

N O T I C E

THIS DOCUMENT HAS BEEN REPRODUCED FROM
MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT
CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED
IN THE INTEREST OF MAKING AVAILABLE AS MUCH
INFORMATION AS POSSIBLE

"Made available under NASA sponsorship
in the interest of early and wide dis-
semination of Earth Resources Survey
Program information and without liability
for any use made thereof."

E82-10211
CR-168772

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

(E82-10211) GROUND SUPPORT DATA FROM JULY
10 TO JULY 29, 1978, FOR HCMH THERMAL
SATELLITE DATA OF THE POWDER RIVER BASIN,
WYOMING (Geological Survey) 48 p
HC A03/MF A01

N82-23584

Unclass
00211

CSCL 081 G3/43

Ground support data from July 10 to July 29, 1978, for HCMH
thermal satellite data of the Powder River Basin, Wyoming

by

~~S. M.~~ Miller, Ken Watson and Roy Kipfinger

SUSANNE HUMMER-MILLER

Open file report 80-469

1980

This report is preliminary and has not been edited for
conformity with U.S. Geological Survey standards.

Introduction

Radiometric and meteorological data were acquired at three ground stations located approximately 150 km apart in the Powder River Basin, Wyoming. These data were collected from July 10 through July 29, 1978, to support the HCMM (Heat Capacity Mapping Mission) thermal satellite data acquired during this same time period. The parameters measured are direct solar radiance, total solar radiance, sky radiance, air temperature, relative humidity, wind speed, and wind direction. The description of the instrumentation can be found in a report by Miller and Watson (1980). Measurement accuracies are summarized in Table 2.

Data Summary

Ground stations were established at three localities (Fig. 1) in the Powder River Basin. The station sites were selected to characterize the regional meteorological conditions of the Basin and to be close enough together to be maintained daily. Station number 1 was on the Innes ranch northeast of the Pumpkin Buttes. Station number 2 was approximately 10 km north of Sheridan, Wyoming, on property belonging to the Peter Kewit Son's Mining Company. Station number 3 was on the U.S. Bureau of Reclamation land at the dam of Pathfinder Reservoir, approximately 60 km southwest of Casper, Wyoming.

Table 1 summarizes the measurements collected at each site. All of the radiometric and meteorological data were recorded continuously on chart recorders and digitized at half hour intervals. Figure 2 through 40 present these data adjusted to local solar time. For those measurements taken simultaneously at more than one site, the data are

displayed on the same graph with a displacement of the ordinate axis. The amount of displacement is noted in the figure caption. Data for station no. 1 are represented by a solid line, for station no. 2 by a broken line (- . -), and for station no. 3 by another broken line (- . . -). The approximate accuracies of the various measurements are tabulated in Table 2.

Acknowledgements

This field work was made more successful because of the cooperation of Ron Innes, Peter Kewit Son's Mining Co., and the U.S. Bureau of Reclamation. All three provided access to their land and facilities. Thanks goes to Tim Townsend of Stanford University and Rick Levison of the University of Wyoming for their help in collecting the data. This work represents one portion of HCMM investigation under Contract HCM-027 sponsored by the U.S. National Aeronautics and Space Administration.

References

Miller, S. H. and Watson, Kenneth, 1980, Ground support data for the aircraft multispectral reflectance and thermal scanner mission Nov./Dec. 1977, on the island of Hawaii: U.S. Geological Survey Open-File Report, 80-470, p. 40.

Table 1. - Summary of data coverage at each of the three stations from July 10 through July 29, 1978.
(P indicates partial coverage; X indicates total coverage)
(Leaders (- -) indicate no data)

DATE	SKY RADIANCE			DIRECT SOLAR RADIANCE	TOTAL SOLAR RADIANCE	AIR TEMPERATURE	RELATIVE HUMIDITY	WIND SPEED	WIND DIRECTION
	SITE 1	SITE 2	SITE 3	SITE 1	SITE 1 SITE 2 SITE 3	SITE 1 SITE 2	SITE 1 SITE 2	SITE 1 SITE 2	SITE 1 SITE 2
July 10	X	P	P	X	X - - P	X X	X X	X - -	X X
11	X	X	X	P	X P X	X X	X X	X - -	X P
12	X	X	X	- -	X X X	X X	X X	X - -	X - -
13	X	X	- -	P	X X X	X X	X X	X - -	X P
14	X	X	X	X	X X X	P X	X X	X X	X X
15	X	X	X	X	X X X	X X	X X	X X	X X
16	X	X	X	P	X X X	P X	X X	X X	X X
17	X	X	X	- -	X X X	X X	X X	X X	X X
18	X	X	X	- -	X X X	X X	X X	X X	X X
19	X	X	P	- -	X X P	X X	X X	X X	X X
20	X	X	X	- -	X X X	X X	X X	X X	X X
21	X	P	X	- -	X P X	X X	X X	X X	X X
22	X	- -	P	- -	X X P	X X	X X	X X	X X
23	- -	- -	X	P	X X X	X P	X P	X X	X X
24	X	X	X	X	X X X	X P	X X	X X	X X
25	X	X	X	X	X X X	X X	X X	X X	X X
26	X	X	X	X	X X X	X X	X X	X X	X X
27	X	X	X	X	X X X	X X	X X	X X	X X
28	X	X	X	X	X X X	X X	X X	X X	X X
29	X	X	X	X	X X X	X X	X X	X X	X X

Table 2. - Tabulation of the approximate accuracies of the measured parameters.

Instrument	Parameter Measured	Approx. Accuracy
Normal Incidence Pyrheliometer	Direct Solar Radiance	30 W/m ²
Precision Spectral Pyranometer	Total Solar Radiance	25 W/m ²
Precision Infrared Radiometer	Sky Radiance	20 W/m ²
RH/TEMP Sensor	Air Temperature	1° C
	Relative Humidity	5%
Wind System	Wind Speed	1 m/sec
	Wind Direction	25°

LIST OF FIGURES

Figure 1.--Map of northeastern Wyoming showing location of stations.

Figure 2.--Total solar radiance for July 10, 11, 12, and 13 from stations 1, 2, and 3.

Figure 3.--Total solar radiance for July 14, 15, 16, and 17 from stations 1, 2, and 3.

Figure 4.--Total solar radiance for July 18, 19, 20, and 21 from stations 1, 2, and 3.

Figure 5.--Total solar radiance for July 22, 23, 24, and 25 from stations 1, 2, and 3.

Figure 6.--Total solar radiance for July 26, 27, 28, and 29 from stations 1, 2, and 3.

Figure 7.--Direct solar radiance for July 10, 11, 13, and 14 from station 1.

Figure 8.--Direct solar radiance for July 15, 16, 23, and 24 from station 1.

Figure 9.--Direct solar radiance for July 25, 26, 27, and 28 from station 1.

Figure 10.--Direct solar radiance for July 29 from station 1.

Figure 11.--Sky radiance for July 10, 11, 12, and 13 from stations 1, 2, and 3.

Figure 12.--Sky radiance for July 14, 15, 16, and 17 from stations 1, 2, and 3.

Figure 13.--Sky radiance for July 18, 19, 20, and 21 from stations 1, 2, and 3.

Figure 14.--Sky radiance for July 22, 23, 24, and 25 from stations 1, 2, and 3.

Figure 15--Sky radiance for July 26, 27, 28, and 29 from stations
1, 2, and 3.

Figure 16--Air Temperature for July 10, 11, 12, and 13 from stations
1 and 2.

Figure 17--Air temperature for July 14, 15, 16, and 17 from stations
1 and 2.

Figure 18--Air temperature for July 18, 19, 20, and 21 from stations
1 and 2.

Figure 19--Air temperature for July 22, 23, 24, and 25 from stations
1 and 2.

Figure 20--Air temperature for July 26, 27, 28, and 29 from stations
1 and 2.

Figure 21--Relative humidity for July 10, 11, 12, and 13 from stations
1 and 2.

Figure 22--Relative humidity for July 14, 15, 16, and 17 from stations
1 and 2.

Figure 23--Relative humidity for July 18, 19, 20, and 21 from stations
1 and 2.

Figure 24--Relative humidity for July 22, 23, 24, and 25 from stations
1 and 2.

Figure 25--Relative humidity for July 26, 27, 28, and 29 from stations
1 and 2.

Figure 26--Wind speed for July 10, 11, 12, and 13 from station 1.

Figure 27--Wind speed for July 14, 15, 16, and 17 from stations 1 and 2.

Figure 28--Wind speed for July 18, 19, 20, and 21 from stations 1 and 2.

Figure 29--Wind speed for July 22, 23, 24, and 25 from stations 1 and 2.

Figure 30--Wind speed for July 26, 27, 28, and 29 from stations 1 and 2.
Figure 31--Wind direction for July 10, 11, 12, and 13 from station 1.
Figure 32--Wind direction for July 14, 15, 16, and 17 from station 1.
Figure 33--Wind direction for July 18, 19, 20, and 21 from station 1.
Figure 34--Wind direction for July 22, 23, 24, and 25 from station 1.
Figure 35--Wind direction for July 26, 27, 28, and 29 from station 1.
Figure 36--Wind direction for July 10, 11, 13, and 14 from station 2.
Figure 37--Wind direction for July 15, 16, 17, and 18 from station 2.
Figure 38--Wind direction for July 19, 20, 21, and 22 from station 2.
Figure 39--Wind direction for July 23, 24, 25, and 26 from station 2.
Figure 40--Wind direction for July 27, 28, and 29 from station 2.

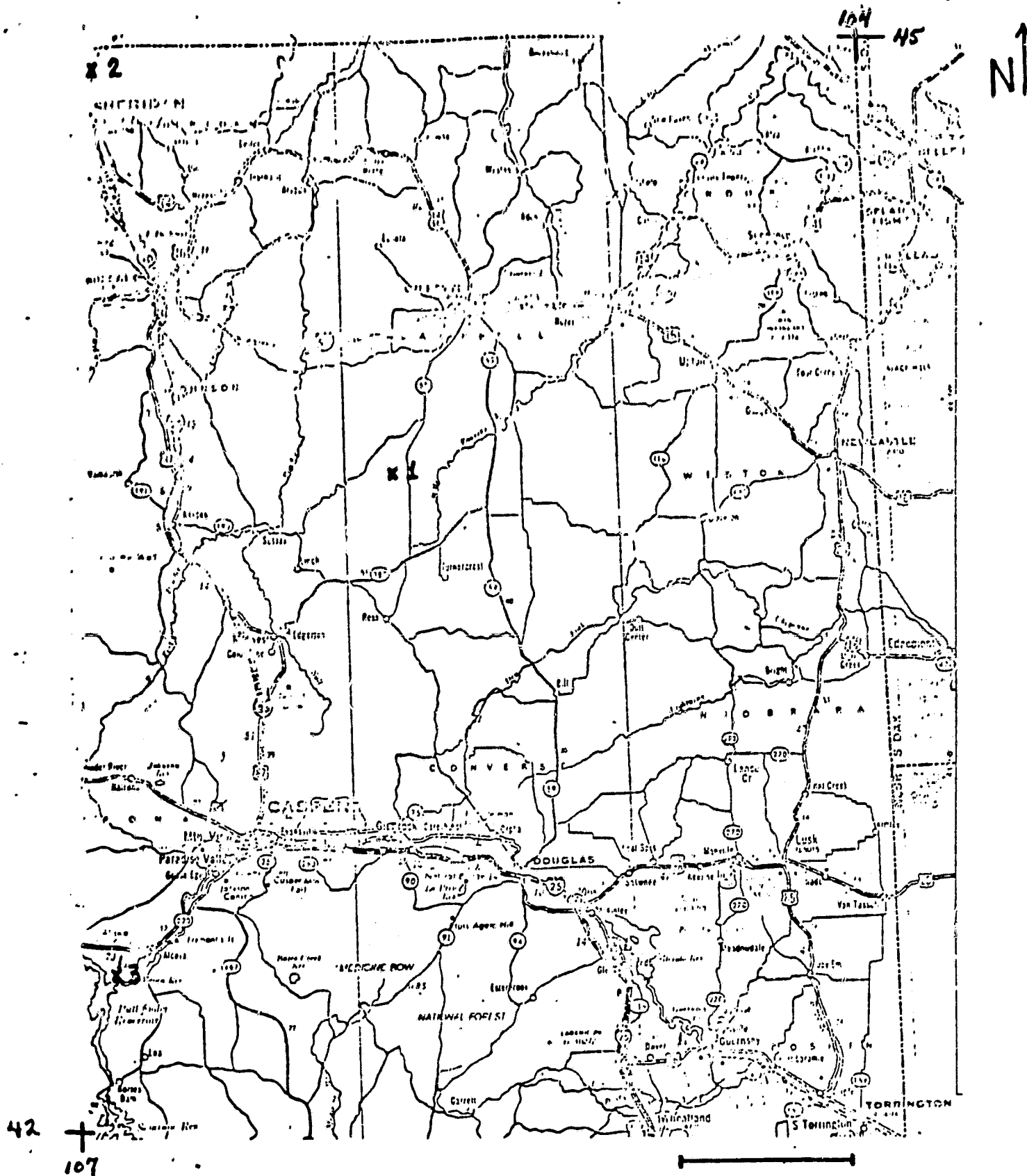


Figure 1. — Map of the Powder River Basin, WY, showing the location of the three ground stations.

0 50 km

ORIGINAL PAGE IS
OF POOR QUALITY

ORIGINAL PAGE IS
OF POOR QUALITY

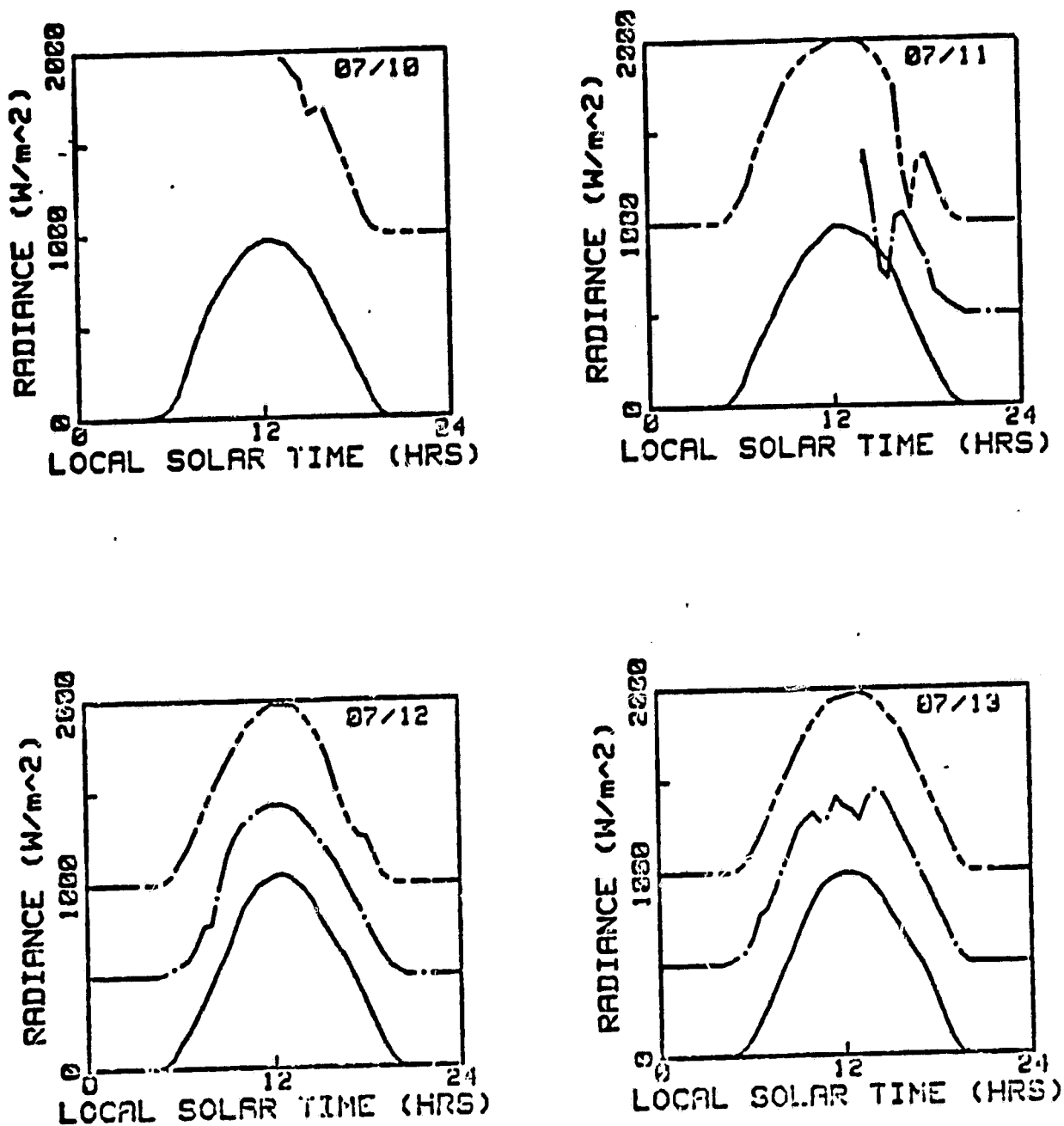


Figure 2. -- Total solar radiance for July 10, 11, 12, and 13 from
station 1 (—), station 2 (---), and station 3
(-.-) (displacement 500 Wm^{-2}).

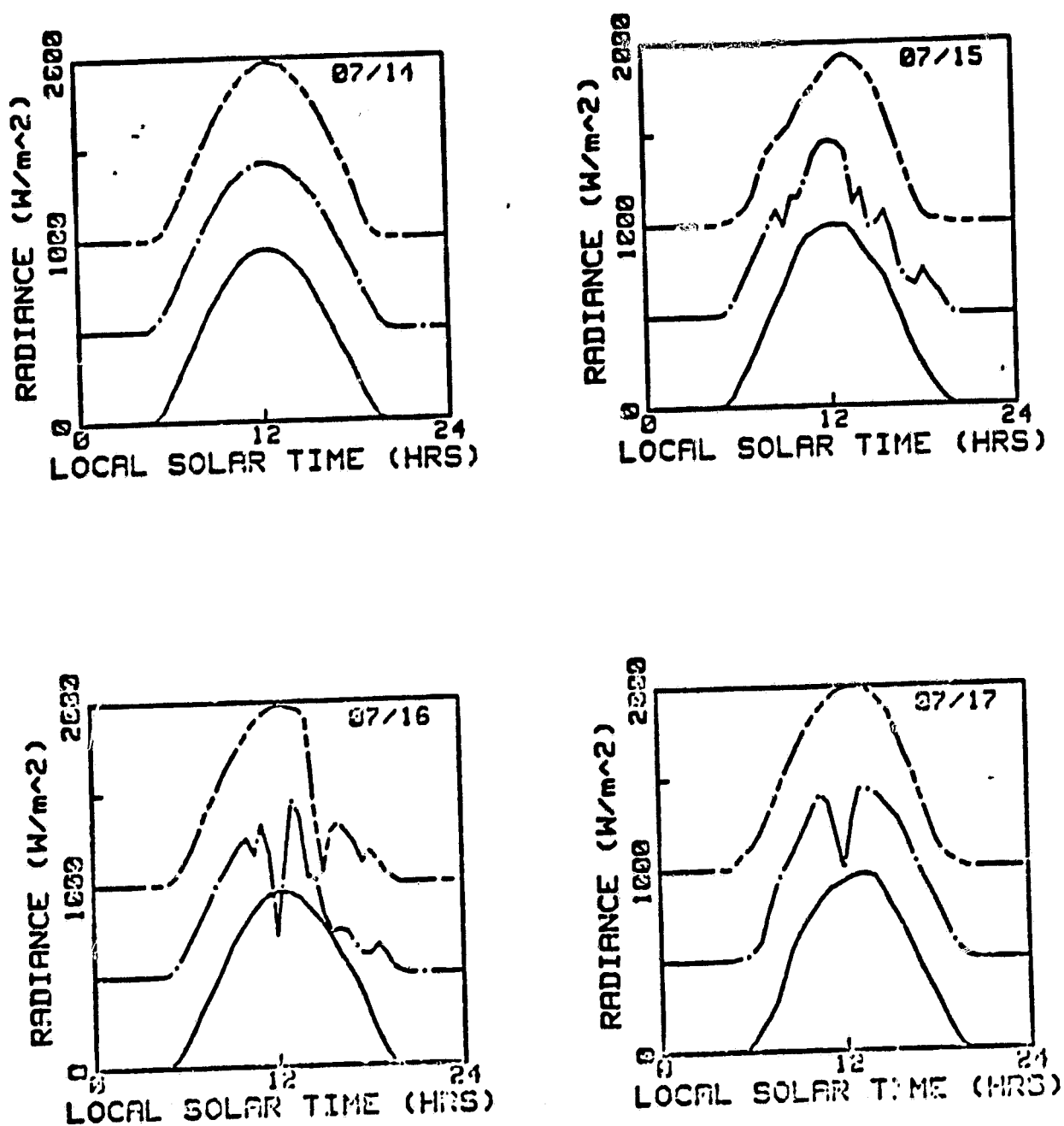


Figure 3. — Total solar radiance for July 14, 15, 16, and 17 from station 1(—), station 2 (---), and station 3 (-.-) (displacement 500 Wm^{-2}).

