REPORT UAG – 41

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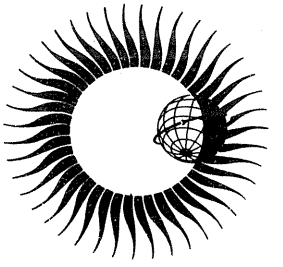
for
Solar-Terrestrial Physics

H–ALPHA SYNOPTIC CHARTS OF SOLAR ACTIVITY DURING THE FIRST YEAR OF SOLAR CYCLE 20

OCTOBER, 1964 – AUGUST, 1965

MARCH 1975



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H–ALPHA SYNOPTIC CHARTS OF SOLAR ACTIVITY DURING THE FIRST YEAR OF SOLAR CYCLE 20

OCTOBER, 1964 – AUGUST, 1965

by

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Boulder, Colorado, USA

and

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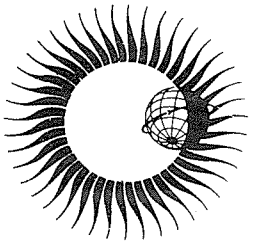
MARCH 1975

Prepared by World Data Center A for
Solar-Terrestrial Physics, NOAA, Boulder, Colorado
and published by

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ENVIRONMENTAL DATA SERVICE
Asheville, North Carolina, USA 28801



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H-ALPHA SYNOPTIC CHARTS OF SOLAR ACTIVITY DURING THE FIRST YEAR OF SOLAR CYCLE 20

October, 1964 - August, 1965

by

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Cambridge, Massachusetts, U.S.A.

Solar activity during the period October 28, 1964 through August 27, 1965 is presented here in the form of charts for each solar rotation constructed from observations made with the chromospheric H-alpha spectral line. These H-alpha synoptic charts are identical in format and method of construction to those published for the period of Skylab observations [McIntosh, 1975]. The sunspot minimum marking the start of Solar Cycle 20 occurred in October, 1964; therefore, these charts represent solar activity during the first year of this solar cycle. It is appropriate to publish these data at this time for comparison with observations to be made during the imminent solar minimum of 1975-1976.

The charts are based on once-daily standard H-alpha observations taken at Sacramento Peak Observatory of Air Force Cambridge Research Laboratories which have been interpreted in terms of large-scale magnetic field regions according to a technique previously described [McIntosh, 1972a, 1972b]. The data are given on the synoptic time scale of a solar rotation, much like those in the Carte Synoptique prepared by the Meudon Observatory. Here, however, the features are shown as they appeared when each longitude zone was 40°W of the sun's Central Meridian.

Each chart is a map of the solar globe built up from the daily observations. The latitude range is ± 70°. The Carrington longitudes are indicated at the bottom and the date of central meridian passage at the top. Each chart includes an overlap of 60° with the preceding and following chart. The date in the lower right corner, e.g., 5/09/74, is the date of preparation of this final version of the synoptic chart to distinguish it from preliminary versions.

The data shown on the charts are:

(1) distinct neutral lines (solid lines)
(2) estimated neutral lines (dashed lines)
(3) filaments (cross-hatched areas)
(4) major sunspots (large solid dots)
(5) H-alpha plage (stipple, density roughly representing brightness)

The distinct neutral lines, indicating magnetic polarity reversals [McIntosh, 1972a, 1972b], are mapped from various H-alpha structures: filaments, filament channels, plage corridors, "iron-filing" patterns of fibrils adjacent to active centers, and arch-filament systems. There are several criteria for drawing in "estimated" neutral lines. Basically, they connect segments of distinct neutral lines, but consideration is also given to the gross distribution of inferred polarities in adjacent regions and, more importantly, on the expected continuity with previous or following solar rotations when a distinct pattern may have been more recognizable in the same general area.

The signs of the magnetic polarities are inferred from Hale's law: leader sunspots in opposite solar hemispheres have opposite polarities. Northern leader spots possess negative polarity during even-numbered solar cycles, while southern leader spots are positive. Active regions from both Cycle 19 and Cycle 20 are present during this period, distinguished by their appearance at low and high latitudes, respectively. The polarities of all areas on the sun are inferred by beginning with a leader sunspot, or the leading portion of a bipolar plage, and alternating polarities with each successive neutral line. Patterns persisting from previous solar rotations are assumed to maintain the same polarity. Magnetic polarities are verified by comparison with solar magnetograms made with photospheric spectral lines whenever magnetogram data are available [Howard et al., 1967]. Corrections to the inferred polarities are usually necessary only in areas of complex patterns outlined by estimated neutral lines.

The patterns are mapped by accumulating the positions of features on H-alpha filtergrams from several consecutive days. Seldom does a single photograph show the patterns in their complete form, owing to the transient nature of the filaments and the variable observing conditions. Structures and positions marked on the charts are a representation of the location and appearance of the features during their entire disk passage. Whenever possible, the H-alpha patterns mapped are the forms seen when the particular features were near W40° on the visible solar hemisphere. This bias toward the West enables a more realistic comparison with energetic particle data measured near the earth.

Whenever a pattern undergoes a conspicuous change from the time of first visibility near the East limb to the time when at W40°, the former neutral-line position is depicted as a line crossed with hachures (e.g., Rotation 1496, near N20°, longitude 200°).

The relative lack of well-defined neutral line structures in the southern hemisphere is due to the low level of solar activity, with the accompanying very low magnetic field strength. Charts for other times in Solar Cycle 20, used in studies of solar cosmic rays [Roelof and Krimigis, 1973; Roelof, 1974; Shea and Smart, 1974], are more complete and more reliable.

The notes for each solar rotation list the dates of the major changes resulting from the birth of regions, the appearance and disappearance of filaments and the larger motions of inferred neutral lines. A list of days of no observations at Sacramento Peak is also included.

This set of H-alpha synoptic charts documenting the beginning of Solar Cycle 20 was originally prepared for use in a thesis [Nolte, 1974] on correlative studies with interplanetary solar wind and energetic solar particle data.

Acknowledgments

We thank the High Altitude Observatory of the National Center for Atmospheric Research (operated by the National Science Foundation) for the loan of daily H-alpha survey films taken at the Sacramento Peak Observatory (Air Force Cambridge Research Laboratories). Thanks are also extended to Susan Wayland and Janice Leighton for extensive checking and editing of each chart. One of us, J. T. Nolte, acknowledges the support of the NOAA Space Environment Laboratory, NOAA Contract 03-3-022-41 and NASA Contract NGR-30-002-097.

