CARTOGRAPHY IN JAPAN
2007-2011

NATIONAL REPORT TO THE 15TH GENERAL ASSEMBLY OF
THE INTERNATIONAL CARTOGRAPHIC ASSOCIATION
Paris 2011

THE NATIONAL COMMITTEE FOR CARTOGRAPHY OF JAPAN
THE JAPAN CARTOGRAPHERS ASSOCIATION

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PREFACE

This is the National Report of Japan to the 15th General Assembly of ICA and the 25th International Cartographic Conference in Paris, France, 2011.

The purpose of this report is to introduce the cartographic activities that have taken place in Japan from 2007 to 2011. The contents describe the following:

1. Activities of the National Committee for Cartography and related academic associations
2. Activities of mapping organizations
3. Activities of public corporations, foundations, museums and libraries
4. Activities of local government
5. Activities of the private sector

The cartographic works carried out in Japan over the past four years have been rather remarkable. Not only have various kinds of digital maps and GISs been published or constructed, but also mobile or ubiquitous map information systems have been developed.

We hope that the cartographers among the many ICA members will be able to better understand the cartographic works of Japan through this report.

Takashi MORITA, Chairman, The National Committee for Cartography, Science Council of Japan
Yoshihisa HOSHINO, President, The Japan Cartographers Association

I. ACTIVITIES OF THE NATIONAL COMMITTEE FOR CARTOGRAPHY AND RELATED ACADEMIC ASSOCIATIONS

1. Activities of the National Committee for Cartography (NCC)

The NCC is a branch of the Science Council of Japan (SCJ), a governmental organization established in 2006 (http://www.scj.go.jp/en/index.html), which directs Japanese academic research. The SCJ is therefore a member of the International Cartographic Association (ICA), and NCC is a national committee of the ICA.
The members of the NCC are nominated by the SCJ on the application of members and associate members of the SCJ. The committee currently has six members. The chairman for the current term is Prof. T. Morita, whose term runs from 2006 to 2009.

1) Activities of the 13th General Assembly of the ICA, and the 23rd International Cartographic Conference in Moscow, Russia, in 2007.
A Japanese delegation of 14 members headed by Prof. T. Morita attended the conference. Five maps were exhibited at the Children's World Map Exhibition, and around 15 maps were shown at the International Map Exhibition. Continuation of the Commission on Ubiquitous Mapping proposed by Japan was agreed by the general assembly, and Prof. T. Morita was also nominated to continue his work as the chairman of the commission.
2) Activities of the 24th International Cartographic Conference in Santiago, Chile, 2009
A Japanese delegation of 7 members headed by Prof. T. Morita attended the conference. Eight papers were presented and four maps were exhibited at the Children's World Map Exhibition, and fourteen maps were shown at the International Map Exhibition.
3) Activities of Japanese members in the ICA Commissions (2007-2011)
The Commission on Ubiquitous Mapping proposed by Japan arranged an international workshop, the Third International Joint Workshop on Ubiquitous, Pervasive and Internet Mapping (UPIMap2008). This was held in Shepherdstown, USA, with the ICA Commission on "Maps and the Internet" on September 10-11, 2008 immediately following AutoCarto 2008. The commission has joined also to the ICA Workshop on Theories of Map Design in the Digital Era, held in Hong Kong, on September 22-25, 2010, and the ICA Workshop on Online Maps with APIs and Map services organized by the Commission on "Maps and the Internet", held in Orlando, USA, on November 19, 2010 immediately following AutoCarto 2010. In both workshops, Japanese members assisted actively through the presentation of their scientific papers.

Fig. 1-1 Proceedings of UPIMap2008


Fig. 1-2 Participants of UPIMap2008

(MORITA Takashi)

2. Activities of the Japan Cartographers Association

The Japan Cartographers Association（JCA）is the only Japanese scientific association whose aims are for advancement of cartography in Japan. JCA is one of the cooperative academic societies of the Science Council of Japan（SCJ）and has close partnership with the National Committee for Cartography of the SCJ.

JCA was established in November 1962 at the time of the First International Cartographic Conference in 1962 in Frankfurt am Main. There are currently about 900 members and the secretariat's office is located in the Japan Map Center Building in Tokyo. The president is Mr. Y. Hoshino, Former Director-general of the Geospatial Information Authority of Japan (GSI).

The activity plan and budget of JCA are decided annually at the general assembly, which is usually held in late February. Concrete actions are operated by the standing committee, which is consisting of 18 members and chaired by Prof. Y. Kumaki of Senshu University.

