## 2-8. Disaster Analysis Based on Satellite Information

Many earth observation satellites, with various sensors, band-passes, observation bands, resolutions and observation cycles, are circling around the earth (see Table 2-6-1). Many satellite images are accessible by general public and looked forward to utilizations in disaster reduction activities such as the disaster analysis, forecast, etc (see Table 2-6-2).

Table 2-8-1 List of earth observation satellites (2000 —)

| Satellite name | Sensor name | Development organization (Country) | Launching | Service life | Spatial resolution | Purpose of use |
|---|---|---|---|---|---|---|
| Panchromatic | | | | | | |
| EO-1 | ALI (Pan) | NASA (USA) | 2000 | 1 year | 10m | Technical test/research |
| OrbView-3 & 4 | - | Orbital Imaging (USA) | 2000～2001 | 5 years | 0.82m | Commercial purpose |
| QuickBird 2 | - | EarthWatch (USA) | 2001 | 5 years | 0.82m | Commercial purpose |
| EROS-A1, A2 | - | West Indian Space (USA & Israel) | 2000, 2001 | 4 years | 1.8m | Commercial purpose |
| NEMO | COIS (Pan) | NRL/DARPA/STDC (USA) | 2001— | 3-5 years | 5m | Military & commercial purposes |
| IRS-P5 (CARTOSAT-1) | - | IRSO (India) | 2001 — | - | 2.5m | |
| EROS- B1? B6 | - | West Indian Space (USA & Israel) | 2002 - 2004 | 6 years | 0.82m | Commercial purpose |
| ALOS | PRISM | NASDA (Japan) | 2003 | 3-5 years | 2.5m | |
| ROCSAT-2 | - | NSPO (Taiwan) | 2002 | - | - | |
| SPOT 5 | HRG (Pan) | CNES (France) | 2002 | 5 years or over | 2.5 & 5m (Pan) | Commercial purpose |
| KOMPSAT | - | KRI (Korea) | 2003 | - | - | |
| ARIES-1 | - (Pan) | CSIRO (Australia) | 2004 ? | 5 years | 10m | Commercial purpose |
| Hiyper-specter | | | | | | |
| EO-1 | Hyperion | NASA (USA) | 2000 | 1 year | 30m | Technical test/research |
| OrbView-4 | WarFighter | USAF/Orbital Imaging (USA) | 2001 | 3-5 years | 8m | Military & commercial purposes |
| NEMO | COIS & PIC | NRL/DARPA/STDC (USA) | 2001— | 3-5 years | 30m | Military |
| ARIES-1 | - (Hyper) | CSIRO (Australia) | 2004 ? | 5 years | 30m | Commercial, research purposes |
| Multi-specter high spatial resolution (< 10m) | | | | | | |
| OrbView-3 & 4 | - | Orbital Imaging (USA) | 2001 | 5 years | 4m | Commercial purpose |
| QuickBird 2 | - | EarthWatch (USA) | 2001 | 5 years | 4m | Commercial purpose |
| Multi-specter intermediate spatial resolution (< 100m) | | | | | | |
| EO-1 | ALI (Multi) | NASA (USA) | 2000 | 1 year | 30m | Technical test/research |
| CBERS-2 | CCD Camera | CAST & INPE (China & Brazil) | 2001 | ? | 20m (VNIR) 80m (SWIR) | - |
| IRS-P6(ResourcSat) | LISS4 | IRSO (India) | 2001 | - | 6m | |
| IRS-P6(ResourcSat) | LISS3-A | IRSO (India) | 2001 | - | 23.5m (VNIR) 70m (SWIR) | |
| ALOS | AVNIR-2 | NASDA (Japan) | 2003 | 3-5 years | 10m | |
| SPOT 5 | HRG (Multi) | CNES (France) | 2002 | 5 years or over | 10m (VNIR) 20m (SWIR) | Commercial purpose |
| Resource 21 | M10 | Resource21 (USA) | 2003— 2004 | ? | 10m (VNIR) 20m (SWIR) | Commercial purpose |
| Multi-specter low spatial resolution (> 100m) | | | | | | |
| AQUA | MODIS | NASA (USA) | 2001 | 6 years | 250m, 1000m | Research |
| CBERS-2 | WFI | CAST & INPE (China & Brazil) | 2001 | ? | 260m | - |
| IRS-P6(ResourcSat) | AWiFS | IRSO (India) | 2001 | - | 180m | |
| ENVISAT | MERIS | ESA (Europe) | 2001 | 5 years | 300m, 1200m | Research |
| ADEOS-II | GLI | NASDA (Japan) | 2002 | 5 years | 250m, 1000m | Research |
| SPOT 5 | VEGETATION | CNES (France) | 2002 | 5 years or over | 1000m | Commercial purpose |
| Synthetic aperture radar | | | | | | |
| ENVISAT | ASAR (C-Band) | ESA (Europe) | 2001 | 5 years | 12.5m-1000m | Research |
| ALOS | PALSAR (L-Band) | NASDA/JAROS (Japan) | 2002 | 3-5 years | 10,20m or 100m | |
| Radar-1 | SAR | RDL (USA) | 2002— | ? | 1m | Commercial purpose |
| RADARSAT-2 | Multi Pol SAR (C-Band) | CSA/MDA (Canada) | 2003 | 7 years | 3-100m | Commercial purpose |
| TerraSAR | SAR (X, L-Band) | InfoTerra (Europe) | 2003 | ? | 1m | Commercial purpose |
| IRS-3 | SAR | IRSO (India) | 2003 ? | ? | ? | |

