WATER IN LUNAR CRATERS FROM LRO OBSERVATIONS. M.L. Litvak[1], A.B. Sanin[1], I.G. Mitrofanov[1], B.N. Bakhtin[1], W.V. Boynton[2], J.G. Bodnarik[2], G. Chin[3], L.G. Evans[3,4], T.A. Livengood[3,5], A.V. Malakhov[1], T.P. McClanahan[3], M.I. Mokrousov[1], R.D. Starr[3,6] and [5]R.Z. Sagdeev [1]**Space Research Institute, RAS, Moscow, 117997, Russia, litvak@mx.iki.rssi.ru**, [2]University of Arizona, Tucson, AZ, USA, Solar System Exploration Division, NASA Goddard Space Flight Center, MD, USA, [4]Computer Science Corporation, USA, [5]University of Maryland, MD, USA, [6]Catholic University of America, MD, USA.

Instrumentation and Methods. LRO mission successfully continues global mapping of lunar surface started in 2009 and sophisticated data sets gathered from different LRO instruments could be used to test various models of hydrogen distribution in the interior and exterior of large lunar craters. The primary efforts in our analysis were focused on a neutron spectrometry data provided by LEND instrument [1-2]. The conversion of epithermal neutron count rates measured by LEND instrument above lunar poles to Water Equivalent Hydrogen (WEH) content strongly depends from the model assumptions about subsurface structure. One of the major model uncertainties comes from the uncertainty of depth distribution of WEH in the lunar regolith. In our analysis we have used comparison of the relative variation of the epithermal neutron count rate, measured by neutron collimated sensors over lunar regolith with models describing different subsurface hydrogen distribution. The simplest assumption about homogeneous distribution of hydrogen rich material provides lowest limit of hydrogen content in top meter of lunar regolith (see Figure 1) and allow to create maps of hydrogen distribution at moon polar regions. It reveals that spots with high WEH easily visible on the maps are not only located inside some Permanently Shadow Regions (PSR, which includes interiors of large polar craters) but partially covers sunlit areas outside PSR boundaries (Figure 1, see also [3-4]). It is known that water ice is not stable on top of regolith over the illuminated surface [5]. Therefore, the estimations of WEH at sunlit areas, as based on the model of homogeneous water distribution, might not be valid and require at least two layers subsurface structure with different water content where top layer should be dry and protect the bottom one from evaporation. With two layer model and dry layer on the top, one would get some larger values of WEH at the bottom layer.

Using this approach together with analysis of subsurface temperatures (LRO/Diviner, showing possible limits for ice depths, [6]), locations of anomalous UV albedo (LRO/LAMP, interpreted as surface water ice, [7] and variations of proton albedo (LRO/CRaTER, as another complimentary indication of subsurface water ice distribution, [8]) we have estimated the possible range of ice depths at the vicinity of large polar craters (such as Shoemaker, Haworth, Faustini, Cabeus and others) and evaluated maximal WEH values in the lunar subsurface. The preliminary estimations show that at depths below 40 cm at Cabeus and Shoemaker water amount could be as high as 9-11 wt%.

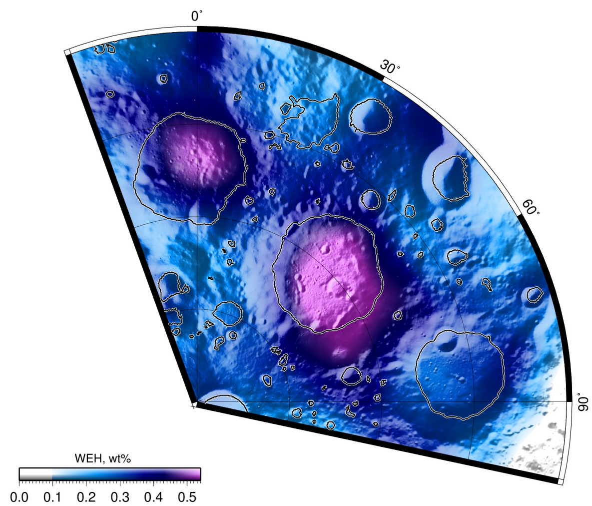

Figure 1. Map of the WEH abundance at Shoemaker, Haworth and Faustini craters derived from the analysis of LEND/LRO neutron data and suggestion about depth homogeneous distribution of susbsurface hydrodgen.

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