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NOTES

1964 - ROTATION 1487

Location Longitude	Location Latitude	Date of Occurrence	Descriptive Notes
25	N25	27 Oct.	Birth of short-lived plage; dissipated on 29 Oct.
17	S20	27 Oct.	Filament disappears; gradually reforms by 04 Nov. when visible as a prominence
05	N20	30 Oct.	Birth of faint plage, with spot group visible for one day
345	N34	03 Nov.	Birth of bipolar plage with spot group visible only this day
335	N34	05 Nov.	Large filament develops near west limb
318	S06	31 Oct.	Birth of bipolar plage with spot group
295	N07	02 Nov.	Filament disappears
285	N18	07 Nov.	Birth of bipolar plage 31 Oct. Small filament forms this day only
285	N32	04 Nov.	Filament disappears
240	S40	9-10 Nov.	Filament disappears
215	N09	14 Nov.	Birth of bipolar plage with spot group
206	N37	14 Nov.	Filament disappears
205	N34	04 Nov.	Birth of bipolar region; spots form by 07 Nov.
180	N30	12 Nov.	Birth of bipolar plage with spot group
150	S05	9-10 Nov.	Filament disappears
135	N20	15 Nov.	Birth of bipolar plage; forms Type-C spot group. Most important active center of this rotation
125	N37	19 Nov.	Birth of bipolar plage with spot group
70	S20	18-19 Nov.	Filament disappears
52	N23	22 Nov.	Filament disappears
51	S10	21 Nov.	Filament disappears

NOTES (Continued)

1964 - ROTATION 1487

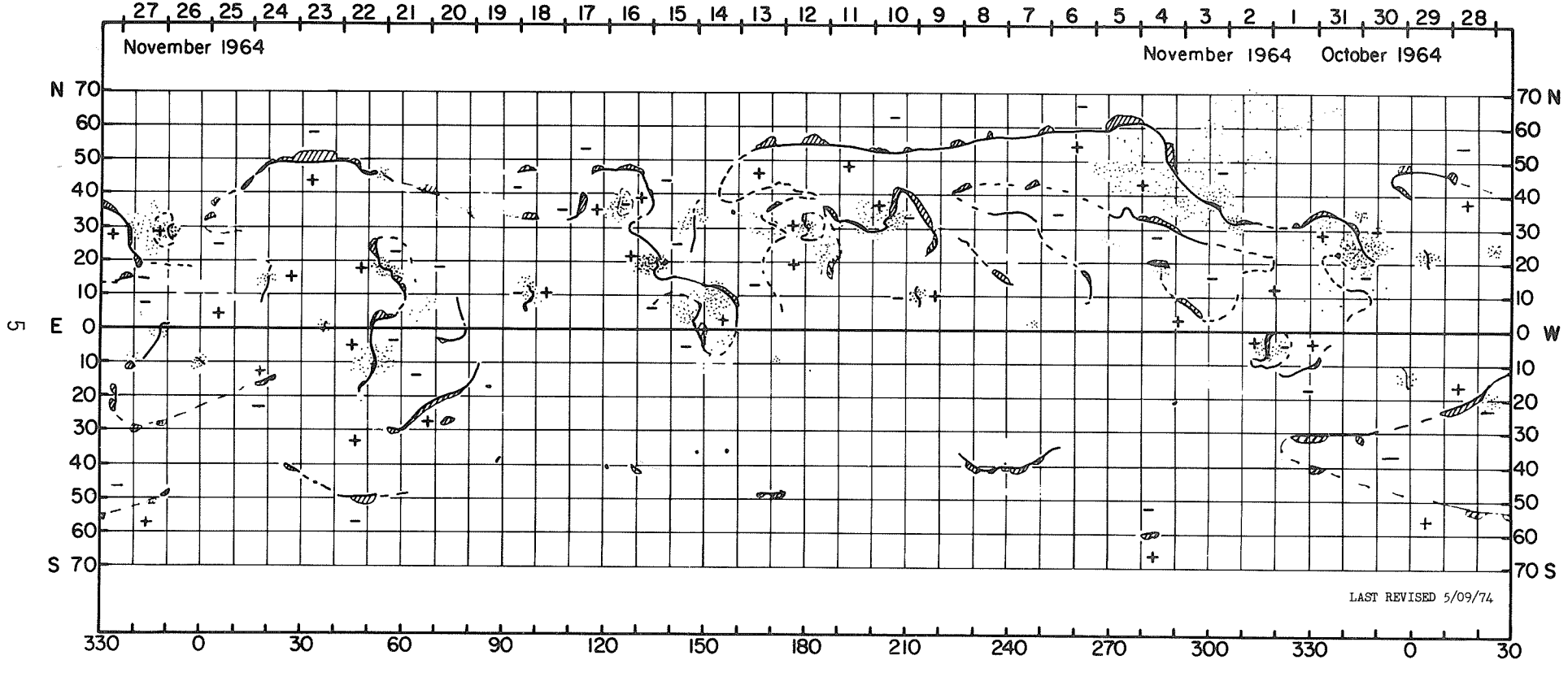
Location Longitude	Location Latitude	Date of Occur.	Descriptive Notes
37	Equator	23 Nov.	Birth of small bipolar plage
35	N50	21 Nov.	Filament disappears
20	N17	28 Nov.	Birth of bipolar plage with spot group

