Long Term observations of Southern Winters on Mars: Evolution from Year to Year. M.L. Litvak[1], I.G. Mitrofanov[1], A.S. Kozyrev[1], A.B. Sanin[1], V. Tretyakov[1], W.V. Boynton[2], D.K. Hamara[2], C. Shinohara[2], R. S. Saunders[3], [1]Space Research Institute, RAS, Moscow, 117997, Russia, max@cgrsmx.iki.rssi.ru, [2]University of Arizona, Tucson, AZ 85721, USA, [3] NASA Headquarters, Washington, DC 20514, USA.

Introduction. The longstanding mapping of martian surface onboard Mars Odyssey allows to follow up annual variations of martian seasonal cycle. It is known that during martian year global redistribution of atmosphere's mass between martian poles comes to condensation of 25% of atmospheric CO_2 at polar regions [1]. During winter period of time the thickness of seasonal deposit may achieve as large as 1 meter poleward 85N/85S [2,3].

To study peculiarities of seasonal cycle and its annual evolution from year to year we have used observations of martian neutron albedo in different energy ranges obtained with High Energy Neutron Detector (HEND) onboard Mars Odyssey [4,5].

Analysis of long term variations of neutron spectroscopy data is proved as a very effective way for observation of seasonal deposit's evolution [6,7]. It was discovered that ground CO_2 frost effectively hides upper water rich surface layers (located poleward 60S/60N latitudes) from the orbit neutron and gamma spectroscopy (GRS, HEND and NS observations). This effect was suggested as a base for estimation of column density of CO_2 deposit at different latitudes [6-9] on North and South of Mars and reconstruction of multidimensional model of CO_2 deposit showing how snow depth varies as function of latitude, longitude and time [8].

In this presentation we focused our efforts on estimation of CO_2 deposit column density and mass to make quantative comparison between southern winters of two successive martian years.

Data Analysis. The seasonal curves of neutron flux at epithermal and fast energy ranges were used to deconvolve evolution of snow depth (column density measured as g/cm^2) at different southern latitudes for previous and current martian years. All curves are extracted from derived HEND data DHD (background subtracted data with reduced solar events presented at the PDS). It were normalized to the data observed at Solis Planum to avoid variations of neutron flux caused by long term changes of Cosmic Gamma Rays flux and systematic effects (gain and temperature drifts in HEND detectors).

The implementation of numerical model of HEND observations and special minimization procedure for getting model parameters allowed finding best fit correspondence between model predictions and observations which lead to estimation such values as deposit column density and mass [see also 8].

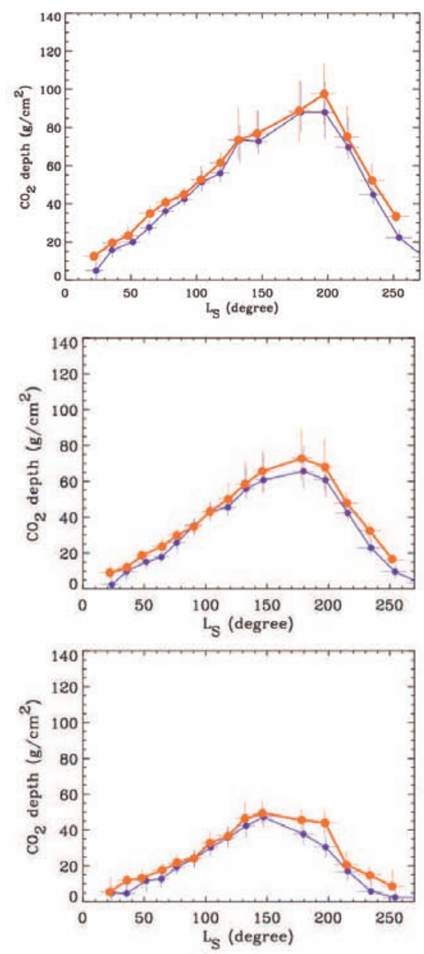

Fig.1. Seasonal curves of CO_2 deposit column density for different southern latitudes. The latitude belt 80S-90S is presented on the top graph, 70S-80S latitude belt is presented at the middle graph and finally 60S-70S is presented at the bottom graph. The blue color corresponds to the observations of previous martian year and red color corresponds to the observations of current martian year.

The results of such analysis are presented on figure 1 where we have shown seasonal curves of CO_2 column density for different martian years. Comparison between these curves reveals the long term stability of seasonal cycle which can be concluded from similarity of front and back slopes (rates of condensation and sublimation of CO_2 frost) and position of major peak (period of L_s=150°-190° when at different latitudes the maximal thickness of CO_2 frost is accumulated) of presented seasonal curves. From other side it is seen that condensed mass may vary by 5-10% from one martian year to another one showing corresponding annual variability of snow depth or bulk density of seasonal deposit.

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