NO. 182 RECENT OBSERVATIONS OF JUPITER'S NORTH NORTH TEMPERATE BELT CURRENT B

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ABSTRACT

An outbreak of thirteen spots in Jupiter's North North Temperate Belt Current B was observed in 1972. These have been measured and compared with measures of the two most previous outbreaks. The drift in longitude of a hypothetical source supports both Reese's original hypothesis of a subsurface source, and Solberg's observation that its period is close to that of System III. There is some evidence that long-enduring atmospheric features exist at lower, unobservable depths.

1. Introduction

The North North Temperate Belt (NNTeB) Current A is a frequently-observed current at the latitude of the NNTeB. This current is evident by dark sections, dark spots, and light gaps in the NNTeB. Prior to 1929-30, dark spots were not observed on the South edge, ($^{S}/$), of this belt (Peek 1958). Subsequently, spots

have been observed on the ^{S}/NNTeB during eleven (of forty) apparitions. These spots have characteristically short periods (9^h54^m), compared to normal Current A spots ($9^h55^m42^s$); and this is designated as Current B. Table I summarizes these apparitions.

TABLE I

Apparition	No. of Spots	Mean Period	Source
1929-30	7	$9^h53^m54^s$	Peek 1958
1940-41	3	54 02	"
1941-42	6	53 55	"
1942-43	6	53 52	"
1943-44	1	53 53	"
1944-45	1	53 51	"
1965-66	2	53 52	Solberg 1972
1967-68	1	53 45	Reese 1969
1968-69	12	53 50	Solberg 1972 Reese 1970
1969-70	9	53 50	Solberg 1972 Reese 1971
1972	13	54 34	Minton 1972

2. Observations, Measures, and Results

Following the 1968-69 outbreak near 60°, Reese (1970) suggested that a subsurface source might be responsible for the non-random distribution in the longitudes at which these spots first appeared. He suggested a period near that of System II. Following the 1969-70 outbreak near 0°, Solberg (1972) observed that this drift was closer to the period of System III. By measuring LPL photographs for these two apparitions, he redetermined these formation longitudes for about half the spots. A least-squares analysis of these measures gives a period of $9^h55^m33^s.9 \pm 0^s.8$ (s.d.). He inferred a period of $9^h55^m32^s$ from those spots with the greatest longitudes.

There was no outbreak of spots in 1970-71, but in 1972 thirteen spots were identified and measured. Figure 1 shows these dark spots and a light feature at which they apparently disappeared. This was observed directly only for Spots 3 and 13. For the other spots the relation is inferred only. Gaps in the coverage prevented direct verification; however, no spots were seen passed the Dislocation. There was a marked tendency for the earliest spots to drift toward decreasing longitudes faster than the later spots. This is shown in Figure 4. This acceleration towards increasing longitude was $0^\circ.0124/day^2 \pm 0^\circ.0028$. Table II summarizes these measures. Although the periods of these spots averaged some 40^s longer than that of Current B, their period was still 70^s shorter than Current A. These outbreaks occurred very close to the longitude predicted from Solberg's least-square analysis of the two previous outbreaks. A least-square analysis of these three outbreaks gives a period of $9^h55^m34^s.3 \pm 0^s.3$ for this hypothetical subsurface source.

