Proceedings of the Research Institute of Atmospherics,
Nagoya University, Vol. 36, No. 2 (1989)

ACTIVE PHENOMENA OF THE SUN IN FEBRUARY 1986

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Abstract

Optical phenomena of solar activity in February 1986 are summarized. There appeared three active regions, NOAA AR4711, 4712, and 4713, and AR4711 and 4713 produced large flares.

1. General Aspect in February 1986

Relation between solar activity and its associated interplanetary and terrestrial phenomena becomes complicated if the activity occurs simultaneously or successively, but it becomes simple and clear if a single active phenomenon occurs on the Sun during the minimum activity phase. The period of February 1986 is close to the ideal case, and provides a good opportunity for studying the solar-terrestrial physics.

Figure 1 shows monthly and yearly means of Sunspot Relative Numbers from 1975 to 1988. The activity is almost minimum in February 1986 in the yearly means. The sunspot sketch on 5 February is shown in Figure 2. Active Regions NOAA 4711, 4712, and 4713 are visible in 30 January – 12 February, 2 – 6 February, and 3 – 15 February. NOAA 4712 region, appeared on 2 February on the west hemisphere, was inactive, but the other regions were active and many flares were observed in both regions.

A synoptic chart in Feb. 1986 (Figure 3) shows that all regions except NOAA 4711 and 4713 regions were quite calm, and NOAA 4711 region emerged in a region with negative polarity. Figure 4 shows a synoptic chart of solar magnetic field in Feb. 1986. Except for NOAA 4711 and 4713 regions, the magnetic field was quiet.

Flare Importance versus time is shown in Figure 5. Large flares occurred on 4, 5, 6, and 7 Feb. in NOAA 4711 region and on 4 Feb. in NOAA 4713 region.

2. Active Region NOAA 4711

A large sunspot group in the solar minimum phase often shows greater activity than that of similar size in the maximum phase. An evolutional characteristic of an active region

shows that the time of its development is usually one half or less than that of its decay. While for NOAA 4711 region the time of its decay is nearly equal to that of its development, implying the loss of magnetic energy was quite fast and violent (Yang et al., 1987, Markova et al., 1987, Smith et al., 1987, Wu et al., 1987, Luo et al., 1988).

Figure 6 shows a vector magnetogram of NOAA 4711 region observed on 31 Jan. at the Okayama Astrophysical Observatory. The development of magnetic field and sunspot was obtained at the Yunnan Observatory as shown in Figure 7 and 8. Umbra N–O (north polarity) was almost stable, while other umbrae N–1, S–1 (south polarity), N–2 and N–3 changed their area/position very fast. Total area for each day, as shown in Figure 8, increased quickly until 4 Feb., and was maximum on 4 and 5 Feb., then decreased at the same rate as its development. A pair of N1 and S1 rotated clockwise around umbra N–0; magnetic shear, due to the movement of umbra S1, became large, and large flares occurred along the neutral line (Hagyard et al. 1988).

References

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Yang, H-S., Hong Q.F., and Ding, Y.J., A constant-α Force-Free-Field Analysis of the Active Region AR 4711 of February 1986, *Solar Phys.*, 117, 57, 1988.

