JunoCam at PJ27: What the pictures show (Part I)

John Rogers (2020 June 26)

PJ27 was on Tuesday June 2; Juno crossed the equator at L1=338, L2=290, L3=356 (a short way p. the GRS). This was another Gravity orbit so only oblique views were taken of the low latitudes.
Full-resolution maps of the South Tropical and Temperate domains have been posted by Kevin Gill and Björn Jónsson, but in other regions this report is based mainly on the 'version 01' images posted by the JunoCam team, as the usual sets of full-quality images and maps are still in preparation.

North Polar Region (Fig.1)

Circumpolar cyclones (CPCs):
Images at very high latitudes clearly show three CPCs, including CPC-7 which has increasingly been separated from the north polar cyclone by an AWO. This AWO is still present.

The Bland Zone, haze bands, & North Polar Hood (NPH):

The Bland Zone is visible in part, but a sector is disrupted by turbulent features, as is not uncommon. Linear haze bands are not seen in and around the disrupted sector, apart from one short one, and only comparatively weak ones elsewhere. A bright-and-dark pair near the limb at top of the image (Fig.1) is the most substantial, the dark band there being the only one visible in the methane image.

The methane image, surprisingly, does not show the methane-bright NPH; instead, the NPR appears dark. The methane-bright NPH was obvious at early perijoves but has been increasingly ill-defined at recent perijoves and is now not visible at all. It remains to be seen whether this can be explained by Juno's changing viewing angle during the mission.

Northern domains (Fig.2)

There are spectacular vistas of FFRs throughout the N5 and N4 domains. Some ground-based images had suggested that the N4 domain had a rather regular series of FFRs around this time, but this is not evident in the rather narrow strip imaged by JunoCam.

Figure 2 is a selection of RGB and CH4 images from the N4 to N2 domains, with the approximate positions of prograde jets marked. **Figure 3** is a ground-based map for context.

An excellent set of methane images was taken at PJ27, spanning the northern hemisphere down to the NNTB (e.g. Fig.2). However, they show no obvious haze features distinct from the visible storms. As always, AWOs and bright strips in FFRs are methane-bright (though not an AWO on the N edge of the Bland Zone), while cyclonic features other than FFRs are neutral in the methane images.

The N3 domain (between the N3 and N4 jets) shows a <<-shaped pattern, most prominent in the methane images, tracing out the zonal wind profile.

Further south, all appears light in the methane image, including an orange sector of NNTB; a dark grey sector of NNTB f. it is a little darker.

Equatorial Belts & Zone

The NEB is complex with much rifting and a mini-barge.

The EZ shows some interesting textures (Fig.4A = image 32): extensive white clouds lying on a broad bluish festoon, which has a sharp, wavy interface with the bland cream-coloured zone south of it, near the equator.

The images also show two outstanding examples of long red haze bands apparently overlying the finer-textured main cloud deck. One example (e.g. Fig.4A) is a pair of these bands flanking a white band, lying obliquely over the NEBs and EZ(N). The other (e.g. Fig.4B) is just N of the SEB(S). (At PJ25 we noticed a similar red band running along the S edge of the SEB(S).)

In the N half of the SEB, the convoluted cloud streaks again suggest *anti*-cyclonic or zero vorticity, as at some other recent perijoves (esp. PJ23).

In the S half of the SEB, image 36 (Fig.4B) gives a closeup view of a 'white barge', one of two that are present (Fig.3). Its outline suggests cyclonic circulation at the p. end but it is not clear at the f. end – just as we saw with the other white barge at PJ23.

Great Red Spot (GRS) & S. Temperate domain (Figures 5 & 6)

Figure 5 presents a preliminary image pair (RGB and CH4) showing the GRS and 'Clyde's spot'. Figure 6 is a full-resolution map by Björn Jónsson (contrast enhanced).

The GRS is well imaged, with much internal detail visible. Wrapped around it are multiple light reddish and methane-bright loops, which may well be the remains of recent flakes. Amateur observers had recorded flakes appearing at the f. end of the GRS on May 14 and 21. (There had been few examples in the preceding few months: possibly a minor one around March 1, and one on April 30.)

