JUPITER IN 2007: FINAL NUMERICAL REPORT

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Part 2: South Polar Region to South Temperate Region

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These high latitudes were not affected by the global upheaval, apart from the STBn jet-stream. The nature of the spots and currents was much the same as in 2006. Their drift rates and latitudes are listed in **Table 2**.

South Polar Region

Until recently the most southerly well-defined jet was at 53ºS (the prograde S^4TBn jet), which forms a permanent sharp boundary to the dark SPR. However, HST and Cassini have confirmed another prograde jet at 61ºS, close to a second (more ragged) albedo boundary at ~62-63ºS which is the edge of an even darker South Polar Belt; and discovered another prograde jet at ~67ºS. The S. Polar Belt is clearly visible in many v-hi-res images in 2006 and 2007, and especially in polar projection maps which Damian Peach made from his 2006 and 2007 images **(Figure 3)**.

In 2007, we tracked a spot further south than any previously: a distinct white spot at 65ºS (in the south edge of the S. Polar Belt), with remarkably fast speed: DL2 = -87 deg/mth **(Figure 4)**. This fits exactly onto the Cassini zonal wind profile within an anticyclonic zone that could be named the 'S5TZ'.

Its high speed is a property shared with AWOs in the other high-latitude domains at 59ºS and 50ºS, and also occasionally at 41ºN, 46ºN and 54ºN. These AWOs also tend to alternate between rapid and more modest speeds, and they shift in latitude as they do so. **Fig.1** shows that they all fit almost exactly on the Cassini zonal wind profile. This behaviour is unlike that in lower-latitude domains where AWOs normally move with a distinctive, steady, slow current.

At least one AWO has been tracked at 59-60ºS in all apparitions since 1996. The largest of these in 2007 (SPR no.2 in Table 2) has been tracked since 2003, and may be the same as one tracked for many years before that [see our 2000/01 report, & Morales-Juberias et al, 2002, Icarus 157, 76-90]. It alternates between rapid prograding and slight retrograding drifts; it displayed the latter for most of this apparition.

Two others (SPR nos.3 & 4) showed regular oscillations in speed with period ~54-66 days, though not in phase. No.4 was also tracked in 2006 and 2008 and showed similar oscillations throughout. For all three spots, the latitude varied along with the speed as in previous years, giving an excellent correlation exactly as in 2006 **(Figs.5 & 6)**.

S.S.S. Temp. Region

Two AWOs at ~50ºS have been tracked since 2003 or earlier. Like the one at 59ºS, they have variable, usually prograding, sometimes oscillating drifts. Both were oscillating between DL2 ~ -10 and -30 until 2007 May, but then accelerated discontinuously to reach speeds of DL2 = -53 and -56! **(Figs.6 & 7)** They showed a modest variation of latitude with speed, consistent with 2006 data and with the zonal gradient observed by spacecraft (Fig.1). Otherwise, there were no other changes observed to accompany their dramatic acceleration; they always lay within a clear S^3TZ.

There was a prominent dark sector of S^3TB, ~80-100 deg. long, its p. end rapidly prograding (S^3TC no.6). Retrograding small dark spots (S^3TC no.5) disappeared as they reached its p. end. Several tiny white spots were prograding along its N edge in the ***S^3TBn jet-stream***. (This jet-stream had been much more active in 2006.)

S.S. Temp. Region

The most prominent features were 8 long-lived AWOs **(Figs.7&8)**. Of these, A1 and A5 were consistently the largest, A6 the smallest. Only A0 showed large changes in drift rate, the others only small changes. A3 and A4 approached to within only 13 deg. (centre-to-centre) in July, then A4 suddenly rebounded, as usually happens with these ovals, maintaining the array.
A new tiny AWO approached A1 from the p. side and was swinging around its N edge on April 29-30, but then there were no more v-hi-res images until May 8 so we could not tell whether they actually merged.

A dark 'barge', f. A2, reddened and disappeared in Feb.-March – a phenomenon that we now recognise as common in temperate belts.

There were white cyclonic oblongs between A1-A2 and between A4-A5; both had already been present in 2006. These white cyclonic circulations always grow longer with time, and this phenomenon was confirmed this year. Their lengths in degrees were as follows:

	Oblong between A1-A2	Oblong between A4-A5
2006 August	11	20
2007 March	14	25
2007 August	17	28

SSTBn jet

Small dark spots were arising, singly or in short chains, in a long sector starting ~70 deg. p. oval BA **(Fig.7)**. They had rapid but diverse and variable speeds **(Fig.9)**; the more consistent tracks were numbered as SSTBn jet-stream spots nos.1-9 in Table 2 (typically , +/-3 deg/mth). The fastest speed (DL2 = -97) was measured for one spot but a similar speed was shown by several shorter tracks. Most of the spots decelerated suddenly at some time in their lives, but some then resumed their original fast speed. They all disappeared as they approached or arrived at the f. end of the STB Remnant **(Fig.9)**.

