JunoCam at Perijove-11 (2018 Feb.7): What the pictures show

--John Rogers [2018 Feb.23]

At PJ-11, as at PJ-10, the effects of the changing orbital orientation were marked. There were no inbound images; just a few closeups of the north pole as Juno flew over it; oblique views extending to the horizon rather than to the nadir during the close fly-over; and then good views of the south pole, and of the whole southern hemisphere when outbound. The JunoCam team devoted a substantial part of the data allocation to getting multiple high-quality images of the poles and the equatorial zone, as well as the more familiar closeup views of the mid-latitudes.

As usual, the JunoCam images have been presented (i) as initial versions posted by the JunoCam team (each projected as if from a point above Juno's track, but with reduced resolution); (ii) as full-scale, high-quality versions by Gerald Eichstädt (strips closer to Juno's actual perspective); and (iii) both cylindrical and polar map projections by Gerald. This report shows some of each version, with gradients and contrast adjustments applied. Latitudes are planetocentric.

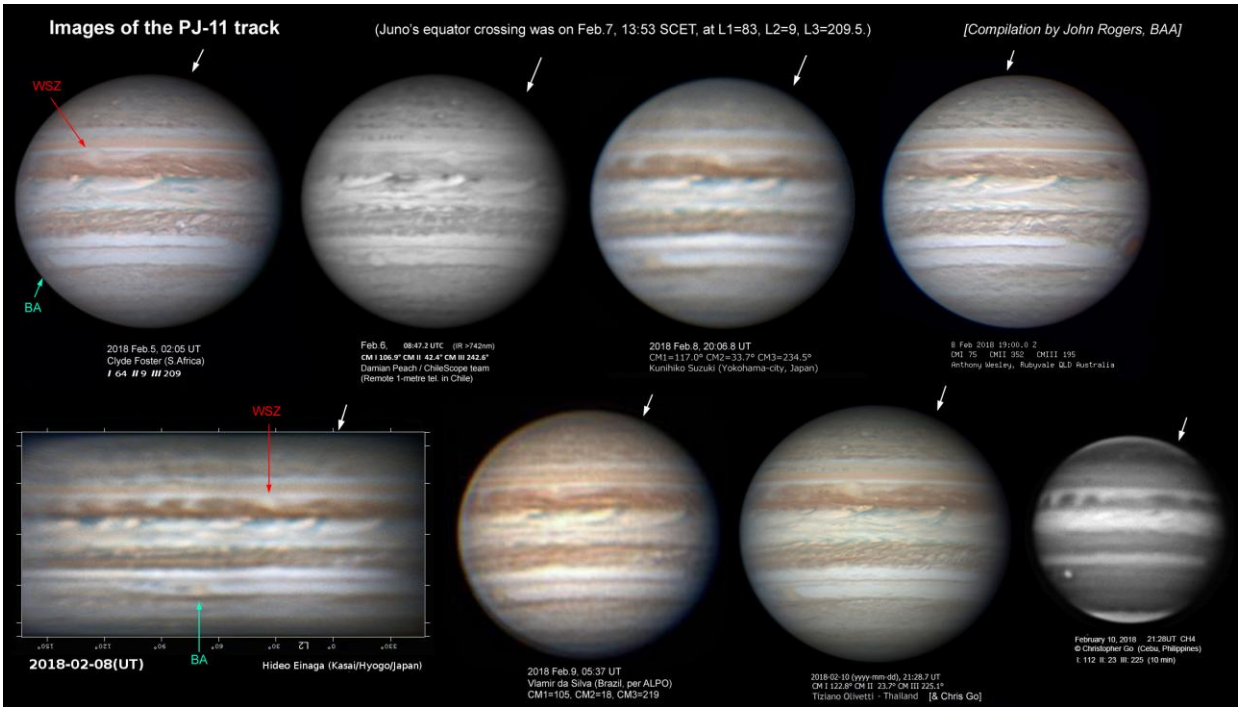

Figure 1

Figure 1 is a set of amateur images covering the spacecraft track for a few days around PJ-11. There were no major known features under the track, but oval BA was within range of some of the JunoCam images.

Figure 2 [below] is a set of the images of the **north polar region and high northern latitudes** (initial versions), including the methane-band image. Figure 3 is a composite of Gerald's polar maps of these images. They show all the familiar features:

--Circumpolar cyclones: this time, a line of three of them, two very distinct with a distorted one between them.

--The bland zone, with linear haze bands of various colours running not-quite-latitudinally through it. In the lower half of these images the bland zone is disrupted, just as turbulent as in regions north and south of it; this was also the case last time this sector was imaged, at PJ-9.

