TECHNICAL MEMORANDUM

10

Monthly report on ECMWF's operational model's performance

C. Girard and J.-F Geleyn

Research Department

October 1979

European Centre for Medium-Range Weather Forecasts
Europäisches Zentrum für mittelfristige Wettervorhersage
Centre européen pour les prévisions météorologiques à moyen

Monthly Report on ECMWF's operational model's performances: October 1979

This report is the second of its kind. The first report on the model's performance for September 1979 has been published as Technical Memorandum No.9, 1979.

To repair an omission in the previous report we indicate here that the denomination October 1979 means all forecasts starting in the month and not all forecasts verifying in it.

The number of diagnostics that can be routinely accumulated to evaluate the model's performance is still fairly limited. For example, no physical diagnostics are presently available. For this reason the special topic of the report will remain small.

1. STANDARD VERIFICATIONS OF THE MODEL'S PERFORMANCE

1.1 Objective scores

Fig. 1 shows the time-evolution (forecast period: 10 days) of the standard deviation of the error in the height fields averaged for the month (20 cases for October 1979), over the atmosphere (200-1000 mb, 20 ^{o}N - 82.5 ^{o}N). Fig. 2 and Fig. 3 show the time-evolution of the anomaly correlation coefficients similarly averaged for heights and temperatures respectively. The same results, plus values at 2 levels, are reproduced in digital form for every 12 hours up to 5 days in Table 1. From September to October the RMS values have increased in accordance with the persistence values but more rapidly than the norm. However values of anomaly correlations are comparable for heights but are slightly better for temperature, remaining above 0.5 overall and above 0.6 for the long waves after 5 days for October.

1.2 Energetics

Figs. 4 to 15 give a comparison of the zonally averaged main energetic terms between model (ENS) and analysis (OBS) for the forecast period including day 7 to 10: kinetic (KE) and available potential (AE) energies, conversion of zonal to eddy kinetic(CK) and available (AE) energies, northward momentum (UV) and sensible heat (TV) fluxes. KE is strongly overestimated in its zonal part and underestimated elsewhere, although only slightly so for wavenumbers 1 - 3, contrary to September where wavenumbers 1 - 3 were underestimates by almost 50%, AE is underestimated at all wavenumbers as in September. CK is more realistic for wavenumbers 1 - 3, but remains in total larger than observations at low latitudes. CA is also more realistic for wavenumbers 1 - 3 remaining in total smaller than observations in the lower troposphere. UV and TV are also more realistic especially in wavenumbers 1 - 3 for October.

1.3 Energy spectra

Figs. 16 to 18 show the space averaged 500 mb height and tropospheric kinetic energy spectra for 3 forecast periods. As in September the kinetic energy decreases with time at high wavenumbers. Contrary to September where it also decreased at low wavenumbers but remained realistic at medium wavenumbers, in October it remains realistic at low wavenumbers but decreases with time for medium wavenumbers. The same comments apply for 500 mb height (see Section 2.1 for further details.)

1.4 Zonally averaged zonal wind and temperature deviations (Fig. 19)

The predicted atmosphere is too cold by more than 1 ^{o}C below 700 mb and south of 60 ^{o}N d above 150 mb. It is warmer than observed at 200 mb between 20^{o} and 40 ^{o}N and in the troposphere north of 70 ^{o}N. A similar pattern was observed in September but in October there is also a too high temperature in polar regions. The predicted

mean zonal wind maximum is larger than observed, is displaced toward the north by 2 - 3^{o} and occurs at higher levels. The mean jet is also more confined than observed with speed deficiencies at both low and high latitudes. When latitudinally averaged, the net result is a zonal circulation smaller than that observed below 150 mb and superior above. The polar temperature error is associated with a weakening of the circumpolar circulation which was not observed in September.

1.5 Geographical distribution of the systematic and root-mean-square errors of the 500 and 1000 mb heights and 850 mb temperatures

Figs. 20, 22 and 24 show maps of the averaged observed and forecast 500 mb height, 1000 mb height and 850 mb temperature fields respectively, valid at day 10. Figs. 21, 23, 25 show the corresponding mean and RMS difference fields at day 10. The general comments made for the month of September about the lack of intensity and eastward shift of the mean troughs and ridges in the 500 mb height field also apply for the month of October. The Pacific jet stream is more intense and extends a good 30^{o} further west in the forecast than in the observations. The region from 180 ^{o}E (pacific jet stream exit) to 90 ^{o}W (Atlantic jet stream entrance) where the observed circulation is weak is forecast to occur between 150 ^{o}W and 60 ^{o}W. Similarly, the more intense flow observed between 90 ^{o}W and 0 ^{o}E is reproduced between 60 ^{o}W and 30 ^{o}E in the forecasts. The fact that the forecast circulation is too strong over the Pacific in general and over both the Pacific and Atlantic observed jet exit regions results in heights being too low to the North and too high to the South of these regions. The three negative centres in the 500 mb height error near Alaska, over Britain and Scandinavia and over USSR also appeared in September. At 1000 mb, the forecast subtropics show a mean anticyclonic circulation which extends from the mid-

oceans and over most of the US and Mediterranean regions in contrast with the observed subtropics. The Aleutian low is too intense and the Icelandic low is slightly underestimated but both systems extend too far to the west. At 850 mb, the temperatures are generally too low over the subtropics, especially over continental land masses as also observed for September. The temperature errors are however slightly less than in September and considering the fact that there was more structure in the temperature field this can be interpreted as a better result, as confirmed by Fig. 3 and Table 1.

2. SPECIAL TOPICS

2.1 More energy spectra

Figs. 26 to 31 show the spectra of kinetic energy for different forecast periods at various pressure levels both observed (OBS) and forecast (ENS). During the first forecast period (day 0-3), the model has lost kinetic energy at high levels and high wavenumbers but has predicted excessive amounts of energy at low levels, medium and low wavenumbers. During the second forecast period (day 4-7) the model becomes deficient in kinetic energy for medium as well as high wavenumbers at high levels but keeps excessive amounts at low levels. During the last forecast period, the model has lost even more energy at high levels and medium and high wavenumbers. The low levels have also lost considerable amounts of energy and starts to show a deficit at high wavenumbers.

2.2 Zonal averages

Forecast and observed zonal averages of temperature at 850 and 500 mb, zonal wind at 300 mb and height at 1000 mb are compared in Fig. 32. The same tendencies noted in September are apparent in October with larger amplitude of the discrepancies between observed and forecast zonal wind and 1000 mb height

2.3 Energetics of the average

Fig. 33 shows the observed and forecast spectra of 500 mb height and tropospheric kinetic energy for the mean state during October forecast period including days 7 to 10. Marked discrepancies between observed and forecast values were noted for September at low wavenumbers with forecast kinetic energy in wavenumbers 2 and 3 in particular representing as little as 10% of the observed. For October the discrepancies are much smaller but still apparent in wavenumbers 1 (50% of observed) and 3 (20%) of the observed. Conversion terms and fluxes (not shown) are also more realistic though still weak. The surprising aspect of these results is that they are associated with an even higher phase error of the long waves (see Section 1.3). This could indicate that, contrary to September when they slowly moved eastwards for the whole integration period, long waves in October quickly adapted to a new position.

			12	24	36	48	60	72	84	96	108	120
HEIGHTS	RMSE (m)	1000-200	20	28	35	44	51	61	69	77	84	91
		500	18	26	33	42	50	60	67	75	82	90
		1000	18	24	32	37	43	48	53	57	62	67
	ACC (%)	1000-200	98	96	93	89	85	79	74	68	62	56
		500	98	96	94	90	86	79	74	68	63	56
		1000	96	92	87	83	77	72	67	61	56	49
TEMPERATURE	RMSE ($0.1^{o}K$)	850-200	13	16	19	22	26	29	31	34	36	39
		500	11	14	17	20	23	27	30	32	35	37
		1850	14	18	22	25	29	32	35	39	41	44
	ACC (%)	850-200	94	91	87	83	78	72	67	61	57	52
		500	96	93	89	85	80	73	68	62	57	51
		850	94	91	87	83	78	73	69	62	59	53

Table 1. October 1979 (20 cases)

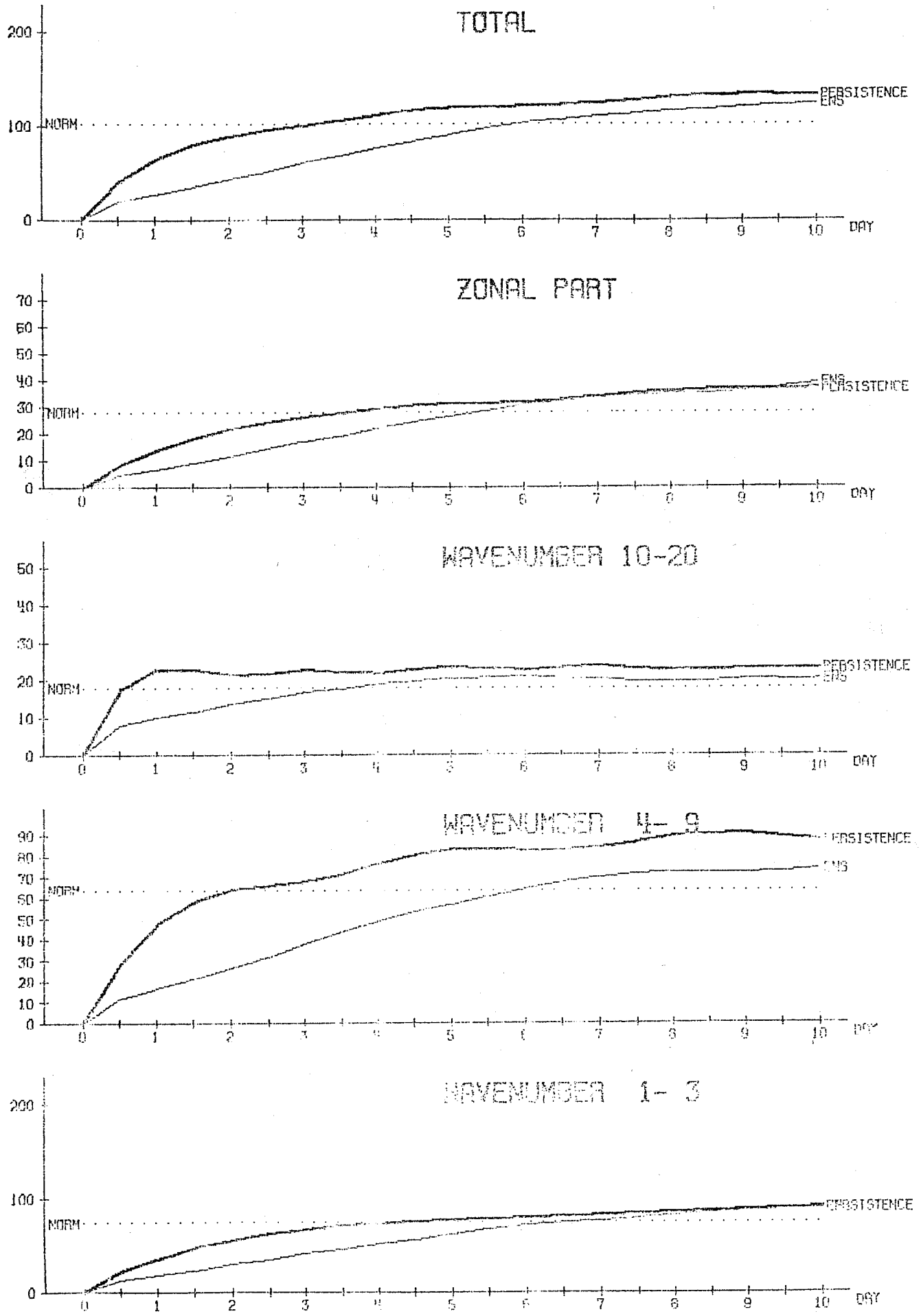

TOTAL
200
100
0
NORM
PERSISTENCE
ENS
0 1 2 3 4 5 6 7 8 9 10
DAY
ZONAL PART
70
60
50
40
30
20
10
0
NORM
ENS
PERSISTENCE
0 1 2 3 4 5 6 7 8 9 10
DAY
WAVENUMBER 10-20
50
40
30
20
10
0
NORM
PERSISTENCE
ENS
0 1 2 3 4 5 6 7 8 9 10
DAY
WAVENUMBER 4- 9
90
80
70
60
50
40
30
20
10
0
NORM
PERSISTENCE
ENS
0 1 2 3 4 5 6 7 8 9 10
DAY
WAVENUMBER 1- 3
200
100
0
NORM
PERSISTENCE
0 1 2 3 4 5 6 7 8 9 10
DAY
MEAN 1000- 200 MB AND 20.0- 82.5 N
RMS ERROR OF HEIGHT (M) 20 CASES

Figure 1

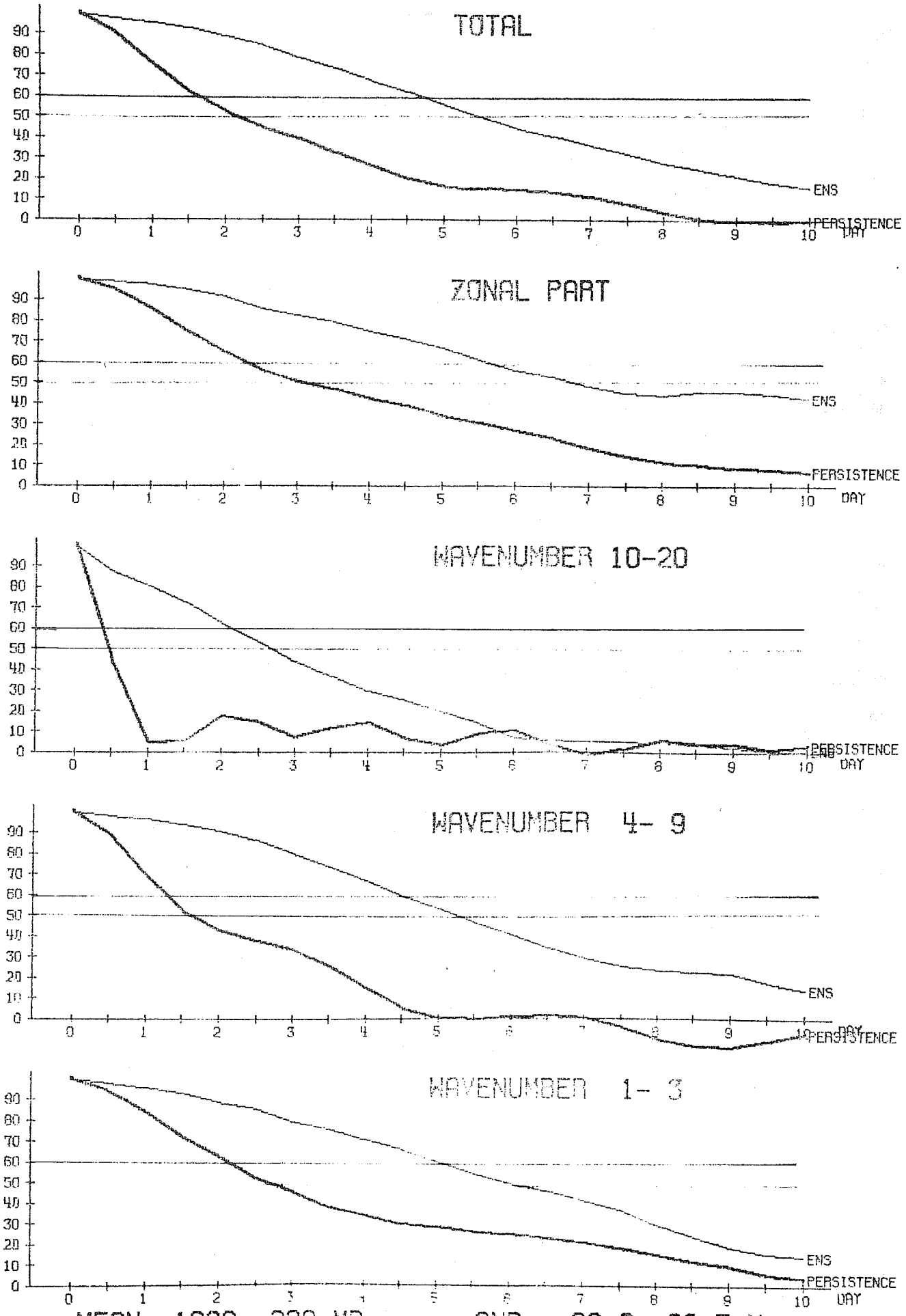

TOTAL
ENS
PERSISTENCE
DAY
ZONAL PART
ENS
PERSISTENCE
DAY
WAVENUMBER 10-20
PERSISTENCE
ENS
DAY
WAVENUMBER 4- 9
ENS
DAY
PERSISTENCE
WAVENUMBER 1- 3
ENS
PERSISTENCE
DAY
MEAN 1000- 200 MB AND 20.0- 82.5 N
CORRELATION OF HEIGHT % 20 CASES

Figure 2

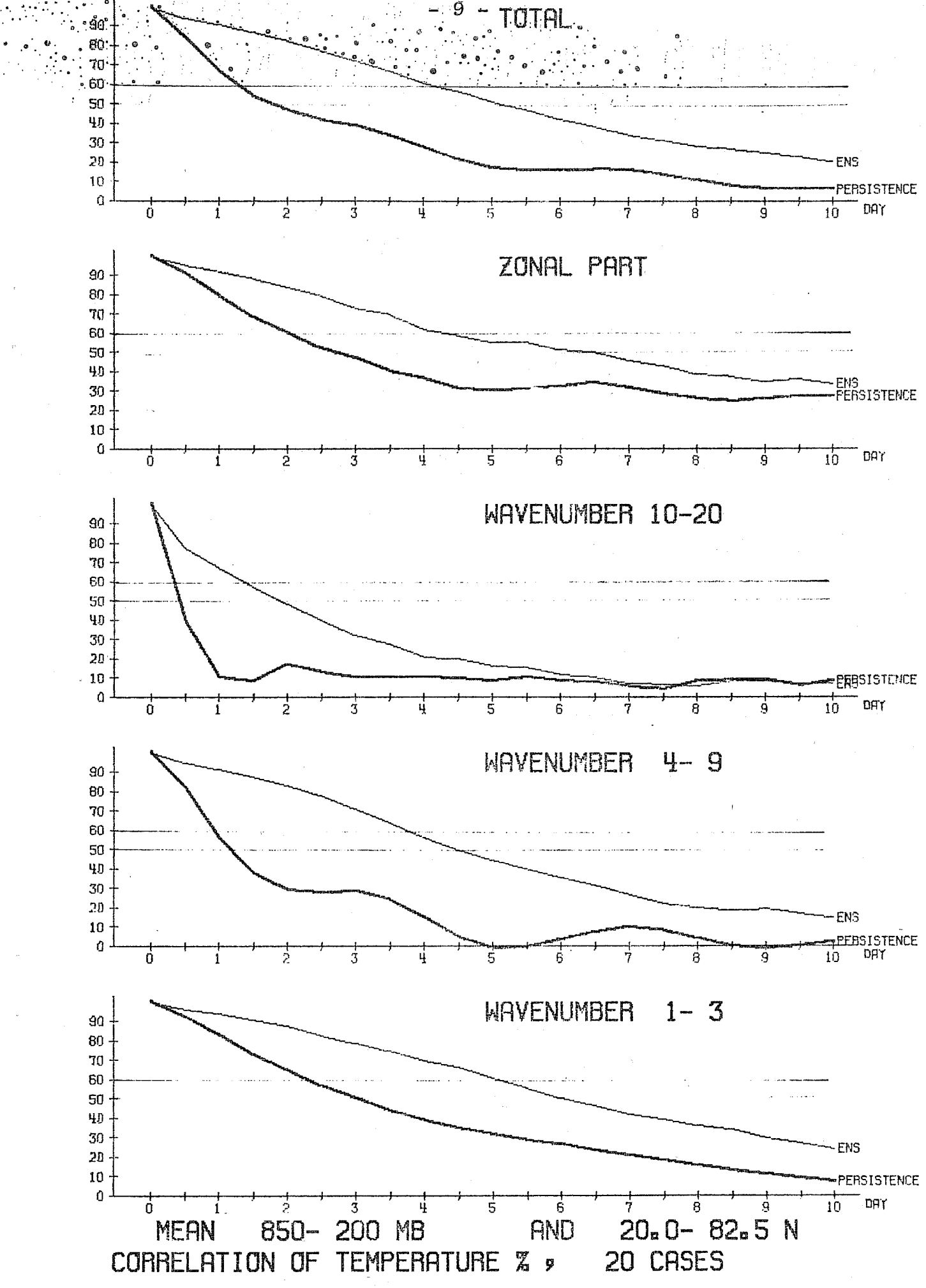

- 9 - TOTAL
ENS
PERSISTENCE
DAY
ZONAL PART
ENS
PERSISTENCE
DAY
WAVENUMBER 10-20
PERSISTENCE
ENS
DAY
WAVENUMBER 4- 9
ENS
PERSISTENCE
DAY
WAVENUMBER 1- 3
ENS
PERSISTENCE
DAY
MEAN 850- 200 MB AND 20.0- 82.5 N
CORRELATION OF TEMPERATURE %, 20 CASES

Figure 3

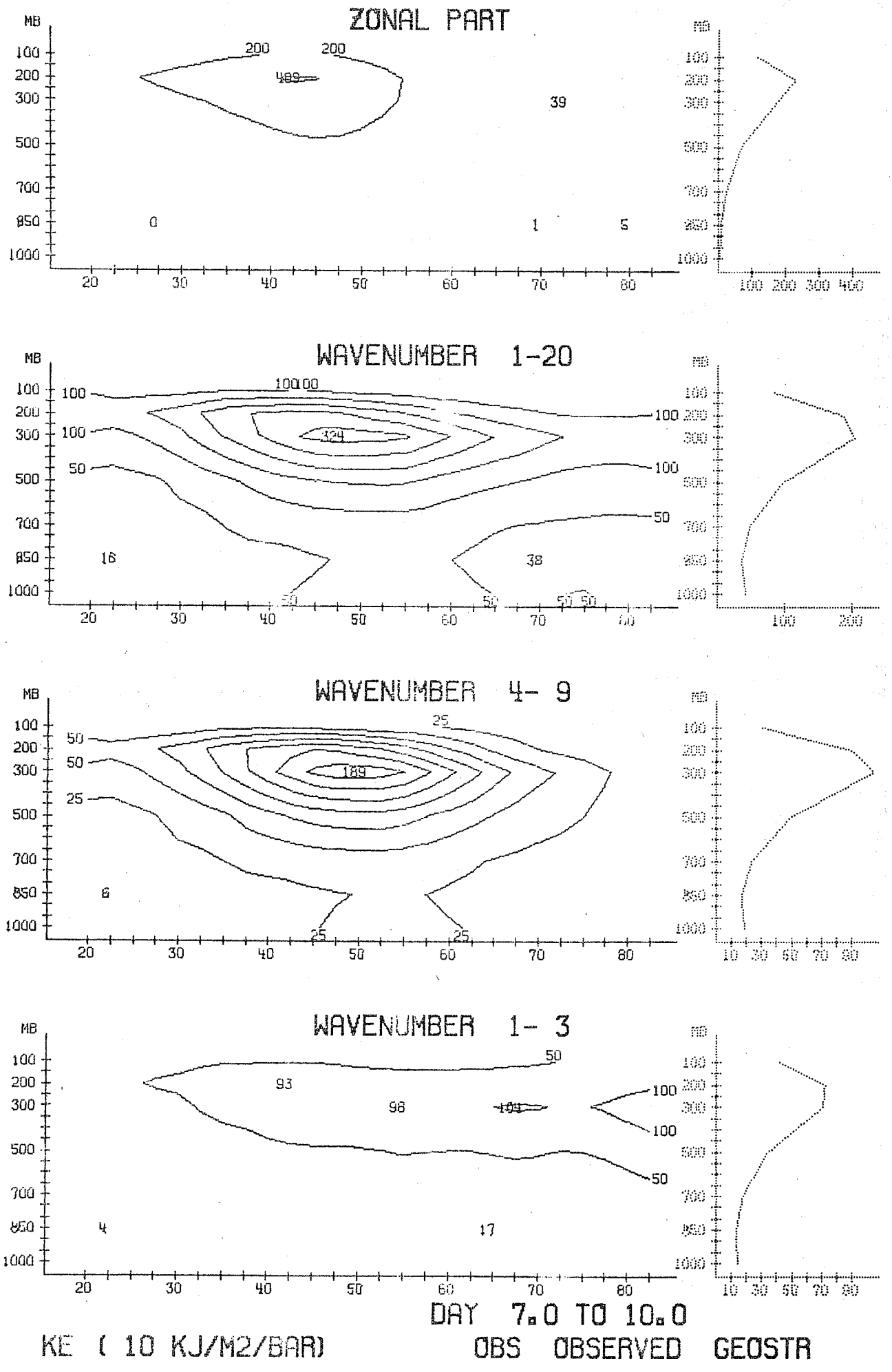

ZONAL PART
MB
100
200
300
500
700
850
1000
200
200
489
39
0
1
5
20
30
40
50
60
70
80
100 200 300 400
WAVENUMBER 1-20
100
100
50
324
100
100
50
16
38
50
50
50 50
100
200
WAVENUMBER 4- 9
50
50
25
189
25
6
25
25
10 30 50 70 90
WAVENUMBER 1- 3
50
93
98
100
100
50
4
17
DAY 7.0 TO 10.0
KE (10 KJ/M2/BAR)
OBS OBSERVED GEOSTR

