ATMOSPHERIC EFFECTS ON THE MAPPING OF MARTIAN THERMAL INERTIA AND THERMALLY DERIVED ALBEDO; J.N. Hayashi[1], B.M. Jakosky[1], R.M. Haberle[2]; [1]Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO 80309, [2]NASA/AMES Research Center, Moffet Field, CA 94035

The most widely used thermal inertia data for Mars assumes the atmospheric contribution is constant and equal to 2% of the maximum solar insolation [1,2,3]. In 1991, Haberle and Jakosky [4] investigated the effect of including a dusty CO_2 atmosphere and sensible heat exchange with the surface on thermal inertia. We recently [5] utilized Haberle and Jakosky's coupled surface-atmosphere model to investigate the effects of such an atmosphere on the thermally derived albedo. The thermally derived albedo is the albedo which, together with the thermal inertia, provides model surface temperatures which best match the observed temperatures. We present new maps of thermal inertia and thermally derived albedo which incorporate dust opacities derived from IRTM data.

We ran the coupled surface-atmosphere model for a series of latitudes, albedos, thermal inertias, pressures, and dust opacities to obtain minimum and maximum temperatures. Then, using the Palluconi and Kieffer [3] map of thermal inertias and thermally derived albedo, we ran a diurnal thermal model assuming a constant atmospheric contribution of 2% of the maximum solar insolation to obtain minimum and maximum temperatures. Pressure was obtained, to first order, from topographic maps. The dust opacity was approximated by averaging the dust opacities [6] for the period between Ls=345°-125°, which is the period used by Palluconi and Kieffer to obtain their thermal inertias and thermally derived albedos. The 2% minimum and maximum temperatures, pressure, and dust opacity were then used to do an interpolation and obtain the coupled model thermal inertias and thermally derived albedos.

The difference between the 2% model and the coupled model thermal inertias and thermally derived albedos are relatively small for most of the planet. The differences between the two models are largest in regions with either high dust opacities, such as Acidalia, Chryse, and Hellas Planitias, or significant topographic relief, such as Valles Marineris, Olympus Mons, and the Tharsis Volcanoes. It is interesting to note that some of the most geologically interesting regions as well as the two lander sites are located within the regions which show the largest difference between the two models.

Figure 1 is a two-dimensional histogram of the coupled model versus the 2% model thermal inertias. The larger the circle, the more map pixels which have the corresponding coupled model and 2% thermal inertias. The coupled model thermal inertias are slightly smaller than the 2% thermal inertias, with the mean difference between the two thermal inertias being approximately 40 $Wm^{-2}s^{1/2}K^{-1}$. This is in agreement with the results presented in [4] which indicated increasing dust opacity would lead to coupled model thermal inertias which are smaller than the 2% model thermal inertias.

Figure 2 is a two-dimensional histogram of the coupled model versus the 2% model thermally derived albedos. The albedos for the two models are very similar, although there is some excursion from a one-to-one relationship at low albedos. The effects which were included in the coupled model were insufficient to account for the differences between the 2% thermally derived albedo and the IRTM measured albedos.

References. [1] Kieffer H.H. et al. (1973) *JGR*, 78,4291. [2] Kieffer, H.H. et al. (1977) *JGR*, 82, 4249. [3] Palluconi F.D. and Kieffer H.H. (1981) *Icarus*, 45, 415. [4] Haberle R.M. and Jakosky B.M. (1991) *Icarus*, 90, 187. [5] Hayashi J.N. et al. (1993) *BAAS*, 25, 1039 (abstract). [6] Martin T.Z. and Richardson, M.I. (1993) *JGR*, 98, 10941.

Figure 1

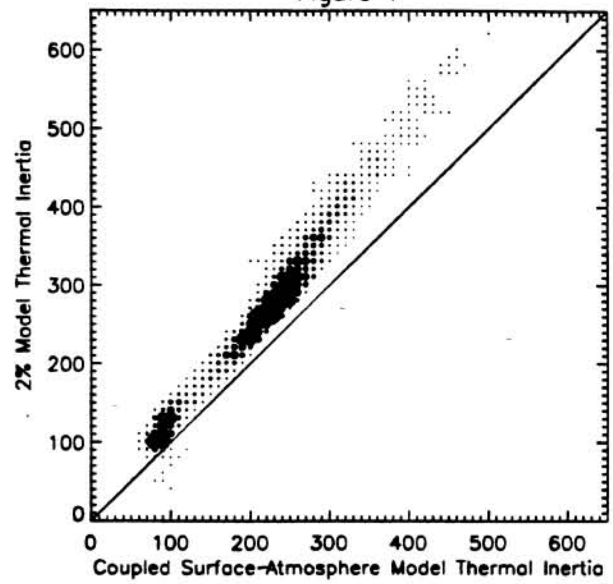

Figure 2