

JunoCam at PJ58: Part II: Jupiter images

John Rogers (BAA) (2024 March)

Juno's Perijove-58 was on 2024 March 3, four hours after its close flyby of Io which reduced the orbital period to 33 days. The orbital inclination was 83.1°. After passing over Jupiter's north polar region and crossing onto the night side, Juno passed through perijove at 48.5°N, and 20.5 minutes later it crossed the equator at L3 = 311. A ground-based map from images a few days earlier is in [Figure 1A](#), and some of the best ground-based images covering Juno's final approach track are in [Figure 1B](#) (compare [Figure 4](#)). [Figure 2](#) shows two of JunoCam's early images with the GRS and the shadow of Io.

Global map & northern domains

With JunoCam again working well, and enough inbound coverage before and after the Io flyby, it was possible to assemble a good global map ([Figure 3](#)). Features of particular interest are as follows ([Figures 4 & 5](#)).

NEB: In the global map, the two longest faded 'barges' (see our PJ57 map and earlier) are now indistinguishable from the surrounding NEB; one more compact one, with an ochre interior, is well shown in [Figure 4](#). Persistent 'rift' activity is leading to further northward extensions of the dark belt, which may be a slowly developing NEB Expansion Event (see our 2023/24 Report no.4). As part of this, the main bright rift has generated five successive anticyclonic dark spots (ADS) in the adjacent NTropZ (as tracked by Shinji Mizumoto), which persist for several weeks then fade. Three of them are present in [Figure 3](#), including ADS-1 (faded but beautifully imaged at PJ57) and ADS-5 (beautifully shown at PJ58, [Figure 4](#)). Note that the faded barge is methane-dark while ADS-5 is methane-bright, showing that the haze cover correlates with their circulation rather than their visual appearance.

NNTB to N4 domain: The N2 domain displays NN-LRS-1 ([Figure 4](#)), alongside orange NNTB, followed by a small dark cyclonic spot or 'mini-barge', and then a very long FFR ([Figure 5](#)). There is also a long FFR in the N4 domain and the two are linked across the N3 domain by a 'bridge' of turbulent FFR activity, which includes several likely thunderstorms ([Figure 5\(C\)](#), [white arrows](#)).

[Figure 5\(B\)](#) shows a particularly neat isolated cyclone-anticyclone pair in the Bland Zone.

[Figure 6](#) is a north polar projection map down to 45°N.

North polar region: Circumpolar cyclones (CPCs)

The PJ58 north polar map is not as complete as the PJ57 map, as JunoCam's field of view barely reaches the north pole, but there was enough to fill in the areas not covered at PJ57. [Figure 7](#) is a composite from both perijoves – the first time we have had such a pair since PJ46/47. [Figure 8](#) shows the PJ58 map alongside those from PJ53 onwards, with the CPCs labelled. The polygon of cyclones still consists of the same 8 CPCs that we have tracked since the first perijoves in 2016-17, surrounding the central North Polar Cyclone, even though their surroundings are constantly changing.

Animation (posted herewith): Animation of PJ58 map pairs showing the three ‘filled’ CPCs. *Right:* images 54 & 60 (26.0 minutes apart) showing the rotation of the CPCs (and extra cyclone) as a whole. CPCs-3 & 4 show an impressive interaction, and this animation confirms that it is a collision between outer lobes of the two cyclones; obviously the structure will not last for as long as one rotation of a cyclone. Perhaps the other striking interactions that we sometimes see between CPCs are similarly transient. *Left:* hi-res images 58 & 60 (9.2 minutes apart), showing counter-rotation in the central regions of CPC-4 (slightly) and CPC-5 (very clearly).

In the labelled PJ58 map in [Figure 8](#), we see that the CPCs are unchanged, and there is also an extra cyclone on the left-hand side (‘X’). But there is no AWO clearly visible inside the octagon! The most economical explanation is that the AWO that was usually N of CPC-3 or -4 had migrated to be N of CPC-6 at PJ57, and has now merged with the more stable one N of CPC-7, which is probably just visible on the terminator.