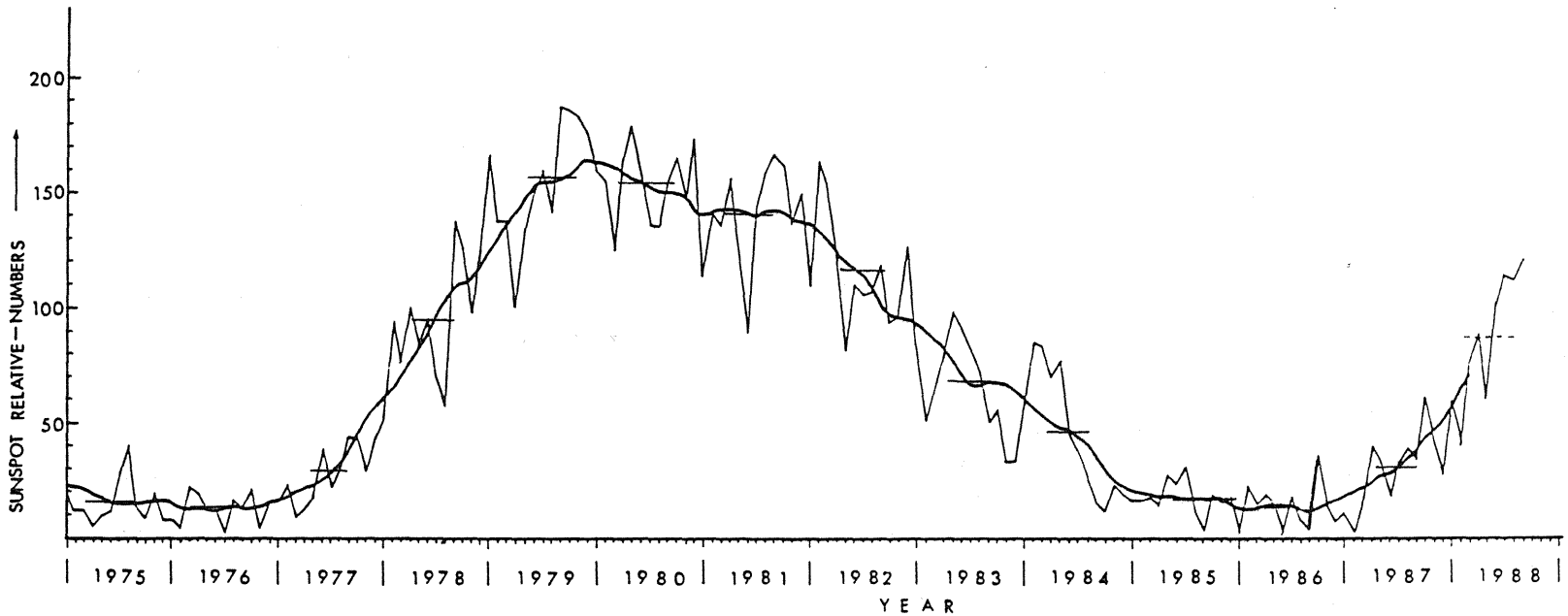

SUNSPOT RELATIVE—NUMBERS
200
150
100
50
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
YEAR

