JUPITER IN 2005 AND 2006 *[continued]*

IV. NORTHERN HEMISPHERE

N. Tropical domain

North Equatorial Belt (NEB) [Chart J10]

The NEB was in the post-expansion phase of one of its quadrennial cycles. It had undergone a classical expansion event in 2004, followed as usual by appearance of more dark 'barges' and bright white ovals. Thus throughout the 2005 and 2006 apparitions, the belt was very broad, enclosing small barges within the belt, and an array of 8 AWOs in its northern part. The other sequel, reddening of the belt, was suggested by the images at the start of 2006, although this was not very strong nor persistent.

'Rifts' (or, if more complex, 'rifted regions') are diagonal turbulent bright streaks within the cyclonic belt, often including transient white spots which are convective plumes. They are present in most if not all years, but their activity is difficult to quantify because they cover a wide range of sizes, latitudes, drift rates, and rates of change. Modern images allow much more detailed characterisation than before, and we have done detailed analyses for 2003/04 [unpublished] and 2007 [Ref.1]. For 2005 and 2006, we describe the main features of rift activity, and we present a ZDP for 2006. The JUPOS project does not track rifts as a whole because of their irregular shape, but tracks individual white spots, whose ensemble largely represents the extent of the active rifts. Because the tracks are often short and imprecise, we here summarise their drift rates in degrees per day. Further study of the images could well yield more information.

In **Chart J10**, the JUPOS chart is extended back to include the start of the last NEB broadening event in early 2004. In 2003/04 there was a long, well-defined rifted region, moving with DL2 = -3.4 deg/day. Its source and f. end was at 13 deg.N, and bright spots were probably streaming Sp. and accelerating within the rift. The NEB broadening event began with the appearance of dark brown anticyclonic spots in the NTropZ in 2004 Feb. and early April. (The most prominent ones are marked as 'NEBO' on Chart J10.) Chart J10 shows individual white spot tracks within the rifted region with DL2 = -3.6 to -4.0 deg/day, and also a new, slower, higher-latitude rifted region developing from the former f. end, with DL2 = -2.0 deg/day, close to the origin of the NEBn outbreaks.

In 2004 Nov-Dec. (Fig.3), a long rift was present in mid-NEB, ~120° long in Nov., possibly the remnant of the long rifted region of 2003/04; but it was not recognised after Dec.

Instead, in early 2005, several rifts containing turbulent white spots appeared at various longitudes (Figs.5, 24-26). The first may well have been the same slow rifted region that arose in early 2004, with DL2 ~ -1.7 deg/day since then; three others originated in early 2005 with similar DL2. These were all mainly at 13-14ºN, although white spots from them were spreading Nf. and Sp. Each of them generated white spots drifting p. at DL2 ~ -3.4 to -3.8 deg/day, at 11-13ºN, and the track of each rifted region as a whole eventually accelerated up to this speed range. This may indicate that the waning source region decays until only short-lived, fast-moving spots are left.

It is notable that the drift rates for these rifts fell into two classes (DL2 = -3.4 to -4.0 deg/day, and -1.6 to -2.2 deg/day); and these match the two classes that were found in the historical record, designated 'North Intermediate Current' (-2.7 to -5.0, av.-3.9 deg/day) and 'Fast North Tropical Current' (up to -2.0 deg/day) [Ref.17 pp.123-125].

These rifts had effects beyond these latitude/speed ranges, right across the NEB. Some of them produced even faster-moving white spots with DL2 ~ -5 to -6 deg/day at 10-11ºN. Moreover, as the rifts were developing in early 2005, they destroyed the large dark NEBs formations at 8ºN as described above. On the NEBn, some of them generated disturbance in the 15-18ºN range including short-lived retrograding white spots in the NEBn jet [Chart J11, magenta points, in 'Rift X'].

