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Technical Report Series
Number 80-6

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DATA REPORT ON SEA LEVEL FLUCTUATIONS IN THE SOUTH ATLANTIC BIGHT, 1977

J. O. Blanton
and
W. C. Maddox, Jr.

Georgia Marine Science Center
University System of Georgia
Skidaway Island, Georgia

DATA REPORT ON SEA LEVEL FLUCTUATIONS IN THE SOUTH ATLANTIC BIGHT, 1977

by

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Savannah, Georgia 31406

August, 1979

TECHNICAL REPORT 80-6

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Report to U. S. Department of Energy

Contract No. DOE/EV/00809-3

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INTRODUCTION

At the beginning of 1977, the Department of Energy supported a multi-institutional project in the South Atlantic Bight (SAB) from Cape Hatteras to Cape Canaveral (Fig. 1) to study the ocean circulation on the continental shelf. One of the purposes of the study was to produce a synoptic data set of coastal sea level and ocean currents that could be used to help verify hydrodynamic models that might be developed in the future.

Ocean currents were simultaneously measured off North Carolina (Pietrafesa, 1979) and off Georgia (Lee, 1979). These measurements were complemented by data from a network of sea level gauges (Fig. 1) supported jointly by the Savannah River Laboratory (DOE) and the National Ocean Survey (NOAA). All gauges were exposed to the open ocean and were unaffected by inlet geometry and river input. Through an interagency agreement, funds were provided for NOAA to maintain two gauges, one at Sapelo Island and one at Wilmington Beach. The remaining gauges were part of the permanent tide gauge network of NOAA. The interagency agreement provided for the expedient transfer of these data to the Savannah River Laboratory, which in turn, asked Skidaway Institute to analyze these data for distribution to DOE contractors and others interested in the oceanography of the South Atlantic Bight.

The data from the sea level network (Fig. 2) covered 13 months for the three stations in Florida. Stations north of Florida had less than 13-month coverage. Six of the seven stations are co-temporal with the current meter data in summer-autumn of 1977.

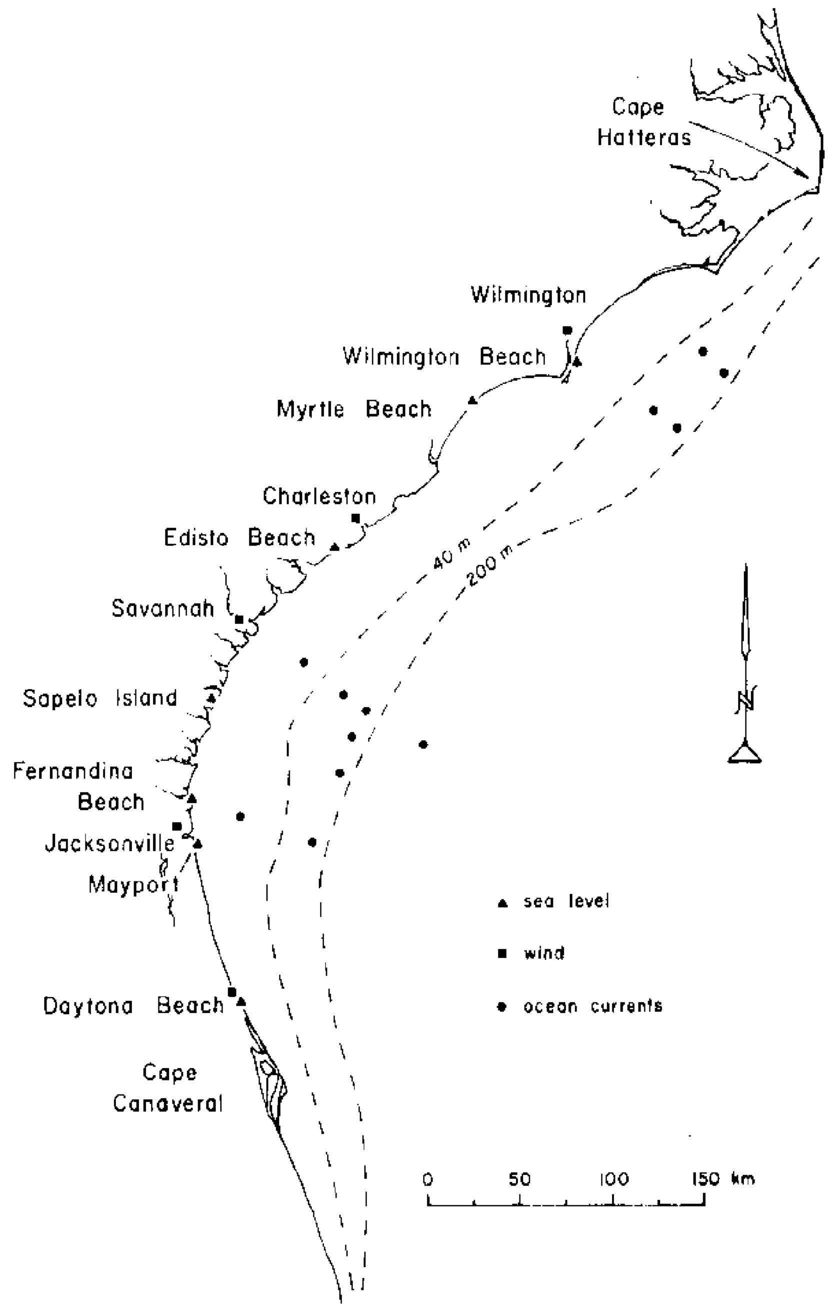

Figure 1. Joint U.S. Department of Energy - National Oceanographic and Atmospheric Administration Sea Level and Ocean Current Network, 1977.

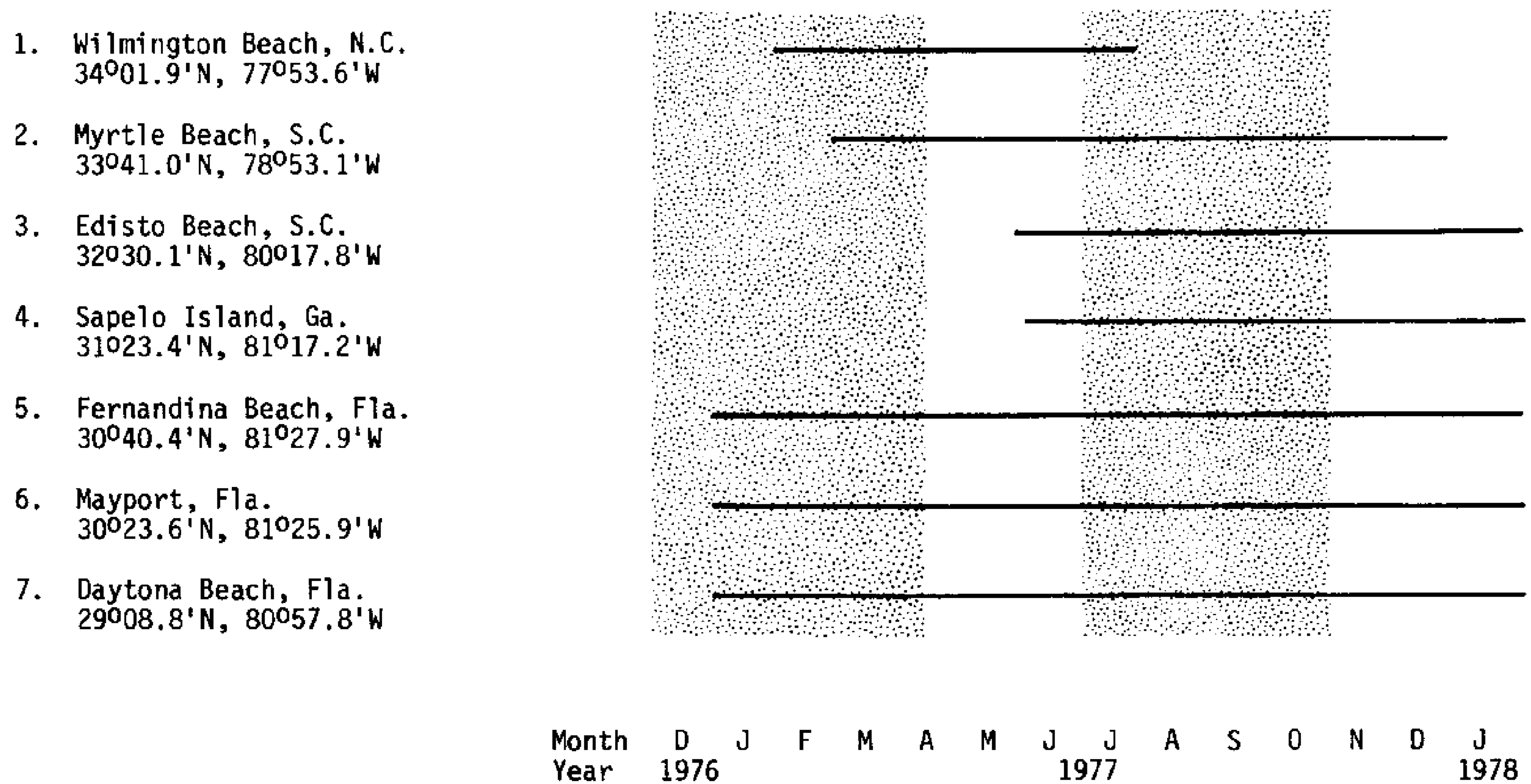

Fig. 2. Time lines showing data returned from DOE-NOS sea level network and the time during which ocean current data were obtained (Fig. 1)

DATA PROCESSING

The sea level data consist of hourly values. The strongest signal in the data is the semi-diurnal tide which was removed in order to see the changing sea level caused by forcing at lower frequencies. The tidal signal was removed with a symmetric Lanczos filter containing 193 weights. This filter removes all fluctuations occurring more frequently than once per 30 hours and the remaining variance in the data preserves the fluctuations due to wind stress and other forces of comparable or lower frequencies. This filter is identical to that used by the University of Miami (Lee, 1979) and North Carolina State University (Pietrafesa, 1979) for smoothing the ocean current data. It is hereafter referred to as the 40-hr low pass filter (40 HRLP). Four days of data were lost from each end of each sea level file due to the filtering process.

Wind stress is one of the more important parameters influencing the change in sea level over frequencies of 0.1 to 0.3 cycles per day. Four coastal weather stations (Fig. 1) report 3-hourly observations that include speed and direction of wind and barometric pressure. The data are supplied by the National Climatic Center in Ashville, North Carolina. Components of wind stress were computed according to the formula

$$\tau_i = -\rho C_D |V_i| V_i \text{ with } i = 1,2$$

where V_i are the north and east components of wind velocity, and ρC_D is taken as 2×10^{-6} gm/cm^3 (Pond and Pickard, 1978).

The three-hourly values of wind-stress and barometric pressure were smoothed by a 40 HRLP filter that approximates the frequency response of the filter that smoothed the hourly sea level data (Fig. 3).

Each 40 HRLP file of sea level data was decimated to 6-hourly values and these were paired with corresponding 6-hourly values of 40 HRLP wind stress and barometric pressure from the nearest coastal weather station. The barometric pressure was used to adjust the sea level file for the "inverted barometer" effect. This effect lowers or raises the sea level by 1 cm/mb. The deviation of barometric pressure from the mean of each station during 1977 was used to adjust the sea level by adding the 6-hourly value of deviation to the corresponding 6-hourly value of sea level. This operation created the final file of adjusted sea level for each station listed in Figure 2.

THE PLOTTED DATA

The appendix of this report contains the adjusted sea level and corresponding wind stress for the NOS/DOE sea level stations (Fig. 2). Each page has one month of data if the station recorded acceptable data for that particular month. The wind stress plots are oriented such that vertical vectors represent winds blowing parallel to the local shoreline. Each plot indicates the orientation of the local shoreline from north. We caution the reader that the vector plots appear to give more emphasis to stress perpendicular to the time axis (i.e. shore-parallel) than stress vectors more nearly parallel to the axis.

A study of the plots show the expected correlation between winds and coastal sea level. Shore parallel to the north and offshore wind stresses lower sea level at the coast while southward and onshore winds

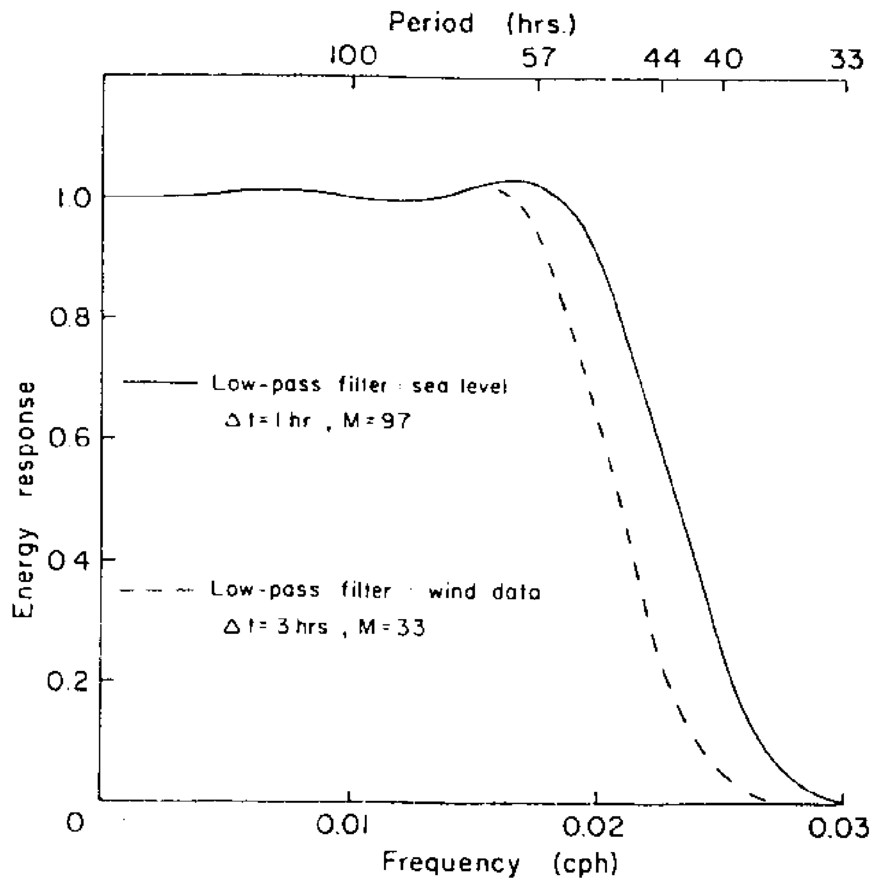

Figure 3. Energy response curves for the 40-hr low pass filters used on the sea level and wind data.

tend to raise sea level. Lee and Brooks (1979) suggest that subtidal coastal sea level fluctuations in the South Atlantic Bight are directly forced by local winds. In fact, the fluctuations appear to integrate the effects of wind over a several hundred kilometer scale. This is best indicated by the remarkable correlation of sub tidal sea level oscillations throughout the SAB (Figs. 4, 5, 6). For example, the low stand of sea level on April 6 (Fig. 4) is associated with a 4-day episode of strong northward wind stress that occurred at all four of the coastal weather stations. The high coastal sea level on 2 October (Fig. 6) corresponds to the strong southward stress throughout the SAB that began on 30 October and lasted for 4 days. The reader can study the Appendix for further examples.

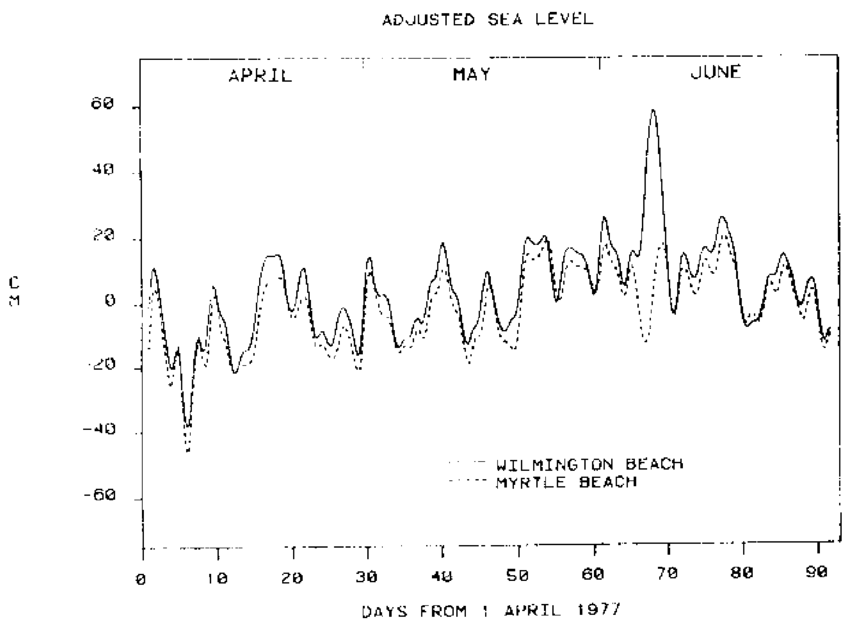

Figure 4. Adjusted sea level during April, May and June for Wilmington Beach and Myrtle Beach.

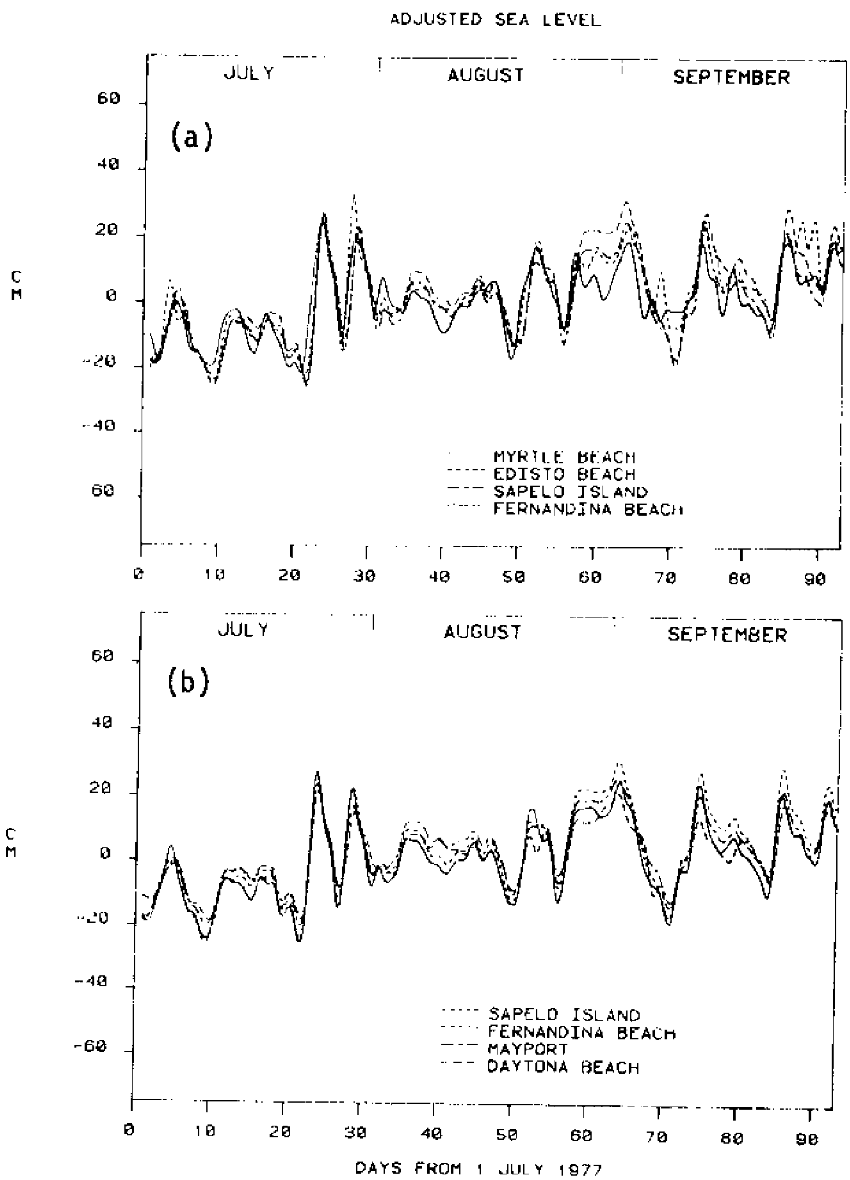

Figure 5. Adjusted sea level during July, August and September for (a) Myrtle Beach, Edisto Beach, Sapelo Island and Fernandina Beach; and (b) Sapelo Island, Fernandina Beach, Mayport and Daytona Beach.

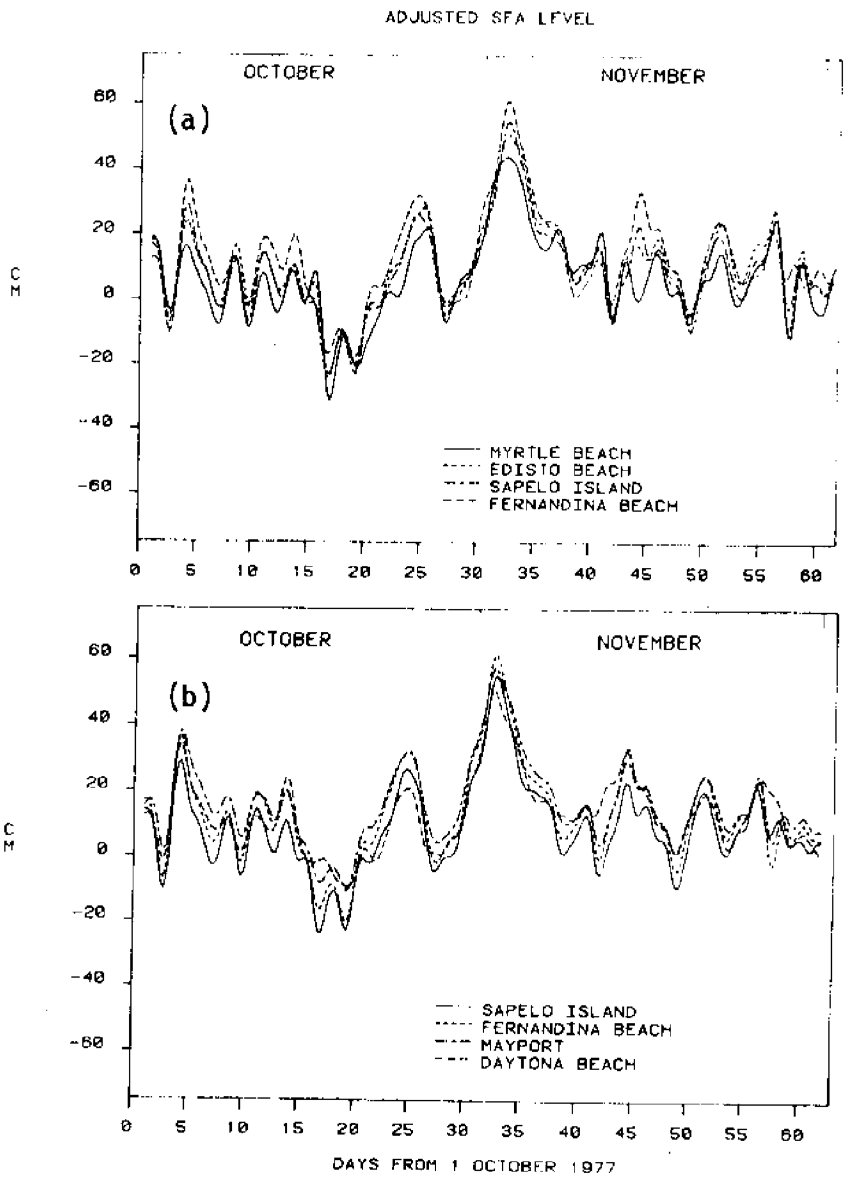

Figure 6. Adjusted sea level during October and November for (a) Myrtle Beach, Edisto Beach, Sapelo Island and Fernandina Beach; and (b) Sapelo Island, Fernandina Beach, Mayport and Daytona Beach.

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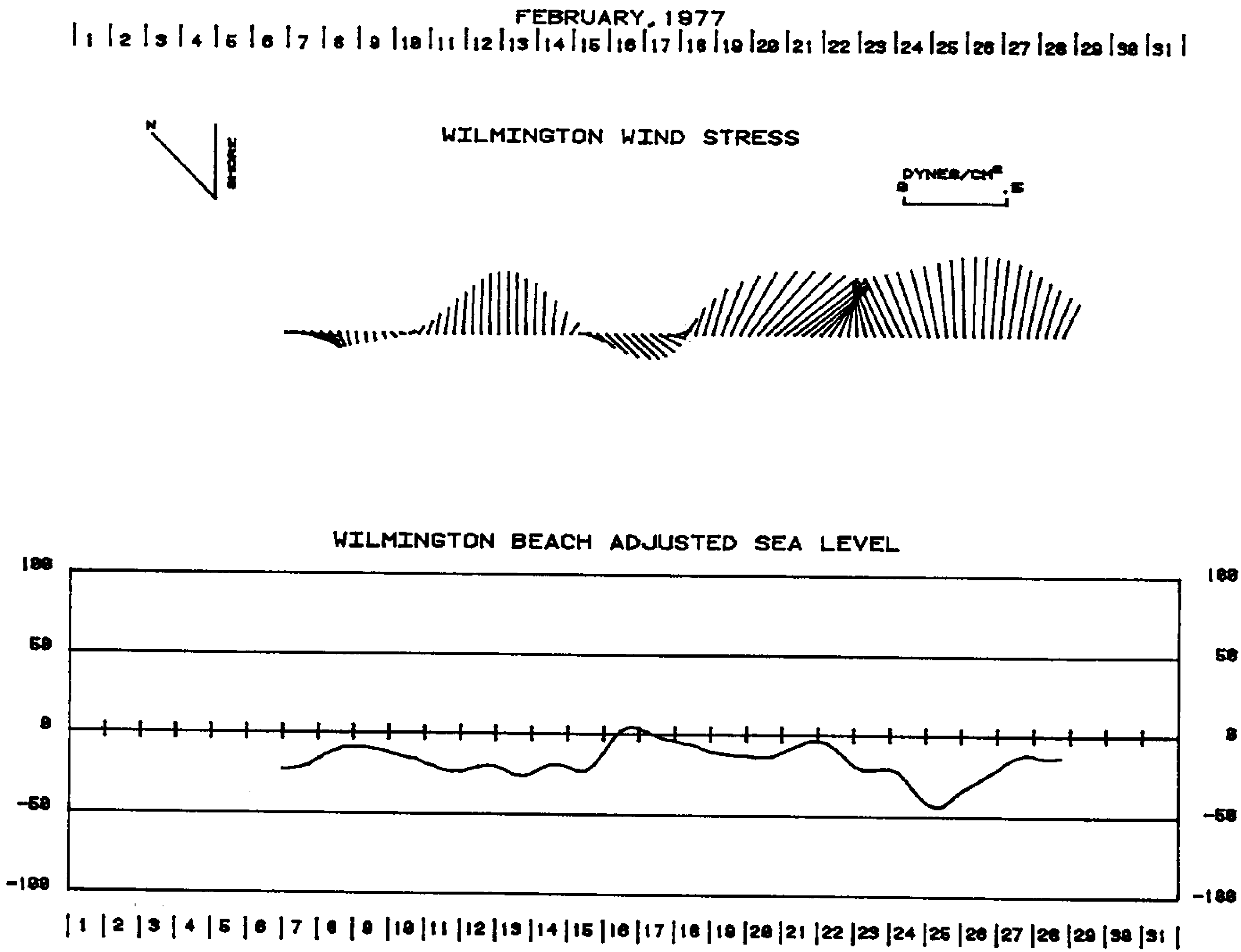
2. Lee, T.N. and D.A. Brooks, 1979. Initial observations of current, temperature and coastal sea level response to atmospheric and Gulf Stream forcing on the Georgia Shelf. Geophysical Research Letters 6(4):321-324.

3. Pietrafesa, L.J., 1979. Continental shelf processes affecting the oceanography of the South Atlantic Bight. Progress Report to the U.S. Department of Energy (Contract No. EY-76-S-09-0902). 82 p.

4. Pond, S. and G.L. Pickard, 1978. Introductory Dynamic Oceanography. Pergamon Press, Elmsford, N.Y. 241 p.

APPENDIX A. WILMINGTON BEACH, NORTH CAROLINA, ADJUSTED SEA LEVEL FOR FEBRUARY THROUGH JULY, 1977.