ORIGINAL PAGE IS
OF POOR QUALITY

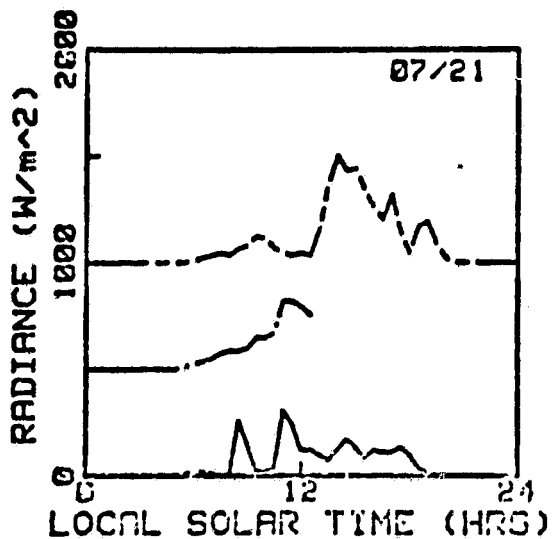
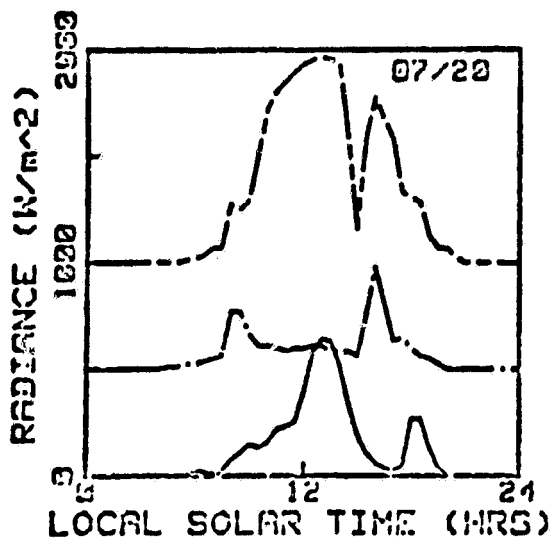
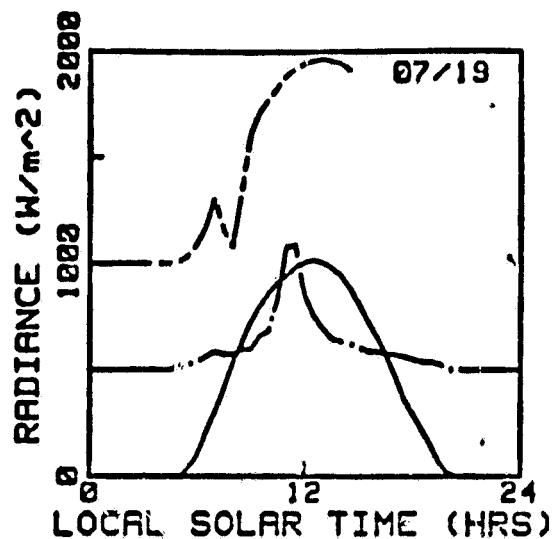
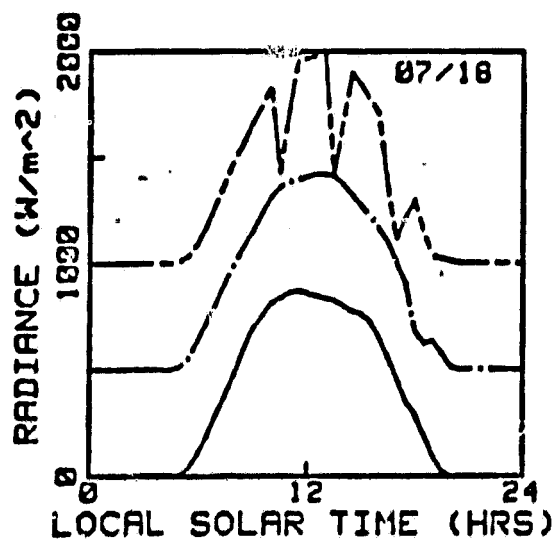


Figure 4. — Total solar radiance for July 18, 19, 20, and 21 from station 1 (—), station 2 (---), and station 3 (-.-) (displacement $500 Wm^{-2}$).

ORIGINAL PAGE IS
OF POOR QUALITY

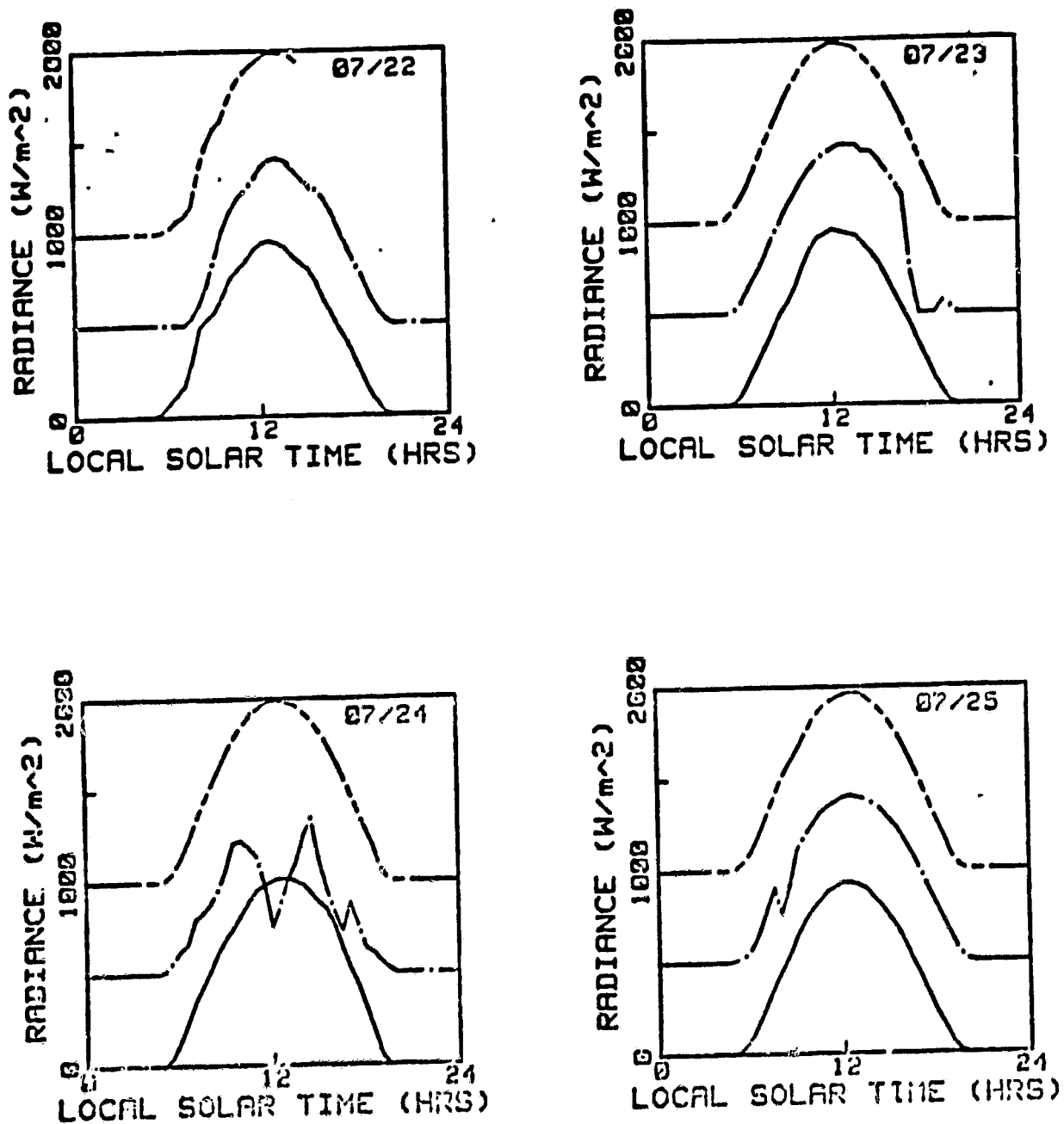


Figure 5. — Total solar radiance from July 22, 23, 24, and 25 from station 1 (—), station 2 (—·—), and station 3 (---) (displacement 500 Wm^{-2}).

ORIGINAL PAGE IS
OF POOR QUALITY

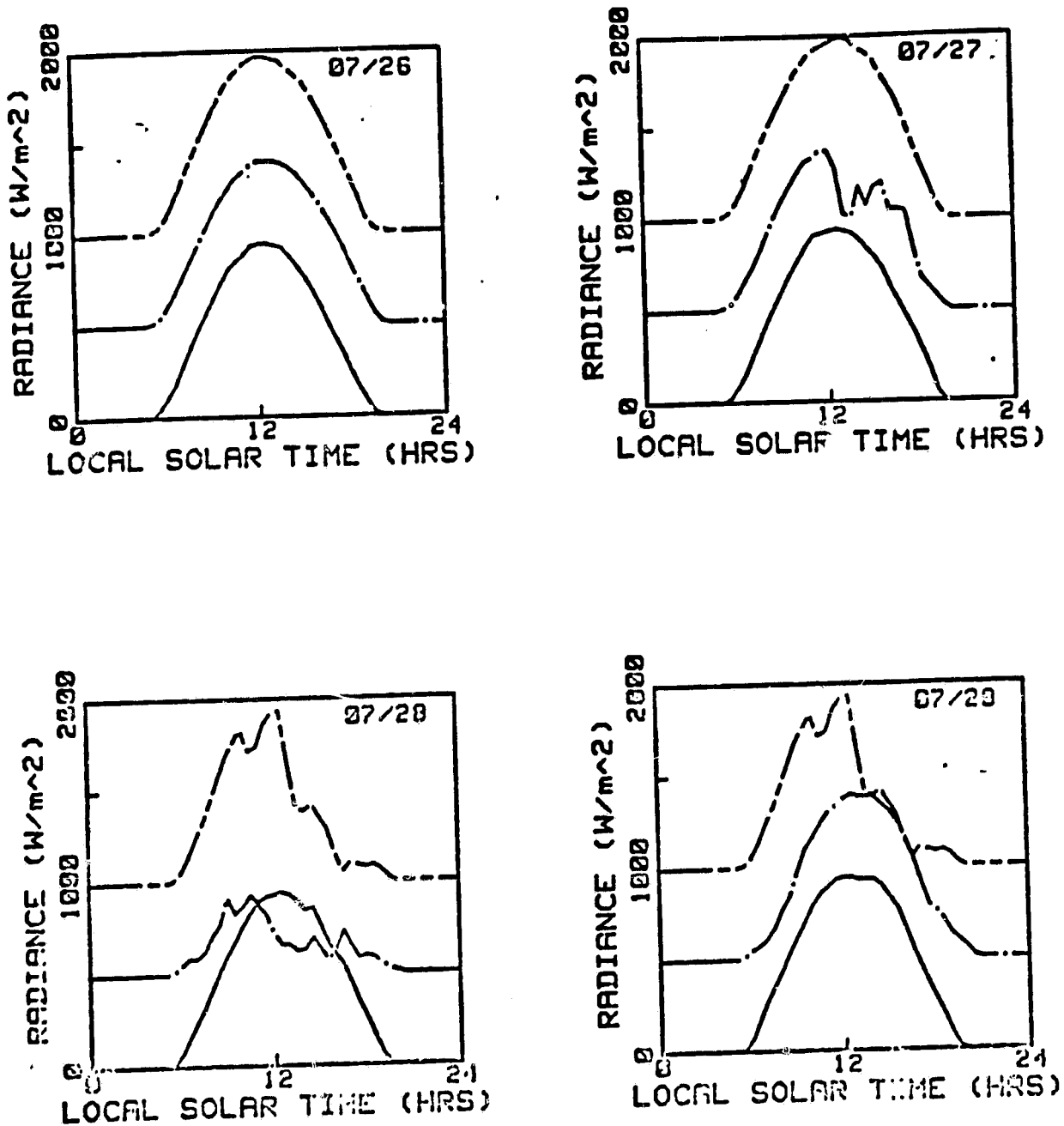


Figure 6. -- Total solar radiance for July 26, 27, 28, and 29 from station 1 (—), station 2 (---), and station 3 (-·-) (displacement 500 Wm^{-2}).

ORIGINAL PAGE IS
OF POOR QUALITY

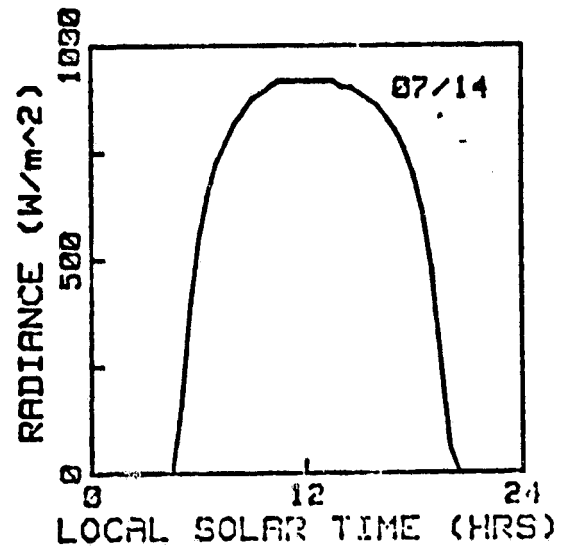
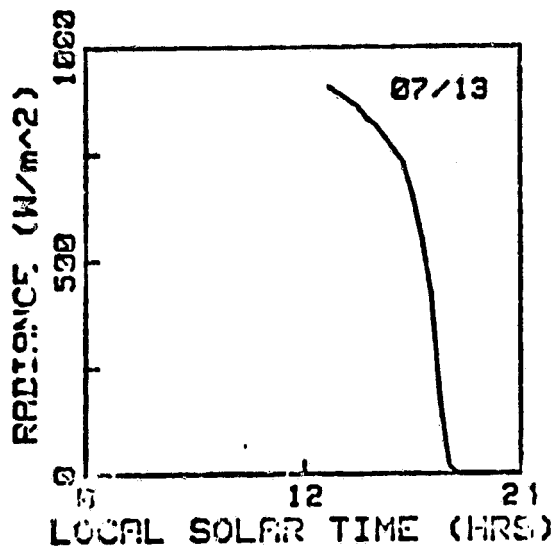
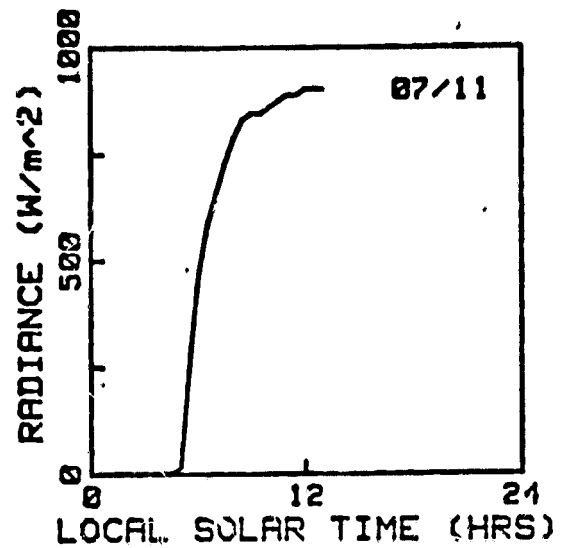
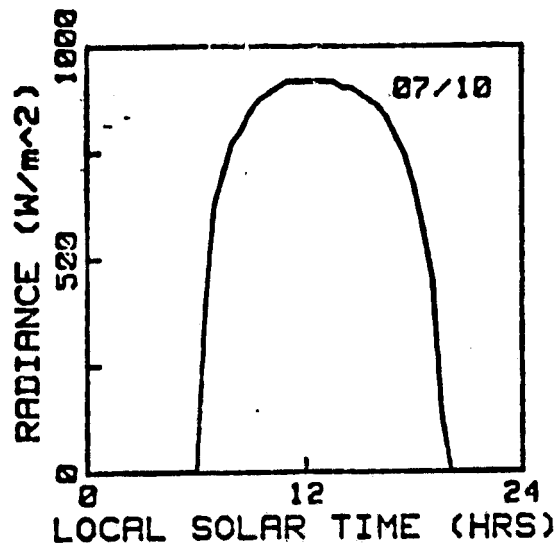


Figure 7. — Direct solar radiance for July 10, 11, 13, and 14
from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY

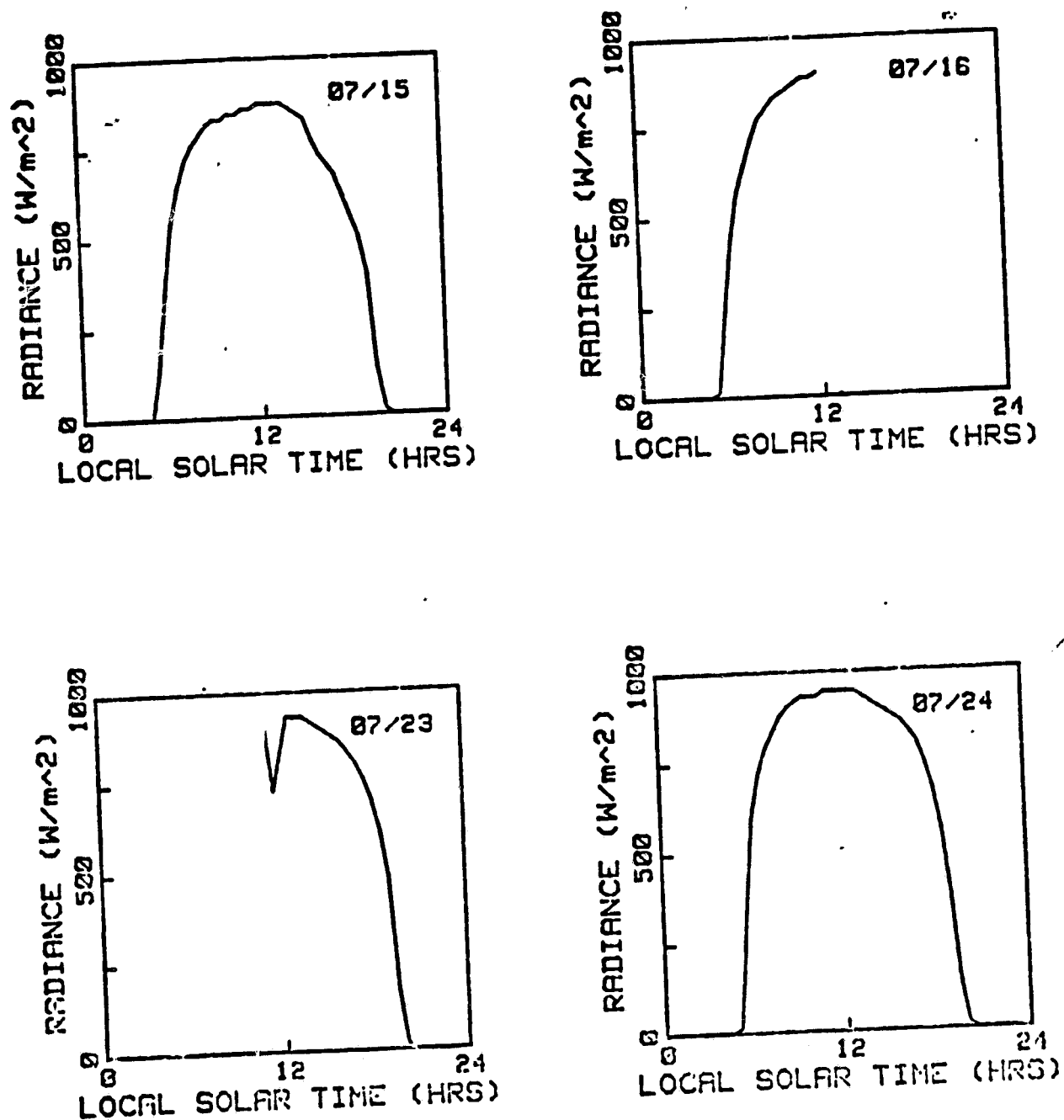


Figure 8. -- Direct solar radiance for July 15, 16, 23, and 24
from station 1.

