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Analysis of Winds Over Lake Okeechobee During Tropical Storm of August 26-27, 1949

Washington
January 1951

HYDROMETEOROLOGICAL REPORTS

(Nos. 6–22 Numbered Retroactively)

No. 1. Maximum possible precipitation over the Ompompanoosuc Basin above Union Village, Vt. 1943.

No. 2. Maximum possible precipitation over the Ohio River Basin above Pittsburgh, Pa. 1942.

No. 3. Maximum possible precipitation over the Sacramento Basin of California. 1943.

No. 4. Maximum possible precipitation over the Panama Canal Basin. 1943.

No. 5. Thunderstorm rainfall. 1947.

No. 6. A preliminary report on the probable occurrence of excessive precipitation over Fort Supply Basin, Okla. 1938.*

No. 7. Worst probable meteorological condition on Mill Creek, Butler, and Hamilton Counties, Ohio. 1937. (Unpublished.) Supplement, 1938.*

No. 8. A hydrometeorological analysis of possible maximum precipitation over St. Francis River Basin above Wappapello, Mo. 1938.*

No. 9. A report on the possible occurrence of maximum precipitation over White River Basin above Mud Mountain Dam site, Wash. 1939.*

No. 10. Maximum possible rainfall over the Arkansas River Basin above Caddoa, Colo. 1939.* Supplement, 1939.*

No. 11. A preliminary report on the maximum possible precipitation over the Dorena, Cottage Grove, and Fern Ridge Basins in the Willamette Basin, Oreg. 1939.*

No. 12. Maximum possible precipitation over the Red River Basin above Denison, Tex. 1939.*

No. 13. A report on the maximum possible precipitation over Cherry Creek Basin in Colorado. 1940.*

No. 14. The frequency of flood producing rainfall over the Pajaro River Basin in California. 1940.*

No. 15. A report on depth-frequency relations of thunderstorm rainfall on the Sevier Basin, Utah. 1941.*

No. 16. A preliminary report on the maximum possible precipitation over the Potomac and Rappahannock River Basins. 1943.*

No. 17. Maximum possible precipitation over the Pecos Basin of New Mexico. 1944. (Unpublished.)

No. 18. Tentative estimates of maximum possible flood-producing meteorological conditions in the Columbia River Basin. 1945.

No. 19. Preliminary report on depth-duration-frequency characteristics of precipitation over the Muskingum Basin for 1- to 9-week periods. 1945.*

No. 20. An estimate of maximum possible flood-producing meteorological conditions in the Missouri River Basin above Garrison Dam site. 1945.

No. 21. A hydrometeorological study of the Los Angeles area. 1939.*

No. 21A. Preliminary report on maximum possible precipitation, Los Angeles area, California. 1944.*

No. 21B. Revised report on maximum possible precipitation, Los Angeles area, California. 1945.

No. 22. An estimate of maximum possible flood-producing meteorological conditions in the Missouri River Basin between Garrison and Fort Randall. 1946.

No. 23. Generalized estimates of maximum possible precipitation over the United States east of the 105th meridian, for areas of 10, 200, and 500 square miles. 1947.

No. 24. Maximum possible precipitation over the San Joaquin Basin, Calif. 1947.

No. 25. Representative 12-hour dewpoints in major United States storms east of the Continental Divide. 1947.*

No. 25A. Representative 12-hour dewpoints in major United States storms east of the Continental Divide. 2d edition. 1949.

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*Out of print.

Hydrometeorological Report No. 26

ANALYSIS OF WINDS OVER LAKE OKEECHOBEE

DURING TROPICAL STORM OF AUGUST 26-27, 1949

ACKNOWLEDGEMENTS

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FIGURES

Analysis of Winds over Lake Okeechobee
during Tropical Storm of August 26-27, 1949

Introduction

For a number of years, the Corps of Engineers, Department of the Army,
has maintained meteorological observation stations at seven hurricane
gates on the shore of Lake Okeechobee, Florida (see frontispiece). In-
tensifying a program for better comprehension of wind and tide relations,
the Corps of Engineers, during the spring and summer of 1949, established
three additional wind recording locations on steel-girder pylons within
the Lake.

On August 23, 1949, the Miami Weather Bureau Office discovered
evidence of a tropical disturbance in the formative stage near latitude
19° N, 61° W - east of the Virgin Islands - and its position was care-
fully tracked thereafter. The disturbance soon developed into a hurri-
cane whose center entered Florida near West Palm Beach between 1830 EST
and 1930 EST of the 26th. Advancing west-northwestward, the hurricane
center crossed northern Lake Okeechobee shortly before midnight of the
same day. Hurricane winds (speeds above 75 mph) were experienced at the
newly-established Lake Stations and at most of the gates and other stations
in the storm path across Florida. The general path of the storm and some
notable features of wind and pressure are shown on figure 1 which is a
reproduction of a chart prepared by the Weather Bureau Office at Miami.
Occurrence of the storm and its movement across Lake Okeechobee provided
what is probably the best coverage on record of surface winds within 100
miles of a hurricane's center. Simultaneous measurement of water level
and wave height during the course of the storm furnished an unequaled

set of data for investigation of relations between the meteorological and
oceanographical elements on a shallow inland body of water during a period
of strong winds.

At the request of the Corps of Engineers, the Hydrometeorological
Section prepared, in November 1949, a preliminary report entitled, "Surface
Winds over Lake Okeechobee, August 26-27, 1949". The report contained
tabulations of ten-minute-average wind speeds and directions for all Lake
and hurricane-gate stations at ten minute intervals, through the period
1300 EST of the 26th to 1000 EST of the 27th. The report also contained
a set of successive maps illustrating the fields of isotachs (lines of
constant 10-minute-average wind speeds) and streamlines (10-minute-average
wind directions) for the same period. Since issuance of the preliminary
report further studies have been made of the August 1949 data. The current
report is intended to present to the meteorological field pertinent ex-
tracts from the preliminary report and the intermediate studies, with the
hope that they may be of assistance in establishing a firmer understanding
of the dynamics of a hurricane.

Wind and pressure data

Esterline-Angus multiple-pen recorder traces were available for the
wind observations of the 3 Lake stations. For wind speed, one pen recorded
the passage of each 1/10 mile of wind and a second recorded the passage of
each 10 miles of wind. As long as the 1/10 mile marks were distinct, the
10-minute averages were determined directly. At the higher speeds the
individual strokes of the 1/10-mile pen became indistinguishable, and
the strokes of the 10-mile pen had to be used. For the high speeds (above
about 35 mph) the duration for passage of each 10 miles of wind was de-
termined, and a smooth curve of wind speed vs. time was plotted for each

station. From these curves, then, the 10-minute-average wind speeds were extracted. Wind direction data were recorded by an 8-pen system. A smooth curve of direction vs. time was drawn for each station, and 10-minute-average directions were taken from the curves.

For Lake Station No. 2, the 10-mile wind speed pen failed to operate during the course of the storm. Use of the 1/10-mile record provided data close to and at some distance away from the storm center, but wind speeds in excess of 35 mph could not be determined with an acceptable degree of reliability. The record of wind direction for this station was satisfactory, however.

Continuous traces of wind speeds and directions were available for the Dines anemometers installed at 6 of the hurricane gates. At Hurricane Gate No. 3 only wind speeds were available. For each station the wind speed trace was divided into 10-minute segments. The 10-minute-average speed was defined as that value determined by a horizontal line bisecting the darkened area of the trace. The same process was used for determination of the 10-minute-average wind directions. This method of averaging was found to be accurate and most rapid when it was tested by comparison with other methods.

Also at the Section's disposal were pressure and wind data from 27 Weather Bureau, Coast Guard, Engineer and private observing stations. None of these data, available at the time of preparation of the preliminary report, were of the recorder type, and some were estimates of wind velocity, but all were used to a greater or lesser degree after qualitative evaluation of the observations.

The pressure and wind fields

After collecting and organizing the basic data, the Section drew half-

hourly surface weather map analyses for the Southern half of Florida for the
period of the hurricane. With these larger maps as guides, detailed analyses
of pressure and wind over the Lake Okeechobee area were made on two separate
sets of charts. Figures 2-10 portray the pressure patterns over the Lake at
half-hourly intervals during the period of storm passage. Figures 11-61
portray the successive patterns of 10-minute-average wind speed and direction
over the same area. The wind charts are for 10-minute intervals during the
critical period of 2000 EST of the 26th to 0200 EST of the 27th, and for
hourly intervals for several hours on either side of the critical period.
The wind values are averaged over the 10-minute period from 5 minutes before
to 5 minutes after the time indicated on each chart.

The wind charts illustrate the tremendous importance of surface friction
on wind speeds measured near ground or water surfaces, and the observations
suggest possible explanations of peculiarities often noted in the pressure
and wind patterns of a hurricane. For instance, the "longitudinal" divergence
(in the direction of the undistorted hurricane wind field) which exists with
an offshore wind, appears at least partially to be compensated by a "transverse"
convergence (across the undistorted streamlines). The opposite effect is
noticeable with winds directed onshore. Such features of the wind, parti-
cularly noticeable on figures 36 and 37 , must play an important role in
producing distortions in isobars passing over a coastline, as in figures 7
and 8 . Similar circumstances, noted in studies of other hurricanes, have
given rise to considerable difficulty in tracing the paths of hurricanes
crossing the Florida coastline.

In addition to gustiness of varying periodicity, the anemograph records
show longer-period (20-30 minute) rises and falls in wind speed during passage

of the storm. Many of these fluctuations must be associated with the spiral bands of turbulence and squally weather observed in airplane flights through tropical storms and shown remarkably well on radar PPI-scope photographs of recent hurricanes. An example of such a photograph for the hurricane of August 1949, however, is shown in figure 62, furnished by the Engineering and Industrial Experiment Station, Electronics Research Laboratory, University of Florida.

Although the wind charts are drawn to suggest a rather uniform acceleration of the surface wind upon leaving land, and of deceleration upon approaching the shore, the precise nature of the acceleration remains much in doubt. Addition of one or more judiciously placed Lake stations would materially aid in clarification of the problem as to how rapidly the wind speeds up or slows down upon crossing a coastline.

The Hydrometeorological Section is continuing to study deviations, such as the above, from symmetrical wind and pressure fields with the aim of developing quantitative methods of introducing them into a generalized wind model. In its present state, the model consists of an empirical description of a symmetrical hurricane surface-wind pattern upon which are superimposed local adjustments to account for effects, on surface wind speed, of a friction factor which varies with the type of surface traversed by the wind. The current model may thus be considered as a first approximation for determining interrelations of wind speed, direction, and duration, and such oceanographical parameters as fetch, wind tide, and wave height. Derivation of the model as it applies to the hurricane of August 1949 is given in the following paragraphs.

Determination of the storm path

General forecasting techniques do not require extremely accurate pin-

pointing of the exact "center" of a hurricane, nor is there a particular need for giving a definition of "center". For some time the Hydrometeorological Section has been attempting to develop a general theoretical representation of tropical storms for the Lake Okeechobee area, and has experienced considerable difficulty reproducing winds near the "center" of such storms through use of cyclostrophic or gradient wind equations. The reason for much of the difficulty is that the wind center and center of minimum pressure are not always coincident. In order to be consistent in location of "center" and yet avoid depending completely upon the pressures at one or two stations near the "center" for location, the Section decided to use a "center of pressure symmetry" to define successive positions along the path. The center of pressure symmetry at any time is defined as that location which produces the best fit of all simultaneous pressure readings to a smooth mean pressure profile for the total storm period over the Lake. Figure 63 shows the path of pressure symmetry determined for the 1949 storm. For comparison, figure 64 shows the path of minimum pressure determined by means of isochrones of minimum pressure and isobars of minimum pressure. It is interesting to note that whereas the center of pressure symmetry passed to the north of Port Mayaca, the center of minimum pressure passed south of it. Due to storm movement, the path of the center of wind rotation is not coincident with either of the above paths.

The wind direction pattern

Assumption of gradient wind conditions with flow parallel to the isobars would result in considerable error in wind direction, particularly near the center. This is illustrated by the fact that the center of minimum pressure passed south of Port Mayaca, and yet the winds backed at that station

as the hurricane moved westward across the Lake. The implication from the observed data, then, is that a "wind center" passed north of Port Mayaca. Therefore, it was necessary to devise a practical means of showing instantaneous wind directions. With a transparent sheet always aligned north and south and always centered at the center of pressure symmetry, wind directions were plotted at ten-minute intervals (figure 65). On this chart the suspected distinct center of wind rotation became evident. The bearing and distance of the wind center from the center of pressure symmetry were determined and this constant vector adjustment was applied to all positions along the path of pressure symmetry to obtain a path of wind rotation. All subsequent measures of distance and references to path are based upon the position of the wind center.

Figure 66A shows the mean deflection of the observed wind direction from a perpendicular to a radius (drawn from the center of wind pattern) as a function of distance from the wind center. There are indications that there may be relationship between rate of change of deflection angle and position of the station relative to the path of the storm center. However, as a first approximation used in this report, it appeared suitable to attribute the deviations from a symmetrical pattern to local station exposure characteristics. Assuming, then, that deviations from a symmetrical pattern are due to local characteristics, and in order to facilitate drawing of a sequence of charts, the mean deflection angles were converted into a spiral as shown in figure 66B. Centering the curve at successive positions of the storm center permits quick reproduction of the mean instantaneous wind directions within the field of the hurricane. Figure 66A suggests that the deflection angle becomes negative for distances less than five

miles from the center of the storm. Actually, two observations within five miles of the center do show such deflection angles. It is interesting to note that the observations suggest outflow from the center which is in agreement with the mechanics necessary to produce dissipation of clouds and the resultant "eye" of the storm.

The wind speed field

In order to establish a general wind-speed field, it was necessary to fix a standard of wind with nearly constant frictional effects. Since there were three stations operating on the Lake, it was decided to use as a base an "over-water" wind as defined by the observations recorded on Lake Okee- chobee. Figure 67 is an envelopment of all 10-minute average speeds re- corded at the Lake stations. For convenience in use for design procedures, envelopments are the most suitable values to use. It should be pointed out that the wind field represents conditions in the vicinity of Lake Okeechobee, and not throughout the life of the storm, and further, the velocities represented are 10-minute averages obtained by procedures pre- viously described.

In order to establish adjustment factors for site and exposure of anemometers at the stations along the shores of Lake Okeechobee, the winds at each station were separated into two categories - off-land, and off- water. For each station a mean percentage of over-water wind was de- termined for each of the two categories. Table I expresses the relation of off-water and off-land winds at each station as a percentage of the over-water wind.

Table I
Percent over-water wind

Station	Off water	Off land
Hurricane Gate No. 1	55	55
" " " 2	73	58
" " " 3	81	64
" " " 4	80	66
" " " 5	89	56
" " " 6	87	57
Port Mayaca	89	64

The low value of off-water wind for Hurricane Gate No. 1 is probably
due to the fact that there is a considerable stretch of marshland on the
water side of the station, so that for practical purposes this station may
be considered as not having a true off-water exposure.

Off-water winds at the remaining stations indicate the effects of de-
celeration as wind approaches the shore, since with onshore winds, one
would otherwise expect well-exposed anemometers to show velocities equal
to the over-water velocities. The cumulative effect of increased friction
over land and consequent convergence at the shore apparently produces a
slowdown of the wind before reaching the shoreline. An item of added
interest in this connection requiring further study is an apparent curvature
of the path of a hurricane when crossing a shoreline. On approaching a shore-
line from water there appears to be an excess of pressure, or mass accumula-
tion, to the right of the path, and a deficit of pressure to the left of the
path. Immediately upon crossing the shoreline and passing onto a surface
of uniform frictional effects, then, the apparent path shifts when the
pressures to right and left approach symmetry.

Applications of the analysis

Reliability of the procedures was tested qualitatively by an attempt
to reproduce observed wind directions and speeds for the storm of August
26-27, 1949. Since the whole procedure is based upon an averaging of the

observed conditions in the storm, it can be expected that there should be a fairly close agreement. Figure 68 is a typical reproduction of the wind direction and speed as outlined by the above procedures. The agreement with observed values plotted at the individual stations indicates that the concurrence is of sufficient accuracy for use in determination of wind-tide and waves for design purposes.
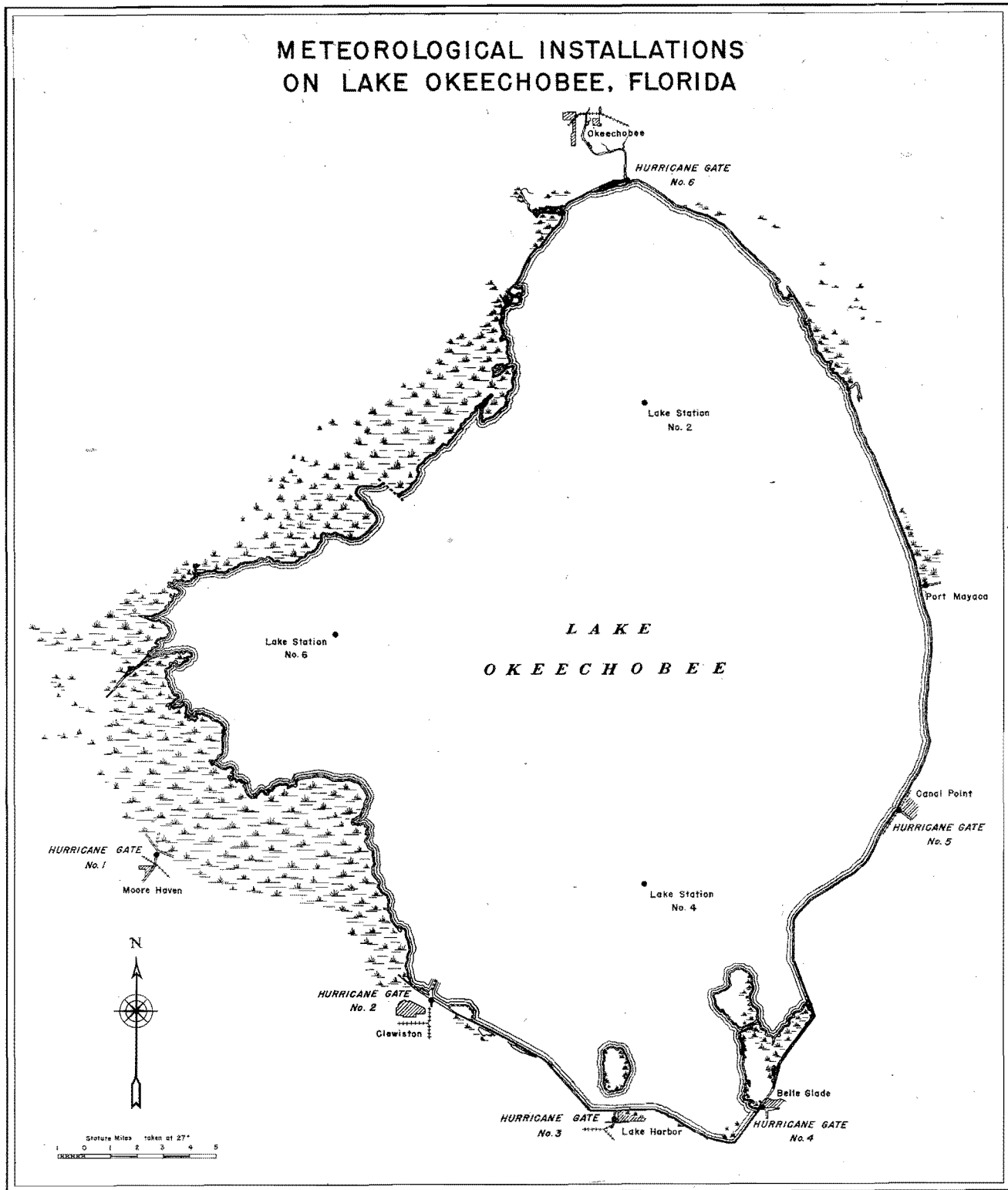
It is believed that the effective hurricane history can be increased over areas commonly visited by such storms by the technique of transposition. In order to assist in the estimation of the maximum possible rainfall over river basins, the Hydrometeorological Section has been applying such techniques to storm rainfall for some years, with considerable satisfaction. At the present time the Section is applying the procedure of wind analysis described, to other tropical storms in Florida for which sufficient data are available to provide a fairly reliable analysis. Within reasonable meteorological limits each of these storms will be transposed in such fashion as to produce a critical sequence of winds at a particular levee or flood control structure. Thus, after the completed transpositions, oceanographers, familiar with the relationships between winds and tides or waves, will be able to estimate the needs of a design structure adequate to cope with a situation arising from critical passage of a tropical storm of magnitude comparable to any which has been experienced in Florida.

This report has deliberately been confined to discussion of the empirical analysis of the 1949 hurricane, based upon the excellent set of observations obtained during the storm. Other tropical storms are being subjected to similar analyses and transpositions by the Hydrometeorological Section. The theoretical aspects of hurricane mechanisms have not been
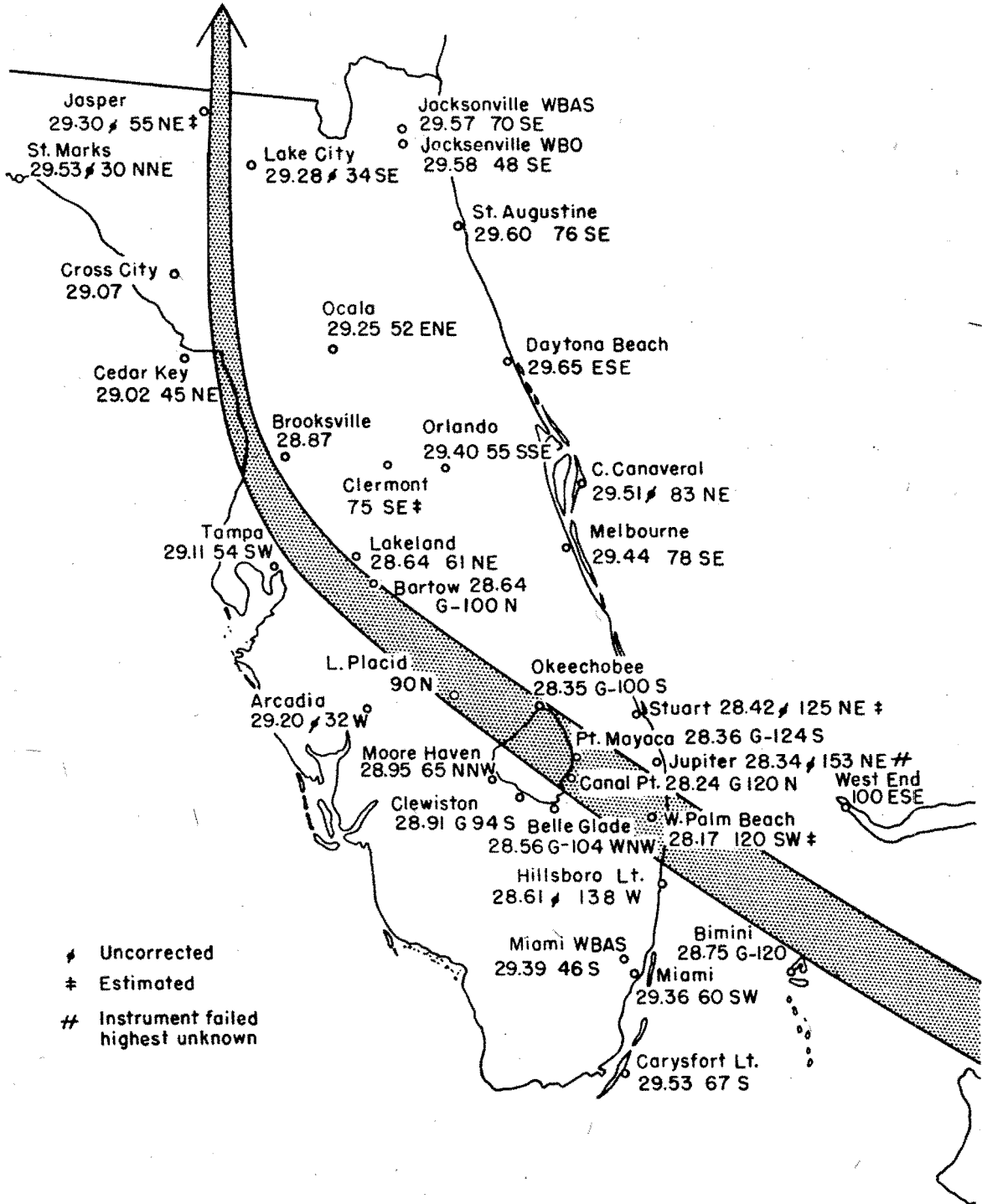
neglected, however, since the problem of estimating maximum possible hurricane winds will require a thorough investigation of all the possible variables. These and other theoretical considerations are a continuing phase of the overall investigation of hurricane winds.