--Two anticyclonic white ovals (AWOs) at 59-60ºN, at the northern edge of the N5 domain, one of them partially overlaid by haze bands. They are *not* methane-bright.
--A dense network of broad haze bands over the N3, N4 & N5 domains, seen near the terminator. There are alternating bright and dark bands, with apparent brown shadowing towards the terminator.
--Masses of folded filamentary regions (FFRs) and general chaos all over these latitudes. In fact, there seems to be even more disruption of latitudinal banding than usual. There are several small AWOs in the N4 domain, including a pair which may be on the point of merging, and one (at 45.5ºN) displaced towards the southern edge of the domain – a phenomenon which we recently documented in this domain from ground-based observations.

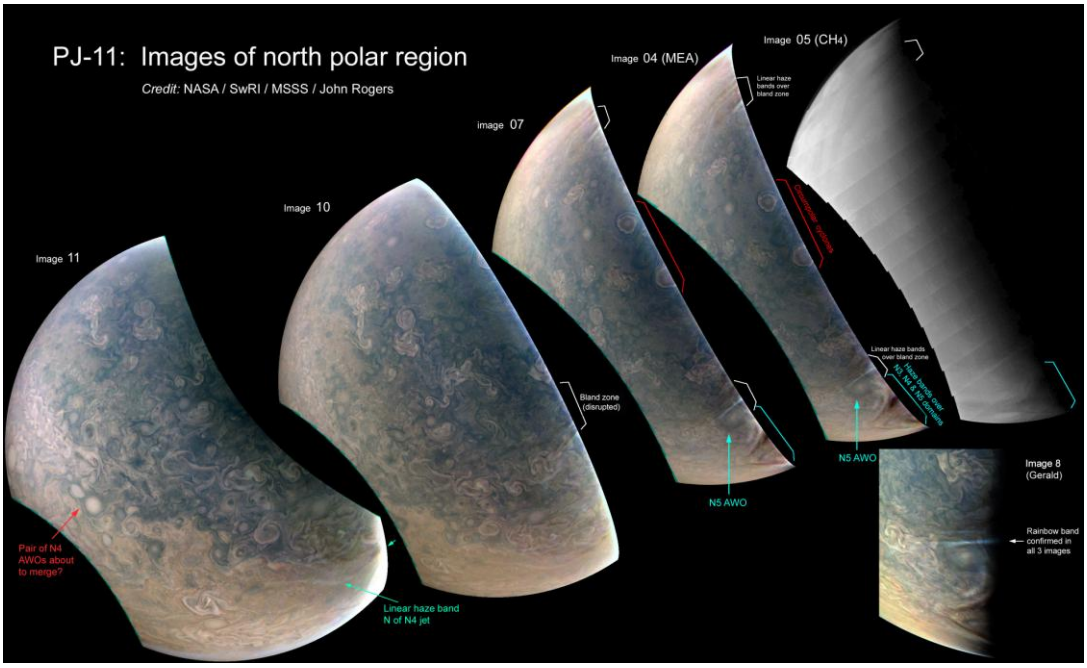

Figure 2

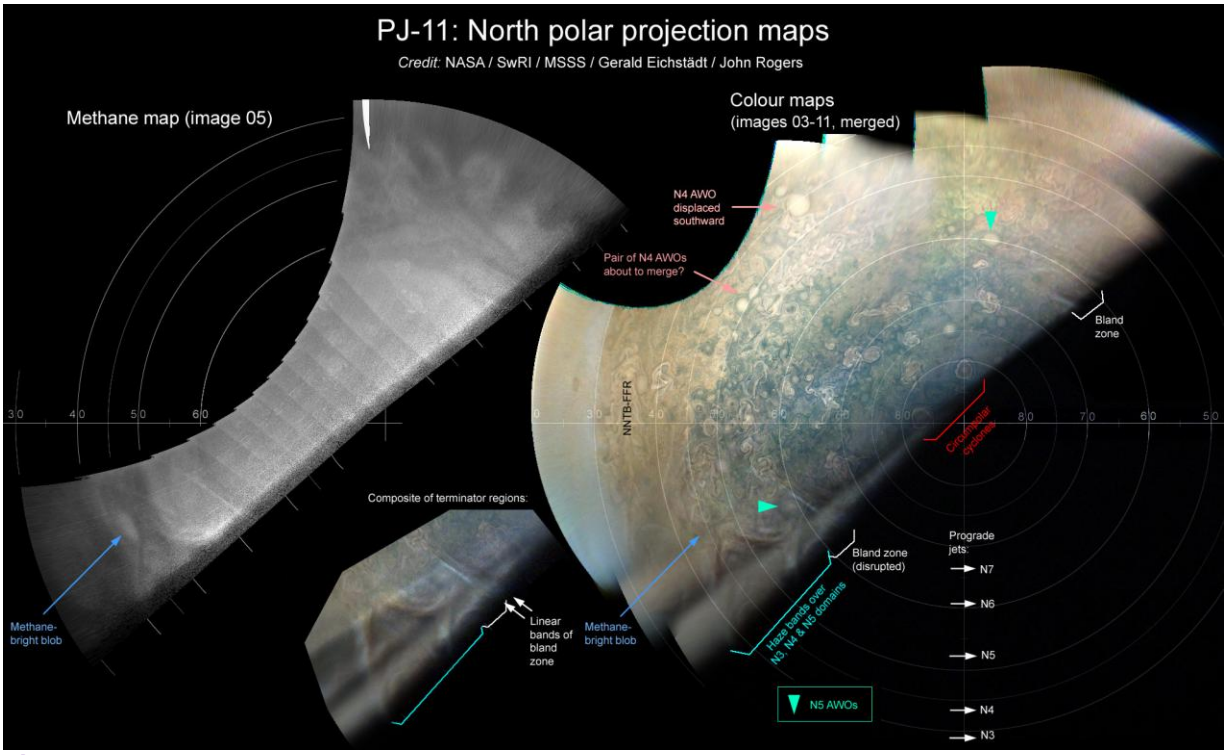

Figure 3

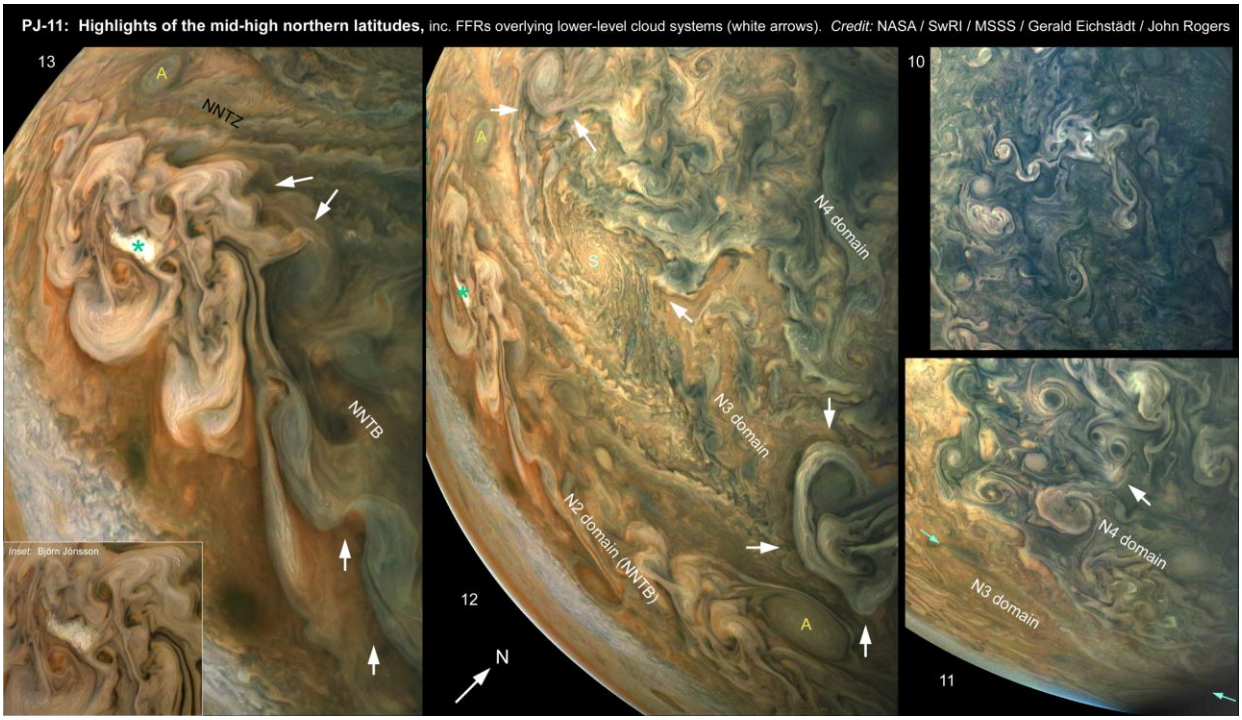

Figure 4

Figure 4 is a gallery of visual highlights from images of the mid/high northern latitudes, including:
(Image 10): A closeup of the disrupted sector of the bland zone, centred on a straggling FFR just N of it at 67.5ºN; it shows glorious baroque swirls, and a very bright convective outbreak in the FFR.
(Image 11): A long linear haze band (arrowed) at 43ºN, parallel to a linear cloud band at 46ºN bordering a FFR. These two bands lie on either side of the N4 prograde jet. (White arrow: see below.*)
(Image 12): In the N3 domain at 40N, a splendid spiral cyclone ('S'), and an ear-shaped lobe of an FFR.* ('A', anticyclonic grey ovals in the NNTZ.)
(Image 13): Closeup of the large FFR in the NNTB.* (There was a similar good closeup of it at PJ-6.) In the centre of the FFR is an exceptionally bright outbreak (asterisk). (*Inset*): Unsaturated version processed by Björn Jónsson: the outbreak is a dense mass of 'pop-up clouds', and we can see its edges casting shadows.
*In FFRs in the N2, N3 & N4 domains, the lighter bands are extensively decorated with lines of 'pop-up clouds' (the tiny shadow-casting clouds), and these bands clearly overlie a deeper weather layer: obvious examples are indicated by large white arrows.