The regular activities of JCA are as follows:

（1）Annual Scientific Conference

A two-day conference including a special lecture is held annually in summer or autumn in Tokyo, with about 200 attendees. The mean number of presentations in aural session, poster session and symposia of 2007-2011 conferences is about 40. Proceedings are distributed to all JCA members before the conference. Maps, geographic information systems and cartographic materials are exhibited at the conference. Exhibitors are the Geospatial Information Authority of Japan (GSI), the Hydrographic and Oceanographic Department of the Japan coast Guard and other government organizations as well as commercial sectors.

（2）Regional Conference and JCA Workshops

The regional conference is held once a year, usually in autumn, in a city excluding Tokyo. The number of attendees of a conference is 40-60. JCA Workshops, mostly a half-day program, are also held three to four times a year.

（3）Excursions

A one-day or two-day excursion are held in conjunction with the annual scientific conference and the regional conference. The workshops occasionally include an excursion.

（4）Commissions

JCA has eight commissions（see below）, some of which correspond to ICA commissions. Each commission has its own activities directed by the leadership of chairperson. They sometimes plan symposia of the annual scientific conference or the regional conference, excursions and JCA workshops as well as the commission workshops. The JCA Commission on Ubiquitous Mapping managed UPIMap2008（International Joint Workshop on Ubiquitous, Pervasive and Internet Mapping, 2008）, which was held in September, 2008 in Shepherdstown, USA by the ICA Commissions on Ubiquitous Mapping and on Maps and the Internet.

Commission on History of Cartography
Commission on Cartographic Terminology
Commission on Children and Cartographic Education
Commission on Professional Education and Training
Commission on Marine Cartography
Commission on Hypermedia maps
Commission on Ubiquitous Mapping
Commission on School GIS Education

（5）Publications

JCA publishes a quarterly journal '*Chizu -- Kukan Hyogen no Kagaku*（Map, Sciences of Spatial Representation）. It is composed of scientific papers, various reports, book reviews and news. Each issue has a paper map（occasionally a CD）as an appendage. Since the appendages are selected from unique and not-easy-to-get materials, JCA members get many interesting maps in this way.

（6）Website and Mailing List

JCA makes its activities public through website（http://www.jmc.or.jp/gakkai/index.html）. JCA also operates a mailing list, which is useful for exchange of information.

（7）Collection of Maps and Relating Materials

Maps and various materials relating to maps are collected principally by way of donation or exchange including those from foreign institutions.

（8）Commendation

JCA made a regulation of commendation 'JCA Award' in 2006. The first commendation ceremony was held in the general assembly of 2007 and two JCA members whose scientific papers in *Chizu* are excellent, a map-publishing company, a high school teacher, and 56 JCA members who contributed specifically to the promotion of JCA are awarded.

（9）Cooperation with Other Scientific Organizations

JCA is a member of the Japan Geoscience Union（URL: http://www.jpgu.org/）which is composed of 46 scientific societies in Japan covering geophysics, geology, geography and relating sciences. JCA conducts “Mapping and spatial representation in geoscience” session as one of the regular sessions of the annual meeting of the Japan Geoscience Union. JCA also a member of both the Japanese Geographical Union（URL: http://wwwsoc.nii.ac.jp/ajg/union/）and the Committee on the Cooperation of Societies of Human and Economic Geography and Geography Education（web page is linked from http://wwwsoc.nii.ac.jp/hgeog/index.html）. JCA takes actions for the promotion of cartography and its education through these unions. JCA supports many events of map exhibition, map contest, workshop, training course, etc. organized by the Geospatial Information Authority of Japan (GSI), Japan Map Center, scientific societies, local organizations, etc.

(KUMAKI Yohta)

3. Certification of GIS engineer organized by the GIS Association of Japan (GISA)

GIS Association of Japan (GISA) established GIS Certification Association (GISCA) under the corporation of related academic societies including JCA in October 2006. The roles of GISCA are the certification of “GIS Expert” and “GIS Expert Emeritus” to the professional individuals and the certification of GIS education to the academic and social education organizations. More than 200 people were certified as GIS Expert since the certification has started. GISCA draws upon the method of GISCI in US and modifies it for Japan to evaluate GIS professionals.

The title “GIS Expert Emeritus” is presented to the people who have been taking leadership to the field of GIS more than 25 years, if the certification committee decides the certification by the nomination from GIS related organizations. 13 people shown under have been celebrated since 2010.