METEOROLOGICAL INSTALLATIONS
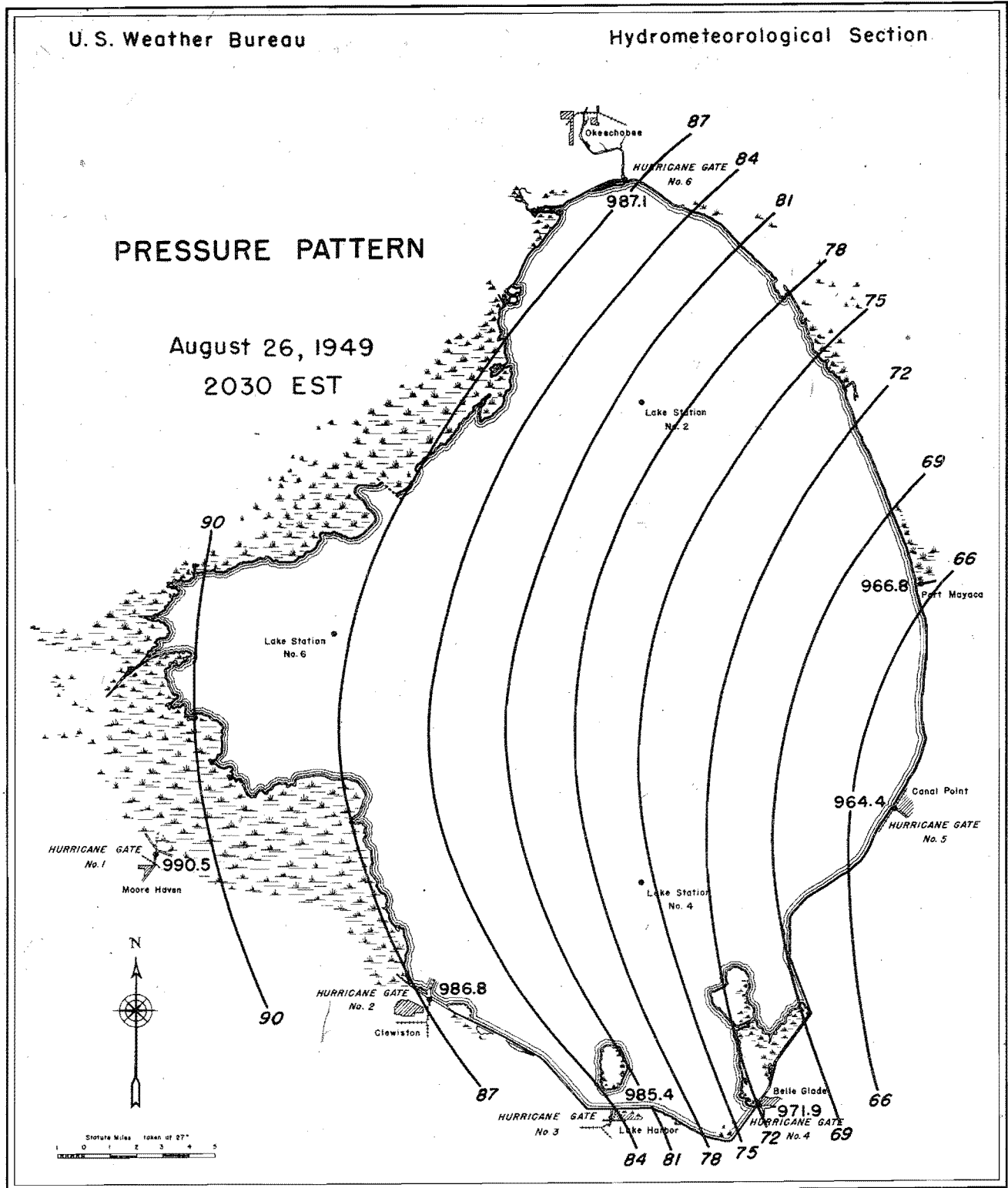# ON LAKE OKEECHOBEE, FLORIDA

Okeechobee

HURRICANE GATE
No. 6

Lake Station
No. 2

L A K E

O K E E C H O B E E

Lake Station
No. 6

Port Mayaca

Canal Point

HURRICANE GATE
No. 5

HURRICANE GATE
No. I

Moore Haven

Lake Station
No. 4

N

HURRICANE GATE
No. 2

Clewiston

Belle Glade

HURRICANE GATE
No. 3

Lake Harbor

HURRICANE GATE
No. 4

Statute Miles   taken at 27°

1 0 1 2 3 4 5

Jasper
29.30 ✦ 55 NE ‡

St. Marks
29.53 ✦ 30 NNE

Lake City
29.28 ✦ 34 SE

Jacksonville WBAS
29.57 70 SE

Jacksenville WBO
29.58 48 SE

St. Augustine
29.60 76 SE

Cross City
29.07

Ocala
29.25 52 ENE

Daytona Beach
29.65 ESE

Cedar Key
29.02 45 NE

Brooksville
28.87

Orlando
29.40 55 SSE

C. Canaveral
29.51 ✦ 83 NE

Clermont
75 SE ‡

Melbourne
29.44 78 SE

Tampa
29.11 54 SW

Lakeland
28.64 61 NE

Bartow 28.64
G-100 N

L. Placid
90 N

Okeechobee
28.35 G-100 S

Stuart 28.42 ✦ 125 NE ‡

Arcadia
29.20 ✦ 32 W

Pt. Mayaca 28.36 G-124 S

Jupiter 28.34 ✦ 153 NE ⌗

Moore Haven
28.95 65 NNW

Canal Pt. 28.24 G 120 N

West End
100 ESE

Clewiston
28.91 G 94 S

Belle Glade
28.56 G-104 WNW

W. Palm Beach
28.17 120 SW ‡

Hillsboro Lt.
28.61 ✦ 138 W

Bimini
28.75 G-120

✦ Uncorrected

‡ Estimated

⌗ Instrument failed
   highest unknown

Miami WBAS
29.39 46 S

Miami
29.36 60 SW

Carysfort Lt.
29.53 67 S

EXTREMES OF WIND AND BAROMETRIC PRESSURE,
DURING HURRICANE OF 26-27 AUGUST 1949 IN FLORIDA
AFTER WBO MIAMI

14

PRESSURE PATTERN

August 26, 1949
2030 EST

File 5011

Figure 2

U.S. Weather Bureau

Hydrometeorological Section

PRESSURE PATTERN

August 26, 1949

2100 EST

16

PRESSURE PATTERN
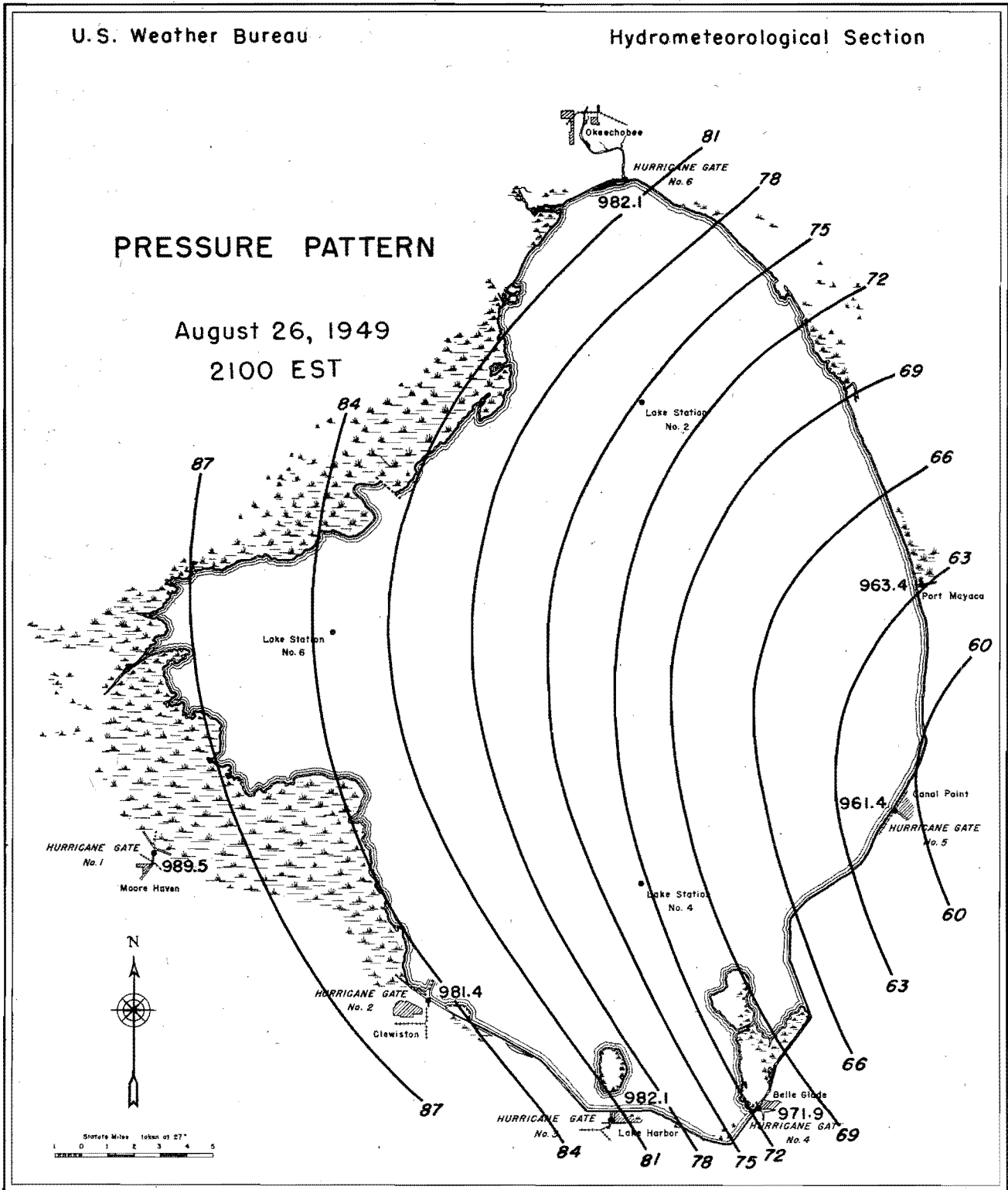
August 26, 1949
2130 EST
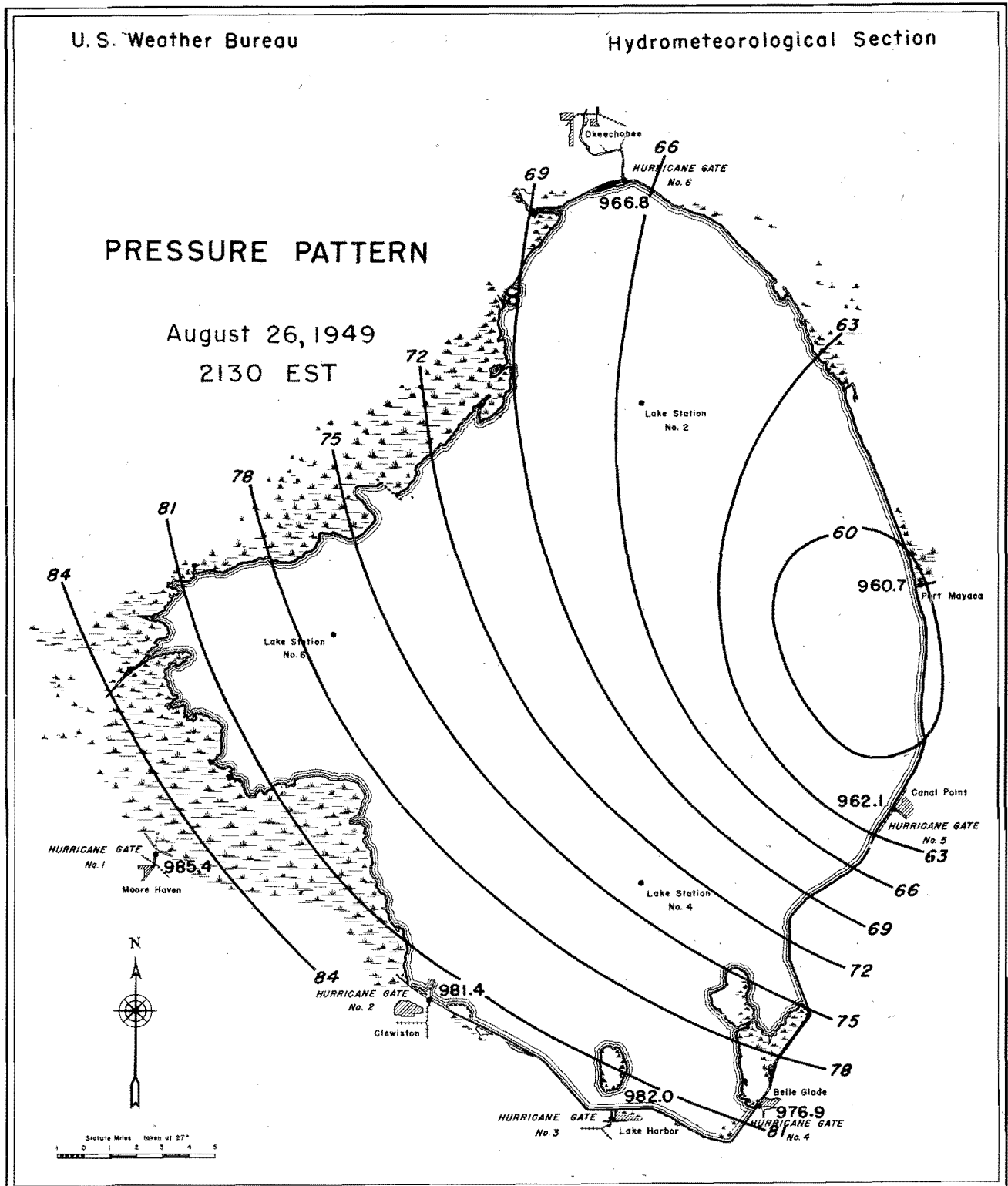
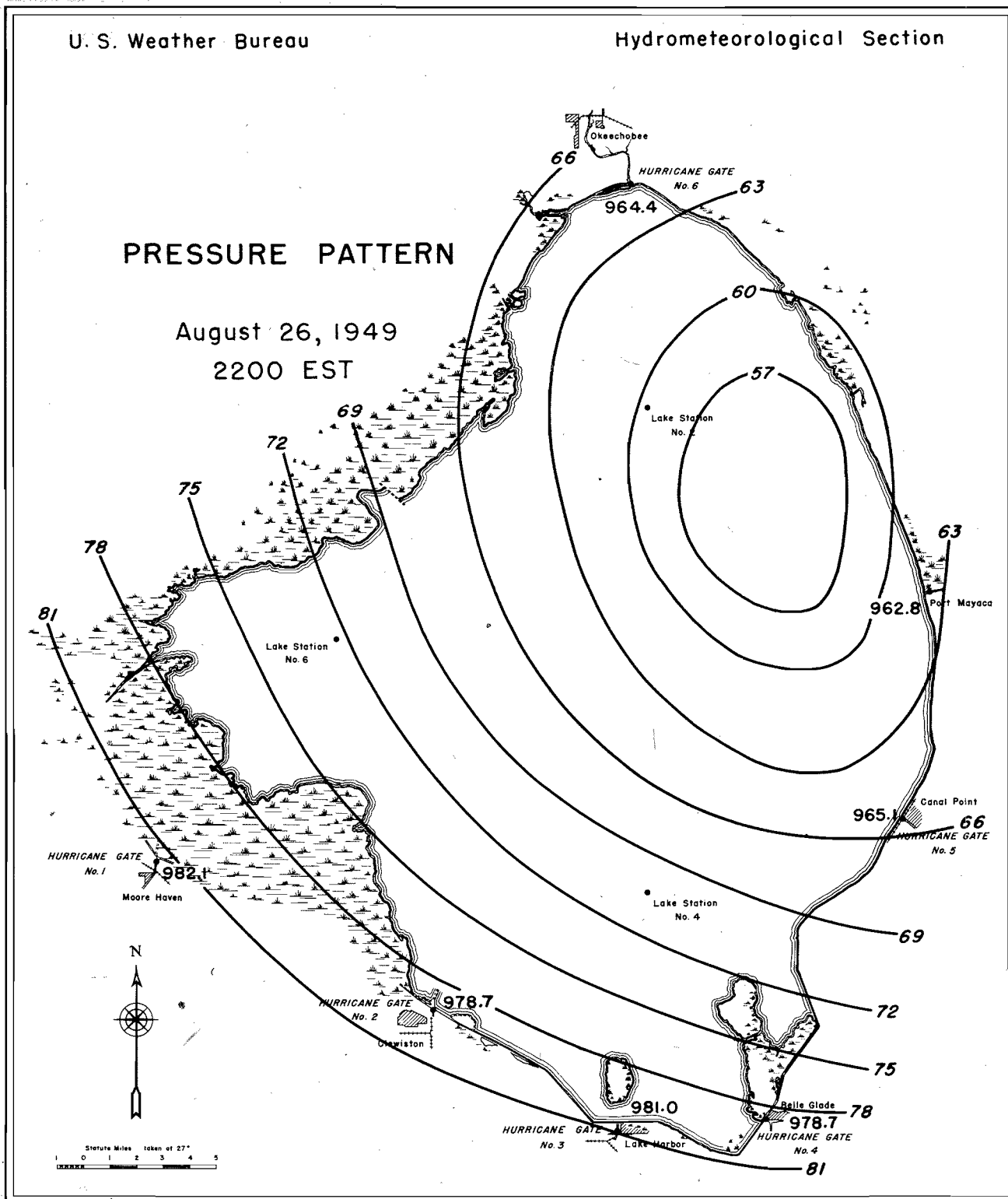File 50II   Figure 4

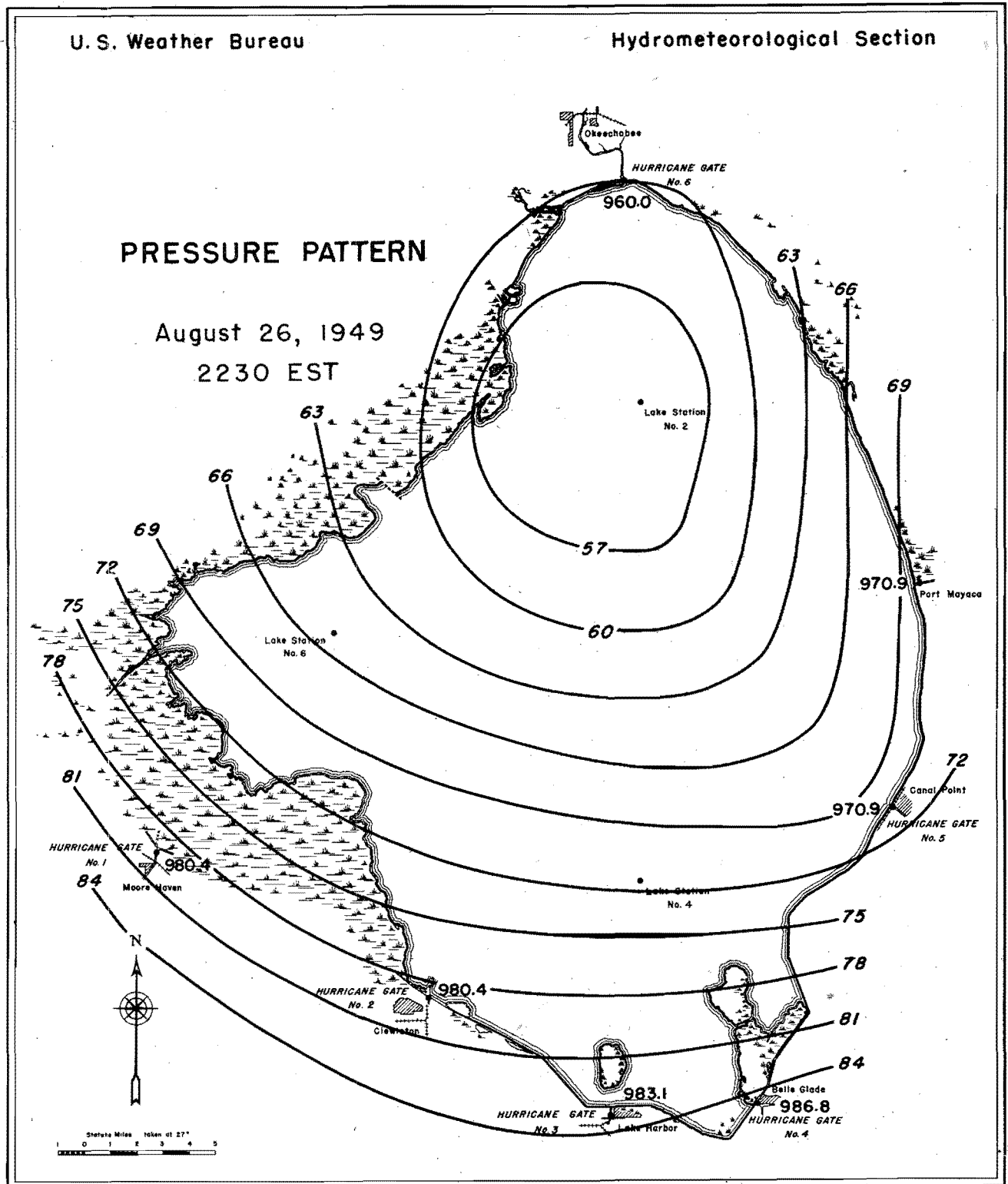U. S. Weather Bureau   Hydrometeorological Section

PRESSURE PATTERN

August 26, 1949
2200 EST

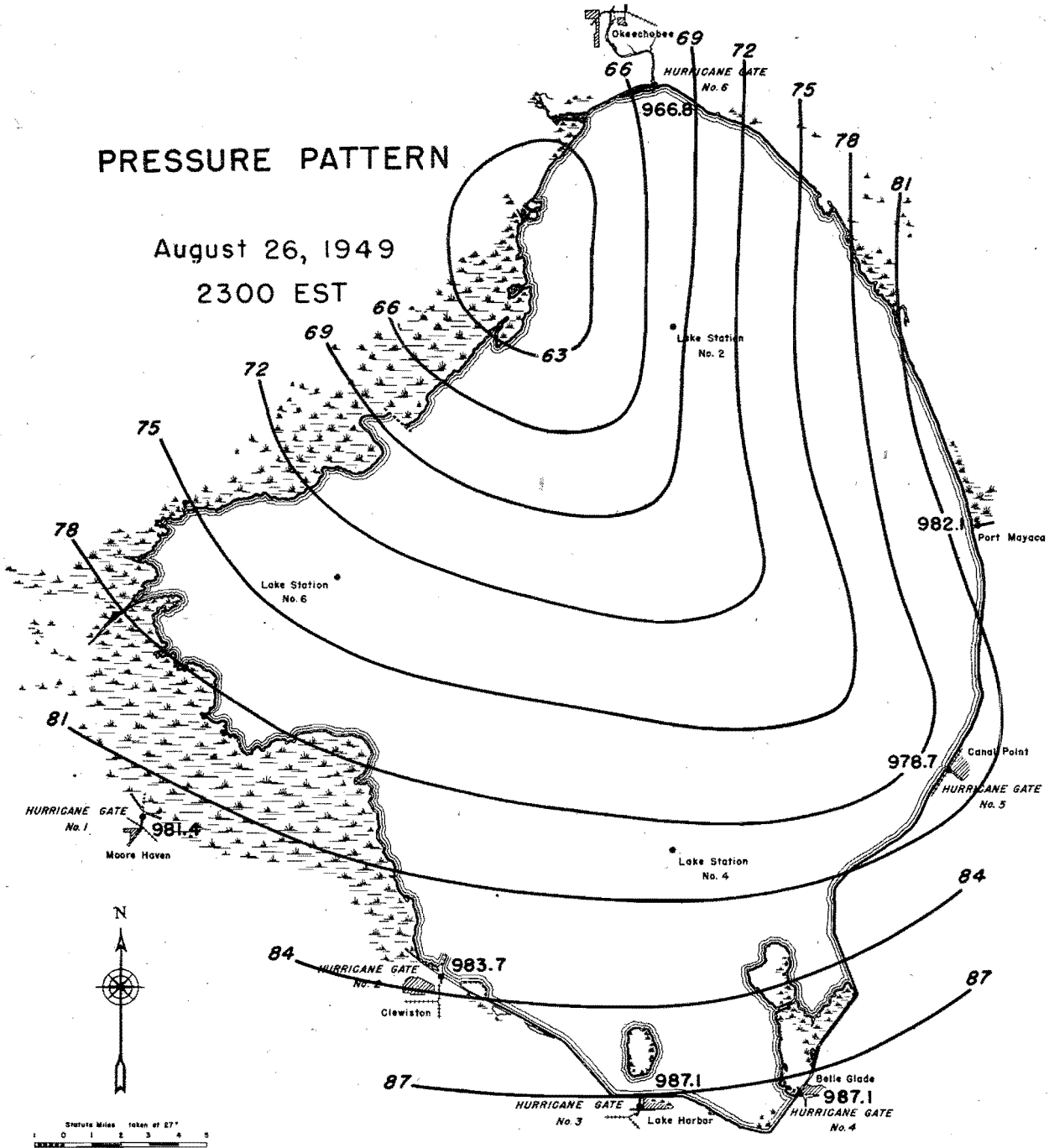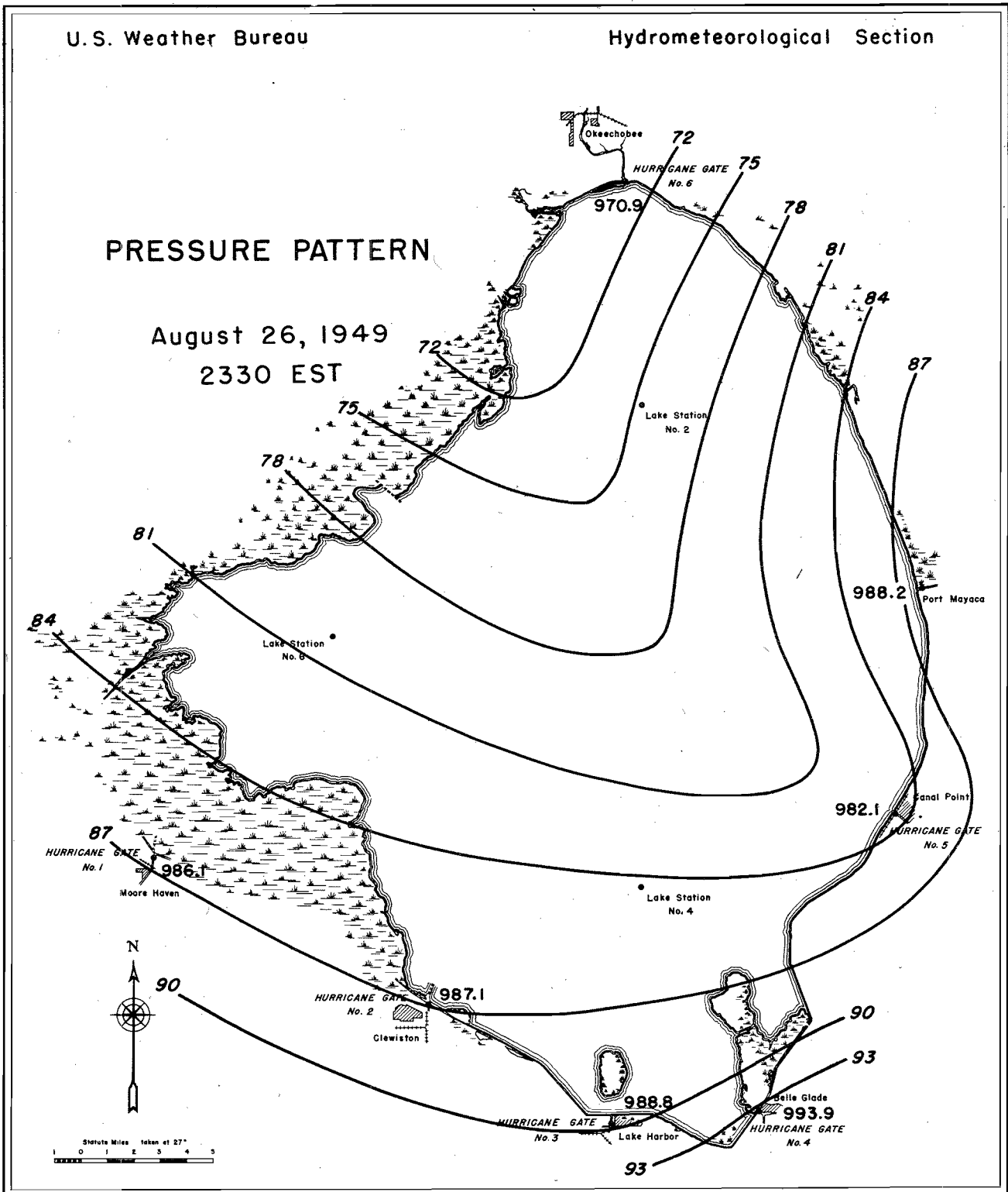File 50ll   Figure 5

18

U.S. Weather Bureau   Hydrometeorological Section
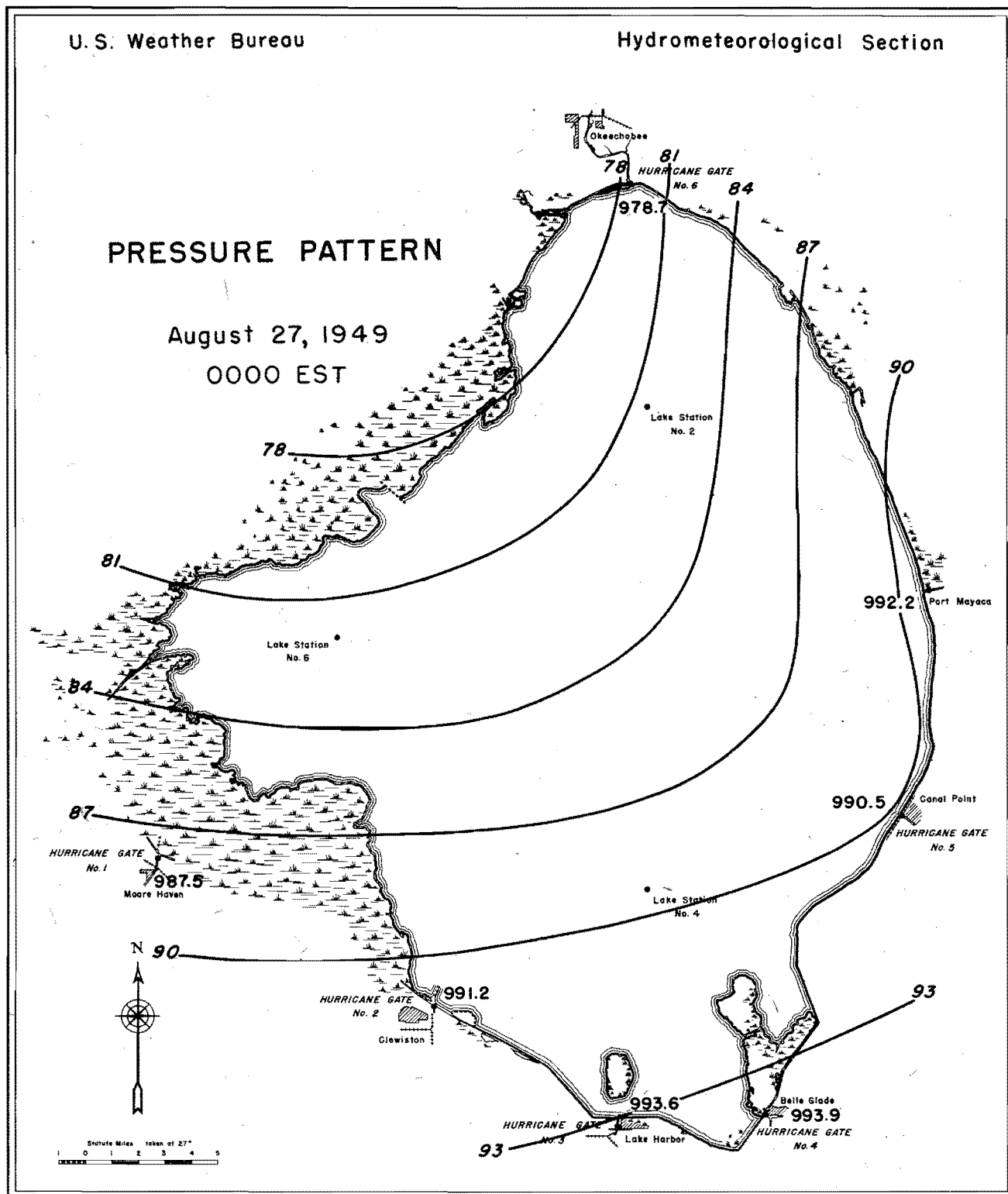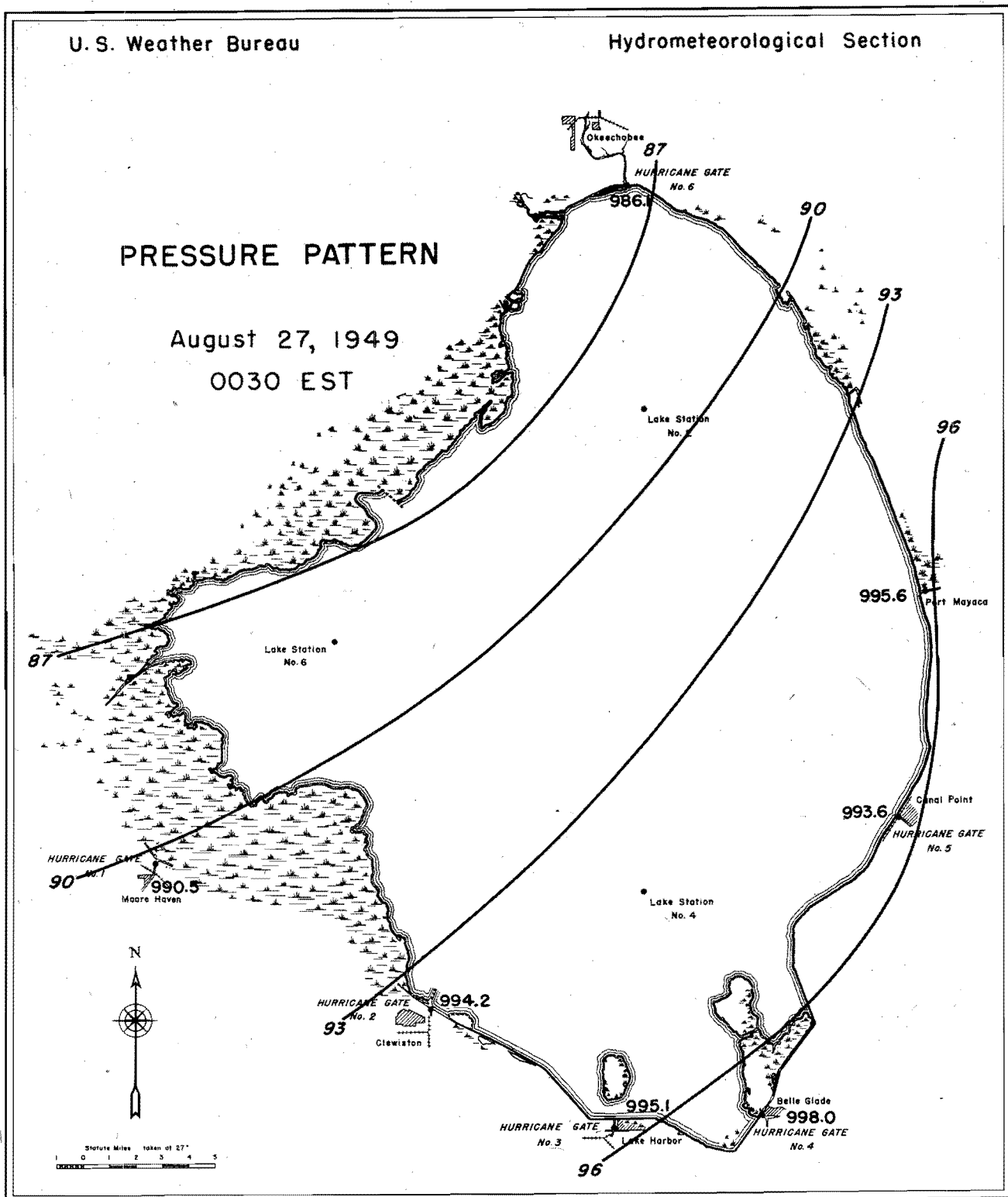
PRESSURE PATTERN