Figure 4

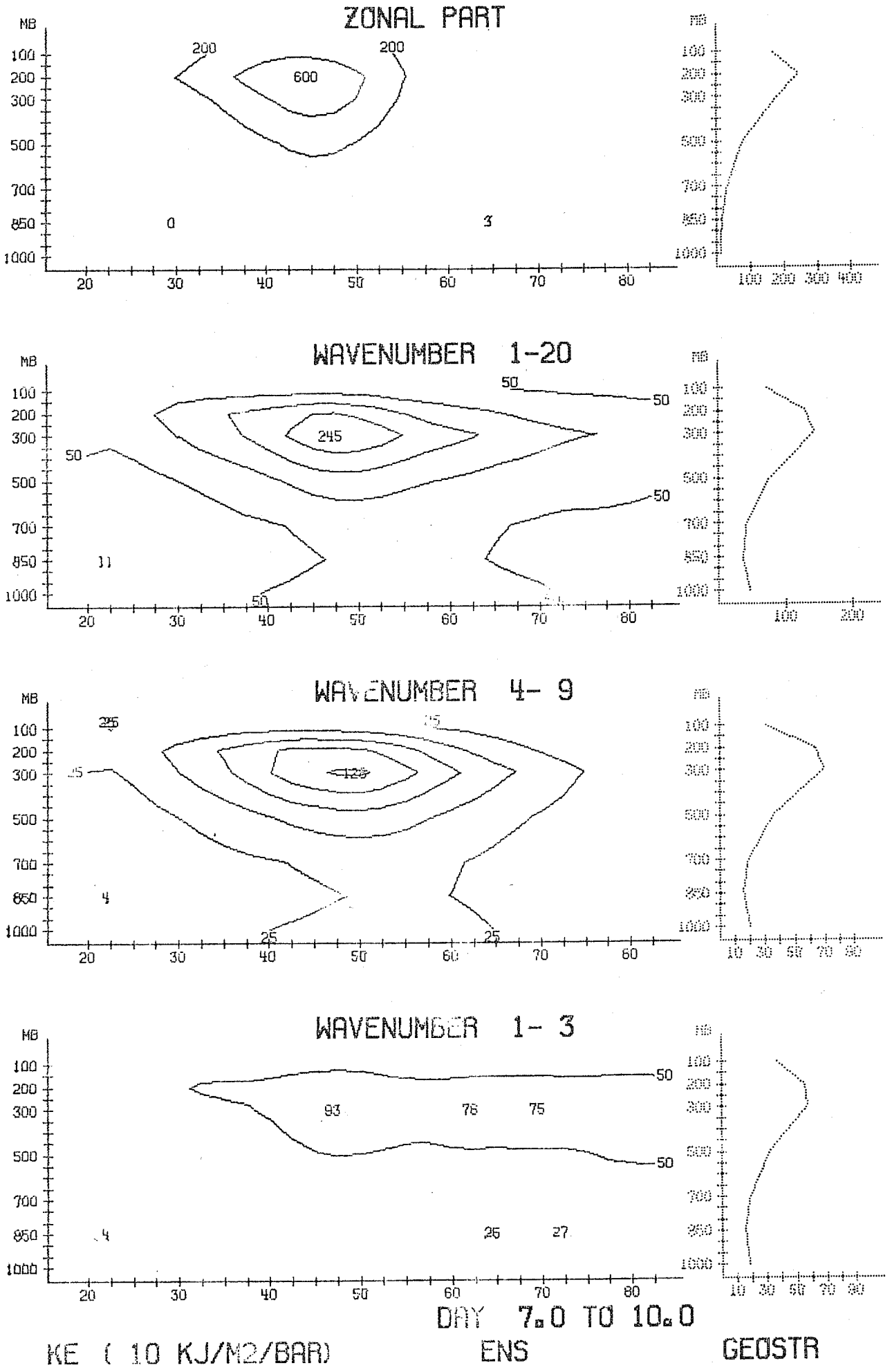

ZONAL PART
MB
100
200
300
500
700
850
1000
200
200
600
0
3
20
30
40
50
60
70
80
100
200
300
400
WAVENUMBER 1-20
50
50
245
50
50
11
50
WAVENUMBER 4- 9
25
25
4
25
25
WAVENUMBER 1- 3
50
93
78
75
50
4
26
27
DAY 7.0 TO 10.0
KE (10 KJ/M2/BAR)
ENS
GEOSTR

Figure 5

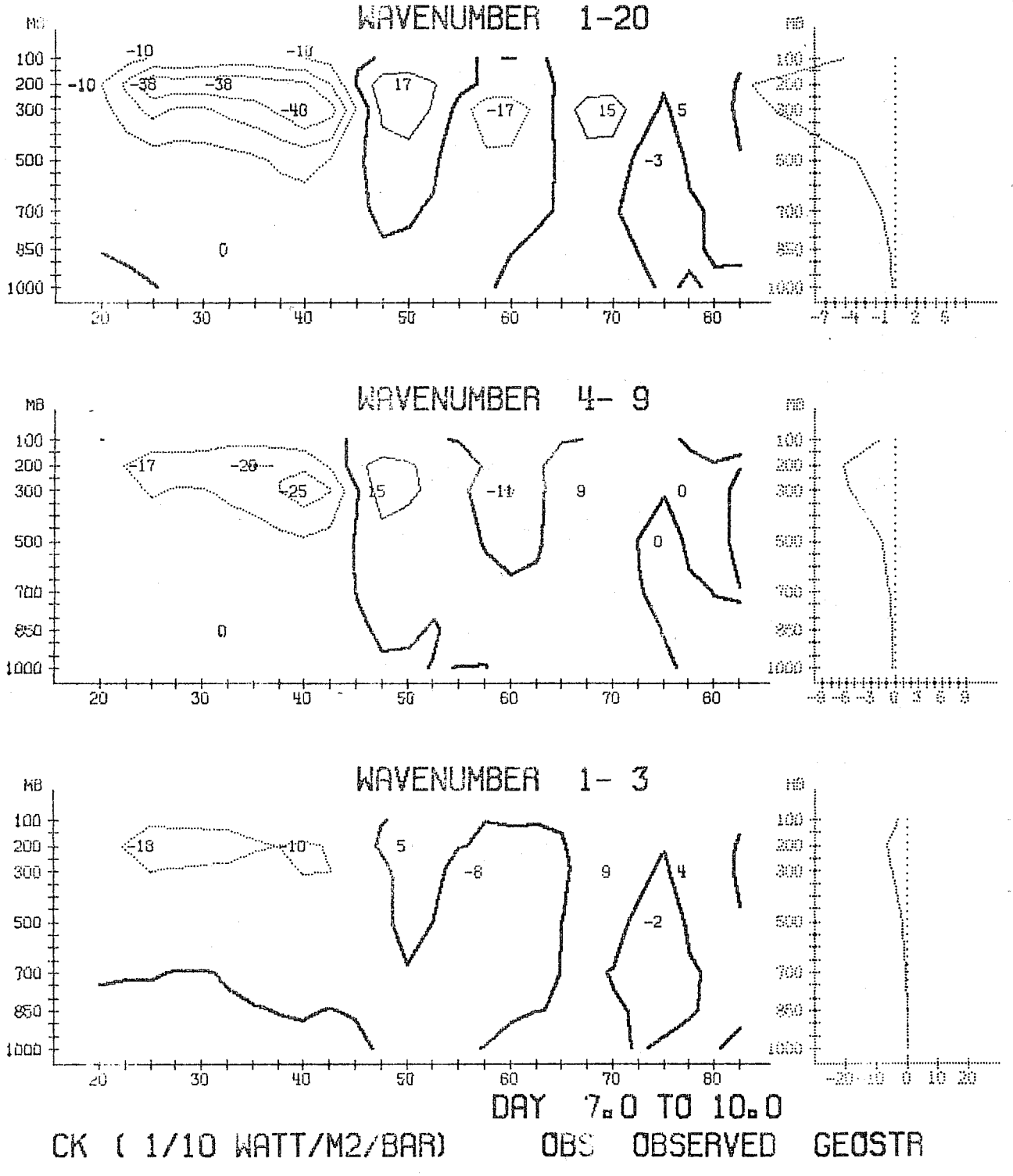

WAVENUMBER 1-20
WAVENUMBER 4- 9
WAVENUMBER 1- 3
MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
DAY 7.0 TO 10.0
CK (1/10 WATT/M2/BAR)
OBS OBSERVED GEOSTR

Figure 6

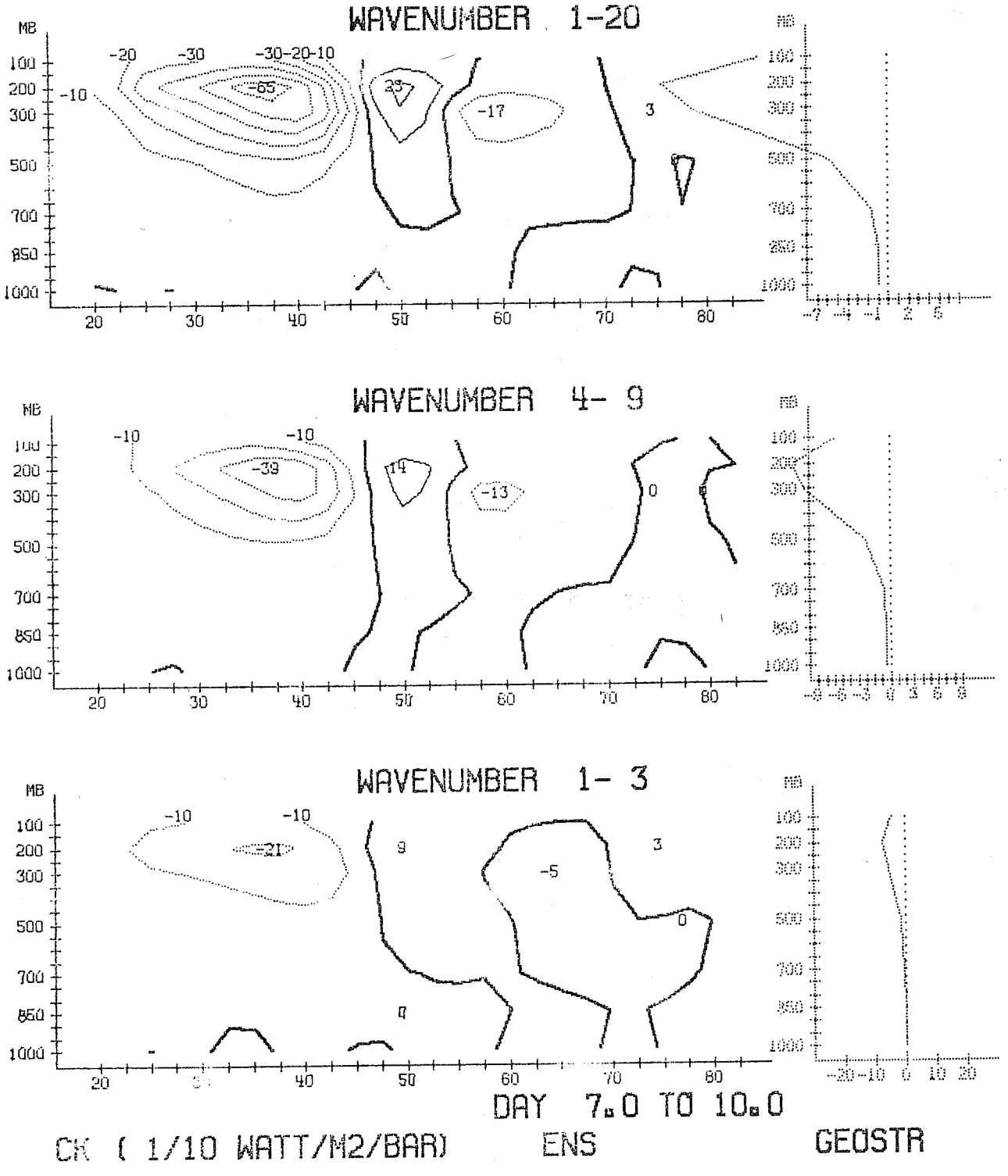

WAVENUMBER 1-20
MB
100
200
300
500
700
850
1000
-20
-30
-30-20-10
-10
-65
25
-17
3
20
30
40
50
60
70
80
-7
-4
-1
2
5
WAVENUMBER 4- 9
-10
-10
-39
14
-13
0
-9
-6
-3
0
3
6
9
WAVENUMBER 1- 3
-10
-10
-21
9
-5
3
0
-20
-10
0
10
20
DAY 7.0 TO 10.0
CK (1/10 WATT/M2/BAR)
ENS
GEOSTR

Figure 7

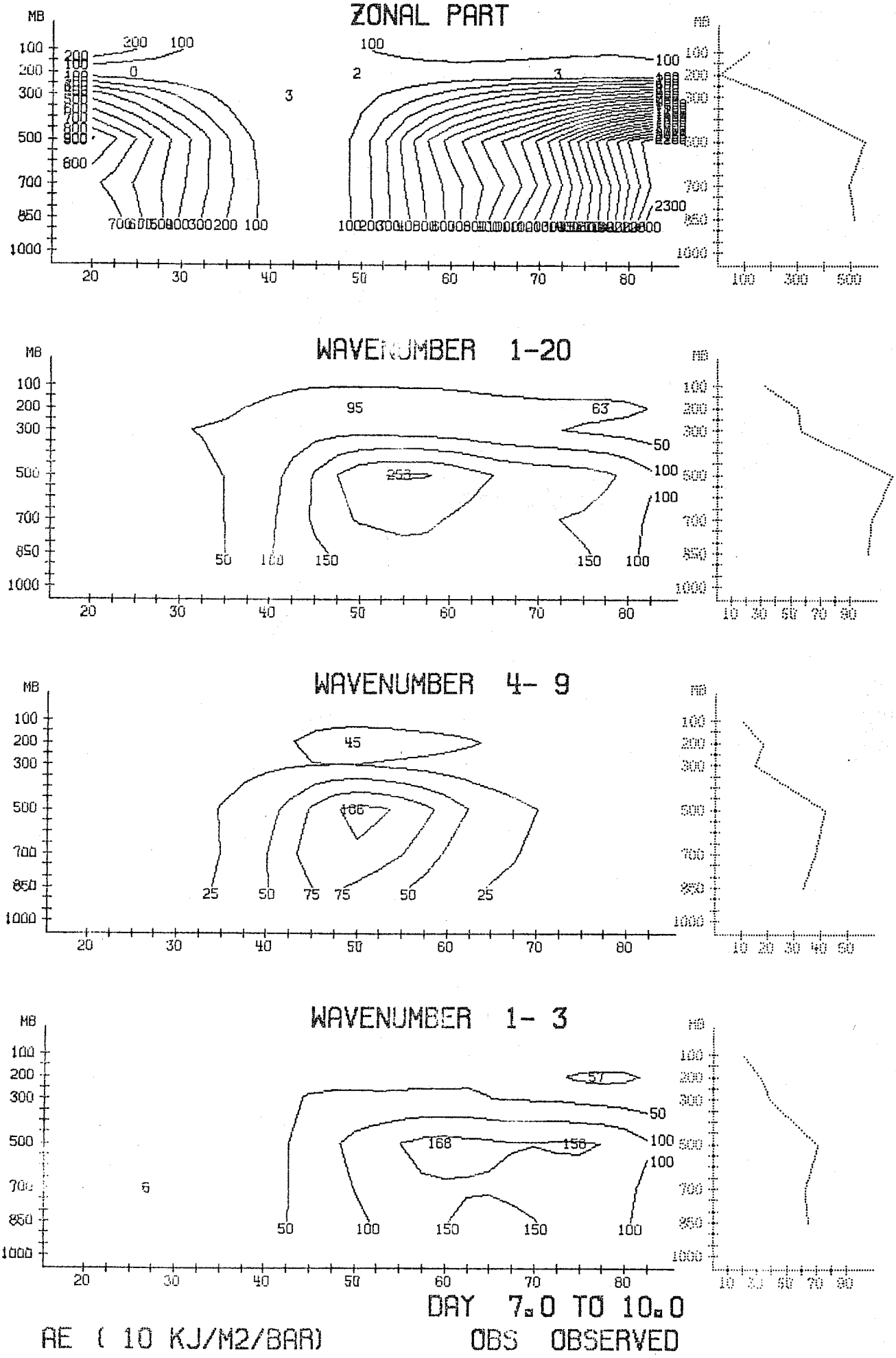

ZONAL PART
WAVENUMBER 1-20
WAVENUMBER 4- 9
WAVENUMBER 1- 3
MB
DAY 7.0 TO 10.0
RE (10 KJ/M2/BAR)
OBS OBSERVED

Figure 8

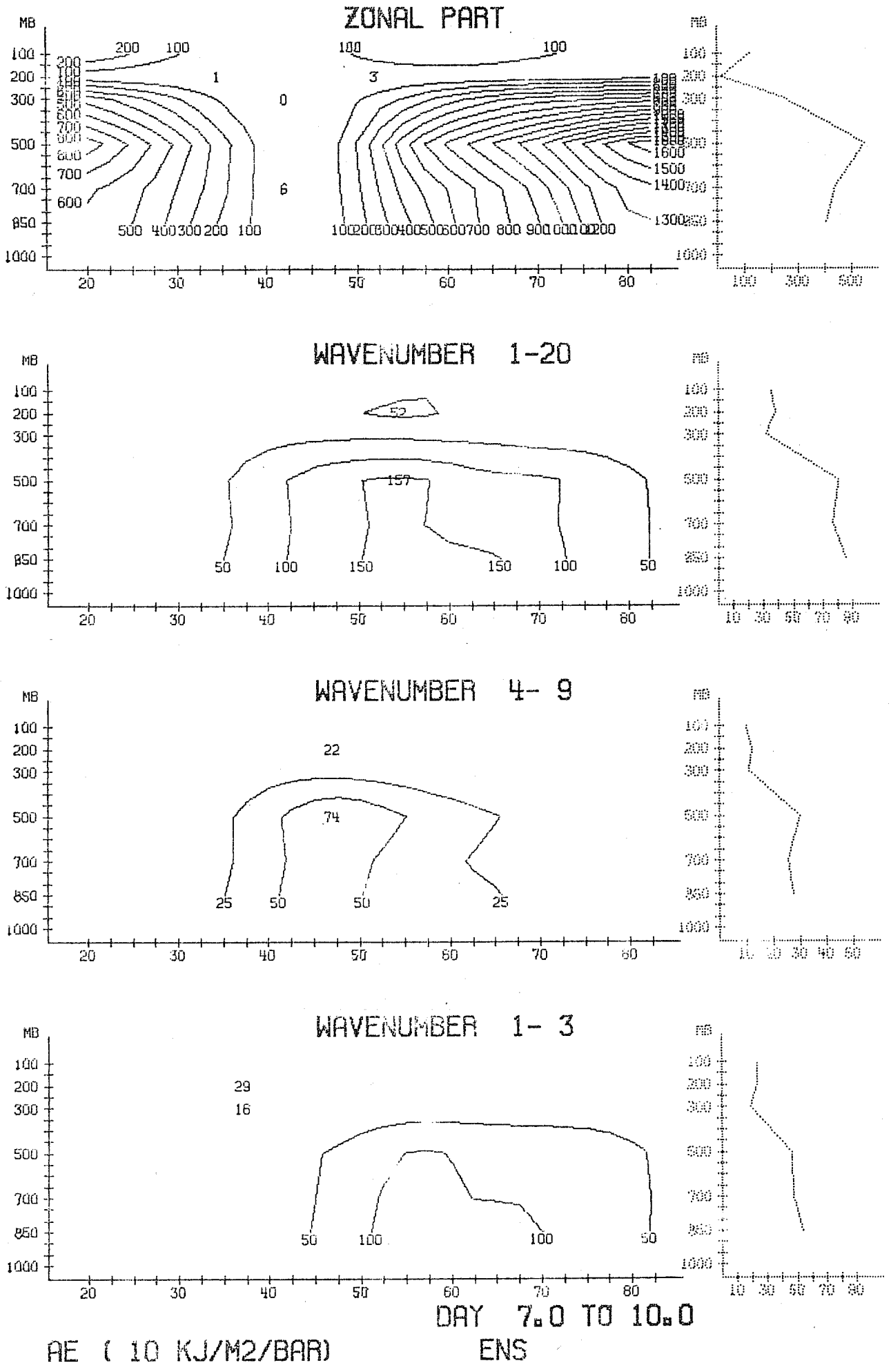

ZONAL PART
WAVENUMBER 1-20
WAVENUMBER 4- 9
WAVENUMBER 1- 3
MB
DAY 7.0 TO 10.0
AE (10 KJ/M2/BAR)
ENS

Figure 9

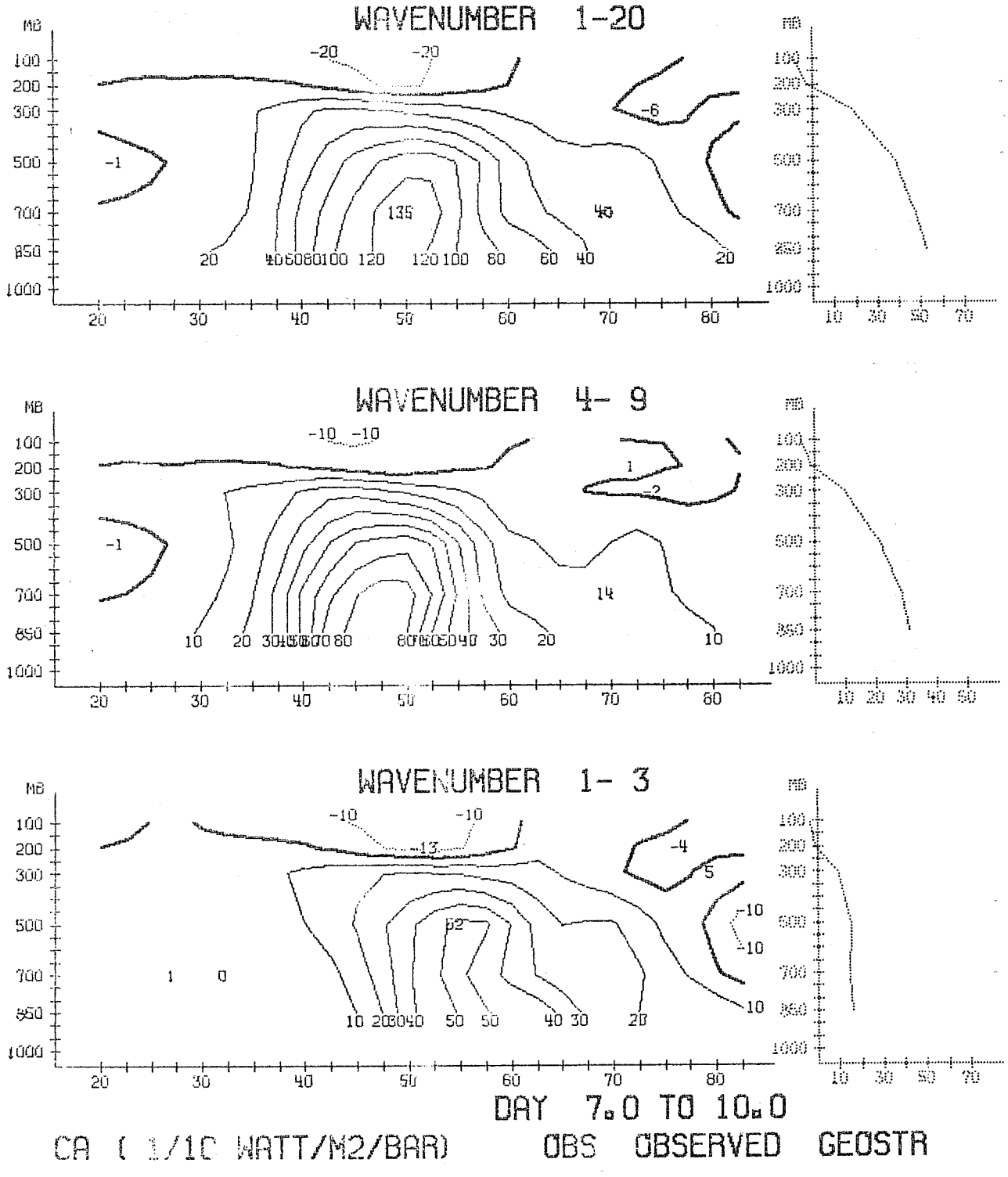

WAVENUMBER 1-20
WAVENUMBER 4- 9
WAVENUMBER 1- 3
MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
DAY 7.0 TO 10.0
CA (1/10 WATT/M2/BAR) OBS OBSERVED GEOSTR