Figure 1

1986 年 2 月 5 日

09 時 20 分

天気：快晴

透明度： 3

シンチレーション： 3

像の良さ： 3

P = −13.70

Bo = − 6.18

Lo = 72.73

Δl = 0.18

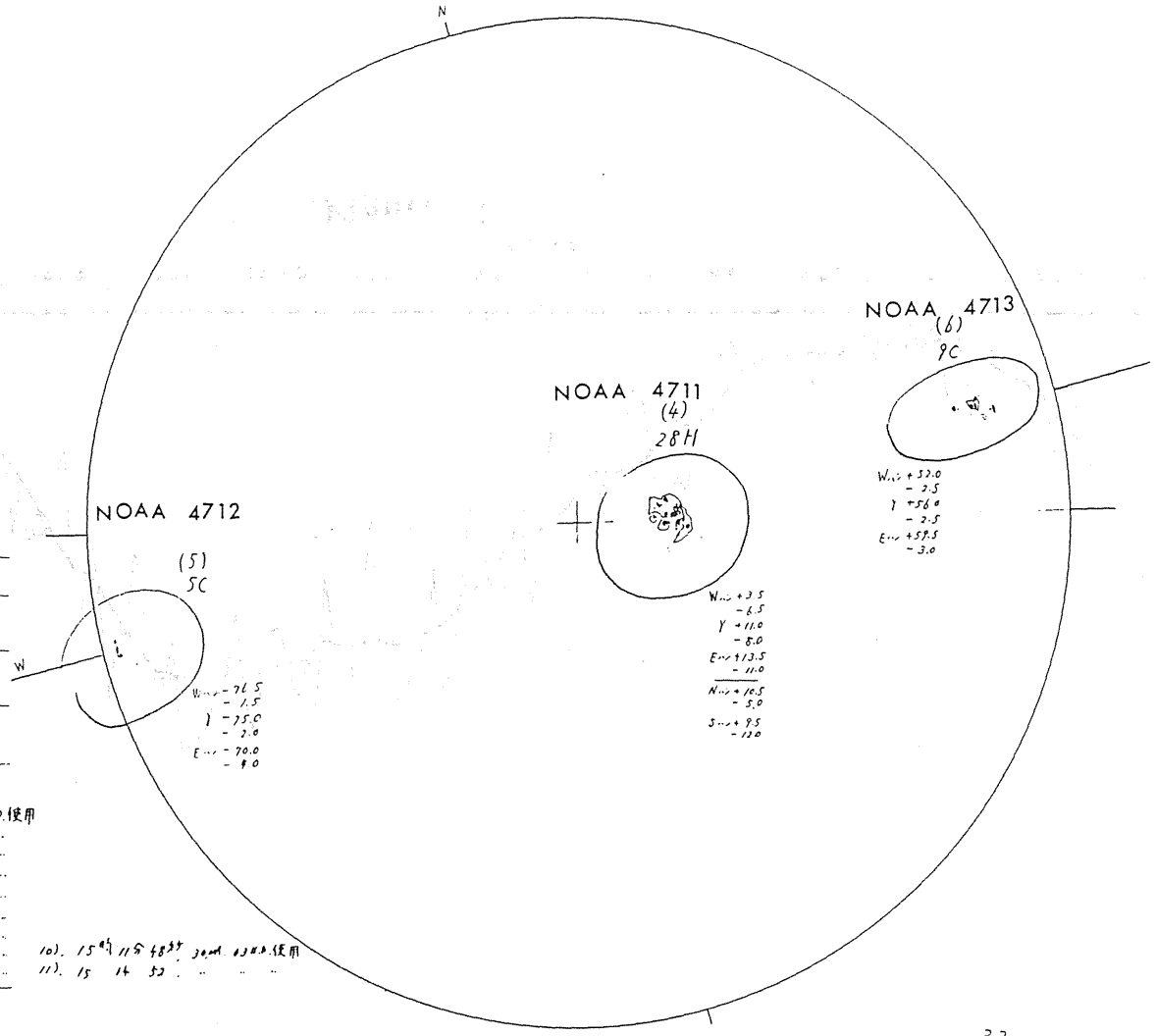
L = 72.55

	g	f	R
N	0	0	0
S	3	42	43.20
合計	3	42	43.20

写真：

1). 09時 20分 34秒 115mA. 0.1N.D.使用
2). 09 21 09 . 〃 〃 〃
3). 09 21 45 . 〃 〃 〃
4). 09 48 05 . 〃 〃 〃
5). 09 54 20 . 〃 〃 〃
6). 09 56 21 . 〃 〃 〃
7). 10 00 31 . 〃 〃 〃
8). 10 06 47 . 〃 〃 〃
9). 10 13 22 . 〃 〃 〃
10). 15時 11分 48秒 30mA. 0.3N.D.使用
11). 15 14 52 . 〃 〃 〃

観測者： 名取



No. 32

Figure 2

PRELIMINARY H-ALPHA SOLAR SYNOPTIC CHART
CARRINGTON ROTATION NUMBER 1771
(January 14 to February 10, 1986)