In 2006, although rifts were still present, they did not give extensive tracks on the JUPOS **Chart J10**; the longest tracks lasted only a few weeks and all had DL2 ~ -1.6 to -1.8 deg/day. Nevertheless, we measured precise speeds and latitudes for all discernible tracks for white spots, and plotted them on **Fig.32**. Again the largest number were clustered around DL2 = -1.7 deg/day, lat. 13.7ºN; and all adhered closely to the spacecraft ZWP, as we have usually found for NEB rifts regardless of the level of activity. (Conversely the f. end of a white rift appeared to lie well north of the ZWP – probably because it represented disturbances emanating from a rift that was centred further Sp.)

NEBn ***[Chart J11]***

As the apparition started in late 2004, the NEB broadening was complete and the classic appearance of bright AWOs ('portholes') and dark brown 'barges' was developing; by 2004 Dec.31 there were 4 portholes and 2 barges. Three more portholes and 6 more barges developed in early 2005, along a track travelling at DL2 ~ -2.8 deg/day. This speed suggested that a mid-NEB disturbance such as a rift might have induced these circulations as it passed, but no such rift was visible. (The last rifted region did appear close to this notional track but not until the end of Feb., when the circulations had already appeared; and it had a different speed (DL2 = -1.7 deg/day).)

The only AWO to have survived the 2004 NEB expansion event was white spot Z (WSZ) [Ref.12] **(Figs.33 & 39)**, which was still prograding more rapidly than any other spots of this type. In both 2005 and 2006, it was greatly disturbing the extensive arrays of persistent barges and portholes **(Chart J11)** as it ploughed through them, causing mergers of circulations p. it, and turbulence and eddying f. it.

The retrograding NEBn jet was detected both in the wake of some NEB rifts (see above), and in the wake of WSZ; any such detection is rare. Just f. WSZ, in 2005 and even more clearly in 2006, the NEBn jet was revealed by bright spots with DL2 = +35 to +45 deg/month. They presumably represented an instability in the jet downstream of WSZ. They disappeared 30-40º f. WSZ, and at that point, new barges and portholes were appearing.

The speed-vs-latitude chart for the whole NEB (**Fig.32**) shows well-defined ZDPs consistent with previous understanding:
--Most spots lie close to the Cassini ZWP, including the white spots which mark the peak of the NEBn retrograding jet.
--The well-defined circulations – barges and AWOs – lie on a 'blunter' ZDP (green curve in Fig.32), indicating that they are less affected by the retrograding jet.
--WSZ itself lies on the Cassini ZWP.
--Several small white spots in the NEB in 2006 lie anomalously far S for their speeds, because they are on the S edges of barges, presumably linked to them.
--The new barges that arose f. WSZ in 2006 lay further N than the older barges, probably because they were assembled from retrograding disturbances (see below).

The small new barges that arose ~25-35º f. WSZ in 2006 lay unusually far N for their speeds, at 15.7—16.3ºN (**Fig.32**). This was surprising because their tracks overlapped, both in longitude and in latitude, the tracks of the retrograding white spots in the NEBn jet, despite their great difference in speed. We therefore investigated the origin of two such barges, B9 and B10, in detail (**Fig.P33**). Barge B9 first appeared as a small dark brown spot on 2006 May 18-20, near the end of the turbulent wake f. WSZ, and was virtually stationary in L2 from then on, although it was buffetted by two white spots on May 24-29. The origin of barge B10 was more interesting. It was assembled from successive retrograding dark spots; and the first of these was a brown streak between two retrograding white spots (DL2 = +21, +24, lat. 17.1ºN) in the wake of WSZ (**Fig.P33**). The earliest part of B10's track, from May 2 to June 3, consisted of 3 separate segments, at least 2 of which showed retrograding speed (DL2 ~ +22) and increasing latitude (from ~15.5 to ~16.7ºN), close to the spacecraft ZWP; then from June 12, there was a fourth such segment but with DL2 ~ +7, and the new barge then settled down to its near-stationary final track, on the typical ZDP. These retrograding features were brown streaks, often kinked and oblique, drifting north in parallel with the oblique rifts of the wake; two of them can be seen merging on May 10-12; and the product developed into a stable barge on May 20, once it was out of the turbulent sector. We suspect that these brown streaks were ripples on the retrograding jet, perhaps forming at a distance from WSZ where the speed or turbulence of the jet dropped below a critical value, and amplifying into an eddy. Then eventually, as the incipient circulation drifted beyond the end of the wake, it became a stable barge.