Figure 10

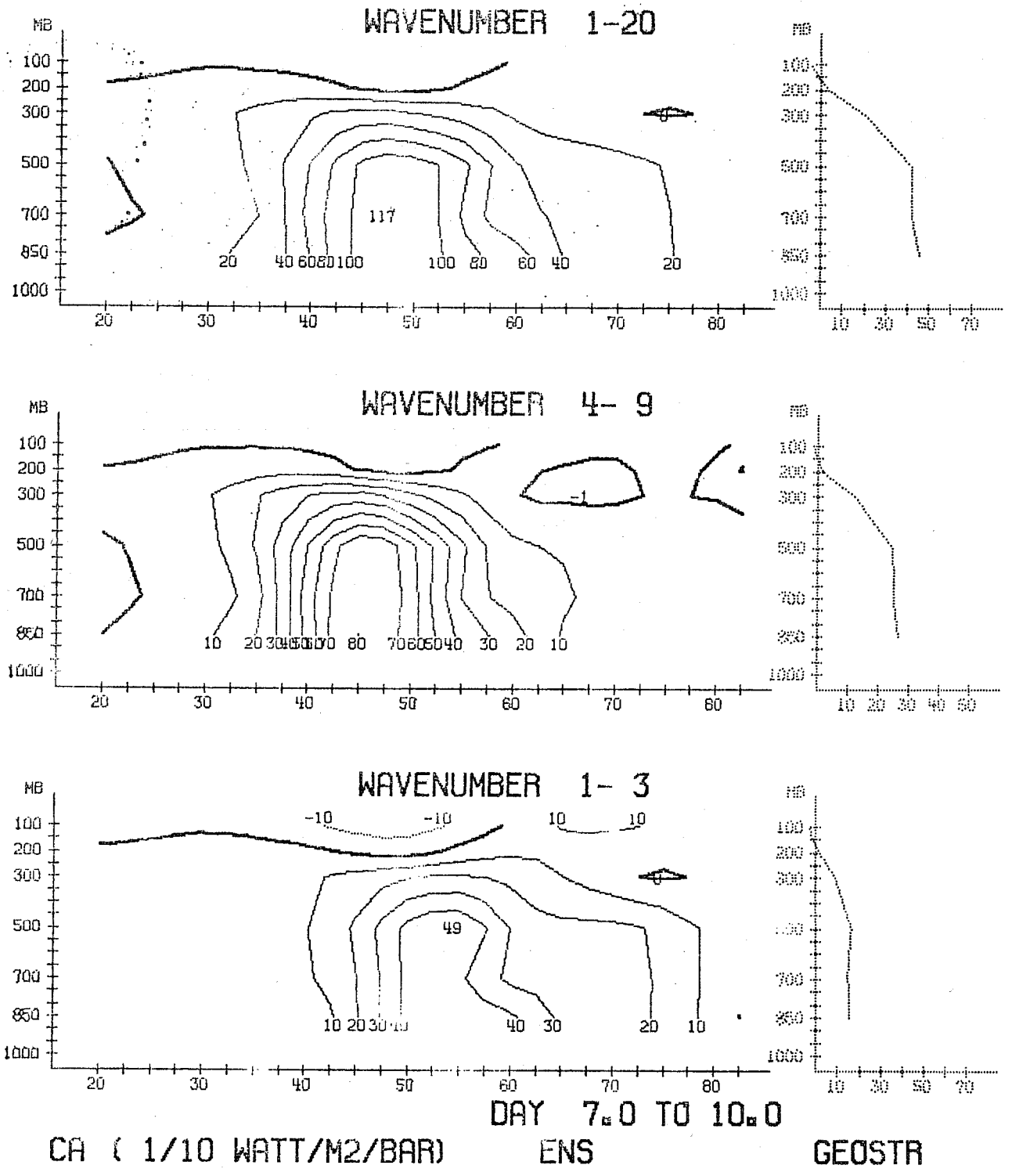

WAVENUMBER 1-20
MB
100
200
300
500
700
850
1000
117
20 40 60 80 100 100 80 60 40 20
20 30 40 50 60 70 80
WAVENUMBER 4- 9
-1
10 20 30 40 50 60 70 80 70 60 50 40 30 20 10
WAVENUMBER 1- 3
-10 -10 10 10
49
10 20 30 40 30 20 10
DAY 7.0 TO 10.0
CA (1/10 WATT/M2/BAR) ENS GEOSTR

Figure 11

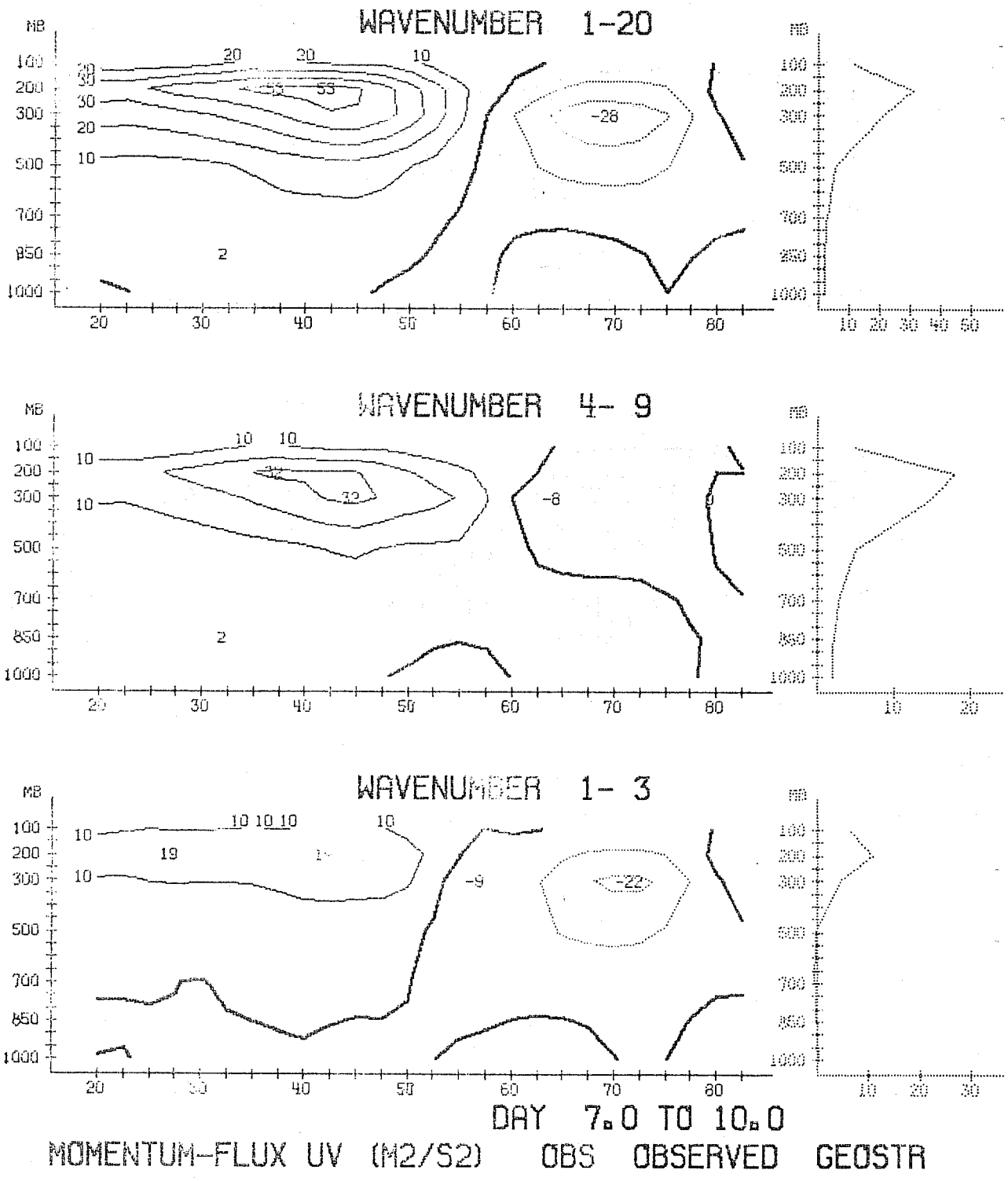

WAVENUMBER 1-20
MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
WAVENUMBER 4- 9
WAVENUMBER 1- 3
DAY 7.0 TO 10.0
MOMENTUM-FLUX UV (M2/S2) OBS OBSERVED GEOSTR

Figure 12

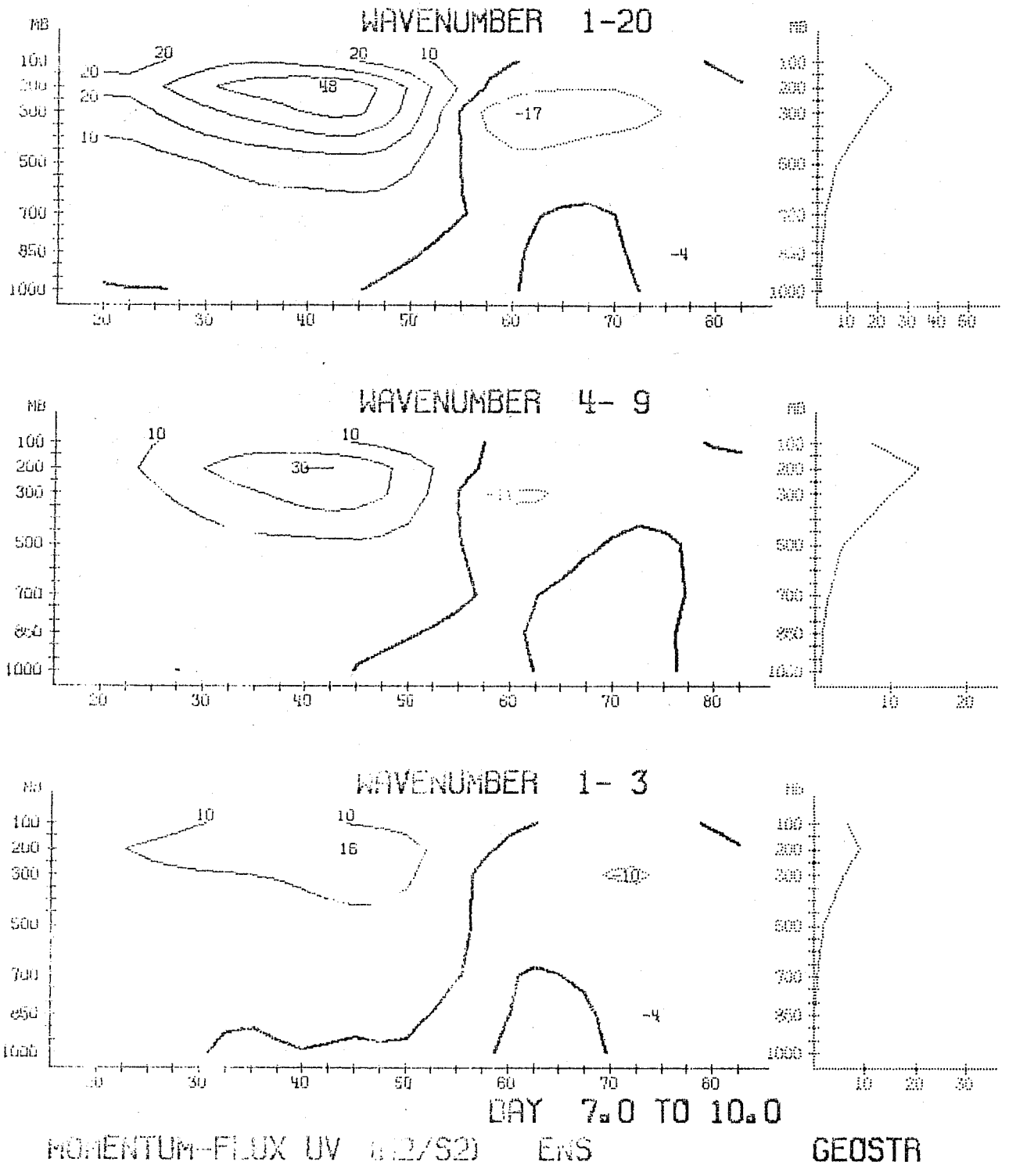

WAVENUMBER 1-20
WAVENUMBER 4- 9
WAVENUMBER 1- 3
MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
10
20
30
40
50
60
48
-17
-4
36
16
DAY 7.0 TO 10.0
MOMENTUM-FLUX UV
ENS
GEOSTR

Figure 13

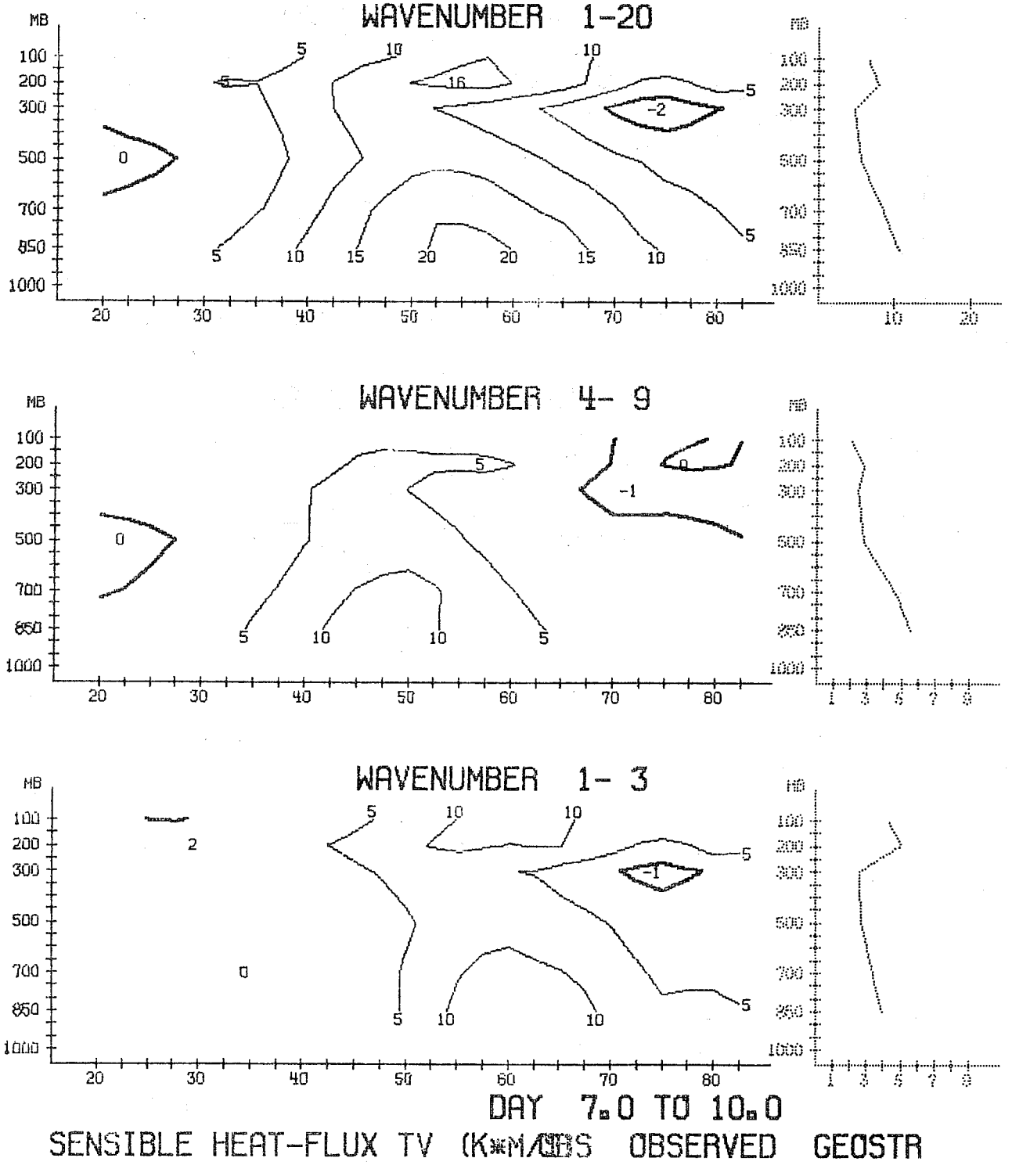

WAVENUMBER 1-20
WAVENUMBER 4- 9
WAVENUMBER 1- 3
MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
DAY 7.0 TO 10.0
SENSIBLE HEAT-FLUX TV (K*M/SEC) OBSERVED GEOSTR

Figure 14

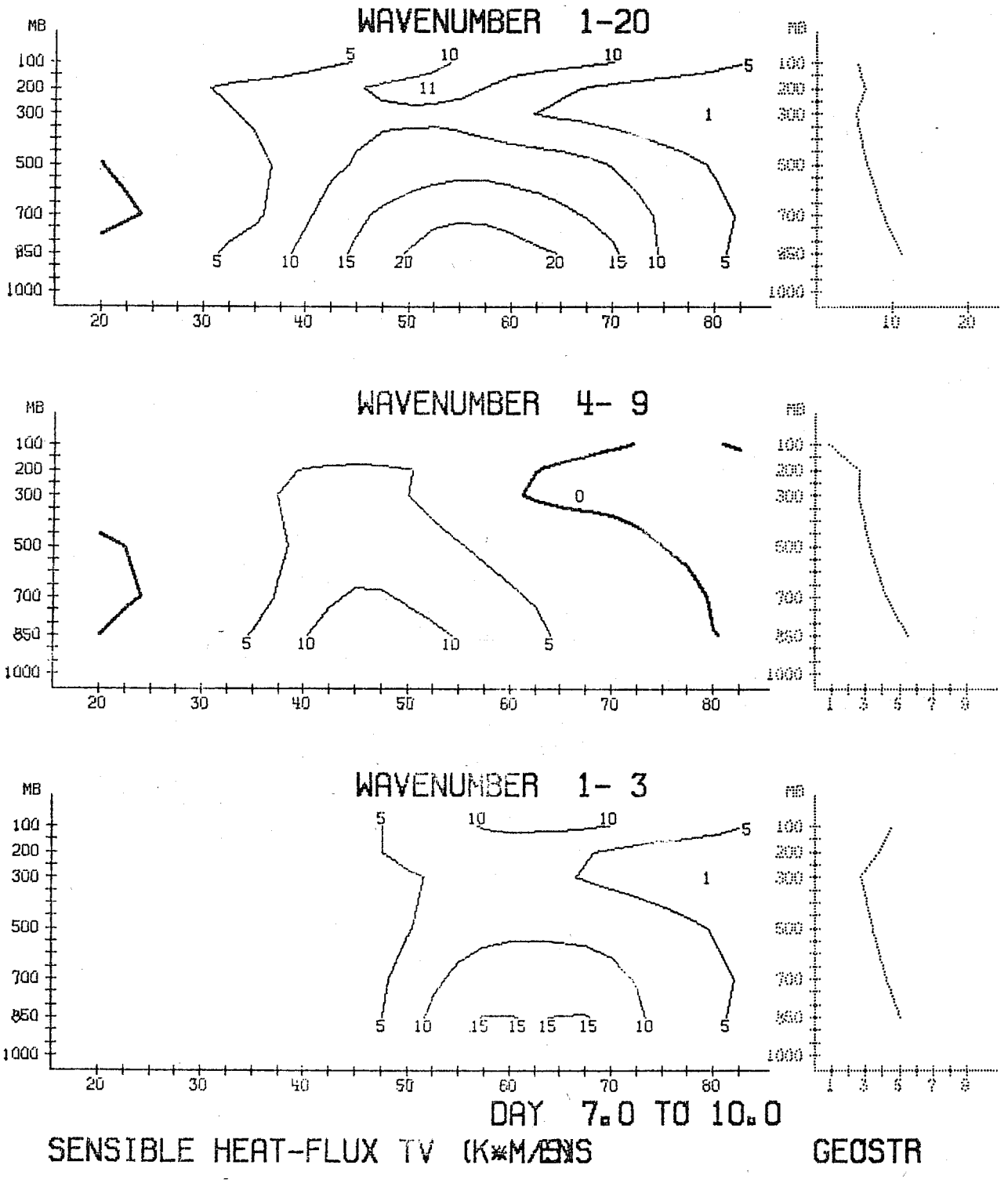
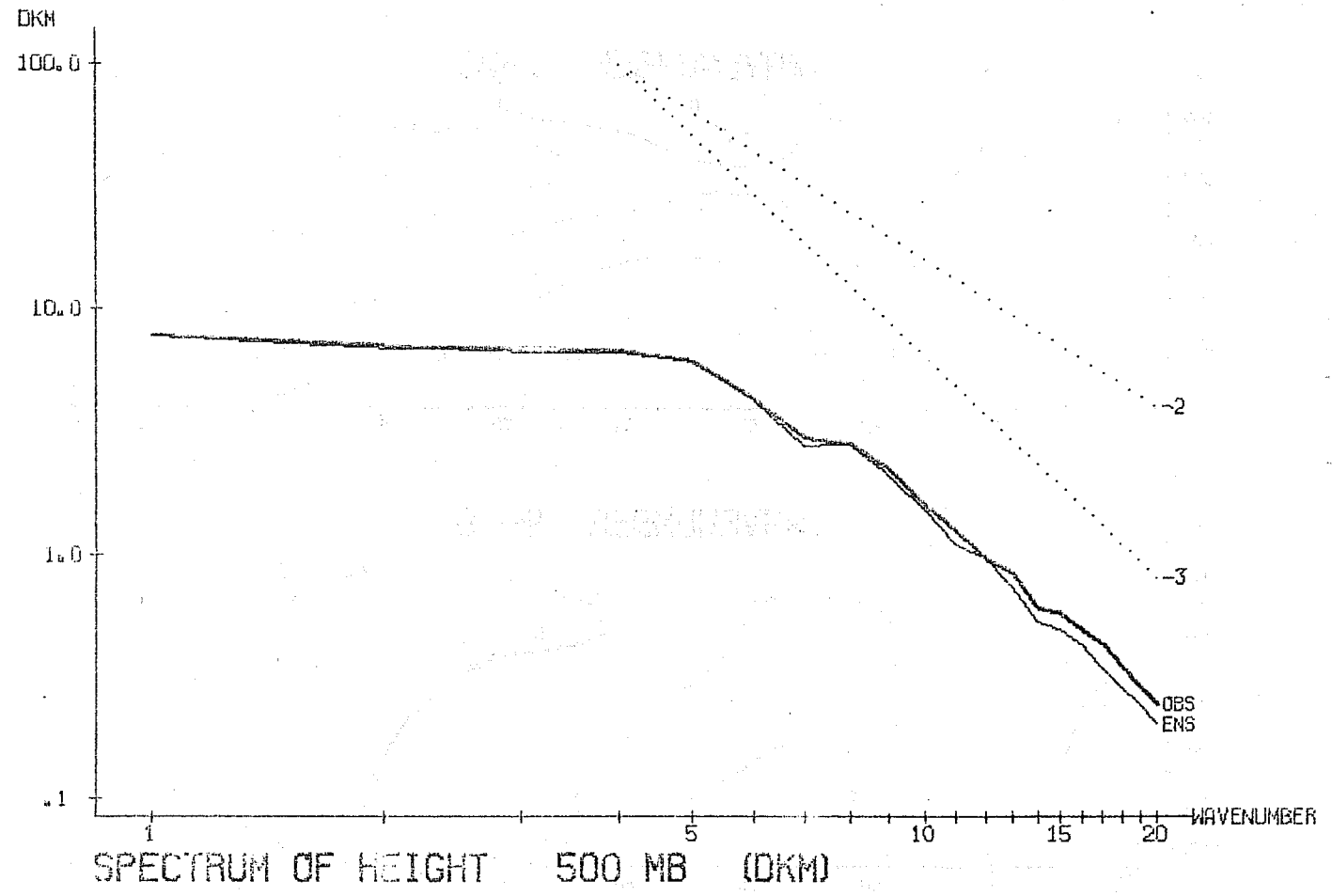

WAVENUMBER 1-20
MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
WAVENUMBER 4- 9
WAVENUMBER 1- 3
DAY 7.0 TO 10.0
SENSIBLE HEAT-FLUX TV (K*M/S
GEOSTR

Figure 15


DKM
100.0
10.0
1.0
.1
-2
-3
OBS
ENS
1
5
10
15
20
WAVENUMBER
SPECTRUM OF HEIGHT 500 MB (DKM)