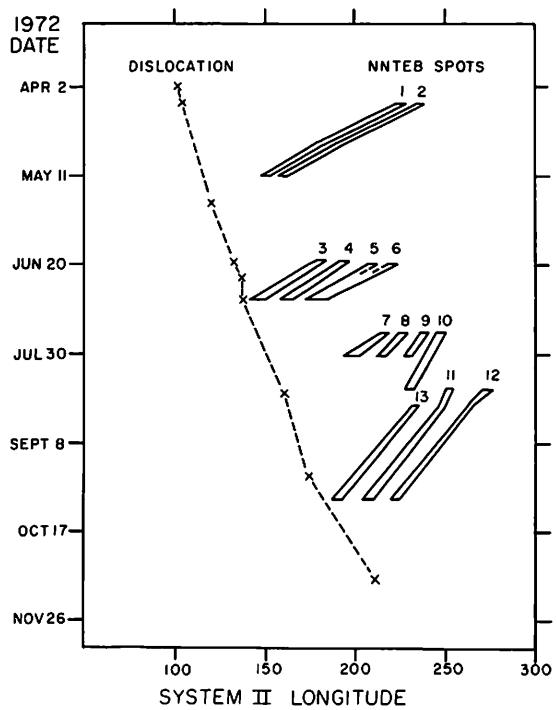

Fig. 1 Drift curves for 13 dark spots in NNTeB and of Dislocation

The longitudes at which the 1972 spots faded from view coincided with an abupt *dislocation in latitude of the NNTeB.* This dislocation is shown in Figure 2. The aspect appears very similar to that described for 1942-43 (Peek 1946). The dates of these aspects are not tabulated by Peek (1958), who finds them to occur when part of the belt is strong (dark), and part of it faint. It appears to be the rule, rather than the exception, that outbreaks occur when the NNTeB is dark at some longitudes and faint at others. The more common reported aspects of this belt are "double", "conspicuous", and "faint".

TABLE II

Spot No.	Limiting Dates	No. of dates	Limiting Longs.	Drift per day	Period (9^h+)
1	Apr 10 - May 11	3	226°.6 - 151°.8	-2°.42	54^m01^s
2	Apr 10 - May 11	3	237.6 - 160.7	-2.49	53 58
3	Jun 19 - Jul 6	3	184.3 - 147.6	-2.17	54 11
4	Jun 19 - Jul 6	3	196.1 - 162.7	-1.98	54 20
5[p]/	Jun 20 - Jul 6	2	208.9 - 174.1	-2.16	54 12
6[f]/	Jun 20 - Jul 6	2	224.3 - 186.7	-2.34	54 05
7	Jul 21 - Jul 31	2	218.7 - 198.9	-2.00	54 19
8	Jul 21 - Jul 31	2	227.6 - 216.5	-1.12	54 55
9	Jul 21 - Jul 31	2	240.0 - 236.7	-0.94	55 02
10	Jul 21 - Aug 15	3	249.4 - 231.7	-0.71	55 11
11	Aug 14 - Oct 2	3	254.0 - 208.5	-0.95	55 20
12	Aug 15 - Oct 2	3	277.0 - 222.8	-1.13	54 54
13	Aug 22 - Oct 2	2	234.5 - 190.4	-1.08	54 56

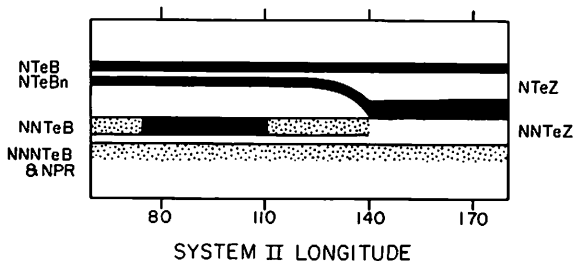

Fig. 2 Aspect of Dislocation as of June 26, 1972

A least-square analysis of the *drift of this dislocation* shows that it was $173^{\circ}.0 \pm 7^{\circ}.9$ per year during the 1972 apparition, corresponding to a period of $9^{h}56^{m}00^{s}.1 \pm 0^{s}.9$. This long period has been found near the latitude of the NNTeB only once before. In 1934 an "anomalous" spot had a period of $9^{h}56^{m}03^{s}$ (Peek 1958).

The drift of the 1972 NNTeB spots was somewhat analogous to the drifts of SEBs spots during the June 1971 SEB disturbance. In both cases, the earliest spots drifted with the largest rate.