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

October 13, 18, 29, November 9, 11, 18, 26

Hα SYNOPTIC CHART

1964- ROTATION 1487



NOTES

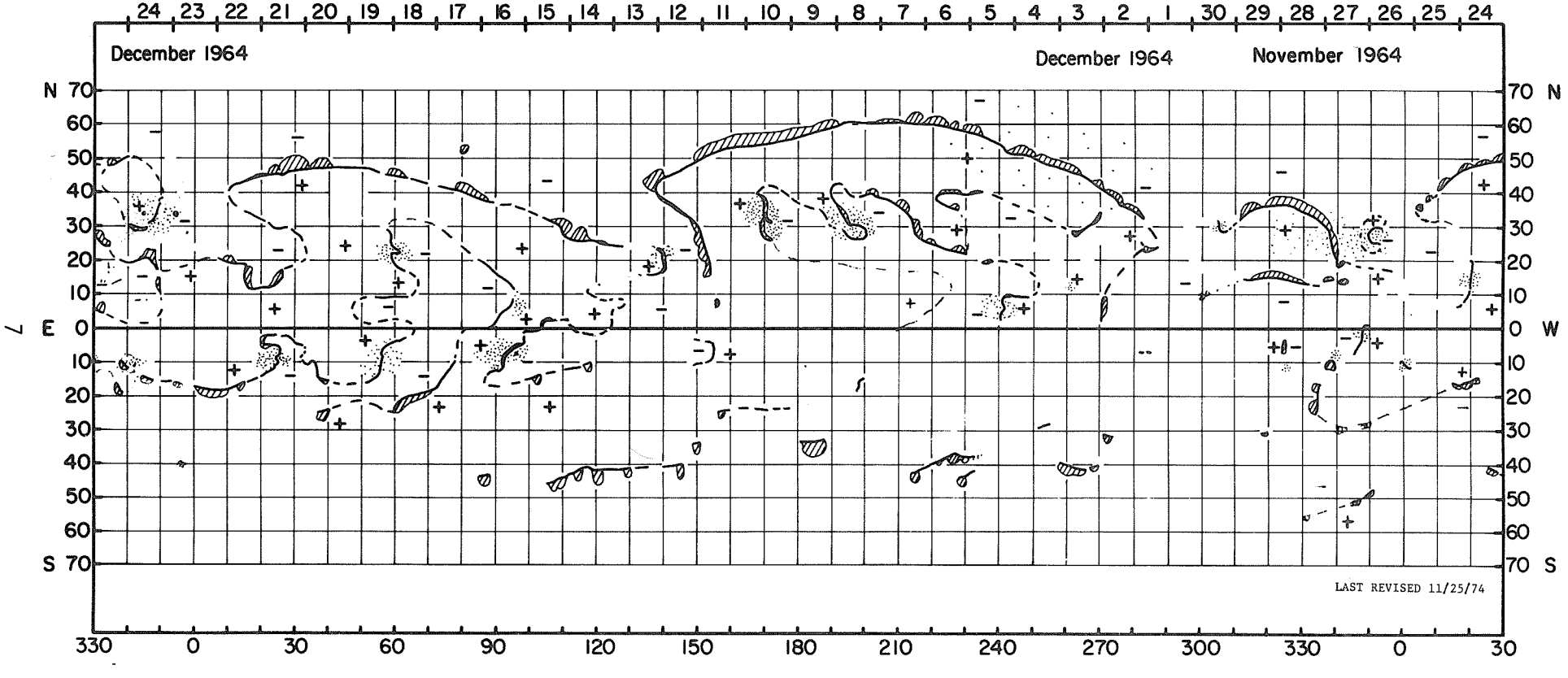
1964 - ROTATION 1488

Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
351	N27	24 Nov.	Birth of bipolar region with spot group; additional growth on 01 Dec.
305	N30	29 Nov.	Birth of small plage; gone by 01 Dec.
140	N22	13 Dec.	Birth of bipolar region
110	S42	16-17 Dec.	Filament disappears
97	N07	19 Dec.	Birth of bipolar region
58	N23	15 Dec.	New growth in small, old active region
22	S10	14-15 Dec.	Bipolar region probably born near east limb
15	N15	18-19 Dec.	Filament disappears

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

November 26, December 2, 3, 4, 5, 8, 16, 18, 22

Hα SYNOPTIC CHART
1964 – ROTATION 1488



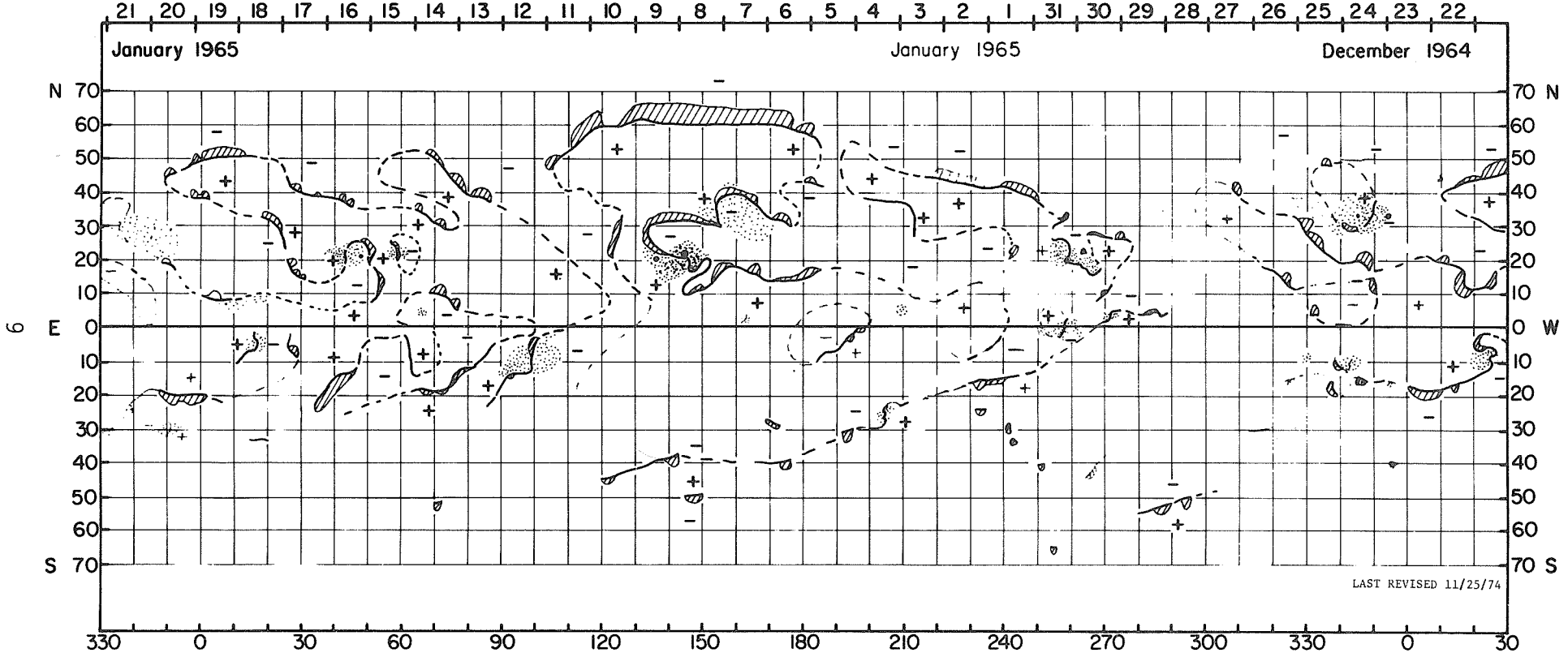
1964, 1965 - ROTATION 1489

Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
340	S10	19 Dec.	Birth of active region
271	N02	28 Dec.	Birth of bipolar region
260	N22	28 Dec.	Birth of bipolar region with spot group; additional growth on 31 Dec.
255	S01	26 Dec.	Probable birth of bipolar region with spot group
245	N40	3 Jan.	Filament appears only on this day
225	N45	29 Dec.	Filament disappears
210	N05	3 Jan.	Birth of short-lived, faint plage
205	S27	5 Jan.	Birth of bipolar region with spot group visible for one day
178	N14	10 Jan.	First appearance of filament
162	N03	9 Jan.	Only appearance of small bipolar region with bright plage
135	N28	5 Jan.	Filament disappears; reforms by 8 Jan.
125	N25	8 Jan.	Filament faintly appears, completely visible by Jan. 9, possibly disappears at west limb 14-15 Jan.
45	N20	13 Jan.	Birth of bipolar region with spot group; additional growth on 17 Jan.
40	S15	14-15Jan.	Filament disappears
20	S04	18 Jan.	Mt. Wilson magnetogram noise level approximately same as the strength of this plage
18	N16	17 Jan.	Birth of small, short-lived, bipolar region
16	S04	16 Jan.	Birth of bipolar region
10	N16	17 Jan.	Birth of small, short-lived, bipolar region