Mergers of barges and portholes
P. WSZ, mergers were being caused by its relentless advance: two mergers of barges, and two interactions of AWOs with WSZ itself.

One merger of barges was well observed in 2005 May [Ref.11]. Our description from [Ref.11] is reproduced here as a Footnote*, and a version of the image set is **Fig.34.** Another such merger occurred in 2006 March, early in the apparition so not measured in detail [Ref.5 no.2]. In each case the f., faster-moving barge was at ~14ºN, lower latitude than usual. The barge resulting from the latter merger was the last remnant of an array of 3 barges and 3 portholes: all the others had been wiped out during solar conjunction.

***Footnote** -- text from [Ref.11]:*

3.6. Merger of cyclonic barges in the North Equatorial Belt (2005 May)

These two barges, here called B1 (eastern) and B2 (western), behaved almost identically to the pair in 2001 (Fig.7)..... As in the approach in 2001, B2 was about 0.8° further south than B1. The parameters did not change significantly for several months, until mid-April. Then, 2-3 weeks before the merger, B2 drifted even faster, while B1 began moving further north (reaching a maximum latitude 16.5°N on May 4 as they came into contact). However these changes may have been incidental: such changes had not occurred prior to the previous mergers of barges, and they may have been induced by a substantial bright convective streak ('rift') in the cyclonic NEB, which passed the barges in mid-April.

When the barges came into contact, there was no visible circulation. After contact, they became indistinct (only a diffuse reddish cloud was visible for several days) but this resolved to show that B2 had slid past B1 and partly emerged southeast of it without change of latitude, although the relative albedo of the two components varied rapidly. However a merger clearly occurred as indicated by the properties of the single barge that emerged.

The resulting barge survived despite an encounter with another vigorous 'rift' in the NEB in mid-May, and in June, it again became a distinct barge as dark as the others and twice as long as either parent, with a drift rate intermediate between those of the two parents.

Latitudes before merger (March-April): B1, 15.7 N; B2, 14.8 N.
After merger (May), 15.3 N; (June-July), 15.6 N.

In 2006 Feb., just as it induced the last barge merger p. it, WSZ underwent another sudden, unexplained acceleration, soon reaching DL2 = -19 (which would be its fastest speed ever until 2012). This led to its first definite collisions with other AWOs p. it: one in 2006 June, and one in 2006 Sep..

The collision in 2006 June was well observed, and described in detail [Ref.5 nos.9 & 10], and some of the images are reproduced here in **Fig. 35**, with our final JUPOS measurements. WSZ converged on another slow-moving array of 3 barges and 3 portholes, all of which had persisted from 2005. The most f. of these, which we called WSY, then became the first NEBn AWO ever observed to come into direct contact with WSZ. We confidently expected a merger – but it did not happen. The two AWOs halted for a while, then squeezed past each other on June 27-29, WSY progressively shrinking until it disappeared in early July a few days after the passage. The JUPOS chart confirms the impression from the images, also contrary to expectation, that while WSY remained almost stationary, the larger WSZ accelerated and moved N to get around it!

The JUPOS measurements (Fig. 35A) confirm that all these spots were anticyclonic (north of the NEBn jet); so the post-encounter little light spot (WSY') was indeed a remnant of AWO WSY, and not a cyclonic white spot produced in a merger. If any part of WSY did merge with WSZ, it was not visible – although WSZ appeared multiple in v-hi-res images a few days after the passage, which might be evidence of a merger. However, if the encounter had been observed at slightly lower resolution, WSY would not have been resolved during or after the passage, and we would confidently have called it a merger!

