A LARGE-SCALE DISTURBANCE IN A SINGULAR TRIPLE VORTEX IN SATURN'S ATMOSPHERE

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Introduction: The zonal wind profile of Saturn, has a singular structure, with a double peak that reaches maximum zonal velocities close to 100ms^{-1}[1]. In this region, a singular triple vortice formed in 2012 and has remained active until present, confirming that vortices in Saturn can be long-lived [2]. In May 2015 a disturbance started to develop at the location of the triple vortex. Since at the time Cassini orbits were not favorable to the observation of the region, we were granted Director Discretionary Time of the Hubble Space Telescope to observe the region before the perturbation faded away. Here we report the properties of the triple vortex and of the disturbance that developed at its location.

The tripole system: History, evolution and local motions: Cassini ISS images captured with CB2 and MT3 filters suggest that the triple vortex consist of a cyclone surrounded by two anticyclones. The three vortices are almost circular, with diameters ~2000-3000km (See figure 1). We have tracked the motion of the system since 2012. The system is located at an average 58.5º±0.8ºN, and it drifts 11.55º/day, u=69.0±1.6ms^{-1}, essentially following the wind profile, with slight oscillation of amplitude ~10º and a period of ~8 months.

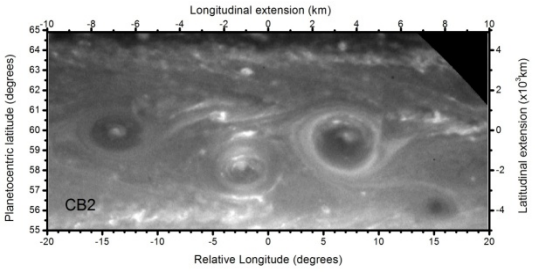

Figure 1: Map projection of a Cassini ISS image of 27 Feb 2013 showing the ACA system.

Using Cassini high resolution images, we detected and measured local motions within the vortices. They confirm the cyclonic/anticyclonic character of the vortices, and allow us to estimate the eddy vorticity, of the order of 3±2×10^{-5}s^{-1} in the cyclon, and -5±2×10^{-5}s^{-1} and --3±2×10^{-5}s^{-1} in the case of the two anticyclones.

The disturbance: Using images captured from Earth, we found that the disturbance expanded eastwards at -1.65º/day. Cassini images at the time of the disturbance showed the presence of a vortex south of the system at 55ºPC that was again visible at the expected location of the end of the disturbance once it had subdued, in Sep 2015, and which could be found in earlier images, approaching the tripole at 1.70º/day. This suggests that the the origin of the disturbance is the interaction of this vortex with the tripole.

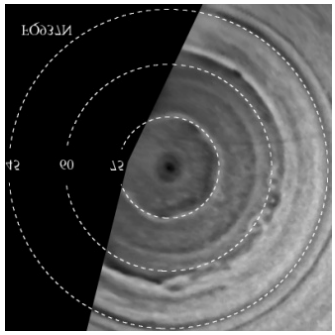

Figure 2: The disturbance in a polar projections of a HST WFC image of the 30-06-2015.

HST WFC images (see Figure 2) allowed us to retrieve motions of local features in the perturbed region at the time of the disturbance. They follow within error the average zonal wind profile, showing that the dynamics of the region is dominated by the advection by the zonal winds and confirming that the disturbed area is the result of the advection of the clouds created by the interaction of the tripole with the vortex at the south.

References

[1]Del Genio, et al. (2009) Chaper 6 in: Saturn after Cassini-Huygens. M. Dougherty, L. Esposito and T. Krimigis (edt.), Springer-Verlag, 113-159.
[2]del Río-Gaztelurrutia,et al. (2010). Icarus, 209, 665-681.

Acknowledgements

Work supported by AYA2015-65041-P; Grupos Gobierno Vasco IT-765-13; and UFI11/55 (UPV/EHU). We acknowledge the three orbits from HST assigned for this research (DD Program 14064, IP A. Sánchez-Lavega).