DYNAMIC MARS: NEW DARK SLOPE STREAKS OBSERVED ON ANNUAL AND DECADAL TIME SCALES. K. S. Edgett[1], M. C. Malin[1], R. J. Sullivan[2], P. Thomas[2], J. Veverka[2], [1]Malin Space Science Systems, P.O. Box 910148, San Diego, CA 92191-0148, USA; [2]CRSR, Space Sciences Building, Cornell University, Ithaca, NY 14853, USA.

Introduction: Dark slope streaks are long, sometimes tapered features common to steep slopes in the higher albedo equatorial regions of Mars. They were first observed in some of the highest resolution Viking orbiter images [1–3] and numerous subsequent examples have been found in high resolution (1.4–20 m/pixel) Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) images taken since September 1997. Sullivan *et al.* [4] summarized first-year MOC observations of dark slope streaks and possible formation mechanisms. In general, they appear to result from mass movement, but details regarding the particle sizes, nature of their flow, and initiation mechanisms are still under study. The purpose of this paper is to present an exciting new observation that will eventually lead to an understanding of the rate at which dark slope streaks form, and the rate at which they disappear (thought to be via dust mantling). This paper reports two cases where the same location was photographed twice, and new dark slope streaks were observed in the more recent images. The first case shows changes that occurred between 1978 and 1999 (~1 Mars decade), the second case shows changes that occurred between early 1998 and late 1999 (~1 Mars year).

Change in 11 Mars Years: On 7 May 1978 (L_s ~83°), the Viking 1 orbiter acquired a ~17.5 m/pixel image of an 11.6 km diameter impact crater located within the Schiaparelli Basin at 1.8°S, 343.9°W. A portion of this image, 748A12, is shown in Figure 1a. This was one of the various examples from the Viking mission that showed the existence of dark slope streaks on Mars. The crater was next seen on 15 August 1999—L_s ~187°, about 11.3 Mars years later (MGS MOC image M04-01105 in Figure 1b), and again about 11.5 Mars years since the 1978 image at L_s ~246° on 18 November 1999 (M09-04689 in Figure 1b). The arrows in Figure 1b indicate the streaks that we can confidently identify as being new in 1999 relative to the 1978 image. Some of the streaks seen in 1978 appear to remain in 1999, perhaps indicating either that the rate at which streaks fade or become obscured is slower than the rate that new ones form or that certain slopes are sites of repeated streak formation over the course of 11 martian years. Figure 1 shows only the northeast quarter of the crater at 1.8°S, 343.9°W, and the MOC images indicate at least 7 new streaks occurring on the crater wall and at least 6 on slopes outside the crater rim. To first order, one might conclude that this is approximately 1 new streak per year for this quarter of the crater, or perhaps 4 new streaks per year if the entire crater was in view. Regardless, the images in Figure 1 indicate a planet upon which mass movements occur today in the modern martian environment.

Change in 0.9 Mars Year: The second example in which new dark slope streaks are observed is a much more dramatic example than that shown in Figure 1. Instead of documenting changes that occurred since the Viking missions, Figure 2 shows a case in which new slope streaks formed in less than 1 martian year and were photographed exclusively by the MGS MOC. Figure 2a is a subframe of a MOC image taken on 1 February 1998 at L_s ~266. Figure 2b shows the same location on 18 November 1999 at L_s ~246, less than 1 Mars year later. The location is the southeastern quarter of an impact crater north of Apollinaris Patera at 6.0°S, 183.8°W. Three new dark slope streaks formed during the 0.92 Mars year interval between the two pictures. During this same interval, the older streaks that were present in February 1998 remained visible.

Discussion: The 1999 MOC images presented here were specifically targeted to look for changes in the number and relative brightness of dark slope streaks over time. New streaks are observed, and it is observations like these that will eventually lead to a better understanding or determination of slope modification rates in the modern martian environment. Differences in spatial resolution and illumination conditions between older and newer images can make quantification of these changes difficult, but for the moment what is interesting is the fact that changes can be documented at all. The presence of new slope streaks is a key indicator that geologic processes other than wind action are in fact at work on Mars today. We also note that the newer streaks (Figs. 1b and 2b) are darker than older streaks seen in earlier images, consistent with the hypothesis [*e.g.,* 1–4] that dark slope streaks fade with time. The appearance of a new dark streak is probably a sudden, catastrophic change, while the disappearance of an older streak may be a more gradual process because older streaks remain visible over annual and possibly decadal time scales.

References: [1] Morris E. (1980) *JGR, 87*, 1164-1178. [2] Williams, S. H. (1991) *LPSC XXII*, 1509-1510. [3] Ferguson and Lucchitta (1984) *NASA TM 86246*, 188-190. [4] Sullivan R. *et al.* (1999) *LPSC XXX,* #1809.