The second encounter between AWOs was in 2006 Sep. It came too late to be covered in detail, but the convergence and apparent merger can be seen in **Fig.36.**

Also in NEBn in 2006 June but remote from all this activity, two AWOs showed sudden accelerations to DL2 ~ -27 for a week or so, and prograded until each one reached the next barge p. it, at which time the AWO halted (DL2 ~ +5), and the barge soon disappeared. One of these AWOs ('white spot T') showed an especially variable track throughout the apparition, but always keeping to the anticyclonic gradient in the ZDP.

N1 (North Temperate) domain

N1 jet (NTBs jetstream)

The NTB was still absent in 2005 and 2006, but a tenuous N.Tropical Band was visible in enhanced images, at ~23.6ºN, which is the latitude of the NTBs jet. In 2005, several small dusky spots here revealed the peak speed of the NTBs jet, faster than at any time since 1991. As we reported [Ref.13], small tracers had a mean speed of DL1 = -108 (±2) deg/mth [u_3 = 146.4 (±0.9) m/s; lat. 23.5 (±0.3) ºN], significantly faster than at any time since 1995 or probably since 1990, suggesting that the jet peak itself had accelerated at cloud-top level, and that the jet was beginning to return to the super-fast state. But in 2006, there were only hints of motion on this jet: there were not enough distinct spots to track anything.

NTB and NTZ

With the NTB still absent in 2005 and 2006, there were just a few faint spots and streaks at 28-30ºN, which could be roughly tracked with DL2 ~ +23 (typical N. Temperate Current), but no distinct spots.

At ~30-33ºN, however, there were several more distinct, short-lived dark spots with DL2 ~ +23 to +30. Most remarkably, in each year (as noted by Mettig at the time), there was at least one dark spot retrograding much faster, DL2 ~ +75. This may be the first ground-based detection of the NTBn jet peak. Moreover, in each case this NTBn jet spot interacted with the opposing NNTBs jetstream (which carried numerous spots – see below). In 2005, the NTBn jet spot reduced its speed to DL2 ~ +4 as it passed two NNTBs jet spots, and then perhaps interacted with a third one.

In 2006, the NTBn jet spot (retrograding at 32ºN) suddenly reversed its drift, moved north (to 33.3ºN), and merged with a passing NNTBs jet spot, which then continued in the usual latitude for these spots (35ºN). This interaction is shown in Fig.35B (images) and Fig.37 (charts). It was a small but distinct dark spot before the reversal; then it was particularly dark on July 2 just as it merged with the NNTBs jet spot. A second, fainter spot (no.2) followed a similar track and probably merged with the first spot after it reversed its drift.

N2 (N.N.Temperate) domain

N2 jet (NNTBs jetstream) [Chart J12]

In 2005 and 2006, many small dark spots were running in the NNTBs jet at all longitudes, continuing the vigorous outbreak which began in 2003/04. Most of them had DL2 = -80 to -92 deg/mth; within this 'core' range, the means were as follows:
2005: DL2 = -86 (±3) deg/mth at 35.0 (±0.20) ºN;
2006: DL2 = -86 (±4) deg/mth at 34.8 (±0.14) ºN.
The ZDP **(Fig.38)** is a well-defined anticyclonic gradient, both within this core range, and encompassing outlying spots at higher and lower speeds and latitudes (included in the means in the Tables), as well as the mean jet peak from spacecraft (DL2 = -101 at 35.1ºN). Surprisingly, the gradient extends to even higher speed and latitude, for a pair of spots in 2006 and one spot in 2005 (Fig.38), which may indicate some variability of the jet with time and/or longitude. Apart from such variability, the anticyclonic ZDP is fully consistent with the dark jet spots being anticyclonic vortices that 'roll' along the jet peak as defined by spacecraft, ~15 deg/mth (6 m/s) slower and ~0.2º further south.