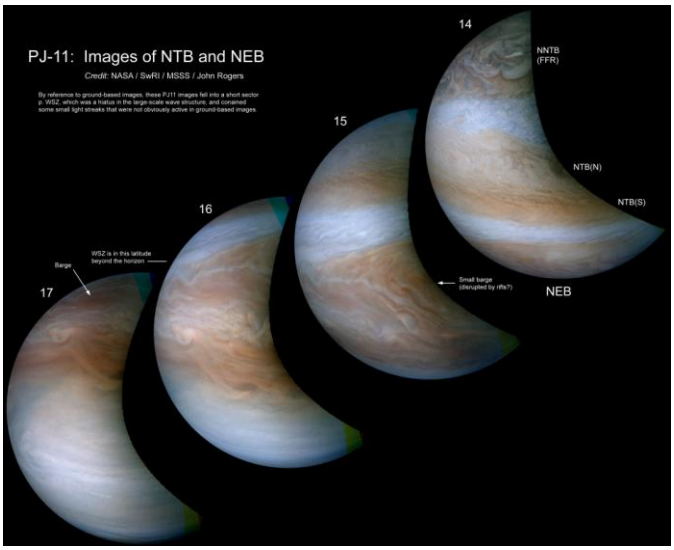

Figure 6 *[Figure 5 is on next page]*

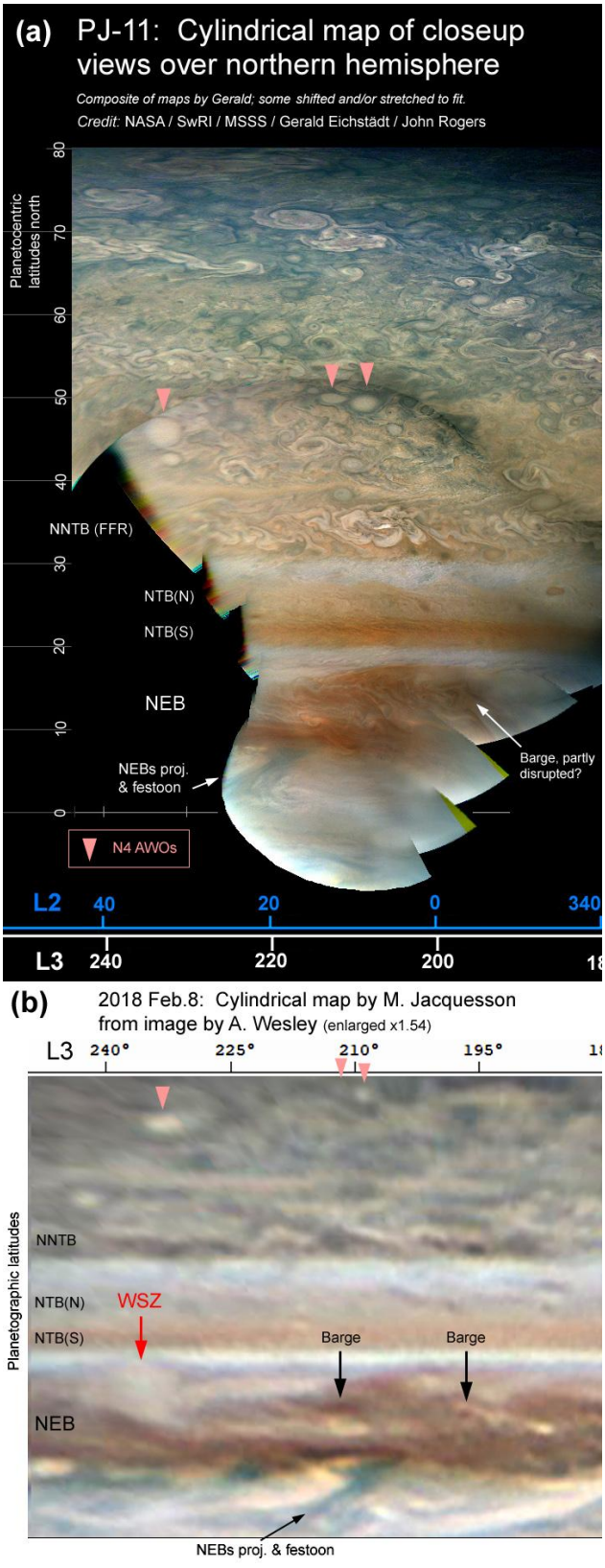

Figure 5 [left]

Figure 5a is a composite cylindrical map of the closeup images of the northern hemisphere; Figure 5b is a ground-based map made ~30 hours later and aligned in longitude.
Figure 6 shows the images covering the NTB and NEB, which were mapped in Figure 5a.
In the **North Temperate Belt**, the NTB(N) is much calmer now and rapidly fading (lightening). Much of it is covered with bland, flat-looking swathes of cloud, which have extensions into tiny cyclonic vortices (not resolved in this lo-res initial version) The NTB(S) is still strongly orange, and the N. Tropical Zone is now white and calm.
In the **North Equatorial Belt**, we see a broad dark bulge between two barges, butneither barge is distinct: one appears diffuse, and the other is small and partly disrupted. (White Spot Z (WSZ) lies over the horizon.) From the altitude of just 3469 km, the NEB appears to contain impressive-looking white rifts, but these are actually so small as to be barely visible in ground-based images (Figures 1 & 5b). On the NEBs edge is a fine dark formation ('projection' or 'hot spot').