FEBRUARY, 1977
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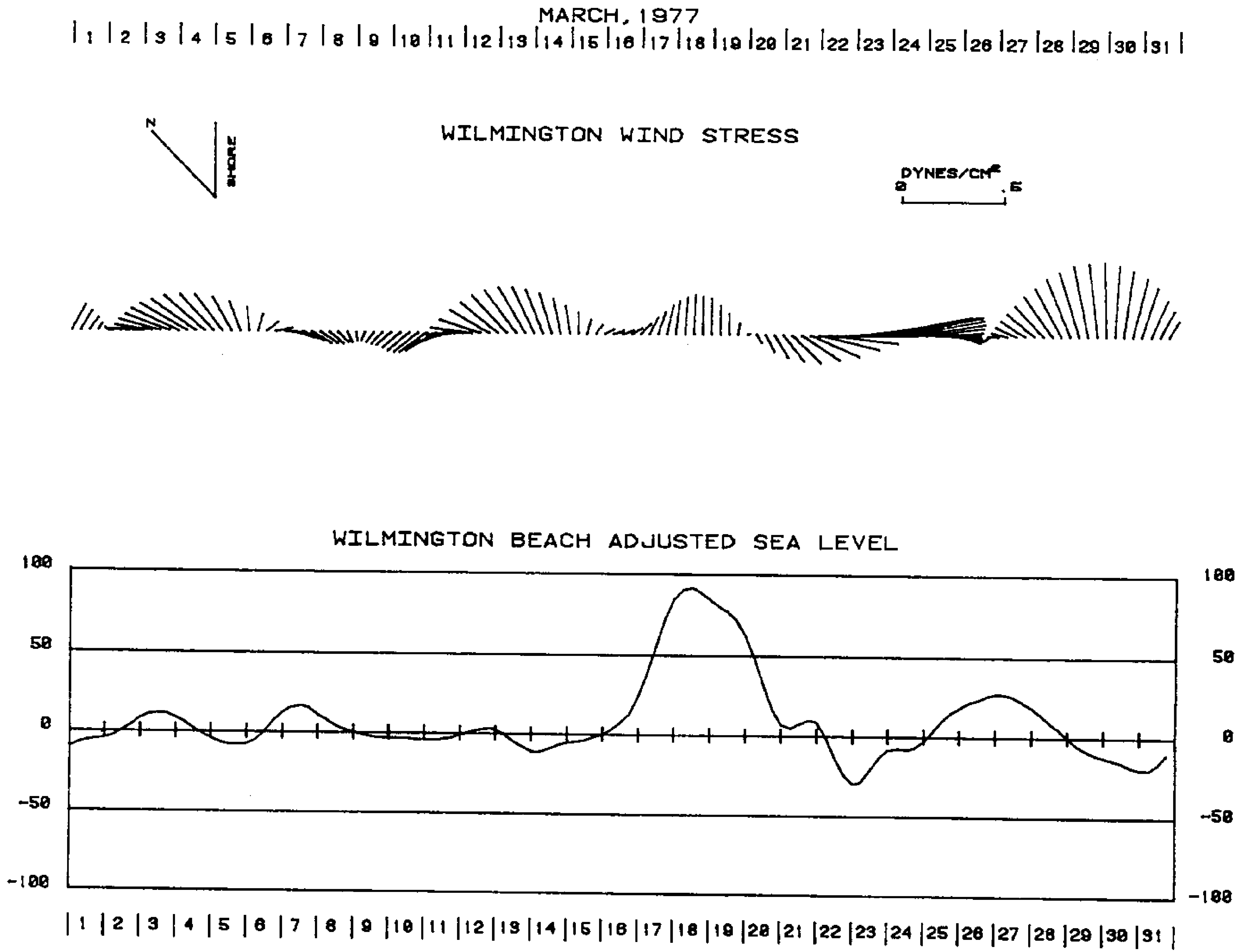
WILMINGTON WIND STRESS
N
SHORE
DYNES/CM²
0 .5
WILMINGTON BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31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N
SHORE
DYNES/CM²
0
.5
WILMINGTON BEACH ADJUSTED SEA LEVEL
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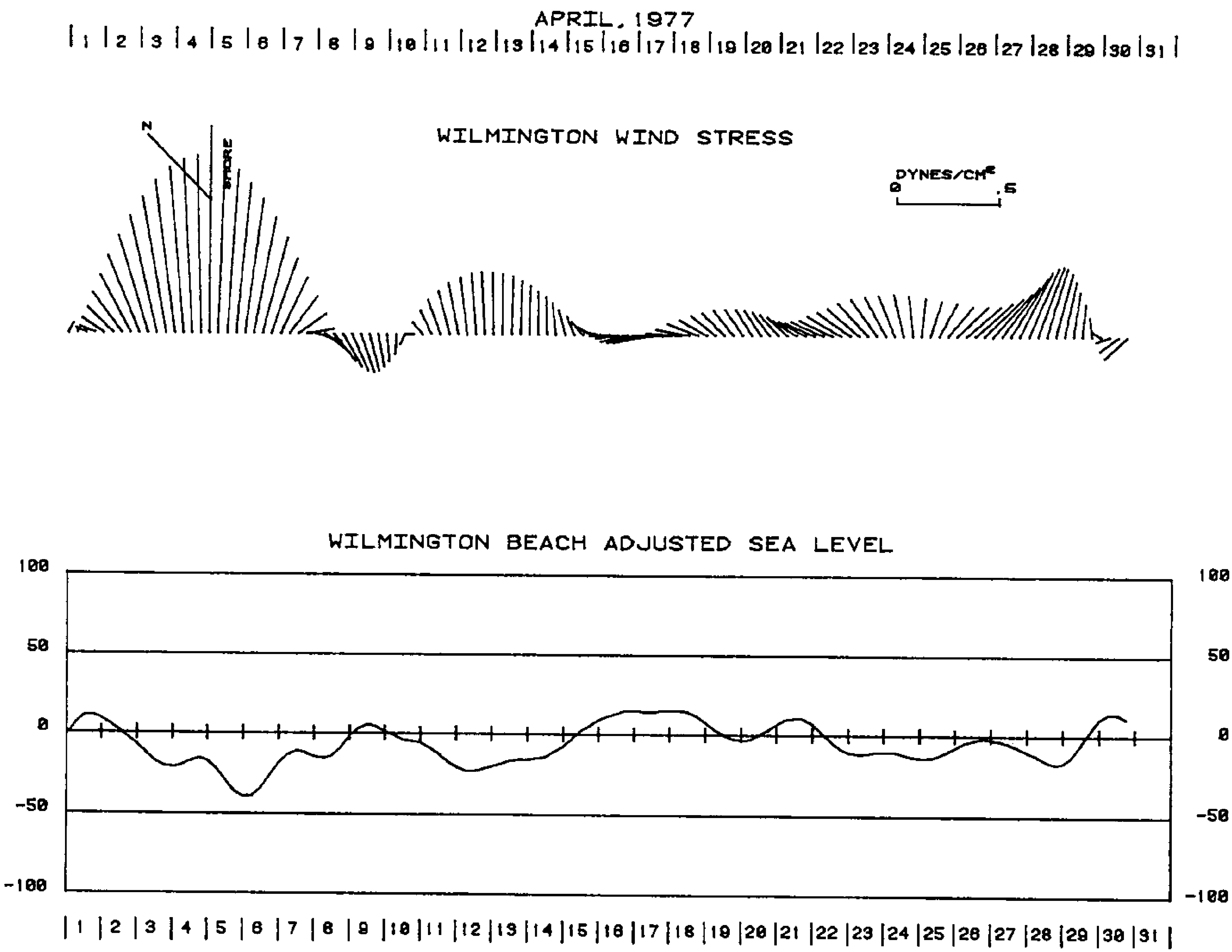
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


APRIL, 1977
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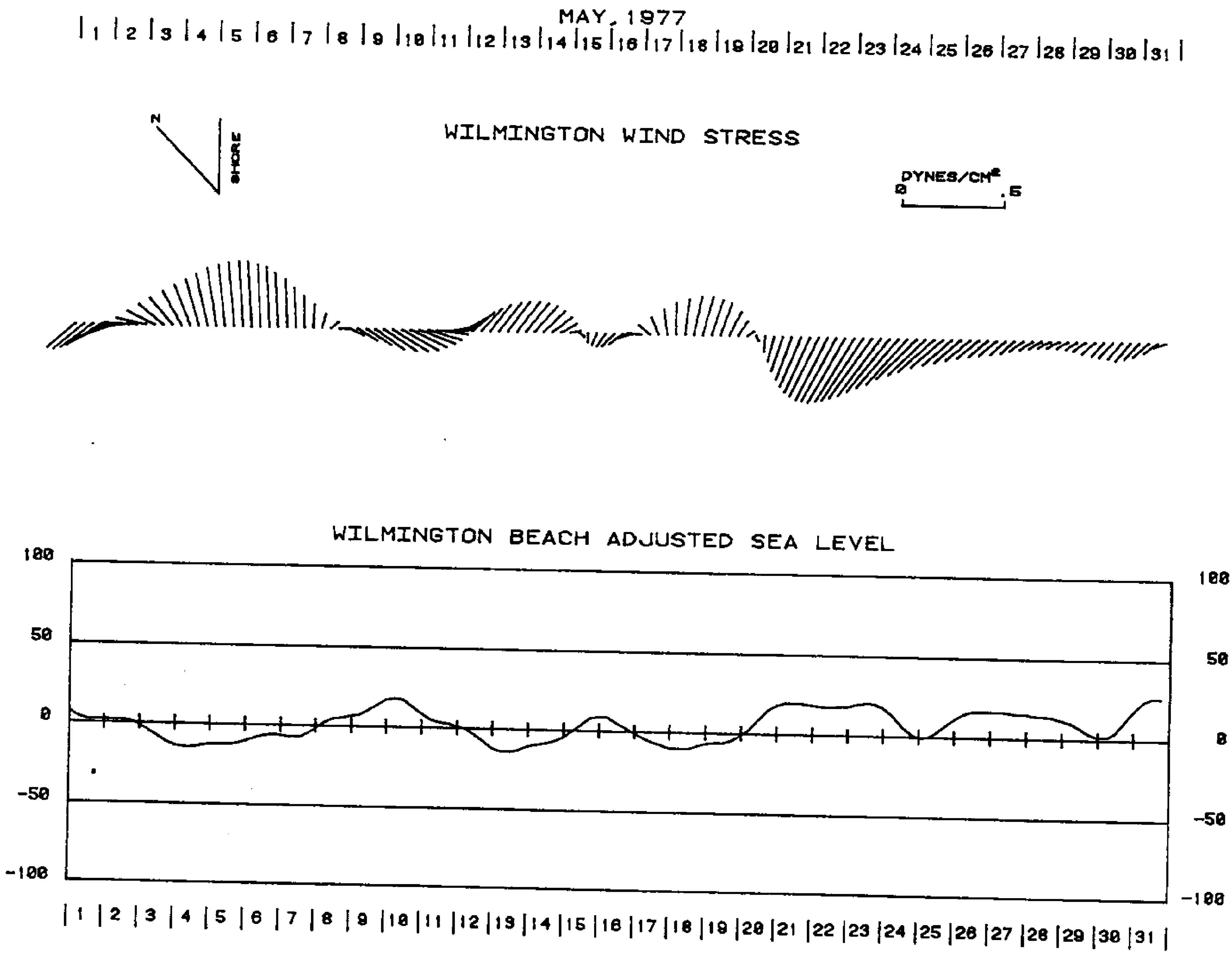
WILMINGTON WIND STRESS
N
SHORE
DYNES/CM²
0
.5
WILMINGTON BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


MAY, 1977
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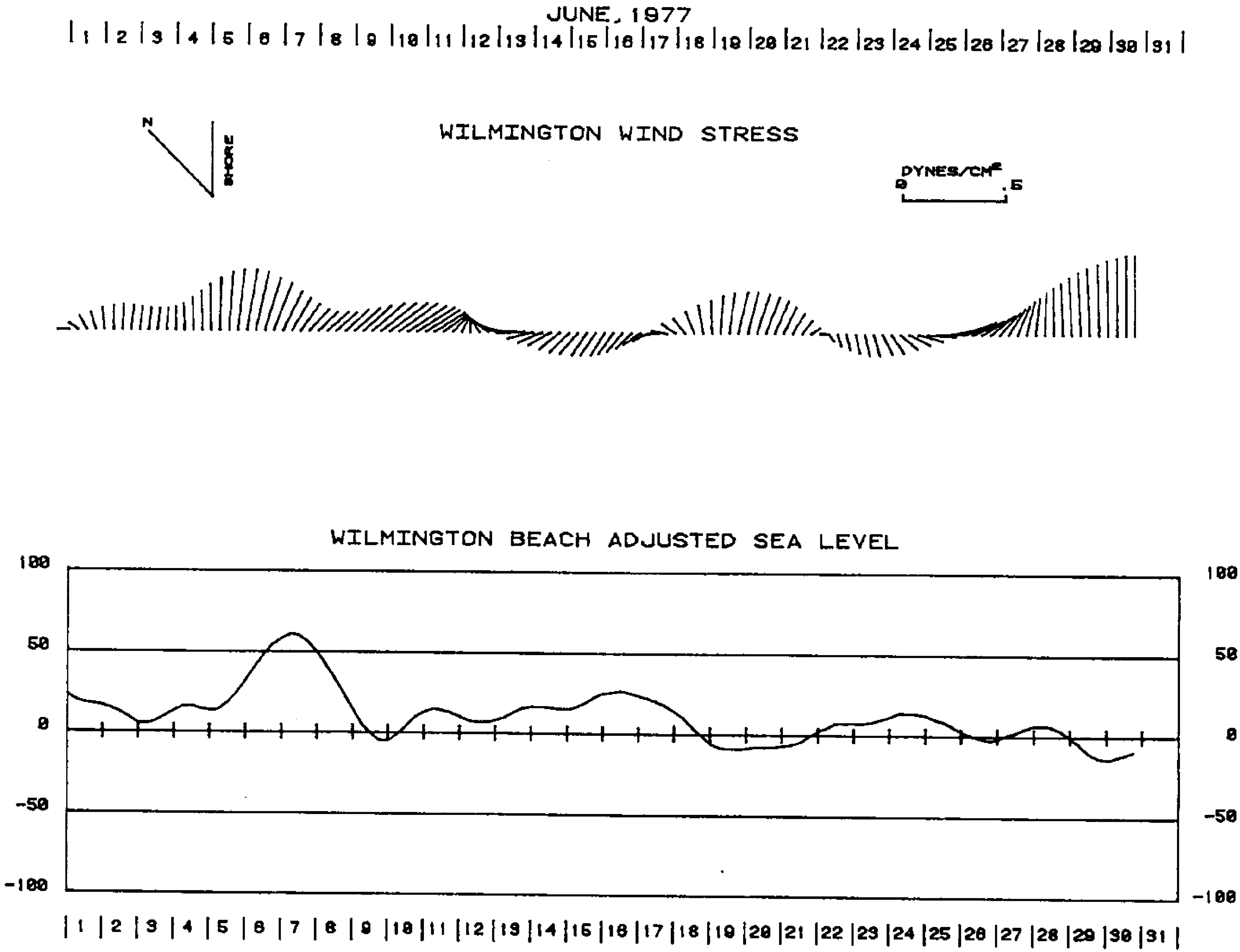
WILMINGTON WIND STRESS
N
SHORE
DYNES/CM²
0 .5
WILMINGTON BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


JUNE, 1977
WILMINGTON WIND STRESS
N
SHORE
DYNES/CM²
0 .5
WILMINGTON BEACH ADJUSTED SEA LEVEL
CM
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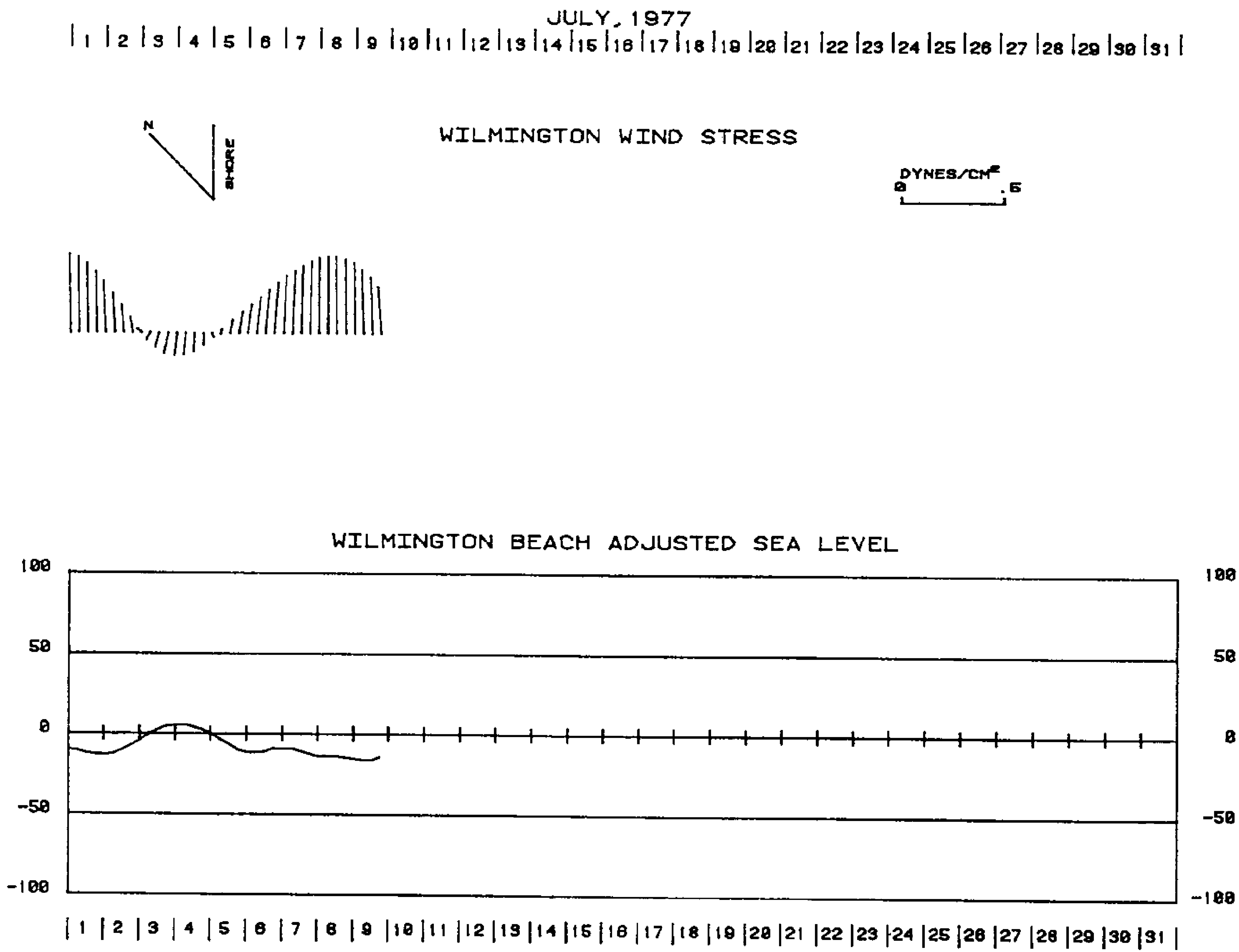
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31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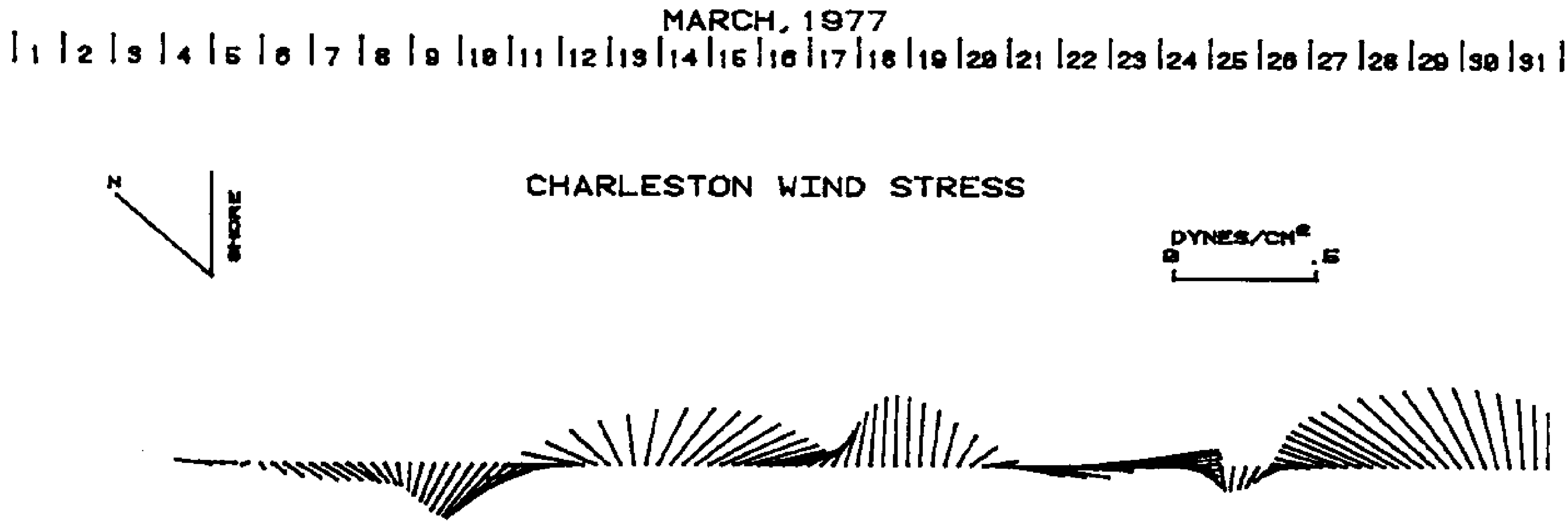
N
SHORE
WILMINGTON WIND STRESS
DYNES/CM²
0 .5
WILMINGTON BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

APPENDIX B. MYRTLE BEACH, SOUTH CAROLINA, ADJUSTED SEA LEVEL FOR MARCH THROUGH DECEMBER, 1977.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DYNES/CM²
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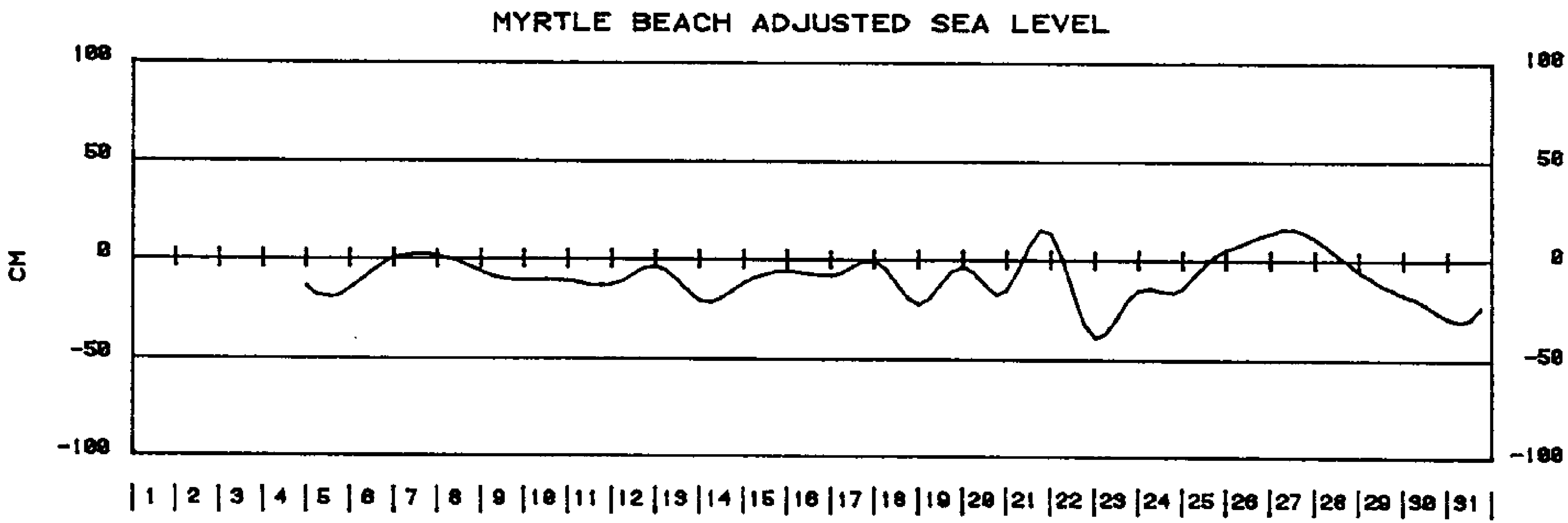
MYRTLE BEACH ADJUSTED SEA LEVEL
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-100
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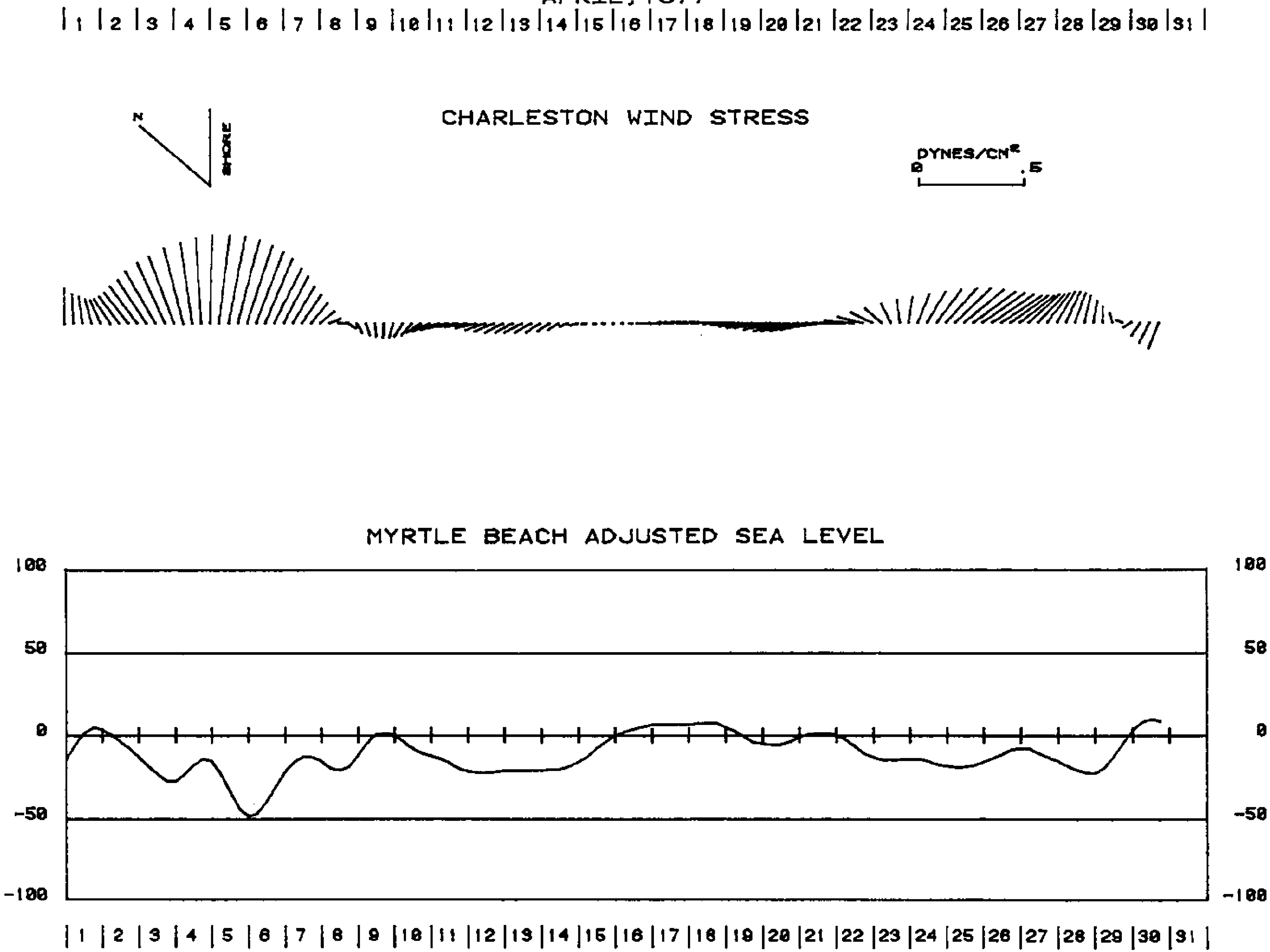
APRIL, 1977



