

Temporal variations in the stratosphere within a Titan year

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Abstract

We have probed Titan's stratosphere (150-450 km) using Cassini/ CIRS nadir spectra taken during the past 5 years by averaging the spectra and binning them over 10° in latitude for both medium (2.5 cm^{-1}) and high (0.5 cm^{-1}) spectral resolutions. Latitudinal variations were previously inferred in a number of works (Flasar et al., 2005; Coustenis et al., 2007, 2010; Vinatier et al., 2007, 2010; Teanby et al., 2006, 2007, 2008). Here, we have looked for temporal variations in temperature and composition, within the duration of the Cassini mission with CIRS data but also with respect to the measurements taken during the Voyager encounter in 1980, almost a Titan year ago. For variations within the Cassini mission we have formed 5 year-around spectral selections (one for each mission year from 2005 to 2009) in the FP3 and FP4 CIRS focal planes and searched for variations in temperature and composition at northern (around 50°N) and southern (around 50°S) latitudes. We look for variations in temperature and composition as the season on Titan progresses. The results show that the gases generally increase in abundance from 2004 to 2009 in the northern hemisphere and decrease in the southern in agreement with (Teanby et al. 2008). When compared to the Voyager data (res= 4.3 cm^{-1}), we find the current mixing ratio values for the gaseous components to be lesser in the Northern hemisphere with a possible indication for interannual variations, because - for at least some of the species - the abundances will not reach the enhancement in the North found in 1980. The contrary trends are observed in the South. We test GCM from the work of Rannou et al (2005). We also compare with the

disk-average results from ISO (1997). With this study we seek to set constraints on seasonal, photochemical and circulation models and to make predictions as to the spatial variations of the chemical composition on Titan for the upcoming years, when the season will finally become exactly the one of the Voyager encounter in 1980 and then move towards summer solstice in the north during the Cassini extended Solstice mission.

References

Coustenis, A., et al., Icarus, 189, 35, 2007.
Coustenis, A., et al., Icarus 207, 461-476, DOI: 10.1016/j.icarus.2009.11.027, 2010.
Flasar, F. M., et al., Science, 308, 975, 2005.
Rannou, P., et al., Adv. Space Res. 36, 2194-2198, 2005.
Teanby, N., et al., Icarus 181, 243, 2006.
Teanby, N., et al., Icarus 186, 364, 2007.
Teanby, N., et al., Icarus 193, 595, 2008.
Vinatier, S., et al., Icarus, 188, 120, 2007.
Vinatier, S., et al., Icarus, 205, 559-570, 2010.