JunoCam images at PJ69

John Rogers (2025 Feb.27)

Juno's Perijove-69 occurred on 2025 Jan.28 (23:05 UT at spacecraft, 23:42 UT Earth-received time). As usual, the best images were taken during the final half-hour of approach before crossing the north polar region at 82.3ºN, 11 min before perijove which was on the dark side. Unfortunately, while the spacecraft was traversing the most intense radiation belt, radiation-induced spots and data dropouts reappeared on some of the inbound images (including Figure 1); however all were usable. Perijove was at 58.4ºN, again at 3500 km altitude, and equator crossing occurred 25.5 min later at L3 = 192.

As always, this report is based on work by the NASA JunoCam team (Drs Candy Hansen, Glenn Orton, & Tom Momary), with image processing and map projections by Gerald Eichstädt. Conventions & abbreviations are as in previous reports.

The inbound images included good coverage of a large FFR in the NNTB (Figure 1). JunoCam had obtained spectacular closeup colour images of these earlier in the mission, but they were rarely covered in CH4 images. Now there are good CH4 images, which show the different altitudes of cloud-tops and hazes in the complex structure of the FFR. Methane-bright points (blue arrows) are mostly white strips of cloud in RGB, although not necessarily the brightest ones, and not orange clouds -- although one (the uppermost at right) appears to be an orange cloud on a dark background. However, the ochre NNTB is generally lighter in methane than the FFR except for some of the white strips (also compare the methane and RGB maps in Figure 3). It's also notable that the NTB consists of multiple methane-dark bands although it is all light in RGB.

Figure 2 is a ground-based map of the planet at this time. Some longitudes were not covered at the highest resolution because of wintry observing conditions for many observers, but we will post elsewhere a map from higher-resolution images 4 days earlier.
Figure 3 is our JunoCam global map, from hi-res inbound images (northern hemisphere) and lo-res outbound images (southern hemisphere).
The most important feature is the NTBs jet outbreak; the first plume had appeared on Jan.10 and the second on Jan.27 (see 2024/25 reports nos.4 & 5, about to be posted on the BAA Jupiter Section web site). However, both plumes were on the dark side during Juno's imaging, and these latitudes appeared undisturbed in the dayside images (Figures 1 & 3).

Night lights: Aurora and lightning

With the perijove track being on the dark side, JunoCam has been routinely taking "lightning search images", with lossless compression since PJ65. Several of the PJ69 images showed the most definite detections yet (Figure 4); two are included in the map (Figure 3). The bright arc in image 40 is part of the aurora; the map shows that it is close to the lowest-latitude part of the main auroral oval (Figures 3 & 6). In image 42 a very faint band represents the main auroral oval, with a much brighter strip of aurora on or above the horizon. In image 44, the bright spots in image 44 are lightning flashes, at 20.6ºN, the latitude of the NTBs jet plumes.

Figure 5 aligns the map of this dark-side image with amateur maps of the region showing the NTBs plumes just hours before and after PJ69. By great good fortune, part of plume 1 (green arrow), was just within JunoCam's field of view, and the main lightning flashes coincided with its edge. Thus JunoCam has proved that these convective plumes are giant

thunderstorms. The weaker flash, several degrees following the plume, could be associated with one of the smaller white spots (magenta arrows) that drift westwards away from the edge of the main plume, being swept away into its wake, suggesting that these are not just passive clouds but also active thunderstorms.

Northern circumpolar cyclones (CPCs)

Figure 8 is our map of the northern CPCs, in the usual style; compare with the previous two maps in our PJ68 report. Figure 9 is a composite of this with the PJ66 map, giving a complete view of the octagon of CPCs. (The last time we posted one of these was at PJ65.)

The CPCs have not changed their position or morphology much, except that CPC-8, the weakest one, has recovered some spiral structure.
This is the first time we have viewed CPC-2 since PJ63 and PJ64, and the PJ69 map has clearly better resolution. It shows that CPC-2, although mostly a well-formed spiral, has a small central region which appears anticyclonic as in the odd-numbered (filled) CPCs; at least, its cyclonic rotation must be weaker in the central region, if not reversed. This was also evident at PJ63.