'Clyde's spot' was the highlight of PJ27. It was at the site of an inconspicuous streak and white spot that we tracked in ground-based images, but suspected of being a new cyclonic circulation. Early on May 31, Clyde Foster observed a sudden eruption of a very methane-bright plume in it. By good fortune, Juno flew over it two days later on June 2, and the resulting images indeed show a most unusual spot, apparently an expanding high-level white cloud. It is roughly oval but with brighter lobes at E and W sides, all still methane-bright. The spot does not show popup clouds, but is marked by numerous concentric arcs: Andy Casely commented that these could represent gravity waves in the expanding cloud. Surrounding streaks confirm that it is within a strongly cyclonic vortex, although it may be over-riding those streaks on the S side. *More information about this spot is in the attached abstract submitted to the EPSC 2020.*

Further f., the later images (e.g. Fig.7) show the STB dark spot that was imaged close-up at PJ26. This is the other cyclonic vortex that has recently appeared in this STB sector. Cloud textures imply that there is no cyclonic circulation between the two spots.

South Polar Region

Circumpolar cyclones (CPCs):

In these preliminary images, three of the CPCs can be seen (Figure 8), with some dark haze bands to the left of them. As always, CPC-4 is the biggest and is oval. It seems to have several small shadow-casting clouds in its central disk. More should be revealed when full-quality images are completed.

Figure 1:

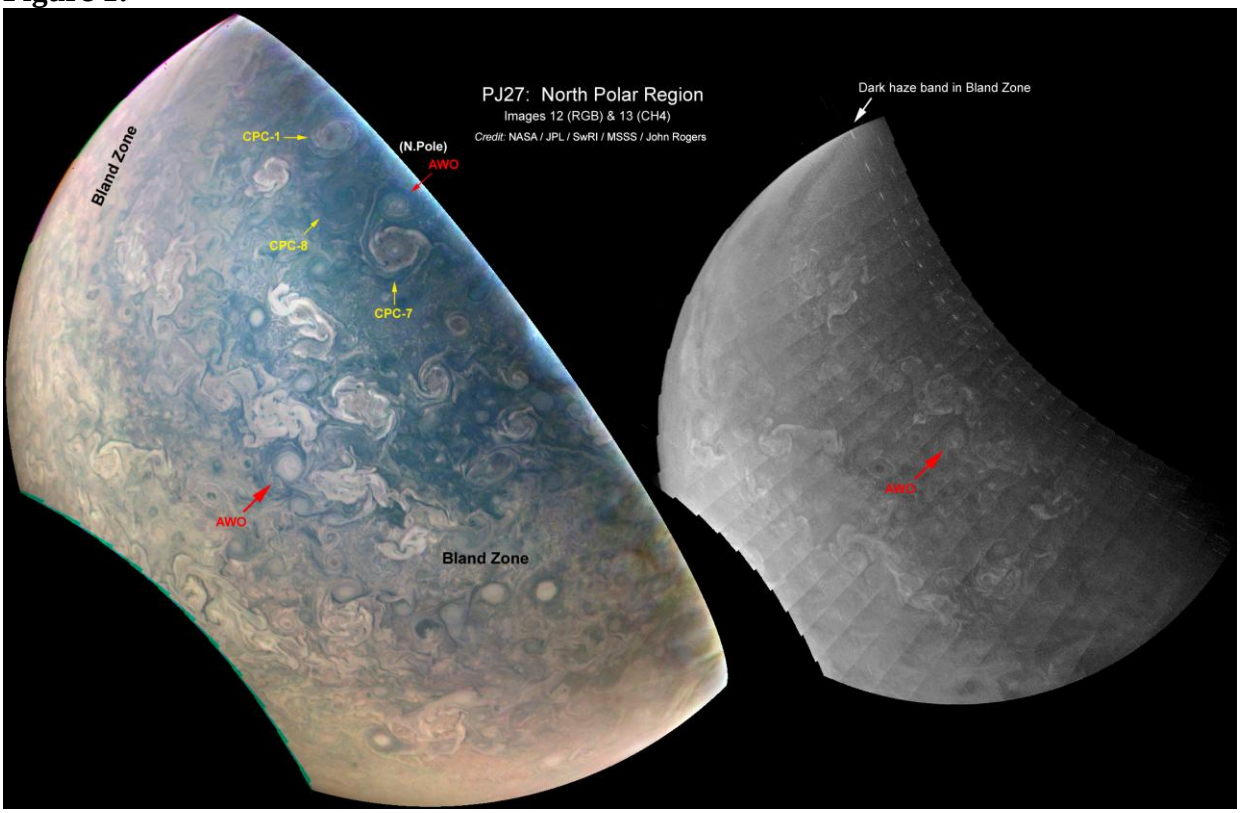


Figure 2: ***[on next page]***

Figure 3:

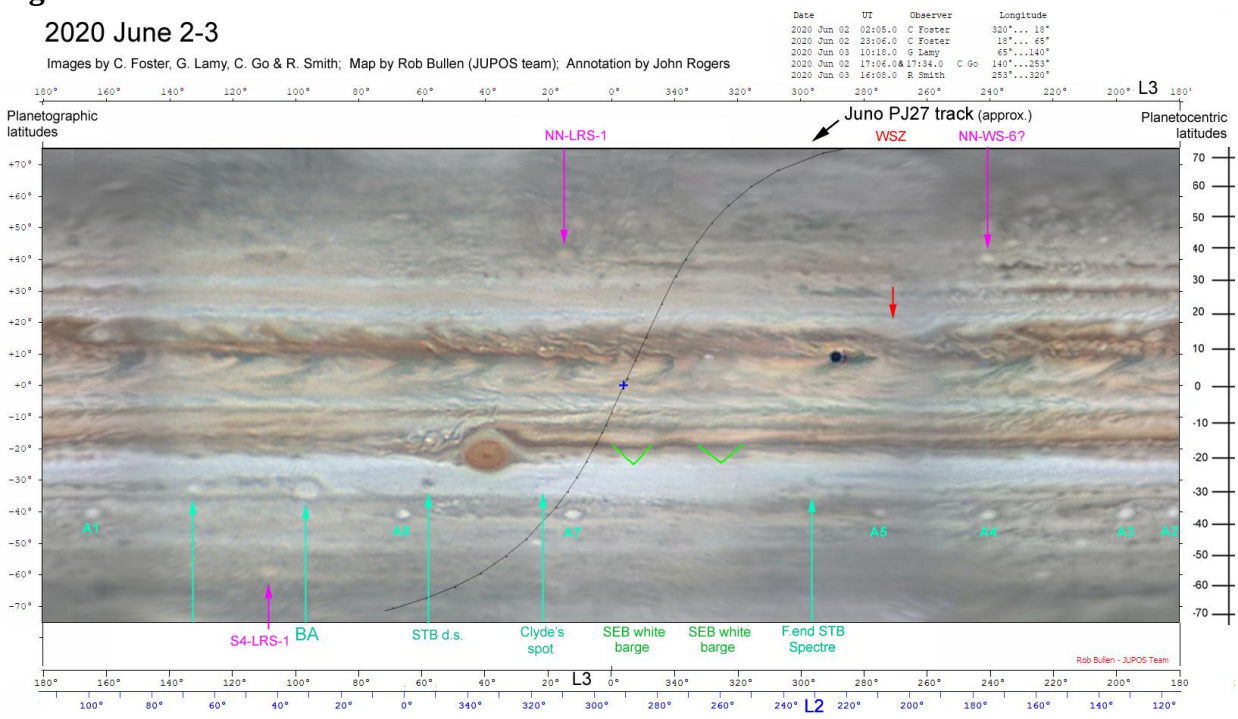


Figure 2:

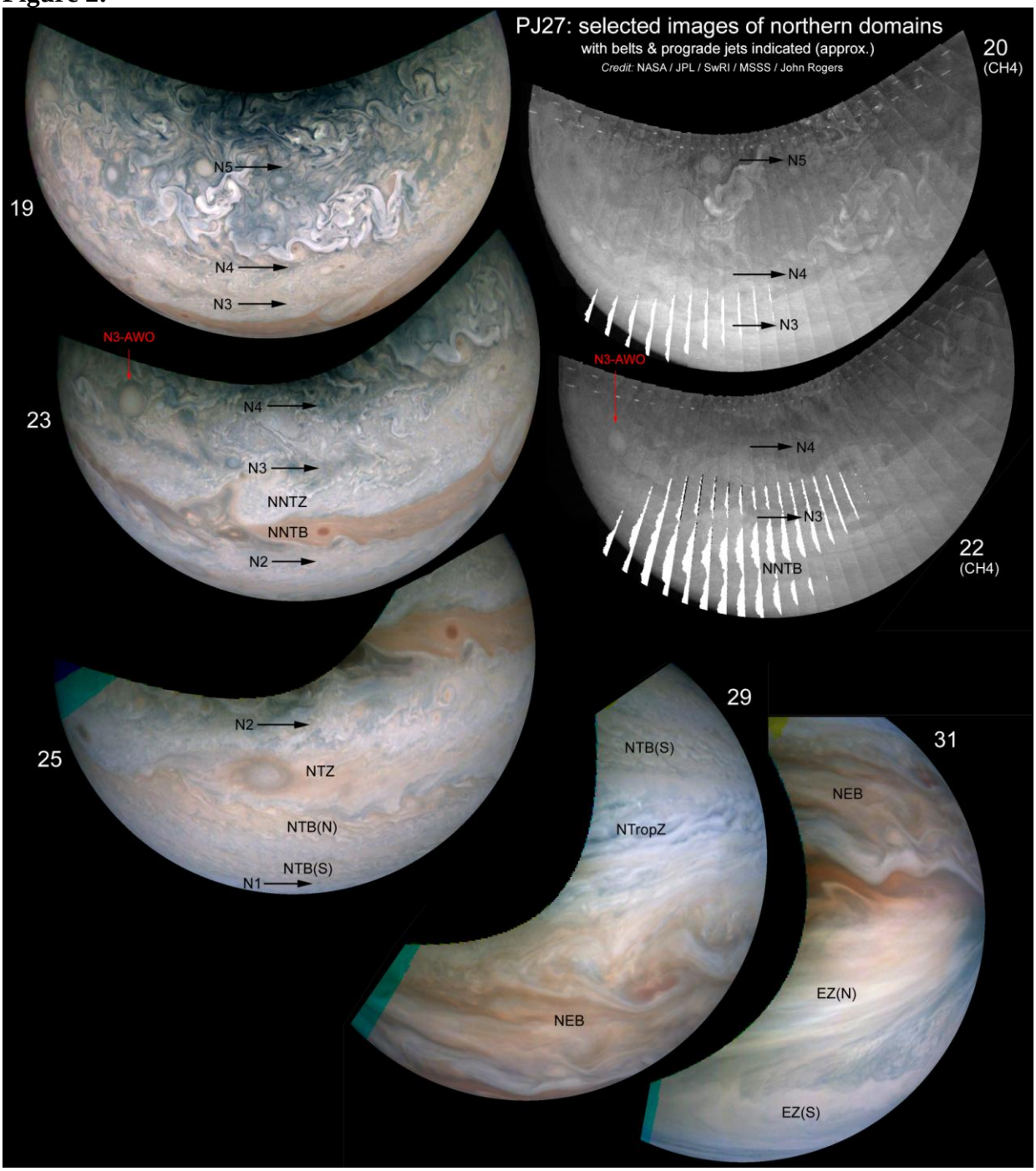

PJ27: selected images of northern domains
with belts & prograde jets indicated (approx.)
Credit: NASA / JPL / SwRI / MSSS / John Rogers
19
N5
N4
N3
N3-AWO
23
N4
N3
NNTZ
NNTB
N2
20
(CH4)
N5
N4
N3
N3-AWO
N4
N3
NNTB
22
(CH4)
25
N2
NTZ
NTB(N)
NTB(S)
N1
29
NTB(S)
NTropZ
NEB
31
NEB
EZ(N)
EZ(S)