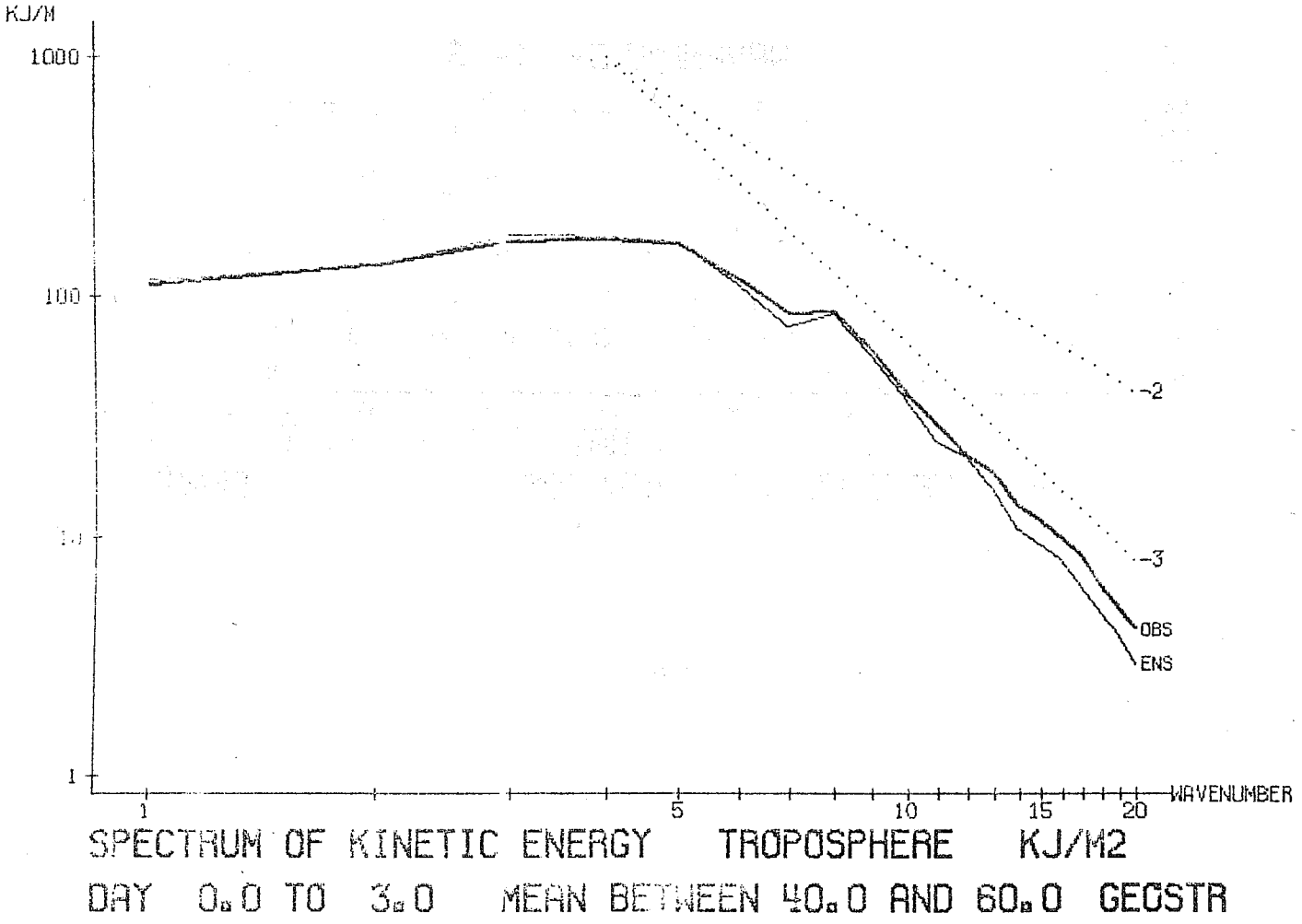
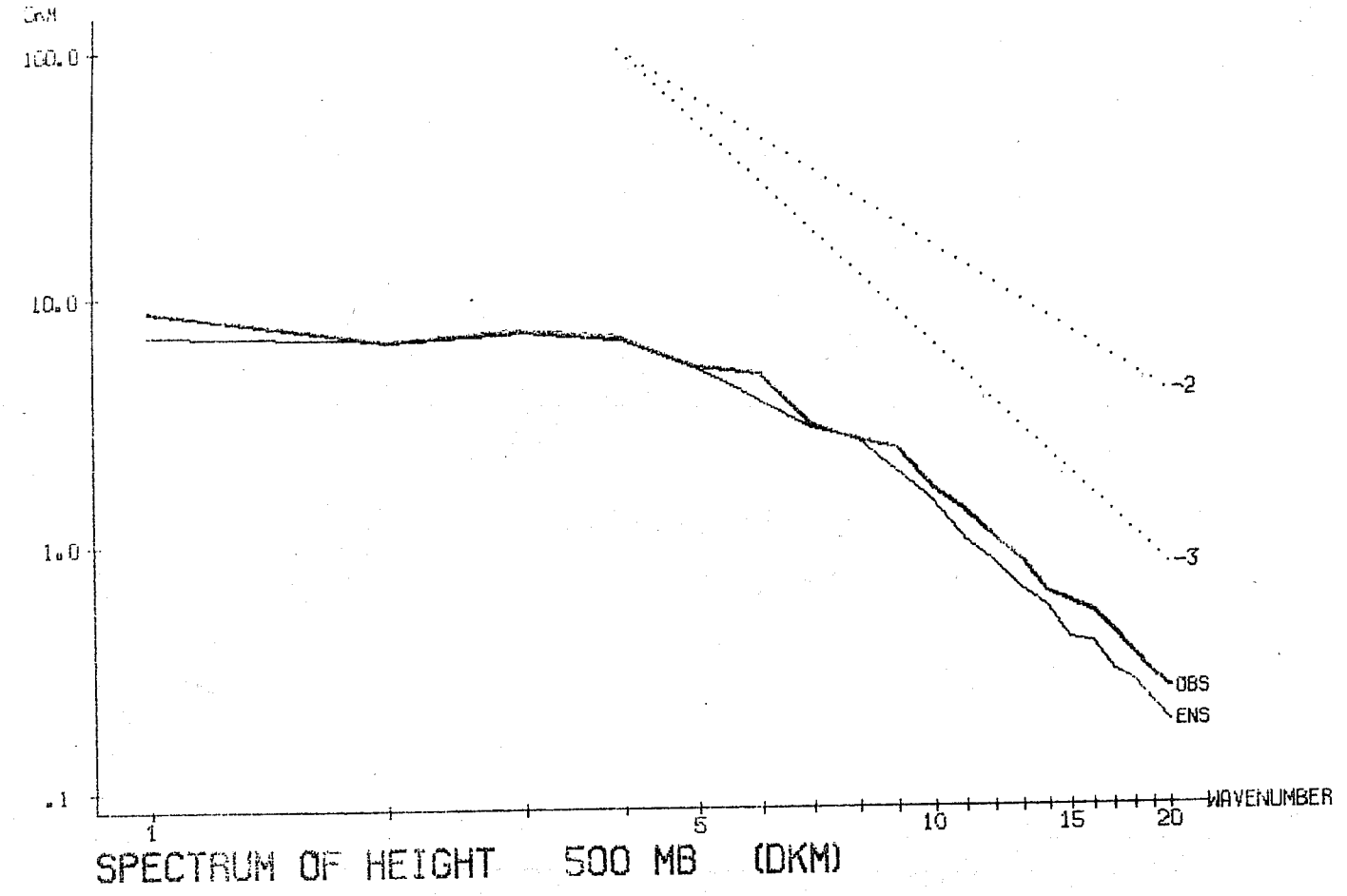

KJ/M
1000
100
1
-2
-3
OBS
ENS
1
5
10
15
20
WAVENUMBER
SPECTRUM OF KINETIC ENERGY TROPOSPHERE KJ/M2
DAY 0.0 TO 3.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 16


DKM
100.0
10.0
1.0
.1
-2
-3
OBS
ENS
1
5
10
15
20
WAVENUMBER
SPECTRUM OF HEIGHT 500 MB (DKM)

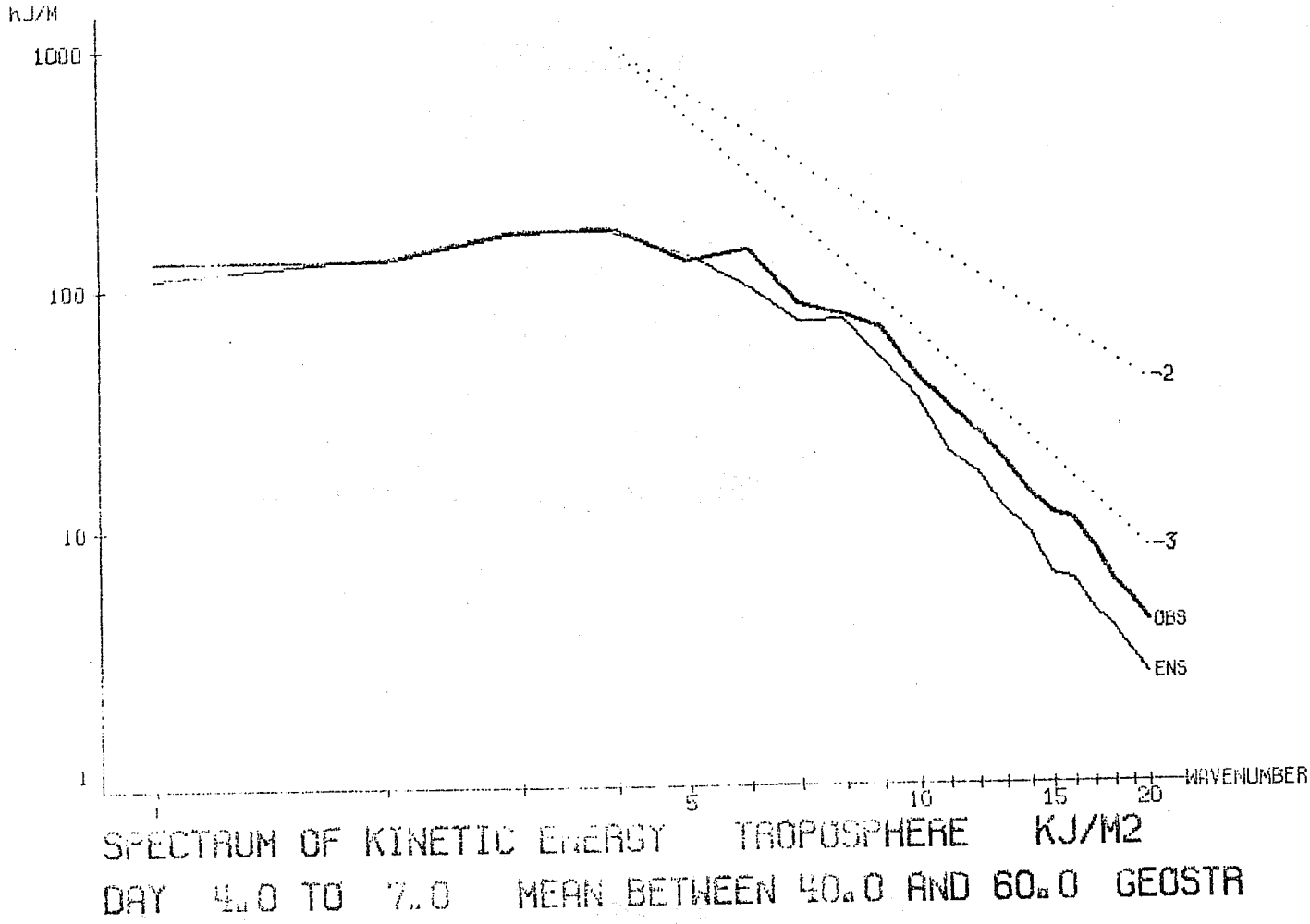
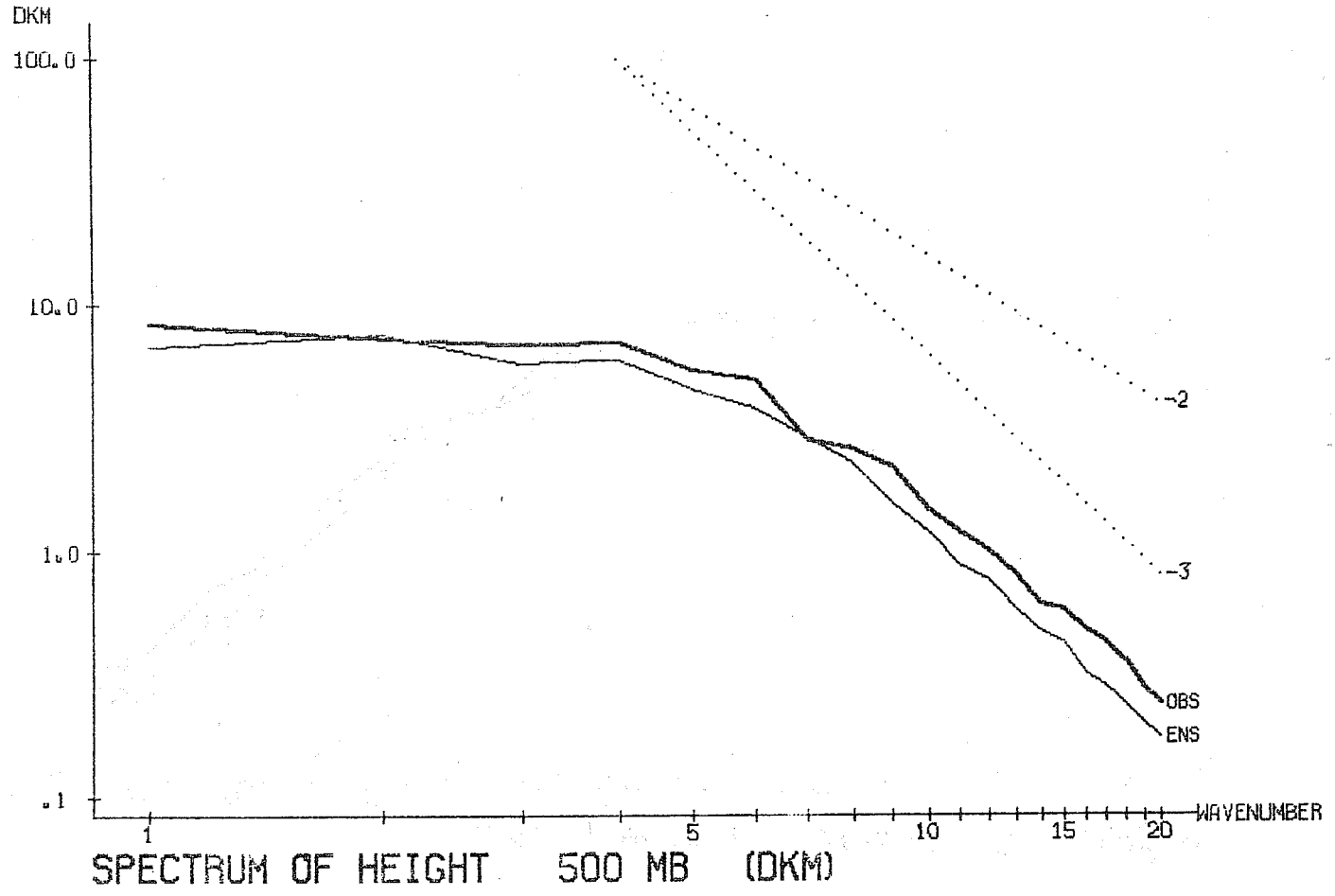

KJ/M
1000
100
10
1
-2
-3
OBS
ENS
5
10
15
20
WAVENUMBER
SPECTRUM OF KINETIC ENERGY TROPOSPHERE KJ/M2
DAY 4.0 TO 7.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 17


DKM
100.0
10.0
1.0
.1
-2
-3
OBS
ENS
1
5
10
15
20
WAVENUMBER
SPECTRUM OF HEIGHT 500 MB (DKM)

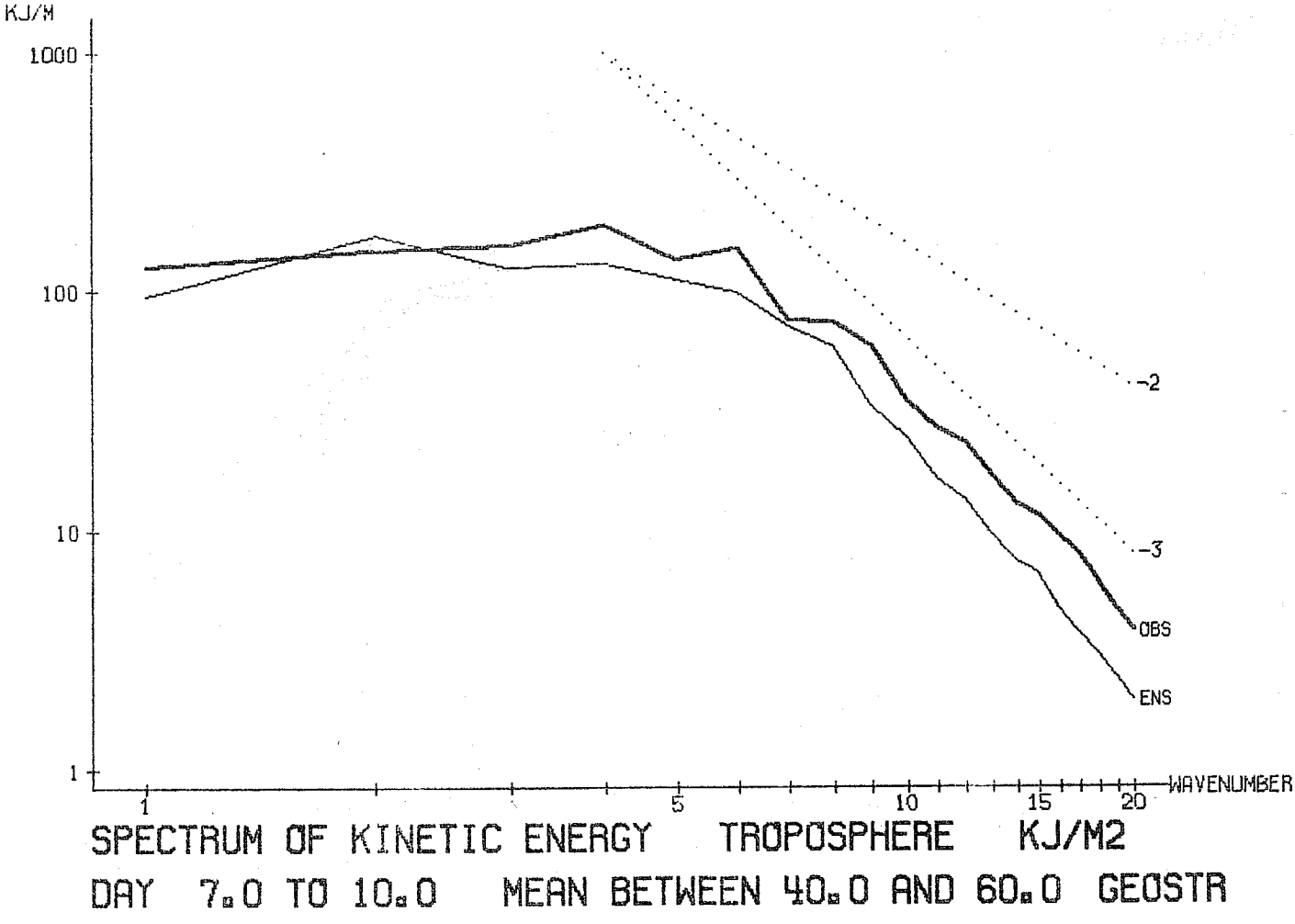
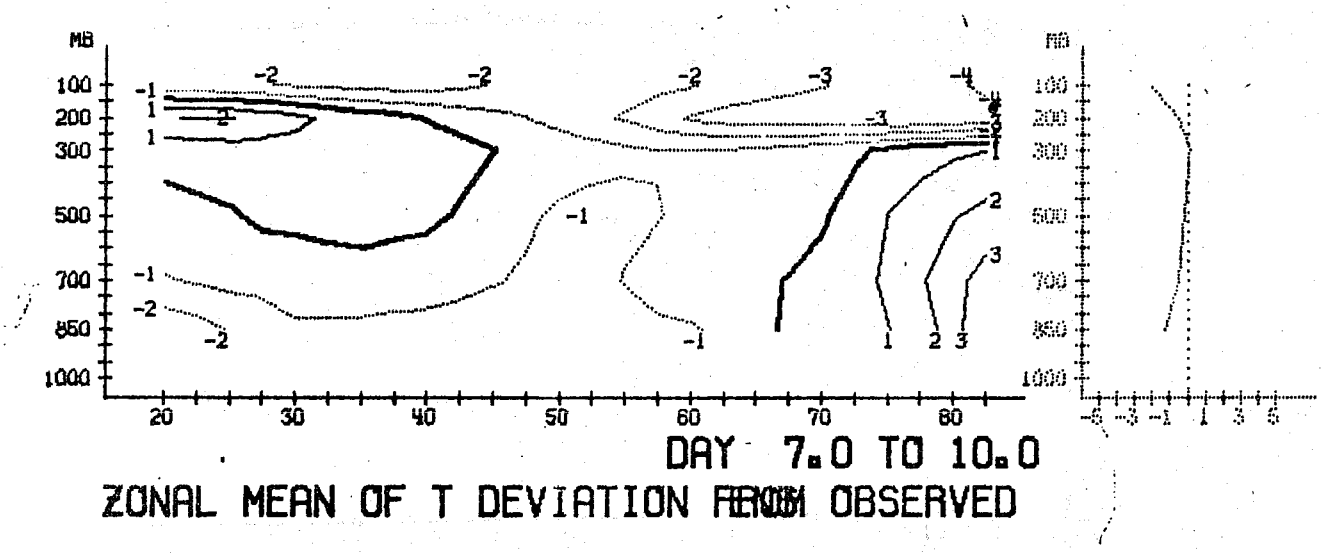
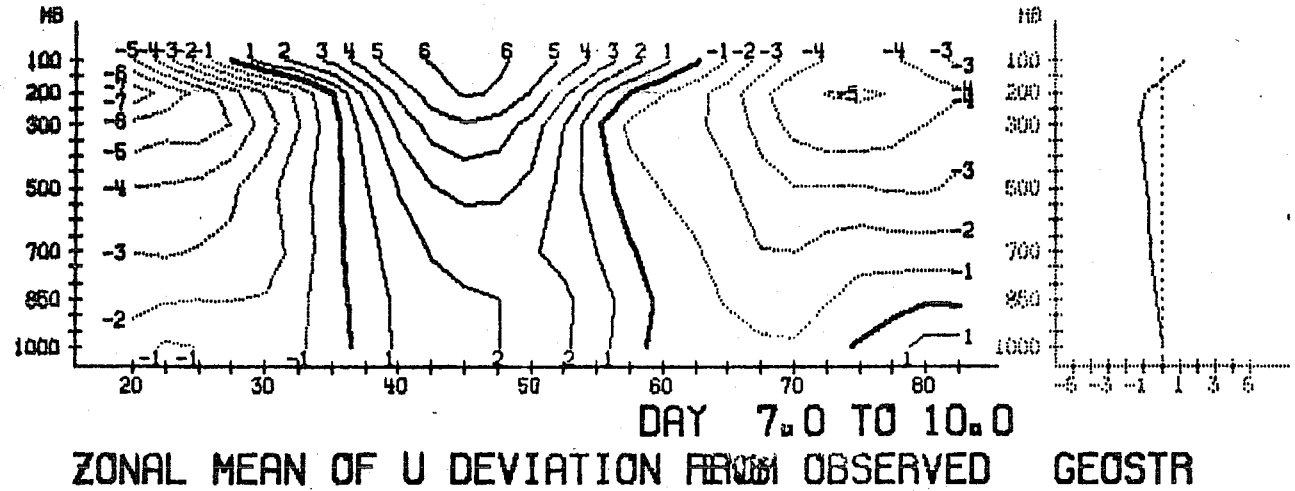

KJ/M
1000
100
10
1
-2
-3
OBS
ENS
1
5
10
15
20
WAVENUMBER
SPECTRUM OF KINETIC ENERGY TROPOSPHERE KJ/M2
DAY 7.0 TO 10.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 18

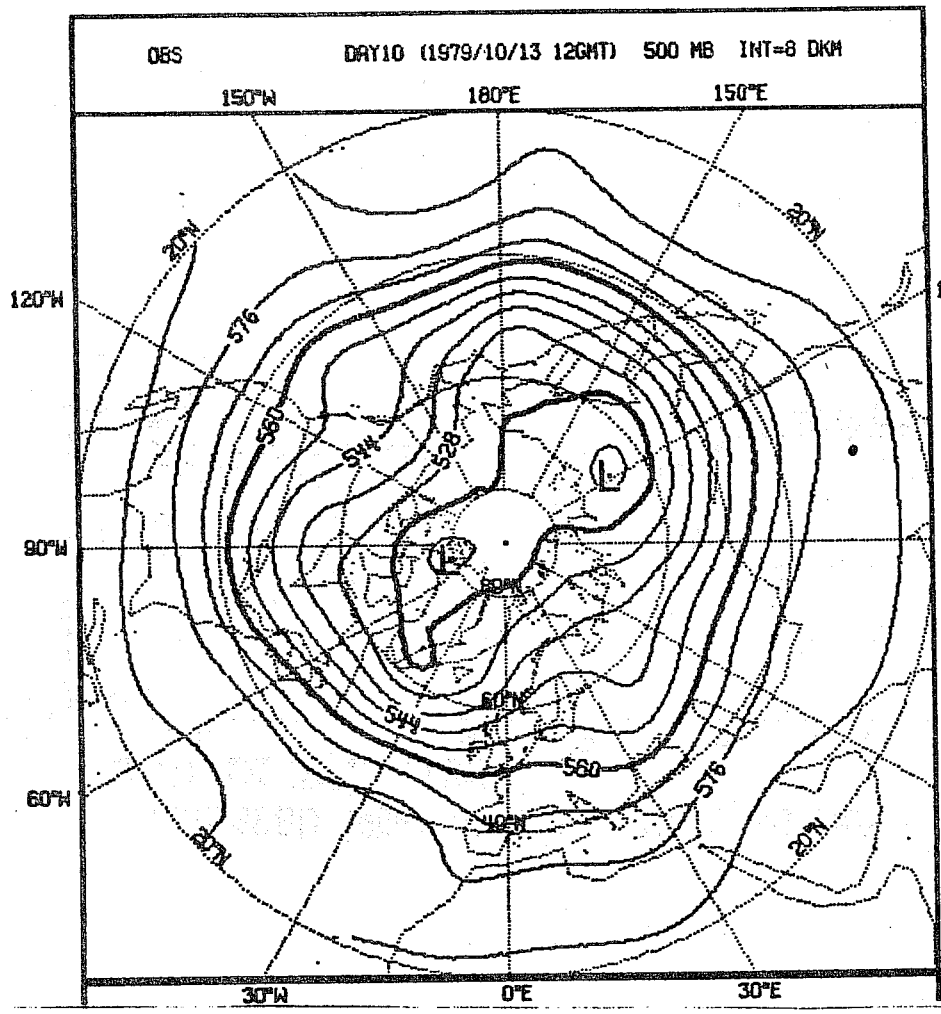

MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
DAY 7.0 TO 10.0
ZONAL MEAN OF T DEVIATION FROM OBSERVED

(a)

