Joint observations of Martian seasonal cycle from HEND/Odyssey and FREND/TGO. M.L. Litvak[1], I.G. Mitrofanov[1], A.V. Malakhov, A.B. Sanin[1],W.V. Boynton[2], [1]Space Research Institute, RAS, Moscow, 117997, Russia, litvak@mx.iki.rssi.ru, [2]University of Arizona, Tucson, AZ 85721, USA.

Introduction: Starting from 2002 Mars Odyssey successfully continues orbital observations. It includes global orbital mapping of Mars neutron flux variations (GRS instrument with HEND and NS subsystems) with following deconvolution of water ice distribution [1-3, 5] and longstanding monitoring of martian seasonal caps [4-8].

Recently ExoMars Trace Gas Orbiter (TGO) mission started its primary phase of science observations of Mars atmosphere and surface [9]. Now it approaches to one year of continuous mapping.

Here we would like to show new data acquired by Fine Resolution Epithermal Neutron Detector, FREND, onboard TGO. This neutron spectrometer uses a collimated neutron telescope to improve the spatial resolution of the surface observations from 300 km (as has been implemented for neutron observations onboard Mars Odyssey) down to ~60 km.

The main goal of the investigation is to compare simultaneous HEND/Odyssey and FREND/TGO observations of Mars near polar regions and to perform monitoring and joint analysis of growth and sublimation of Martian seasonal caps (evolution of boundaries of seasonal caps) at different scales.

Data Analysis: It is known that growing and sublimation of Martian snow caps is seen as seasonal variations of neutron flux above Martian polar regions. It makes neutron observations a valuable technique to monitor behavior of seasonal caps and study their evolution within one seasonal cycle or search for inter annual variations. The measured counting rate in neutron detectors and its seasonal variations could be interpreted in terms of column depth (g/cm^2) and mass (kg) of the seasonal CO_2 deposit based on the numerical models of neutron production and scattering in Martian atmosphere and surface (including upper layer of temporal CO_2 deposit).

On Figure 1 we have illustrated time history of CO_2 frost column density variations within one seasonal cycle derived from HEND/Odyssey data and on Figure 2 one can see the preliminary comparison between latitude profiles of neutron flux measured jointly by HEND/Odyssey and FREND/TGO at different seasons.

References: [1] Feldman W.C. et al., (2002), *Science*, 297, 5578, 75-78. [2] Mitrofanov I.G et al. (2002), 297, 5578, 78-81. [3] Boynton W.V. et al., (2002) *Science*, 297, 5578, 81-85. [4] Mitrofanov I.G. et al., (2003) *Science*, 300, 2081-2084. [5] Litvak M.L. et al. (2006) *ICARUS*, 180, 1, 23-37. [6] Kelly N. J. et al (2006) *J. Geophys. Res*., E03S07. [7] Litvak M.L. et al., (2007) *J. Geophys. Res*., E03S13. [8] Prettyman T. H. et al., (2009) *J. Geophys. Res*., 114, CiteID E08005. [9] Vago, J. et al. ESA ExoMars program: The next step in exploring Mars. Solar System Research, **49**, 7 (2015).

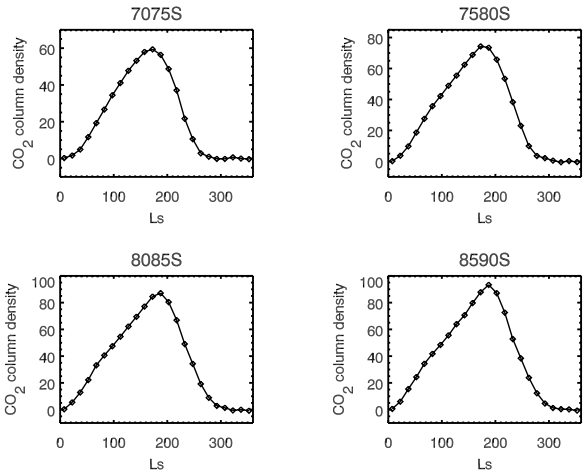

Figure 1. Seasonal variations observed at different southern latitudes within one seasonal cycle.

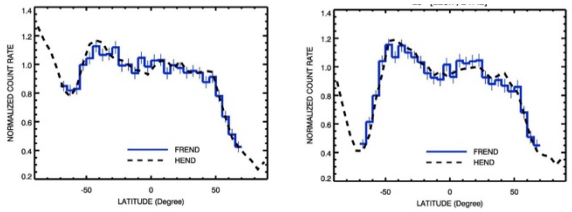

Figure 2. Latitude profiles of cross normalized FREND and HEND counting rates (bold and dashed lines, respectively). Two seasonal intervals of L_s [170°-187°] and [227°-247°] show the appearance of the seasonal CO_2 deposit during the fall period of the northern hemisphere and its disappearance in spring in the southern hemisphere.