EPSC Abstracts
Vol. 12, EPSC2018-843, 2018
European Planetary Science Congress 2018

JunoCam Imaging Jupiter through PJ14

M. A. Ravine (1), C. J. Hansen (2), G. S. Orton (3), C. Thepenier (3), T. W. Momary (3), M. A. Caplinger (1), S. K. Atreya (4), A.P. Ingersoll (5), S. J. Bolton (6), F. Tabataba-Vakili (3), J. H. Rogers (7) and G. Eichstädt (8).

(1) Malin Space Science Systems, San Diego, California, USA (ravine@msss.com), (2) Planetary Science Institute, Tucson, Arizona, USA, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA, (4) University of Michigan, Ann Arbor, Michigan, USA, (5) Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California, USA, (6) Southwest Research Institute, San Antonio, Texas, USA, (7) British Astronomical Association, London, UK and (8) Independent scholar, Stuttgart, Germany.

Abstract

Juno's imaging system, JunoCam, acquired moderate- to high-resolution color images of Jupiter over all latitudes. We have detected a variety of features in these images, for example: long-lived circumpolar cyclones, very small cumulus-like cloud features generically referred to as "pop-up clouds", high-altitude hazes, and an abundance of "mesoscale" wave trains.

1. Introduction

Juno's imaging system, JunoCam, has acquired color images of Jupiter for thirteen of the first fourteen perijove passes (PJ1 through PJ14, but not PJ2). The moderate-resolution polar images and high-resolution images at lower latitudes show an atmospheric circulation much more complex than previously detected.

2. JunoCam Instrument

JunoCam has a single CCD detector with an integral color-strip filter that enables the instrument to image in four color bands—blue, green, red and the 889-nm methane band. The JunoCam lens maps a field of view of 58° across the width of the detector, perpendicular to the spacecraft scan direction. Repeated readout of the filtered sections of the CCD with rotation allows JunoCam to build up a color image. While the nominal design life of the camera was eight perijove passes, it continues to function after fourteen passes with no radiation-induced degradation. For details, see Hansen et al. (1).

3. JunoCam Imaging

Around each perijove pass of the Juno spacecraft, JunoCam acquires multiple half-disk color images of the North and South Poles at high emission angle (> 70°). These images have a spatial scale at the cloud tops of ~50 km/pixel. Resolution increases at lower altitudes and latitudes, to a minimum of less than 5 km/pixel at perijove.

3.1 Circumpolar Cyclones

Circumpolar cyclones continue to be static in System III and have not changed their fundamental configuration (**Figure 1**), with eight around the north polar and five around the south pole (2). They rotate cyclonically with velocity increasing with radius from the center. Their centers are generally unmoving or in one case, actually anticyclonic.

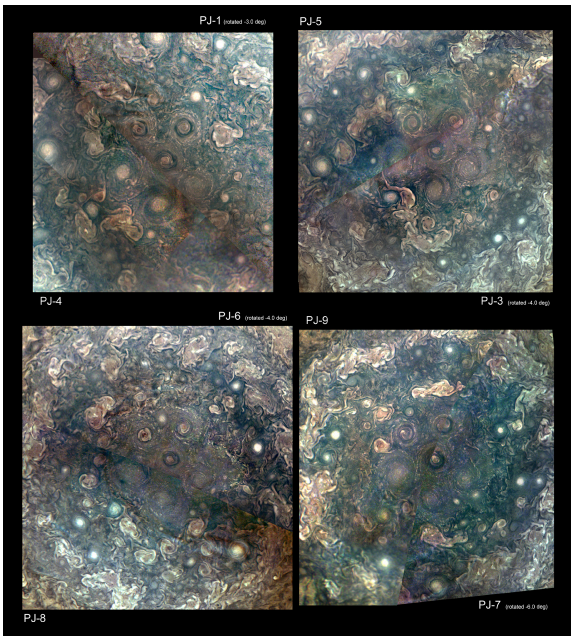

Figure 1: Southern Circumpolar Cyclones have been stable in System III for more than one year.