Three associated long-lived anticyclones are labelled a,b,c, as in our PJ68 report. Anticyclones a and b are white ovals, which have moved several degrees back and forth but not changed in appearance. Figure 10 is a closeup of AWO-a at PJ69 (image 35). Anticyclone c is a smaller vortex fixed north of CPC-7.

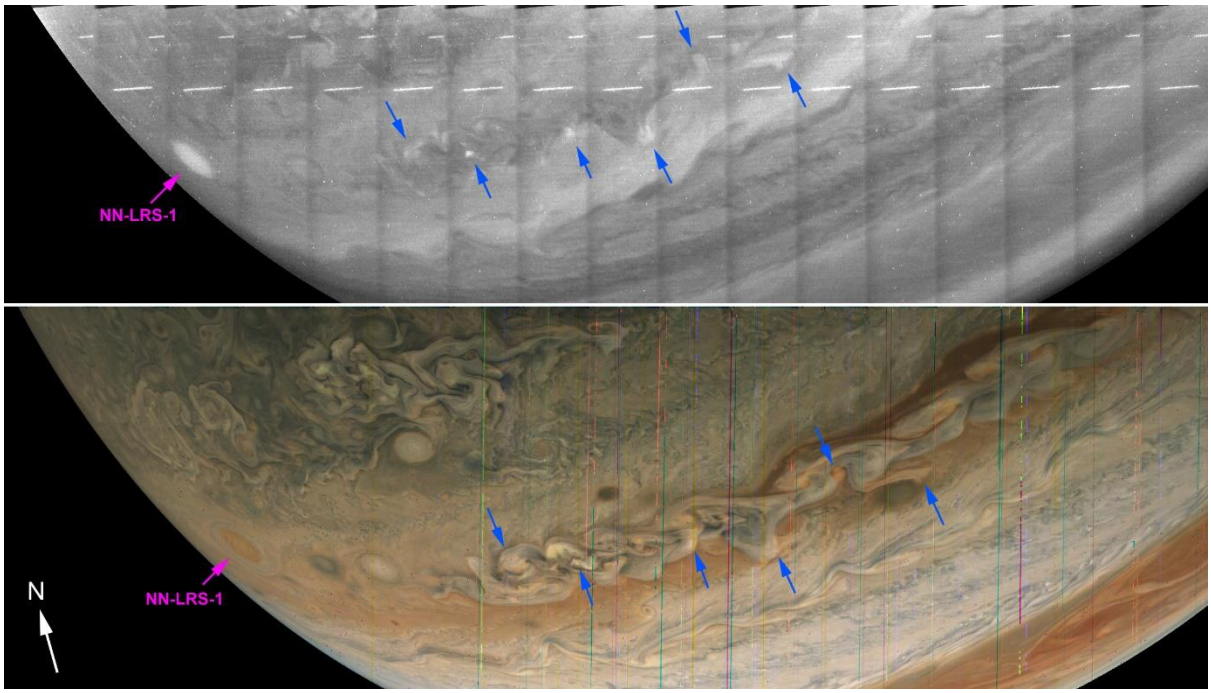


Figure 1. PJ69 images 20 (CH4) & 21 (RGB), showing the long FFR in the NNTB.