August 26, 1949
2230 EST

Okeechobee

HURRICANE GATE No. 6

960.0

63

66

69

63

Lake Station No. 2

66

69

57

72

970.9   Port Mayaca

75

60

78

Lake Station No. 6

81

72

84

Canal Point

970.9

HURRICANE GATE No. 5

HURRICANE GATE No. 1

980.4

Moore Haven

Lake Station No. 4

75

N

78

HURRICANE GATE No. 2

980.4

81

Clewiston

84

Belle Glade

983.1

986.8

HURRICANE GATE No. 3   Lake Harbor

HURRICANE GATE No. 4

Statute Miles   taken at 27°

File 5011

Figure 6

PRESSURE PATTERN

August 26, 1949
2300 EST

U. S. Weather Bureau   Hydrometeorological Section

File 5011   Figure 7

U.S. Weather Bureau   Hydrometeorological   Section

PRESSURE PATTERN

August 26, 1949
2330 EST

Okeechobee

HURRICANE GATE
No. 6

970.9

72

75

78

81

84

87

72

75

78

81

84

87

Lake Station
No. 2

988.2 Port Mayaca

Lake Station
No. 8

982.1 Canal Point

HURRICANE GATE
No. 5

HURRICANE GATE
No. 1

986.1

Moore Haven

Lake Station
No. 4

N

90

HURRICANE GATE
No. 2

987.1

Clewiston

90

93

Belle Glade

988.8

993.9

HURRICANE GATE
No. 3

Lake Harbor

HURRICANE GATE
No. 4

93

Statute Miles   taken at 27°
1 0 1 2 3 4 5

File 5011   Figure 8

U.S. Weather Bureau

Hydrometeorological Section

PRESSURE PATTERN

August 27, 1949

0000 EST

File 5011

Figure 9

929182 O - 51 - 4

22

PRESSURE PATTERN

August 27, 1949
0030 EST

U.S. Weather Bureau

Hydrometeorological Section

File 5011

Figure 10

U.S. Weather Bureau   Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

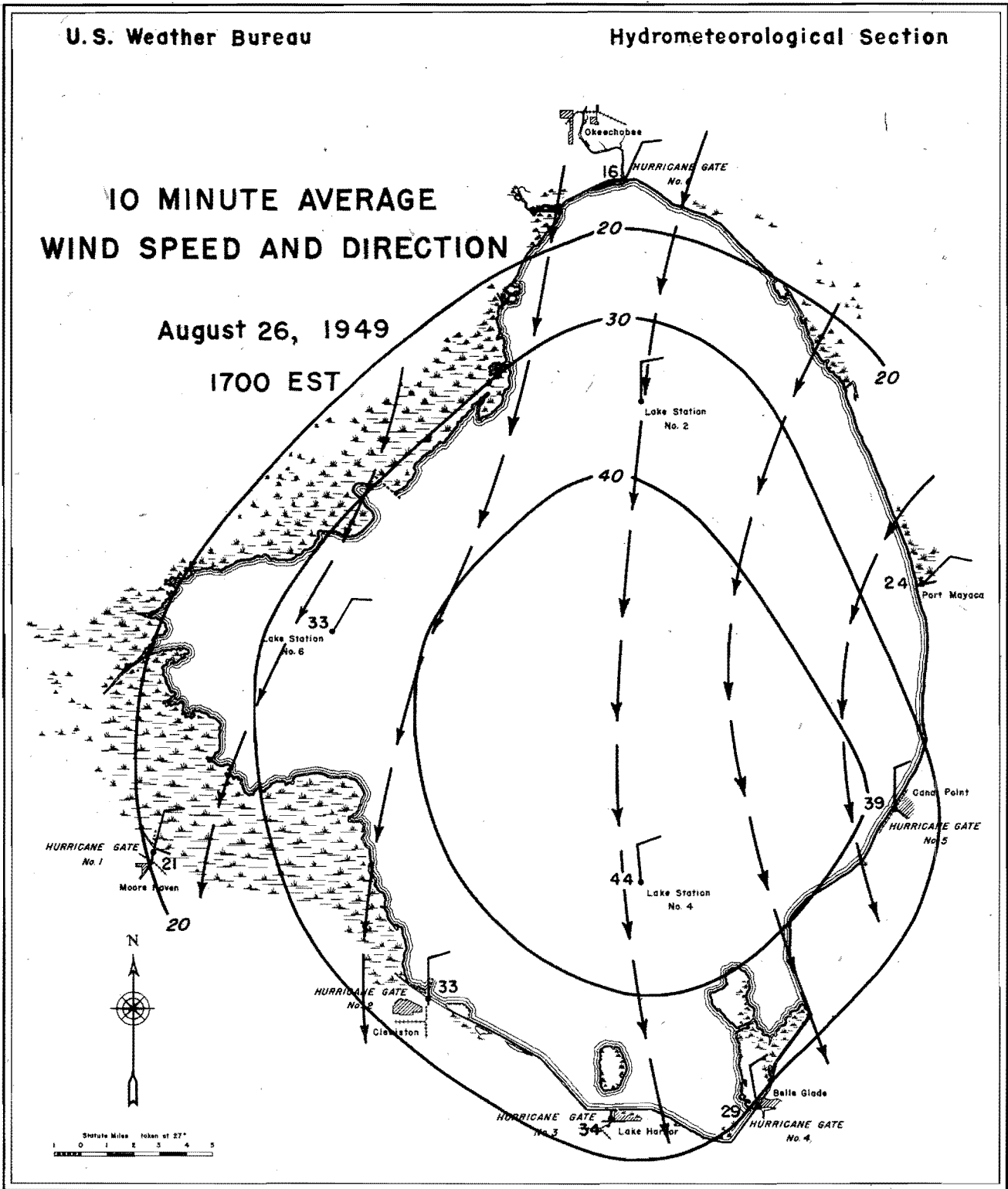1300 EST

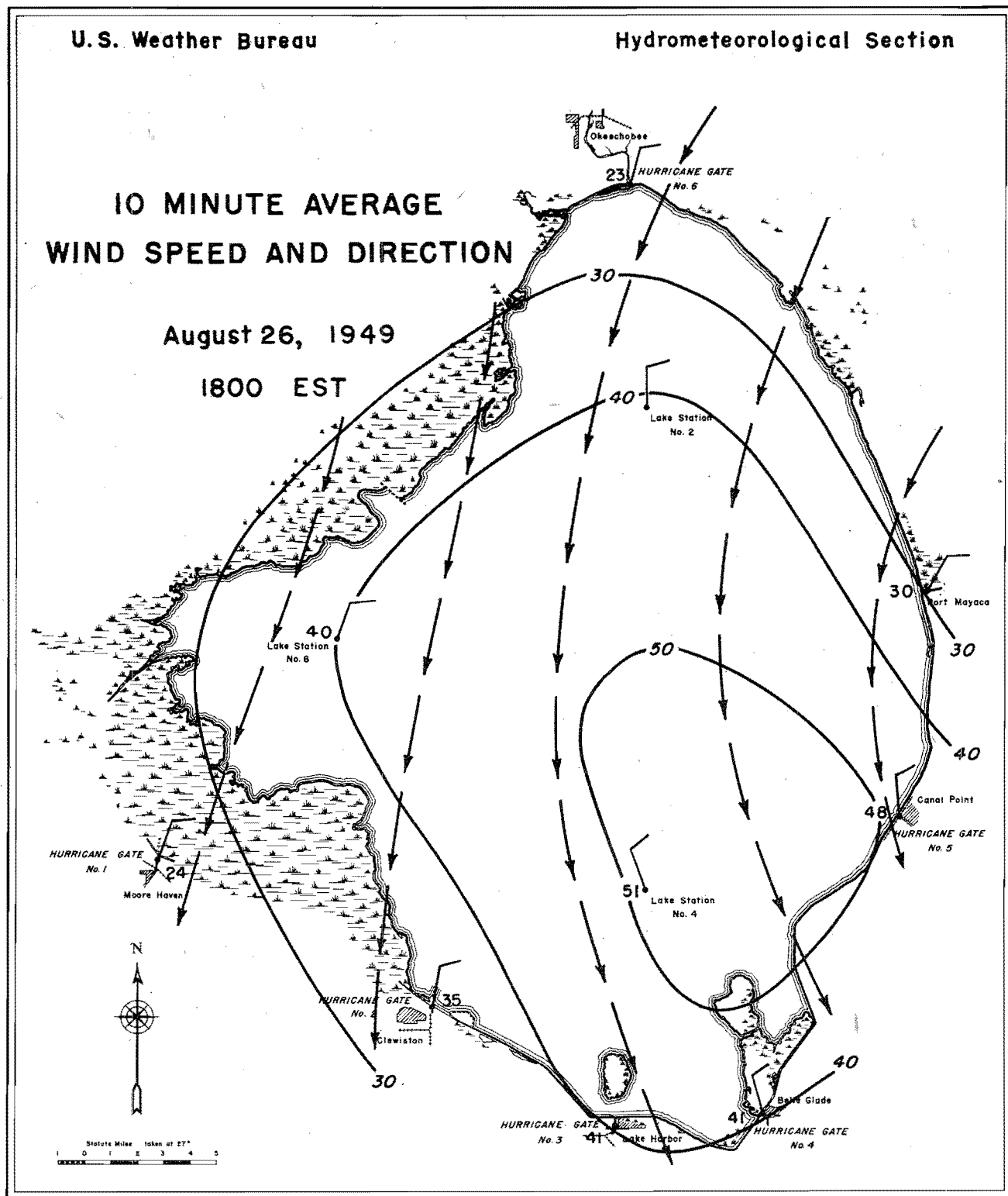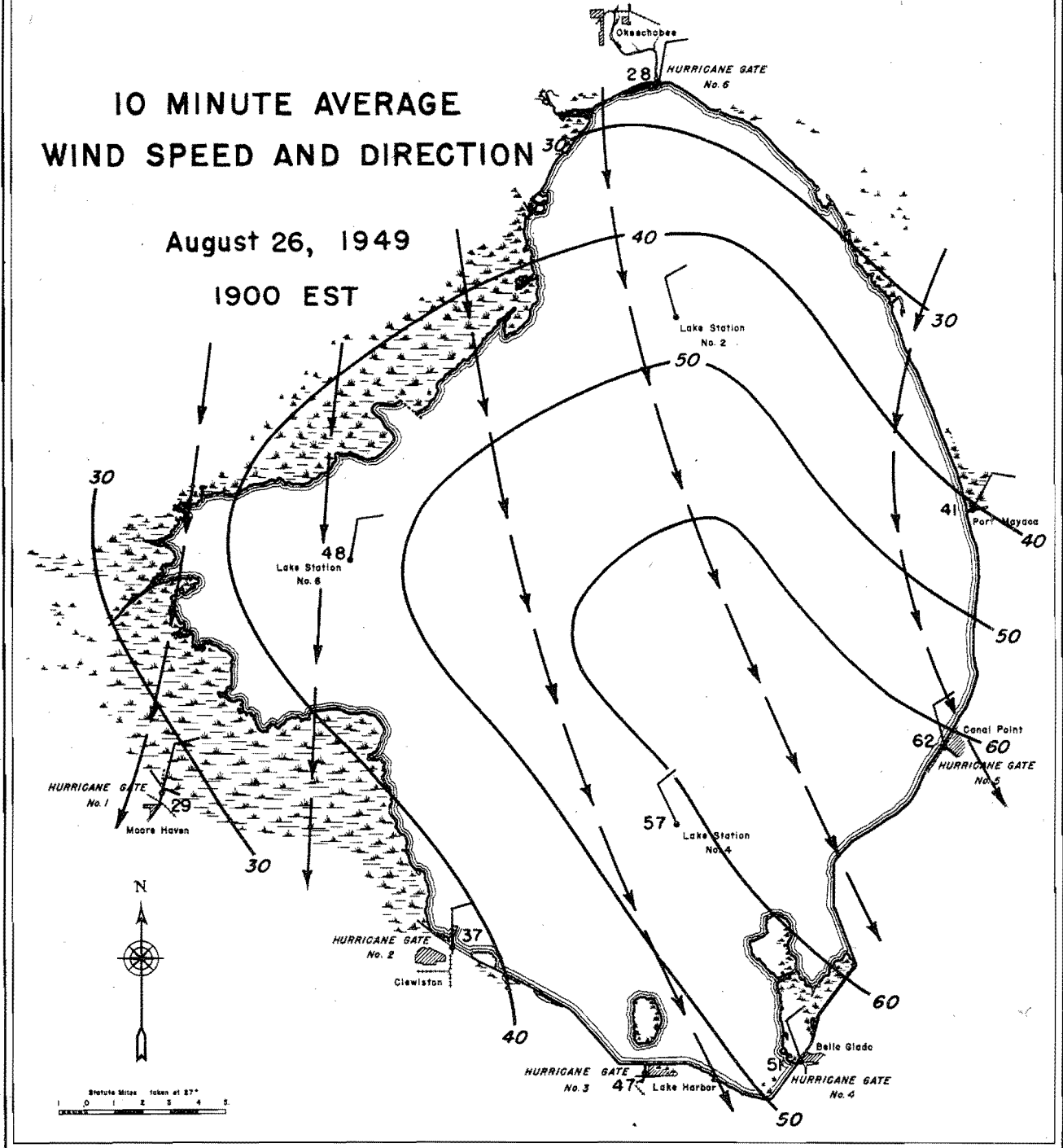File 5011   Figure II

24

U.S. Weather Bureau   Hydrometeorological Section
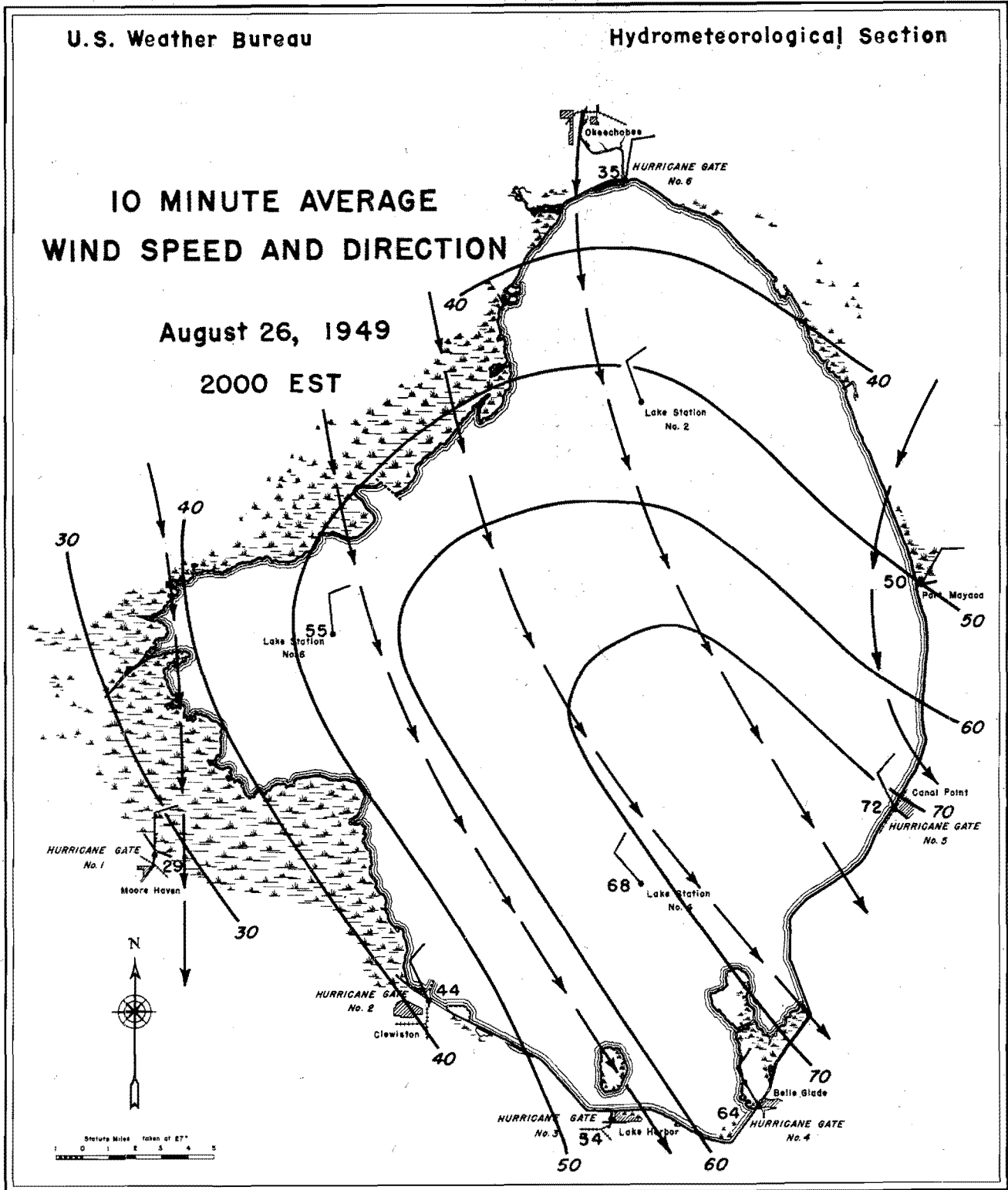
10 MINUTE AVERAGE
WIND SPEED AND DIRECTION
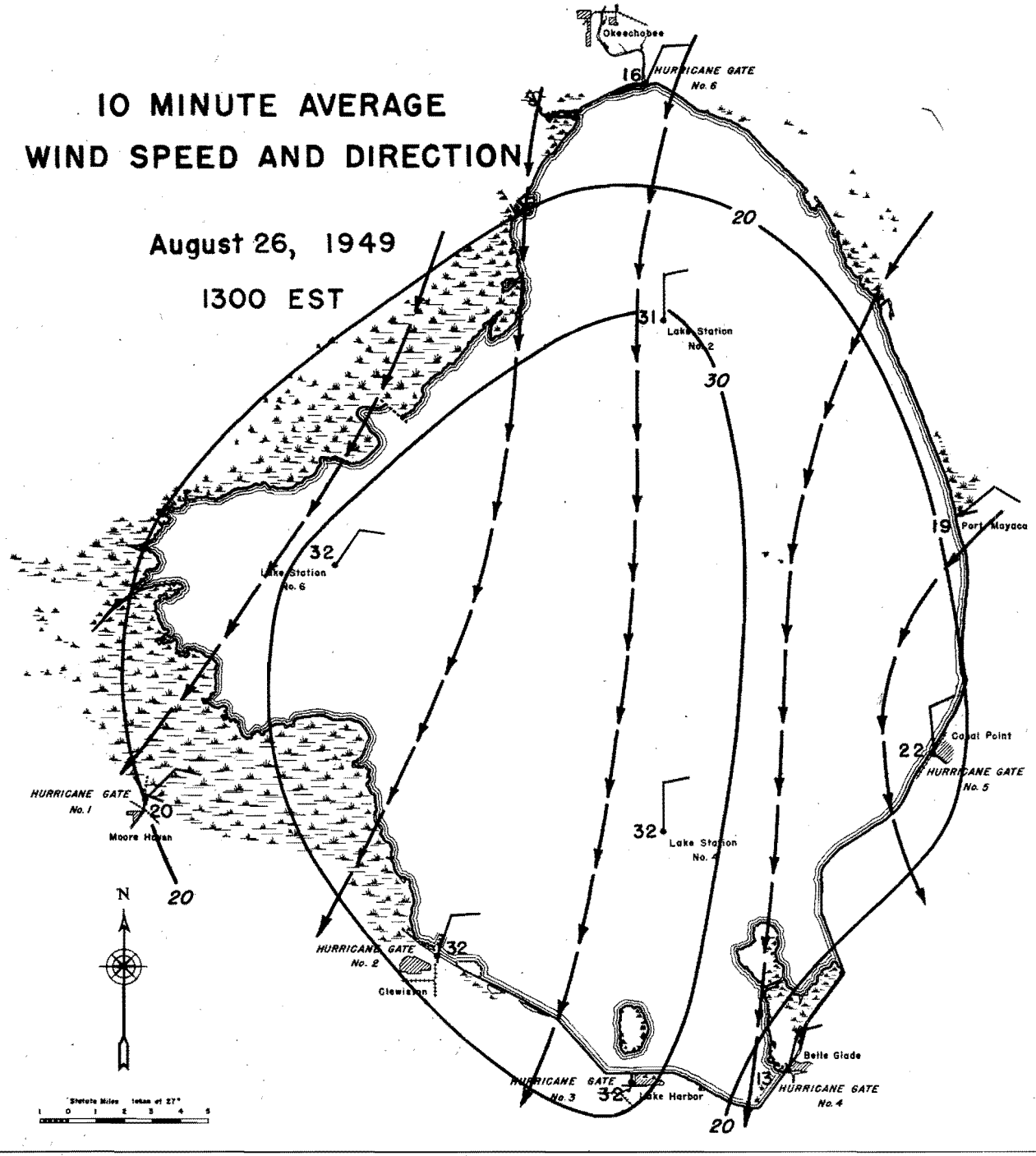
August 26, 1949
1400 EST
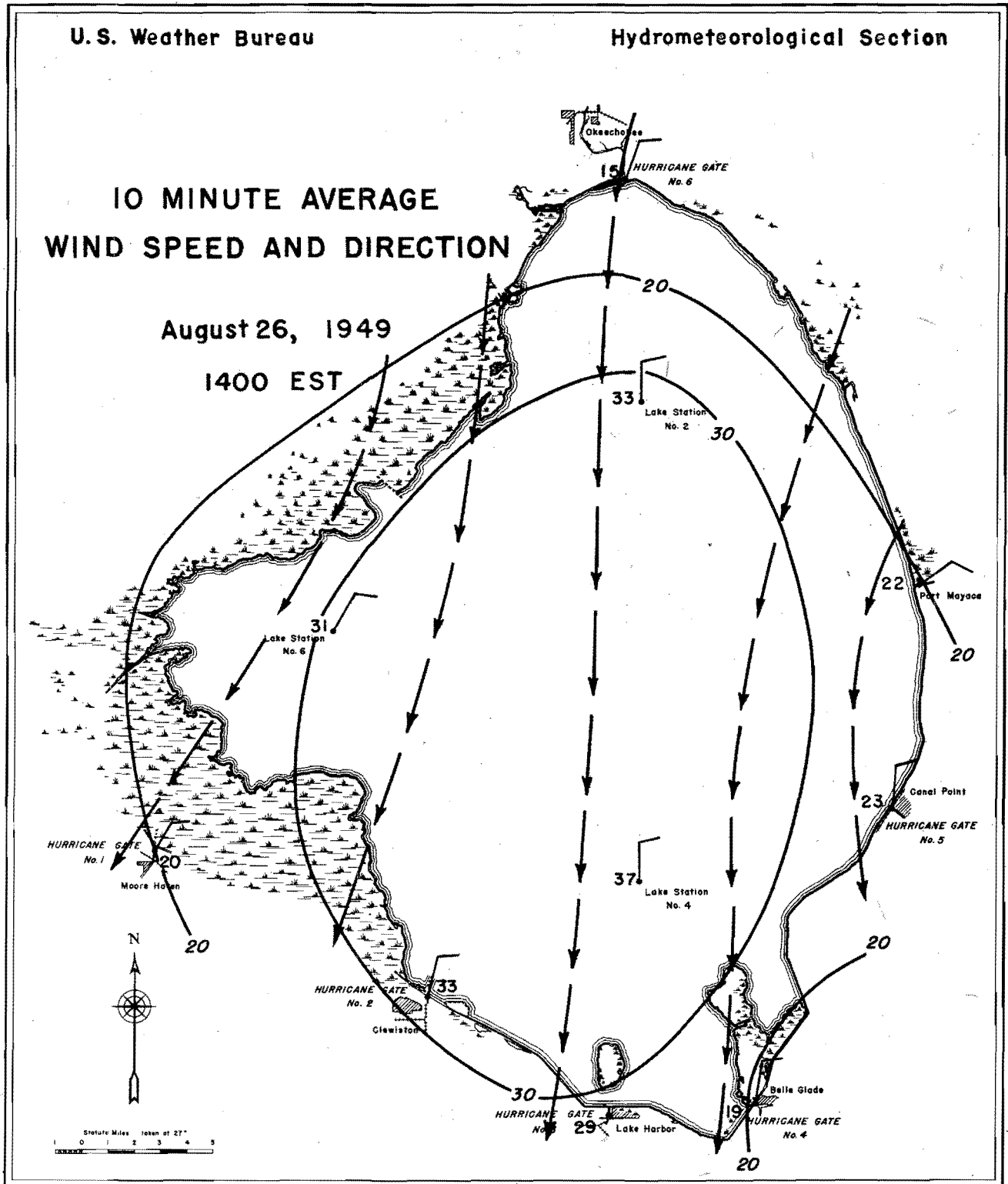
File 5011   Figure 12

