

THE CASE FOR SUBSURFACE IMAGING ON VENUS BY MAGELLAN SAR; S. D. Wall and C. Elachi, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

Penetration of surface materials on Earth by synthetic-aperture radar (SAR) radiation has been documented using both Seasat and SIR sensors [1], [2], [3]. Proof that penetration has occurred, of course, requires either the presence of buried receivers or other ground truth, as it is not possible with a normal SAR to distinguish subsurface returns from those reflected at the surface. Planetary SAR data, such as that returned from the Magellan radar, do not have that luxury, and the presence of subsurface returns must be inferred indirectly. Knowledge of, or even an indication of, the existence of this effect in the data can have a strong influence on the interpretation of images.

The depth to which SAR can image features within a volume depends on (a) the strength of the reflection at the surface interface and the degree to which the volume absorbs the radiation on its way in and out of the material, and (b) the dynamic range of the SAR system. The absorption is typically measured by the "skin depth" of the material in the volume, which is the depth at which a fraction  $1/e$  of the radiation just under the surface remains. Typical terrestrial materials have skin depths of a few meters. The Magellan SAR has sufficient dynamic range to provide visible image contrast from features as deep as two to three skin depths.

In this paper we will present somewhat speculative evidence suggesting that, in at least one region, the Magellan images may display subsurface features. The argument will be based on the functional form with which the intensity of lineaments in the Crater Farm decreases as these features cross into a unit of darker backscatter which surrounds the craters in that region. In several cases (four at this writing) the decrease in intensity of juxtaposed lineaments as they intersect the darker unit is well-fit by an exponential with the same decay rate. The similarity in the intensity decrease rate and form is significant and is consistent with either (a) a ridge or scarp which descends linearly into a level covering of penetrable material, or (b) a level ridge or scarp covered by a linear sloping penetrable material. Further, the decay rate is constant over surface lengths consistent with the dynamic range of the SAR system and a darker-unit skin depth of 1 - 3 m. Alternative explanations of the exponential decay, and fits to the data which are other than exponential, are less likely.

Comparison will be made of these results with the detection of subsurface features in Seasat SAR images in the Mojave Desert, where an igneous dike, exposed for part of its length, descends into and is eventually buried beneath 2 m of dry alluvium [1].

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