# Jupiter in 2018: Report no.5 (2018 June 17)

**John Rogers** (British Astronomical Association)

This is a quick update from opposition (May 9) through Juno's perijove 13 (PJ13; May 24) to the latest JUPOS charts (June 15). Time has not permitted extensive assembly of images nor assessment of charts, but several other recorders have made compilations or animations that are referenced below. The most notable changes are: a new ochre coloration in the Equatorial Zone; passage of the S. Tropical Disturbance past the GRS; and two mergers of ovals, in the NNTZ and SSTZ.

A map from April 29-30 was posted in report no.3. Figure 1 is a map from May 23-24, coinciding with PJ13. Figure 2 is the latest map, from June 9-10. Thanks to Marco Vedovato for all these. Figure 3 is a set of images showing the PJ13 track for a week around the perijove date. Figure 4 is a set of methane-band images around the planet.
North is up in all these figures. I am very grateful to everyone who has provided images.

*N.N. Temperate (N2) domain:*
The most interesting event was the merger of 2 anticyclonic white ovals (AWOs) in the NNTZ, NN-WS-4 and an unnamed one. They converged rapidly until nearly in contact on May 23 (as pointed out by Andy Casely). The merger was in progress on May 25 (images by Kazanas, Buda, Tranter), 27 (Hsieh), and 29 (Hsieh), leaving a single AWO on May 30. Many of these images have been compiled by K. Horikawa on ALPO-Japan:
http://alpo-j.asahikawa-med.ac.jp/kk18/j180601s.htm.

*N. Temperate (N1) domain:*
The NTB(N) is largely faint, but there is still a turbulent sector, emitting a chain of prograding dark spots on its p. side and dark material in the NTZ (the N. Temperate Disturbance) on its f. side. The NTB(S) is still a homogenous orange belt, but not as vivid as last year.

*N. Tropical domain:*
The NEB has not changed much on the last 2 months. The expanded N half has not completely whitened. The large wave pattern is still visible but not as conspicuous nor regular as it was, both in visible light (Figure 2) and in the methane band (Figure 4). Most barges have dwindled to invisibility (JunoCam got nice closeups of very small ones at PJ12 and PJ13). There are 3 prominent AWOs (provisionally labelled WS-a and –d, from last year, and WS-x, newer), plus WSZ in which only the small northerly white spot is bright. WS-x is adjacent to the largest remaining barge, an obvious dark spot due N of the GRS. Most features are stationary in L2 except for WSZ which has DL2 = -4 deg/month. Less distinct circulations could still be present within the large wave pattern. There are also now some bright rifts in the southern NEB.

*Equatorial region:*
The array of 12 dark projections/festoons on NEBs is now fairly regular and they have DL1 ranging from +1 to +7 deg/month.

The most notable change is a new coloration event that has developed in recent months, the first since 2012. It is a broad Equatorial Band from ~1ºN to 4ºS, pale orange or ochre in colour, though with grey festoons from the NEBs along its northern edge and a narrow grey-brown band along its southern edge. Its colour was first obvious in the JunoCam closeups at PJ11 and

PJ12 (see our reports on those perijoves), thanks to the high colour saturation applied to those images, but is more realistically shown in the ground-based images.

*S. Tropical domain:*

Everyone has been watching the S. Tropical Disturbance as it passed the GRS. Its p. end (p-STropD) arrived at the f. edge of the Red Spot Hollow on Feb.4, and turbulent material from it promptly began streaming around the S side of the GRS and accumulating turbulence in the S. Temperate domain and S half of the STropZ on the p. side of the GRS. An **animation (Figure 5)** showing this from March 30 to April 7 (from maps made by Michel Jacquesson) is posted with this report. It shows intense turbulence in the STropD and the sector p. the GRS, and yet the prograde STBn and retrograde SEBs jets are still clearly present in both sectors. It also shows the recirculation from STBn to SEBs at the f. end of the STropD. This animation covers PJ12 on April 1, when JunoCam took awesome images of the highly turbulent sector p. the GRS (see our PJ12 report). Animations over longer intervals, showing the progress of the STropD as a whole, have been produced and posted by S. Mizumoto of ALPO-Japan:

http://alpo-j.asahikawa-med.ac.jp/kk18/j180529r.htm

and by Marco Vedovato of the JUPOS team:

http://pianeti.uai.it/images/STrD-end.gif or:

http://alpo-j.asahikawa-med.ac.jp/kk18/j180610r.htm

However, my prediction that the p-STropD would re-form p. the GRS was not fulfilled. The prediction was based on the visual records of the Great STropD in the early years of the 20th century ago, and these records are reviewed in the **Appendix**. In fact, the reassembly of the p-STropD in those years was never as rapid as subsequent summaries have suggested. I suspect that on each passage, the p-STropD broke up into innumerable eddies as it passed the GRS (as in 2018), and after some months these happened to entrain the SEBs retrograde jet into a recirculation that recreated the p-STropD. However, in 2018 this did not happen; the SEBs jet was never deflected and the p-STropD never re-formed.

The f. end (f-STropD) continued to prograde steadily towards the GRS and arrived at the f. edge of the Red Spot Hollow on May 30, dwindling to a tenuous streak which lasted until June 1. Then, all the turbulence of the STropD had passed the GRS and the STropD did not re-form.

We wondered whether the convective disturbance in the SEB f. the GRS, which had been intertwined with the STropD, would survive its disappearance. Indeed it did. On May 26 (at L2=334) and again on June 2 (at L2=336) a new bright white spot erupted in the SEB, extending and renewing the usual convective 'rifts' f. the GRS. This spot was methane-bright on June 7 (Kardasis) and 12 (Go).

The GRS is still very red, as has been noted visually by several observers (e.g. Richard McKim and Carmelo Zannelli) while Christophe Pellier notes that it is in its darkest state for years in UV images.

It did show a dramatic acceleration as the STropD passed it, as expected, but this only started in early April, 2 months after the p-STropD arrived. It has had DL2 = -0.1 deg/month since then.

**Figure 6** is a JUPOS chart of the GRS, with extrapolations to 2019 Feb.12 when Juno will fly over it or near it at PJ18. We can expect the GRS to decelerate again, but a range of longitudes is possible, depending on whether it decelerates now or 2 months after the f-STropD passed, and on how much it decelerates. I find a likely range of L2 = 299-306 (L3 = 238-245) for its centre on Feb.12. The GRS is 14 deg long. Juno will cross the equator at L3=243, putting it near L3=249 as it passes the GRS, so it now seems likely to pass over or near the f.(W) edge of the GRS.

*S. Temperate (S1) domain:*

The transformation of the STB Ghost into a dark STB sector, when it approached oval BA, was described in Report no.2. This sector persists, and has generated an even darker sector of the STZ f. it, representing the 'South-following tail' that is characteristic of dark STB sectors. Embedded in the 'tail' is a small AWO which has sometimes appeared reddish and methane-bright (Figure 4, April 27). The JUPOS chart shows that several dark spots have retrograded further f. this, with DL2 ~ +19 deg/month.

Oval BA is only pale orange. It now has a dark rim around it, and dark material prograding on the STB(N) Np. it, as expected. However it has not yet clearly changed its motion, which remains consistent with its previous 2-month oscillation. We will have to wait another 2 months to see whether it has accelerated as predicted.

The STB Spectre was nicely imaged by JunoCam at PJ13; it is still intact, and longer than before. The sector f. it is affected by the turbulence from the STropD so we wait to see whether this will have any long-term effect.

*S.S. Temperate (S2) domain:*
The most interesting event was the merger of 2 AWOs (called A6 and A7) in the SSTZ, which happened simultaneously with the similar merger in the NNTZ. The AWOs converged rapidly until in contact on May 24 (shown in Juno's outbound images) and 25. They were spiralling together on May 26 (excellent image by Go), and on May 28 the merged oval was elongated at 13:30 (Wong, Go) but rounded up at 23:30 (Pereira). Animated maps of this merger (from May 14-28) have been posted by Marco Vedovato:
http://pianeti.uai.it/images/A6-A7-merging.gif or
http://alpo-j.asahikawa-med.ac.jp/kk18/j180601r.htm

*South Polar region:*
Andy Casely (Australia) has been obtaining excellent images in the IR continuum and in the methane band which have high resolution up into the polar regions, and he has made polar projection maps from his own and other observers' IR images, from which he has produced this animation of the south polar region with a frame approximately every four to six days:
https://photos.app.goo.gl/rOO6RsSE6Xp1XGqN2
--and now updated to June 11:
https://photos.app.goo.gl/hUV8ABBreO6hBMjw1
These animated maps show not only the motions of known ovals, but also the hitherto unknown motions of stormy patches (FFRs) up to ~74 deg.S, beyond the jets. They will be valuable in comparison with Juno's maps of this region for research on the dynamics of this region.

