GLOBAL DISTRIBUTION OF UNIQUE SURFACE PROCESSES IMAGED BY THE MARS ORBITAL CAMERA. M. K. Rifkin and J. F. Mustard, Brown University, Dept. of Geologic Sciences, Box 1846, Providence, RI, 02912 (Moses_Rifkin@brown.edu).

Introduction: The high resolution images obtained by the Mars Orbital Camera (MOC) portray the Martian surface in greater detail than ever before [1]. As a result, we are able to identify terrains that were previously unobservable at the limit of resolution and to consider many new processes. We are systematically analyzing the high resolution MOC images to determine the spatial extent of (a) young indurated surfaces [2, 3], (b) dark linear features related to small-scale "dust devil" storms, (c) dark slope streaks believed to be evidence of mass movement, and (d) a unique morphology related to young volcanic flows.

Methods: We have examined more than 8000 of the high resolution images from the MOC pre-mapping and early mapping phases for the presence of various unique morphological features. Based on this examination, we have created a binary database, coding each image based on the presence or absence of each morphology. This database was then imported into the Geographic Information System (GIS) analysis software package, ArcView, created by the Environmental Systems Research Institute (ESRI). The use of GIS analysis for planetary geology allows us to examine the spatial relationships present in the database, and is a powerful tool for planetary research [4].

We focus on three specific morphologies that are related to surface processes and the fourth a unique volcanic morphology. The young indurated surface morphology is analyzed in detailed by [2] and [3] and will not be discussed here. In Figure 1 are shown typical dark lineations which are commonly several pixels wide. These lineations are thought to result from dust devils on the Martian surface [5]. As the surface heats, the rising air will occasionally begin to spin and move laterally, creating a dust devil. The resultant suction can remove the fine airfall dust that lies on the martian surface, creating dark streaks in the wake of the dust devil. This process is believed to be active today. We identified 230 images (2.8% of the total number of high resolution MOC images examined) that exhibited these dust devil tracks.

Examples of dark slope streaks are shown in Figure 2. These distinctive dark streaks were first observed in Viking Orbiter images, but the MOC images provide a clearer view of their properties. The streaks follow local slopes and avoid obstacles, appear to emanate from a small, sharp origin and widen downslope. These streaks have been explained as the result of dust avalanches down a slope face, triggered by seismic or wind action [6]. The process creating the landslide streaks is thought to be active today. The streaks often appeared in groups, as shown in Figure 2; single streaks are rarely observed. We identified 130 images (1.6%) that contain these dark landslide streaks.

Finally, we focused on images exhibiting a unique morphology as shown in Figure 3. This has been interpreted to be indicative of volcanic lava flows [7] where the rough surface texture results from cooling and contraction of the lava surface with continued flow and subsurface deformation. This morphology is distinct from volcanic morphologies observed elsewhere, primarily due the pronounced ridges, apparent rafting, and youth [8]. We observed 70 images (0.8%) that contained this morphological unit.

Results: The locations of images that displayed these features are shown in Figure 4. It is clear that these terrains are not distributed evenly across the Mars. Thus their distributions provide insight into surface processes..

The volcanic lava flows (blue points) are the most limited in their spatial extent. They are found almost exclusively in or near to Martes Valles with a few scattered sites observed in the Tharsis region. The origin of this unique flow morphology has been recently examined by [7]. They suggest the closest analog is the 1783-1784 Laki lava flow in Iceland where a partially solidified flow was broken up and transported. The distribution shown in Figure 4 is very well correlated with regions of high radar backscatter in the Martes Valles region noted by [9]. We recognize many more occurrences in the Tharsis regions than [7], most of which again are associated with high radar backscatter. However not all regions of high backscatter show this terrain.

The dust devil tracks are concentrated in the northern hemisphere and occur mostly between 45º and 75º latitude. They are also found along the periphery of the Tharsis bulge and Arabia. The high latitude distribution is likely related to the active atmospheric conditions during the recession of the polar hood and is well correlated to observations of dust activity [e.g. 10]. The high concentration in the north suggests that dust devils are a major processes for lofting dust into the atmosphere.

The dark slope streaks are concentrated in the high albedo regions of Tharsis and Arabia (Figure 4). The distribution is consistent with that described previously [11] though this is the first published map. The interpretation of a disturbance of a near surface layer of dust seems reasonable given the strong association with bright regions and areas of dust deposition. However, elements of the formation and

the cause of the very strong albedo contrast remain uncertain.

References: . [1] Malin M. C. et al., (1997) *Science* 279, 1681-1685. [2] Mustard J. F. et al., (2001), this volume. [3] Rifkin M. K. et al. (2001), this volume. [4] Hare T. M. et al. (1998) *LPS XXIX,* 515-516. [5] Edgett K. and Malin M. C., (2000) *JGR-Planets*, 105, 1623-1650. [6] Sullivan R. et al. (1999) *LPS XXX*, #1809. [7] Keszthelyi et al., (2000) *JGR-Planets*, 105, 15, 027-15,049. [8] Hartman W. K. and Berman D. C. (2000) *JGR-Planets*, 105, 15011-15026. [9] Harmon J. K. et al., (1999) *JGR-Planets*, 104, 14,065-14,089. 704 [10] James PB, et al., (1999) *Icarus* 138: 64-73. [11] Ferguson and Lucchitta (1984) NASA TM86246, 188-190.