To follow the recent history of these features in more detail, [Figure 8](#) is a set of our north polar maps from PJ53-PJ58 (down to 75°N, reduced to 40 px/deg). They continue the series from PJ49-PJ52 (in our PJ52 report) and the PJ46-PJ47 pair (in our PJ47 report; there were no images at PJ48) and previous maps. Note:

--The CPCs: No changes in their individual morphologies except for CPC-8. CPC-7 has always been displaced away from the pole.

--CPC-8 was a beautiful spiral from PJ46-PJ52. But then it was disturbed at PJ53 and PJ55, and chaotic at PJ54, PJ56 & PJ57, when it has seemed weak and in danger of being totally disrupted.

--The extra cyclone at the left edge, marked ‘X’. Such a cyclone was first seen here at PJ30, and persisted up to PJ40 [described in our PJ40 report]. It was notably large at PJ43, and still present at PJ45. Since then this region has only been imaged infrequently, as follows. At PJ50, cyclone ‘X’ was either absent or reduced to a smaller cyclone somewhat displaced. At PJ54 there was a double cyclone here, and now this rather small one at PJ58. (These are the only times this region has been imaged.)

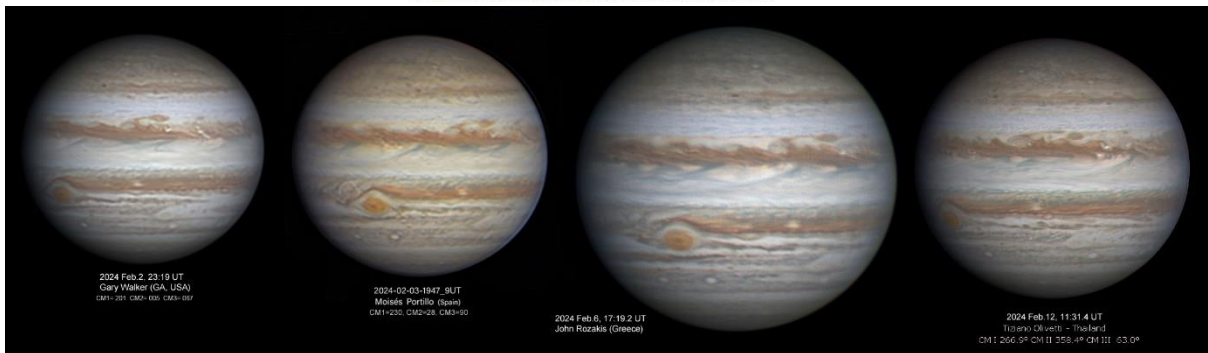
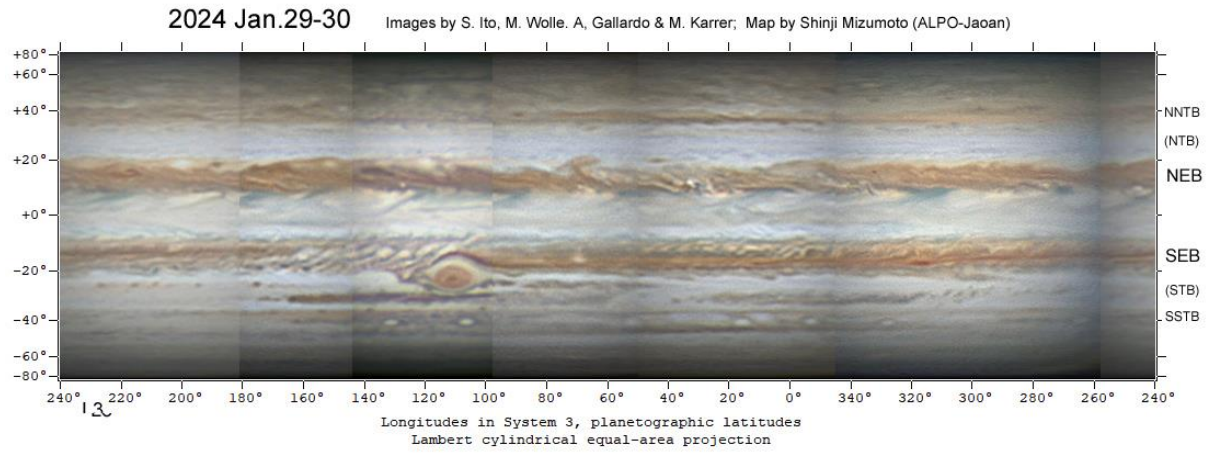
--AWO outside octagon, on lower side: This has stayed in roughly the same place from PJ52 to PJ57. Prior to that, if the identifications are correct, it was drifting anticlockwise around the periphery of the octagon at latitude 79°N (in keeping with the sense of circulation of the CPCs), at least from PJ47 to PJ51, after which it probably merged with a smaller AWO and stopped moving. [See our PJ52 report.]

