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Actual Satellite Imagery Sources

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Actual Satellite Imagery Sources

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Abstract. The huge benefit of the Internet is that it not only connects people from all over the world but also provides information that would otherwise be unavailable. Anyone who needs access to the latest satellite imagery can take it via many platforms provided remote sensing data, either for free from the websites belonging to national research and space centers or for a fee charged by commercial companies. The article offers an overview of the most used services, whose data are available and suitable for processing using EarthExplorer – a platform of the U.S. Geological Survey agency.

1. Introduction

There are many sources of satellite data we can use to solve earth positional and disaster problems. Some platforms will let us view the data in a web browser, some offer download options so we can process it and extract meaningful insights [1]. It is up to our requirements to decide which application to use with the most up-to-date satellite imagery, whether national or commercial.

When searching for data, the first thing that we need to do is to define an area of interest. It is defined by the x, y coordinates of each corner of the boundary, but by using EarthExplorer, the platform of the U.S. Geological Survey (USGS), which is a very useful application to search, download and analyze remote sensing data and imagery, we can upload a shapefile that contains the boundary instead. The next step consists of defining the data that we want to download. The internet offers a significant amount of data through the national and commercial platforms, which differ by the principal owner, sensor type, spatial resolution, and swath width. An example of internet-provided remote sensing platforms for forestry applications is shown in the table 1, all of which gather data useful to forest monitoring based on their type of sensor, spectral and spatial resolutions, length of data sets, and ground coverage [2].

Table 1. Remote Sensing Satellites and Sensors used in Forestry Applications

Platform	Principal Owner	Initial Service Date	Sensor Type	Spatial resolution (m)	Swath Width (km)
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ERS	EU	1991	SAR	30	100
IRS	India	1995	MS/Pan	23/6	142/70
Landsat	USA	1982	MS	30	185
NOAA	USA	1979	MS	1100	2399
Radarsat 1,2	Canada	1995	SAR	10-100	50-100
SPOT	France	1986	MS/Pan	20/10	60

2. Sources of Remote Sensing Imagery

Aerial Imagery. According to the used evaluation method, aerial imagery can be divided into analog, analytical and digital. Analog aerial images were evaluated in the oldest photogrammetry instruments, based on manual operation. Analytical photogrammetry was based on the application of mathematical analytical equations to define the 3D position in imagery using an analytical device. In digital remote sensing, the original images are not evaluated but scanned images on a computer [3].

Advanced Very High-Resolution Radiometer (AVHRR) provides multispectral images from the National Oceanic and Atmospheric Administration (NOAA) satellite. The satellite has been in polar orbit since 1979, allowing for 24 hours coverage of the entire globe, which is mainly used for meteorological purposes. Images are available twice a day, in the morning and the afternoon with a resolution of 1.1 kilometers. AVHRR can provide global land cover data. at a given time in 2400 x 6400 kilometers images [4].

Satellite Imagery for Improving Official Statistics provided by Committee on Earth Observation Satellites (CEOS). Satellite imagery data are used to create global and national statistics that help improve various climatologic, environmental, social, human, and other conditions., including progress on the 2030 Development Agenda for Sustainable Development [5].

Commercial Satellites data. Commercial remote sensing provides data to commercial companies. The best positioning accuracy of all commercially available satellites is provided by GeoEye-1, which was launched in 2008. It is the highest resolution commercial satellite for Earth viewing, collecting 0.41-meter images on panchromatic images and 1, 65-meter in multispectral images (blue, green, red, and infrared)

Declassified data. In the twentieth, satellite imageries were used only by the secret services. The satellites were used only for espionage purposes. The American Satellite Corona belonged in 1959 among the first spy satellites. It was equipped with two cameras that constantly rotated and recorded the image on film cassettes. The films were sent to the ground by parachutes. In 1995, the images were declassified and it was found that the smallest object that the camera could capture was 8 meters in size. In the 1970s, military satellites were more accurate with a higher resolution of up to one meter [6].

