WATER ICE ALBEDO VARIATIONS ON THE MARTIAN NORTHERN POLAR CAP: A PROGRESS REPORT. A. S. Hale[1], D. S. Bass, and L. K. Tamppari[3], [1]NASA Jet Propulsion Laboratory (MS 264-235, 4800 Oak Grove Drive, Pasadena, CA 91109 amy.s.hale@jpl.nasa.gov), [2]NASA Jet Propulsion Laboratory (MS T1722, 4800 Oak Grove Drive, Pasadena, CA 91109 deborah.s.bass@jpl.nasa.gov), [3]NASA Jet Propulsion Laboratory (MS 301-422, 4800 Oak Grove Drive, Pasadena, CA 91109 leslie.k.tamppari@jpl.nasa.gov).

Introduction: The Viking Orbiters determined that the surface of MarsÕ northern residual cap is water ice. Many researchers have related observed atmospheric water vapor abundances to seasonal exchange between reservoirs such as the polar caps, but the extent to which the exchange between the surface and the atmosphere remains uncertain. Early studies of the ice coverage and albedo of the northern residual Martian polar cap using Mariner 9 and Viking images reported that there were substantial internannual differences in ice deposition on the polar cap [1], a result which suggested a highly variable Martian climate. However, some of the data used in these studies were obtained at differing values of heliocentric solar longitude (L_s). Reevaluation of this dataset in [2] indicated that the residual cap undergoes seasonal brightening throughout the summer, and indicated that this process repeats from year to year. In this study we continue to compare Mariner 9 and Viking Orbiter imaging observations and thermal data of the north residual polar cap to data acquired with Mars Global SurveyorÕs Mars Orbiter Camera (MOC) instrument.

In the current study, our goal is to examine all released data from MGS MOC in the northern summer season, along with applicable TES data in order to better understand the albedo variations in the northern summer and their implications on water transport. To date, work has focused primarily on the MOC dataset. In 1999, data acquisition of the northern polar regions began at L_s = 107, although there was little north polar data acquired from L_s= 107 to L_s = 109. We examined a total of 409 images from L_s = 107 to L_s=148. We have also examined data from 2000 from L_s= 93 to L_s= 110; additional progress is ongoing. Here we present a progress report of our observations, and continue to determine their implications for the Martian water cycle.

Result 1: After brief comparison to Mariner 9 and Viking Orbiter imaging data, we found a surprising result. It appears that some MOC data exhibited albedo changes contrary to those described in [1]. That is, the cap did not appear to consistently brighten with water ice as the summer continues (**Figure 1**). This result was surprising to us because we had hoped to see a continuation of the trend we had reported previously.

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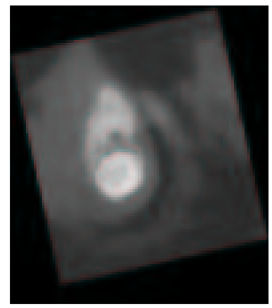

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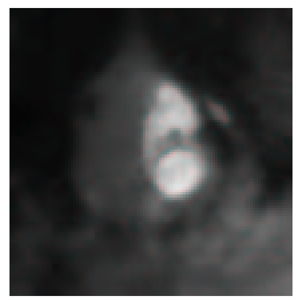
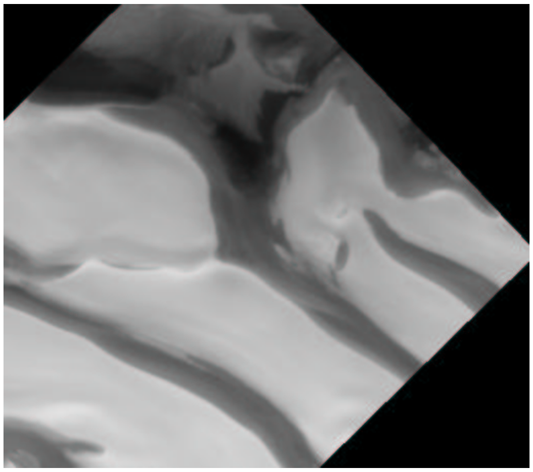


Figure 1. MGS MOC images of region near 85N, 270 W. Crater bowl is approximately 60 km in diameter. Images were acquired with a red filter and were processed using ISIS. Data were chosen for consistency with Viking data published in [Bass *et al.*, 2000]. **(a)** MGS MOC image M00-01627 acquired in 1999 at L_s = 122. Image shows approximately the same amount of frost as Viking Orbiter mosaic 726A50, 52. **(b)** MGS MOC image M01-02151 acquired in 1999 at L_s = 140. All MGS images show lower albedos than Viking Orbiter data acquired in the same season.

