Variability on Intermediate Time Scales in the Mars Pathfinder MET Data. Jeffrey R. Barnes[1] and Scott Bennett[2], College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis OR 97331, [1]barnes@oce.orst.edu, [2]sbennett@oce.orst.edu.

The temperature and pressure data collected by the Mars Pathfinder (MPF) mission exhibit distinct improvements in several respects over data from the Viking Landers. In particular, MPF temperatures were measured simultaneously at three heights above the surface and were less distorted by the physical presence of the spacecraft than was the case for the Viking Landers. Also, the MPF pressure sensor's digital readouts have 14-bit precision vs. the 10-bit precision of the Viking Landers. In most observation sessions, sampling rates were also higher than those of the Viking Landers and MPF was the first mission to observe entire sols at high sampling rates. These improvements in the collected data make possible the clear detection of features and events at the MPF site that were undetectable or only marginally detectable in the Viking data.

Our main focus to date has been on the four sessions that contain complete coverage of entire sols (sols 25, 32, 38, and 55) and the session covering sol 68, though analyses of this session have been limited due to two large gaps in the data. In each of these sessions certain striking features appear. In the daytime, the dominant features in the temperature measurements are the rapidly increasing mean temperature after sunrise until mid-afternoon, the even more steeply decreasing temperatures thereafter until around sunset, the high variance of temperatures beginning at 0730-0830 Local True Solar Time (LTST) and continuing until 1600-1630 LTST, and a quasi-periodic (or possibly periodic) oscillation of the short-term mean apparent during the time of high variance. (See Figure 1.) We attribute the time of high variance to convective activity from solar heating.

Beginning near sunset, the steep temperature drop was interrupted by brief (~30 minutes) episodes of fluctuating temperatures, during which the short-term mean temperature might level off or even increase slightly. (See three warming events in the period 1820-2000 LTST in Figure 1.) Two possible explanations for these episodes are cold air drainage events and "bursting" events associated with the collapse of the daytime planetary boundary layer. The rate of temperature decrease lessened considerably when the temperature returned to approximately the same point it had reached by the onset of high variability in the morning. For the rest of each night, the temperature decrease slowed and showed low-amplitude fluctuations on several time scales.

Diurnal and semidiurnal pressure tidal modes were easily detected in the Viking data, and crude estimates of the amplitudes of modes 3 and 4 were marginally possible. The vastly improved MPF pressure sensor's nominal precision was .241 microbar vs. Viking's ~88 microbars, which has allowed analysis of the higher-order tidal amplitudes. We find that the amplitudes of modes 3, 5, 7, 9, and 11 are much smaller than the amplitudes of the adjacent even-numbered modes, which suggests that non-linear interaction of tidal modes redistributes energy in favor of the even-numbered modes beyond mode 2 (semidiurnal) up through mode 12.

The pressure records of all four complete-sol sessions and the sol 68 session show interesting features. The diurnal pressure maximum occurred at 0800-0845 LTST each sol, after which the pressure fell throughout the day until reaching the minimum around 1800 LTST. The minimum was then followed immediately by a very sharp rise in pressure over the next two hours and then a small drop over a period ranging from .75 to 2.0 hours. Thereafter, the pressure resumed its rise at a slower rate than the initial rise after the pressure minimum. (See Figure 2.) GCM simulations with uniform atmospheric dust distributions appear to be capable of representing much of the structure of the diurnal pressure cycles for this season and region.