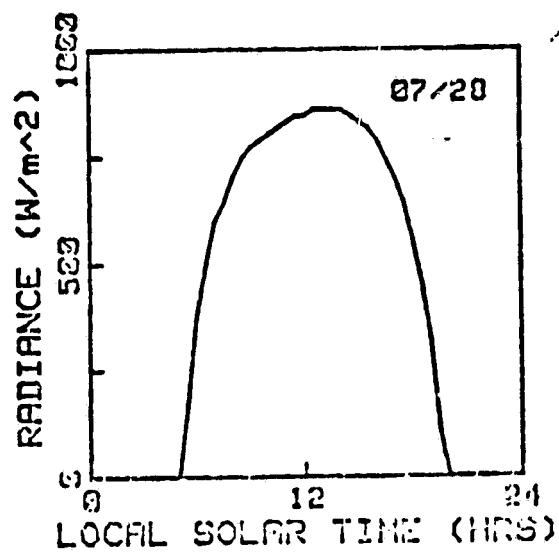
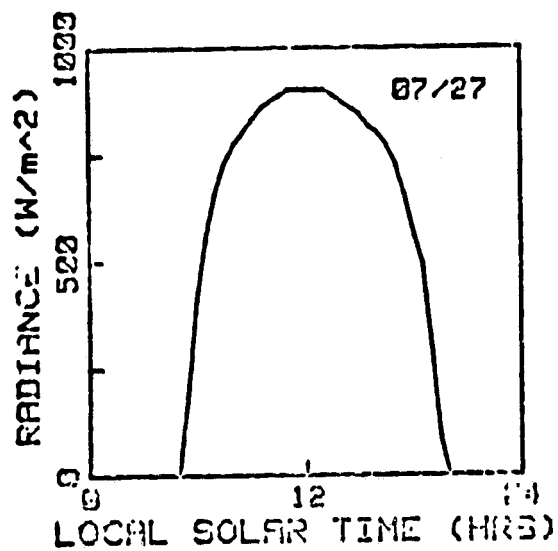
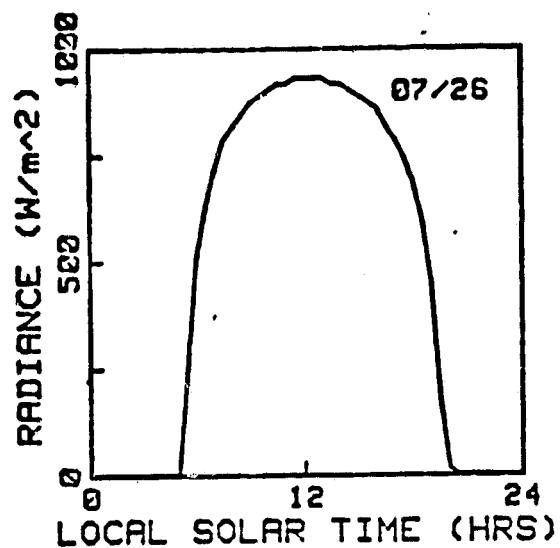
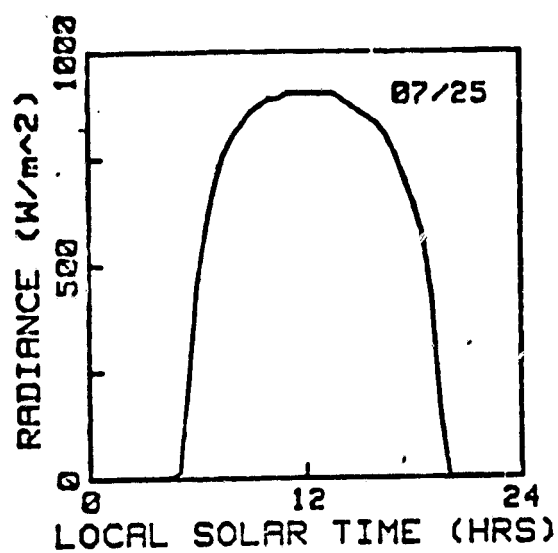


Figure 9. — Direct solar radiance for July 25, 26, 27 and 28
from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY

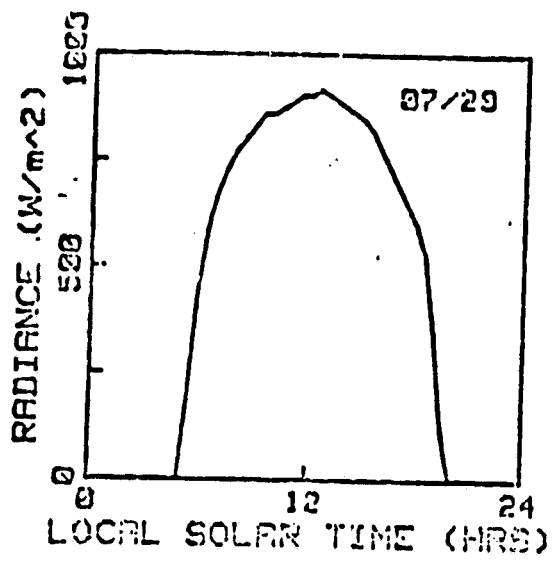


Figure 10. -- Direct solar radiance for July 29 from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY

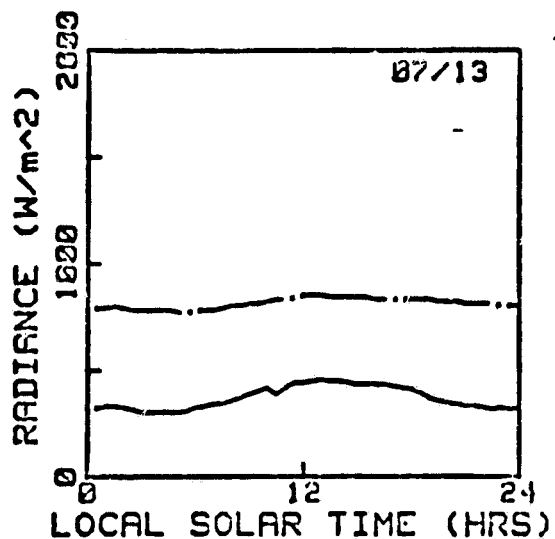
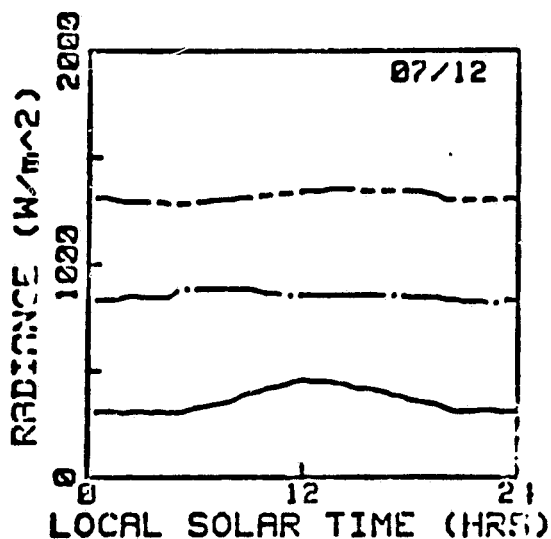
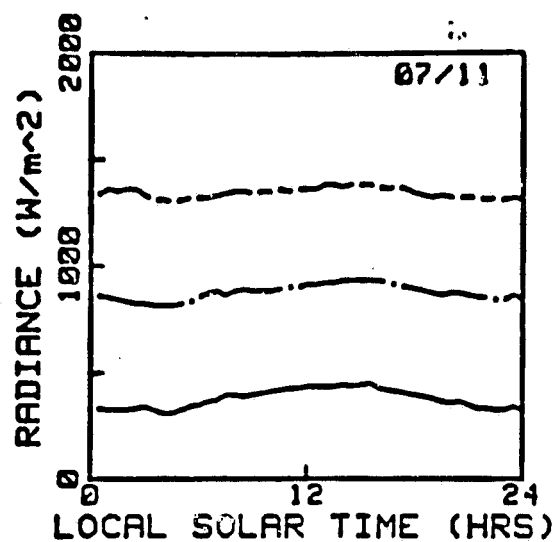
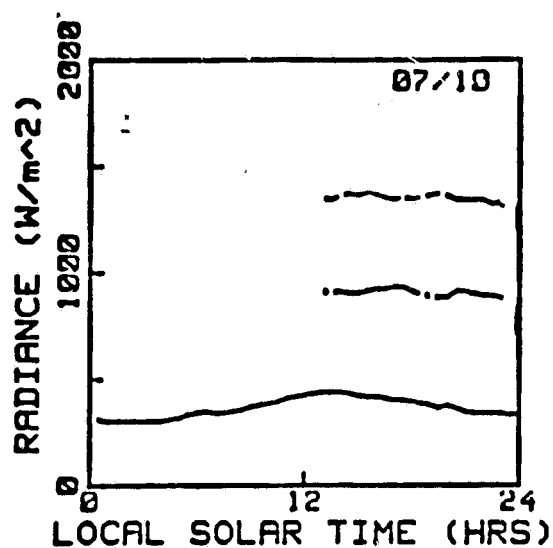


Figure 11. -- Sky radiance for July 10, 11, 12, and 13 from station 1 (—), station 2 (---), and station 3(— · —) (displacement 500 Wm^{-2}).

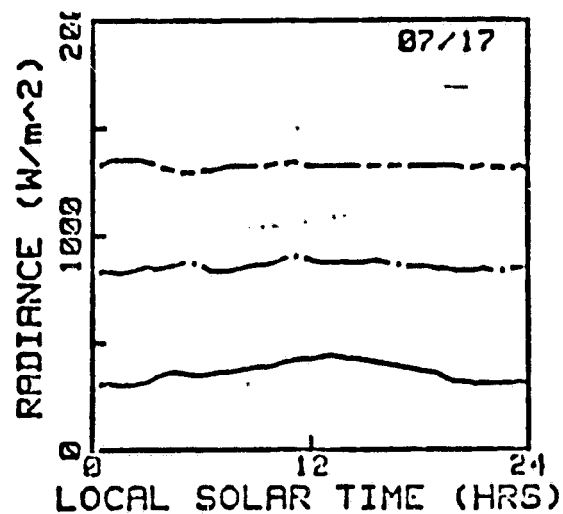
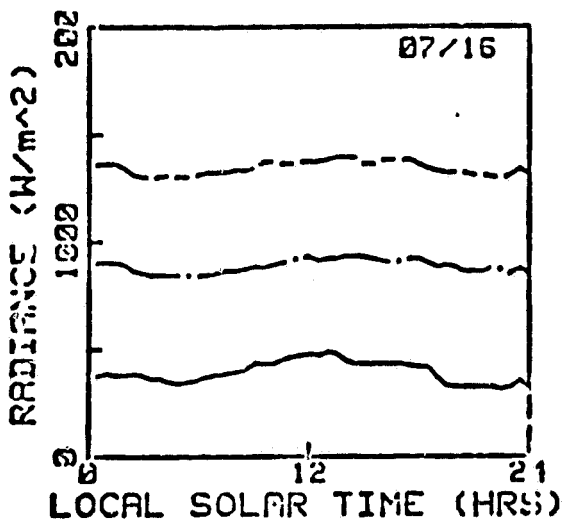
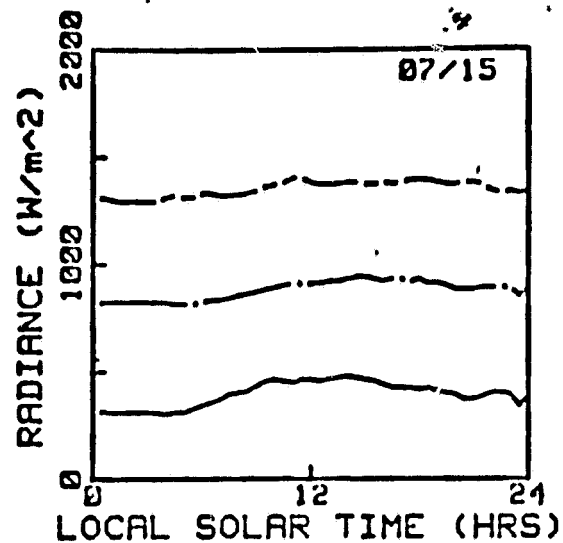
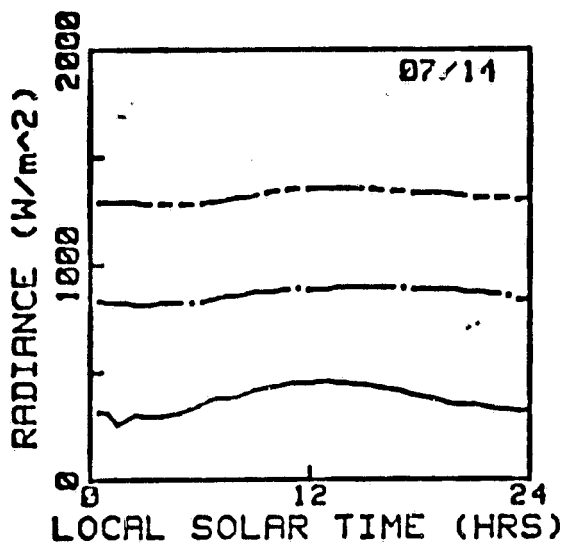


Figure 12. -- Sky radiance for July 14, 15, 16, and 17 from station 1 (—), station 2 (---), and station 3 (-.-) (displacement 500 Wm^{-2}).

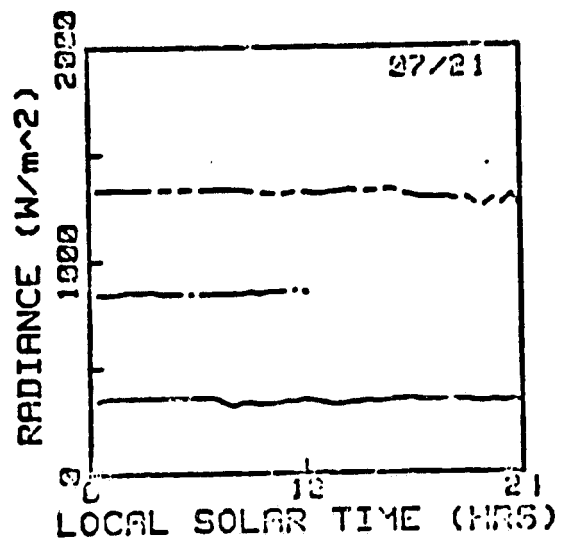
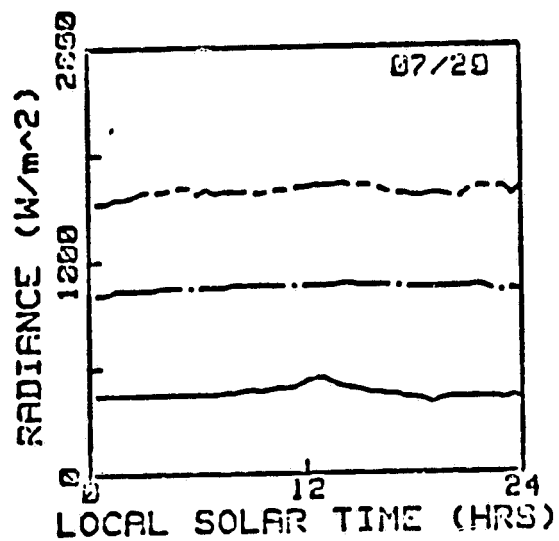
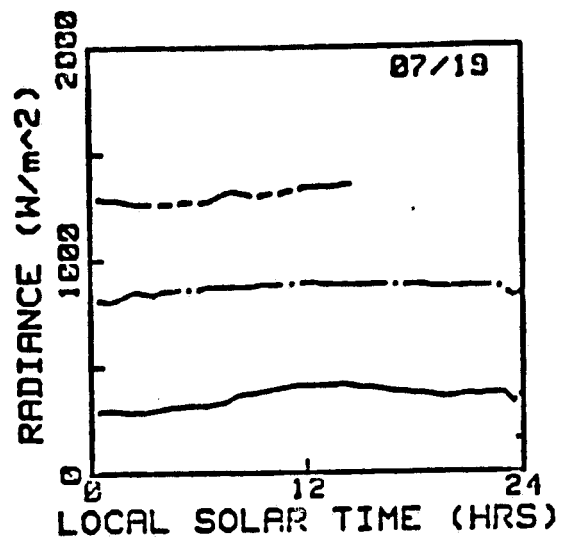
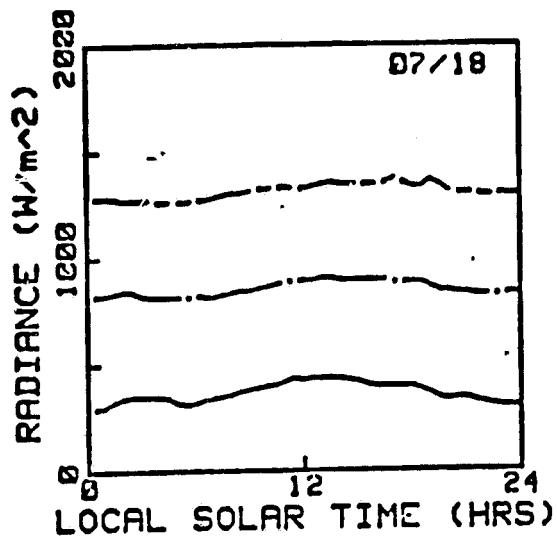


Figure 13. -- Sky radiance for July 18, 19, 20, and 21 from station 1 (—), station 2 (—·—), and station 3 (---) (displacement 500 Wm^{-2}).

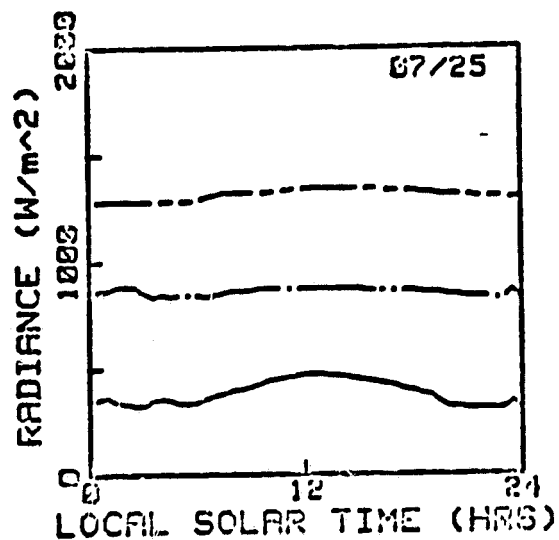
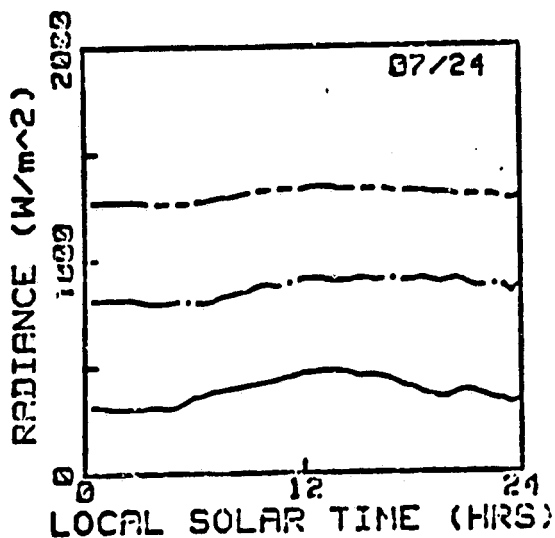
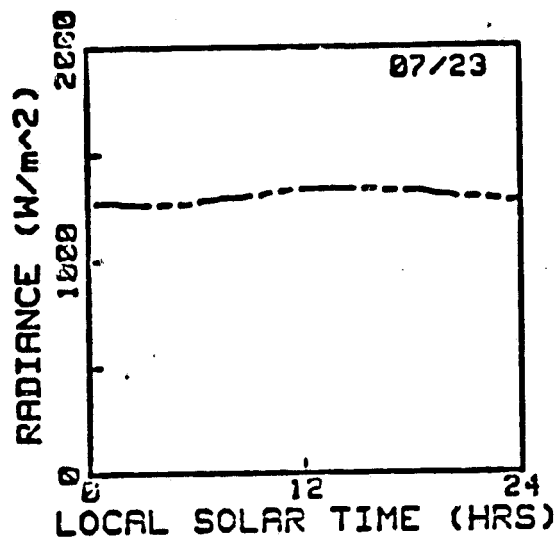
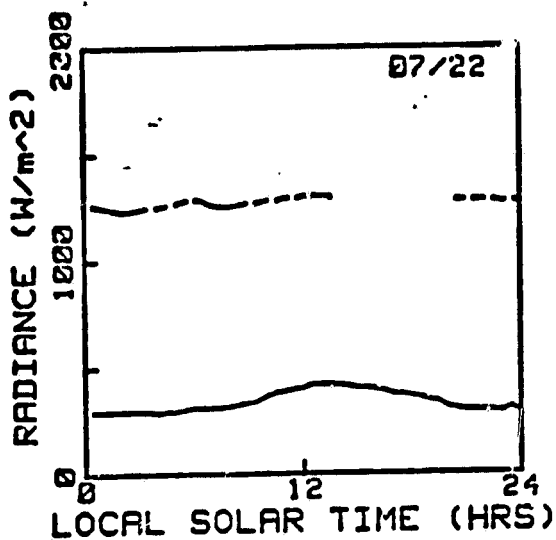


Figure 14. -- Sky radiance for July 22, 23, 24, and 25 from station 1 (—), station 2 (---), and station 3 (-.-.-) (displacement 500 Wm^{-2}).