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CHARLESTON WIND STRESS
N
SHORE
DYNES/CM²
0 .5
MYRTLE BEACH ADJUSTED SEA LEVEL
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50
0
-50
-100
CM
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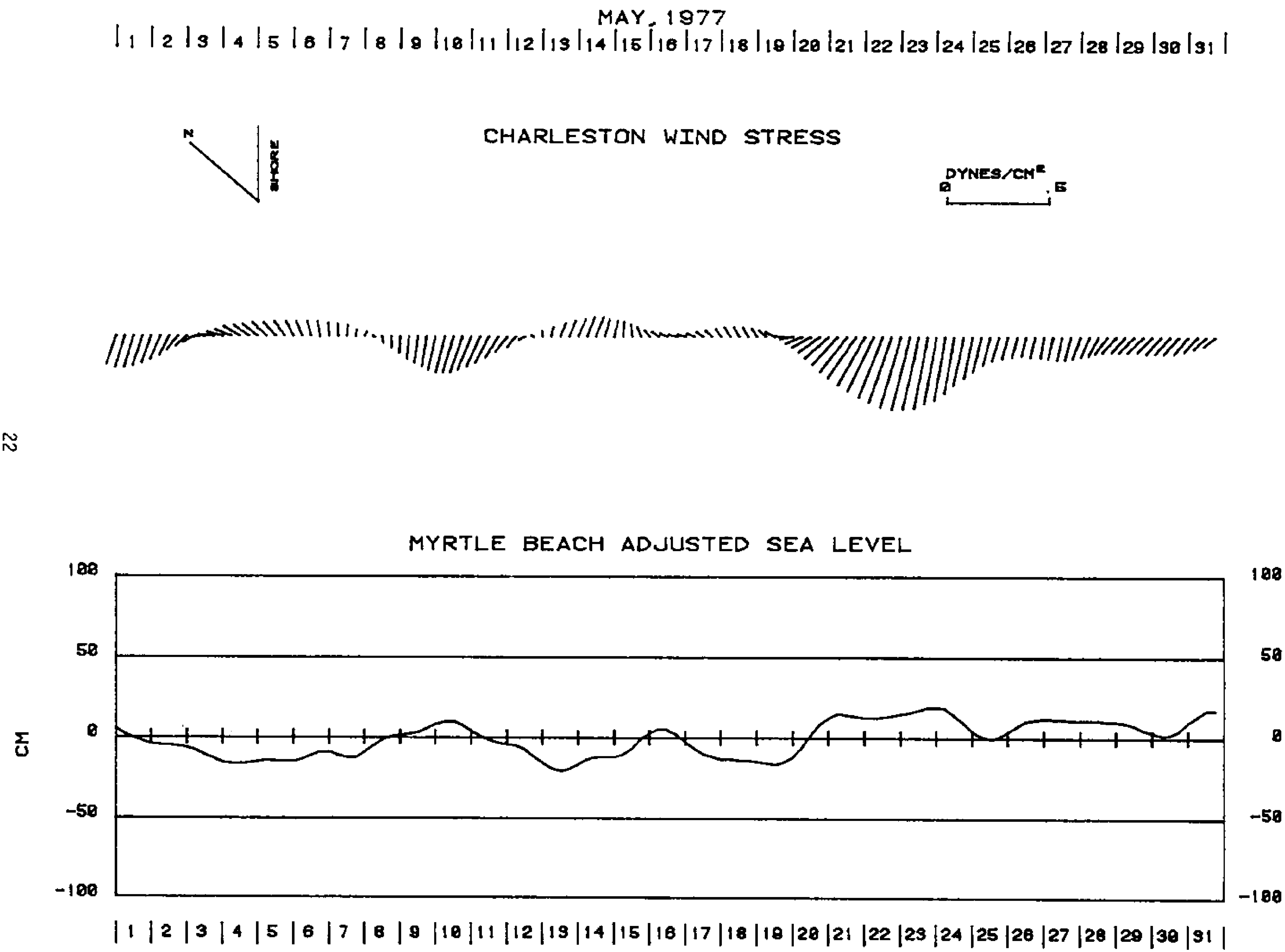
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CHARLESTON WIND STRESS
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SHORE
DYNES/CM²
0
.5
MYRTLE BEACH ADJUSTED SEA LEVEL
CM
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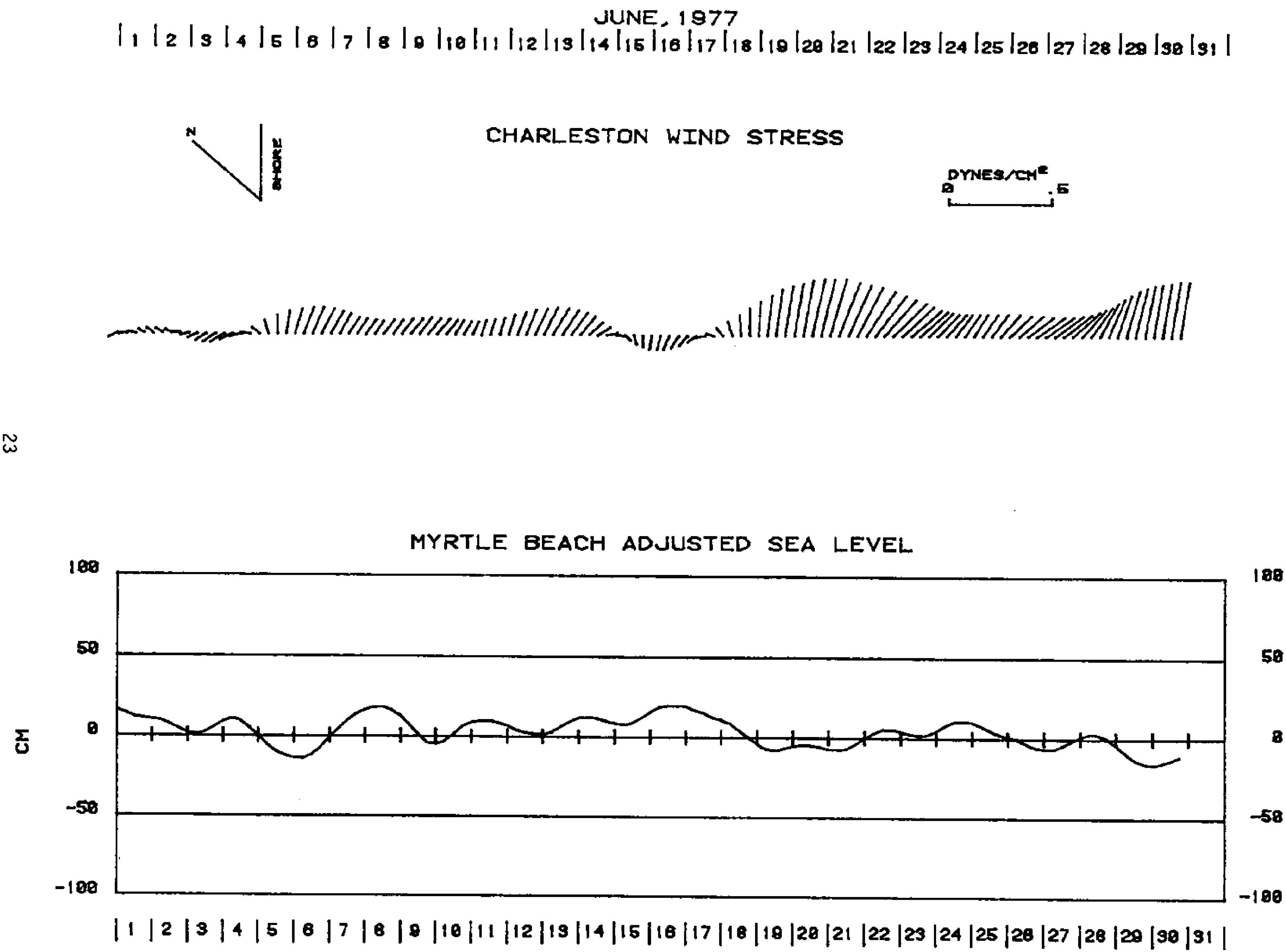
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31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N
SHORE
CHARLESTON WIND STRESS
DYNES/CM²
0 .5
MYRTLE BEACH ADJUSTED SEA LEVEL
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0
-50
-100
CM
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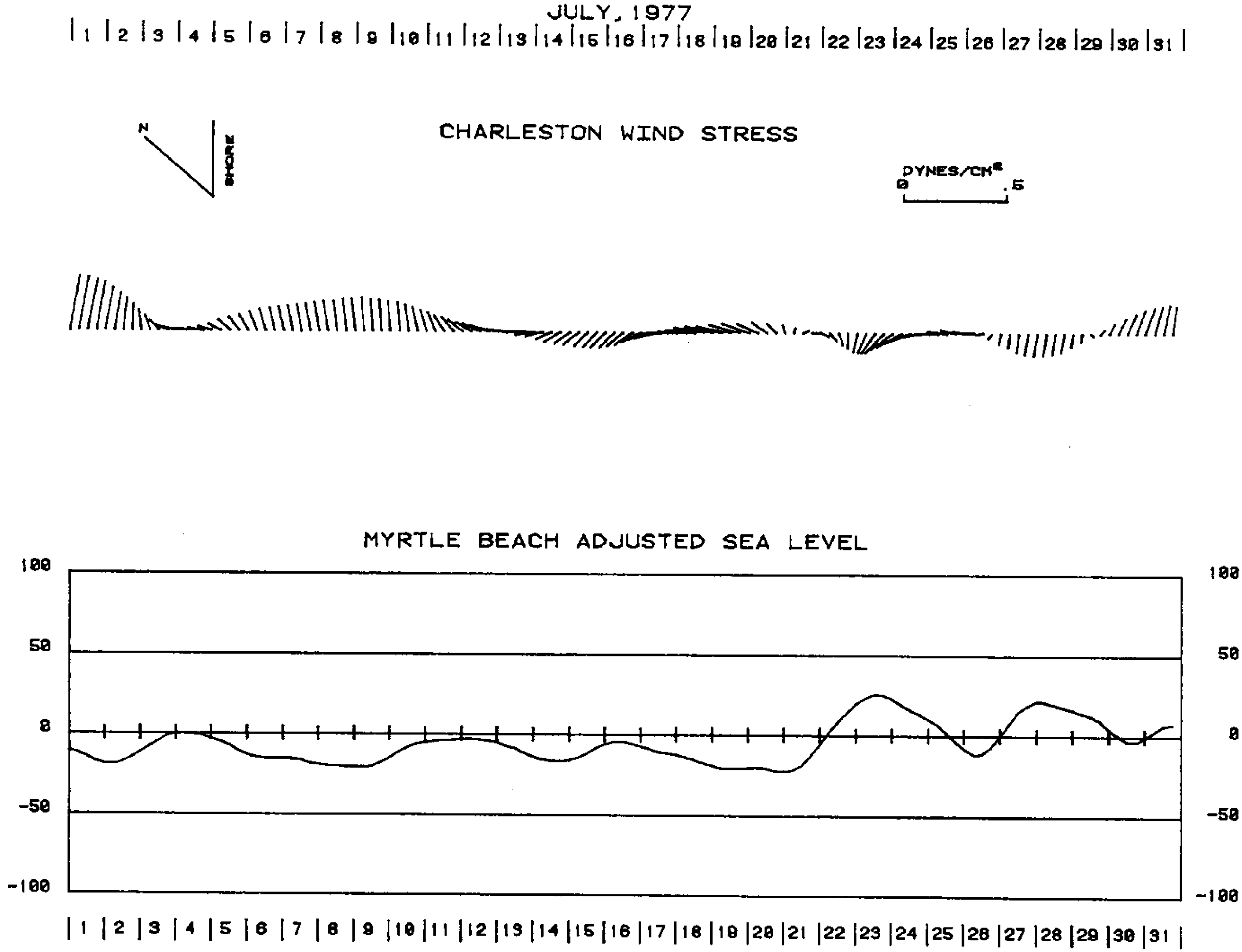
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DYNES/CM²
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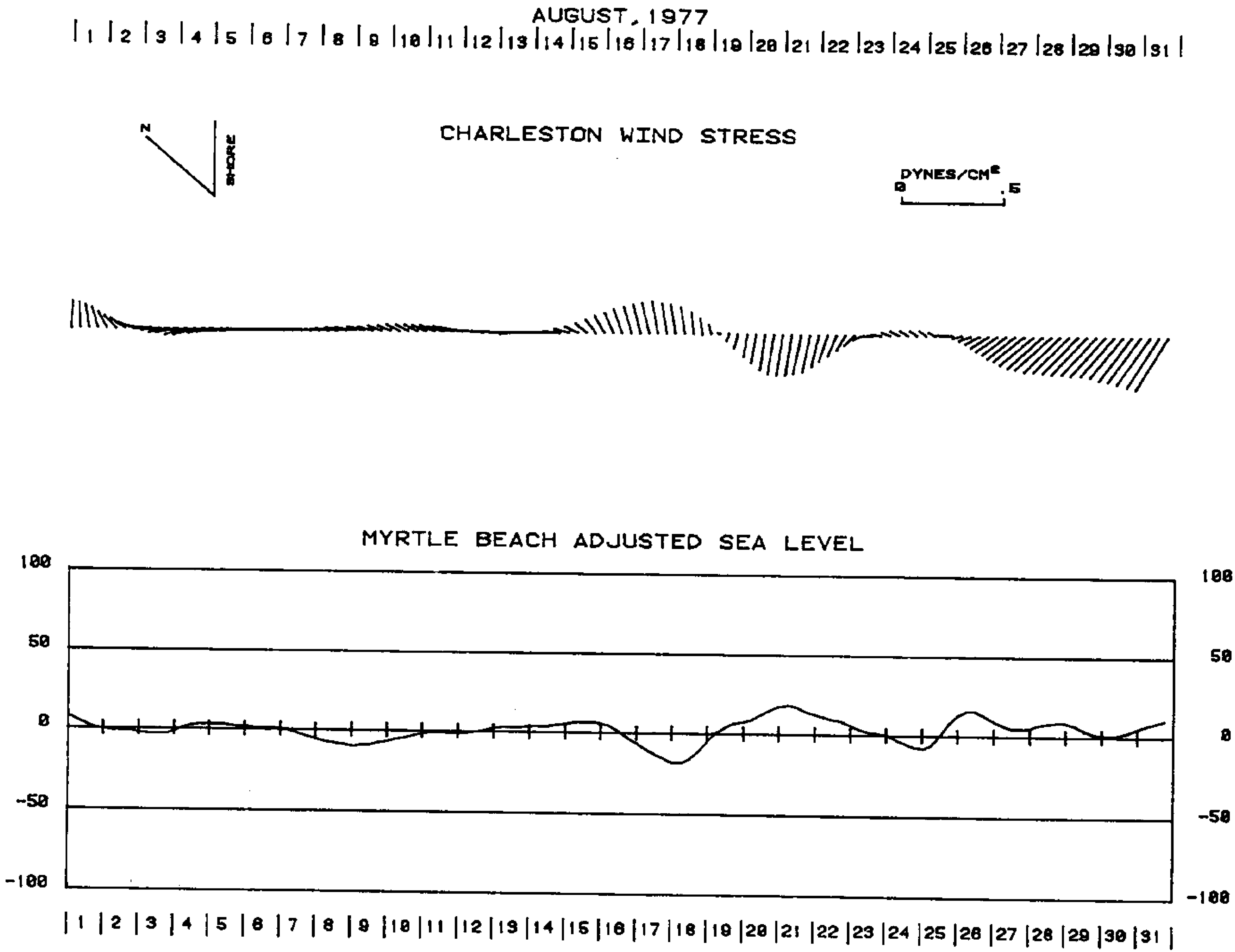
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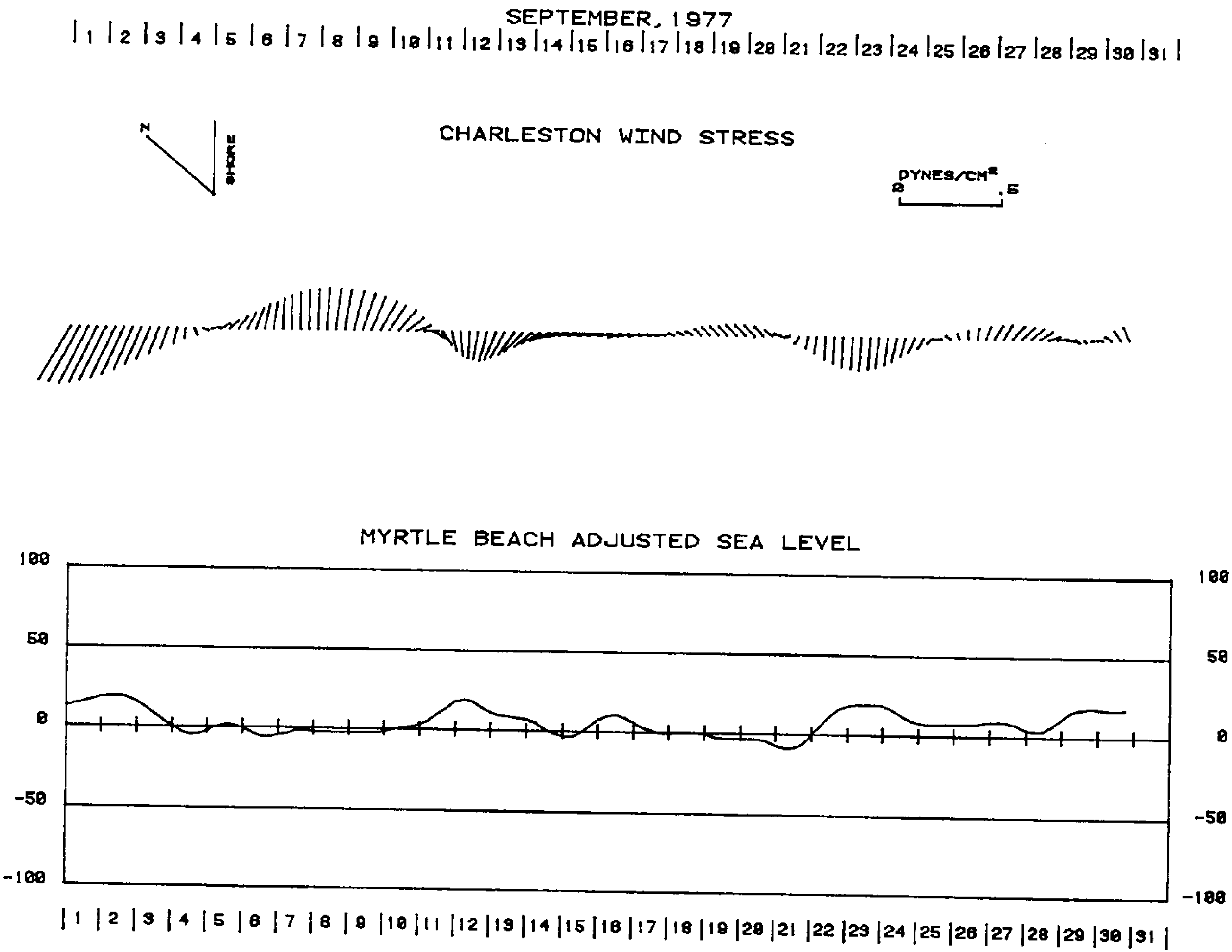
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-100
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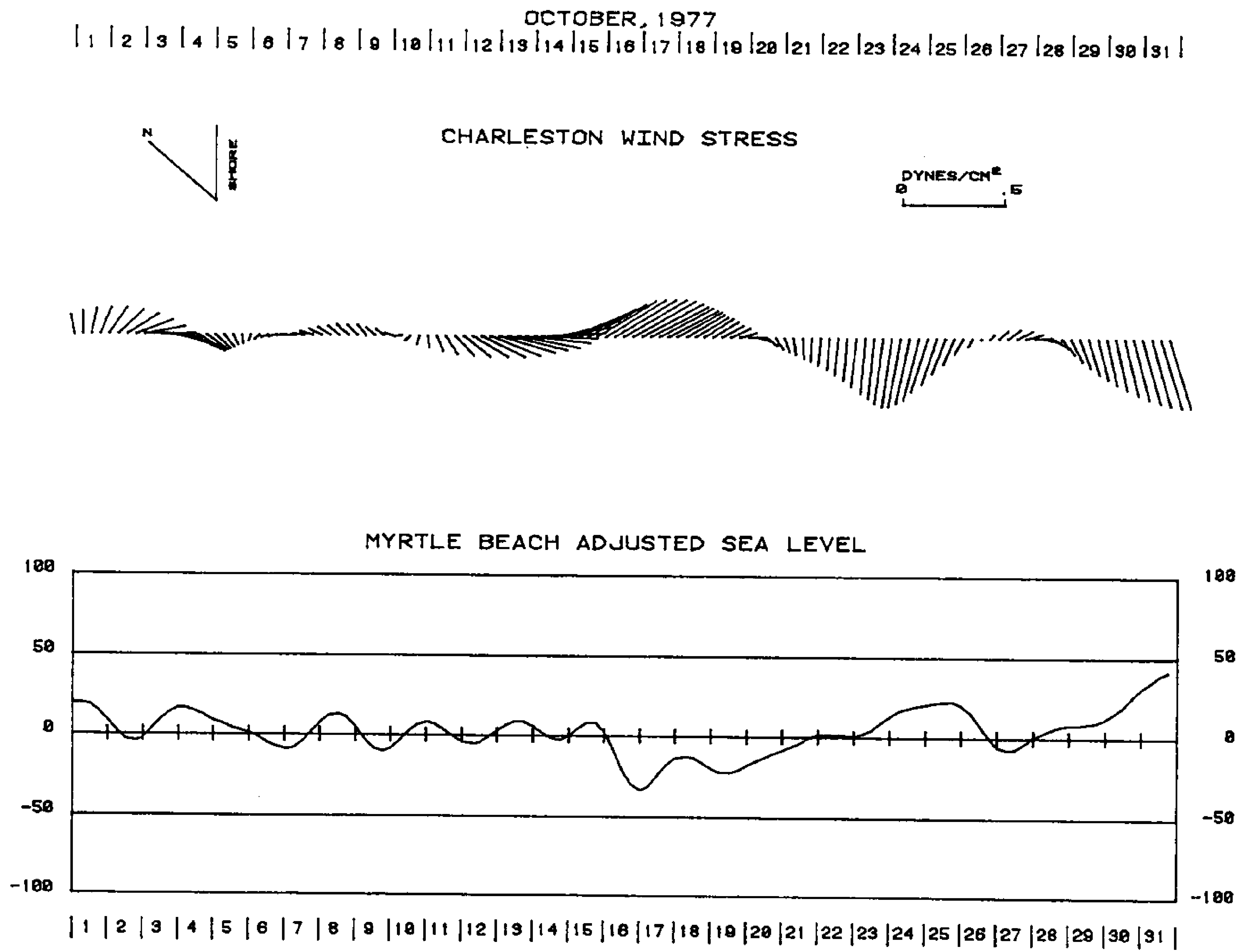
OCTOBER, 1977
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N
SHORE
CHARLESTON WIND STRESS
DYNES/CM²
0 .5
MYRTLE BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
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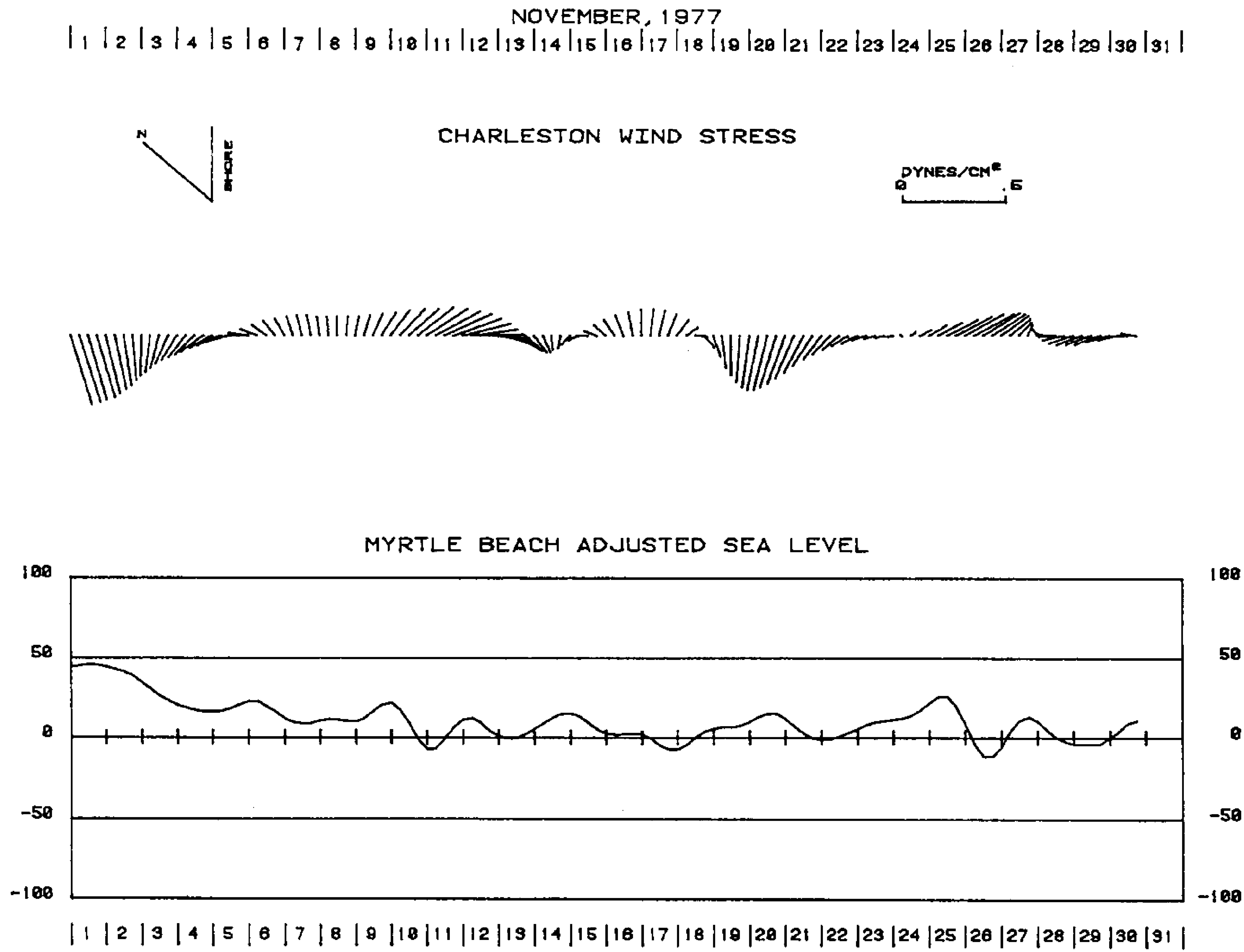

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CHARLESTON WIND STRESS
N
SHORE
DYNES/CM²
0
.5
MYRTLE BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
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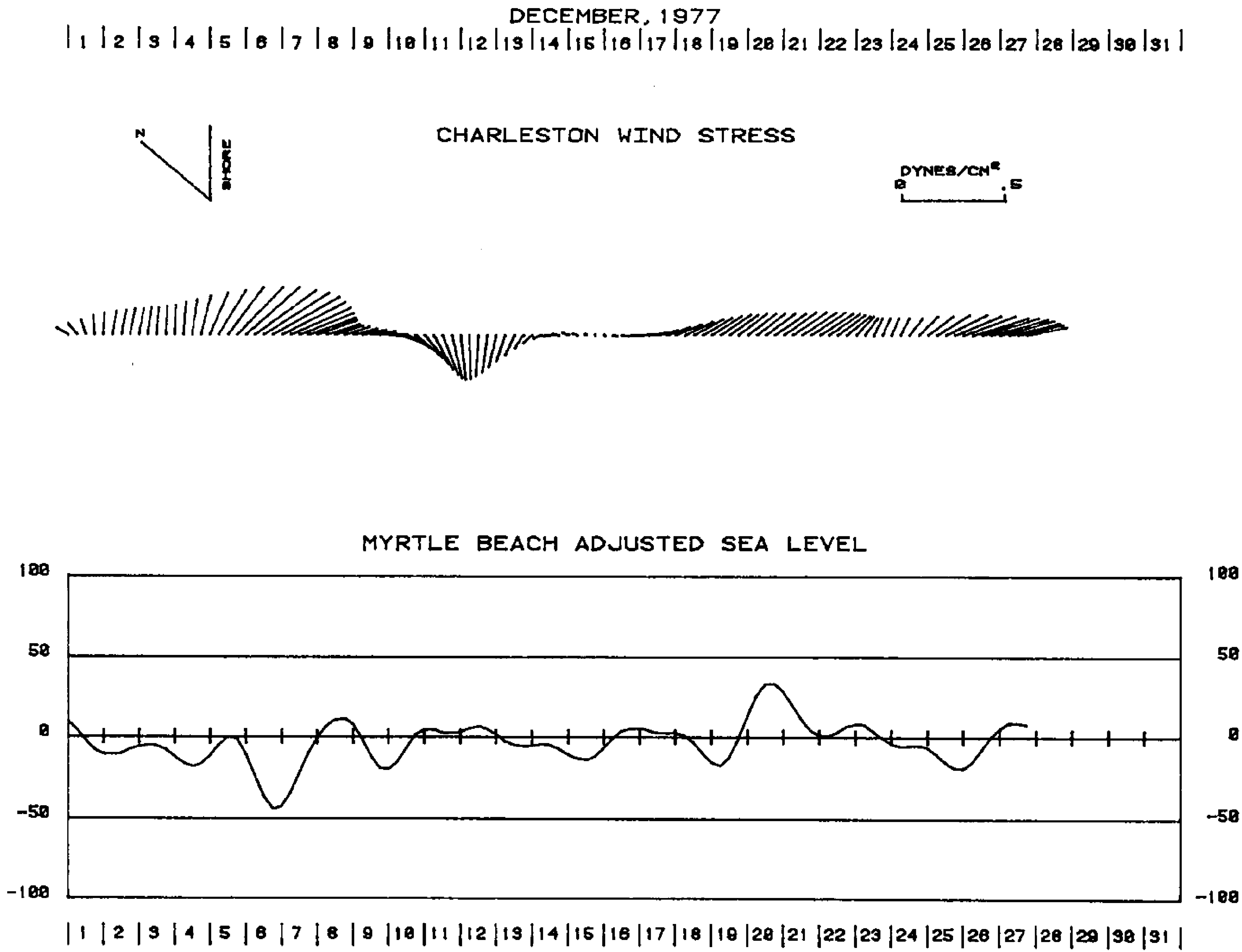
DECEMBER, 1977
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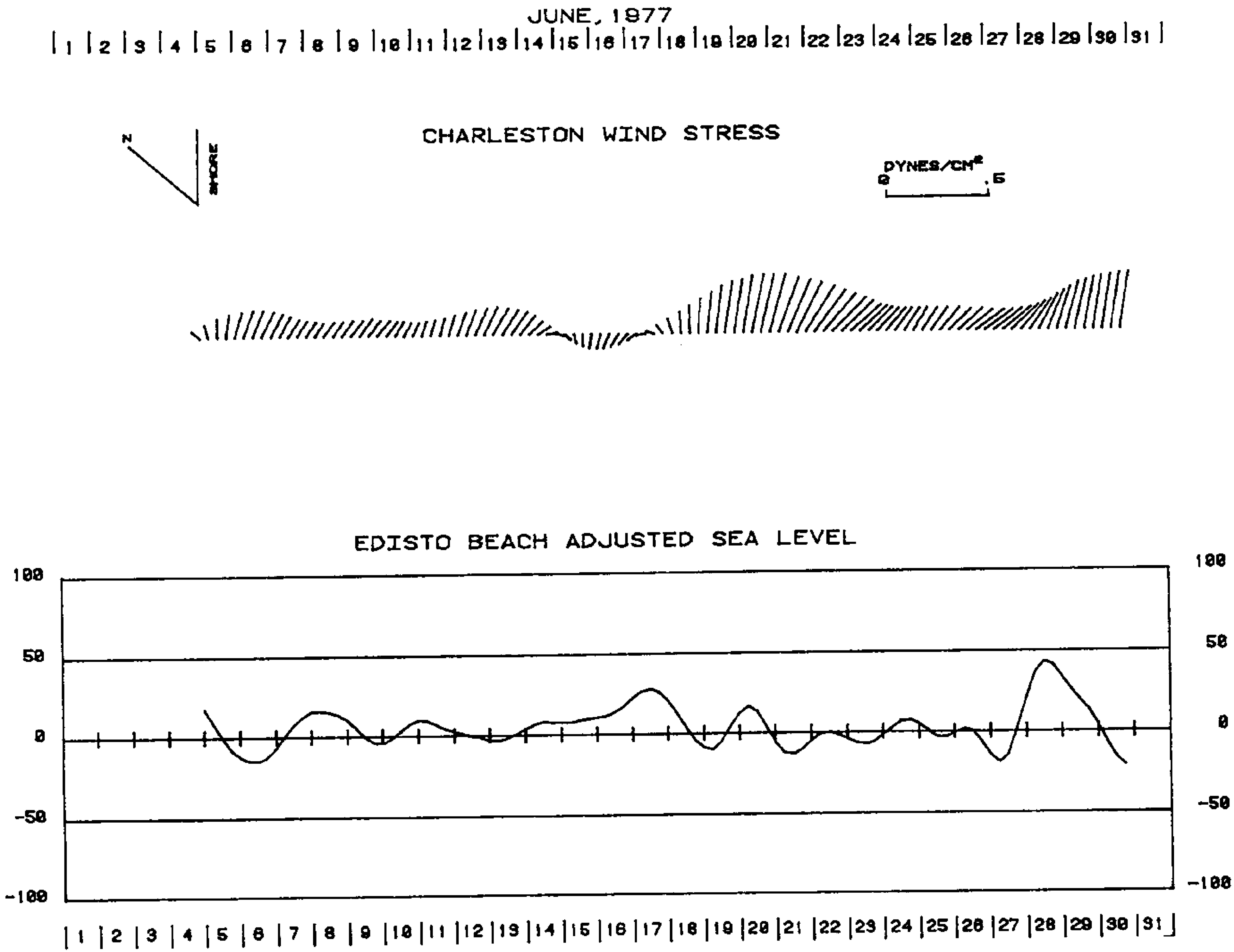
CHARLESTON WIND STRESS
N
SHORE
DYNES/CM²
0 .5
MYRTLE BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100

APPENDIX C. EDISTO BEACH, SOUTH CAROLINA, ADJUSTED SEA LEVEL FOR JUNE, 1977 THROUGH JANUARY, 1978.


JUNE, 1977
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CHARLESTON WIND STRESS
N
SHORE
DYNES/CM²
0
.5
EDISTO BEACH ADJUSTED SEA LEVEL
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0
-50
-100
CM
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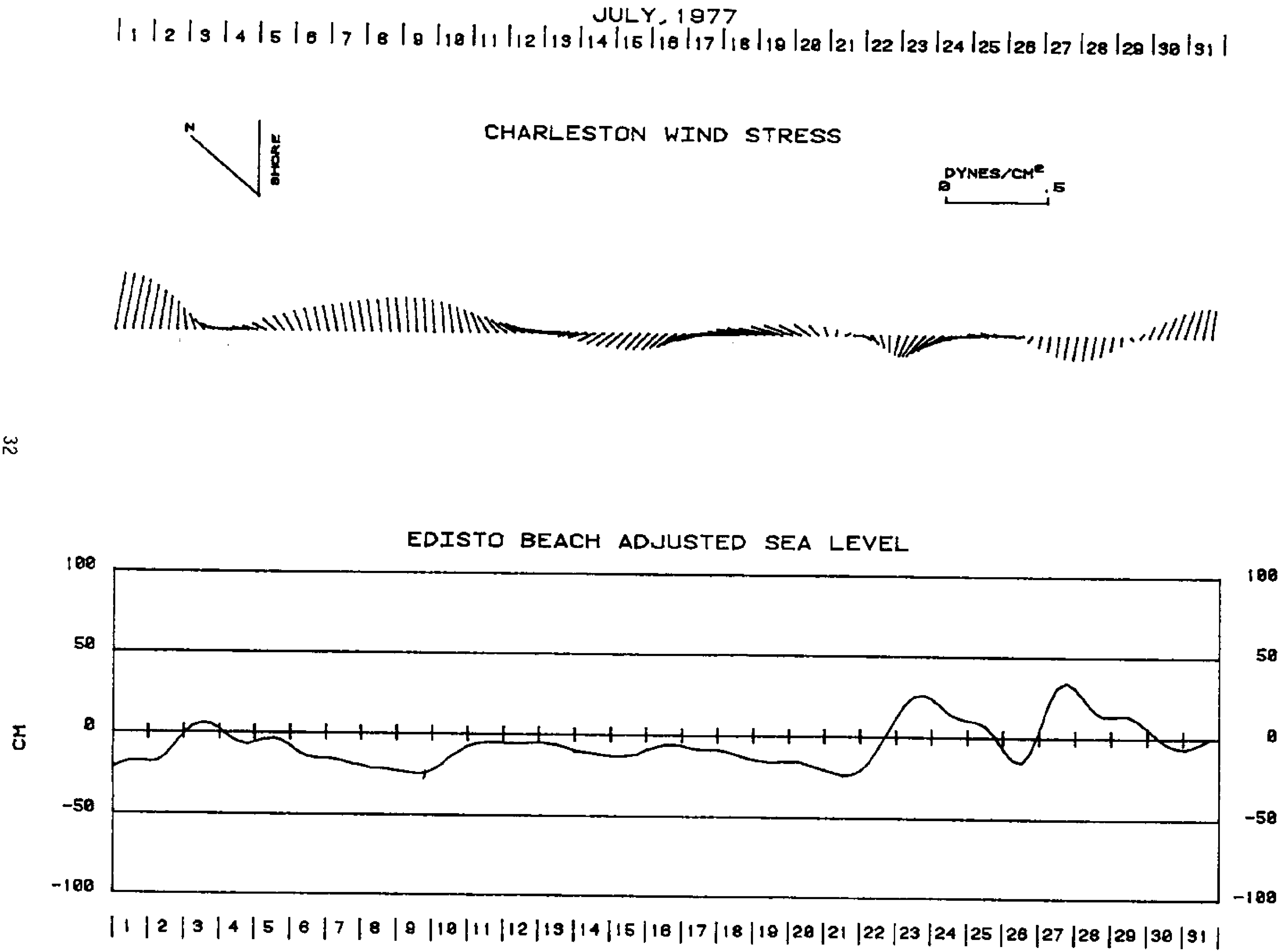

