SCATTERING BY VENUS' SURFACE; R.A. Simpson, G.L. Tyler, M.J. Maurer, E. Holmann, and P.B. Wong,
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During 1992 Magellan altimetry echoes were processed to yield scattering functions \( \sigma_o(\phi) \) over near-nadir angles \( \phi \leq 10^\circ \) from some 2000 Venus orbits [1]. SAR image strips acquired simultaneously at oblique angles were also reduced to give scattering functions but over a few degrees of incidence angle in the range \( 15^\circ \leq \phi \leq 45^\circ \). By sorting, the altimetry and SAR results can be combined to give composite scattering functions for much of Venus' surface. The data in hand should allow definition of such composite functions for 70-80% of Venus at resolutions of 20 km — approximately one million separate functions.

Figure 1 is an example of a composite scattering function from Magellan observations southeast of Alpha Regio. The surface is one of the smoothest found on Venus from analysis of the altimetry echoes; the data at small incidence angles match an expression derived by Hagfors [2] for scattering by a gently undulating surface with gaussian height distributions and an exponential autocorrelation function. The Hagfors free parameter can be interpreted as an rms surface slope \( \sigma \approx 0.9^\circ \).

Scattering at angles greater than \( 30^\circ \) is likely to be dominated by mechanisms other than mirror-like reflection from properly oriented surface facets. Thus, it is not surprising that the radar cross section derived from the corresponding image strip does not fall on the Hagfors curve. Small scale structure, irregularities, and inhomogeneities in the regolith likely are responsible for the enhancement over the Hagfors prediction. Achieving a satisfactory interpretation of oblique backscatter results within the context of the gently undulating surface seen at near nadir may be possible through integration of numerical modeling techniques with more conventional analysis methods. If so, the link between radar remote sensing observations and sound geologic interpretation will be strengthened.

Figure 1. Composite Venus backscatter function derived from Magellan data (a). Results of altimetry inversion are indicated by "x"; the best Hagfors function fit is given by the solid line. A single point "o" represents the mean SAR backscatter. Detail on the SAR scattering vs. angle is shown in (b); a histogram of pixel values is shown in (c).