U.S. Department of the Interior
U.S. Geological Survey
Earth Science
Information Center (ESIC)

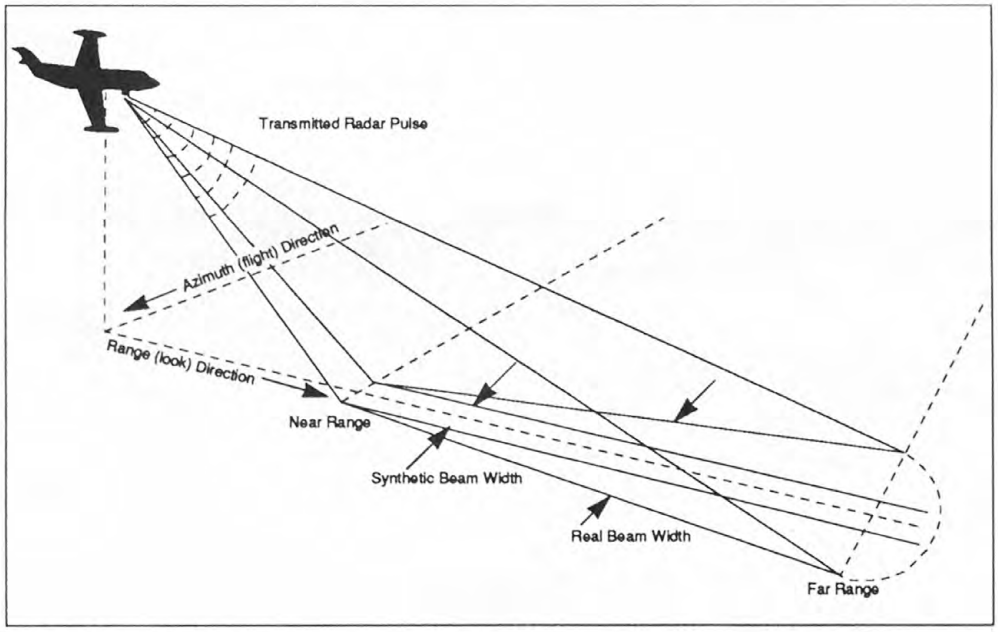
Factsheet

Side-Looking Airborne Radar

Characteristics

Side-looking airborne radar (SLAR) systems provide their own illumination. Consequently, images can be collected regardless of the weather or time of day. This property, coupled with SLAR imaging geometry, makes the images different from other types of remotely sensed data.

SLAR images are created by transmitting a beam of microwave energy to the ground at an angle perpendicular to the aircraft flight path. The signal strikes the terrain and scatters, then a portion returns to the radar receiver. The strength of this back-scattered return depends on surface features and is recorded as shades of gray on the processed image. The side-looking geometry of the system produces shadows of varied length depending on the angle of illumination and the surface relief.



How SLAR images are acquired.

These shadows can make subtle terrain features, such as faults and folds, easier to detect and identify than on other kinds of images. This characteristic makes SLAR images useful to scientists involved in mineral and energy exploration and earth hazards studies.

Most commercially available SLAR systems operate in the X band at frequencies of 12.0-8.0 gigahertz (GHz or billions of cycles per second) and wavelengths of 2.4-3.8 centimeters. Usually these systems transmit and receive horizontally polarized signals (HH). Experimental radar systems, designed to aid in the development of satellite-borne units, operate at one or several frequencies and have multipolarization capabilities.

Commercial SLAR systems have constant range and azimuth resolution throughout the image of approximately 10 by 15 meters or better. However, resolution and detectability are not the same thing with radar; objects smaller than one meter in size may be routinely detected because of the strong radar return of some objects. The look direction ("west-looking," for example) of a SLAR image refers to the illumination direction. The choice of SLAR project design parameters such as look direction and beam angle is usually based on the geologic structure of the area. For example, linear structures such as faults that are parallel to the look direction may not be easily detected since they show little radar shadow. In analyzing radar images, the images should be turned so the shadows are toward the viewer. This practice assists in interpreting hills as hills and valleys as valleys.