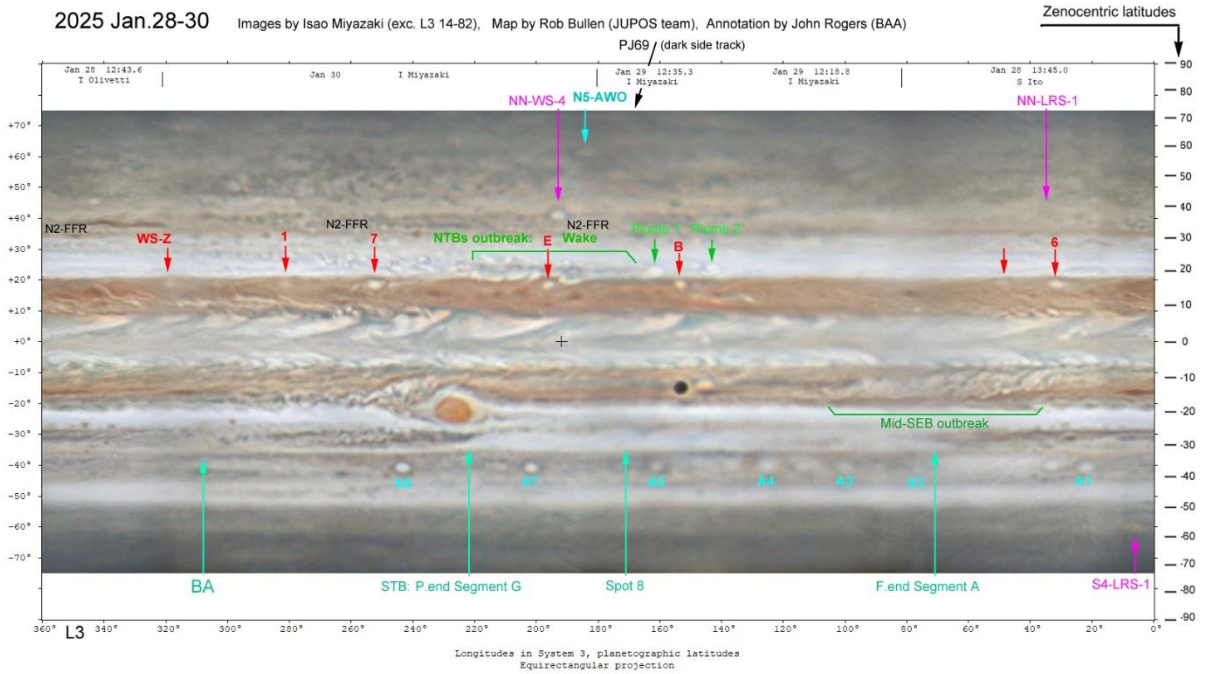


Figure 2. Ground-based map from amateur images. Important features are labelled including anticyclonic ovals in the NNTZ (labelled in magenta) and the northward-expanded NEB (in red), and FFRs in the NNTB (in black). The NTBs and mid-SEB outbreaks are labelled in green.