(2010)

Toshiro Edamura (Professor Emeritus, Kobe University)

Masao Iri (Professor Emeritus, University of Tokyo)

Michio Nogami (Professor Emeritus, Tokyo Metropolitan University)

Atsuyuki Okabe (Professor Emeritus, University of Tokyo)
Hiroyuki Kohsaka (Professor, Nihon University)
Teruko Usui (Professior, Nara University)
Etsuo Yamamura (Professor Emeritus, Hokkaido University)
Yuji Murayama (Professor, University of Tsukuba)

(2011)
Kenji Ohmasa (Professor, University of Tokyo)
Yosihisa Hoshino (Former Director-general of the Geospatial Information Authority of Japan (GSI))
Kazuhiko Ohtake (Former Director-general of the Geospatial Information Authority of Japan (GSI))
Takashi Morita (Professor, Hosei University)
Ryosuke Shibasaki (Professor, University of Tokyo)

GISCA also certifies GIS educations provided by academic and industrial organizations. More than 30 education programs have certified by June 2011.
(http://wwwsoc.nii.ac.jp/gisa/en/ENG_top.html)

(OTA Morishige)

Ⅱ. ACTIVITIES OF MAPPING ORGANIZATIONS

Most of the cartographic works in Japan is carried out under the Survey Act. Main objectives of the act are to coordinate various survey works efficiently, to standardize accuracy and to avoid duplicated work.
Survey work is mainly classified into two categories by the act. The first one is the Fundamental Survey executed nationwide by the Geospatial Information Authority of Japan (GSI), and the other is the Public Survey for local governmental projects or special projects which are carried out by other governmental or public organizations such as the Forestry Agency, the Geological Survey of Japan/National Institute of Advanced Industrial Science and Technology (GSJ/AIST), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), etc.
Preparation of various kinds of charts and nautical publications is carried out by the Hydrographic and Oceanographic Department of the Japan Coast Guard, MLIT.

1. Geospatial Information Authority of Japan, Ministry of Land, Infrastructure, Transport and Tourism

(1) Topographic Mapping

1) Developing and Updating the Digital Japan Basic Map

The Digital Japan Basic Map integrates geographical information on Japan with map information that conforms well with fundamental geospatial data (see 1.(4) 4)), ortho image using digital aerial photographs, and geographical name information which is keywords to search for locations such as names of natural geographic features and inhabited areas. As it integrates information digitally, it can satisfy needs of various users, including for highly specialized uses such as national land management and disaster mitigation.

- Map information

  Integrating information necessary for land management, such as topography and structure, into fundamental geospatial data such as roads and buildings to prepare map information for use as the nation's new basic land information.

  The Internet allows for prompt distribution of up-to-date map information.
- Geographical name information

  The names of natural geographic features such as mountains, rivers and islands, and names of inhabited areas such as towns are converted into a database then developed into geographical name information that can be used for various purposes. It serves as the base for displaying territories, managing national land and as a location search key, making it absolutely essential information for promoting the use of geospatial information.
- Ortho image

  The GSI improves ortho images (orthophoto) using digital aerial photographs in the city planning area and its environs. Ortho images are indispensable for the creation and updating of map information because map information can be overlaid onto ortho image. They are positioned as a new information infrastructure in the Information and Communication Technology (ICT) society.

2) Large Scale Topographic Maps

In 2003, using technology of aviation laser scanner surveying, the GSI started publication of very detailed and highly precise DEM (digital elevation model), which grid interval was 5-meter.
Table 2-1 shows the coverage of large and medium scale topographic maps prepared by the GSI during the past four years.

Table 2-1 Coverage of Large and Medium Scale Topographic Maps by GSI

Title		FY2007	FY2008	FY2009	FY2010
1:10,000	Revision	24 sheets	45 sheets	-	-
1:25,000	Revision	372,849 km^2	372,907 km^2	372,910 km^2	372,914 km^2
1:50,000	Revision	81 sheets	98 sheets	43 sheets	-

3) Small Scale Maps

Small scale maps and others published by the GSI are shown in Table 2-2 and Table 2-3 (June, 2011).

Table 2-2 Publication of Digital Maps

Title	Area
DM 2500 (Spatial Data Framework)	Urban Planning Area
DM 5000 (Land use)	Metropolitan Area, Kinki Area
DM 25000 (Spatial Data Framework)	All Japan
DM 25000 (Map Image)	All Japan
DM 25000 (Administrative Boundaries)	All Japan
DM 25000 (Geo. Names, Pub. Facilities)	All Japan
DM 25000 (Land condition)	All Japan
DM 50000 (Map Image)	All Japan
DM 200000 (Map Image)	All Japan
DM 5000000(Combined)	All Japan and Surroundings
DM 5m Grid (DEM)	Saitama, Tokyo, Yokohama&Kawasaki, Nagoya, Kyoto&Osaka, Kochi, Fukuoka, Miyazaki, Kashiwazaki, Iizuna, Niigata, Sendai, Kobe, Mt. Kurikomayama
DM 10m Grid (DEM (Volcanic Areas))	24 Volcanic Areas
DM 50m Grid (DEM)	All Japan
DM 250m Grid (DEM)	All Japan
The National Atlas of Japan	All Japan