U.S. Weather Bureau

Hydrometeorological Section

10 MINUTE AVERAGE
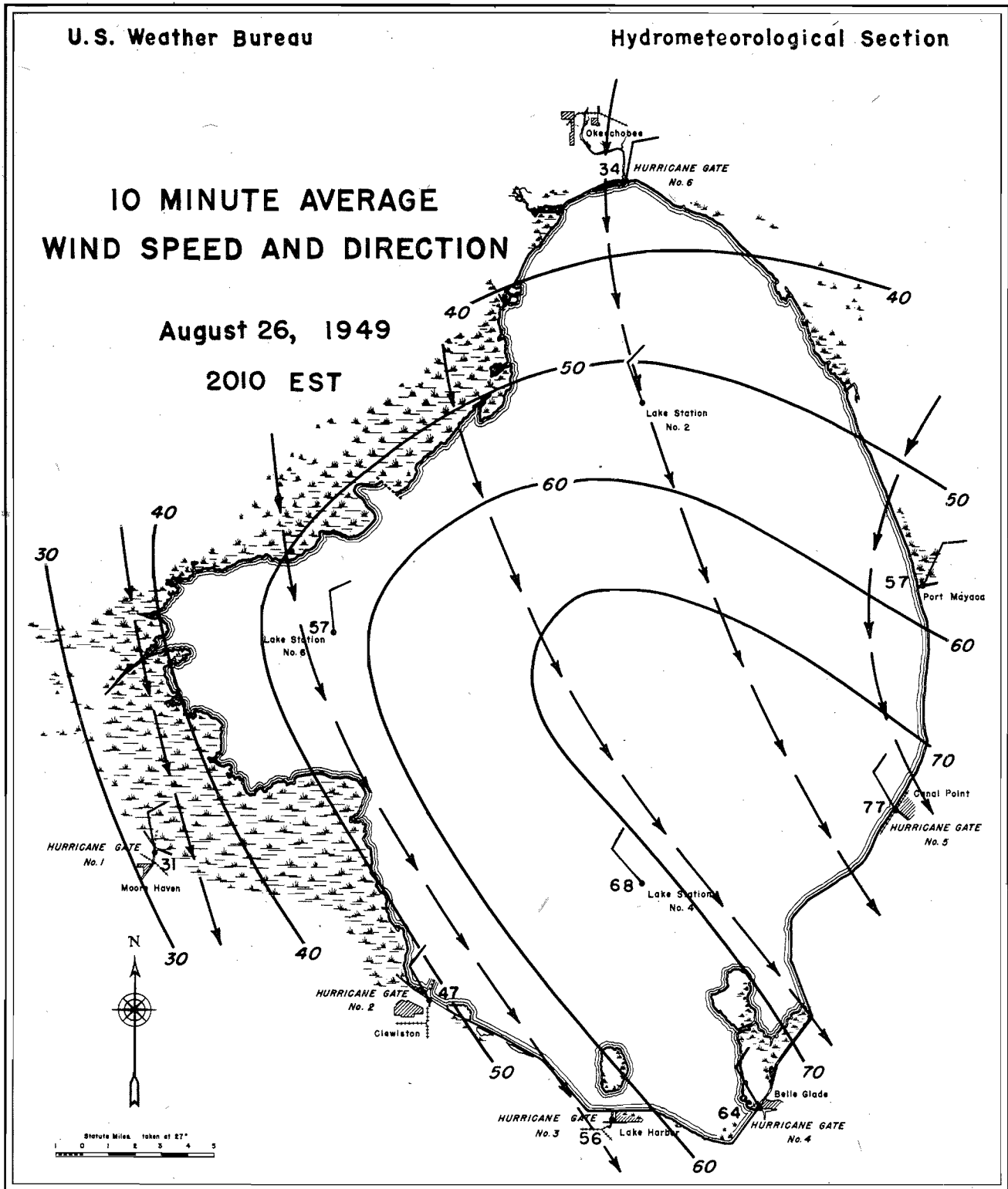WIND SPEED AND DIRECTION

August 26, 1949

1500 EST

Figure 13

U.S. Weather Bureau   Hydrometeorological Section

10· MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

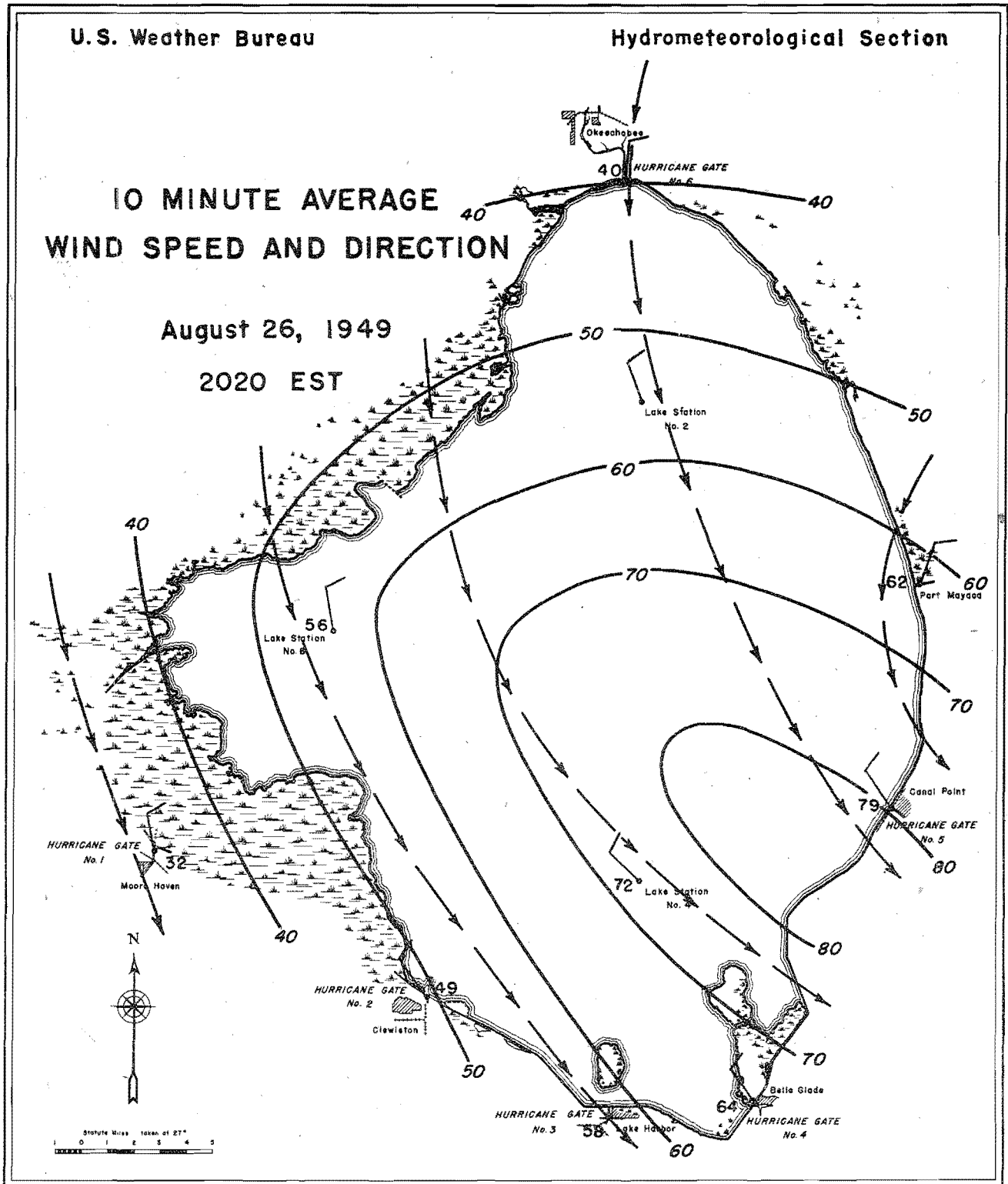1600 EST

File 5011   Figure 14
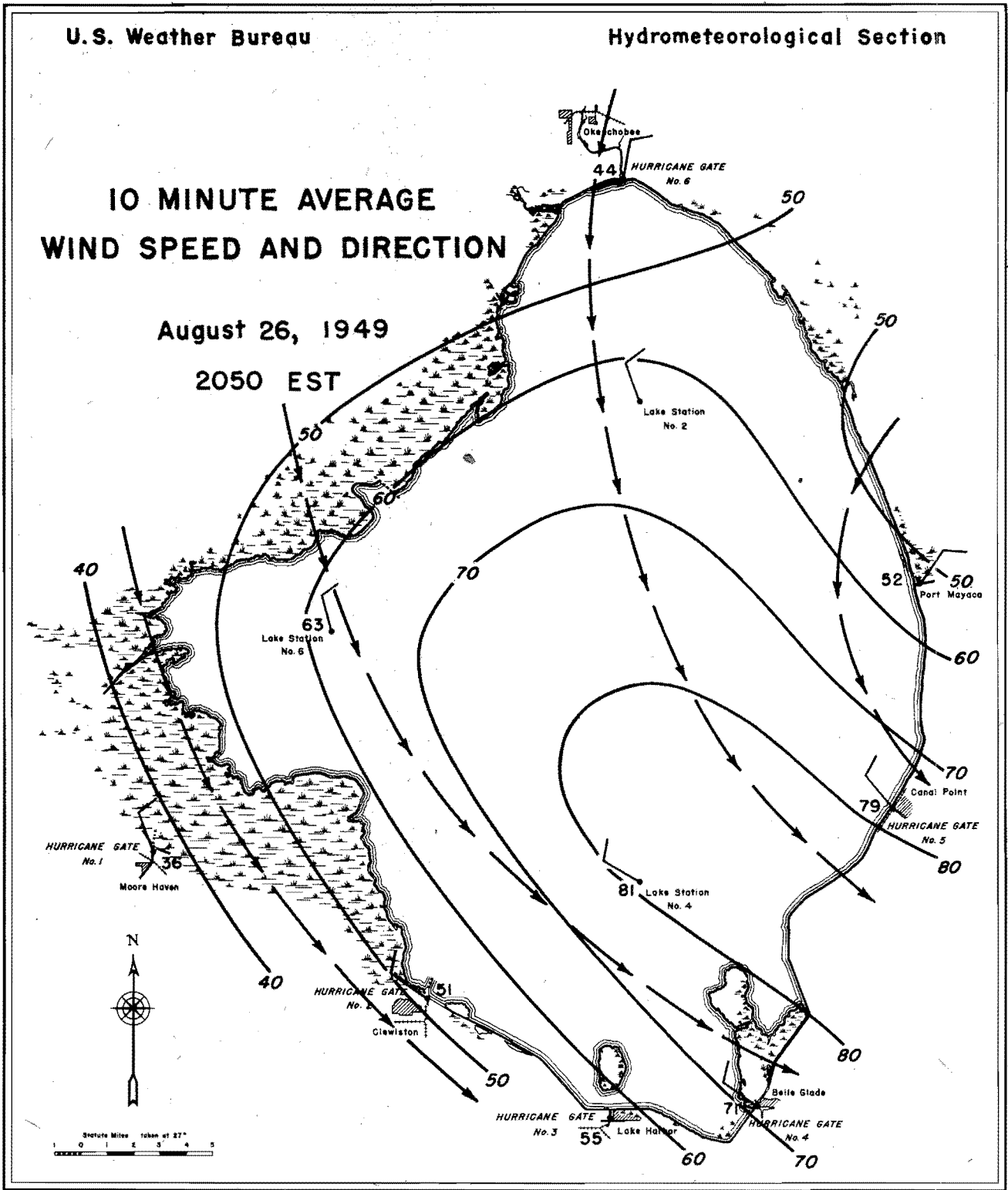
27

U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE WIND SPEED AND DIRECTION

August 26, 1949

1700 EST

File 5011   Figure 15

28

U.S. Weather Bureau — Hydrometeorological Section
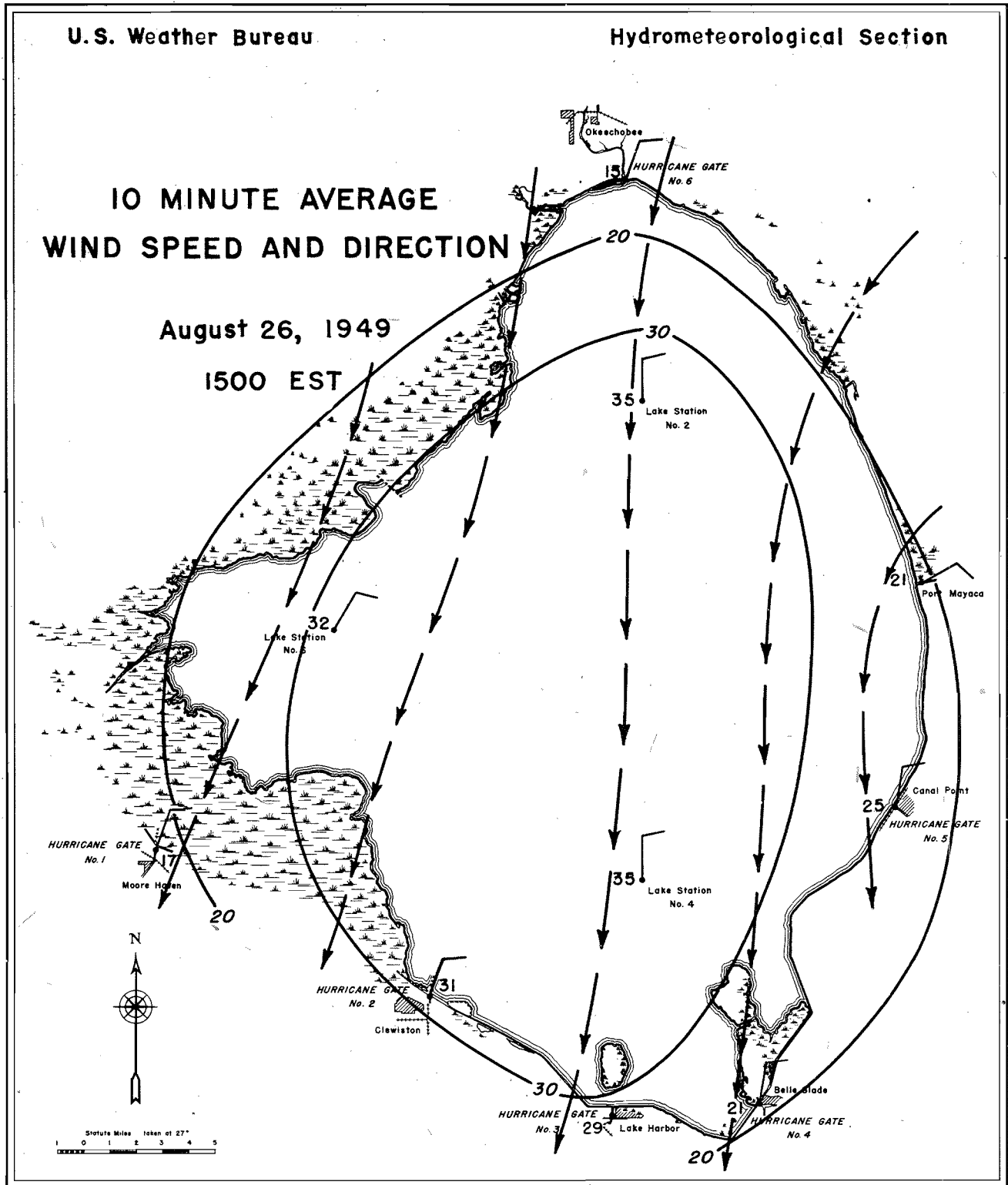
10 MINUTE AVERAGE WIND SPEED AND DIRECTION
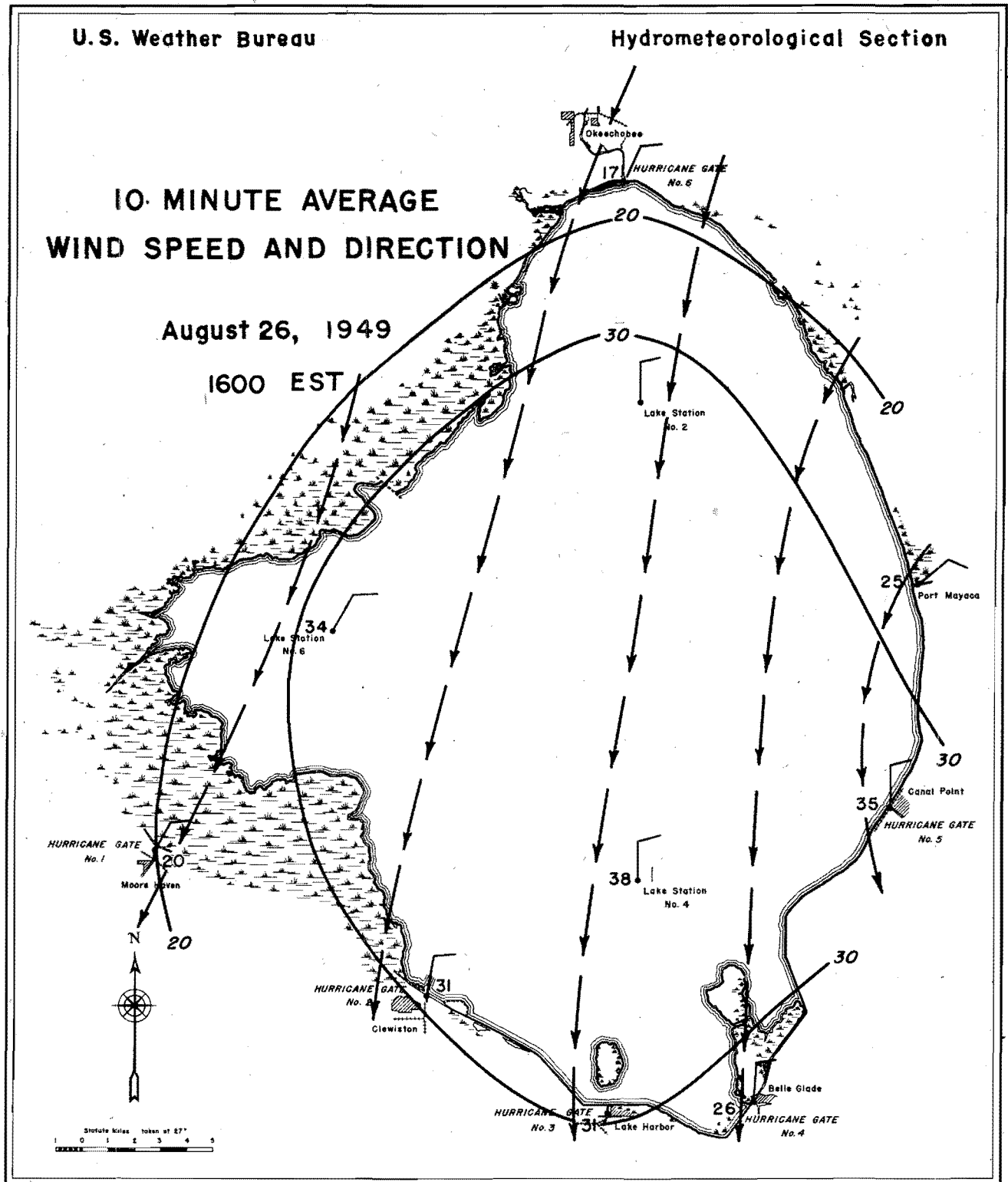
August 26, 1949 — 1800 EST

File 5011

Figure 16

U.S. Weather Bureau Hydrometeorological Section

IO MINUTE AVERAGE WIND SPEED AND DIRECTION

August 26, 1949

1900 EST

File 5011 Figure 17

929182 O - 51 - 5
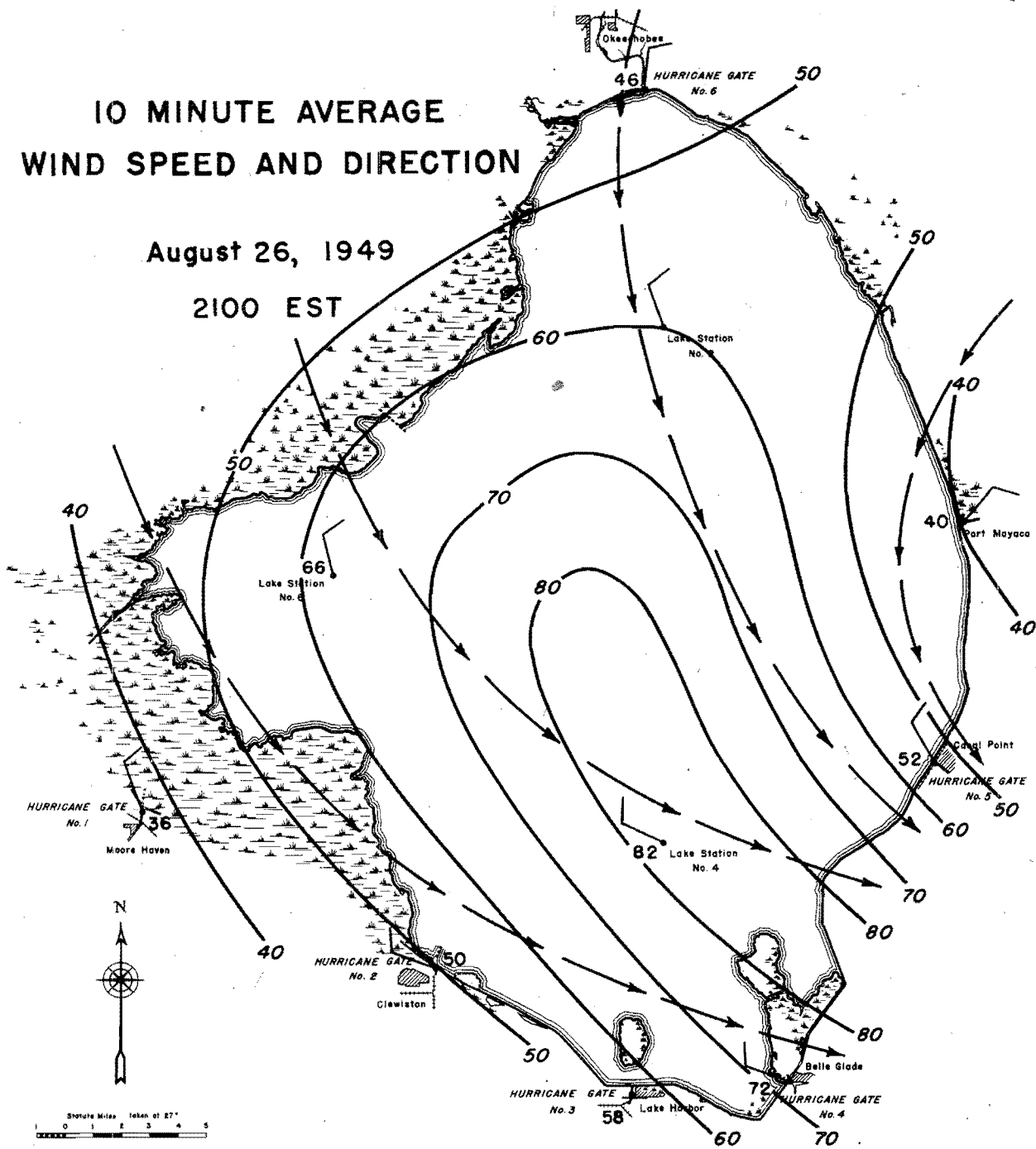
U.S. Weather Bureau   Hydrometeorological Section
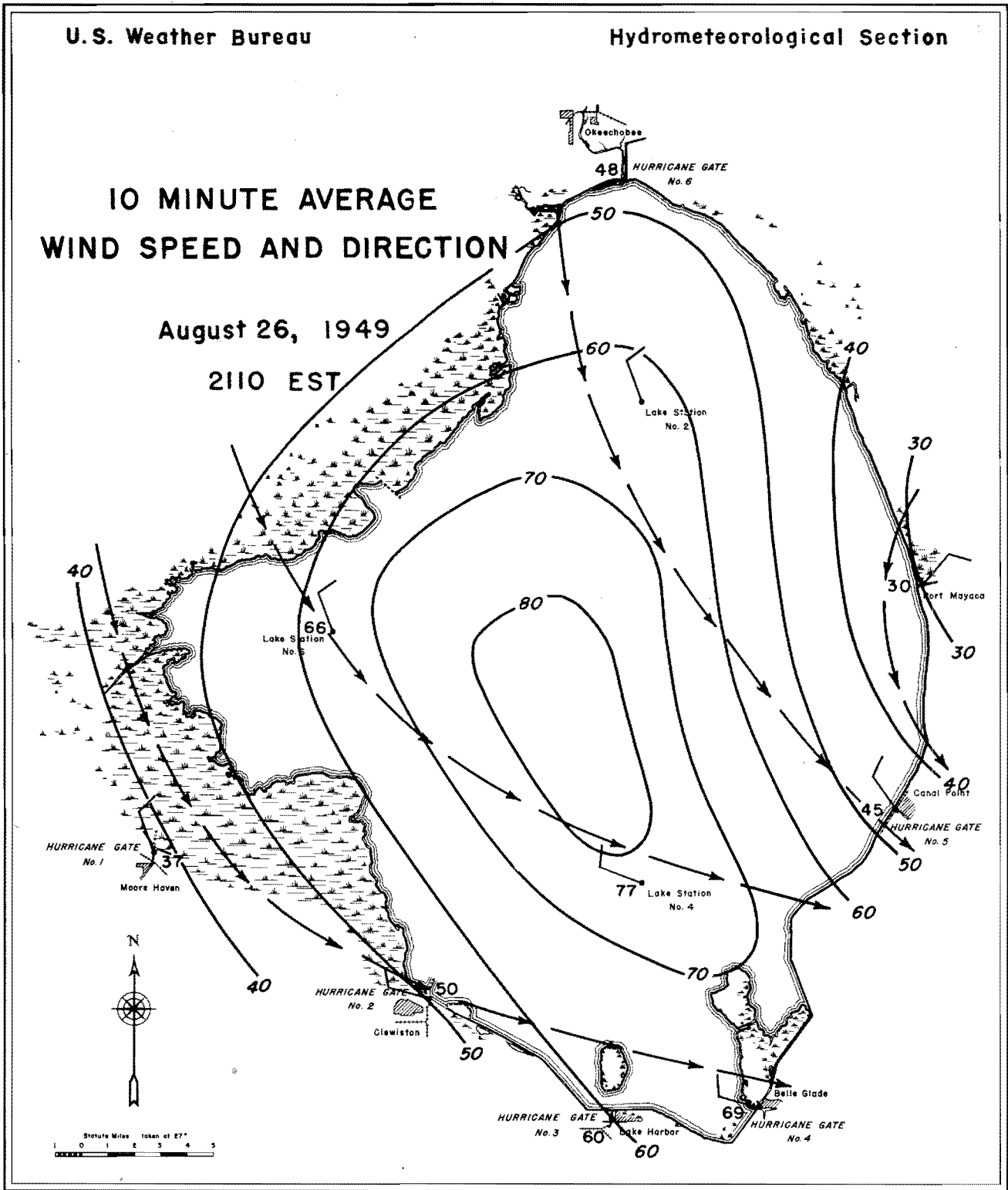
10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949
2000 EST

File 5011   Figure 18

31

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2010 EST

U.S. Weather Bureau

Hydrometeorological Section

File 5011

Figure 19

U.S. Weather Bureau

Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2020 EST

File 5OII

Figure 20

U.S. Weather Bureau

Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2030 EST

File 50II

Figure 21

U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE
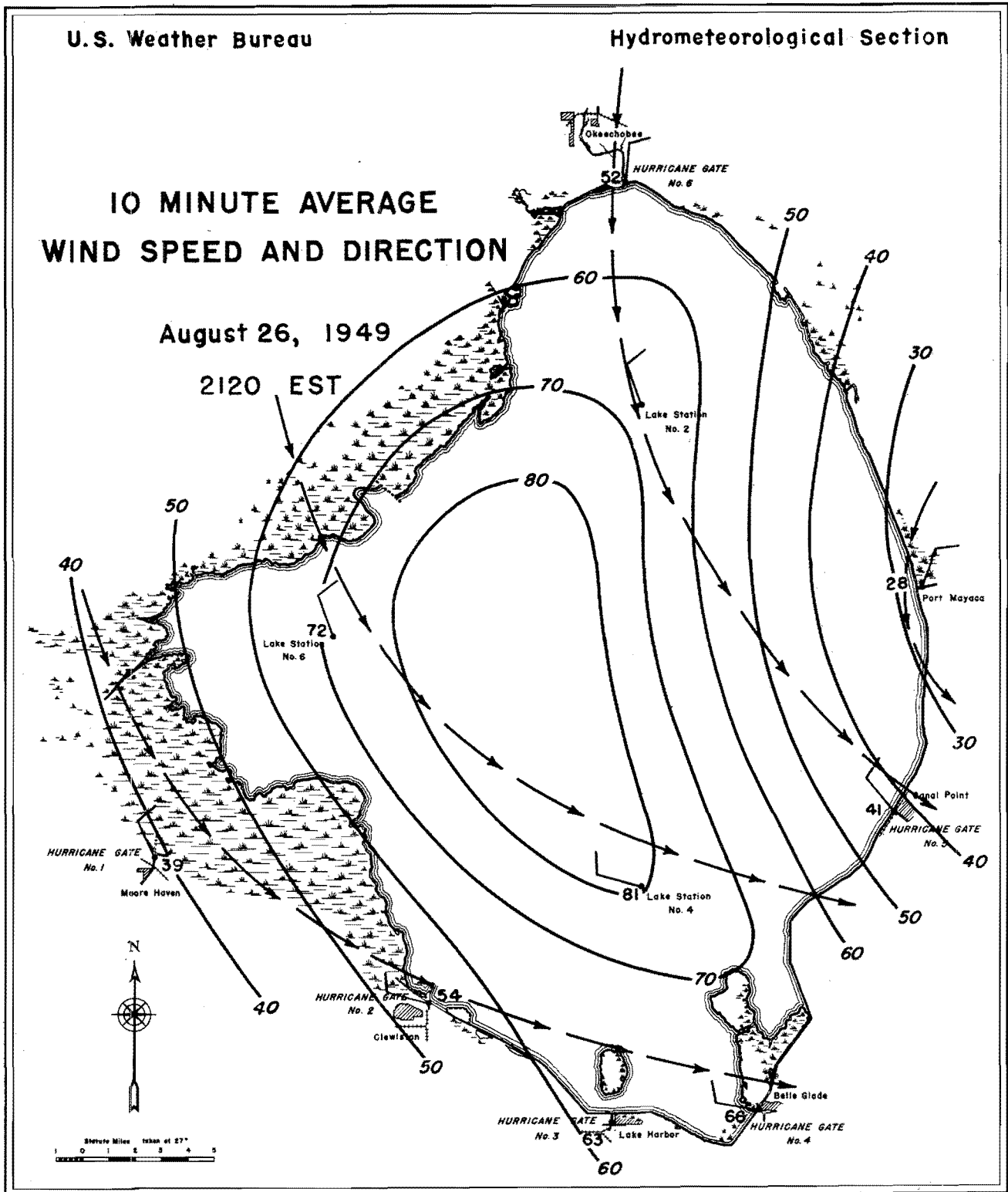# WIND SPEED AND DIRECTION