--AWOs inside octagon. There is usually one N of CPC-7; it was absent at PJ46, but a small vortex reappeared there at PJ51, and from PJ52 to PJ57 it was a small AWO, fixed in position. There has also been one N of CPC-3/4/5 at many PJs, swinging unpredictably in longitude. (It was present whenever viewed from PJ40 to PJ55; the region was not observed at PJ56 or PJ57.) But at PJ57, there was an AWO N of CPC-6, which may have been the same oval that had suddenly accelerated around the pole, close to the AWO N of CPC-7. Perhaps they merged; the resulting oval may be just visible, very blurred, at the edge of the PJ58 field of view.

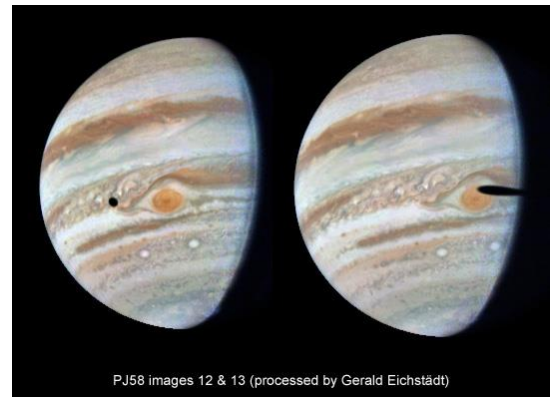
South polar region

The PJ58 south polar images, like those at PJ57, show a plethora of haze bands at the terminator, and part of the Long Band (not shown here). A composite map of the south polar region is [Figure 9](#). Three of the CPCs can be seen protruding from the polar darkness (yellow arrows).

Figures (small copies) are on following pages:

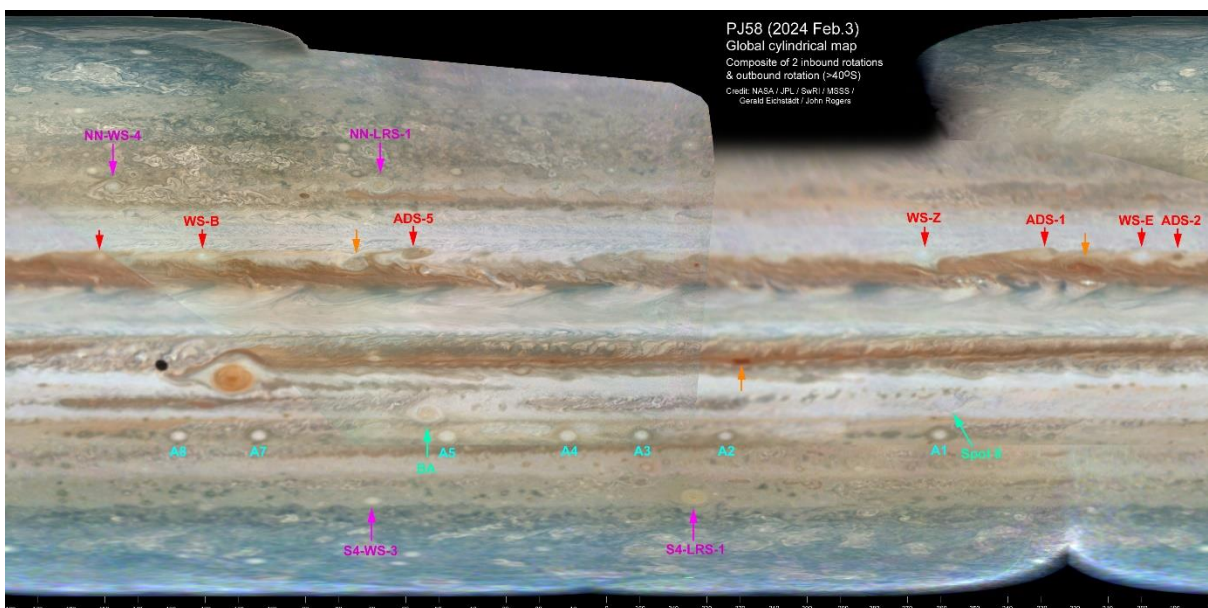


Above: **Figure 1(A & B).**