3. Interpretation

The latitude dislocation of the NNTeB was observed for seven months during 1972, but not previously. Because of its long life, influence in the spots' disappearance, and slow rotation relative to System II (once every two years), its observed drift was projected back through the previous two well-observed outbreaks. Figure 3 shows the formation (dot) and disappearance (cross) longitudes of these NNTeB spots, a least-squares lines representing the drift of the hypothetical source, and the projected drift (180°/yr) of the dislocation (dotted line).

A relation appears to exist between the location of the spot disappearances and the extrapolated position of the dislocation. One could perhaps interpret this as the spots fading near 210° (±50°) System II longitude, with the relation resulting from the commensurate periods of the dislocation and System II. The well-observed disappearances in 1972 support a direct positional relationship between dislocation and spot disappearance. In fact,no spots were seen in 1971 when the dislocation was in conjunction with the source.

These phenomena could be interpreted as the removal of an inversion by two processes. The first is similar to that proposed earlier (Minton 1972, Kuiper 1972) for SEB disturbances, wherein a surface feature or surface event triggers a rapid break-through of an inversion with subsequent spot formation. The second is similar to that proposed by Kuiper (1972) to explain the longevity of oval features. As they propagate slowly through System II longitudes, they remove the inversion. The proposed longevity of the dislocation implies that long-enduring atmospheric features exist at lower, unobservable depths.

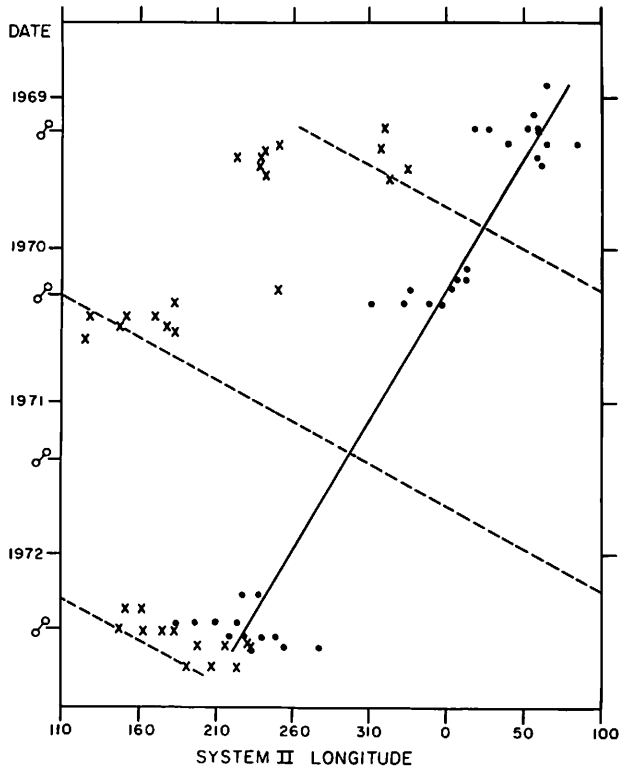

Fig. 3 *Dots:* longitude and date of formation of NNTeB dark spots; *crosses:* disappearances of same. *Solid line:* drift of hypothetical subsurface source; *dashed lines:* measured (1972) or estimated (1969-71) drift of Dislocation, invisible but assumed present before 1972.

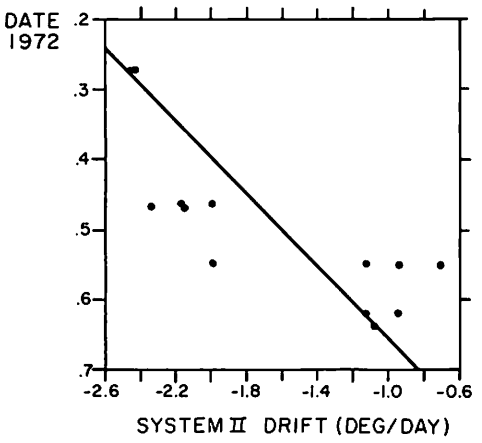

Fig. 4 Change in drift rates of the 13 dark spots

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