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CHARLESTON WIND STRESS
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.5
EDISTO BEACH ADJUSTED SEA LEVEL
100
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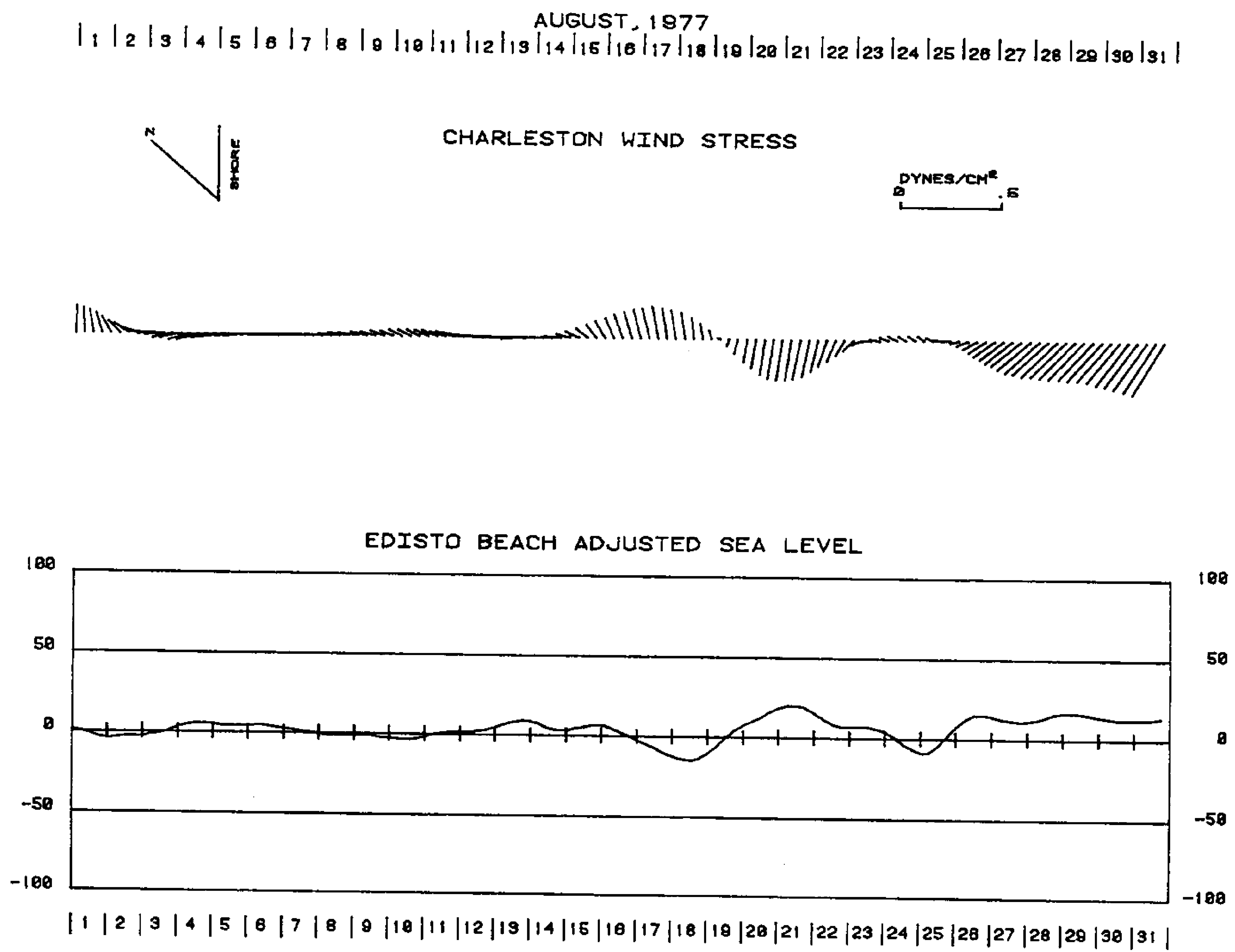
0
-50
-100
CM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SHORE
CHARLESTON WIND STRESS
DYNES/CM²
0 .5
EDISTO BEACH ADJUSTED SEA LEVEL
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-50
-100
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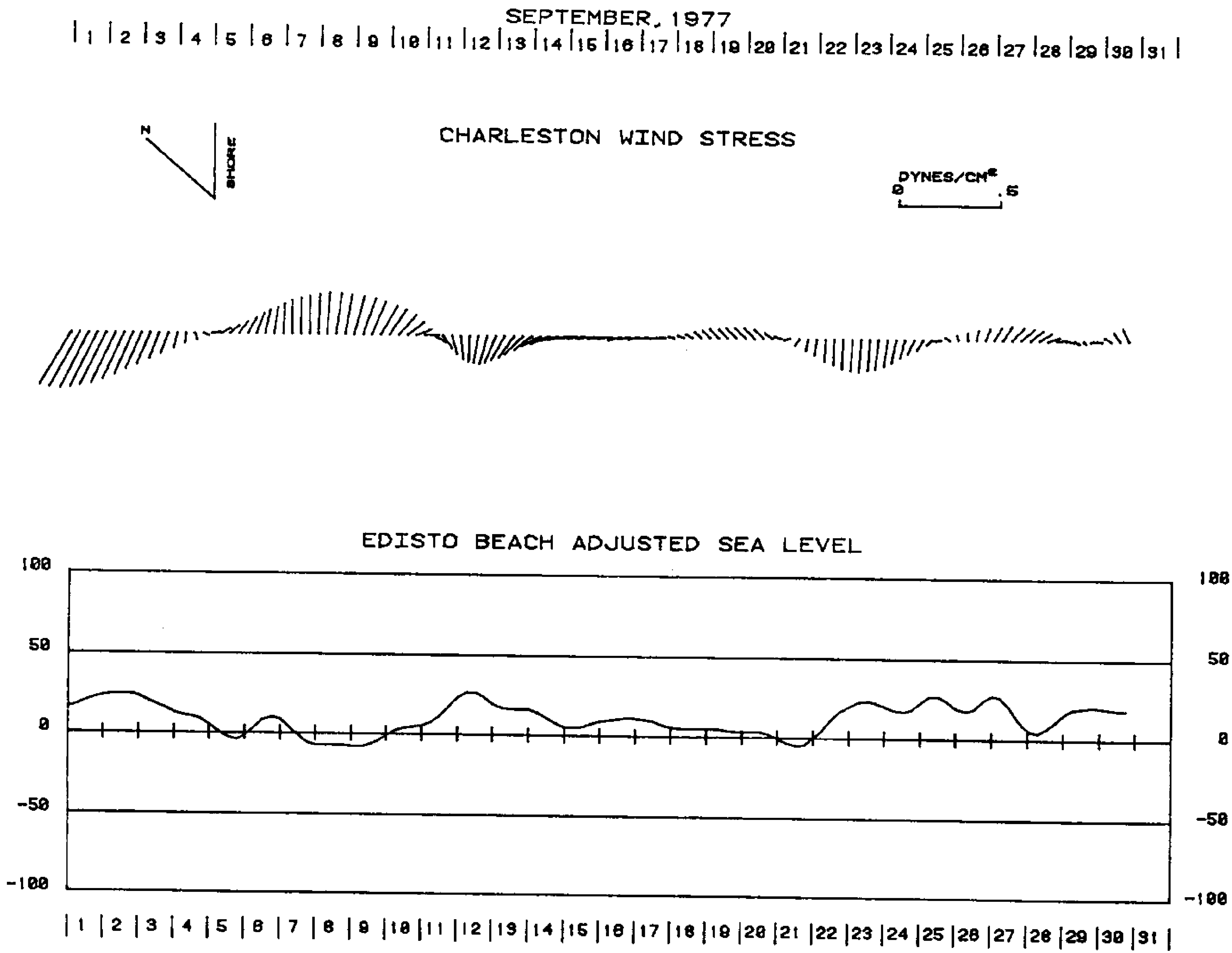
SEPTEMBER, 1977
CHARLESTON WIND STRESS
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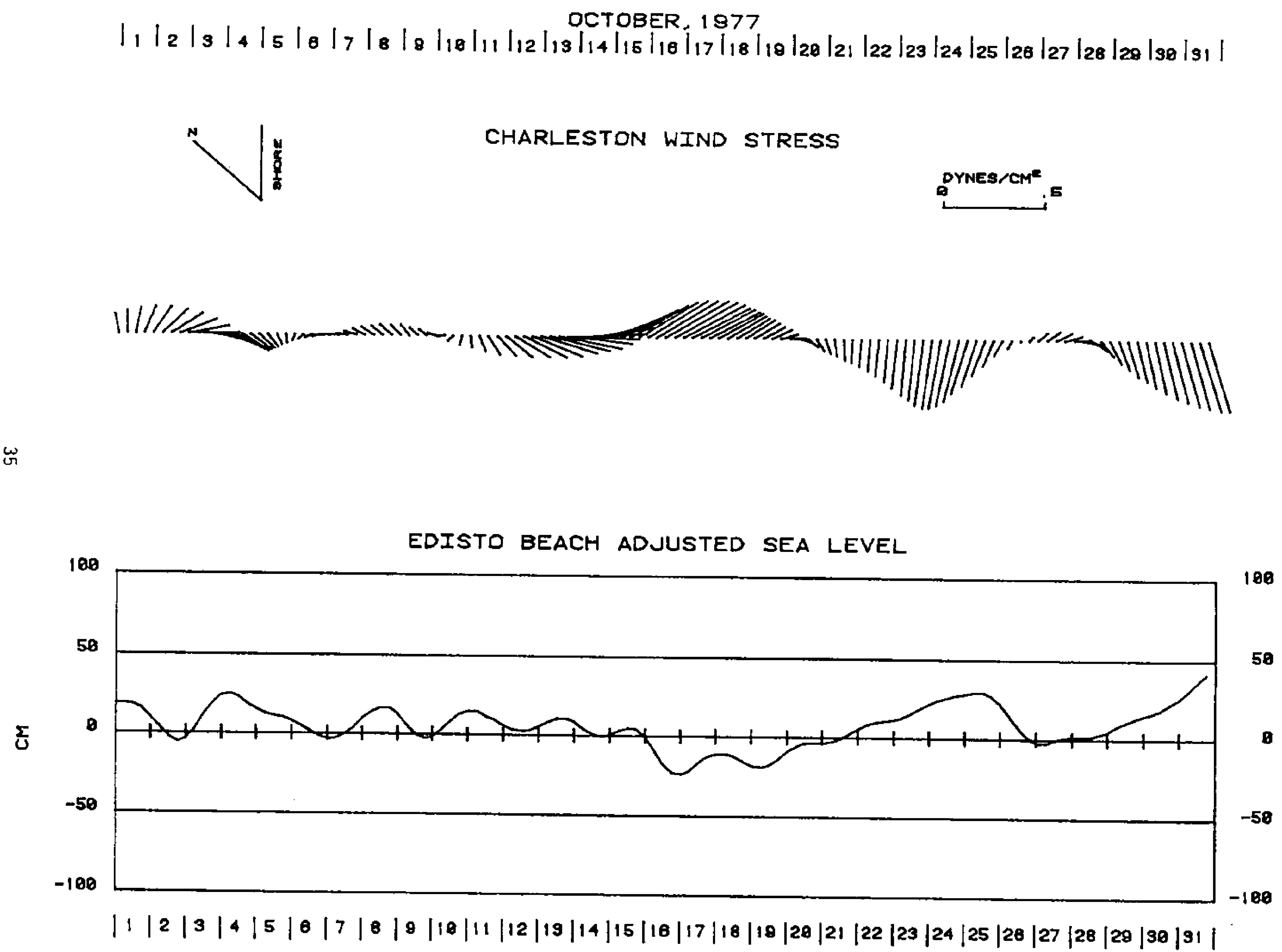
-50
-100


OCTOBER, 1977
CHARLESTON WIND STRESS
N
SHORE
DYNES/CM²
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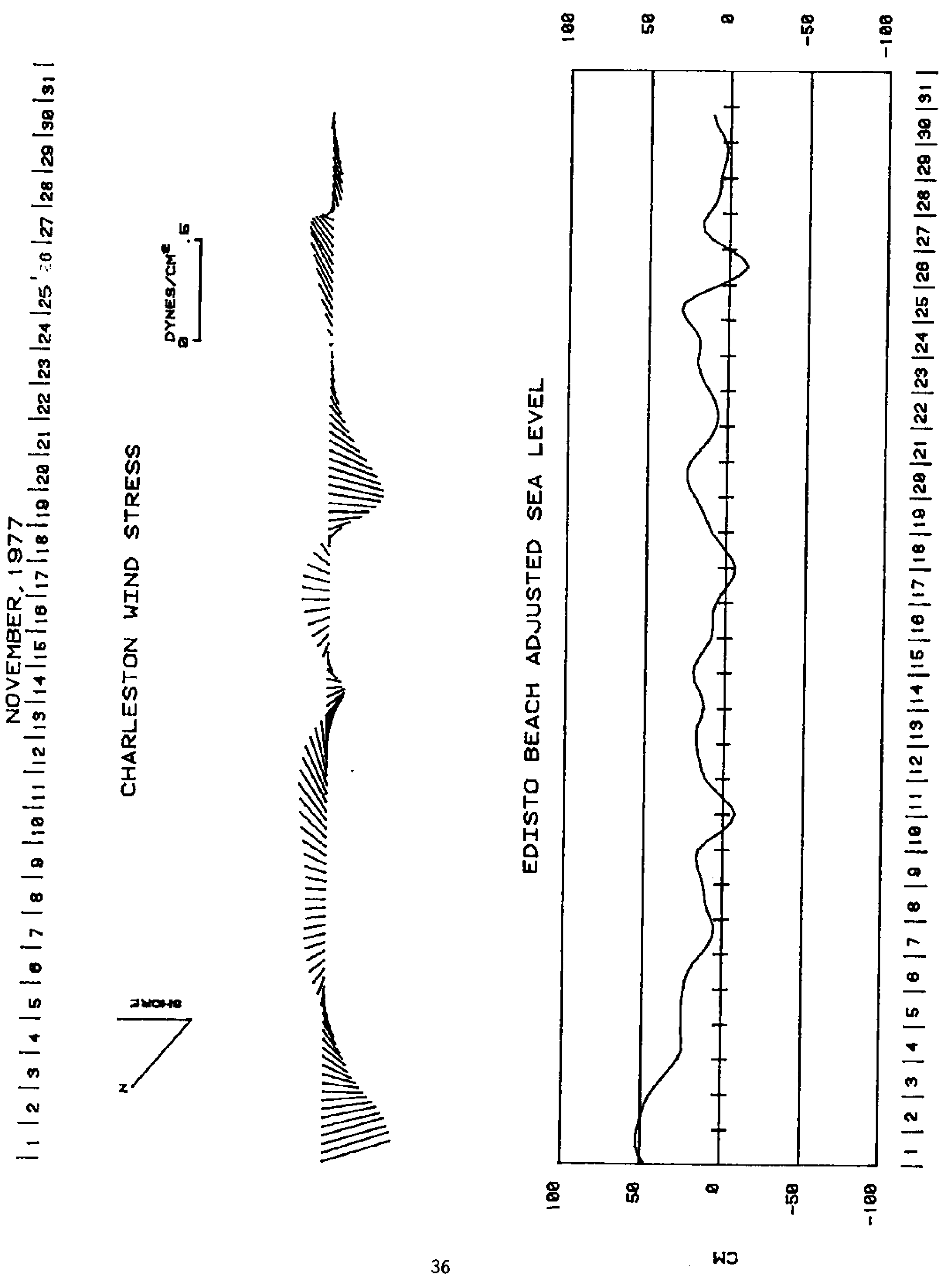
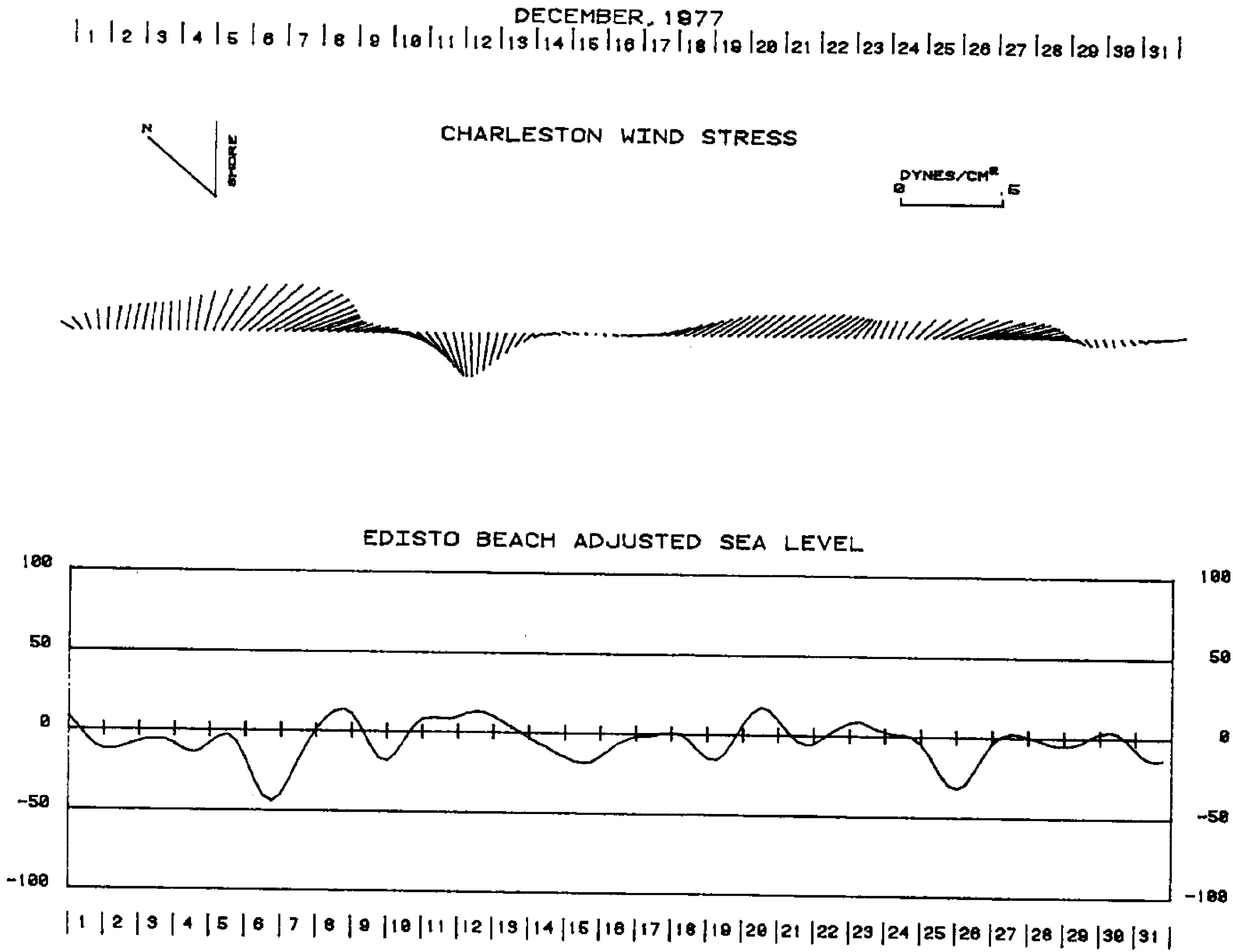
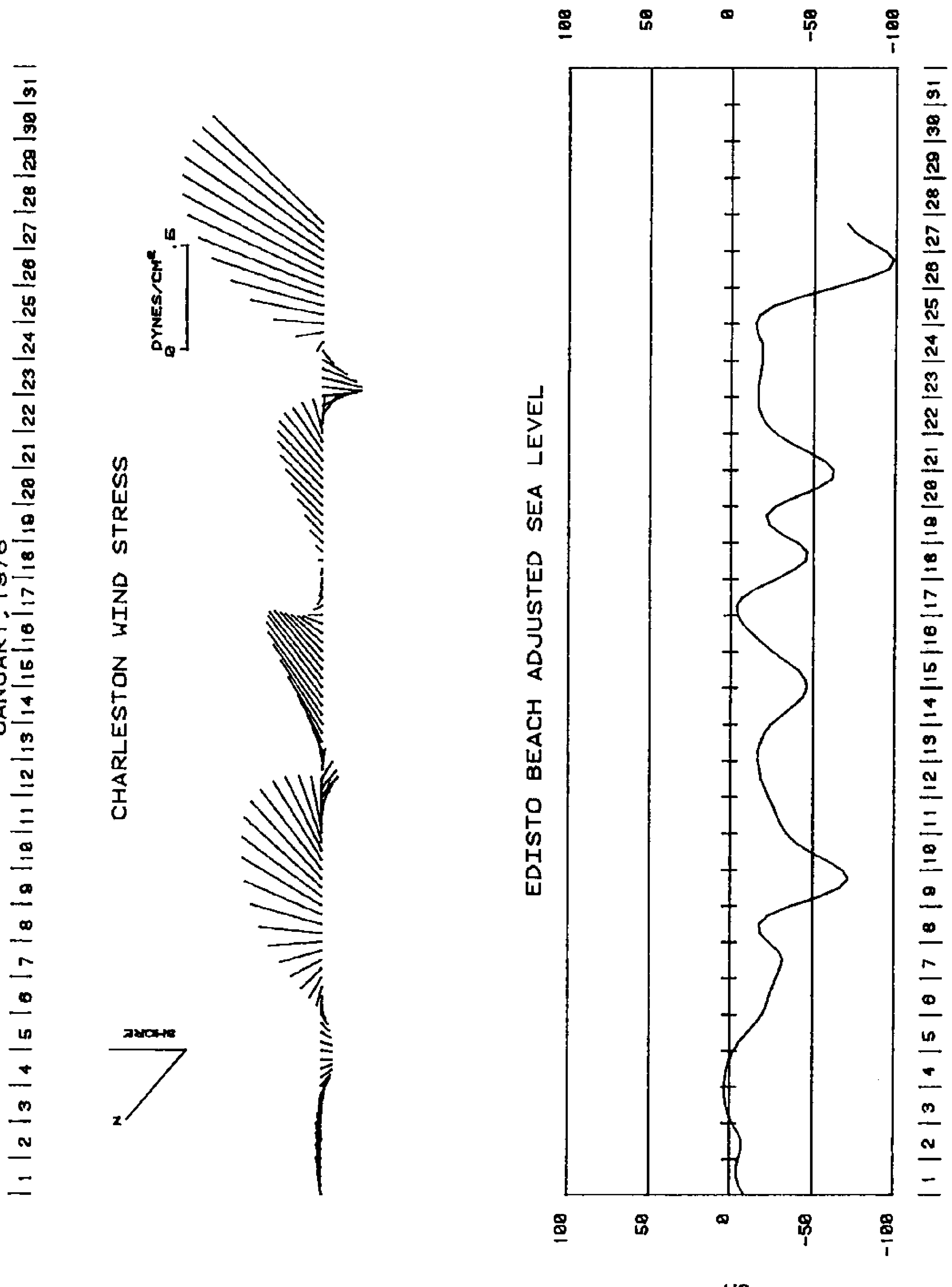
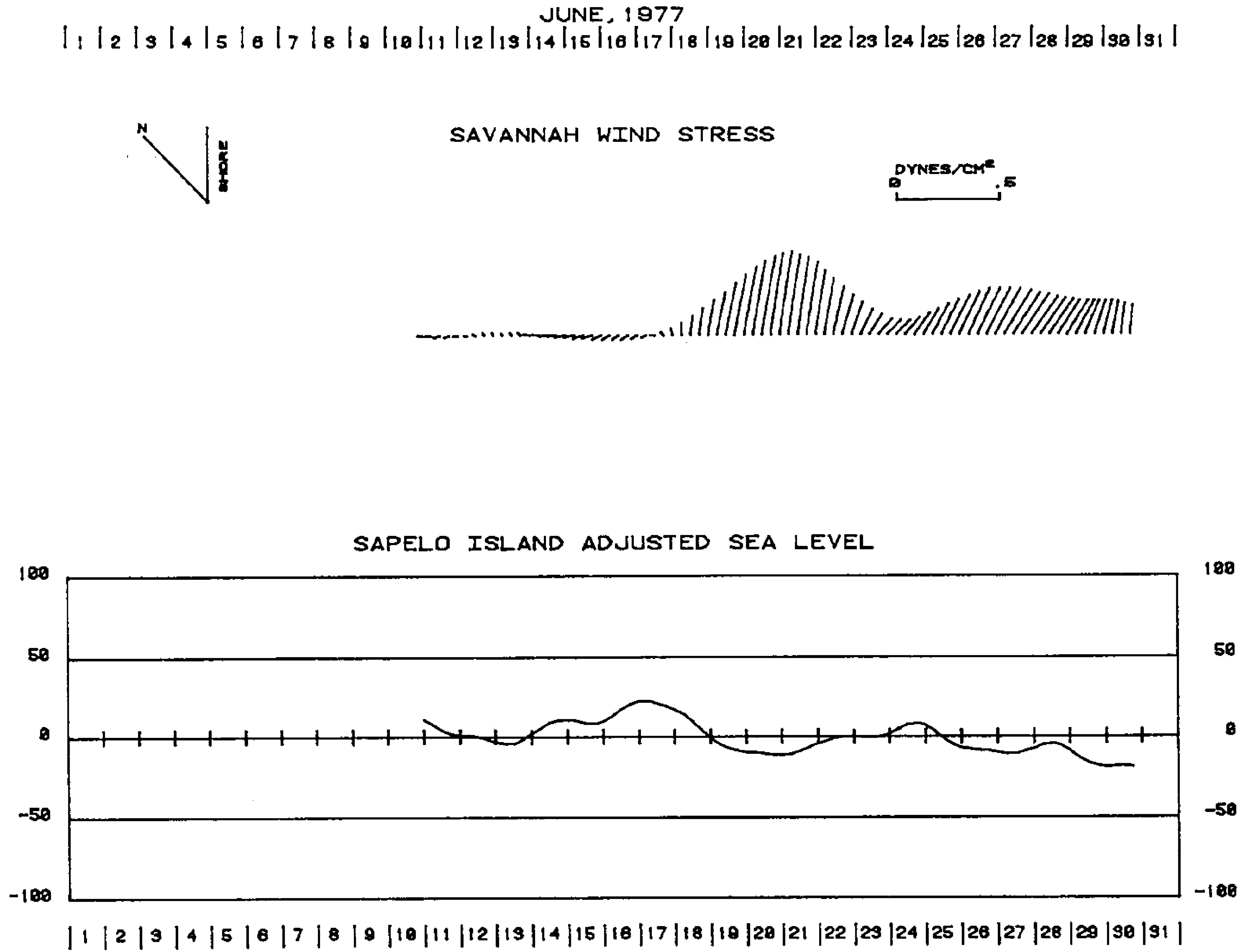
.5
EDISTO BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100

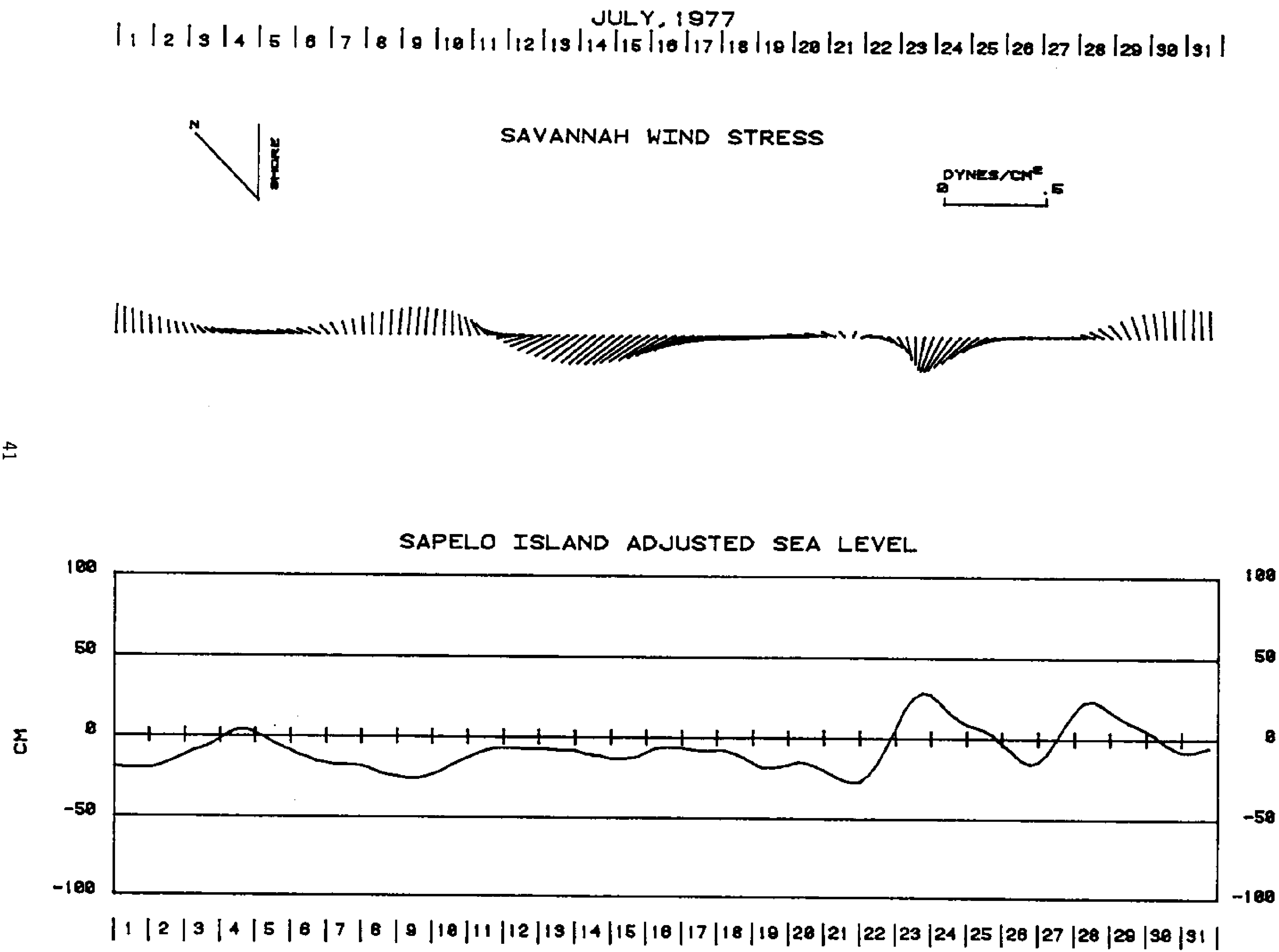

NOVEMBER, 1977
CHARLESTON WIND STRESS
SHORE
N
0 DYNES/CM² .5
EDISTO BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

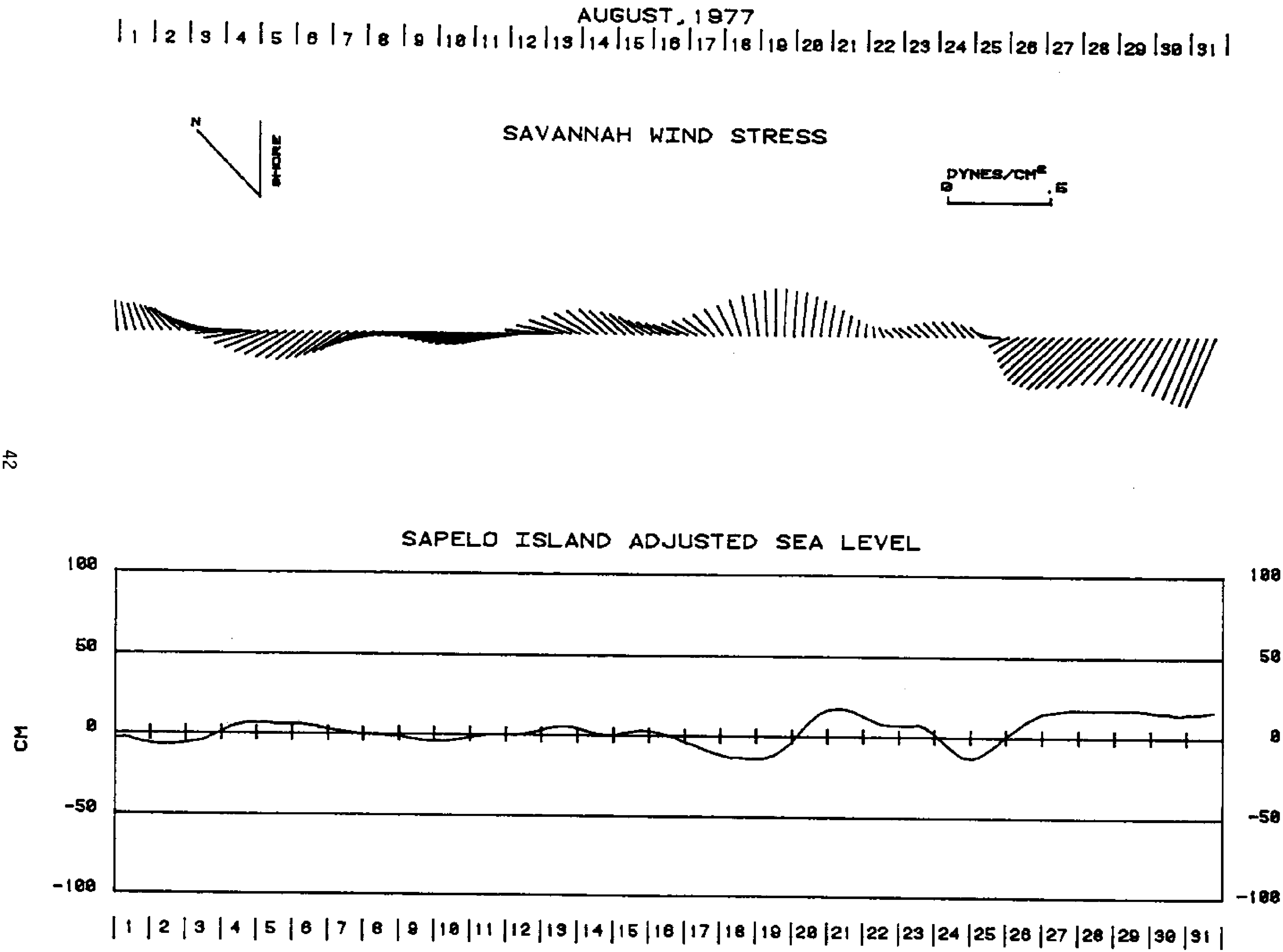

DECEMBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
CHARLESTON WIND STRESS
DYNES/CM²
0 .5
EDISTO BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


JANUARY, 1978
CHARLESTON WIND STRESS
N
SHORE
DYNES/CM²
0
.5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
EDISTO BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM

APPENDIX D. SAPELO ISLAND, GEORGIA, ADJUSTED SEA LEVEL FOR JUNE, 1977 THROUGH JANUARY, 1978.