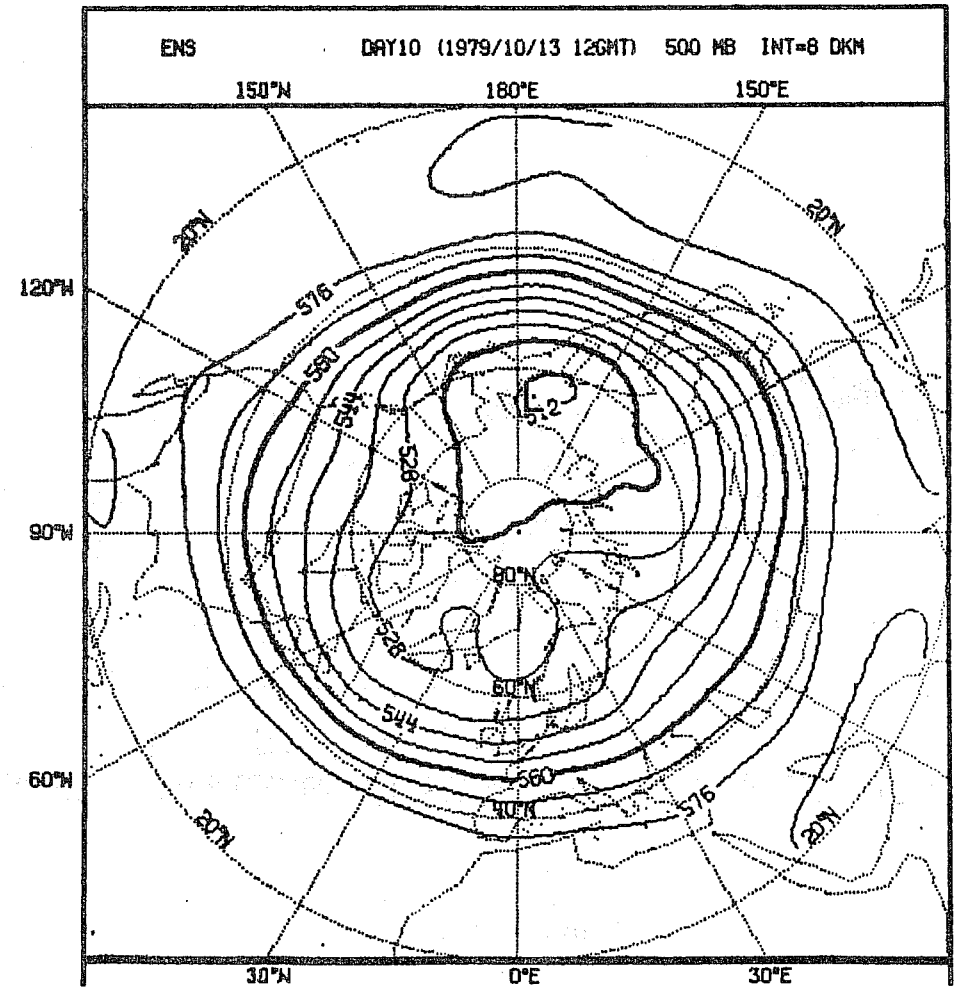

MB
100
200
300
500
700
850
1000
20
30
40
50
60
70
80
DAY 7.0 TO 10.0
ZONAL MEAN OF U DEVIATION FROM OBSERVED GEOSTR

(b)

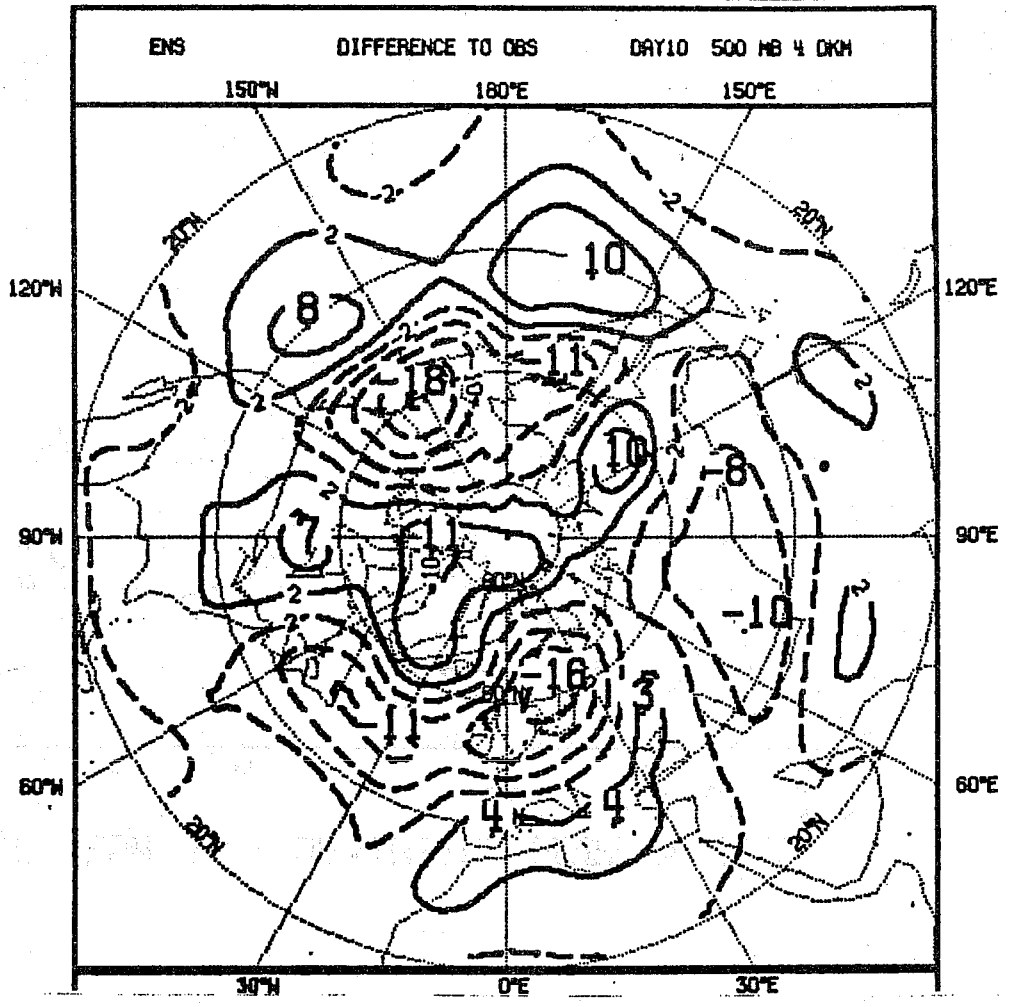
Figure 19


OBS DAY10 (1979/10/13 12GMT) 500 MB INT=8 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
40°N
60°N
528
544
560
576

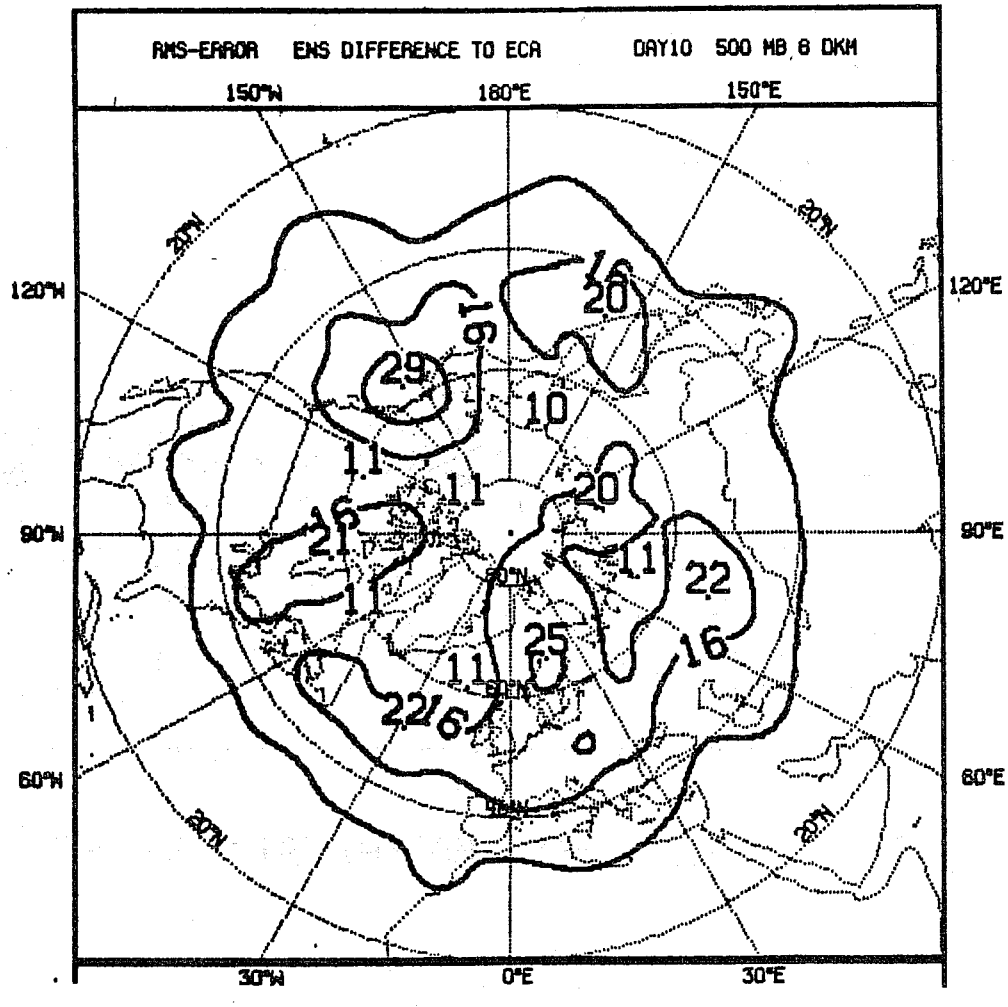
(a)


ENS DAY10 (1979/10/13 12GMT) 500 MB INT=8 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
40°N
60°N
528
544
560
576

(b)

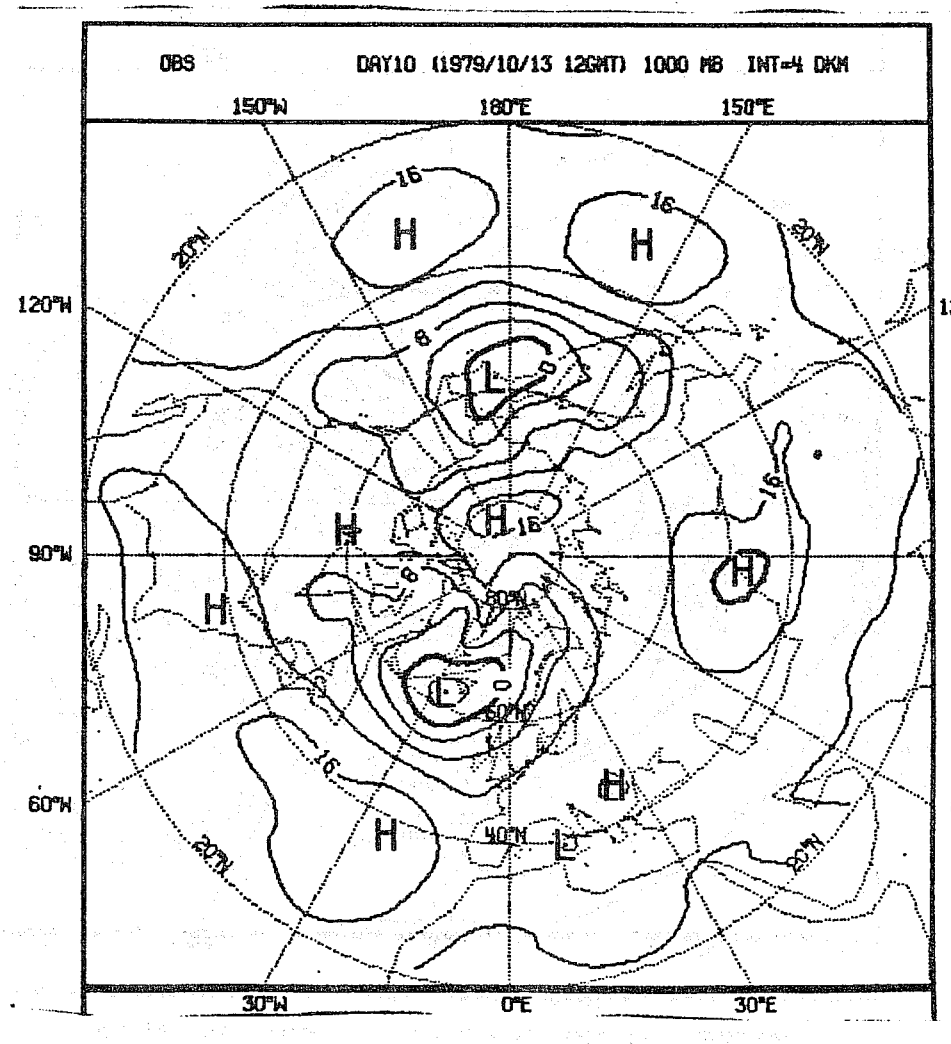

ENS DIFFERENCE TO OBS DAY10 500 MB 4 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
80°N

(a)

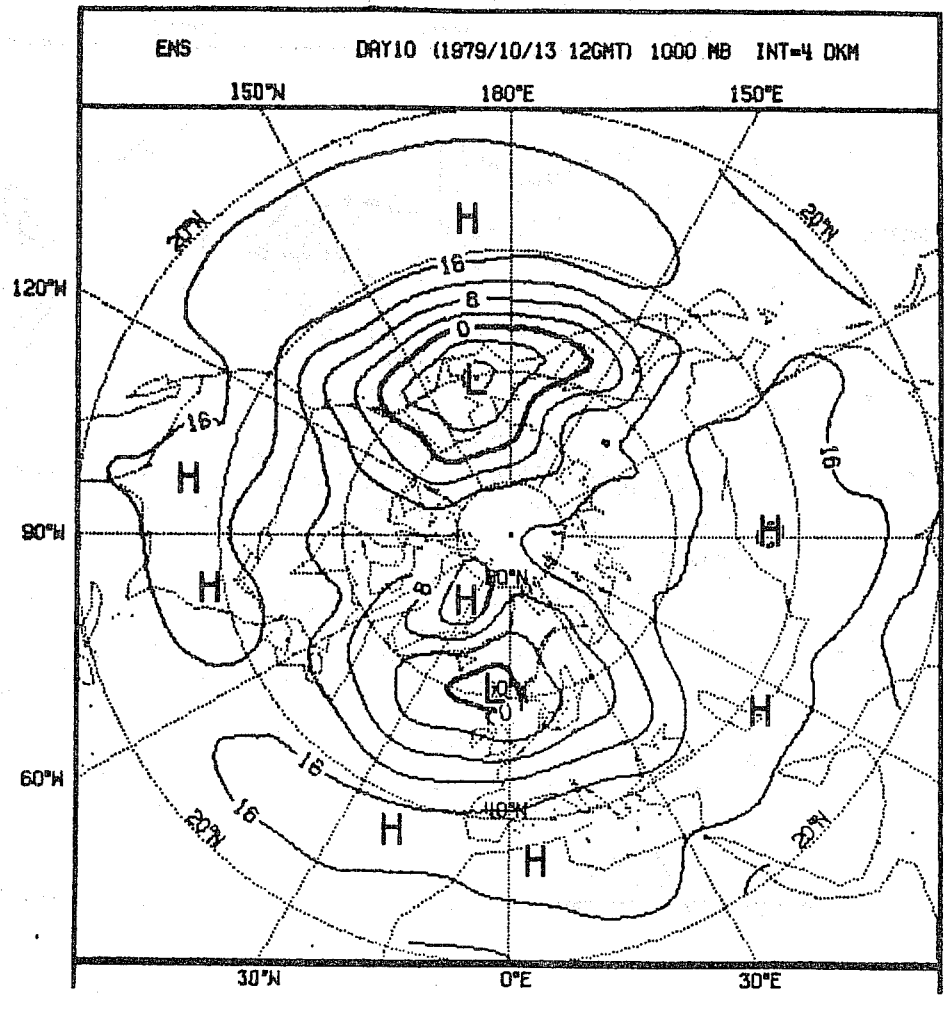

RMS-ERROR ENS DIFFERENCE TO ECA DAY10 500 MB 8 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
80°N

(b)

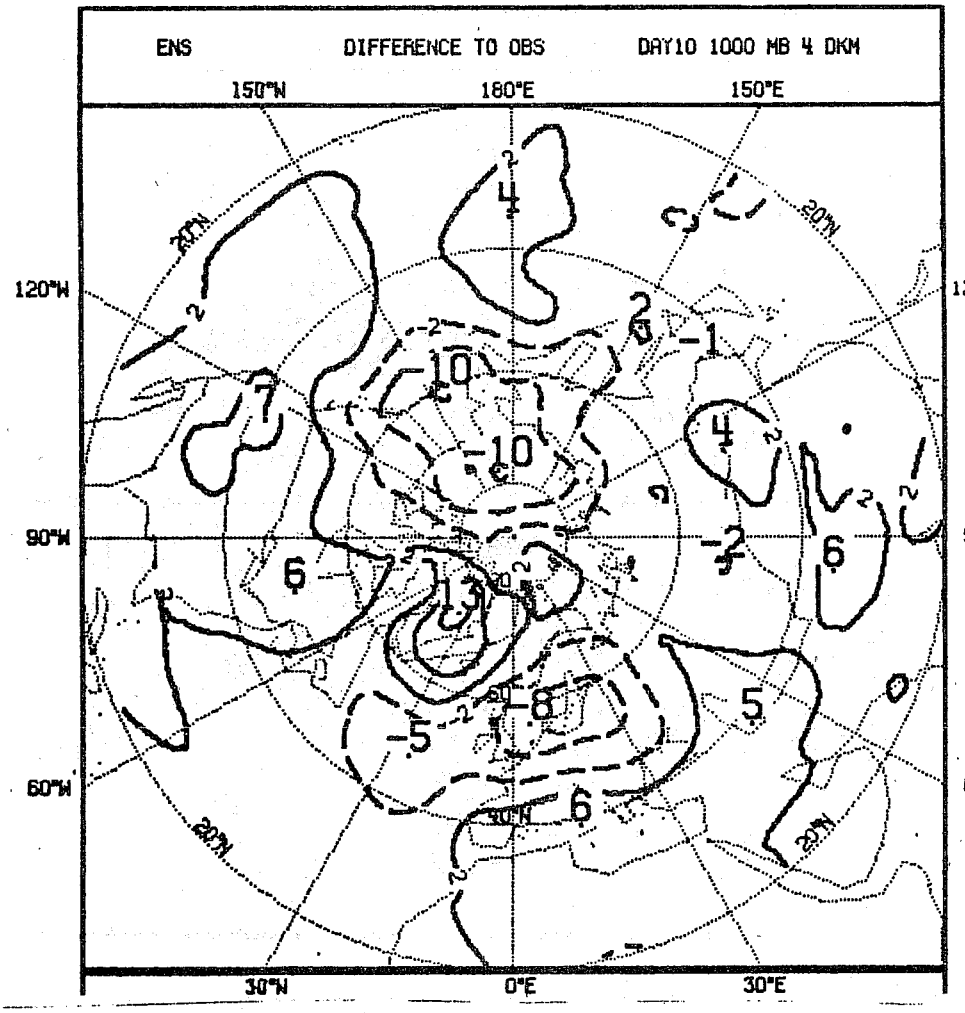
Figure 21


OBS
DAY10 (1979/10/13 12GMT) 1000 MB INT=4 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
40°N
60°N
16
8
0
H
L

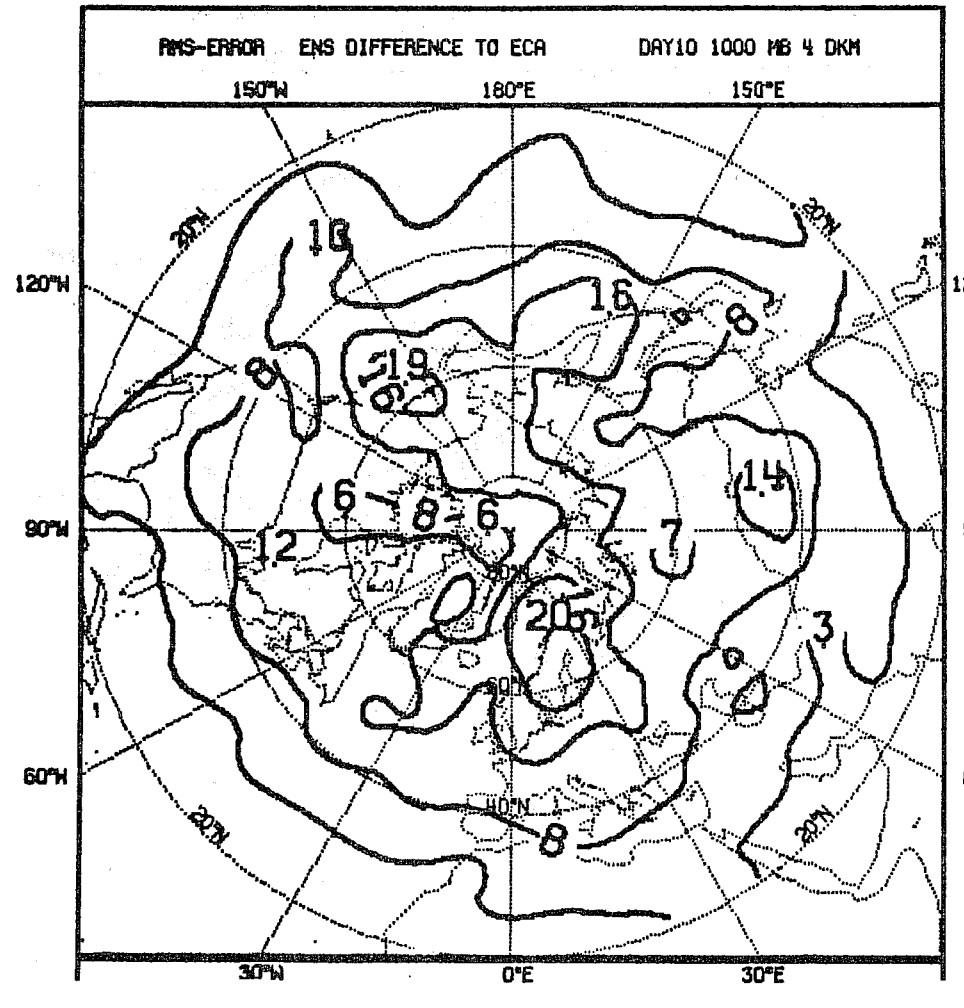
(a)


ENS
DAY10 (1979/10/13 12GMT) 1000 MB INT=4 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
40°N
60°N
16
8
0
H
L

(b)