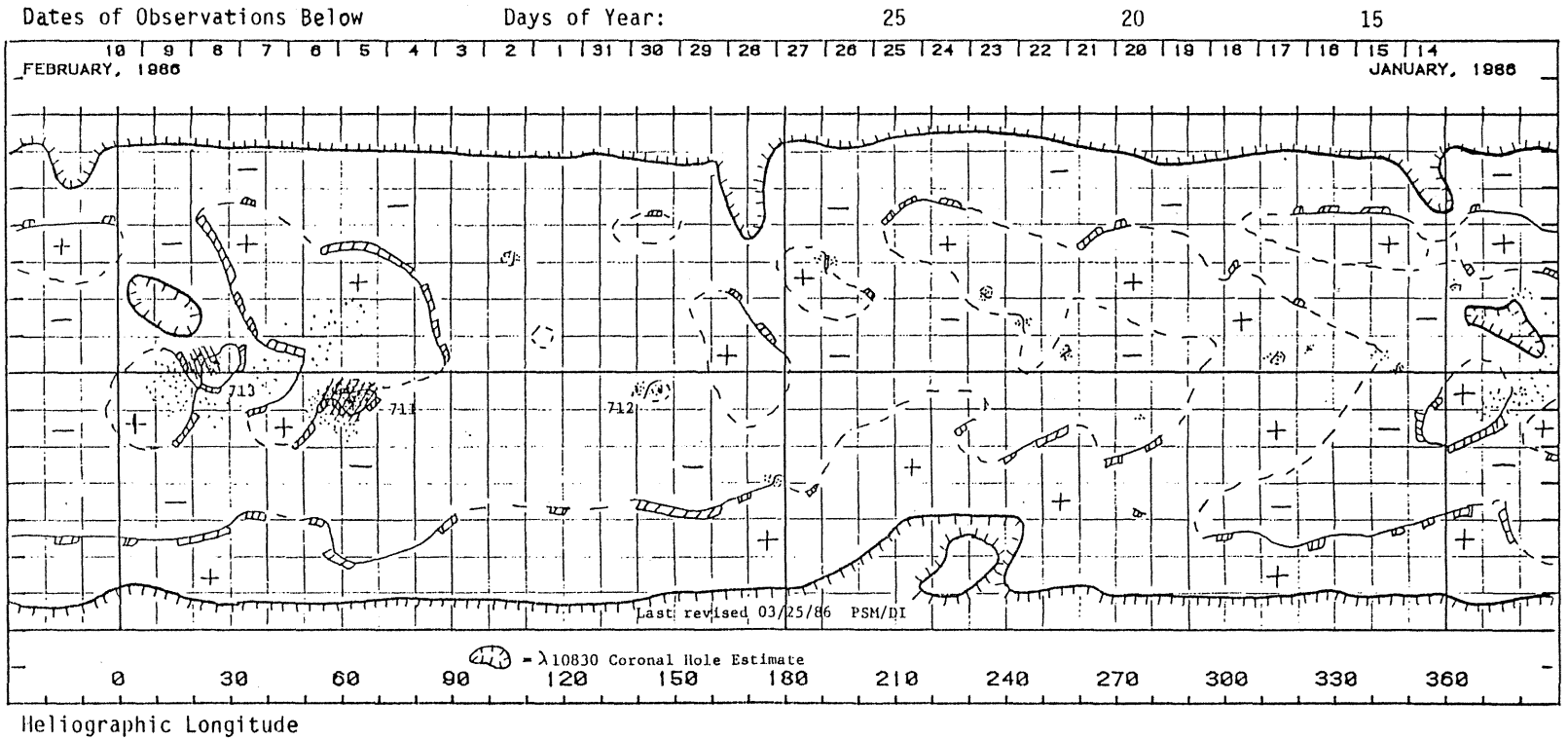


Figure 3

SOLAR MAGNETIC FIELD SYNOPTIC CHART

CARRINGTON ROTATION NUMBER 1771
(January 14 to February 10, 1986)