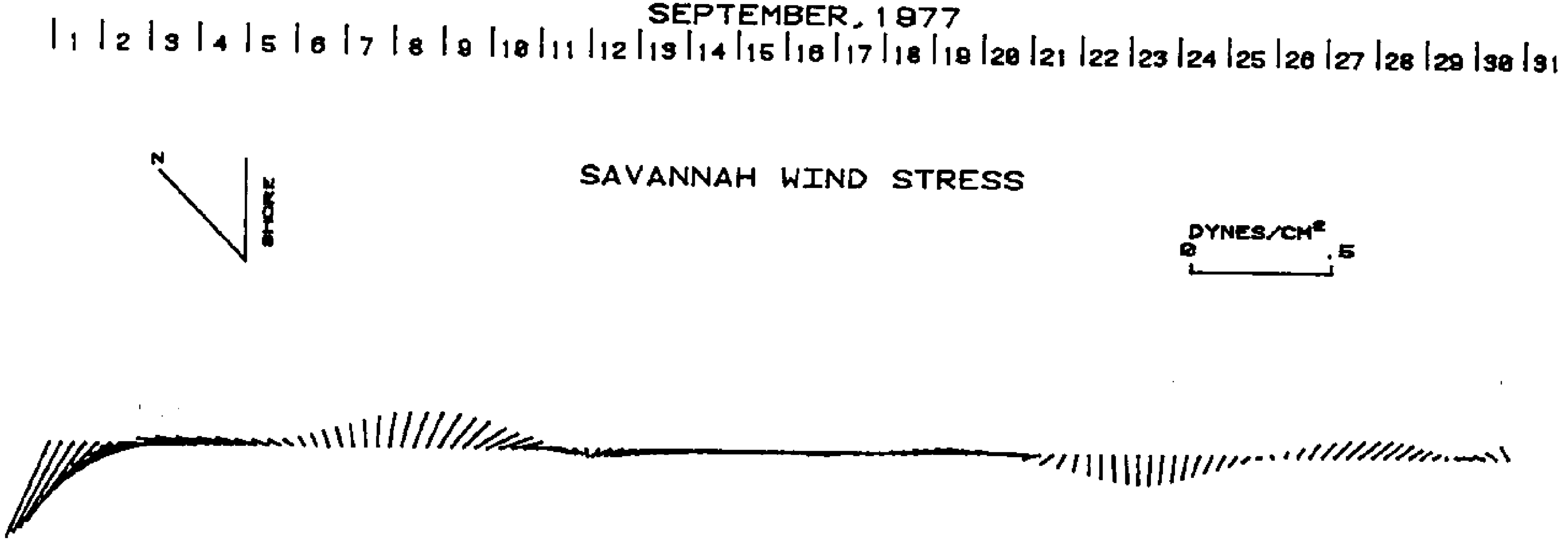

JUNE, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
SAVANNAH WIND STRESS
DYNES/CM²
0 .5
SAPELO ISLAND ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


JULY, 1977
SAVANNAH WIND STRESS
N
SHORE
DYNES/CM²
0
.5
SAPELO ISLAND ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100

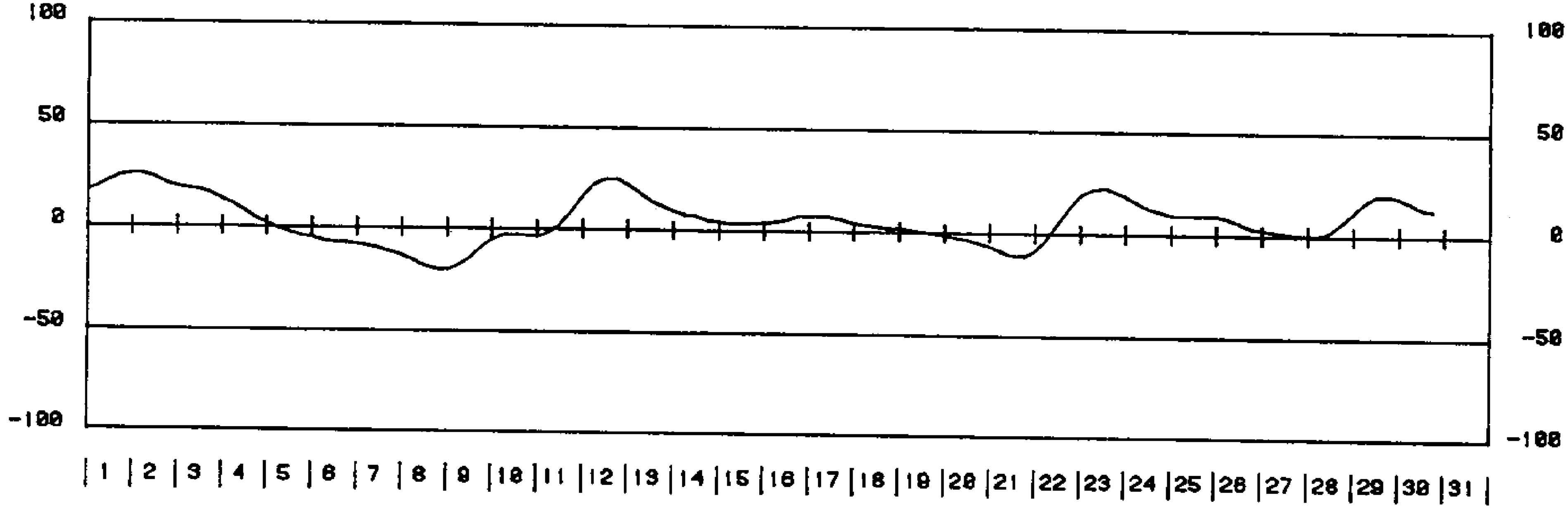

AUGUST, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
SAVANNAH WIND STRESS
DYNES/CM²
0 .5
SAPELO ISLAND ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

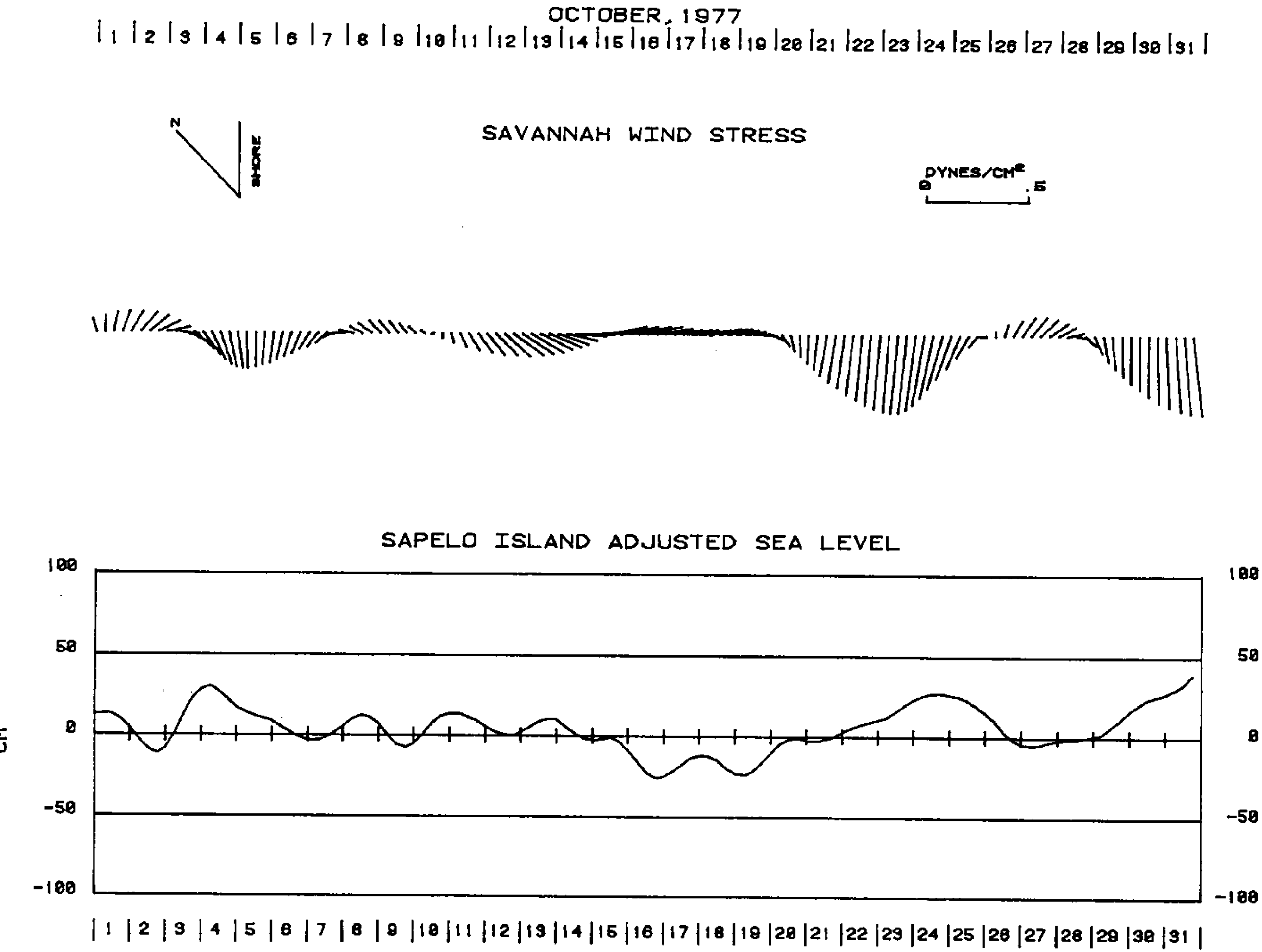
SEPTEMBER, 1977

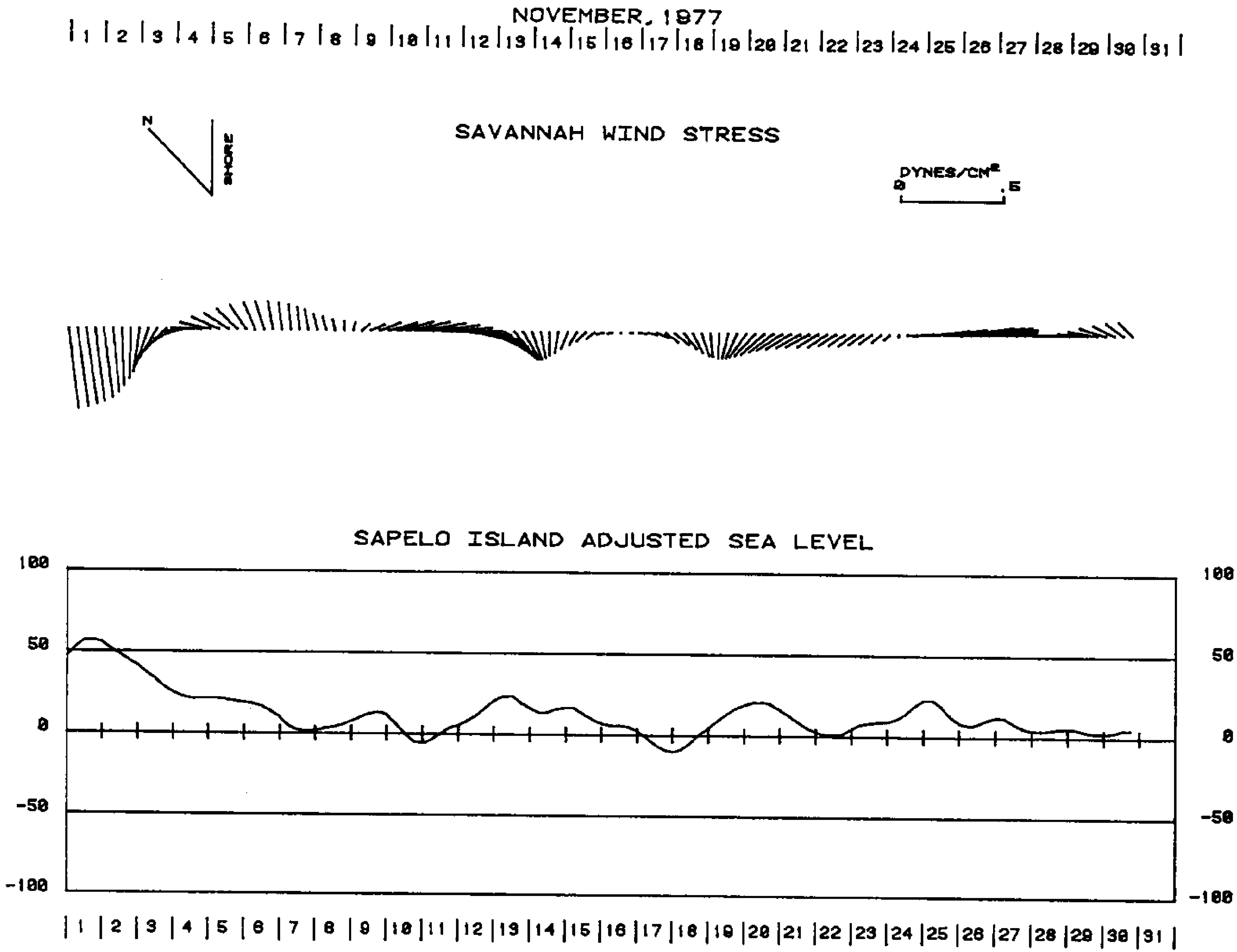
SAVANNAH WIND STRESS

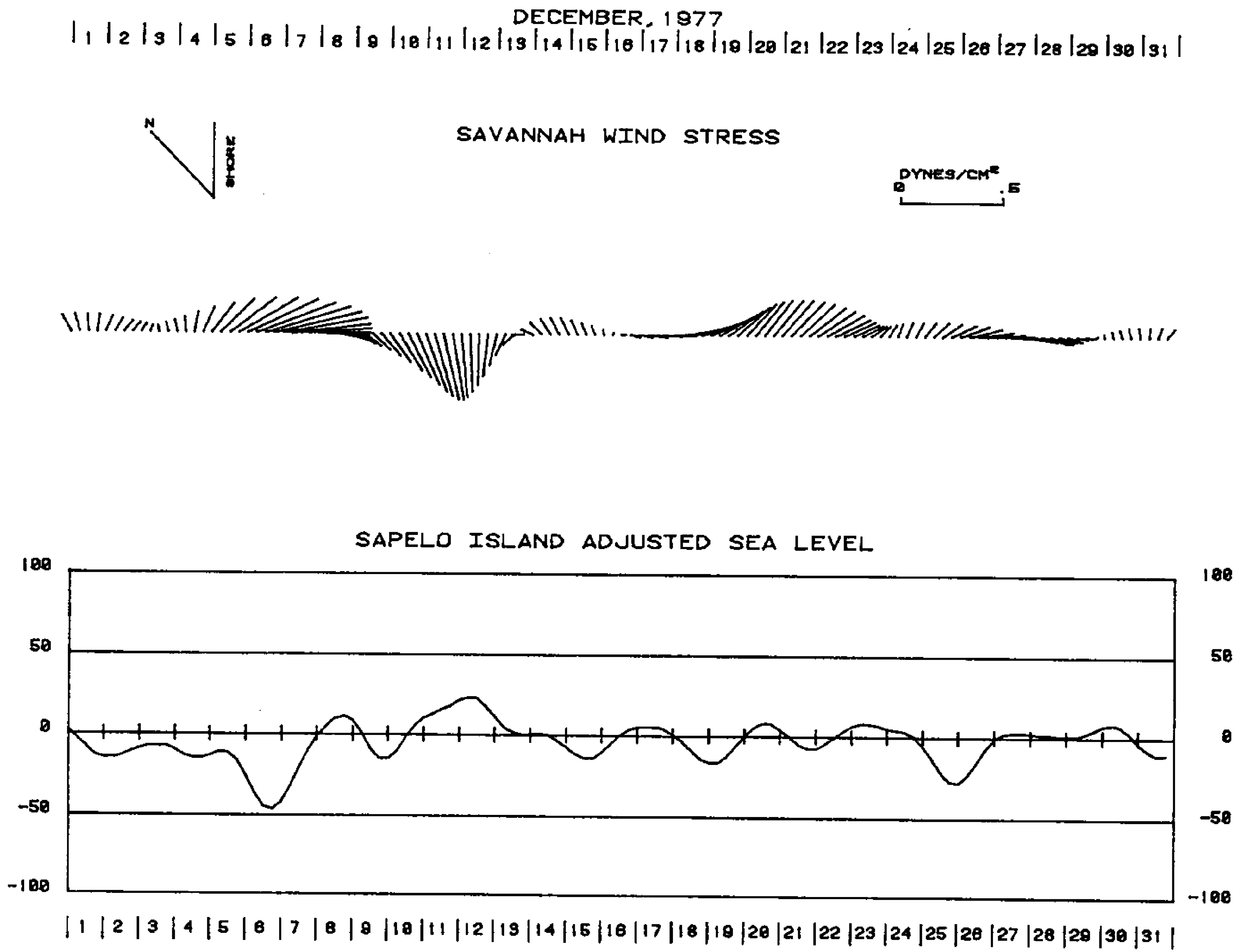


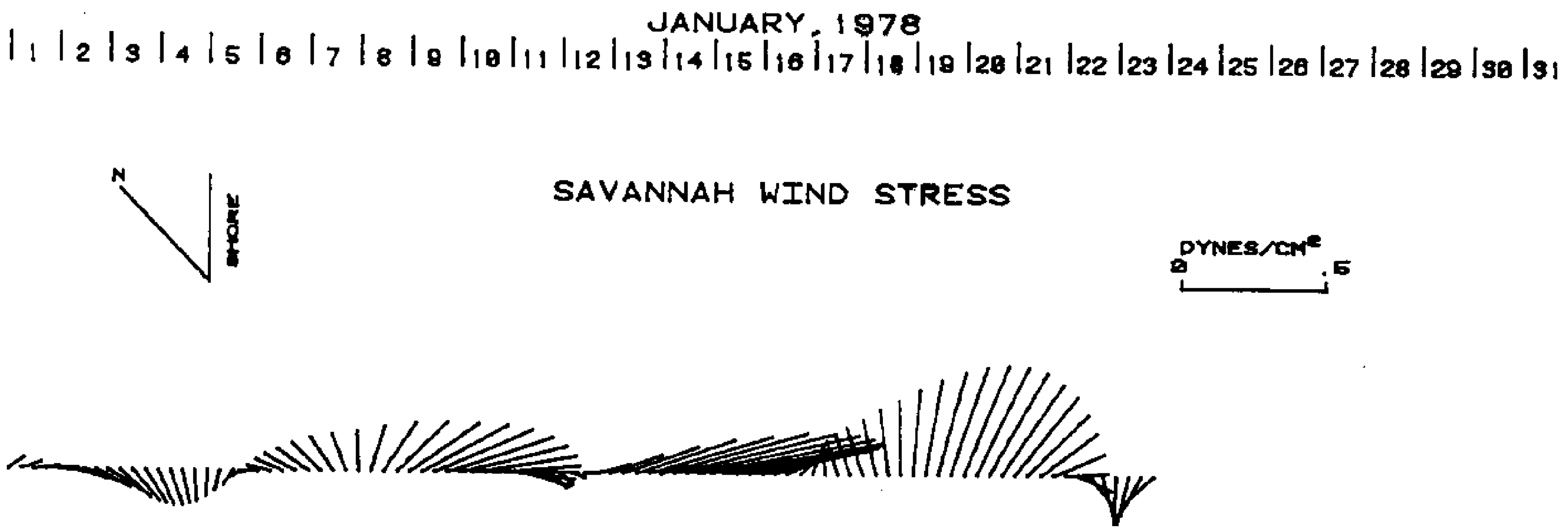
SAPELO ISLAND ADJUSTED SEA LEVEL

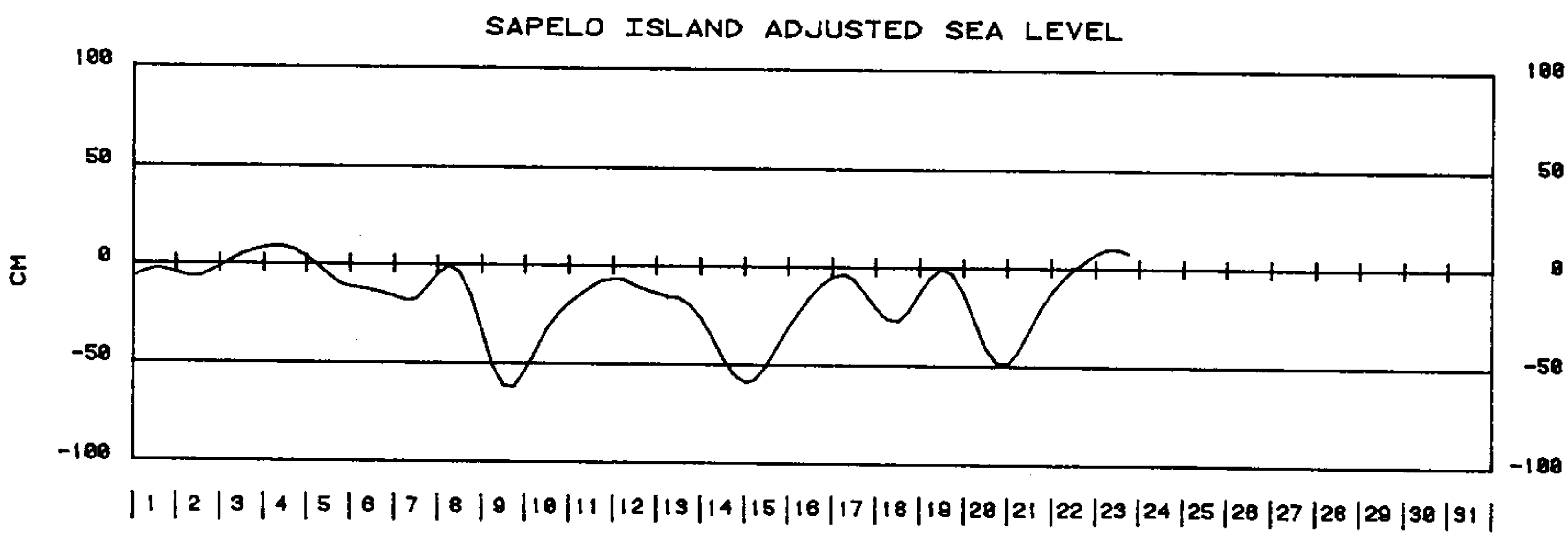



OCTOBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
SAVANNAH WIND STRESS
DYNES/CM²
0 .5
SAPELO ISLAND ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

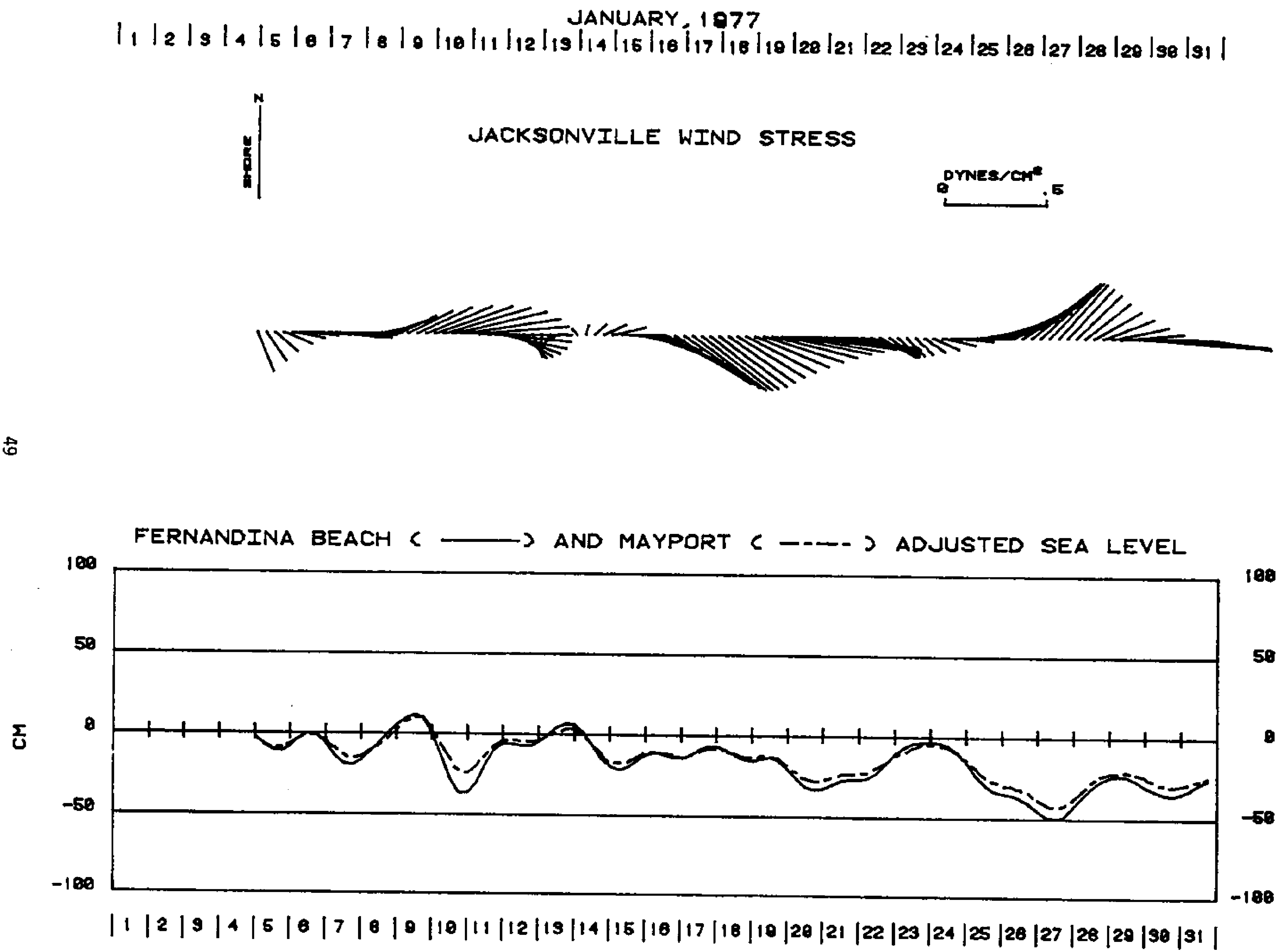

NOVEMBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
SAVANNAH WIND STRESS
N
SHORE
DYNES/CM²
0 .5
SAPELO ISLAND ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM


DECEMBER, 1977
SAVANNAH WIND STRESS
N
SHORE
DYNES/CM²
0
.5
SAPELO ISLAND ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

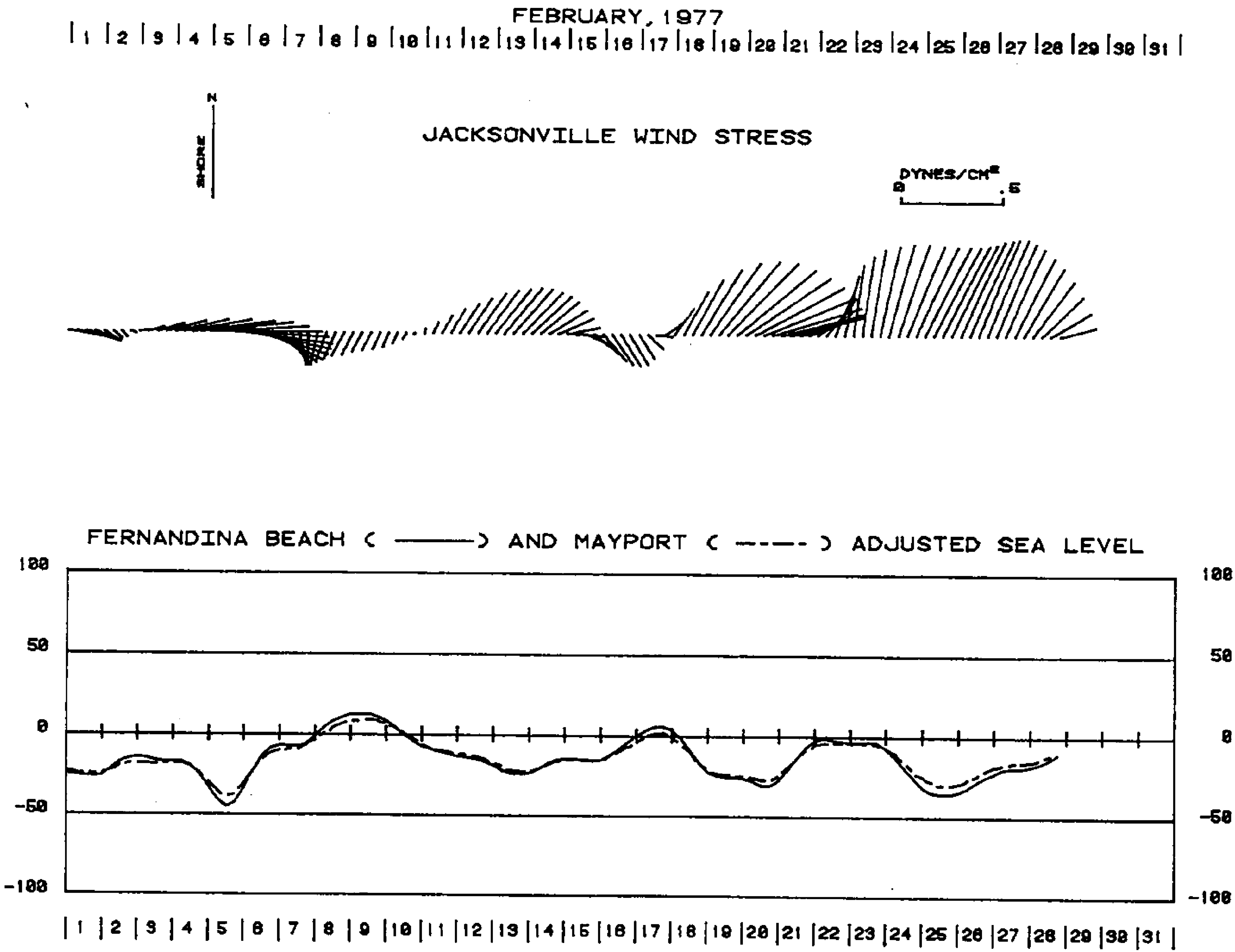

JANUARY, 1978
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
SAVANNAH WIND STRESS
N
SHORE
DYNES/CM²
0 .5


SAPELO ISLAND ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

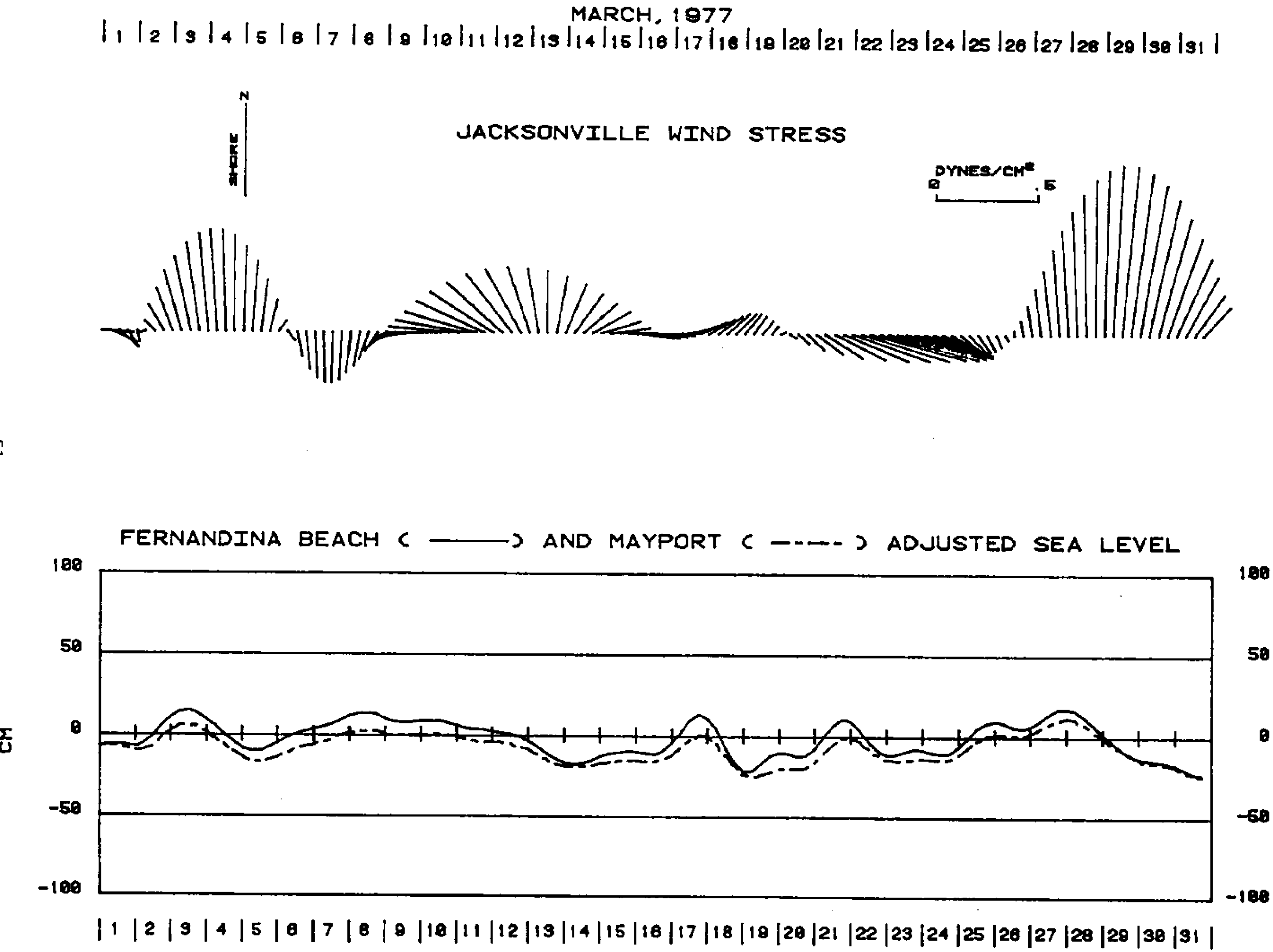
APPENDIX E. FERNANDINA BEACH, FLORIDA, AND MAYPORT, FLORIDA ADJUSTED SEA LEVEL FOR JANUARY, 1977 THROUGH JANUARY, 1978.