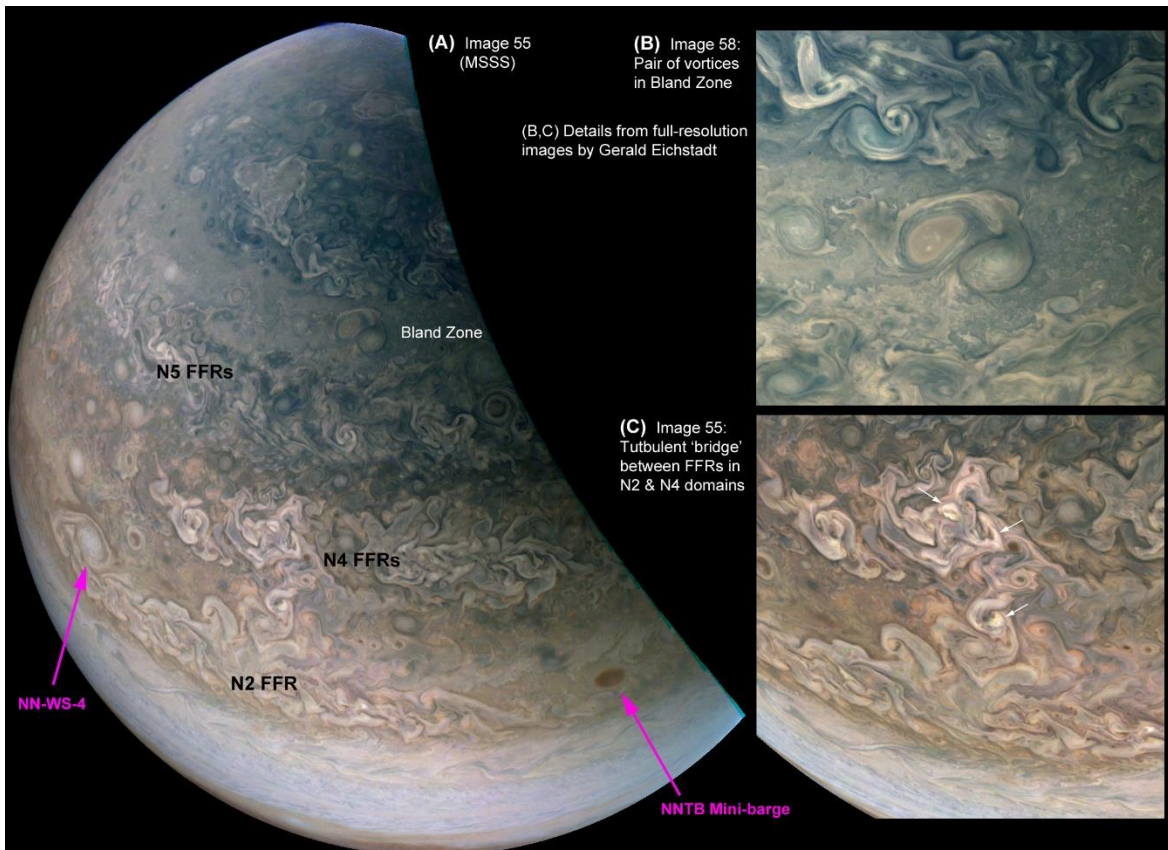
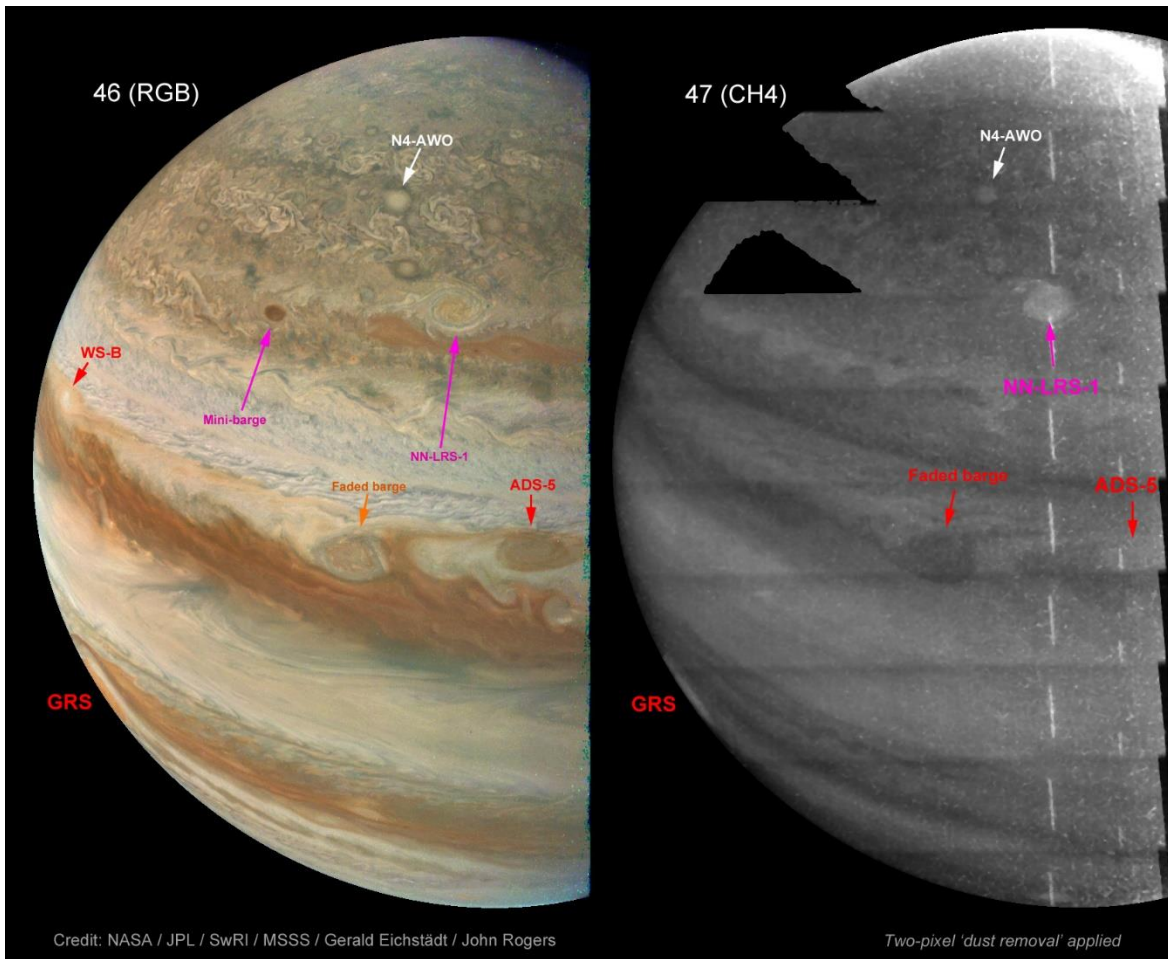