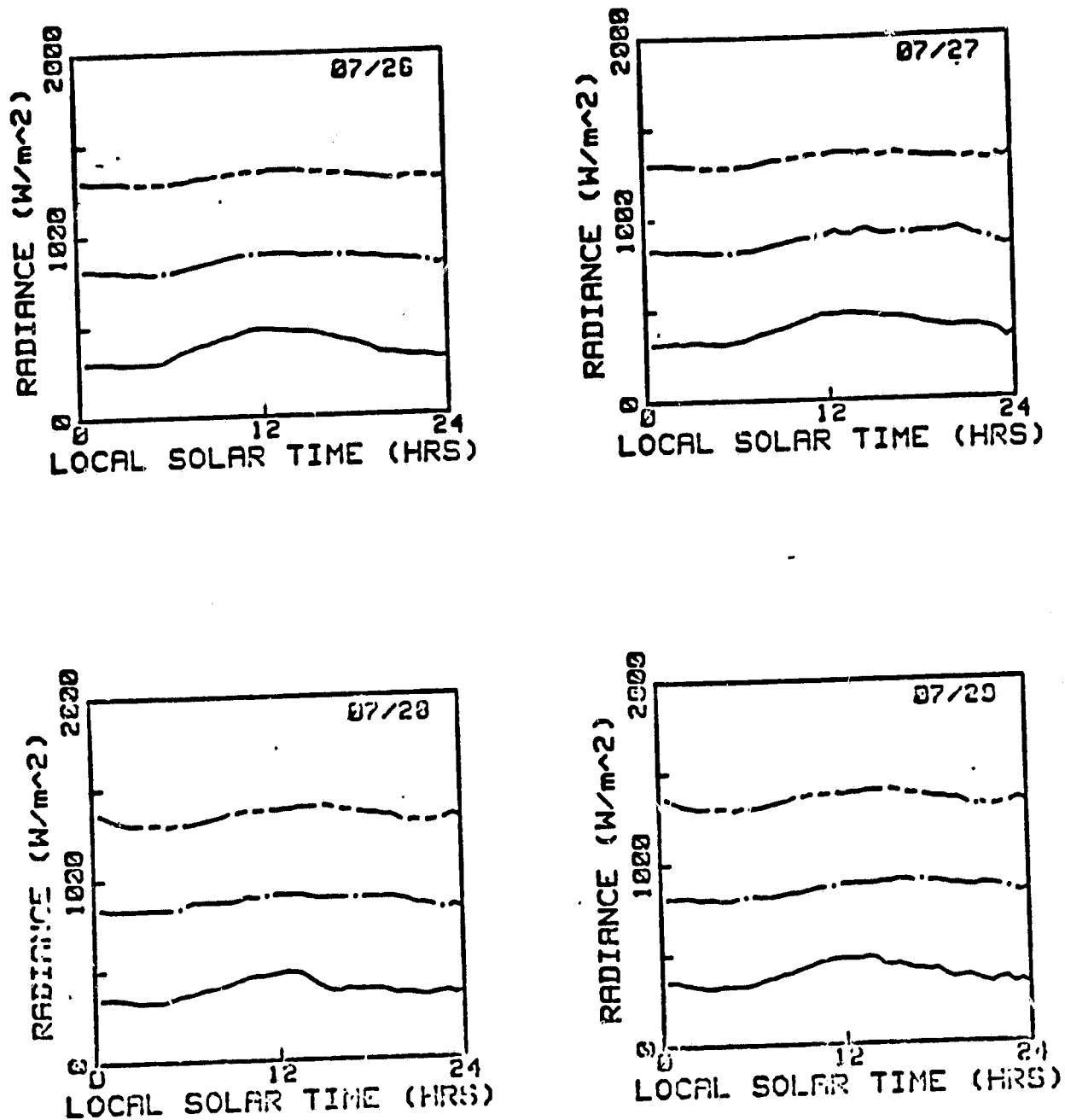


Figure 15. -- Sky radiance for July 26, 27, 28, and 29 from station 1 (—), station 2 (---), and station 3 (-.-) (displacement 500 Wm⁻²).

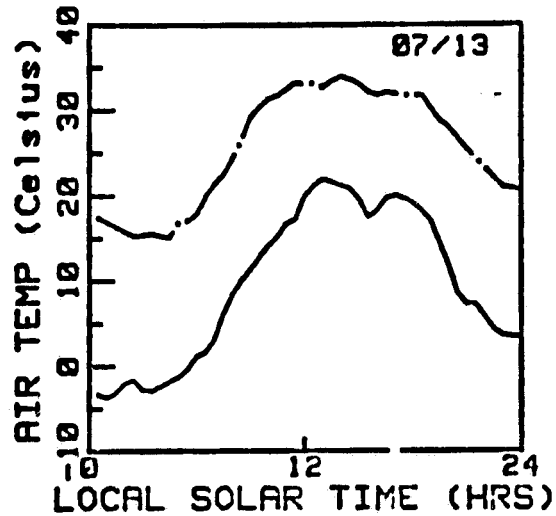
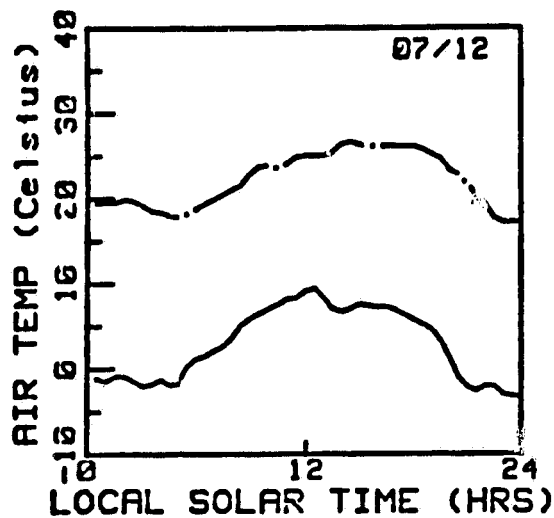
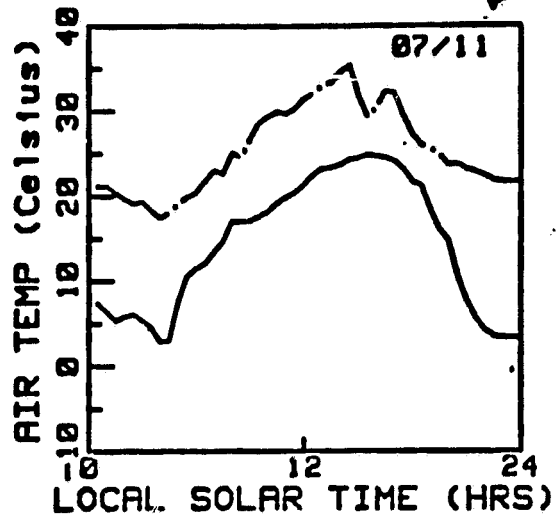
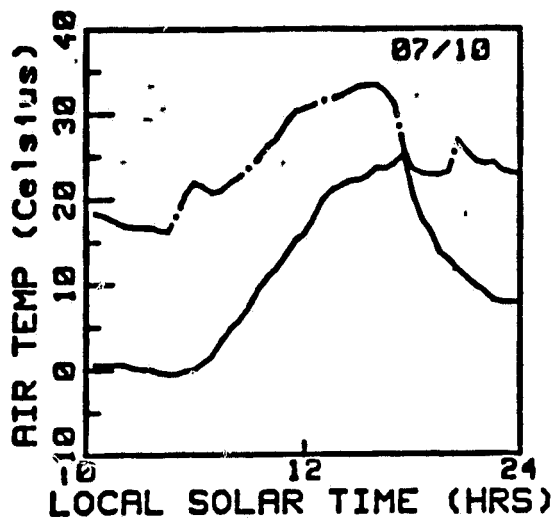


Figure 16. — Air temperature for July 10, 11, 12, and 13 from station 1 (—), and station 2 (— · —) (displacement 10°C).

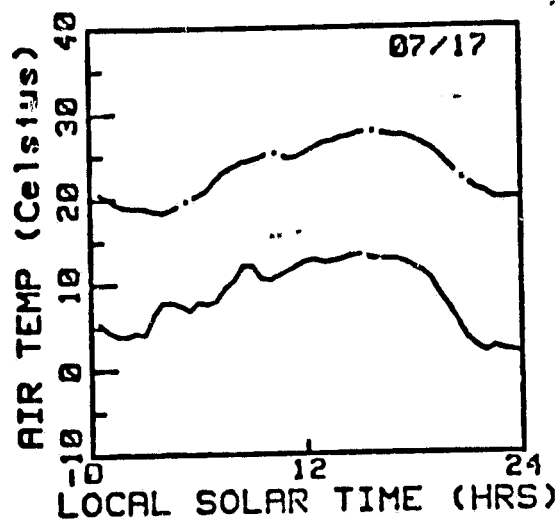
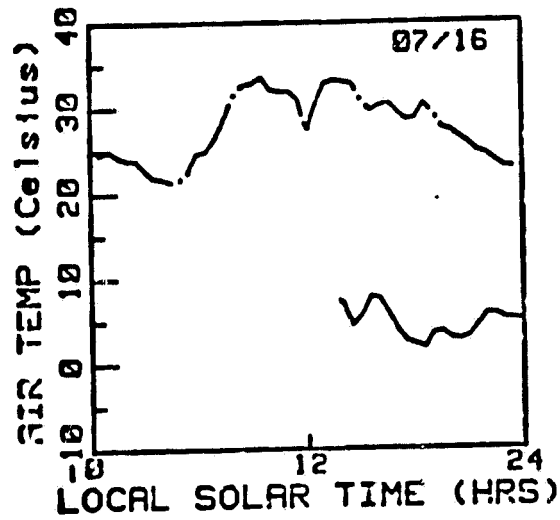
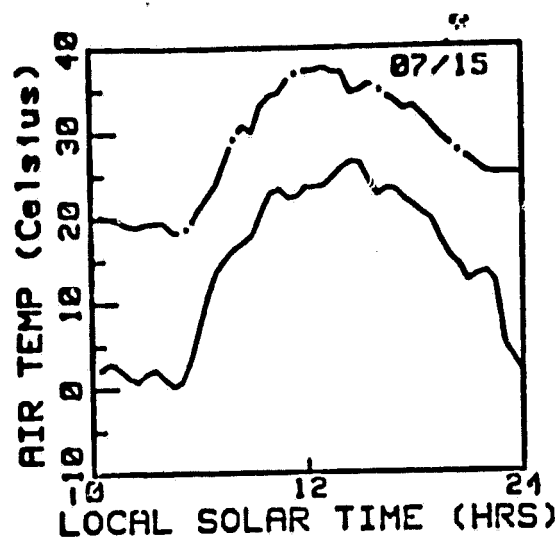
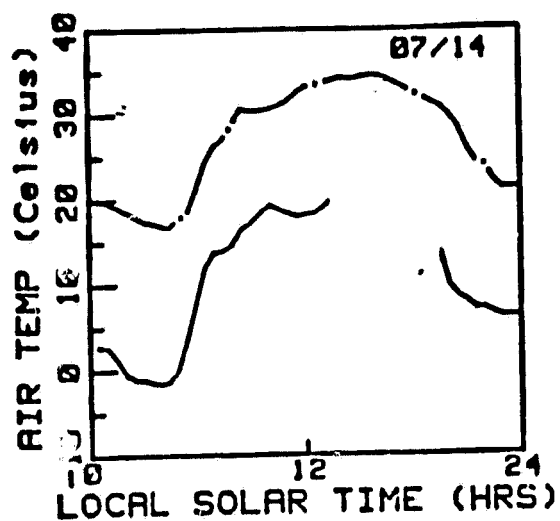


Figure 19. -- Air temperature for July 14, 15, 16, and 17 from station 1 (—), and station 2 (---) (displacement 10°C).

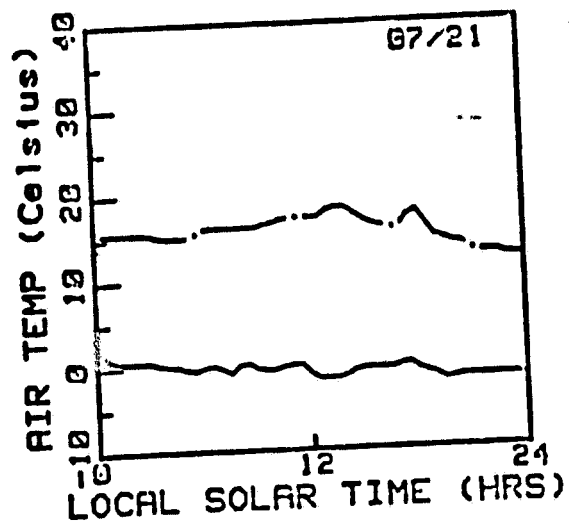
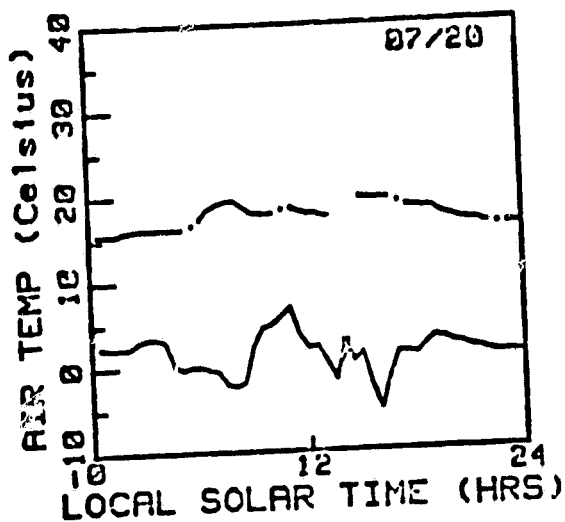
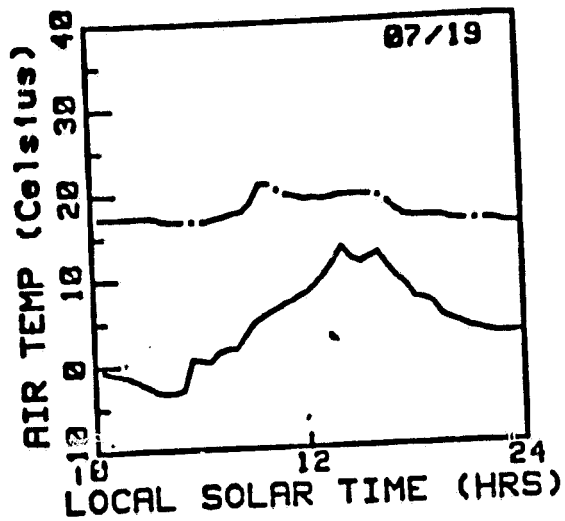
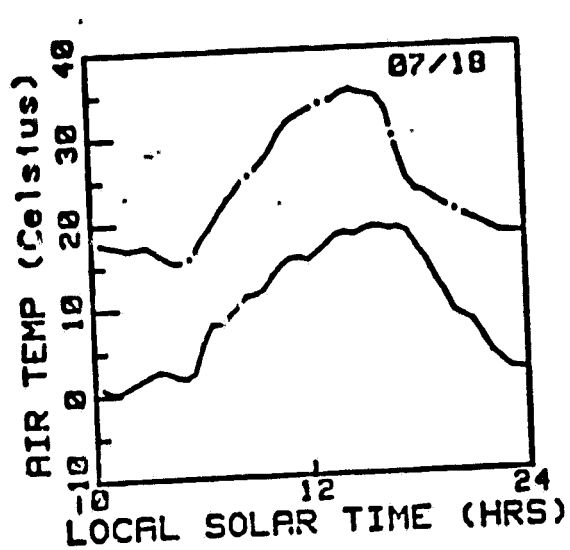


Figure 18. -- Air temperature for July 18, 19, 20, and 21 from station 1 (—), and station 2 (---) (displacement 10°C).

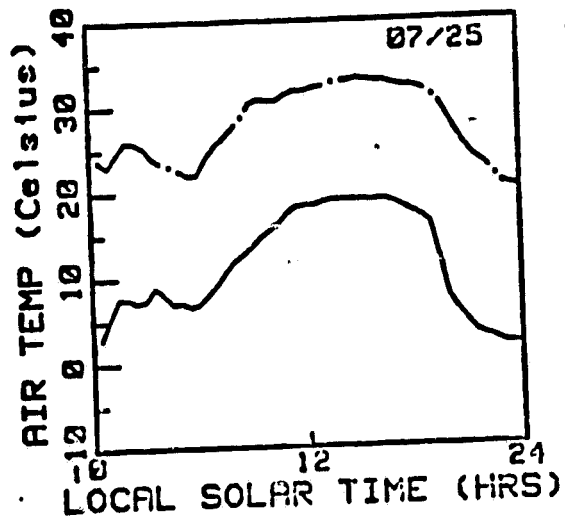
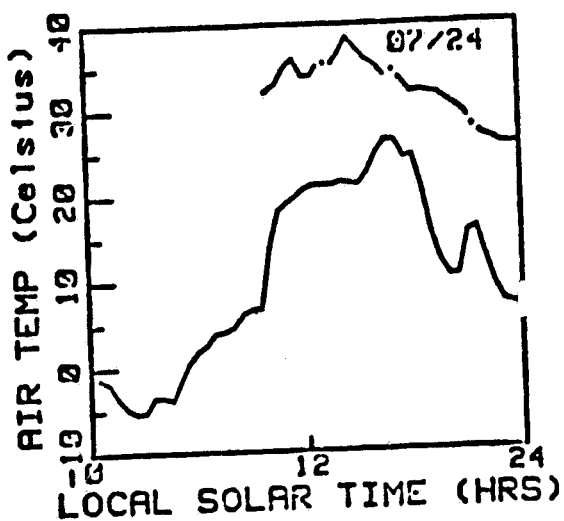
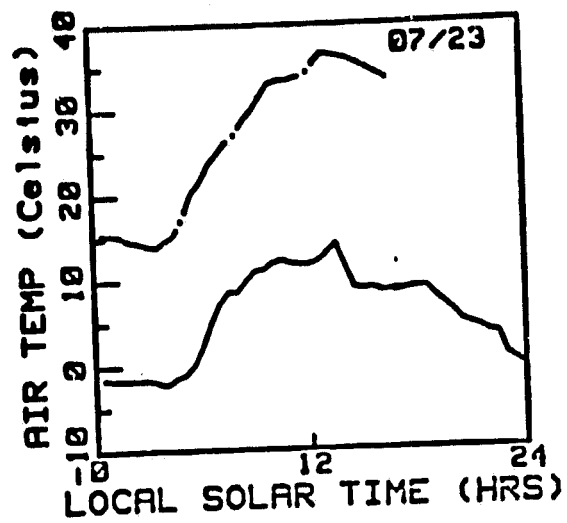
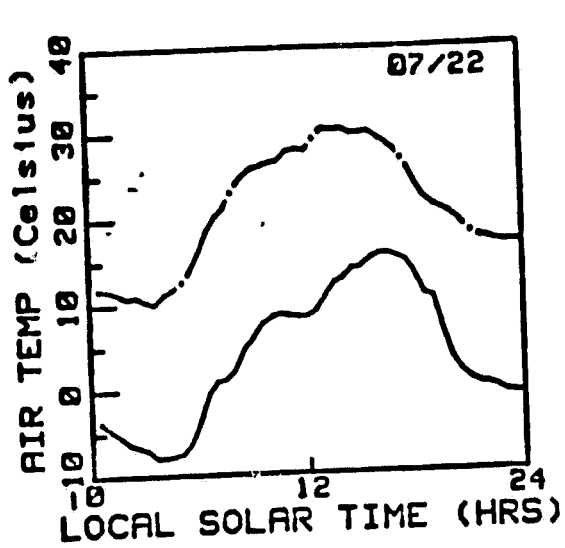


Figure 19. -- Air temperature for July 22, 23, 24, and 25 from station 1 (—), and station 2 (---) (displacement 1°C).

