**SLOPE REDUCTION OF SMALL POLAR CRATERS AS A FUNCTION OF THERMAL AMPLITUDE.**

Ariel N. Deutsch¹, Michael K. Barker², Caleb I. Fassett³, Jennifer L. Heldmann¹, Anthony Colaprete¹, and James W. Head¹, ¹NASA Ames Research Center, Moffett Field, CA 94035 (ariel.deutsch@nasa.gov), ²NASA Goddard Space Flight Center, Greenbelt, MD 20771, ³NASA Marshall Space Flight Center, Huntsville, AL 35804, ⁴Brown University, Providence, RI 02912.

**Introduction:** Some areas at the lunar poles experience seasonal temperature variations >150 K [1]. Such large temperature swings over short timescales have important implications for volatile activity [2], regolith mobilization, and landscape degradation [3]. Here we are interested in how thermal stresses influence the degradation of small polar craters, using slope as a morphometric measure of degradation.

**Methods:** Starting with a lunar crater database [6], we identified all craters that (i) are unambiguously craters, (ii) are located between 87 and 90°S (where the highest-resolution topographic measurements exist) [7], (iii) have diameters <7 km (to mitigate scale-dependent crater degradation effects), (iv) are not located on the walls of larger craters (to mitigate effects of impacts into sloped terrain), and (v) are not superposed by other small craters (to mitigate influences of imprinting topography). This resulted in a study population of 1,337 craters, with an average diameter of 2.15 km.

For each crater, we extracted slope and azimuth (γ) measurements using new Lunar Orbiter Laser Altimeter (LOLA) topography models [7, 8]. Azimuth (i.e., direction of slope) heavily influences the amount of incident solar radiation [9, 10], and is used to define EF slopes (γ=180°E ± 30°) and PF slopes (γ=0°E ± 30°). For PF and EF walls of each crater, we extracted (i) the median seasonal thermal amplitudes (K) from Diviner (240 mpp [1]), which is the difference between maximum and minimum temperatures for each season, and (ii) the average illumination from LOLA (60 mpp [9]), a value between 0 (permanent shadow) and 1 (complete illumination) indicating the average visible fraction of the Sun’s disk over a lunar precession cycle.

**Initial Results: Thermal amplitude.** We measure statistical variation in the population of PF slopes with respect to thermal amplitude, but not in EF slopes. PF slopes that experience seasonal thermal amplitudes >120 K are relatively lower than PF slopes of similarly sized and similarly located craters that experience lower thermal amplitudes. It is possible that high thermal amplitudes have contributed to slope reductions because of freeze-thaw cycles and/or creep (no melting) causing downslope movement of ice, as has been suggested for some ice-bearing craters on Mars [11]. Slope reduction at high thermal amplitudes may be related to the presence of volatiles because it is observed at PF slopes (where ice is predominantly predicted to be cold trapped [e.g., 4, 5, 9, 10]), but not at EF slopes.

**Average illumination.** We do not find any statistically significant difference in the slopes of crater walls between slopes that receive higher vs. lower levels of average illumination (integrated thermal pressure), suggesting that the temperature swing, as opposed to average illumination conditions, is a driving factor in the reduced slopes of particular PF walls.

**Discussion:** Crater slopes can be influenced by a myriad of factors, including the crater-forming conditions (e.g., impact angle, target composition, target slope) as well as modification processes (e.g., regolith gardening, impact bombardment and emplacement of distal ejecta, thermal cycling) and the crater’s age (i.e., exposure time to modification processes). Here we use population statistics of 1,337 similarly sized and similarly located craters to provide insight into the possible influences of volatiles and thermal degradation on crater slopes at the lunar south pole.