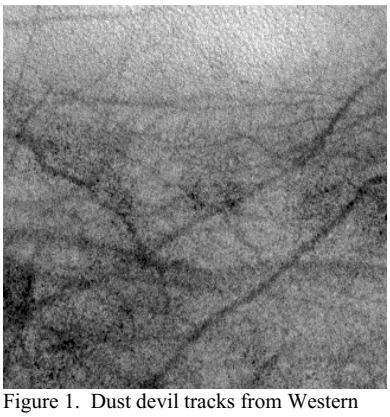

Figure 1. Dust devil tracks from Western Utopia (Image M0000800, 59.00º N, 242.07º W, 3.15 m/pixel, 324 pixels across). This is a small section from the northern part of the image.

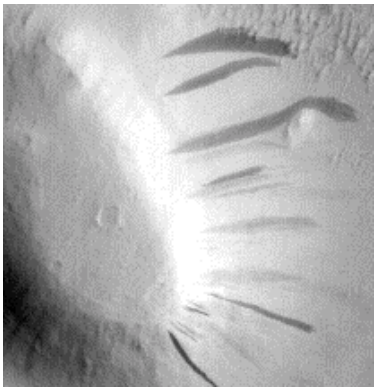

Figure 2. Dark landslide streaks from Amazonis Plantia (Image M0301280, 24.23º N, 173.85º W, 4.51 m/pixel, 207 pixels across). This is a portion from the northern half of the image.

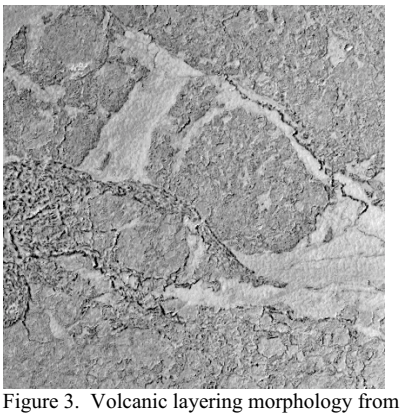

Figure 3. Volcanic layering morphology from central-west Elysium Basin (Image FHA01248 5.84º N, 209.97º W, 4.39 m/pixel, 439 pixels across). This is a small detail from the southern portion of the image.

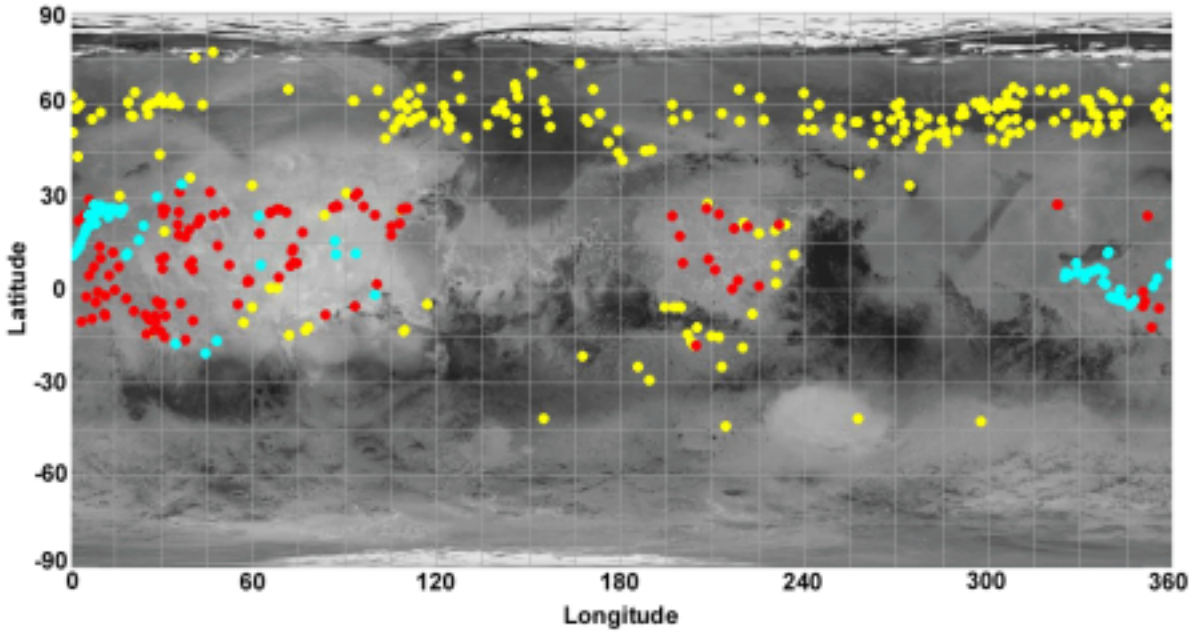

Figure 4. The GIS spatial display of the MOC images exhibiting described above. The background image is the Mars Digital Image Mosaic, based on a mosaic of images from the Viking imager.

Yellow - dust devil tracks (Figure 1) Red - dark landslide streaks (Figure 2) Blue - volcanic layering (Figure 3).