**Prospects for PJ14**

At PJ14 on 2018 July 16, Juno will cross the equator at L1=36, L2=192, L3=74.5.
As the views of low latitudes will be oblique, I am no longer producing predictive maps and there is no voting for targets, but reference to the map in Fig.2 shows that it will cover the sector ~60 deg p. the GRS. This sector includes the N. Temperate Disturbance, various structures in the NEB, and the sector of S. Temperate domain that is currently still turbulent as a result of the STropD, though I cannot say what it will look like at PJ14.

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**APPENDIX** *[in separate PDF]*: **Historical records of the Great S. Tropical Disturbance (STropD) passing the Great Red Spot (GRS).**

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## FIGURES *[MINIATURE VERSIONS]*:

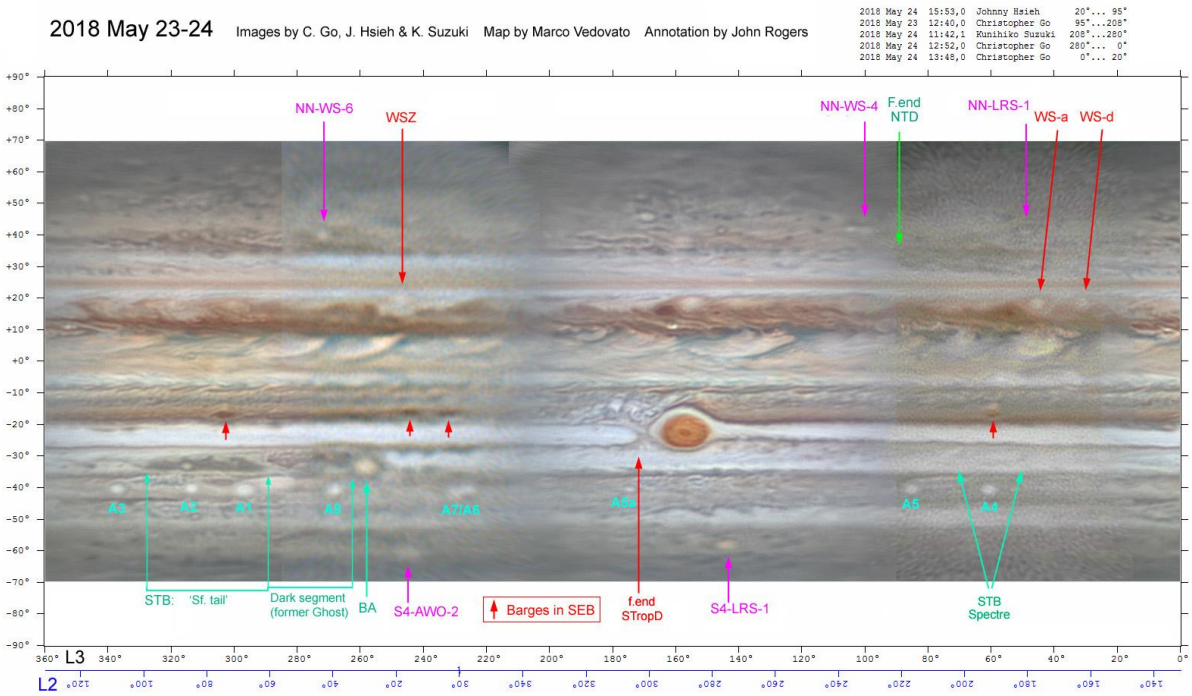


**Figure 1.**

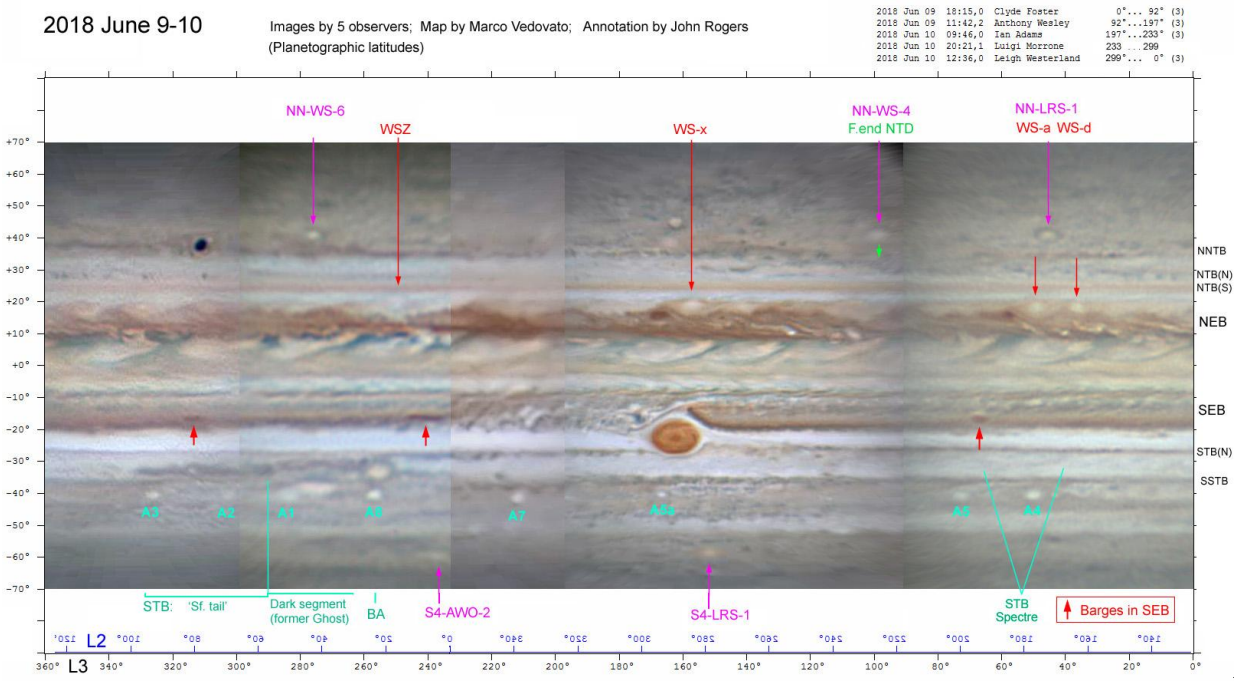


**Figure 2.**

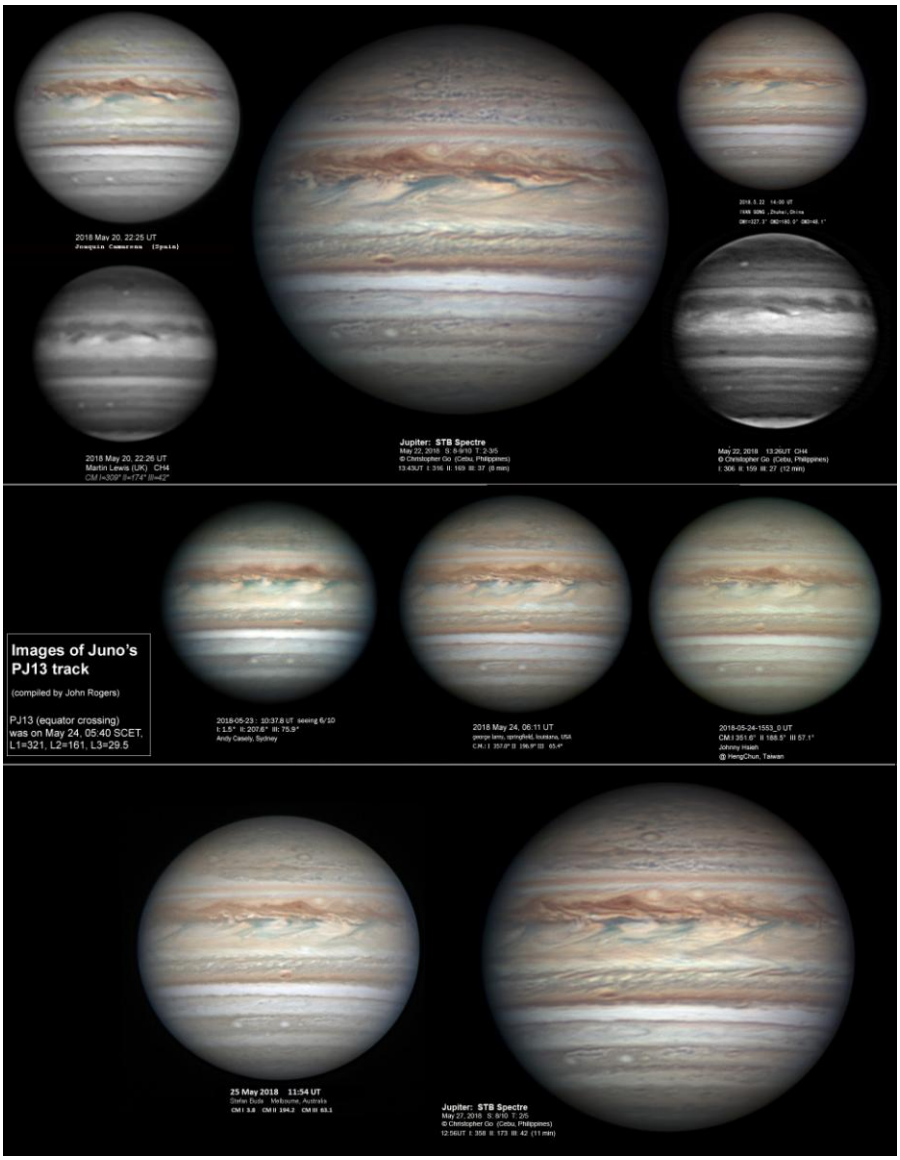


**Figure 3.**

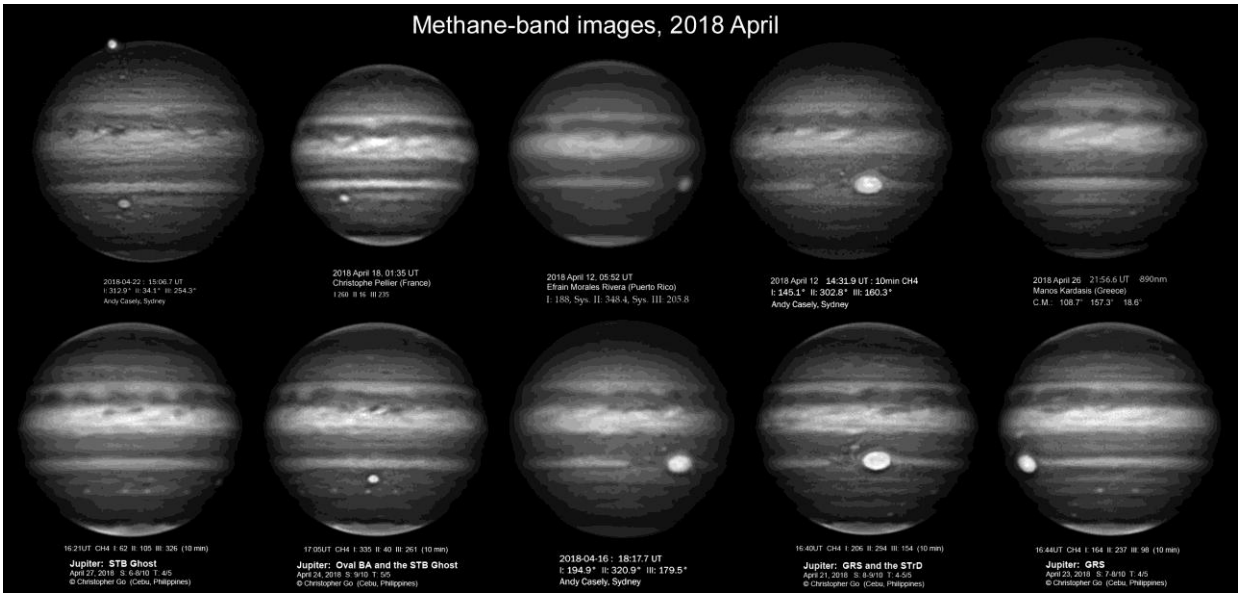


**Figure 4.**

**Figure 5** *[posted separately]:* Animation of the STropD and GRS, 2018 March 30 to April 7 (from maps made by Michel Jacquesson).