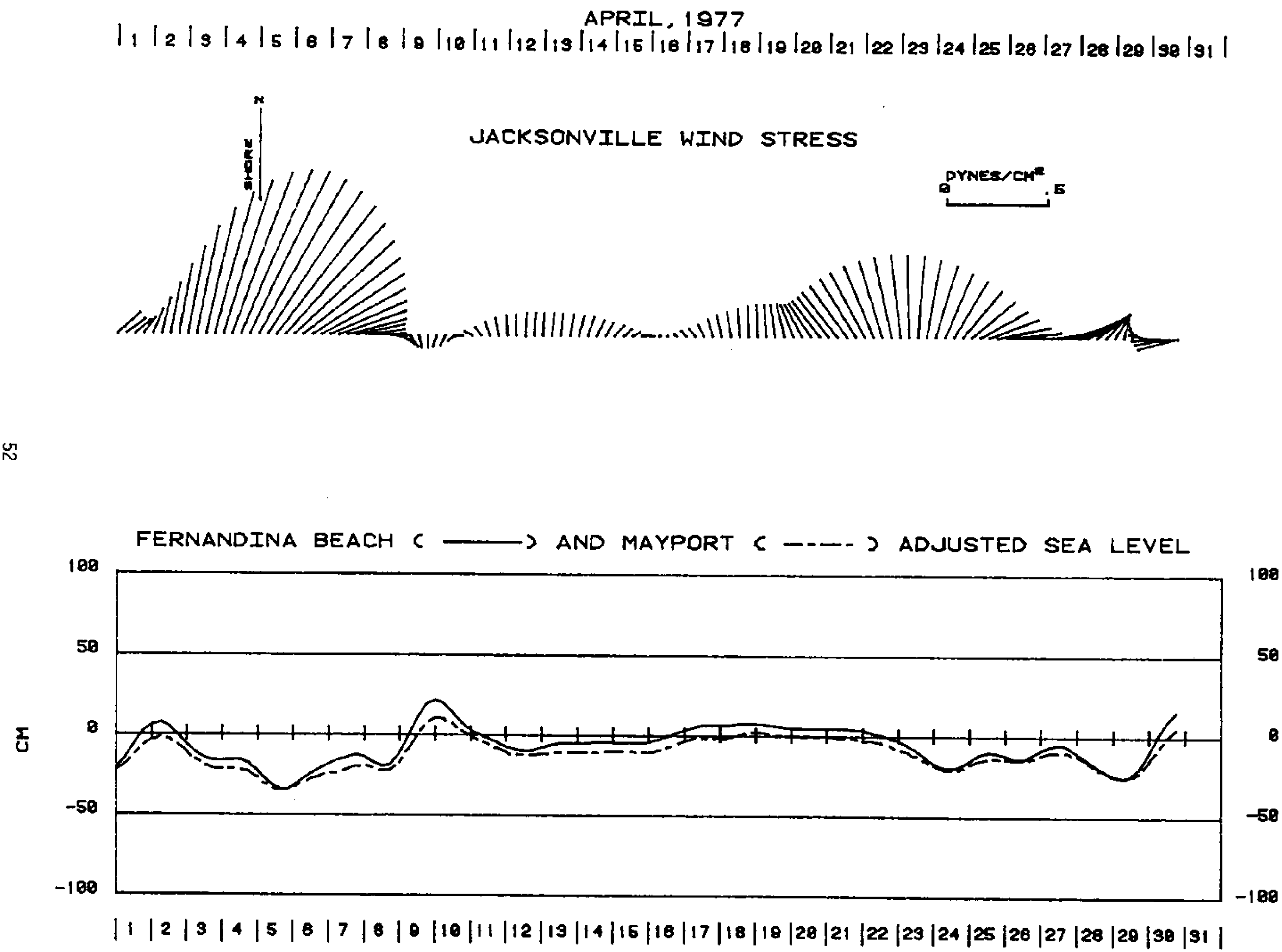


JANUARY, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5
FERNANDINA BEACH (————) AND MAYPORT (- - - -) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

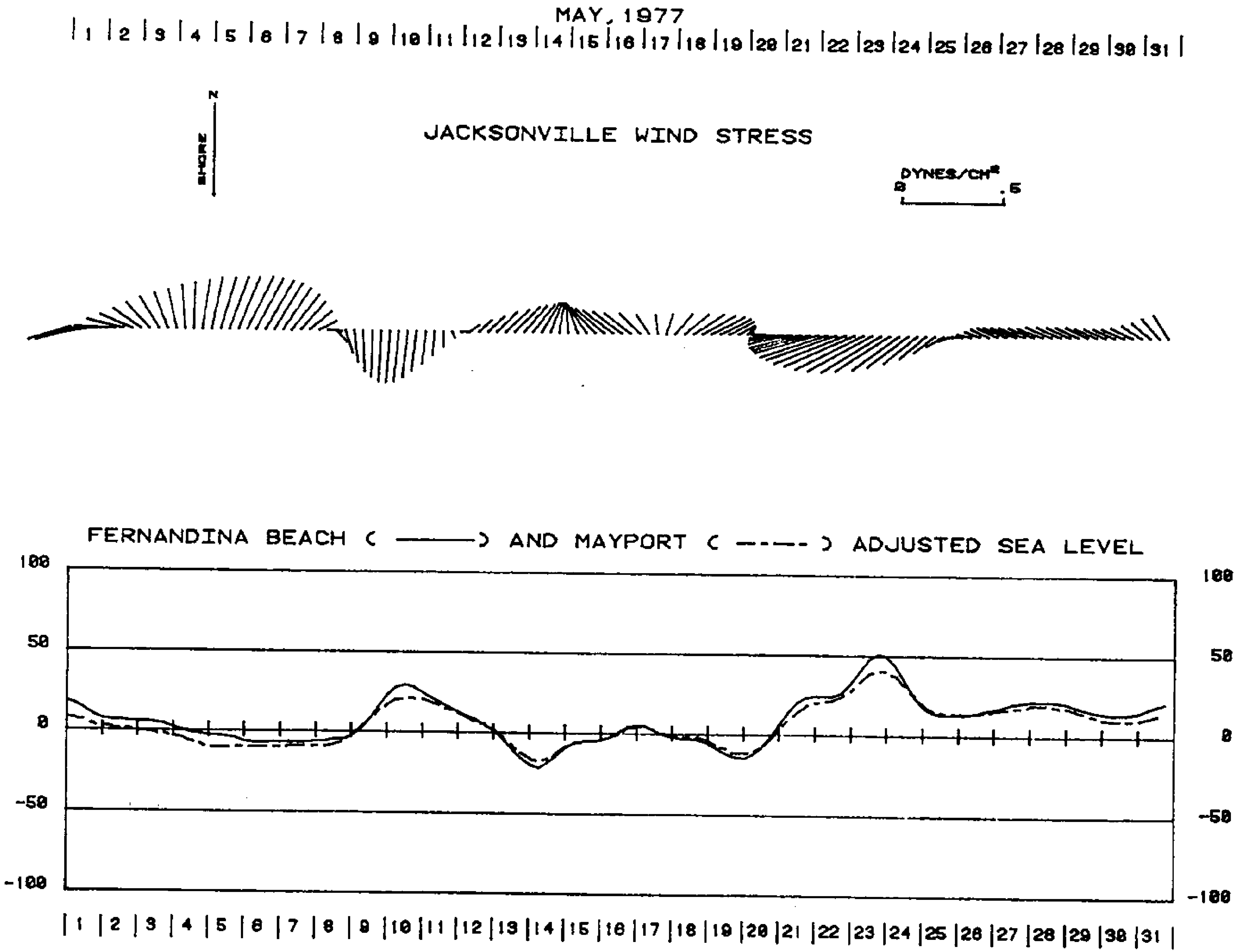


FEBRUARY, 1977
JACKSONVILLE WIND STRESS
N
SHORE
DYNES/CM²
0
.5
FERNANDINA BEACH (————) AND MAYPORT (- - - -) ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

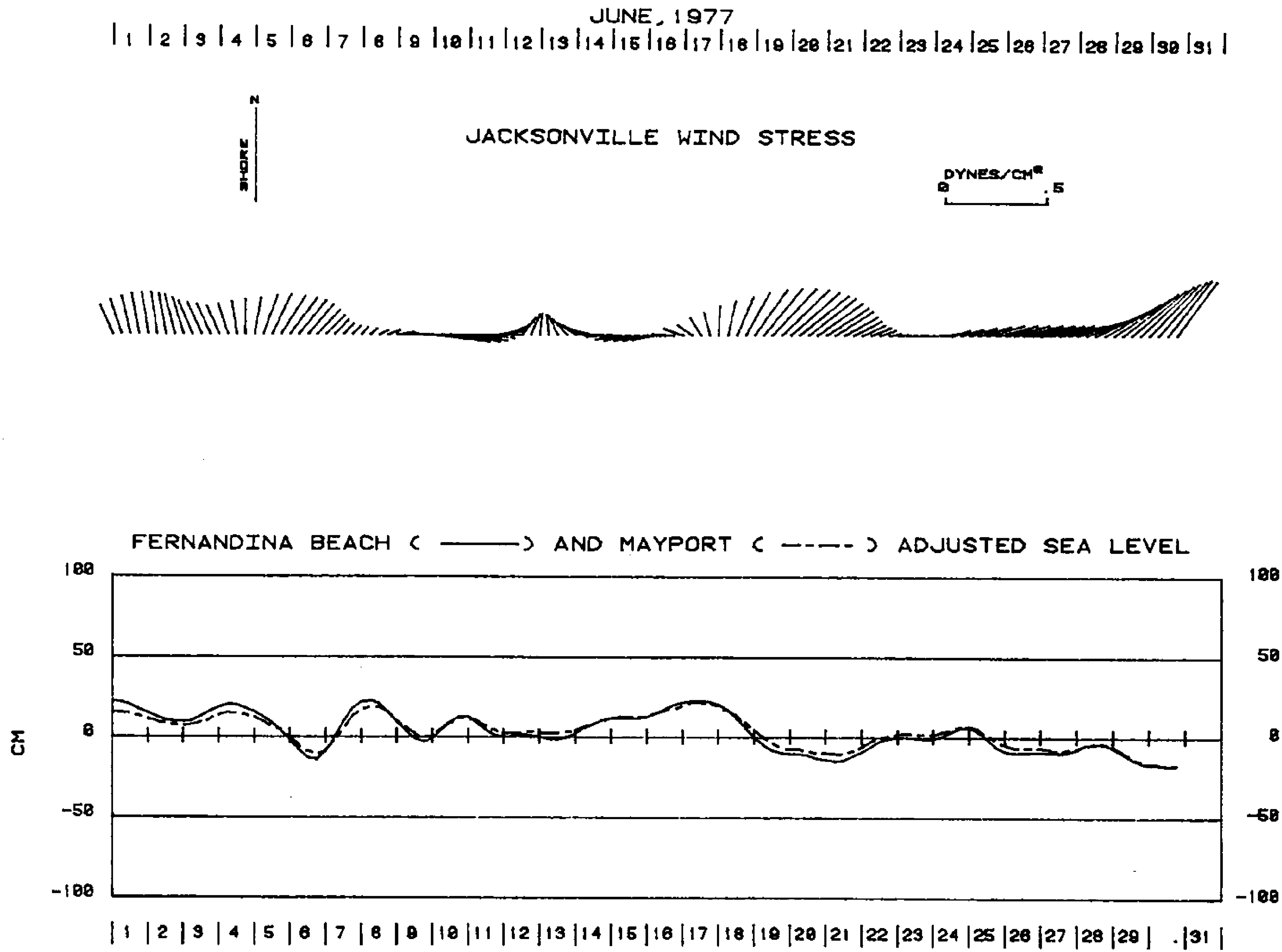

MARCH, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
JACKSONVILLE WIND STRESS
N
SHORE
DYNES/CM²
0 .5
FERNANDINA BEACH (————) AND MAYPORT (-·-·-) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM



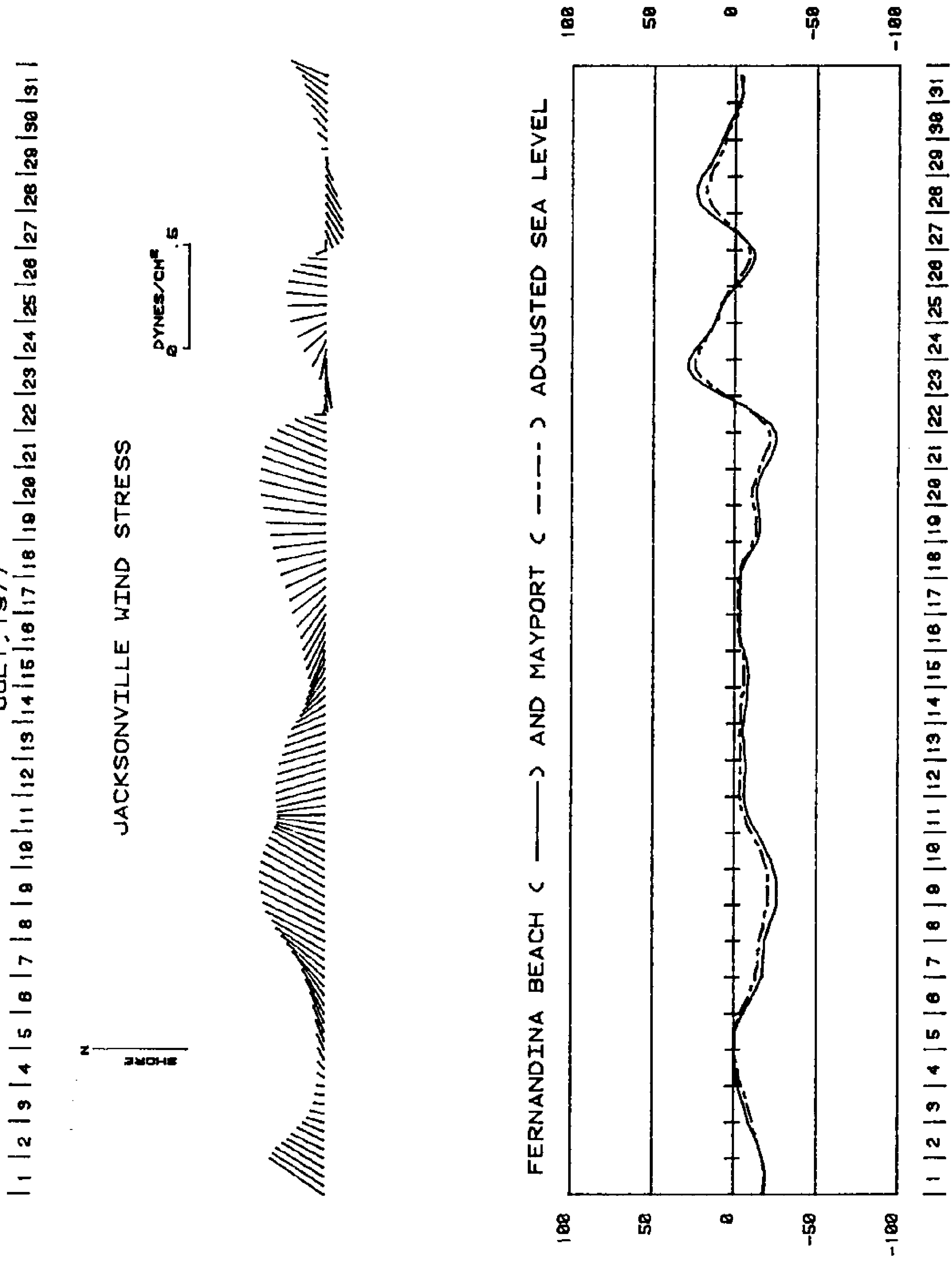
APRIL, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5
FERNANDINA BEACH (————) AND MAYPORT (----) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM



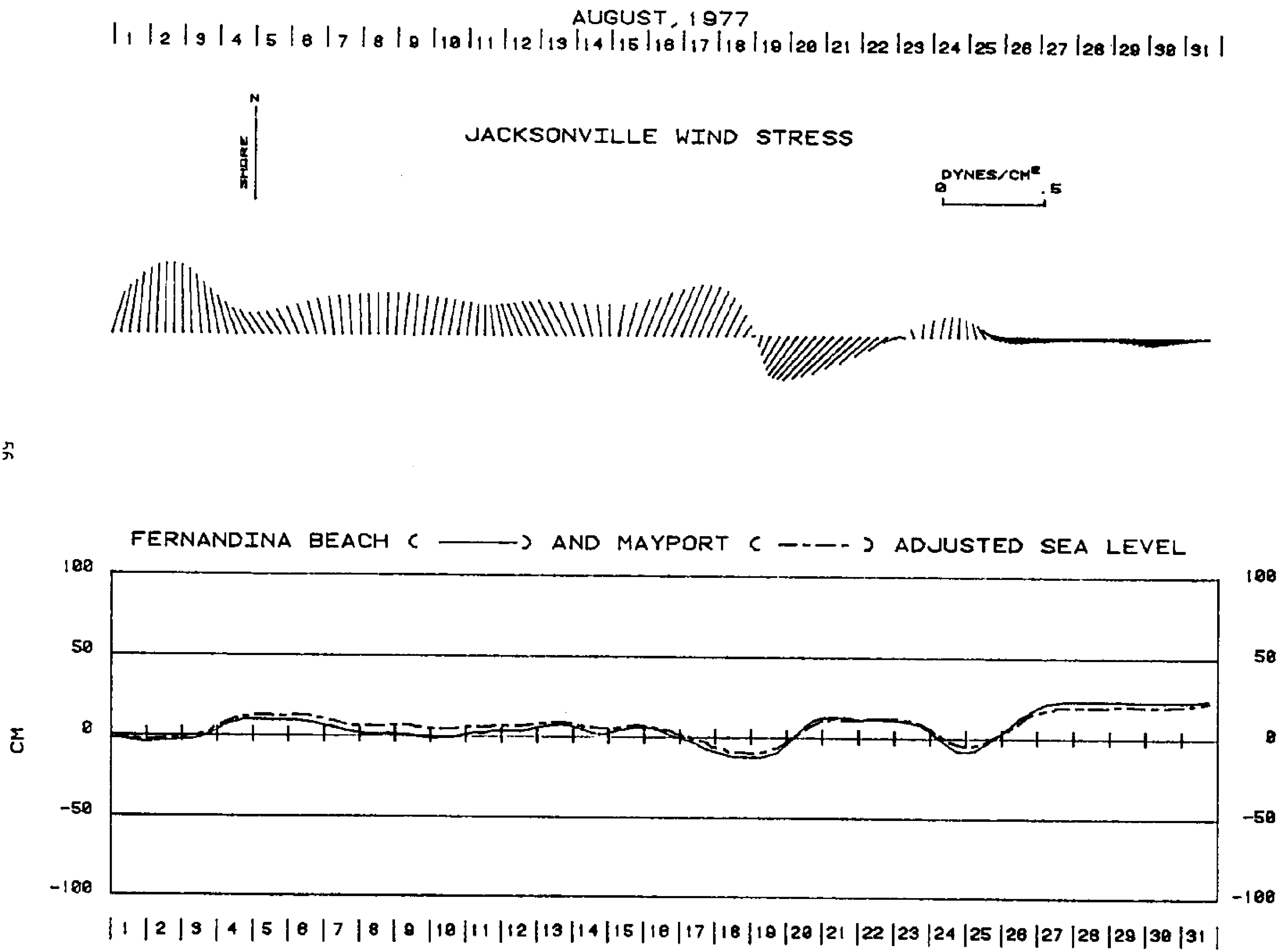
MAY, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5
FERNANDINA BEACH (———) AND MAYPORT (–·–·–) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

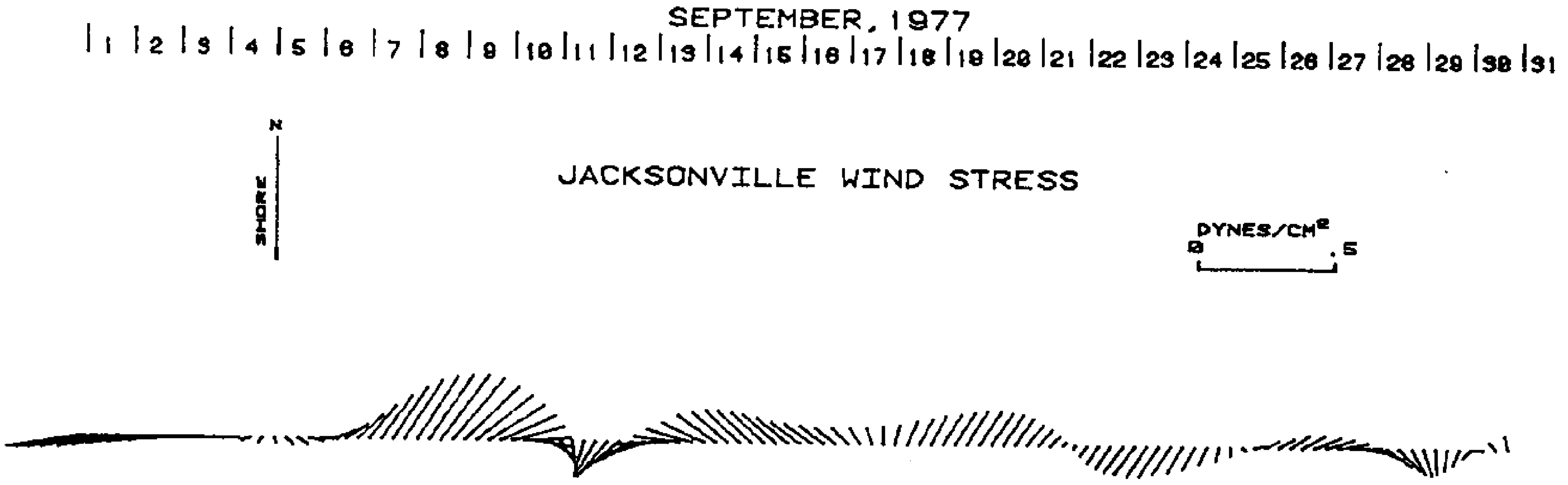


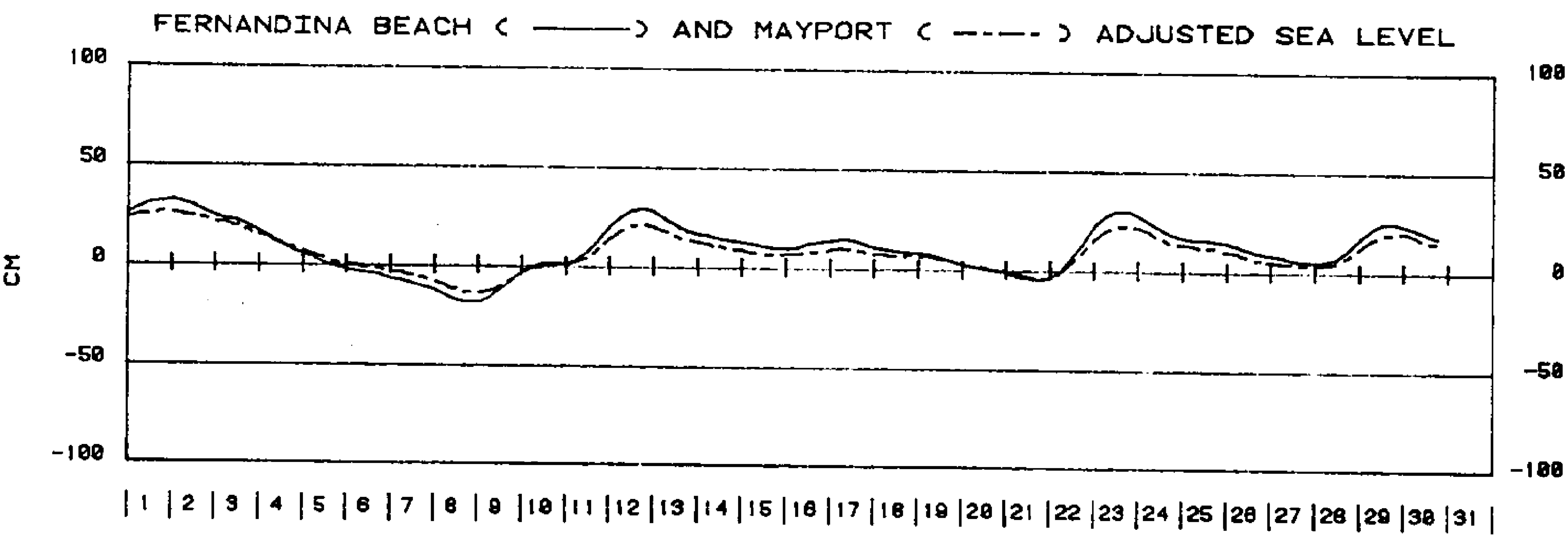
JUNE, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5
FERNANDINA BEACH (———) AND MAYPORT (- - - -) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 31

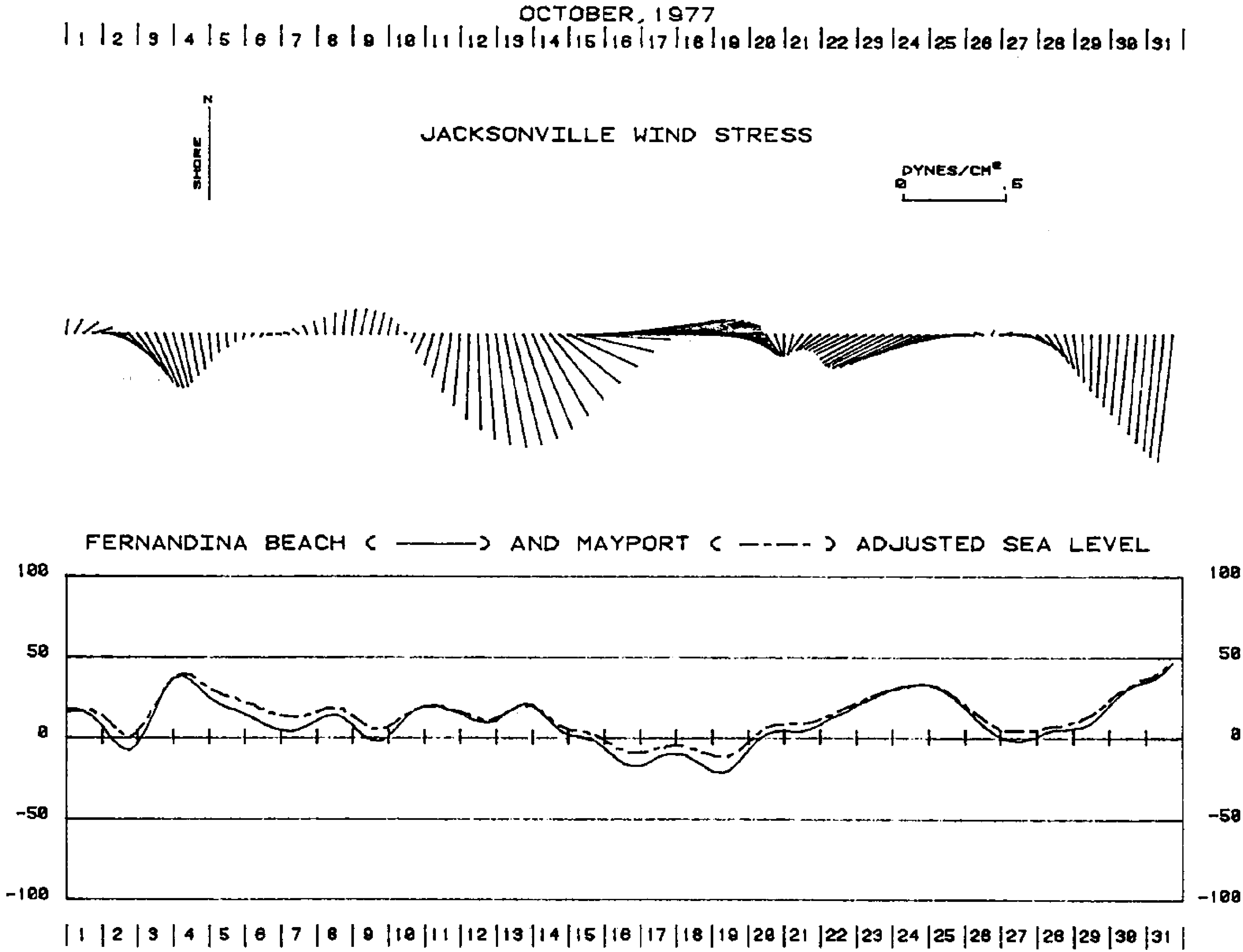


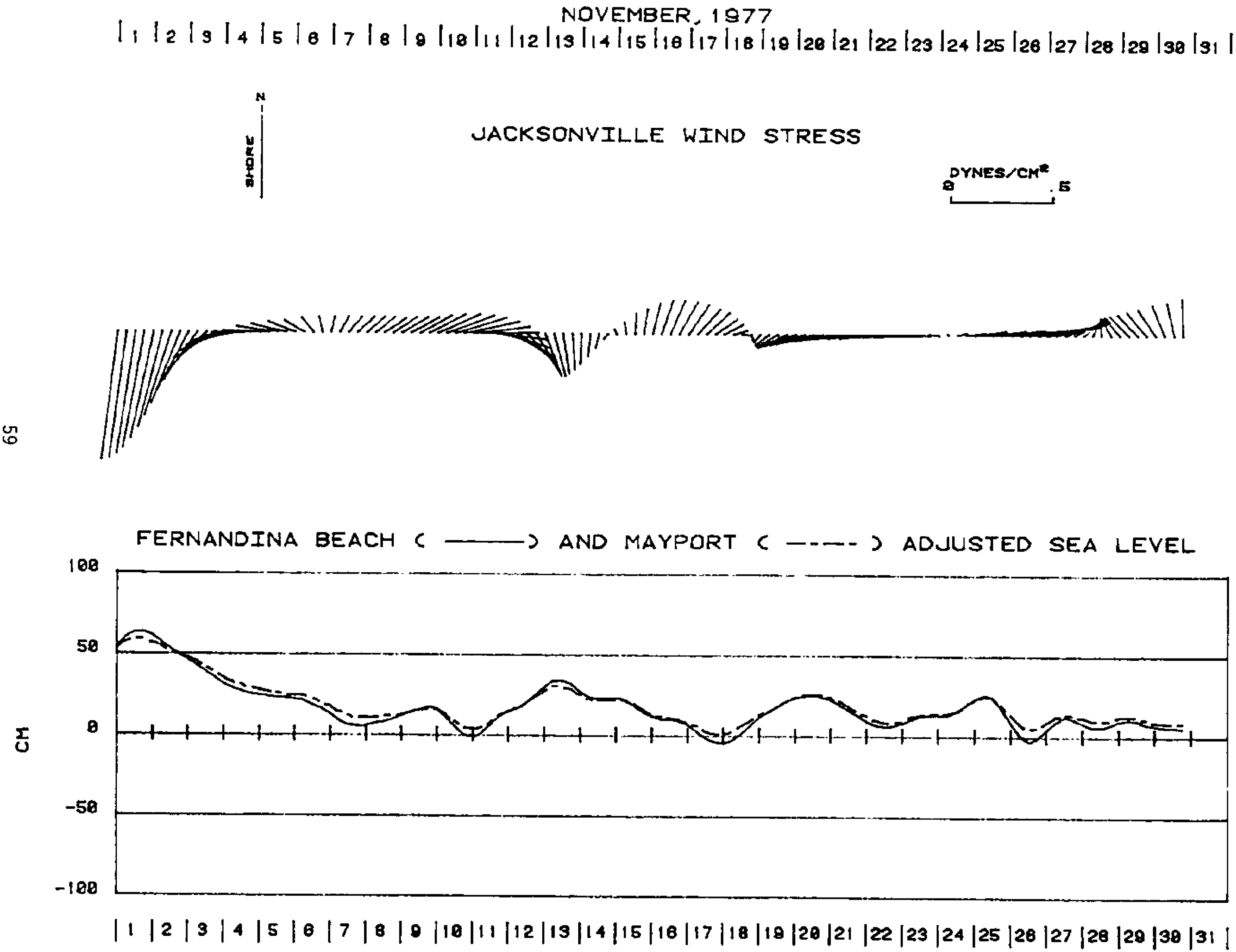
JULY, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
JACKSONVILLE WIND STRESS
N
SHORE
DYNES/CM²
0
.5
FERNANDINA BEACH (——) AND MAYPORT (-·-·-) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM

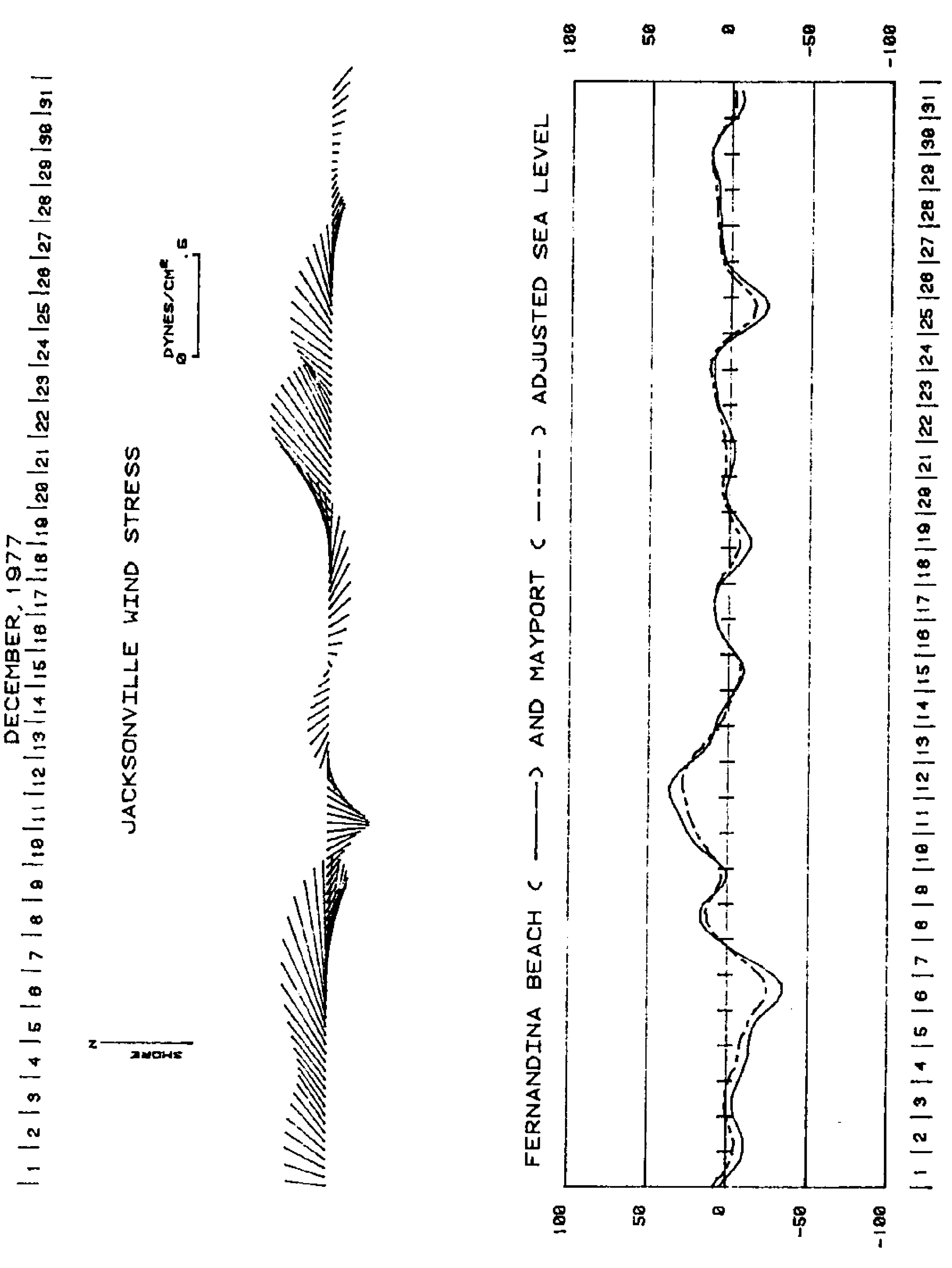

AUGUST, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5
FERNANDINA BEACH (———) AND MAYPORT (-----) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


SEPTEMBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5

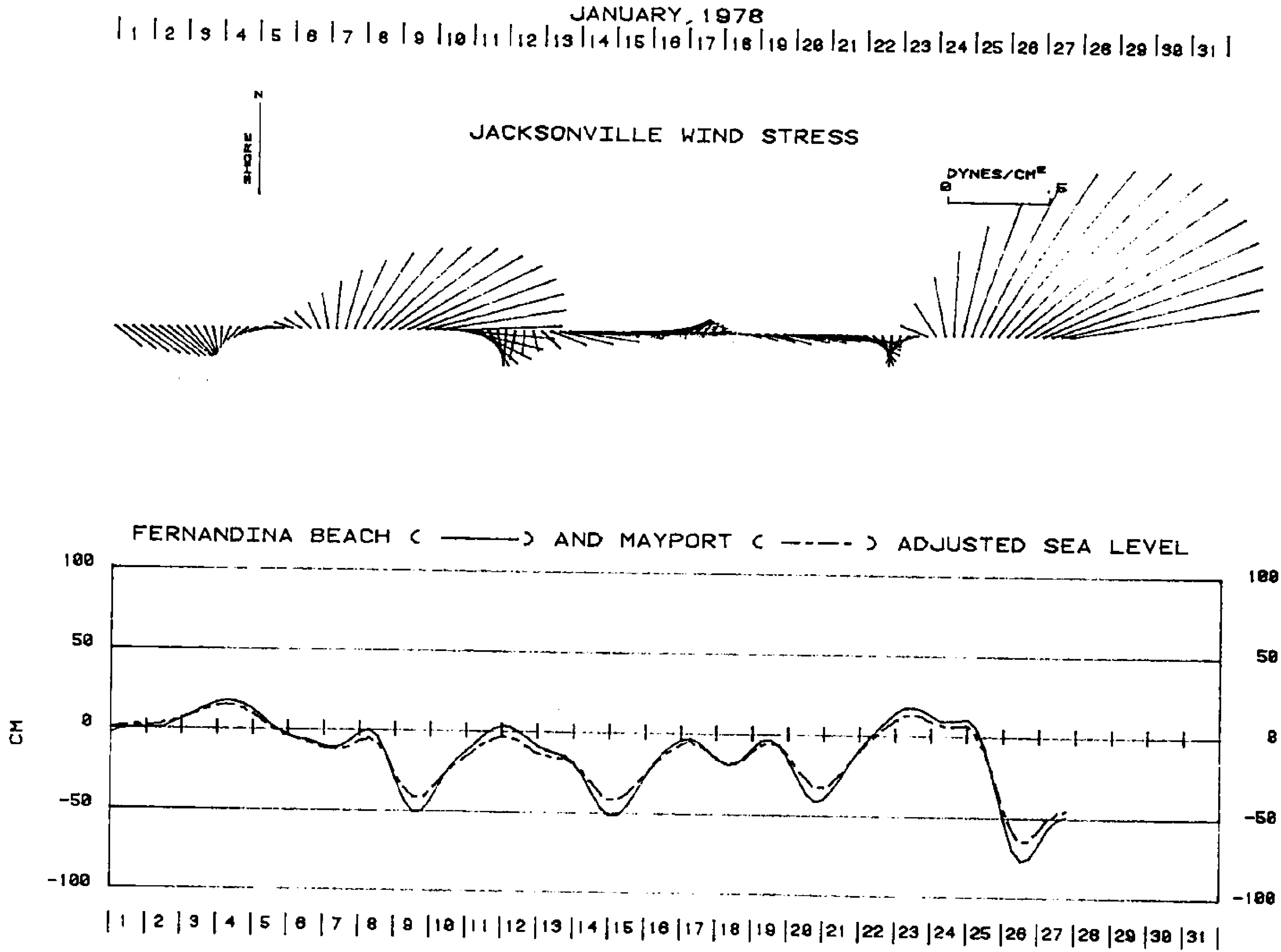

FERNANDINA BEACH (———) AND MAYPORT (- - - -) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


OCTOBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5
FERNANDINA BEACH (———) AND MAYPORT (- - -) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


NOVEMBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0 .5
FERNANDINA BEACH (———) AND MAYPORT (- - - -) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM



DECEMBER, 1977
JACKSONVILLE WIND STRESS
N
SHORE
0 DYNES/CM² .5
FERNANDINA BEACH (———) AND MAYPORT (— — —) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

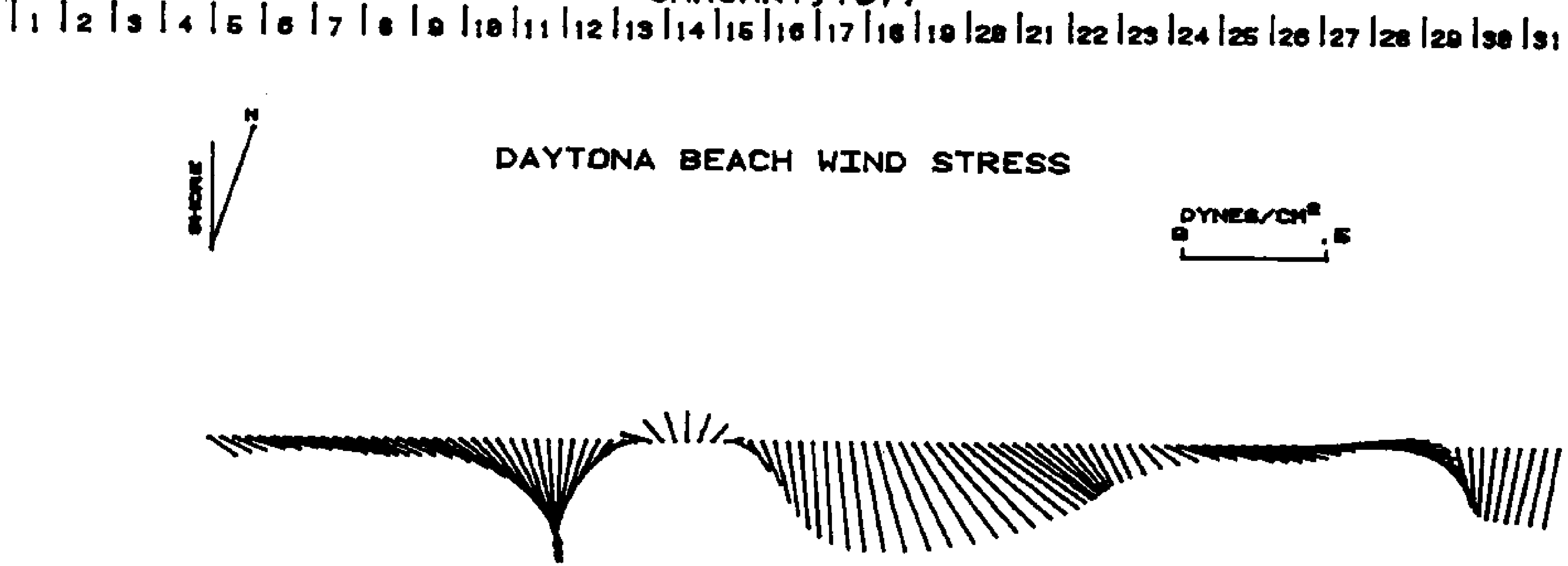


JANUARY, 1978
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
JACKSONVILLE WIND STRESS
DYNES/CM²
0
.5
FERNANDINA BEACH (————) AND MAYPORT (- - - -) ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

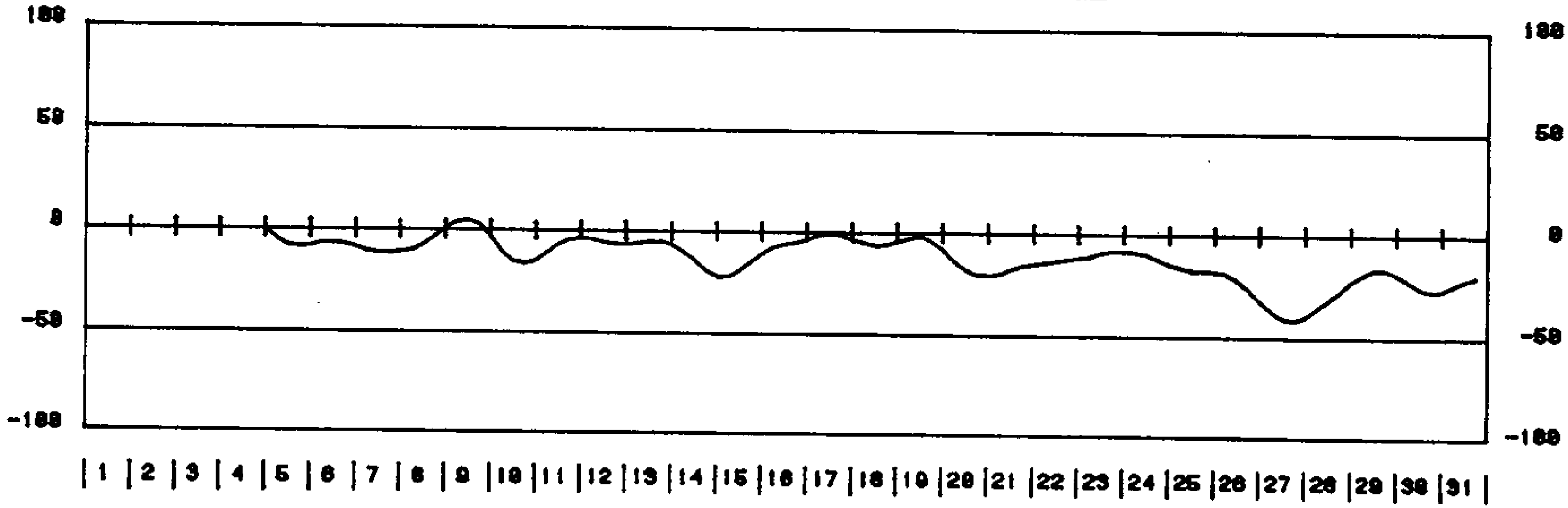
APPENDIX F. DAYTONA BEACH, FLORIDA, ADJUSTED SEA LEVEL FOR JANUARY, 1977 THROUGH JANUARY, 1978.

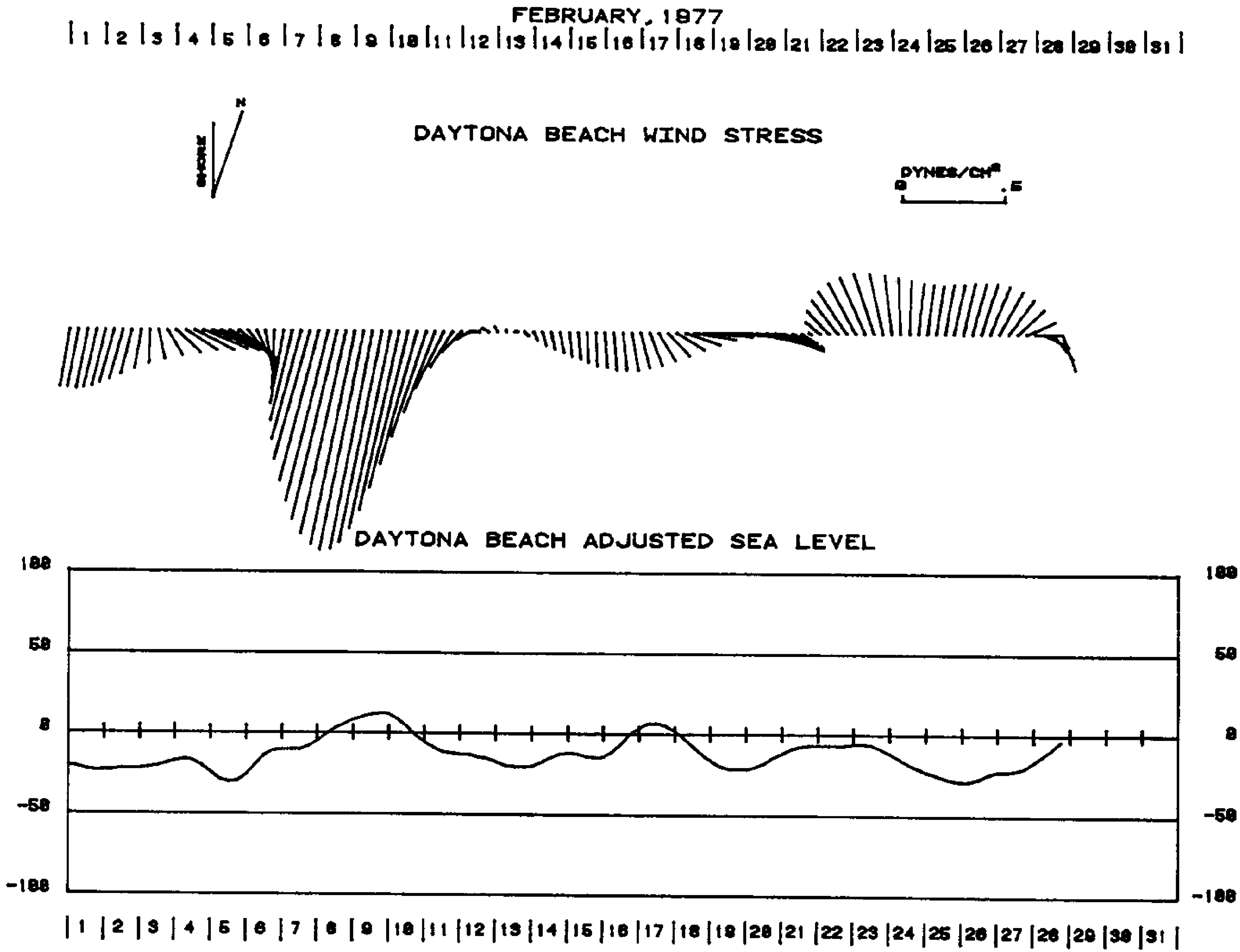
JANUARY, 1977

DAYTONA BEACH WIND STRESS



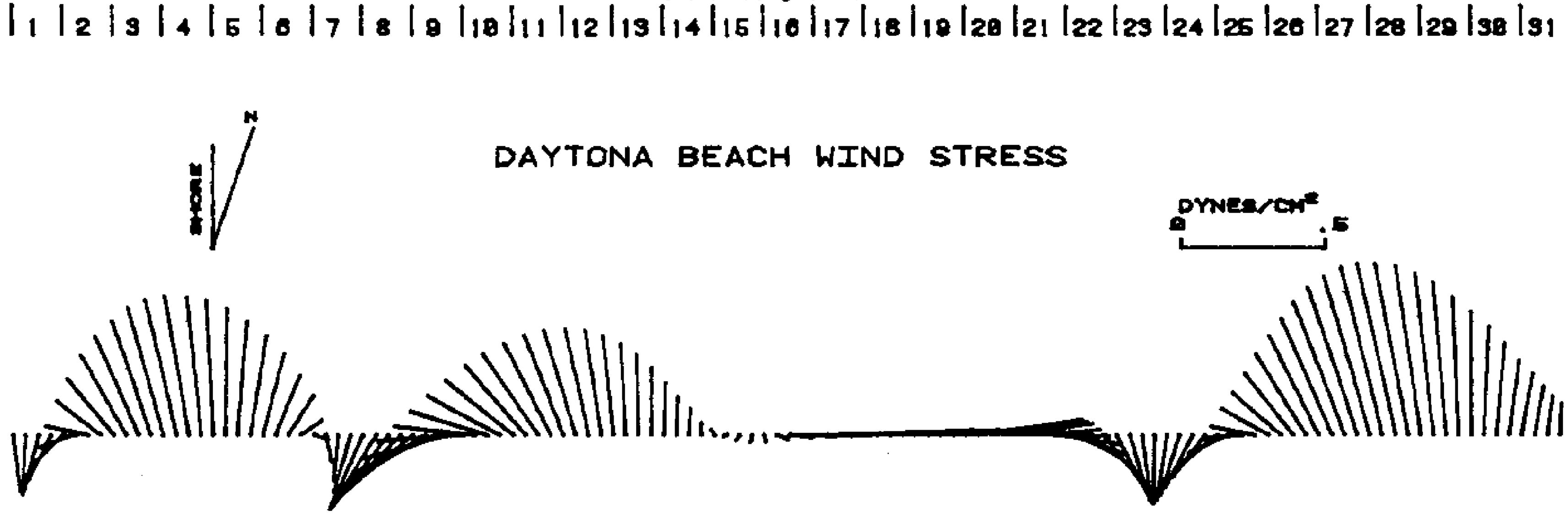
DAYTONA BEACH ADJUSTED SEA LEVEL



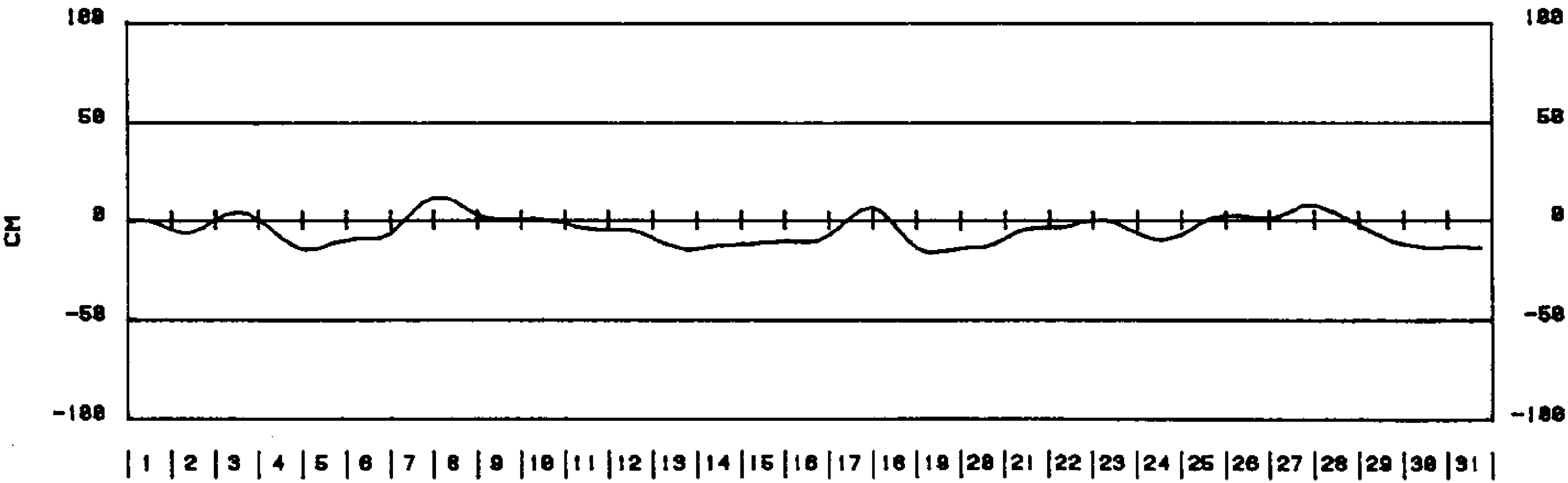


FEBRUARY, 1977
DAYTONA BEACH WIND STRESS
N
SHORE
DYNES/CM²
0
.5
DAYTONA BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100

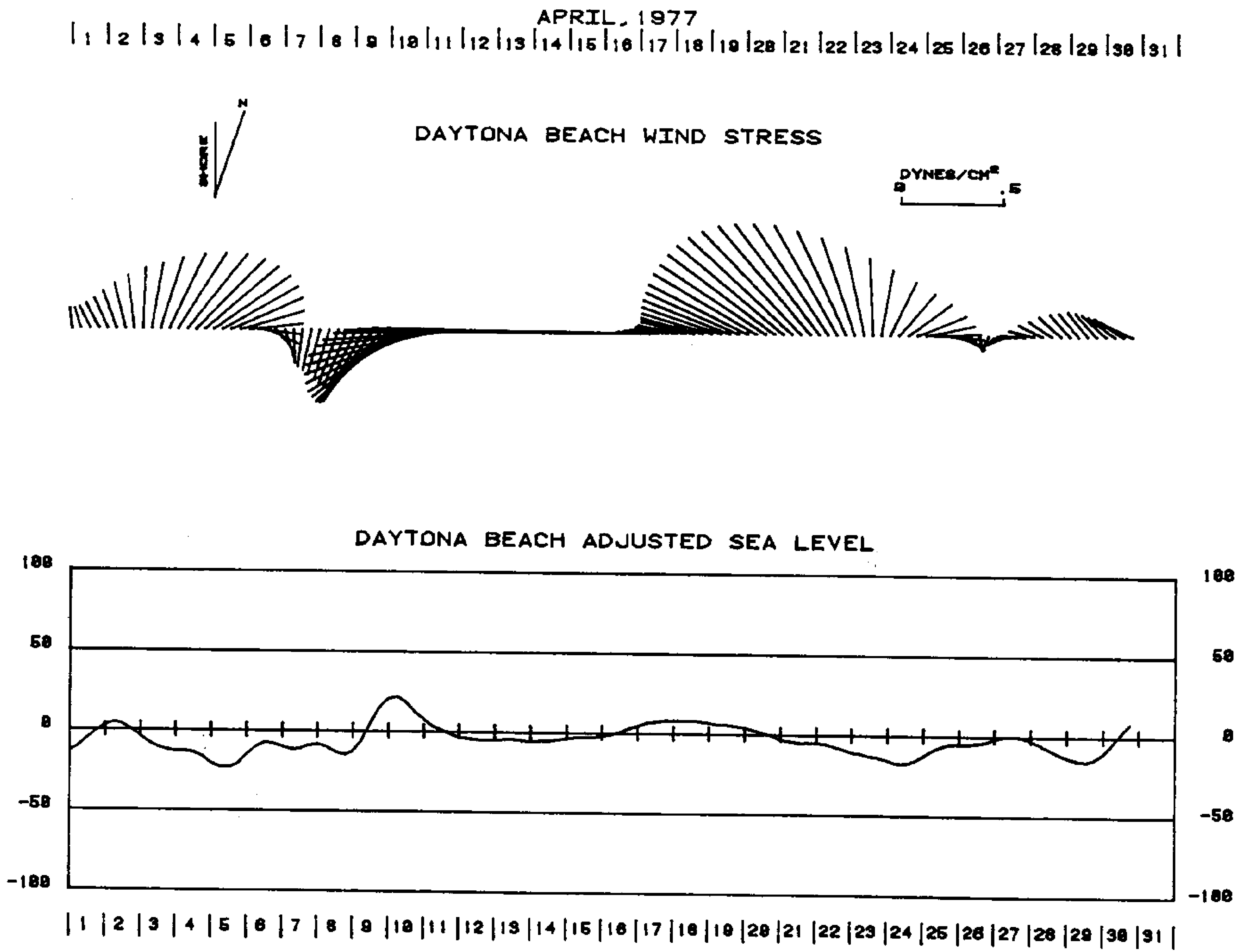
MARCH, 1977

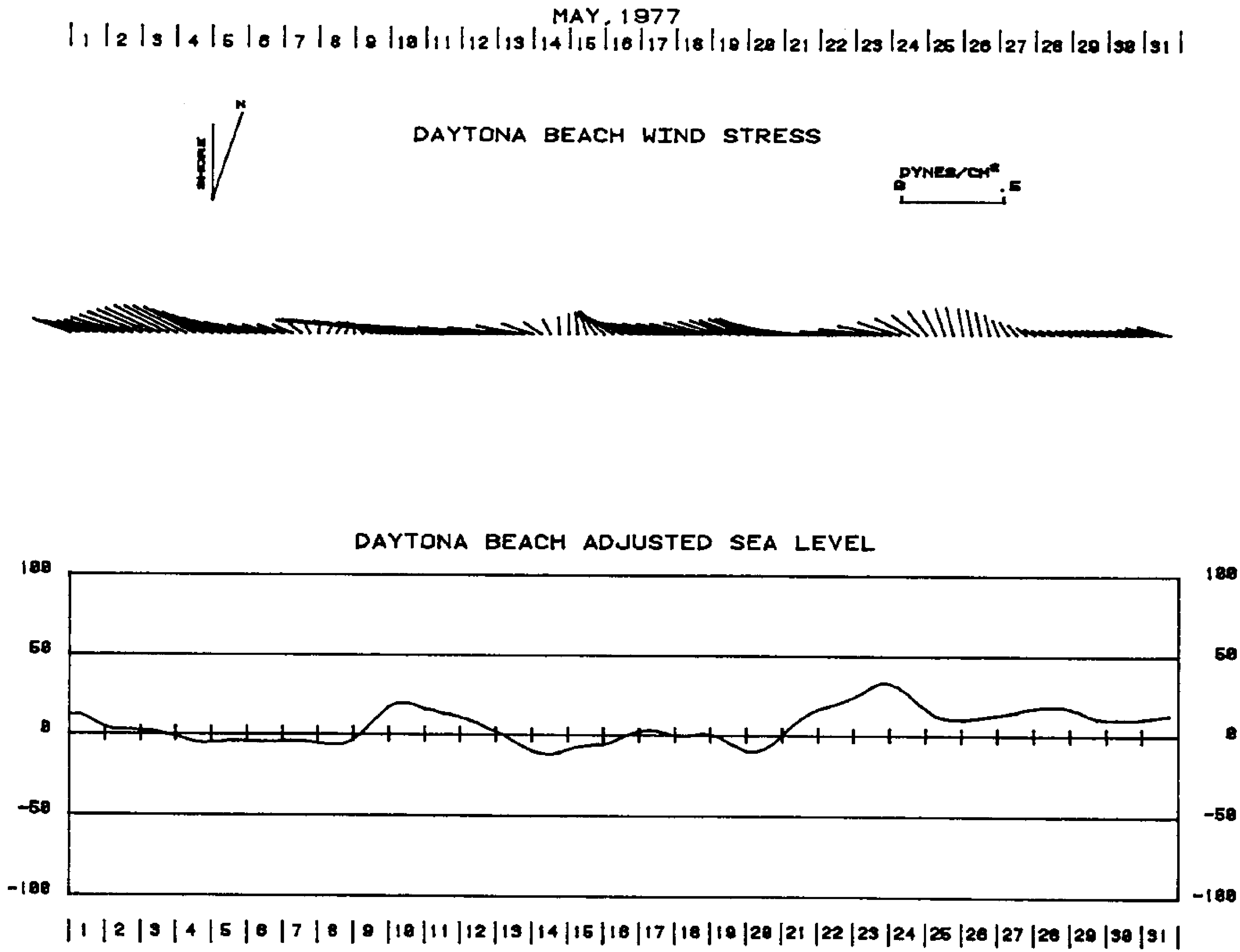


| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
DAYTONA BEACH WIND STRESS
N
SHORE
DYNES/CM²
0
.5



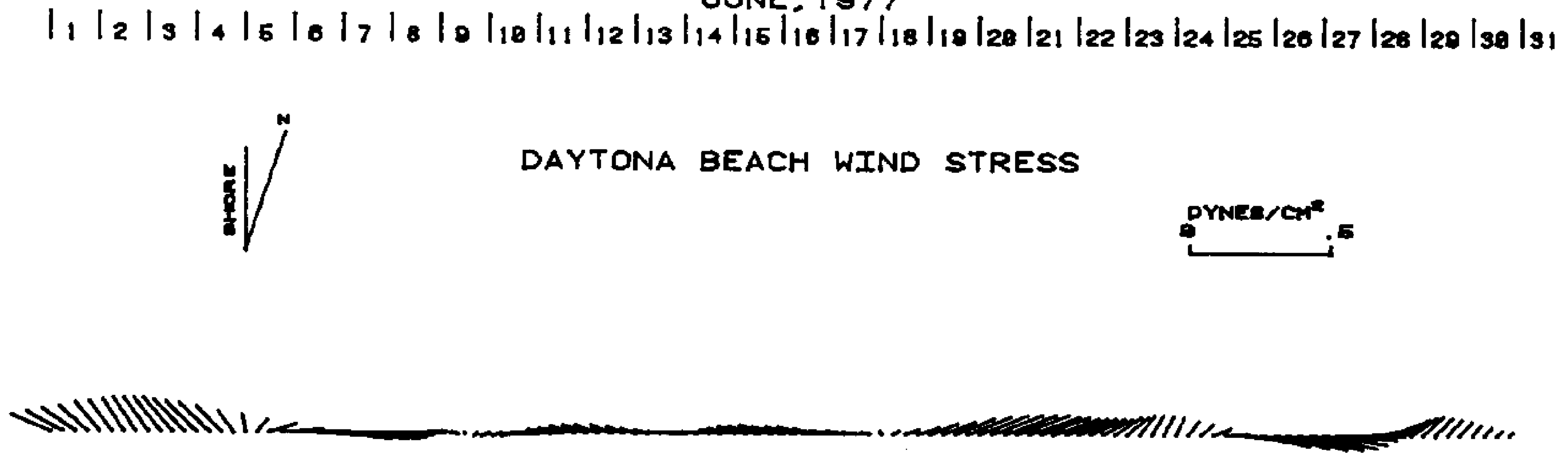
DAYTONA BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |


