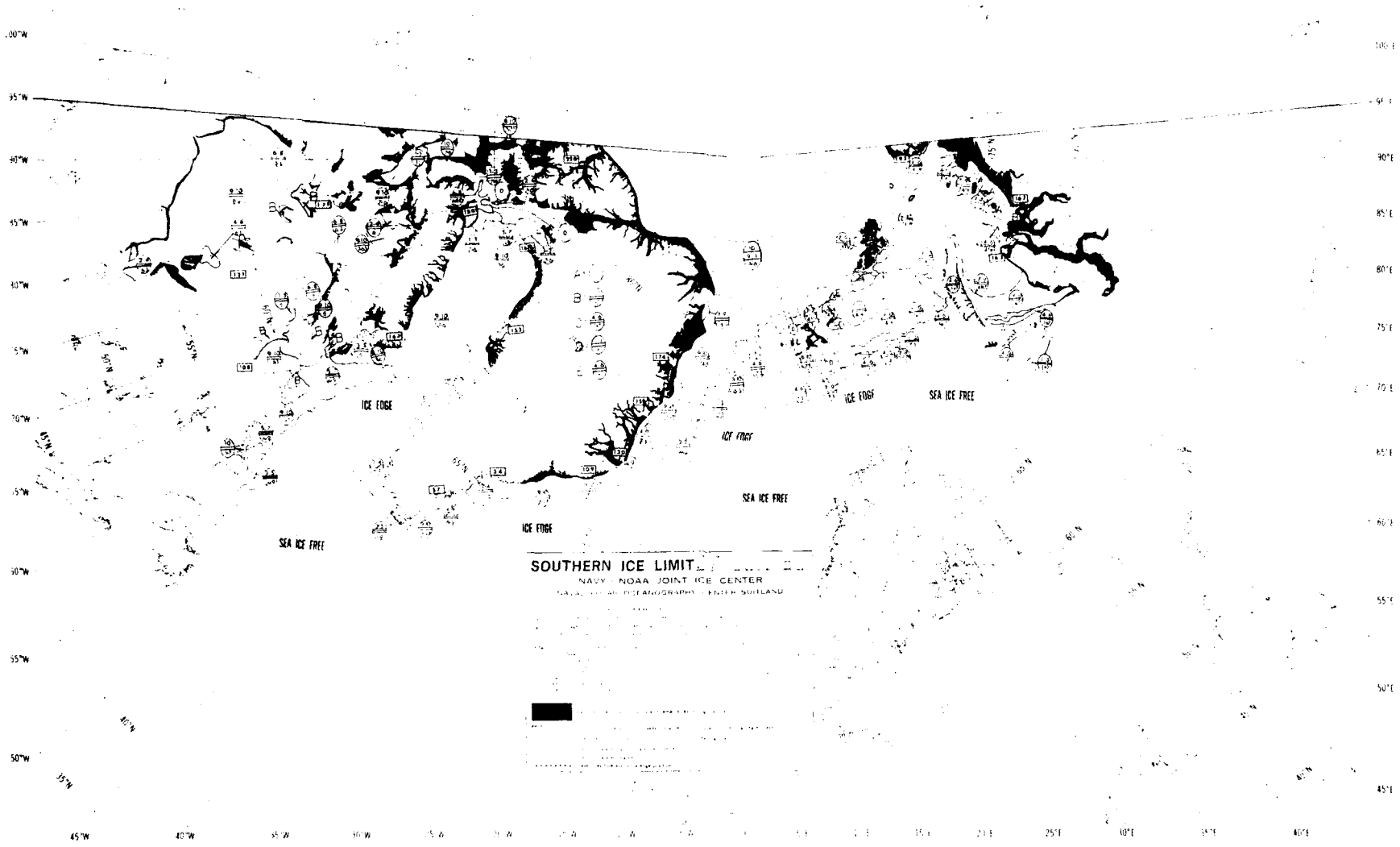
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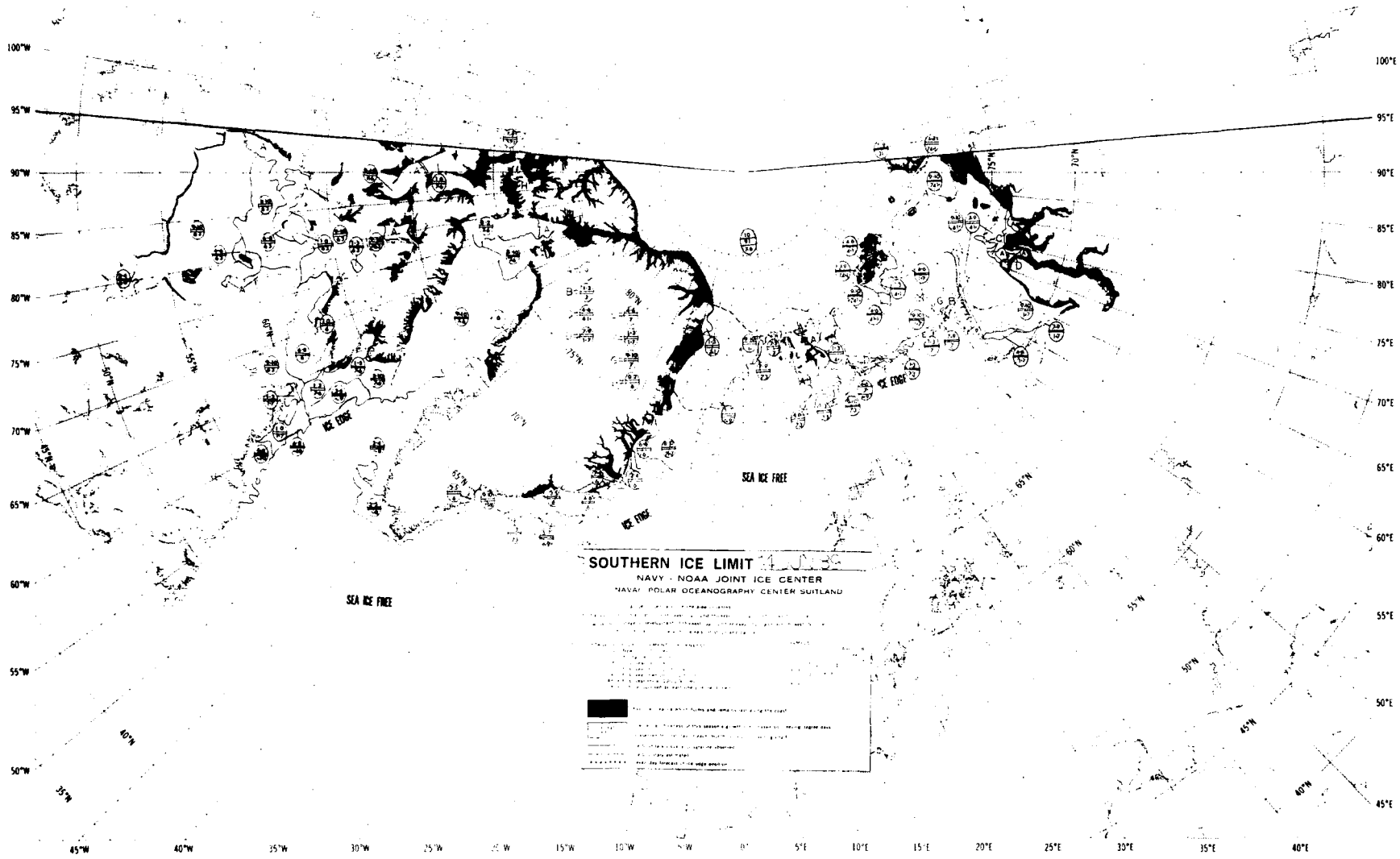
SOUTHERN ICE LIMIT
NAVY - NOAA JOINT ICE CENTER


SOUTHERN ICE LIMIT
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
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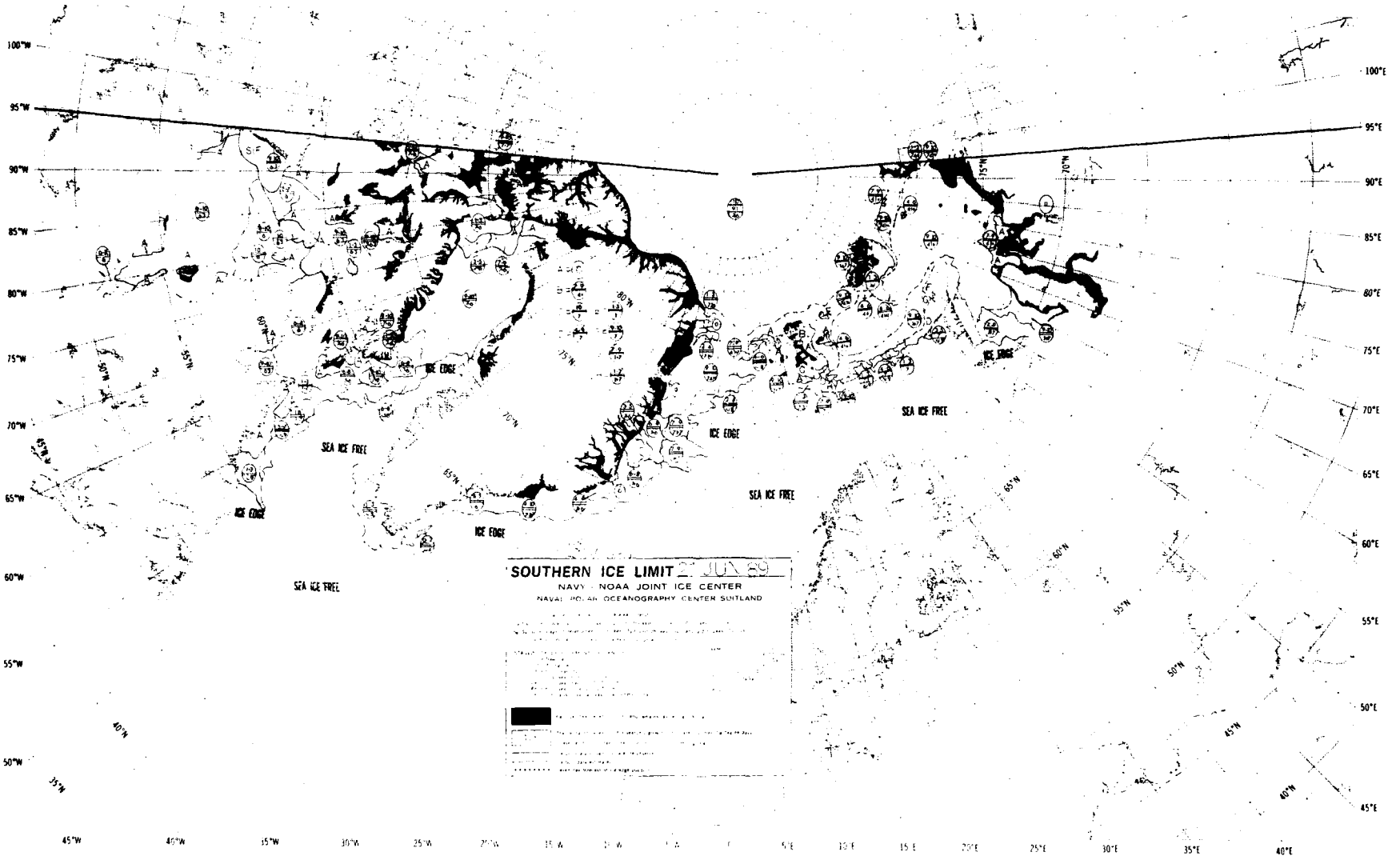
SOUTHERN ICE LIMIT 27 JUN 89
NAVY - NOAA JOINT ICE CENTER
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ICE EDGE
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ICE EDGE
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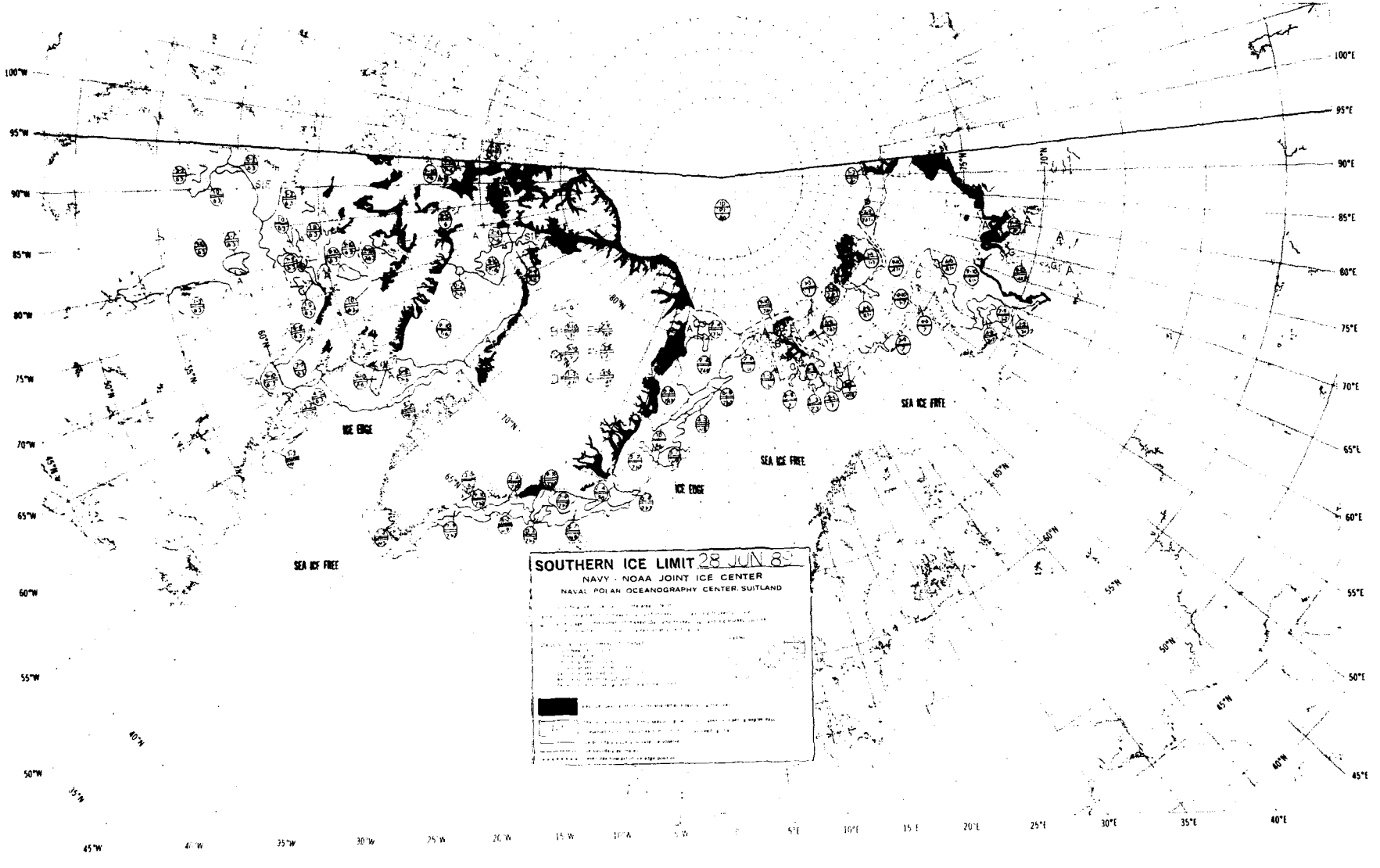
SOUTHERN ICE LIMIT 28 JUN 8
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
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ICE EDGE
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SEA ICE FREE
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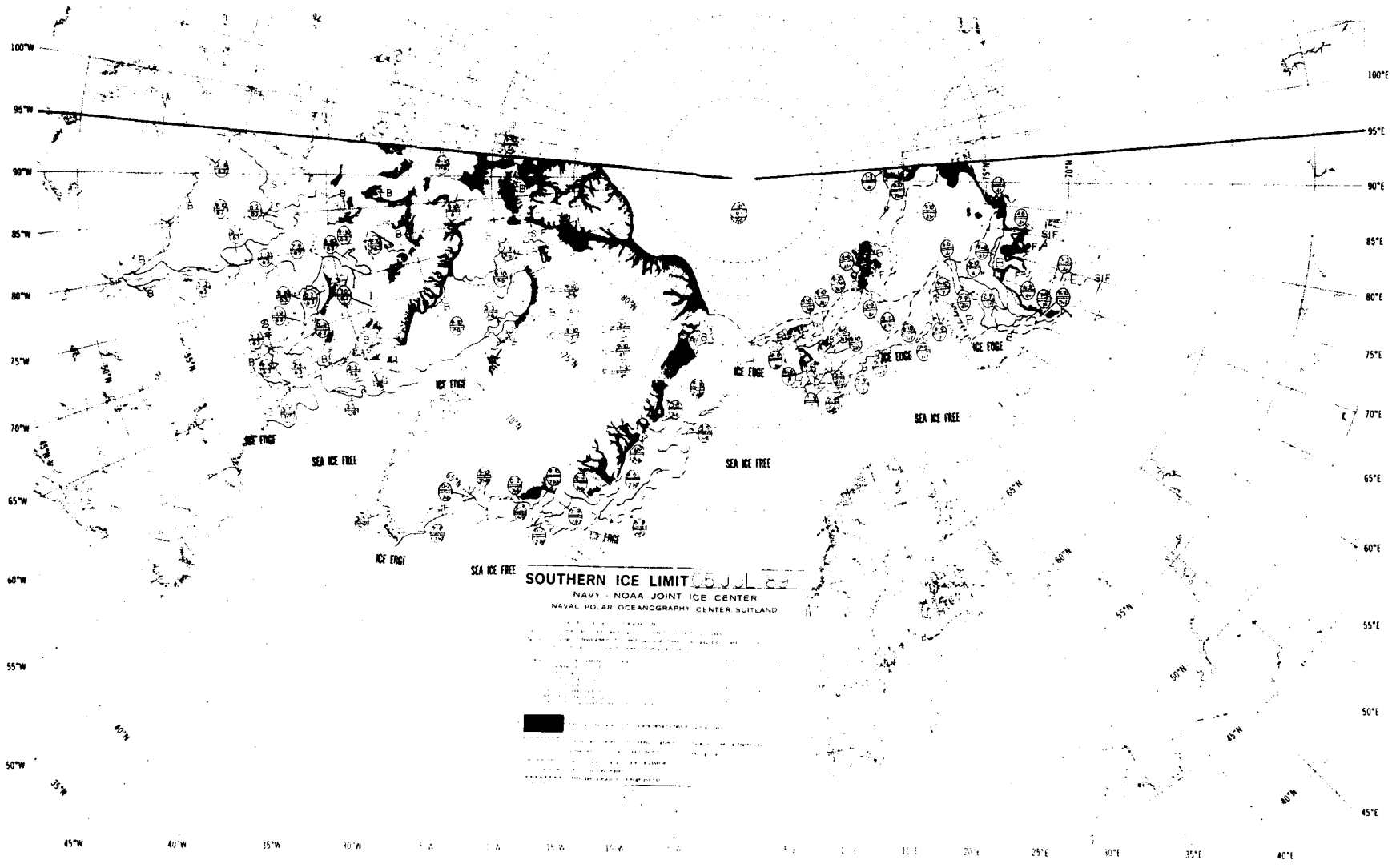
SOUTHERN ICE LIMIT
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
SIF
100°W
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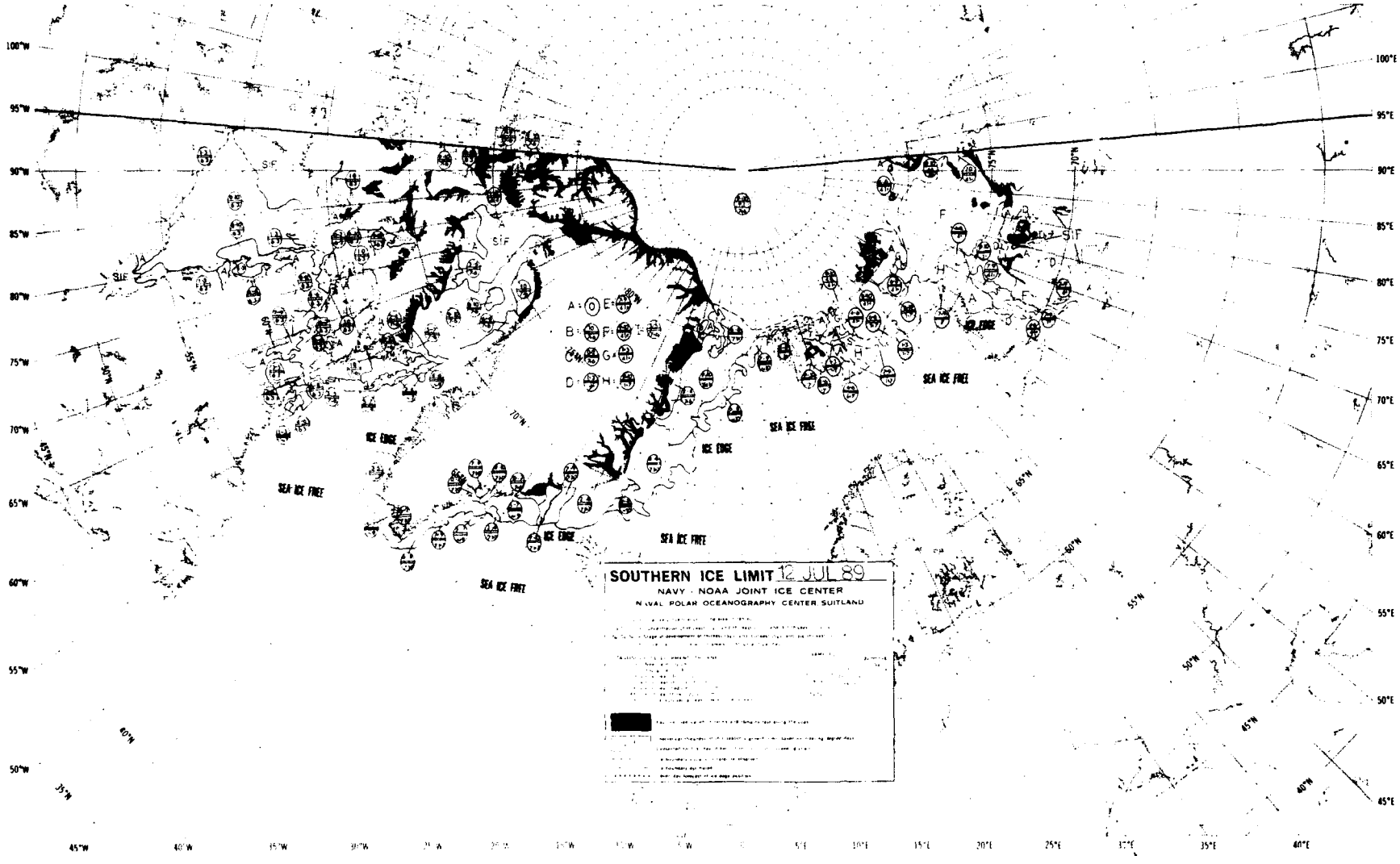
SOUTHERN ICE LIMIT 12 JUL 89
NAVY - NOAA JOINT ICE CENTER
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SEA ICE FREE
ICE EDGE
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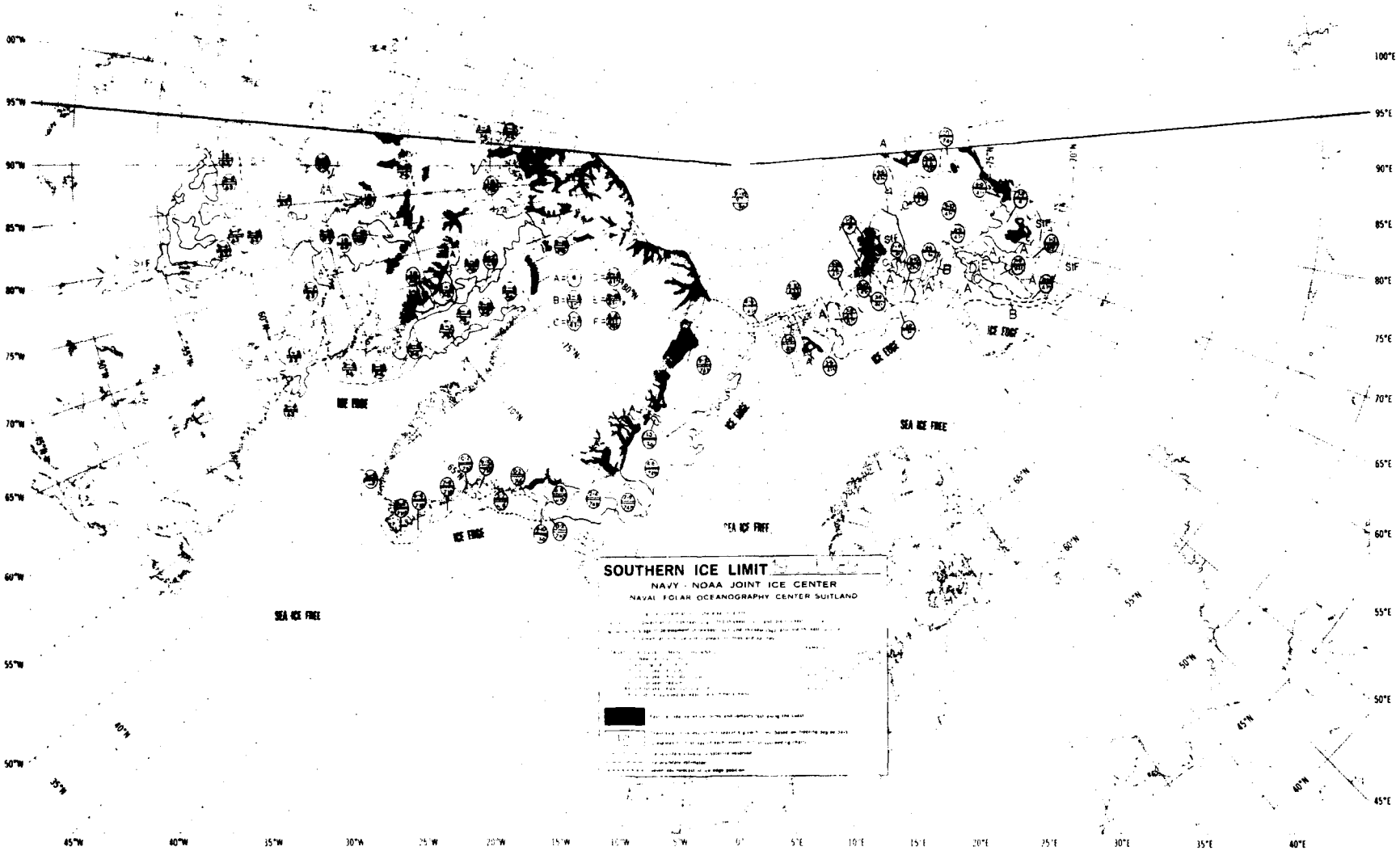
SOUTHERN ICE LIMIT
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
SIF
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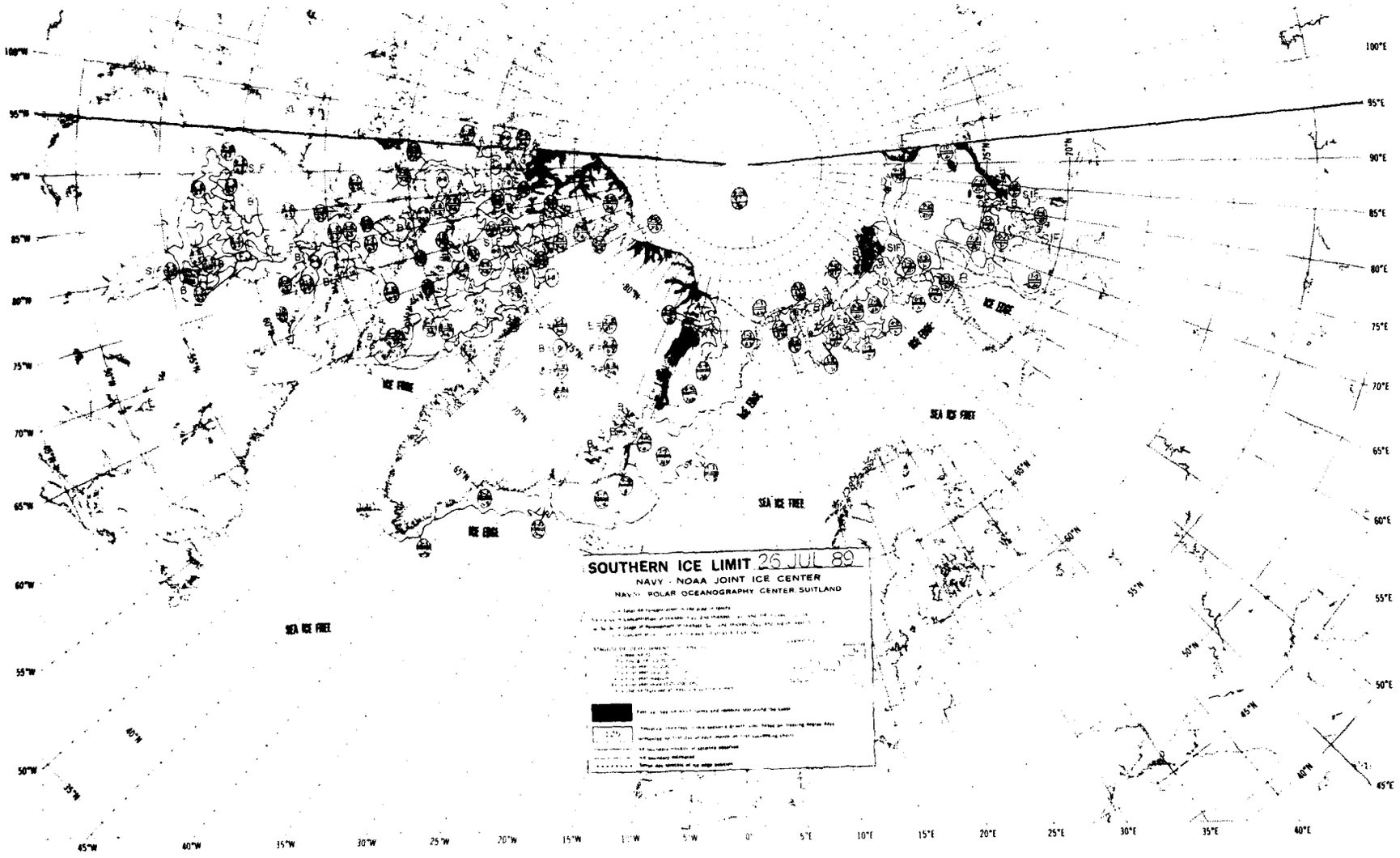
SOUTHERN ICE LIMIT 26 JUL 89
NAVY - NOAA JOINT ICE CENTER
NAVY POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
100°W
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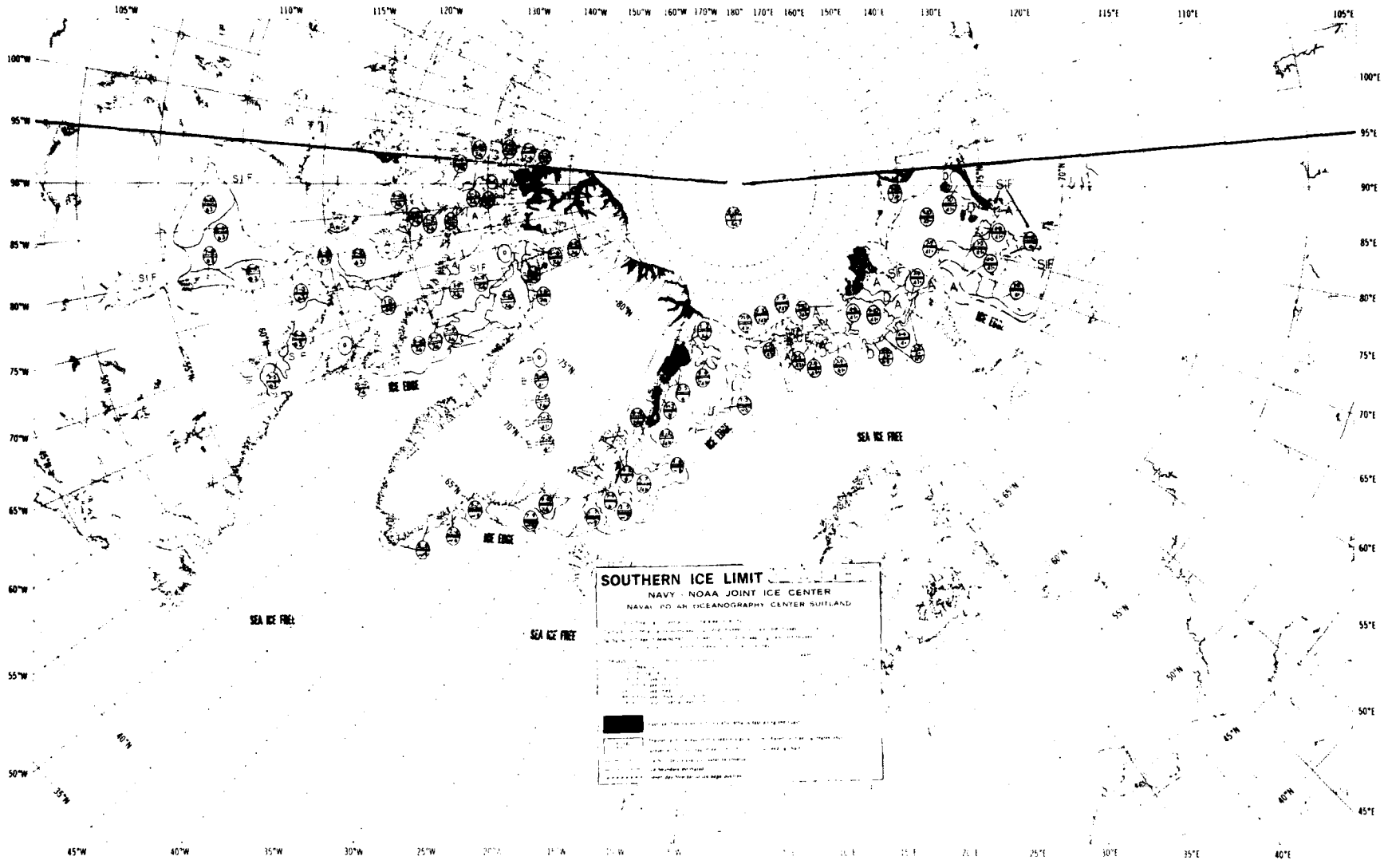
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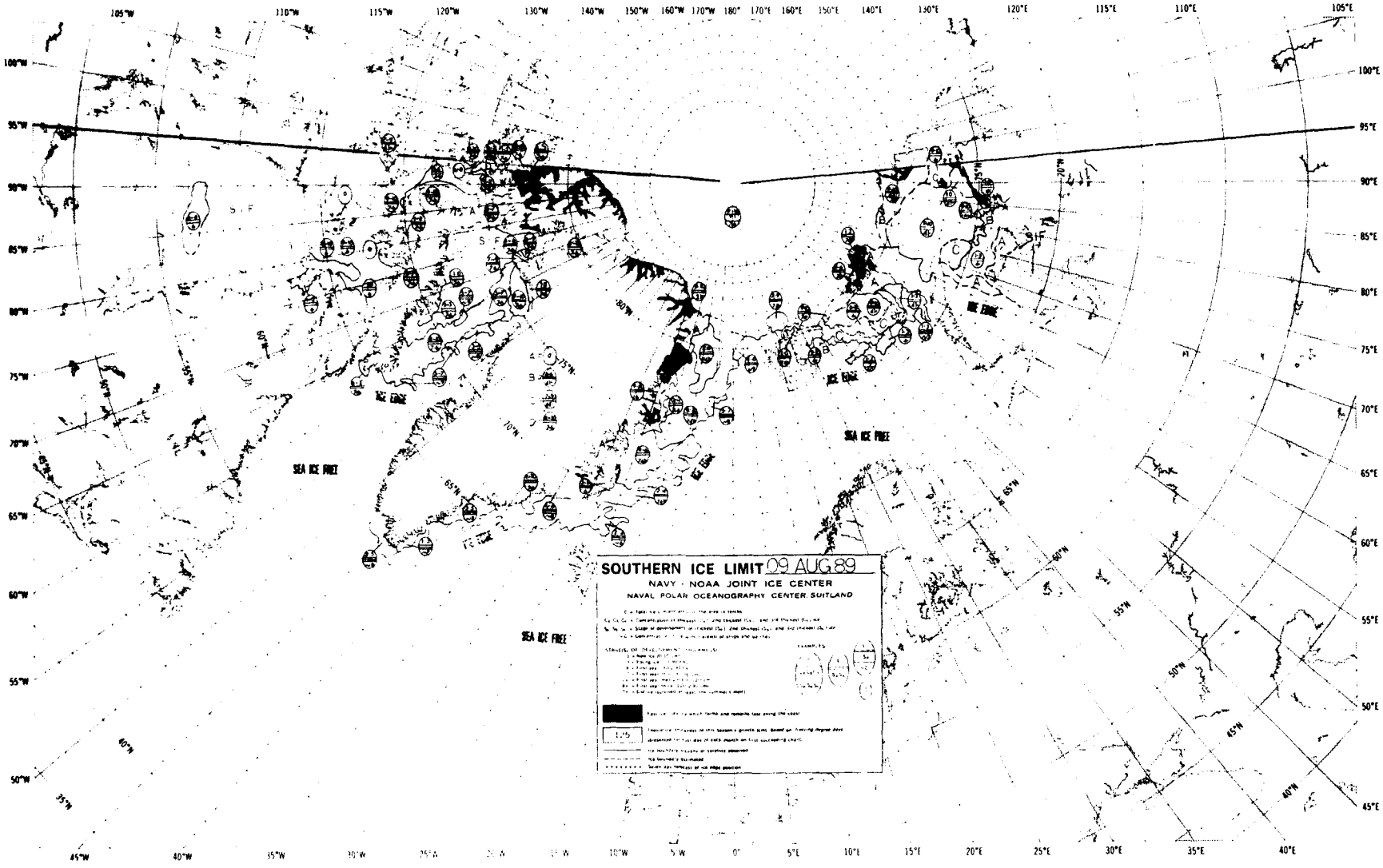
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
SIF