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

December 22, 25, 27, 31, January 1, 6, 7, 12, 14, 20

Hα SYNOPTIC CHART
1964,1965 - ROTATION 1489



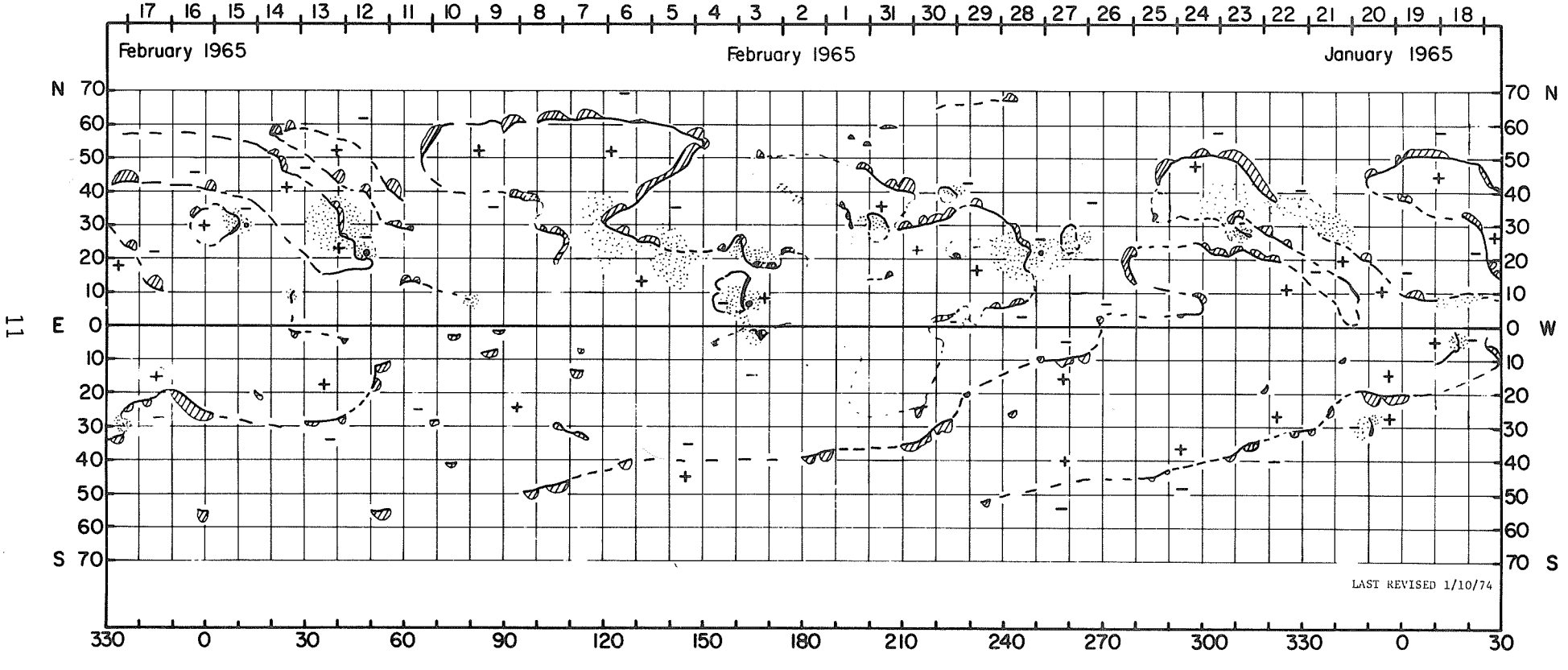
NOTES

1965 - ROTATION 1490

Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
355	S20	17 Jan.	Filament disappears
350	S30	23-24 Jan.	Birth of bipolar region
314	S35	25 Jan.	Small filament disappears
311	N29	18 Jan.	Birth of bipolar region with spot group; additional growth on 26 Jan.
280	N20	22-27 Jan.	Variable filament; disappears 27 Jan.
264	S08	29 Jan.	Small filament disappears
202	N31	27 Jan.	Birth of bipolar region with spot group
175	N41	28 Jan.	This filament appears only on this day, at east limb
160	N22	6 Feb.	Birth of small bipolar region with spot group
105	N25	4 Feb.	Filament disappears
78	N08	12 Feb.	Birth of bipolar region with spot group

DAYS WITHOUT H-ALPHA PHOTOGRAPHS
January 23, February 1, 7, 8, 9, 10, 15.

Hα SYNOPTIC CHART
1965 – ROTATION 1490



NOTES

1965 - ROTATION 1491

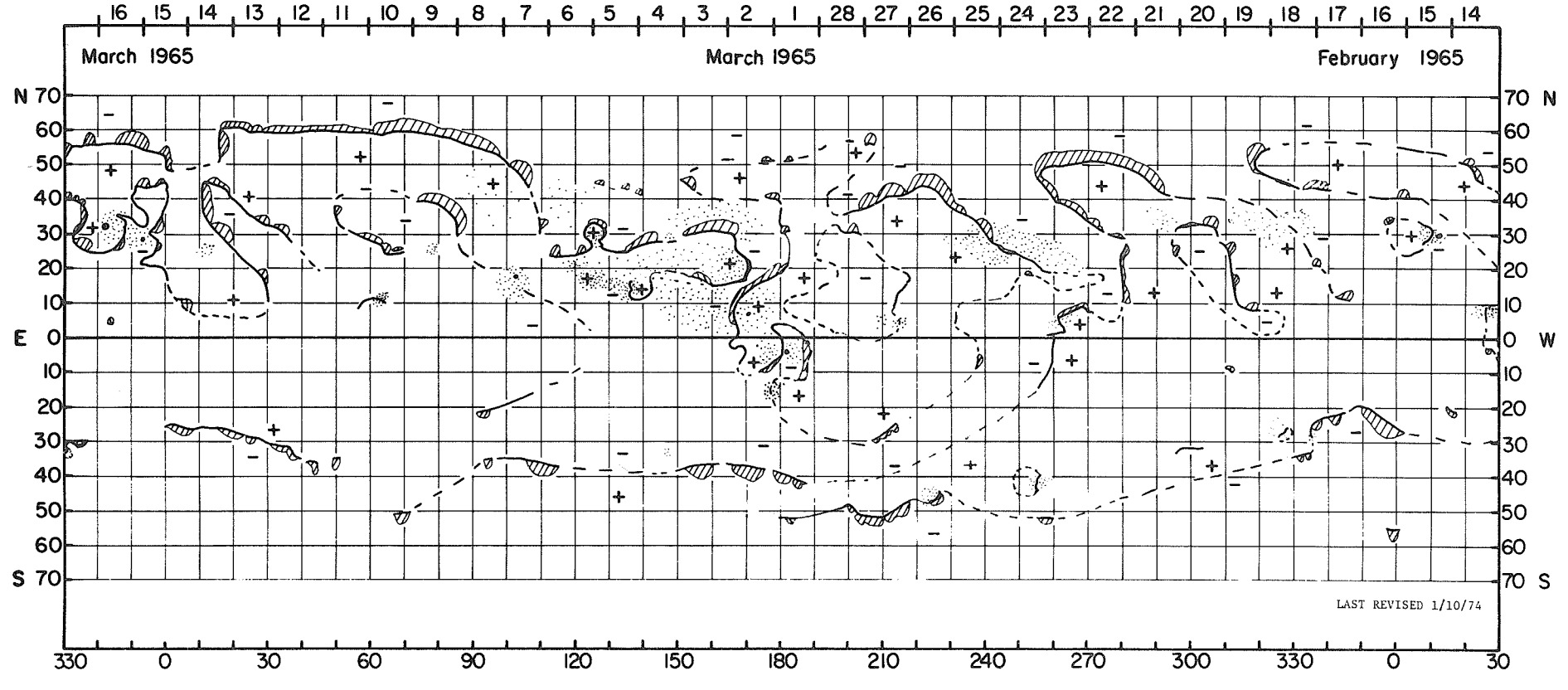
Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
355	S25	17 Feb.	Most of filament disappears
335	S27	19 Feb.	Birth of bipolar region
327	S27	19 Feb.	Birth of bipolar region
265	N08	20 Feb.	Filament starts to appear, completely visible by February 21, disappears February 22
265	N38	21-22 Feb.	Filament gradually disappears
225	N40	26-27Feb.	Filament disappears
178	S15	27 Feb.	Birth of bipolar region
135	N13	5 Mar.	Birth of bipolar region with spot group
125	N30	4 Mar.	Birth of bipolar region with spot group
60	N10	14 Mar.	Birth of bipolar region
13	N25	13 Mar.	Birth of bipolar region
5	N08	18 Mar.	Filament fragment disappears

