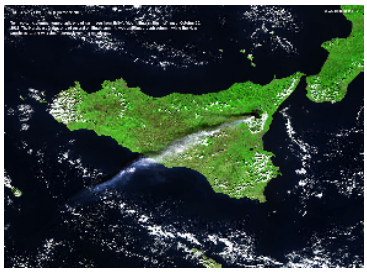
Satellite imagery

In This Space



Television screens and computer monitors deliver an enormous variety of color to the human eye by combining only three colors: red, green and blue (RGB). Based on just the RGB portion of the spectrum, people commonly perform the kind of discrimination done by remote satellite sensing. We tend to associate green with vegetation and blue with water, and many rocks are shades of tan and gray.

Some satellites capture sunlight reflected from the surface of the Earth in these three spectral bands; this information can be recombined to generate a color image. However, most satellites designed for remote sensing have additional bands in other parts of the electromagnetic spectrum that contain a wider range of information. As an example, the Landsat 7 satellite captures seven spectral bands plus a grayscale panchromatic band. Three bands in the visible spectrum roughly cover red, green and blue colors. A very near infrared (VNIR) band helps differentiate types of vegetation, while one in the near infrared (NIR) is sensitive to the amount of water in plants, or turgidity. Surface geology is discriminated by a short-wave infrared (SWIR) band. In addition, the Landsat 7 pan band covers most of the visible spectrum and some of the VNIR. This pan band has a higher resolution than the other bands and helps to sharpen final images. These seven bands detect sunlight reflected from the Earth's surface.

Other remote sensing satellites detect different bands; some have more bands than Landsat 7, and others have fewer. Thus, the specific methodology applied to distinguish surface and near-surface features is somewhat dependent on the satellite.

Radar uses a single frequency for illumination; therefore there is no color associated with raw Radar imagery. However, Radar provides at least two significant benefits from its not being dependent on natural light: the ability to image through clouds, and the ability to image at night. The wavelength of the microwaves used in Radar are longer than those of visible light, and are less responsive to the boundaries between air and the water droplets within the clouds.

Radar imaging can also be used to obtain height information about the surface. In a method called interferometric SAR, two antennas view the same surface simultaneously from a different angle, or a single antenna views the same surface on separate passes. In the first case the 2 images can be combined to extract 3D information, while in the second case images can be combined to determine small changes in elevation over a period of time. This method can detect changes caused by surface movement as small as 1 cm, which can monitor subsidence over reservoirs.

Remote imaging has a wide variety of uses, both outside and within the E&P industry. It can help in planning infrastructure and assessing flood risks, both in a map view and using 3D surface modeling. It can map surface mineral deposits, and can help in CO2 storage planning and monitoring. Glacial activity can be reconstructed through evaluation of moraines. By comparing older satellite images to new ones, changes in land use or condition can be evaluated. Ground-water levels can be determined and monitored, which is also input for seismic studies, since the water table is often the first refractor encountered by the seismic signal. One objective within the E&P industry is to determine the risks associated with conducting a seismic survey.

List of new technologies

Title	Creator	Modified
NovaSAR-S	user-348e7	Apr 15, 2015
Skybox Imaging	user-348e7	Apr 15, 2015
Pipeline Integrity Management from Space	user-348e7	Apr 15, 2015