DM: Digital Map, DEM: Digital Elevation Model

Table 2-3 Publication of Paper Map Preparation

Title	Number of sheets	Size of sheets
1:10,000 Topographic Map	307	52.0 x 73.8 cm
	4	
1:25,000 Topographic Map	4355	46.0 x 58.0 cm
	16	59.4 x 84.1 cm
1:50,000 Topographic Map	42	46.0 x 58.0 cm
	1,249	46.0 x 58.0 cm
	4	
1:200,000 Regional Map	130	46.0 x 58.0 cm
1:500,000 District Map	8	78.8 x 109.1 cm
	8	78.8 x 109.1 cm
1:1,000,000 Nippon	3	78.8 x 109.1 cm

1:5,000,000 Japan and its Surroundings	1	78.8 x 109.1 cm
1:25,000 Composite Map	2	63.6 x 93.9 cm
1:50,000 Composite Map	3	63.6 x 93.9 cm
1:100,000 Composite Map	2 4	63.6 x 93.9 cm 78.8 x 109.1 cm
1:300,000 Composite Map	1	78.8 x 109.1 cm

(2) Thematic Maps

The GSI is engaged in various kinds of thematic mapping in cooperation with other governmental organizations for the purpose of providing basic geographic information for regional development, disaster prevention, etc.

Table 2-4 shows some typical thematic maps prepared and published by the GSI during April 2007 – March 2011.

Fig.2-1 and Fig.2-2 shows parts of “Volcanic Land condition map of Mt. Fuji” and “Land condition map Kochi”, respectively.

The GSI generates digital thematic maps by both digital mapping method and digitization from existing maps. Table 2-5 shows some typical digital thematic maps prepared and published by the GSI during April 2007-March 2011.

The GSI and MLIT promote establishment of portal site for hazard maps produced by local governments. The GSI provides geographic information, such as land condition, for making various kinds of hazard maps.

Table 2-4 Thematic Mapping by GSI (FY2007 – FY2010)

Type of Map	Scale	Number of sheets
Basic volcano map	1:10,000	4
Volcanic Land condition map	1:10,000, 1:25,000	3
Land condition map	1:25,000	18
Lake chart	1:10,000	4
Active fault map in urban area	1:25,000	36

Table 2-5 Digital Thematic Mapping by the GSI (FY2007 – FY2010)

Title	Format	Item or explanation	Original Source
Digital Map 5000 (Land use)	JPGIS	Land use for housing, covering the three main urban areas of Japan	City Planning Map, Aerial Color Photograph, etc.
Digital Map 25000 (Land condition)	JPGIS	Land condition	1:25,000 Land Condition Map

