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Atmospheric spirals in spring time on the edge of the North Pole of Mars

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We report on atmospheric of dynamical phenomena observed at the edge of the North Polar cap of Mars during the Northern Hemisphere Spring Equinox, before aphelion. We used images obtained by the Visual Monitoring Camera (VMC) [1] and High Resolution Stereo Camera (HRSC) [2] onboard Mars Express. VMC images were analyzed with tools described in previous works [3-4] and HRSC images were analyzed from map-projections.

The observations cover the period from March 3 to October 6, 2019, corresponding to the solar longitude range $L_s = 350^\circ - 90^\circ$ (Martian Years 34 to 35). We observed a rich phenomenology typical of this season [5] consisting on the continuous formation of circumpolar dust patches, large frontal arc-shaped features, flushing and textured local dust storms and spirals of dust and water ice clouds at latitudes $60^\circ\text{N}-70^\circ\text{N}$. In this presentation we concentrate on the study of three spiral systems and their dynamical properties comparing the phenomena with previously observed cyclonic systems [6].

Two large spiral systems were observed on 26-27 May 2019 ($L_s = 30^\circ$) centered at latitudes and longitudes ($55^\circ\text{N}, 346^\circ\text{E}$) and ($67^\circ\text{N}, 240^\circ\text{E}$) with a zonal length of 1,000 – 2,100 km and meridional size ~ 700 and 800 km. They moved with velocities of 17 and 40 m/s. The first one was formed by a mixture of dust and water-ice clouds and the second only by dust. The third system consisted in two coupled spirals observed on 4 October 2019 ($L_s = 88^\circ\text{N}$) at ($69^\circ\text{N}, 183^\circ\text{E}$) with a zonal length of 1,260 km and meridional extent 540 km and centers separated by 2,230 km moving together with a velocity of 41 m/s. We present other properties of such vortices and discuss the possible baroclinic nature for their origin.

References:

[1] Ormston, T. et al., Acta Astronautica, **69**, 703-713 (2011)

- [2] Jaumann, R. et al., *Planetary and Space Science*, **55**, 928-952 (2007)
- [3] Sánchez-Lavega, A. et al., *Icarus*, **299**, 194-205 (2018)
- [4] Hernández-Bernal, J. et al., *Geophys. Research Lett.*, **46**, 10330-10337 (2019)
- [5] Kahre, M. A. et al. The Mars Dust Cycle, in R. Haberle, R. T. Clancy, F. Forget, M. D. Smith and R. W. Zurek (Eds.), *The Atmosphere and Climate of Mars* (pp. 295-337). Cambridge, U.K. Cambridge University Press. (2017)
- [6] Sánchez-Lavega A. et al., *J. Geophys. Res.*, **123**, 3020-3034 (2018)