Figure 7 is Juno's view of the **Equatorial Zone** (Gerald's version). Several such images were returned with best quality in order to survey the 'mesoscale waves' in the EZ, and indeed they are widespread in a swathe of white cloud southeast of the large dark NEBs formation. They are long sets of parallel streaks separated by no more than a few hundred km.
The central band of the EZ looks quite orange in this image, but ground-based images show this colour to be faint and not unusual.

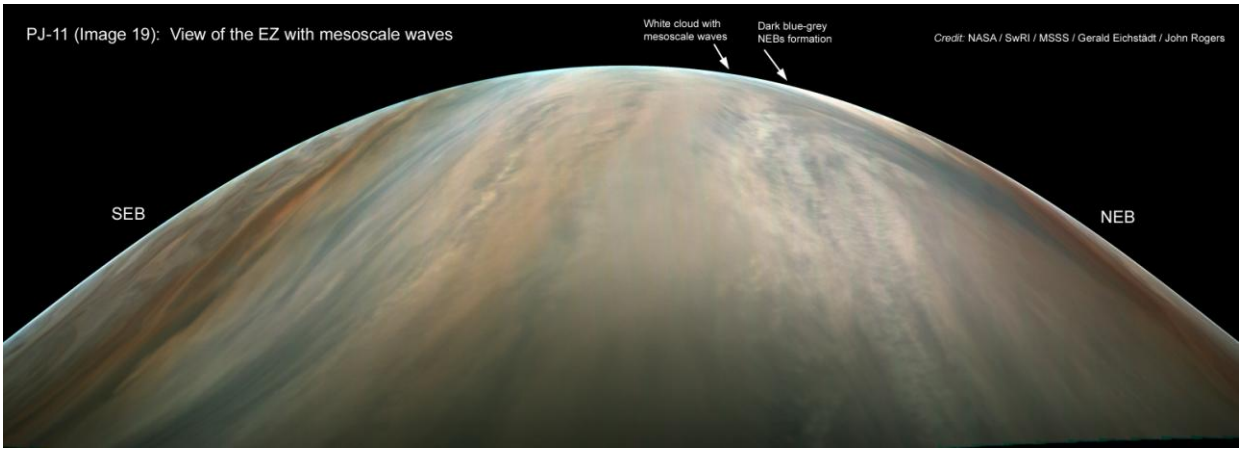

Figure 7

The **South Equatorial Belt** was undisturbed in the sector imaged, but showing the usual beautiful multicoloured swirls. The **South Tropical Zone** is mainly white, but its south part is occupied by the anomalous dark belt, the South Tropical Band. ('Pop-up clouds' appear to be present as usual, but not well seen because of the oblique angle and high sun.)

