LOCAL DUST STORMS IN THE MARTIAN NORTHERN HEMISPHERE: 1998 MGS/MOC OBSERVATIONS.

B. A. Cantor[1] and P. B. James[1], M. J. Wolff[1], M. C. Malin[2], E. Jensen[2], K. S. Edgett[2], [1] Department of Physics and Astronomy, The University of Toledo, Toledo OH 43606-3390 (bcantor@astro1.panet.utoledo.edu), [2]Malin Space Science Systems, Post Office Box 910148, San Diego CA 92191-0148.

Introduction: MGS-Mars Observer Camera (MOC) wide-angle (WA) red (580-620 nm) and violet (400-450 nm) filter observations obtained during the 1998 Martian dust storm season from L_s= 300°-318° have resulted in the detection of five local dust storm events in the Martian northern hemisphere. The first three dust storms were observed in Amazonis Planitia, while the other two local events were observed in Chryse Planitia (see Table 1). It should be noted that a sixth local dust storm was observed in the Southern Hemisphere just south of the crater Schroeter (6.2°S, 296°W), in Syrtis Major Planum. The mapping orbit of MGS during SPO1 allowed MOC to monitor each of these regions on multiple occasions, in such a way that a single region could be viewed at different times of the day on three alternating orbits.

TABLE 1
Local Dust Storm Activity: MOC-SPO1 Observations

Orbit	Local Time	L_s	Storm Center Lat.	Storm Center Long.	Size (km^2)
204	10:25	300.77	31.0	156.6	3705
223	09:55	306.25	30.6	156.3	3513
225	09:05	306.52	33.9	147.0	1046
235	09:20	309.67	22.5	49.8	401+
247	09:33	313.05	-6.2	296.0	3785
252	09:21	314.45	17.0	53.6	----

For the Chryse region, the timing of the storms coincides well with previously detected dust storms in the same region by ground-based observations [1,2,3], Mariner 9 [4], and the Viking Orbiter 1 [5]. From this it is suggested that between about L_s=309° and L_s=354° the Chryse dust storms are a common morning occurrence. The Amazonis dust storms are a new discovery by MOC. No northern winter hemisphere dust storms in Amazonis have been detected previously. Only one previous storm in that region has been observed and that occurred in a different season during L_s=252° [6].

An example of one of the local dust storms in Amazonis as seen by the MOC WA red filter is shown in Figure 1. This image has been enhanced to increase the contrast between the storm and the Martian surface. This early morning dust storm which is probably induced by downslope winds is blowing off the aureole of Olympus Mons in a northwestern direction. The turbulent structure seen in the dust storm is due to convective uplifting [7]. The poor albedo contrast between the dust storm and the Martian surface suggests that the surface is covered with a layer of dust that acts as a source for local dust storms.

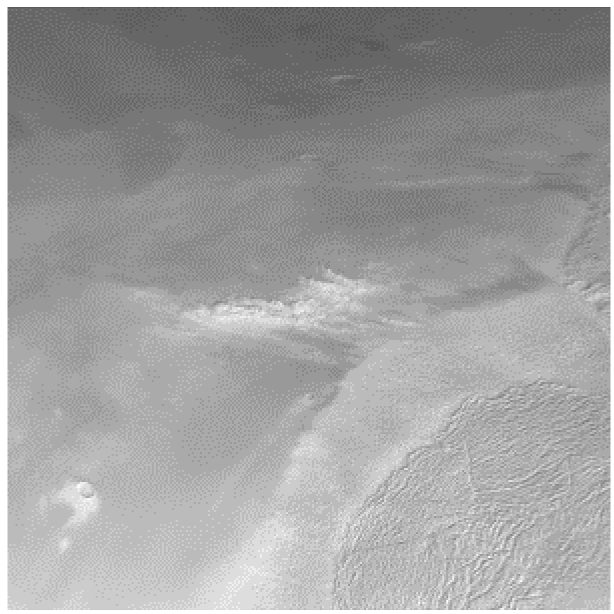

Figure 1. Local dust storm in Amazonis observed with MOC WA-Red filter.

At this time, atmospheric dust opacities for two of the five northern dust storms have been modeled; see Figure 2. Dust optical depths for both the red and violet filter observations were modeled by adopting the discrete-ordinate, multiple scattering radiative transfer code (DISORT) [8]. This code has in the past been used successfully with HST Mars observations to determine visible wavelength atmospheric dust opacities [9]. The uncertainty associated with the model derived atmospheric dust optical depths for the MOC wide-angle observations are ±0.6. Red and violet filter derived dust optical depths are self-consistent with one another within the uncertainties. The maximum dust optical depths derived from the red filter observations for the two dust storms were in excess of 2.0.

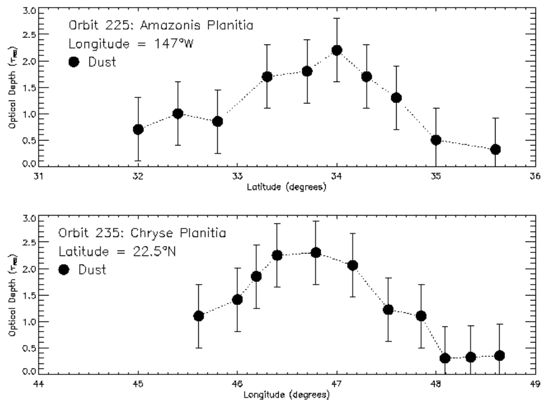

Figure 2. Dust optical depths modeled from MOC-WA red filter observations of local dust storms in Amazonis and Chryse Planitia.

References: [1] McKim, R. J. (1990) *JBAA* 102, 5. [2] Martian, L. J. and Zurek R. W. (1993) *JGR* 98,3221-3246. [3] McKim, R. J. (1996) *JBAA* 106, 185-200. [4] Leovy, C. B. et al. (1972) *Icarus* 17, 373-393. [5] James, P. B. and Evans N. (1981) *GRL* 8, 903--906. [6] Peterfreud, A. R. (1985) *Icarus*. [7] James, P. B. (1985) Cambridge Univ. Press, Cambridge pp. 85-100. [8] Stamnes, K. et al. (1988) *Appl. Opt*. 27, 2502-2509. [9] Wolff, M. J. et al. (1997) *JGR*, 102, 1679-1692.