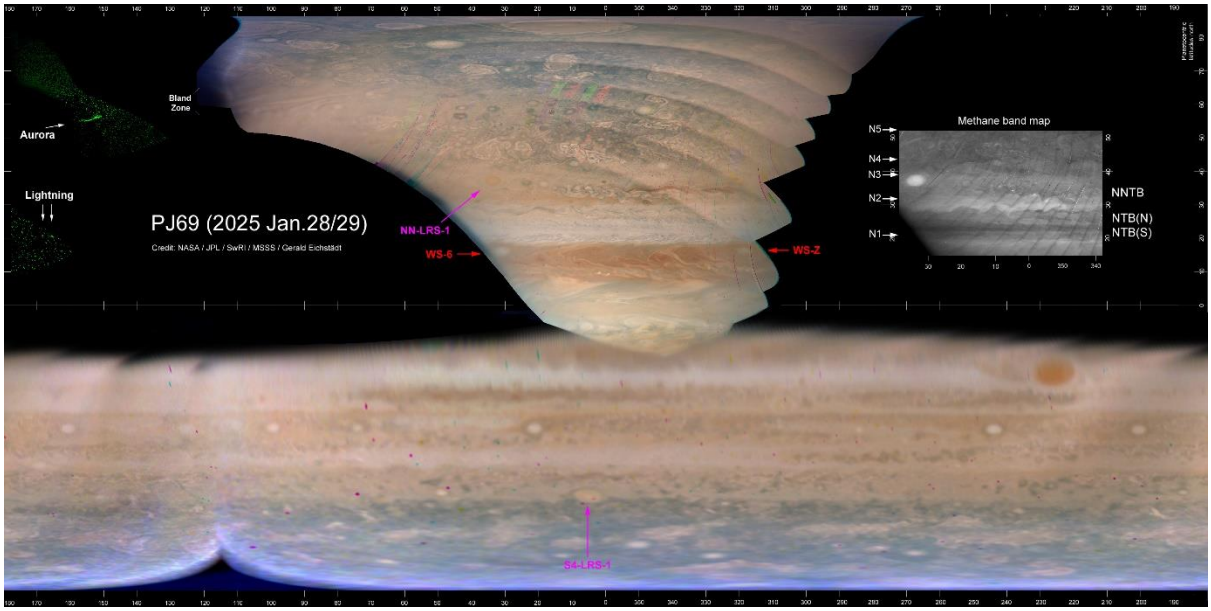


Figure 3. PJ69 JunoCam global map, from hi-res inbound images (northern hemisphere) and lo-res outbound images (southern hemisphere).

Figure 4. Small parts of three dark-side images showing definite bright features. *Image 40:* Aurora (also shown in image 39). *Image 