No.10 was in a separate sector, f. oval BA. It ran up to the f. end of the dark STB sector (STC no.3) and seems to have joined the dark spots there (arrow in Fig.9).

Nos. 11 & 12 (DL2 = -35) (Figs.7&9) were not typical jet-stream spots; they were coupled to AWOs A8 and A0, which were moving unusually fast until June. They were among several tiny dark projections from SSTBn flanking these AWOs, and probably represented instability of the SSTBn jet at the AWOs (like the STBn jet at the AWOs in Voyager movies or at oval BA more recently). During June, A8 decelerated, and SSTBn proj. no.11 decelerated even more, to DL2 = +3, concurrently shifting N; but it remained attached to the SSTBn. Likewise in early June, A0 decelerated suddenly, and the SSTBn projections flanking it became indistinct, but a few weeks later one reappeared further N with slower, variable drift (DL2 ~0 -> +13 -> -11); again, it remained attached to the SSTBn. So these little projections were oscillating on the SSTBn, but not recirculating.

S. Temp. Region

The only major anticyclonic spot was **Oval BA**, which retained its orange colour from the previous year, although the colour faded somewhat during 2007. [It has been well shown in many previously posted images of STrD-1; also **Figs.11 & 12** in next part.] Its track, remarkably, showed 3 cycles of an oscillation with period ~ 90 days, in phase with that of the GRS! We have searched previous years' charts for any similar oscillation without a clear positive result. (In even-numbered years, its motion is perturbed by passing the GRS. In odd-numbered years, it has shown smaller changes in speed which are not convincingly correlated with those of the GRS.)

F. oval BA, there was the now-familiar large-scale structure: the single dark segment of STB, punctuated by a small AWO (STC no.2), and followed by a string of slow-moving dark spots in the STZ. The latter (nos.5-17) came in groups with different speeds, one group having DL2 = +33: equal to the full retrograding speed of the STBs jet-stream!

There is a second long-lived large structure in this domain, a cyclonic cell called the **STB Remnant (Fig.10)**. As usual it had low contrast, being very pale blue-grey, within a sector of very faint STB. It was passing the GRS from April to June. It showed little change all year, but as it passed the GRS the STB(N) alongside it darkened for ~2 months. Also, as the p. end emerged p. the GRS in May, an additional oblique faint streak appeared just p. it; this feature persisted.

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TABLE 2 & FIGURES ARE ON FOLLOWING PAGES.....

Table 2.

2007: Positions and drift rates: S. Polar to S.Temperate regions

Current/ Spot no.	*Description*	*L2(O)*	*DL2*	*Lat.*	*(SD)*	*Dates*	*Notes*
SPR							
1	WS	101	-87	-65.2	0.9	Apr.23 - June 6	
2	WS	112	-20	-59.4	0.6	Feb-Mar.	Long-lived, largest
			+4.5	-58.5	0.4	Apr.-May	
			(-1)	-58.9	0.5	June	
			+5.5	-58.2	0.8	July-Sep.	
3	WS	177	-29	-60.0	0.6	) Feb-Aug	Oscillating, P = 54-66 d
			0	-59.3	0.8	)	
4	WS	285	-20	-59.8	0.6	Feb-Aug	Oscillating slightly
5	DS	147	+1	-56.5	0.6	May-June	
6	DS	127	-33	-54.9	0.6	May-June	
S3TC							
1	WS	122	-17	-50.6	0.65	Feb-Apr.	Oscillating
			-26	-50.7	0.43	May-July	
			-56	-50.9	0.63	July-Aug	
2	WS	217	-13	-50.5	0.64	Mar-April	Variable speed
			-30	-50.8	0.5	May	
			-53	-51.1	0.5	June-Aug.	
3	DS	-	-11	-46.3	0.4	Aug-Sep.	
4	Series of >=5 dark streaks	80-200	-11	-47.1	0.7	Apr-Aug	Dark streaks in S3TB
5	Series of >=7 small dark spots	280-10	+11	-48.9	0.7	Apr-Aug	In broad S3TZ; Serial behaviour; disappeared at no.6
6	P. dark S3TB	(360)	-38	-45.8	0.4	June-Aug.	Variable speed
S3TBn jet		*L2(Aug.1)*					
1	WS	305	-104	-43.8	0.5	June-Aug.	One of several such spots
SSTC		*L2(O)*					
	AWOs:			[-40.6]	*		*Assumed latitude
A1		301	-29			Jan-Sep.	
A2		329	-28.6			Jan-Sep.	
A3		11	-28.9			) Jan.-May,	A3 & A4 approached then
A4		31	-28.9			) then var.	rebounded to original tracks
A5		70	-27.6			Jan-Sep.	
A6		104	-27			Mar-Sep.	
A8		217	-29.6			Feb-Sep.	
A0		256	-21; -38; -19; -34			Feb-Apr-May; June-Aug-Sep.	Zig-zag oscillations
	Cyclonic WOs:			-38.7	0.2		
C1	bet.A6-A8	116	-26.8			Feb-Sep.	
C2	bet.A6-A8	184	-24.4			Feb-Sep.	
C3	bet.A6-A8	202	-24.2			Feb-July	Then rebounded from A8
C4	bet. A1-A2	see above	-28.8			Feb-Sep.	
C5	bet.A4-A5	see above	-28			Jan-Sep.	
SSTC	**(omitting A0)**	**mean:**	**-27.7**			**(+/- 1.8)**	