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

February 23, 26, March 2, 3, 9, 10, 11, 16

Hα SYNOPTIC CHART

1965 – ROTATION 1491



NOTES

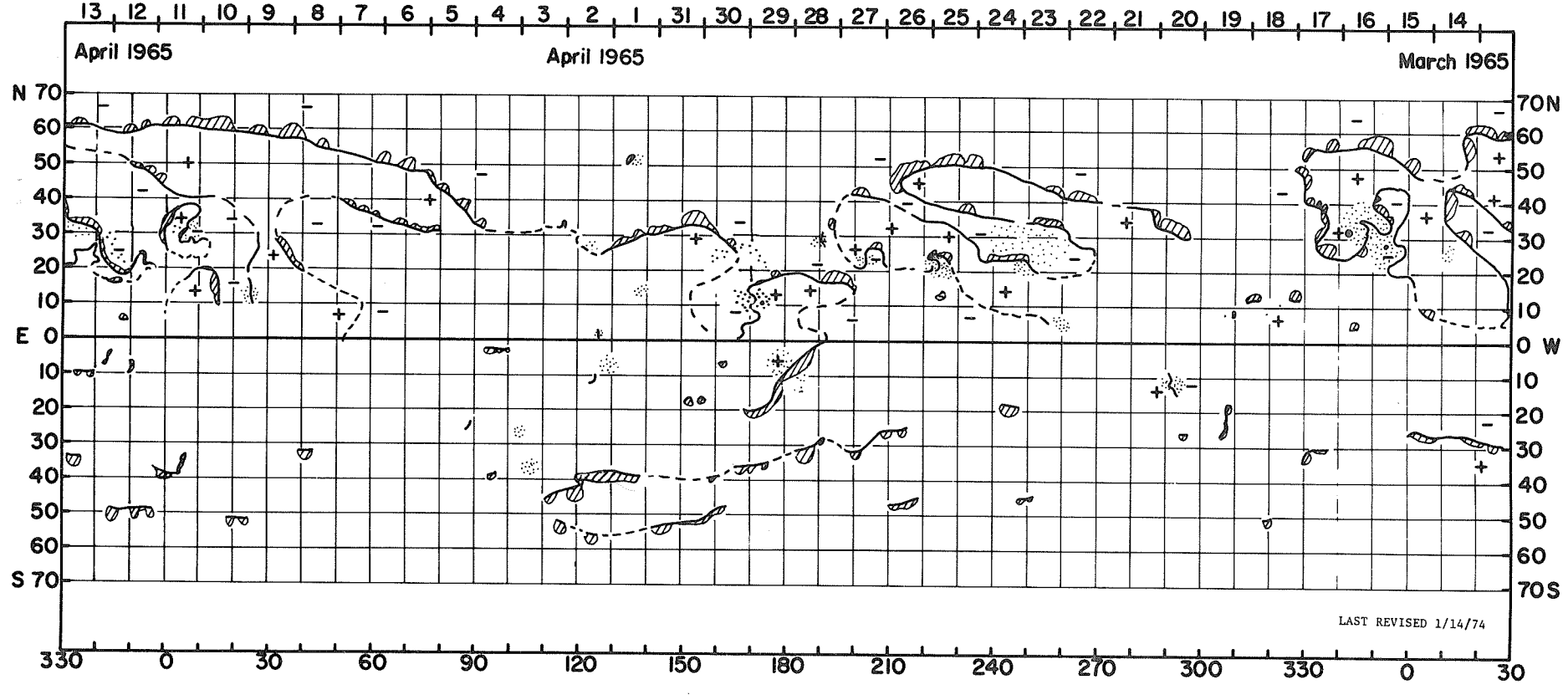
1965 - ROTATION 1492

Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
350	N26	18 Mar.	New growth of region
292	S12	17 Mar.	Birth of bipolar region
270	N40	18 Mar.	Filament disappears
262	N06	26 Mar.	Birth of bipolar region
260	N33	18 Mar.	Filament disappears
203	N23	25 Mar.	Birth of bipolar region with small spot
195	N17	27 Mar.	Filament disappears
190	N29	27 Mar.	Birth of bipolar region
180	S08	28 Mar.	Most of filament disappears, reappears 31 Mar.
125	S37	1 Apr.	Filament disappears
108	S36	6 Apr.	Birth of bipolar region
38	N24	7-8 Apr.	Filament disappears