42:* More of the main auroral oval, seen as a bright streak along the horizon and a broad faint glow below. *Image 44:* Lightning flashes at 20.6ºN, in the main NTBs plume and just following it. (All images due to Gerald Eichstädt .)

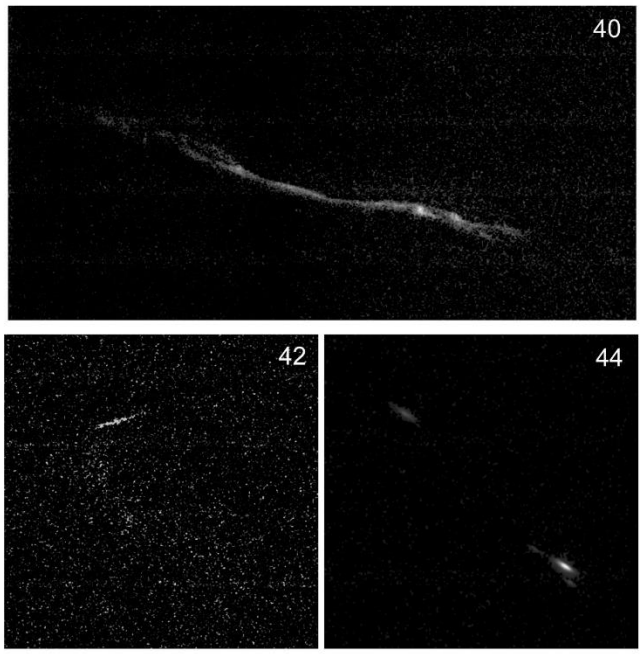
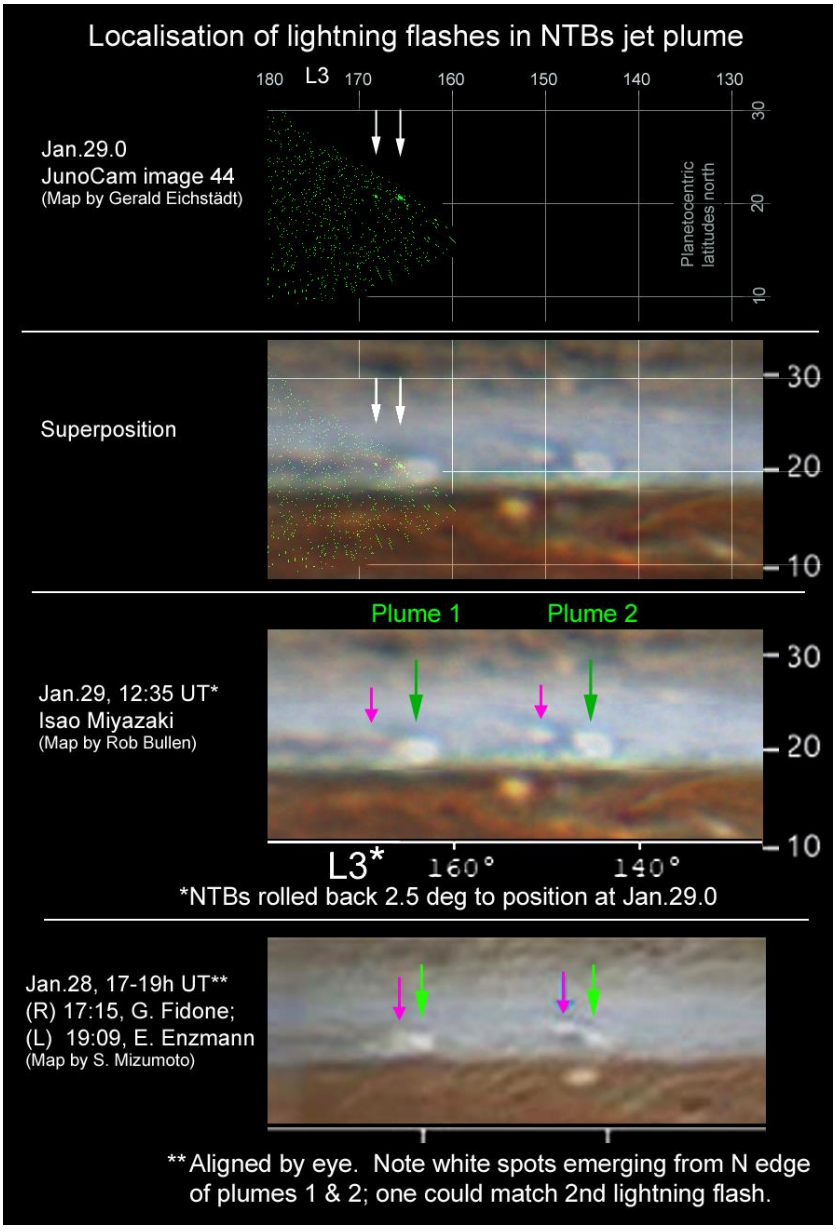