Applications

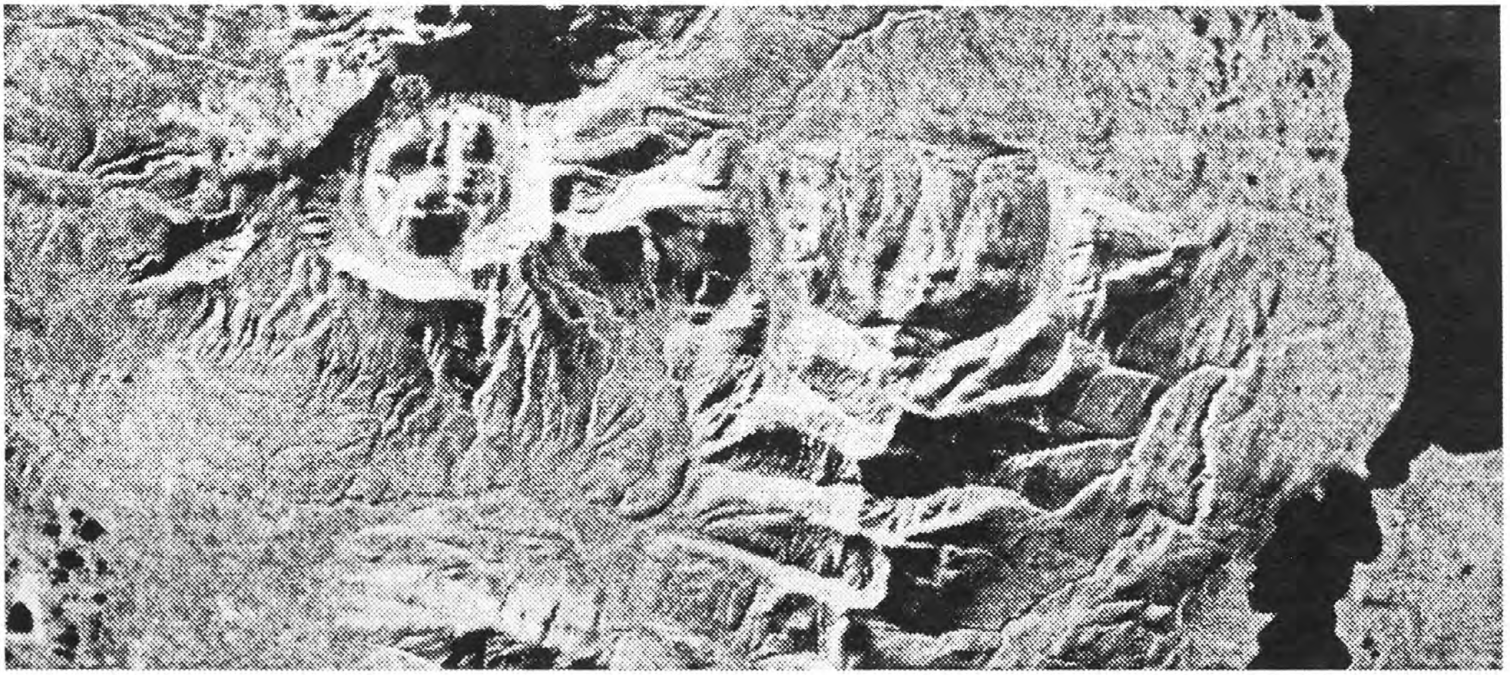
SLAR data are particularly valuable when used with traditional earth science and other remotely sensed data. Scientists have effectively used SLAR data all over the world to aid in mapping geologic features that have contributed to the discovery of mineral and energy reserves and to identify potential environmental hazards.

SLAR data on more than 25 million square kilometers have been gathered in Brazil, Colombia, Ecuador, Guinea, Indonesia, Japan, Nigeria, Peru, and the United States.

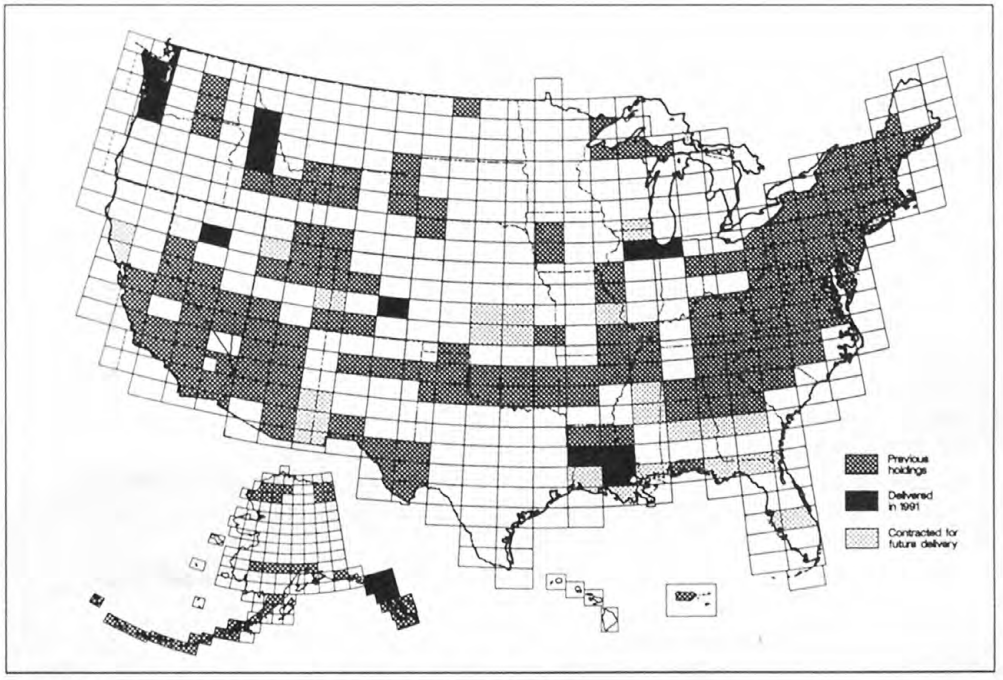
Since SLAR also penetrates most clouds, it has been used to prepare image-based maps of perpetually cloud-covered areas of the world such as the Brazilian rain forests, Aleutian Islands, and parts of Panama.

U.S. Geological Survey SLAR Data

The U.S. Geological Survey's (USGS) SLAR images most often consist of image strips and 1:250,000-scale map-controlled mosaics. More than half of the available SLAR image strips are also on computer-compatible tapes (CCT's). Some SLAR data are available on compact disc read only memory (CD-ROM). The CCT and CD-ROM digital files retain much more of the recorded dynamic range of the data than do photographic copies. For example, photographic copies are usually limited to a dynamic range of about 15 decibels, whereas digital files hold an available dynamic range of 30-40 decibels, allowing more detailed interpretation.



Radar Image , Southeast look, Ugashik, Alaska.



Project areas coverage under the USGS SLAR Program, 1980-1991.

Ordering Information

SLAR products available from the USGS include contact strip images, radar mosaics, and digital data. Indexes on paper, film, or microfiche, mission flight logs and final project reports, custom photographic products, and some CD-ROM discs are also available. For more information contact:

Sioux Falls-ESIC
EROS Data Center
Sioux Falls, SD 57198
605-594-6151