NEUTRON SUPPRESSED REGIONS (NSRs) USING THE LRO NEUTRON DETECTOR EXPERIMENT LEND. G. F. Droege[1], W. V. Boynton[1], I. G. Mitrofanov[2], and the LEND team. [1]The University of Arizona, Tucson, AZ USA, gdroege@lpl.arizona.edu, [2]Institute for Space Research, 117997 Moscow, Russia, imitrofa@space.ru

Introduction: The Clementine mission initially suggested that deposits of water ice might exist in the permanently shadowed regions (PSRs) near the lunar south pole [1]. Subsequent data were taken by the Lunar Prospector Neutron Spectrometer (LPNS), revealing suppression of epithermal neutrons at the poles above 70° latitude, interpreted to indicate enhancement of hydrogen, predominantly within PSR areas [2].

Here we present data from the Lunar Exploration Neutron Detector (LEND) instrument onboard the NASA Lunar Reconnaissance Orbiter (LRO) that provides further context and statistics for interpreting and defining the neutron suppressed regions (NSRs).

Methods: A map of the epithermal neutron counting rate was made by binning the LEND counts from the four collimated epithermal neutron detectors using HEALPix [3] bins of 1.7 km. The maps are smoothed by a Gaussian filter. Uncertainty maps based on counting statistics were made and smoothed by the same filter.

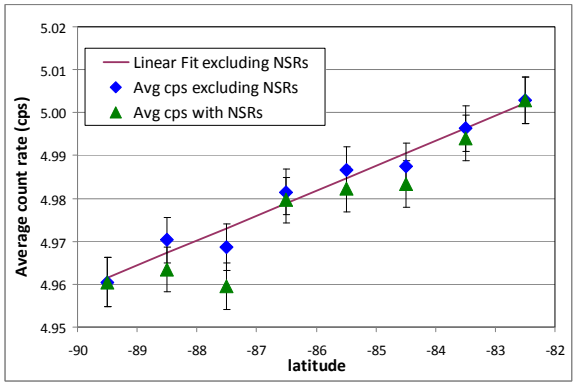

Fig1. Average count rate of collimated epithermal neutrons in one-degree latitude bands.

Areas of enhanced hydrogen content are found by looking for regions of lower-than-normal epithermal counting rates. To do this we first made a difference map by determining the average epithermal neutron counting rate as a function of latitude in one-degree latitude bands between -82° and -90° (fig 1). A general decrease in count rate (increase in H content) is observed toward the pole. A preliminary difference map was made by subtracting these latitude-dependent count rates from the smoothed map. The resultant map is similar to that shown in figure 2, but before we generated the final difference map, we re-made the latitude-dependent count rate plot excluding the HEALPix bins that had values lower than -0.05 on the preliminary difference map. A linear fit to these values (fig. 1) was made and was used to generate the final difference map (fig 2.)

Results: It can be seen that there are two very large neutron suppression regions (NSRs) that correspond to the Cabeaus and Shoemaker craters as originally noted in [4]. Contours have been added at the -0.04 cps level to help define the spatial extent of these NSRs.

Discussion: As noted elsewhere [5], the NSRs are not closely related to the PSRs. The NSR at Shoemaker does follow the outline of the local PSR, but the one at Cabeus is substantially larger than the Cabeaus PSR. Many other PSRs show no evidence of any neutron suppression.

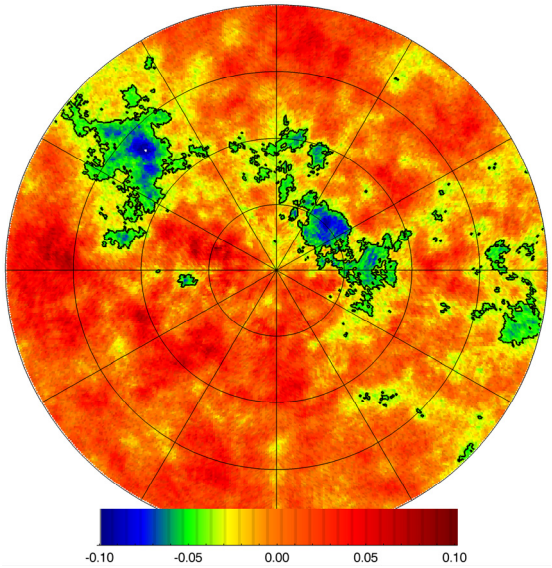

Fig2. South polar map of count rate differences from 82°S. The contour is at -0.04 cps. All values < -0.04 cps are significant at the 3σ level or greater.

Another interesting observation is the general increase in background H content with latitude. Since it is unreasonable to argue that the influx of H is any greater in the polar regions than elsewhere, this relationship argues for a general mobility of H with a greater deposition and retention due to lower temperatures with closer proximity to the pole.

References: [1] P. D. Spudis *et al.*, *Solar Syst. Res.* 32, 17 (1998). [2] W. C. Feldman *et al.*, *Science* 281, 1496 (1998). [3] Hierarchical Equal Area isoLatitude Pixelization, http://healpix.jpl.nasa.gov. [4] I.G. Mitrofanov, *et al.* (2010) *Science*, 330, 483–486. [5] Mitrofanov *et al.*, This volume, (2011)