Jupiter in 2025/26, Report no.4

(2025 Dec.31)

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This is a report on Jupiter's atmospheric features from August up to mid-December, including preliminary data on drift rates from the JUPOS team. It is illustrated mainly by hi-res images so as to follow the finest details, but images from many other observers have contributed to the feature tracking and we are very grateful for all images.

An improved method for combining infrared resolution with visible colour, without the usual colour distortion in IR-RGB images, has been pointed out to me by observer Tom Williams (see Fig.9). It was developed by Con Kolivas ('Ittaku') in Australia, and it uses IR wavelet decomposition, thus combining the optimised sharpness of an IR image with the real colours of an RGB image [Ref.1].

Summaries and whole-planet maps during these months have been posted in our previous 2025/26 reports nos.1-3. Here we show aligned sets of maps (hi-res ones by Rob Bullen unless otherwise stated) of the northern hemisphere (Fig.1), the equatorial region (Fig.2), and the southern hemisphere (Fig.3). Shinji Mizumoto posts more frequent maps on the ALPO-Japan web site. The Appendix contains annotated **JUPOS charts** for many of the domains.

The attached **animation** comprises 3 images taken at ~10-hour intervals on 2025 Nov.29-30, showing the winds all over the planet, including the NTBs jet, the GRS, and new FFRs from recent outbreaks in the STB & SSTB.

Conventions and abbreviations are as in our previous reports. For longitudes, maps are plotted in System 3 (L3), but drift rates are given in System 2 (DL2, deg/30d) unless otherwise stated: to calculate drift rate in System 3, DL3 = DL2 +8.0 deg/30d. Latitudes are planetographic. North is up in all figures. P. = preceding = east; f. = following = west.

N2 domain *[see JUPOS chart]*

NNTZ ovals:

There are still just two large, long-lived anticyclonic ovals, NN-LRS-1 and NN-WS-4.
LRS-1 has been quite reddish throughout the apparition (Figs.4,5,9, & Animation).
WS-4 was a white spot until early Sep., then essentially invisible until late Nov., but it could be followed in CH4 images. In Dec. it can be discerned in v-hi-res images by its faint *bluish* outline (Fig.7).
The JUPOS chart shows that both were almost stationary in L3 throughout the apparition (DL2 = -8 and -9 deg/30d respectively). On Dec.10, NN-WS-4 was at L3=178, L2=296; NN-LRS-1 at L3=6, L2=124.
There is also a smaller AWO (labelled WS-o), slightly more southerly at 39-40°N, with DL2 = +8 deg/30d (well shown in Figs.4 & 9).
There were retrograding dark spots with DL2 = +14, +9, +5 deg/30d, at >40°N; and one dark spot at 39-40°N had DL2 = +14 (Sep-Nov.).

NNTB segments:

In Aug-Sep. there were several conspicuous, dark brown NNTB segments at 38-39°N, ~10-50° long; one of these split into 3 during Sep. Some of these segments became redder during Oct-Nov. then faded to light orange in late Nov. (see Fig.1 & JUPOS chart), although other long NNTB segments remained.

The NNTB segments had DL2 ranging from -7 to +4, mean = -0.7 (±3.2; N=8).
Thus all major features in the domain had drifts consistent with the usual N.N. Temperate Current, with some smaller spots in the middle of the domain having more positive (retrograding) speeds, as usual.

NNTBs jet:
The NTB upheaval in 2025 Jan. had suppressed or masked the activity on this jet, as usual. NNTBs spots had largely disappeared after Feb., as the NTZ was greatly disturbed due to the NTB upheaval and only sparse, fragmentary tracks remained, and this was still the case until Nov., apart from one track with DL2 = -88 (Sep.5—Nov.10, then decelerating), and a pair with DL2 = -74 that appeared on Oct.29. A few more have appeared in Nov.