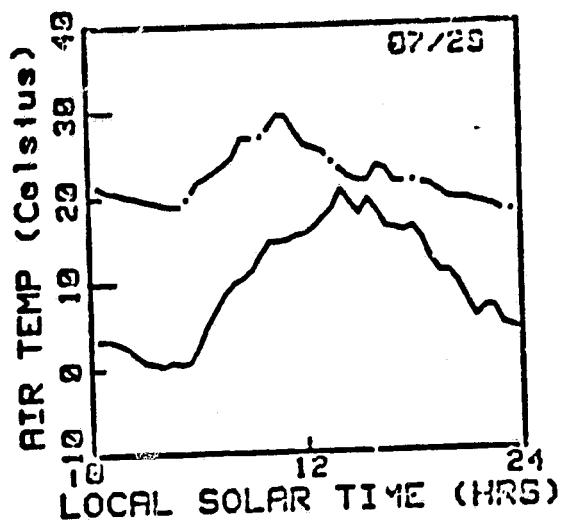
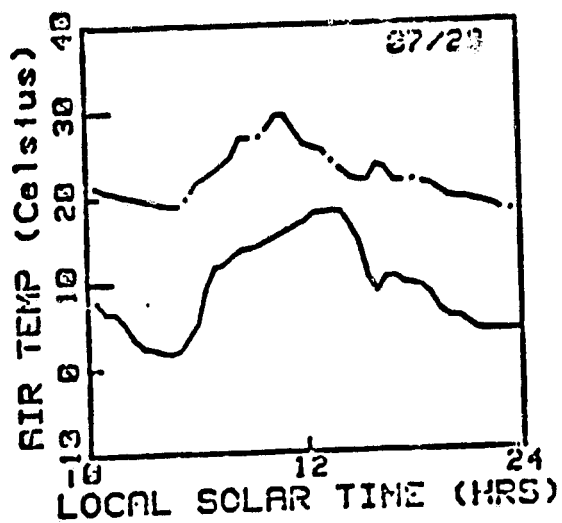
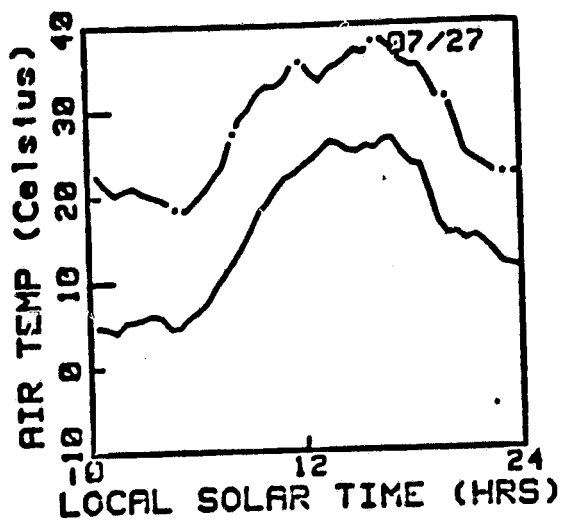
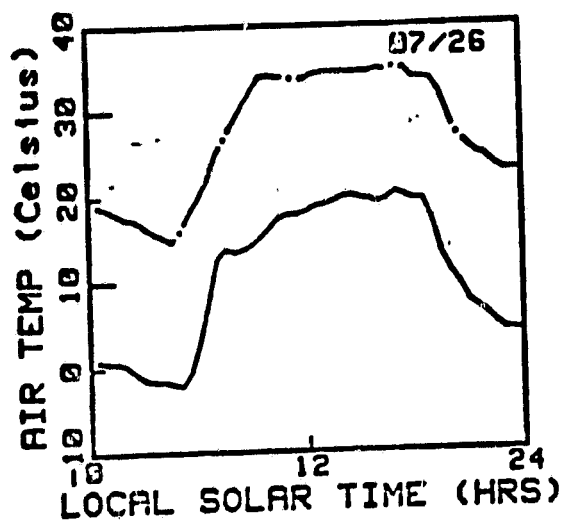


Figure 20. — Air temperature for July 26, 27, 28, and 29 from station 1 (—) and station 2 (—·—) (displacement 10°C).

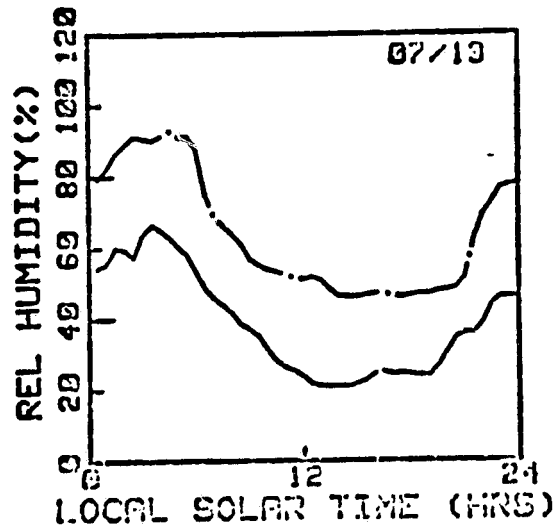
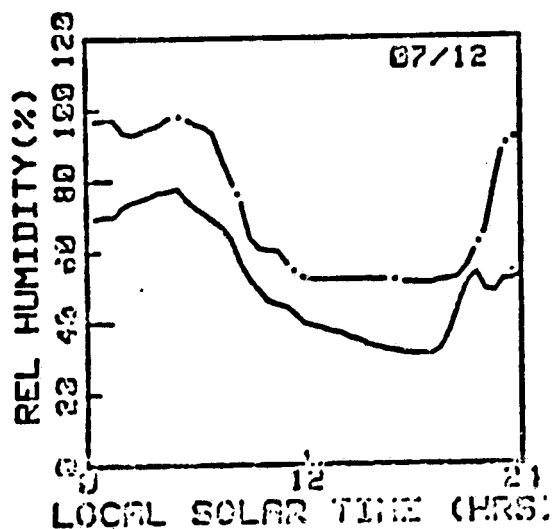
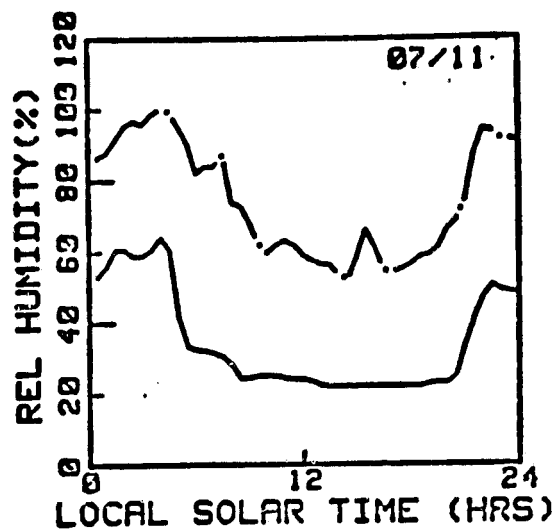
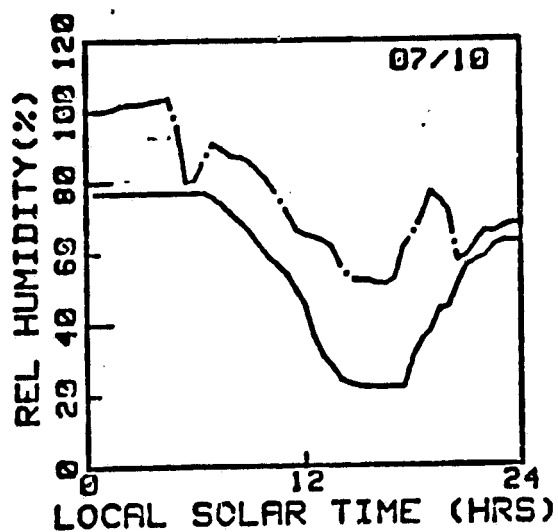


Figure 21. -- Relative humidity for July 10, 11, 12, and 13 from station 1 (—) and station 2 (—·—) (displacement 20% RH).

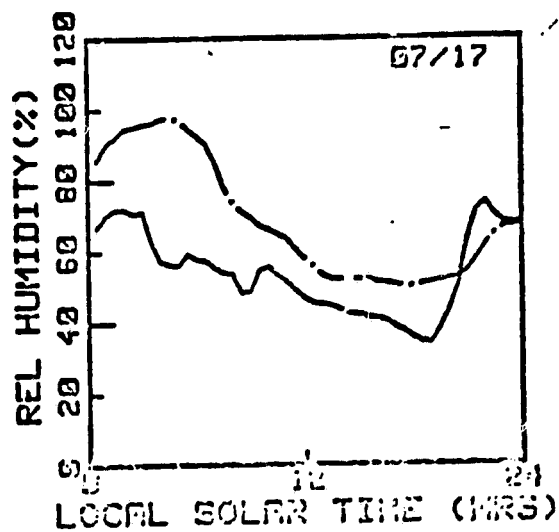
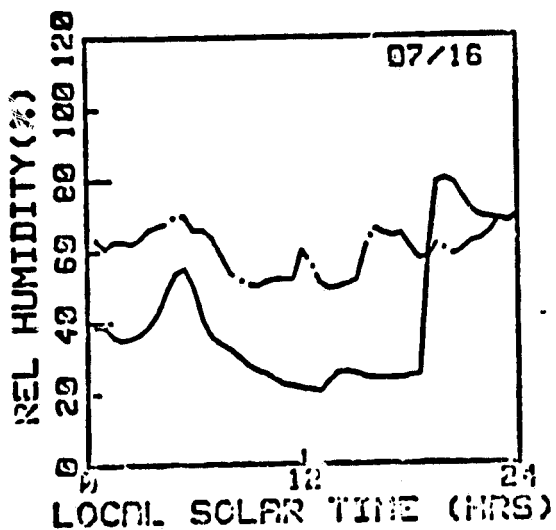
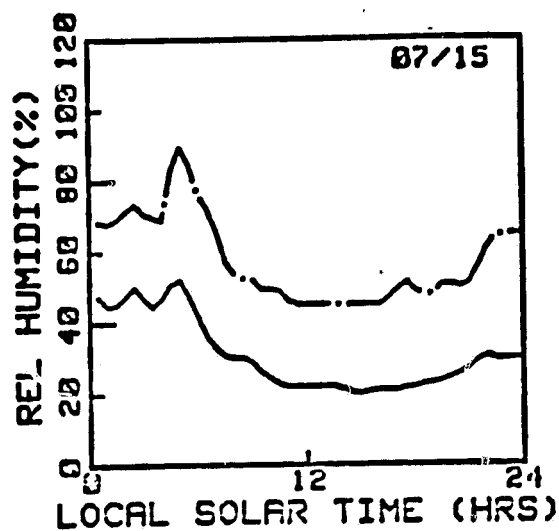
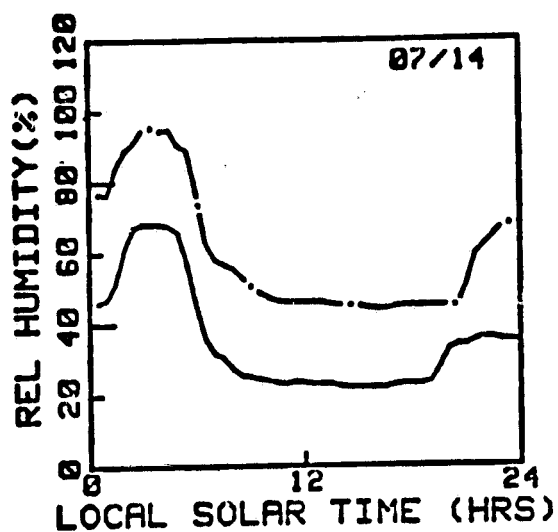


Figure 22. -- Relative humidity for July 14, 15, 16, and 17 from station 1 (—) and station 2(---) (displacement) 20% RH).

ORIGINAL PAGE IS
OF POOR QUALITY

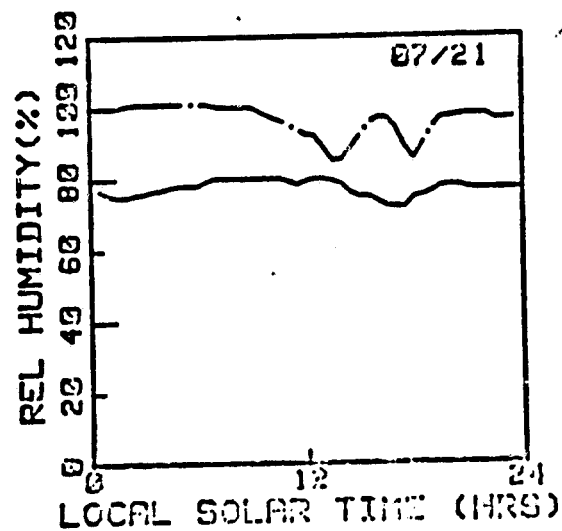
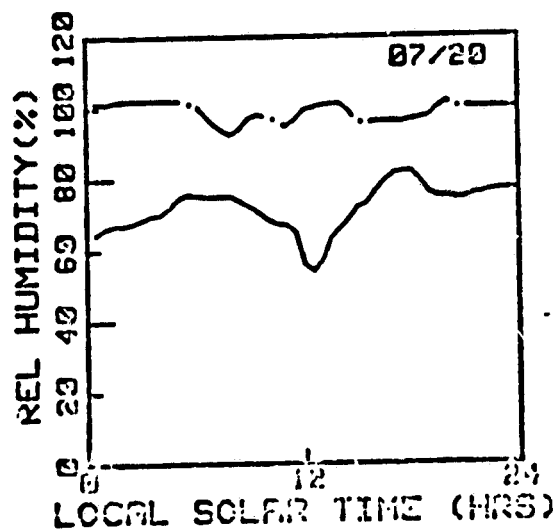
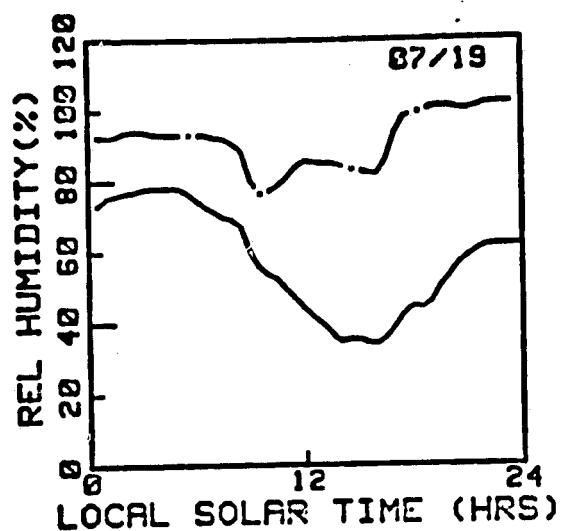
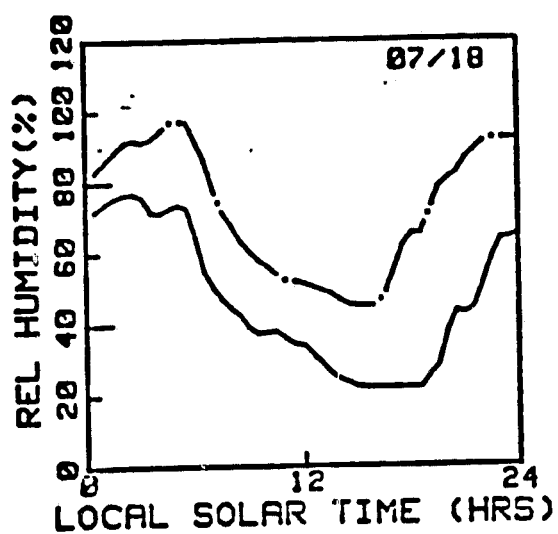


Figure 23. -- Relative humidity for July 18, 19, 20, and 21 for station 1(—) and station 2(---) (displacement 20% RH).

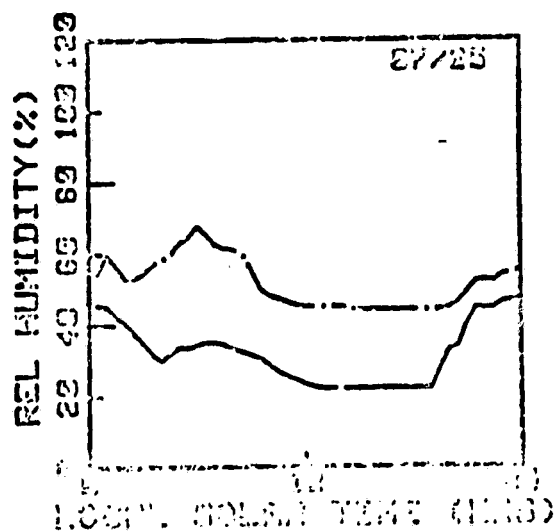
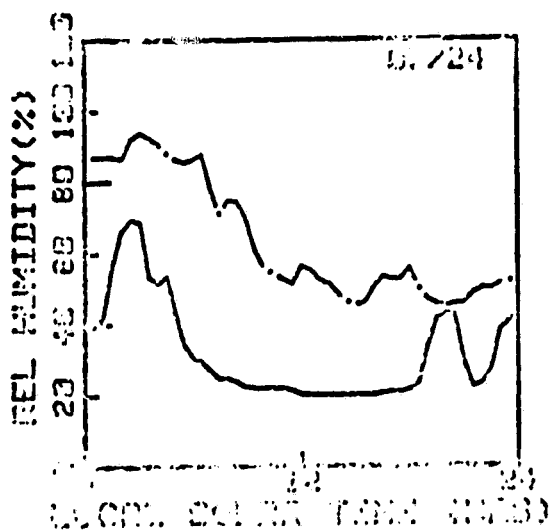
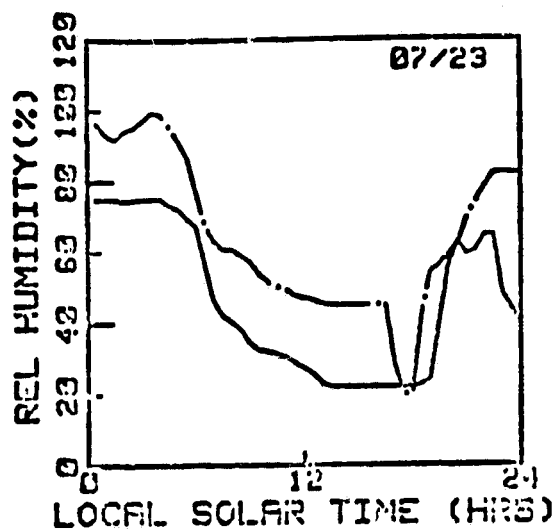
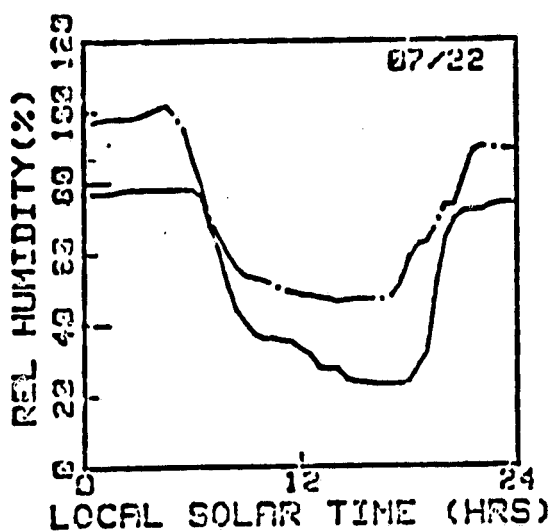


Figure 24. -- Relative humidity for July 22, 23, 24, and 25 from station 1 (—) and station 2(---) (displacement 20% RH).