SOUTHERN ICE LIMIT 09 AUG 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
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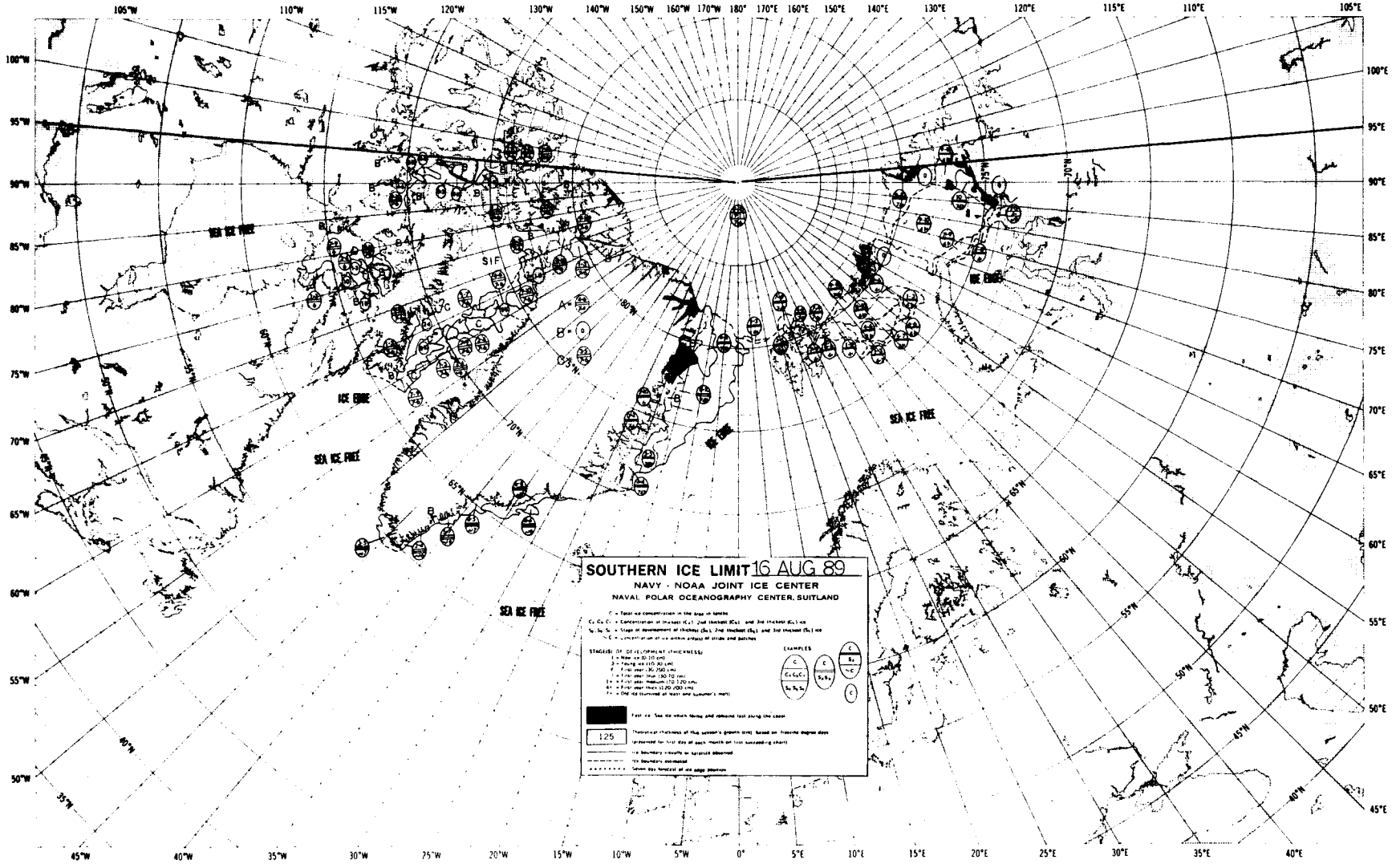
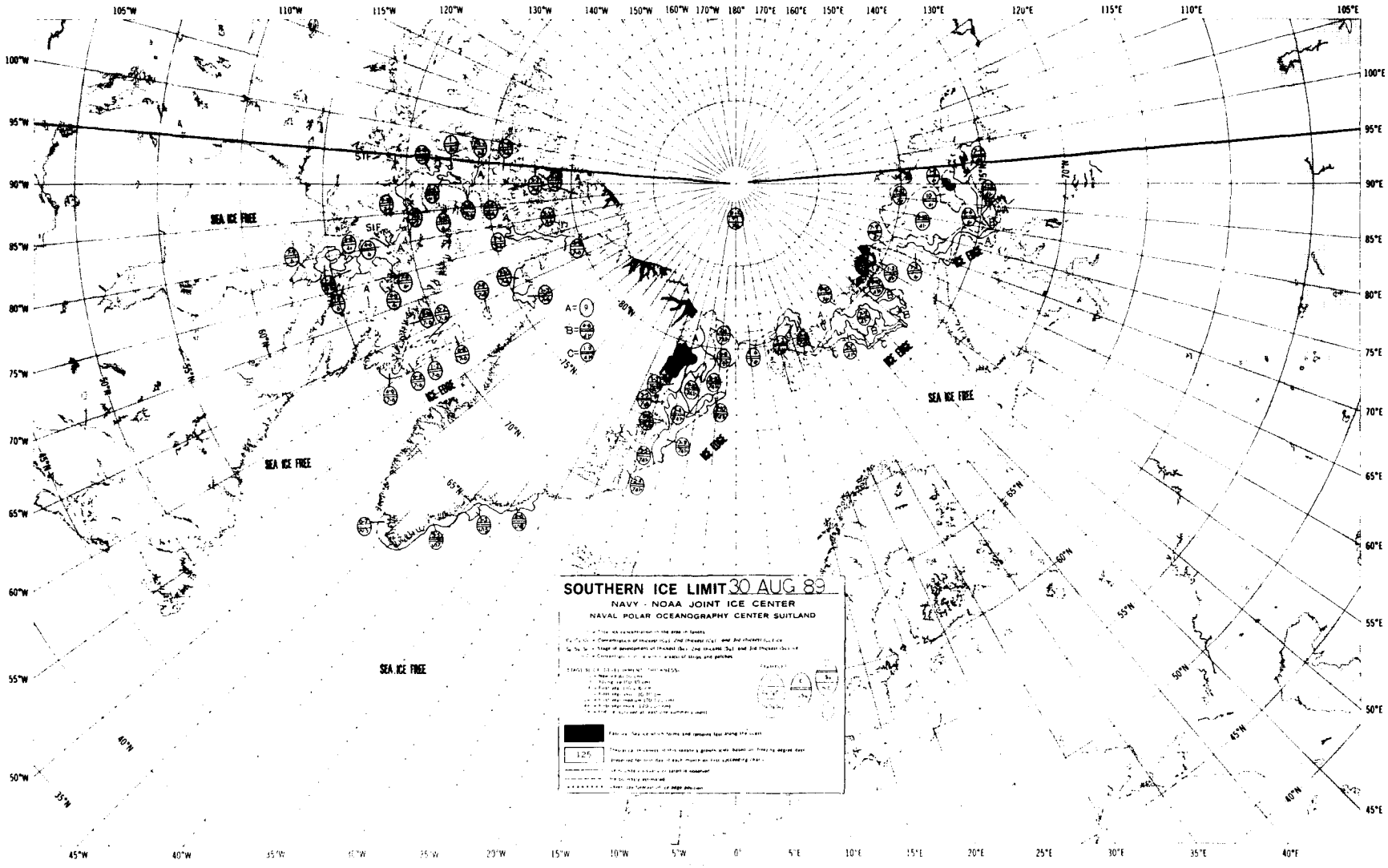

SOUTHERN ICE LIMIT 16 AUG 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SEA ICE FREE
ICE EDGE
SIF
EXAMPLES
125

SOUTHERN ICE LIMIT 23 AUG 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND


SOUTHERN ICE LIMIT 30 AUG 89
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NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
STF
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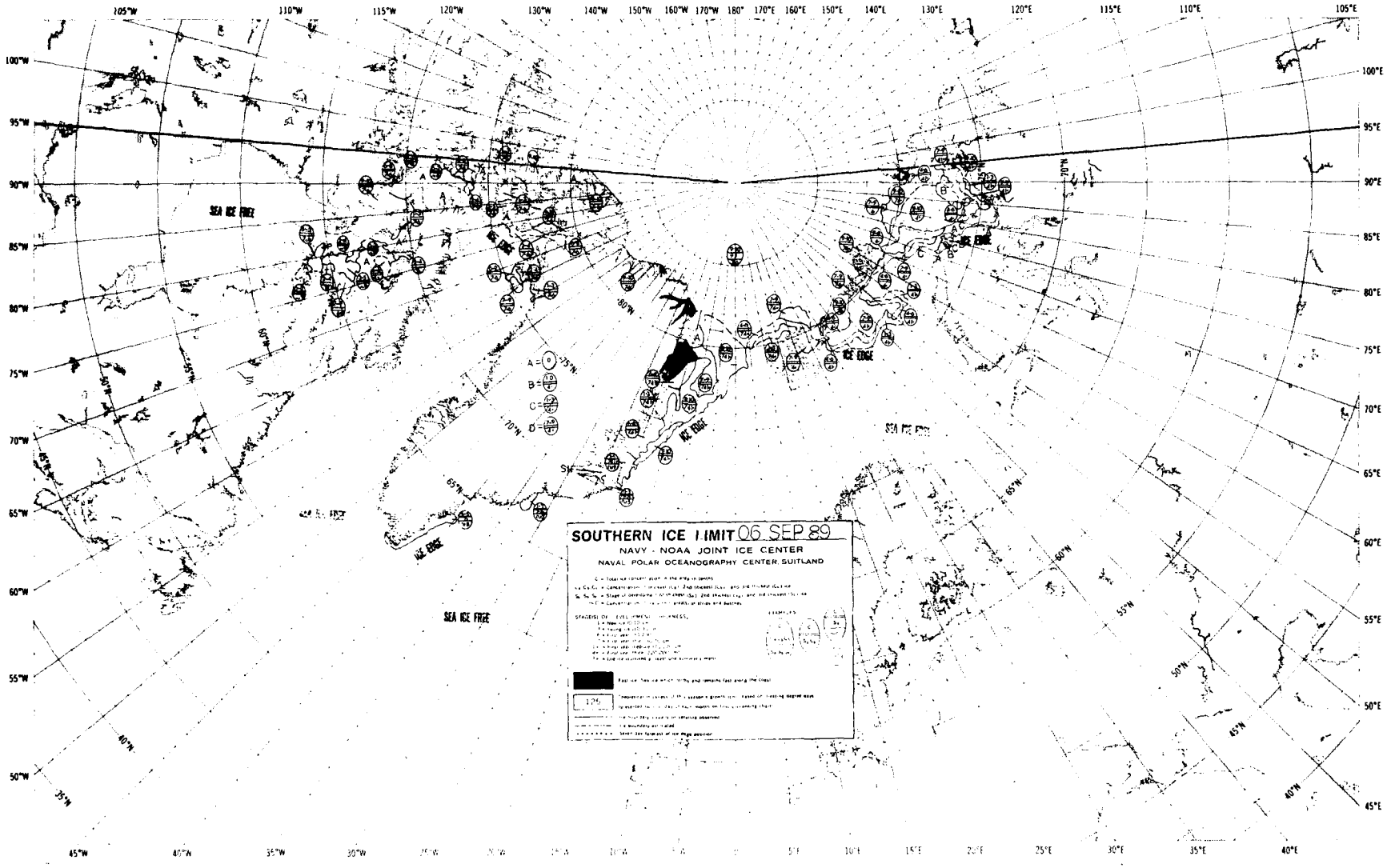
SOUTHERN ICE LIMIT 06 SEP 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
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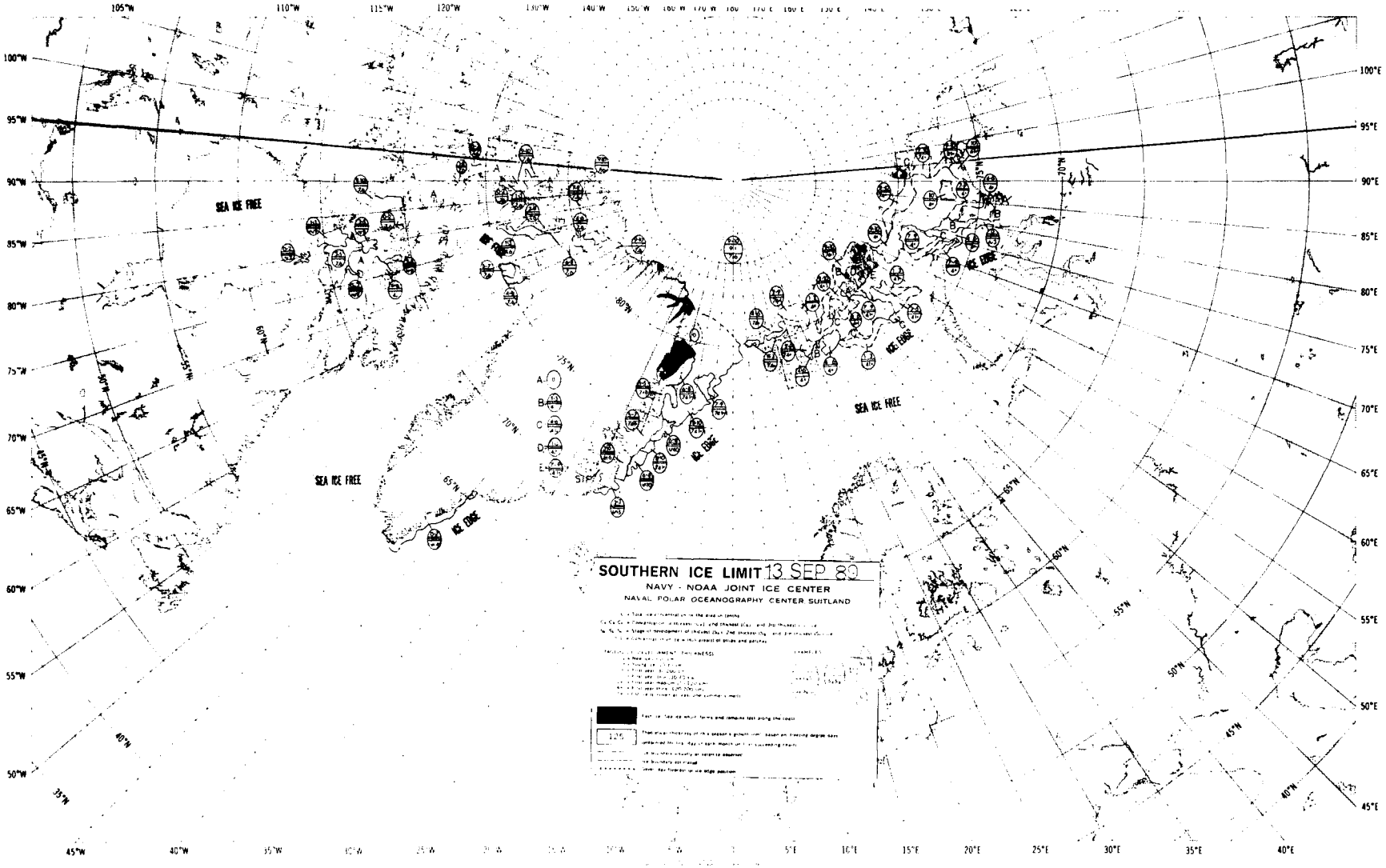
SEA ICE FREE
SEA ICE FREE
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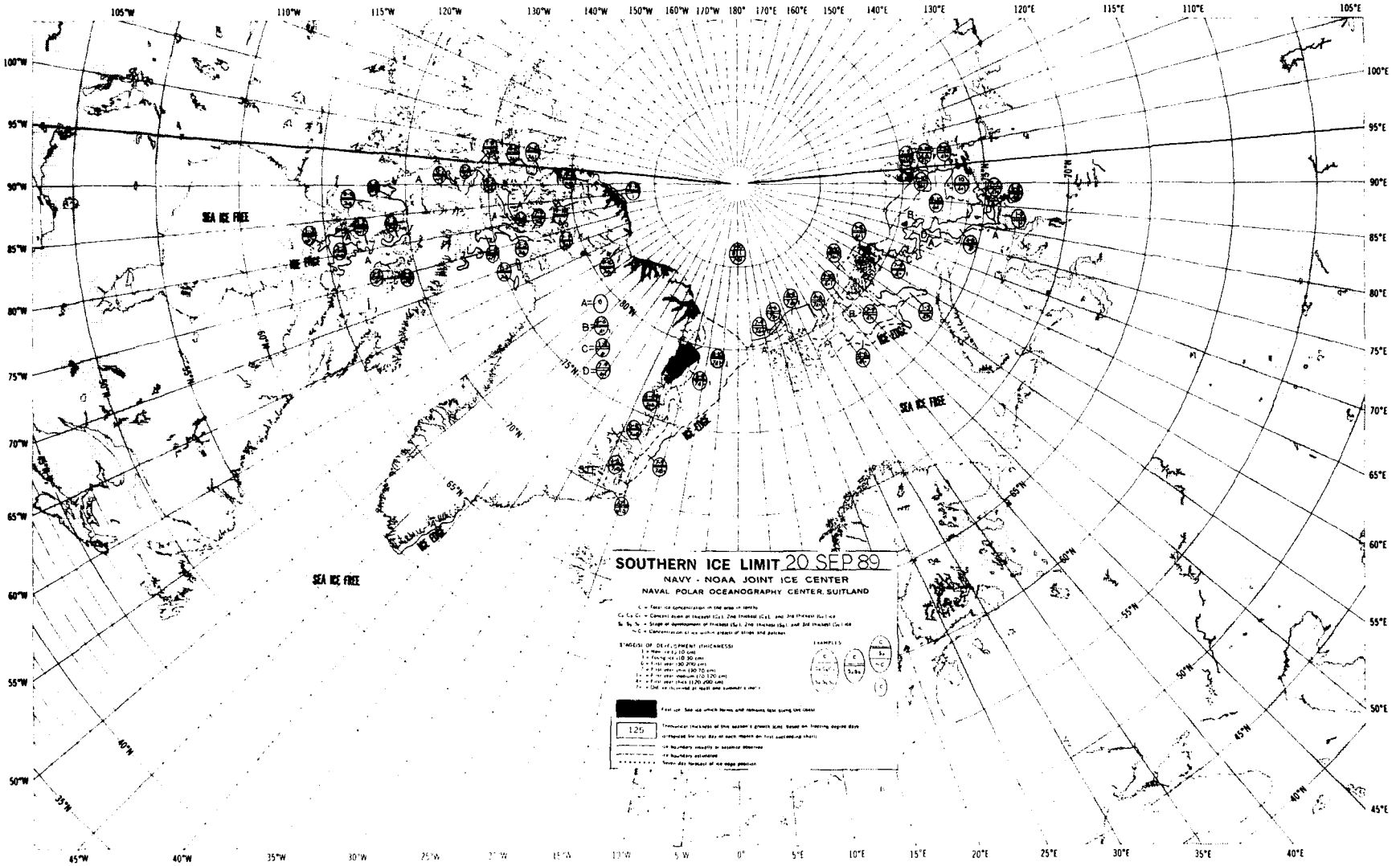
SOUTHERN ICE LIMIT 13 SEP 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND


SOUTHERN ICE LIMIT 20 SEP 89
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NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
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ICE EDGE
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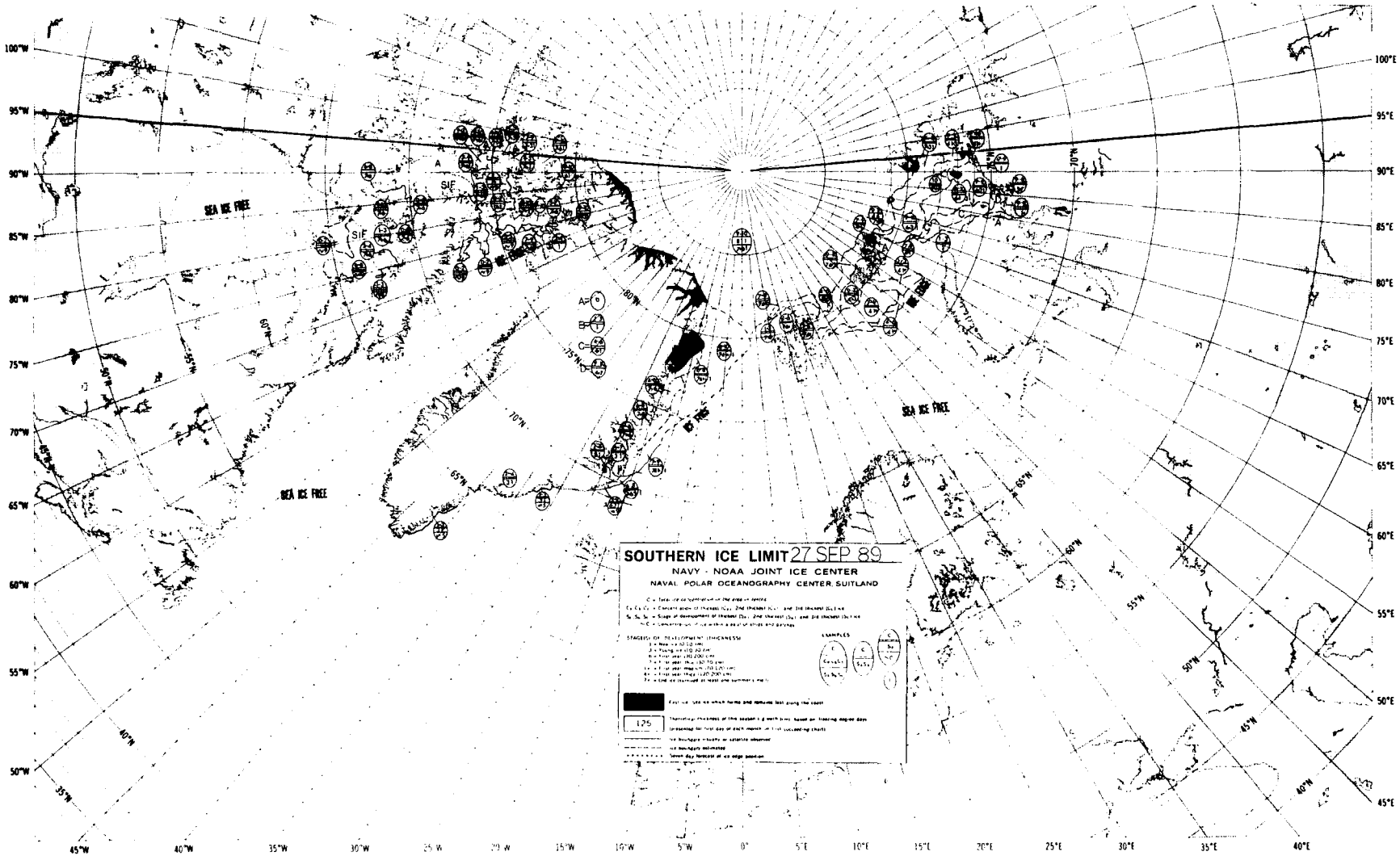
SOUTHERN ICE LIMIT 27 SEP 89
NAVY - NOAA JOINT ICE CENTER
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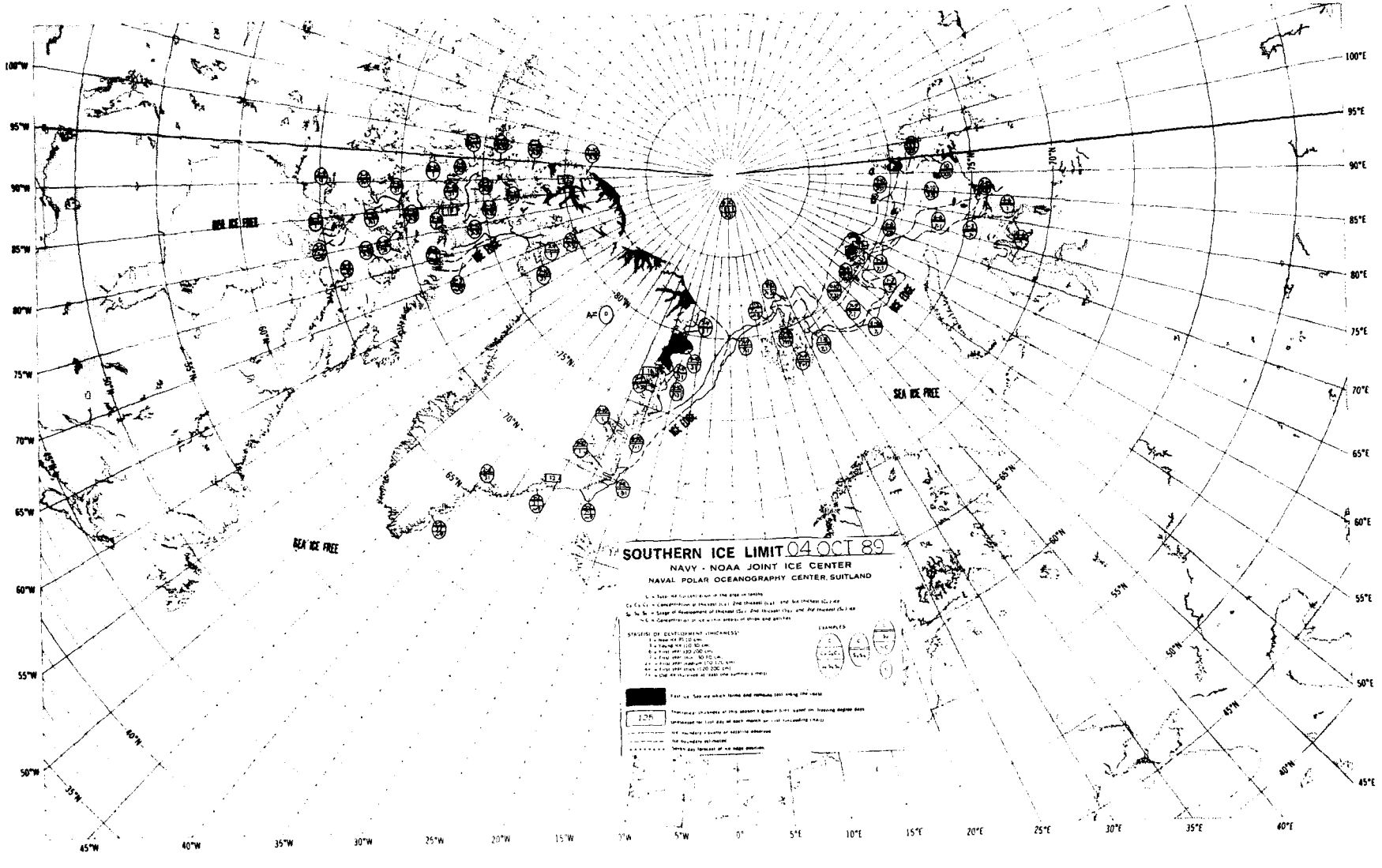
SOUTHERN ICE LIMIT 04 OCT 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
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ICE EDGE
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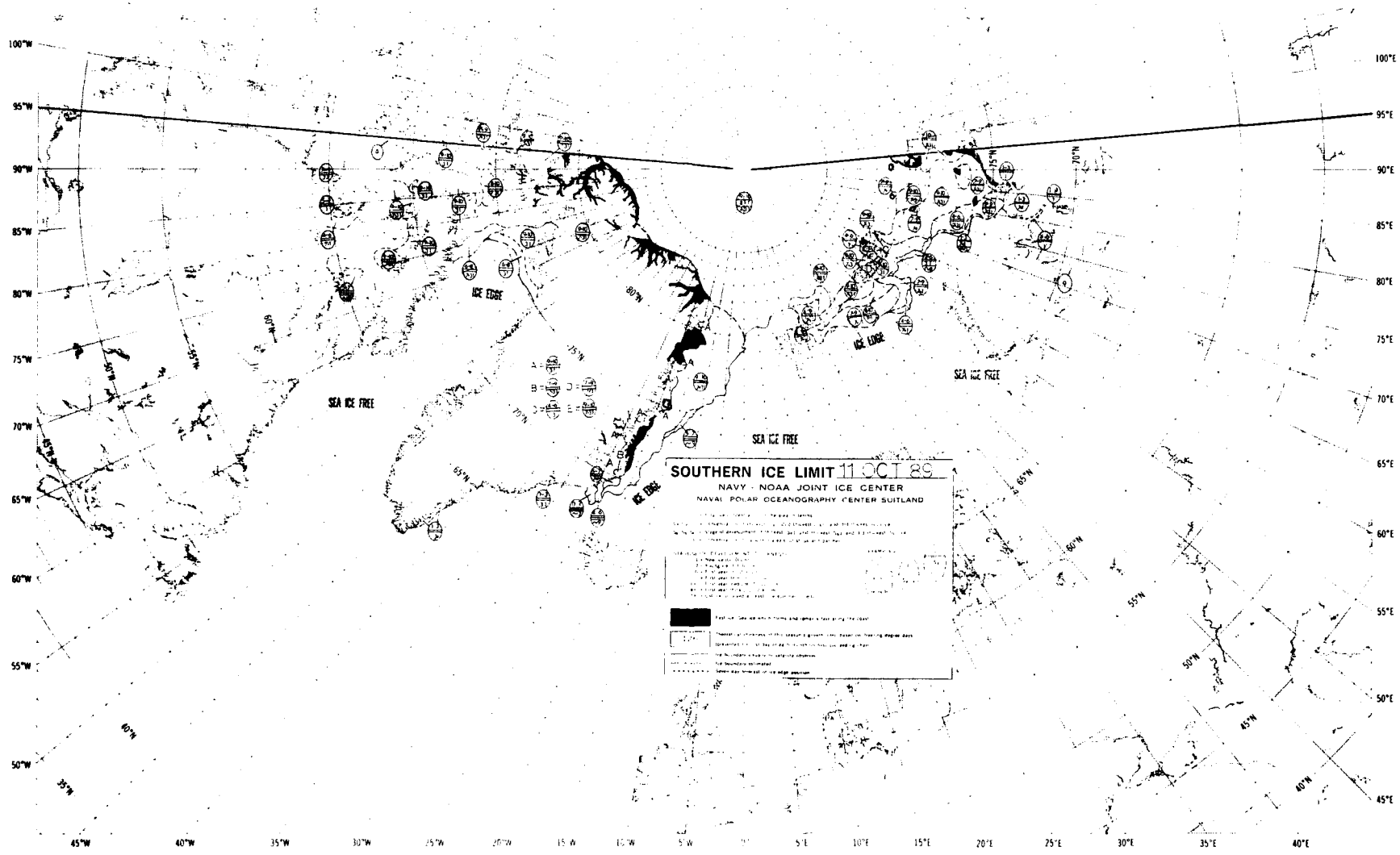
SOUTHERN ICE LIMIT 11 OCT 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
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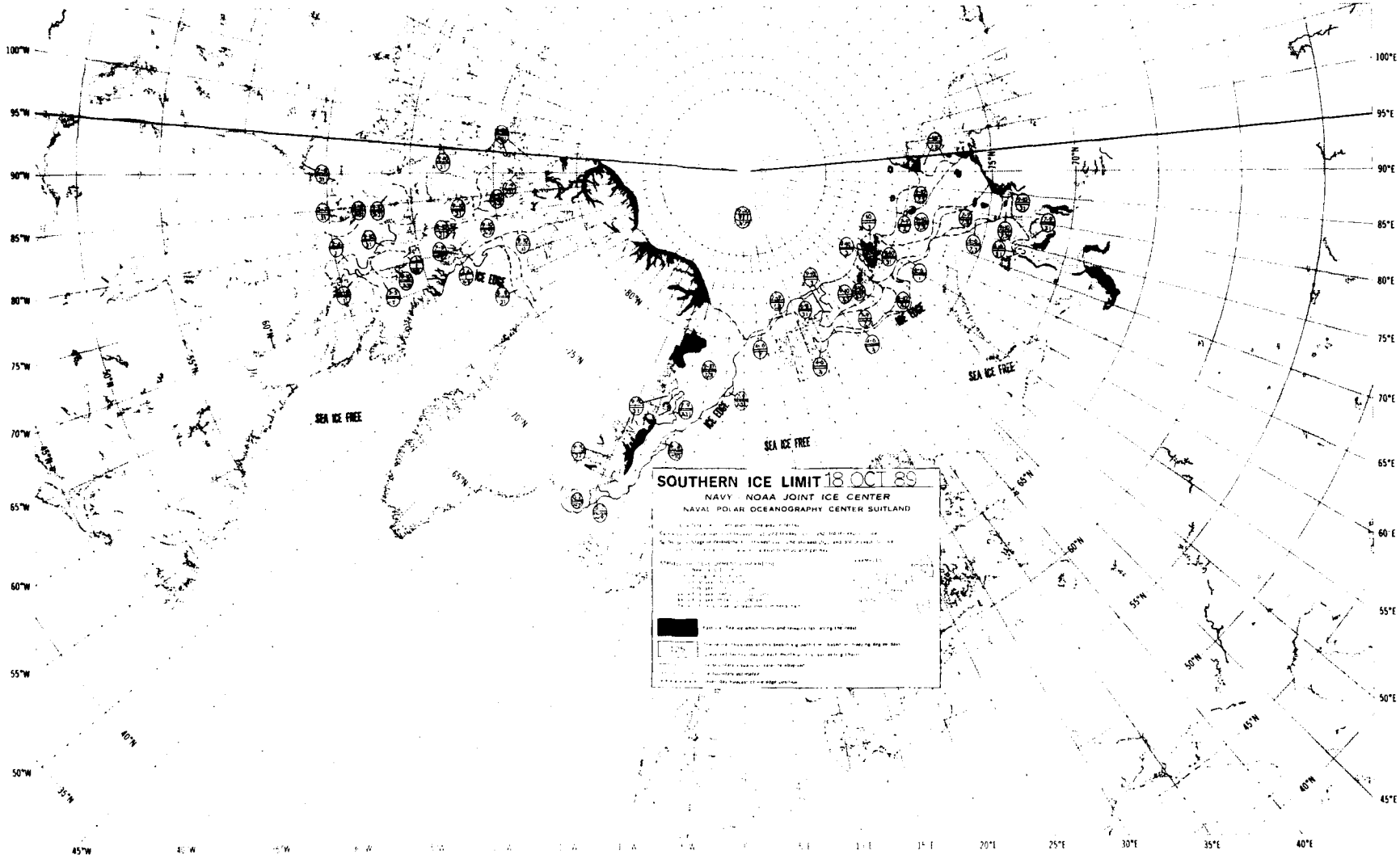
SOUTHERN ICE LIMIT 18 OCT 89
NAVY NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
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SEA ICE FREE
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ICE EDGE
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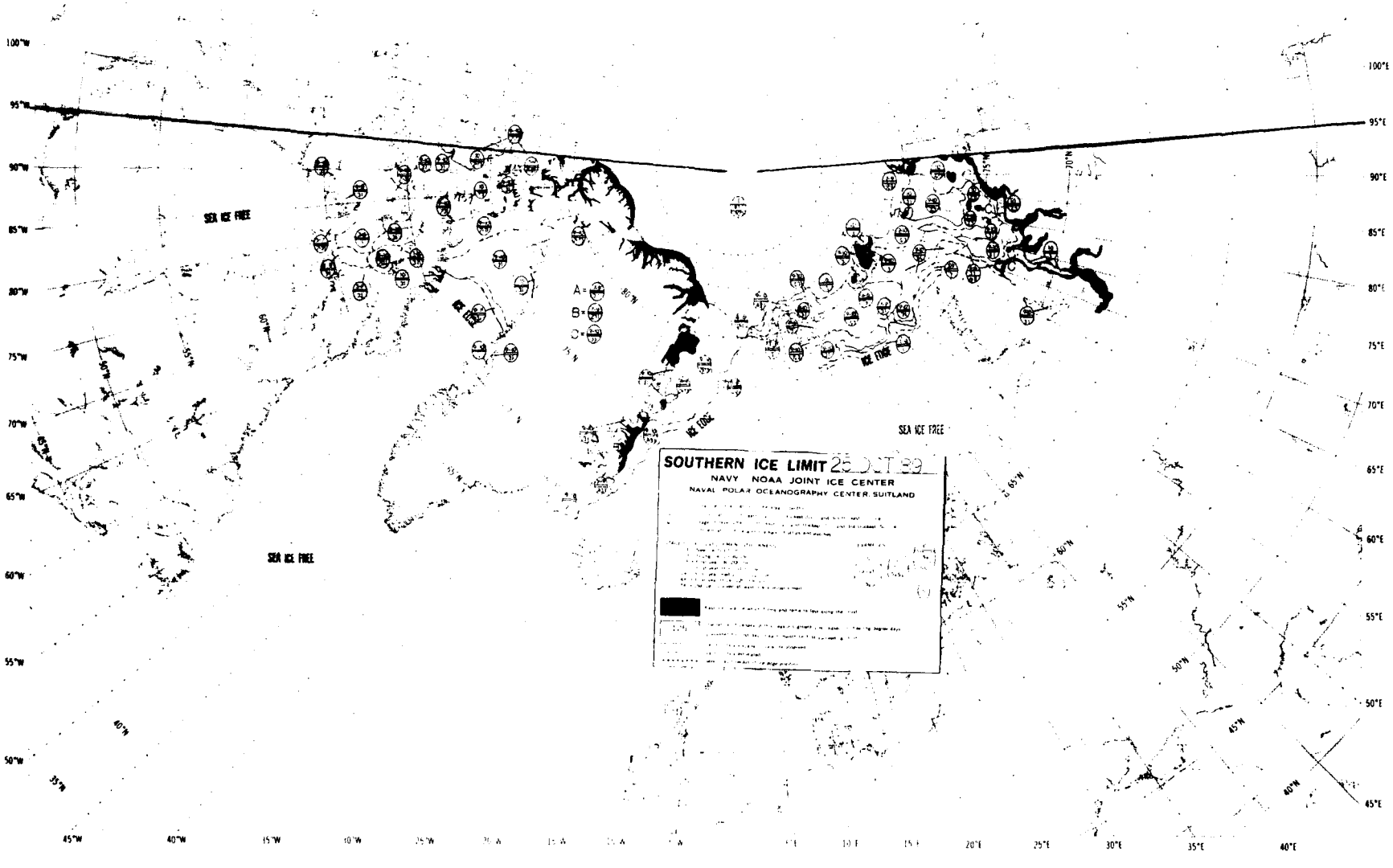
SOUTHERN ICE LIMIT 25 OCT 89
NAVY NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
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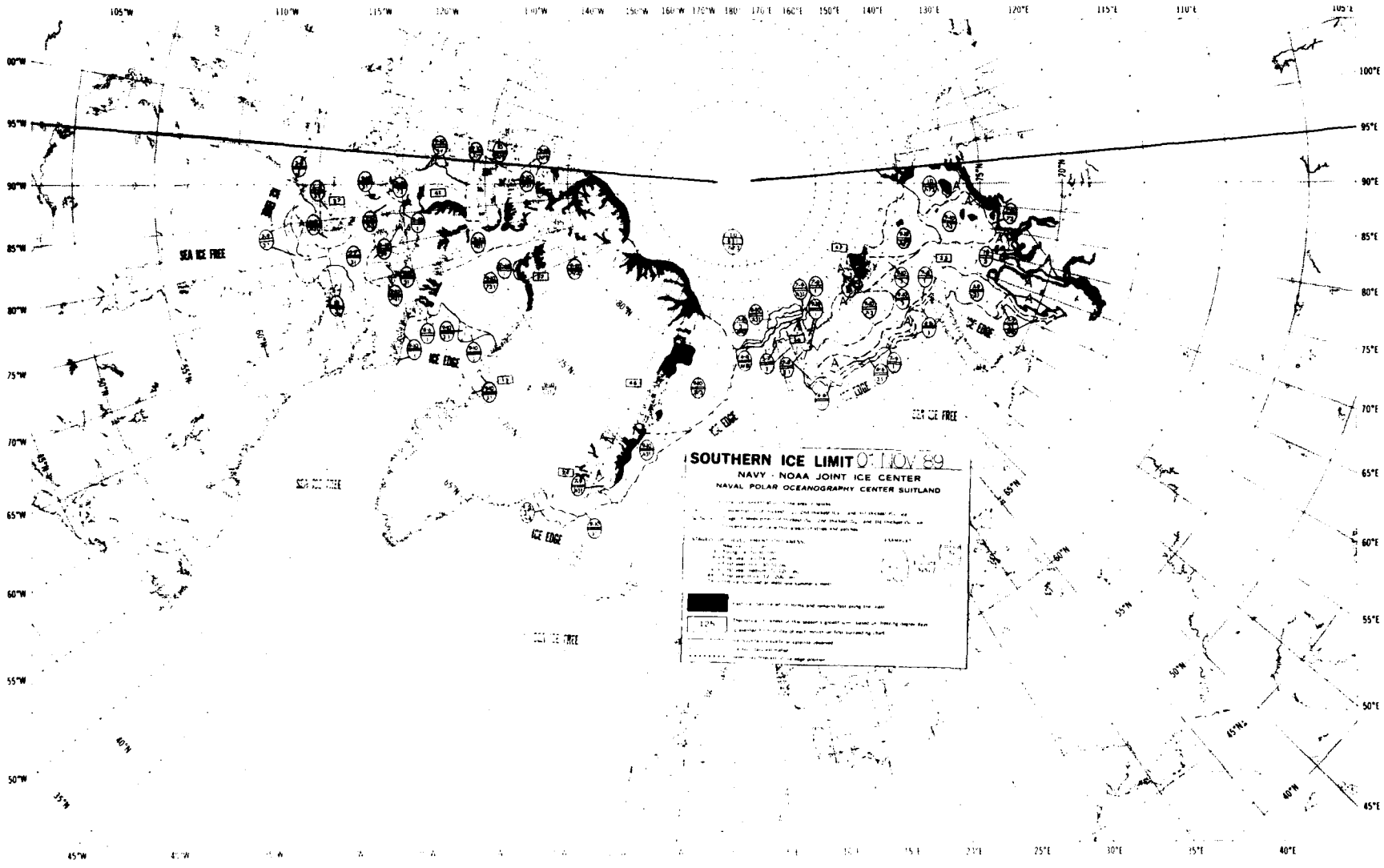
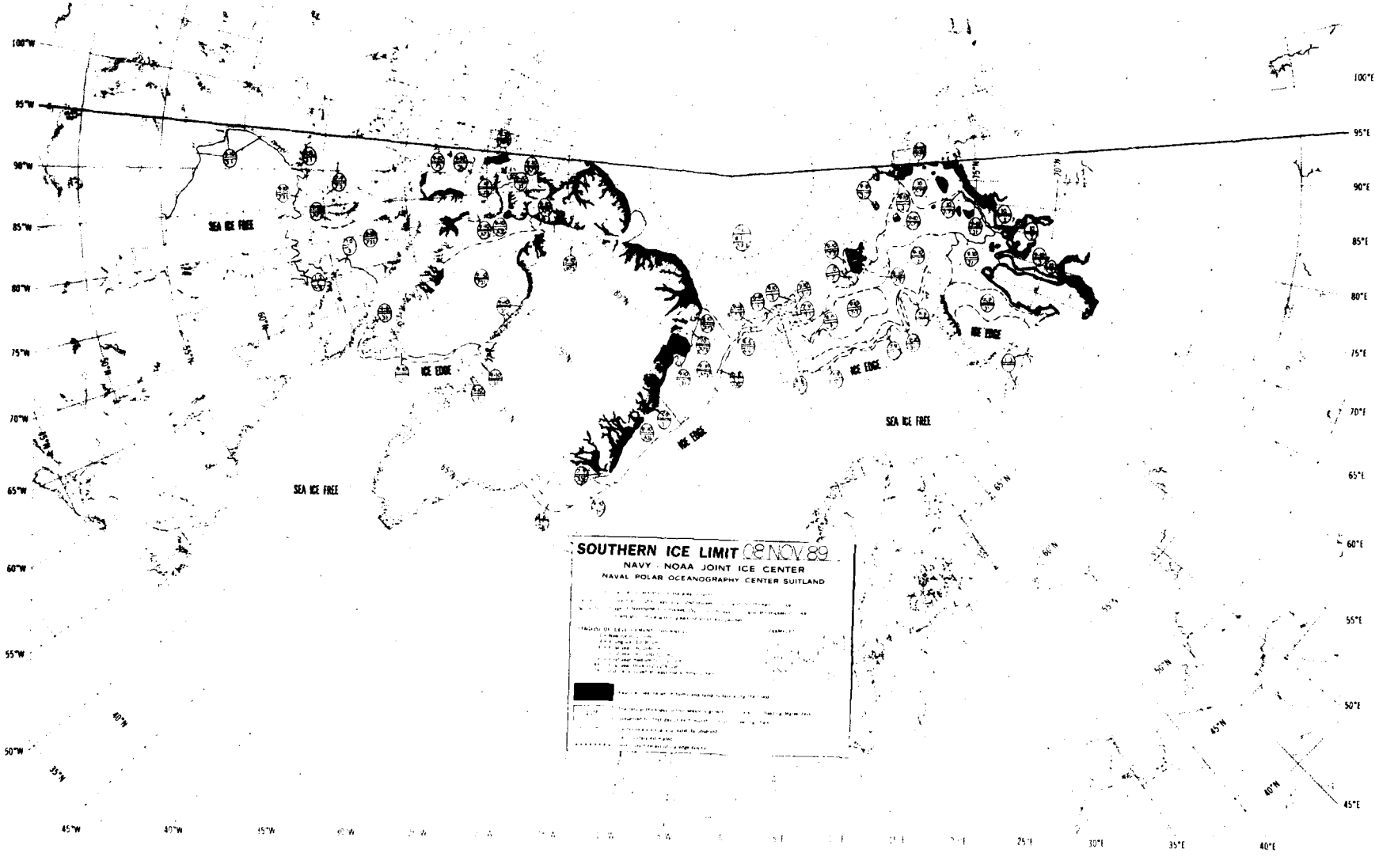