NNTB

With the NTB absent, the dark northern belt was NNTB. A long segment was present in 2004 Dec. but then expanded, and in early 2005 became strikingly reddish (Fig.5). This may have been associated with the outbreak of NNTBs jet spots.
In 2005 May, the orange NNTB was still prominent around half the planet. In some images, there was also a diffuse yellowish shading to the south of it (NTZ) – an example of a coloration that spread beyond the visible belt/zone boundary, though not at all longitudes.
In 2006, a faint orange-fawn NNTB was still visible at some longitudes, though fading. Elsewhere in 2006, there was a solid dark NNTB around half the planet (Fig.6). The p. end was very gradual in April though still visible up to Sep. The f. end was more distinct, prograding from L2 = 48 (March) to 10 (June) then re-establishing itself at L2 = 30 (July) (an example of 'serial behaviour' in this domain).

Spots in the N2 (N.N.Temperate) domain [Chart J13]

We have published a long-term report on the bright spots (anticyclonic ovals) of the NNTZ [Ref.14], but not yet on the dark spots of this domain. The behaviour of all spots observed in 2005 and 2006 appears to be typical of long-term behaviour in this domain, and very similar to the behaviour we have documented in high-latitude southern domains [Refs.6 & 7, & see above].
In both 2005 and 2006, the following spots were clearly tracked (see **Chart J13 & Fig.39**):

At 38ºN: There was a well-defined dark spot or 'barge' near-stationary at L2 = 20 (in 2005) and another such at L2 = 140 (in 2006). Each of these was just Sp. a NNTZ AWO: in 2005, this was LRS-1 (**Fig.14**); and in 2006, it was WS-5 (**Fig. 16**). WS-5 appeared to be repelled on contact with the barge, although the approach of retrograding dark spots may have been more signficant (see below). However the barge later "disappeared in a puff of red smoke" in mid-2006 [Ref.4, & **Fig. 16**]. This was a well-observed example of a cyclonic dark barge turning red before it faded away. (The images in late 2005 were insufficient to determine how the previous barge disappeared.)

At 40ºN: Retrograding dark spots with DL2 ~ +12 were present in a limited longitude sector, which probably persisted in both years (see **Chart J13**). (A similar sector was present in 2004.) In 2005, they had irregular tracks at L2 145 --> 170. In 2006, they were more distinct, occurring at L2 110 -->

150, with slightly varying speeds up to DL2 = +17. These were in the latitude of the NNTBn jet and an anticyclonic gradient on its N side (**Fig.41**), but the retrograding speed was less than the maximum recorded by spacecraft. The disturbed sector was probably long-lived with overall DL2 ~ -2.6 deg/mth from 2005 May to 2006 Aug., i.e drifting with the NNTC, so we suspected that it might be arising from a persistent but inconspicuous turbulent cyclonic region in the NNTB (as also seems likely in the S1, S2 and S3 domains). Any such feature was below the resolution of most images, but the best images in 2006 did show a region of smallscale disturbance as predicted **(Fig.39).**
In all these respects, these retrograding dark spots were entirely homologous to those which have repeatedly observed in the S1, S2, and S3 domains [Refs.6 & 7, & see above].

At 41ºN: Here in the NNTZ are the anticyclonic ovals, which we have already analysed in detail [Ref. 14]. Four of them were present in each apparition, two of which were the long-lived methane-bright ovals (NN-)LRS-1 and WS-4 **(Figs.8,39,40)**. Their visibility in methane-band images allows them to be tracked between apparitions in spite of their large and sudden variations in drift rate. LRS-1 had lost its red colour by 2005, when it was dull white, but regained slight colour in 2006, when it was pale fawn coloured like the adjacent NNTZ. In 2005, two smaller AWOs were also tracked; one of them might be identical to one of the minor ovals in 2006 but as it was not methane-bright we cannot be sure. Of the two minor ovals in 2006, one was named WS-5 as it subsequently persisted for several years. The other was a rare Little Red Spot, here named LRS-3 **(Figs. 39 & 40)**. It was much smaller than LRS-1 but also methane-bright with an oscillating track, period ~2-3 months, on a ZDP close to the spacecraft ZWP (see Chart J13 & Fig.41).