ORIGINAL PAGE IS
OF POOR QUALITY

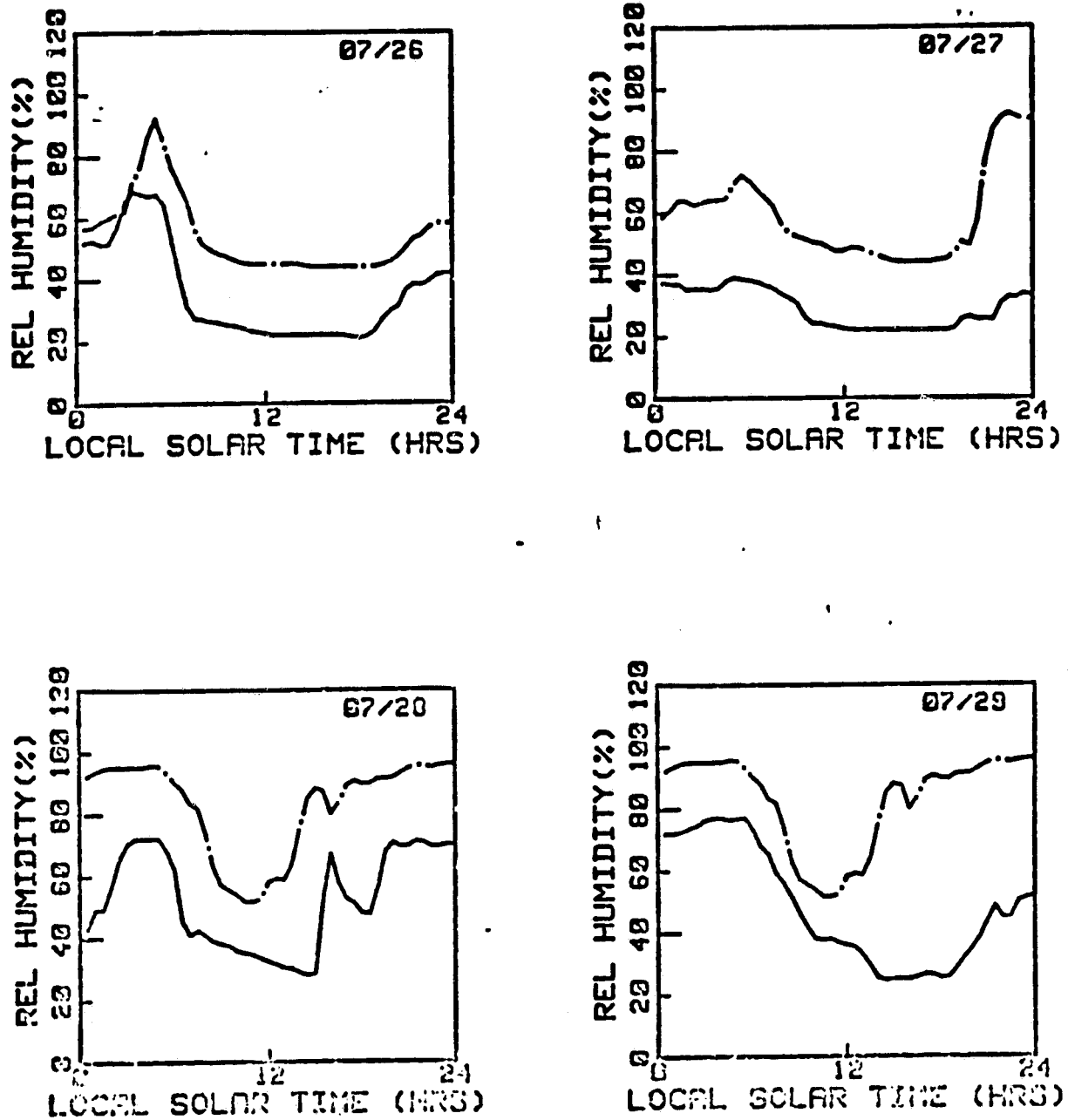


Figure 25. — Relative humidity for July 26, 27, 28, and 29 from station 1 (—) and station 2(---) (displacement 20% RH).

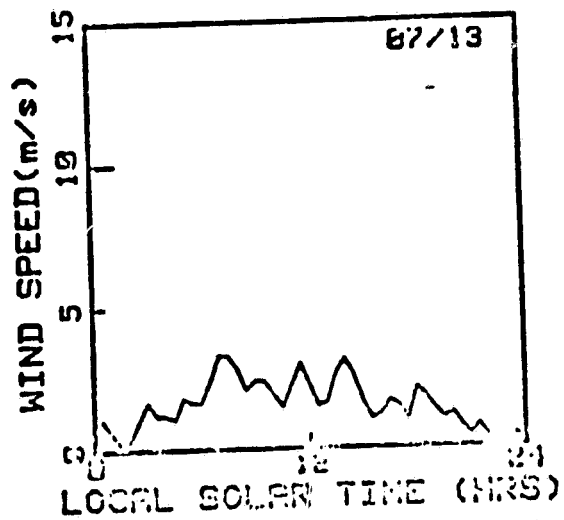
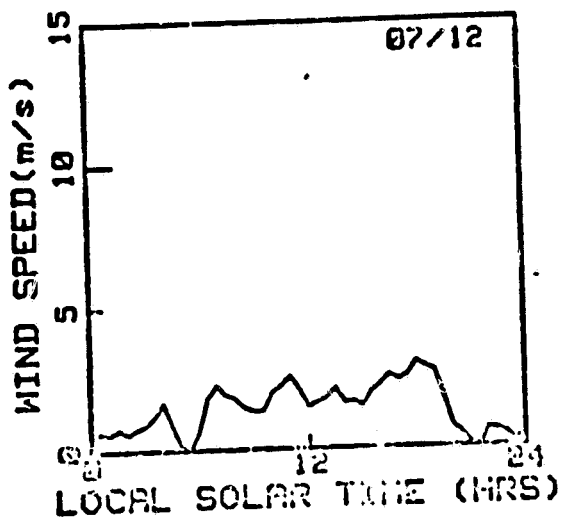
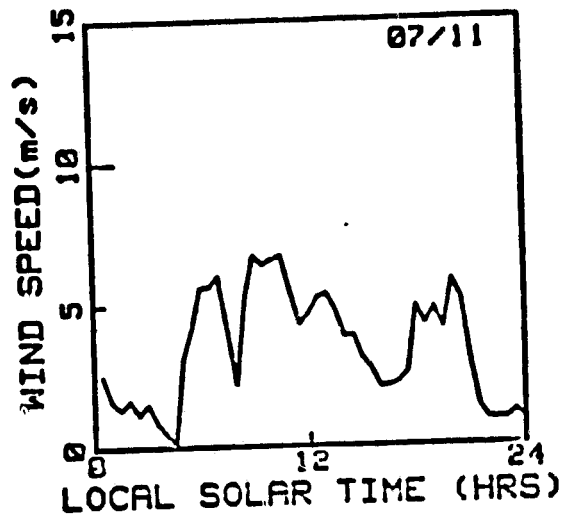
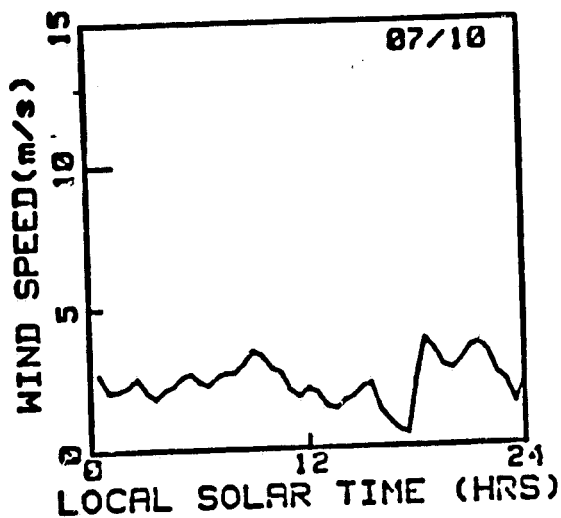


Figure 26. -- Wind speed for July 10, 11, 12, and 13 from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY

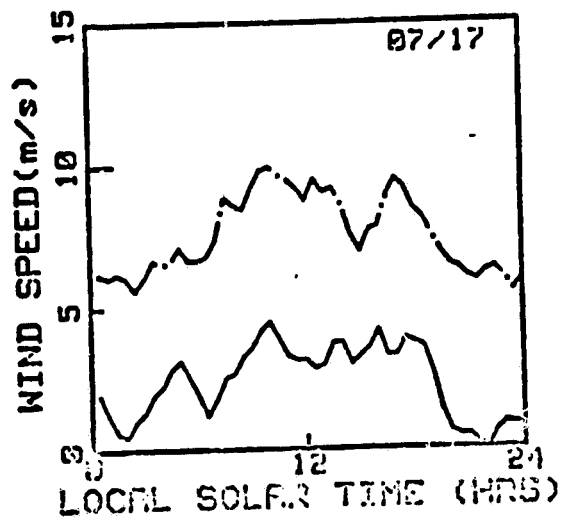
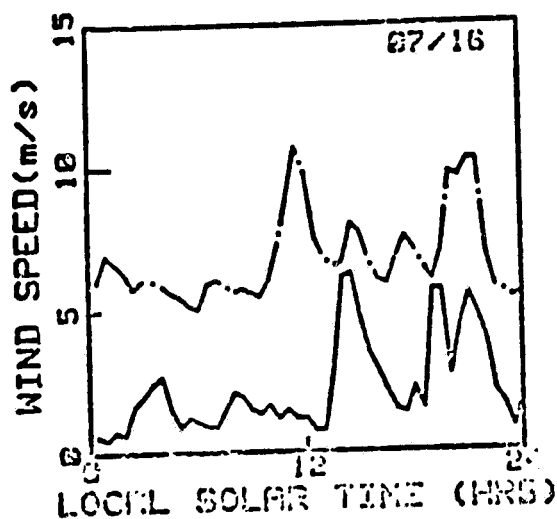
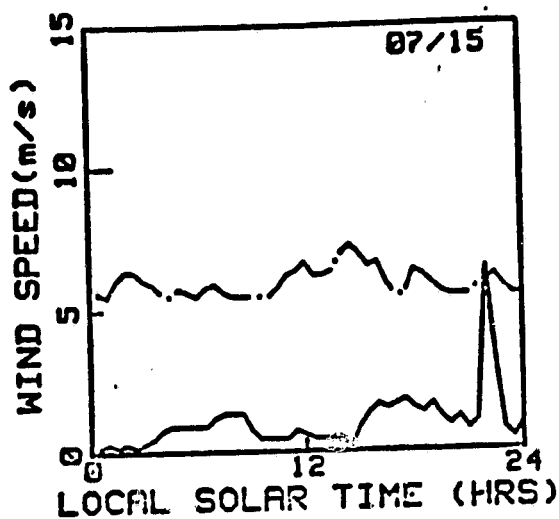
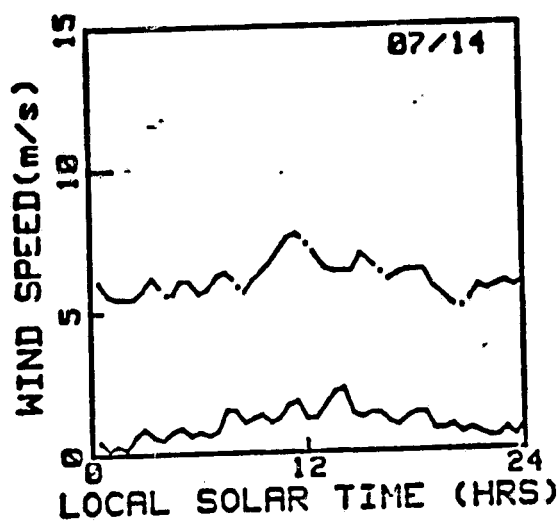


Figure 27. -- Wind speed for July 14, 15, 16, and 17 from station
1 (—) and station 2 (---) (displacement 5 m/s).

ORIGINAL PAGE IS
OF POOR QUALITY.

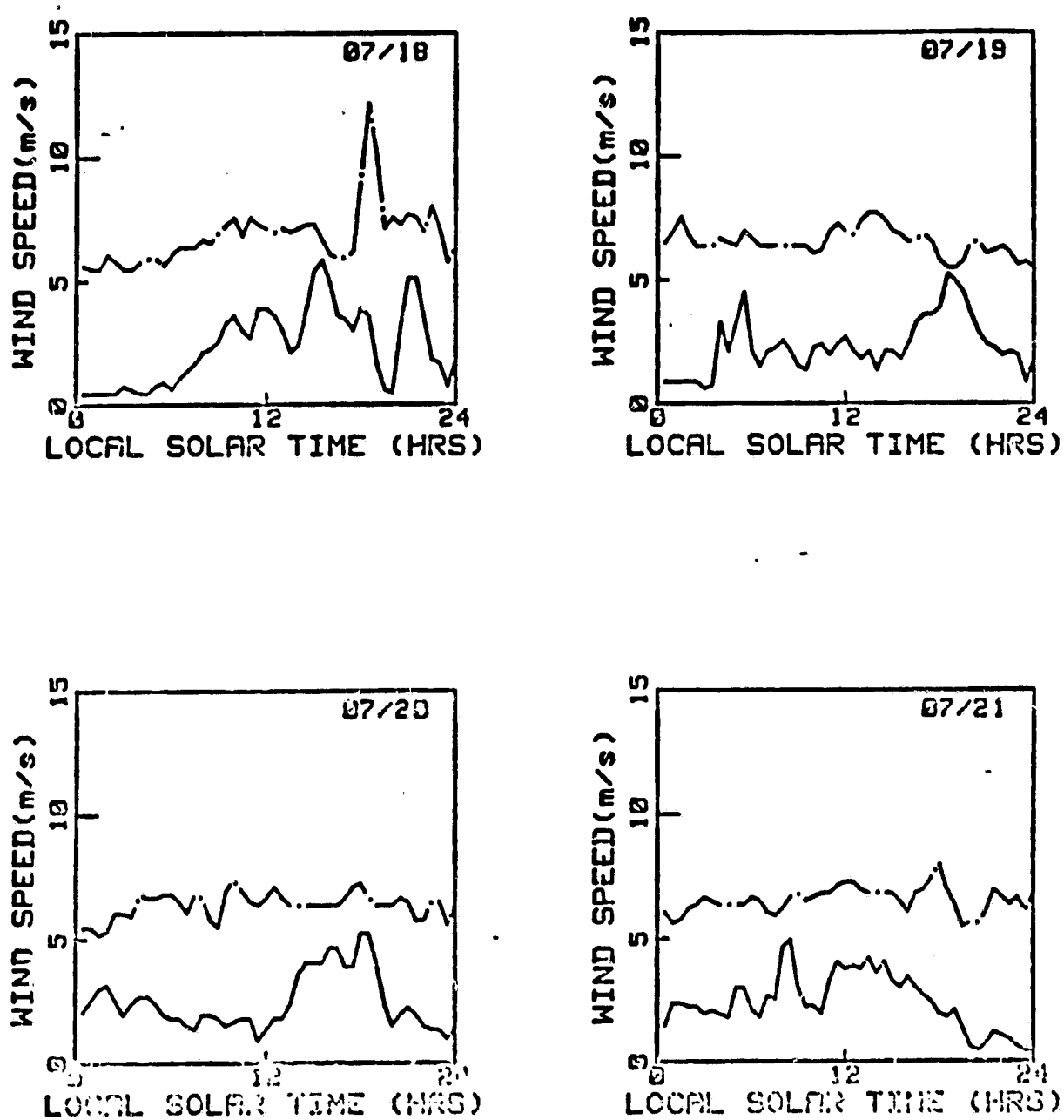


Figure 28. -- Wind speed for July 18, 19, 20, and 21 from station 1 (—) and station 2 (---) (displacement m/s).

ORIGINAL PAGE IS
OF POOR QUALITY

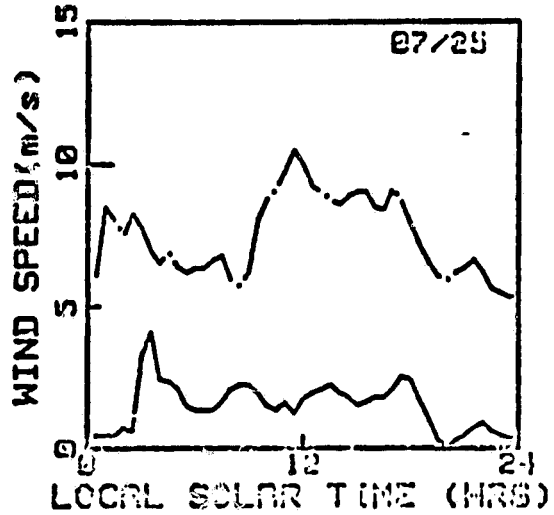
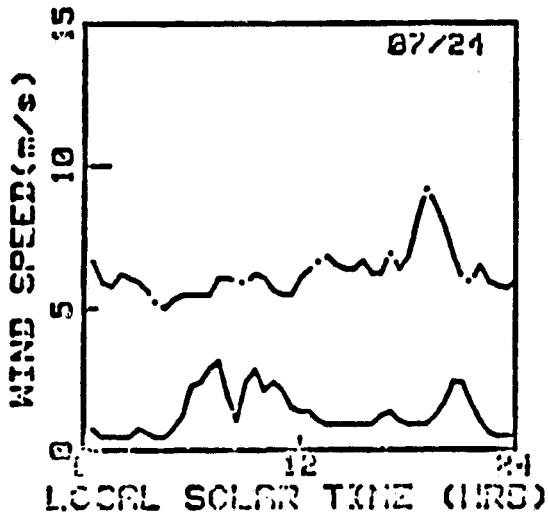
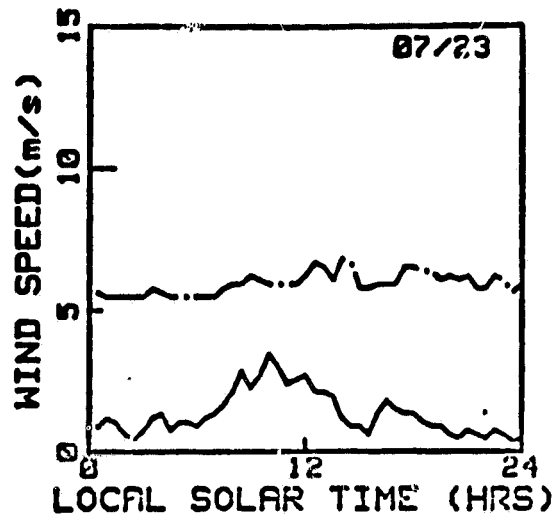
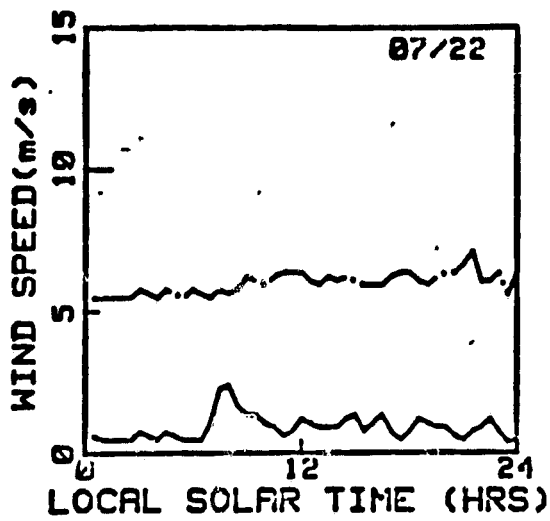


Figure 29. -- Wind speed for July 22, 23, 24, and 25 from station 1
(—) and station 2 (---) (displacement 5 m/s).