<u>SSTBn jet</u>							
1-9	9 tiny d.ss.	~125-220	-66	-35.2	0.6	Mar-Sep.	Variable drifts. All vanished at
		(range:)	-41 to -97				or near f. end of STB Rem.
	(inc. 2 spots:)	--	-84	-35.2	0.4	Mar-Apr.	
10	tiny d.s.	--	-50	-34.7	0.6	June-July	Then decelerated (see text)
11,12	2 tiny dk.projs.	(223), 268	-35	-34.6	0.4	June	Then shifted to N:
11	tiny dk.proj.	**	+4	-34.0	0.35	June-Aug.	After shifting to N.
		**L2 = 211 (Aug.1)					
<u>STC</u>							
1	Oval BA	313	-14.5 -> -13	-32.8	0.4	Dec-Sep.	
2	Smaller AWO	348	-12 -> -11	-33.6	0.3	Jan-Aug.	
3	F.end dark STB	5	-16	-30.9	0.4	Jan-Sep.	
4	D.s.	(16)	-23 [sic]	-33.3	0.5	Mar-May	
5-10	5 d.ss.	25-60	~0	-33.1	0.4	May-July	
		(range:)	-6 to +8				
11-14	4 d.ss.	**	+33	-31.9	0.9	July-Aug.	) All 7 dark spots in
15-17	3 d.ss.	**	+17	-32.0	0.8	Aug.	) L2 range 340-20.
18	STB Remnant	112	-17	n.d.		Feb-Sep.	Length 20 deg.
STC	**(nos.1,2,3,18)**	**mean:**	**-13.9**			**(+/- 2.3)**	

<u>In these tables:</u>

Description: DS, dark spot; WS, white spot; bet., between; >=, greater than or equal to.

L2(O): System II longitude at opposition on 2007 June 5.

Values in brackets are extrapolated.

DL2: Drift in L2 in degrees longitude per 30 days.

Values in brackets are imprecise or variable.

Lat.: Zenographic latitude.

SD: Standard deviation of latitude measurements.

All features were tracked with at least 5 positions, usually many more.

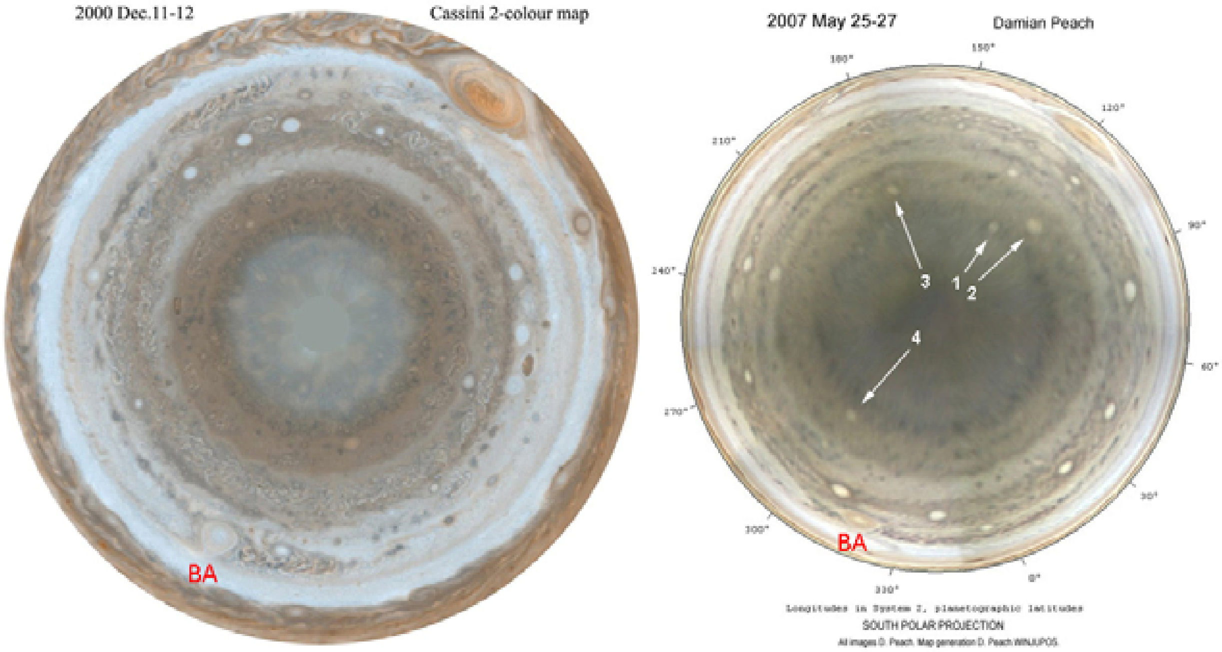
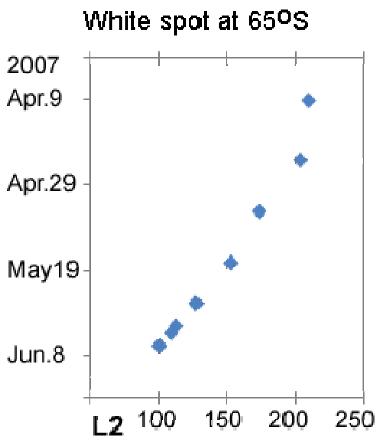