SOUTHERN ICE LIMIT 01 NOV 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
125


SOUTHERN ICE LIMIT 08 NOV 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
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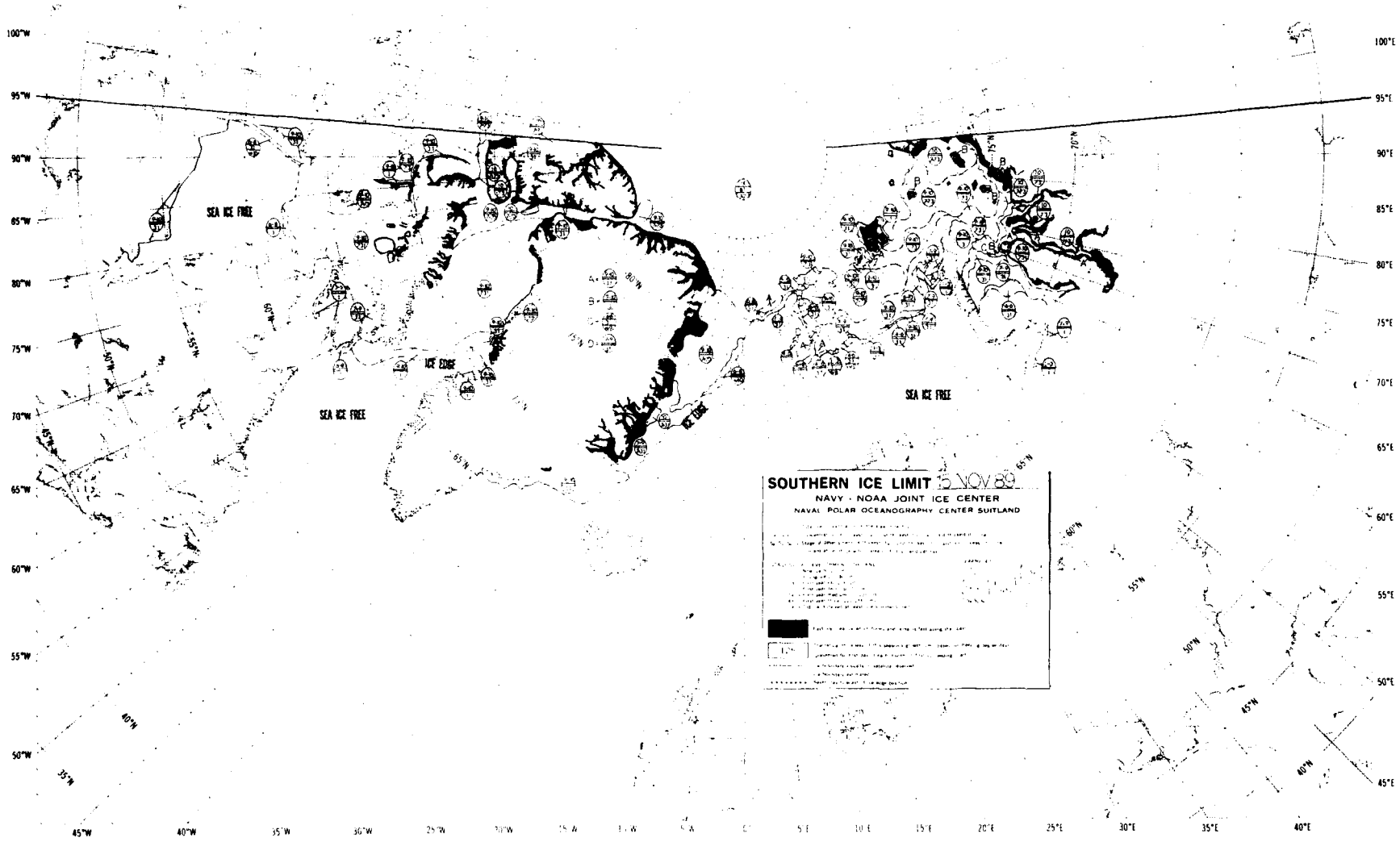
SOUTHERN ICE LIMIT 15 NOV 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
ICE EDGE
100°W
95°W
90°W
85°W
80°W
75°W
70°W
65°W
60°W
55°W
50°W
45°W
40°W
35°W
30°W
25°W
20°W
15°W
10°W
5°W
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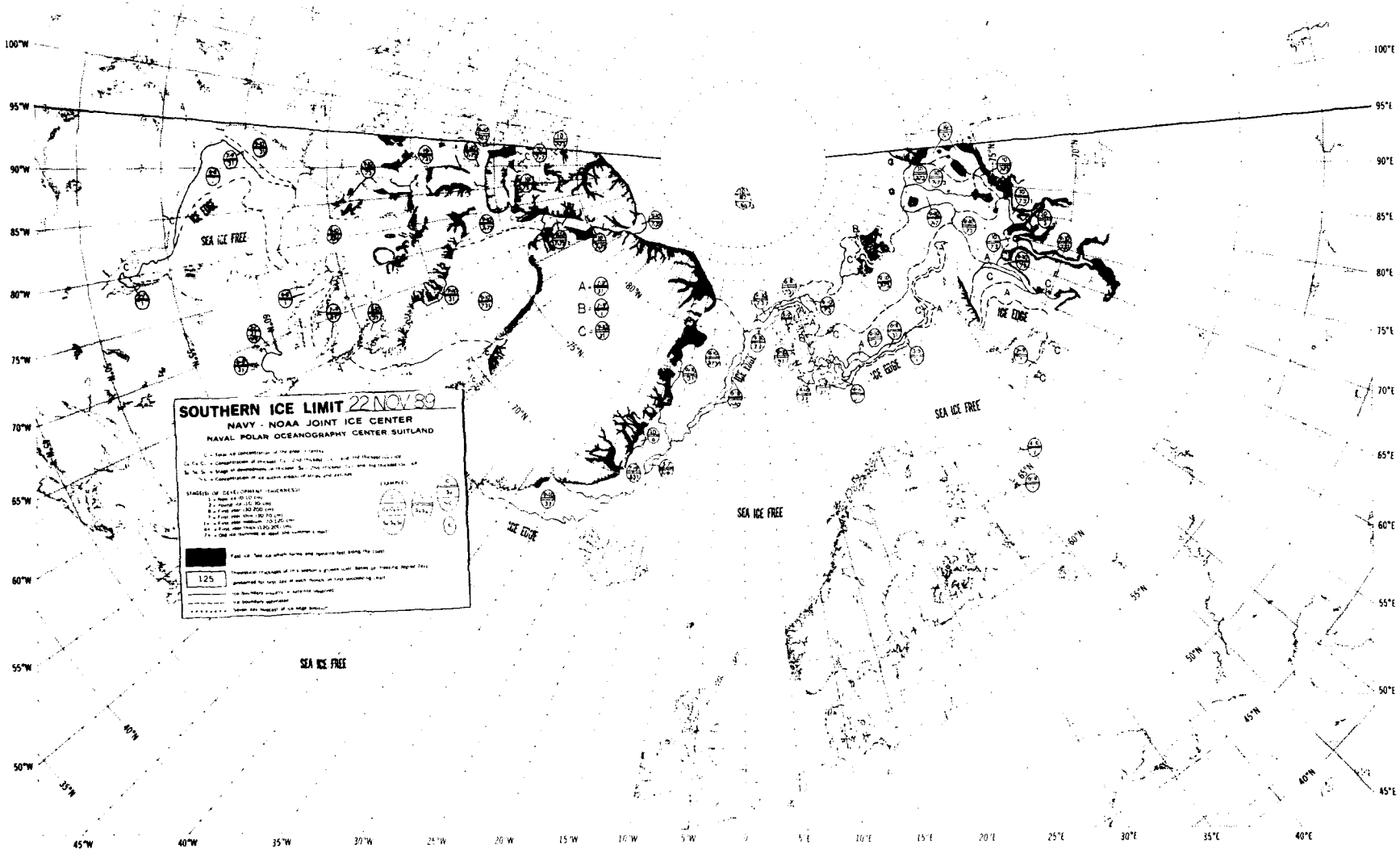
SOUTHERN ICE LIMIT 22 NOV 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
A
B
C
125
100°W
95°W
90°W
85°W
80°W
75°W
70°W
65°W
60°W
55°W
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45°W
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30°W
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10°W
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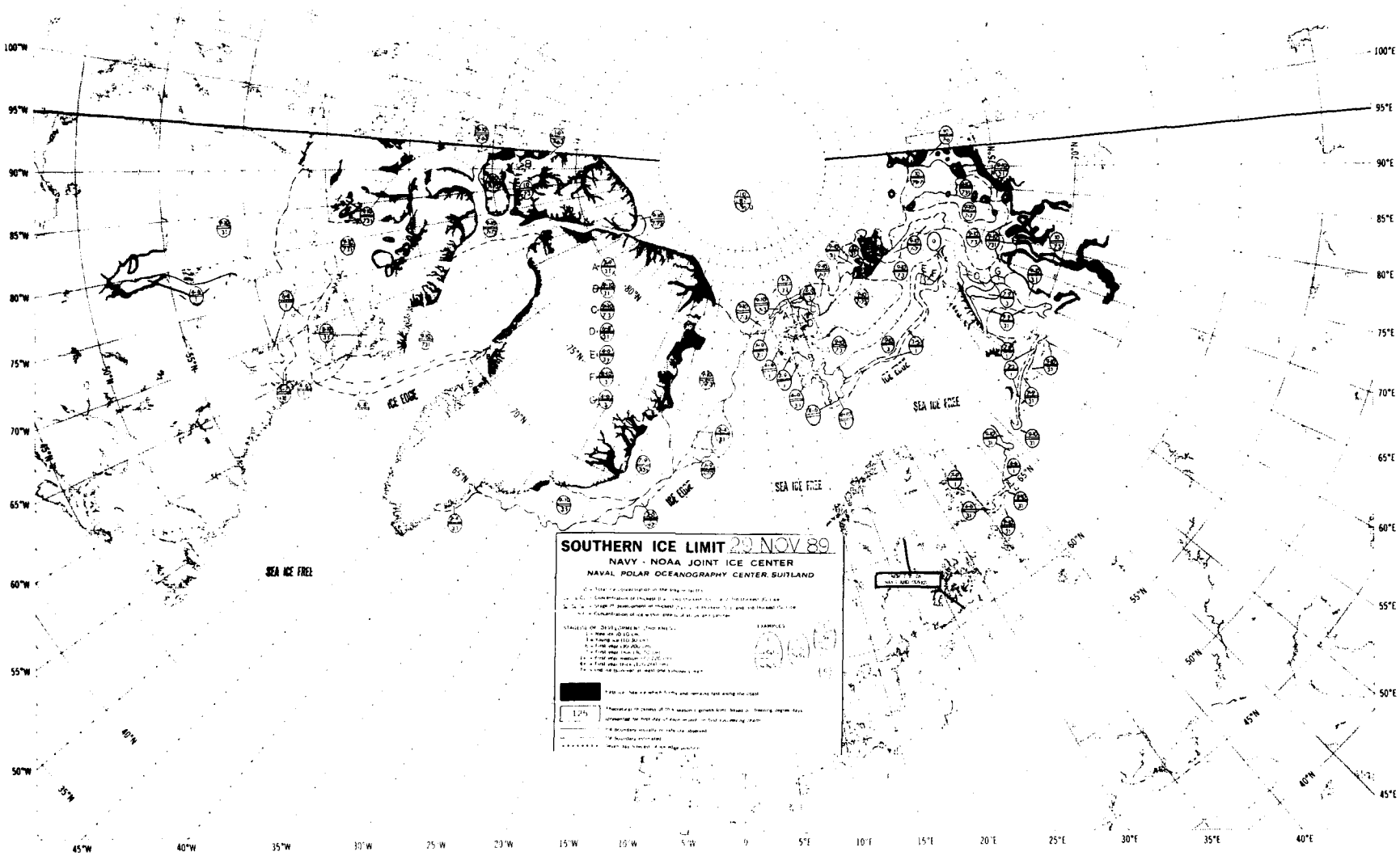
SOUTHERN ICE LIMIT 29 NOV 89
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SEA ICE FREE
ICE EDGE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
ICE EDGE
EXAMPLES
125
100°W
95°W
90°W
85°W
80°W
75°W
70°W
65°W
60°W
55°W
50°W
45°W
40°W
35°W
30°W
25°W
20°W
15°W
10°W
5°W
0
5°E
10°E
15°E
20°E
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30°E
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40°E
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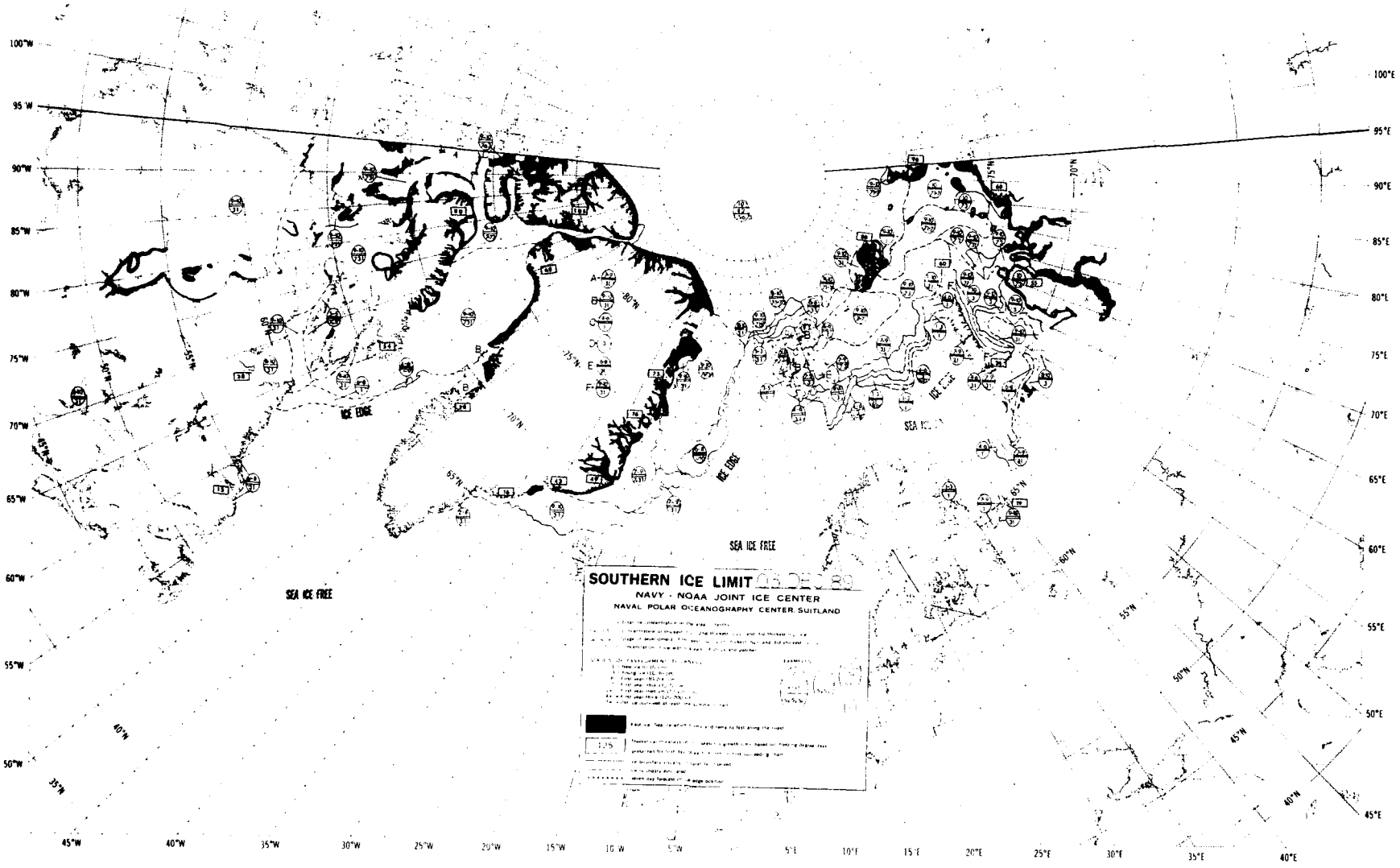
SOUTHERN ICE LIMIT
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SEA ICE FREE
ICE EDGE
100°W
95°W
90°W
85°W
80°W
75°W
70°W
65°W
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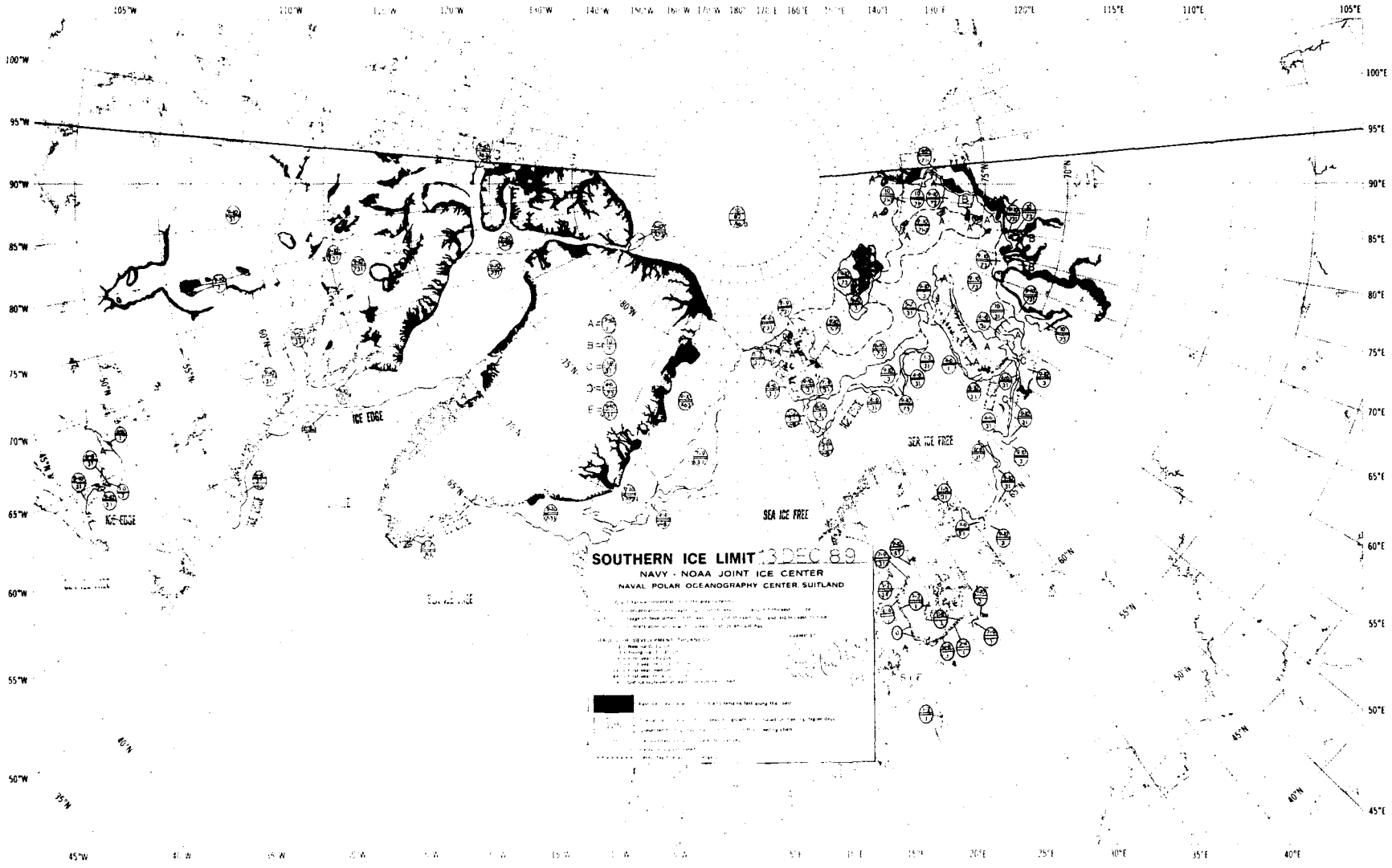
SOUTHERN ICE LIMIT 13 DEC 89
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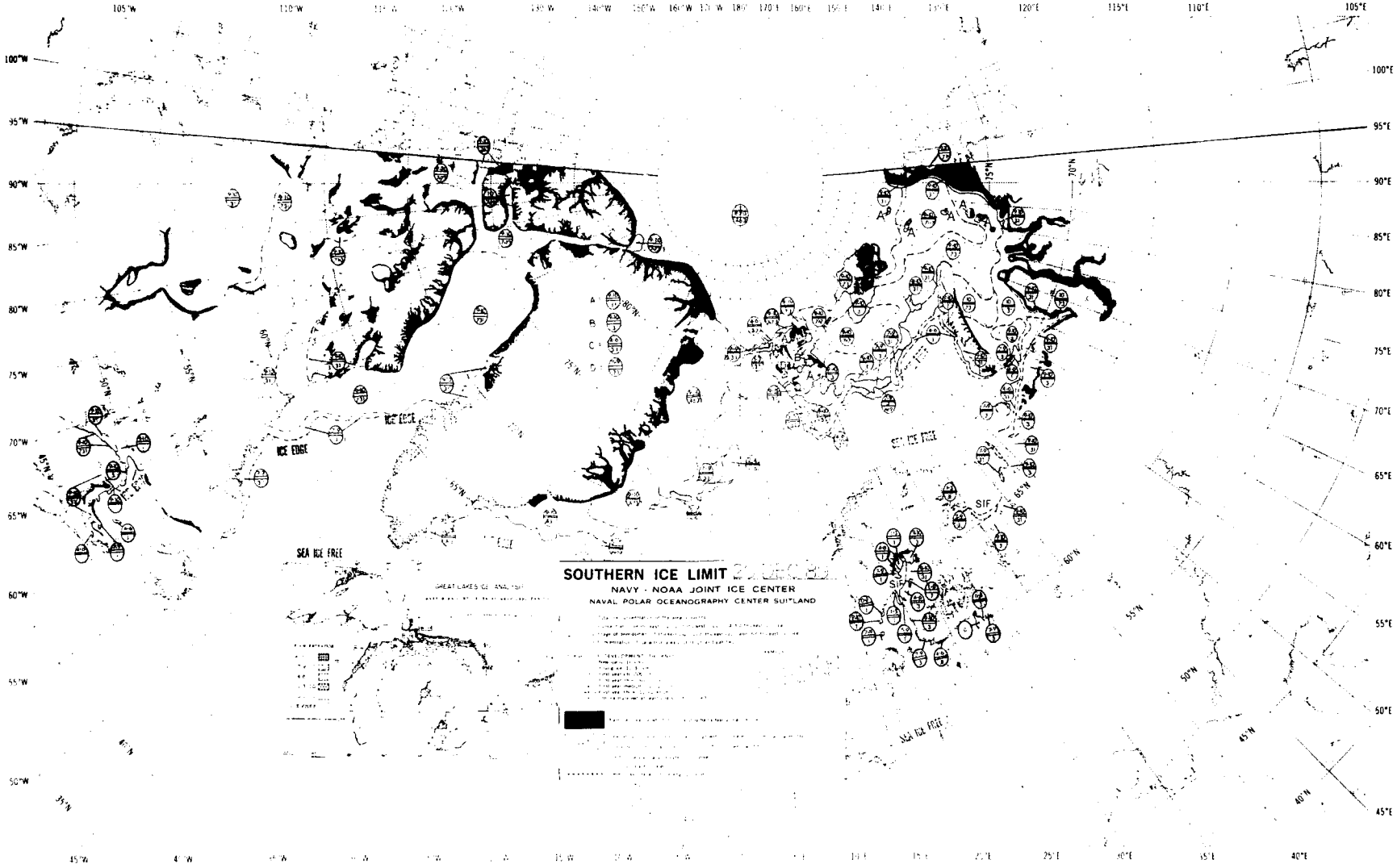
ICE EDGE
SEA ICE FREE
A=
B=
C=
D=
E=


SOUTHERN ICE LIMIT
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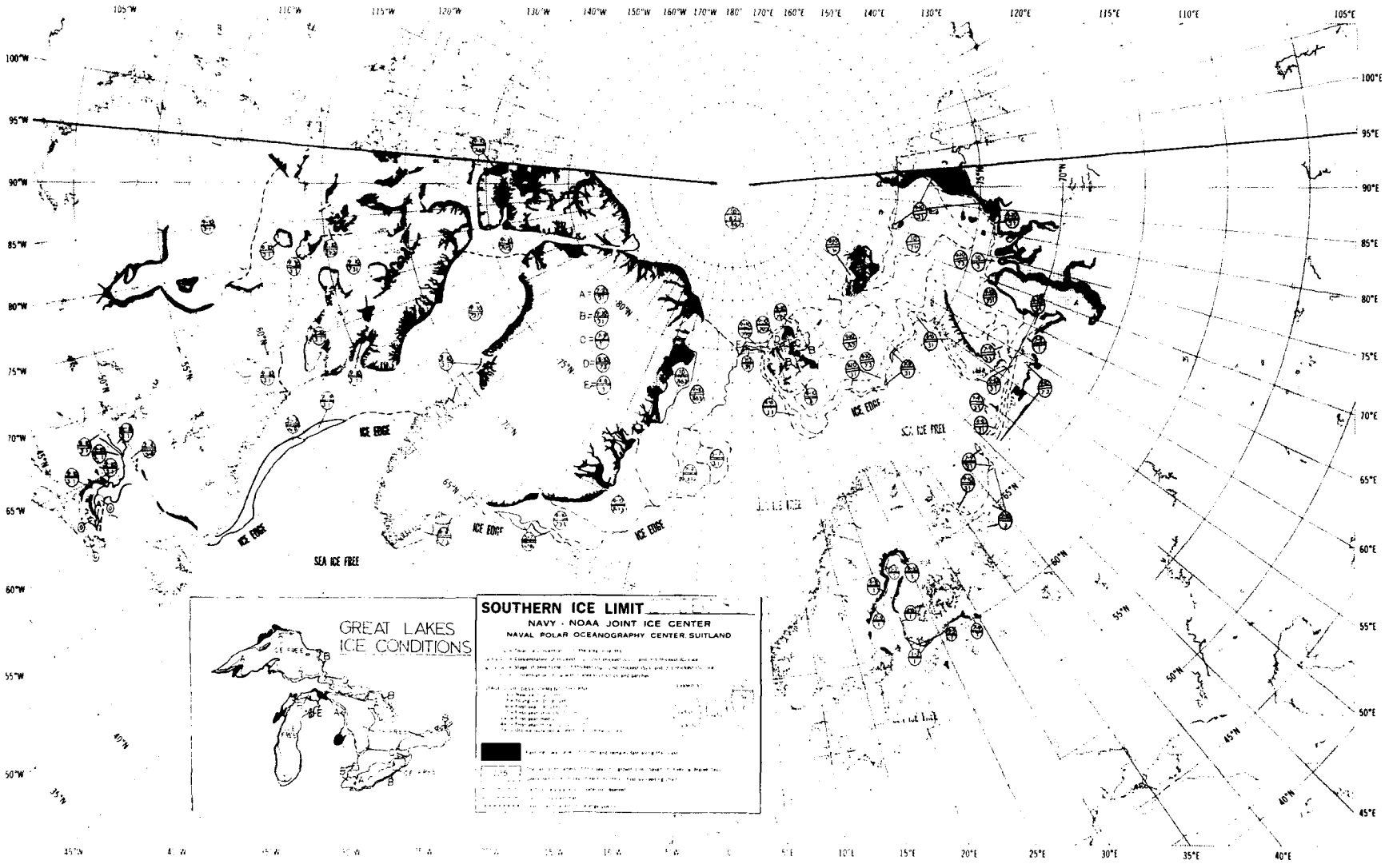
ICE EDGE
SEA ICE FREE
SIF
A
B
C
D


SOUTHERN ICE LIMIT
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
GREAT LAKES
ICE CONDITIONS
ICE EDGE
SEA ICE FREE
A =
B =
C =
D =
E =

NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT
YELLOW SEA
ICE EDGE
SEA ICE FREE
ICE EDGE
SEA ICE FREE
ICE EDGE
SEA ICE FREE
75°E
80°E
85°E
90°E
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105°E
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115°E
120°E
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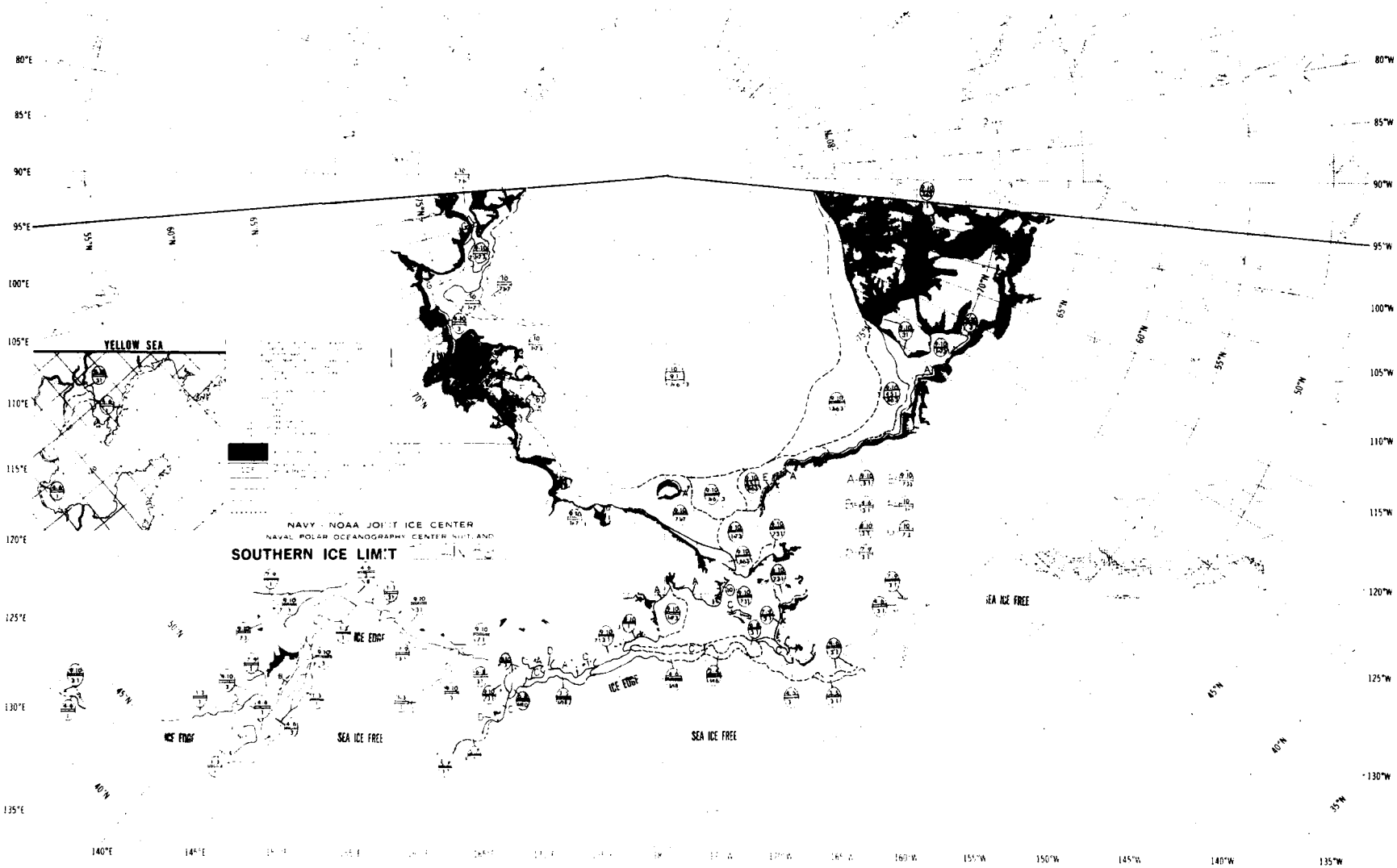

NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT
YELLOW SEA
ICE EDGE
SEA ICE FREE
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85°E
90°E
95°E
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105°E
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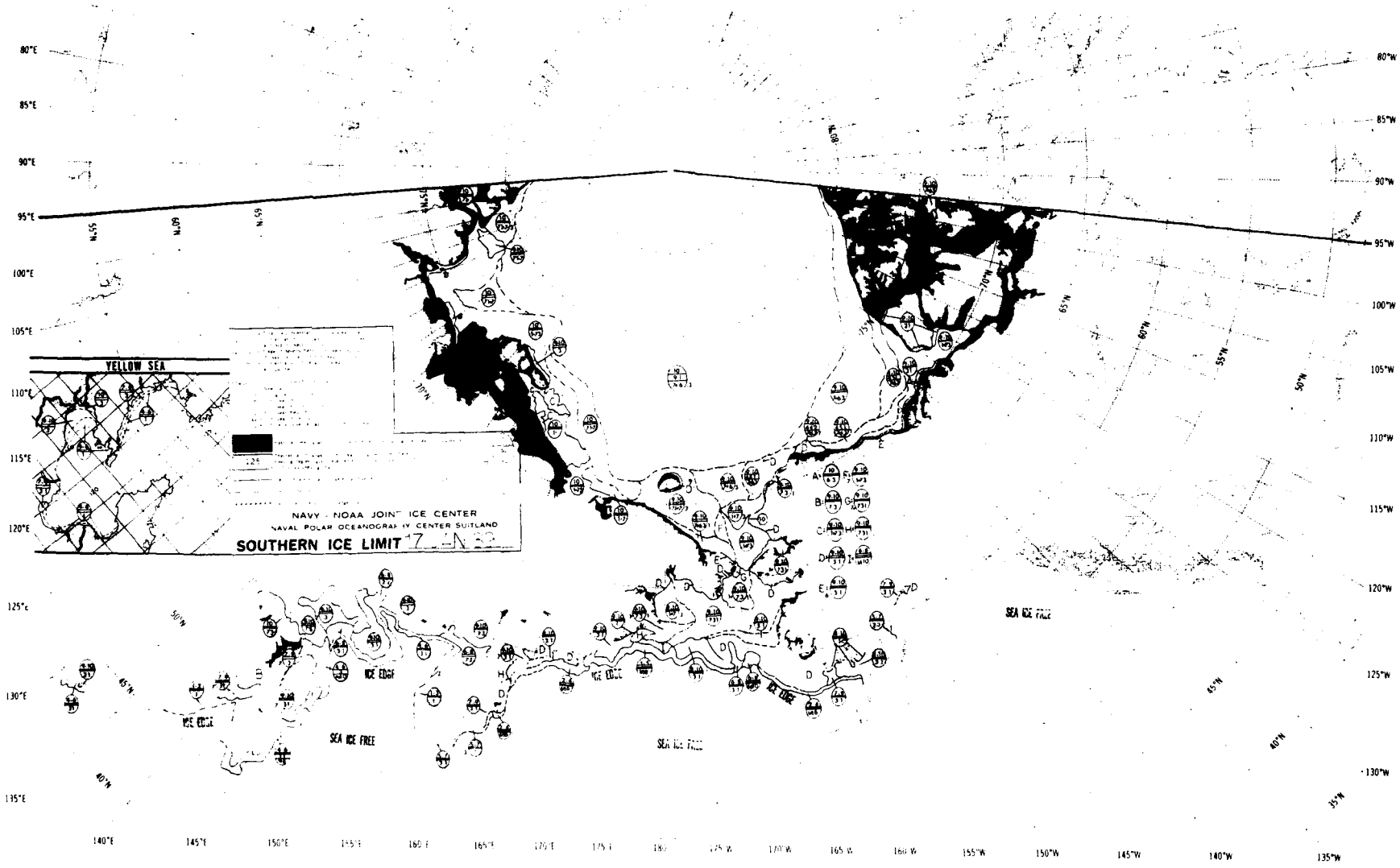
YELLOW SEA
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT
ICE EDGE
SEA ICE FREE
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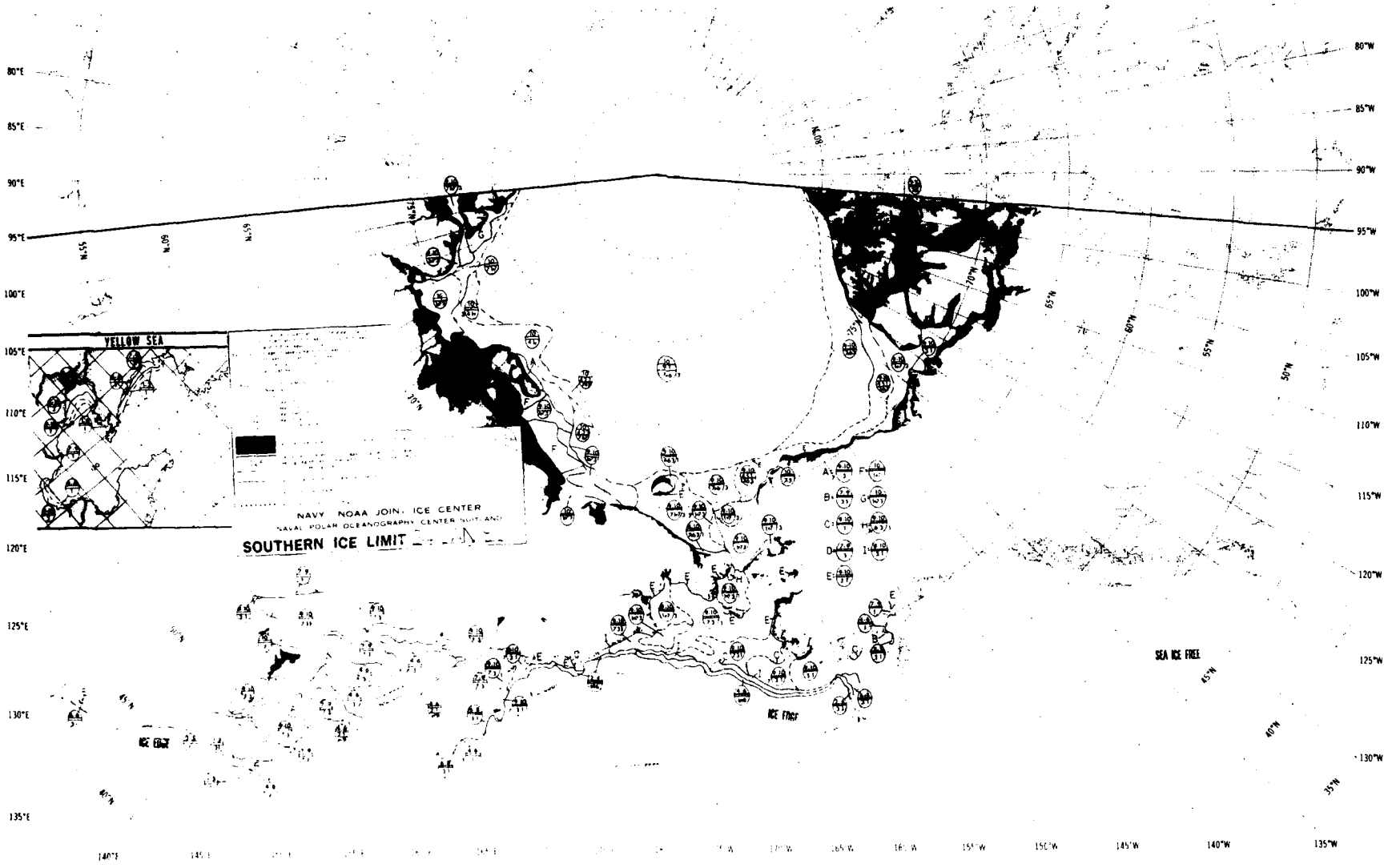
YELLOW SEA
NAVY NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT
ICE EDGE
ICE EDGE
SEA ICE FREE
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85°E
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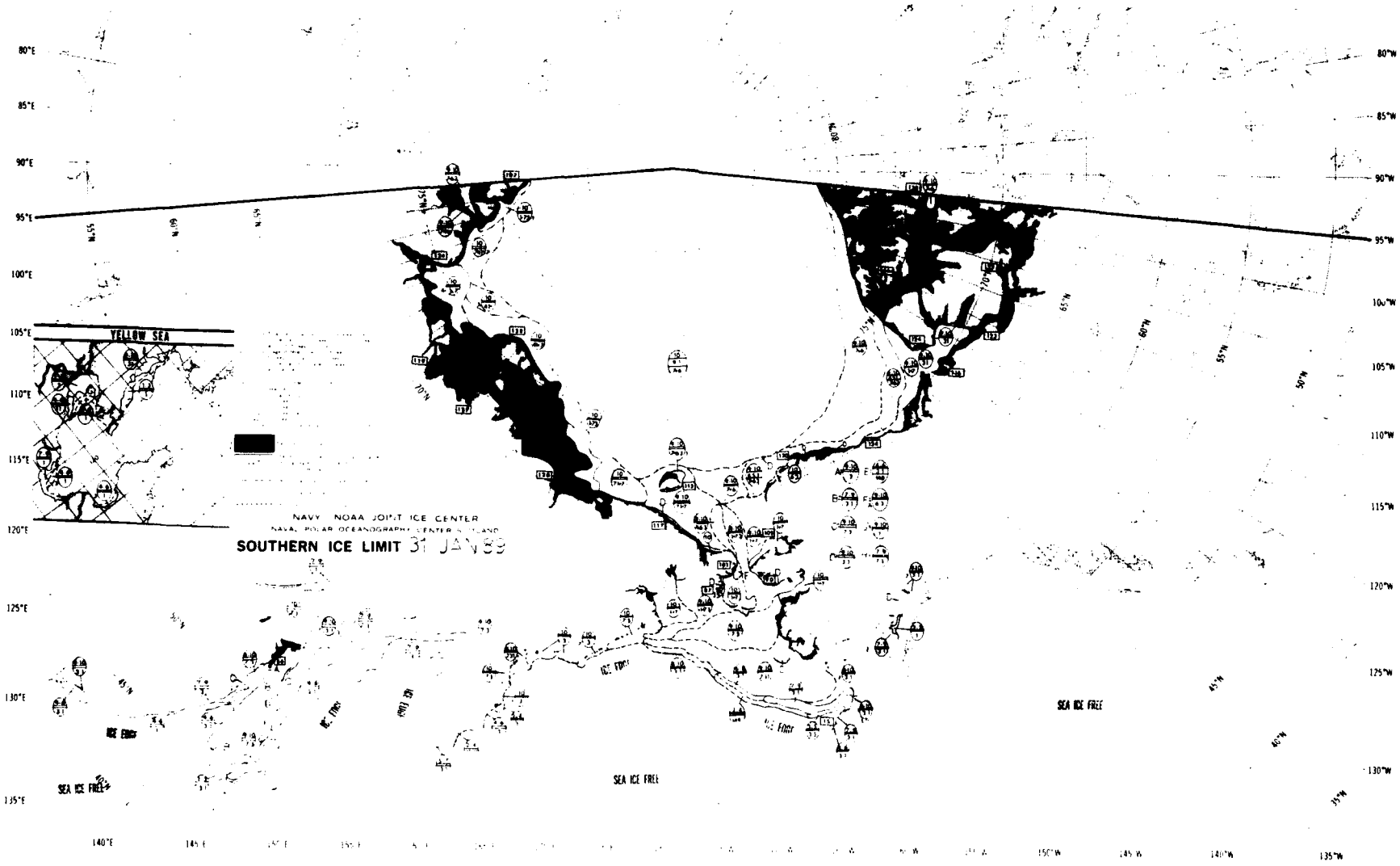
YELLOW SEA
NAVY NOAA JOINT ICE CENTER
SOUTHERN ICE LIMIT 31 JAN 89
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
ICE EDGE
ICE EDGE
80°E
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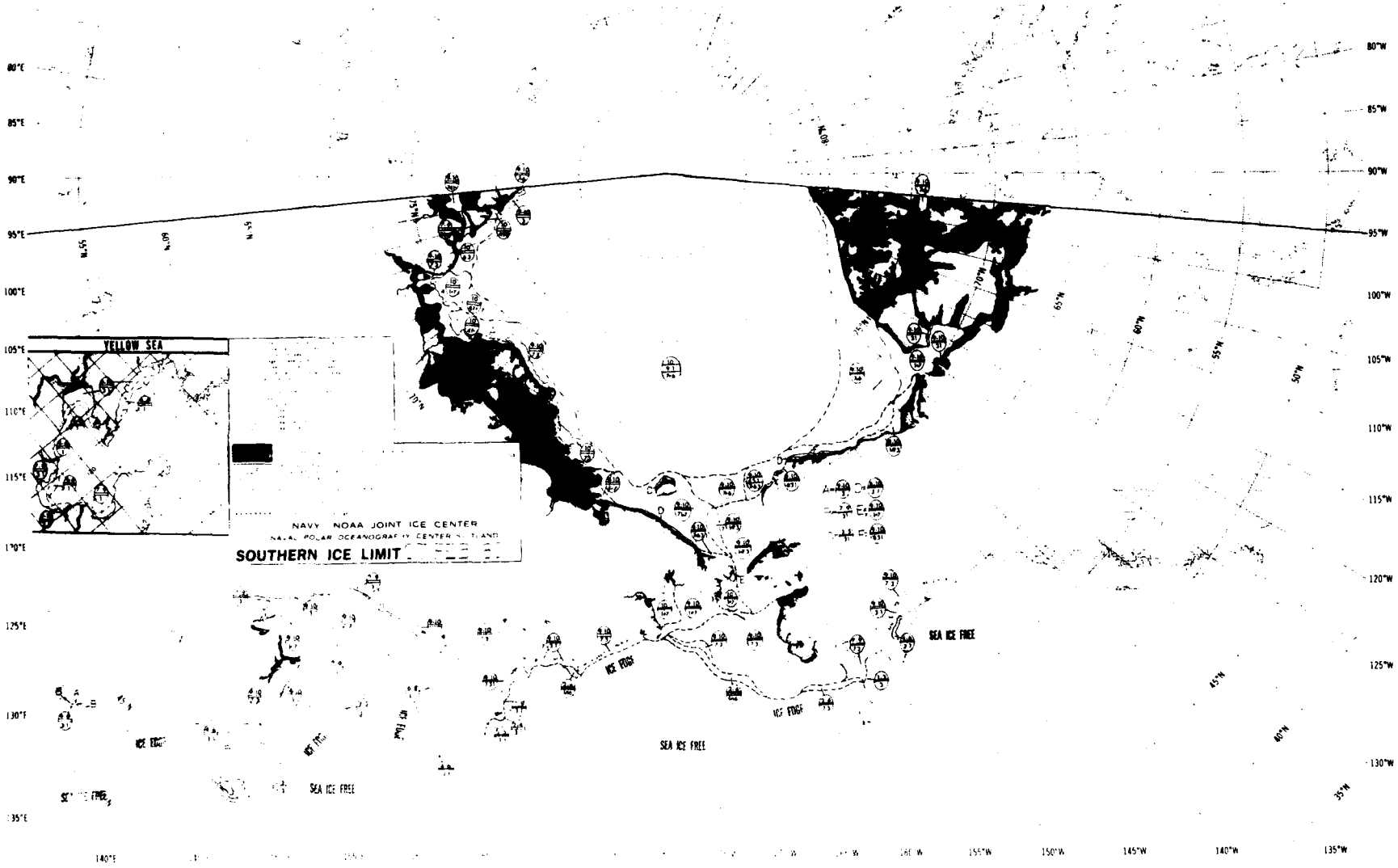
80°W


YELLOW SEA
NAVY NOAA JOINT ICE CENTER
SOUTHERN ICE LIMIT
ICE EDGE
SEA ICE FREE
80°E
85°E
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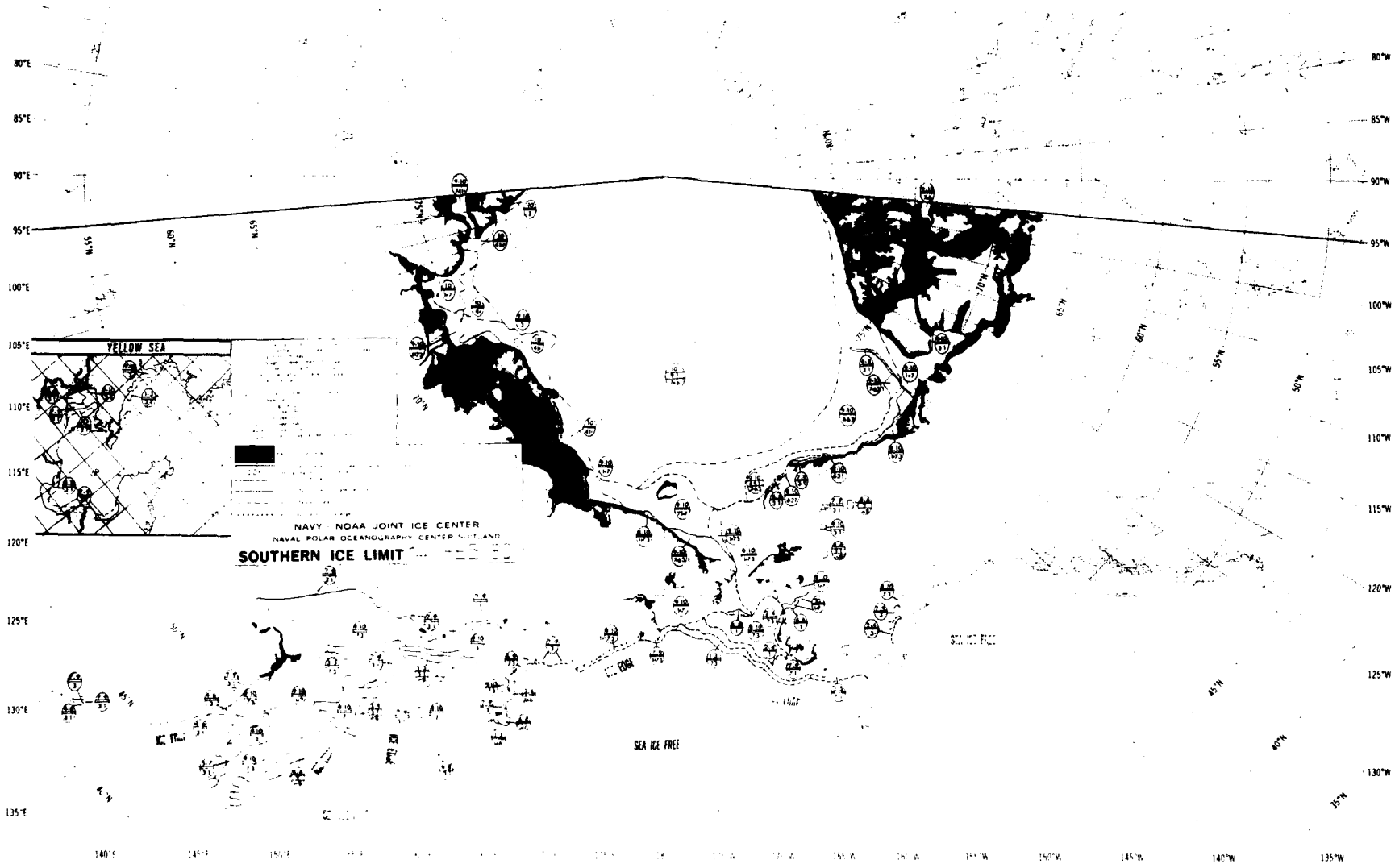
YELLOW SEA
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER
SOUTHERN ICE LIMIT
SEA ICE FREE
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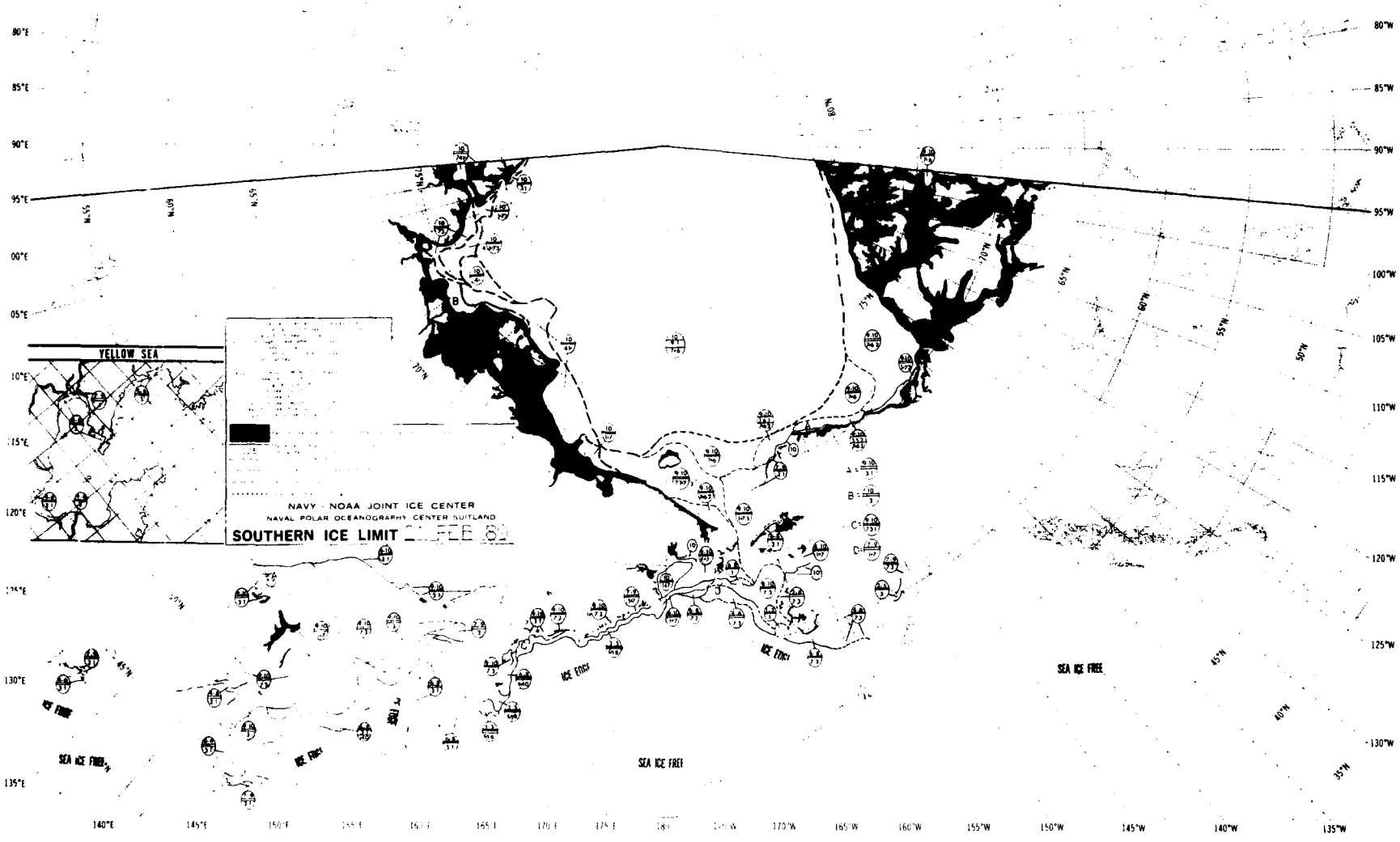
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT
YELLOW SEA
SEA ICE FREE
ICE FREE
ICE EDGE
80°E
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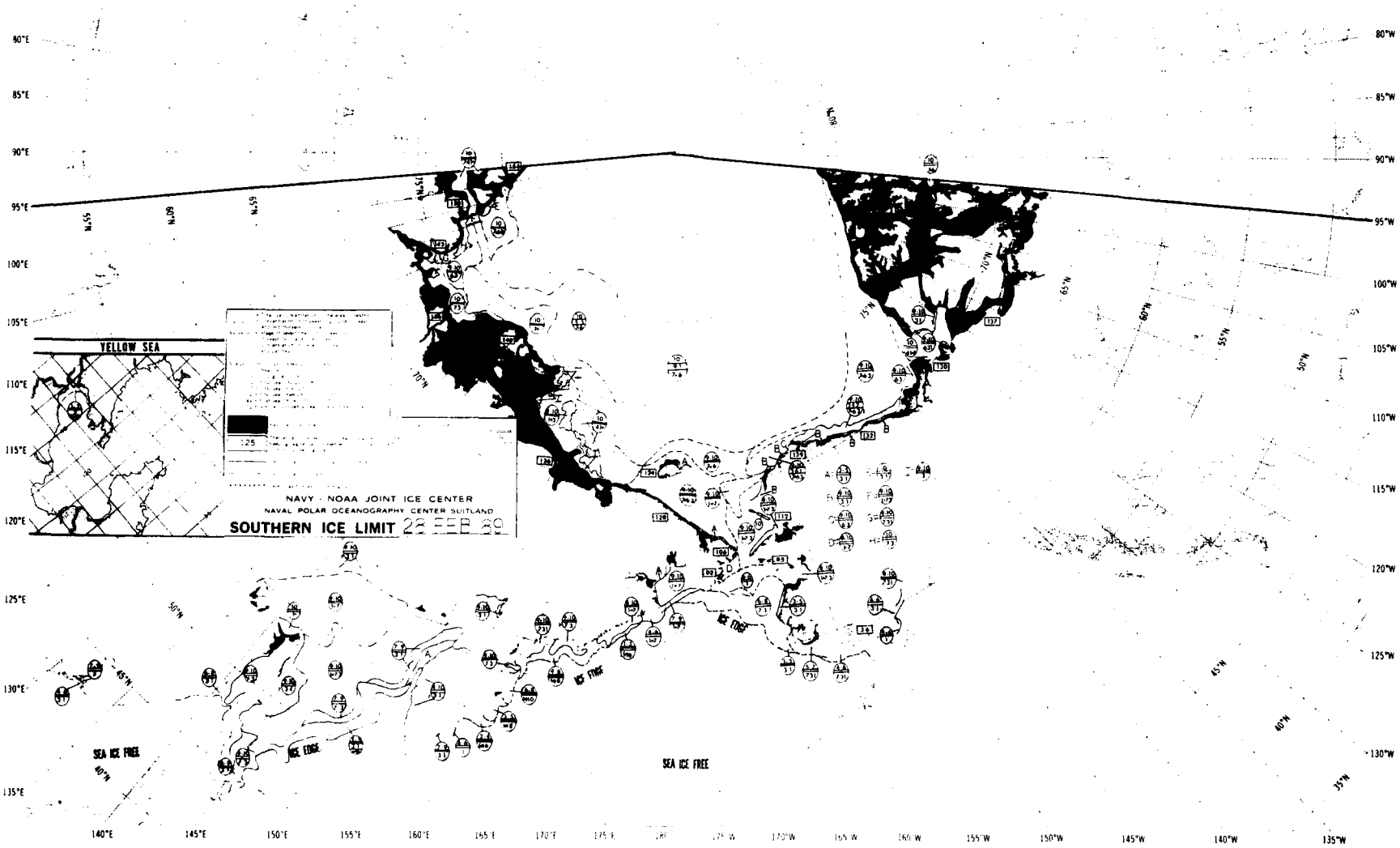

YELLOW SEA
NAVY · NOAA JOINT ICE CENTER
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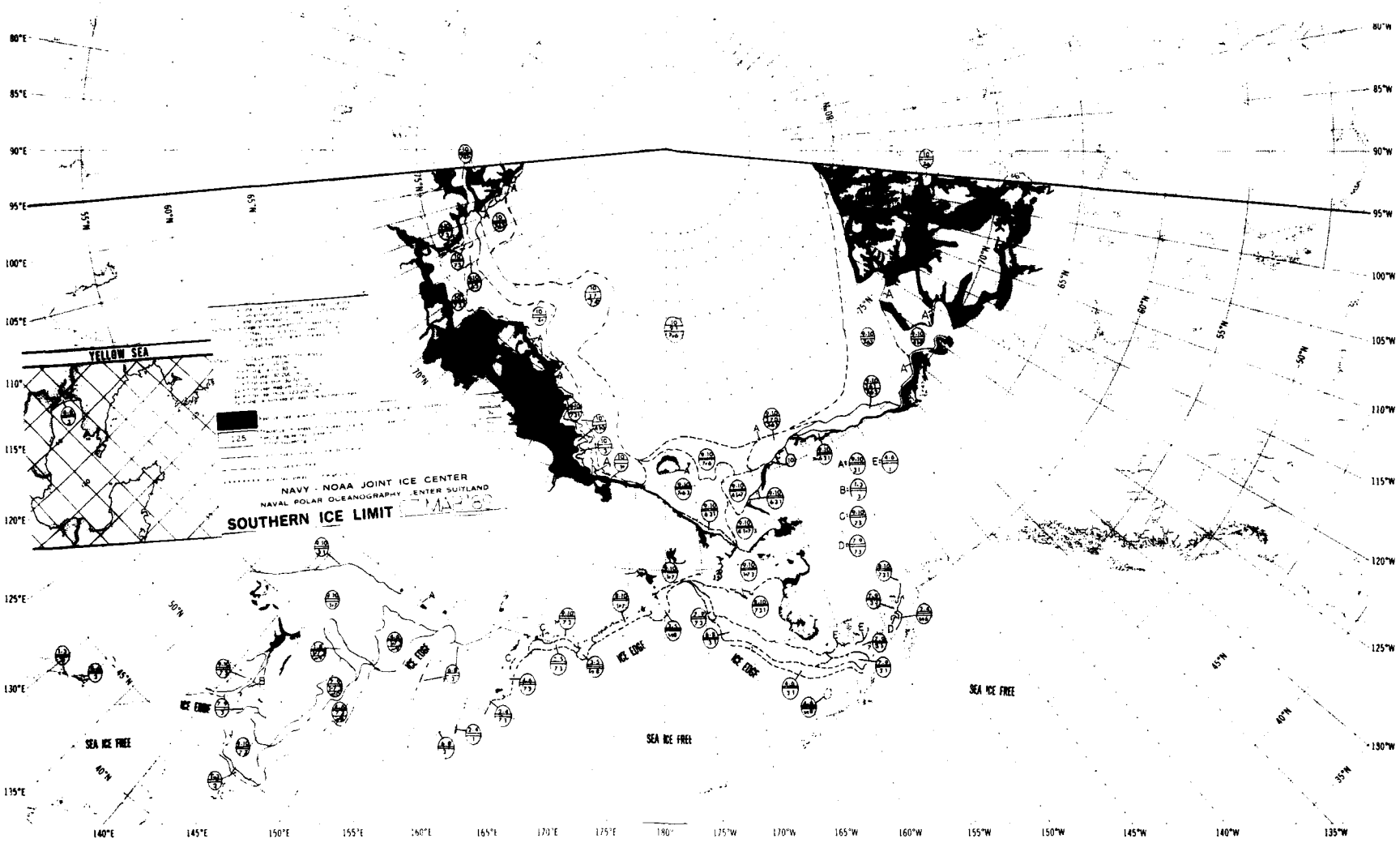
SOUTHERN ICE LIMIT 28 FEB 89
SEA ICE FREE
ICE EDGE
ICE FINGE
SEA ICE FREE


NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT
YELLOW SEA
ICE EDGE
SEA ICE FREE
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85°E
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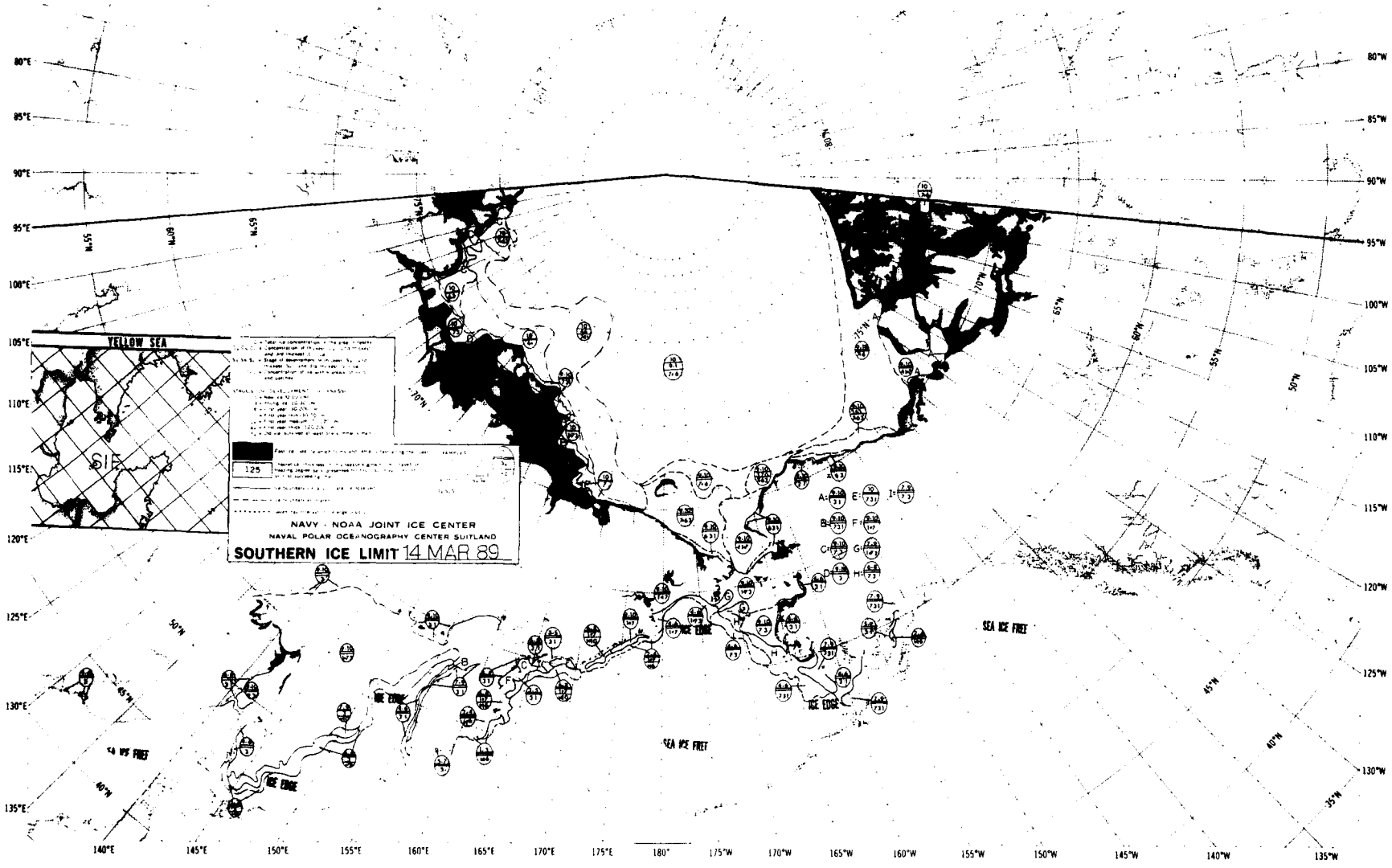
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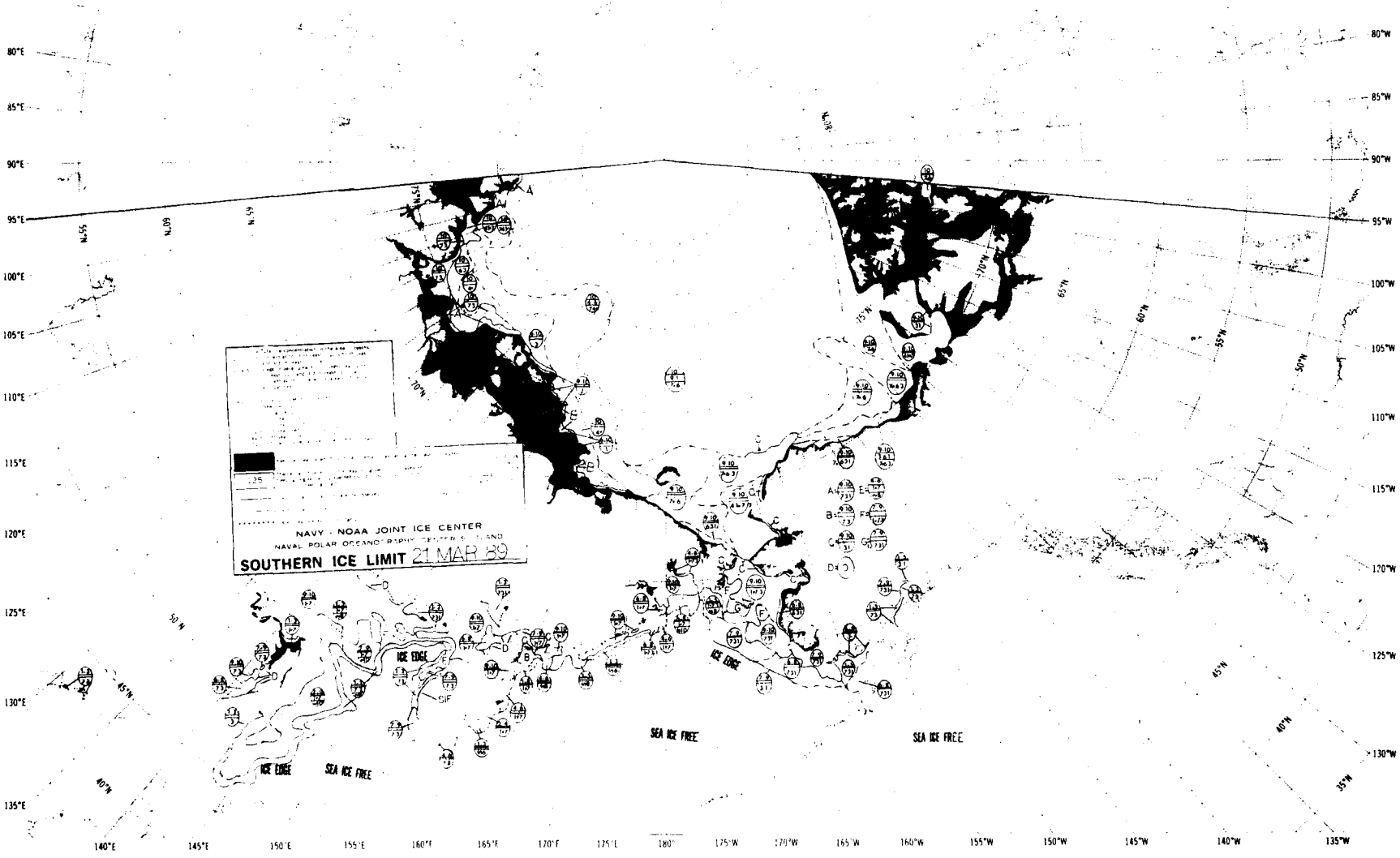
SOUTHERN ICE LIMIT 14 MAR 89
YELLOW SEA
SEA ICE FREE
ICE EDGE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SOUTHERN ICE LIMIT 21 MAR 89
ICE EDGE
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ICE EDGE
SEA ICE FREE
ICE EDGE
SEA ICE FREE
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NAVY - NOAA JOINT ICE CENTER
SOUTHERN ICE LIMIT
ICE EDGE
SEA ICE FREE
ICE EDGE
SEA ICE FREE
ICE EDGE
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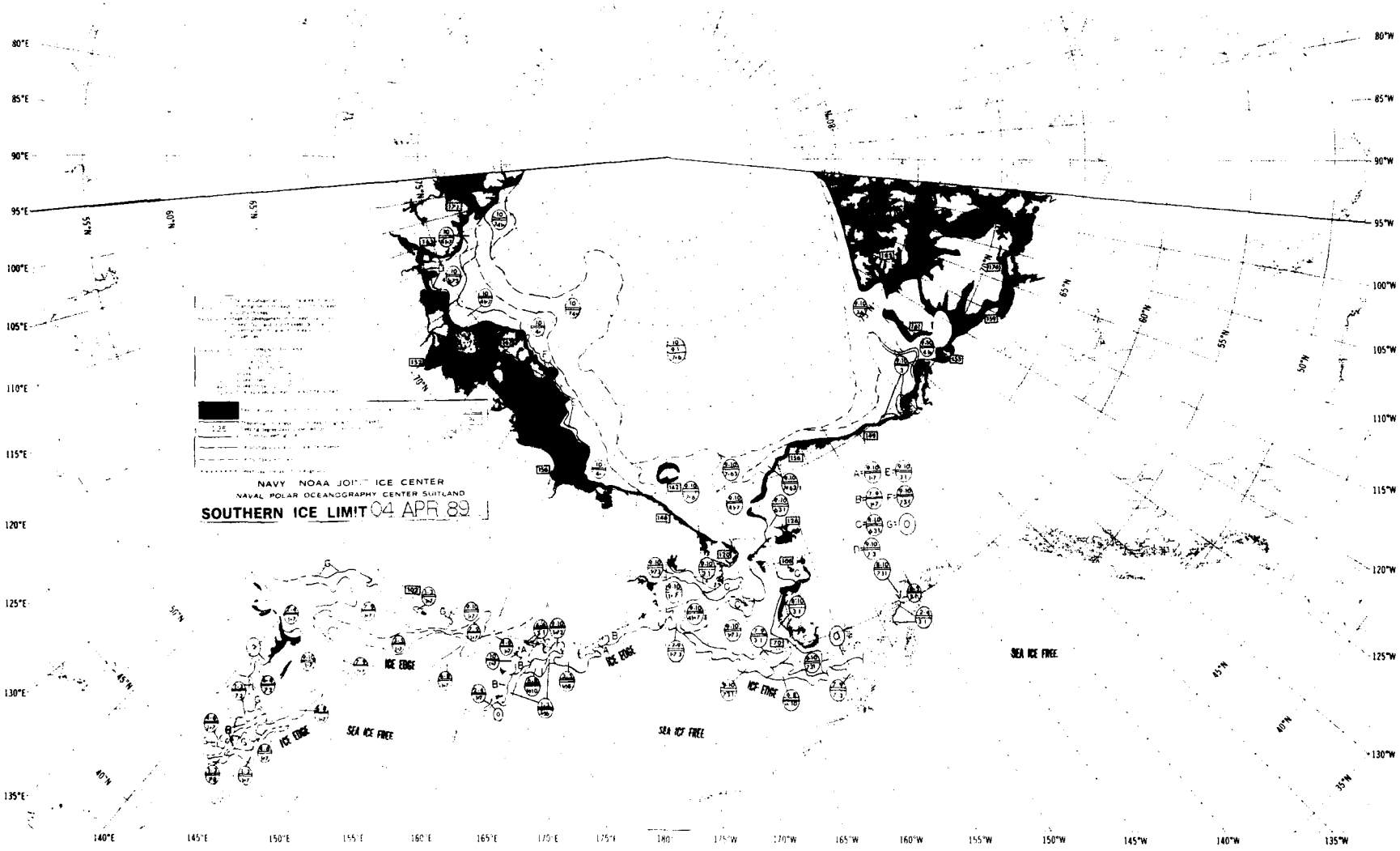
NAVY NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 04 APR 89
ICE EDGE
SEA ICE FREE
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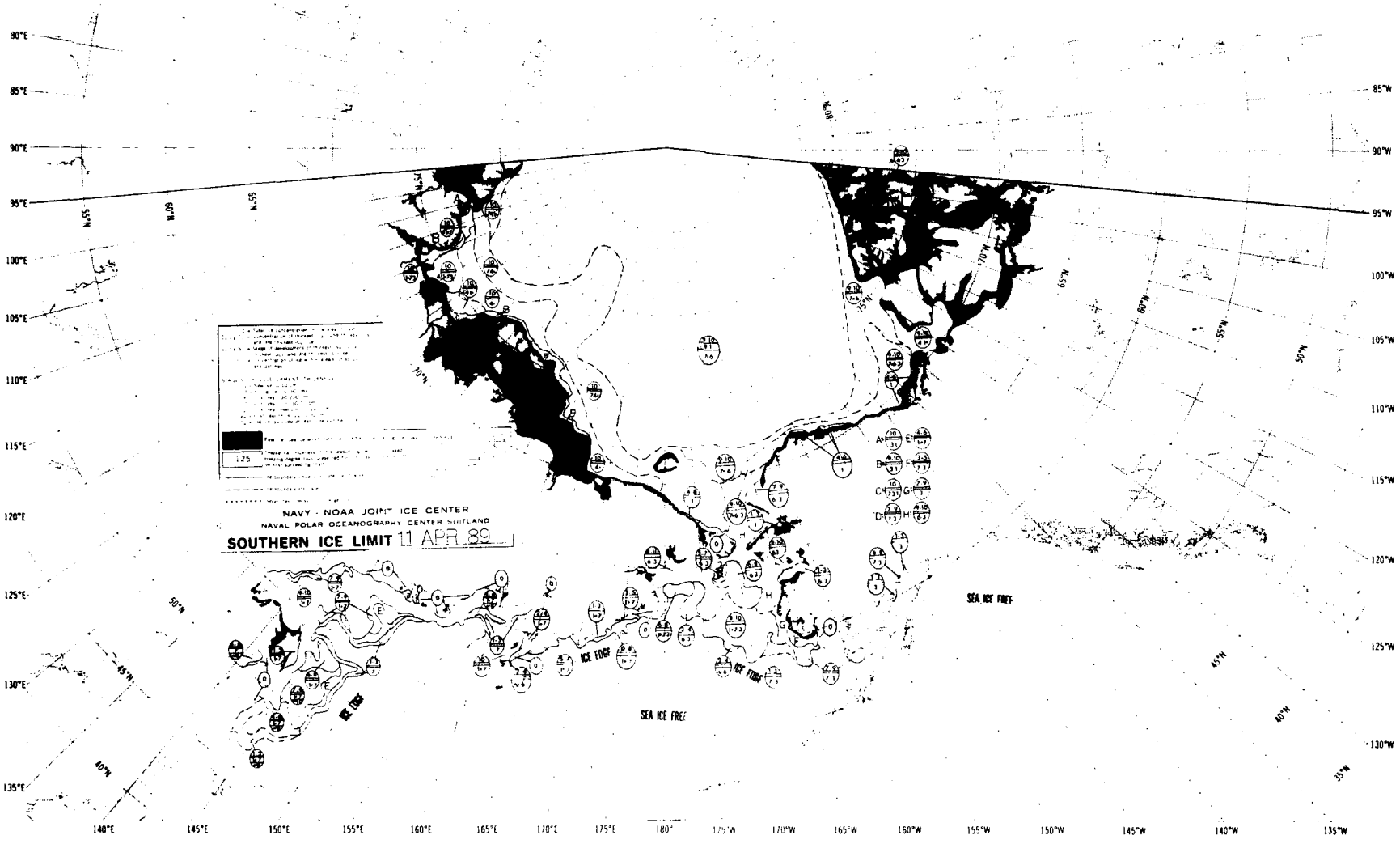
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 11 APR 89
ICE EDGE
SEA ICE FREE
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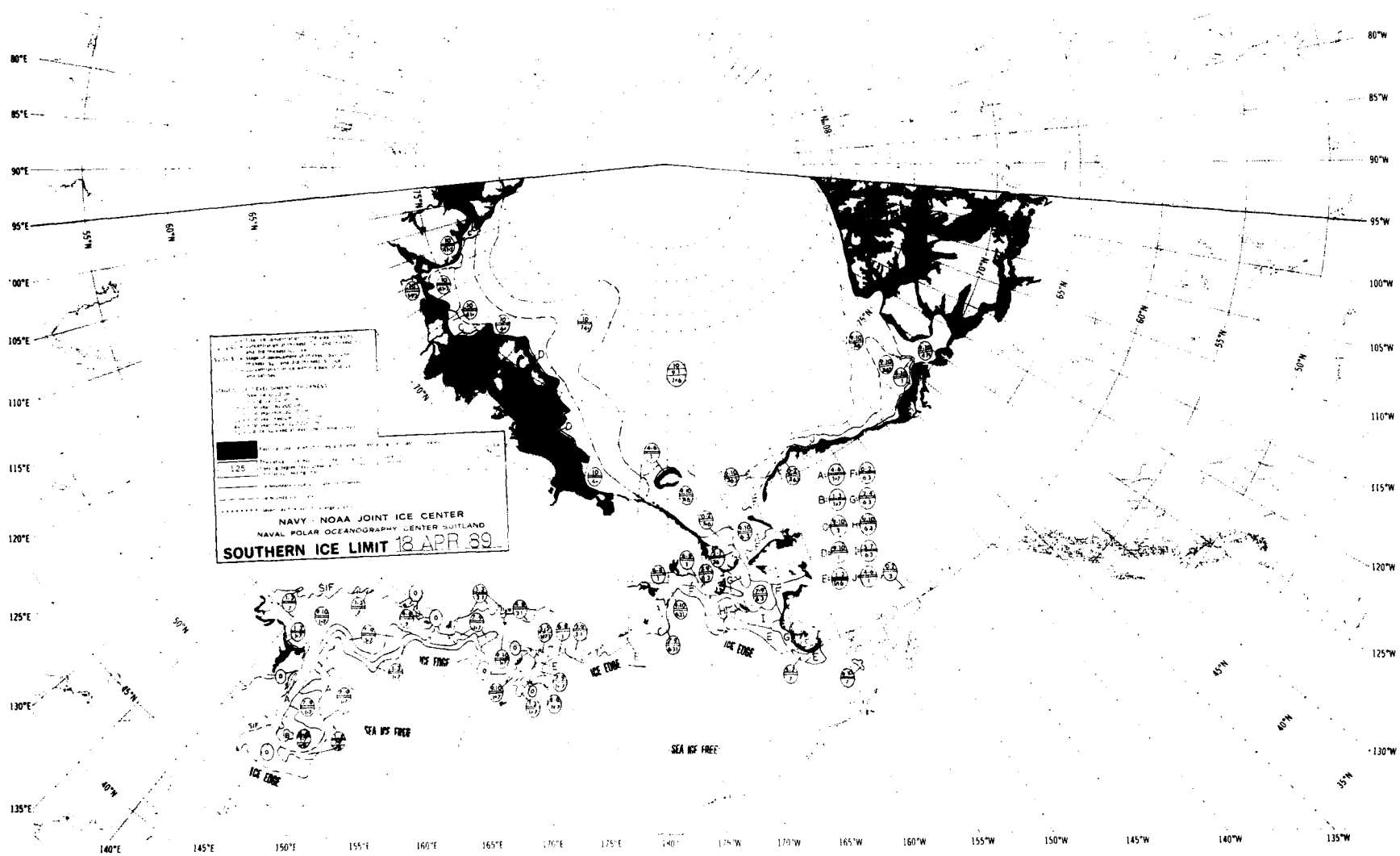
NAVY · NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 18 APR 89
ICE EDGE
SEA ICE FREE
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NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 25 APR 89
125
ICE EDGE
SEA ICE FREE
80°E
85°E
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100°E
105°E
110°E
115°E
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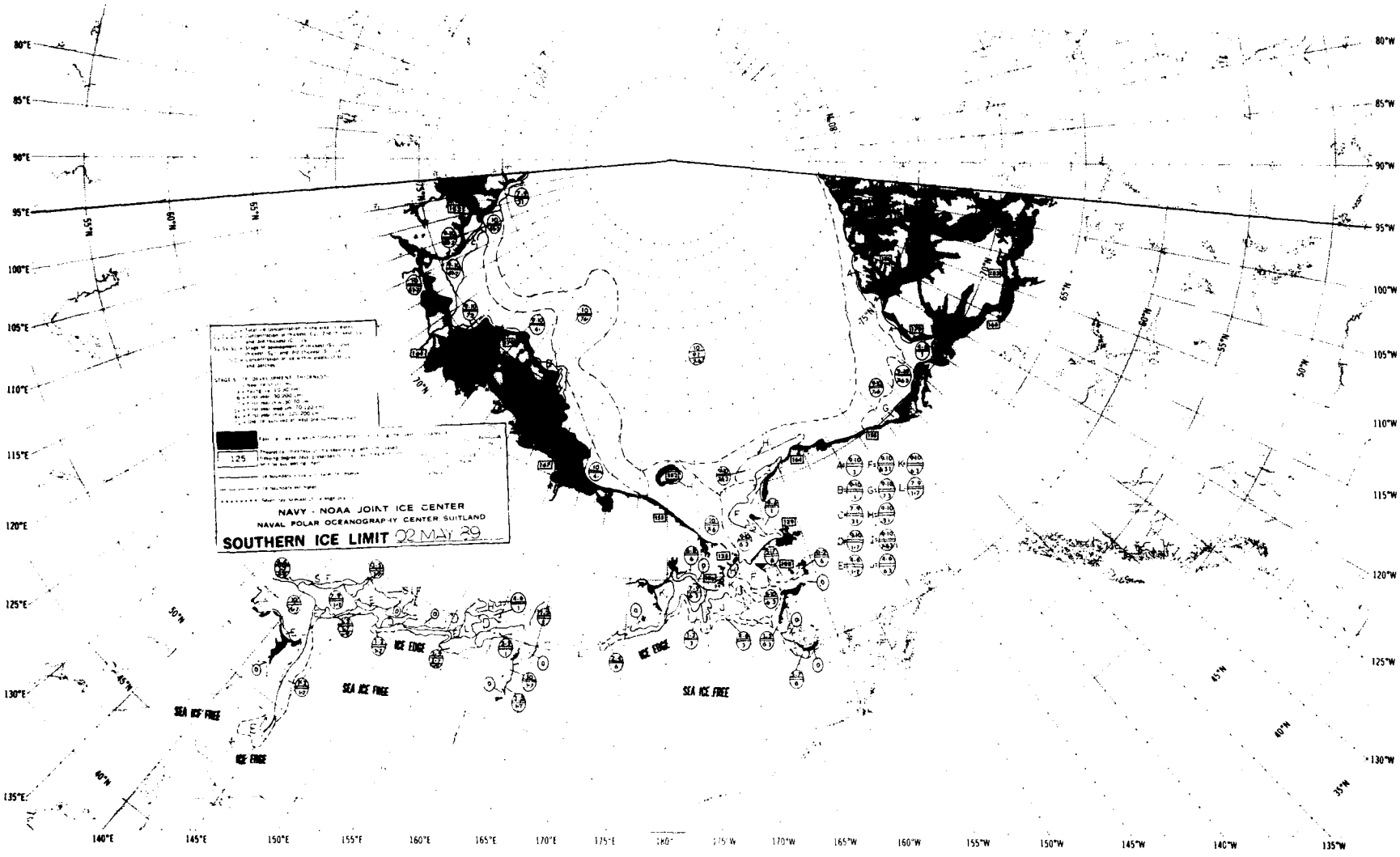
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 02 MAY 29
ICE EDGE
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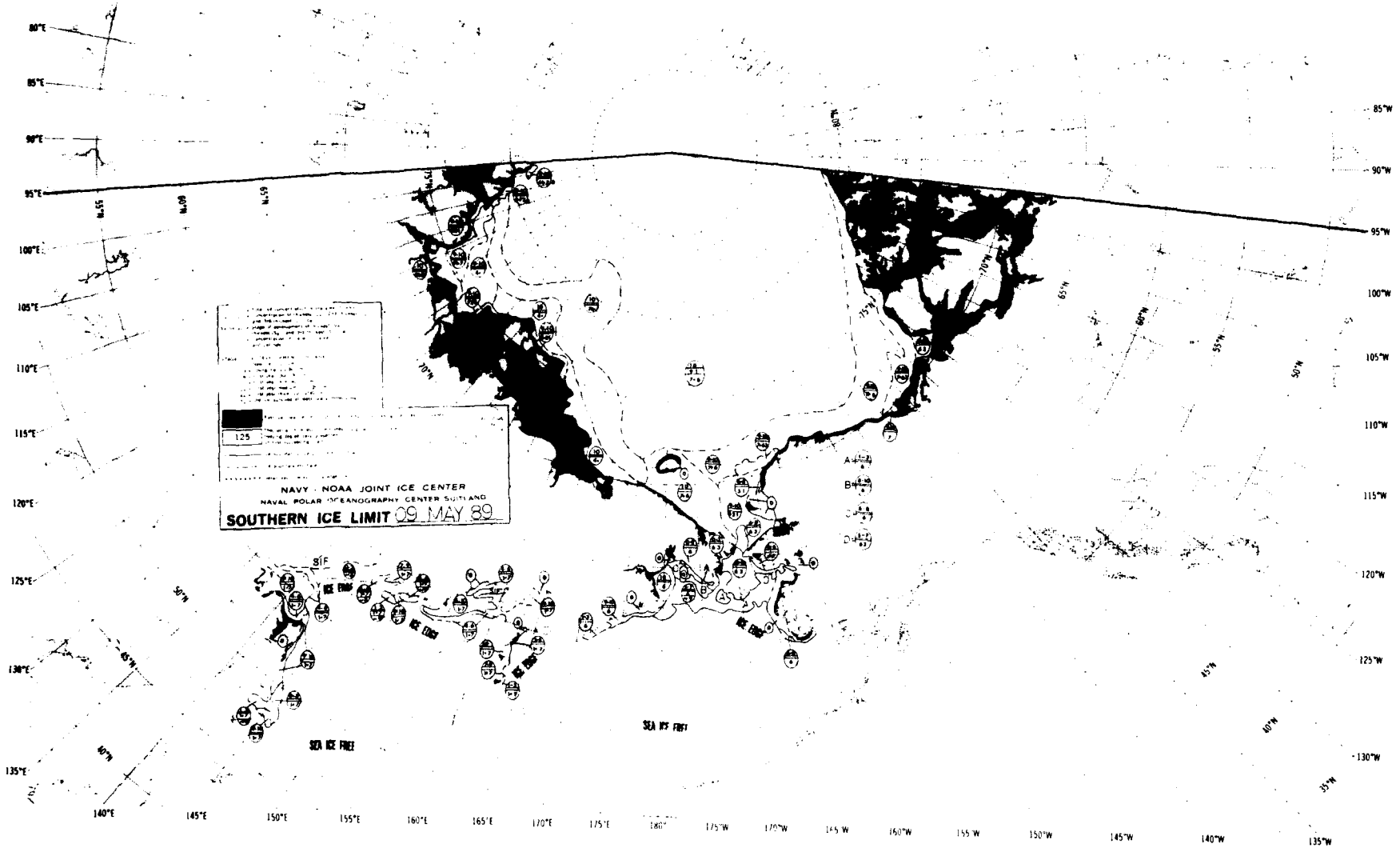
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
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125
SEA ICE FREE
SEA ICE FIRST
ICE EDGE
80°E
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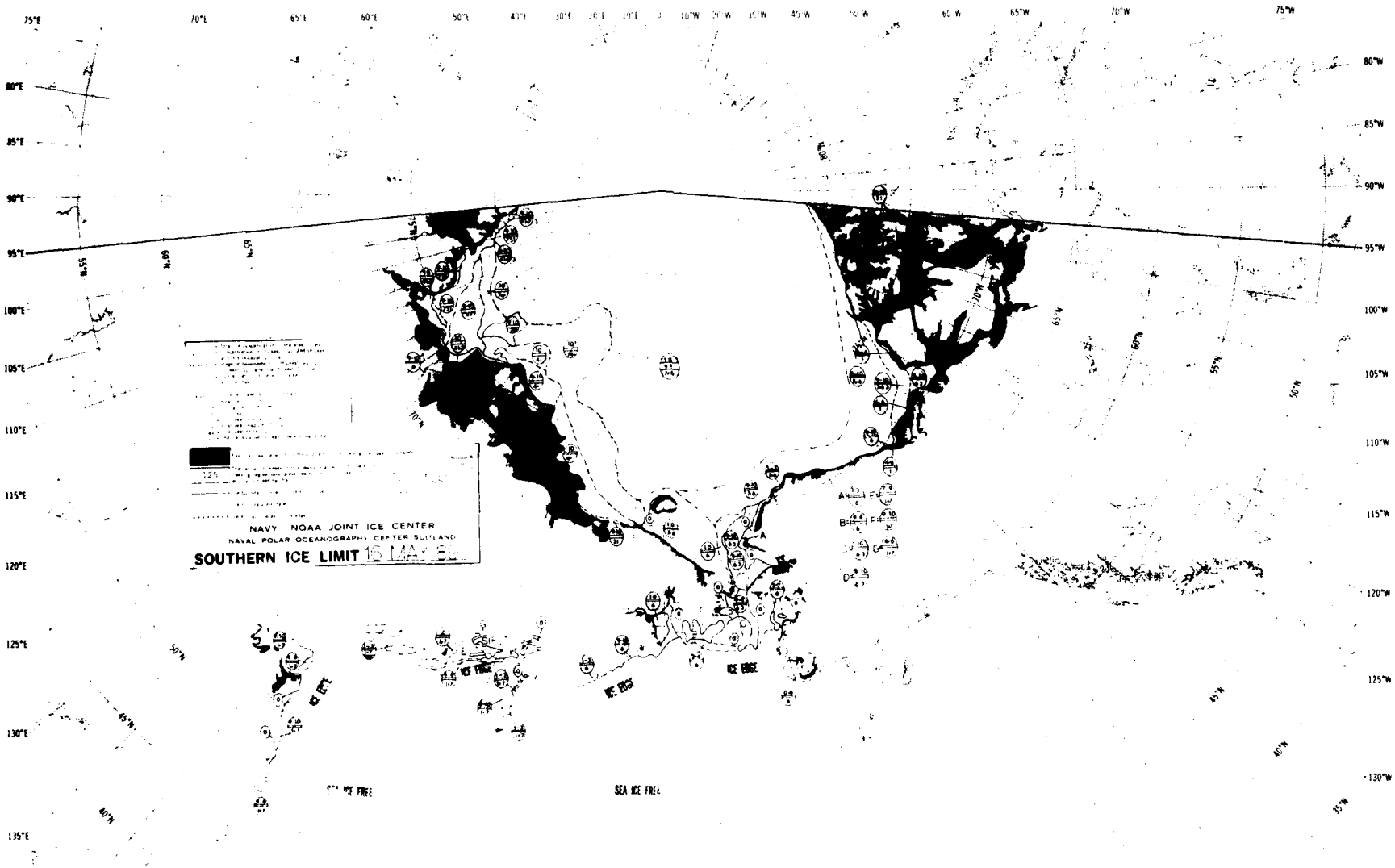
NAVY NOAA JOINT ICE CENTER
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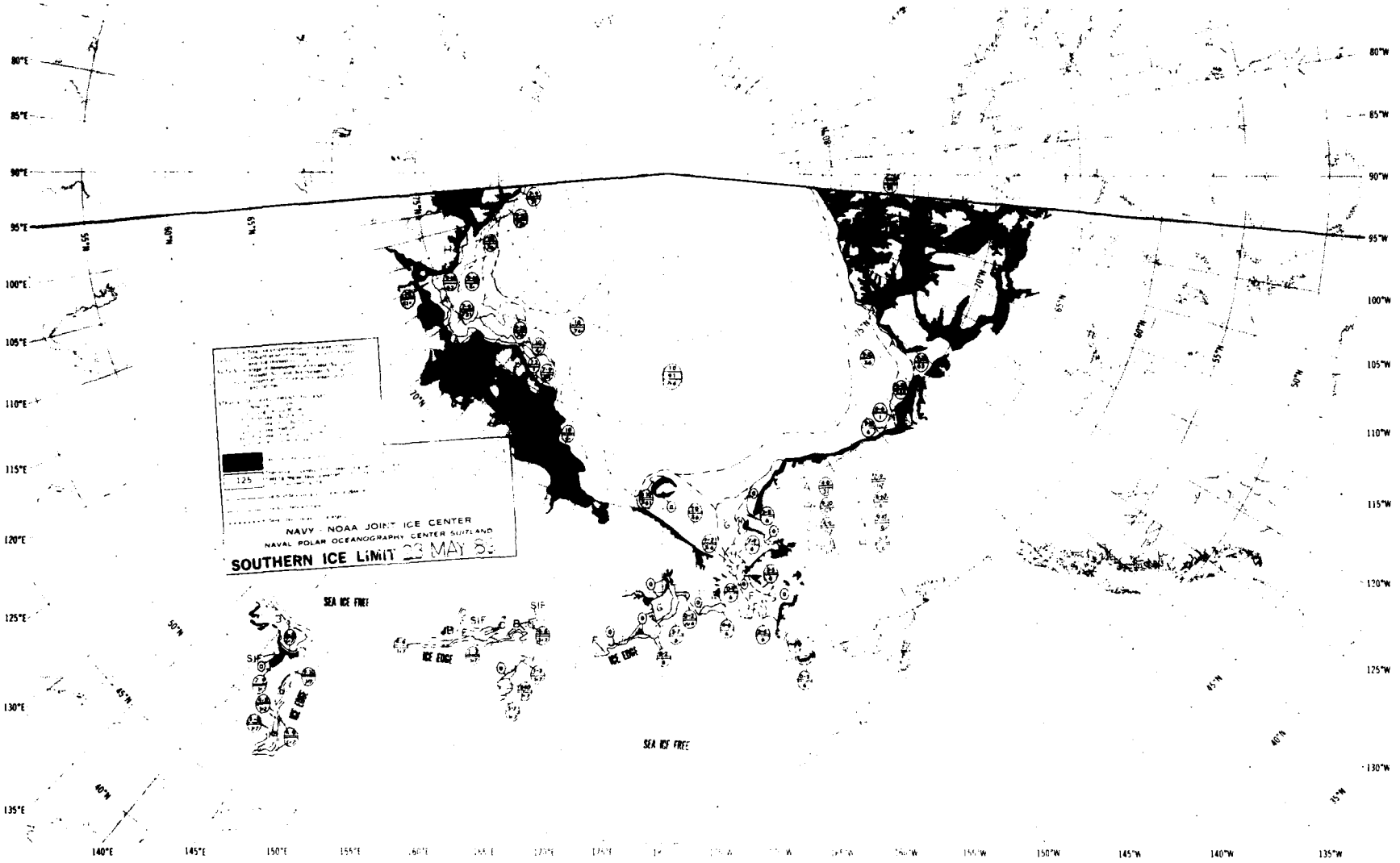
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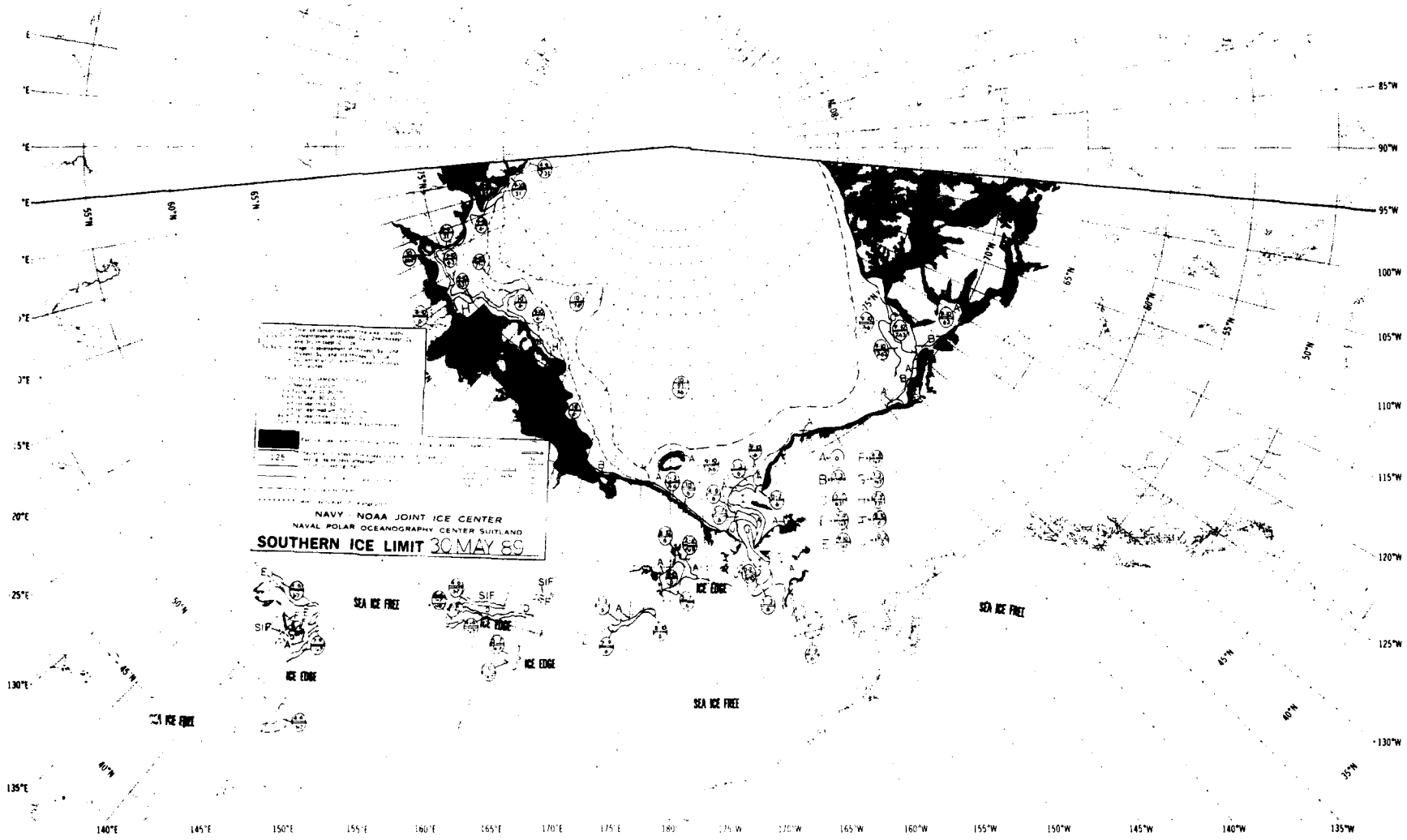
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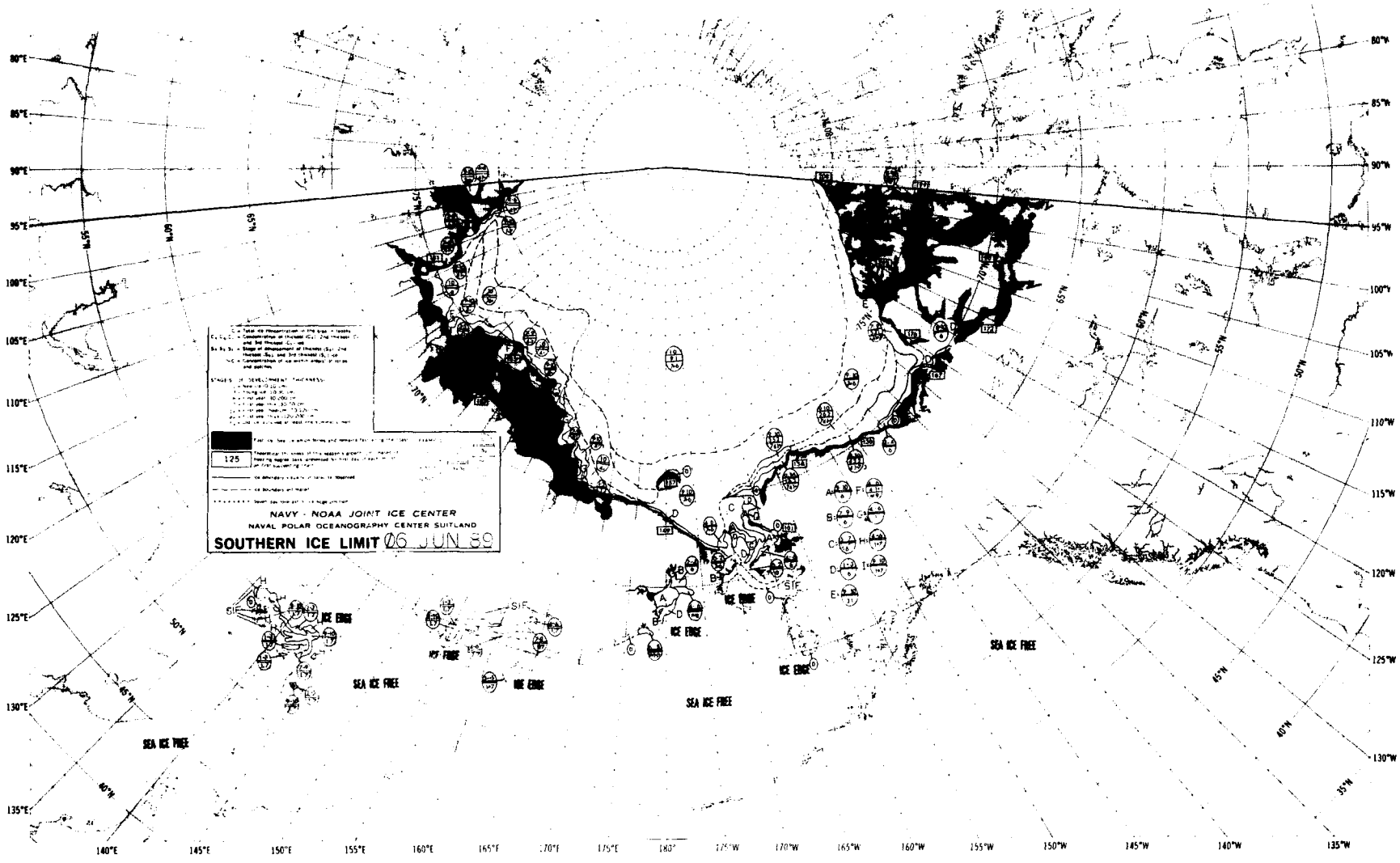
NAVY - NOAA JOINT ICE CENTER
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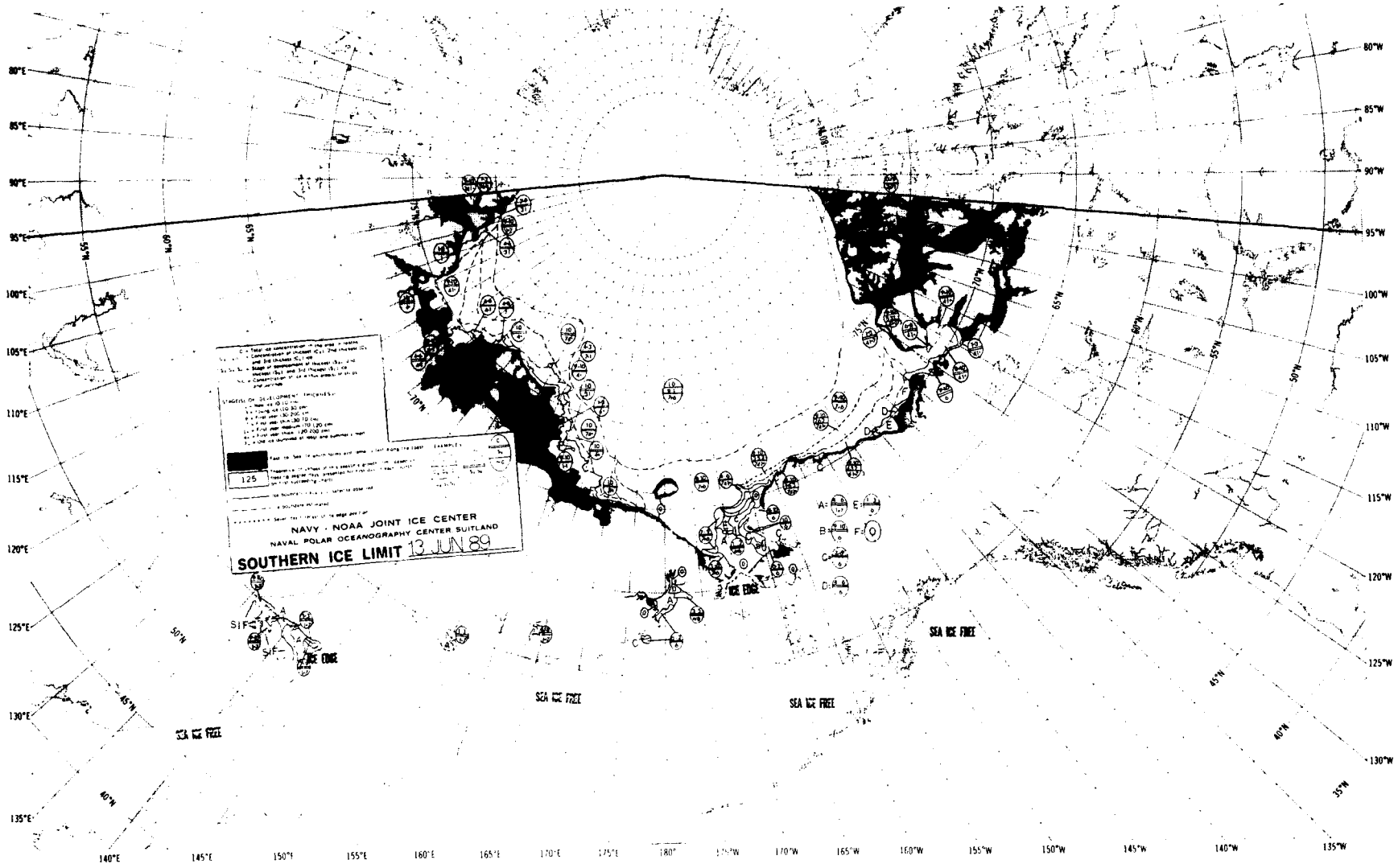
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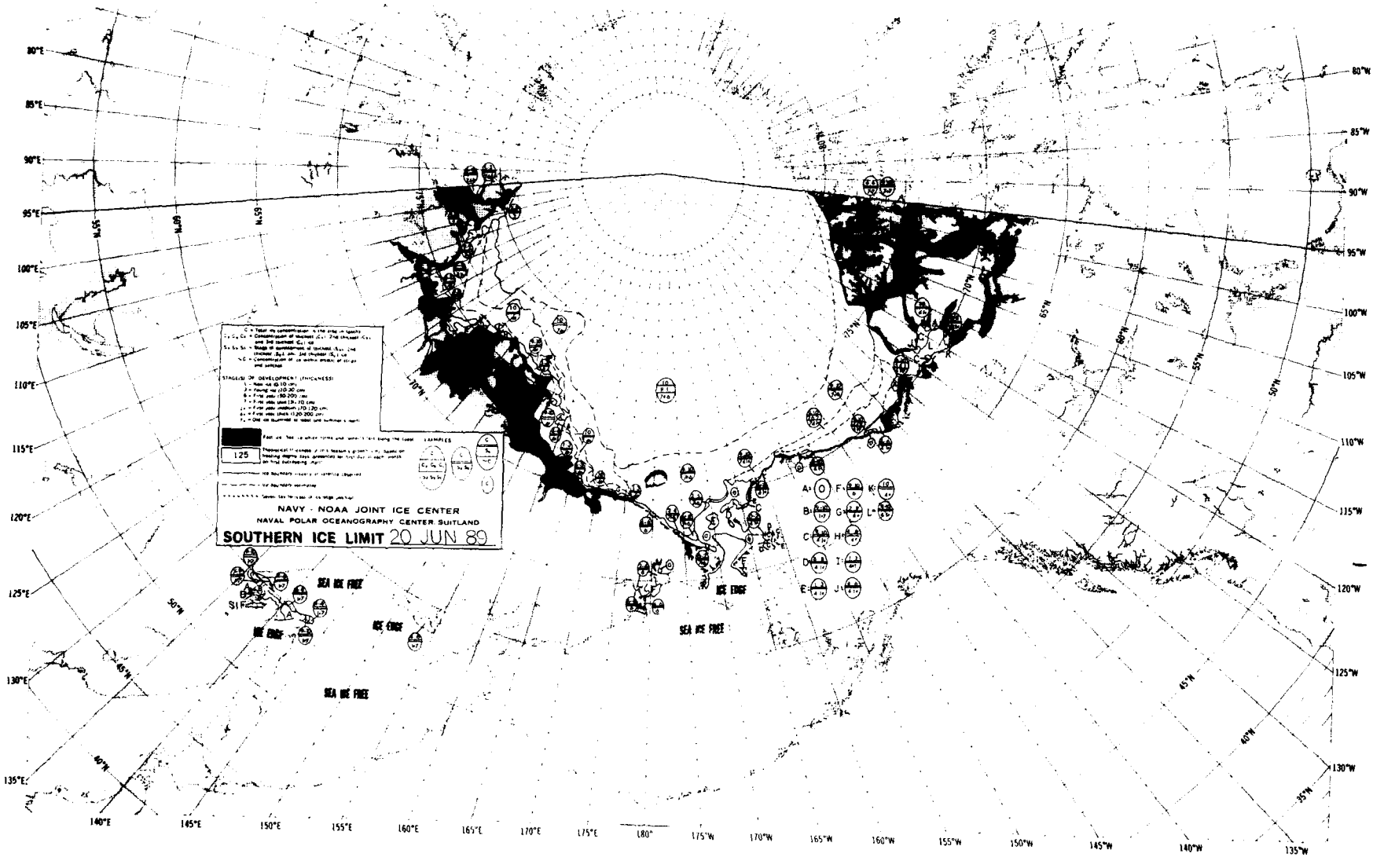
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ICE EDGE
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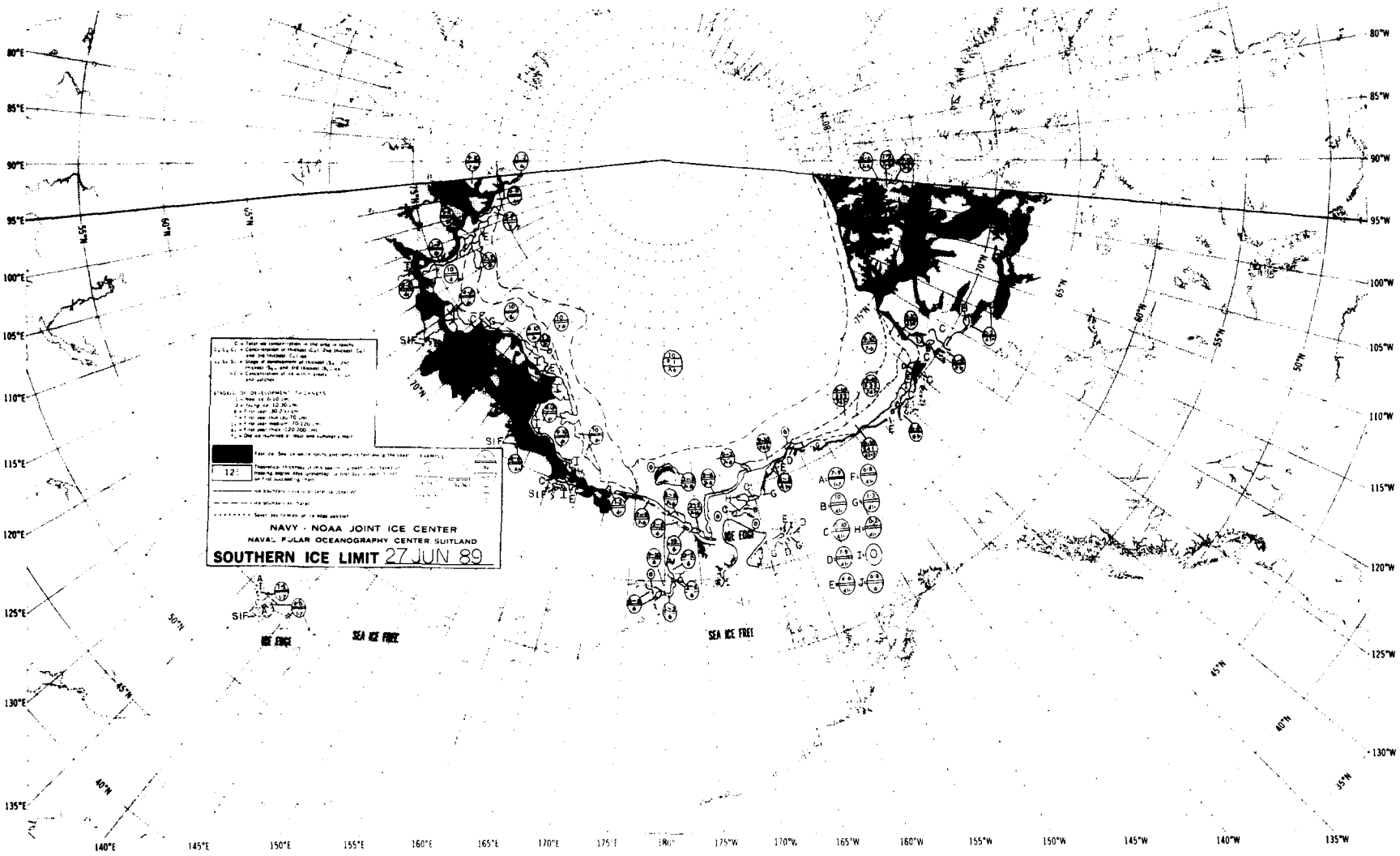
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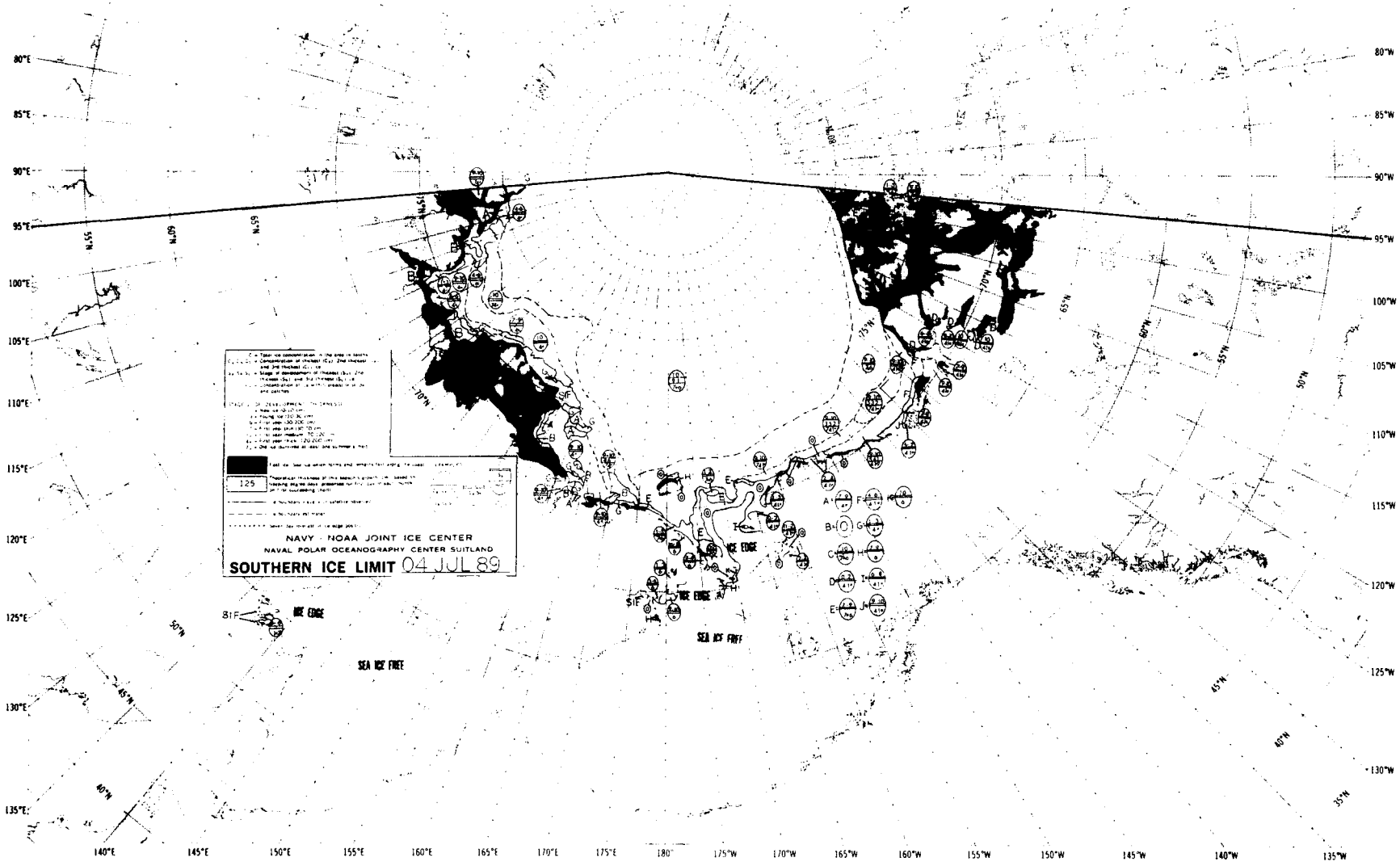
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 04 JUL 89
ICE EDGE
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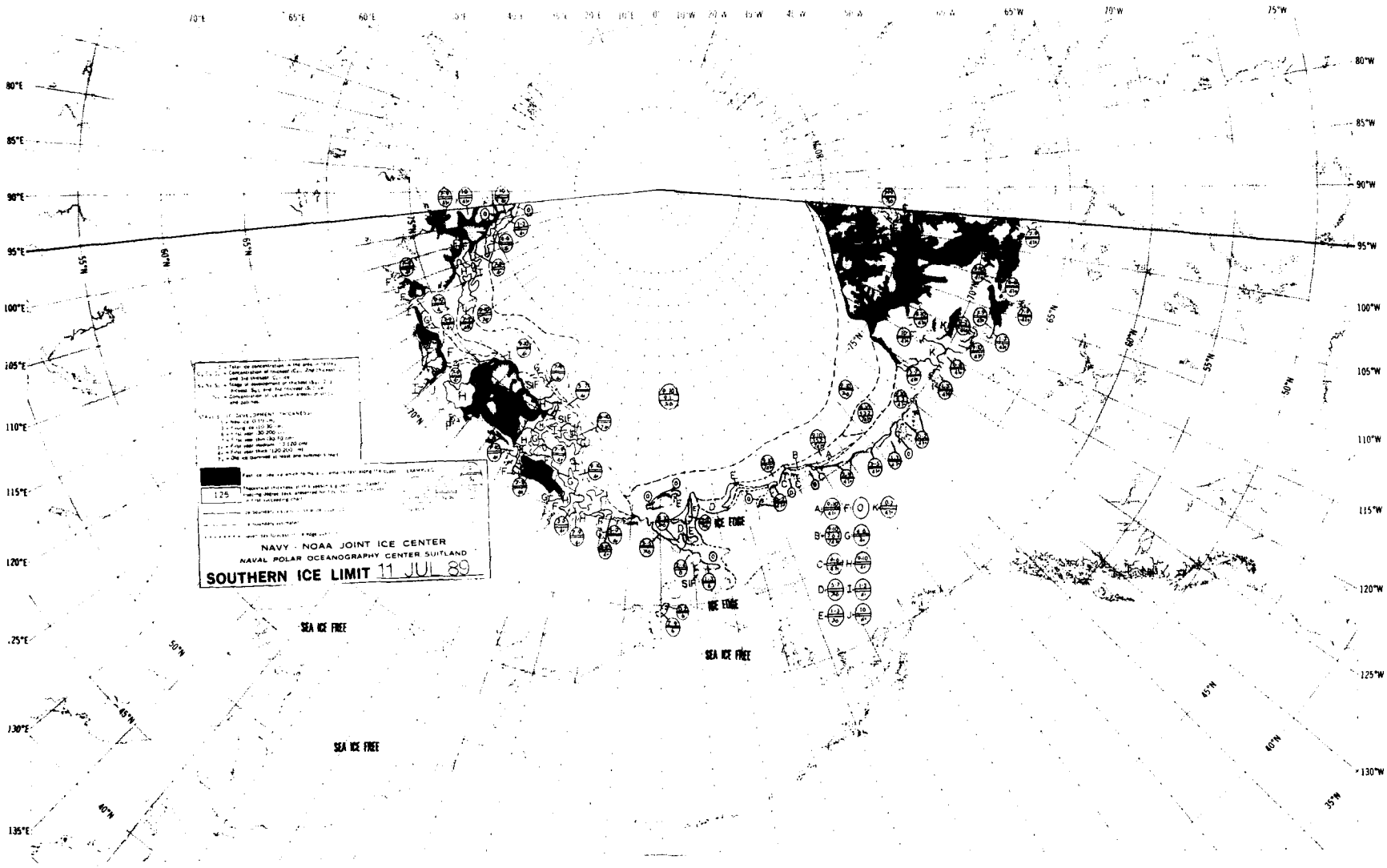
NAVY - NOAA JOINT ICE CENTER
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SOUTHERN ICE LIMIT 11 JUL 89
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ICE EDGE
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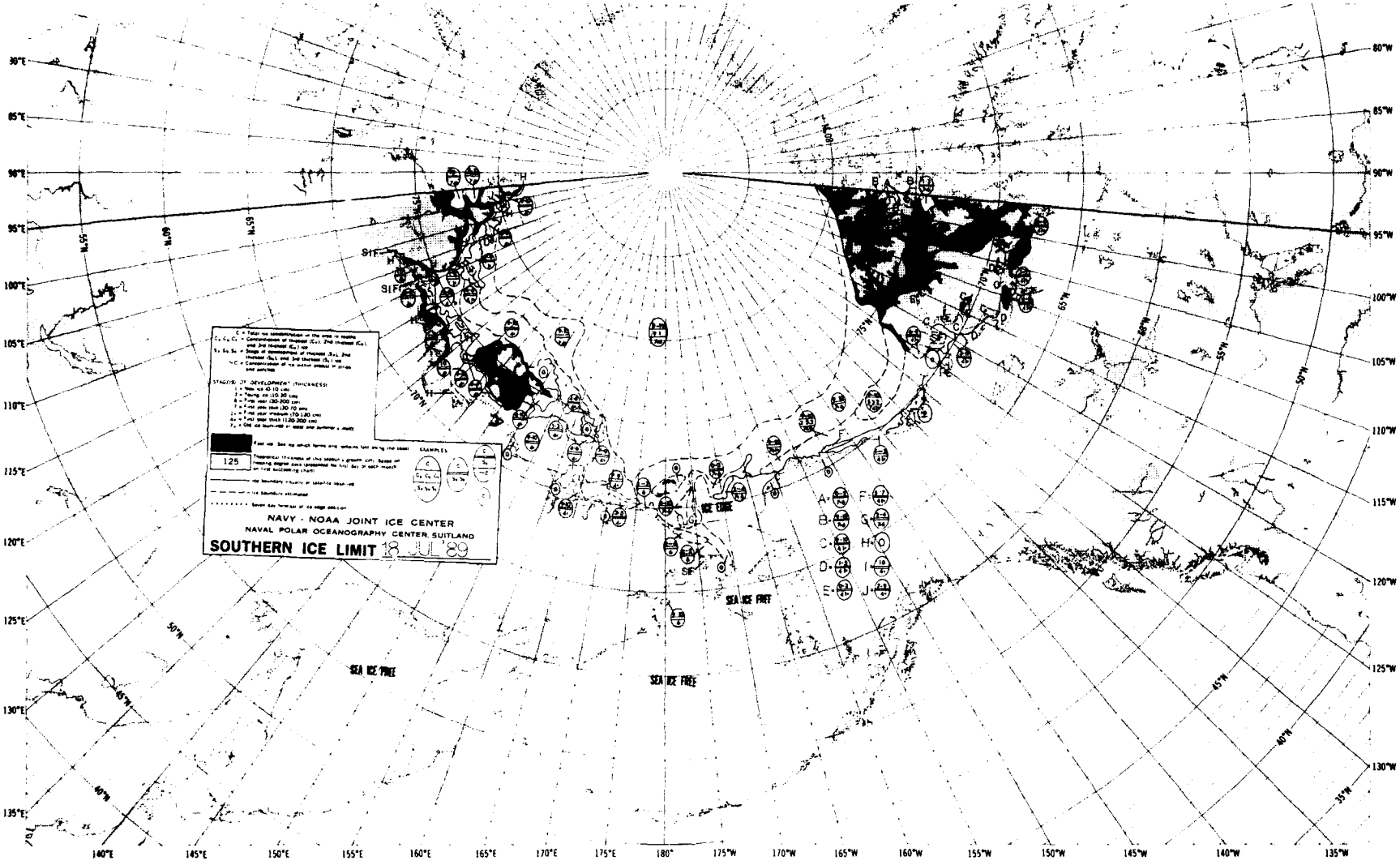
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 18 JUL '89
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
125
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80°E
85°E
90°E
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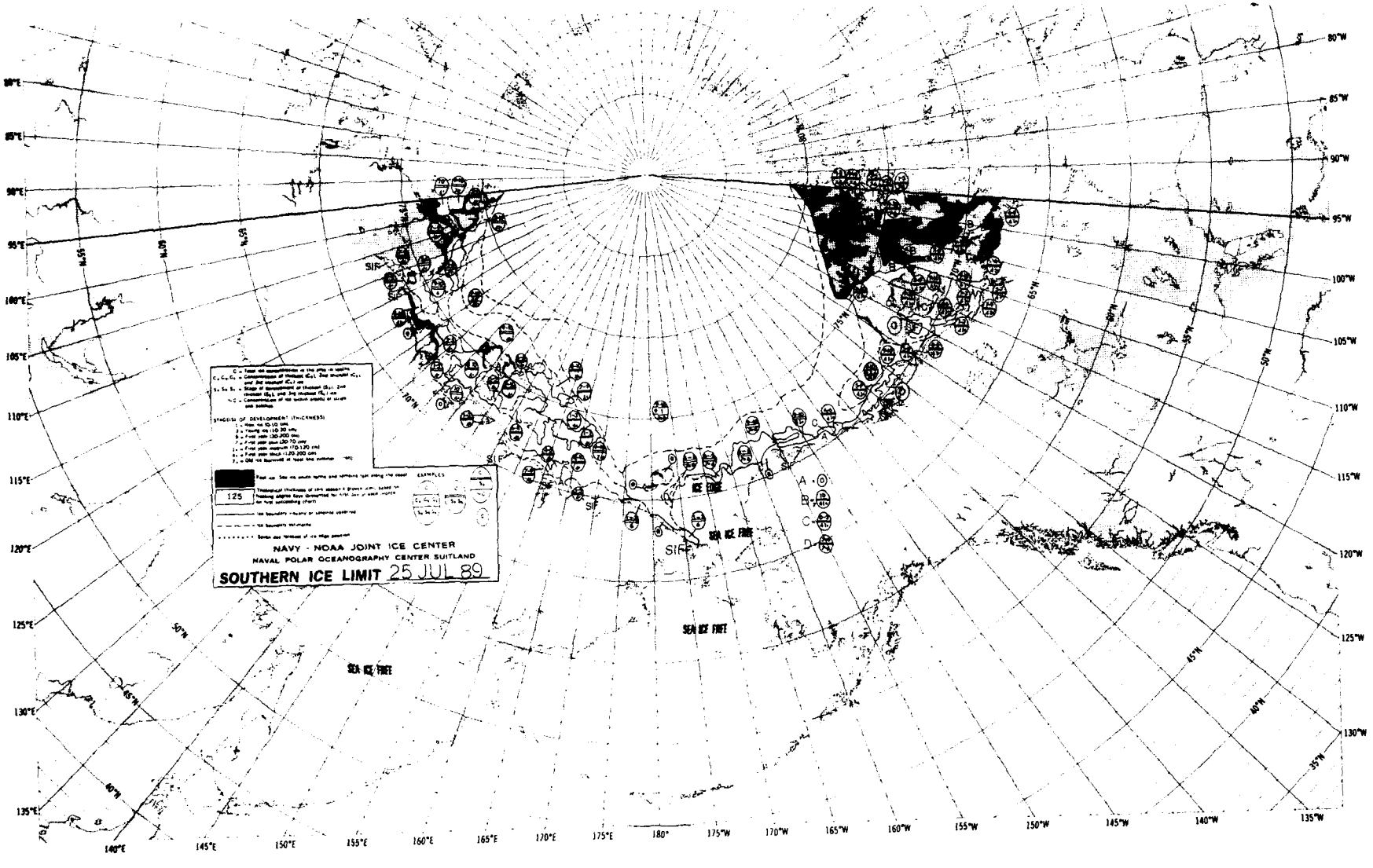
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 25 JUL 89
ICE EDGE
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
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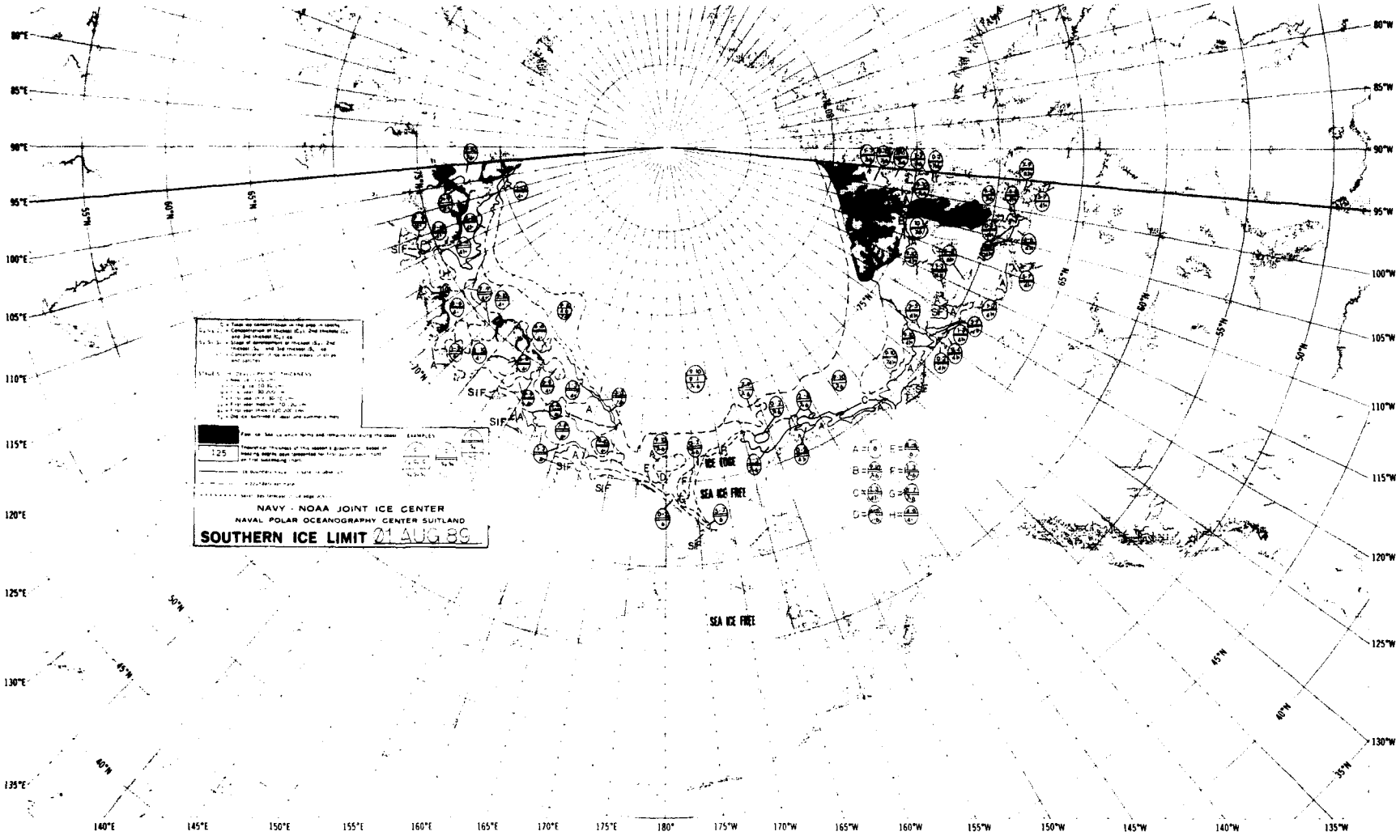