Figure 5. Alignment of the NTBs outbreak region from maps in Figures 2 & 3, showing how the lightning flashes come from the edge of the first plume and just west of it.



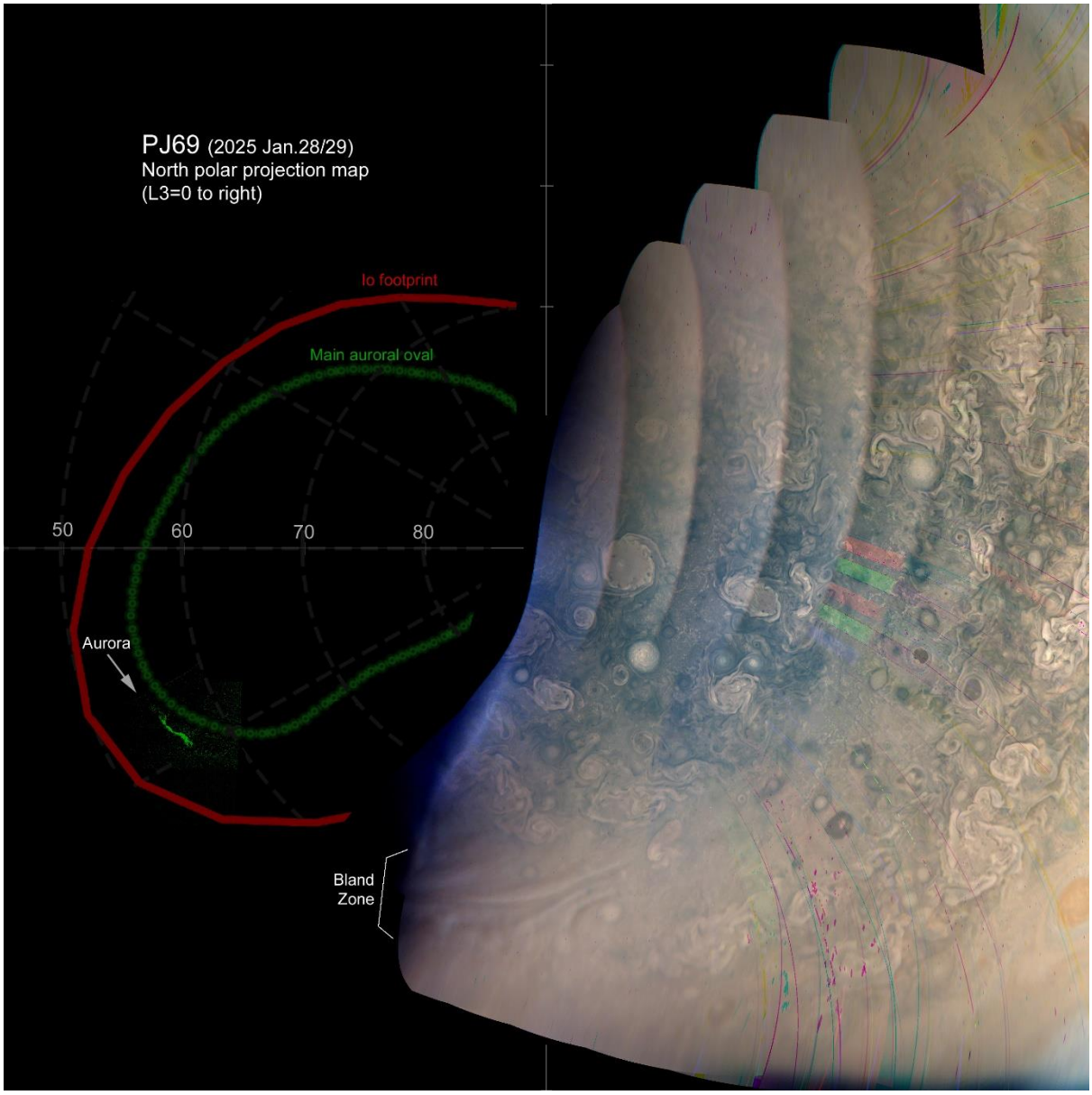


Figure 6. North polar projection map of the JunoCam images, down to 45ºN at edges, including the aurora from image 44. The standard positions of the main auroral oval (on average) and of Io's magnetic footprint are marked.

Figure 7. South polar projection map of the JunoCam images, down to 45ºS at edges.

