

TIME-DEPENDENT DUST ACCUMULATION ON THE MARS PHOENIX WIND INDICATOR. C. Holstein-Rathlou^{1*}, H.P. Gunnlaugsson¹, J.P. Merrison¹, P. Nørnberg¹, M.D. Ellehoj², K.M. Bean³, M.T. Lemmon³, L. Tamppari⁴, P. Smith⁵ and the Phoenix Science Team⁵, ¹ Aarhus University, Department of Physics and Astronomy, bld. 1520, DK-8000 Aarhus C, Denmark, ²Niels Bohr Institute, University of Copenhagen, DK-1200 Copenhagen-Ø, Denmark, ³Dept. of Atmospheric Science, Texas A&M, College Station, Texas, USA, ⁴Jet Propulsion Laboratory, Pasadena, California, USA, ⁵Lunar & Planetary Laboratory, University of Arizona, Tucson, Arizona, USA
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Introduction: Time dependent dust accumulation on the Telltale fibers was observed during the Phoenix mission. Removal of dust seems coupled with dust devil passings at the Phoenix landing site and investigations are underway to determine the wind speeds needed for the dust removal.

Observations: The NASA Mars Mission Phoenix lasted 152 sols corresponding to $L_s = 76^\circ$ to 148° [1]. During this time wind speeds and directions were measured with a mechanical anemometer, the Telltale (Fig. 1), by analyzing the position of the Kapton cylinder in pictures taken with the Surface Stereo Imager (SSI).

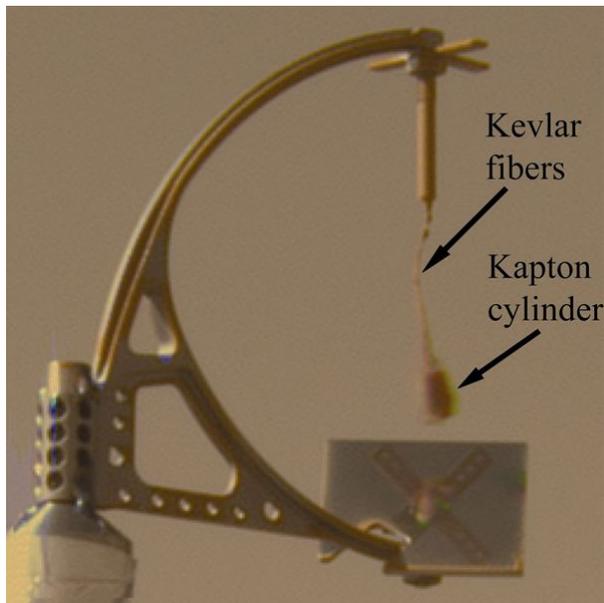


Figure 1: Color composite image of the Telltale taken on $L_s \sim 119^\circ$ [2]

The Kevlar fibers were originally monitored for dust accumulation to assess the possible error to the wind measurements. Laboratory tests have shown that this effect introduces a negligible error, however the time dependency of the dust accumulation displays interesting features.

The dust accumulation can be seen in the Telltale images (Fig. 2). Since neither the fibers nor the dust thereupon are optically thick, a dust factor was calcu-

lated assuming exponential absorption through the dust loaded fibers (Fig. 3). At $L_s \sim 78^\circ$ the dust accumulation is minor as seen from the contrast between the fibers and the background. This contrast increases steadily until $L_s \sim 114^\circ$. On later sols, the fibers appear thinner, indicating that they have been partially cleared of dust. The first major dust-devil days, were at $L_s \sim 112^\circ$ and $L_s \sim 120^\circ$ (Fig. 4), suggesting that dust devils have cleaned dust off the fibers. The behavior appears to be more erratic hereafter, but there are clear indications of periods with accumulation and removal.

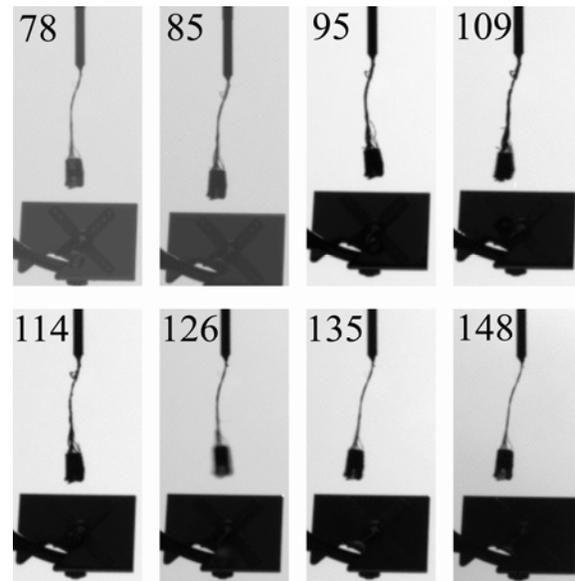


Figure 2: Images of the Telltale taken around 15:35 LMST at the solar longitudes indicated [2].

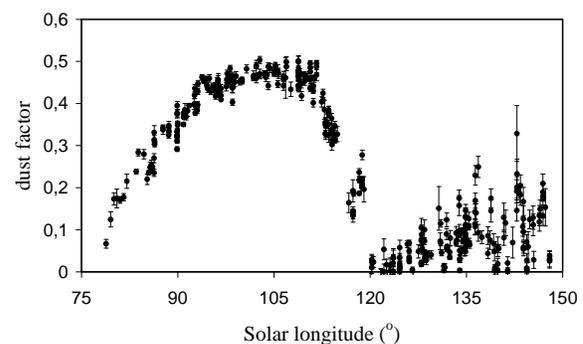


Figure 3: The calculated dust factor of the dust loaded fibers as a function of solar longitude.

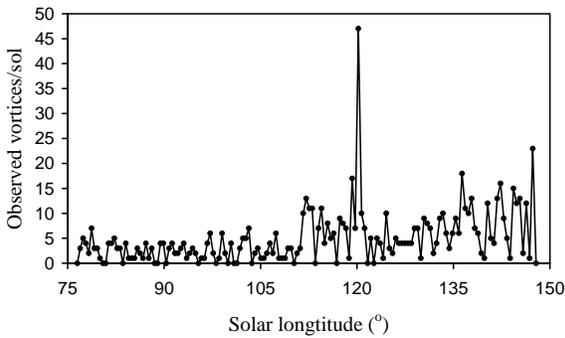


Figure 4: Number of vortices per sol observed at the Phoenix landing site by characteristic 5-20 sec. drop in the pressure (from [3]).

Future investigation: The highest wind speed recorded at the Phoenix landing site of 16 m/s [2] can only just lift sand particle agglomerates from the surface [4]. The fibers seem to be unaffected by wind speeds of that caliber, and rely more heavily on the passing of dust devils to provide wind speeds of the order 35-40 m/s [3]. Laboratory testing is underway to determine the critical wind speeds needed to remove dust from the fibers, possibly providing a measurement of wind speeds in the dust devils seen at the Phoenix landing site.

The dust quantity on the fibers will also be investigated to determine the amount of material the fibers can amass. For constant atmospheric dust concentration, the accumulation is probably proportional to the wind speed as long as the wind speeds do not reach the level needed to remove dust.

References: [1] Smith, P.H., *et al.* (2009) *Science*, **325**, 58. [2] Holstein-Rathlou, C. *et al.* (2010) *JGR* in press. [3] Ellehoj *et al.*, (2010) *JGR* in press. [4] J.P. Merrison (2007), *Icarus*, **191**.