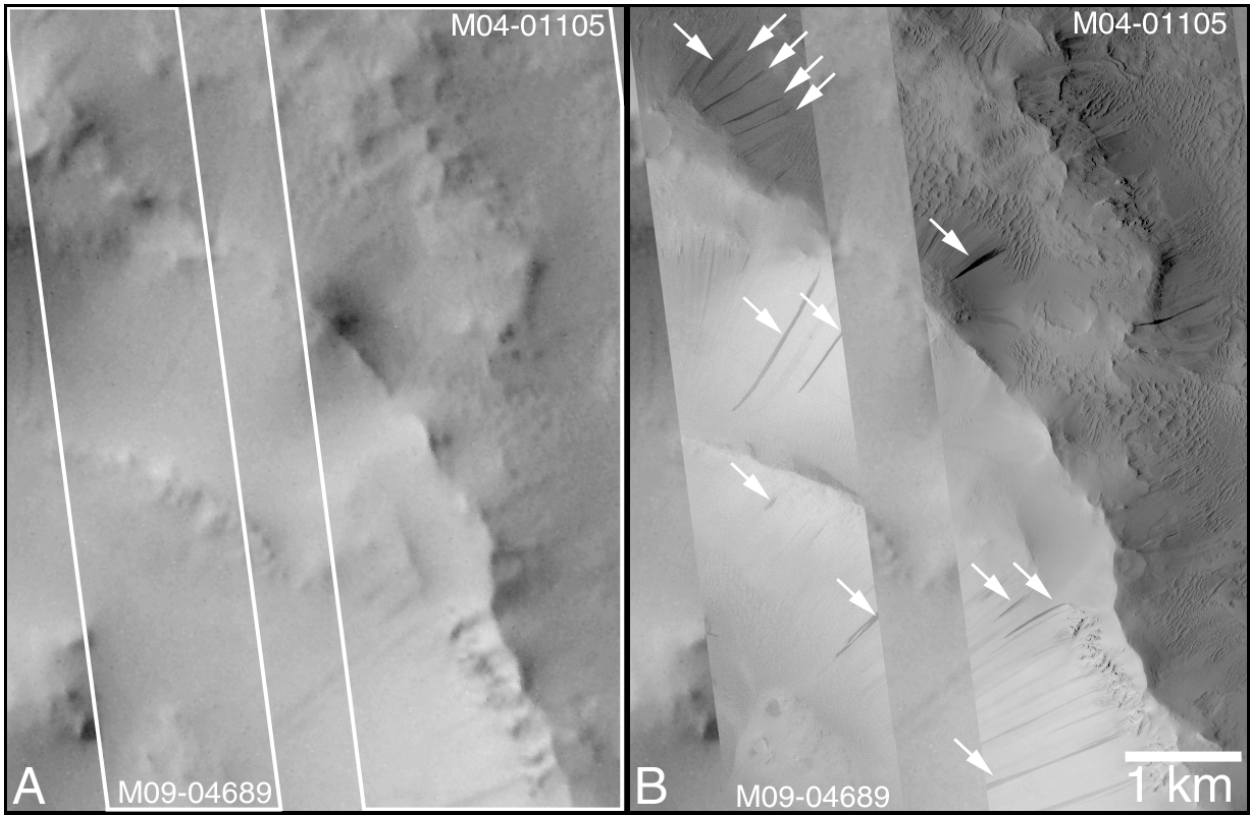

Figure 1. Appearance of new dark slope streaks over 11 Mars year interval. **(A)** On the left is a subframe of Viking orbiter image 748A12 taken in May 1978. White outlines indicate the location of two MOC images obtained in 1999. **(B)** On the right are the two MOC image subframes (M09-04689 from November 1999, and M04-01105 from August 1999) overlain on the earlier Viking image. New dark slope streaks are indicated by arrows. Location is a crater at 1.8°S, 343.9°W. North is up, illumination is from the left.

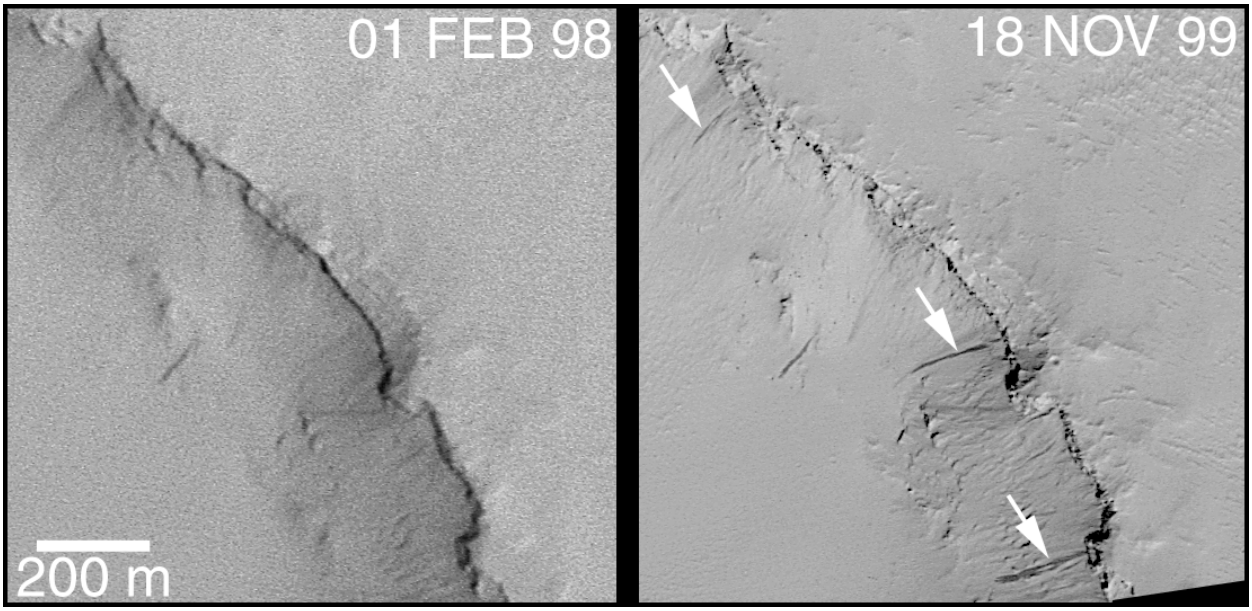

Figure 2. Appearance of 3 new dark slope streaks (arrows) after a 0.92 Mars year interval. Image on left is subframe of MGS MOC AB1-11304, image on right is M09-04872. These are located in a crater at 6.0°S, 183.8°W. Both views are illuminated from the lower right, north is toward the left.