August 26, 1949
2040 EST
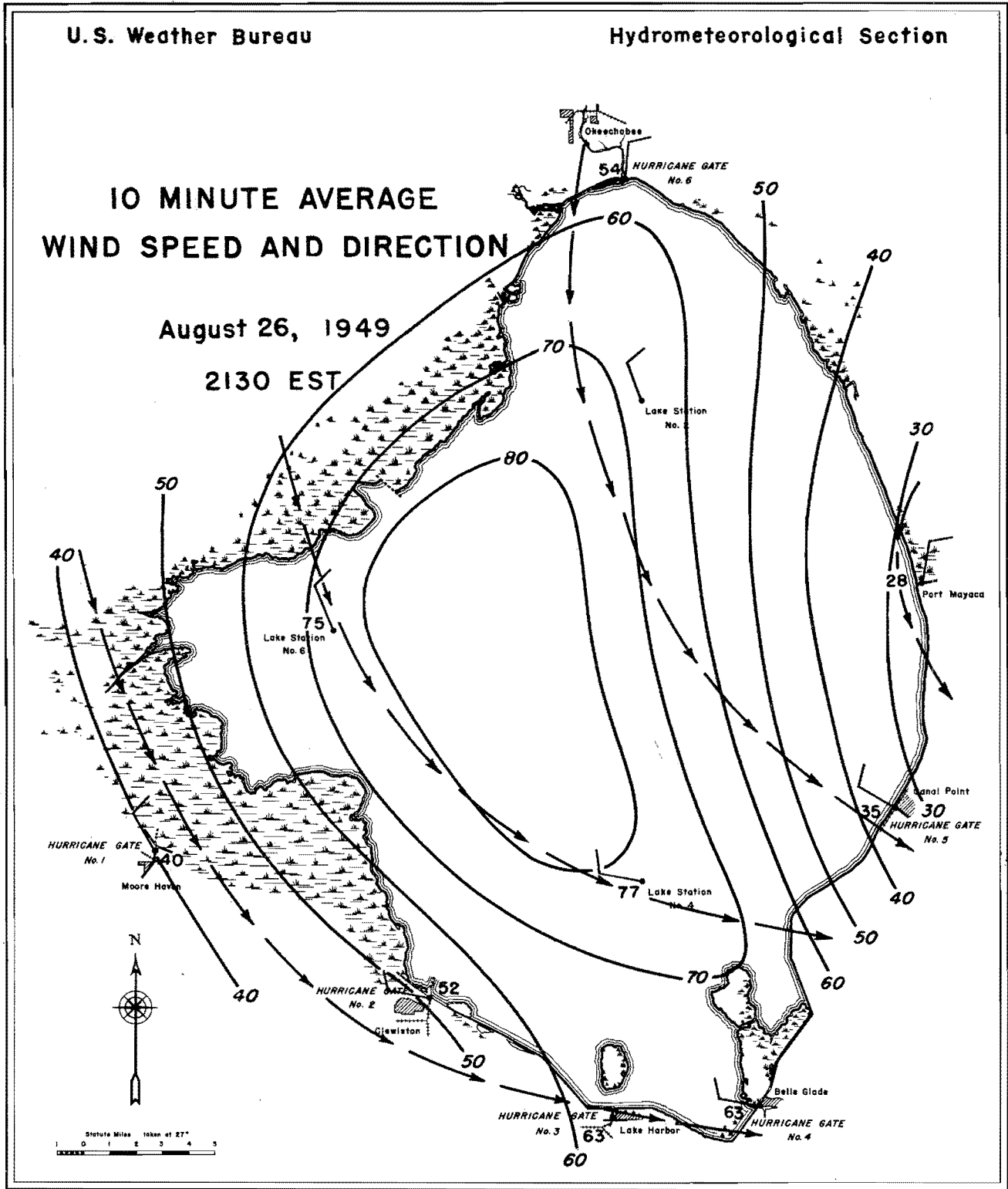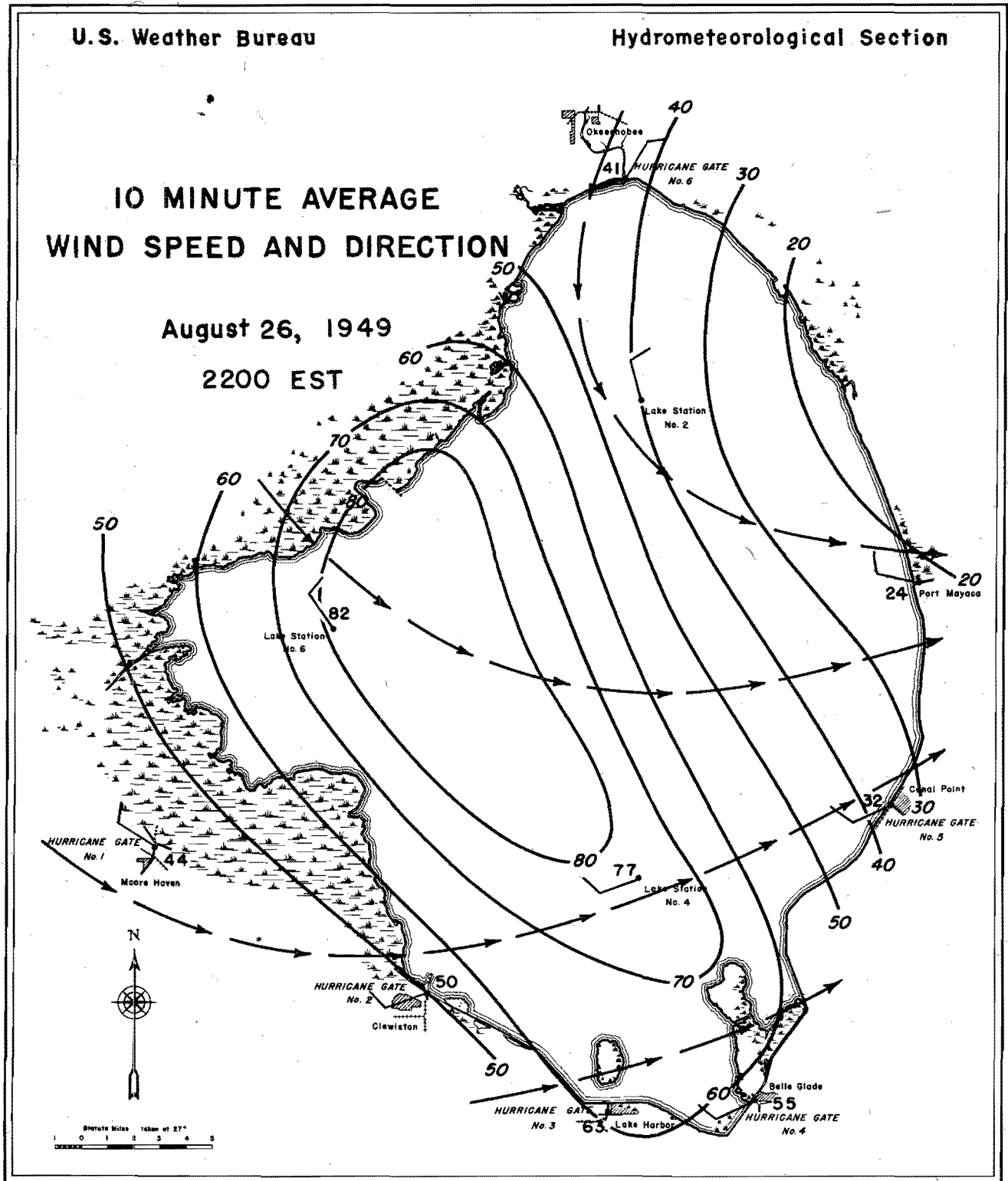
File 5011   Figure 22

U.S. Weather Bureau

Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949
2050 EST

Okeechobee

44 HURRICANE GATE No. 6

50

50

Lake Station No. 2

50

40

70

63 Lake Station No. 6

52 50 Port Mayaca

60

60

70 Canal Point

79 HURRICANE GATE No. 5

80

HURRICANE GATE No. I

36 Moore Haven

81 Lake Station No. 4

N

40

51 HURRICANE GATE No. 2

Clewiston

50

80

Belle Glade

71 HURRICANE GATE No. 4

HURRICANE GATE No. 3

55 Lake Harbor

60

70

Statute Miles taken at 27°
1 0 1 2 3 4 5

File 50ll

Figure 23

U.S. Weather Bureau

Hydrometeorological Section

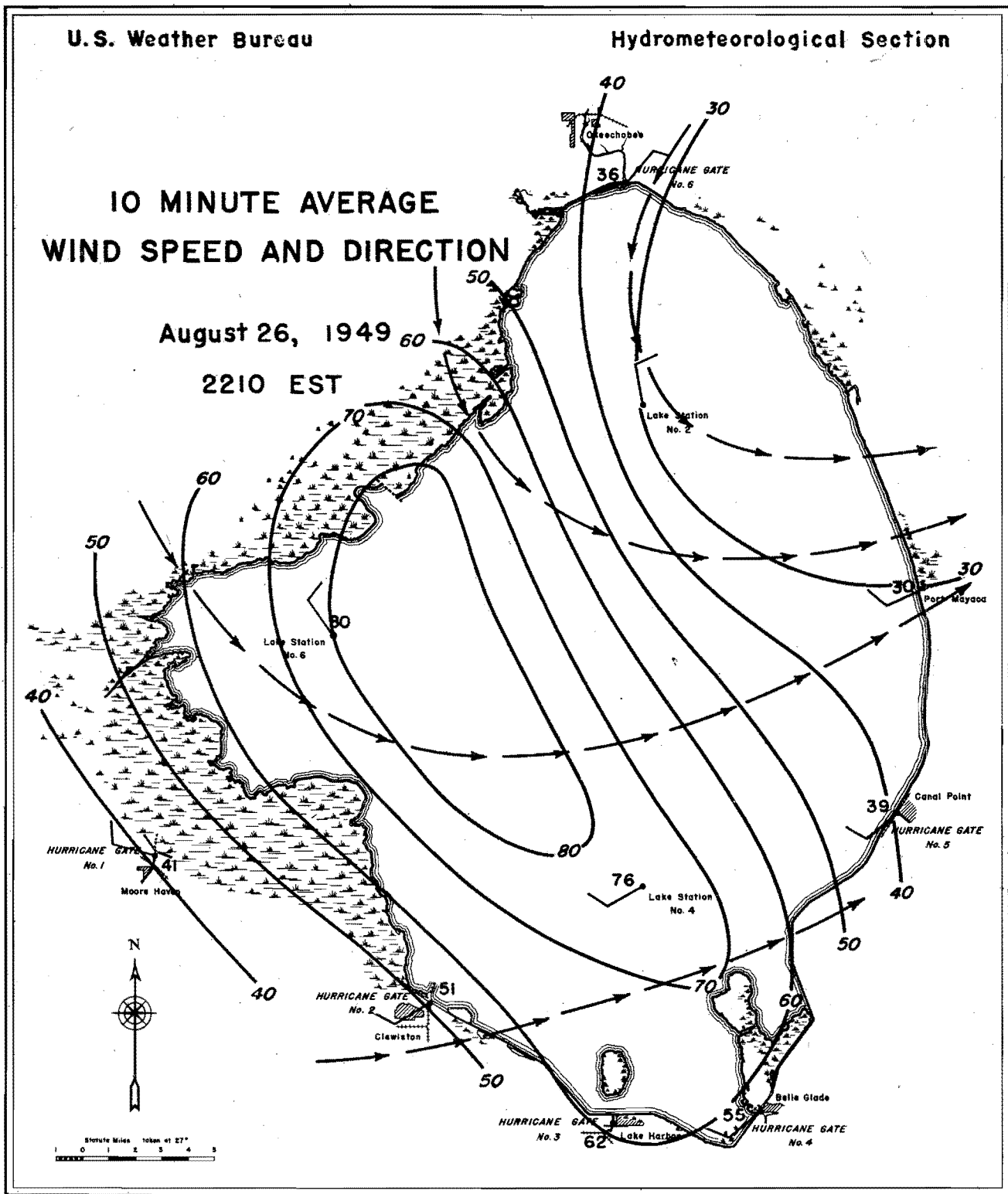IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2100 EST

Okeechobee

46 *HURRICANE GATE No. 6* 50

50

60

Lake Station No. 2

50

40

40

40

40

Port Mayaca

40

40

66
Lake Station No. 6

70

80

52 Canal Point

HURRICANE GATE No. 5 50

60

HURRICANE GATE No. I

36

Moore Haven

82 Lake Station No. 4

70

80

N

40

50
HURRICANE GATE No. 2

Clewiston

50

80

Belle Glade

72 *HURRICANE GATE No. 4*

HURRICANE GATE No. 3

58 Lake Harbor

60

70

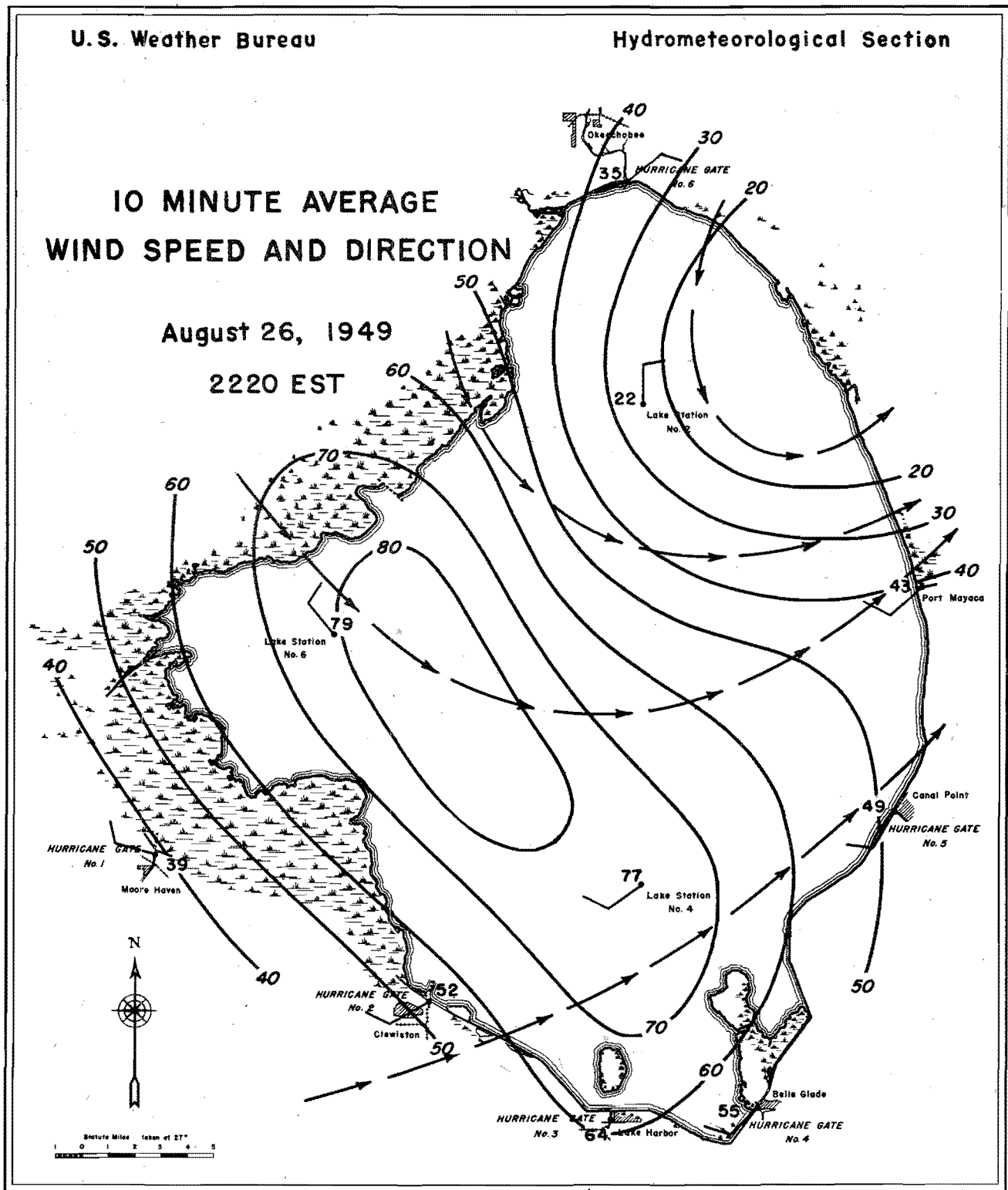Statute Miles   taken at 27°
1 0 1 2 3 4 5

File 50II

Figure 24

U.S. Weather Bureau   Hydrometeorological Section
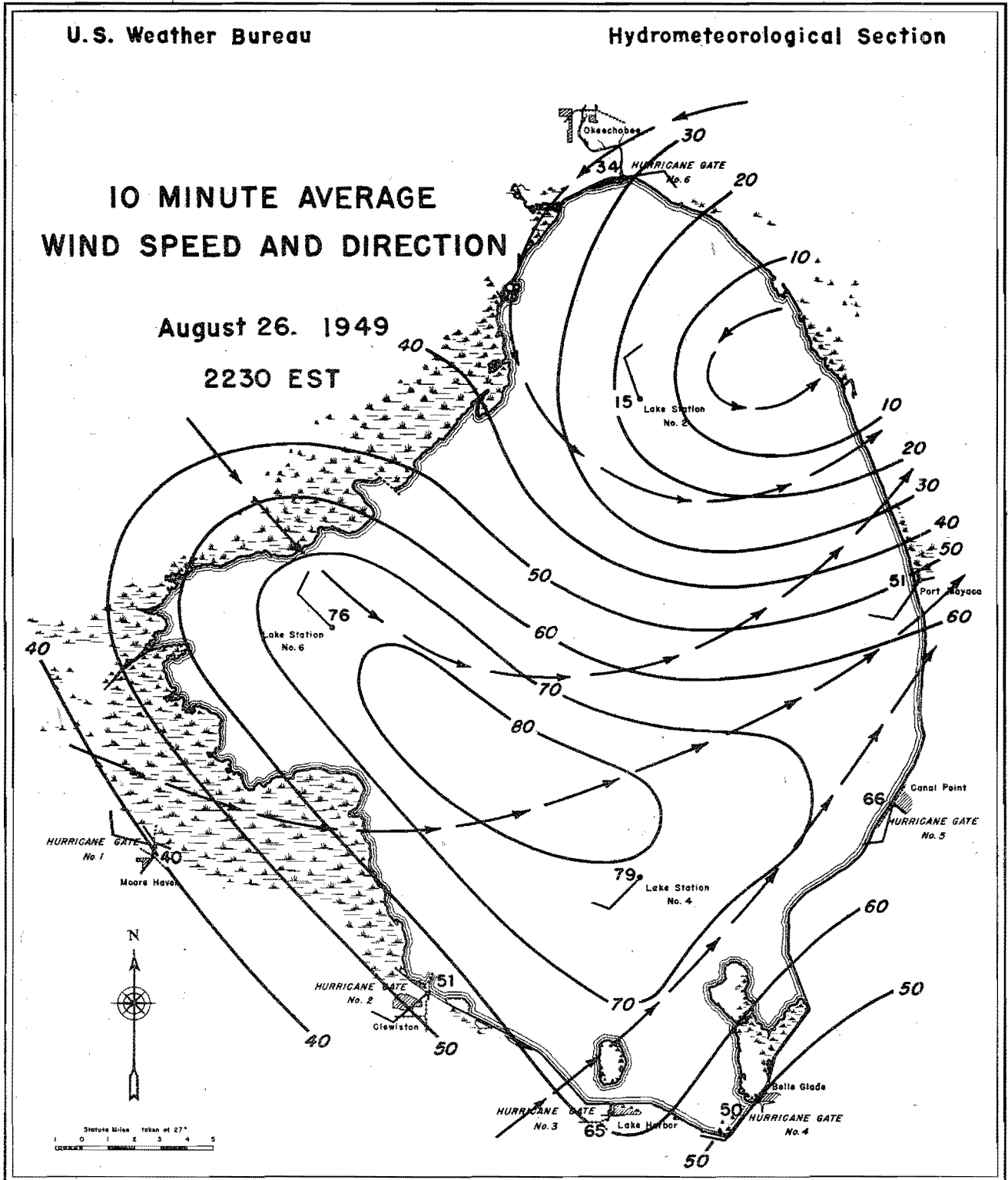
10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2110 EST

File 5011   Figure 25

929182 O - 51 - 6
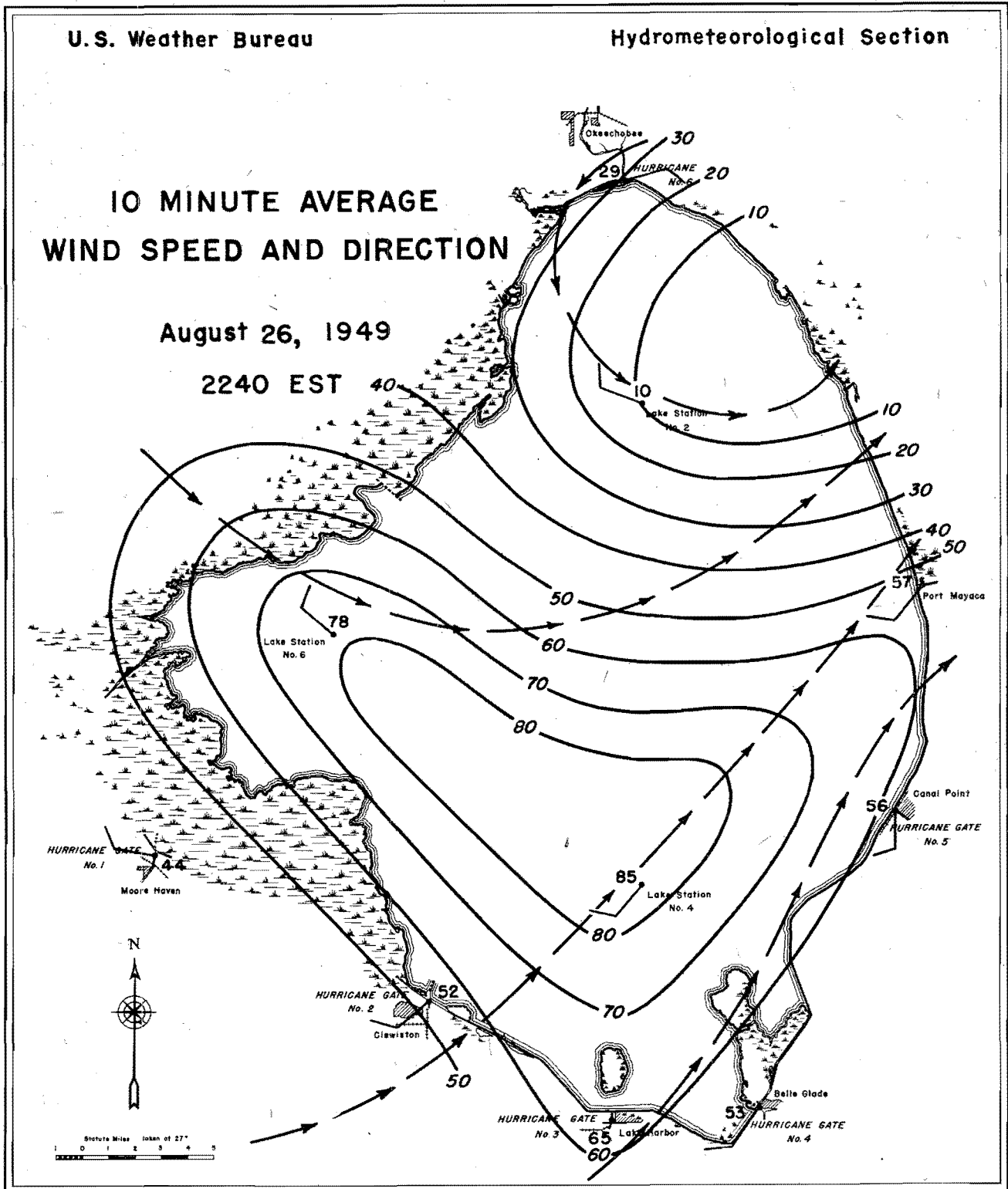
U.S. Weather Bureau   Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2120 EST

File 5011   Figure 26

39

U.S. Weather Bureau — Hydrometeorological Section

10 MINUTE AVERAGE WIND SPEED AND DIRECTION

August 26, 1949

2130 EST

File 5011

Figure 27

U.S. Weather Bureau

Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION
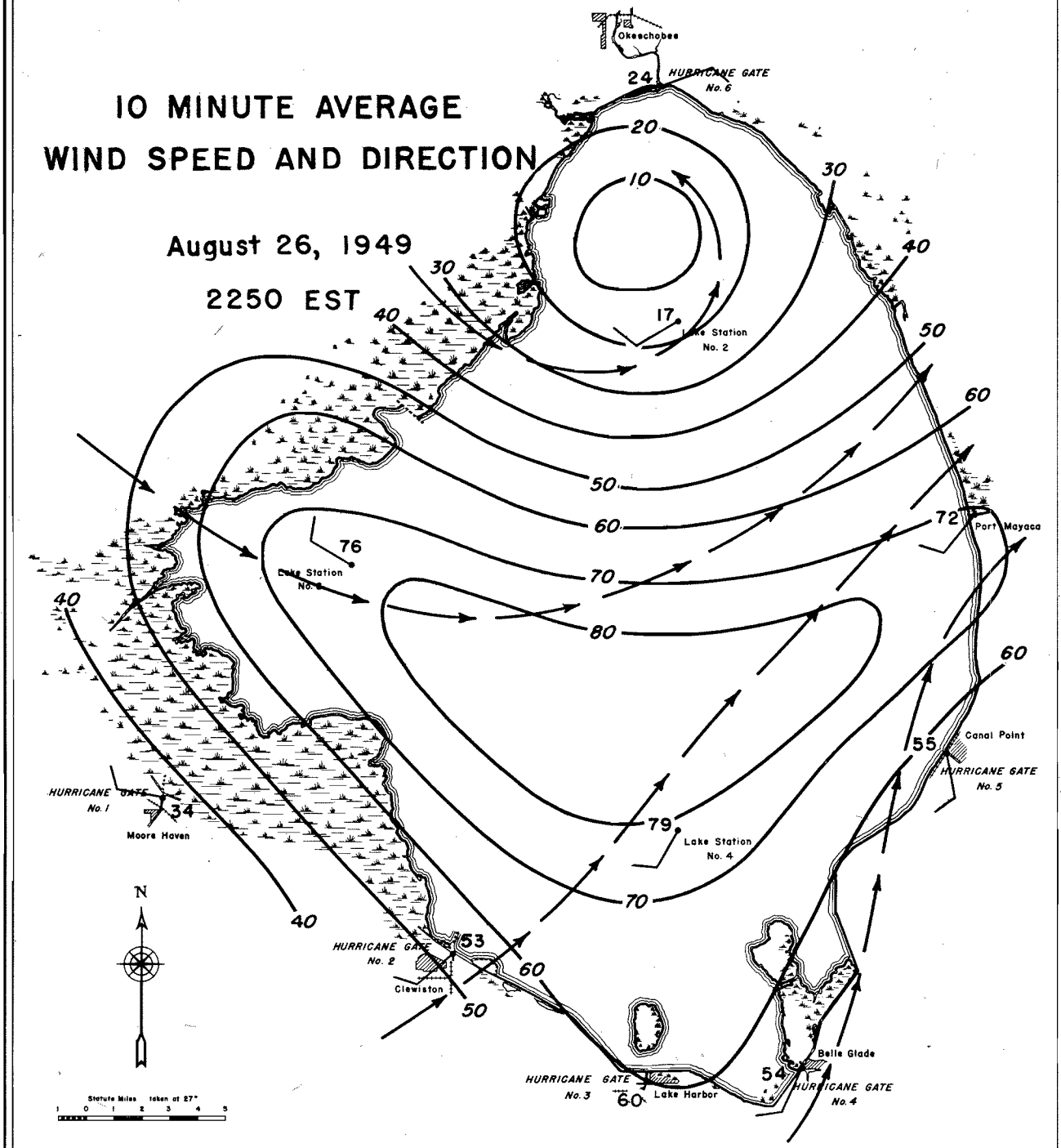
August 26, 1949

2140 EST

File 5011

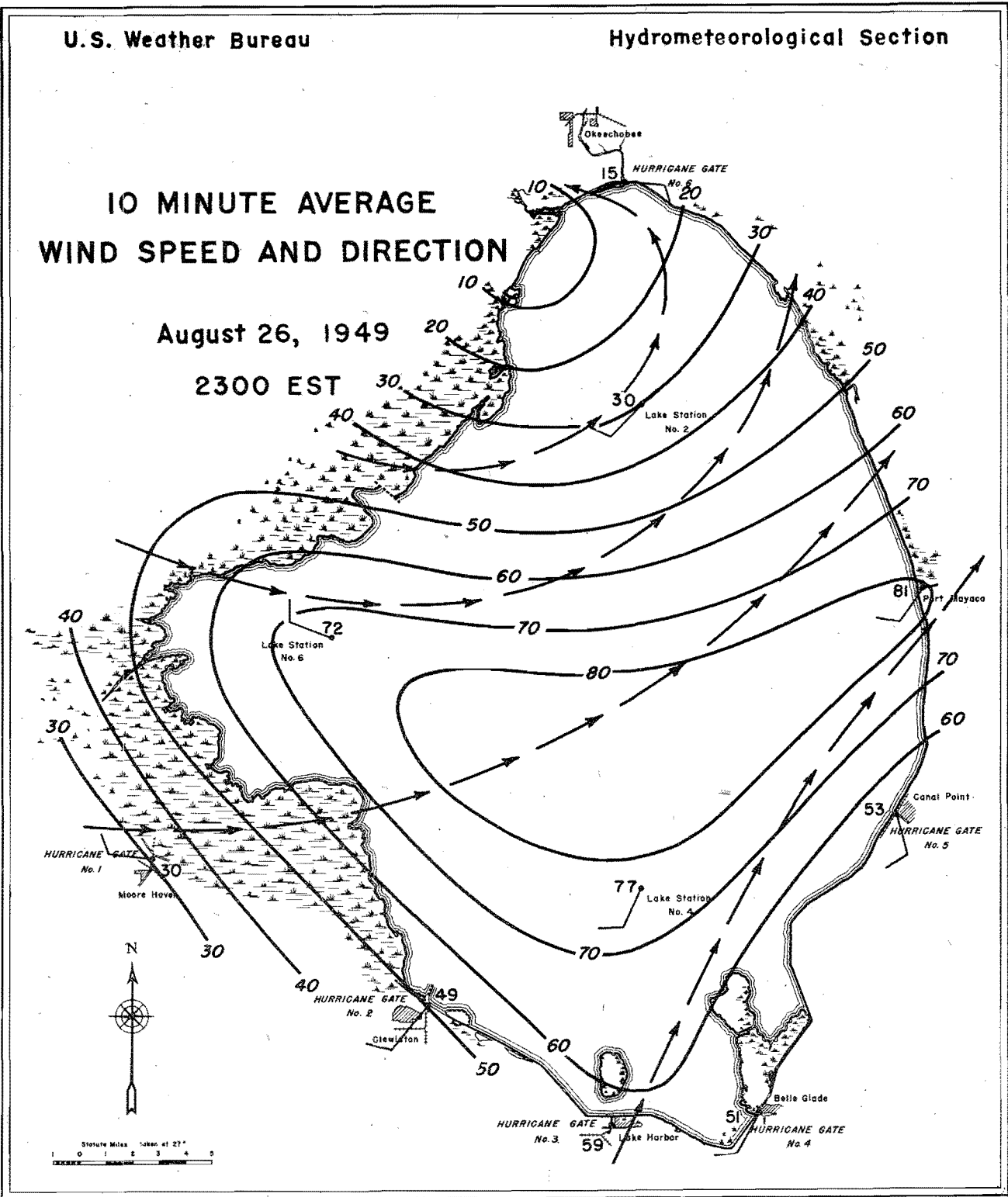Figure 28

U.S. Weather Bureau   Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2150 EST