A novel finding is that an AWO sometimes decelerates suddenly and shifts south when it encounters the leading spot in a chain of retrograding dark spots (Chart J13), apparently repelled by them. This happened to WS-4 in 2004 April (not shown) and again in 2005 June, and to WS-5 in 2006 April (Fig.16). It does not always happen (sometimes an AWO passes the retrograding spots intact), but it accounts for some of the sudden decelerations of these AWOs. Exactly the same behaviour was observed in the S3 domain for S3-AWO-1 in 2011 [Refs. 6 & 32]. This is therefore a general phenomenon of these high-latitude domains.

N3, N4, N5 domains (North Polar Region)

There were no distinct belt or zone segments N of the NNTZ.

N3 jet:

In each year, at least one dark spot was tracked at ~42.2ºN with DL2 ~ -40, approaching the peak speed of the N3TBs jet. Another small dark spot in 2006, at 43.4 (±0.5) ºN with DL2 = -63, although sparsely observed, corresponds to the jet peak.

N3 domain (Chart J14):

In both years there were numerous spots, both white and dark, at ~45-46ºN, moving with DL2 ~ -12 to -23, i.e. typical N^3TC. In 2005, similar white spots were also present at ~44ºN. In this domain, according to spacecraft ZWPs, the westward jet at 45ºN does not attain retrograde velocity so we describe it as a velocity minimum (DL2 = -5). Nevertheless, the ZDP **(Fig.41)** is typical in being close to the spacecraft ZWP on either side of 45ºN, but 'blunter' so that the velocity minimum for spots which we detect at 45ºN in each year is DL2 = -10 to -12. But the positions of the spots on either side of the velocity minimum are surprising. In 2005, they were mostly white spots on the southern (cyclonic) side, whereas in 2006, they were mostly dark and white spots on the northern (anticyclonic) side, with the ZDP for white spots ~0.5º N of that for dark spots. Then in 2007 [Ref.1] the ZDPs were almost identical to those for 2006, but with the white and dark spots interchanged! We cannot offer specific explanations. But it may be significant that the N3 domain in spacecraft images is usually packed with FFRs (below the resolution of ground-based images), indicating considerable turbulence, and they sprawl across the velocity minimum, so they may be able to spawn quite a variety of cyclonic and anticyclonic spots, all within the prevailing N^3TC.

N4 domain (Chart J15)

In both years there were slow-moving white spots (with a few dark spots), showing typical N^4TC drift of DL2 ~ 0 (at ~50ºN) to +11 (at ~52ºN, coinciding with the peak of the retrograde jet in the spacecraft ZWP). In this range they had a well-defined cyclonic ZDP **(Fig.42).** In 2005 there were also bright spots at ~53ºN on the anticyclonic side.

In each year, one of the white spots temporarily shifted north (to ~54ºN) and adopted a rapid prograding motion before reverting to its previous latitude and motion. In 2006 **(Chart J15)**, the spot concerned was near L2 ~ 90, at 52ºN on the retrograding jet, with DL2 ~+10 just before and after. In May it suddenly accelerated to DL2 ~-20 for a week or two – apparently dragged behind a large white patch at 57ºN, also moving at DL2 = -20**.** The images are not sufficient to show details.

N5 domain

In latitudes 55-58ºN, in 2005, there was a short-lived white spot with DL2 ~ -30. In 2006, there was the short-lived white patch at 57ºN with DL2 = -20 just mentioned. These rapid speeds indicate that they were on the flank of the N6 jet. There was also a white spot at 58.5ºN in 2006 April, but otherwise nothing was tracked at >58ºN.

Thus, in both 2005 and 2006 we have detected consistent trends in both high southern and high northern latitudes:
--Variable speeds of long-lived AWOs (sometimes as periodic oscillations, especially in the south);
--detection of spots on almost all prograding jetstreams;
--long-lived sectors of slow-moving dark spots near the retrograde jet (though usually with less extreme speeds, as the ZDPs are 'blunter' than the ZWP on the retrograde side).

