LANDING SITE SURFACE CHARACTERISTICS FROM TES EPF OBSERVATIONS. J.L. Bandfield, Department of Geological Sciences, Arizona State University, joshband@asu.edu.

Introduction: Thermal infrared multiple emission angle observations (referred to as Emission Phase Functions or EPF's) are well suited to characterize surfaces at decimeter and larger scales. By observing a surface from different angles, it is possible to provide a quantitative assessment of a region based on the relative proportions of warmer (sunlit, low thermal inertia particulates) versus cooler (shaded, high thermal inertia rocks) surfaces present in the field of view.

Landing site characterization often requires extrapolation of scales. The highest resolution imagery currently available for the Martian surface allows for an assessment of surface textures at scales of ~10 m [e.g. *1*]. Mars Orbiter Laser Altimeter pulse gate data provides information on the range of elevations within the laser footprint, which is roughly 140m [*2*]. TES EPF spectrometer and bolometer observations can directly characterize the meter scale surface morphology of proposed landing sites.

TES Multiple Emission Angle Observations: TES observations of a surface display differences in the measured radiance that indicate an anisothermal surface with variations as a function of viewing angle and surface texture. Due to the relatively high thermal conductivity of solid materials, the temperature differences between viewing angles of smaller scale roughness features (less than a few cm) will not be as prominent and become insignificant for sand sized particles.

There are two primary contributions to the difference in measured radiance with viewing angle; 1) different proportions of sunlit versus shaded slopes in the field of view (FOV), and 2) different proportions of materials of variable thermal inertia and albedo in the FOV. In the first case, the derived surface temperature will appear to decrease while passing over the surface from south to north. The second will result in lower apparent daytime temperatures at high emission angles symmetrical about the nadir observation (Figure 1).

Figure 1 displays surface temperatures derived from EPF observations for two sites. Temperatures are derived near 1300 cm^{-1} and atmospheric effects have been removed following the methods of [*3*]. The MPF EPF observation has a low solar incidence angle and slopes will not greatly affect the retrieved temperature. High inertia rocks are present, however, and decrease the apparent temperature at high emission angles viewed from both the north and south. The Phoenix landing site observation displays significant temperature asymmetry about the nadir observation as would be expected for a surface with slopes and a high solar incidence angle. A simple model of north-south facing surfaces of variable slope was constructed using a thermal model (the KRC thermal model was provided by H. Kieffer) to predict the apparent temperature as a function of view angle and slope.

TES EPF observations can provide quantitative information about surface characteristics that are highly complimentary to the existing set of landing site characterization tools. These techniques have potential to reduce landing site uncertainties and mission risk.

References: [1] Malin, M.C. and K.S. Edgett (2001) *JGR, 106,* 23,429-23,570. [2] Garvin, J.B. et al. (1999) *GRL, 26,* 181-184. [3] Bandfield, J.L. and M.D. Smith (2003) *Icarus., 161,* 47-65.

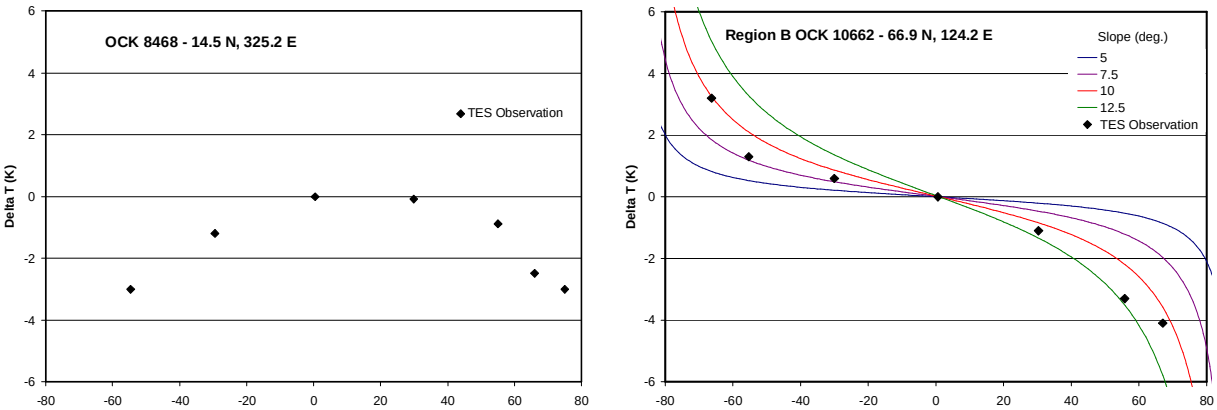

Figure 2. Martian surface temperatures as a function of emission angle derived from daytime EPF observations. The temperature is relative to the nadir observation for each sequence. Negative emission angles are viewed from the south and positive angles are viewed from the north. The left plot displays a relatively symmetrical behavior expected for a rocky surface (near the Pathfinder landing site) with a solar incidence angle of ~30° and azimuth of ~270°. The plot on the right displays an observation in the western portion of the Phoenix B area compared with modeled north-south facing slopes. These observations indicate that the average slopes present are ~10 degrees and probably higher if a full range of slope azimuths are taken into account.