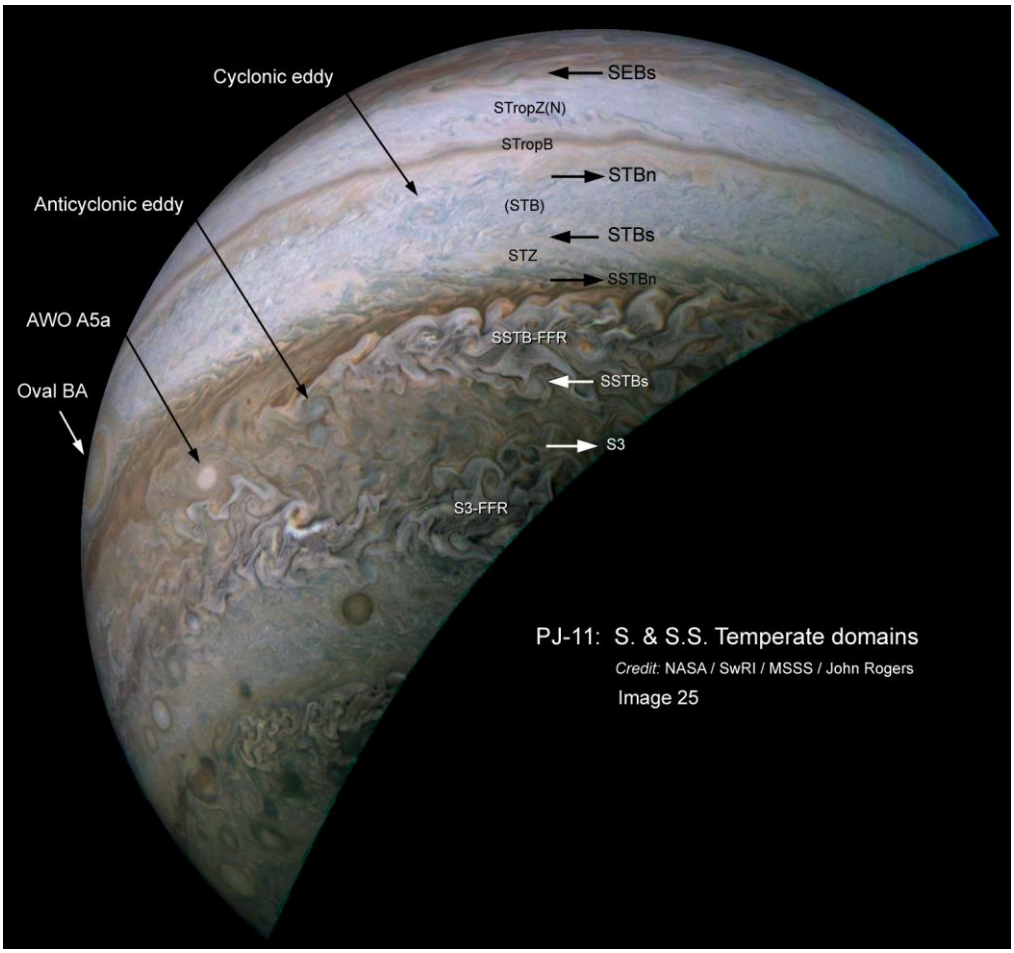

Figure 8a

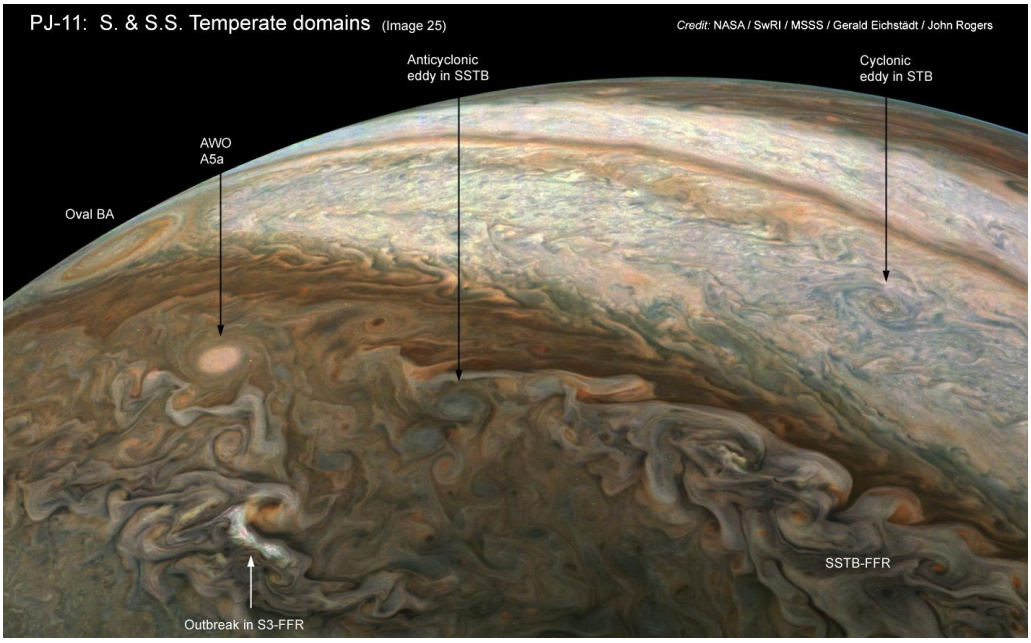

Figure 8b

Figure 8 shows the S. and S.S. Temperate domains (Fig.8a: initial version; b: Gerald's version). The **South Temperate Belt** (STB) is entirely white, but contains one little vortex which I think may be very interesting. This is the stretch where I have been hoping for a new cyclonic circulation to emerge. There was nothing here at PJ-9, but now we do see an inconspicuous cyclonic eddy. This may not amount to anything, but I think it could develop into a conspicuous dark spot later this year, which would become the next STB structured segment.

In the **SSTB**, the large FFR is splendidly shown, and a small grey anticyclonic vortex is just the sort of thing that I think has been emerging from it and evolving into mini-AWOs which eventually merge with AWO A5a.

