

Surface Stereo Imager Observations of Dust Devils at the Phoenix Landing Site. K. M. Bean¹, M. T. Lemmon¹, Phoenix Science Team, ¹Department of Atmospheric Science, 3150 TAMU, Texas A&M University, College Station, TX 77843-3150, kbean1988@neo.tamu.edu, lemmon@tamu.edu

Introduction: The Surface Stereo Imager (SSI) on board the Phoenix Mars Lander observed 76 wind events. 37 unique dust devils were spotted, and 11 events were likely strong gusts of wind, not dust devils. The dust devils were not observed until late in the mission.

Discussion: Dust devils were suspected at the Phoenix landing site after an imaging campaign by the Mars Global Surveyor (MGS) found dust devils in the north polar regions of Mars. [1] Before landing, the Mars Reconnaissance Orbiter (MRO) observed dust devils within Phoenix's landing ellipse. [2]

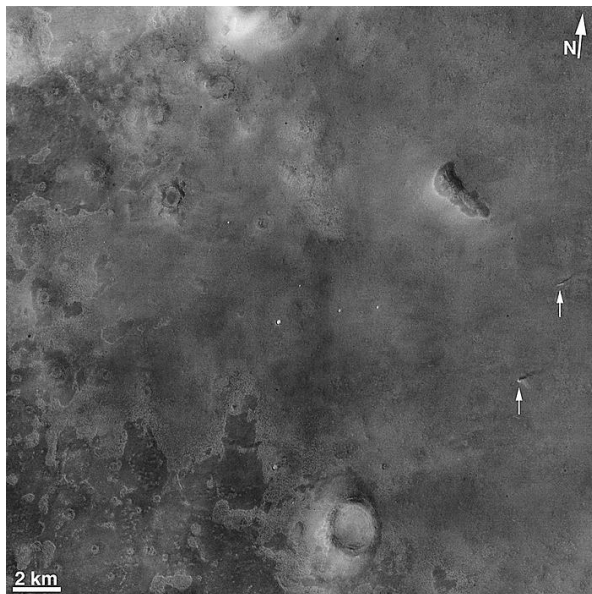


Image 1: Dust devils spotted within the Phoenix landing ellipse by MRO approximately one month before landing. [2]

There were dust devils observed approximately one month before landing, but the earliest dust devil spotted by the SSI was on sol 104, well after the primary mission ended. After sol 104, dust devils were spotted frequently. The pressure data shows several dips that are indicative of dust devils prior to successful SSI observations of the dust devils. [3] Image sets were dedicated to search for dust devils, and at least one dust devil was spotted in 7 of the 12 sets. Image sets consisted of 14 to 50 images of the horizon, taken mostly between 11:00 and 16:00 local true solar time (LTST). All horizon images from sol 73 to 151 (end of

mission) were processed for incidental dust devils, but only sol 104 revealed incidental dust devils while taking a slice of the multispectral panorama. The dust devils sightings seemed almost cyclical, but since the observations were not taken every day nor at the same time of day, the sightings may not necessarily be cyclical. However, it is also likely the seemingly cyclical nature may be caused by passing weather systems. [3]

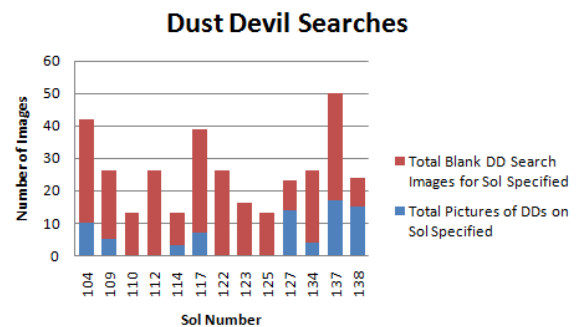


Fig. 1: A graph depicting the success rate of dust devils searches. Sol 104 was the incidental sol.

To review the images, the contrast was enhanced. This allowed very faint wind events, down to a ~3% difference of the background albedo, to be more easily viewed. The majority of the dust devils were too faint to appear until after this processing. Each event was kept track of in a database by sol, local true solar time, the SSI's pointing, and filter. A reference pixel was also marked to make it easier to find the wind event.

A total of 76 events were found in the images from sol 104 through sol 138. In the sets of sequential images, dust devils could move inbetween capturing each image. Based on the observable physical characteristics and the distance travelled between images, there were 37 unique dust devils imaged during the mission. Another 11 events are more likely to be strong gusts of wind that picked up regolith. This was based on the events lacking the telltale characteristics of dust devils, such as vertical lift and ability to stay cohesive for a considerable length of time.