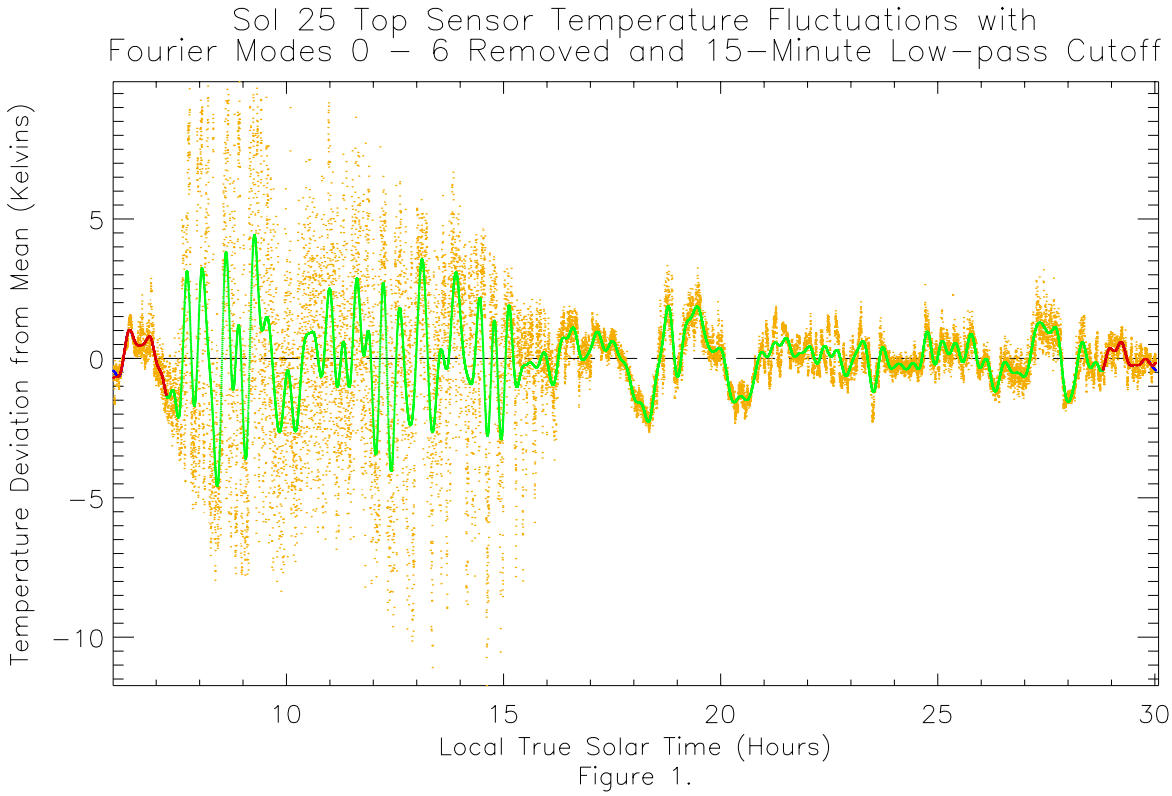

Figure 1.

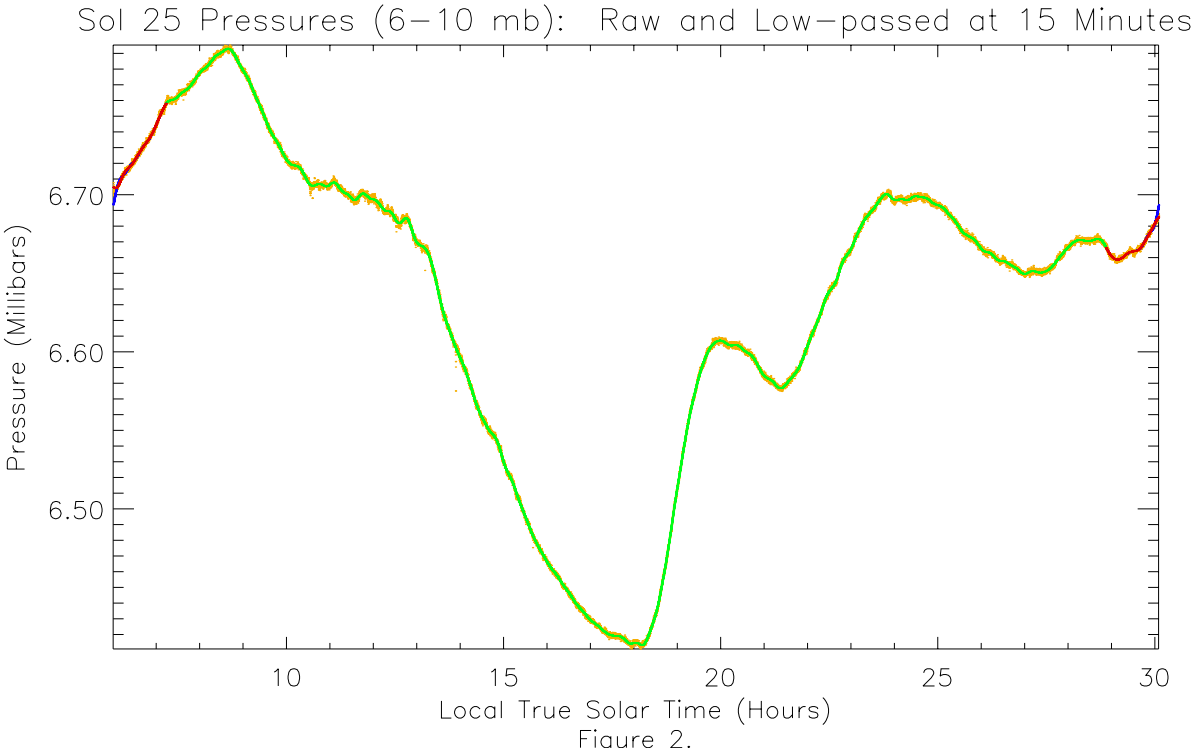

Figure 2.