Geophysical Research Abstracts
Vol. 18, EGU2016-18232-2, 2016
EGU General Assembly 2016
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Diurnally modulating neutron flux in the Moon's high-latitudes: Evidence for transported hydrogen volatiles and/ or complex regolith compositions in topographic slopes

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We report evidence that the Moon's diurnally modulating neutron flux is being forced by a latitude dependent mix of 1) transient hydrogen-bearing volatiles near the surface in the upper latitudes and 2) regolith temperature variation in lower latitudes. In this study we investigate diurnally varying neutron flux measurements from the Lunar Reconnaissance Orbiter's (LRO) Lunar Exploration Neutron Detector's Collimated Sensor for Epithermal Neutrons (LEND CSETN) and surface temperature observations from the Diviner radiometer poleward of $>\pm 45°$. Our presentation shows that the modulating neutron flux is not consistent with a regolith temperature control for latitudes $>70°$. The anticorrelation may be evidence for transported lunar hydrogen volatiles or highly non-uniform regolith compositional dynamics. Observational evidence is consistent with regolith temperature being the source of the neutron flux modulation in the northern mare (45° to 60°) and may be related to its mafic composition and fast neutron contributions. Predictions for hypothesized regolith temperature effects are evaluated using insolation inferred from the Lunar Observing Laser Altimeter (LOLA) topography.