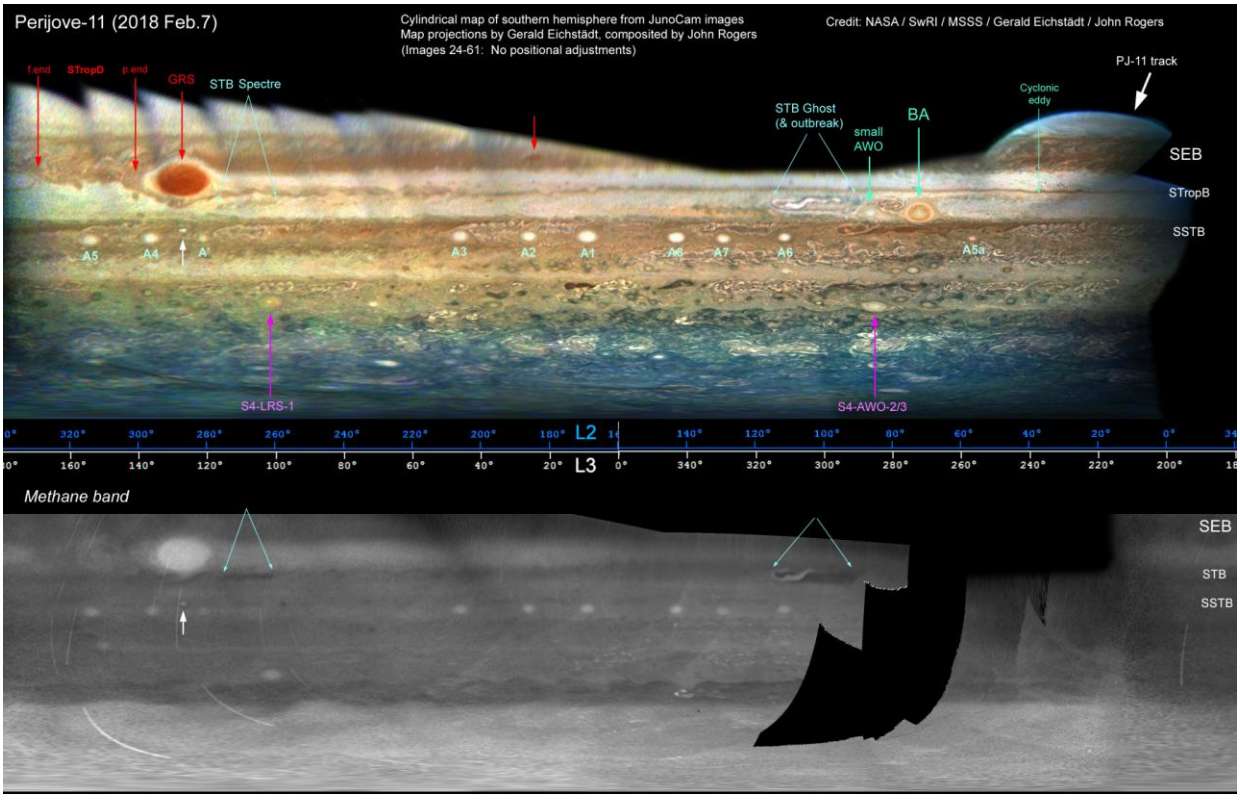

Figure 9

Figure 9 shows a **map of the whole southern hemisphere** made from the outbound images, plus a methane-band map. They clearly show the exciting events taking place at other longitudes. (See our PJ-10 map for indications of the flow patterns. Ground-based images of these events will be shown in a separate report.)

Following oval BA, the STB Ghost has been dramatically disrupted by a vigorous convective outbreak which began on Feb.4. This map shows the bright white (and methane-bright) clouds being swirled around the cyclonic circulation.

On the other side of the planet, the S. Tropical Disturbance (discovered by JunoCam at PJ-9) had arrived at the GRS in the previous 2 weeks and has been increasingly emitting dark material around the south side of the GRS. This material is also interacting with the STB Spectre, which has undergone patchy darkening: the JunoCam methane map is useful in showing the outline of the Spectre (which is methane-dark, like the Ghost). These interactions will develop further in the coming weeks and JunoCam may get a good view at PJ-12.