N.Temperate domain

The NTB is fully revived, following the upheaval that started with the NTBs jet outbreak in 2025 Jan., with two well-separated components. The NTB(S) is ochre, while the NTB(N)/NTZ formed a broad, fairly dark grey band in Aug-Sep. with a wavy line in its midst probably marking the NTBn retrograde jet. During Oct-Nov., the NTZ gradually cleared, so by Dec. it was a clear whitish zone, between the wavy dark NTBn and the unevenly delineated NNTBs (see maps in Fig.1).
The JUPOS chart for the NTB(N) (lats.+29 to +33°N; not shown) shows tracks with typical N. Temperate Current A (NTC-A) speeds of DL2 ≈ +22 to +31, but they are fragmentary, suggesting that the NTBn wave patterns are not stable.
The JUPOS chart of the NTB(S) (lats.+25 to +29°N) displays 4 very small dark spots with somewhat variable speeds between Aug. and Dec. Three have DL2 ranging from -89 to -64 (DL1 = +140 to +165), thus representing the NTC-B, which is often displayed 1-2 years after a NTBs jet outbreak; however these spots would have been too small to detect until recent years. The fourth spot moves much faster, DL1 = +28 --> +39 --> +52 (Aug.10—Dec.6).

NTBs jet (see Fig.2):
Of the three dark spots that had been present on the NTBs throughout Sep., with DL1 ranging from -27 deg/30d to +25 deg/30d, two merged with the slowest-moving, largest one on Sep.30 and in late Oct. The survivor moves with steady DL1 = -19 at 23°N (Nov.1—Dec.11).

The varying speed of this jet is of interest to indicate whether there will be another cycle, and we obtained values for it by three methods, all somewhat imprecise but in good agreement:
i) Maps at intervals of ~100 days during Oct-Nov. show not only these dark spots, but also several small cream-coloured oblongs in the ochre NTB(S), at 23.5°N; three of these had mean DL1 ≈ -70.
ii) The JUPOS chart shows several features between Nov.22 and Dec.10 (approx.): a short dark streak with DL1 = -80 (±3), and a dark streak and a light streak both with DL1 ≈ -70.
iii) An animation of 3 v-hi-res images at 10-hour intervals on Nov.29-30 shows the rapid motion of small faint grey-brown streaks all along this belt. Combined with a pair of images on Nov.28, they give mean DL1 ≈ -84 (±24) deg/30d.
These methods probably all refer to the same population of small faint streaks, giving mean DL1 = -76 (±7). This is significantly faster than the usual NTC-C speed so the streaks are probably not vortices, but it is too early to tell whether the jet is accelerating towards another great outbreak.

N.Tropical domain *[see JUPOS chart & Fig.1]*

The NEB has been broad ever since the expansion event which started in 2023 Oct. and became complete in mid-2024.
It has the typical post-expansion appearance with an array of at least 6 ‘portholes’ (AWOs) and 6 ‘barges’ (dark brown cyclonic spots).

The 5 major AWOs have disparate labels (Z, B, E, 6, 7) representing their origins in different cycles; all are bright white ovals. A new, smaller one has appeared, here labelled Y, developing from a dull grey spot in Aug. to a white oval in late Nov. All these AWOs and barges have mean DL2 = -2.2 (±3.0; N=15).
There is also a small white spot retrograding between WS-6 and WS-B (DL2 = +6.5).
There have been 7 distinct barges, two of which merged around Dec.1, plus a few smaller ones, some of which have merged (see JUPOS chart).
The expanded northern part of the NEB has been fading from Oct. to Dec., leaving a wavy NEBn edge at 17-18°N (see maps).
There are some rifts in the NEB, particularly the small brilliant white spots that appear in the NEB(S) at 10-11°N.

Equatorial region *(see Fig.2)*

NEBs (see JUPOS chart):
With the general darkening of the EZ, the NEBs dark formations (NEDFs) appear as large dark bluish plateaux, associated with conspicuous dark festoons and bright plumes.
On the JUPOS chart, the main tracks for NEDFs have DL1 ranging averaging +3.7 (±2.5) deg/30d. There are also several short tracks for faster features in the range 7-9°N, with DL1 ≈ -18, -20, -27, -35, and -41 deg/30d.