File 5011   Figure 29

U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2200 EST

43

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2210 EST

U.S. Weather Bureau

Hydrometeorological Section

File 5011

Figure 31

44

U.S. Weather Bureau　　　　Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949
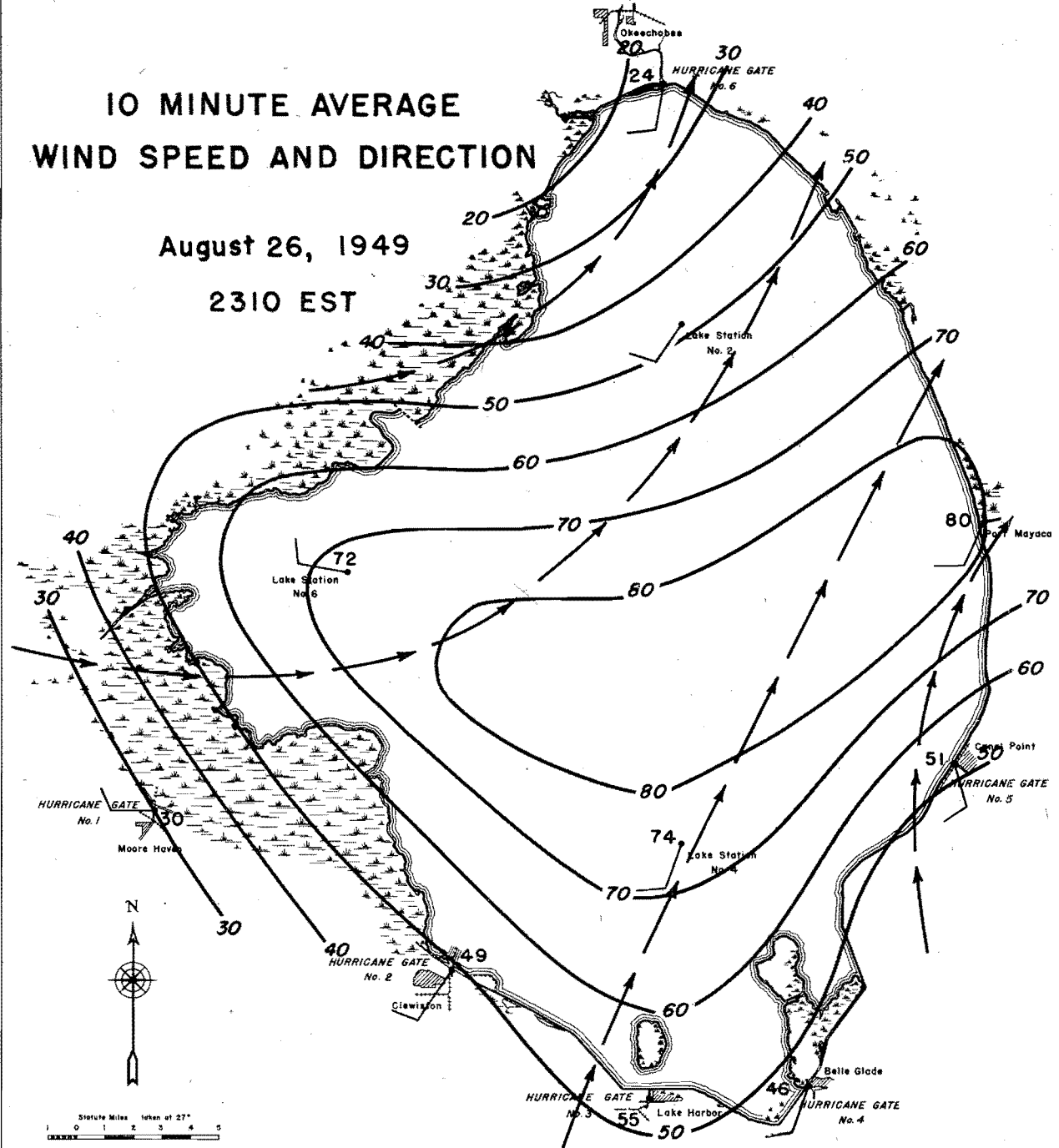
2220 EST

File 50II　　　　　　　　Figure 32

U.S. Weather Bureau

Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26. 1949
2230 EST

Figure 33

U.S. Weather Bureau　　　　Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2240 EST

File 5011　　　　Figure 34

U.S. Weather Bureau — Hydrometeorological Section
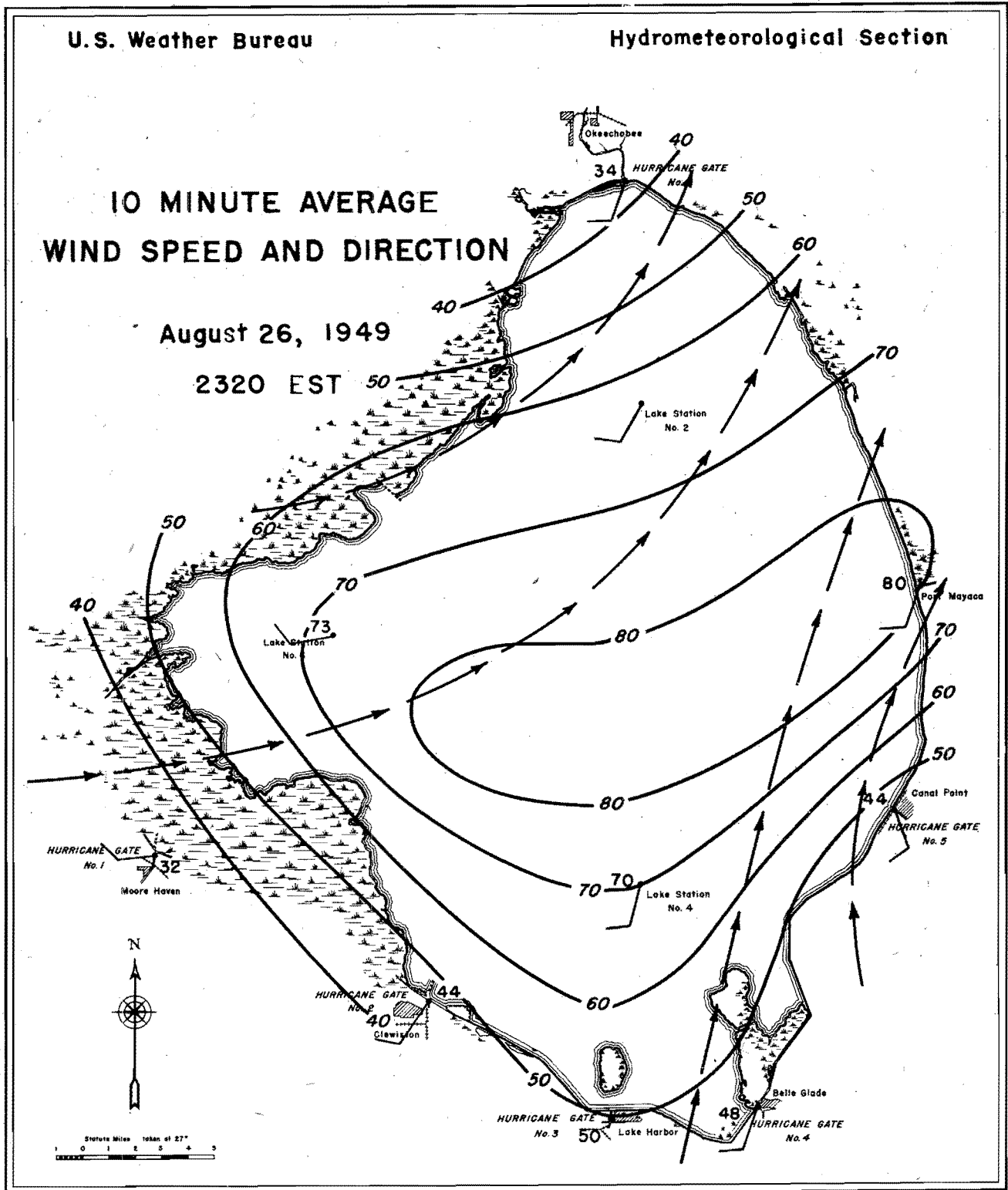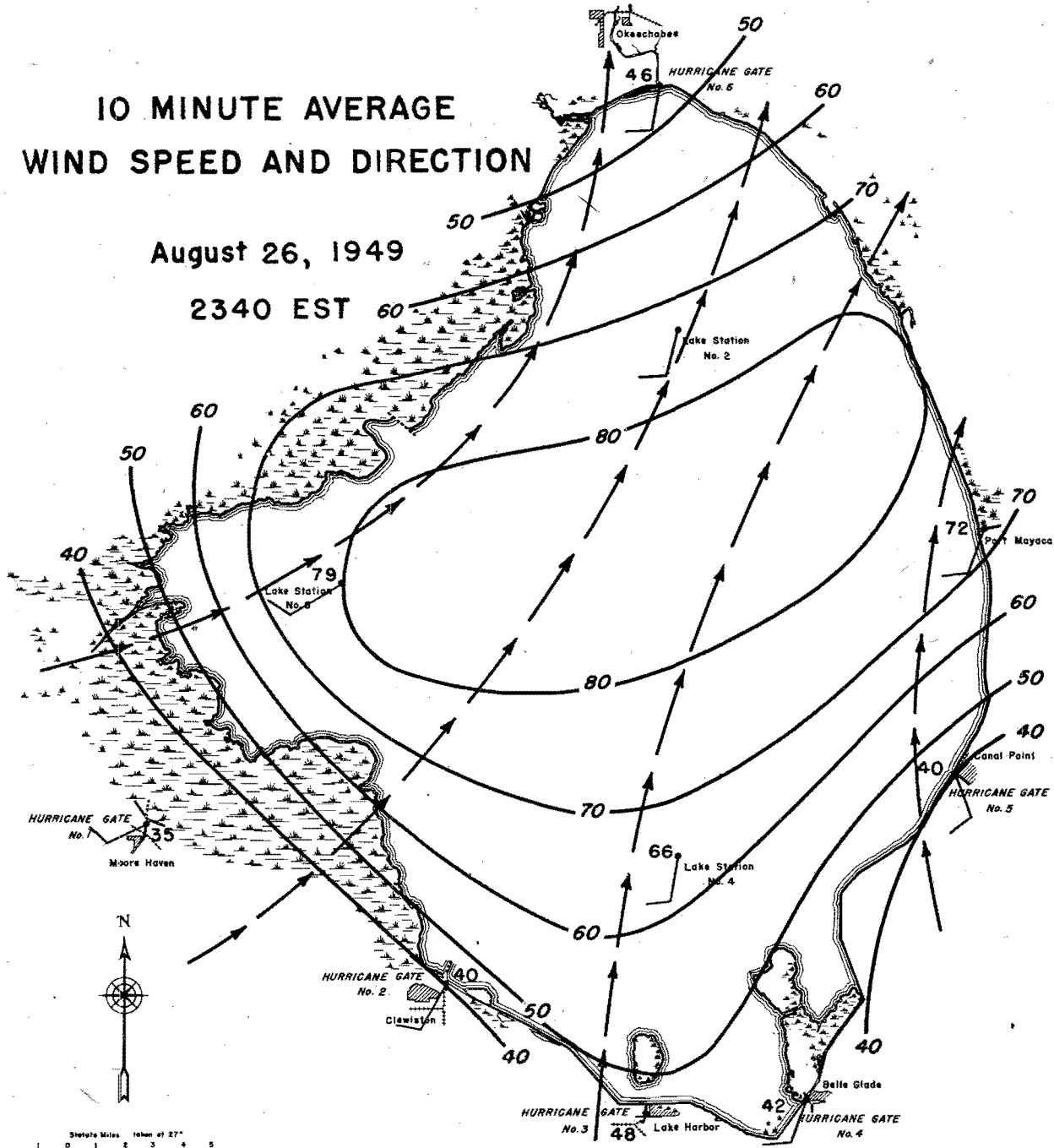
IO MINUTE AVERAGE
WIND SPEED AND DIRECTION
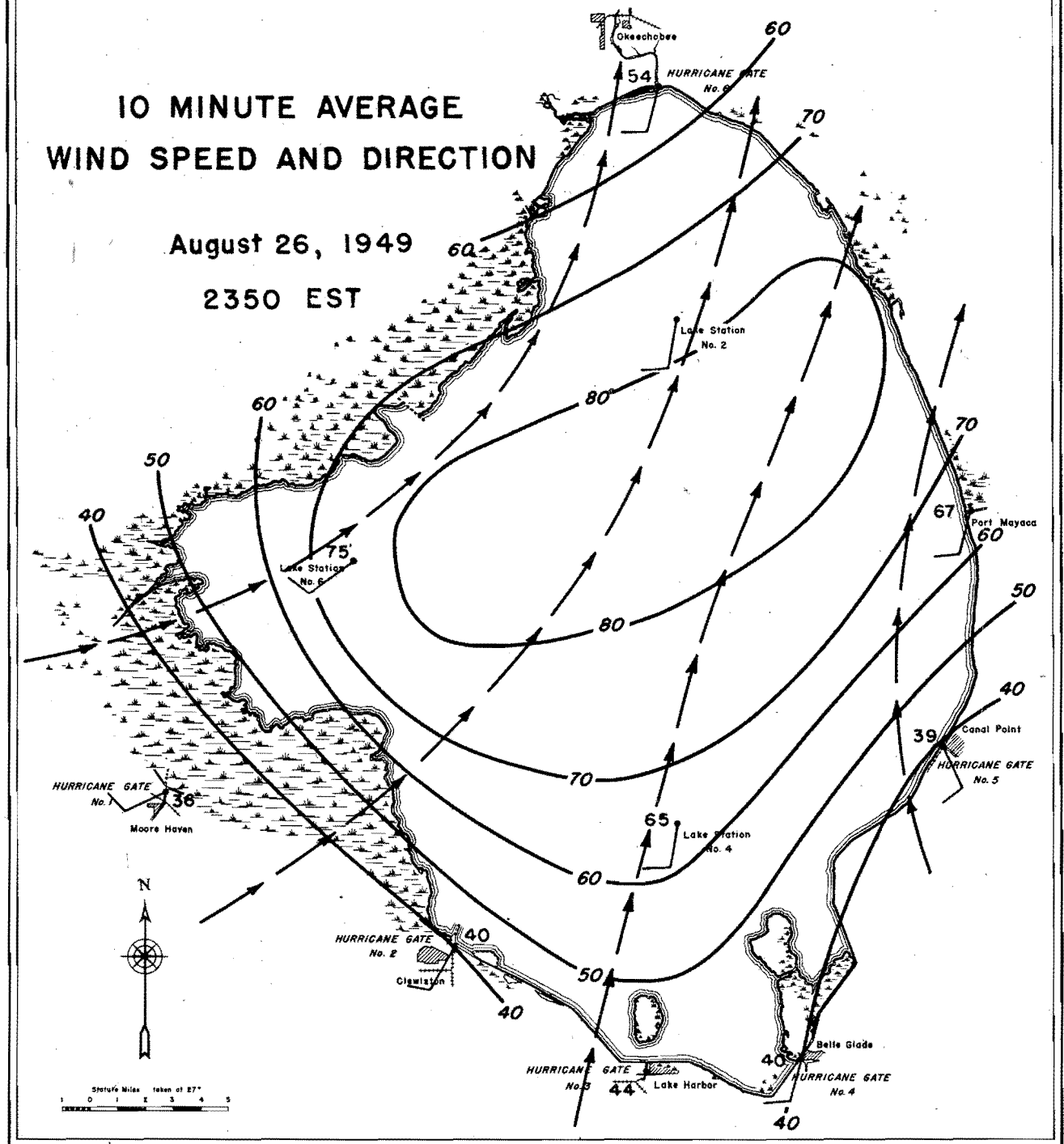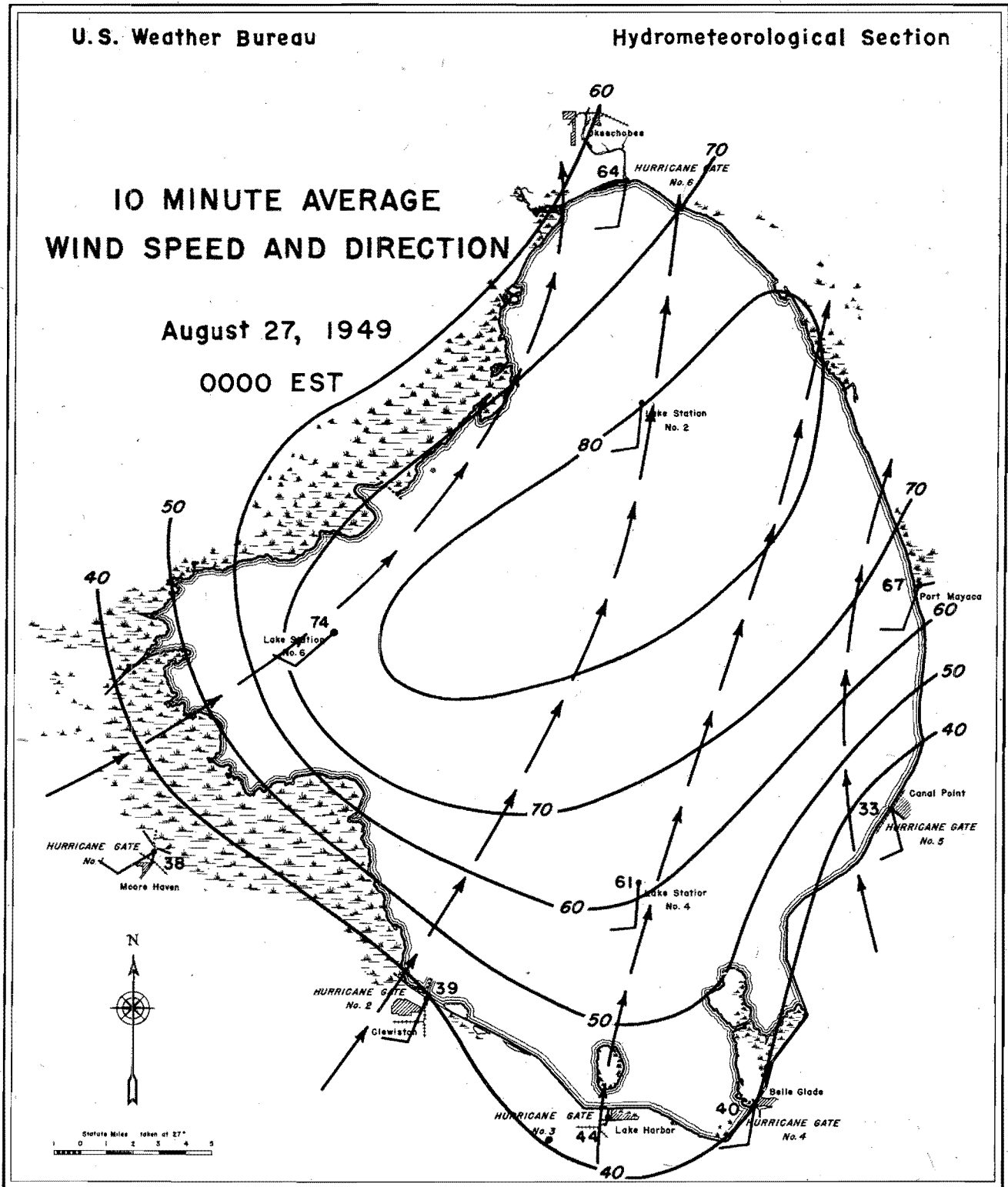
August 26, 1949
2250 EST

File 50II

Figure 35

U.S. Weather Bureau

Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION
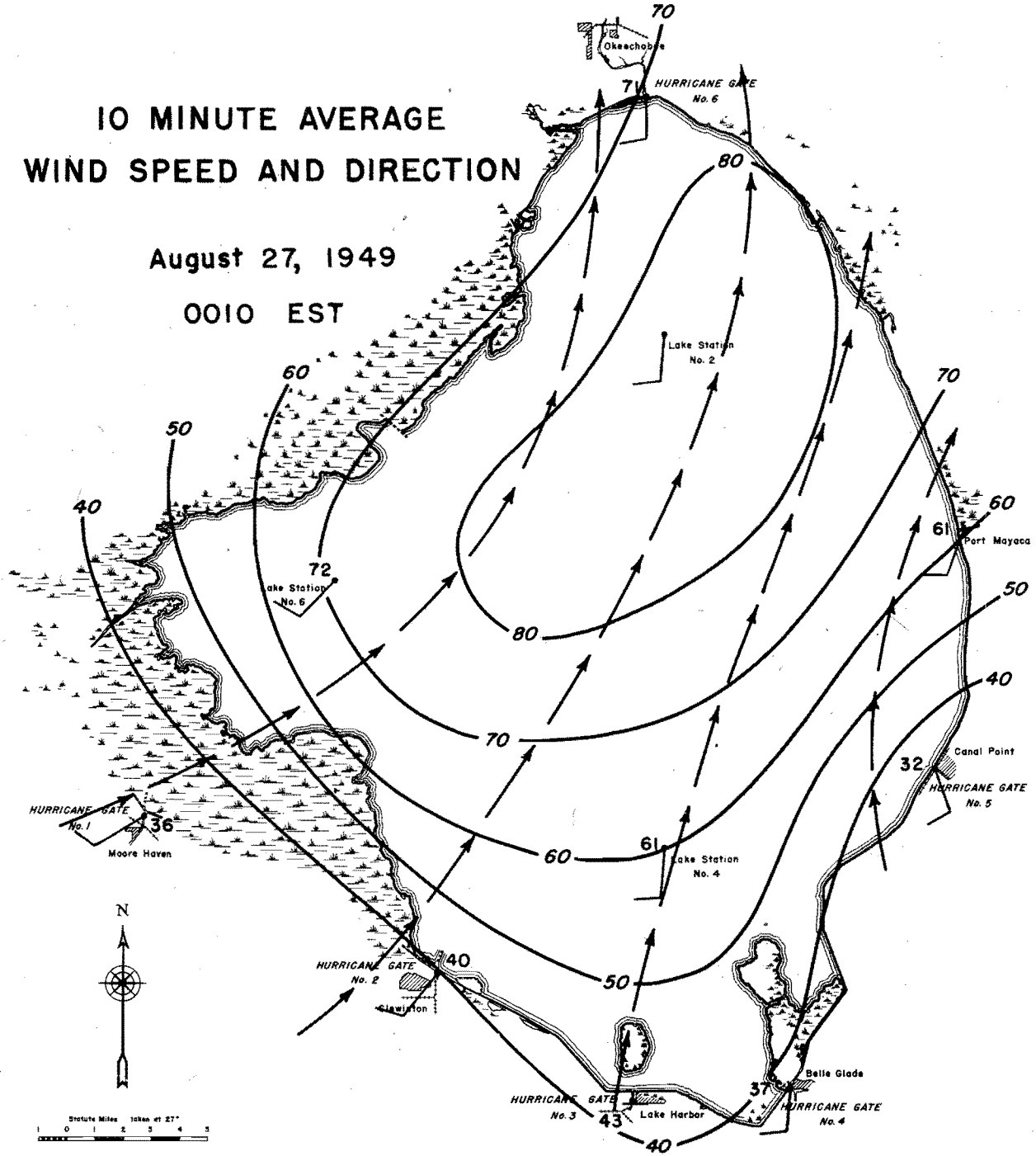
August 26, 1949

2300 EST

File 5011

Figure 36

U.S. Weather Bureau

Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2310 EST

File 5011

Figure 37

U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2320 EST

Okeechobee

HURRICANE GATE No.

Lake Station No. 2

Lake Station No.

73

Port Mayaca

80

Canal Point

HURRICANE GATE No. 5

HURRICANE GATE No.1

32

Moore Haven

N

Lake Station No. 4

Statute Miles

HURRICANE GATE No.

44

40

Clewiston

Belle Glade

48

HURRICANE GATE No. 3

Lake Harbor

HURRICANE GATE No. 4

File 5011   Figure 38

51

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2330 EST

U.S. Weather Bureau

Hydrometeorological Section

File 5011

Figure 39

U.S. Weather Bureau   Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2340 EST

U.S. Weather Bureau　　　　　　　　　　　**Hydrometeorological Section**

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 26, 1949

2350 EST

File 5OII　　　　　　　　　　　　　　　　　　　　　　Figure 41

U.S. Weather Bureau   Hydrometeorological Section
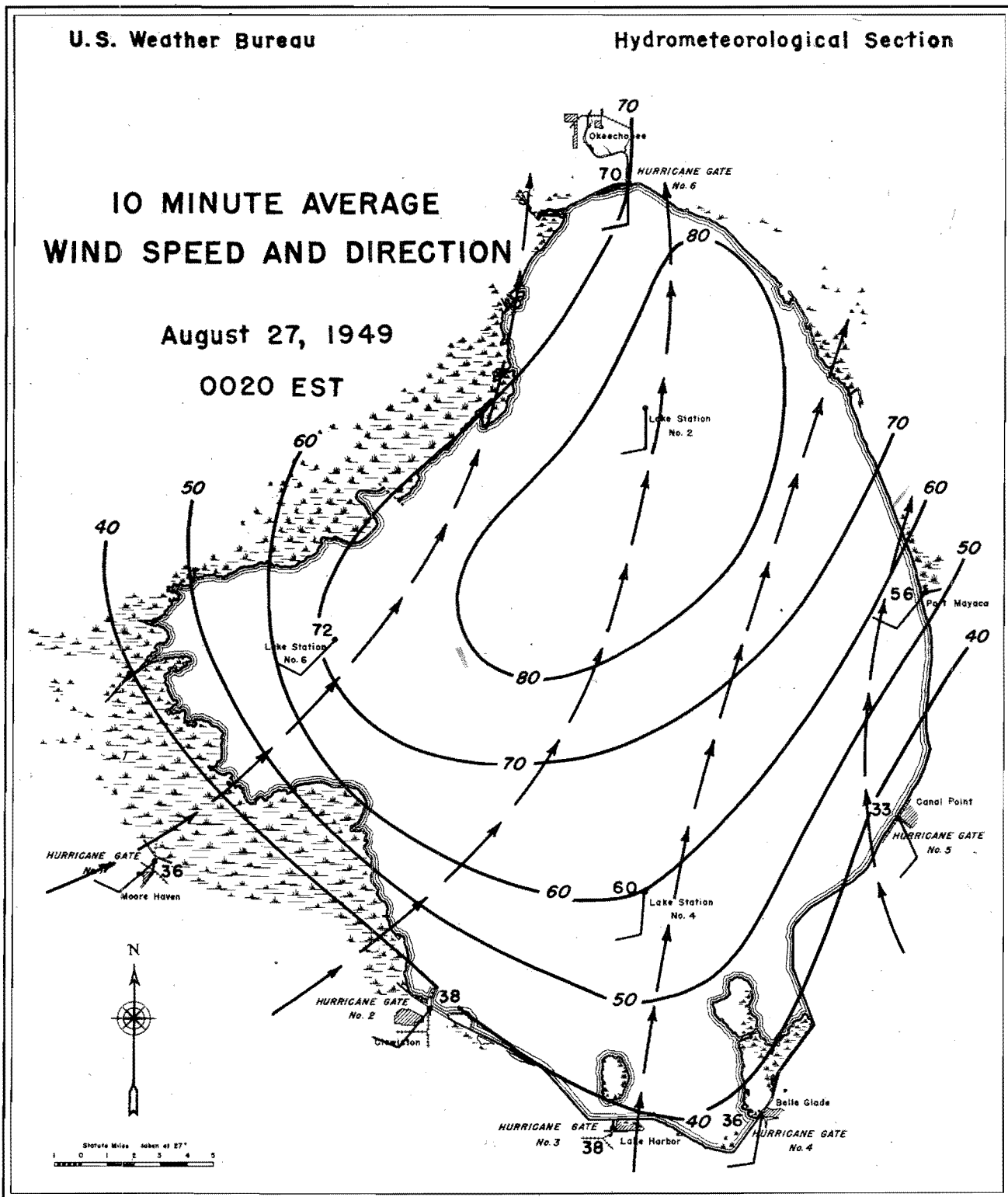
IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

OOOO EST

    Figure 42
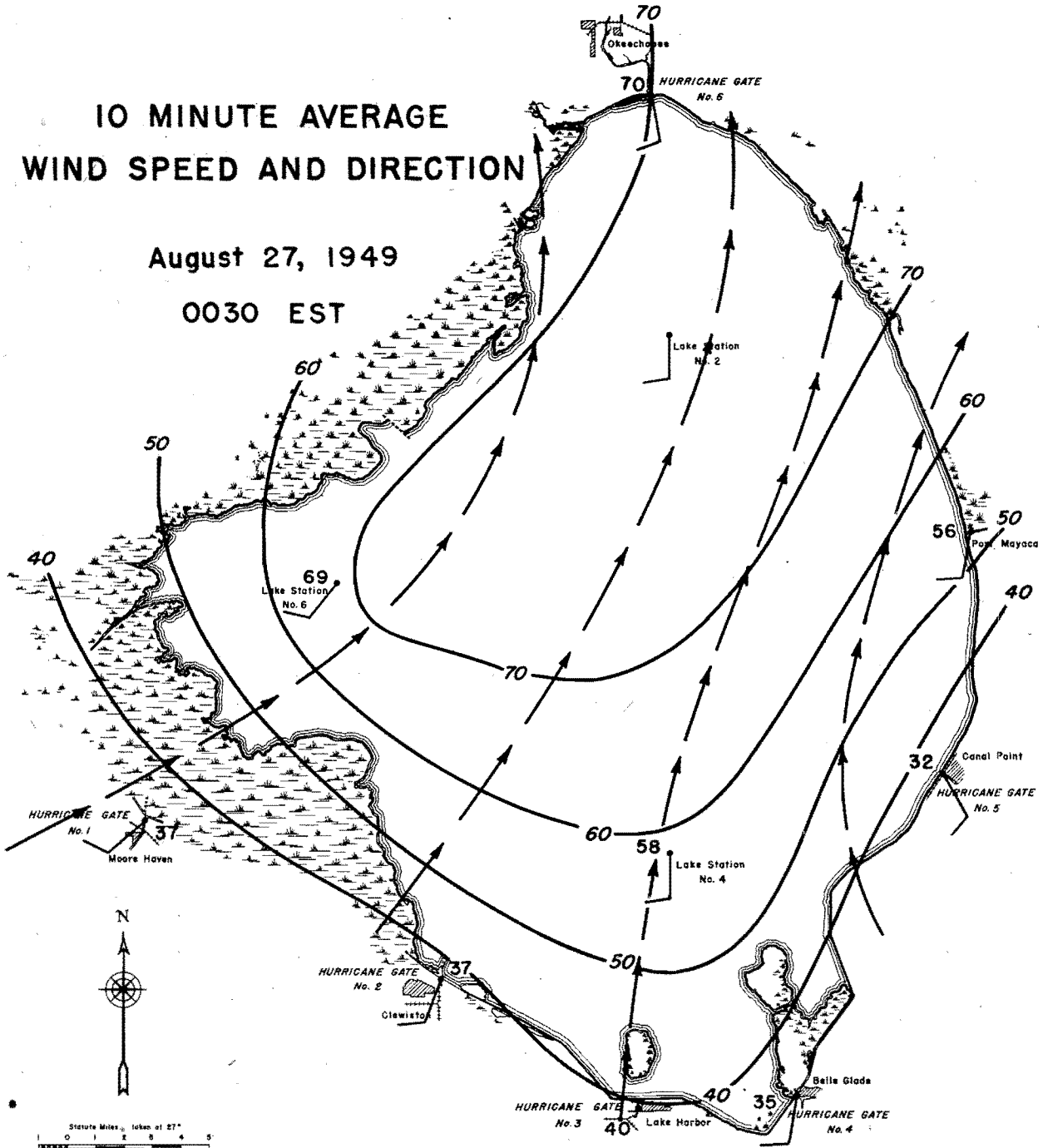
U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0010 EST

