ON DUST STORMS OBSERVED AT THE PHOENIX LANDING SITE.

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Introduction: Images taken of the North Polar region on Mars by the Mars Color Imager (MARCI) [1] onboard Mars Reconnaissance Orbiter, during the landed operations of the Mars Phoenix Lander provides new opportunities for interpreting data from the Lander on a global scale. In this contribution, we make use of optical data [2], wind-data [3], pressure data [4] and MARCI images [5, 3] to discuss two different origins of dust activity at the landing site.

Results: Several “dust storms”, i.e. periods with sudden rise in optical depth were observed at the Phoenix landing site during its 150 sol mission (L_S = 76º to 150º) cf. Fig. 1.

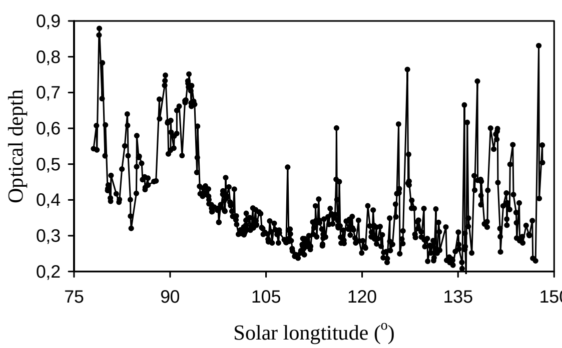

Fig. 1: Optical depth measured from solar absorption (from [2]).

In the beginning of the mission (L_S < 100º), two periods were observed with increased dust load in the atmosphere, around L_S ~80º and from L_S = 88º to L_S = 94º. These events were not associated with increased wind speeds (c.f. Fig. 2). These events can be seen as slightly elevated pressure levels on an otherwise steadily declining pressure curve due to seasonal condensation at the South Pole (cf. Fig. 3). When the latter event is traced back in MARCI images, it is observed that the event originates when the remaining CO_2 frost evaporates from the polar region.

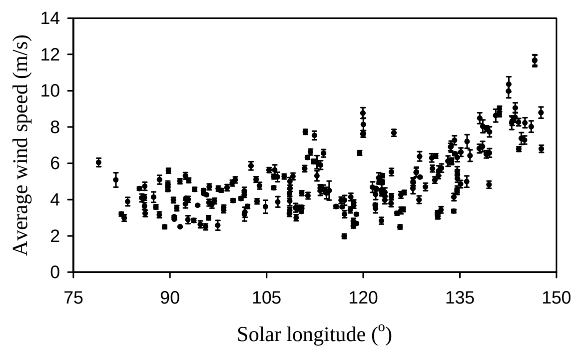

Fig. 2: Average daytime wind speeds as recorded by the Telltale instrument (from [3]).

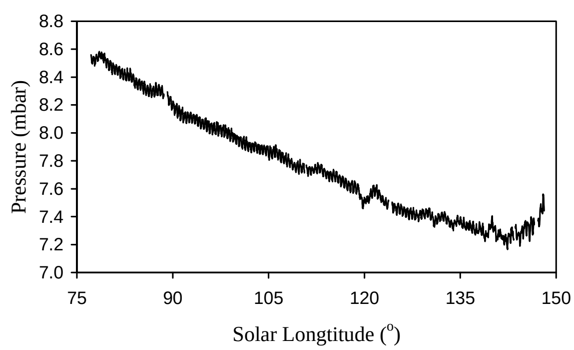

Fig. 3: Pressure at the Phoenix landing site (from [4]).

The wind data shows that these events are not associated with storm systems. More likely there is dust just below the CO_2 frost layer that is easily put into suspension when the CO_2 evaporates, or that the evaporation assists the dust to be lifted into suspension.

In the latter half of the mission, several individual days showed elevated dust levels along with increased wind speeds, which were generally from West. In MARCI images, these events are associated with the passing of condensate clouds.