Figure 4:

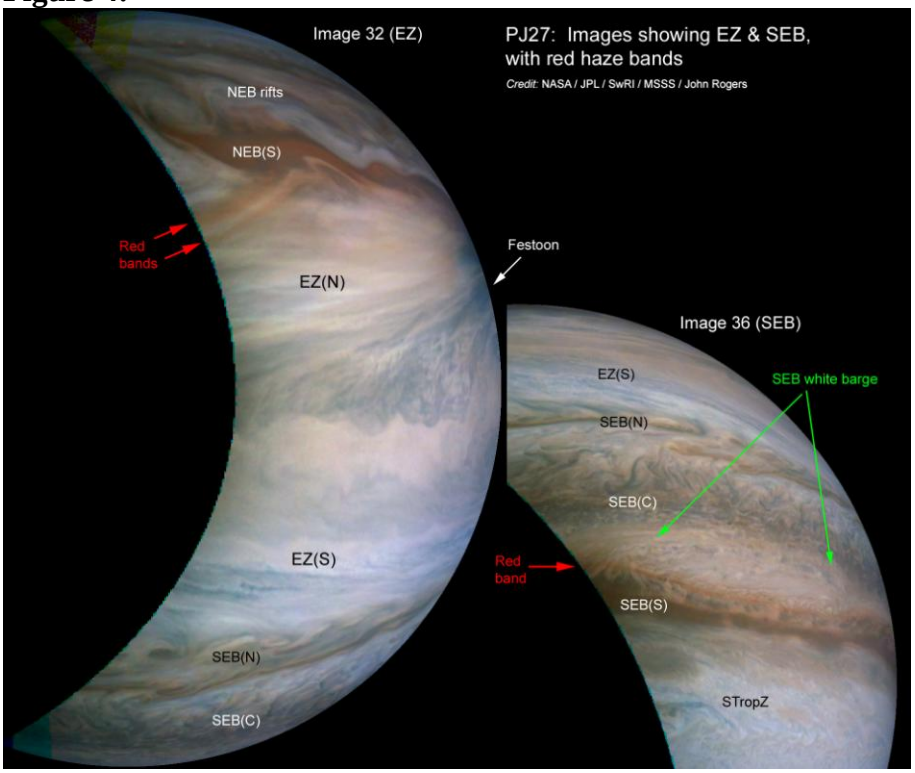


Figure 5:

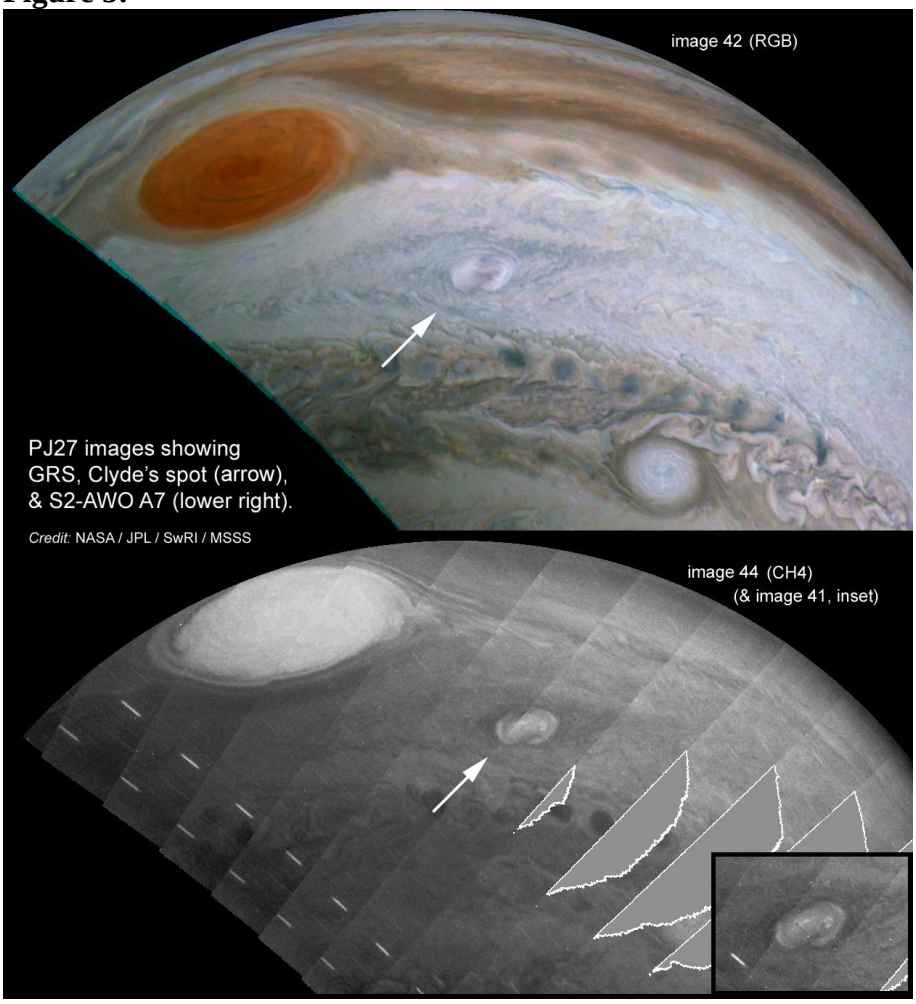


Figure 6:

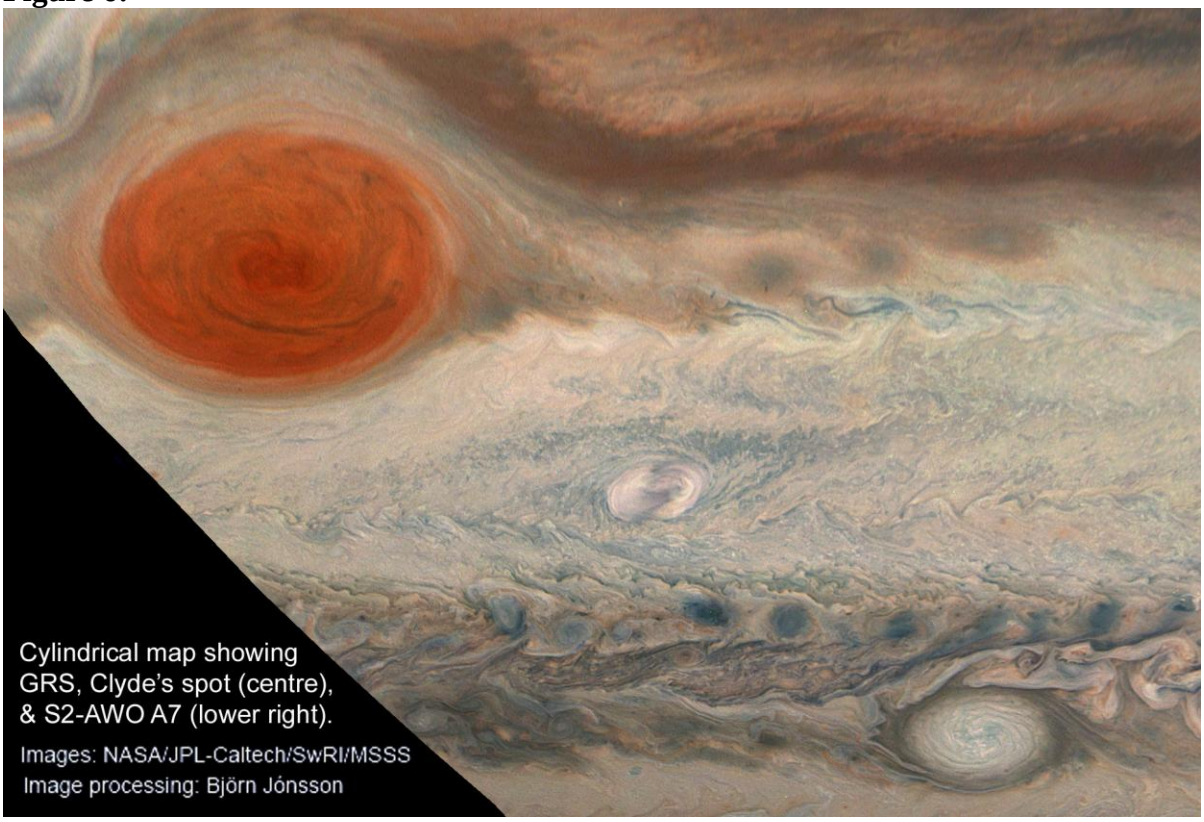


Figure 7:

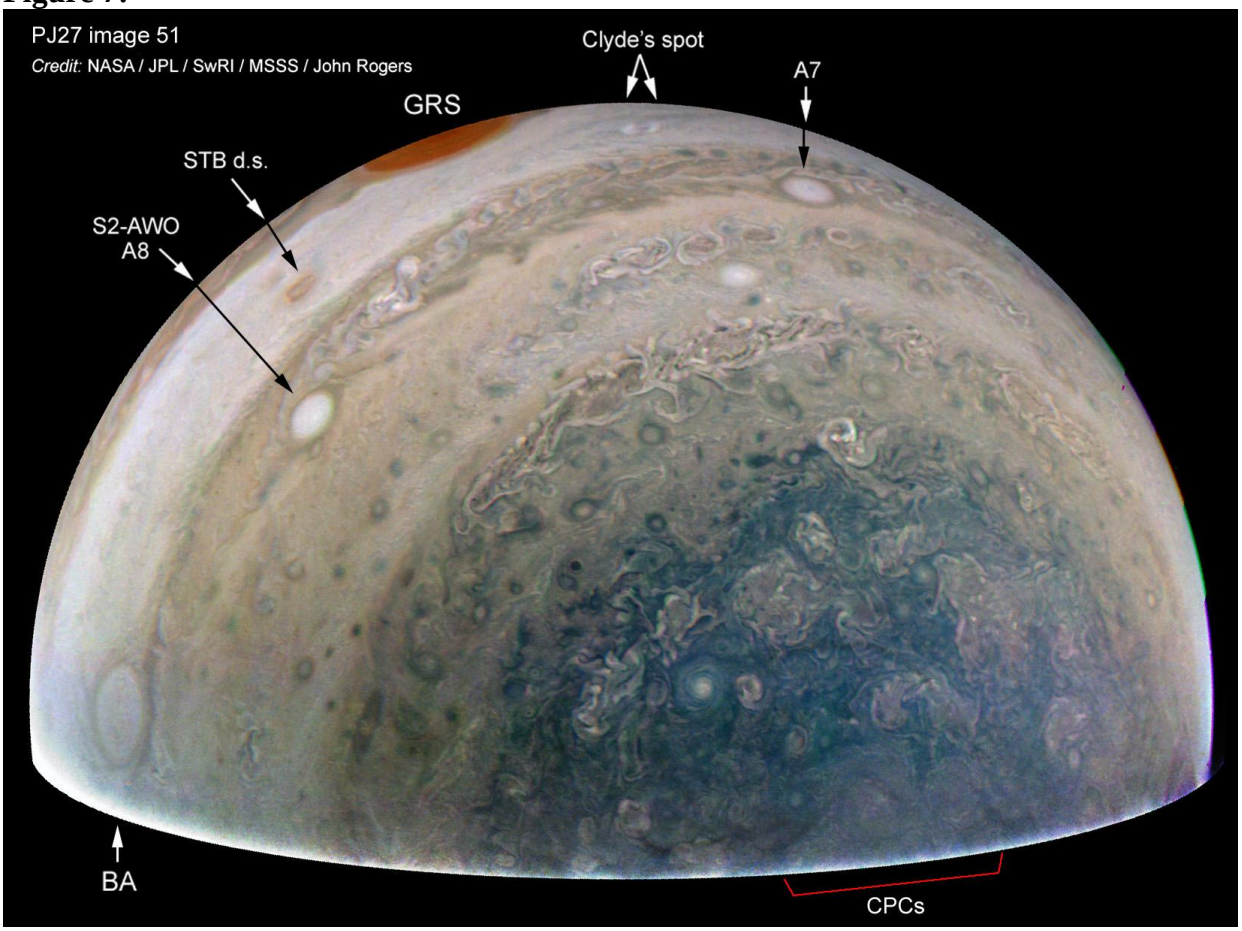
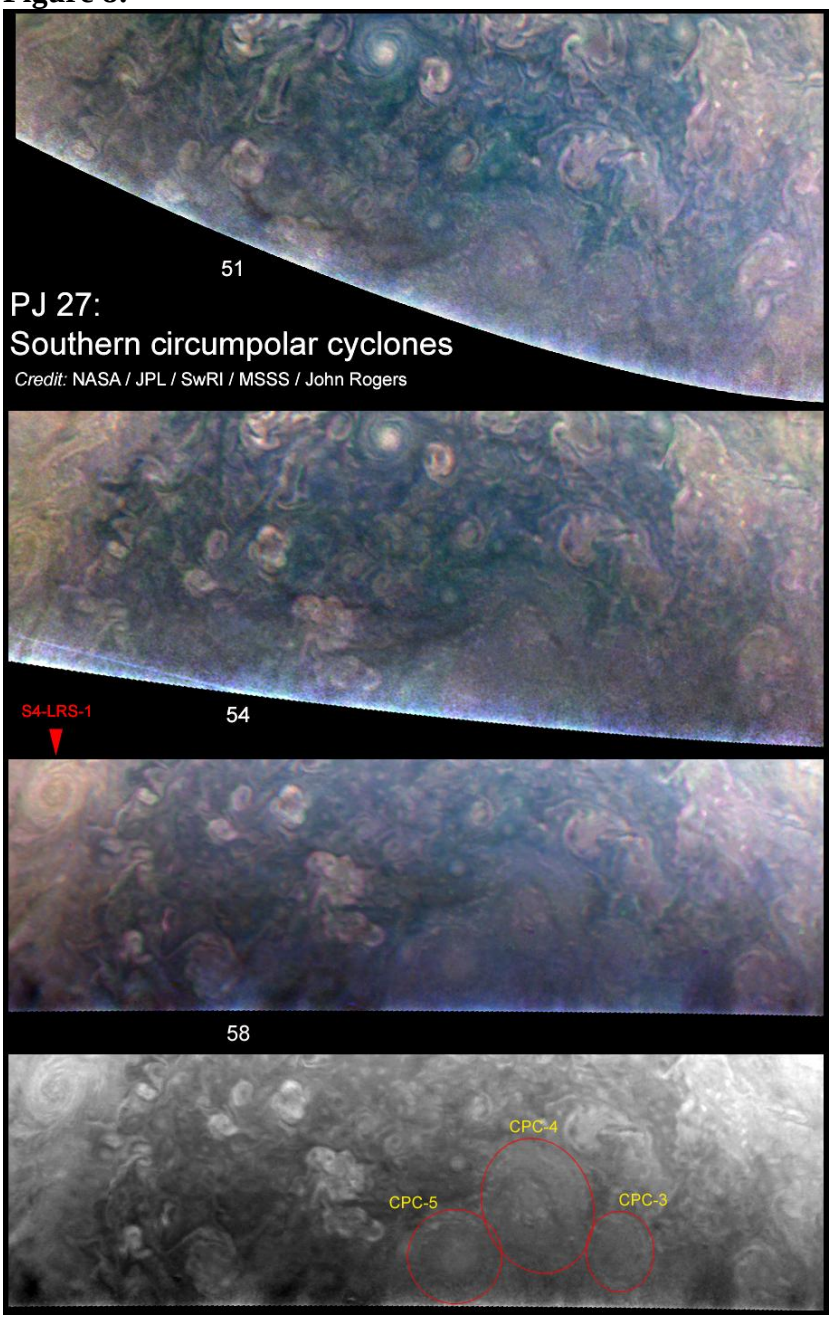


Figure 8: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PJ 27:
Southern circumpolar cyclones
Credit: NASA / JPL / SwRI / MSSS / John Rogers
S4-LRS-1
54
58
CPC-4
CPC-5
CPC-3