WINDS AT THE MARS PHOENIX LANDING SITE. C. Holstein-Rathlou[1], H.P.Gunnlaugsson[1], J. Merrison[1], P.Taylor[2], C. Lange[3], J. Davis[3], M. Lemmon[4], and the Phoenix Science Team, [1]Department of Physics and Astronomy, Aarhus University, Ny Munkegade 120, bld. 1520, DK-8000 Aarhus C, Denmark, [2]Dept. of Physics and Astronomy, York University, Toronto, Canada, [3]Dept. of Mechanical Engineering, University of Alberta, Edmondton, Canada, [4]Dept. of Atmospheric Science, Texas A&M, College Station, TX, USA, (holstein@phys.au.dk)

Introduction: The Telltale is a mechanical anemometer consisting of a lightweight cylinder suspended by Kevlar fibers that are deflected under the action of wind (Fig. 1). The Telltale is mounted on top of the meteorological (MET) mast at roughly 2 meters height above the surface [1]. Images taken with the Surface Stereo Imager (SSI) of the Telltale deflection allows the local wind speed and direction to be quantified at the Phoenix landing site.

Many different aspects of the local weather at the Phoenix landing site have been studied using the Telltale data, including the accuracy of predictions from global climate models, slope wind effects, midnight temperature turbulence, daily temperature differences and possible temperature inversion arising from frost formation.

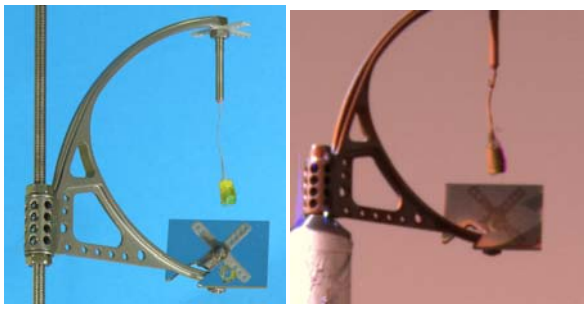

Fig.1: Left: The Telltale as imaged on Earth, **Right:** Color image taken around sol 50 on Mars.

Telltale data: The wind data is not continuous due to dependency on the availability and operational constraints of the SSI. Images were taken in series of 3 to 100 images with a spacing down to 50 sec. Nighttime imaging of the Telltale began on Sol 43. A total of ~6000 Telltale observations were made during the mission.

At night winds are calm with Easterly winds of about 4 m/s. As the day progresses surface heating gives rise to convective turbulence resulting in wind speeds scattering from 1 to 12 m/s. Wind directions complete a full circle during the day possibly due to slope wind effects (cf. Fig. 2).

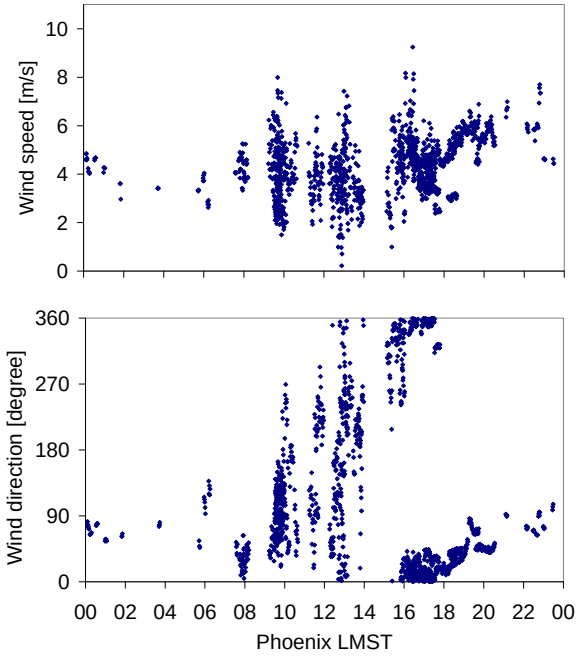

Fig. 2: Telltale data from sols 31-60 displaying the diurnal trends. The wind directions are normal meteorological convention, with North being 0°, East being 90°, South being 180° and West being 270°.

Among the interesting features at the landing site is the total lack of any aeolian features such as dunes as has been observed at all other landing sites on Mars. OM images [2] show that the building material to make dunes exists at the landing site, and Telltale data show that conditions for particle movement are (barely) met. It is suggested that the surface is active on a timescale faster than the time needed to build up aeolian features e.g. around rocks.