Fig.3. Maps of the South Polar region: (left) from Cassini, 2000; (right) from Damian Peach on Barbados, 2007. The spacing of the belts appears different because different projection systems were used. The SPR white ovals are indicated as in Table 2 and Fig.7.



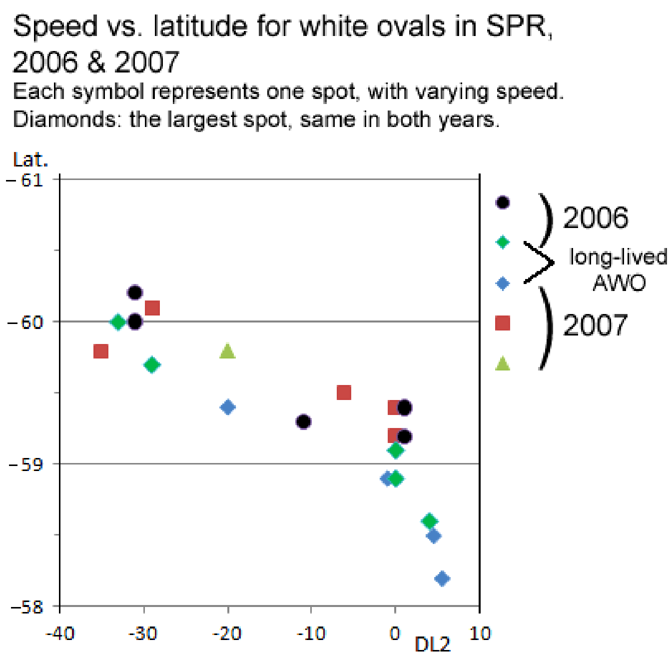


Fig.4 [left]. Drift of a white spot at 65°S (SPR no.1). JUPOS data are replotted in Excel.

Fig.5 [right]. Chart of speed vs. latitude for AWOs at ~59-60°S, in 2006 and 2007. As shown in Fig.1, the gradient agrees very closely with the gradient observed from Cassini.