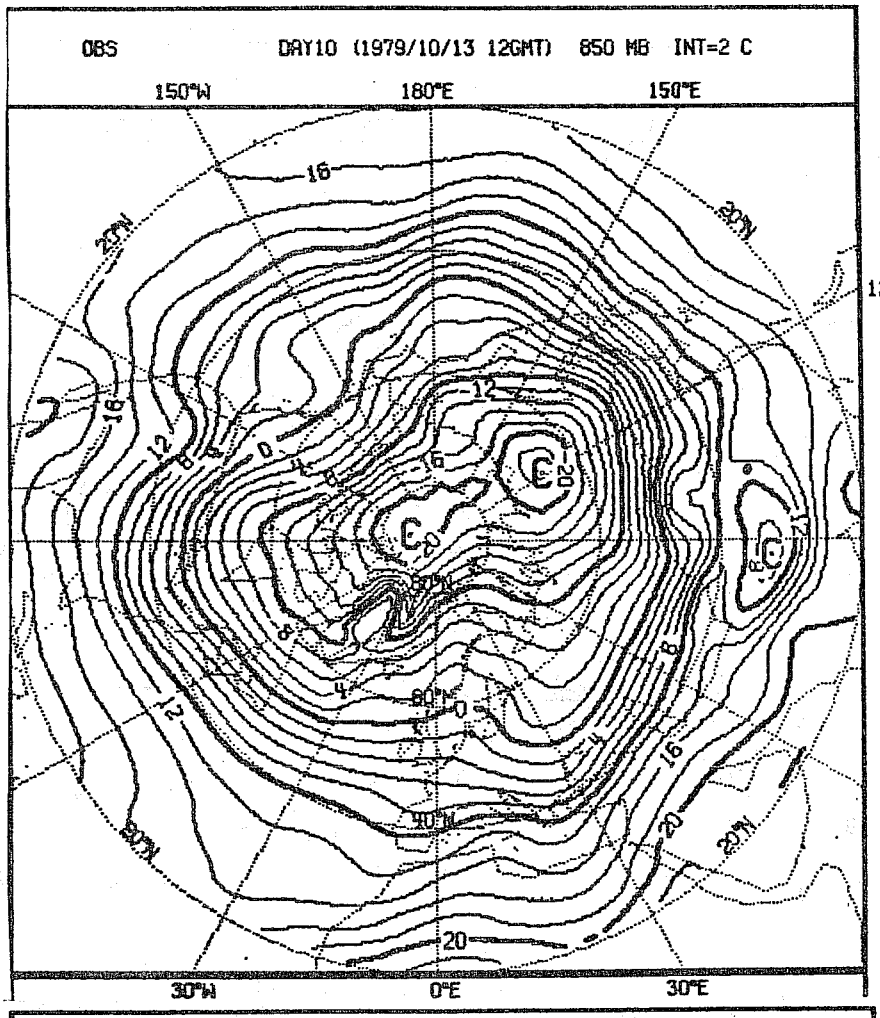

ENS DIFFERENCE TO OBS DAY10 1000 MB 4 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
30°N

(a)

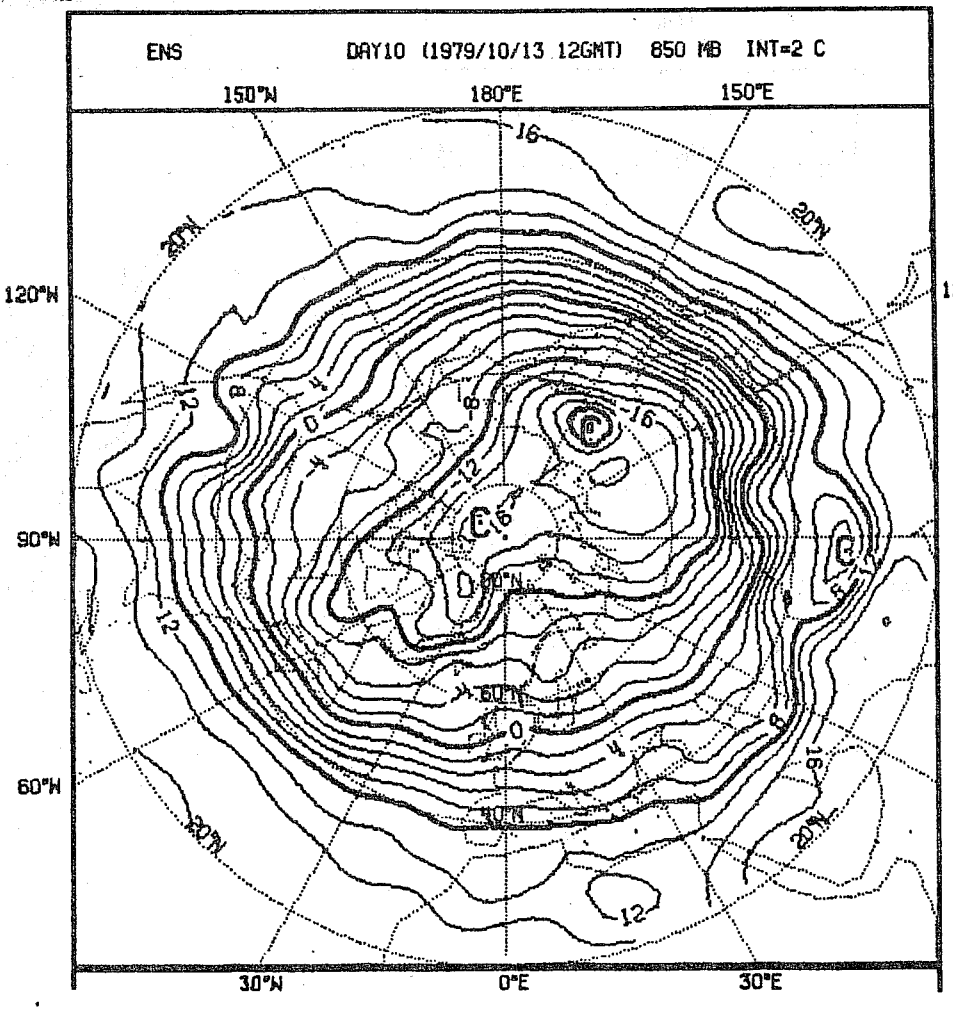

RMS-ERROR ENS DIFFERENCE TO ECA DAY10 1000 MB 4 DKM
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
30°N

(b)

Figure 23

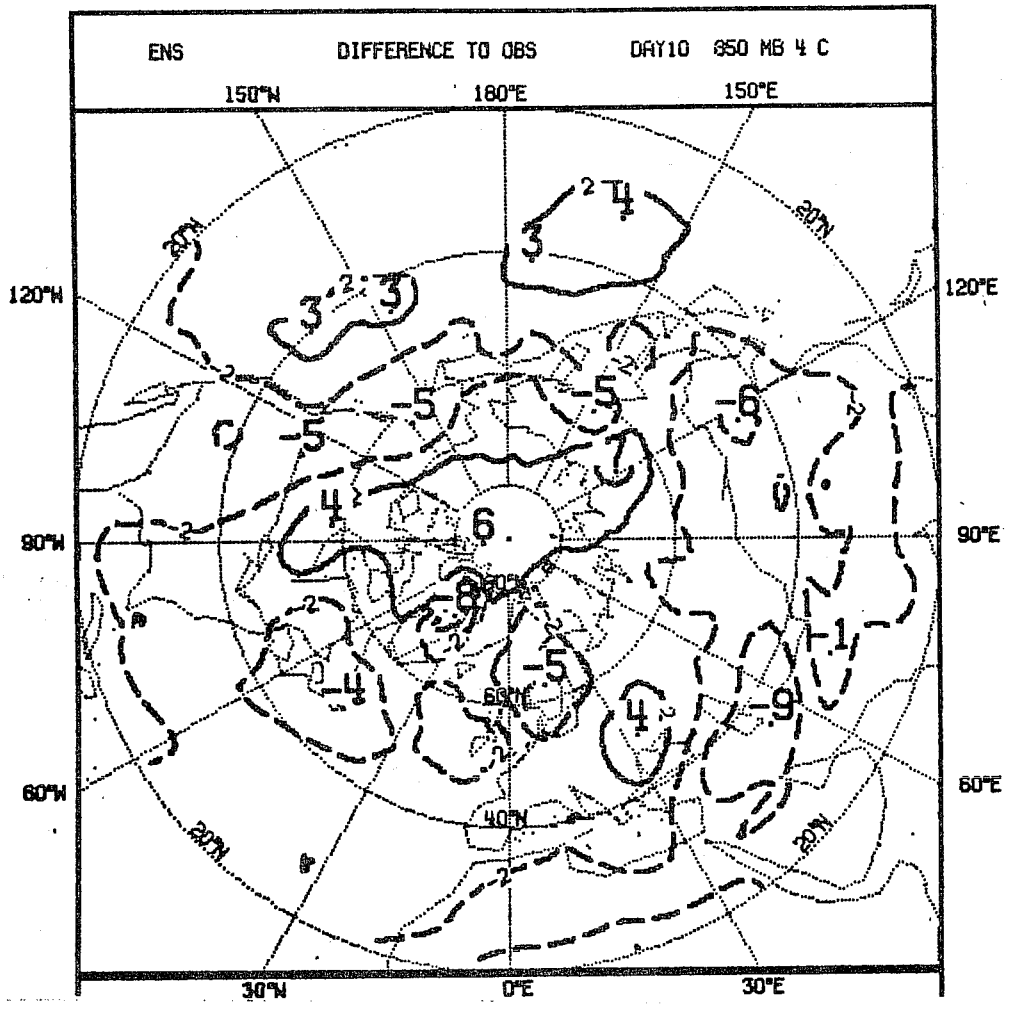

OBS
DAY10 (1979/10/13 12GMT) 850 MB INT=2 C
150°W
180°E
150°E
120°E
90°E
60°E
30°W
0°E
30°E
20°N
40°N
60°N
80°N
90°N

(a)

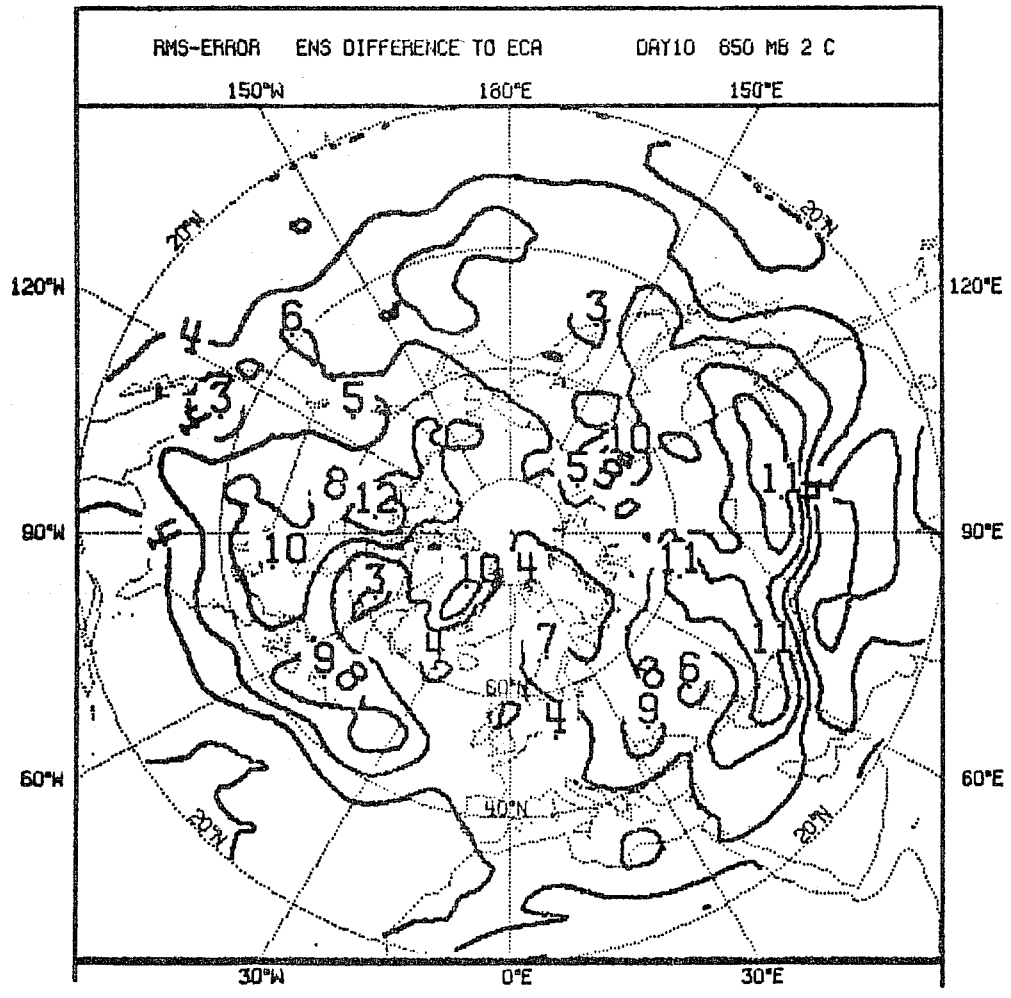

ENS
DAY10 (1979/10/13 12GMT) 850 MB INT=2 C
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
40°N
60°N
80°N
90°N

(b)

Figure 24

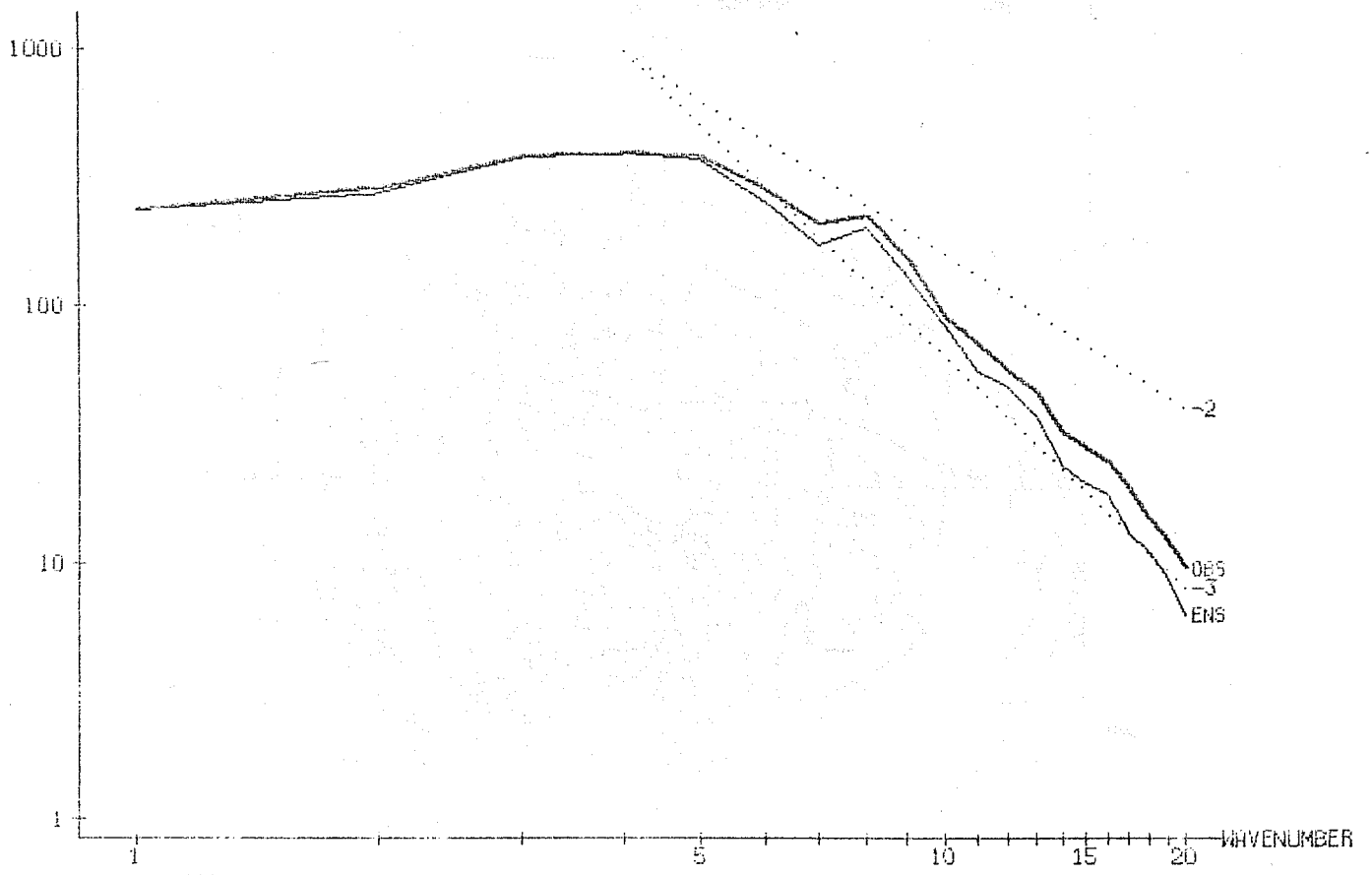

ENS DIFFERENCE TO OBS DAY10 850 MB 4 C
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
40°N
60°N

(a)

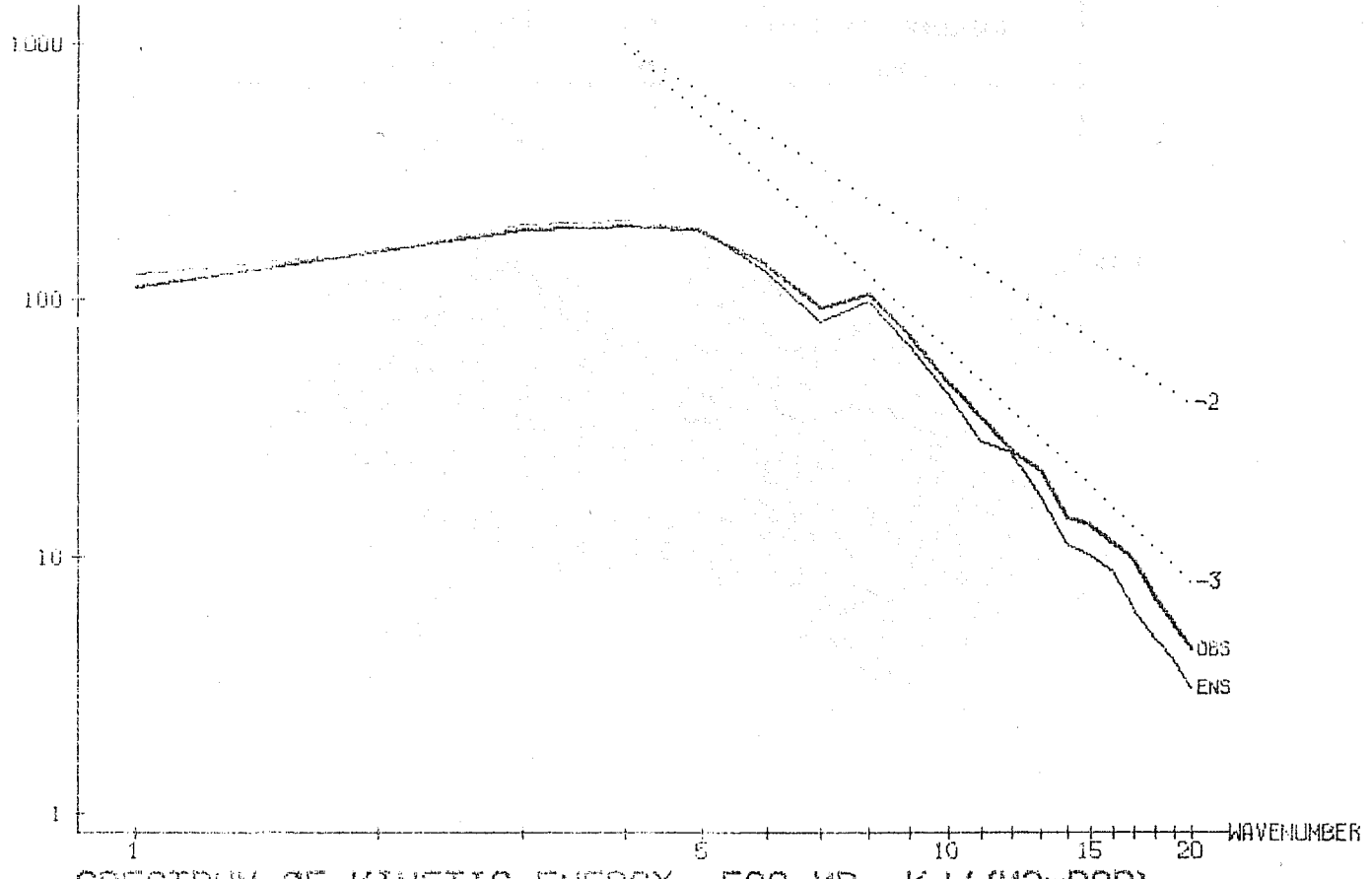

RMS-ERROR ENS DIFFERENCE TO ECA DAY10 850 MB 2 C
150°W
180°E
150°E
120°W
120°E
90°W
90°E
60°W
60°E
30°W
0°E
30°E
20°N
40°N
60°N

(b)

Figure 25



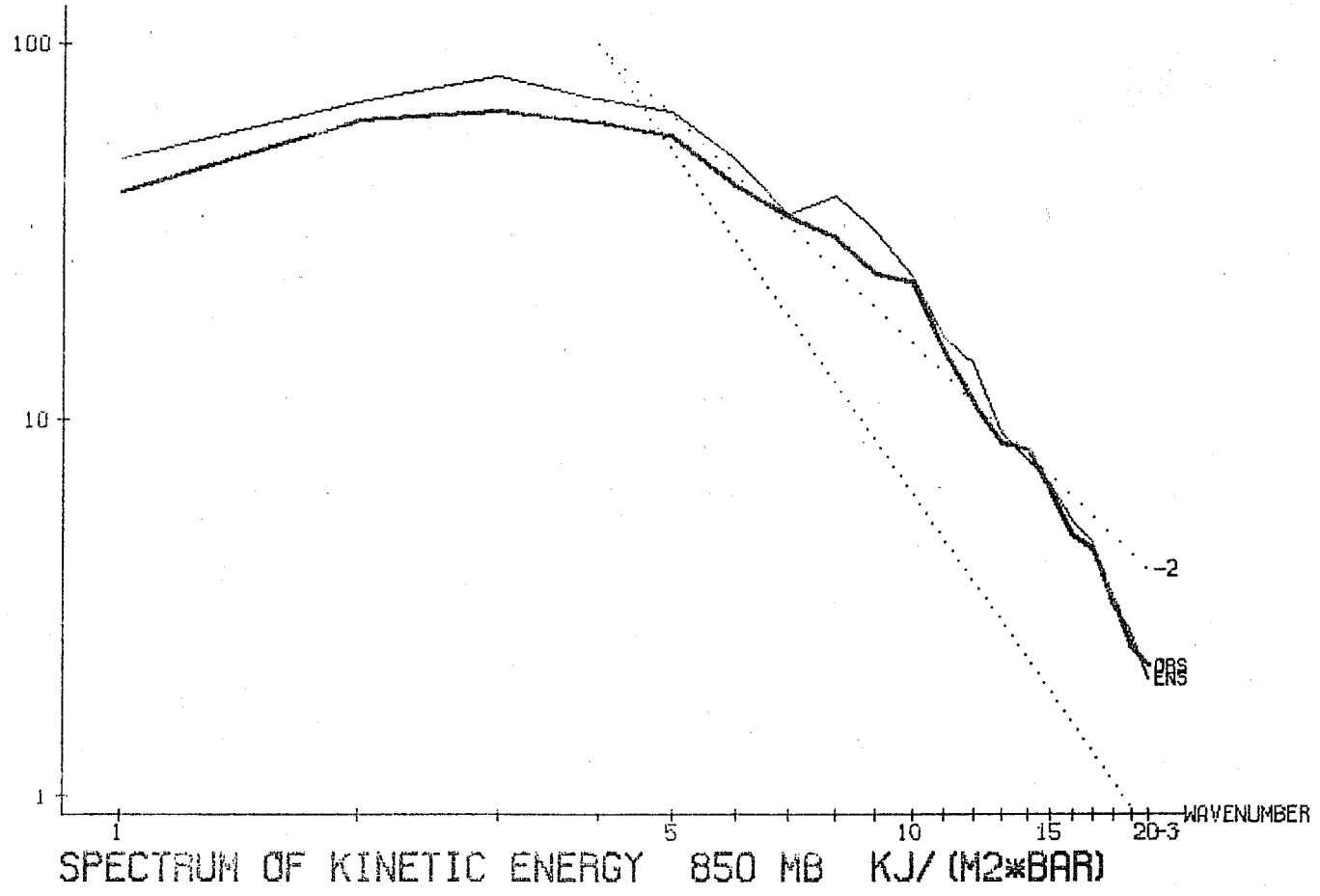
SPECTRUM OF KINETIC ENERGY 300 MB KJ/(M2*BAR)



SPECTRUM OF KINETIC ENERGY 500 MB KJ/(M2*BAR)

DAY 0.0 TO 3.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 26


100
10
1
-2
OBS
ENS
1
5
10
15
20-3
WAVENUMBER
SPECTRUM OF KINETIC ENERGY 850 MB KJ/(M2*BAR)

