HIGH ALBEDO EVENTS INDICATE WATER ICE IN MARS' SOUTHERN POLAR CRATERS.

C. R. Boom[1] and J. C. Armstrong[1], [1]Department of Physics, Weber State University, 2508 University Circle, Ogden, UT 84408.

Introduction: Continuing the work done previously in the northern polar craters examining crater-interior water ice deposits [1-2], a sample of craters in the southern polar region of Mars has been analyzed using Mars Global Surveyor Thermal Emission Spectra (TES) temperature and albedo measurements. While thermal inertia of the surface appears to be inconsistent with the presence of water [3], transient water ice may be present during the polar springs [1-2]. We examine a distinct group of craters which display a sudden re-brightening or continual brightening of the interior of the crater mid-spring, at solar longitude, L_s, of 200 to 230 degrees, even when the nearby surface albedo continues to decrease. We compare the location of these high albedo events to the distribution of water-equivalent hydrogen of the near surface [4] as well as to the analysis previously done with the northern craters [1]. We specifically consider the depth, latitude, size, and elevations of the craters, considering many of the possible factors for the distribution of the high albedo events. We hope to gain insight and better understanding into the distribution and causes of these high albedo events.

Method: Using MOLA elevation data [5], all craters between -90N and -60N with diameters larger than 45 kilometers having rims distinguishable from the surrounding surface were examined. A total of 180 craters were analyzed. Diameters and depths were measured using tools provided on the JMARS program [6]. Depth of each crater was taken from the highest point in elevation and subtracting the lowest to get a maximum depth of the crater. The albedo was examined as it changed annually. Data from both the morning (am) and afternoon (pm) was analyzed. Distribution of the craters was compared to the Water Equivalent Hydrogen (WEH) of the surface and near surface [4], as well as to work done in the northern craters [1].

Results and Discussion: Variations in albedo readily distinguished 81 craters with high albedo events (HAEs) starting at L_s between 200 and 230 degrees (see Figure 1). Data for am albedo is less abundant than pm data, but appears consistent, supporting 52 of the 81 craters. The remaining craters did not have enough data taken in the am to support or contradict the pm evidence. The data appears consistent with the water equivalent hydrogen of the near surface (see Figure 2). Data was taken external to each crater, and HAEs were present in twelve of the 277 area observed. Eleven of this area was found in a region that could potentially be caused from variations in layered deposits from the southern polar cap [7], but further investigations are necessary to determine the total area involved.

A χ^2 analysis was conducted to determine the following statistical significances and probabilities [8]. There is no statistical difference between the depth of craters with or without water, nor is there a statistical significance in the diameters. The water craters are higher in elevation by 219 m. This, however, could be an artifact of the distribution of the craters. The craters with water tend to be closer to the pole, which has higher elevation.

As we compare the results and distributions to the northern polar region [1], we find within ten degrees of the pole, one of four craters in the north have evidence of water, while all four in the south have evidence of water. Between 70 and 80 degrees latitude, both north and south, the number of craters analyzed increase to 23 in the north and 67 in the south. Nine (39.1 percent) of those in the north show HAEs, with two of those only showing am evidence. Sixty-one (91.0 percent) of those in the south show HAEs, with 13 showing evidence in the pm only. Between 60 and 70 latitudes, there are 33 craters analyzed in the north and 110 in the south. HAEs are seen in eight (24.4 percent of total) craters in the north and 16 (14.6 percent of total) in the south. It should be noted there is a significant discrepancy in the number of craters available. The craters sampled in the northern hemisphere larger than 45 km numbered 5, and the all southern craters larger than 45 km numbered 180. Of the total percentages larger than 45 km, three of the five (60 percent) northern craters showed evidence of water, while 81 of the 180 (45 percent) in the southern craters showed evidences of water. Southern HAEs cluster toward the pole, while the northern craters appear randomly distributed. HAE craters in the southern region did not extend below where the seasonal cap freezes, at ~65°S [7].

Further Investigations: Interesting variations in the temperature suggest inter-crater variability, as well as possibly inter-annual variability, which would require an investigation into several craters exhibiting this behavior. An analysis of the southern polar cap region should be done to examine if there is evidence of further HAEs related to layered deposits from the southern seasonal caps. Also, statistical analyses could be completed on a complete sampling of the northern craters, to compare to all craters available.

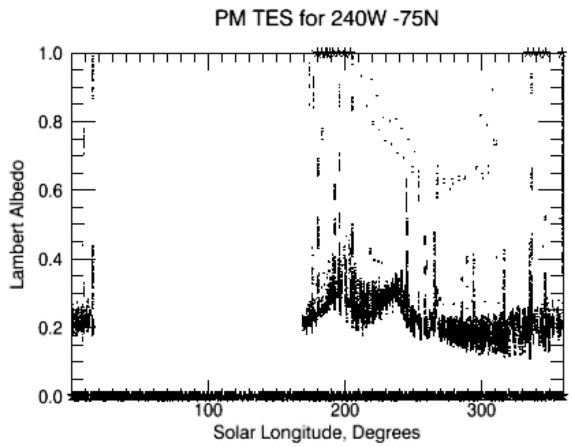

Figure 1. Example of a high albedo event (HAE). The high albedo events tend to begin between 200 and 230 solar longitude.

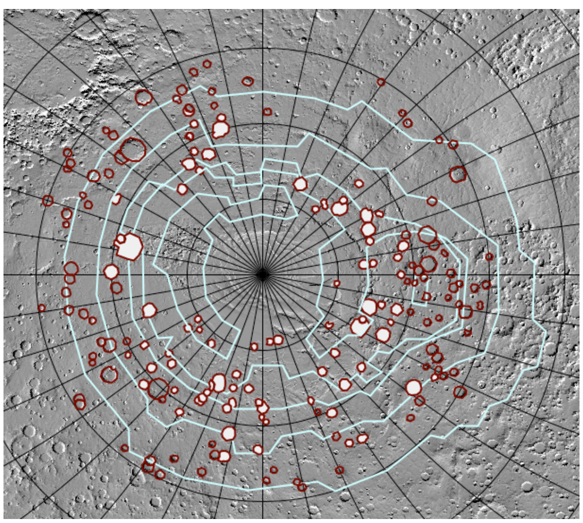

Figure 2. Map of all craters examined. Craters filled in white exhibit evidence of High Albedo Events (HAEs). Outlined craters show no evidence of HAEs. The contours, from pole outward, are 45%, 40%, 35%, 25%, and 15% water equivalent hydrogen abundance [4].

References: [1] Armstrong, J.C., Nielson, S.K., and Titus, T.N. (2006), *Geophys. Res. Lett., 34*, L01202. [2] Armstrong, J.C., Titus, T.N., and Kieffer, H.H. (2005), *Icarus, 174*, 360-372. [3] Putzig, N.E. et al. (2005), *Icarus, 173*, 325-341. [4] Feldman, W.C., et al. (2004), *J. Geophys. Res.,, 109,* E09006. [5] Neumann, G.A., et al. (2003) *LPS XXXIV,* Abstract 1978. [6] Gorelick, N.S., et al. (2003) *LPS XXXIV,* Abstract 2057. [7] Barlow, N.G., (2008) *Mars*, 151-161. [8] Hogg, R.V., and Tanis, E.A. (2006), *Probability and Statistical Inference, 7ed.,* 521-532.