SIMULATION OF VENERA AND MAGELLAN RADAR IMAGES FROM SEASAT DATA.

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The global morphology and physical properties of the surface of Venus are topics of growing interest to the geoscience community. Venera 15, 16 Orbiter image data were acquired north of approximately 35° latitude, with radar cell widths of several kilometers and an incidence angle of about 10 degrees. These data provide the largest, contiguous image mosaics at the highest spatial resolution. Thus, Venera data are receiving considerable attention and analysis aimed at deciphering the geological history of the planet. One intent of this paper is to quantitatively simulate Venera images over well-known geological targets on Earth using Seasat data, and to then evaluate the geological information contained in the simulated data. An additional intent is to use Seasat data to quantitatively simulate Magellan images for the same areas. Magellan is an Orbiter scheduled for launch in 1989 and includes a radar that will produce images over 80 percent of the surface, with an order of magnitude better resolution than Venera, more radar looks, and a higher signal to noise ratio.

SEASAT digital images were filtered and resampled to simulate key radar parameters associated with Venera and Magellan systems. These parameters include resolution, number of looks, signal to noise ratio, pixel spacing, and incidence angle. Also, Magellan-unique parameters, including the use of burst-mode radar to reduce data rate and the inclusion of an adaptive quantization scheme, were included in the generation of the simulations. Four regions were chosen for the simulations: (1) Sonoran desert, Mexico, to show dunes; (2) The Missouri Ozarks, to show a fluvially-dissected plateau; (3) The Appalachian Valley and Ridge Province, Pennsylvania, to show eroded anticlines and synclines; and (4) The Pine Mountain thrust zone in Tennessee and Virginia and associated fluvial dissection. Venera simulations over the Sonoran scene show broadly mottled backscatter patterns that cannot be uniquely interpreted as dune fields. The length scales of the dune fields are too small to be discerned with cell widths of several kilometers. The Magellan simulation of Sonora clearly shows the dune morphologies, including star and barcan dunes. For the Missouri scene, the Venera simulation shows the major valleys but does not allow characterization of the dendritic planform of the dissected plateau. A complete channel inventory down to higher order streams can be done from the Magellan simulations. For the Appalachians, major structures are discernable from the Venera simulations, although the high degree of fluvial dissection of the surfaces can only be discerned with the Magellan simulations. Further, for the Valley and Ridge Province, only the Magellan simulations provide enough information to separate anticlines from synclines. It is doubtful that the Pine Mountain structure would be readily interpreted as a thrust fault in the Venera simulation, although the Magellan simulation is clear in that regard. Results strongly imply that with Venera resolution, tectonic landforms of regional scale can be discerned. On the other hand, one should expect considerable variance in interpretations of the data because many diagnostic structural indicators will not be discernable. Further, effects of exogenic processes will be very difficult to discern if surface processes produce materials and landforms with similar length scales and morphologies on Earth and Venus. Results imply that it is premature to conclude from Venera data that Venus is a planet where endogenic processes dominate over exogenic processes.