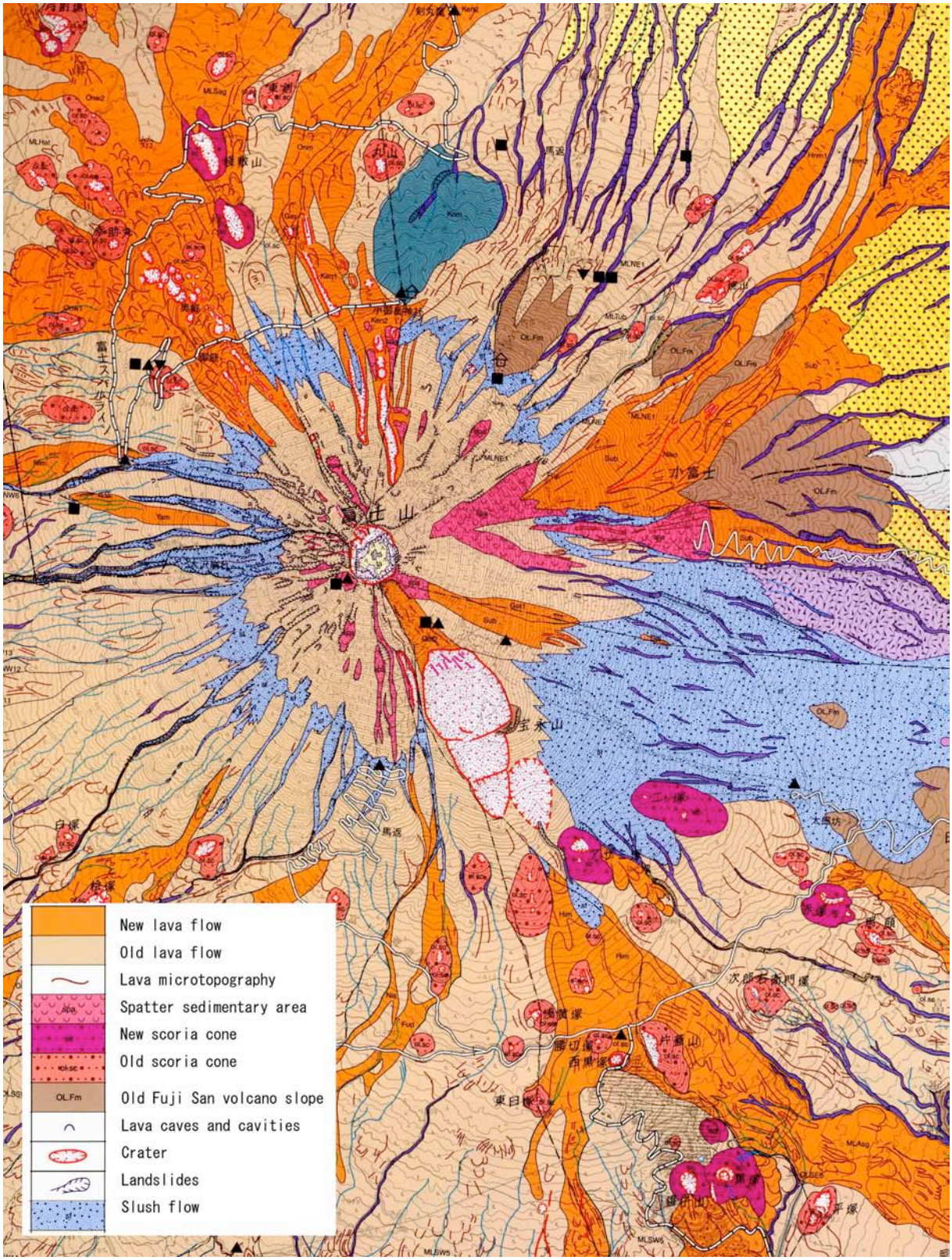


Fig.2-1 Volcanic Land condition map of Mt. Fuji

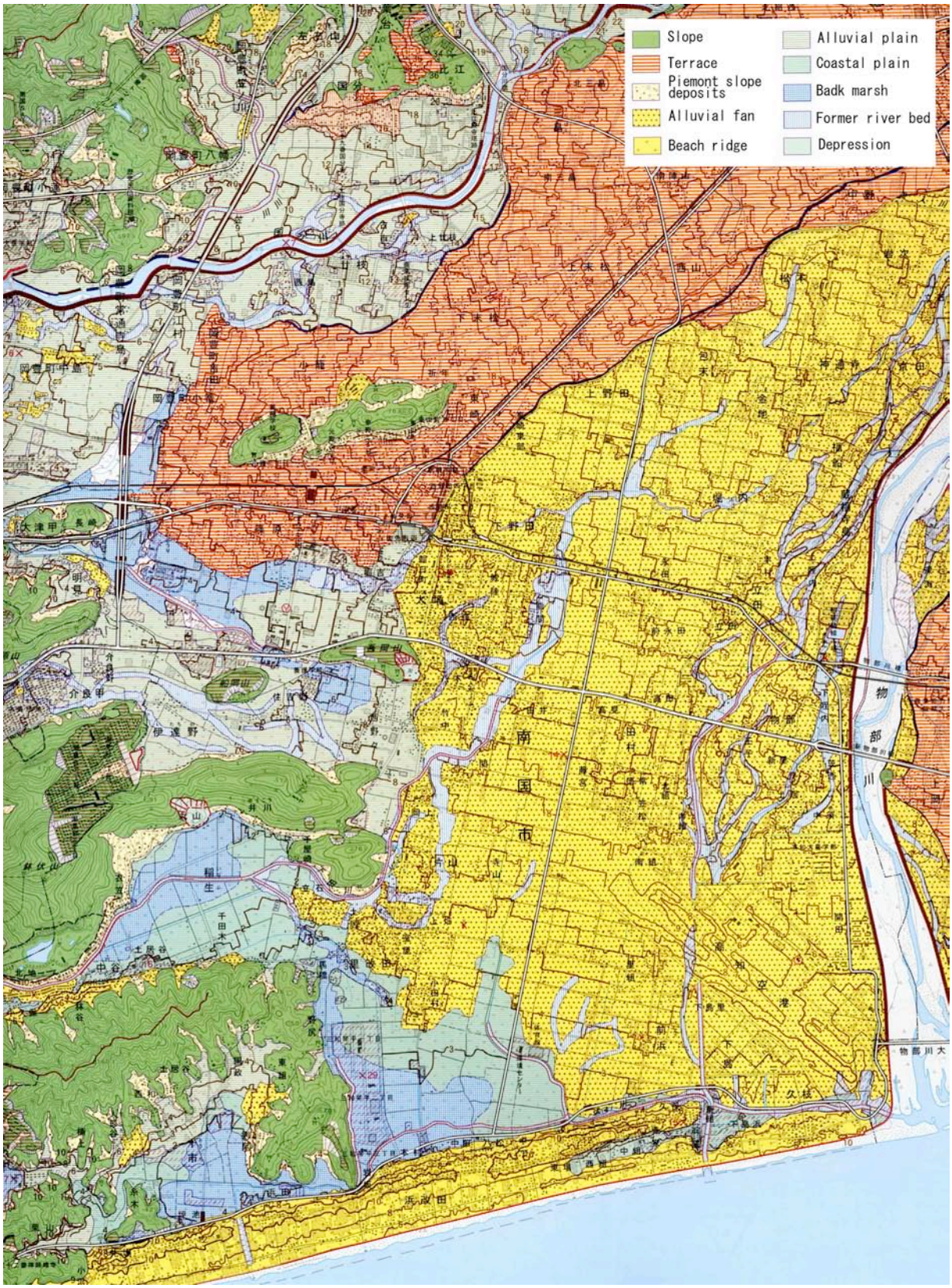


Fig.2-2 Land condition map “Kochi”

(3) The National Atlas of Japan

The first edition of the National Atlas of Japan compiled by the GSI was published in 1977. The GSI revised the National Atlas of Japan, Revised Edition, in 1990. Furthermore, the GSI has developed an Electronic Atlas System for the computer use, and a CD-ROM Atlas was published in 1997.

(4) Development of Geospatial Information Infrastructure

1) Basic Act for the Advancement of Utilizing Geospatial Information

The government enacted a new law "Basic Act for the Advancement of Utilizing Geospatial Information" in May 2007. The purpose of this Law is to advance policies concerning the Advancement of Utilizing Geospatial Information (hereinafter, "AUGI") in a comprehensive and well-planned manner by establishing basic principles and clarifying the responsibilities of State and local governments as well as specifying basic elements for measures on AUGI, in view of the fact that AUGI is essential in establishing the economy and society in which the citizens can lead a safe and quality life at present and in the future. Given that geospatial information, including geospatial framework information, statistical information and geo-imagery, provides essential infrastructure for the improvement of the quality of the citizens' lives and the sound development of the national economy, AUGI shall be conducted based on the comprehensive and systematic implementation of policies including accurate and proper development and distribution of digital geospatial information, promotion of technologies like the Geographic Information System (GIS) and Satellite-Based Positioning (SBP), capacity building, enhancement of coordination among State and local governments and related institutions.