Equatorial Zone (EZ):
A pale grey-brown Equatorial Band gradually appeared at the start of 2024, and was notable in 2024-25; it is now fading (2025 Nov-Dec.).
This fits a cycle of 'equatorial disturbances' proposed by Arrate Antuñano et al. (2018) [Ref.2], on the basis of cloud clearances observed in the thermal infrared waveband at 5 μm. Neither cloud clearances at 5 μm, nor visible reddish coloration, alone reveal a clear periodicity. But viewing both together, the 6-7-year periodicity is consistent.

SEBn & SED (see JUPOS chart):
The JUPOS chart tracks numerous SEBn jet spots ('chevrons') in the hemisphere p. the SED, with mean DL1 = -40.6 (±5.4) (range -31 to -47).

South Equatorial Disturbance (SED): The SED appeared inconspicuously in 2022 (see Report 2022/23 no.3) but was often not conspicuous until this year. It was striking in Sep & Oct. (Fig.2), with a very dark bluish portion having an exceptional greenish tint and being extremely dark in the methane band (illustrated in Report no.2; & see Fig.7). In mid-Nov. it was at L1 ~ 100, still drifting with DL1 = +1.1 deg/day. But since mid-Nov. it has become rather obscure.

On the JUPOS chart the SED has usually shown up as a gap in the otherwise widespread pattern of SEBn jet spots ('chevrons'), although sometimes also tracked as a spot itself. Surprisingly, the JUPOS chart now shows two other such gaps with similar drift rates, about 75° and 180° p. the main SED, although they are not visually obvious and do not perturb the SEBn jet speed; they may be similar wave phenomena.

S. Tropical domain

The SEB is normal, with post-GRS disturbances continuing as usual, including some methane-bright outbreaks (e.g. Figs.8 & 9). There are at least two slow-moving, reddish mini-barges within it.

STropZ: In Aug-Sep, there was a dark grey band at 21°S made up of dark condensations (not tracked), and a tenuous S. Tropical Band at 24-25°S also with some dark condensations (DL2 ranging from -30 to -61 deg/30d). These bands broke up and largely cleared away during Oct., apart from residual streaks prograding short distances from the p. end of the GRS.

Meanwhile in Sep., three dark spots with slow drifts (DL2 = +8, +6, +10) began to develop at 22-23°S. Two are small but the middle one (DL2 = +6) is a large brown anticyclonic ring, which is weakly methane-bright [see Report no.2 Fig.2], and Figs.4&7. We can call it *Spot Q*, as we have named similar spots in past years. They have weakly retrograde drifts and in some cases they last until they reach the GRS, though at the present relative speed of 5 deg/30d this would take several years. On Dec.10, Spot Q was at L3=185, L2=303.

Great Red Spot (GRS): Some of the best images of the GRS are in the Animation and Figs.5 & 8 & 9. As shown in Report no.2, during solar conjunction the GRS accelerated and lengthened (Fig.10). Measurements by Shinji Mizumoto and by the JUPOS team agree that the speed from March to Nov., across solar conjunction, was about DL2 = +0.8 deg/30d (±0.15). The length has recovered slightly, to 11.6°, but this is still historically very small, and may be just a fluctuation. On Dec.1 it was at L3=321, L2=79.

S. Temperate domain *(see JUPOS chart & Fig.3)*

Since 2020, the domain is in a new regime; we have just posted a thorough review of its behaviour from 2018 to 2024 [Ref.3]. There are two dark STB segments, A & G, which have now expanded to form a long dark belt around most of the circumference. Oval BA now travels at the same speed as the cyclonic segments (which apparently determine the S. Temperate Current: typically DL2 = -17 deg/30d). Recent drift rates, from JUPOS charts, were as follows (first during the 2024/25 apparition, then across solar conjunction):

Feature	Start	End	DL2		Start	End	DL2
P.end Segment G	2024 Nov.	2025 Apr.	-16.4		2025 Apr.	2025 Oct.	-20.8
Oval BA	2024 Sep.	2025 Apr.	-16.4		2025 Mar.	2025 Oct.	-17.2
F.end Segment A	2024 Sep.	2025 Apr.	-15.8		2025 Mar.	2025 Sep.	-16.4

Oval BA has been quite strongly reddish so far this apparition, due to its internal reddish annulus (Figs.3, 4, 7). On Dec10, BA was at L3=214, L2=332.