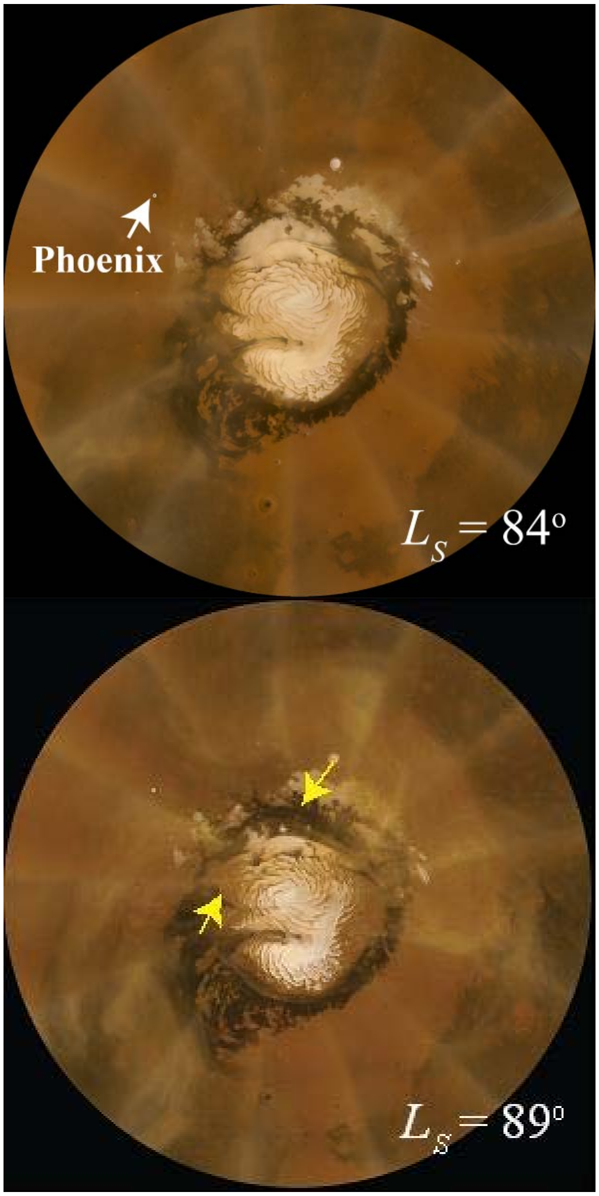

Fig. 4: MARCI images of the north polar region taken at the solar longitudes indicated.

These events became more frequent in the latter part of the mission, and one of the strongest occurred at L_S = 120°. The pressure data shows dips from the otherwise declining pressures indicating low pressure weather systems. Simultaneously the wind data shows elevated wind speeds as these systems pass over the landing site. Another characteristic feature of the passing of these systems is elevated dust-devil activity [5].

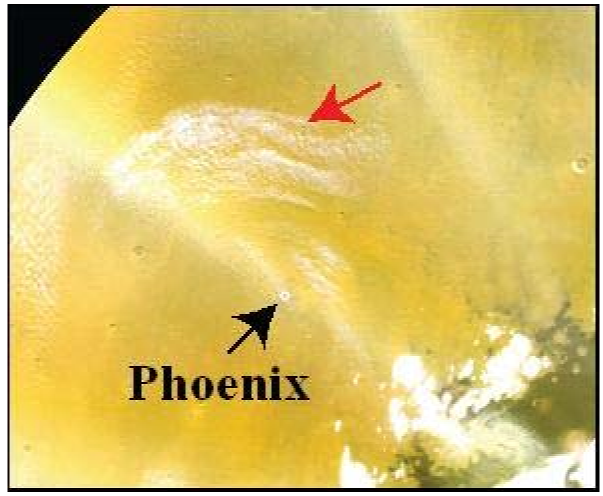

Fig. 5: Contrast enhanced MARCI image taken at Ls = 120°.

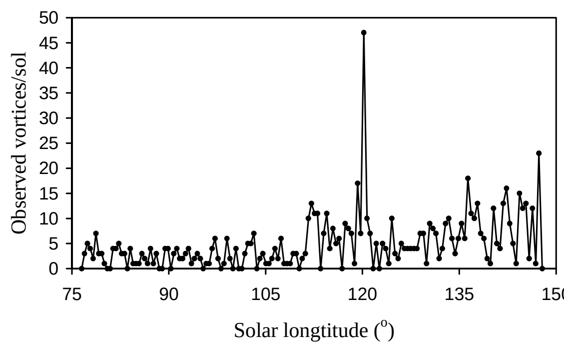

Fig. 6: Number of vortices per sol observed at the Phoenix landing site by characteristic 5-20 sec. drop in the pressure (from [5]).

In MARCI data, it is seen that when these weather systems approach the North Polar region, dust storms are initiated [3]. This was also the case on sol 150, when a condensate cloud was seen just south of the landing site. By sol 151 the cloud had reached the North Polar region and a dust storm was beginning to form. The passing of this dust storm over the landing site led to reduced power that eventually led to loss of communications with the lander.

References: [1] Malin M. C. (2001) JGR 106, 17651, [2] Tamppari, L. *et al.*, (2010) *JGR*, in press. [3] Holstein-Rathlou, C. *et al.*, (2010) *JGR*, in press. [4] Taylor, P. *et al.*, (2010) *JGR* in press. [5] Ellehoj *et al.*, (2010) *JGR* in press.