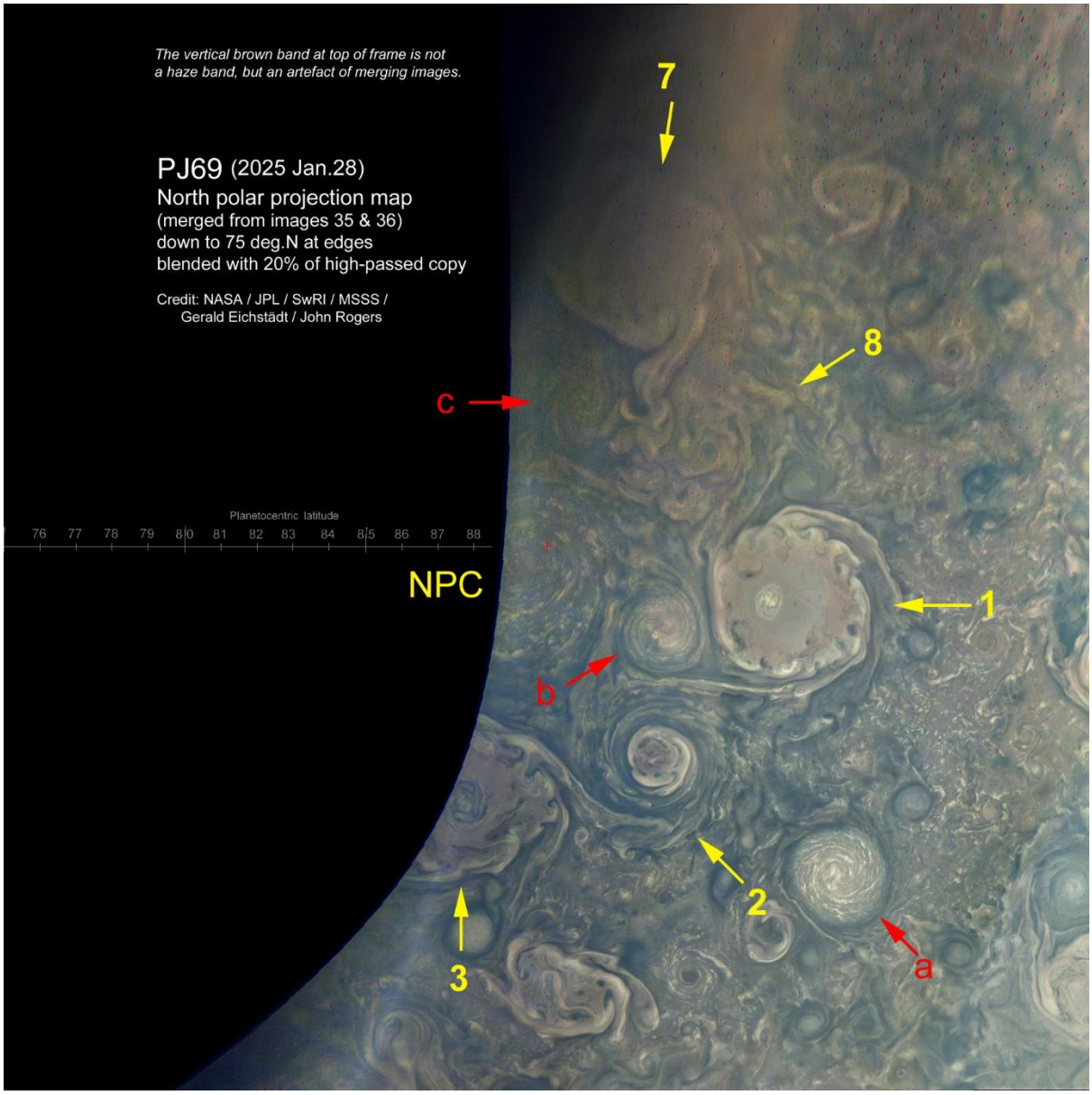


Figure 8. North polar projection map of the JunoCam images, down to 75ºN at edges, showing the CPCs and associated AWOs. (A full-size, unlabelled version of this map is in the associated ZIP file.)