Global Zonal Drift Profile

A complete ZDP covering all observable latitudes, using all the JUPOS results from 2005 and 2006, is presented in **Fig.42**. (Some of these data have been presented at larger scale in other figures.) This is the most complete global ZDP ever obtained from ground-based observations when the planet is showing normal behaviour, and it can be compared with the ZDP that we published for 2007 [Ref.1] when the planet was undergoing a global upheaval. There do not appear to be any systematic differences except for the previously recognised distortions of the SEBs and NTBs in 2007 during the great outbreaks of spots on those jets. In both years, our ZDP agrees well with the spacecraft ZWP with certain recognised, systematic exceptions:
1) Large anticyclonic ovals mostly lie at lower latitude than their speed would suggest, probably because of their local distortion of the retrograde jet;
2) In most domains (but not the SEBs nor the highest-latitude domains), spots follow a well-defined ZDP which is 'blunter' than the ZWP near the retrograde jet, so the retrograde jet peak is not observed – except for a few exceptional spots on the NEBn and NTBn, which lie on the ZWP jet peak rather than the general ZDP.
3) On the SEBn and NEBs, the large features have characteristic drifts that are slower than the prograde jet peak, probably because they are wave phenomena.

V. IMAGES OF THE GALILEAN MOONS, 2006

Improved imaging techniques have led to more and more well-resolved images of the satellites, including some which detect surface features. Here are some of the best images, mostly from 2006.
Transits of Io on its shadow near opposition are shown in Fig.4 (2005) and Fig.43 (2006).
Transits of Io showing its dark red polar caps are shown in Figs.26, 28, & 39 (all examples by Peach and Tyler in 2006 April). Transits of Europa are shown in Figs.14, 26 & 34 (examples by Peach in 2005) and Fig.23 (by Pretorius on 2006 July 13).
Transits of Ganymede, over Jupiter's north polar region in 2006, are shown in Fig.44 (April 12) and Fig.45 (April 19 and 26). Hi-res images of Ganymede off the disk, showing dark regions and crater ray systems, are shown in Fig.46.
Some more shadow phenomena are shown in Fig.47.

In admiring these images, note that processing techniques tend to introduce some artefacts on these tiny, high-contrast disks. Sharpening tends to brighten the limb and darken the centre (which may also be a consequence of diffraction in the telescope). Colour alignment is difficult. Also, as Ganymede's surface is darker than that of the planet, the imager often brightens Ganymede selectively to show both together. Nevertheless, comparisons with projected views from spacecraft maps show that real features are detected on Io and Ganymede – a remarkable achievement for amateur observers.

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no.1. New activity in Jupiter's South Equatorial Belt

no.2. SEB and NEB activity

no.3. Reddish oval BA & NEB & NNTB

no.4. Long-lived circulations in the S.S. Temperate domain

no.5. 'Oval Q' in the South Tropical Region

no.6. Atlas of Jupiter: a set of v-hi-res images, 2006 April

no.7. S. Temperate domain: reddened oval BA, and the other circulating complex

no.8. Interacting spots in the NEB (report, 2006 June 7, with Fig.8-10)

no.9. Interim reports on STB (Oval BA passing GRS), STropB, GRS (internal rotation measured), EZ (S. Eq. Disturbance; dramatic darkening; NEB interactions), & NNTB

no.10. NEBn: The enigmatic encounter with white spot Z (Report, 2006 July 30, with Fig.15)

no.11. Interim reports on the SSTB (cyclonic white ovals break up) and STB (a remnant or a forerunner?) http://www.britastro.org/jupiter/2006report11.htm

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FIGURE LEGENDS (continued)

Fig.32: ZDP for NEB and NTropZ, 2005 and 2006.

Fig.33: NEBn, 2006: Origin of barges B9 & B10.
(A) Images showing WSZ and its 'wake' with the incipient barges enclosed in an ellipse (B9) and a box (B10).
(B) Enlargement from the JUPOS chart: longitude vs time. Barges B9 and B10 arise near the f. end of the retrograding 'wake' f. white spot Z. Note how B10 is seen first as a dark spot retrograding between two white spots in the 'wake', and then as a succession of similar dark spots at the same longitude, eventually stabilising as the barge.
(C) Latitude vs time for incipient barge B10 and the preceding white spots, aligned with (B).