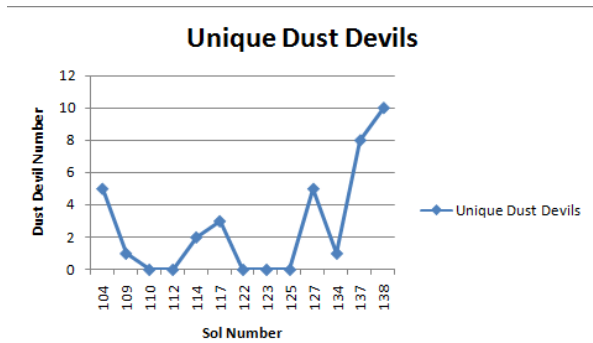


Fig. 2: A graph depicting the number of unique dust devils between sols 104 and 138. The lines are linear interpolations between data points.

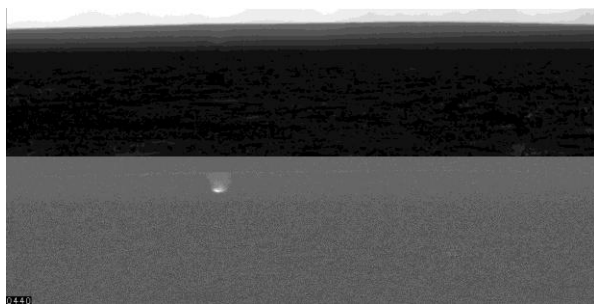


Image 2: A dust devil observed on sol 109 at 15:01:41 LTST. The top half of the image is the raw image, and the bottom half is the contrast-enhanced image.

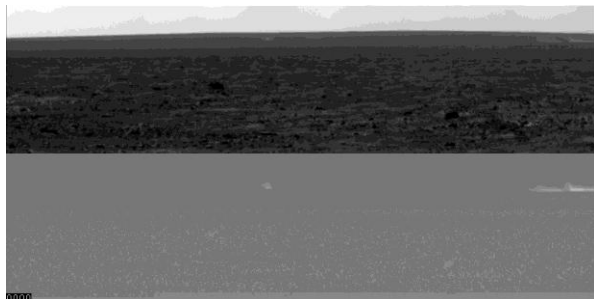


Image 3: A dust devil and a gust of wind observed in the same image taken on sol 127 at 13:17:35 LTST. The dust devil is in the center of the image, and the gust of wind on the right edge. The top half of the image is the raw image, and the bottom half is the contrast-enhanced image.

As the mission progressed, more wind events were observed. This is most likely due to the changing seasons. Summer was fading into autumn in the last third of the mission's surface operations.

Most dust devils were observed during midday, peaking in the 13:00 LTST hour. Most images were taken during the 13:00-15:00 time frame. Data from the Mars Pathfinder mission also shows that dust devils frequently occur during this time frame. [4] No dust

devils were observed in the 12:00 and 16:00 hours, but relatively low amount of images were taken during these times.

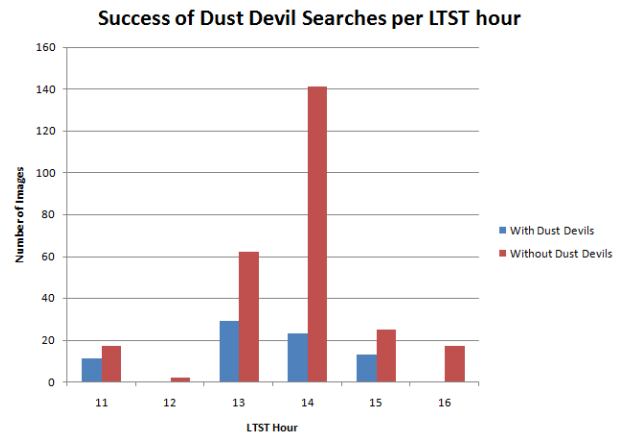


Fig. 3: A graph depicting the number of successful vs. unsuccessful dust devil images per hour. The incidental sol and all specific dust devil searches are included.

Summary: The SSI observed 76 wind events, which were determined to be 37 unique dust devils and 11 strong gusts of wind. Wind events were not seen in images until the last third of Phoenix's surface operations. The majority of dust devils occurred between 13:00-15:00 LTST and peaked during the 13:00 LTST hour.

References: [1] Drake N. B., Tamppari L. K., Baker R. D., Cantor B. A., and Hale A. S. (2006) *Geophys. Res. Lett.*, 33, L19S02, doi: 10.1029/2006GL026270. [2] Malin, M. C., M. R. Kennedy, B. A. Cantor, and K. S. Edgett (2008), Malin Space Science Systems Captioned Image Release, MSSS-30, http://www.msss.com/msss_images/2008/05/06/. [3] Ellehoj M. D. et al (2008) *AGU Fall 2008 Meeting*, Abstract U11B-0032. [4] Murphy, J. R., and Nelli S. (2002) *Geophys. Res. Lett.*, 29(23):4.