

# **Geo-Surface Environmental Application**

## **based on 3D Spatial Images and GIS**

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Human beings have lead their lives on the basis of Earth and been in pursuit of more success and quality of life. At this time, it should be noticed that spatial information technology as aerospace technology, electronic technology, and surveying technology have taken root deep in their lives, industries and public affairs. In particular, satellite images have established as important technology that improve human economic activities and the quality of life, ranging from making image maps of the nationwide, managing cities and transportation, monitoring disasters, detecting the environment in a scientific way, farming, forest, and fishery, to marketing, real estate, tourism, medical care, welfare and others. And also, the satellite images, as the information infrastructure of ubiquitous society, have been effectively used for cities, forests, rivers and streams, seas, and disaster prevention, by improving the basic geographical information on land into more scientific real-life information.

The satellite images data that have been most widely used in the world include Landsat-7 and 5, Quickbird, IKONOS, MODIS, SPOTS, ASTER, and others. In the country, KOMPSAT satellite image series are widely used by public institutions, related research institutes and companies. Other countries, like the USA, France, India, Japan, Canada, Russia, and European nations, have developed the private systems for remote earth exploration to use the data, for long. And some countries like Israel, China, Brazil, South Korea, Pakistan, have endeavored to share these efforts and achievements with the advanced countries. The United States of America launched Landsat-1 in 1972; it has used Landsat-7 since July 1999. It has produced, circulated and applied commercial satellite images such as IKONOS, QUICKBIRD, GEOEYE that are matching satellite photographs.

South Korea has a multitude of artificial satellites, and plans for launching artificial satellites, including Uribyeol-1, the first artificial satellite launched in 1992, Mugunghwa-1-5,

broadcasting and communications satellites (1995~2006), KOMPSAT satellite image series for Earth observation, marine observation, and scientific experiment (KOMPSAT-1 launched in 1999; KOMPSAT-2 in 2006; KOMPSAT-3 scheduled to be launched in 2012; KOMPSAT-5 in 2012), COMS for marine and meteorological observation (in 2010). In the future to come, the country plans to launch KOMPSAT satellites: 5<sup>th</sup> Satellite, a multi-purpose practical satellite, equipped with a synthetic aperture radar (SAR), 3 Satellite, a multi-purpose satellite, equipped with high-resolution satellite images (70m-class), 3A Satellite equipped with a thermal infrared observation function. And our country has operated 4 national satellites; 20 countries have operated about 970 satellites in the world.

In the country, satellite images have a diversity of uses in real lives. For instance, meteorological information depends on satellite images to predict and prevent meteorological disasters and calamities caused by global climate change. It would be no exaggeration to say that there are not so important tools as satellite images in preventing meteorological disasters. The fields of using satellite images are as follows:

#### 1) Mapmaking

At the present time, less dependence has been placed on artificial satellite images for making maps than on aerial photographs that have the excellent ability to distinguish a topographic features and facilities. The 1990s saw SPOT experimentally used for making maps. Recently, with the increasing commercialization of high-resolution satellite images, technology for making numerical maps have been being developed by the use of high-resolution satellite images such as digital interpretation on numerical image treatment systems and satellite images. Mid-resolution satellite images from KOMPSAT-1, with 5~20m spatial resolution, and IRS-1C, SPOT, are largely used for making maps. Among others, SPOT satellite images that make it possible to acquire stereo images and have a relatively stable system have been most widely used. Now the high-resolution satellite images from IKONOS, QUICKBIRD, and KOMPSAT-2 are actively being used for 1/5,000 numerical maps and thematic maps for various fields.

#### 2) Water resources

Our country, with its intention to put into motion the plans to re-build major rivers including four grand rivers, has recently used 25-meter aerial photographs and radar data to get 3-dimension accurate information on rivers and river beds, which makes it possible to construct an information system that can control 4 grand rivers (the Han-gang River, the Nakdong-gang River, the Yeongsan-gang River, and the Geum-gang River) by means of making the information spatial information. Recently, it has applied on the evaluation of rivers health (survey of water quality) and the survey of river-basin control to this information system to perform both quantitative and qualitative evaluation of rivers.

### 3) Disasters and calamities

The world as well as our country has been frequently faced with serious natural disasters such as flood, drought, earthquake, tsunami, and forest fire, caused by meteorological calamity. Our country has nationally controlled natural disasters such as inundation from flood, forest fire from drought, and landslide. And in particular, the spatial information is to systemize a series of processes ranging from site information comprehension to prediction, and the information is shared by the related department of the central government and between those of local governments in order to minimize damage from those natural disasters. For this purpose, a diversity of site sensor information as well as satellite images and aerial photographs are integrated and controlled, real-time, especially in relation to a disaster site.

### 4) Forests

The field of forests uses satellite images to get a variety of information including vegetation information, forests distinction, mountain use information, forest disaster information and others. They are used for developing systems for monitoring a change in the resources and analyzing damage from forest fire. Landsat is most widely used in forestry, since the satellite images for forests use the spectral characteristics for analysis.

### 5) The environment

The field of the environment is very wide in scope and of high correlation with other fields which is one of the fields that make the most use of satellite images. In South Korea, the Ministry of Environment has made a host of thematic maps, 1/5,000 and 1/1,000 scales, used

for a variety of environmental fields. Satellite images are actively used in vegetation classification, ground coverage, water pollution control, tidal flat control, water resources and river-basin control, and environmental modeling, and others.

#### 6) Agriculture

Agriculture uses satellite images for crop classification and grouping, soil analysis, climate analysis, disaster analysis, and crop situation and forecasts. KOMPSAT-2 is brought into play for agriculture statistical surveys performed across the country. And digital aerial photographs and satellite images from foreign countries are used for crop interpretation (paddy fields and fields), crop yield analysis and prediction, and agriculture disaster detection.

#### 7) Marine

The marine field uses satellite images to conduct research for sea resource analysis, coastal and breeding fishing ground control, ecosystem control including tidal flat control, and sea pollution prevention. It uses broadband low-resolution satellite images like SeaWiFS, OSMI, and MODIS. South Korea has recently used 25cm aerial photographs to conduct a survey of coastal breeding situations across the Korean Peninsula and an inspection of illegal fish breeding, and giving services to fishermen.

#### 8) Meteorological phenomena and climate

The most important task in the field of meteorological phenomena and climate is to conduct the modeling and prediction of ozone-layer formation. Furthermore, satellite images are used for the measurement of earth radiant energy and reflected energy and the modeling of the earth climate. Low-resolution meteorological satellite images are widely used; and the thermal band of mid-resolution satellite images like Landsat TM is used in some regions. This is a plan to achieve spatial information such as heat island and wind roads, which have become global, hot issues.

In addition, the fields of land use planning and city planning and water resource depend on satellite images, too. Especially, land use planning and city planning requires high-resolution satellite images and largely uses digital aerial photographs. Satellite images are of

wide use in various fields concerning the Earth: calculation of solar heat and wind energy, the fields of new and renewable energy, and site information on difficult-to-reach areas. For that reason, South Korea has built such data as many kinds of satellite image data and digital aerial photographs from both domestic and foreign artificial satellites pursuing the development of a variety of applied fields of its national satellite images through their uses in the national ODA project as well as through their uses for the central government's departments, other public organizations, public research institutes, colleges and private research institutes.