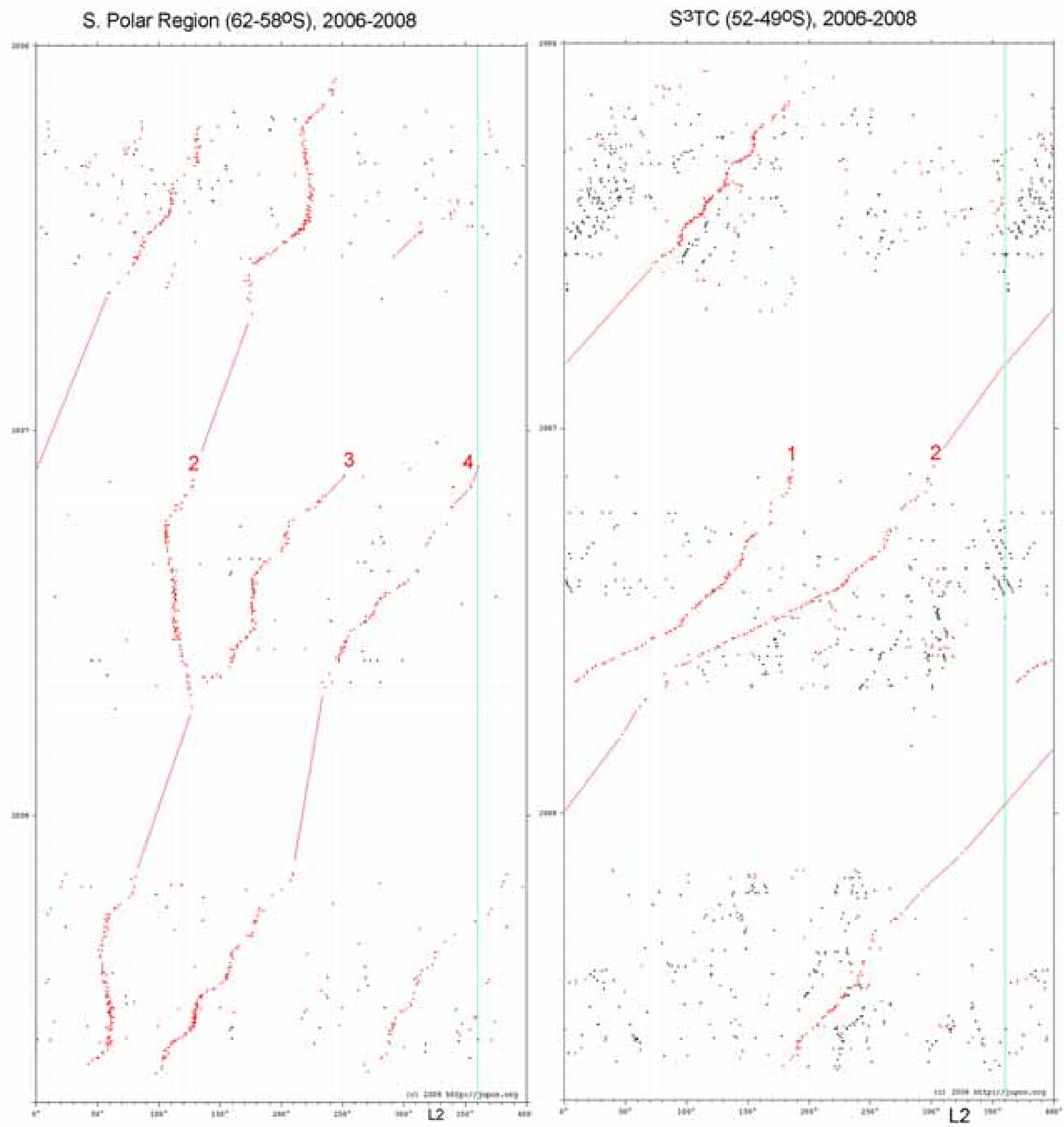


Fig.6. JUPOS charts showing drifts from 2006-2008 in the SPR (lats.-62/-58) and S.S.S.Temp. Region (lats. -52/-49). They show the long-lived AWOs [red points], some of which show oscillating movements.