Right: **Figure 2.**

Below: **Figure 3.**



Below: **Figures 4 & 5**



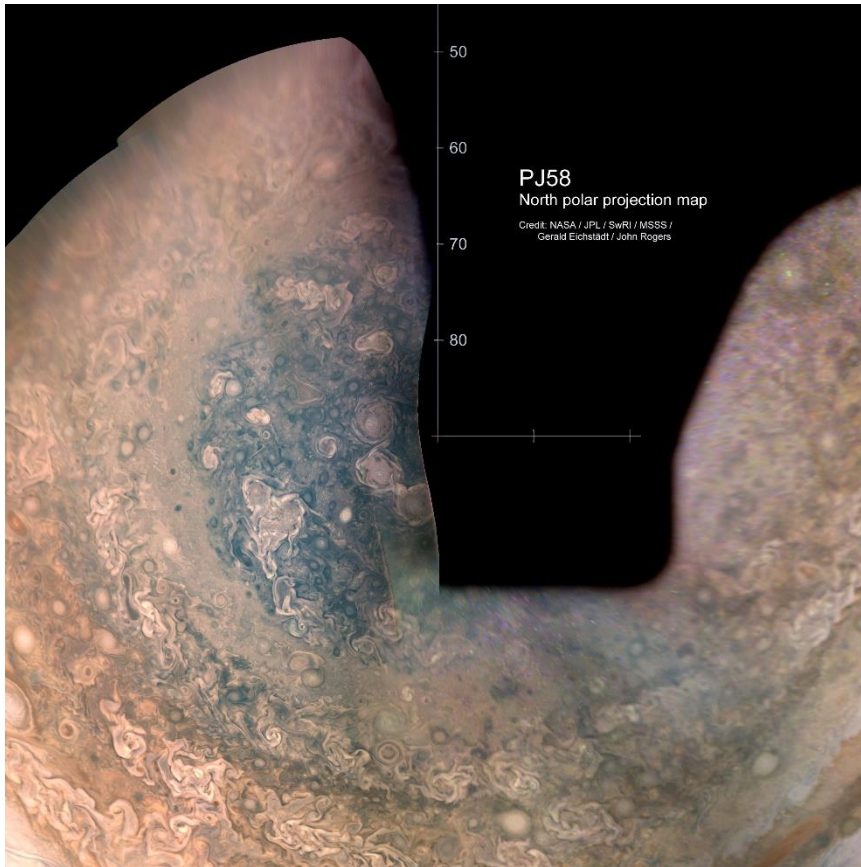
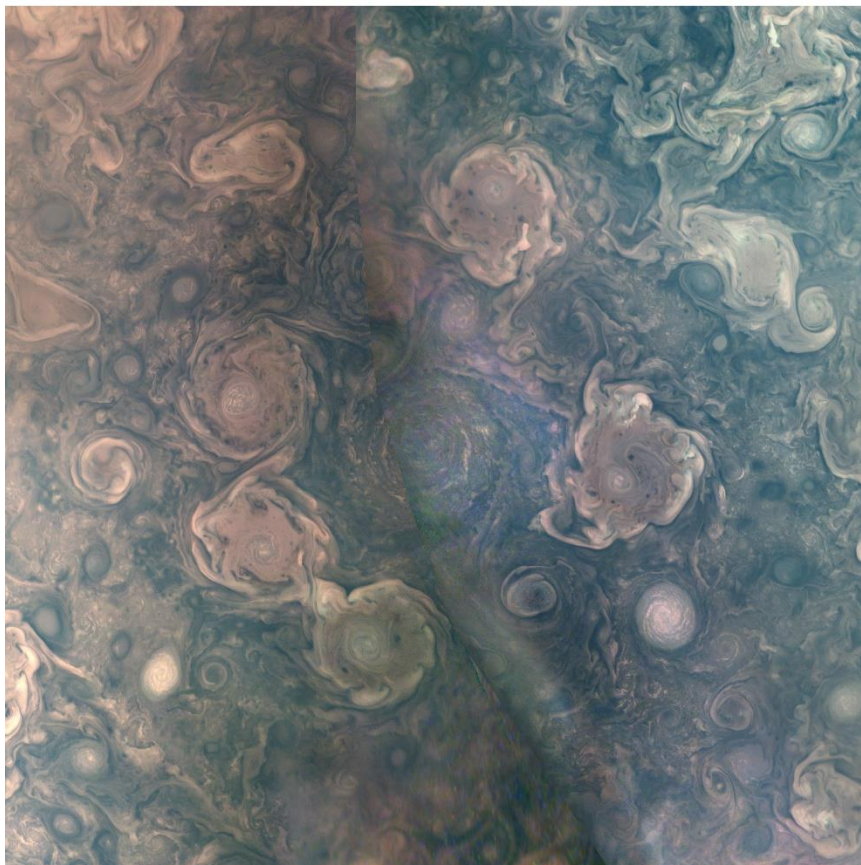