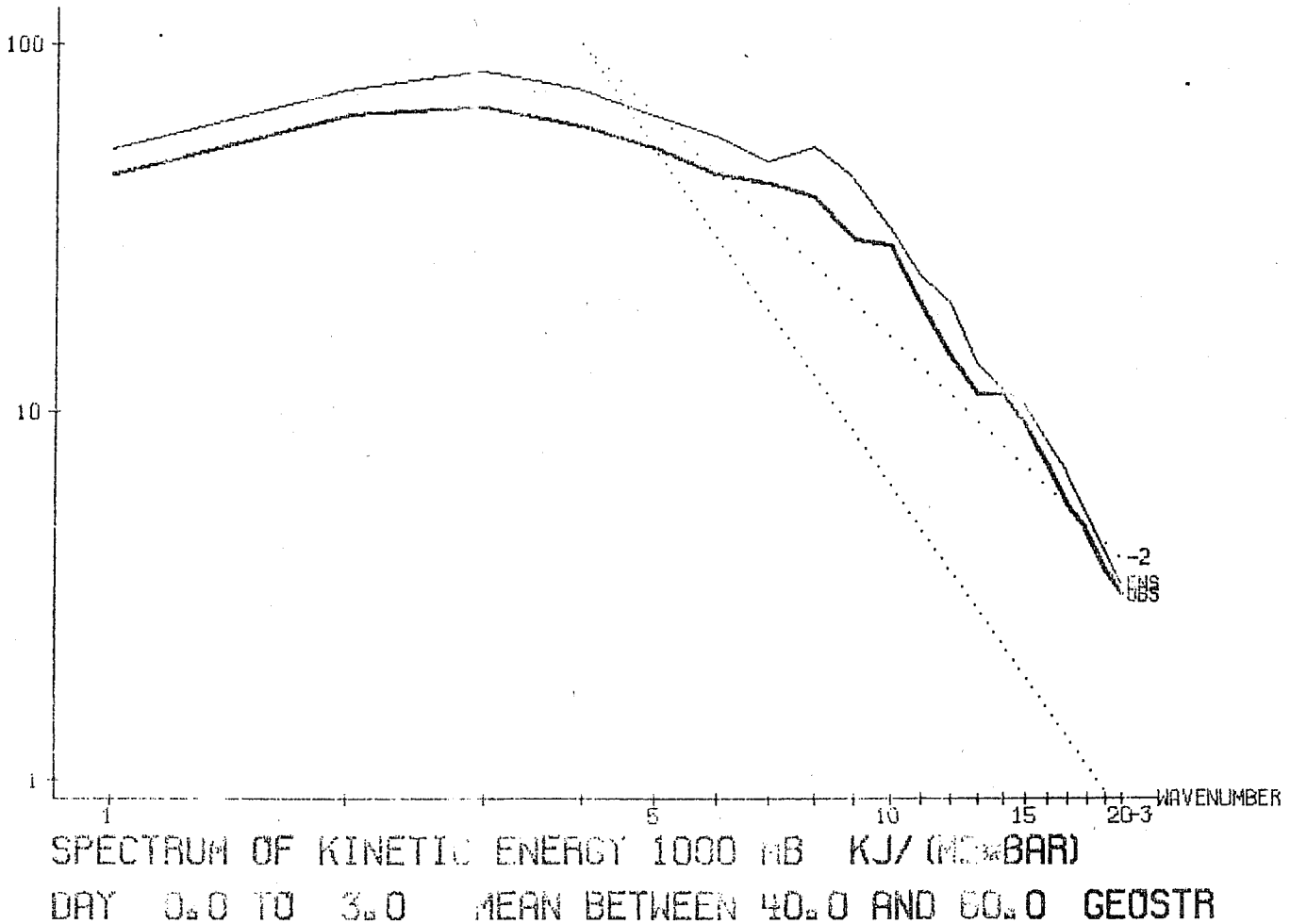
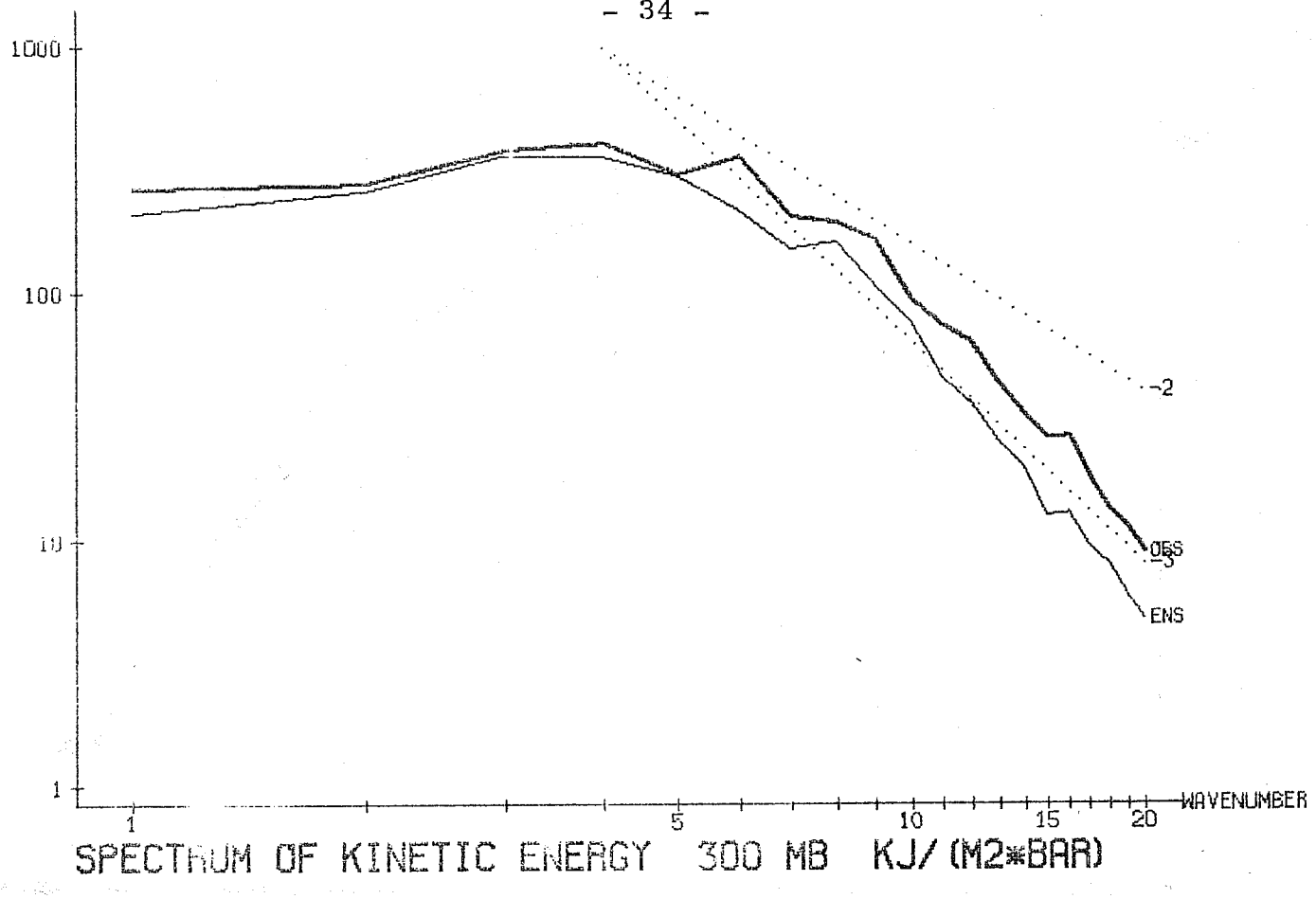
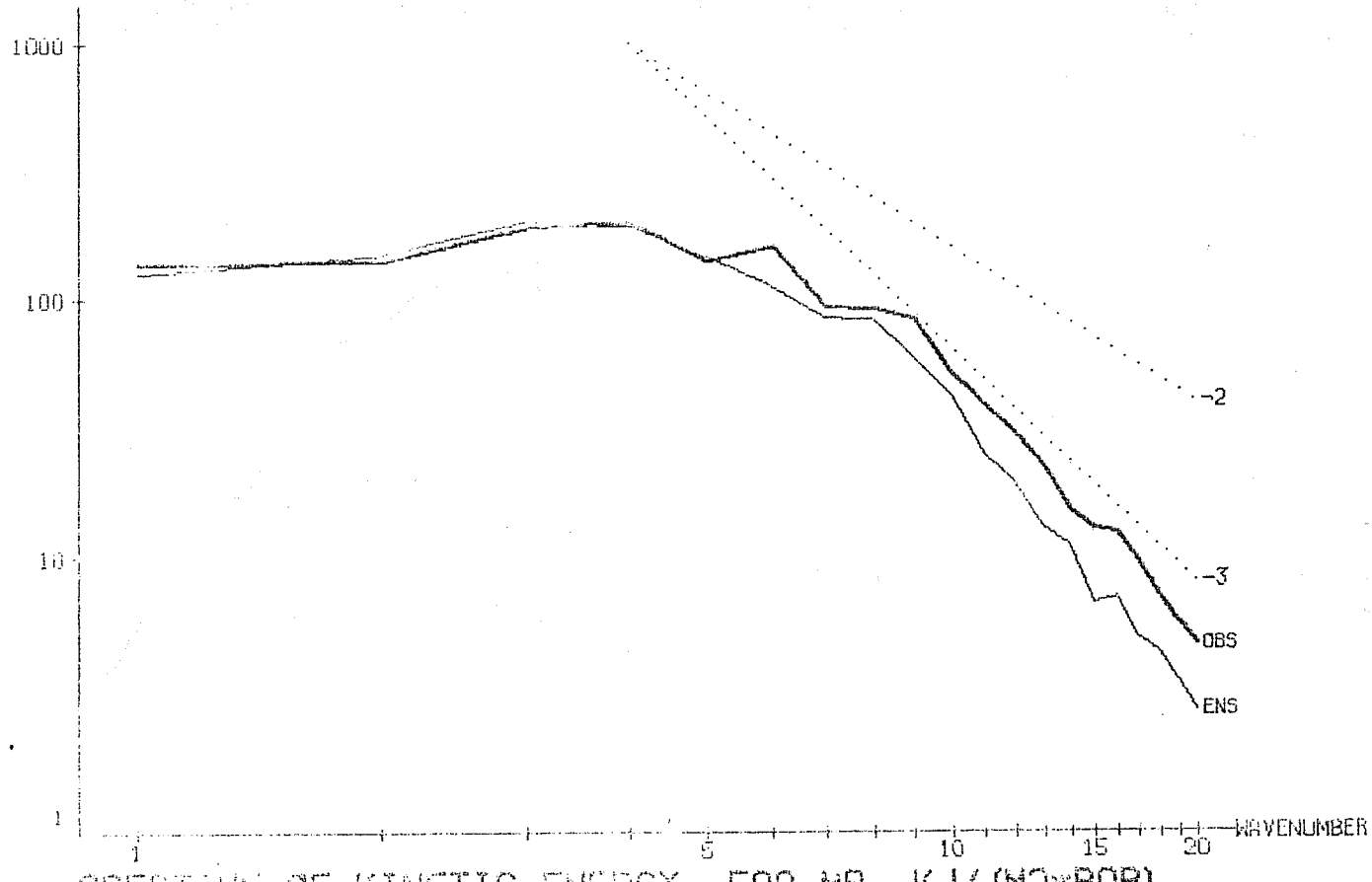

100
10
1
-2
ENS
OBS
1
5
10
15
20-3
WAVENUMBER
SPECTRUM OF KINETIC ENERGY 1000 MB KJ/(M2*BAR)
DAY 0.0 TO 3.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 27

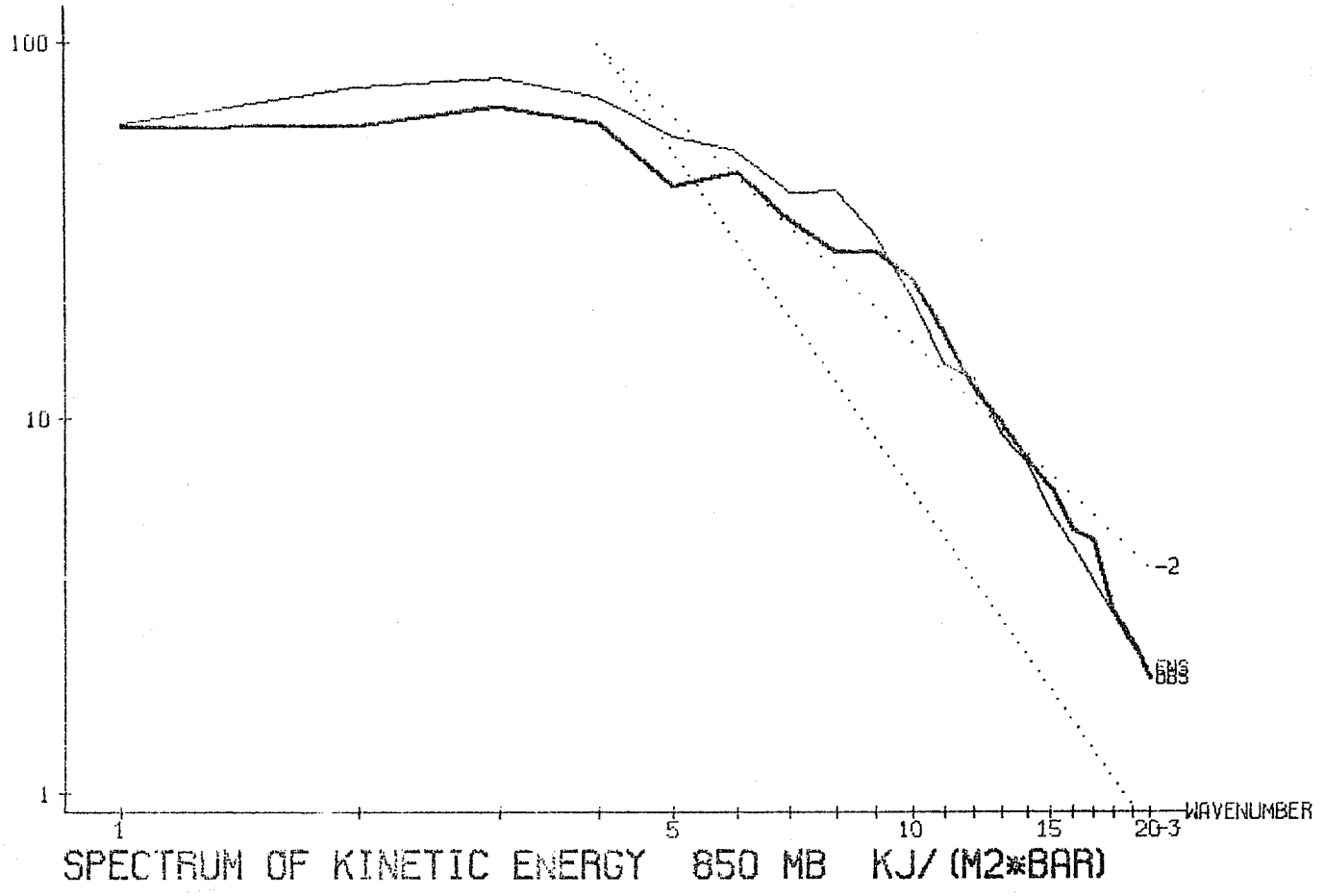


SPECTRUM OF KINETIC ENERGY 300 MB KJ/(M2*BAR)



SPECTRUM OF KINETIC ENERGY 500 MB KJ/(M2*BAR)
DAY 4.0 TO 7.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 28


100
10
1
1
5
10
15
20-3
WAVENUMBER
-2
ENS
OBS
SPECTRUM OF KINETIC ENERGY 850 MB KJ/(M2*BAR)

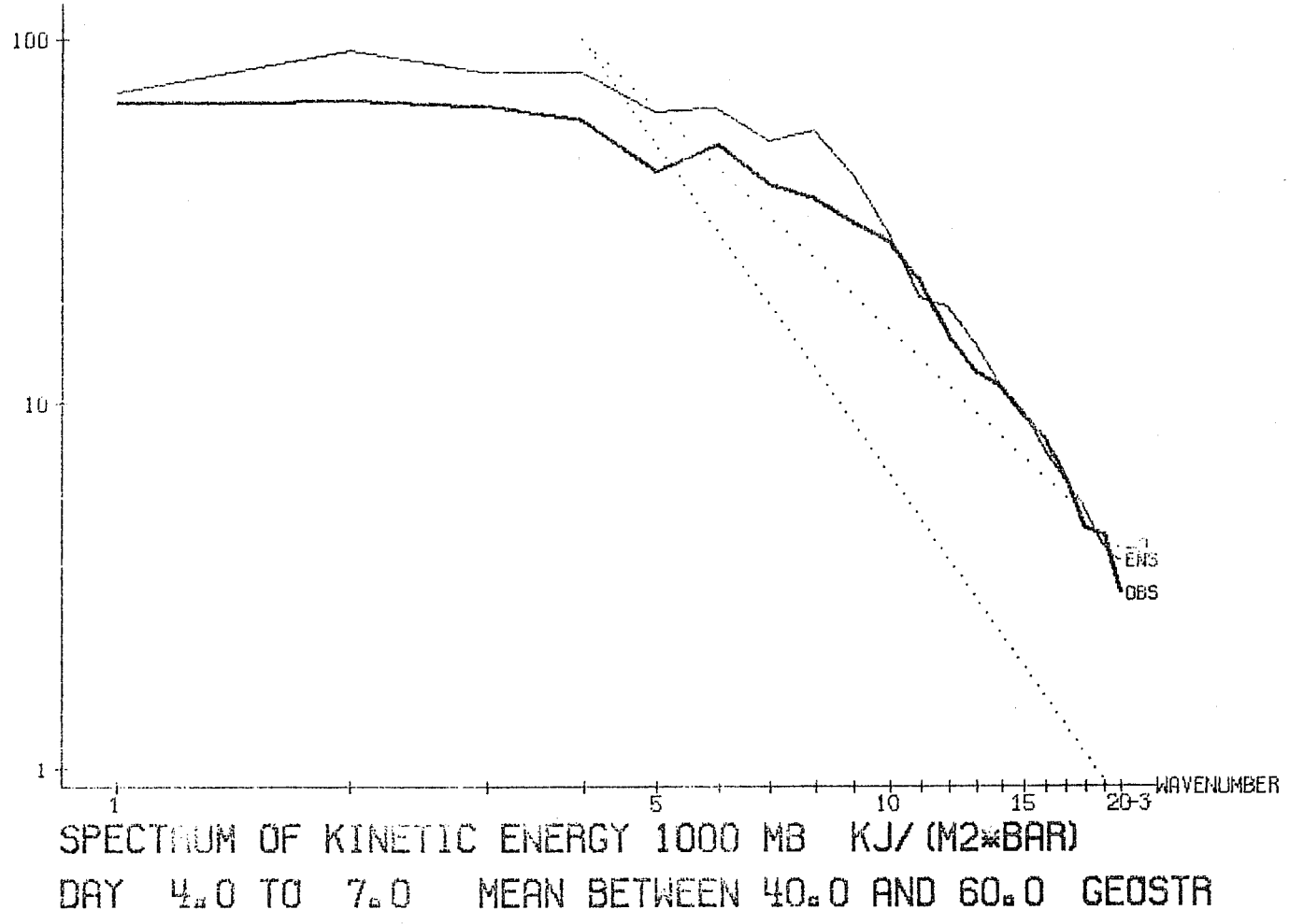
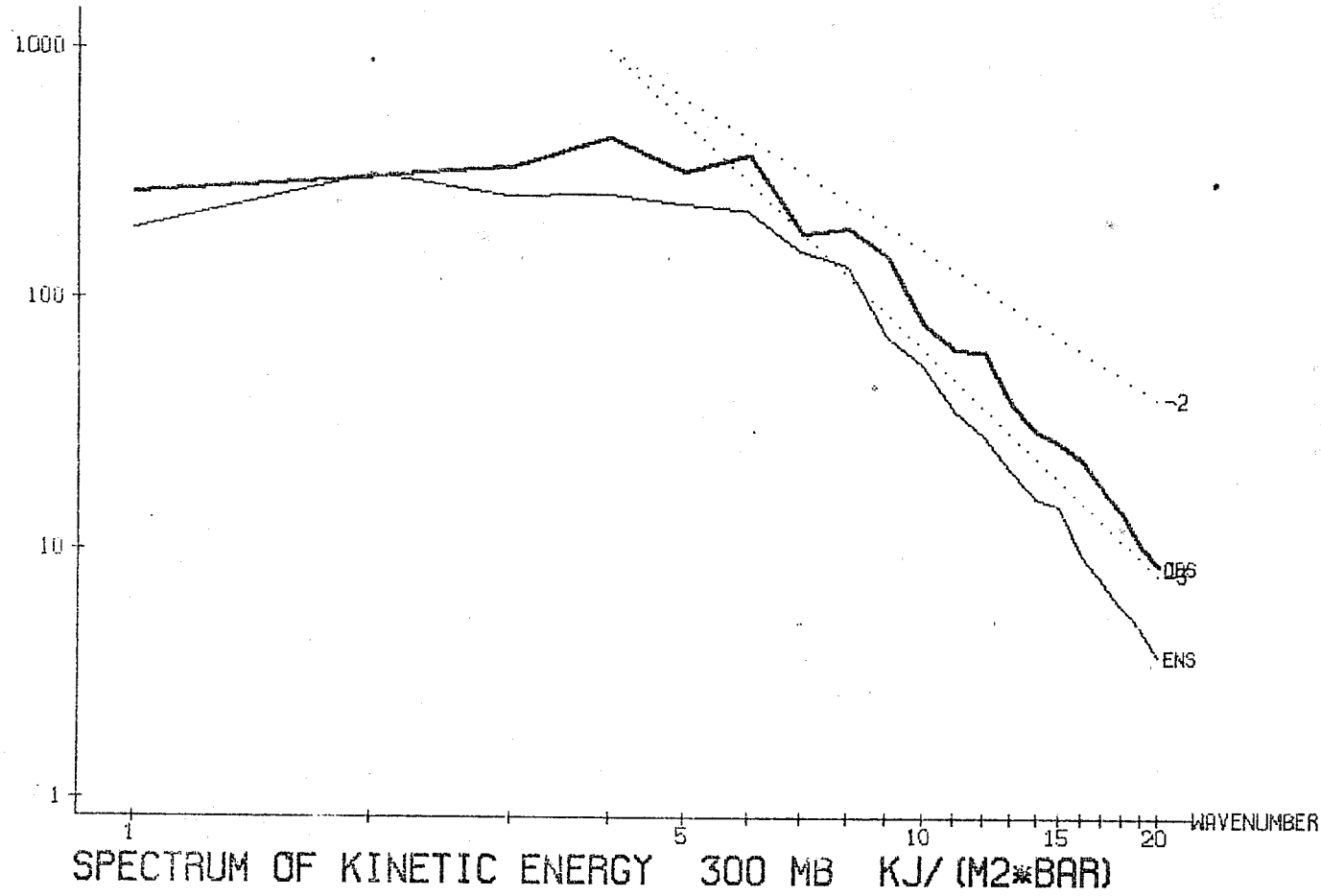

100
10
1
1
5
10
15
20-3
WAVENUMBER
-1
ENS
OBS
SPECTRUM OF KINETIC ENERGY 1000 MB KJ/(M2*BAR)
DAY 4.0 TO 7.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 29


1000
100
10
1
-2
-3
OBS
ENS
1
5
10
15
20
WAVENUMBER
SPECTRUM OF KINETIC ENERGY 300 MB KJ/(M2*BAR)