ORIGINAL PAGE IS
OF POOR QUALITY

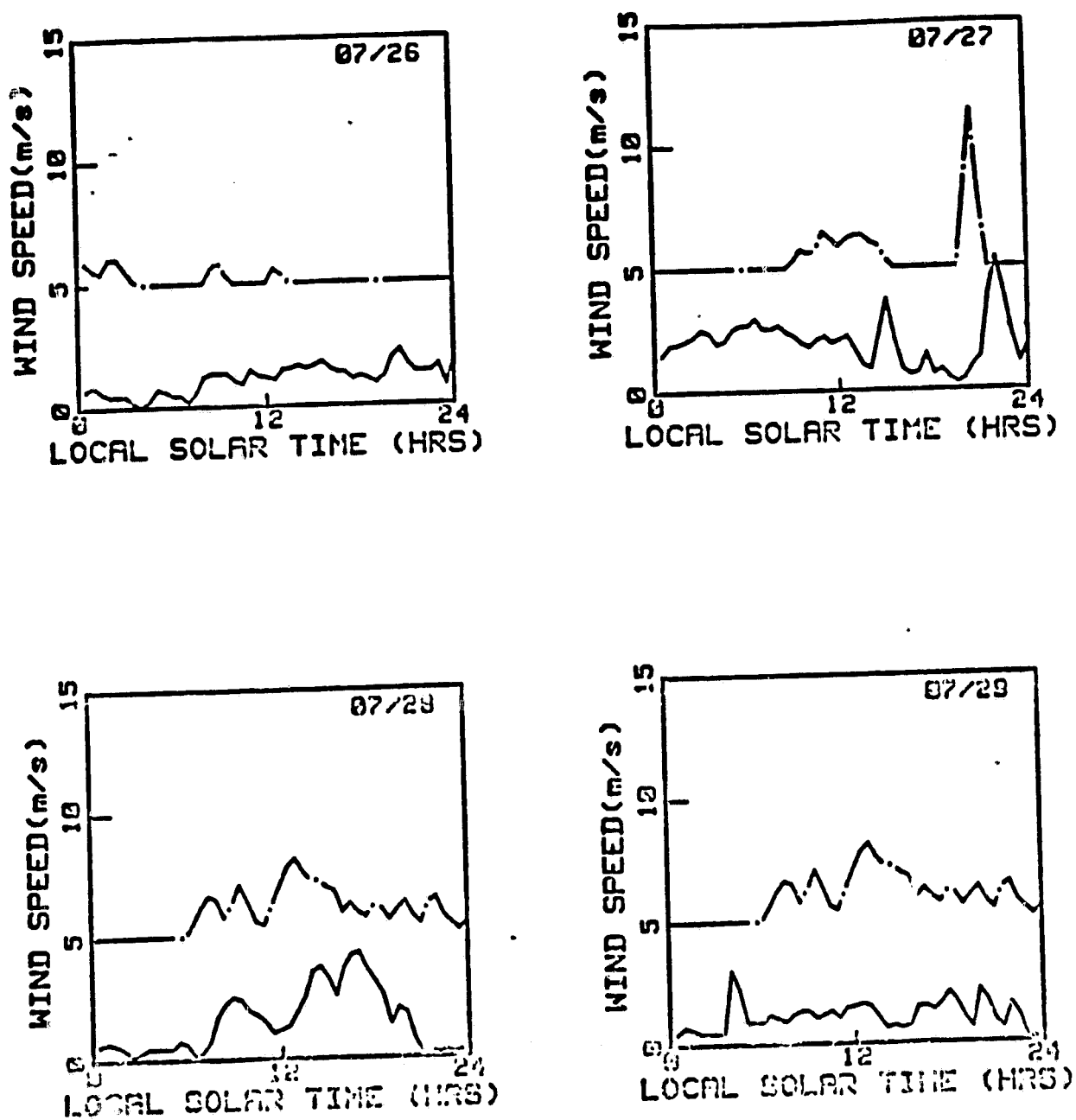


Figure 30. — Wind speed for July 26, 27, 28, and 29 from station 1 (—) and station 2(---) (displacement 5 m/s).

ORIGINAL PAGE IS
OF POOR QUALITY

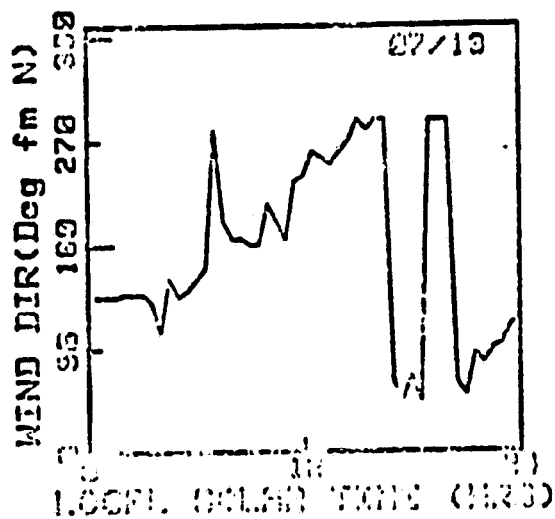
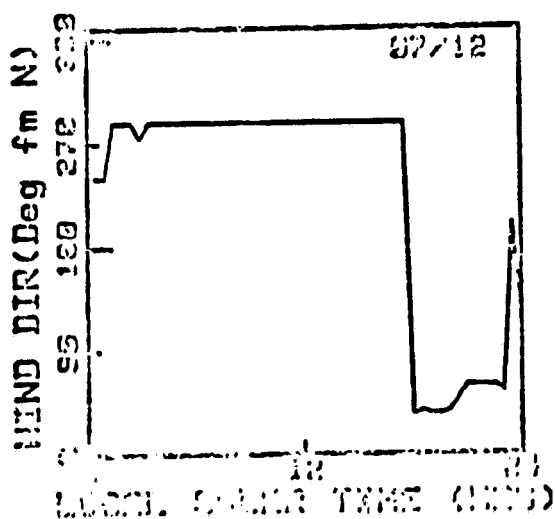
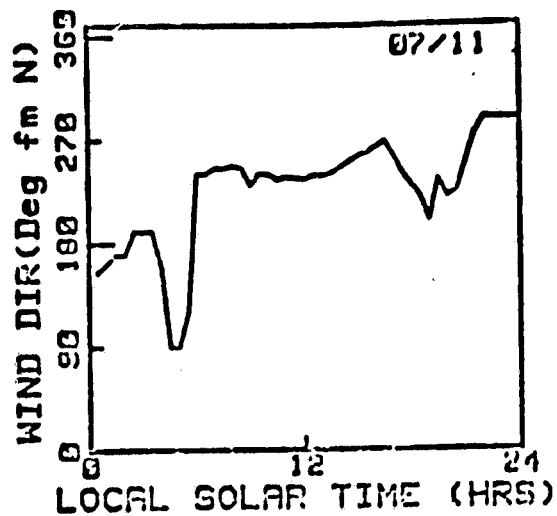
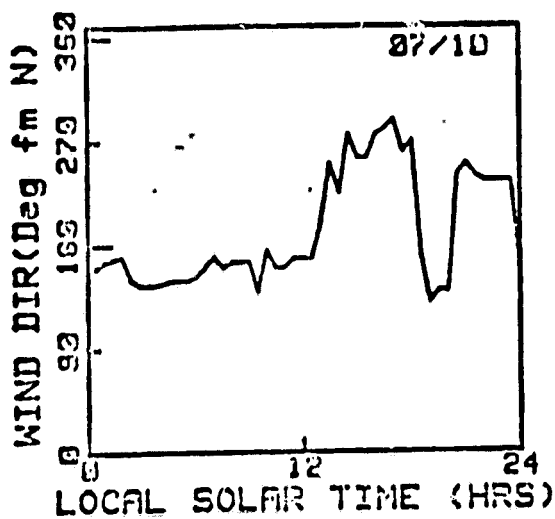


Figure 31. -- Wind direction for July 10, 11, 12, and 13 from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY.

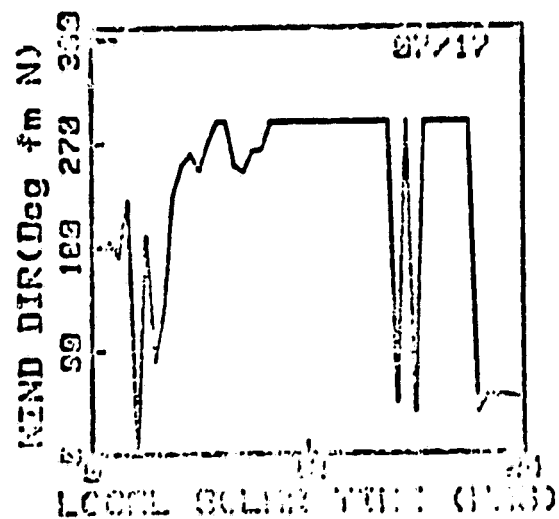
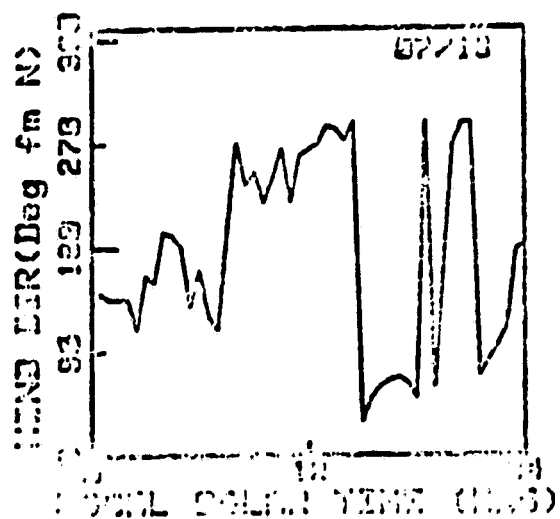
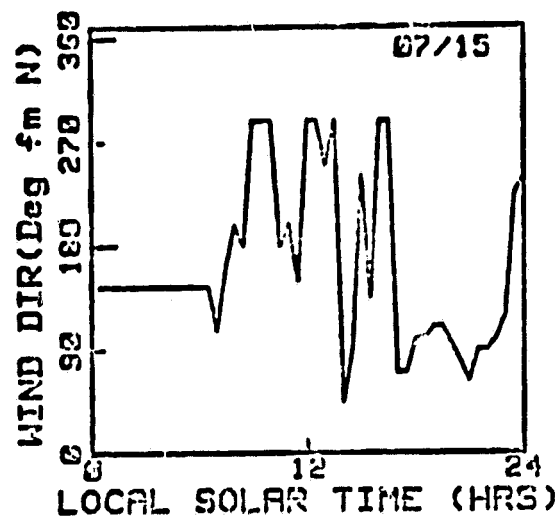
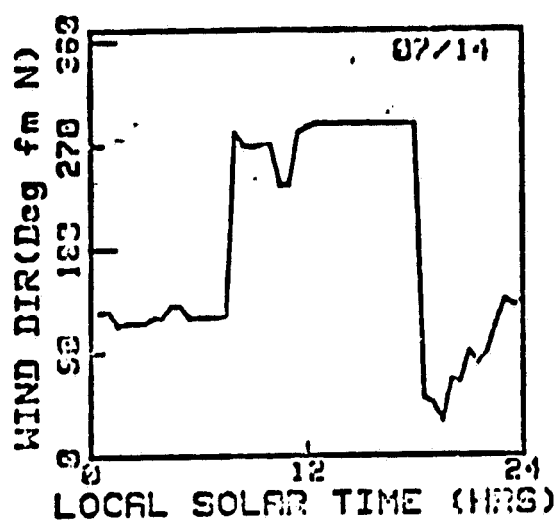


Figure 32. — Wind direction for July 14, 15, 16, and 17 from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY.

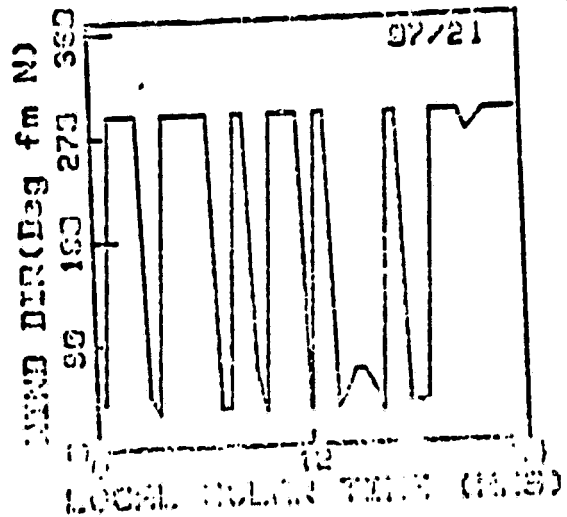
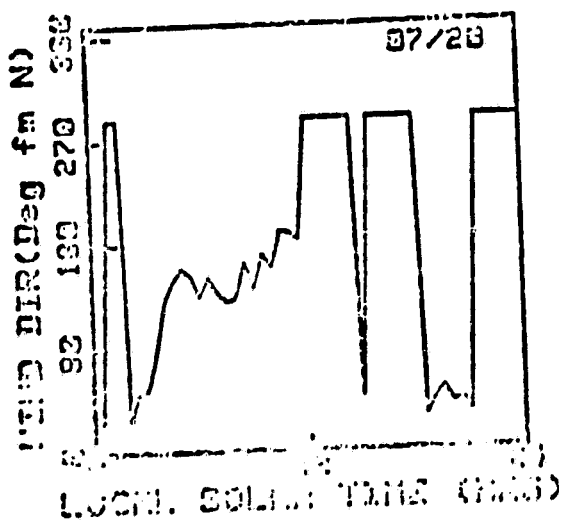
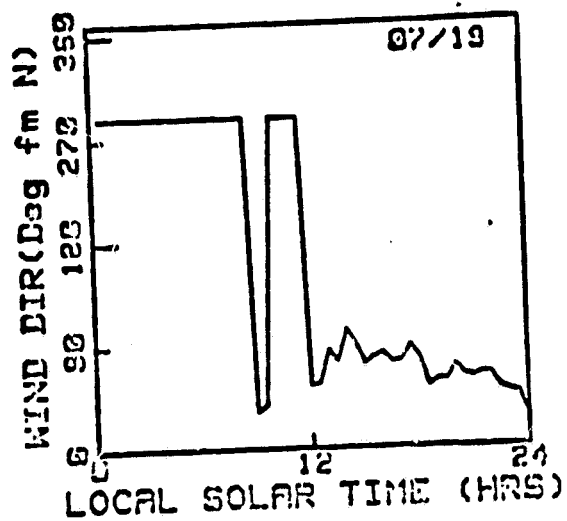
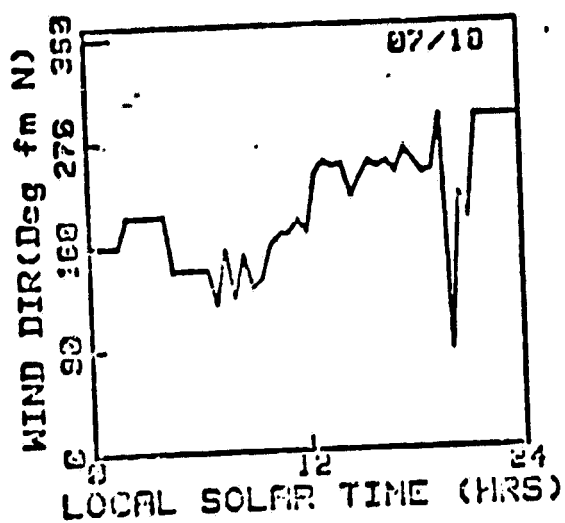


Figure 33. -- Wind direction for July 18, 19, 20, and 21 from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY.

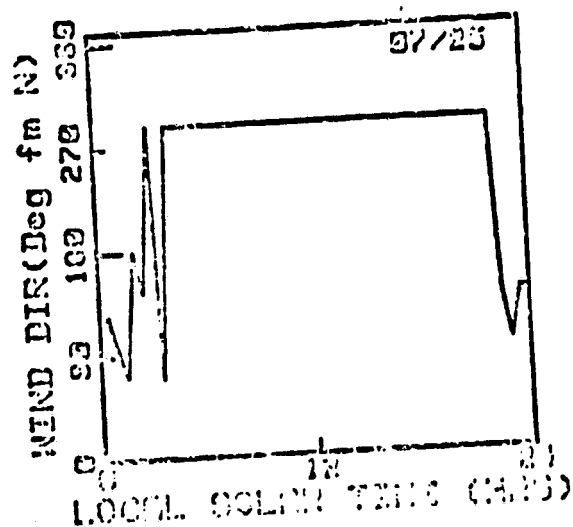
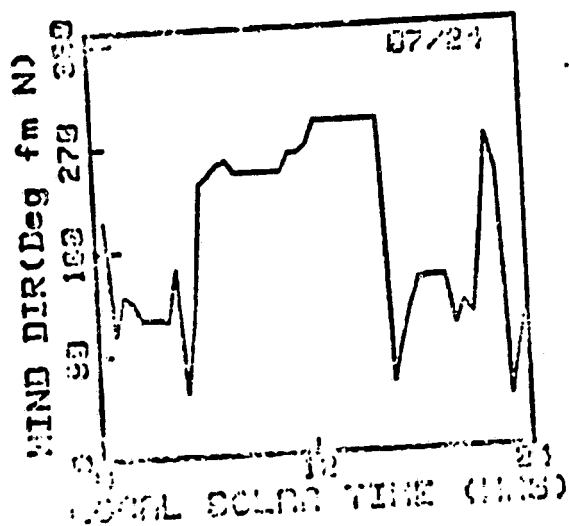
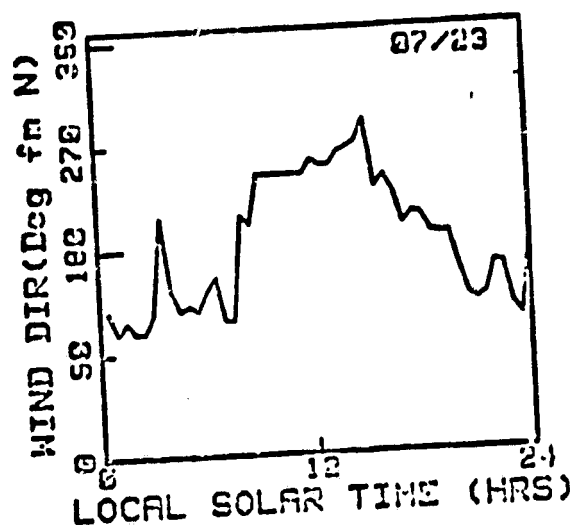
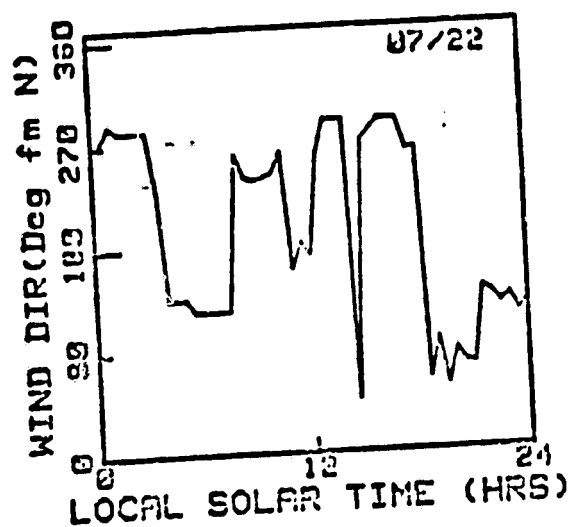


Figure 34. — Wind direction for July 22, 23, 24, and 25 from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY

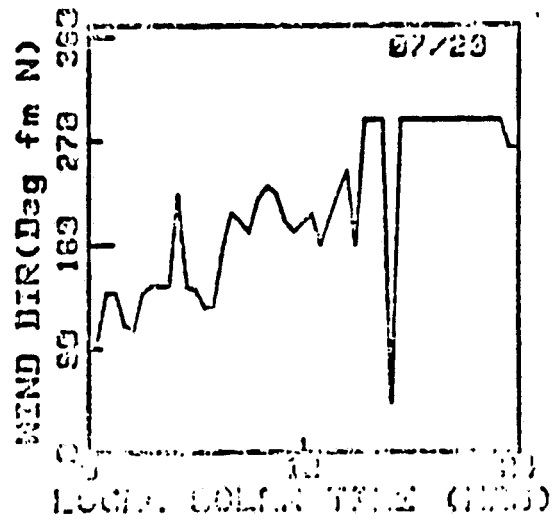
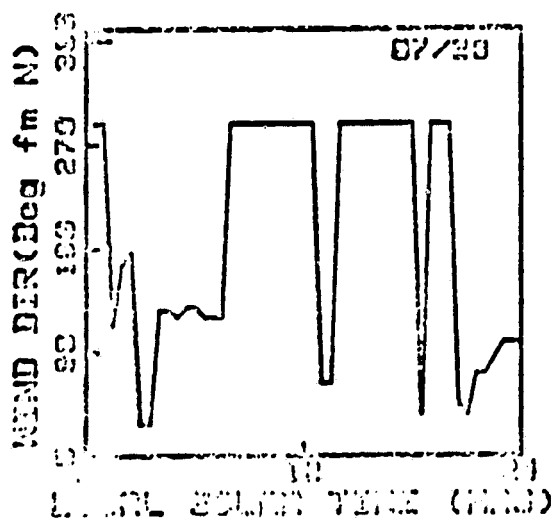
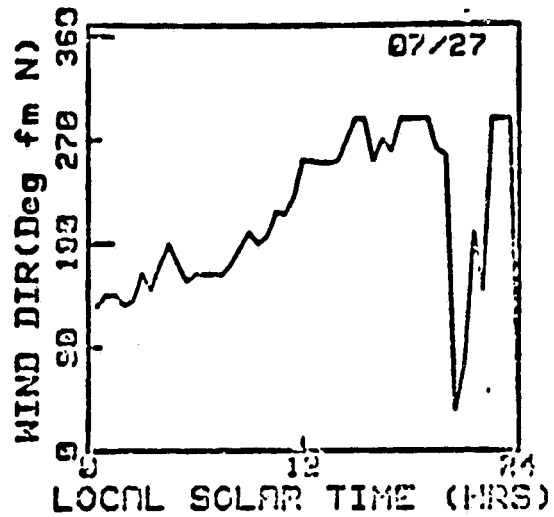
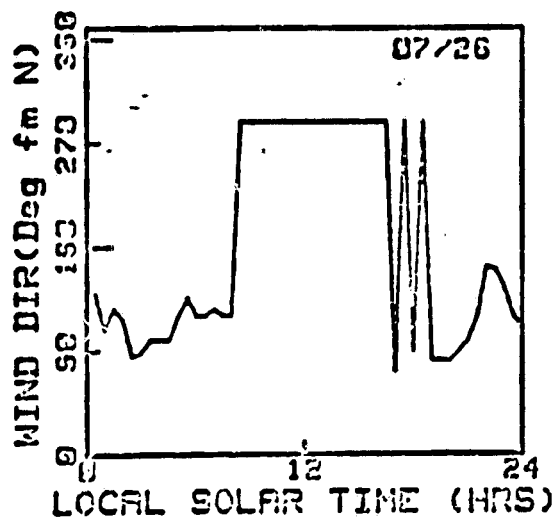


Figure 35. -- Wind direction for July 26, 27, 28, and 29 from station 1.