Figure 6.

Northern circumpolar cyclones (PJ57 & PJ58)



PJ58

Credit: NASA / JPL / SwRI / MSSS / Gerald Eichstädt / John Rogers

PJ57

Figure 7.

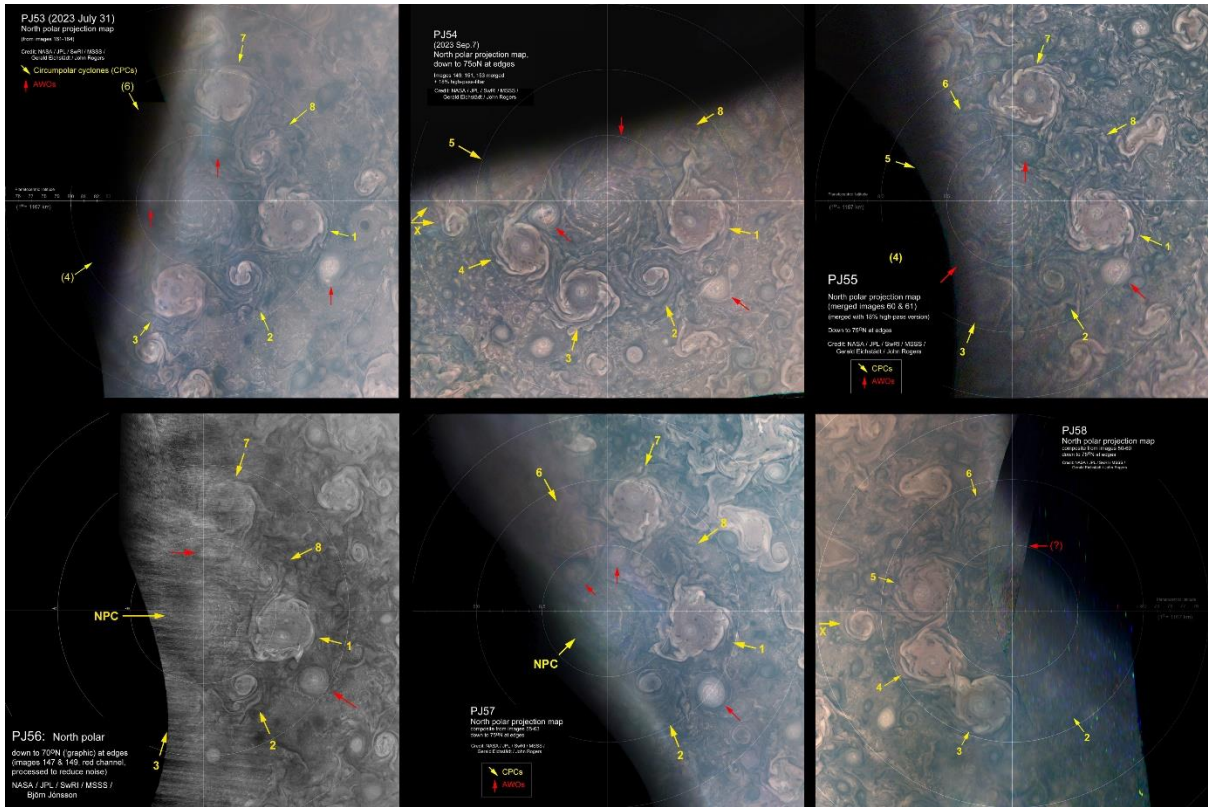


