GeoSAR: A System For Obtaining High-Resolution, True Ground Surface, Digital Elevation Models at Regional Scales

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GeoSAR, the Geographic Synthetic Aperture Radar, is a commercial interferometric SAR mapping system that is expected to be fully operational by the year 2000. Among its many innovations and unique capabilities will be the ability to image the Earth and create digital elevation models and topographic maps, in a variety of GIS formats, at two widely separated radio frequencies. An across-track interferometric X-band (3 cm wavelength) system and a combined interferometric/ polarimetric P-band (86 cm) UHF system will provide imagery and topography with different sensitivities to surface vegetation and other surface parameters. Specifically, it is expected that the combination of images at these two frequencies will permit the removal of a large portion of the tree canopy and vegetation structure from the digital topography, enabling the generation of maps of the true ground surface.

GeoSAR is being designed to yield horizontal ground resolutions of 1 meter (maps will typically be generated with a 5 m pixel spacing, however). Vertical resolutions well below a meter for relative height accuracy and 1 meter for absolute height accuracy are expected. (Thick vegetation and tree cover may degrade this somewhat.) The resulting DEMs will compare favorably with those obtained by other techniques, and will be obtainable at lower cost and with quicker turnaround. GeoSAR will be able to map simultaneously two 10-km wide strips on either side of the aircraft and will have a maximum mapping rate of over 60,000 km^2 per day.

GeoSAR will yield multiple useful layers of geocoded information for use in GIS systems and terrain analysis. In addition to dual-frequency DEMs of higher planimetric and height resolution than those distributed by the USGS, for example, GeoSAR will provide several amplitude maps (one X-band and two P-band polarimetric maps) containing radar brightness information. These may be normalized in different ways to yield different visual appearances and to convey different surface information. Interferometric correlation layers at each frequency contain information about surface and vegetation characteristics and permit errors to be determined for the height estimates. These in turn yield improved products from the height maps, such as slope, curvature, vegetation, and land classification maps. Such products should be of great interest in areas as diverse as hydrology, geology, geodesy, and ecology. Examples of these products using data derived from the existing TOPSAR system will be shown.