ORIGINAL PAGE IS
OF POOR QUALITY.

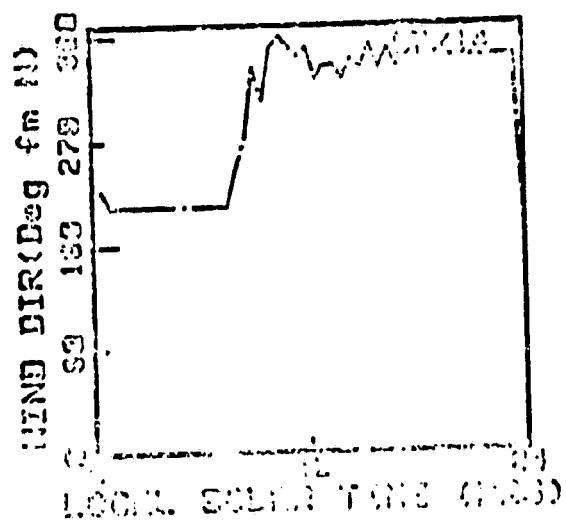
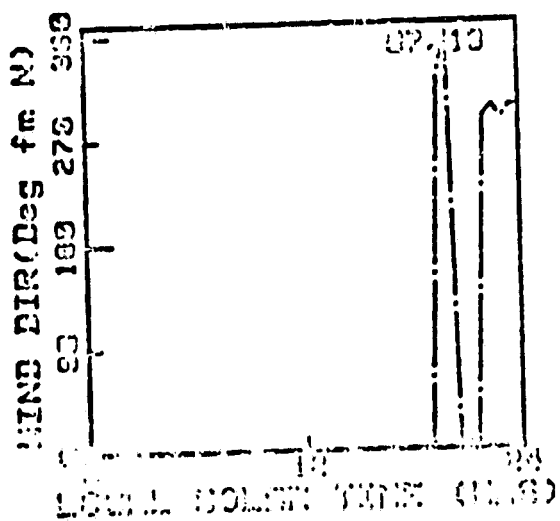
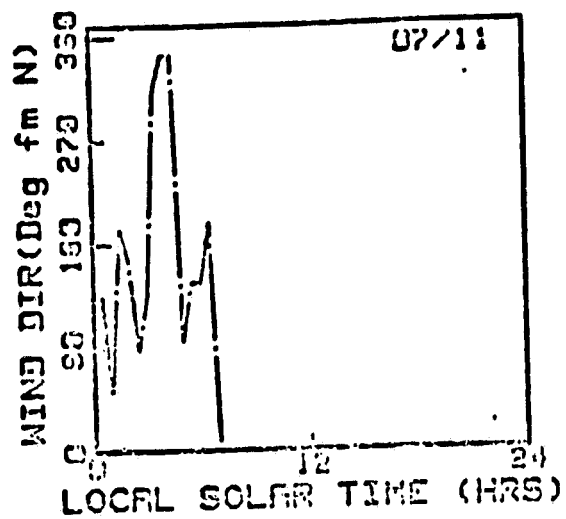
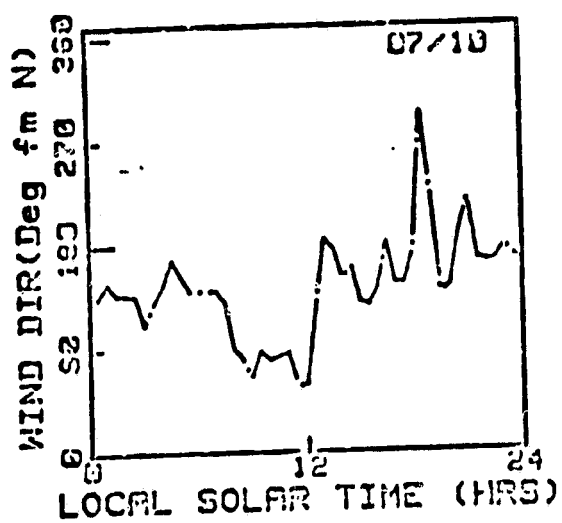


Figure 36. -- Wind direction for July 10, 11, 13, and 14 from station 2.

ORIGINAL PAGE IS
OF POOR QUALITY.

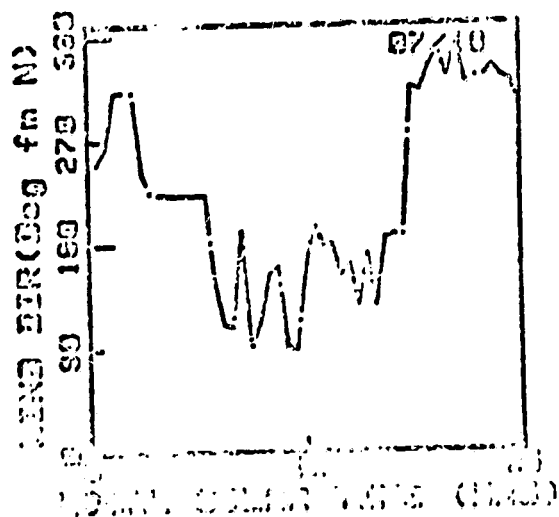
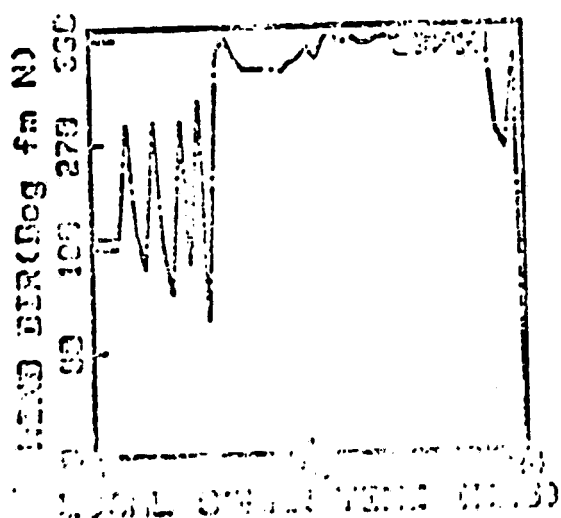
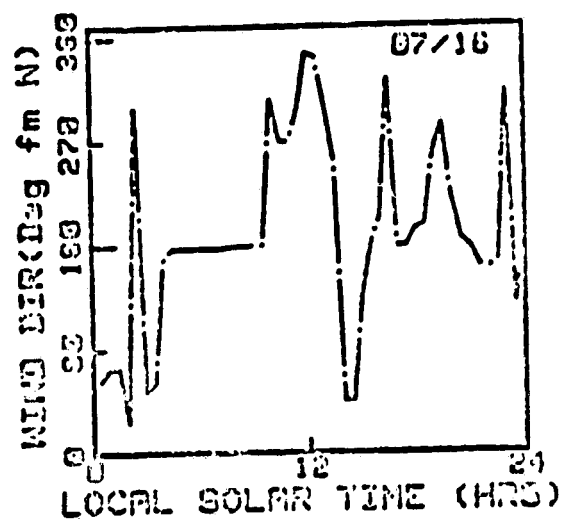
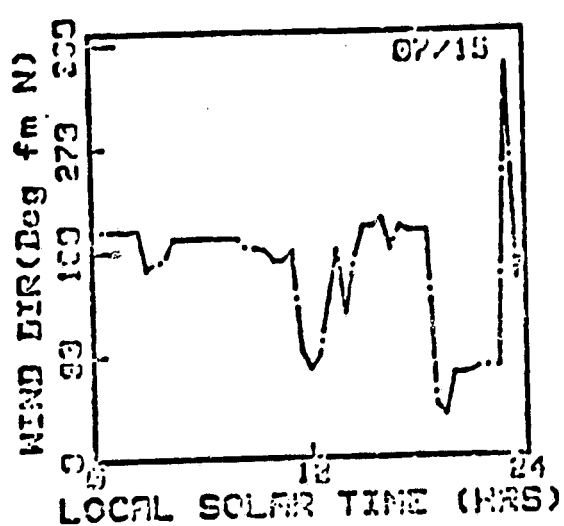


Figure 37. -- Wind direction for July 15, 16, 17, and 18 from station 2.

ORIGINAL PAGE IS
OF POOR QUALITY

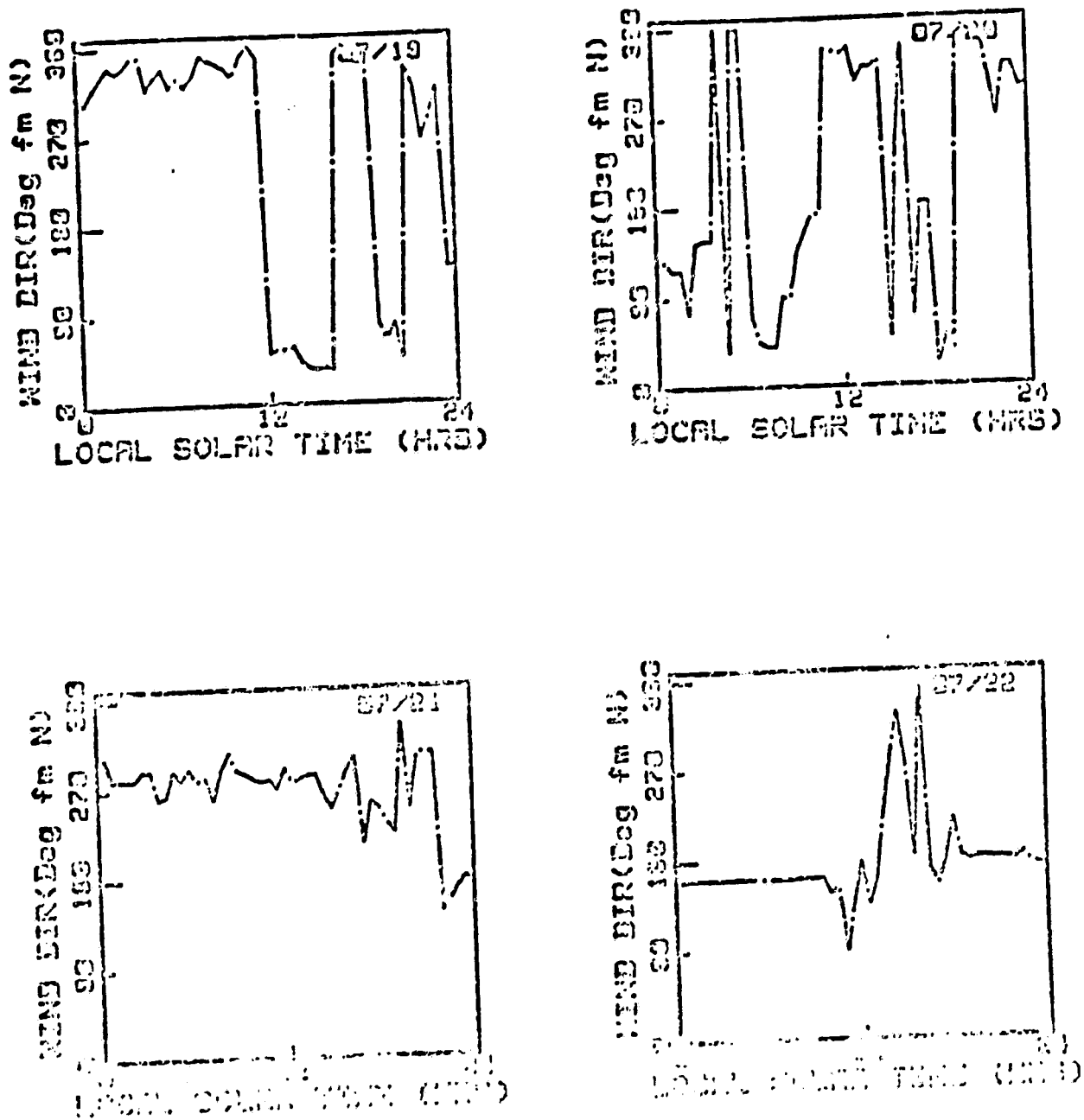


Figure 38. -- Wind direction for July 19, 20, 21, and 22 from station 2.

ORIGINAL PAGE IS
OF POOR QUALITY

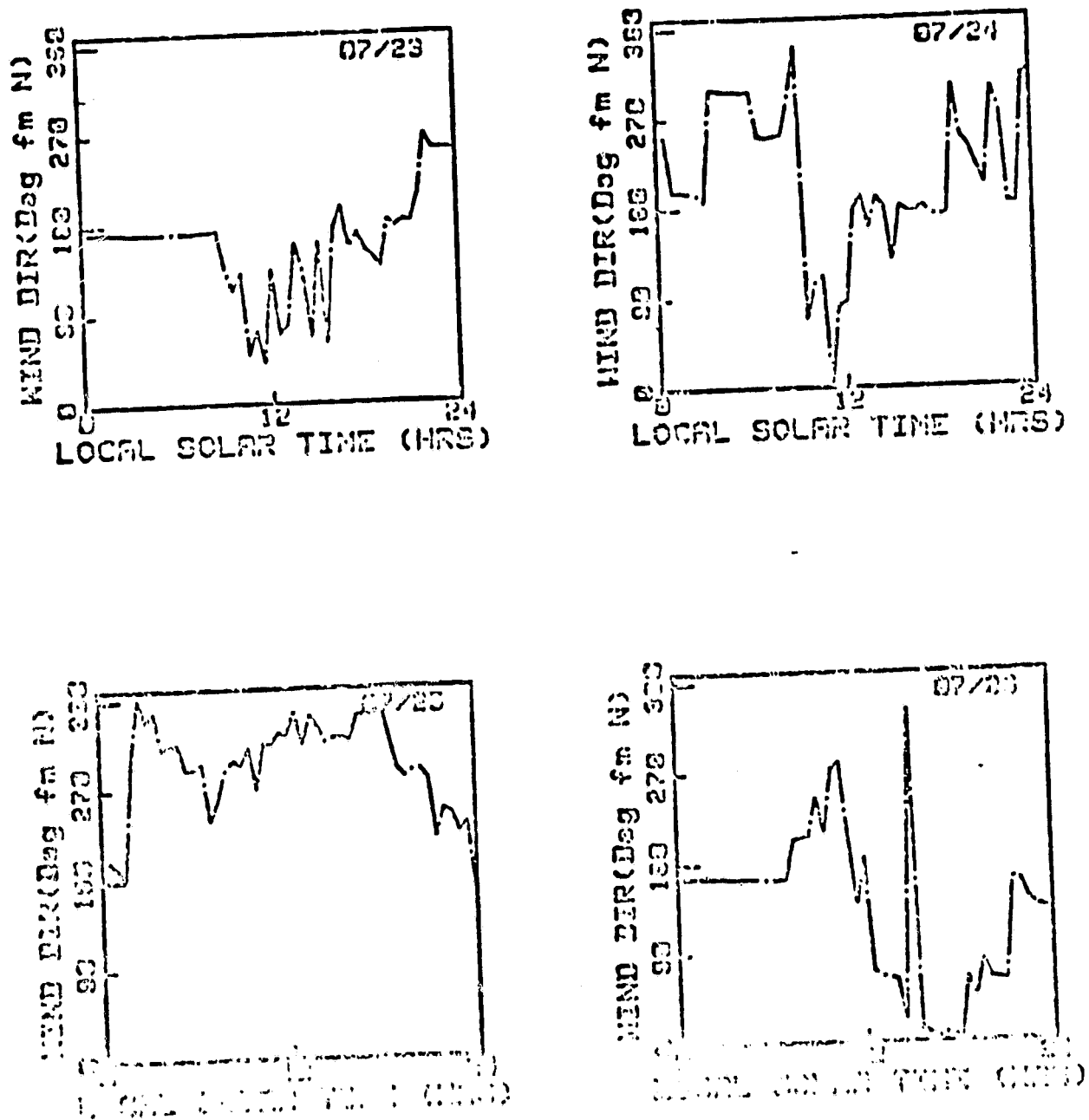


Figure 39. -- Wind direction for July 23, 24, 25, and 26 from station 2.

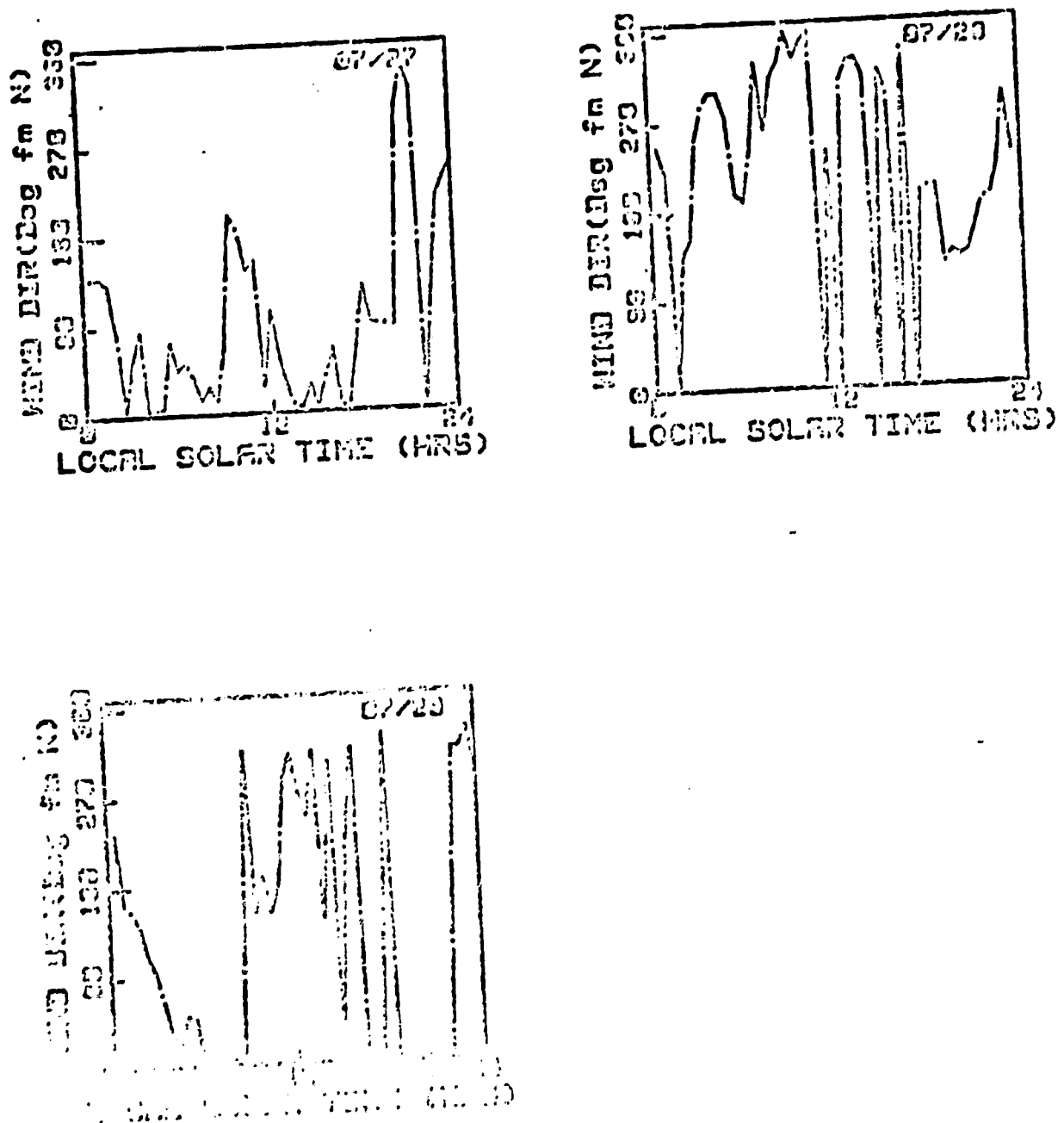


Figure 40. -- Wind direction for July 27, 28, and 29 from station 2.