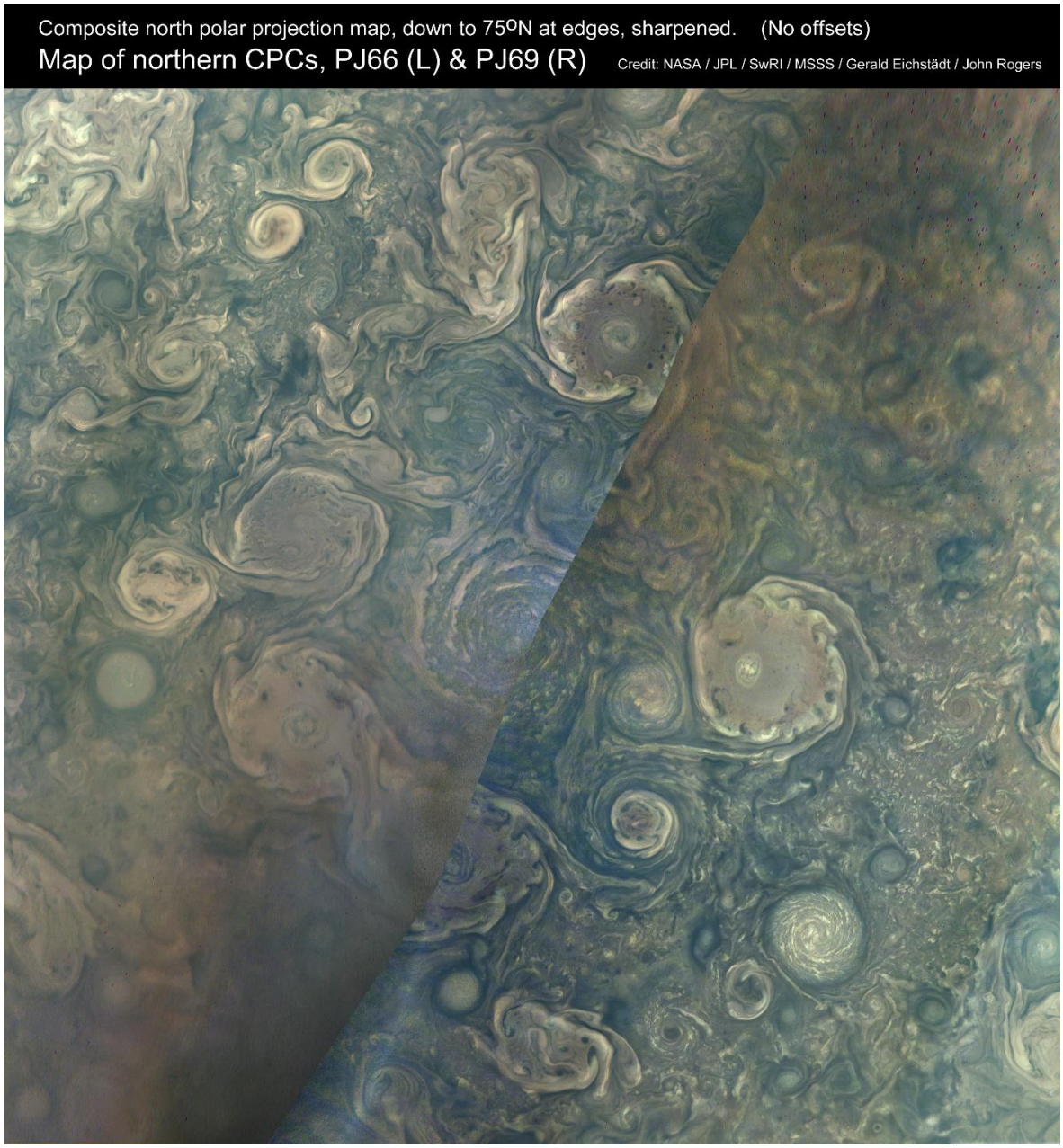


Figure 9. Composite map of the octagon of CPCs from PJ66 and PJ69.

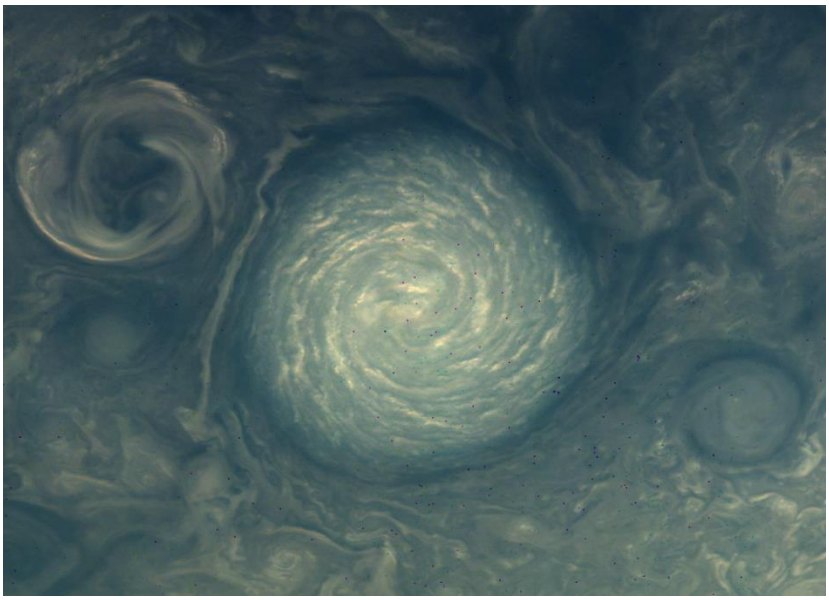


Figure 10. Closeup of the long-lived AWO-a, just outside the octagon of cyclones (PJ69 image 35).