2) Basic Plan for the Advancement of Utilizing Geospatial Information

In order to carry out policies concerning AUGI in a comprehensive and well-planned manner, the State Administration developed "Basic plan for the Advancement of Utilizing Geospatial Information" in 2008 (Cabinet decision on April 15, 2008). In the Basic Plan, basic strategies for the policies concerning AUGI, measures related to GIS and policies related to Space-based Positioning, Navigation and Timing (Space-based PNT) are stated. The period of the Basic Plan is fiscal year 2008 through 2011. To promote measures formulated in this Basic Plan, the Action Plan for the Advancement of Utilizing Geospatial Information (G-Spatial Action Plan) was enacted in August 2008. Under the G-Spatial Action Plan, the GSI is carrying out a number of diverse important measures including the improvement, upgrading, provision, and standardization of geospatial information such as Fundamental Geospatial Data.

3) Metadata and Clearinghouse

In Japan, LCGIS made an agreement to provide Japanese clearinghouse with metadata. Japanese Metadata Profile (JMP) defines schema for these metadata. Current version of JMP is 2.0 revised in May 2004, and based on ISO 19115:2003. JMP2.0 is composed of core metadata and additional elements such as keywords or distribution information to support clearinghouse facilities. From 2008, Japanese central government and local governments are required to maintain metadata based on JMP2.0, and to submit them to the GSI whenever they survey for public project. The GSI adds these metadata to clearinghouse.

Each organization taking part in Japanese clearinghouse maintains one or more node servers which support ISO 23950 as its retrieval protocol. The GSI provides server tools to support the Japanese language environment, and has operated the Japanese clearinghouse gateway since 2000.