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

March 16, April 7, 12

Hα SYNOPTIC CHART
1965 — ROTATION 1492



NOTES

1965 - ROTATION 1493

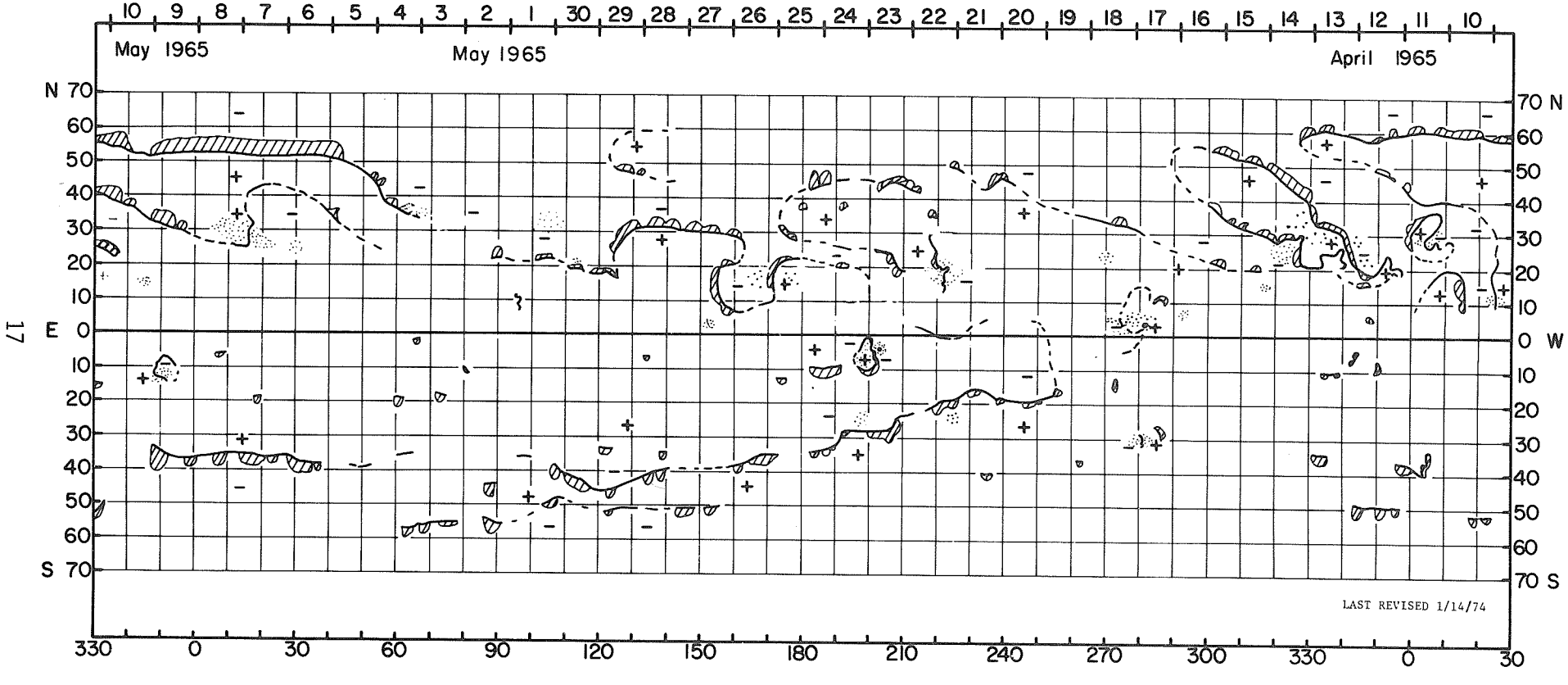
Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
282	S31	13 Apr.	Birth of bipolar region
270	N22	21 Apr.	Birth of bipolar region
240	N47	19 Apr.	Small filament disappears
223	S23	29 Apr.	Birth of bipolar region
220	N16	21 Apr.	Significant growth
210	N44	22-23 Apr.	Filament disappears
200	S05	25 Apr.	Birth of bipolar region with spot group
172	N07	28 Apr.	Filament disappears
145	N30	28-30 Apr.	Filaments along 40° neutral line gradually disappear; partially reforms 30 Apr., disappears 3 May
80	N33	2 May	Birth of bipolar region
70	N35	7 May	Birth and major growth of bipolar region
17	N28	1 May	Probably born less than 2 days prior to east limb passage on 1 May

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

April 12, 22, May 4

Hα SYNOPTIC CHART

1965– ROTATION 1493



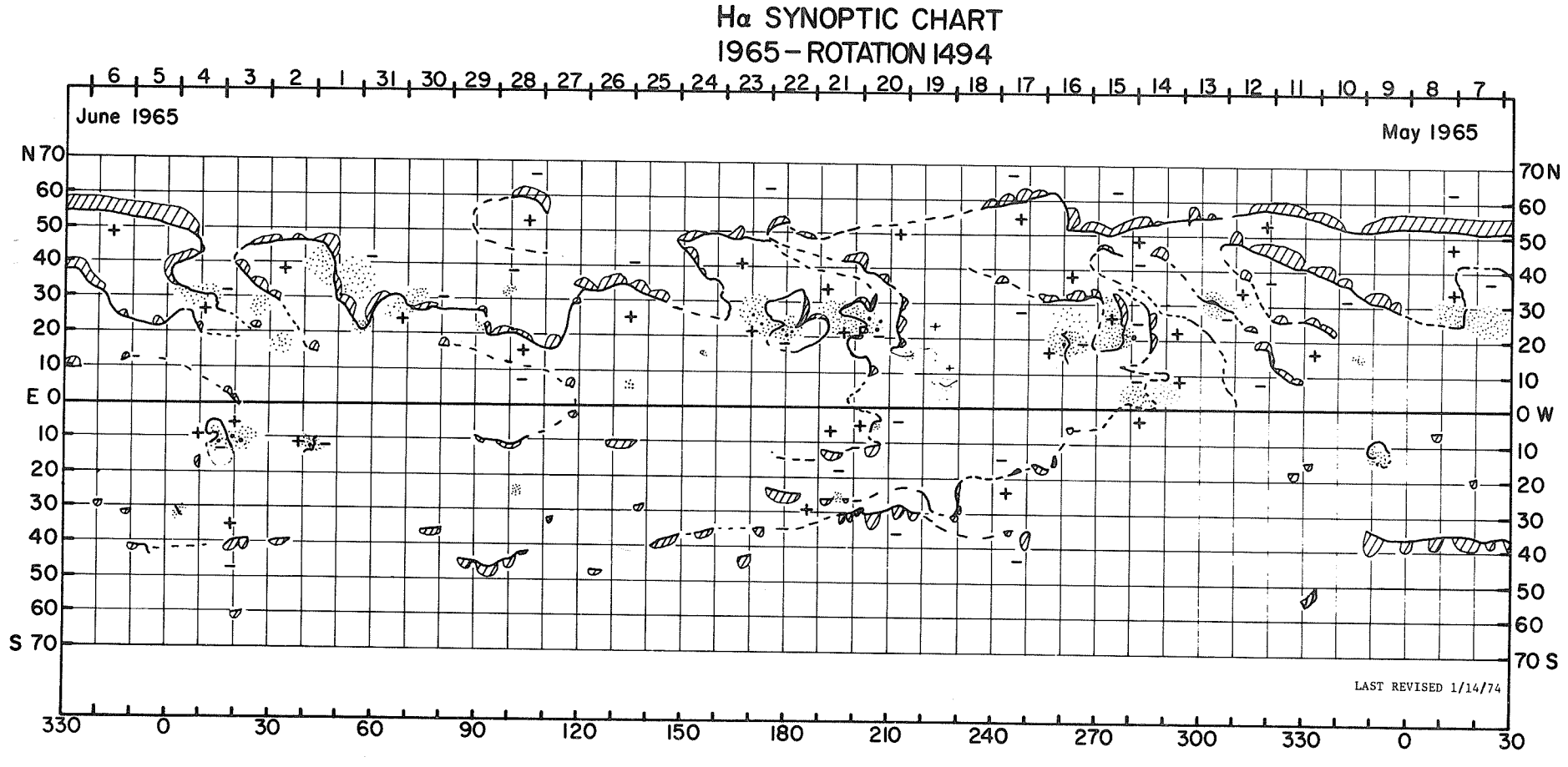
NOTES

1965 - ROTATION 1494

Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
351	S13	11 May	Birth of bipolar region
347	N13	13 May	Birth of bipolar region
340	N40	9 May	Filament disappears
276	N22	15 May	Major growth of region and spot group
270	N32	15 May	Filament disappears
260	N18	17 May	Birth of bipolar region with spot group
228	N08	19 May	Birth of bipolar region
214	N14	20 May	Birth of bipolar region
210	N21	25 May	Birth of active region near west limb
161	N41	27 May	Birth of small bipolar region
135	N07	30 May	Only appearance of small weak region
105	S26	3 June	Birth of active region near west limb
55	N25	30 May	Semi-circular filament disappears
43	S12	2 June	Birth of bipolar region with spot group
34	N16	28 May	Birth of weak bipolar region
28	N27	6 June	Birth of bipolar region
20	S12	1 June	Birth of bipolar region with complex spot group
1	S31	5 June	Birth of bipolar region