APRIL, 1977
DAYTONA BEACH WIND STRESS
N
SHORE
DYNES/CM²
0
.5
DAYTONA BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

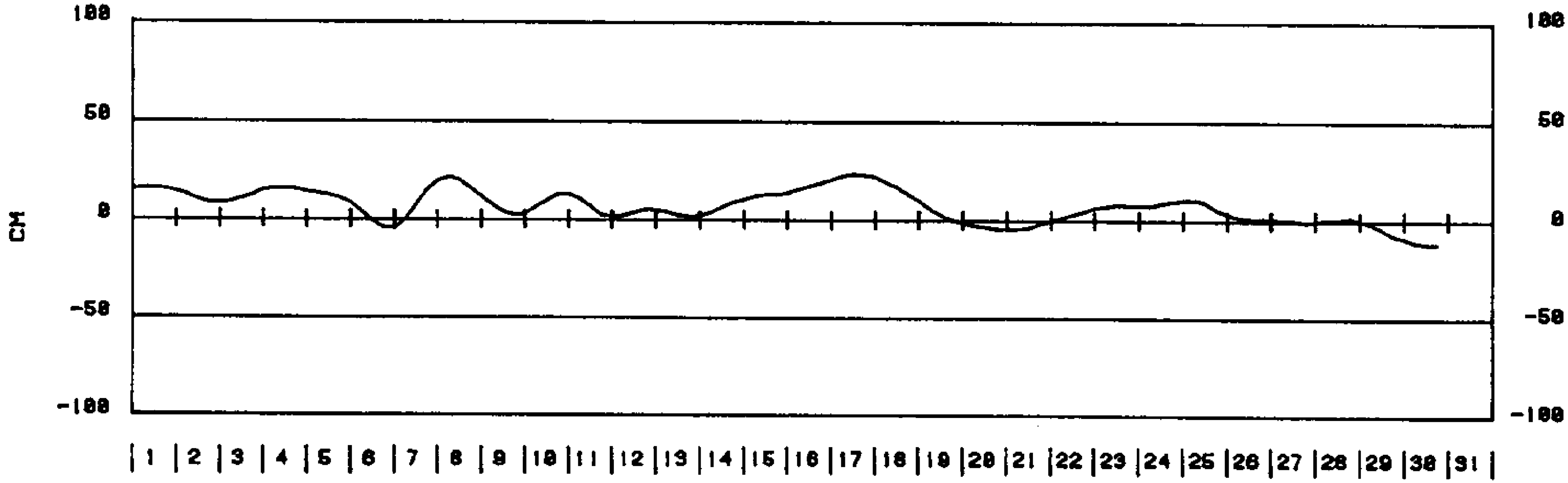


MAY, 1977
DAYTONA BEACH WIND STRESS
N
SHORE
DYNES/CM²
0
.5
DAYTONA BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

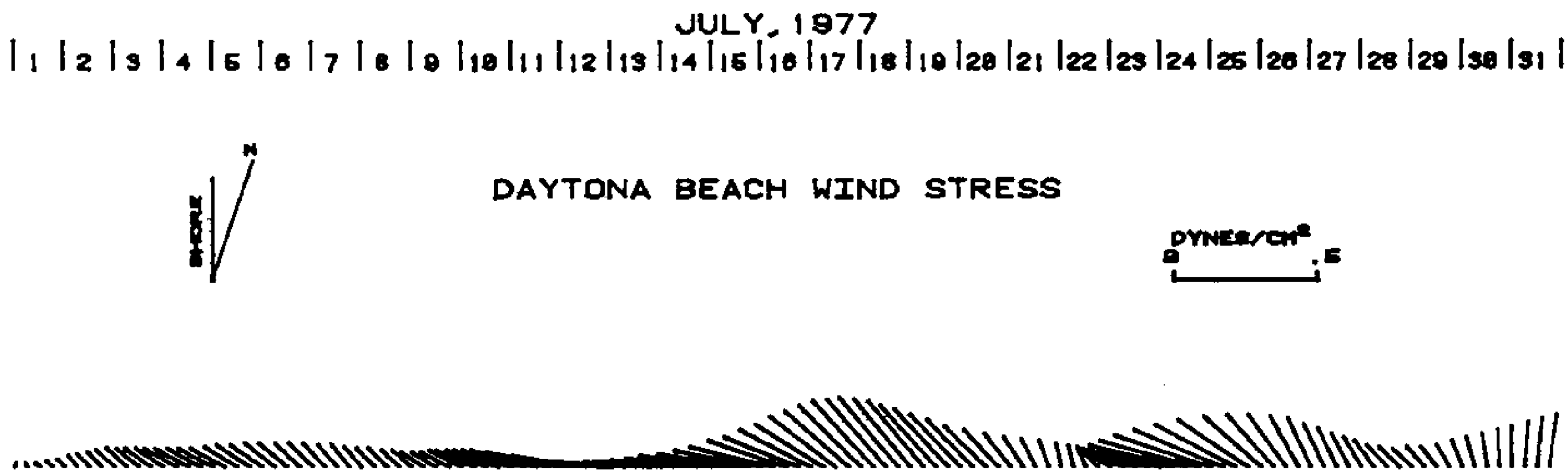
JUNE, 1977

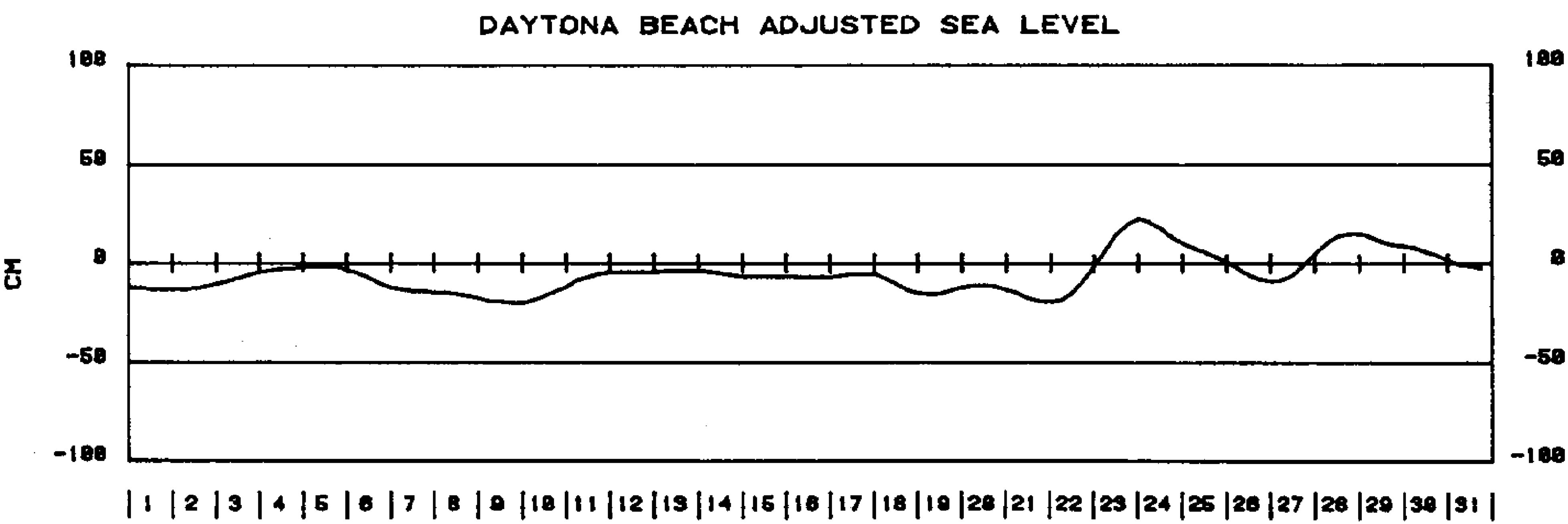


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
DAYTONA BEACH WIND STRESS
N
SHORE
DYNES/CM²
0 .5

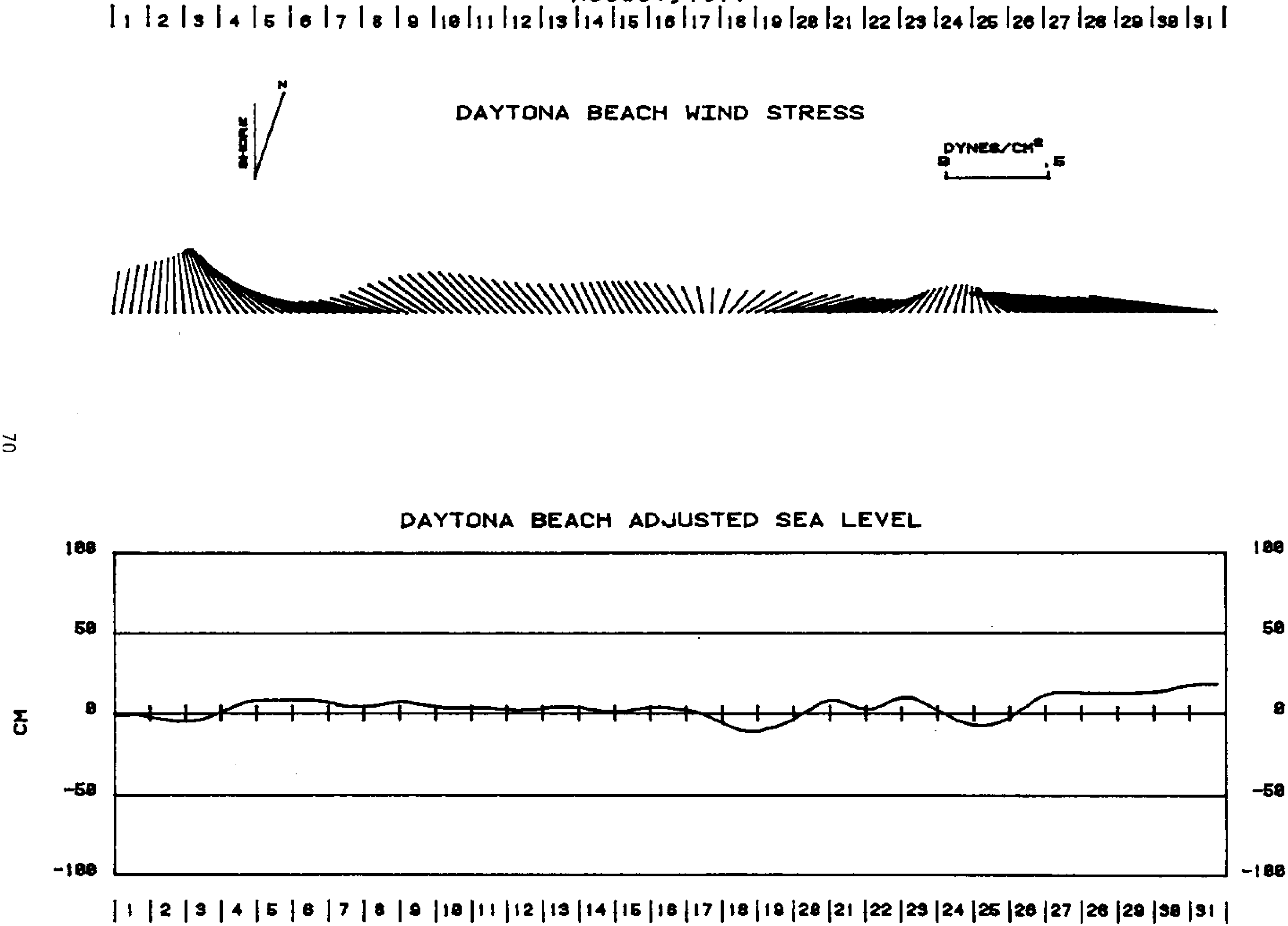


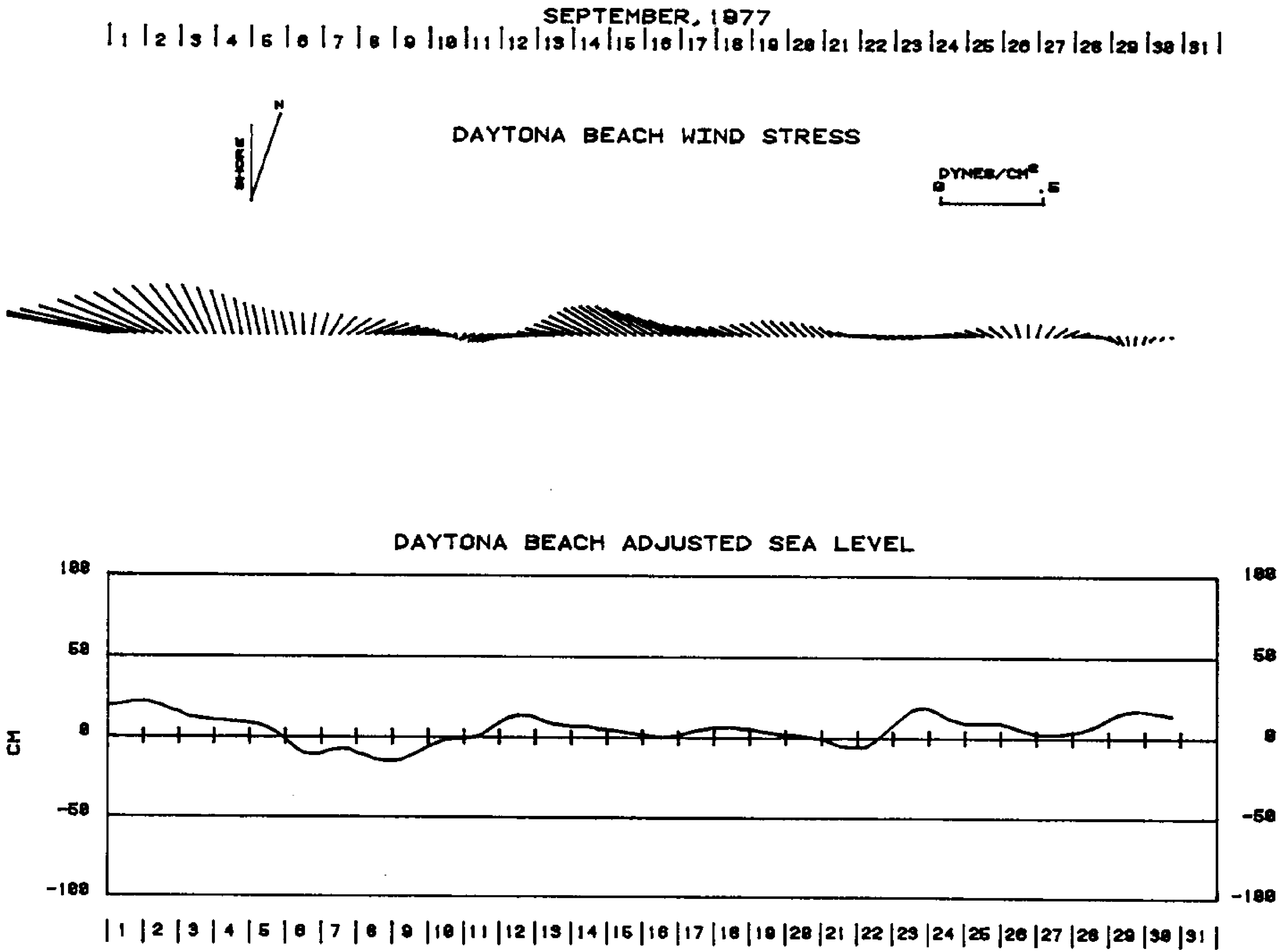
DAYTONA BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

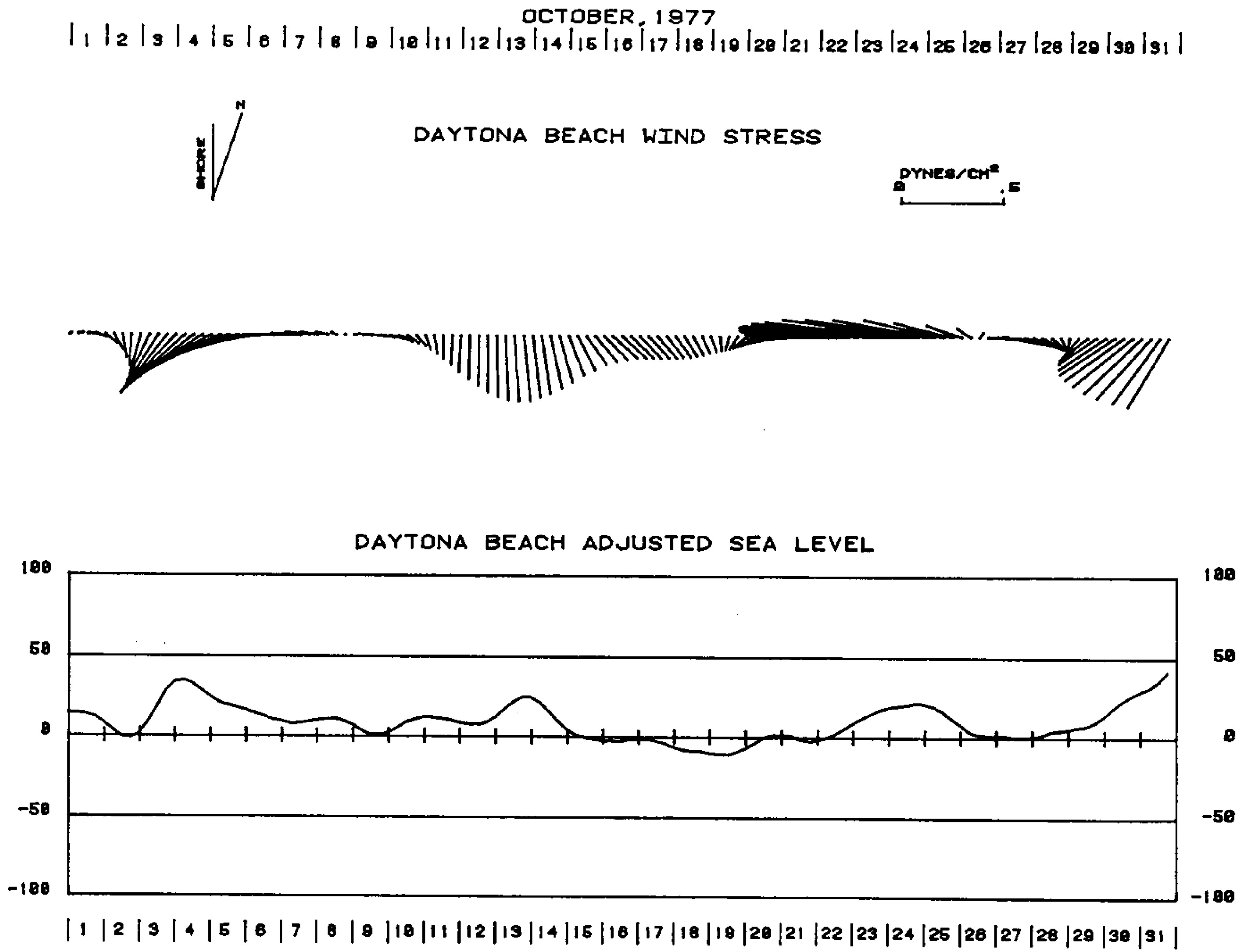

JULY, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
DAYTONA BEACH WIND STRESS
DYNES/CM²
0 .5


DAYTONA BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

AUGUST, 1977

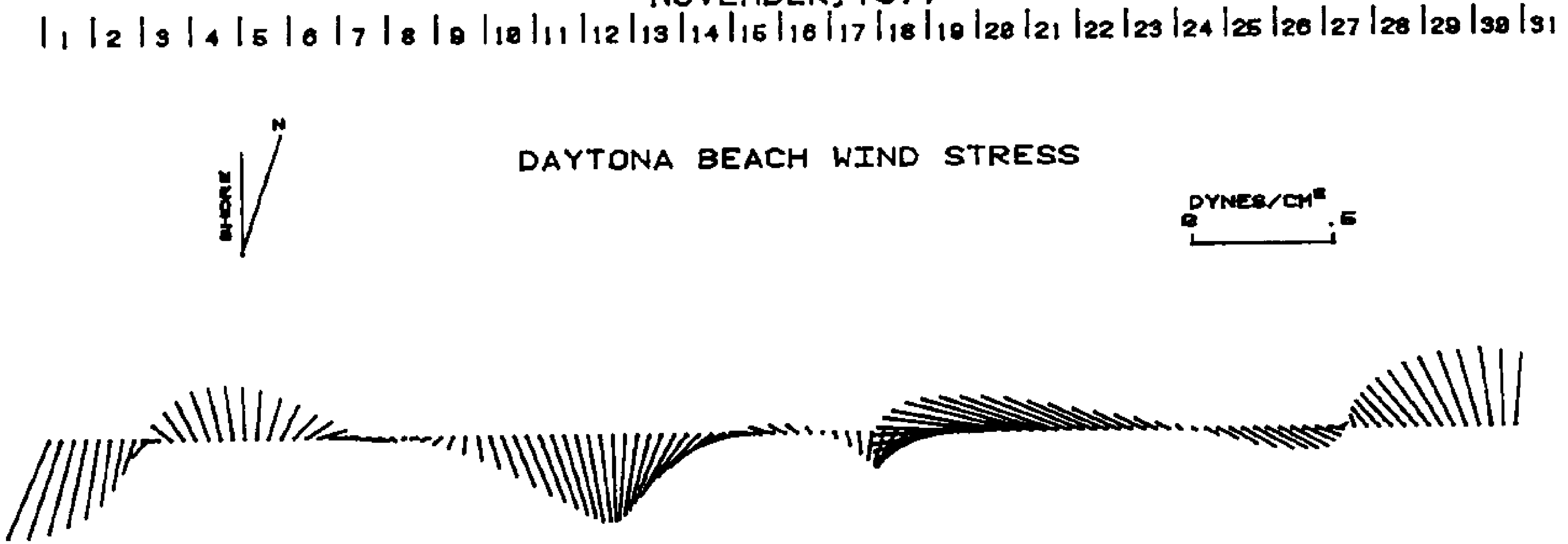

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
DAYTONA BEACH WIND STRESS
DYNES/CM²
0
.5
DAYTONA BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

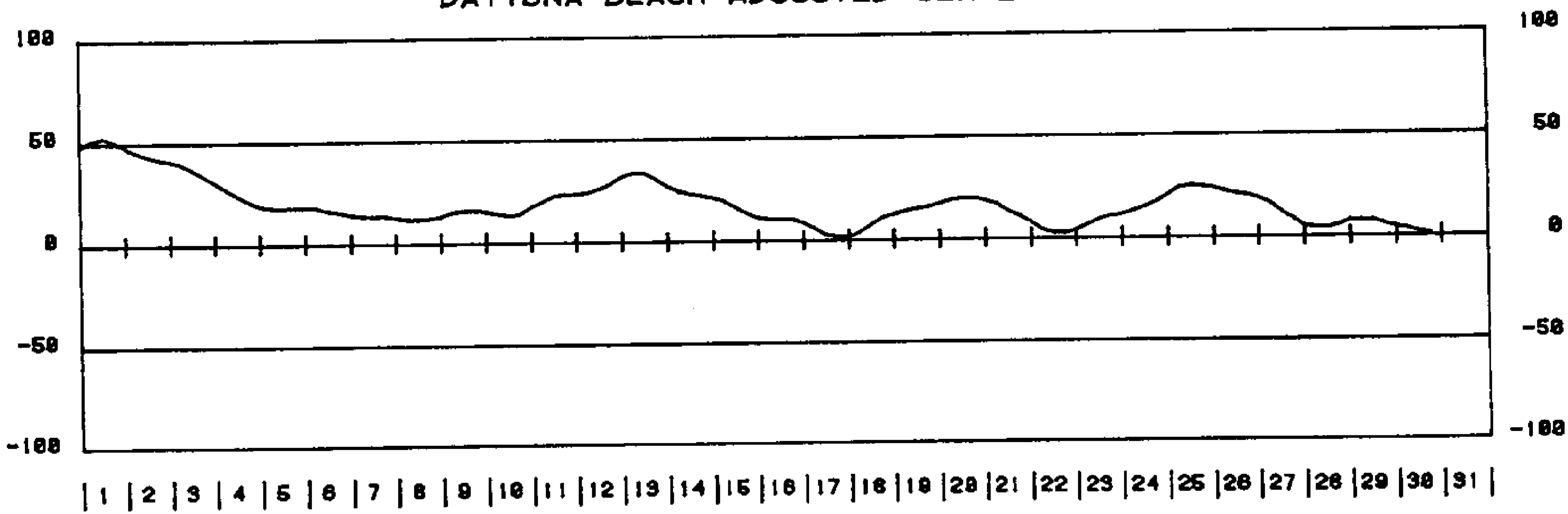

SEPTEMBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
DAYTONA BEACH WIND STRESS
DYNES/CM²
0 .5
DAYTONA BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

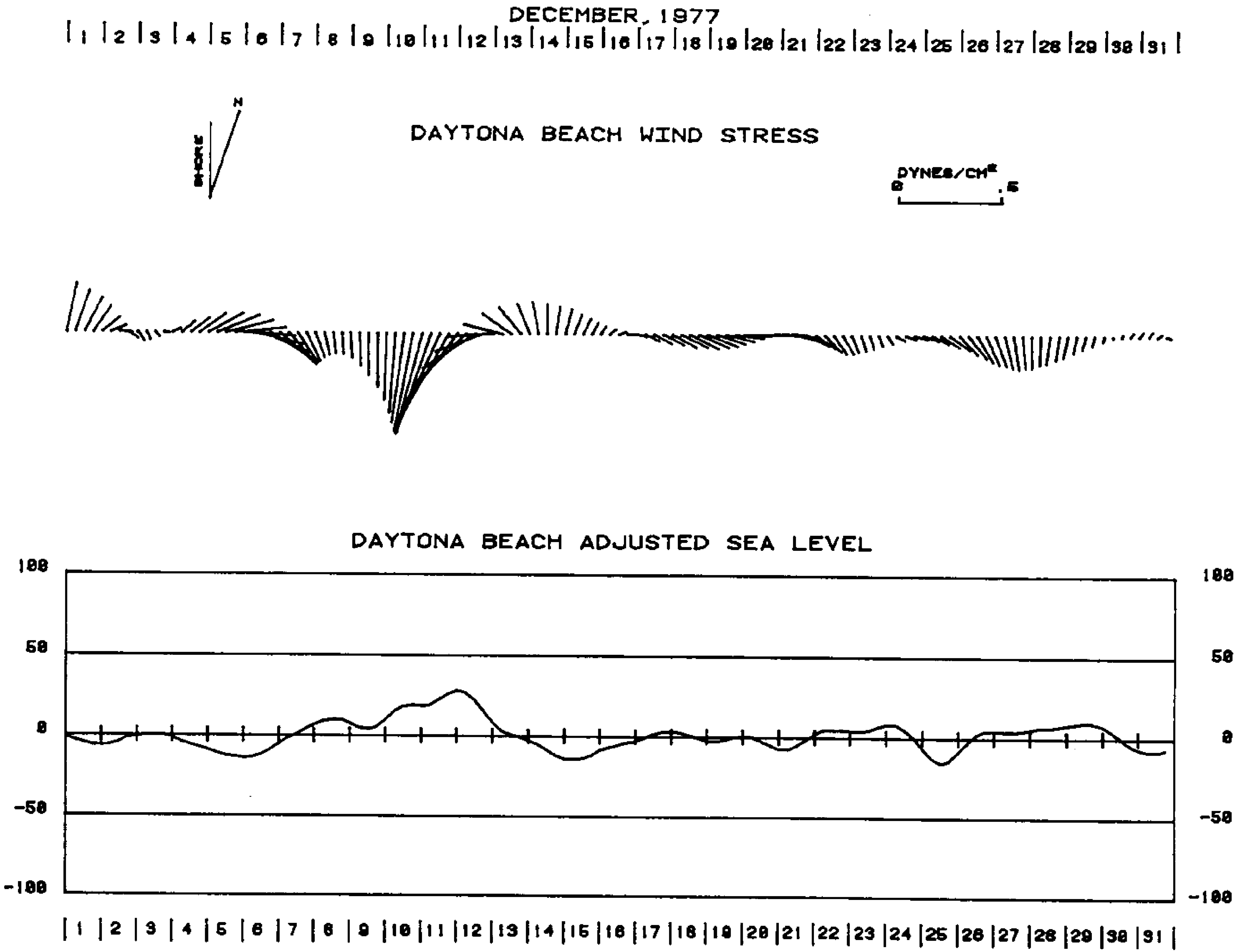


OCTOBER, 1977
DAYTONA BEACH WIND STRESS
SHORE
N
DYNES/CM²
0 .5
DAYTONA BEACH ADJUSTED SEA LEVEL
CM
100
50
0
-50
-100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

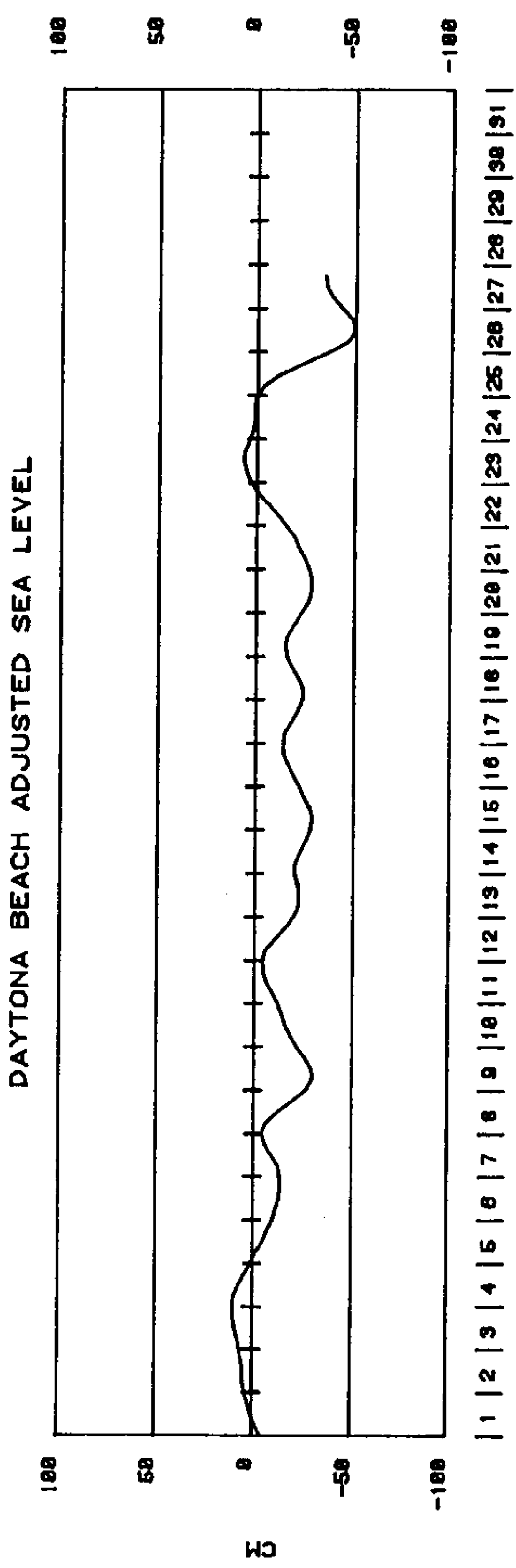
NOVEMBER, 1977






DECEMBER, 1977
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
N
SHORE
DAYTONA BEACH WIND STRESS
DYNES/CM²
0 .5
DAYTONA BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


JANUARY, 1978
DAYTONA BEACH WIND STRESS
DYNES/CM²
0
.5
N
SHORE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31


DAYTONA BEACH ADJUSTED SEA LEVEL
100
50
0
-50
-100
CM
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31