Digital Topographic Data from Topsar Radar Interferometry: Fernandina Volcano Galapagos Islands

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ABSTRACT

In May 1993, the TOPSAR airborne Interferometric radar collected a digital topographic data set for Volcan Fernandina, Galapagos Islands. These data have a spatial resolution of 10 meters, and a vertical accuracy of about 2 meters. In addition to the topographic measurements simultaneous quad-pol L-band (24 cm) and P-band (70-cm) SAR data were collected. Almost the entire island (about 550 square kilometers) was mapped during a series of over flights by the radar, which is flown on the NASA/JPL DC-8. To help interpret these TOPSAR data, we have assembled a data base that includes Landsat Thematic Mapper, panchromatic SPOT, and JERS-1 OPS and SAR images. Furthermore, the island represents one of our Space Shuttle Radar (SIR-C/X-SAR) "Super-Sites", which will be imaged during flights planned for April and August 1994.

The resultant topographic map is a unique set for Volcan Fernandina, which has previously never been completely mapped topographically due to cloud cover. The TOPSAR data serve as both a test case for the validation of the radar interferometric measurements, and for the analysis of this infrequently visited basaltic shield volcano. For example, the production of shaded relief and slope maps from TOPSAR data, and their comparison with the SPOT and TM images, has proven to be the most useful analysis method to date. While lava flows can be mapped from the optical data, shaded relief maps that simulated diverse lighting geometries aid the identification of cinder cones and show that there are no prominent rift zones on the volcano that indicate structural control on the distribution of intrusions. Maximum slopes exceed 30-degrees on the upper flanks of the valcano, and pose major problems for current models for the internal structure of the volcano's summit area.

This paper will review the utility of TOPSAR data for volcano logical studies, and will include an analysis of the "error maps" which describe the quality of the phase correlation generated by the radar on a pixel-by-pixel basis. TOPSAR data were also collected for the adjacent Isabela Island (about 4,500 square kilometers), and an up-date for the on-going analysis of these data will also be presented.