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 21 AUG 89
ICE EDGE
SEA ICE FREE
SEA ICE FREE
SIF
80°E
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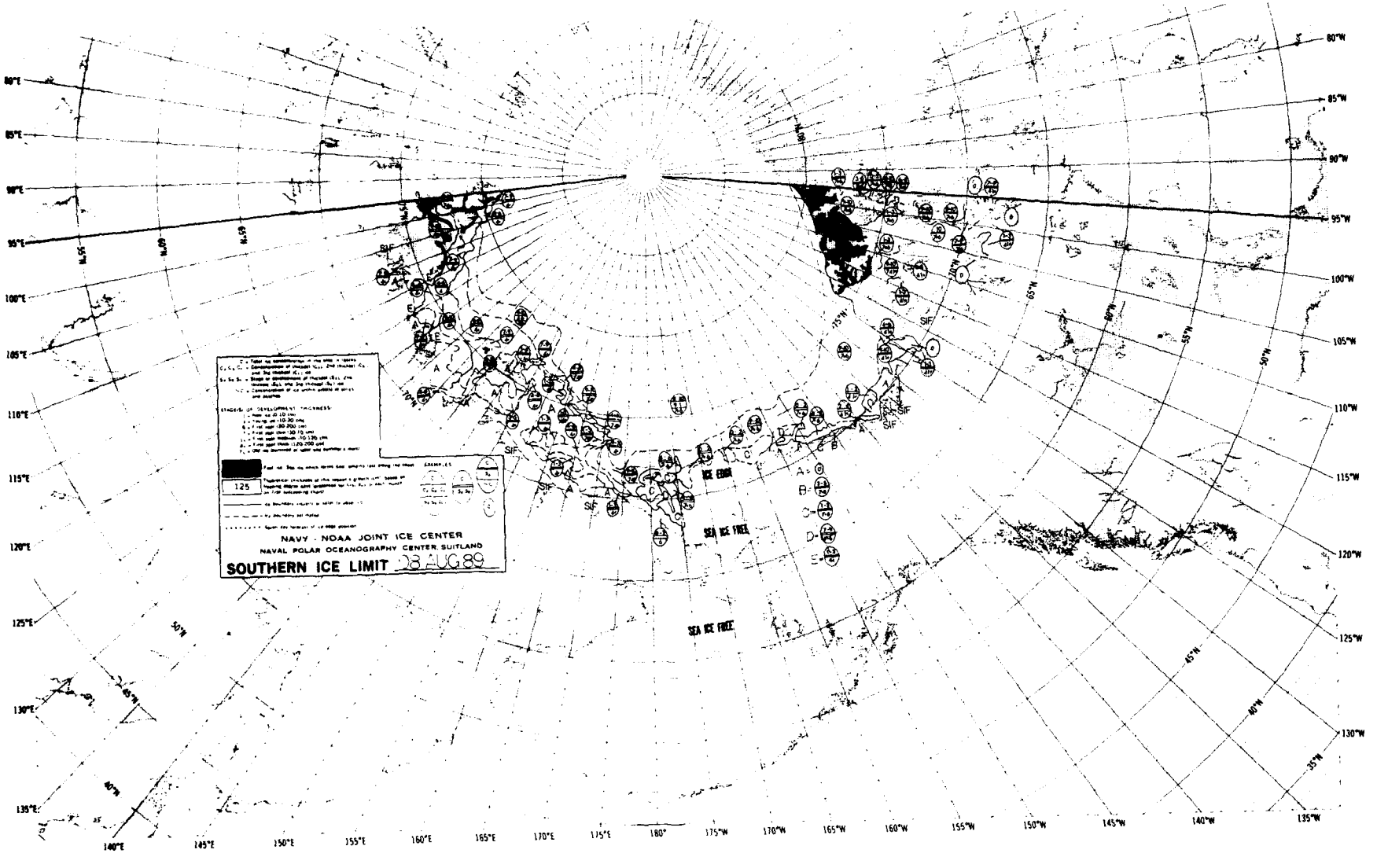
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 08 AUG 89
ICE EDGE
SEA ICE FREE
SEA ICE FREE
125
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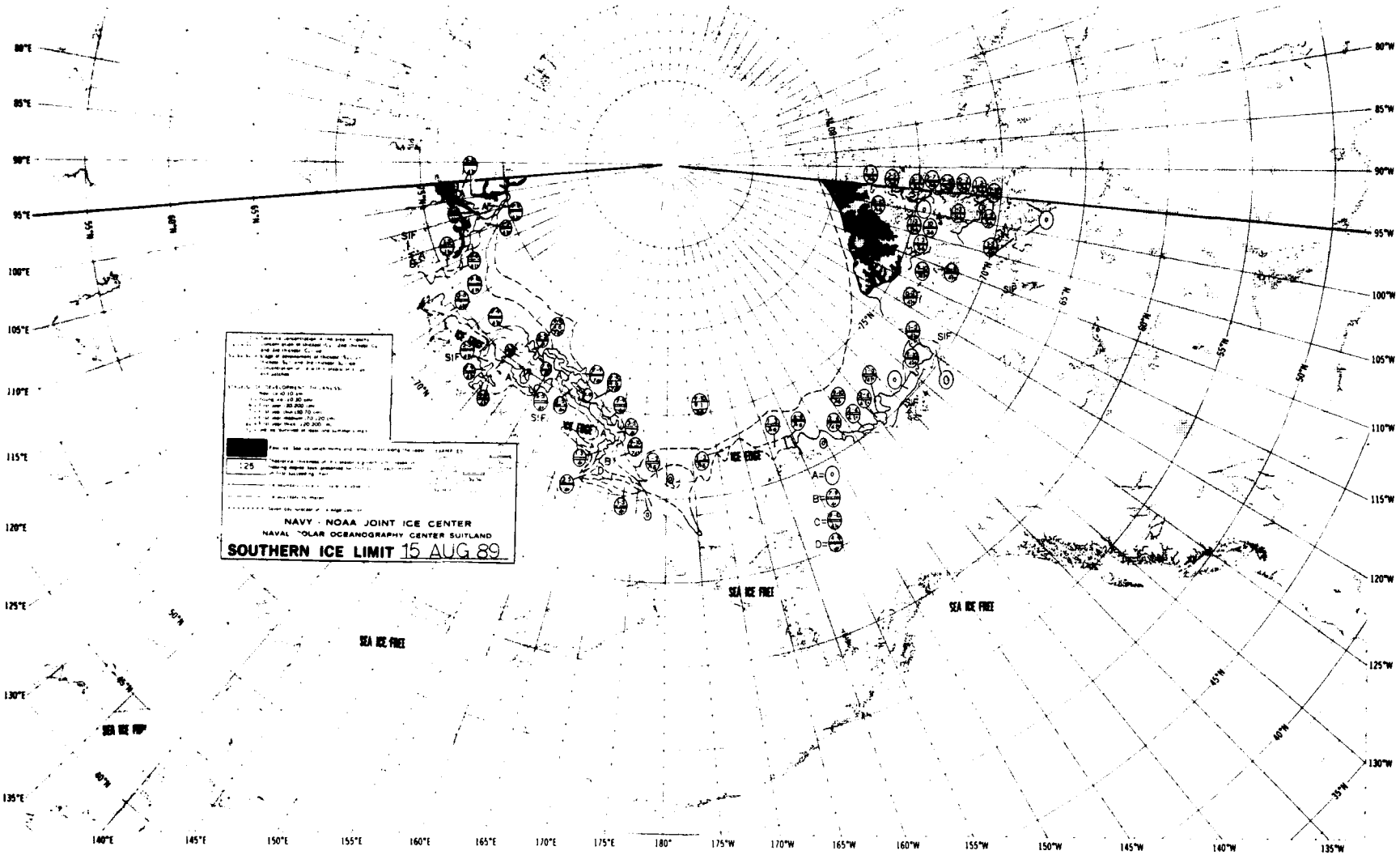
NAVY - NOAA JOINT ICE CENTER
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SOUTHERN ICE LIMIT 15 AUG 89
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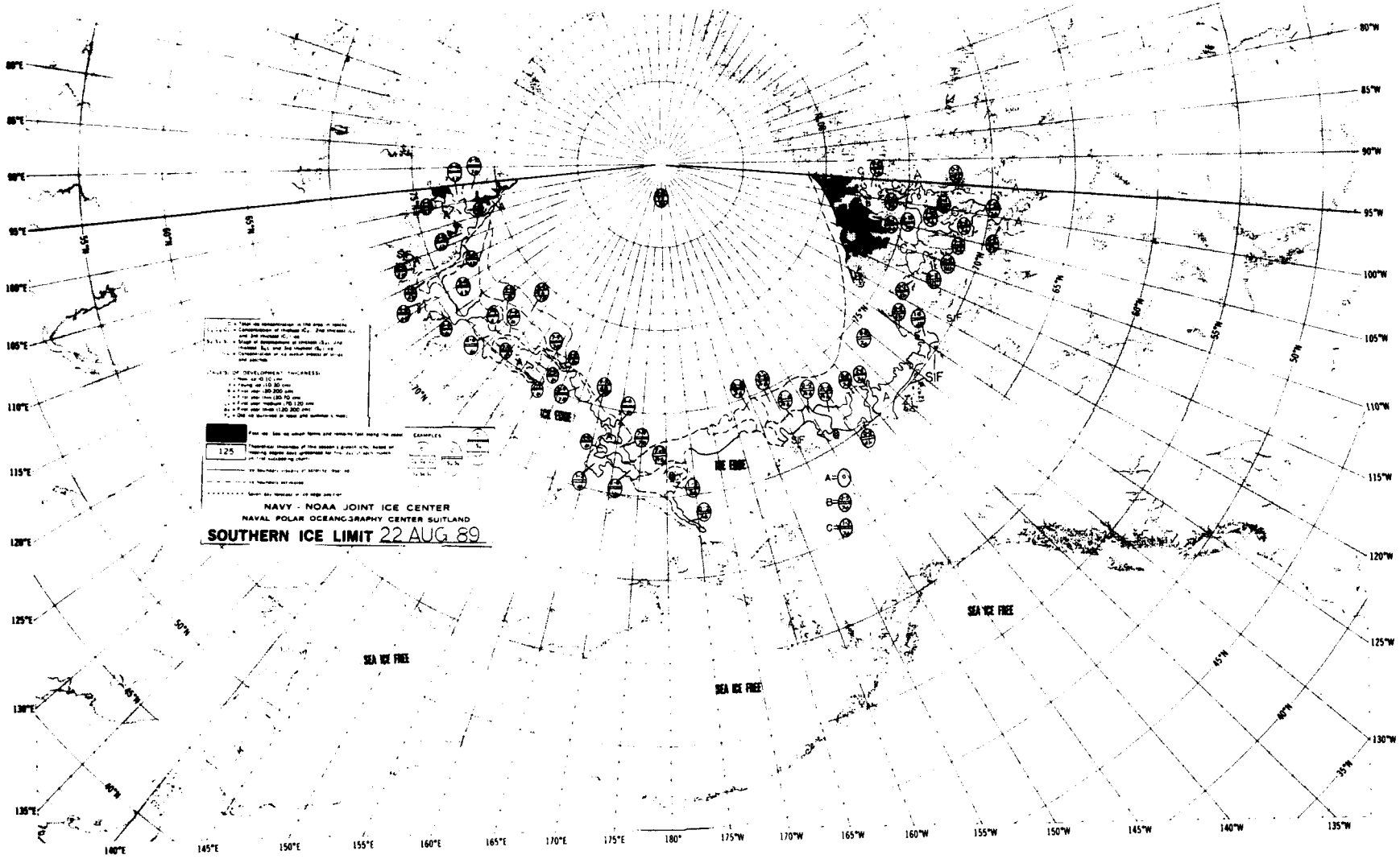
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SEA ICE FREE
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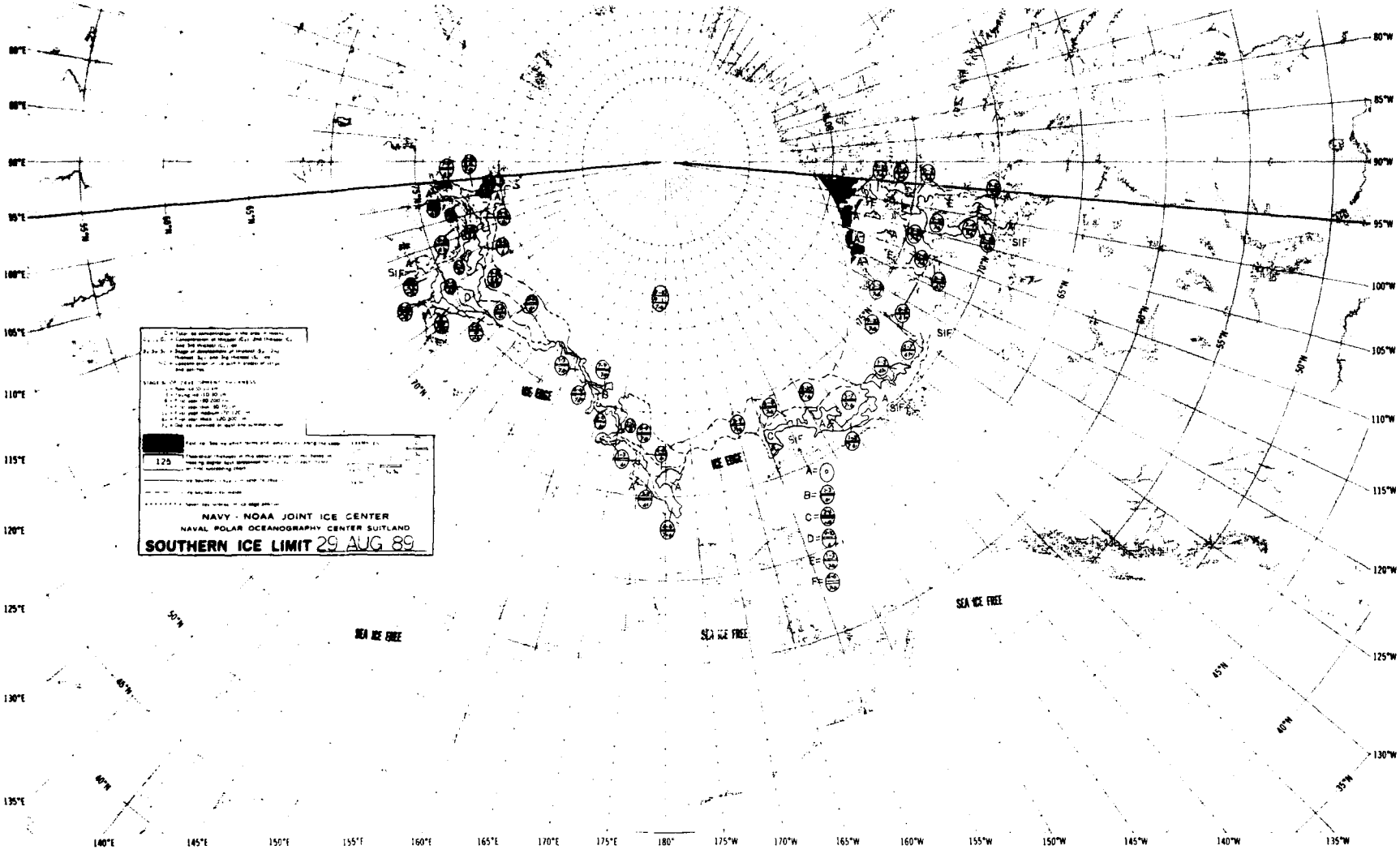
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 29 AUG 89
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SEA ICE FREE
SEA ICE FREE
ICE EDGE
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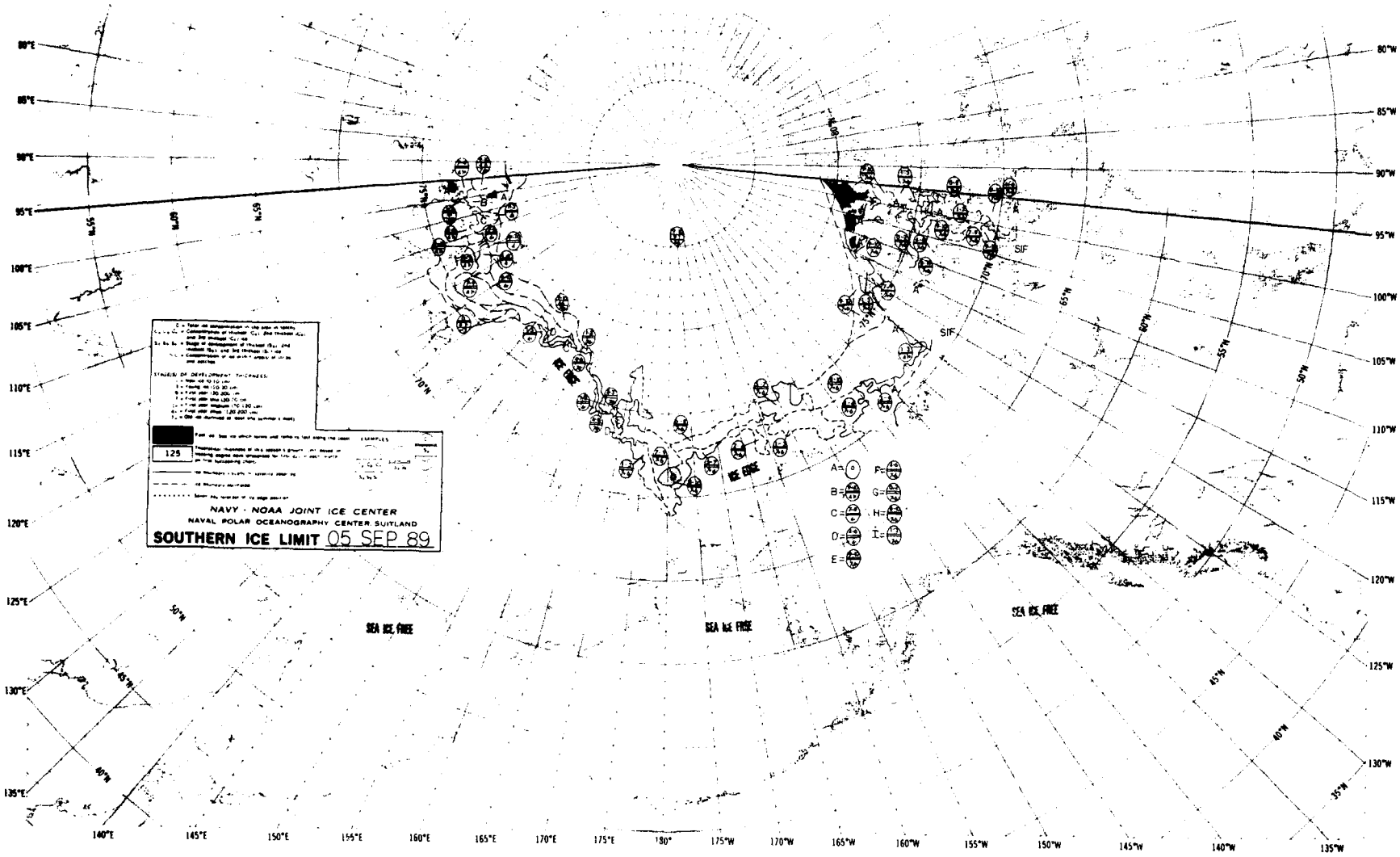
NAVY · NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 05 SEP 89
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
ICE EDGE
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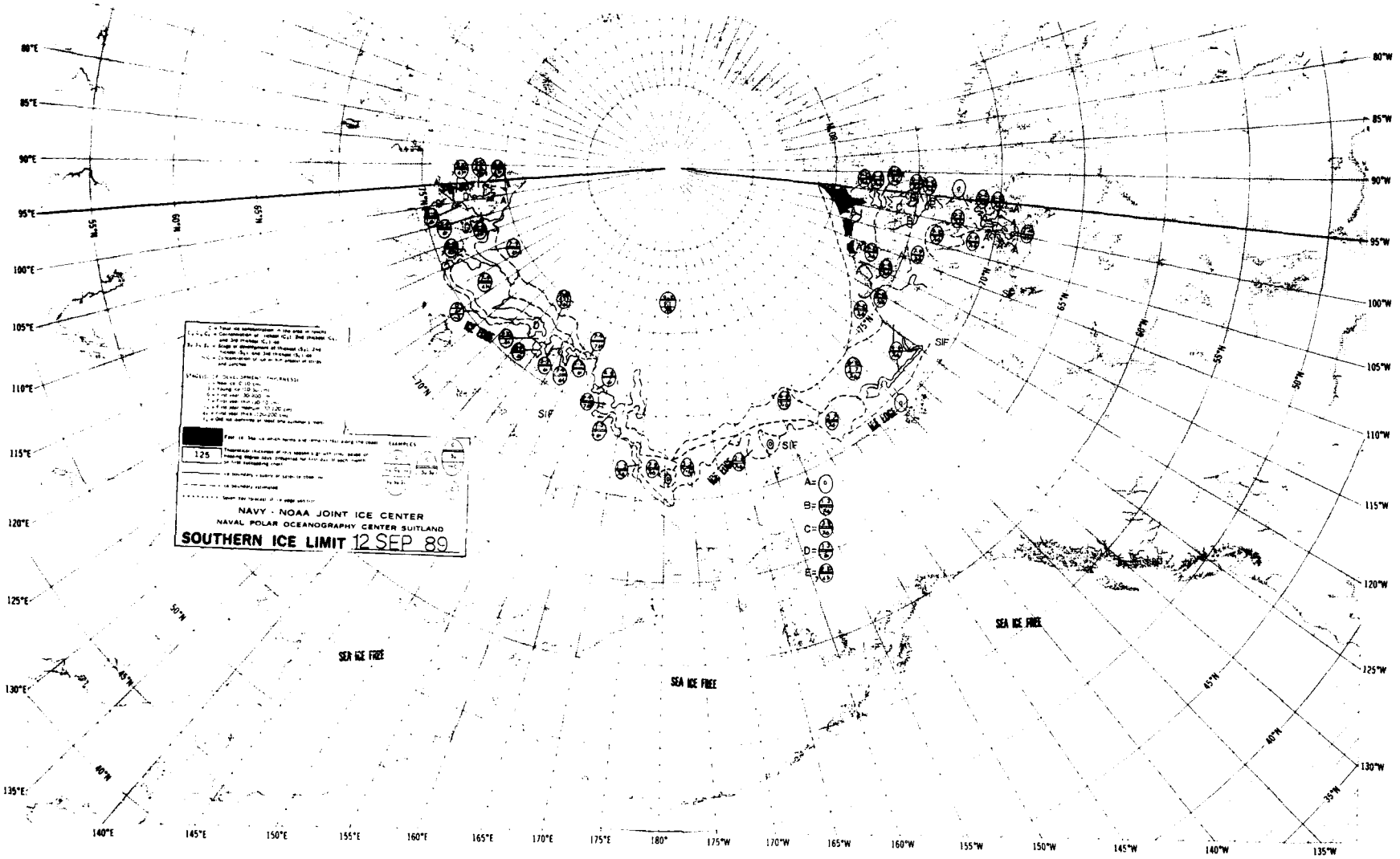
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 12 SEP 89
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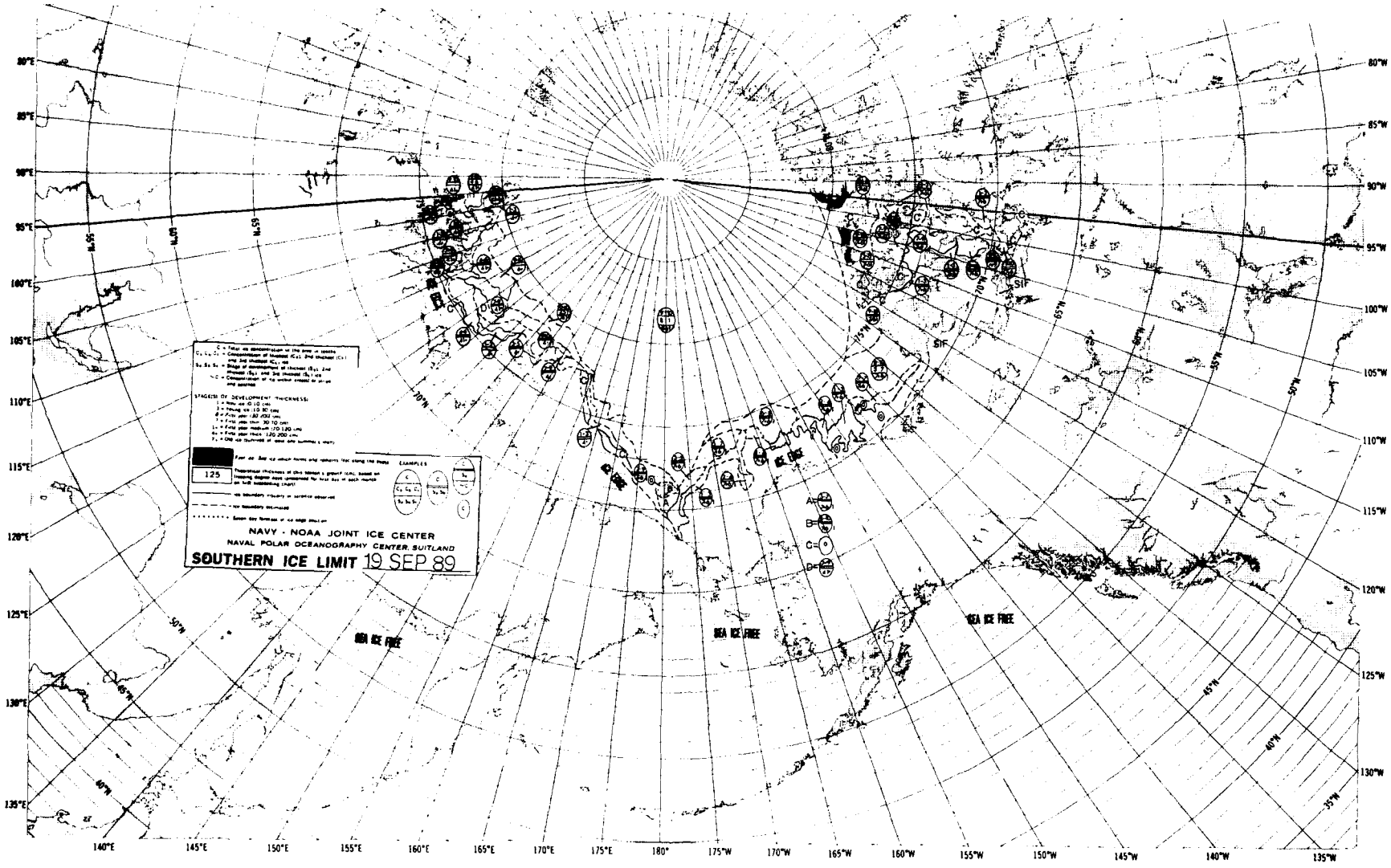
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 19 SEP 89
EXAMPLES
STAGES OF DEVELOPMENT THICKNESS
125
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
ICE EDGE
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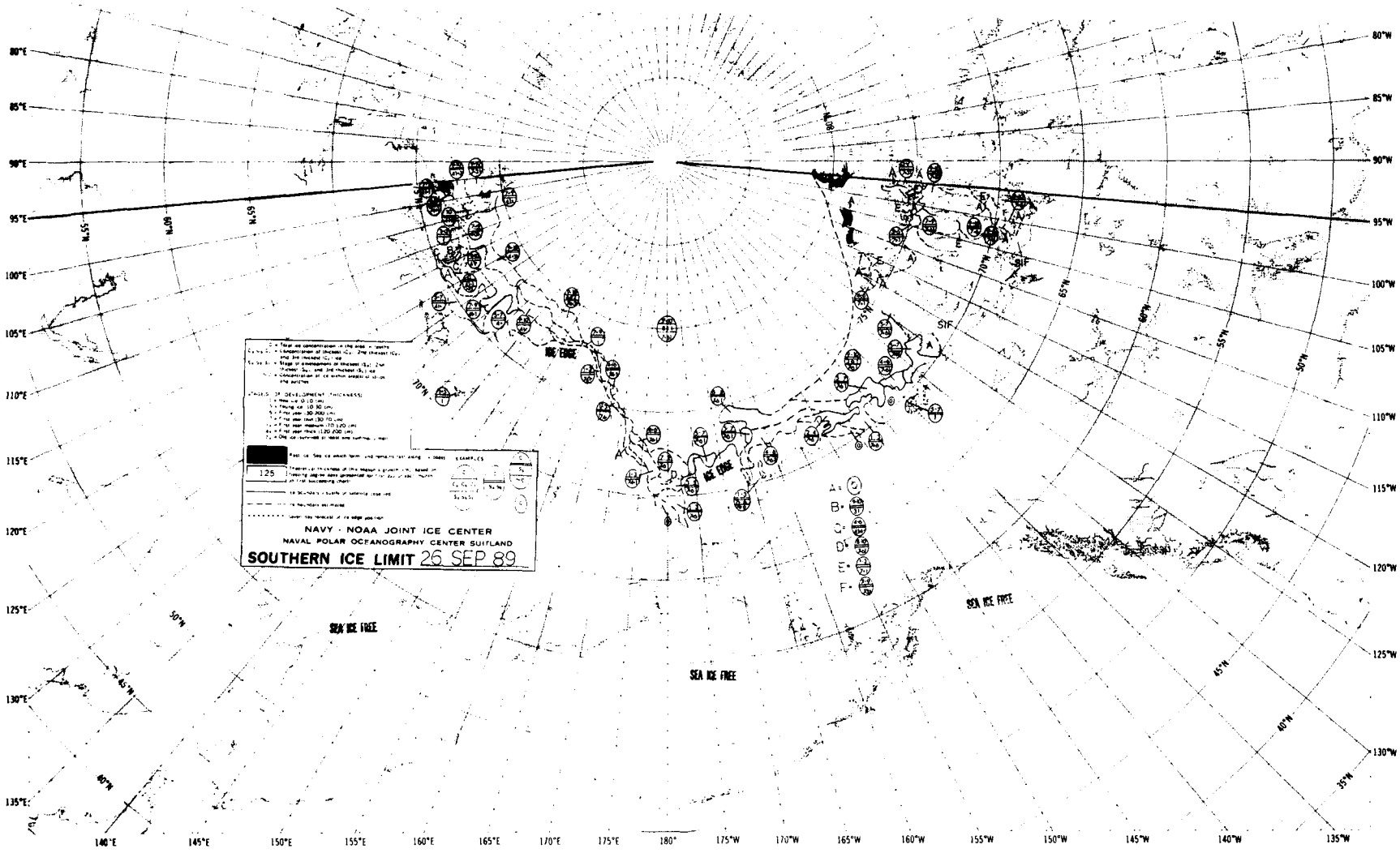
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 26 SEP 89
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SEA ICE FREE
SEA ICE FREE
ICE EDGE
ICE EDGE
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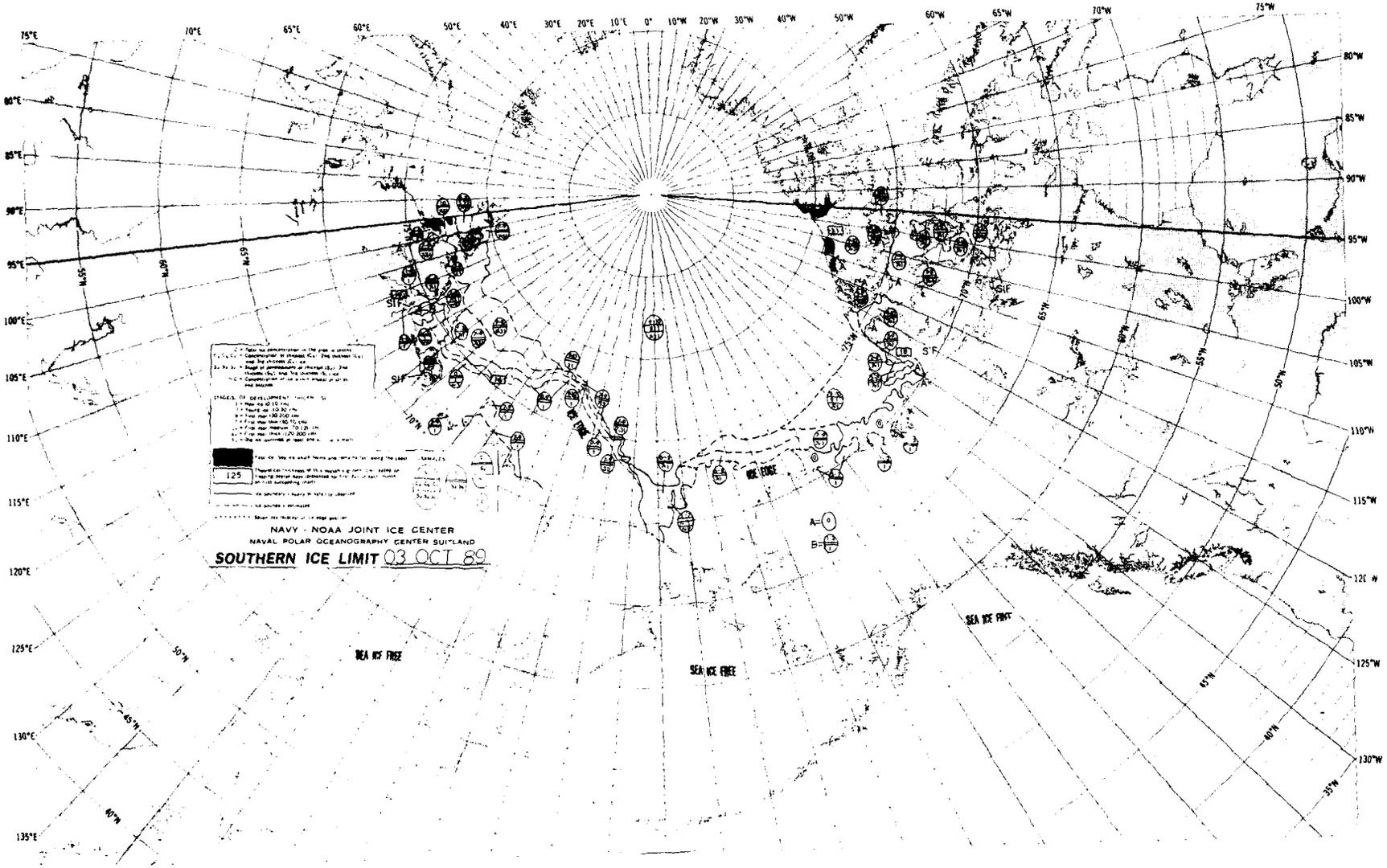
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
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SEA ICE FREE
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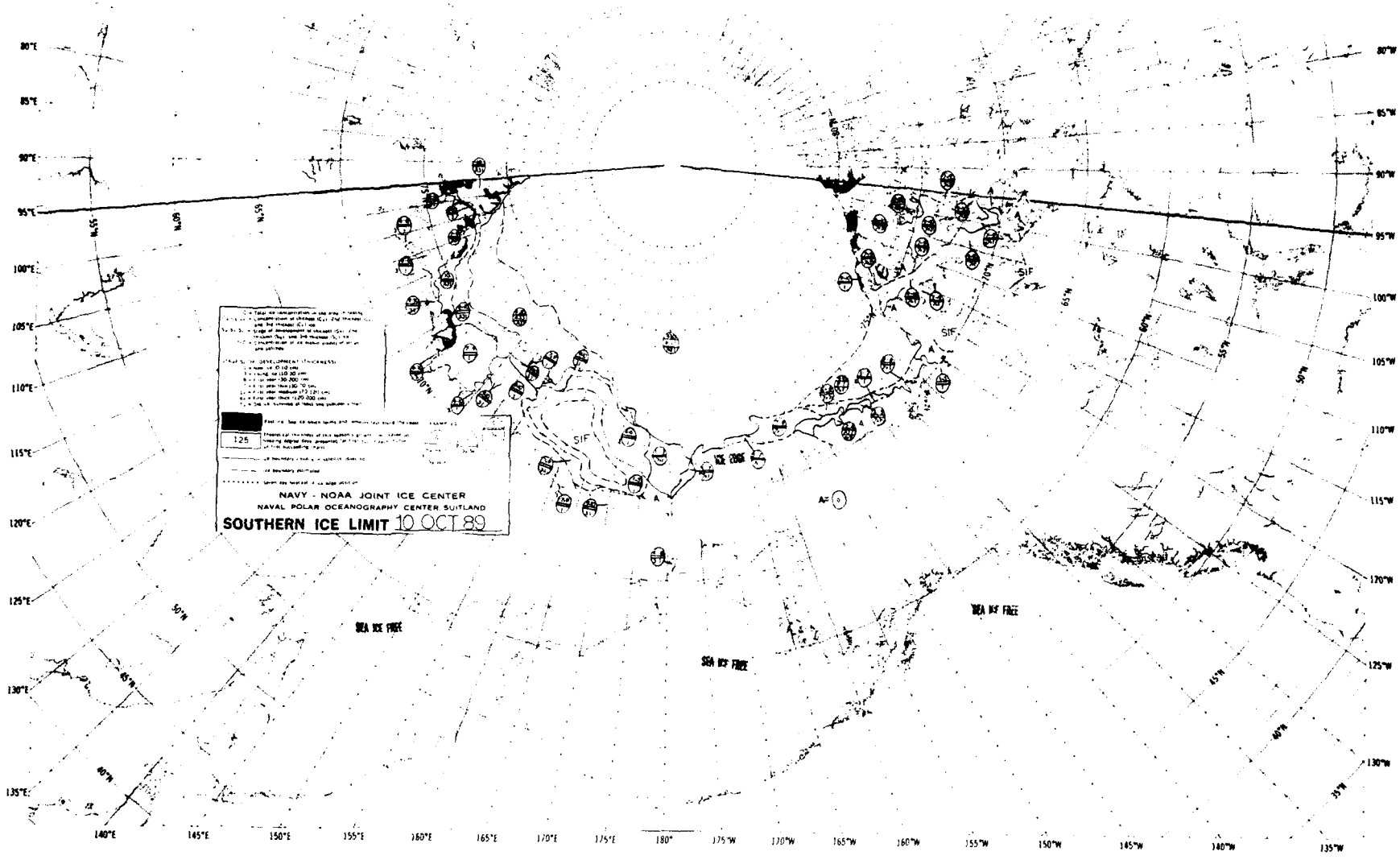
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 10 OCT 89
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SEA ICE FREE
SEA ICE FREE
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SIF
SIF
ICE EDGE
80°E
85°E
90°E
95°E
100°E
105°E
110°E
115°E
120°E
125°E
130°E
135°E
140°E
145°E
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155°E
160°E
165°E
170°E
175°E
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175°W
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165°W
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150°W
145°W
140°W
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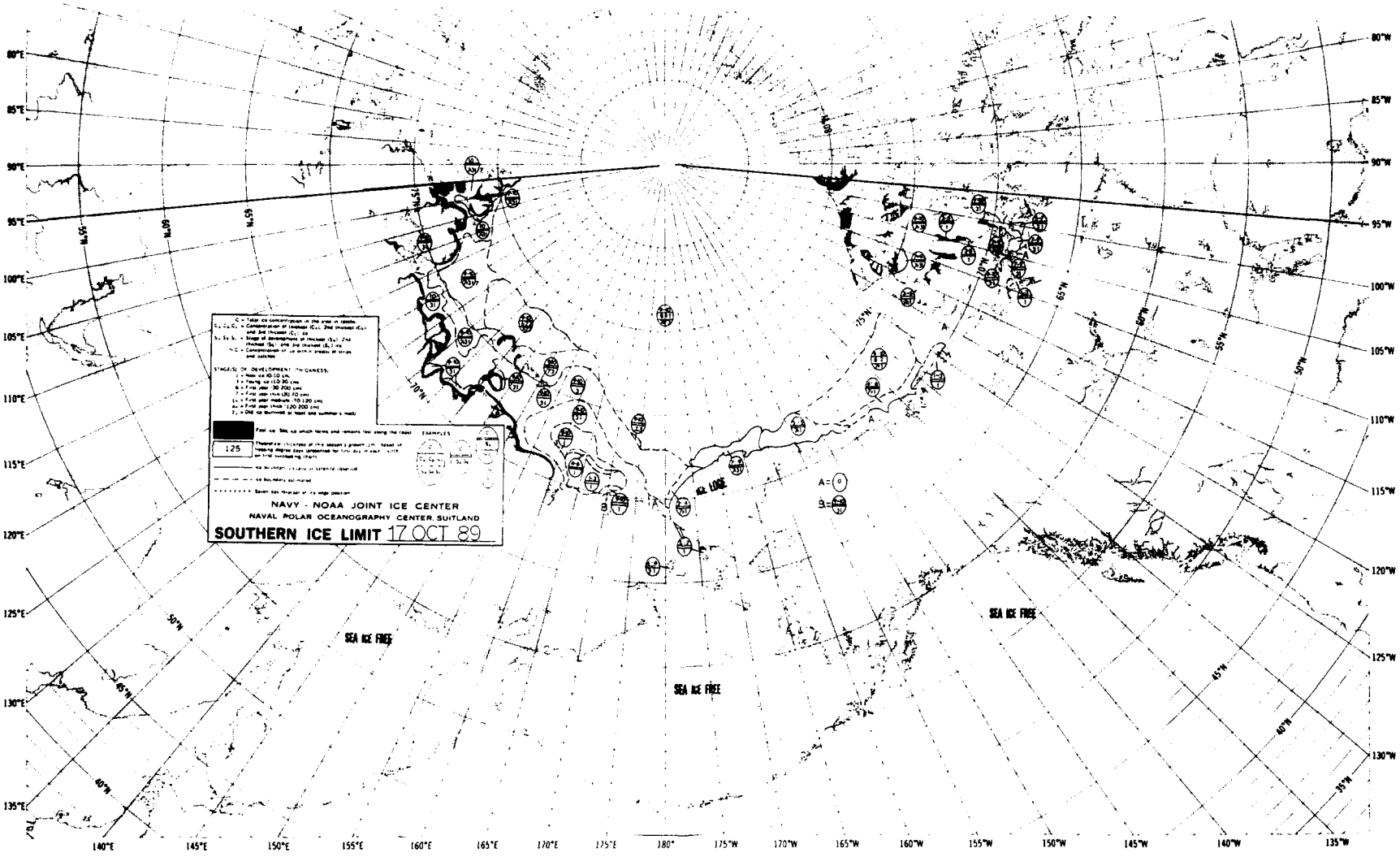
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 17 OCT 89
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
ICE EDGE
125
80°E
85°E
90°E
95°E
100°E
105°E
110°E
115°E
120°E
125°E
130°E
135°E
140°E
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175°W
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145°W
140°W
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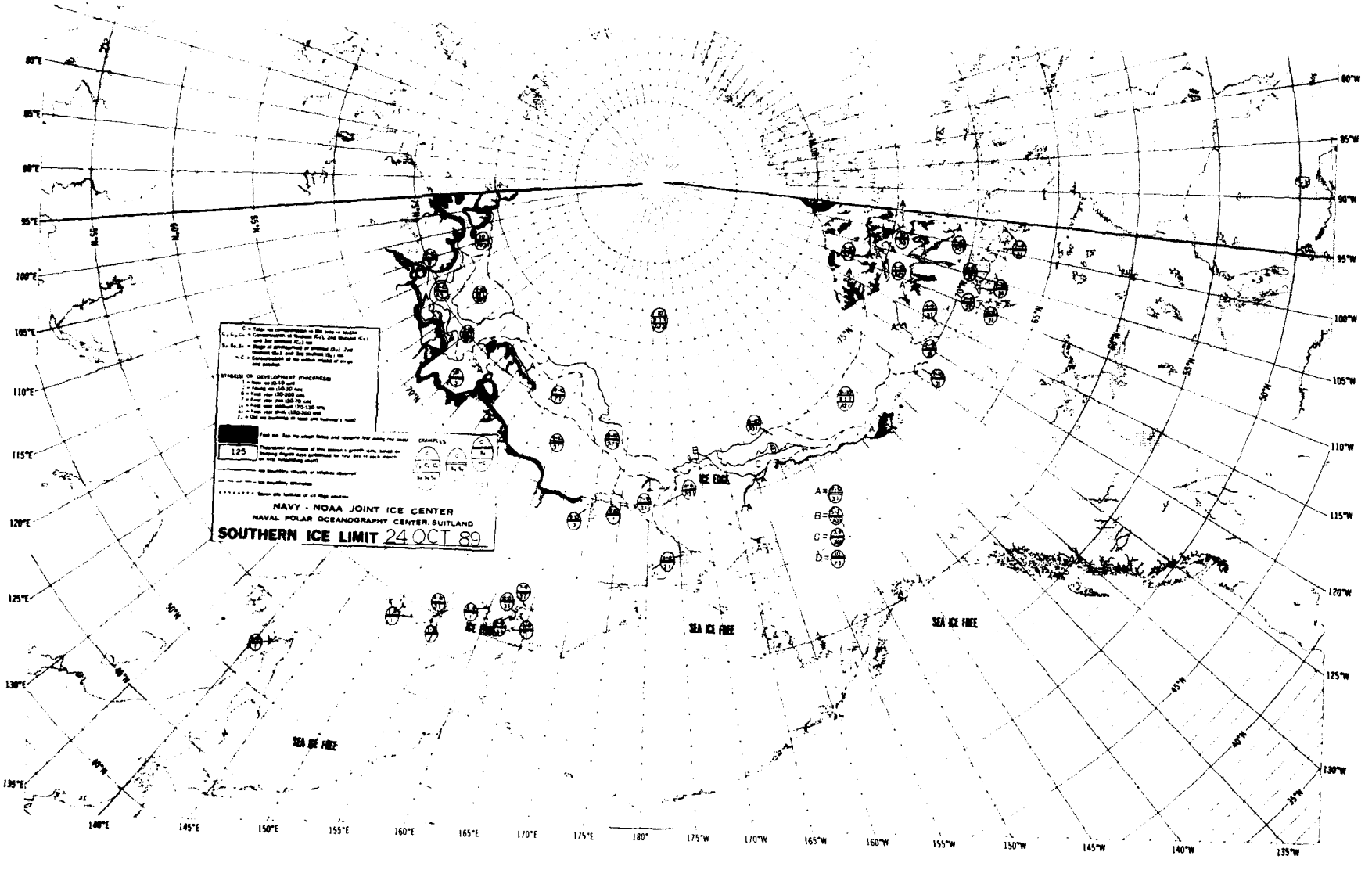
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NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 24 OCT 89
ICE EDGE
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
A=
B=
C=
b=
80°E
85°E
90°E
95°E
100°E
105°E
110°E
115°E
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125°E
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160°E
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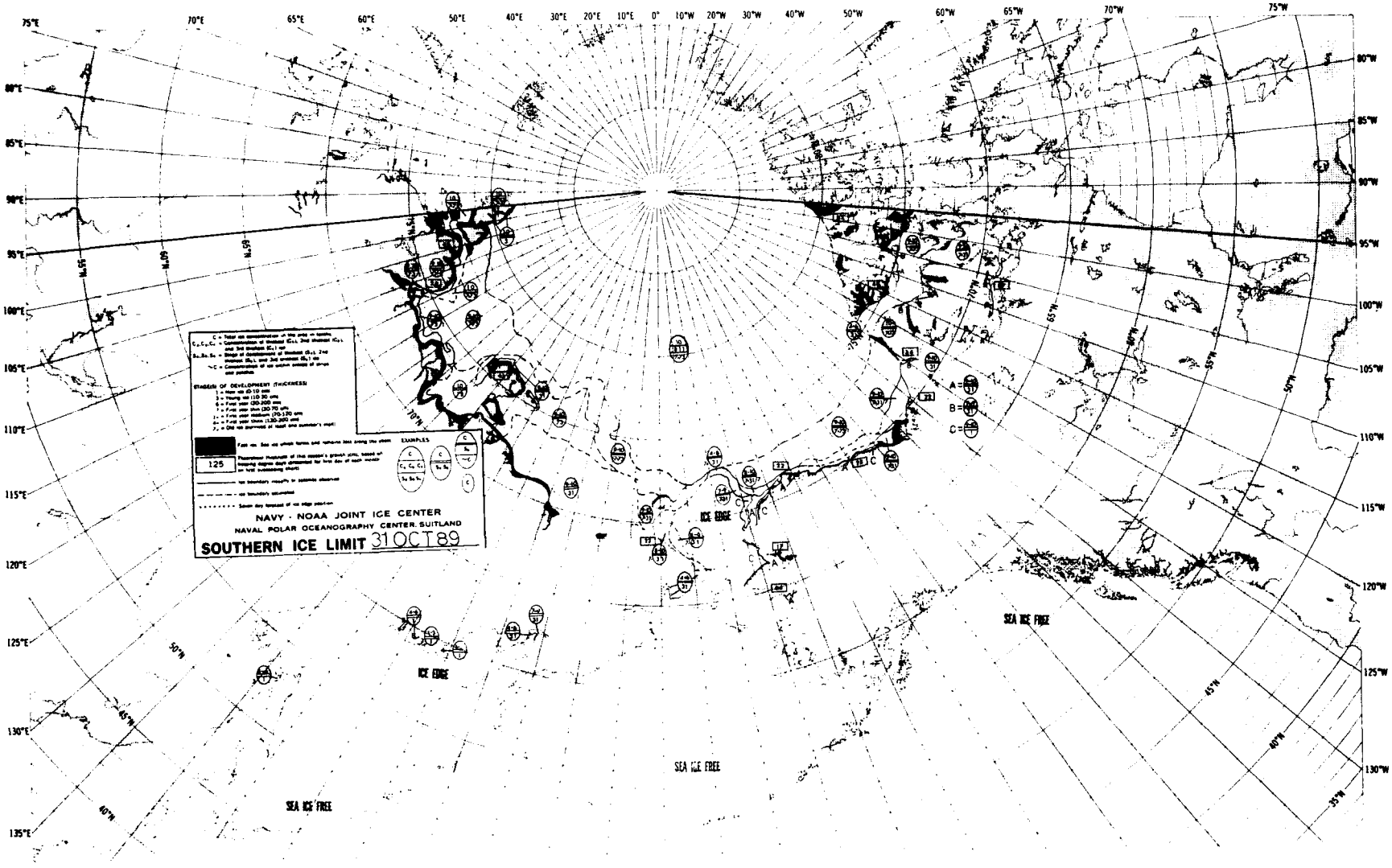
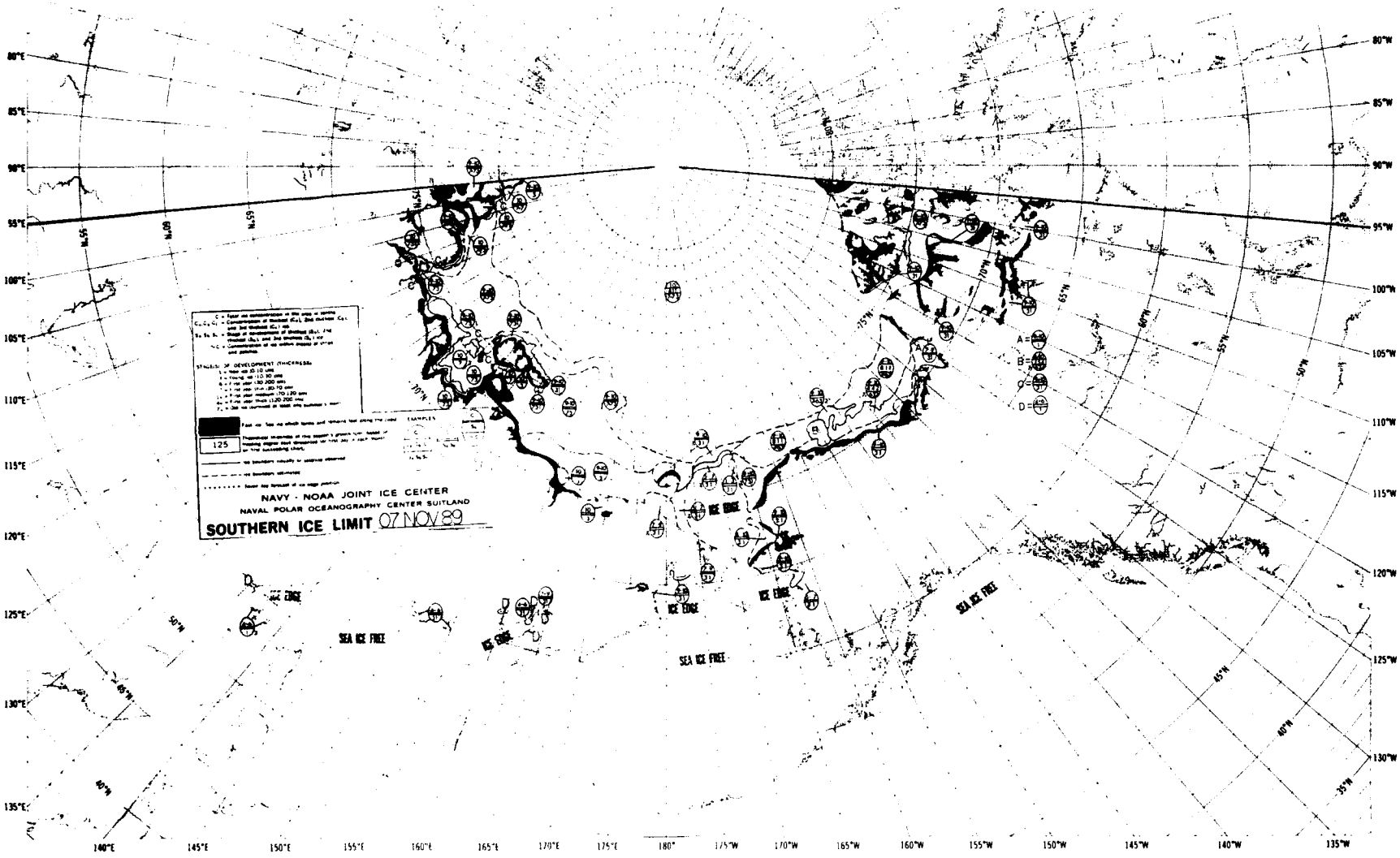
85°W
80°W


NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 31 OCT 89
ICE EDGE
ICE EDGE
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
A =
B =
C =


NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 07 NOV 89
SEA ICE FREE
ICE EDGE
A=
B=
C=
D=
125
80°E
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90°E
95°E
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105°E
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115°E
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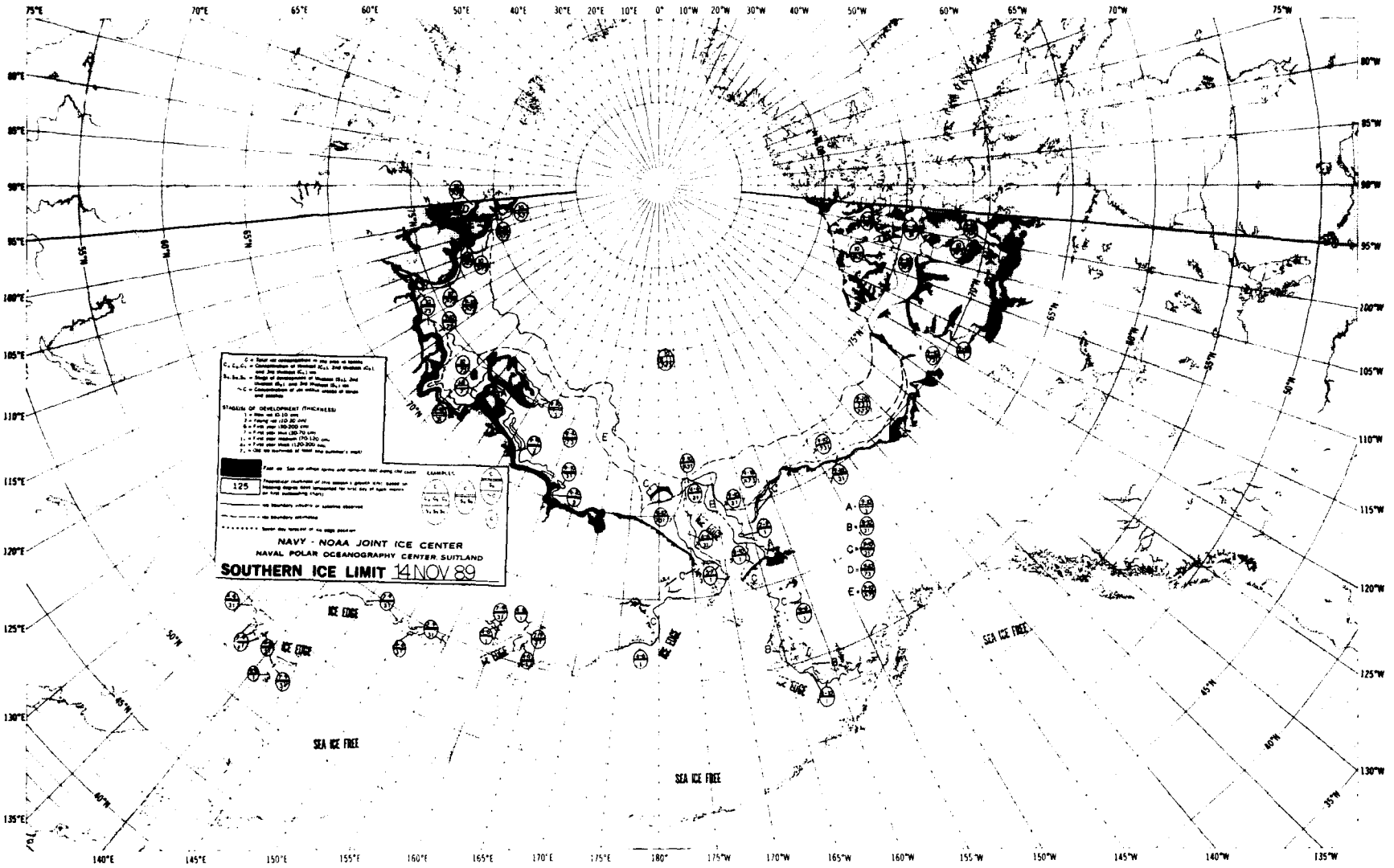
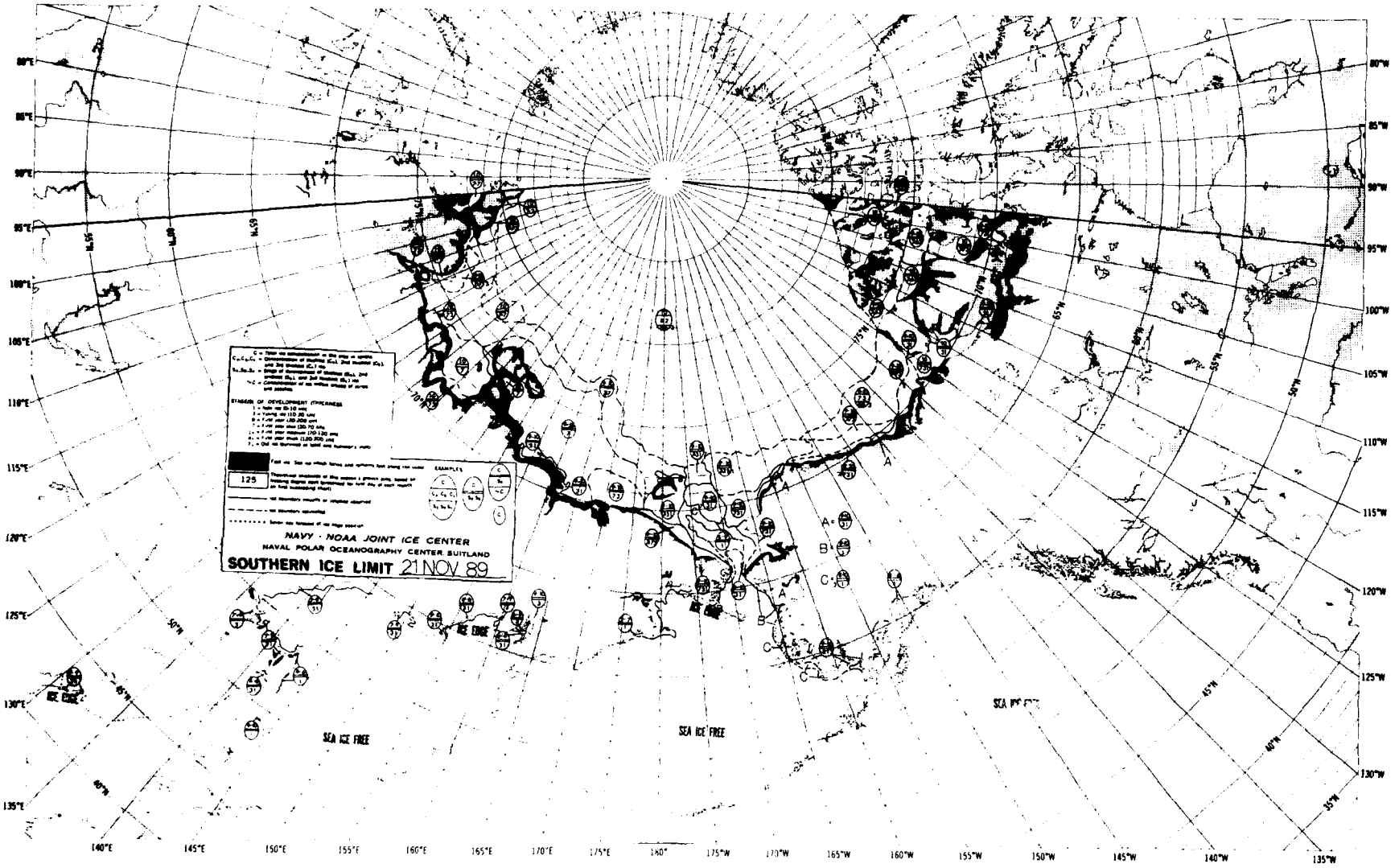
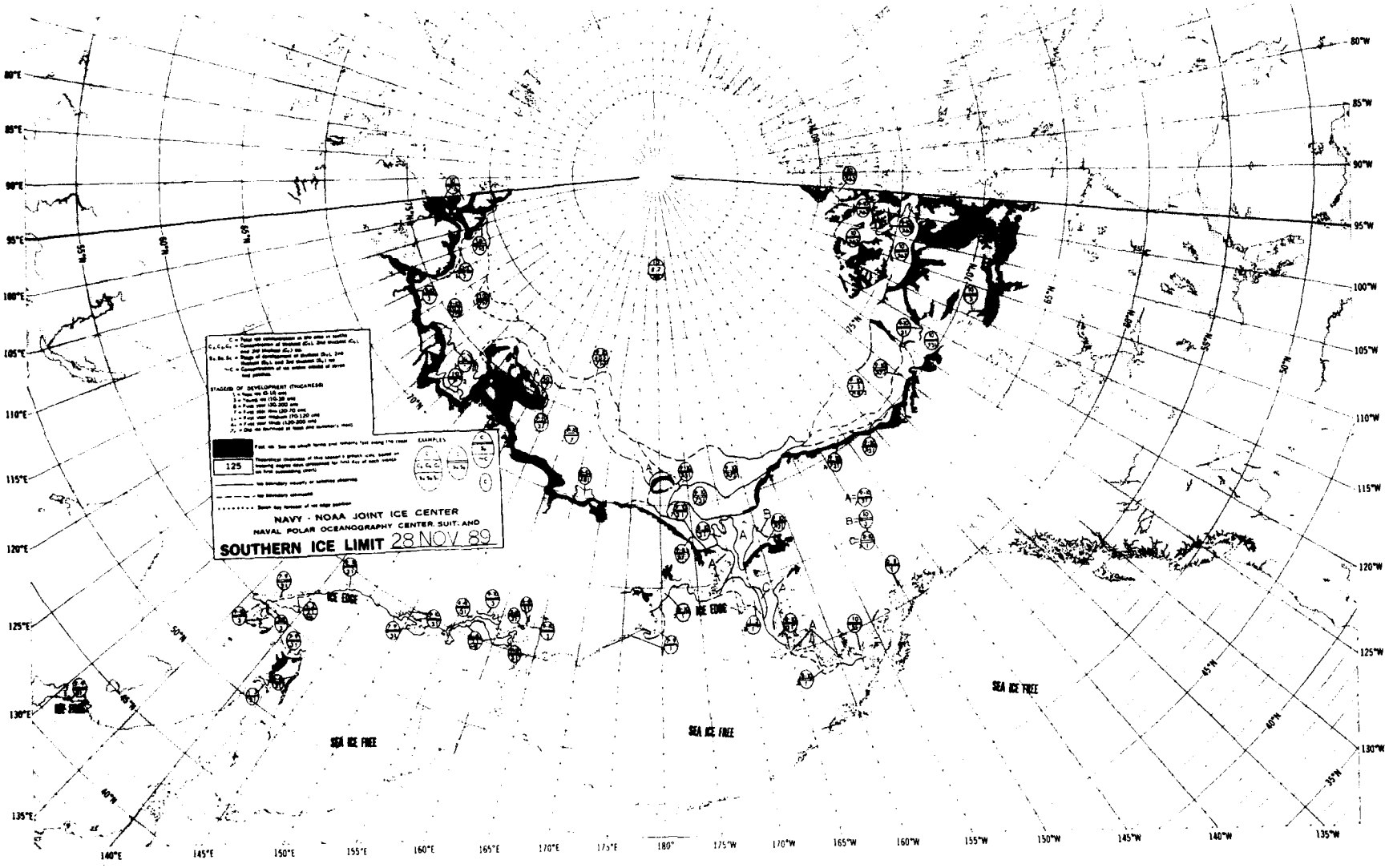

NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 14 NOV 89
STAGES OF DEVELOPMENT (THICKNESS)
125
ICE EDGE
SEA ICE FREE
A
B
C
D
E


NAVY · NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER SUITLAND
SOUTHERN ICE LIMIT 21 NOV 89
SEA ICE FREE
SEA ICE FREE
ICE EDGE
ICE EDGE
ICE EDGE
125


NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUIT, AND
SOUTHERN ICE LIMIT 28 NOV 89
STAGES OF DEVELOPMENT (THICKNESS)
EXAMPLES
125
ICE EDGE
ICE EDGE
ICE EDGE
SEA ICE FREE
SEA ICE FREE
SEA ICE FREE
80°E
85°E
90°E
95°E
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85°W
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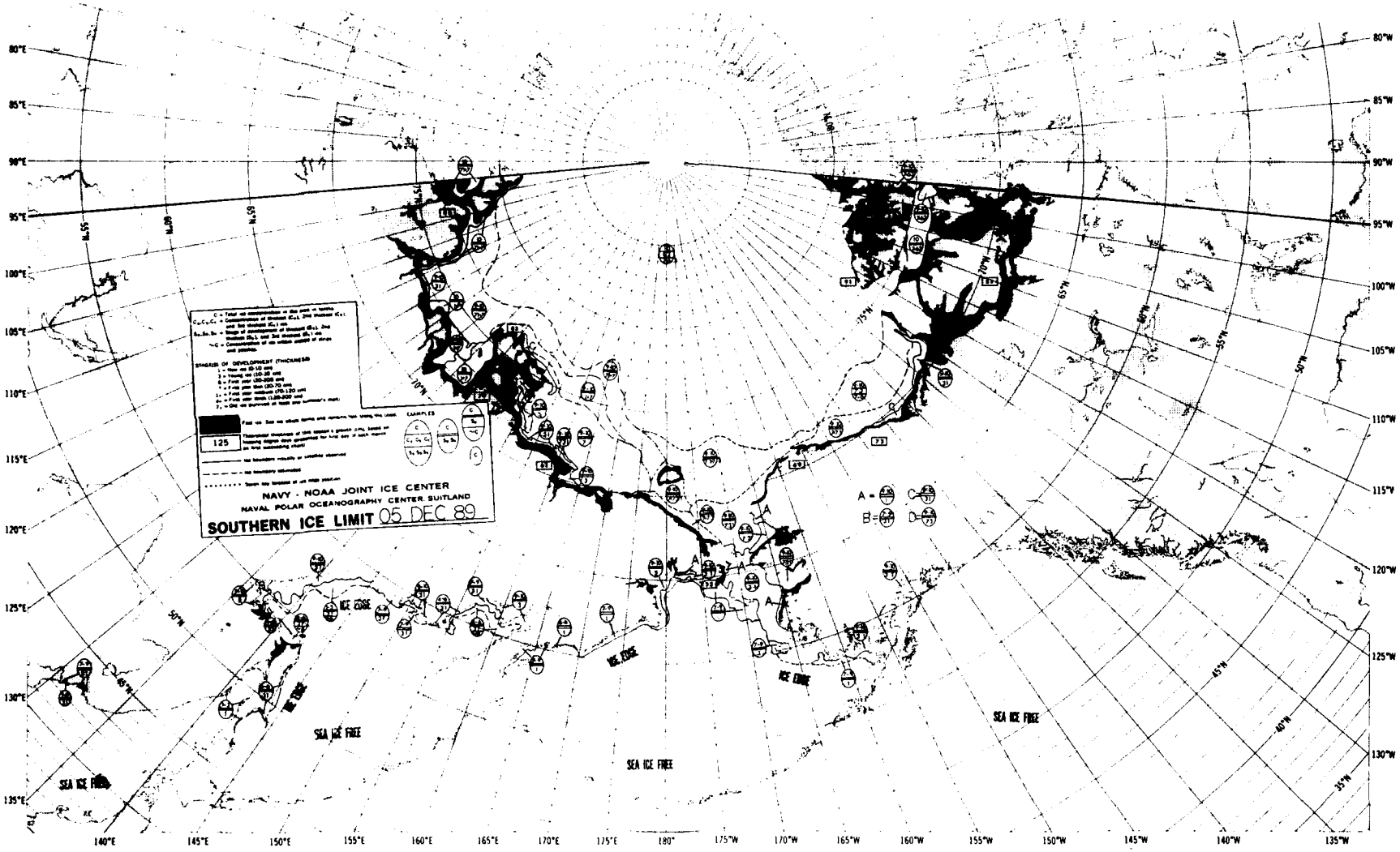
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 05 DEC 89
125
EXAMPLES
ICE EDGE
SEA ICE FREE
A =
B =
C =
D =
80°E
85°E
90°E
95°E
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105°E
110°E
115°E
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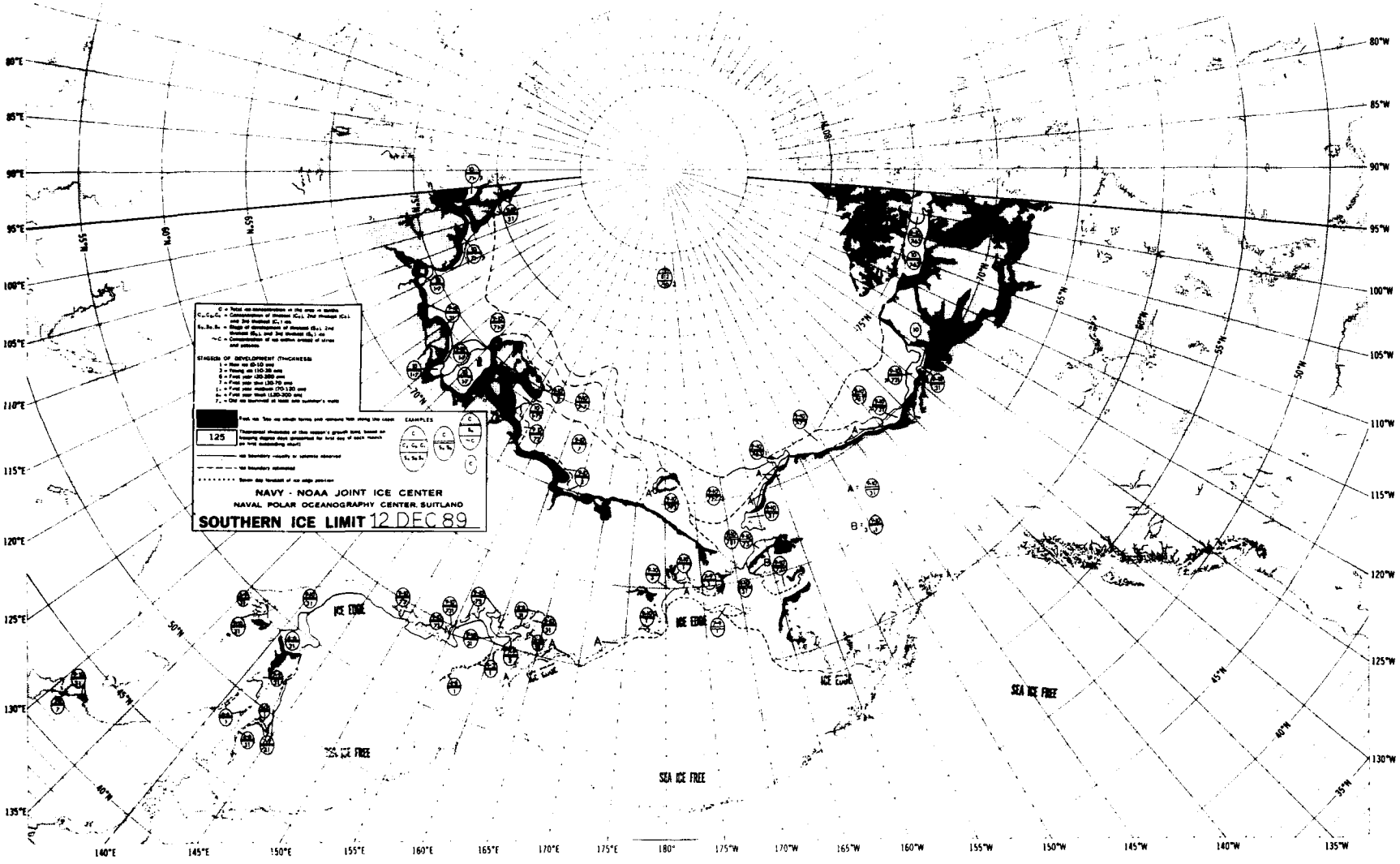
NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 12 DEC 89
STAGES OF DEVELOPMENT (THICKNESS)
EXAMPLES
125
ICE EDGE
SEA ICE FREE
80°E
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95°E
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95°W
90°W
85°W
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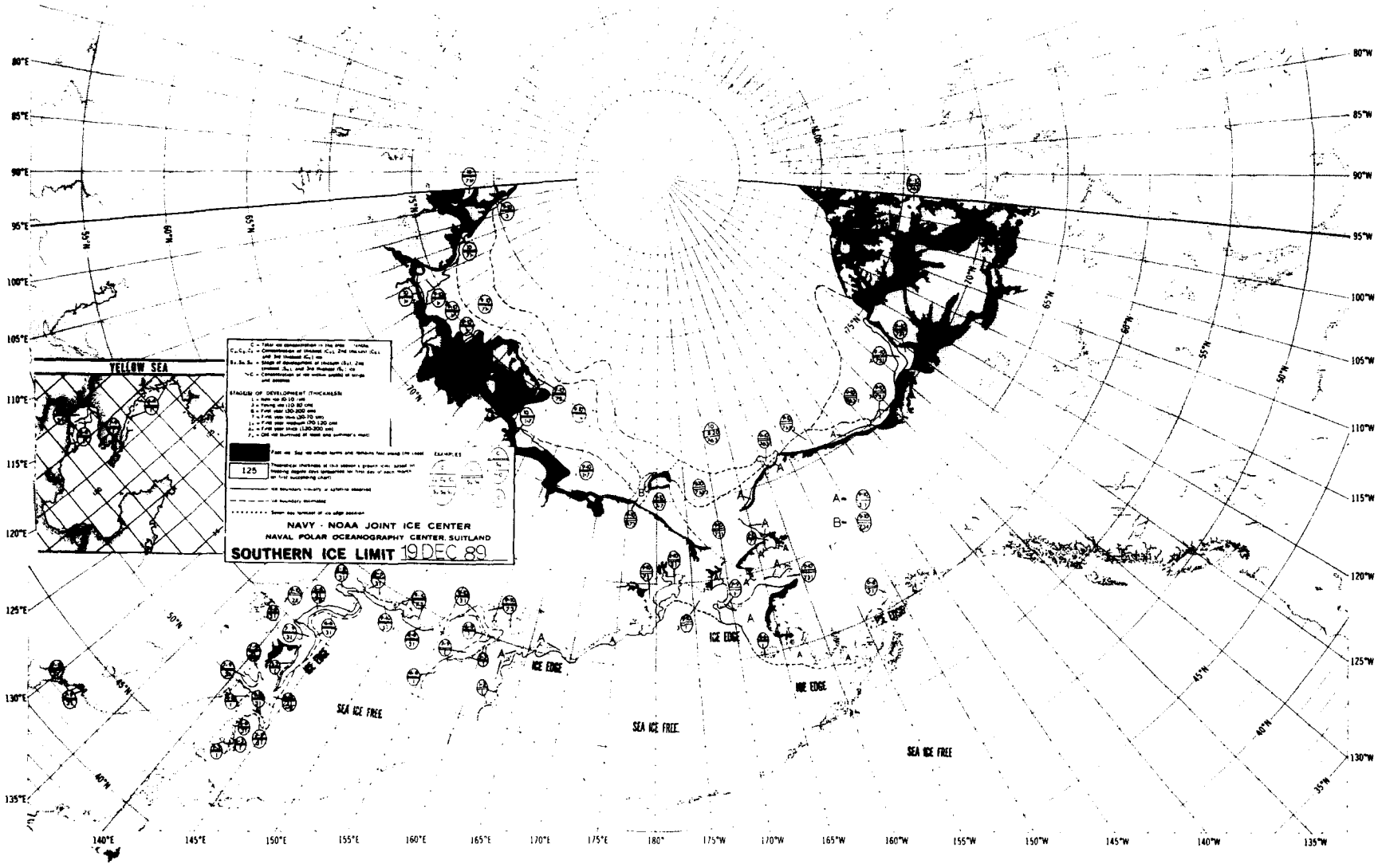

NAVY - NOAA JOINT ICE CENTER
NAVAL POLAR OCEANOGRAPHY CENTER, SUITLAND
SOUTHERN ICE LIMIT 19 DEC 89
YELLOW SEA
SEA ICE FREE
ICE EDGE
80°E
85°E
90°E
95°E
100°E
105°E
110°E
115°E
120°E
125°E
130°E
135°E
140°E
145°E
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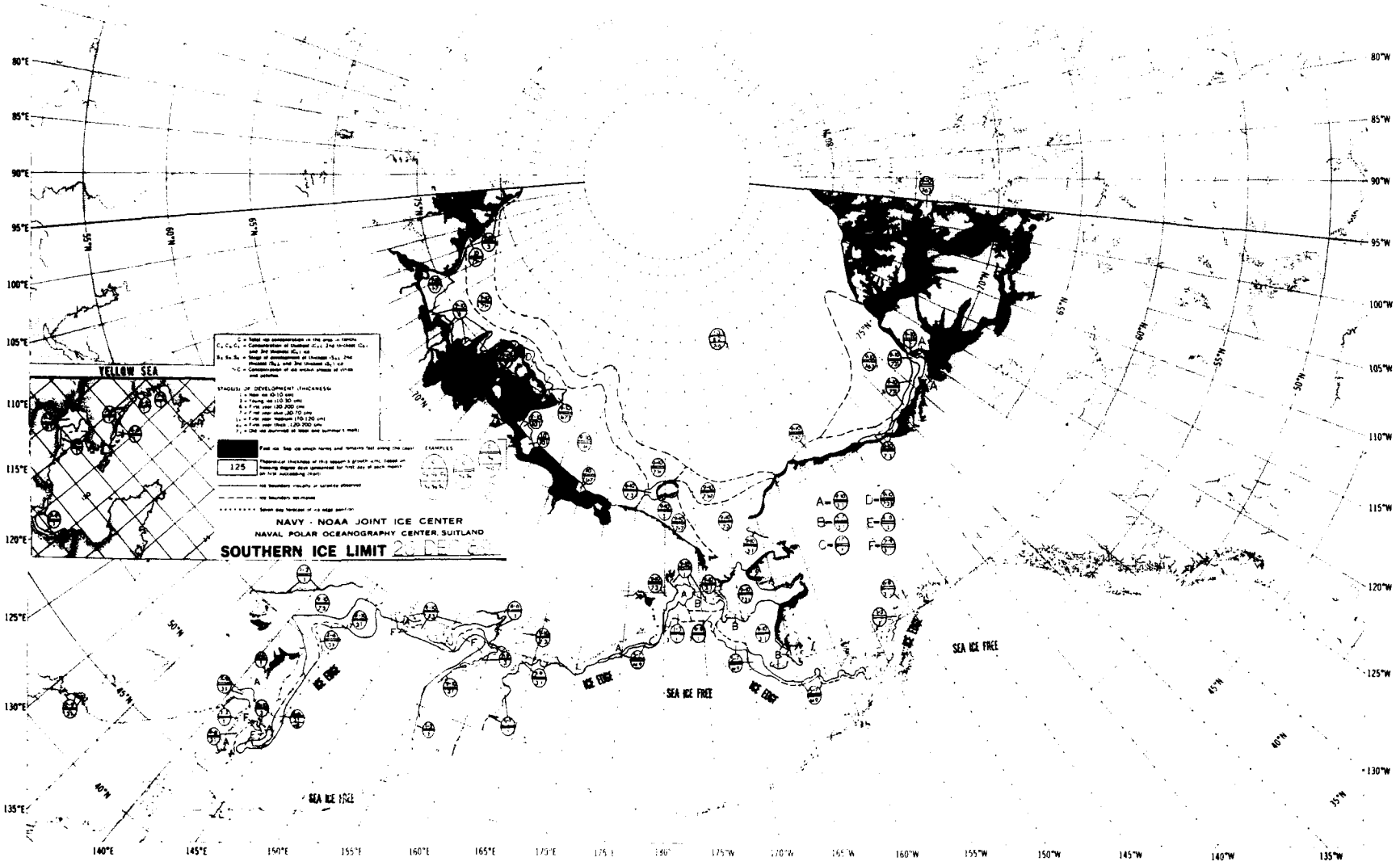

USCOMM-NOAA-ASHEVILLE, N.C. 4-90-175

ABLE 1. SATELLITE DATA UTILIZED DURING 1989 (ARCTIC)

Time period		Satellite Remote Sensing				
From	To	Sensor Platform	Sensor Type	Spectral Region	Resolution	Coverage
1-89	12-89	NOAA-10	AVHRR			
			HRPT/LAC			
			VIS	0.58-0.68 um	1 km	Regional
			NIR	0.725-1.10 um		
			IR	10.5-11.5 um		
			GAC			
			VIS	0.58-0.68 um	4 km	Global
			IR	10.5-11.5 um		
1-89	1-89	NOAA-11	AVHRR			
			HRPT/LAC			
			VIS	0.58-0.68 um	1 km	Regional
			NIR	0.725-1.10 um		
			IR	10.5-11.5 um		
			GAC			
			VIS	0.58-0.68 um	4 km	Regional
			IR	10.5-11.5 um		
1-89	11-89	DMSP-F(8)	VIS	0.4-1.1 um	3.7 km	Global
			IR	10.2-12.8 um	4.4 km	
1-89	12-89	DMSP-F(9)	VIS	0.4-1.1 um	3.7 km	Global
			IR	10.2-12.8 um	4.4 km	
			SSM/I	1.55 cm (19.35 GHz)	50 km	Global
				0.81 cm (37.0 GHz)	35 km	Global
1-89	9-89	GEOSAT	Radar Altimeter	N/A	7 km	Regional

Abbreviations and Acronyms

AVHRR - Advanced Very High Resolution Radiometer
cm - Centimeter
GAC - Global Area Coverage
HRPT - High Resolution Picture Transmission
IR - Infrared
km - Kilometer
LAC - Local Area Coverage
NIR - Near Infrared
SSM/I - Special Sensor Microwave Imager
VIS - Visible
um - Micrometer
GHz - Gigahertz