The STB is much the same as in the last apparition, with Segments A and G both becoming divided into sections by turbulent regions (Fig.3). In 2025 Jan.-April, there were FFRs just f. BA and a short way p. BA, both persisting from the turbulent origins of these segments while other sections had become calmer. The f. part of Segment A contained a red mini-barge and a cream-coloured streak near the f. end.

In 2025 Aug-Dec., Segment A has contained a prominent FFR ~20-45° f. BA, then a red mini-barge (not the same one as last apparition) in which the new outbreak erupted on Sep.22, forming another FFR (see Report no.2 & below). The section f. this is split horizontally by a long light strip (Fig.5), which has become a distinct light reddish streak near the f. end, drifting at the same speed as the rest of Segment A.

Segment G still has a FFR close to Oval BA; the part p. it is a dark belt, though with disturbance on its N edge, and its p.end came into contact with Spot 8 from Oct. onwards.

A small bright white, methane-bright spot appeared in STB Segment A on Sep.22, then another in the SSTB on Oct.4; these convective outbreaks both expanded to form chaotic regions (FFRs), as initially described in Report no.2. They were both passing the GRS in Nov. In Dec., the one in the STB still appears turbulent although it has stopped expanding, while the one in the SSTB appears to be turning into a dark segment (see below; Fig.8). These are the first fully documented examples of outbreaks initiating FFRs in exactly this manner [Ref.3].

Spot 8 is still present, a pale methane-dark cyclonic loop, as well as the similar but smaller cyclone ~15-20° p. it (see Report no.2 Fig.2, and Figs.4 & 6). On Dec10, it was at L3=89, L2=207.

S2 domain *(see JUPOS chart)*

The 7 long-lived AWOs are still present, now bunched together leaving only ~150° of longitude without one.

Within this sector there was one more white oval, bright but small (Fig.6), tracked on the JUPOS chart from Sep.10 to Oct.30 (and possibly first recorded a year earlier). It disappeared when a large dark spot or ring collided with it on Nov.6-8 (Fig.6); both were probably anticyclonic.

The cyclonic sectors were as followed, denoted by the numbers of the flanking AWOs.

Three cyclonic white ovals/oblongs were present from the start of the apparition in August:

A1-A2: Developed in 2025 Jan., 37-40° long.; in Aug-Dec., 34-37° long.

A3-A4: Oval 9-11° long, slowly drifting to and fro but not changing much.

A4-A5: Seemed to be growing in July-Aug., becoming a white oblong 21° long in Sep. Then the bright *convective outbreak* erupted in it on Oct.4, and rapidly expanded into a FFR (Report no.2). In Nov. this became less obviously disturbed and evolved into a dark oblong with wavy white border (i.e. intermediate between FFR and dark oblong) (Fig.8).

Other sectors:

A2-A3: Rapidly shortening sector containing a FFR.

A5-A7, A7-A8: Nondescript dark sectors (definitely quiet on Aug.22(Williams) & Sep.24(Peach)) until Oct., when both showed irregular dark oblong with wavy white border (like A4-A5). Could this change have been instigated by the outbreak in A4-A5?

A8-A1: This very long sector was white and largely undisturbed except in the f. part. There were a few slow-moving dark spots within it, and the small AWO described above. The f. sector, p. BA, included a FFR in Aug-Sep., and in Oct.part of this became a dark oblong with wavy light border spanning nearly 50° in Nov.

Two areas were remarkably reddish, at least from late August onwards, most strikingly the SSTB around AWO-A1 and a long stretch of adjacent S3TB. There was a smaller area flanking A3 & A4.

High southern domains

The JUPOS charts show continuous activity on the S3 jet, and many retrograding small dark spots in both S3 and S4 domains. In S3, two AWOs are tracked with irregular prograde speed. In S4, S4-LRS-1 has been accelerating: DL2 = +6 (Aug-Sep.), -5 (Sep-Oct.), -20 (Nov.). On Dec.10 it was at L3=39, L2=157.