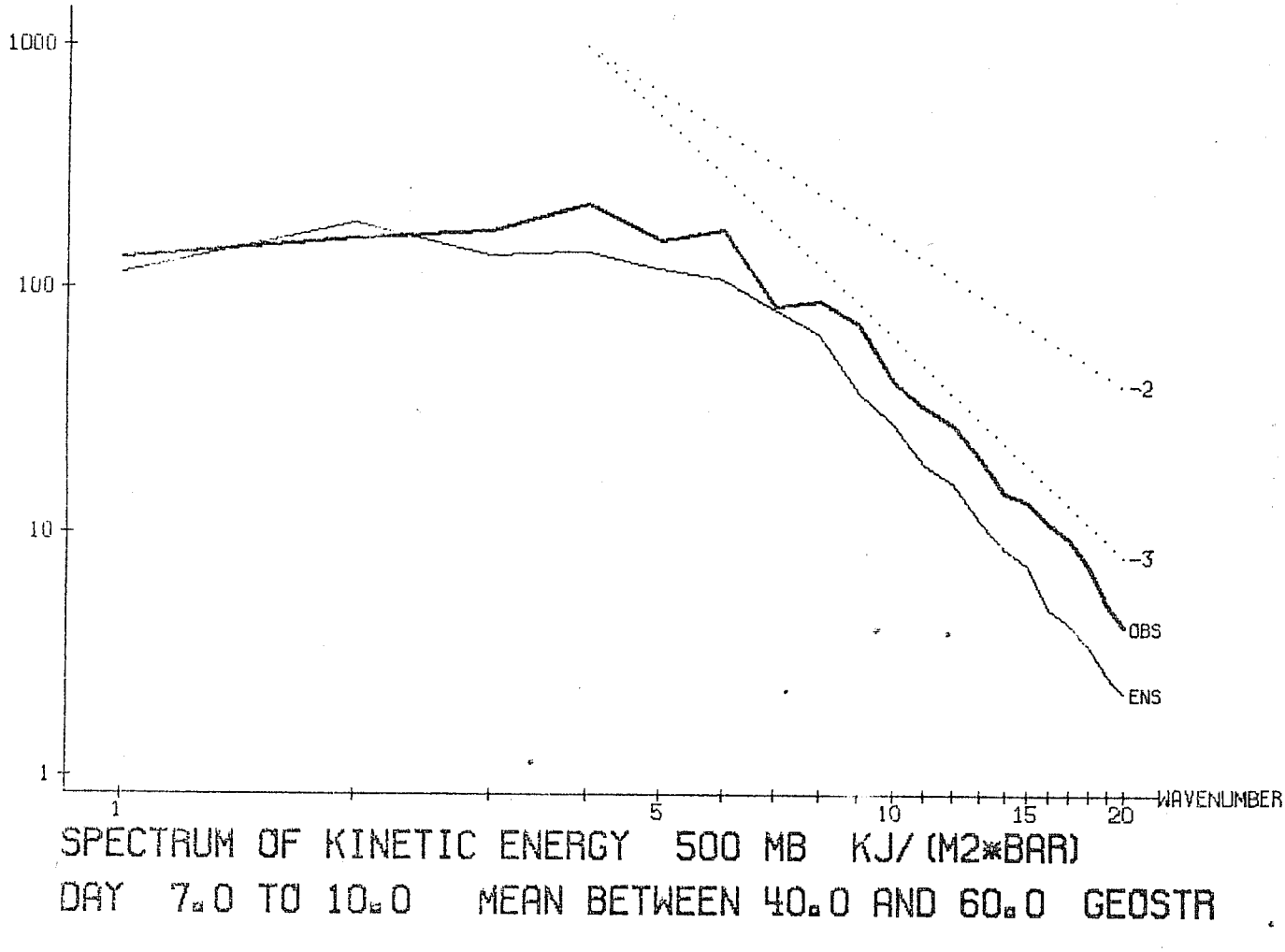
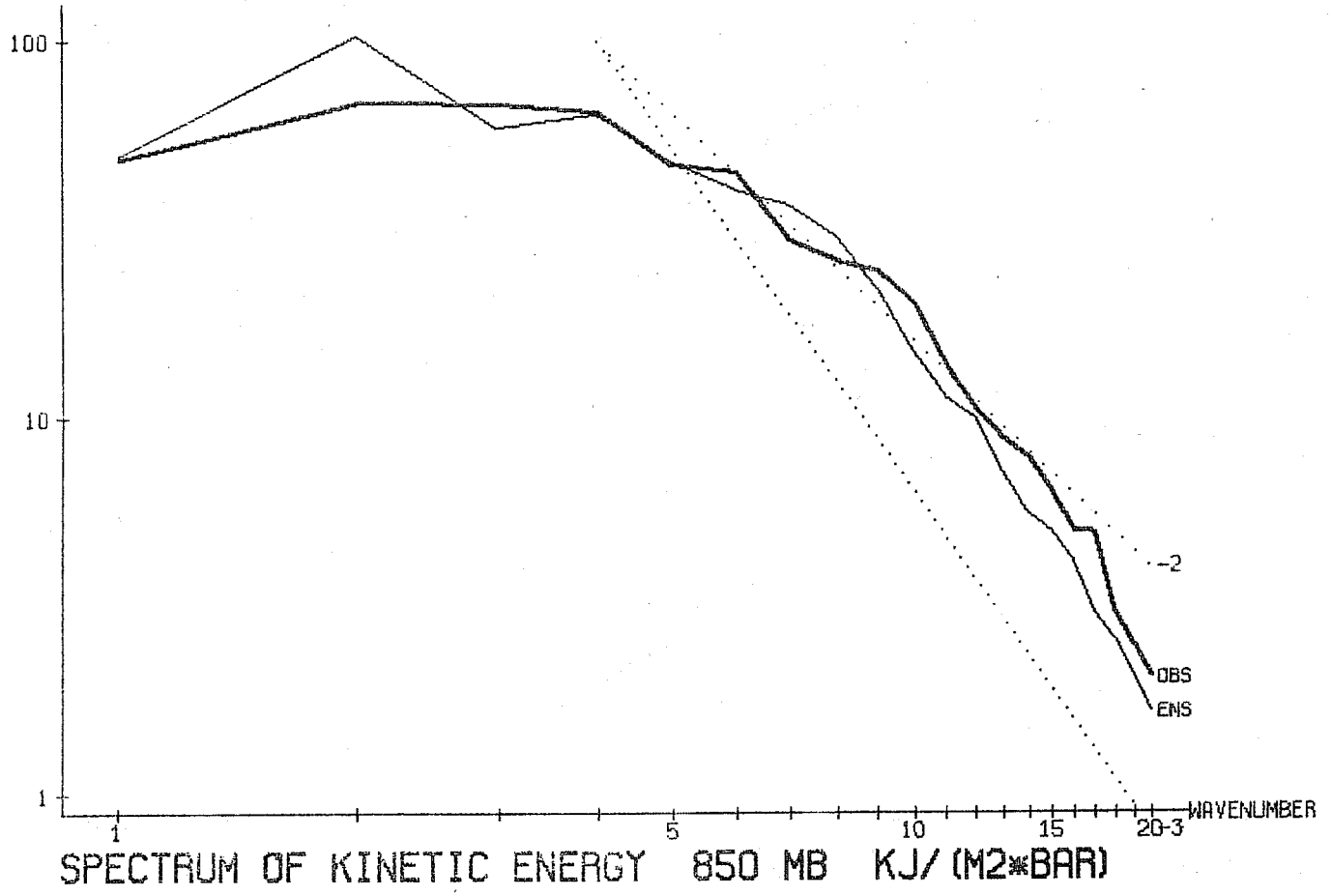

1000
100
10
1
-2
-3
OBS
ENS
1
5
10
15
20
WAVENUMBER
SPECTRUM OF KINETIC ENERGY 500 MB KJ/(M2*BAR)
DAY 7.0 TO 10.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 30


100
10
1
1
5
10
15
20-3
WAVENUMBER
-2
OBS
ENS
SPECTRUM OF KINETIC ENERGY 850 MB KJ/(M2*BAR)

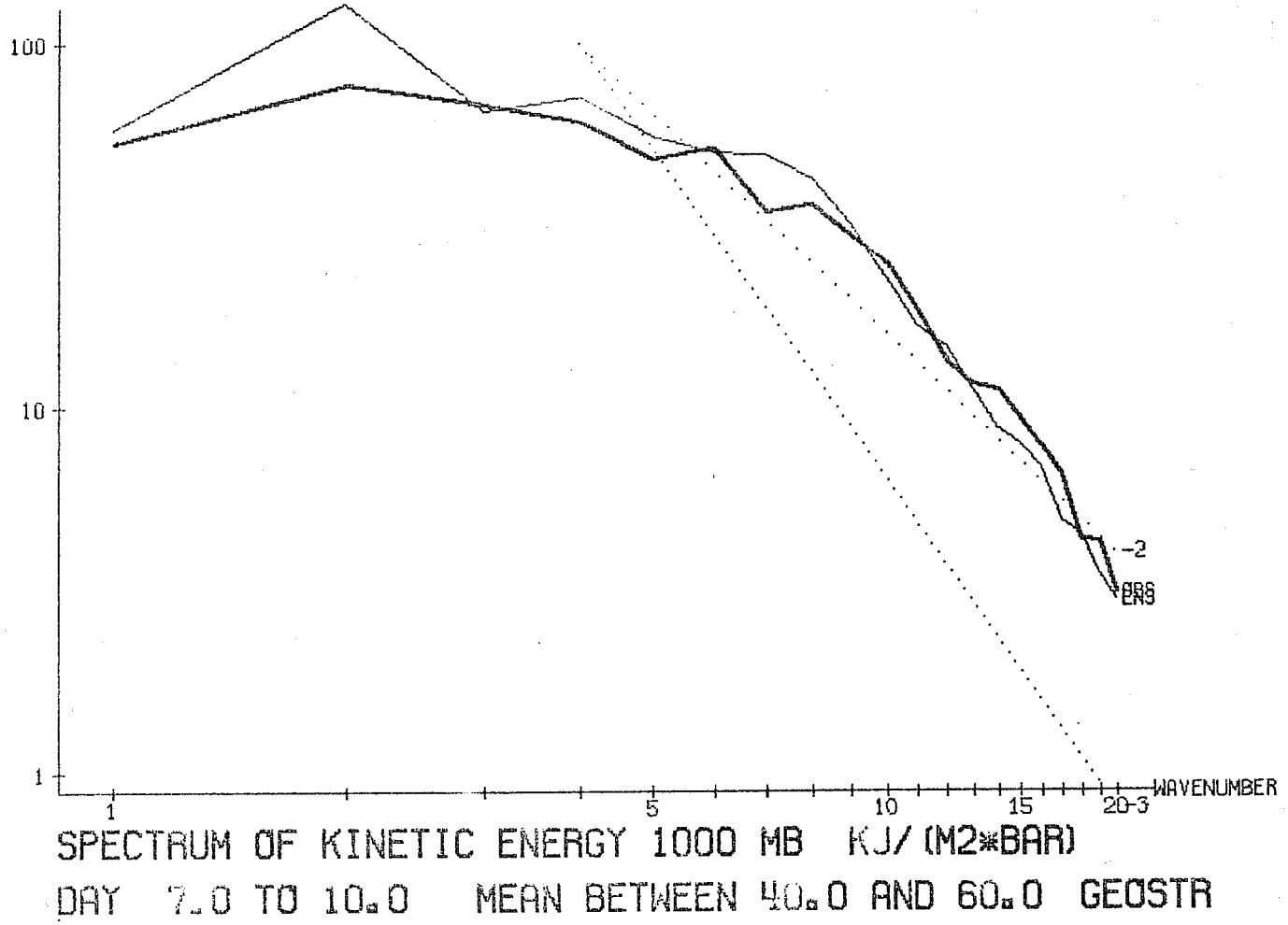
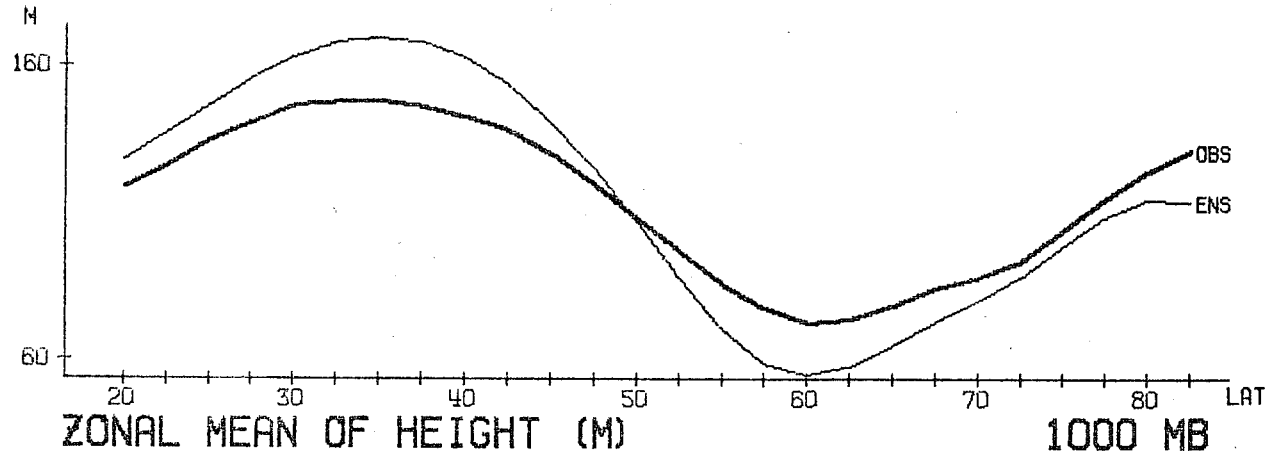
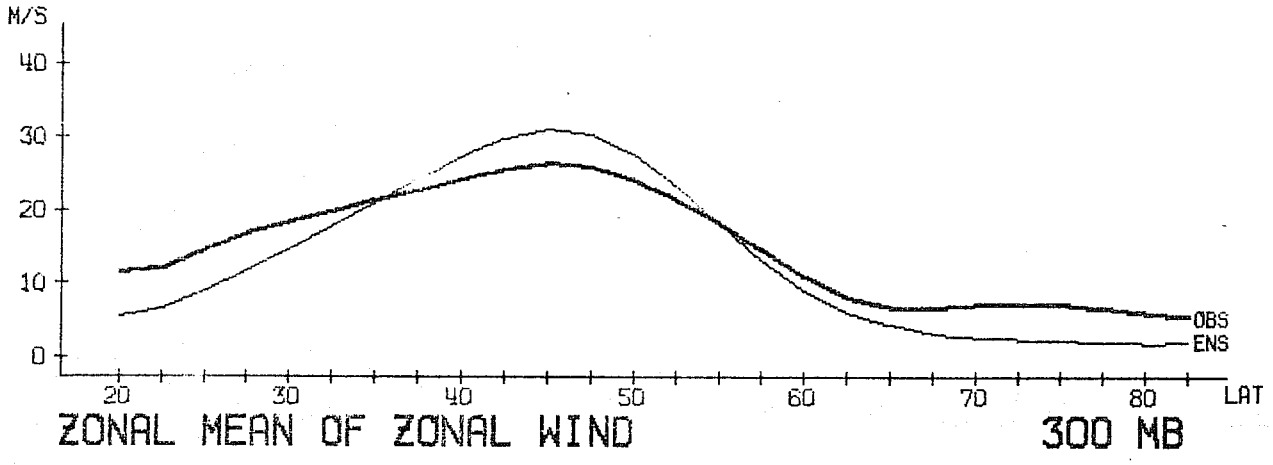
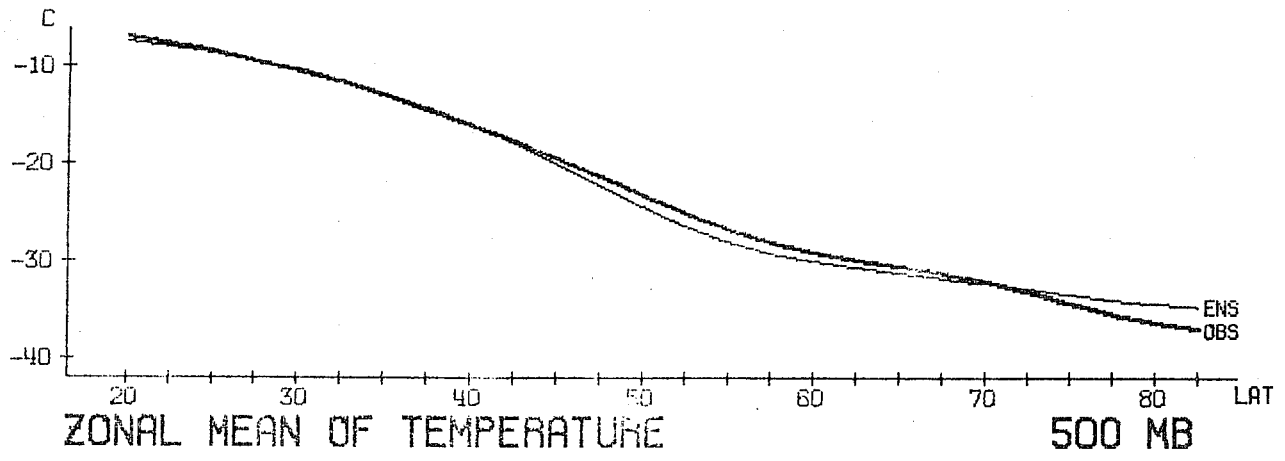

100
10
1
1
5
10
15
20-3
WAVENUMBER
-2
OBS
ENS
SPECTRUM OF KINETIC ENERGY 1000 MB KJ/(M2*BAR)
DAY 7.0 TO 10.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 31


M
160
60
OBS
ENS
20
30
40
50
60
70
80
LAT
ZONAL MEAN OF HEIGHT (M)
1000 MB


M/S
40
30
20
10
0
OBS
ENS
20
30
40
50
60
70
80
LAT
ZONAL MEAN OF ZONAL WIND
300 MB


C
-10
-20
-30
-40
ENS
OBS
20
30
40
50
60
70
80
LAT
ZONAL MEAN OF TEMPERATURE
500 MB

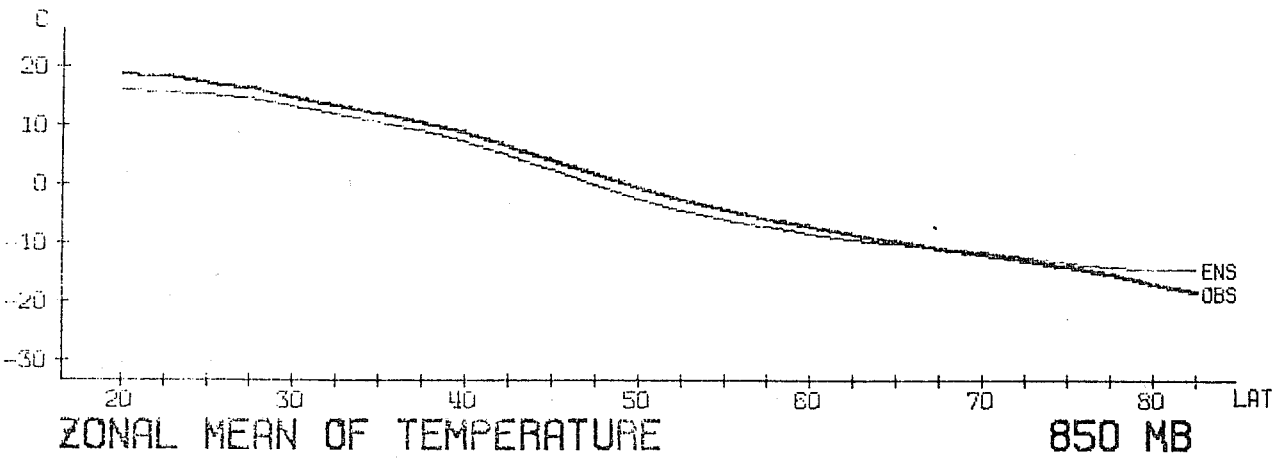
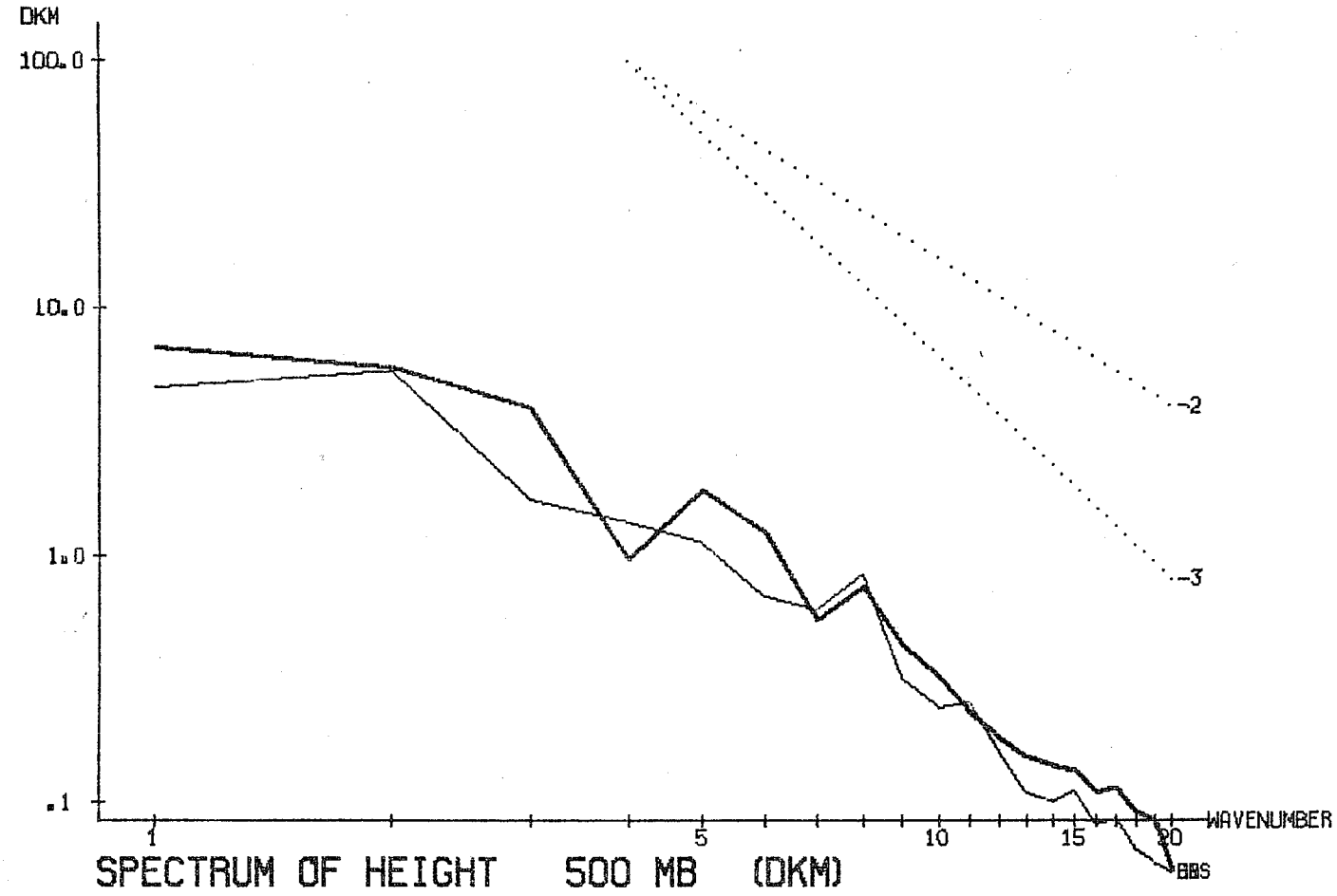

C
20
10
0
-10
-20
-30
ENS
OBS
20
30
40
50
60
70
80
LAT
ZONAL MEAN OF TEMPERATURE
850 MB
DAY 7.0 TO 10.0 MEAN BETWEEN 40.0 AND 60.0

Figure 32


DKM
100.0
10.0
1.0
.1
1
5
10
15
20
WAVENUMBER
-2
-3
OBS
SPECTRUM OF HEIGHT 500 MB (DKM)

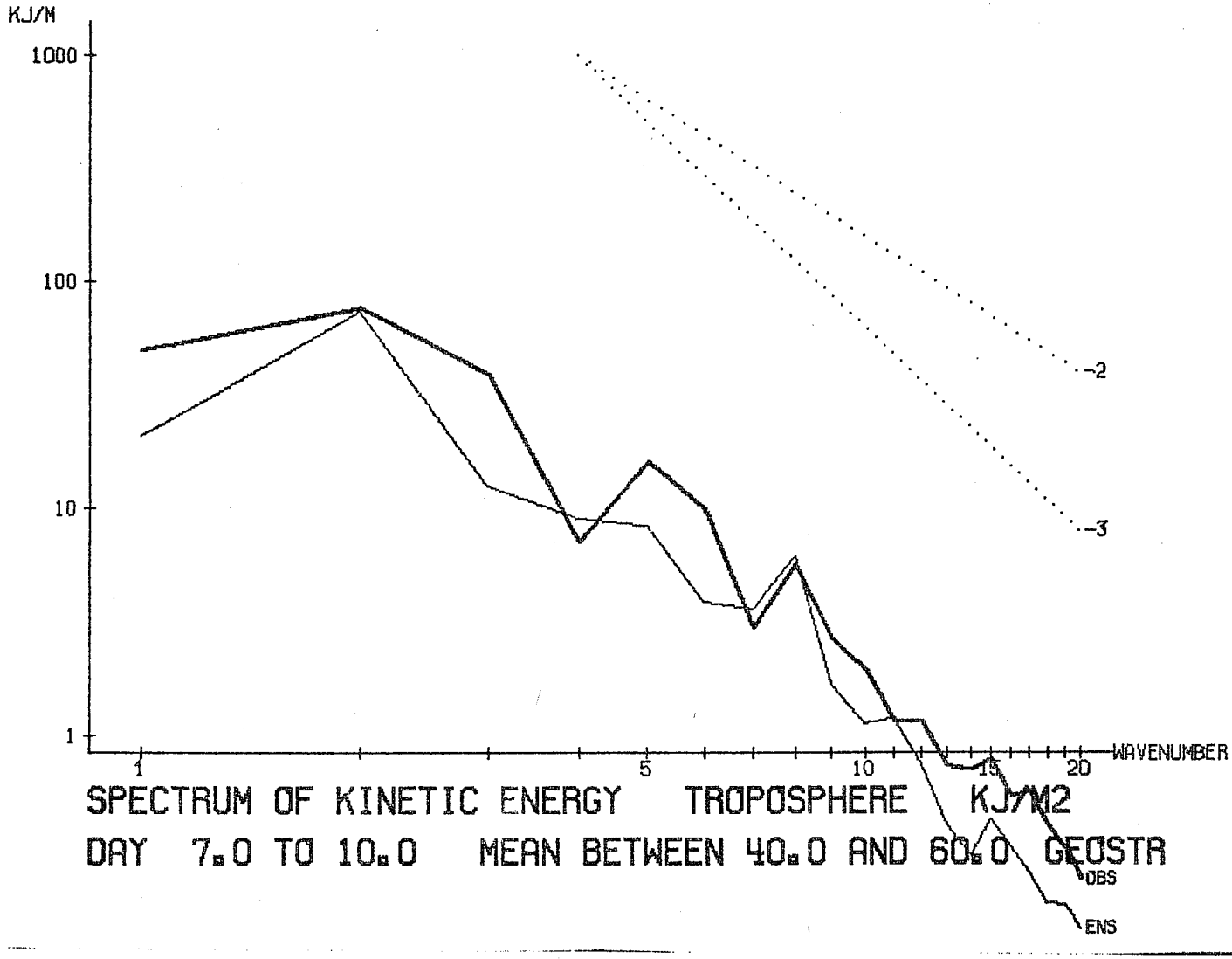

KJ/M
1000
100
10
1
1
5
10
15
20
WAVENUMBER
-2
-3
OBS
ENS
SPECTRUM OF KINETIC ENERGY TROPOSPHERE KJ/M2
DAY 7.0 TO 10.0 MEAN BETWEEN 40.0 AND 60.0 GEOSTR

Figure 33