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Morphological and Positional Changes in Jupiter's Northern Polar Cyclones ►

Shawn Brueshaber, Isabel Williams, John H. Rogers, Gerald Eichstadt, Glenn Orton, Candice Hansen, Leigh N. Fletcher, and Scott Bolton

Juno continues to observe the evolution of Jupiter’s circumpolar cyclones (CPCs) with JunoCam, JIRAM camera/spectrometer, and the Microwave Radiometer. The CPCs have distinctive cloud features, and unique characteristics that, at least in visible and infrared wavelengths, broadly classify into two morphological forms, “filled,” and “chaotic” as in Tabataba-Vakili et al. 2020. We call the chaotic form “spiral” (Fig. 1).

As revealed by JunoCam, the filled CPCs typically appear with large, visibly bright features on the periphery, similar in appearance to a circular saw blade. Just inward, a nearly uniform darker region appears, occasionally displaying small hole-like openings, appearing bright at 5 μm . These darker regions (e.g., Fig. 1 left, CPC #3 & Fig. 2 left) are probably a result of flat, generally non-convective stratiform clouds. The overall appearance of the periphery and just inward is reminiscent of shear-like instability in the flow, distorting the flow into the “blade-like” shapes. Anticyclonic circulation has been witnessed in the center of several filled CPCs. Lightning has also been observed by JunoCam in one of the blade-like cloud features during PJ 31, and we occasionally observe thin, bright curvilinear cloud features and clusters of bright clouds with shadows indicating vertical structure.

The spiral CPCs (Fig. 3), including the central, north polar cyclone have a different morphology than the filled cyclones, appearing as flocculent and tightly wrapped series of alternatively bright and darker spirals. Interestingly, CPC #2 has partially transformed from a chaotic morphology into a filled morphology, similar perhaps to how oval cyclones and barges in the low latitudes can sometimes transform into folded-filamentary cyclones (e.g., Clyde’s Spot; Hueso et al. 2022). Microwave radiometry strongly suggest that the north polar cyclone (NPC) is a third class of polar cyclone that morphologically appears as a spiral type but has a different vertical brightness temperature structure than possessed by any of the CPCs.

This work documents the cloud-top structure of Jupiter’s polar cyclones, their changes, and their positions, which extends the results in Tabataba-Vakili et al. 2020. High resolution modeling seeking to understand the dynamical mechanisms driving the distinct morphologies will require detailed observational “ground-truths,” which this work provides.

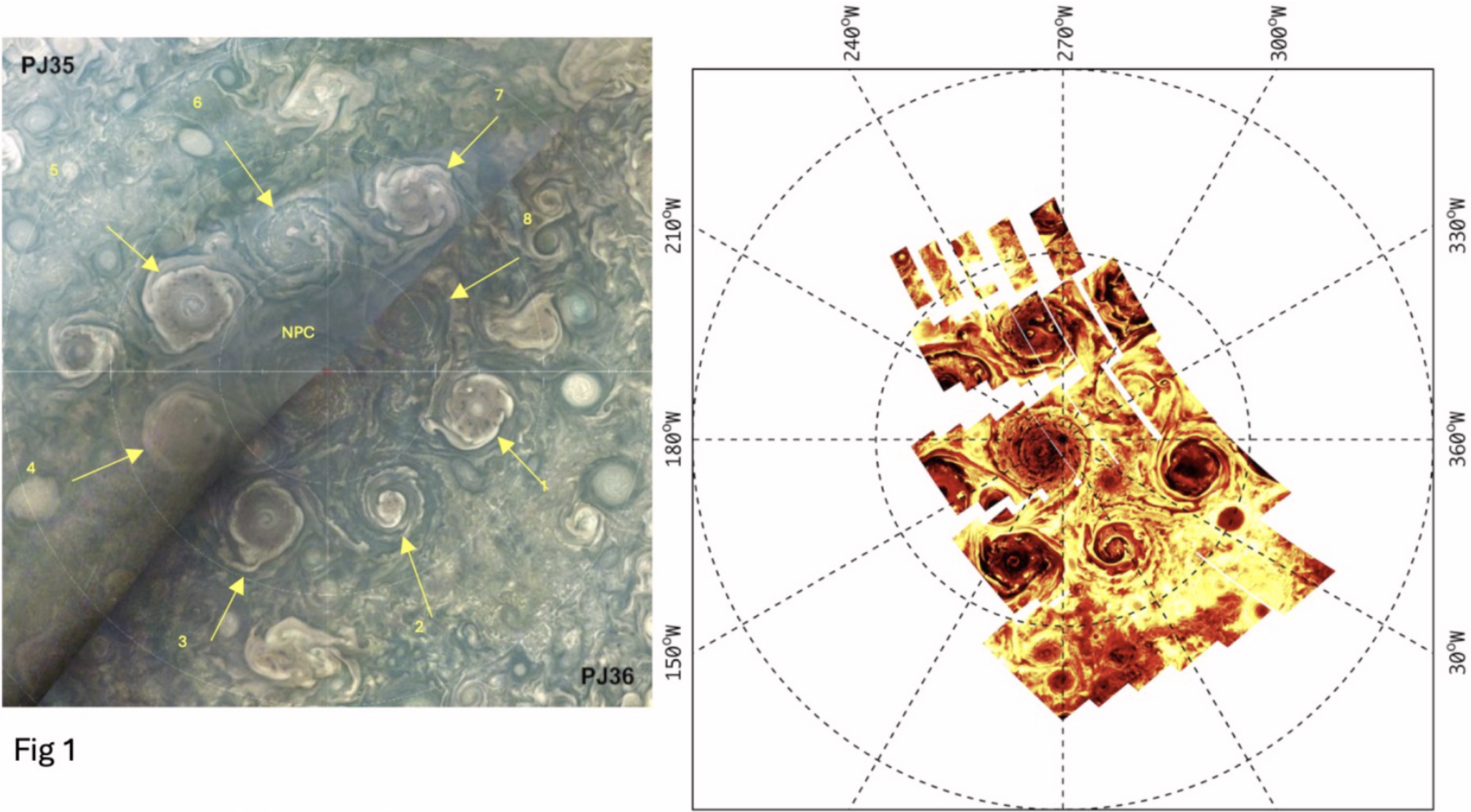


Fig 1

Fig 2

Fig 3