Digital elevation. Both USGS platforms, EarthExplorer and AppEEARS, provide global elevation data using free registration. AppEEARS enables downloading Aster Global Digital Elevation Model with resolution 1 arc-second. EarthExplorer uses digital elevation from three sources: Shuttle Radar Topography Mission with data resolution 1-arc-second (30 m), Global Multi-resolution Terrain Elevation Data 2010 with 30-, 15-, and 7.5-arc-second (1 km, 500 m, 250 m) resolution, and GTOPO30 with resolution 30-arc-second (1 km). The digital elevation model is downloaded in Georeferenced Tagged Image File Format (GeoTIFF) with embedded geographic information. This is a standard image format for GIS applications. The first near-global set of land elevations was created from radar data acquired in the frame of the Shuttle Radar Topography Mission (SRTM), the international project of the National Aeronautics and Space Administration (NASA), and National Geospatial-Intelligence Agency (NGA).

Earth Observing-1 (EO-1 is a satellite for remote sensing of the earth with a resolution of 10 to 30 meters. EO-1 was launched into orbit as part of the New Millennium program. The satellites used for planetary missions demonstrating the technology in the New Millennium program were originally named "Deep Space" and for missions demonstrating technology for missions orbiting the Earth, "Earth Observing". After 2000, the Deep Space series was renamed "Space Technology".

Global Fiducials Program. The Global Fiducials Program is a joint program of U.S. federal civilian agencies, academia, and intelligence. The main goal of the program is to support scientific projects through the Global Fiducials Library, which contains images of important and scientifically interesting areas around the world, mainly from the field of the environmental program [7].

Heat Capacity Mapping Mission (HCMM) was based on observing temperature conditions on Earth, especially in countries Canada, Europe, Africa, and Australia. The satellite mission lasted two years and the temperature was monitored in the interval of 12 to 36 hours. Temperature differences were measured with a radiometer and data were available in digital form.

Environmental Research and Visualization System (ISERV) The Environmental Research and Visualization System (ISERV) acquires images from the International Space Station (ISS). The ISS is a satellite, visible from the earth's surface, that acquires images from a digital telescope. The frequency of shots is 3 images per second and the area they capture is 19x11 km. The images should be used to improve the environment and to help during disasters on earth. Cameras, imageries, and sensors aboard the space station have collected data from natural disasters on Earth since 2012. So far, these systems have collected data for 34 specific events, eight of them involving two or more sensor systems. Satellites JAXA and Roscomos have also collected data in response to natural disasters. NASA and the International Partners continue to select new instruments to add to the station's remote sensing capabilities.

Landsat data. The Landsat program has been the source of terrestrial satellite imagery since 1972. Landsat satellite instruments have taken over a million images that are unique and useful for a variety of areas such as cartography, agriculture, geology, education, and forestry. The most important advantage of remote sensing is the provision of broader and global data that no other device can obtain. This efficiency provided scientists with information about the ecosystem and allowed them to predict the distribution of species and to detect the natural occurrence and changes on Earth on a larger scale and with greater accuracy. Landsat images have also been used to manage natural resources, such as fisheries and forests, and to monitor climate change and its effects. Landsat images, for example, have shown that the level of the Aral Sea has shrunk, making it one of the worst environmental disasters on the planet.

3. Conclusions

Most of the data and platforms presented in this document are provided by the U.S. Geological Survey using EarthExplorer platform, which provides the users the ability to query, search, and order satellite imagery, aerial photography, and cartographic products from several sources. Users anywhere in the world can download the relevant images and use them for their purposes.

Besides the mentioned sources of remote sensing imagery, there are many more platforms that provide raster or digital data through their web services, which offer high-quality and high-resolution data to be used to solve specific scientific and ground problems and disasters, e.g.: *Google Earth*, which offers free access to some of the highest resolution satellite imagery taken from airplanes; *Sentinel Hub*, the most used portal for accessing satellite data, through which users can access all Sentinel products, as soon as they are made available. This also includes a trove of historical satellite images; NOAA, which offers free access to GEOS-R and NOAA-20 data refreshed every 15 minutes; *Copernicus Open*

Access Hub, which is geared towards developers who need low-resolution Earth satellite data for their applications; *Zoom Earth*, which shows the most recent satellite images and aerial views in a fast, zoomable map; NASA WorldView, which is a browsable, open platform that lets us access recently updated satellite data, as well as historical data; NASA EarthData, which offers programmatically access satellite images in almost real-time and many other image viewers and data providers.

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