3.2 "Pop-up" Clouds

These are detected in several regions identified with upwelling, usually bright clouds (**Figure 2**), as well as with brighter banded features within the Great Red Spot. They are on the order of 50 km or smaller – down to the resolution limit of the instrument, often with shadows around the same size.

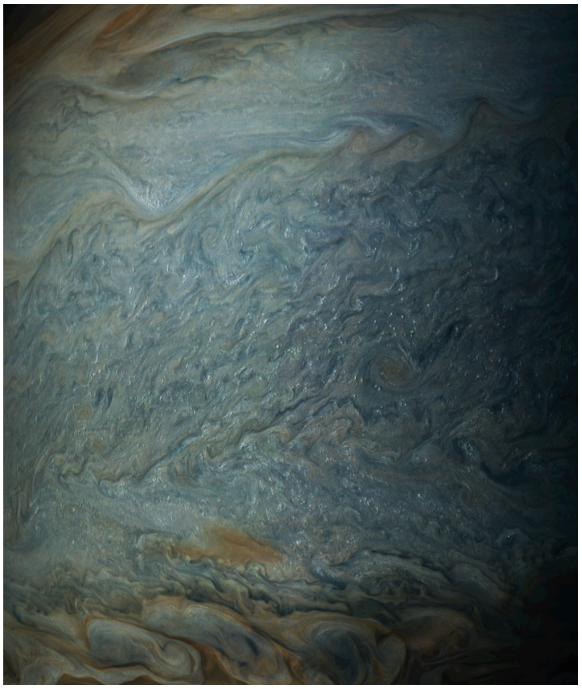

Figure 2: "Pop-up" clouds in the South Temperate Zone, PJ6.

3.3 Mesoscale Waves

We have detected numerous instances of wave trains with wavelengths mostly smaller than those of the mesoscale gravity waves detected by Voyager, Galileo, New Horizons and the Hubble Space Telescope. They are on the same size of the shortest wavelengths detected by the Voyager-2 imaging system. Their wavelengths lie within the 70 - 190 km range (**Figure 3**). Excepting one occurrence at the northern margin of the Great Red Spot, all were found with 10° latitude of the equator. Because of the constrained time sampling dictated by Juno's orbit, it is not possible to estimate the phase velocity of these wave, placing limitations on assessment of alternative mechanisms for their origin.

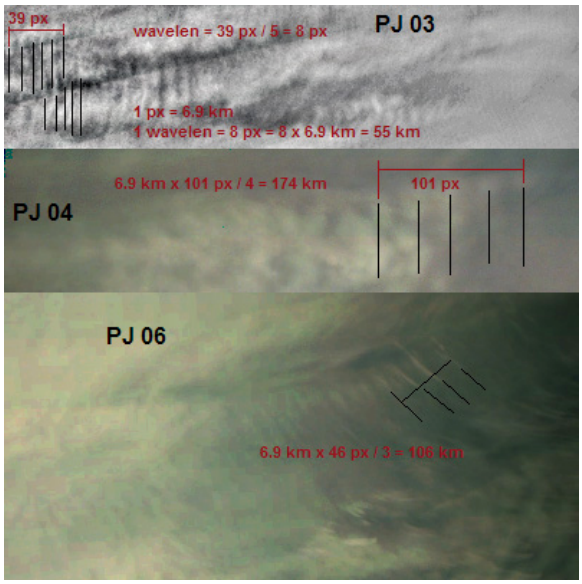

Figure 3: Examples of mesoscale waves.

4. Summary and Conclusions

JunoCam has acquired observations of Jupiter on fourteen successive Juno orbits, revealing a diversity of atmospheric features not previously observed. Orton et al. (3) provide a more detailed discussion of the polar features, as observed in Juno's first perijove. JunoCam will continue these observations for the rest of the Juno Mission.

Acknowledgements

This research was funded by the National Aeronautics and Space Administration through the Juno Project. A portion of these funds were distributed to the Jet Propulsion Laboratory, California Institute of Technology. All JunoCam images can be obtained on the Mission Juno web site (https://www.missionjuno.swri.edu).

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