INTERANNUAL VARIABILITY OF THE MARTIAN RESIDUAL NORTH POLAR CAP. B. A. Cantor[1] and P. B. James[2], [1]Malin Space Science Systems, P.O. Box 910148, San Diego CA 92191-0148 (cantor@msss.com), [2]Department of Physics and Astronomy, The University of Toledo, Toledo OH 43606-3390.

Introduction: Since March 9, 1999, Mars Global Surveyor (MGS) has been observing Mars from an almost circular orbit at an altitude of 378-420 km, which is fixed relative to the sun in such a way that the local time on the illuminated side of the planet is 14:00 at the spacecraft's nadir. Because there is no scan platform on MGS, the Mars Observer Camera (MOC) onboard MGS is always pointed at the nadir. MOC consists of two nadir pointing wide-angle (WA) cameras with red (575-625 nm) and violet (400-450 nm) bandpasses (WAR and WAB) [1]. These wide-angle cameras each use a single 3456-pixel line scan CCD array as a detector and have a field of view of 140° (bounded by the horizon), with a maximum resolution at the nadir of 230 km/pixel.

During the mapping mission, the WA cameras have been continuously mapping the day-side of Mars at a constant resolution of 7.5 km/pixel, using a hard wired variable-summing algorithm. These low resolution images, called daily global map (DGM) images, extend from horizon to horizon. At the equator the local time across these images ranges from 12:17 to 15:43. Although these DGM strips barely overlap at the equator, the mapping orbit of MGS is ideal for polar observations.

Since April 29, 2000 (L_s = 343°), DGM images have been used to monitor the 2000-2001 recession, including the albedo of the north polar cap [2]. A comparison of the average global recession rate with previous spacecraft observations (Mariner 9 [3,4], Viking Visible [5,6] and IRTM [7], and Hubble Space Telescope observations [8]), during non-global dust storm years, show no significant variations through L_s = 70°. However, this was not the case for the Lambert albedo within the residual north polar cap, which decreased from a maximum of about 0.57 at L_s = 35° to 0.38-0.41 at L_s = 58°; see Figure 1. This behavior contradicts that observed by Viking [9], in which the albedo in core regions of the cap increased roughly linearly as a function of insolation. An explanation may relate to five large polar dust storms that occurred between L_s = 35° and L_s = 58° over the residual cap. It is suggested that these storms deposited dust onto the surface of the residual cap, which reduced its albedo. It is interesting to note that the drop in the interior cap albedo corresponds exactly with the onset of the first large storm and levels off after the end of the fifth storm; see Table I. The dust must have been deposited on the surface, since fluctuations in the decrease in cap albedo by atmospheric dust are absent and since the cap albedo does not recover in the time consistent with the duration of these dust events. Since the effect is observed at $\lambda \sim 600$ nm, the layer of dust needed to do this would be thin. A consequence of the lower residual cap albedo compared to previous years would be enhanced absorption of insolation and thereby an enhanced recession rate of the residual cap. Comparisons with the earliest MOC observation from the previous year (Figure 2), which happen to be 10° of L_s later during northern summer, show a residual cap in this year distinctly smaller in all longitude ranges except between 120° W and 198°W. The final extent of the changes is unclear at this time, but further study the residual cap through northern summer is in progress.

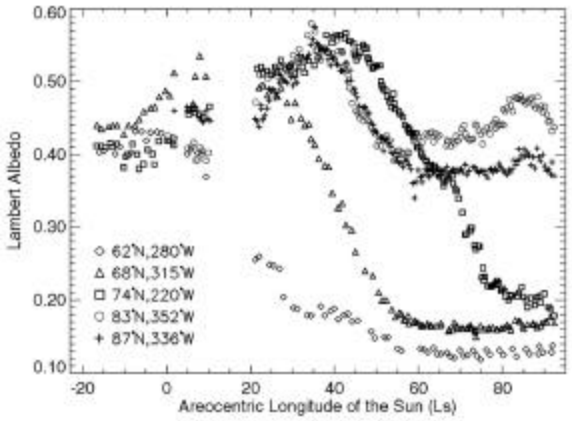

Figure 1. Lambert Albedo of north polar cap as a function of L_s and location. Gap in data between L_s =10° and L_s = 20° is a result of solar conjunction.

TABLE I
Polar Dust Storms

L_s	Central Lat.	Central Long.	Crossover[1]	Duration (days)
34.9°	62.5°	5.7°	320°-10°	2
43.4°	64.6°	352.8°	320°-10°	2
49.7°	77.6°	78.1°	320°-10°	2
53.4°	75.6°	129.5°	60°-120°	2
57.9°	75.2°	90.0°	60°-120°	5

[1]Crossover – The longitude range over which the dust storm crossed onto the residual polar cap.

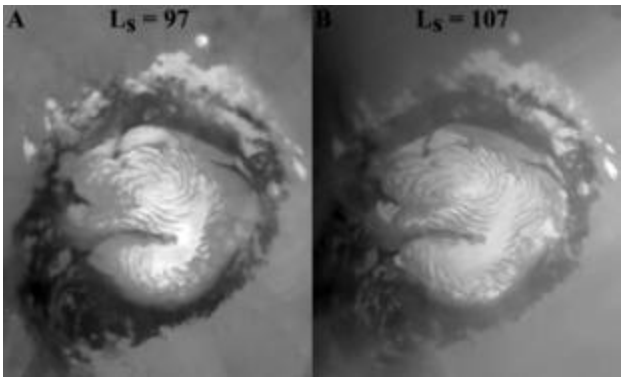

Figure 2 : Views of the residual north polar cap obtained with MOC-WAR on (A) 1/1/01 and (B) 3/9/99, with 0° W longitude at the bottom and increasing clockwise.

References: [1] Malin M. C. et al. (1992) *JGR*, *97*, 7699-7718. [2] James P. B. and Cantor B. A. (submitted 2000) *Icarus*. [3] Soderblom L. A. et al. (1973) *JGR*, *78*, 4197-4210. [4] Briggs G. A. (1974) *Icarus*, *13*, 167-191. [5] James P. B. (1979) *JGR*, *84*, 8332-8334. [6] James P. B. (1982) *Icarus*, *52*, 565-569. [7] Christensen P. R. and Zurek R. W. (1984) *JGR*, *89*, 4587-4596. [8] Cantor B. A. (1998) *Icarus*, *136*, 175-191. [9] Paige D. A. (1985) Ph. D. dissertation, Calif. Inst. of Technol. Pasadena.