ON THE POSSIBLE ALTITUDE THICKENINGS OF AEROSOL COMPONENT IN THE SATURN ATMOSPHERE. O. S. Ovsak[1], [1]Main Astronomical Observatory of the NAS of Ukraine, Zabolotnoho Street 27, Kyiv, 03143, ovsak@mao.kiev.ua.

Introduction: On the visible disk of Saturn there are latitudinal belts that differ in shades of color, contrast and brightness. This may indicate the diversity of physical and/or chemical characteristics and also the altitude and spatial distribution of aerosols in the atmosphere of this giant planet. So far, studies of Saturn's atmosphere are based only on remote sensing data from ground and space telescopes, as well as several orbiters, such as the CASSINI. As a rule, the interpretation of such measurements is based on model calculations using the methods of radiation transfer theory and the use of researchers' assumptions about the probable chemical composition and vertical structure of the gas-aerosol layers in the Saturn atmosphere. However, there is an another way to determine the aerosols vertical characteristics. This is the effective optical depth (EOD) method. This report presents the probable vertical distribution of aerosol component densities obtained by combining the results of the paper [1] on the analysis of Saturn integral disk measurement data and the paper [2] for a number of latitudinal belts measurement data analysis.

Analysis method: In papers [1, 2], the pressure P dependence of the aerosol volume scattering coefficient $\sigma_a(P)$ in the atmosphere, averaged over the integral disk and in the separate latitudinal belts of the Saturn Northern Hemisphere was been determined, respectively. The analysis of measurement data was performed using the EOD method [3, 4], processing algorithms [5] and special computer program codes [6]. A model of a semi-infinite gas-aerosol medium with a polydisperse ensemble of spherical homogeneous aerosol particles with a modified gamma size distribution function used. The model parameters of aerosol particles are: the effective particle radius $r_{eff} = 1.4$ μm, the dispersion $v_{eff} = 0.07$ and the real part of the refractive index $n_r = 1.44$ all were obtained in [7] and confirmed [5, 8, 9]. In particular, in [2] the analysis is based on the results of [10]. Where the dependences on the pressure P of the aerosol scattering component $\tau^a_{eff}(P)$ of giant planet's atmosphere calculated, according to the measurements of the reflectivity of the latitudinal belts 17°, 33°, 49°, 66° of the Saturn Northern Hemisphere (hereinafter 17N, 33N, 49N, 66N belts) in the methane absorption bands with centers at 727 nm and 619 nm wavelengths. In [1] were used the results of analysis [11] of the Saturn geometric albedo measurements data in the wavelength range 300-1000 nm [12]. In both mentioned works [1, 2], using the algorithm [13], the dependences on the pressure of the aerosol volume scattering coefficient $\sigma_a(P)$ were calculated.

Results: Fig. 1 shows the maximum values of the coefficient σ_a and the vertical structure of aerosol layers thickenings in 17N, 33N, 49N, 66N latitudinal belts and for Saturn's integral disk. This structure contains four aerosol clots, designated 'cluster 1', 'cluster 2', 'cluster 3' and 'cluster 4'.

- The greatest scattering properties of the atmospheric aerosol are determined at two altitudes of the atmosphere. These are 'cluster 1' section, where the maxima of the coefficient σ_a values are located in the 230-290 mbar pressure range and 'cluster 2' section with the location of such maxima in the 370-620 mbar range. Note that the 66N latitudinal belt revealed two maxima of the coefficient σ_a in the 'cluster 2' section.

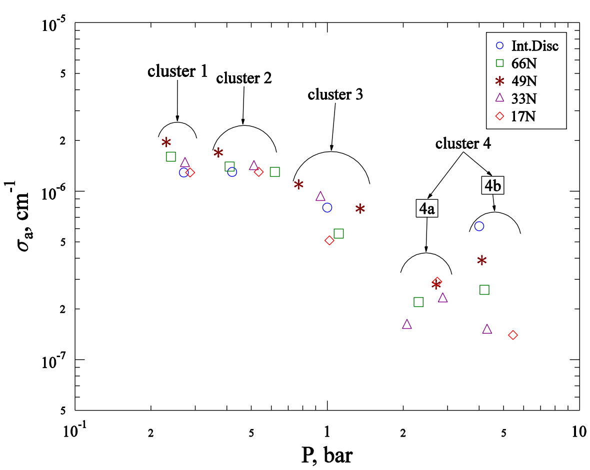

Fig.1 Location of coefficient σ_a maximas and probable vertical structure of aerosol clots in 17N, 33N, 49N, 66N latitudinal belts and for Saturn's integral disk.

- In the $0.9-1.4$ bar atmospheric pressure range one detected the intermediate aerosol 'cluster 3' section, which contains maximum of the coefficient σ_a at the ≈ 1.0 bar pressure level. But we note that in the 49N belt, this thickening contains two maxima of σ_a coefficient.

- In the all studied belts a stretched 'cluster 4' section divided in height into two parts '4a' and '4b', while for the integrated disk only one part '4b' is found.

Conclusion: Pure gas layers in Saturn's atmosphere have not been detected, but the continuous presence of aerosol has been detected at the whole range studied altitude levels. In the studied latitudinal belts of the giant planet Northern Hemisphere, numerical and qualitative differences in the vertical structure of the aerosol component are manifested in the range of atmospheric pressure 0.6-8.0 bar. The obtained dependences on pressure of the coefficient σ_a as well the altitude levels of the maximum aerosol concentrations in the atmosphere of the Northern Hemisphere latitudinal belts generally correspond to the characteristics calculated for the integral disk of the giant planet.

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