In the S.S. Temperate (S2) domain, the long-lived AWOs (A1 to A8) have been joined by a new small one. Between this one and A4, due S of the GRS, the map shows a brilliant white point (white arrow; also methane-bright), likely to be a new convective plume. Indeed, ground-based images show this was absent up to Feb.5 and first recorded on Feb.7 (by David Carlish, one rotation before the PJ-9 map). On subsequent days it seemed to be less bright.

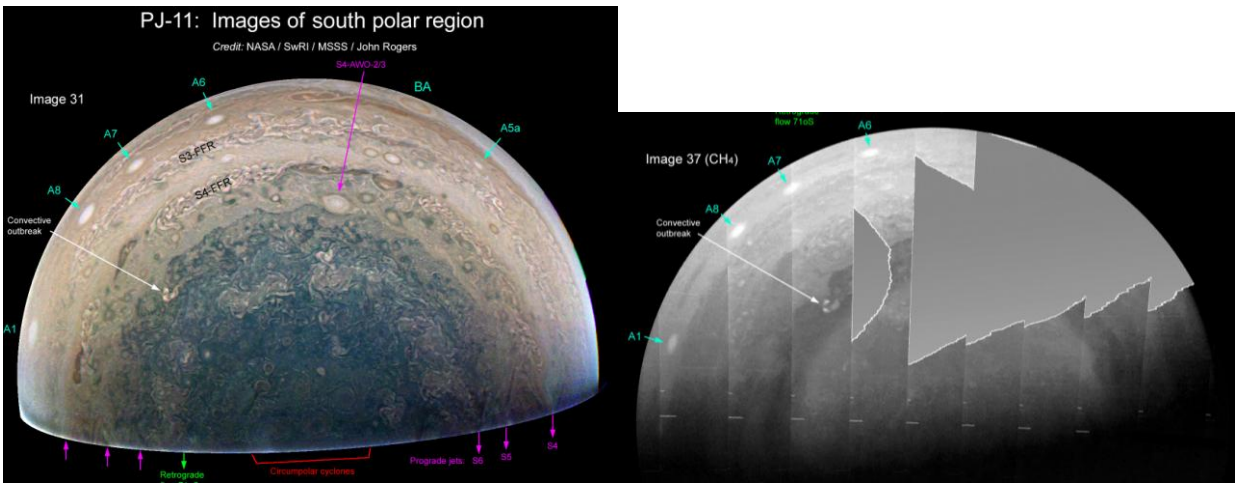

Figure 10

Figure 10 shows the South Polar region, with a methane image as well.

The S3 and S4 domains both show many vortices and large FFRs. In the S3 domain, there is a very bright outbreak in the large FFR (Figure 8). In the S4 domain, a large AWO is probably the result of a very recent merger of long-lived AWOs-2 and -3, as the JUPOS chart up to late December showed them converging toward this longitude and date.

The **South Polar region** (Figure 10) shows the same features that we have described at previous perijoves, including the cluster of circumpolar cyclones.