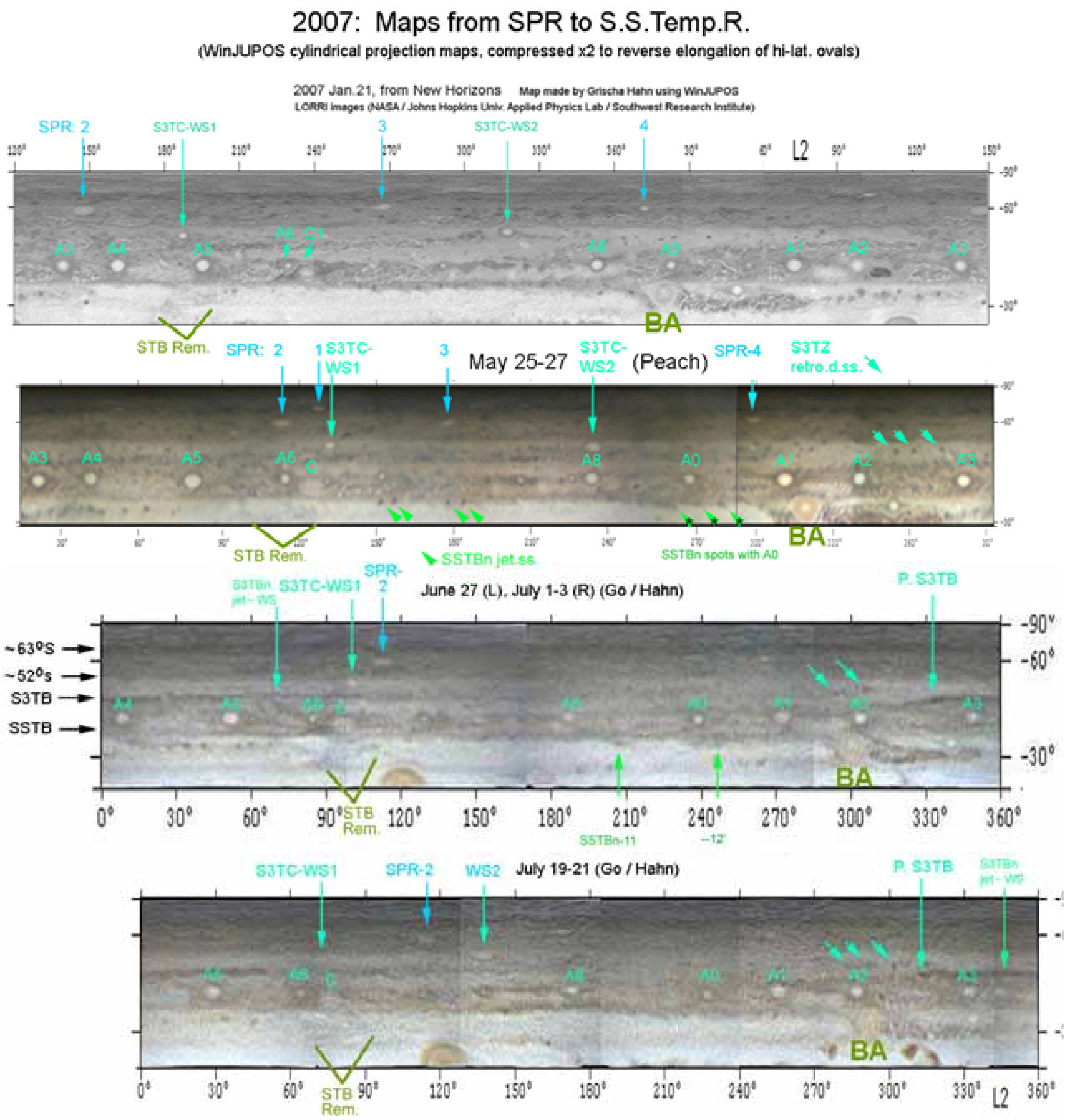


Fig.7. Maps of the high southern latitudes. Cylindrical projection maps (Fig.2) were rescaled to partially compensate for the foreshortening of ovals at high latitudes. Features are labelled as in Table 2.