Temperature differences: The meteorological mast on the Phoenix lander measured air temperatures continuously throughout the mission with three thermocouples at heights of roughly 1.25, 1.50 and 2.00 meters above the surface [3]. Measurements showed directional dependency in the temperature difference

between the lowest thermocouple and the average value of the two upper thermocouples. The greatest differences are observed when winds travel across the Phoenix lander to reach the MET mast carrying heat from the instruments and communication antennas past the lowest thermocouple (cf. Fig. 3).

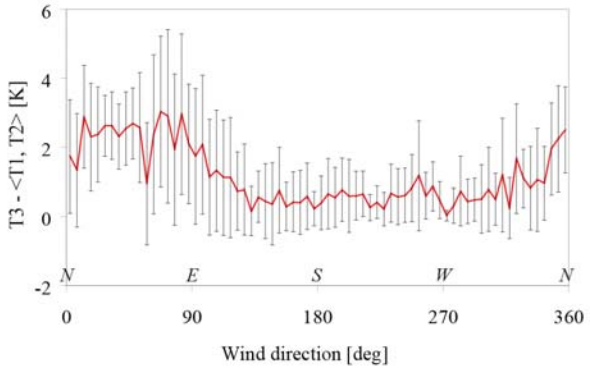

Fig. 3: Temperature difference as function of wind direction. Winds coming from N – NE – E must pass across the Phoenix lander.

Late night turbulence: Temperature data recorded at the Phoenix landing site by the MET station shows turbulence at about midnight LMST throughout the mission. (Fig.4).

To investigate this turbulence the path of an air mass has been calculated backward in time by assuming that the air mass behaves as a rigid body and using Telltale data as initial values.

Nighttime winds at the Phoenix landing site are mainly Easterly and modeling has the air masses passing over Heimdall crater, transporting turbulent winds from the only major topographical feature in the vicinity of the landing site (cf. Fig. 5).

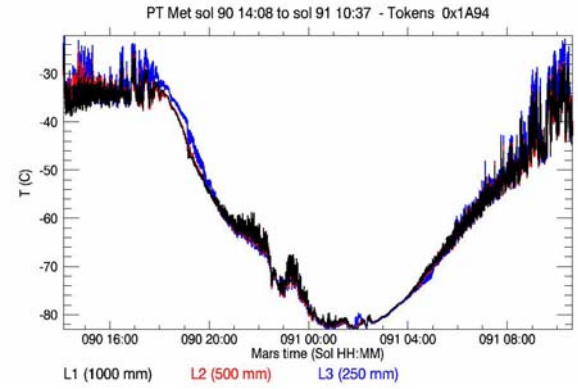

Fig. 4: Preliminary Phoenix MET temperature from sols 90/91 [4]

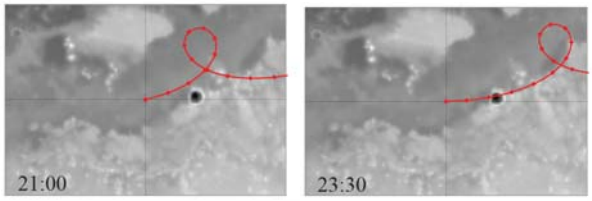

Fig. 5: Images showing the calculated path of the air mass at different times of day shown on MOLA image. The dots show 1 hour separation.

Temperature inversion: Towards the end of Phoenix's primary mission weather conditions resulted in frost formation on the ground as well as the Telltale mirror. A 64 image Telltale observation sequence on the night of Sol 79/80 showed frost forming as time progresses. Temperature measurements taken at the same time shows the upper thermocouple becoming colder than the middle thermocouple as the frost begins to form (cf. Fig. 6).

Whether this temperature difference is due to frost forming on the upper thermocouple is being investigated.

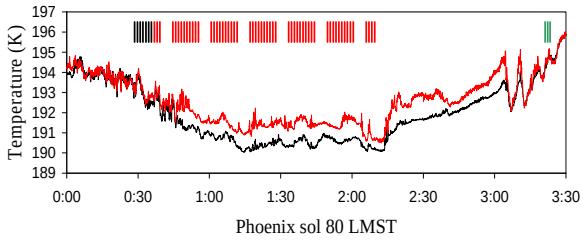

Fig. 6: Temperature curves for Sol 79/80 for upper (black) and middle (red) thermocouple. Lines mark the times Telltale images were taken, color indicating whether frost was not present (black), was present (red) and seemed to be sublimating (green).

References:

[1] H.P. Gunnlaugsson, (2008), *JGR, 113*, E00A04
[2] T. Pike, (2009), *JGR, in prep.*
[3] P. Taylor et.al., (2008) *JGR, 113*, E00A10
[4] P. Taylor et.al., *JGR, in prep.*