Table 2-8-1 List of earth observation satellites in recent years
Source: Earth Observation from Space (ERSDAC, 2001)

| Hazard | Use of EO satellites |
|---|---|
| Hurricanes & tornadoes | Weather satellites are used extensively for detection and tracking of storms and contribute effectively to the forecasting capability. Recent satellite missions providing more detailed and frequent measurements of sea surface wind speed and tropical rainfall mapping have significantly improved forecasts. |
| Volcanic eruptions & earthquakes | In-situ systems and Global Positioning System (GPS) satellites provide valuable information on seismic and volcanic activity. EO satellites provide complementary data in support of disaster mitigation and response: interferometry techniques of radar sensors are used to monitor fault motions and strain, and signs of Earth surface deformation and topographic changes. Very high resolution sensors are used to map damage assessment, direct response efforts, and aid reconstruction planning.<br><br>Satellite data is the primary information source employed by the g Volcanic Ash Advisory Centres operational world-wide which issue volcanic ash cloud warnings, an essential information source for international aviation safety. |
| Wildfires | A number of satellites now contribute routinely to each stage of wildfire hazard management world-wide, including: fire risk mapping using land cover and fire fuel assessments, moisture data, digital elevation maps, and meteorological information – all derived from satellite; fire detection and early warning; fire monitoring and mapping; burned area assessment. |
| Oil spills | Synthetic Aperture Radar (SAR) data is used as the basis for ocean surveillance systems for oil slick detection, to provide enforcement and monitoring capabilities to deter pollution dumping. The SAR data is processed within 1-2 hours of the satellite overpass and used by pollution control authorities to cue aircraft surveillance. Surveillance systems are currently operational in Norway, and Denmark, and under trial in the Netherlands, Germany, and the UK.<br><br>SAR data and optical data are also used to develop information in support of major coastal oil spills, to assist in mapping pollution extent and managing the response. |
| Drought | Currently, multichannel and multi-sensor data sources from geostationary satellites and polar orbiting satellites are used routionely for determining key monitoring parameters such as: precipitation intensity, amount, and coverage, atmospheric moisture and winds. Instruments with spectral bands capable of measuring vegetative biomass are also used operationally for drought monitoring. The Famine Early Warning System (FEWS) in Africa, for example, exploits operational use of satellite technology to reduce the incidence of famine in sub-Saharan Africa by monitoring the agricultural growing season. Monitoring is carried out through "greenness maps" derived every 10 days from the AVHRR instrument, and from rainfall estimates. |
| Floods | Earth observation satellites are used for the development of flood impact prediction maps, contributing measurements of landscape topography, land use, and surface wetness for use in hydrological models. Weather satellites provide key information on rainfall predictions to assist flood event forecasting. Since optical observations are hampered by the presence of clouds, SAR missions (which can achieve regular observation of the earth's surface, even in the presence of thick cloud cover) are frequently used to provide near real-time data acquisitions in support of flood extent mapping. |