Kitt Peak National Observatory

Dates of Observations

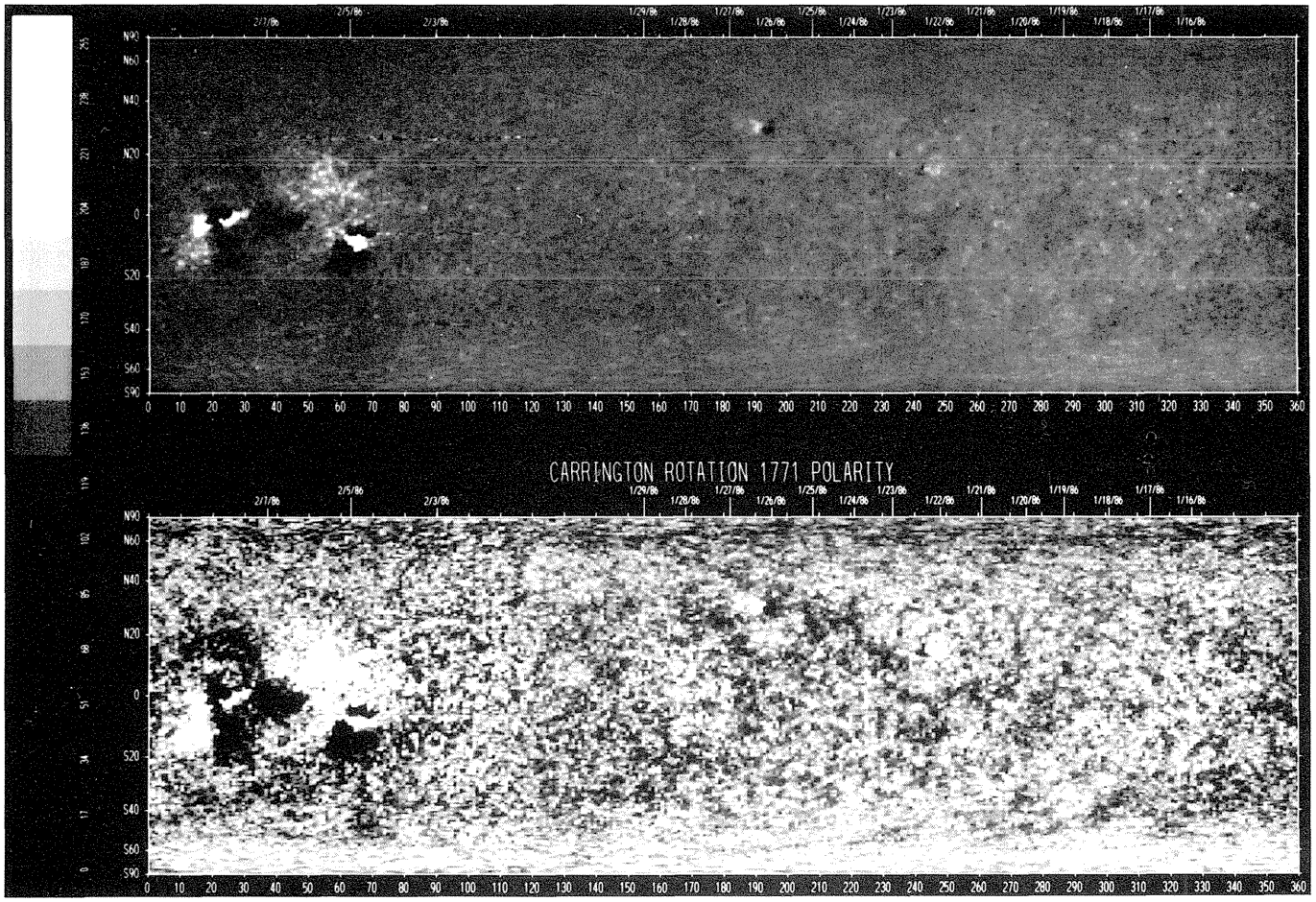


