SLOPE PROPERTIES OF SOME TERRESTRIAL SURFACES AND IMPLICATIONS FOR PLANETARY RADAR INTERPRETATION; T.M. McCollom and B.M. Jakosky, Laboratory for Atmospheric and Space Physics and Department of Geological Sciences, University of Colorado, Boulder, CO 80309-0392

The radar scattering properties of planetary surfaces have been used by many investigators to infer the roughness of the surfaces on the scale of a meter to several tens of meters. The roughness of the surfaces are estimated by comparison of radar spectra with a model of radar scattering developed by Hagfors, and are generally reported as an rms slope. In an effort to test assumptions made by the Hagfors' model and to gain a better understanding of surface roughness estimates, we determined the surface slope distributions of a number of terrestrial surfaces by field measurement.

Slope distributions for the terrestrial surfaces differed considerably from the distributions assumed in the development of the Hagfors' model. In particular, the terrestrial surfaces had fewer flatter slopes and a greater proportion of steep slopes than assumed by the model.

Rms slope values for the measured terrestrial surfaces ranged from 0° for an evaporative basin to 16.5° for sand dunes and a lava flow. By comparison, rms slope values estimated for planetary surfaces have ranged from less than a degree to about 10°, with the majority of planetary surfaces in the lower end of this range (<5°). Only the flattest two measured terrestrial surfaces had rms slope values less than 5°, while half of the measured surfaces had rms slopes >10°.

We also used the Hagfors' model of radar scattering to predict the return that would be expected from planetary surfaces where different surface types were present in the field of view. The expected returns for surfaces with varying fractions of two surface types were modelled by scaling the expected return from each surface separately and adding the results together to estimate the combined return. The shapes of the resulting spectra differed from those predicted by the Hagfors' model for homogeneous surfaces, with the combined spectra having a broader central peak than expected for a homogeneous surface. Since the shape of the spectra is important in determining the rms slope, rms slope values estimated for the combined spectra are lower than the values determined by combining slope distributions and calculating the rms slope directly. These results suggest that the radar-determined rms slope of a rugged area could be substantially underestimated by the presence of a few patches of flat surface in the view area.

Together, these results suggest that current methods of determining surface roughness from radar significantly underestimate the roughness of planetary surfaces. Furthermore, the results indicate that it is not merely a matter of "scaling up" the presently reported rms slopes to get a more satisfactory range of values. Rather, we are unable to ascribe a specific geologic meaning to radar-determined rms slope values, and suggest that rms slope values are most useful in distinguishing geologic units.