References

1. C. Kolivas ('Ittaku'), on the Cloudy Nights forum: https://www.cloudynights.com/forums/topic/984355-jupiter-nir-08-nov-25-24-dob/#findComment-14405340

2. A. Antuñano, L.N. Fletcher, G.S. Orton, H. Melin, P.T. Donnelly, N. Rowe-Gurney, J.S.D. Blake, J. Rogers and J. Harrington. **'Infrared Characterisation of Jupiter's Equatorial Disturbance Cycle'** *Geophysical Research Letters* 45 (no.20), 10987-95 (2018 Oct.). https://doi.org/10.1029/2018GL080382.

3. J. Rogers, G. Adamoli, R. Bullen, M.Jacquesson, M. Vedovato, H-J. Mettig, C. Foster, C. Hansen, G. Eichstaedt, G. Orton, T. Momary (2025 Dec.). **'Jupiter's South Temperate Domain, 2018-2024'** https://britastro.org/section_information_/jupiter-section-overview/long-term-reports-publications/jupiters-south-temperate-domain-2018-2024

Figures

Figure 1. Sets of maps of the northern hemisphere, aligned in L3.

Figure 2. Sets of maps of the equatorial region (and the NTBs jet), aligned in L1.

Figure 3. Sets of maps of the souhern hemisphere, aligned in L3.

Figure 4. Some of the best images all around the planet, Dec.16-25, plus two methane-band images. Also note Io & shadow in the first images, and Callisto & shadow in the lower middle image.

Figure 5. Images in 2025 Aug-Sep. (& one on Nov.16) showing NN-LRS-1, and the f. part of STB Segment A containing a light reddish streak and a strongly red mini-barge (in which a convective outbreak occurred on Sep.22).

Figure 6. Images in Oct-Nov. showing STropZ Spot Q, STB Spot 8 (and the smaller cyclone p. it), and small dark and white ovals converging in the SSTZ; only the dark one survived after Nov.8, with altered course (see JUPOS chart). Satellite transits include Ganymede on Nov.3.

Figure 7. Images in 2025 Nov-Dec. showing the SED (a,b,c), Spot Q (c,d), and NN-WS-4 (c,d,e). The SED was still conspicuously dark greenish-blue as it passed the GRS on Oct.30 (a) & on Nov.8 (b), but less prominent as it began to pass Spot Q on Nov.18 (c), although its core was still very methane-dark. After this the SED became difficult to discern. Spot Q (white arrow) is a distinct brown oval, weakly methane-bright (c,d). NN-WS-4 (magenta arrow) is moderately methane-bright throughout, but it was invisible in RGB images (c) until late Nov. when hi-res images began to reveal it as a tenuous bluish ring (d,e).

Figure 8. Images in Nov. showing the GRS and the two new convective outbreaks in the STB (started Sep.22) and SSTB (started Oct.4). A cyan line underlines the SSTB outbreak, and the STB outbreak lies between it and the GRS. Earlier stages were shown in Report no.2. SSTB AWOs are numbered.

Figure 9. Hi-res images including the GRS, Dec.16-20. The first three images were taken at ~10-hr intervals and could be derotated to make an animation like that of Nov.29-30. Note some fast-moving streaks on the NTBs jet, and the developing bright swirl in the post-GRS disturbance in the SEB, which is methane-bright (see fourth image). Details within the GRS are changing but are not distinct enough to measure its rotation. Ganymede and its shadow are in transit in the second image. The last two images were taken by two UK observers almost simultaneously, thus validating the fine details; the one by Tom Williams shows the value of the new technique he has adopted for combining near-infrared resolution with RGB colour [Ref.1].

Figure 10. Charts of the GRS longitude, (a) by the JUPOS team, in a system moving at +0.93 deg/30d in L2; (b) by Shinji Mizumoto of the ALPO-Japan, in a system moving at +1.71 deg/30d in L2. The usual 90-day oscillation is obvious, and the acceleration during the latest solar conjunction. Mizumoto also pays careful attention to the intermittent phenomena of the 'Hook' (dark band from the SEB around the f. and S sides of the GRS, which appears at intervals of 1-2 years, and generates a S. Tropical Band at the p. side) and the 'Chimney' (bright white rift in the rim of the Red Spot Hollow, which appears in synchrony with the 90-day oscillation). (c) Length of the GRS, by Mizumoto.