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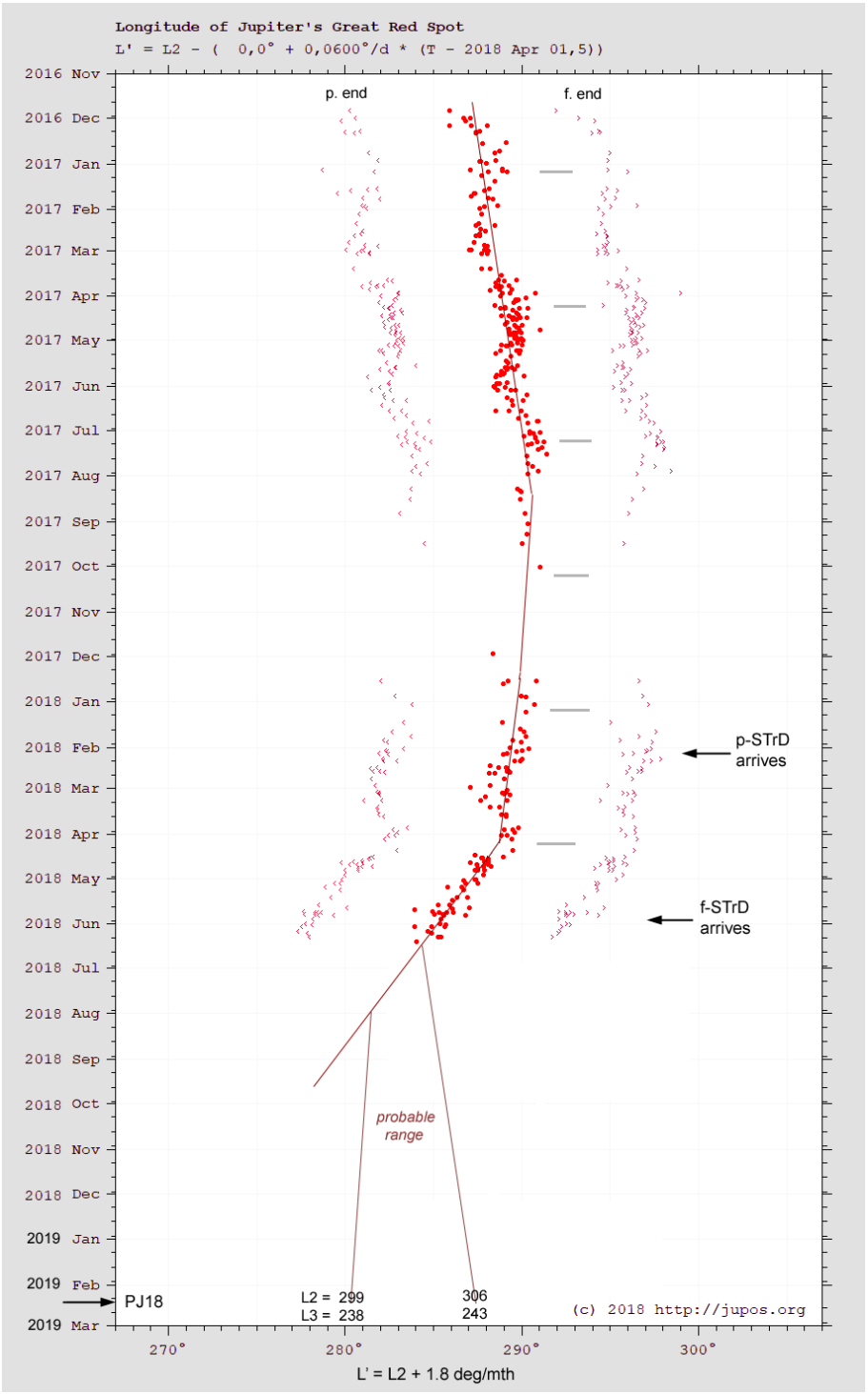


**Figure 6.** JUPOS chart of the GRS, extrapolated to PJ18.