Table 2-8-2 Application examples of the Earth Observation Satellite data
Source: CEOS Earth Observation Handbook (ESA, 2005)

In this country, take for example, the disaster reducing working group of the satellite remote sensing steering committee[1] disclosed to public[2] in 2000 the "Introduction to the disaster analysis methods that utilize satellite information" which summarizes analysis examples of satellite data applied to actual disasters and interprets the disaster analysis methods, in order to introduce extensively the methods of utilizing the satellite remote sensing technology to persons in charge of the administration of disaster reduction at local public bodies and general public. Further, the committee opened to public[3] in 2006 the "Results of forerunning analysis based on ALOS observation data", taking the opportunity when a long-waited start of operation of the Japanese earth observation satellite "Daichi (Good Earth)" (ALOS).

The "Introduction to the disaster analysis methods that utilize earth observation satellite information" provides useful information for persons in charge of administration of disaster reduction as well as for researchers in Asia. In order to assist the promotion of disaster reduction measures at member countries, Asia Disaster Reduction Center obtained the right to print and disclose the English version, and opened[4] it public.

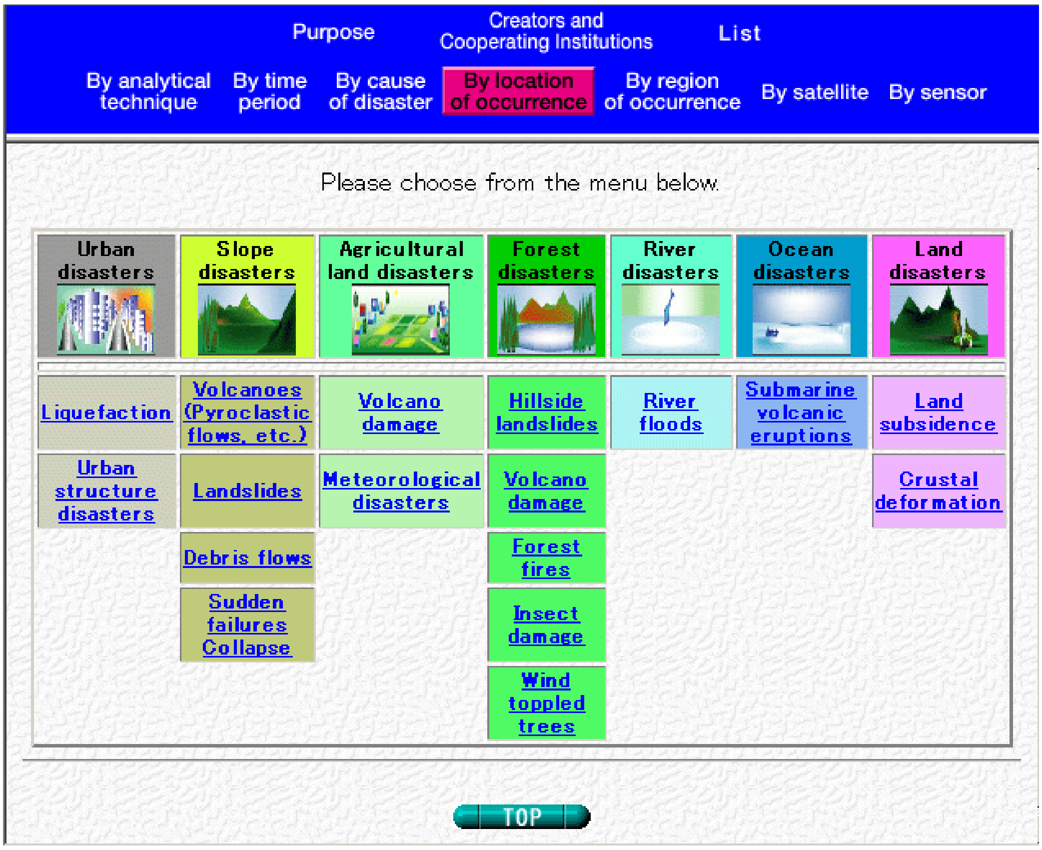


Fig.2-8-3　Examples of analysis based on places of occurrence

[1] Organization provided in the Remote Sensing Technology Center Foundation to carry out specialized research and examination used for planning, designing and coordinating steering measures related to the research, development and examination of remote sensor technology and satellite systems as well as the dissemination and utilization of satellite data.

[2] http://www.restec.or.jp/eeoc/bosai/bousai/v11.htm

[3] http://www.restec.or.jp/eeoc/alos/bosai/bosai.htm

[4] http://www.adrc.or.jp/dmweb/index.html

Moreover, it is examining, jointly with Japan Aerospace Exploration Agency (JAXA), National Institute of Information and Communications Technology (NICT) and Diamond Air Service (DAS), new early access to disaster information and means of sharing information which utilize, among others, Wideband InterNetworking engineering test and Demonstration Satellite (WINDS), a new communication satellite being planned to launch in 2007 by JAXA. (Fig. 2-6-4)

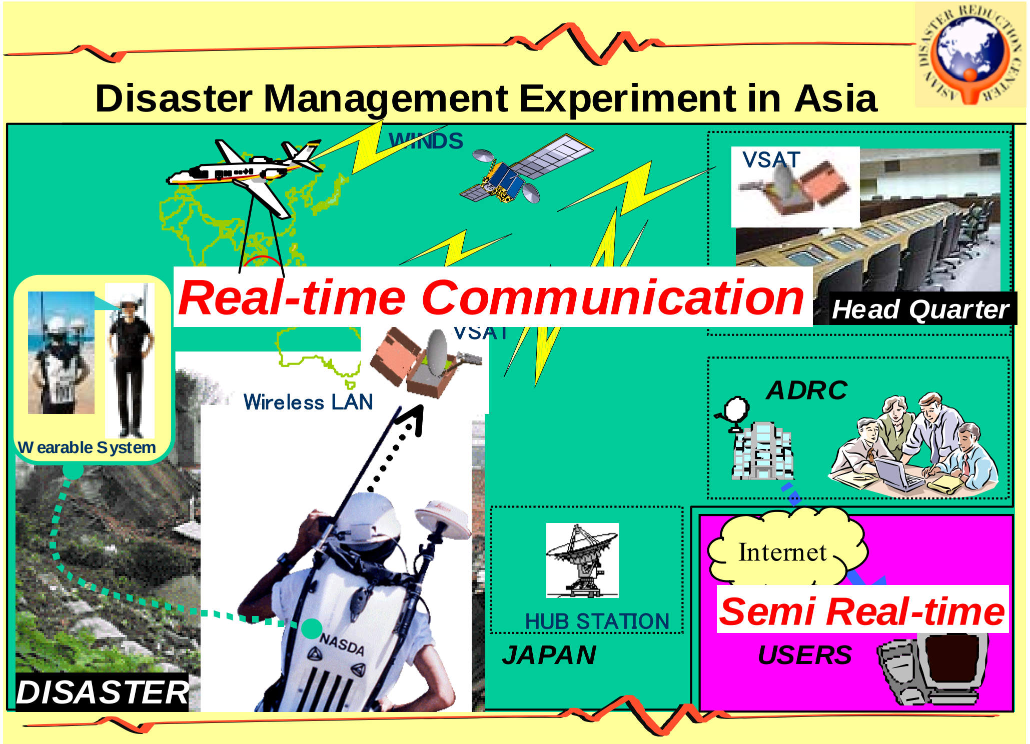


Fig.2-8-4 Disaster information system that utilizes Wideband InterNetworking engineering test and Demonstration Satellite (WINDS)