Figure 8.

PJ58 South polar projection map (down to 45°S at edges) Credit: NASA / JPL / SwRI / MSSS / Gerald Eichstädt

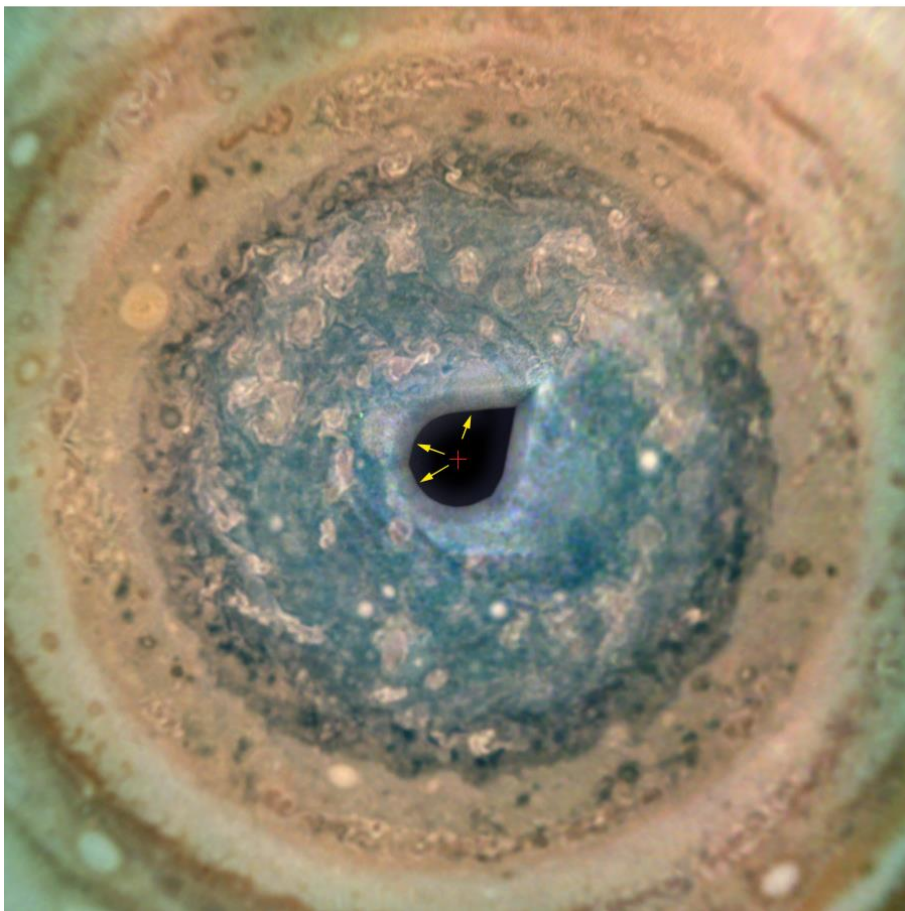


Figure 9.