Figure 4

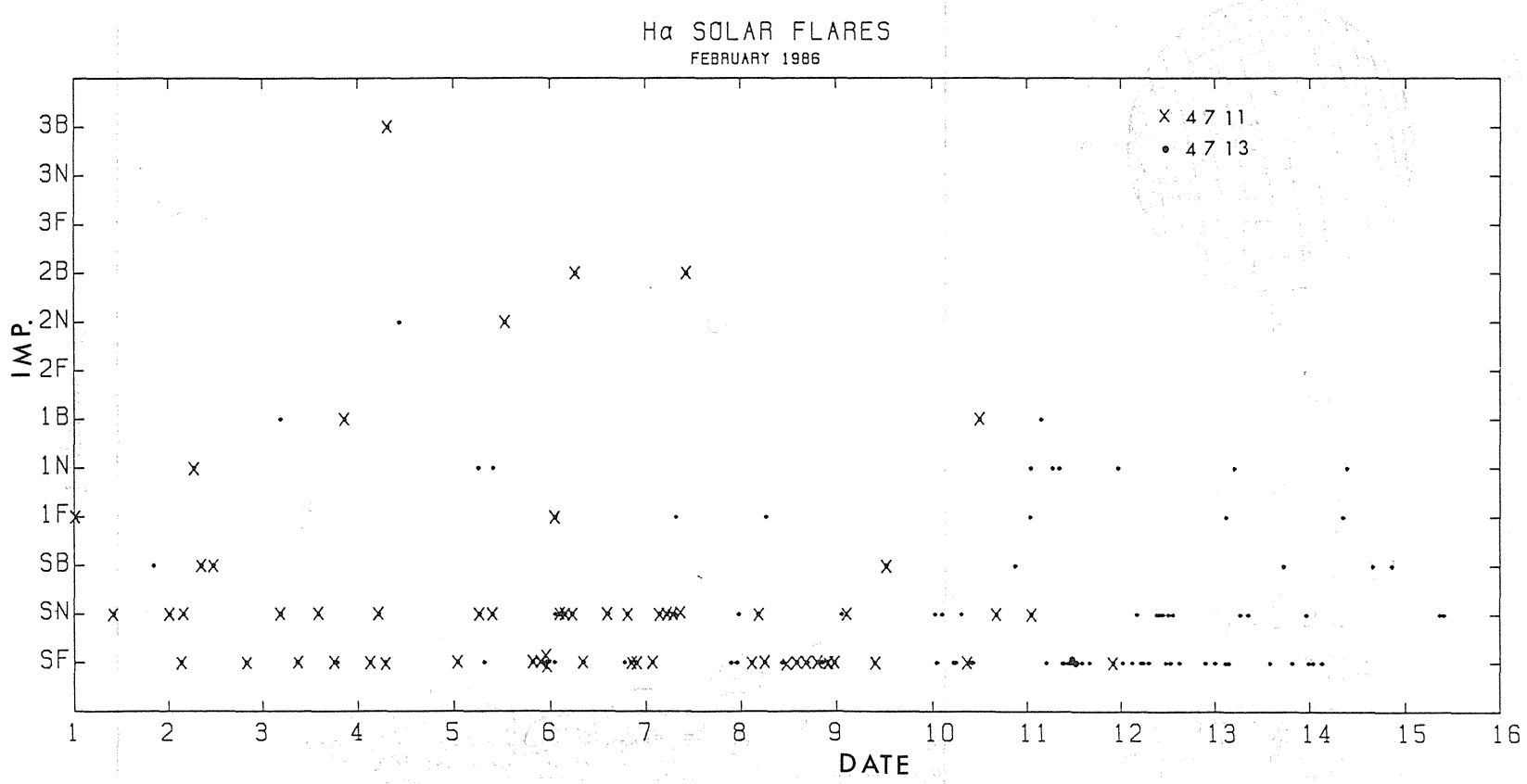
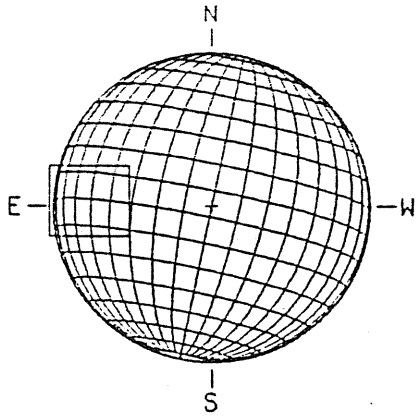