Now there are 23 clearinghouse nodes:

- 16 nodes by 7 ministries of the central government
- 3 nodes by independent administrative institutions such as universities

- 4 nodes by private companies

The URL of the clearinghouse gateway is http://zgate.gsi.go.jp/, in Japanese.

4) Developing and updating fundamental geospatial data

Maps that accurately represent current land conditions are indispensable for land administration by the government and various socioeconomic activities. The use of ICT -based maps is growing widespread and demand for digital maps of a larger scale is growing. With the enactment of the Basic Act on the Advancement of Utilizing Geospatial Information in May 2007, the GSI started improving a new common infrastructure, the Digital Japan Basic Map, in addition to starting work on improving and providing fundamental geospatial data.

- Fundamental geospatial data

  Fundamental geospatial data are reference information on which the positions of geospatial information are based. They are common outline map data that anyone can use via GIS. Since 2007, the GSI has been seamlessly integrating large-scale map data prepared by various organizations to produce fundamental geospatial data, and providing them via the Internet free of charge.

- Grand design for fundamental geospatial data

  Fundamental geospatial data is designed to develop and update through combination of city planning maps and high-accuracy maps (in legal documents, etc.) possessed by various organizations. By proceeding with the development of fundamental geospatial data, it should become easier for local governments to develop legal documents etc., and for the private sector to utilize geospatial information.

  To realize it, the GSI has made up the “Grand Design for Fundamental Geospatial Data” about what fundamental geospatial data should entail and how it should be approached, in order to establish collaborative and cooperative relationships among relevant organizations.

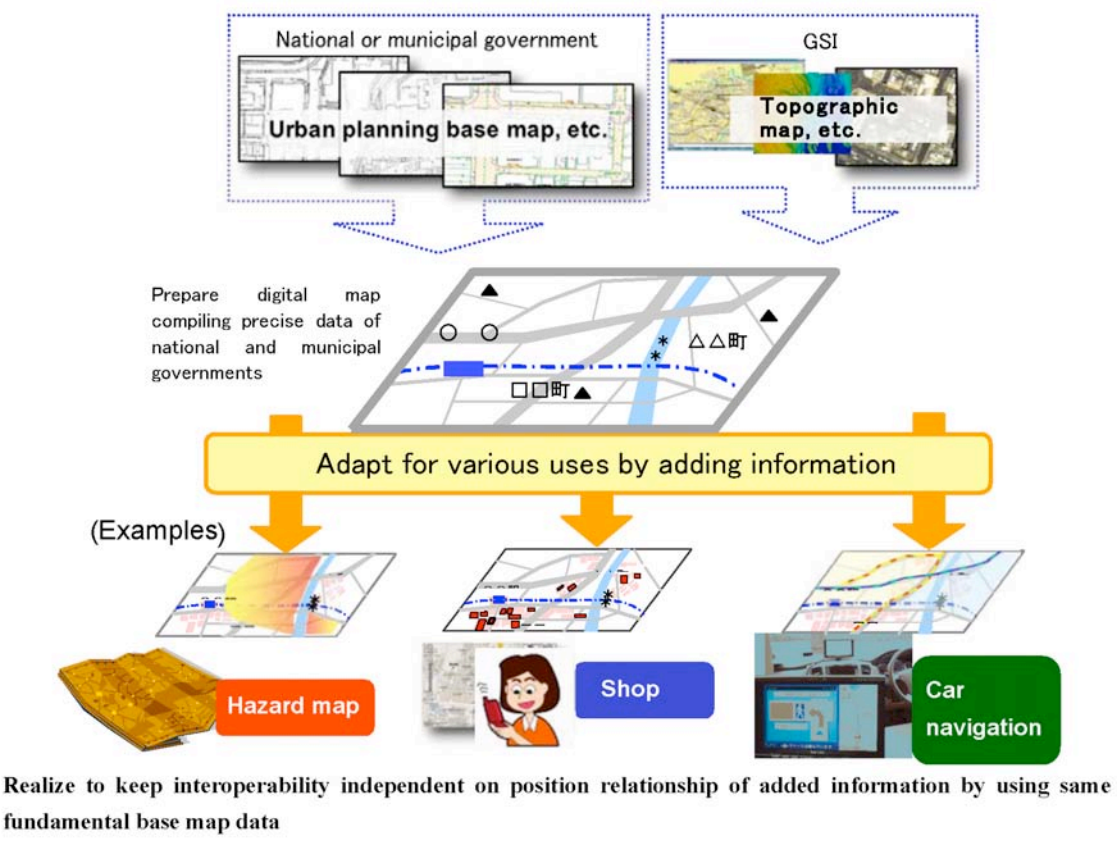


Fig.2-3 Preparation of Fundamental Geospatial Data

5) Digital Japan

Digital Japan is a concept of a virtual space where users can utilize geographical information selecting from data sets stored and maintained by different organizations on the internet and integrating them for certain purpose based on the positional reference data. Digital Japan has various possibilities that enable us to search and analyze geographical information as an infrastructure, as well as to add information to them on demand of users.