DAY WITHOUT H-ALPHA PHOTOGRAPH

May 16


Hα SYNOPTIC CHART
1965 – ROTATION 1494
June 1965
May 1965
6 5 4 3 2 1 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7
N 70 60 50 40 30 20 10 E 0 10 20 30 40 50 60 S 70
70 N 60 50 40 30 20 10 0 W 10 20 30 40 50 60 70 S
330 0 30 60 90 120 150 180 210 240 270 300 330 0 30
LAST REVISED 1/14/74

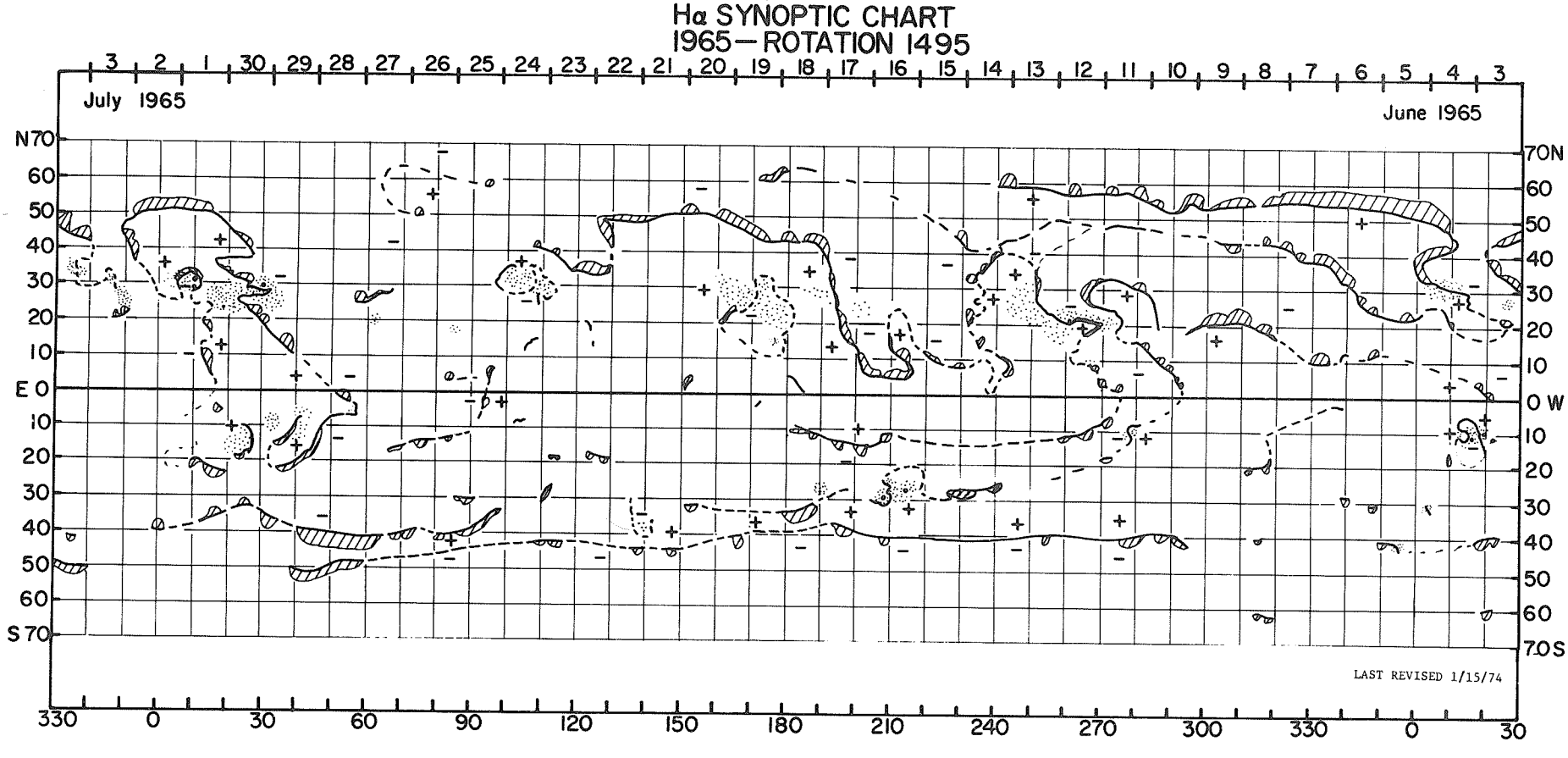
NOTES

1965 - ROTATION 1495

Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
340	N55	11 June	Filament disappears 10 or 11 June
330	N38	11 June	Filament disappears 10 or 11 June
210	S28	16 June	Birth of bipolar region with spot group
190	S28	14 June	Birth of bipolar region
177	N15	18 June	Birth of bipolar region
141	S36	22 June	Birth of bipolar region
125	N33	23 June	Filament disappears
90	S40	24 June	Filament disappears
86	N18	28 June	Birth of bipolar region
62	N20	29 June	Birth of bipolar region
58	S04	29 June	Birth of bipolar region
50	S40	2-3 July	Disappearance of filament fragments
5	N30	27 June	Beginning of renewed growth of region and spot group
1	N28	4 July	Birth of bipolar region

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

June 10, July 3


Hα SYNOPTIC CHART
1965—ROTATION 1495
July 1965
June 1965
3 2 1 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3
N70 60 50 40 30 20 10 E 0
10 20 30 40 50 60 S 70
70N 60 50 40 30 20 10 0 W
10 20 30 40 50 60 70S
LAST REVISED 1/15/74
330 0 30 60 90 120 150 180 210 240 270 300 330 0 30