Hα SOLAR FLARES
FEBRUARY 1986
X 4711
• 4713
IMP.
3B
3N
3F
2B
2N
2F
1B
1N
1F
SB
SN
SF
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
DATE

Figure 5

OKAYAMA OBSERVATORY VECTOR MAGNETOGRAM

FILE-ID : MF131A
DATE : 86/ 1/31
TIME(JST) : 13 47 47 -15 51 6
(UT) : 4 47 47 - 6 51 6
XS= -989 YS= -185
DX= 10 DY= 10
NX= 50 NY= 45
P = -11.7
BO= -6.0
R = 966



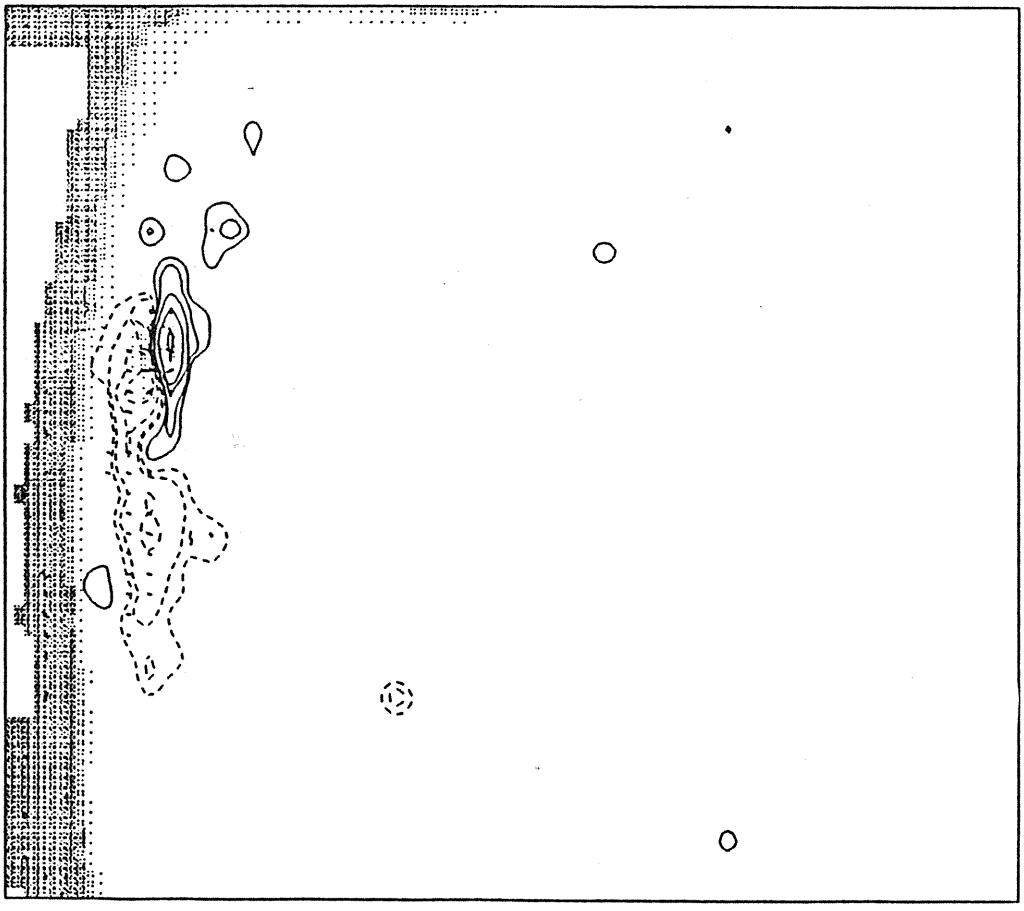
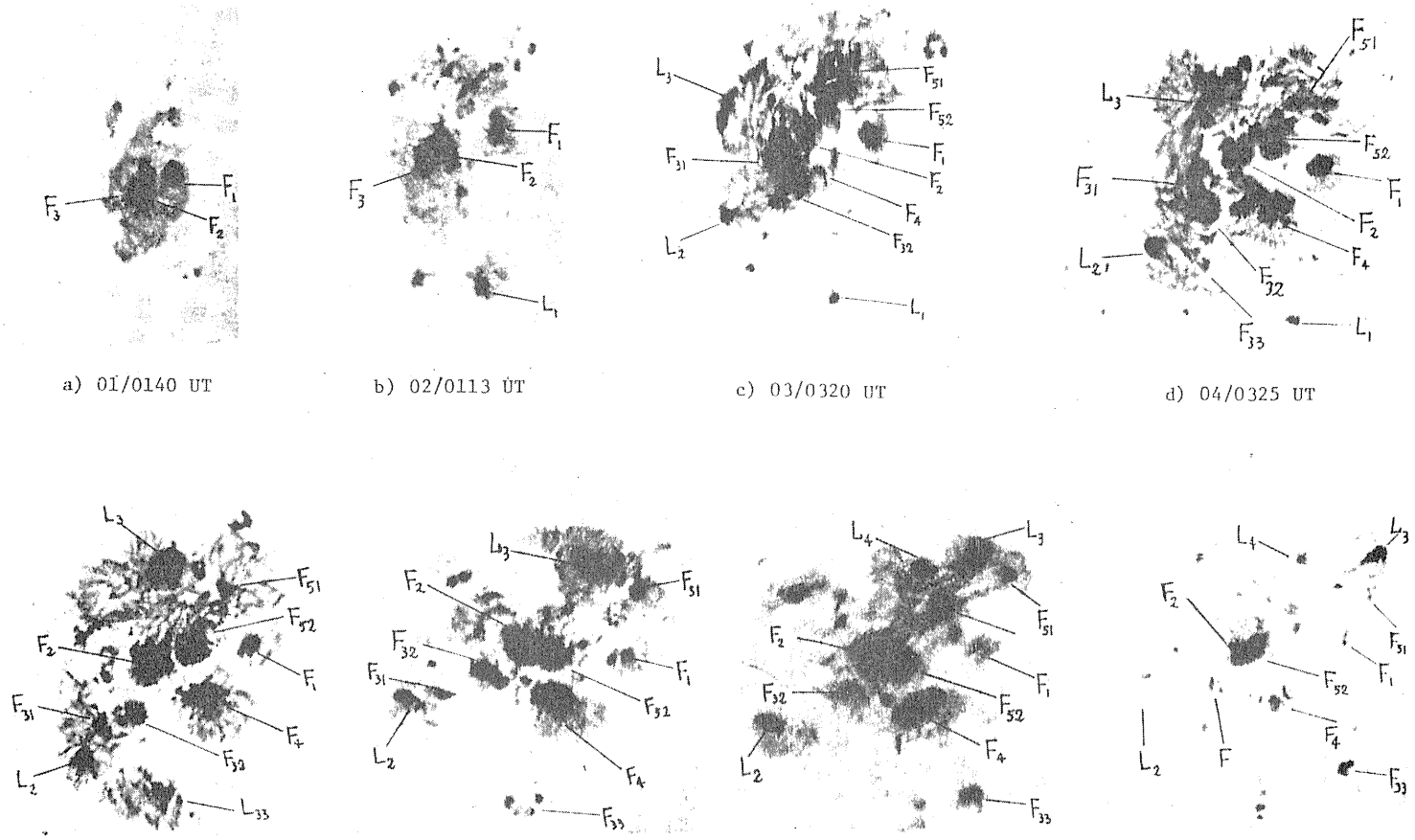