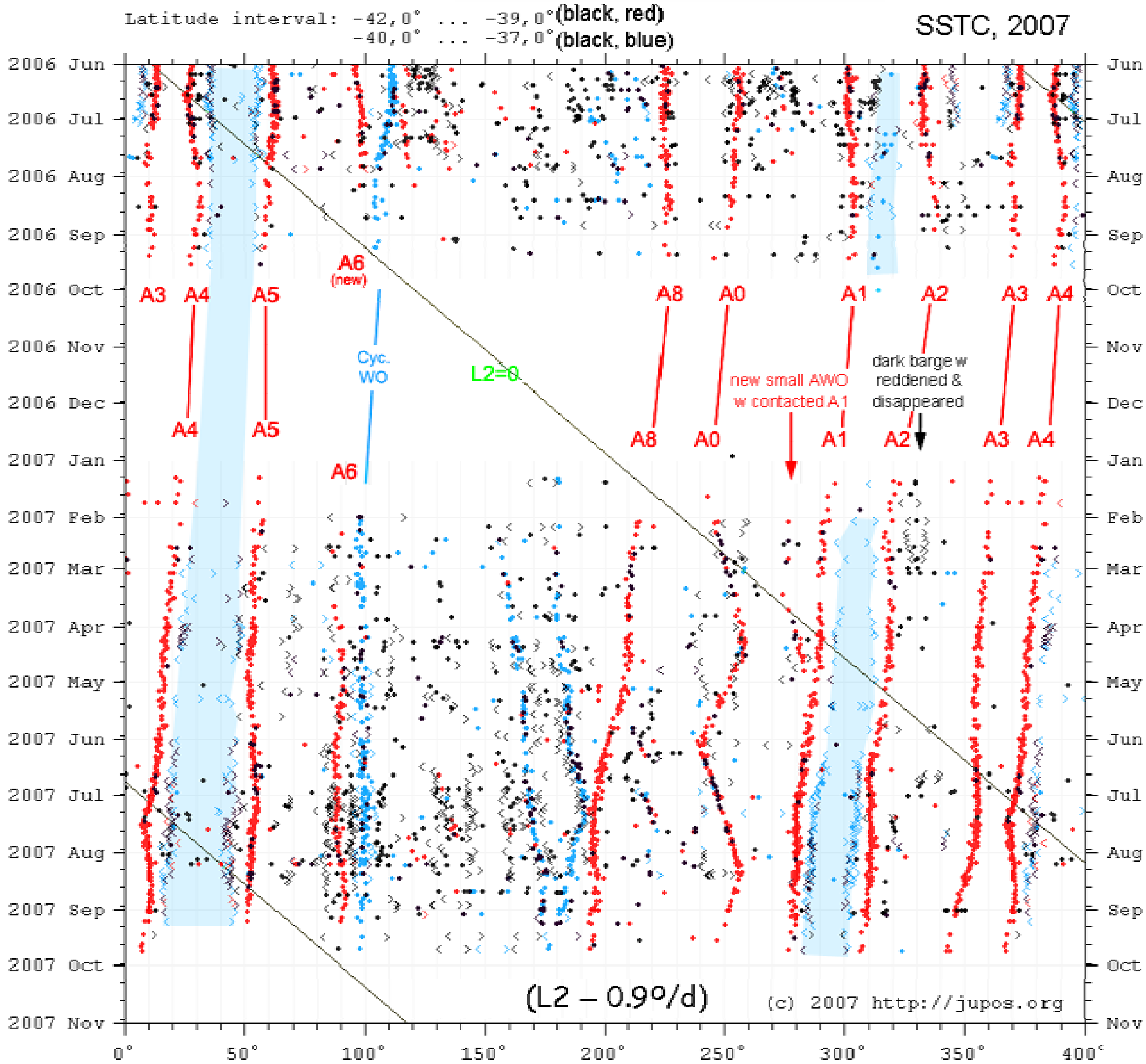


Fig.8. JUPOS chart showing drifts in the SSTC. Latitude charts are combined such that AWOs are red, cyclonic white ovals are blue. Longitude scale moves at -0.9 deg/day (-27 deg/mth) relative to System 2.