NOTES

1965 - ROTATION 1496

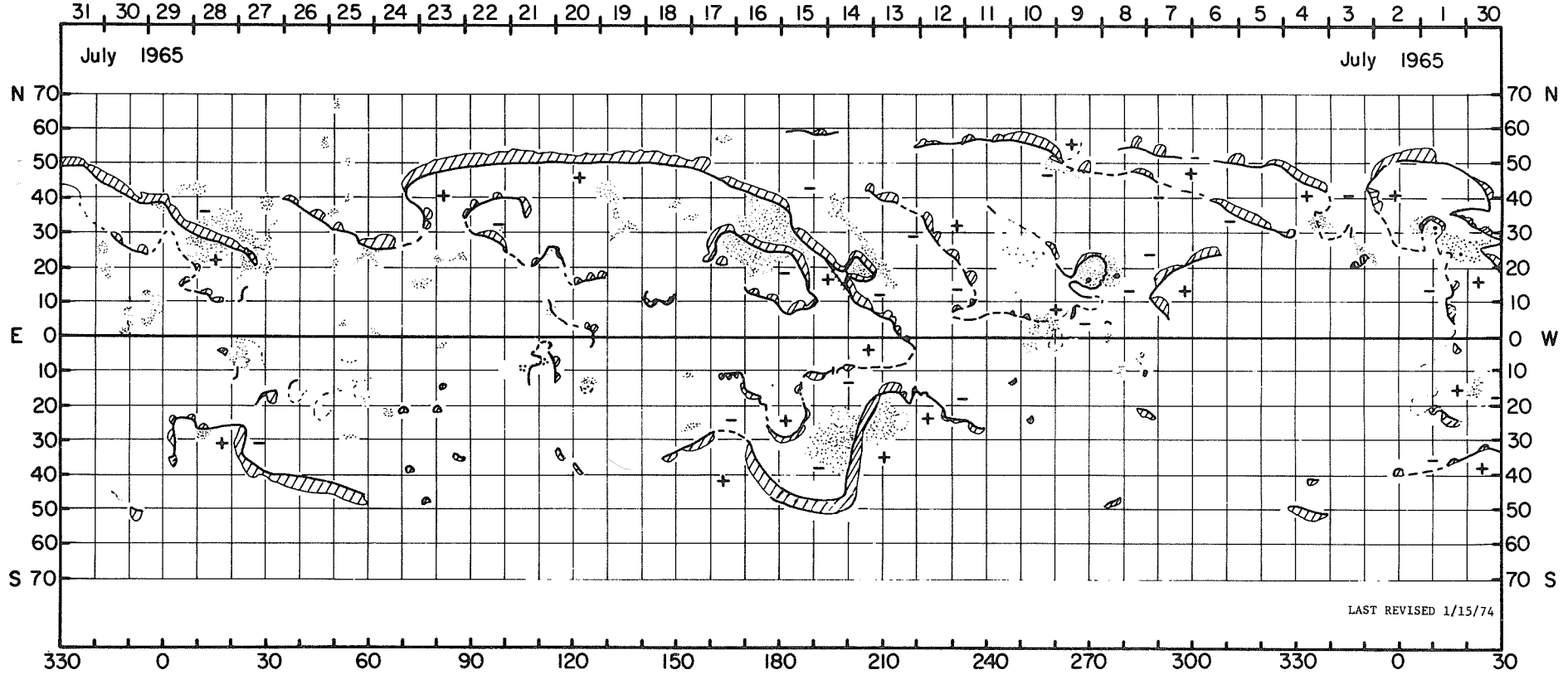
Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
350	N25	3 or 4 July	Birth of bipolar region
337	N33	30 June	Birth of bipolar region
315	N35	7-8 July	Filament disappears
290	N10	9 July	Filament disappears
273	N18	6 July	Birth of bipolar region with type d spot group
258	N35	10 July	Filament disappears
256	N01	11 July	Birth of bipolar region
205	N20	8 July	Probable birth of bipolar region with spot group, the follower portion of which seems to have been incorporated into larger positive area to east by July 17
200	S40	13 July	Vertical portion of filament disappears
195	S45	16 July	Portion of filament disappears
114	N08	20 July	Birth of small bipolar region
12	S26	26 July	Birth of bipolar region

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

July 21, 22, 28

Hα SYNOPTIC CHART

1965- ROTATION 1496



NOTES

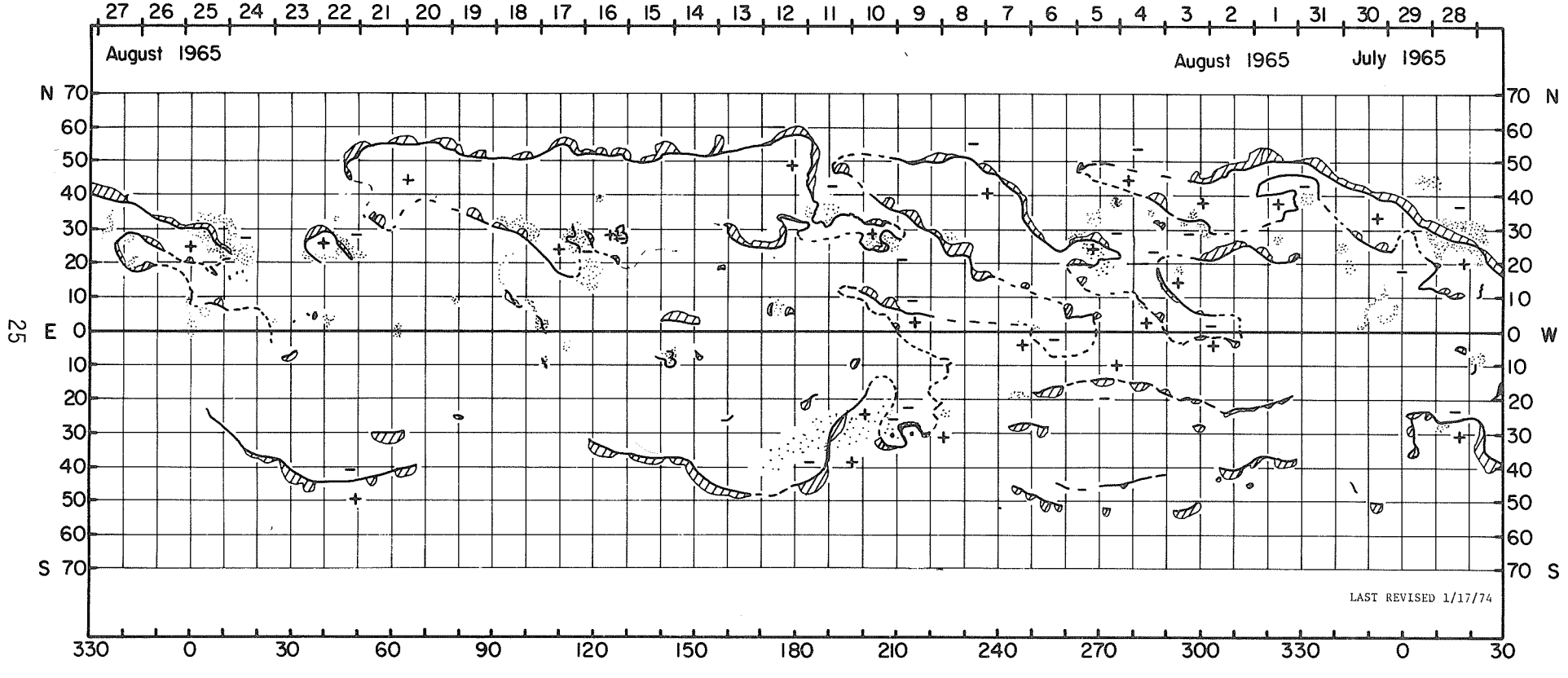
1965 - ROTATION 1497

Location		Date of	
Longitude	Latitude	Occurrence	Descriptive Notes
301	N31	29 July	Birth of bipolar region
290	N13	31 July	Only appearance of filament
276	N38	3 Aug.	Birth of bipolar region
203	N09	11 Aug.	Filament disappears
128	N28	13 Aug.	Birth of small bipolar region
113	N27	12 Aug.	Birth of bipolar region
105	N01	18 Aug.	Birth of small bipolar region
95	N09	17 Aug.	Birth of bipolar region
79	N09	18 Aug.	Birth of small bipolar region
1	N10	22 Aug.	Birth of bipolar region

DAYS WITHOUT H-ALPHA PHOTOGRAPHS

July 28, August 6, 7, 20

Hα SYNOPTIC CHART
1965-ROTATION 1497



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