Figure 6



a) 01/0140 UT

b) 02/0113 UT

c) 03/0320 UT

d) 04/0325 UT

e) e)05/0335 UT

f) 06/0125 UT

g) 07/0150 UT

h) 08/0240 UT

Figure 7

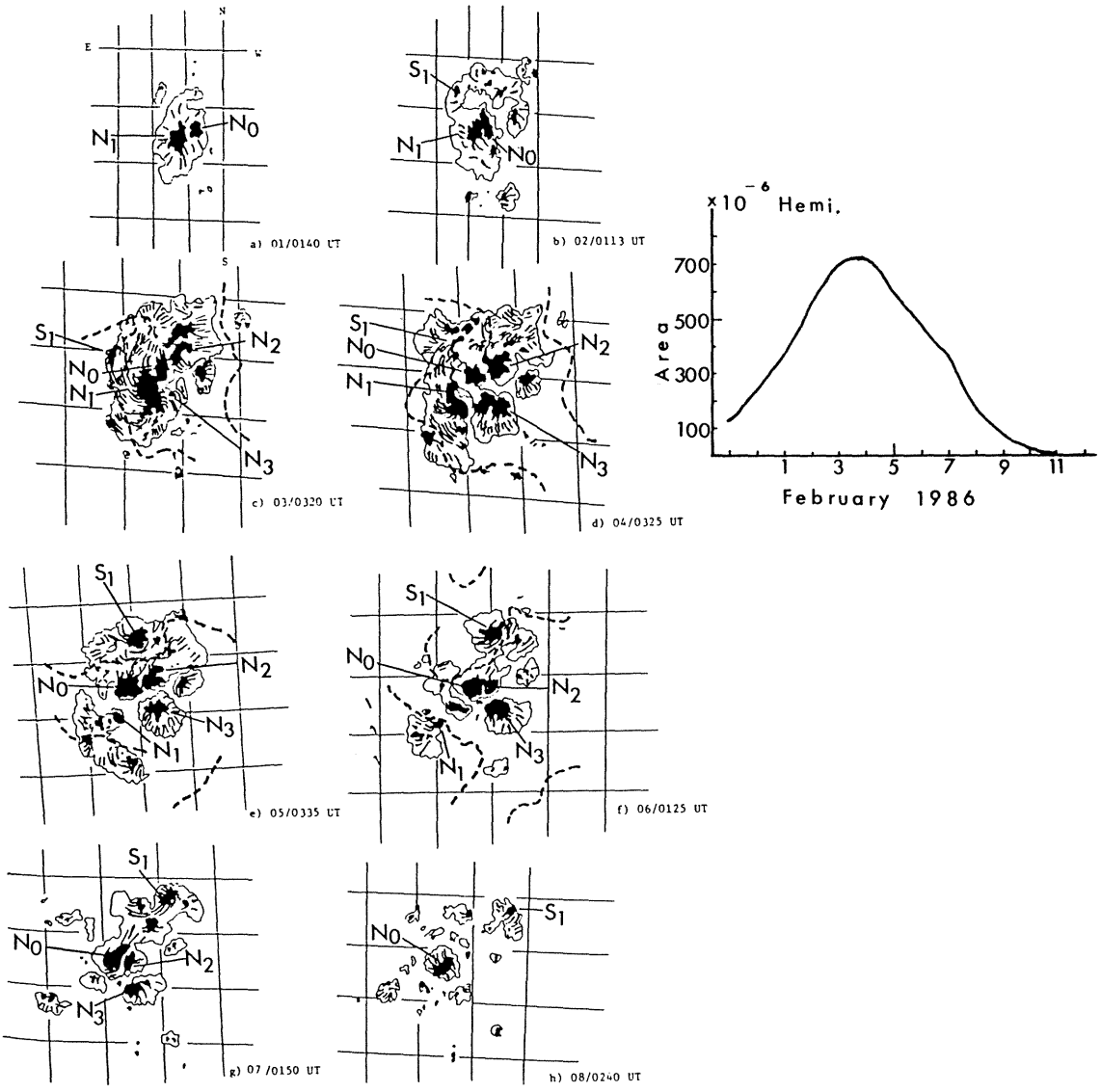

N
E
W
S
N_0
N_1
a) 01/0140 UT
S_1
N_1
N_0
b) 02/0113 UT
S_1
N_0
N_1
N_2
N_3
c) 03/0320 UT
S_1
N_0
N_1
N_2
N_3
d) 04/0325 UT
$\times 10^{-6}$ Hemi.
Area
700
500
300
100
1
3
5
7
9
11
February 1986
S_1
N_0
N_2
N_3
N_1
e) 05/0335 UT
S_1
N_0
N_2
N_3
N_1
f) 06/0125 UT
S_1
N_0
N_2
N_3
g) 07/0150 UT
S_1
N_0
h) 08/0240 UT

Figure 8