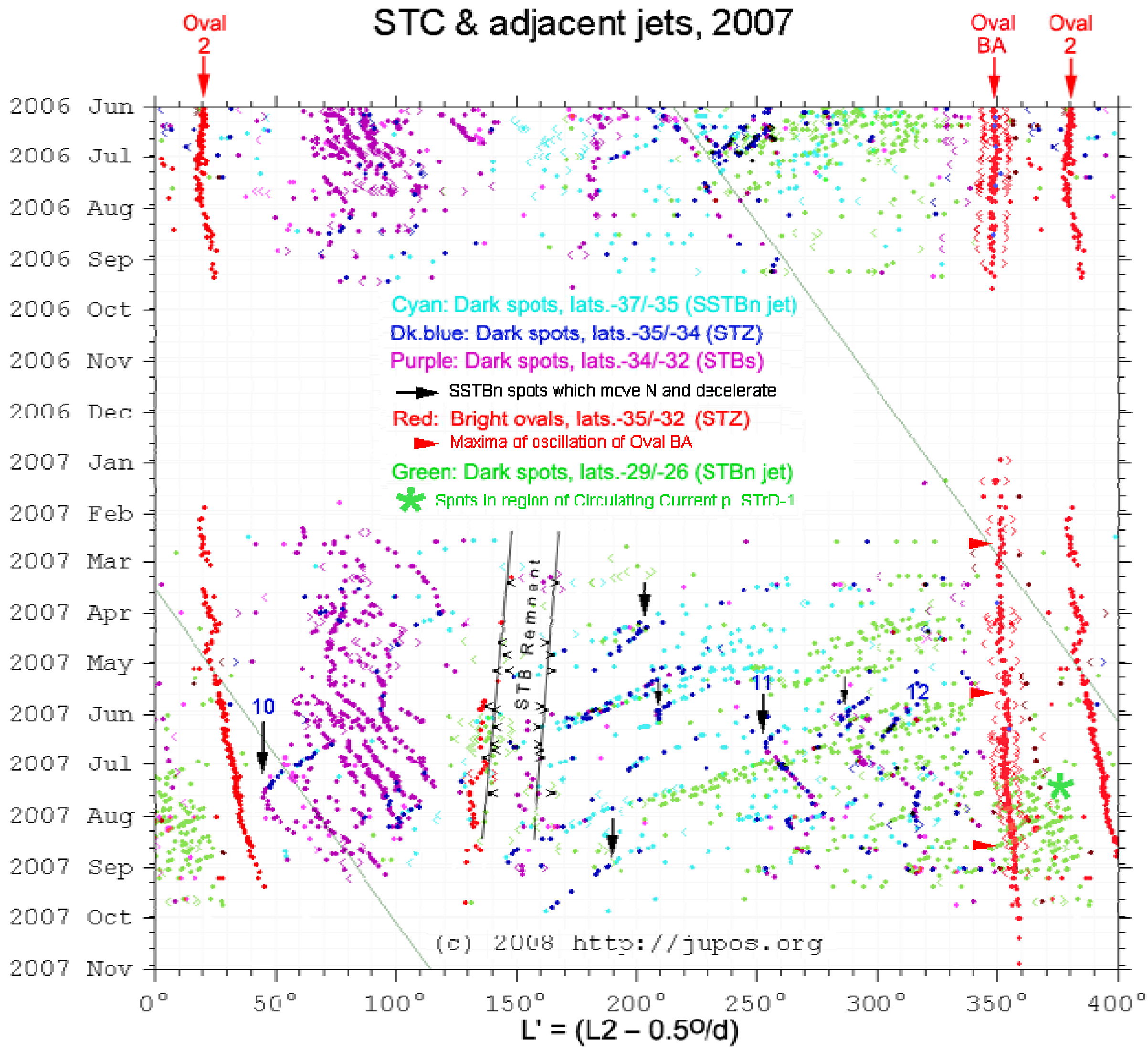


Fig.9. JUPOS chart showing drifts in the STC and adjacent jets. Latitude charts are combined such that latitudinal bands are colour-coded as shown. Arrows indicate some spots which can be seen decelerating and shifting north, in sequence from light blue (SSTBn jet), to dark blue, to purple (STC in STZ). Longitude scale moves at -0.5 deg/day (-15 deg/mth) relative to System 2.

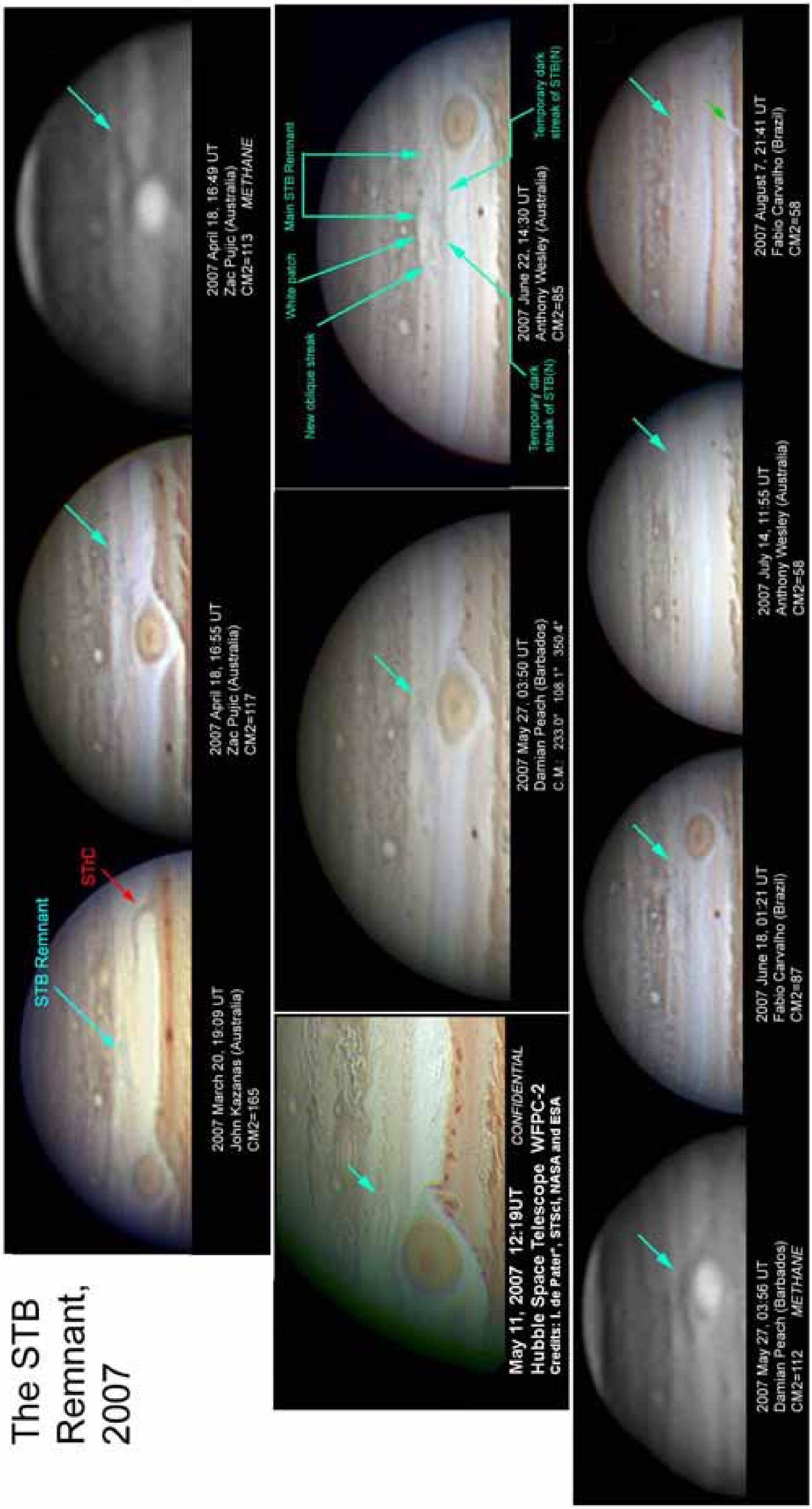


Fig.10. The STB Remnant, 2007.