Result 2: In the Martian summer season as recorded by MOC in 1999, there were no substantial seasonal albedo changes apparent when comparing data acquired in the middle of in the summer season to data acquired later in the summer season (for the dataset as a whole) For example, wide angle red-filtered MOC image M00-02344 acquired at L_s~ 124 and M01-00331 acquired at L_s ~135 in 1999 show no change in albedo within the uncertainty of the MOC instrument (**Figure 2a-b**). This indicates no dramatic change in albedo over the course of a single Martian season. It is possible that a dramatic change in albedo occurred before L_s = 112, but there is no released MOC data available for analysis before L_s = 112 in 1999.



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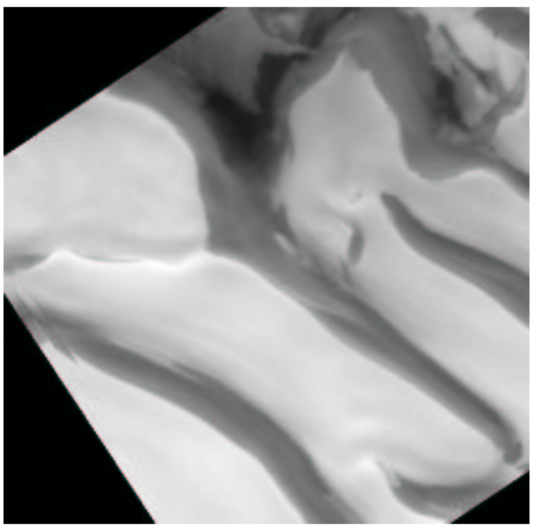

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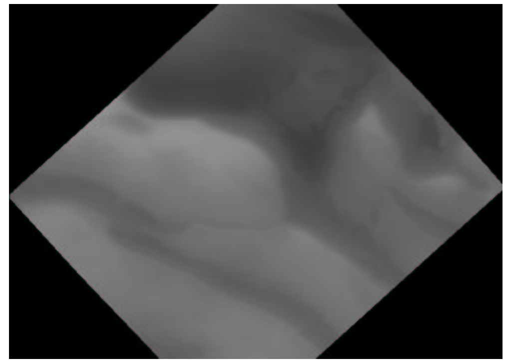
Figure 2. MGS MOC images of region centered at ~ 86N, 180 W acquired in 1999. Images were acquired with a red filter and were processed using ISIS MOC routines. Data were chosen for comparison to data acquired in the same region in the northern summer of 2000-2001 shown in Figure 3. Images in this figure show approximately the same amount of frost when compared to one another. **(a)** MGS MOC image M00-02344 acquired in 1999 at L_s = 124. **(b)** MGS MOC image M0-000331 acquired at L_s = 135 also acquired in 1999.

Result 3: In the 2000 — 2001 early northern summer season, much of the cap again remained at roughly the same albedo, while some regions became markedly brighter and other regions became markedly darker. We examined some of the same regions where data were acquired in 1999. Wide angle red-filtered MOC images M23-000314 acquired at L_s ~ 99 and M23-01643 acquired at L_s ~107 in the 2000 Martian northern summer season show an overall regional decrease in albedo (**Figure 3a-c**). These data also show a localized increase in albedo along the sides of the troughs, which is consistent with the possible ice accumulation described in [1]. These results are also consistent with those presented in. [2], implying that surface albedo may be affected by very small changes in ice volume..



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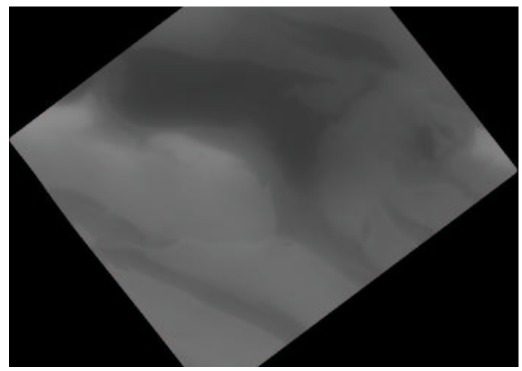

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Figure 3. MGS MOC images of region centered at ~ 87N, 195 W acquired in 1999. Images were acquired with a red filter and were processed using ISIS MOC routines. Data were chosen for comparison to data acquired in the same region in the northern summer of 2000-2001 shown in Figure 3. Images in this figure show an increase in albedo along trough edges, **(a)** MGS MOC image M23-01643 acquired in 1999 at L_s = 99. **(b)** MGS MOC image M23-0314 acquired at L_s = 107 also acquired in 1999.

Conclusions: The results reported here describe far more complexity in water ice albedo variability than had previously been appreciated. It is clear that the entire cap may not be treated as a monolithic body, but rather, individual locations show a variety of influences. One possibility is that topographic effects are quite significant. Another consideration that we are currently investigating is the role of atmospheric effects on surface albedo. Continued study of these phenomena and correlation with other years of data will undoubtedly prove interesting.

Our presentation will continue this study with newly released MOC data.

References: [1]˚Bass D. S et al. (2000) *Icarus, 144,* 382-396. [2]˚Cantor B. et al. (2002) *JGR., 107*.