File 5011   Figure 43

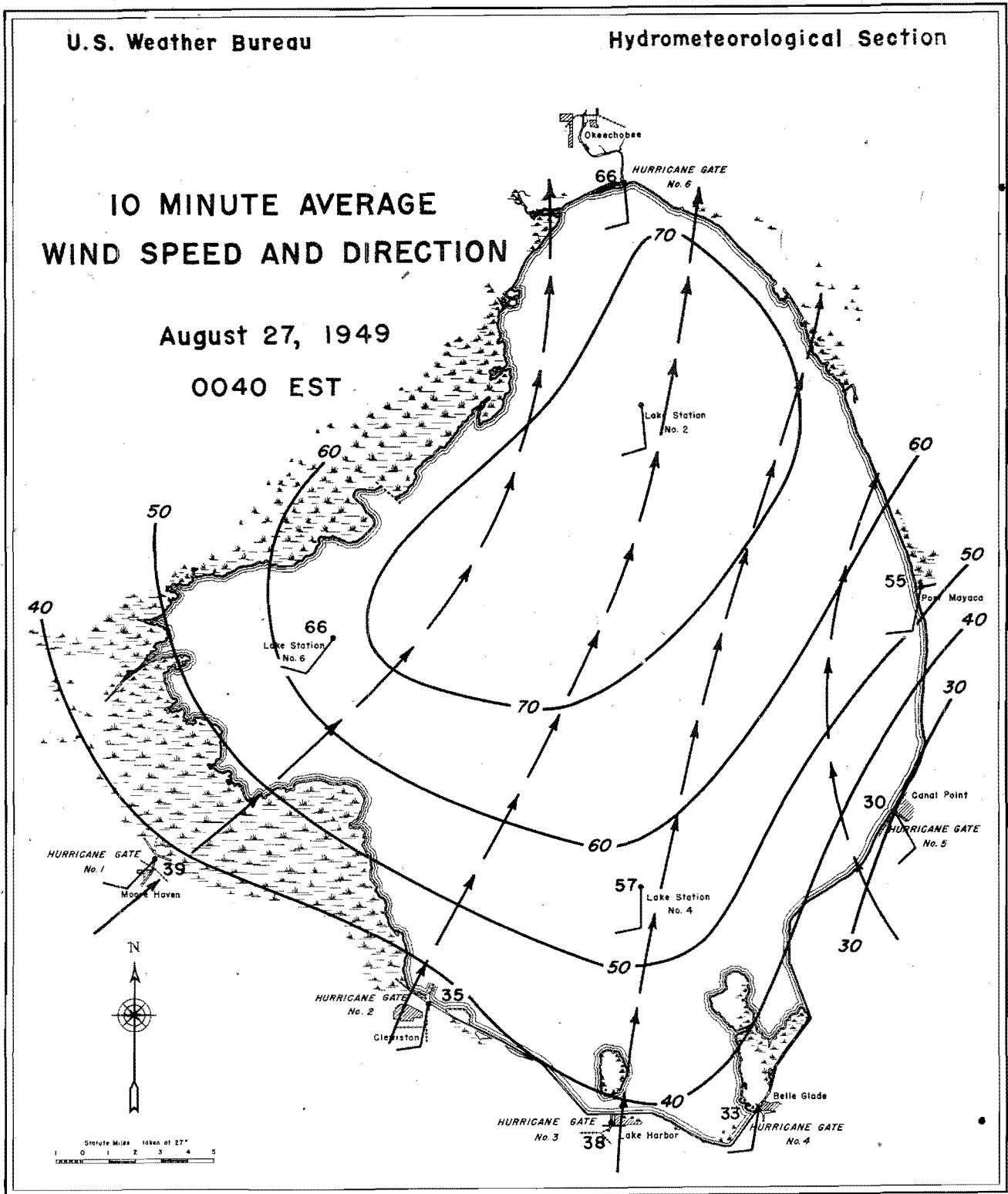U.S. Weather Bureau — Hydrometeorological Section

10 MINUTE AVERAGE WIND SPEED AND DIRECTION

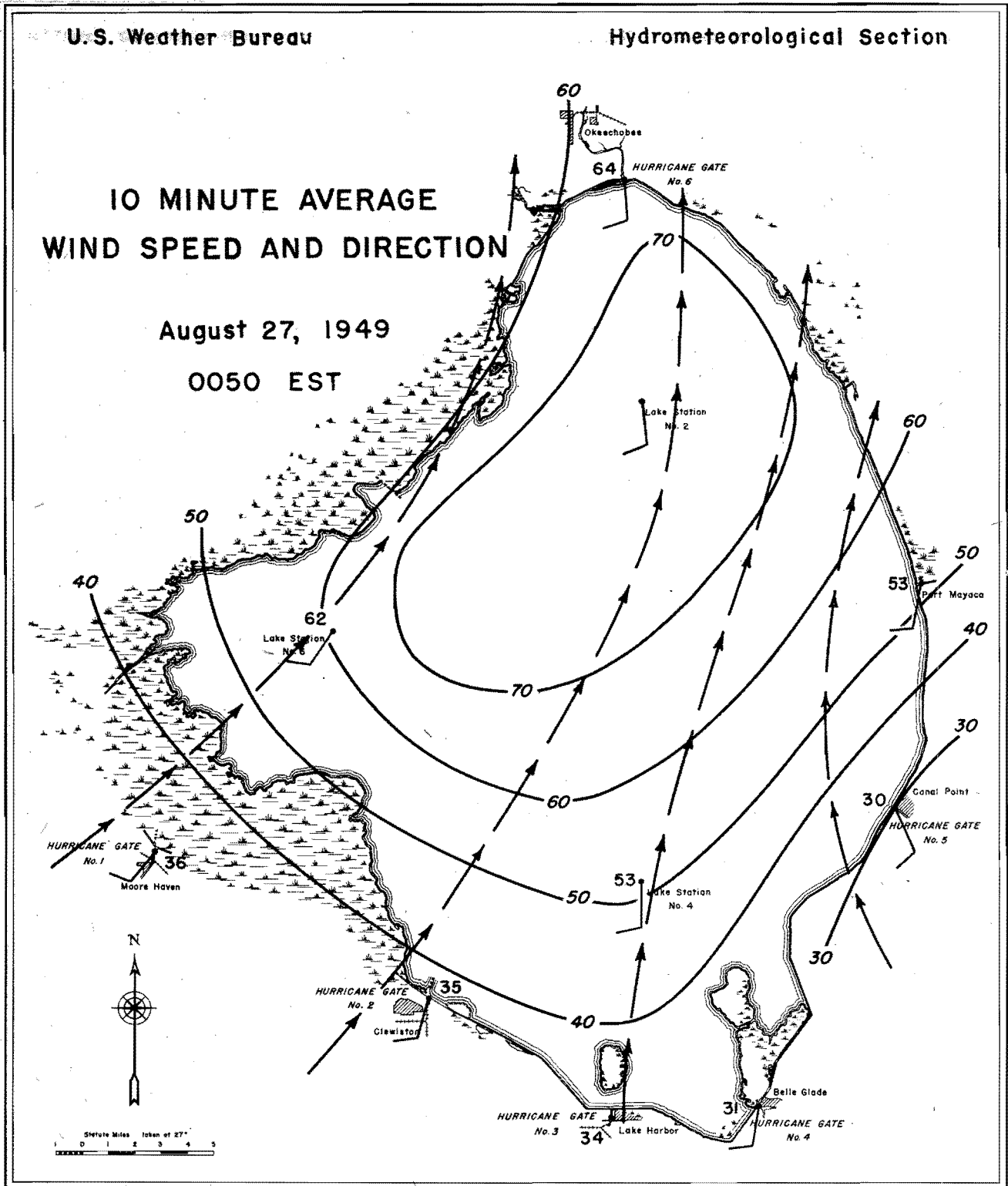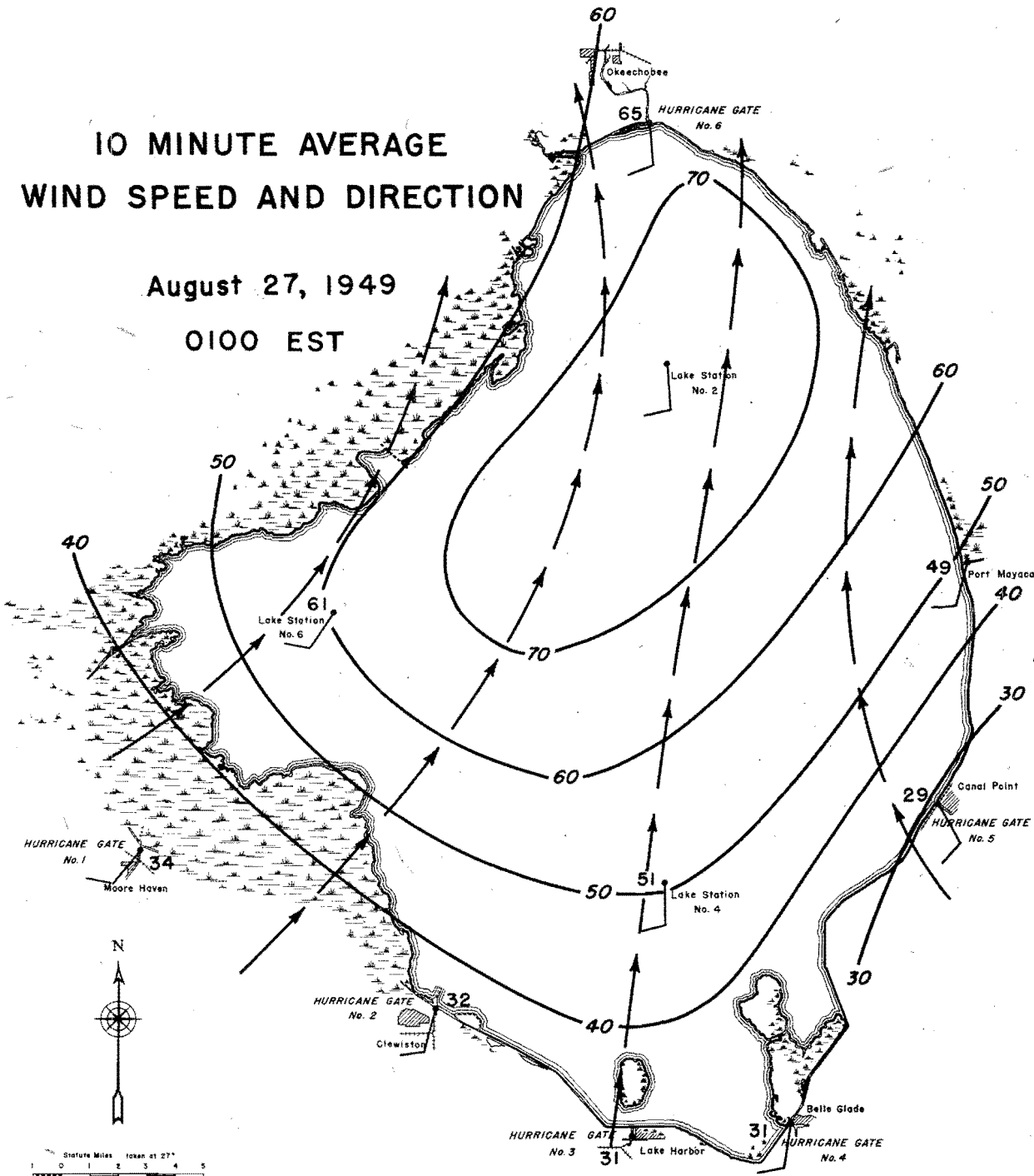August 27, 1949

0020 EST

File 5011

Figure 44

57

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0030 EST

U.S. Weather Bureau

Hydrometeorological Section

File 5011

Figure 45

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

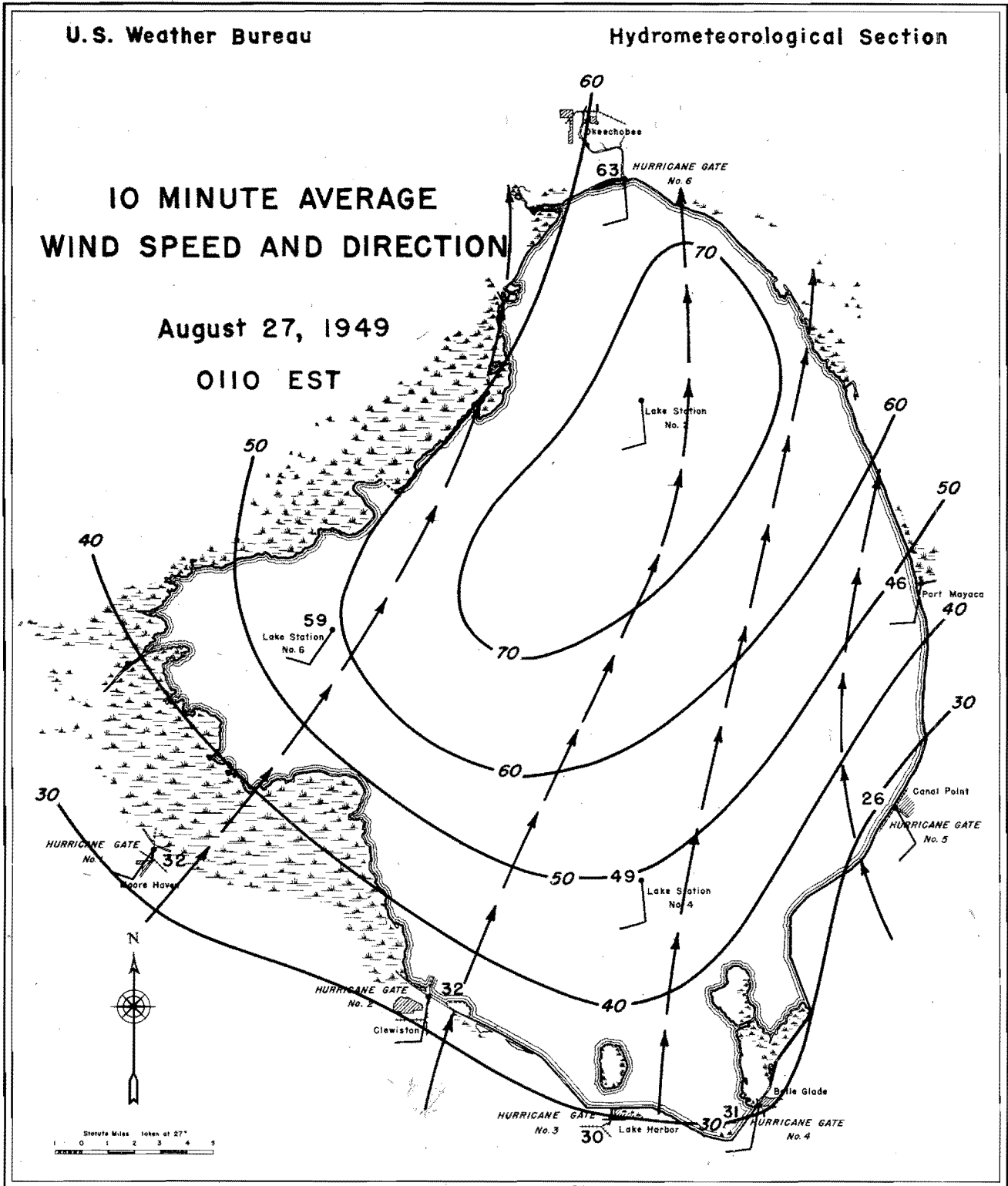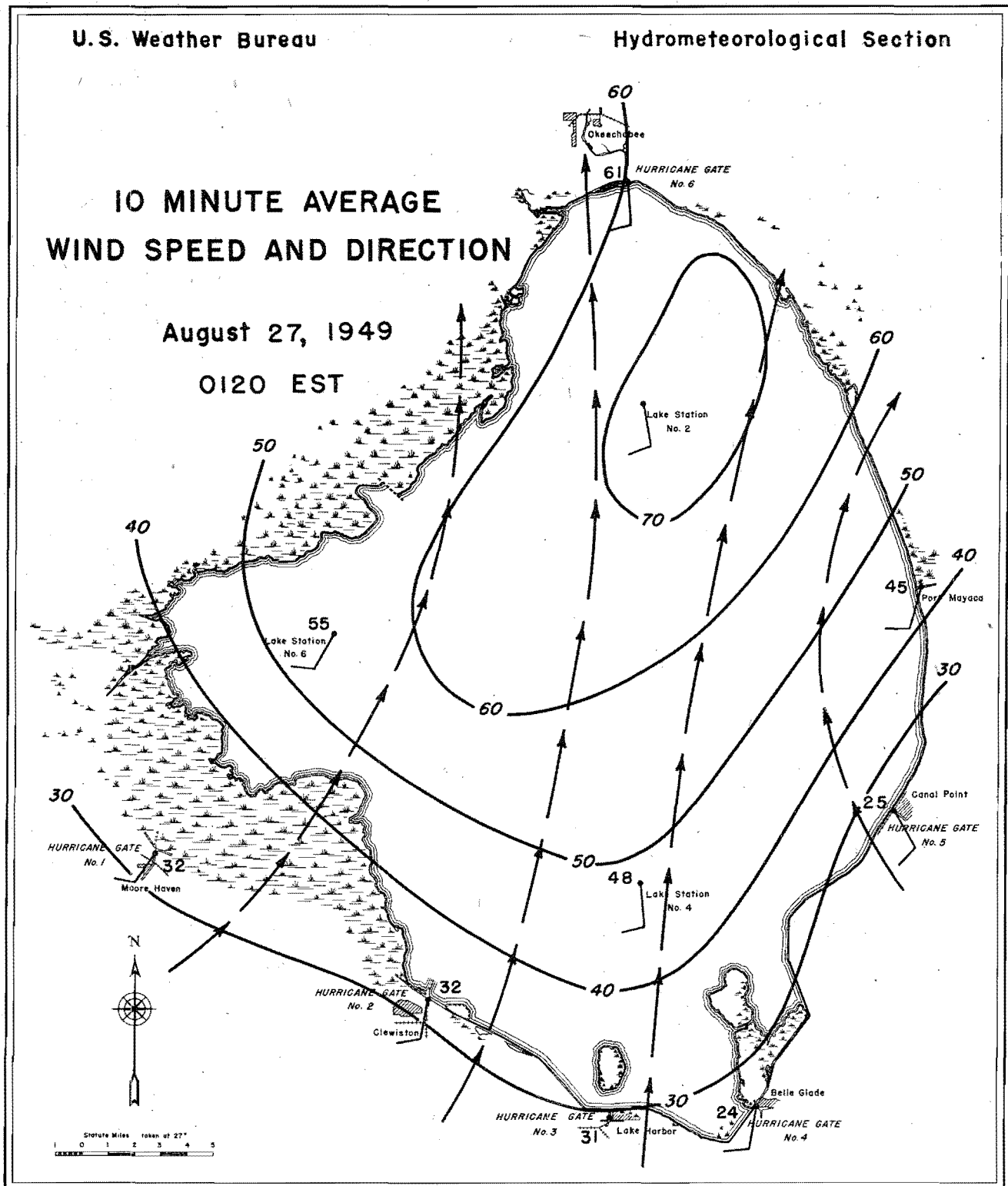## August 27, 1949

0040 EST

File 50II

Figure 46

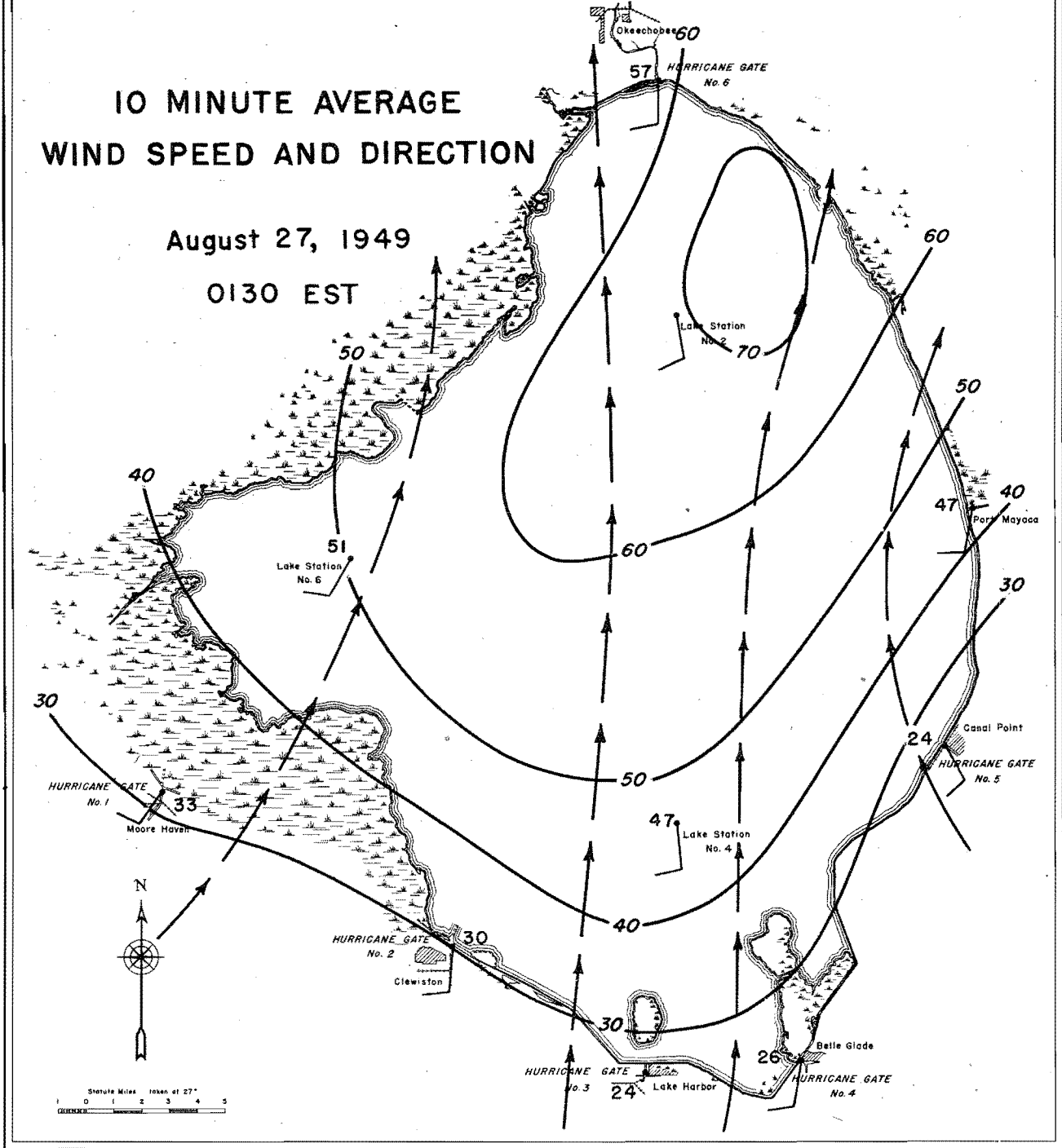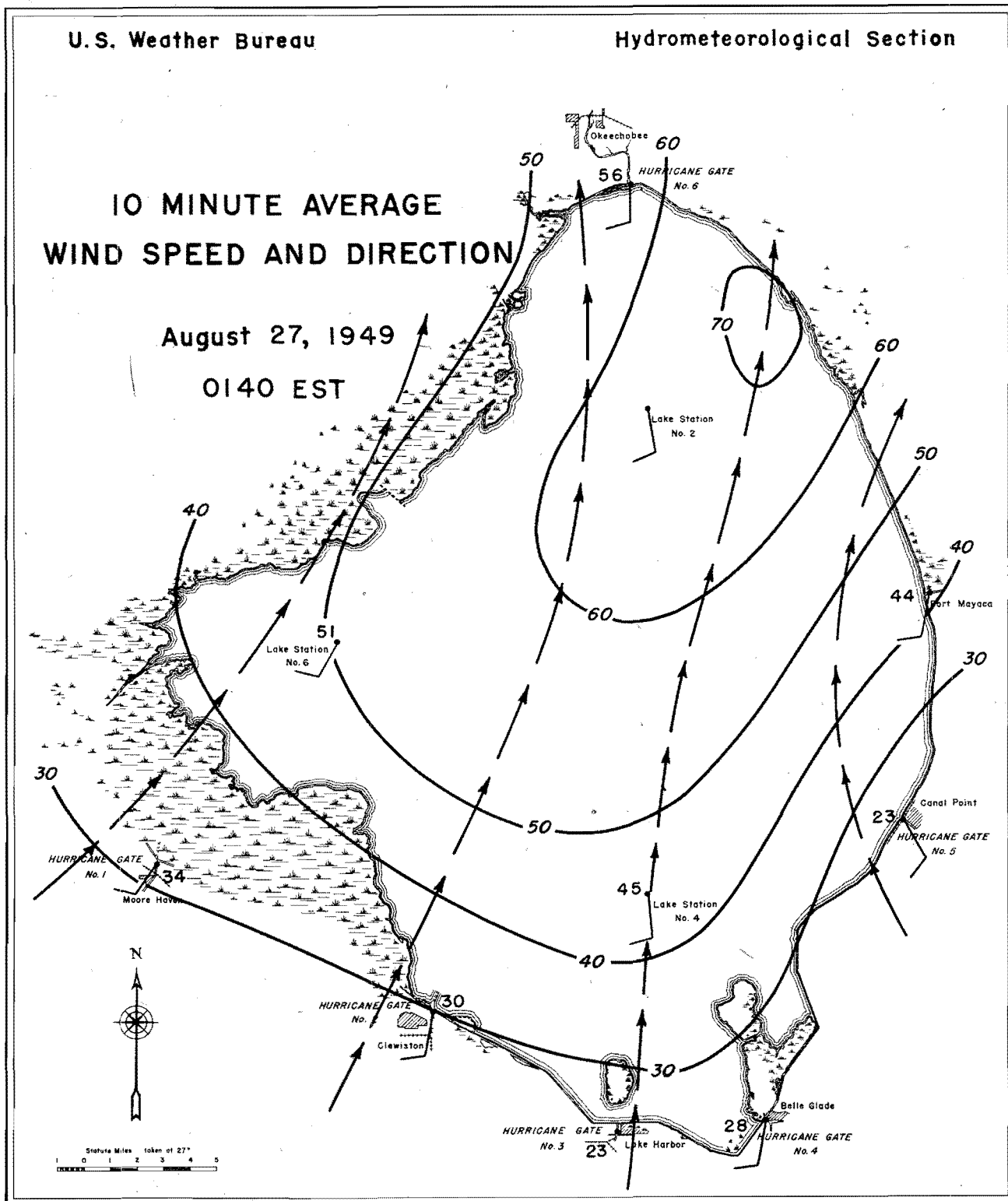U.S. Weather Bureau

Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0050 EST

File 50II

Figure 47

60

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0100 EST

61

U.S. Weather Bureau   Hydrometeorological Section

60

Okeechobee

63   HURRICANE GATE
         No. 6

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0110 EST

70

Lake Station
No. 2

60

50

Port Mayaca

50

40

46

40

59
Lake Station
No. 6

70

30

60

26   Canal Point

HURRICANE GATE
      No. 5

30

HURRICANE GATE
No. I

32

Moore Haven

50   49

Lake Station
No. 4

N

HURRICANE GATE
No. 2

32

Belle Glade

Clewiston

40

31   HURRICANE GATE
         No. 4

Statute Miles   taken at 27°

HURRICANE GATE
No. 3

30   Lake Harbor   30

30

File 5011   Figure 49

U.S. Weather Bureau   Hydrometeorological Section

**IO MINUTE AVERAGE
WIND SPEED AND DIRECTION**

August 27, 1949

0120 EST

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0130 EST

U.S. Weather Bureau

Hydrometeorological Section
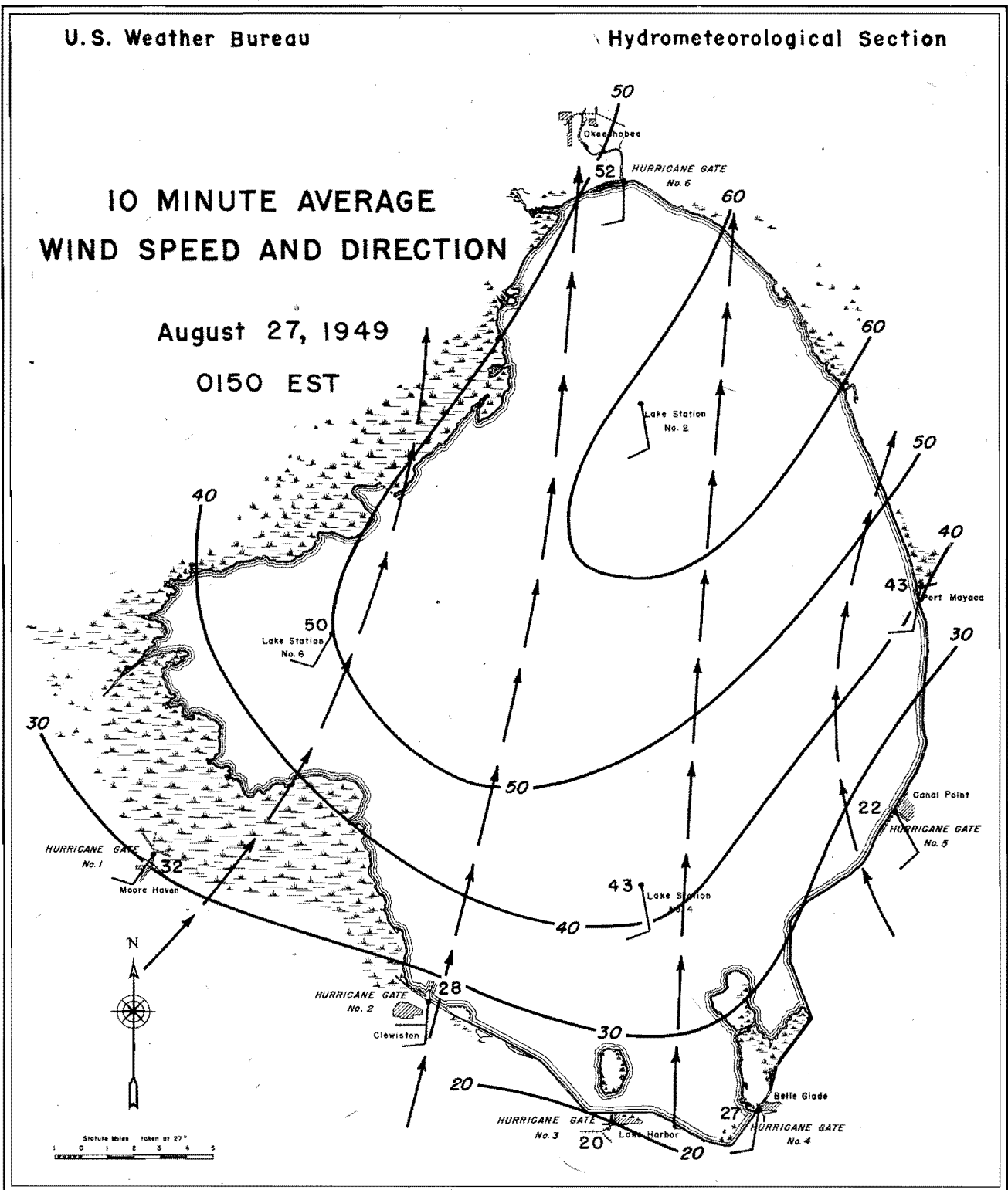
File 50II

Figure 51

U.S. Weather Bureau   Hydrometeorological Section
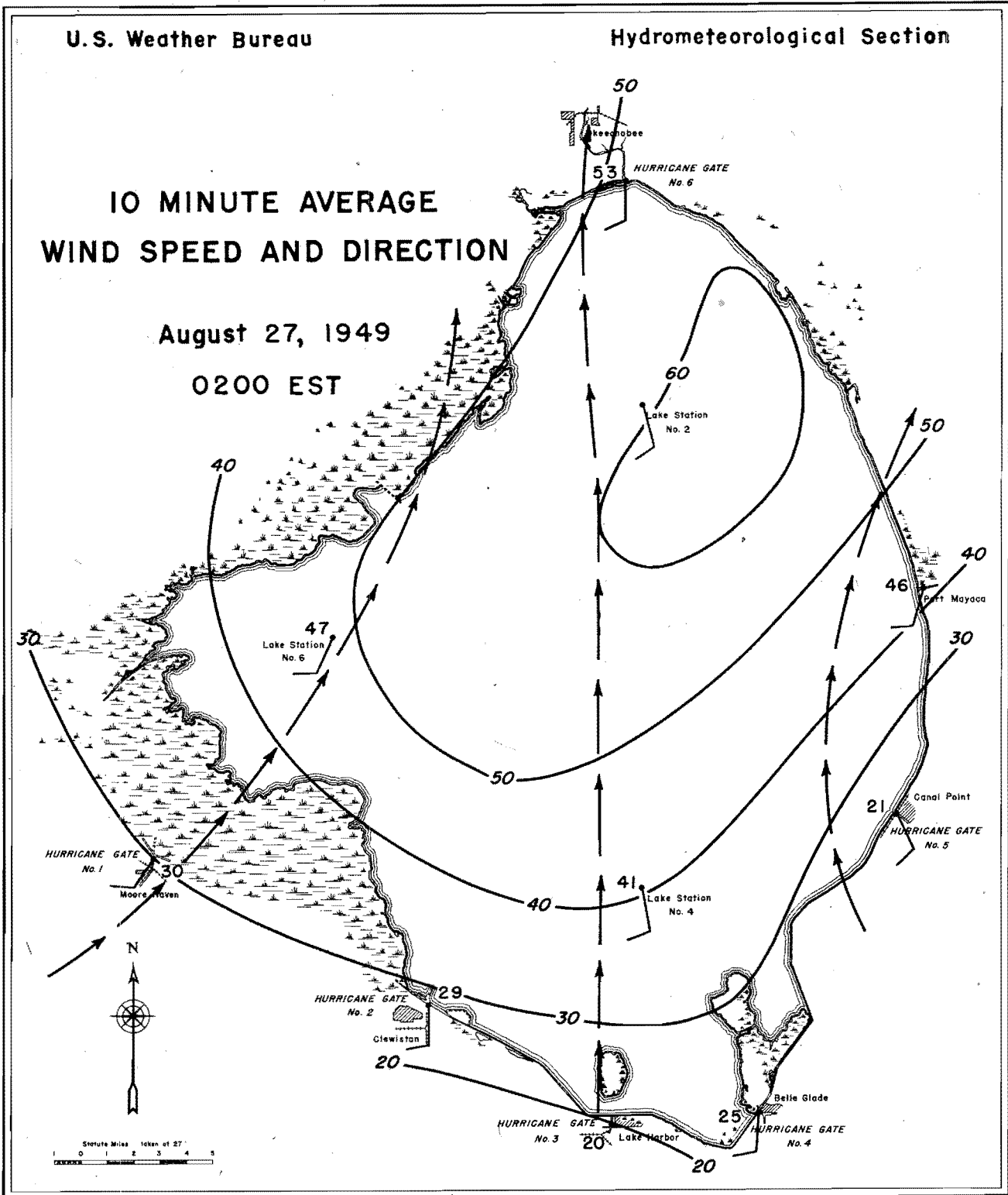
10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0140 EST
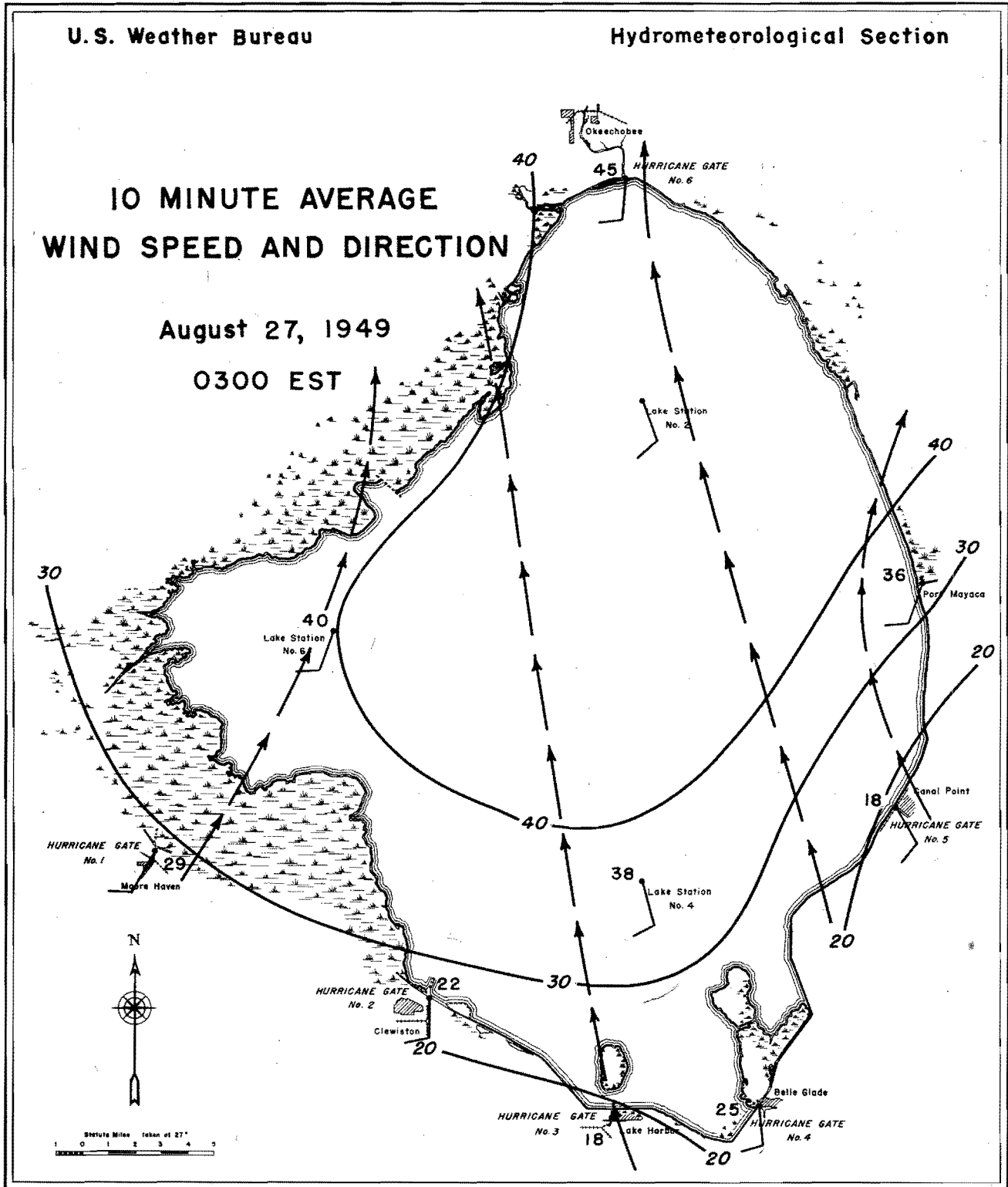
File 5011   Figure 52

U.S. Weather Bureau   Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

OI50 EST

File 50II   Figure 53

U.S. Weather Bureau   Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION
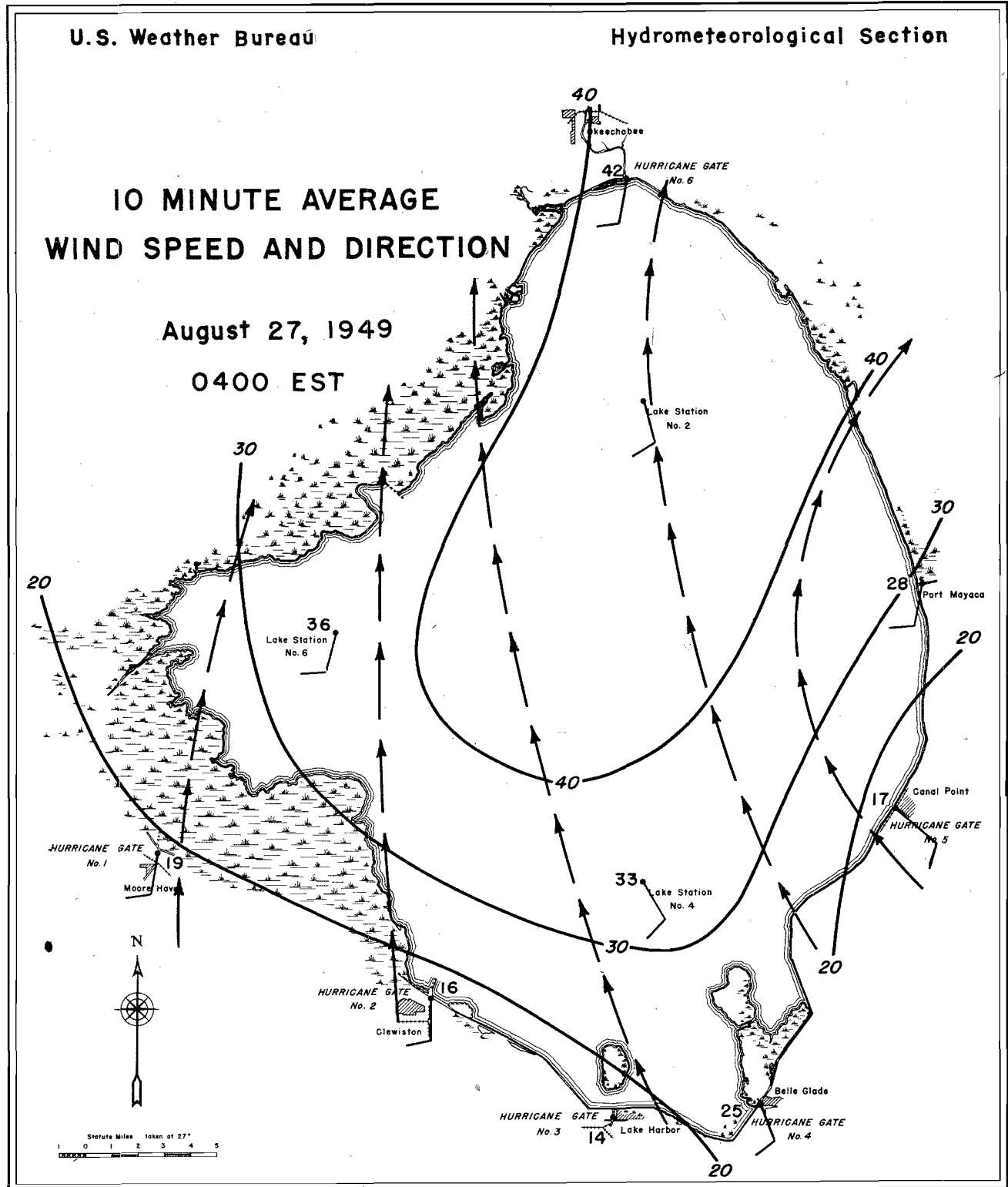
August 27, 1949

0200 EST

File 5011   Figure 54

U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0300 EST

File 5011   Figure 55

U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0400 EST

Figure 57

70

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0600 EST

File 5011

Figure 58

U.S. Weather Bureau   Hydrometeorological Section

IO MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0700 EST

File 50II   Figure 59

U.S. Weather Bureau   Hydrometeorological Section

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0800 EST

Okeechobee

36 HURRICANE GATE
No. 6

31 Lake Station
No. 2

30

30

20   20

25 Port Mayaca

31 Lake Station
No. 6

18 Canal Point

HURRICANE GATE
No. 5

37 Lake Station
No. 4

30   20

N

HURRICANE GATE
No. 1

13
Moore Haven

HURRICANE GATE
No. 2

18

Clewiston

25 Belle Glade

HURRICANE GATE
No. 3

14 Lake Harbor

HURRICANE GATE
No. 4

20

Statute Miles   taken at 27°
1   0   1   2   3   4   5

File 5011   Figure 60

10 MINUTE AVERAGE
WIND SPEED AND DIRECTION

August 27, 1949

0900 EST

U.S. Weather Bureau

Hydrometeorological Section

File 5011

Figure 61

Permission of:
Electronics Research Laboratory,
University of Florida

File 5011   Figure 62

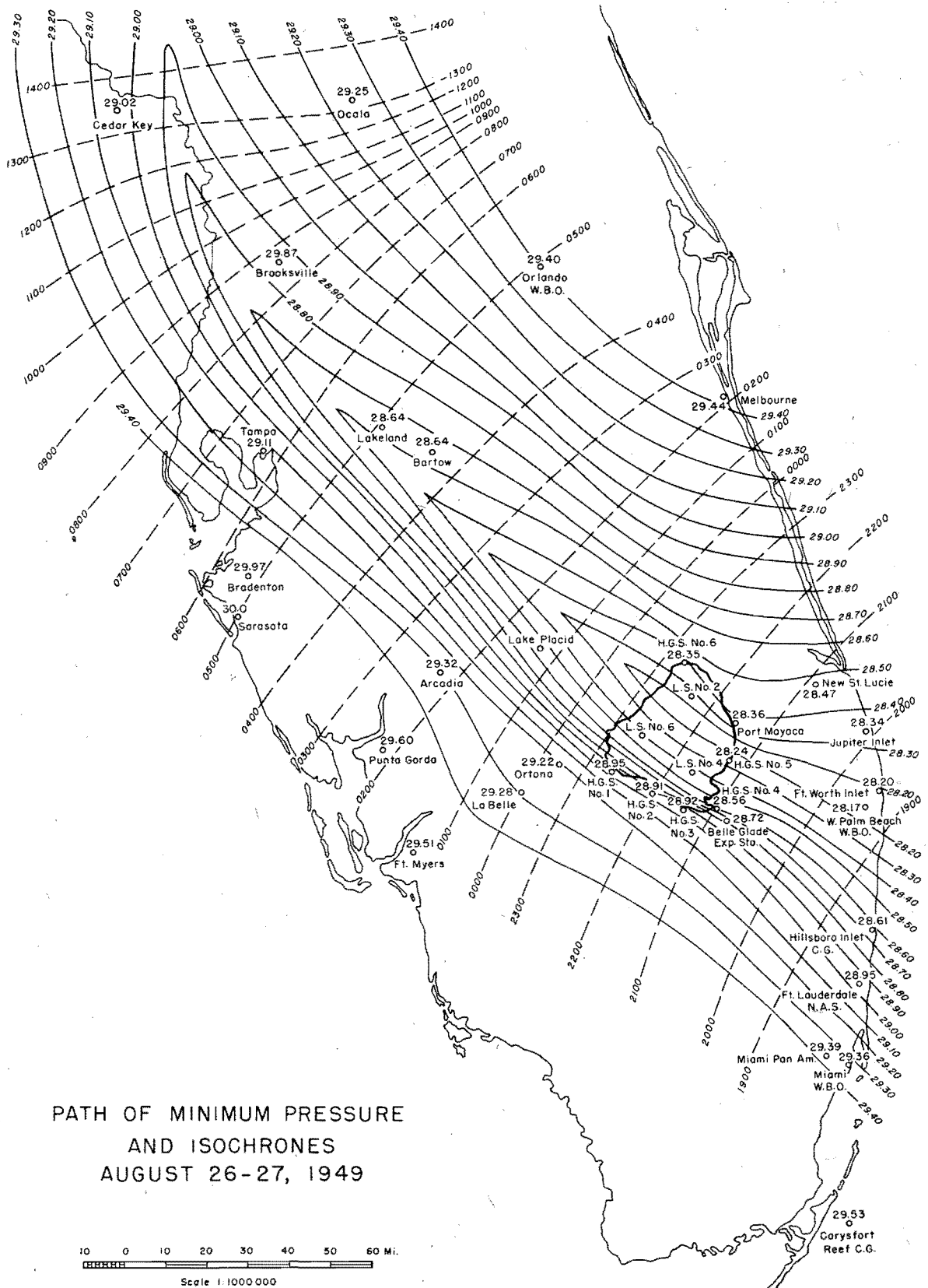PATH OF PRESSURE SYMMETRY
HURRICANE OF AUGUST 26-27, 1949
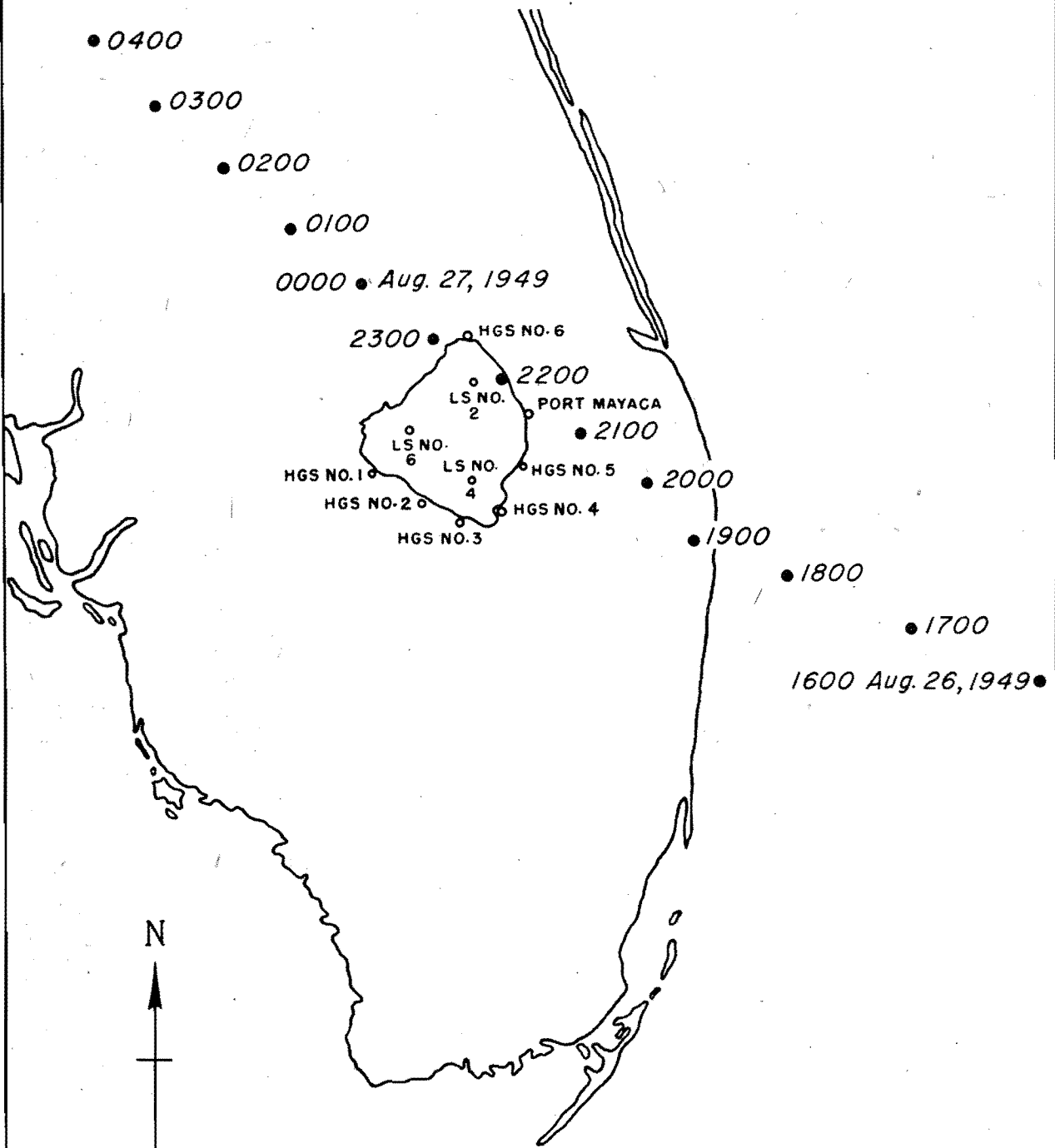
PATH OF MINIMUM PRESSURE
AND ISOCHRONES
AUGUST 26-27, 1949

Scale 1:1000000

FILE 5011

FIGURE 64
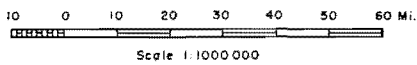
RELATION OF WINDS TO CENTER OF PRESSURE SYMMETRY
AT HALF HOURLY INTERVALS (Except 10 Minute Intervals near the Center)
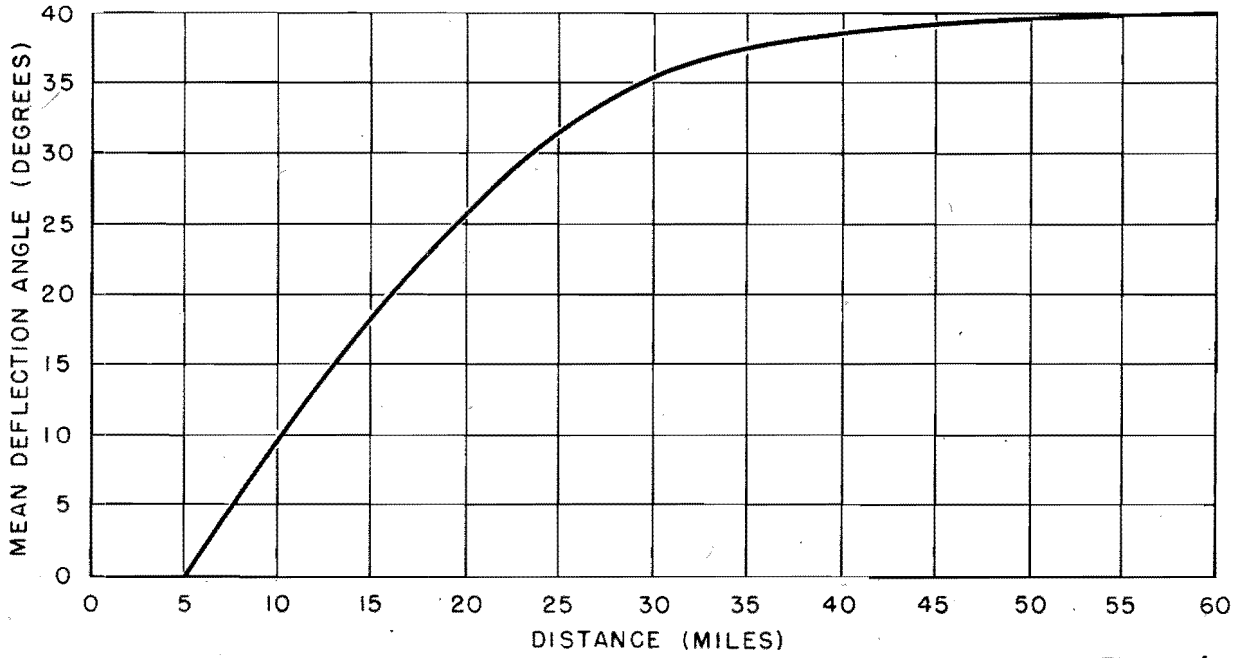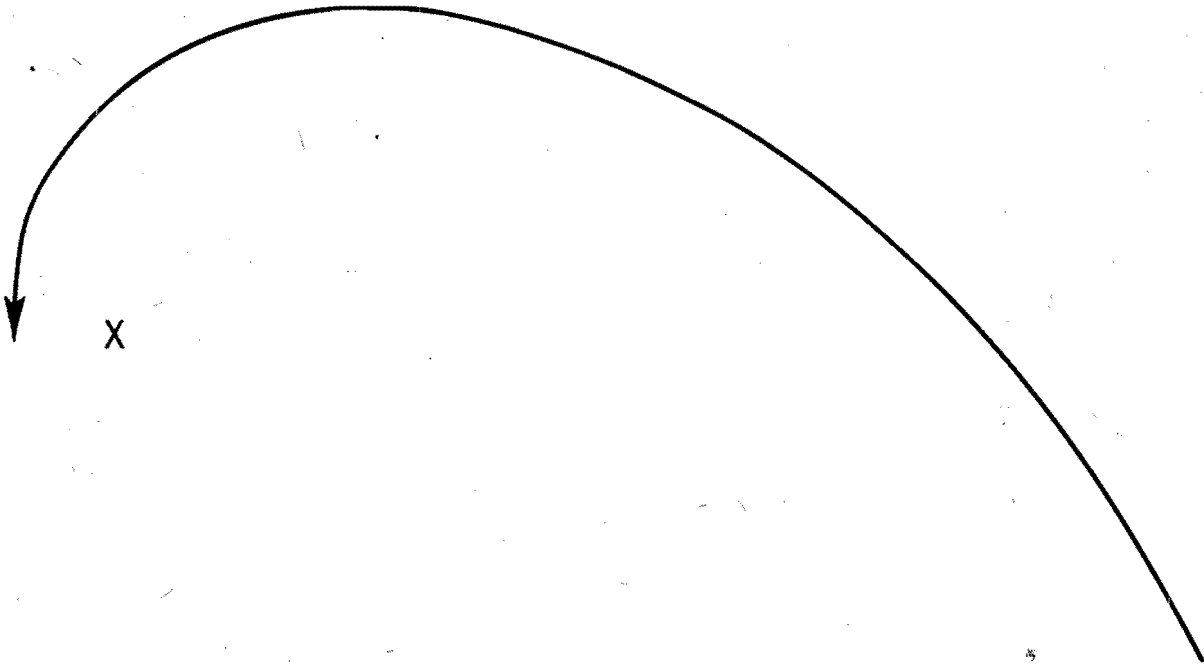### 2000 AUGUST 26 — 0130 AUGUST 27, 1949

LEGEND

X = Hurricane Gate No.1
♦ = Hurricane Gate No.2
◊ = Hurricane Gate No.4
■ = Hurricane Gate No.5
o = Hurricane Gate No.6
□ = Lake Station No. 2
▲ = Lake Station No. 4
△ = Lake Station No. 6
● = Port Mayaca

FIGURE 65

WIND DIRECTION FIELD

Fig. 66 A

Fig. 66 B

WIND SPEED PROFILE FOR
HURRICANE OF AUGUST 26-27, 1949

10 MINUTE AVERAGE WIND SPEED (MILES PER HOUR)

DISTANCE FROM WIND CENTER (MILES)

FIGURE 67

U.S. WEATHER BUREAU

HYDROMETEOROLOGICAL SECTION

RECONSTRUCTED WINDS
OVER LAKE OKEECHOBEE
2130 August 26, 1949