Fig.34: NEBn, 2005: Merger of two barges. (The pair before merger are shown in Fig.13.)
[A version of this compilation was published in Ref.11, and Peach made an animation of the merger from his images.]

Fig.35: NEBn, 2006 June-July: Collision of white ovals Y and Z.
(A) Speed and latitude of each AWO are tabulated and plotted, showing that both ovals obeyed a typical ZDP during the encounter.
(B) Images of the event. *[A fuller image set was posted in Ref.5 no.10.] (Also see Fig.23).*
The images also show recirculation of small dark spot(s) from NTBn to the NNTBs jet. Dark spots in the NNTBs (N2) jet are marked in blue.
The aftermath of the encounter was not well observed, because in the first 3 weeks of July, the Australian observers were all clouded out, while the Philippines were ravaged by 3 typhoons. However, occasional hi-res images showed WS-Z double on July 1-6, and triple on July 11.

Fig.36: NEBn, 2006 Sep: Convergence of white ovals U and Z. The event proceeded as in the previous figure up to Sep.13, when the ovals were unresolved in contact, but no hi-res images were obtained in subsequent days.

Fig.37: Charts of the two small dark spots recirculating from NTBn jet to NNTBs jet, 2006.
(A) Enlargement from JUPOS chart, dark spots, colour-coded by latitude.
(B) ZDP for the recirculating spots. (For spot 1, this shows overlapping track segments independently analysed by G.A. and J.H.R.)

Fig.38: ZDP for N2 (NNTBs) jet spots. Larger symbols in 2006 are for groups of spots.

Fig.39: Hi-res images of the major features in the N2 (N.N.Temperate) domain, and spots further north, 2006 April. Two examples of N2 (NNTBs) jet spots are arrowed.
(Also see Figs.8 & 14 for NN-LRS-1.)
(Left) In the N2 domain, the region of origin of the retrograding spots at 40 deg.N; there appears to be a 'folded filamentary region' (FFR) here, only just resolved, abutting WS-4. Just N of WS-4 is a small AWO prograding in the N^3TC (not well tracked, but similar to later spots with DL2 ~ -22 at 46ºN). Just N of that is a small AWO retrograding in the N^4TC.
(Right) The fawn-coloured NTZ contains vague grey wisps, and a chain of 6 N2 jet spots is prograding on its N edge. In the N2 domain, the two Little Red Spots. Alongside them there is much turbulence in the NNTB latitudes.

Fig.40: The long-lived NNTZ ovals in 2006: (Left) Colour and methane-band images; (Right), hi-res colour images. *[This was Fig.S4 from Ref.14]* . Note that LRS-3 is visibly methane-bright in spite of its small size; WS-5, about the same size, is not methane-bright.

Fig.41: ZDP for N2 and N3 domains, 2006. *Inset:* ZDP for N3 domain in 2005 and 2007, superimposed on the 2006 chart.

Fig.42: **Global Zonal Drift Profile for 2005 and 2006.**
The ZWP from Cassini [Ref.33] is shown for comparison.

IMAGES OF THE MOONS:

Fig.43: Transits of Io on its shadow near opposition in 2006. (For the same in 2005, see Fig.4).

Fig.44: Transit of Ganymede's shadow over Jupiter's north polar region on 2006 April 12. The oblique dark band on Ganymede is the dark areas, Marius Regio and Galileo Regio (Fig.46).

Fig.45: Transits of Ganymede over Jupiter's north polar region on 2006 April 19 and 26.

Fig.46: Hi-res images of Ganymede off the disk, showing dark regions and crater ray systems, with simulations from spacecraft maps for comparison. (North is up, unlike other images.)

Fig.47: Some more shadow phenomena of the satellites:
(A) Io appearing as a crescent in transit due to the phase (Dickinson);
(B) Double shadow transit with Io (Salway);
(C) Ganymede bisected as it enters eclipse (Peach).