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Titan's neutral atmosphere seasonal variations up to the end of the Cassini mission

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In our recent publication [1] we reported new results concerning the seasonal atmospheric evolution near Titan's poles and equator in terms of temperature and composition using nadir spectra acquired by the Cassini Composite Infrared Spectrometer (CIRS) at high spectral resolution during the last year of the Cassini mission in 2017 complementing previous investigations covering almost two Titan seasons. In previous papers [2,3], we reported on monitoring of Titan's stratosphere near the poles after the mid-2009 northern spring equinox. In particular we have reported on the observed strong temperature decrease and compositional enhancement above Titan's southern polar latitudes since 2012 and until 2014 of several trace species, such as complex hydrocarbons and nitriles, which were previously observed only at high northern latitudes. This effect accompanied the transition of Titan's seasons from northern winter in 2002 to northern summer in 2017, while at that latter time, the southern hemisphere was entering winter. Our new data, acquired in 2017 and analyzed here, are important because they are the only ones recorded since 2014 close to the south pole in the mid-infrared nadir mode at high resolution. A large temperature increase in the southern polar stratosphere (by 10-50 K in the 0.1 to 0.01 mbar pressure range) is found associated with a change in the temperature profile's shape. The 2017 observations also show a related significant decrease in most of the southern abundances which must have started sometime between 2014 and 2017 [1]. For the north, the spectra indicate a continuation of the decrease of the abundances which we first reported to have started in 2015 and small temperature variations [1]. We discuss comparisons with other results and with current photochemical and dynamical models which could be updated and improved by the new constraints set by the findings presented here.

[1] Coustenis et al., 2019, Icarus 344, 1 July 2020, 113413 ; [2] Coustenis et al., 2016, Icarus 270, 409-420; [3] Coustenis et al., 2018, Astroph. J. Lett. 854, no2.