EPSC Abstracts
Vol. 7 EPSC2012-561 2012
European Planetary Science Congress 2012

Aerosol size in the Titan detached haze layer vs latitude

T. Cours (1), P. Rannou (1), P. Lavvas (1), and S. Rodriguez (2)
(1) Groupe de Spectrométrie Moléculaire et Atmosphérique (GSMA), CNRS UMR-6089, Université de Reims Champagne-Ardenne, 51687 Reims Cedex 2, France, (2) Laboratoire AIM, Université Paris 7, CNRS UMR-7158, CEA-Saclay/DSM/IRFU/SAp, 91191 Gif/Yvette, France.

Abstract

Titan, the largest moon of Saturn, has a dense atmosphere of about 1.4 bar composed of 98% of nitrogen, 1.4 to 5% of methane and a wide variety of organic trace species produced by a complex photochemistry. Some of these species polymerize to form several haze layers. The most remarkable feature is a global detached haze layer around 500 km, which dropped by 150 km at the equinox [1]. In a previous work [2], we have given an explanation about the origin of the detached haze layer: a dynamical and photochemical origin. In this work we analyzed several images of Titan taken by the ISS camera in order to study this detached haze layer along the latitude, more precisely, in order to study the size distribution of aerosols as function of the latitude.

1. Data and Methods

1.1 Data

To characterize the detached haze layer along the latitude, we used large phase angle images acquired by Cassini probe with the ISS camera at different dates between 2005 and 2008, at 2 phase angles and with different filters. Each image is calibrated in radiance factor (I/F, where I is intensity and πF is the incident solar flux) and geo-referenced. We have taken I/F in the range of latitude 60°S – 60°N and 500 km altitude. To perform the analysis, we assumed that the altitude (500 km) and the number of particles do not vary in the detached haze layer between 2005 and 2008 [1].

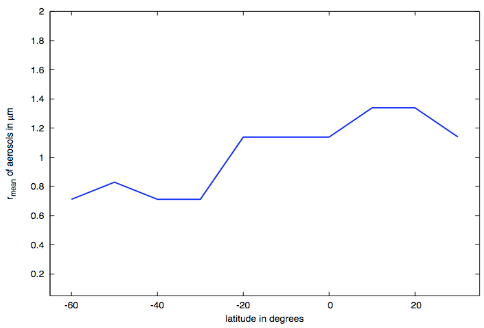
1.2 Methods

To model the scattering of the detached haze layer we used a spherical shell model. We computed first the single scattered intensity for phase angle by a ray tracing model. Then we corrected for the multiple scattering with a scaling factor. This scaling factor was computed with the SHDOMPP radiative transfer solver [3]. Then the radiance factor I/F was computed. In the detached haze layer, the aerosols are distributed in size. The previous work [1] has showed that we could take a 1-exponent law to represent the aerosol size distribution. In this study, we computed the ratio between the I/F at large phase angle and the I/F at a lower phase angle. The computed ratio was compared to the observed ratios taken at different latitudes (range 60°S – 60°N). Thus, the parameter of the size distribution law was fitted to give the best fit between the observed and the computed I/F ratio. The fit was controlled by a χ^2 test.

2. Results

The first results show that the mean radius of the aerosols slightly increases from the southern latitudes to the northern latitudes in the range 60°S - 30°N. In the same way, the exponent of the aerosol size distribution law slightly changes from south to north. These preliminary results are consistent with a dynamical origin of the detached haze layer. The results concerning the range 30°N – 60°N will be presented.

The figure below shows the preliminary results, the mean radius of the aerosols vs latitude. The mean radius tends to increase from the southern latitude (summer hemisphere) to northern latitude (winter hemisphere).



References

[1] West, R. A., Balloch, J., Dumont, P., Lavvas, P., Lorenz, R., Rannou, P., Ray, R., and Turtle, E., Geophysical Research Letter, Vol. 38, L06204, doi:10.1029/2011GL046843, 2011.

[2] Cours, T., Burgalat, J., Rannou, P., Rodriguez, S., Brahic, A., and West, R.A., Astrophysical Journal Letters, Vol. 741, L32 , doi:10.1088/2041-8205/741/2/L32, 2011.

[3] Evans, K. F. 1998, J. Atmos. Sci., Vol. 55, 429, 1998.