To realize Digital Japan, the GSI has launched “Digital Japan Web System” in 2003, which enables us to overlap many kinds of geographical information on the data developed by the GSI and some local governments on the Internet. There are over 3,200 sites using this system as of the end of April, 2011. The portal sites’ URL of this system is http://cyberjapan.jp/, in Japanese.

6) Aerial Photographs

The GSI archives more than a million of aerial photographs. This archive covers all over Japan from 1946 to now, and includes films shot by U.S. Armed Forces until 1957. All photographs are ready for browsing at the counter in the GSI, and for ordering to copy as physical media. A part of photographs, which are shown in Table 2-6 (as of April 2011), are also ready for web browsing (Fig.2-4-1, 2-4-2.)

Table 2-6 Internet browsing services of archived aerial photographs

Period (Year)	Number of pictures (Approx.)
1936-1945	17,000

1946-1960	144,000
1961-1970	138,000
1971-1980	393,000
1981-1990	56,000
1991-2000	71,000
2001-	130,000

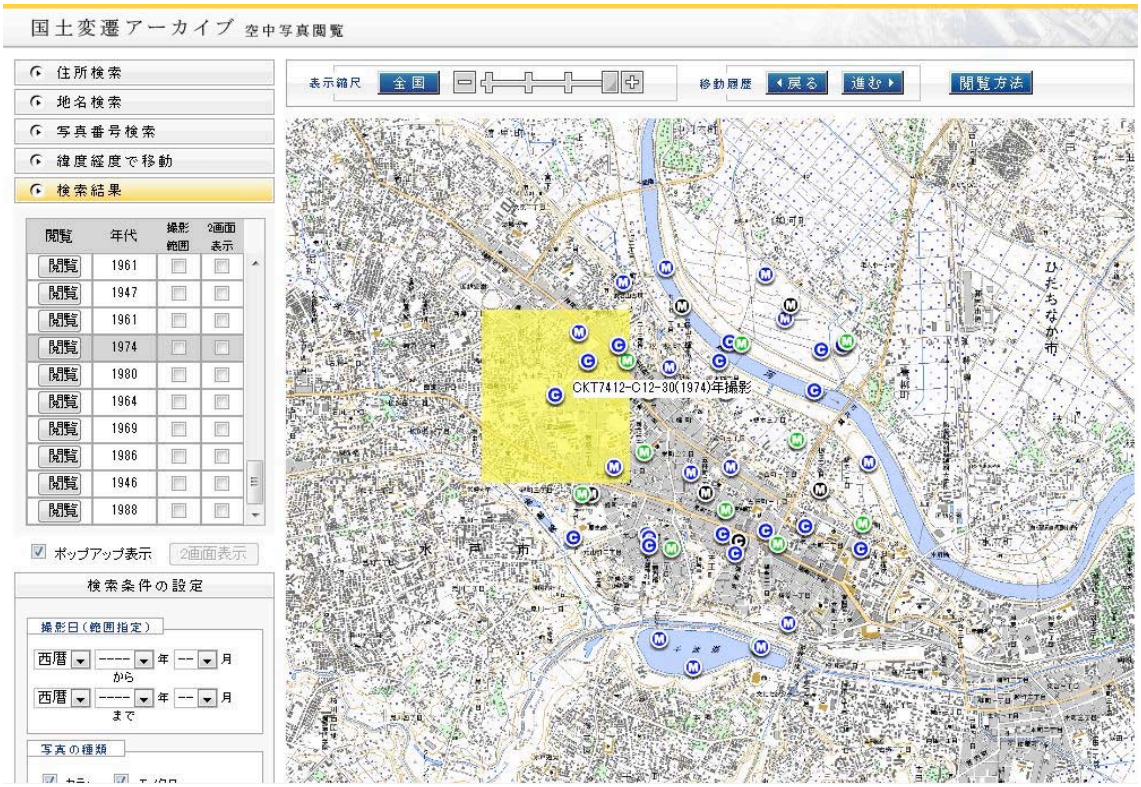


Fig.2-4-1 Internet Browser for Aerial Photographs (Search Result)

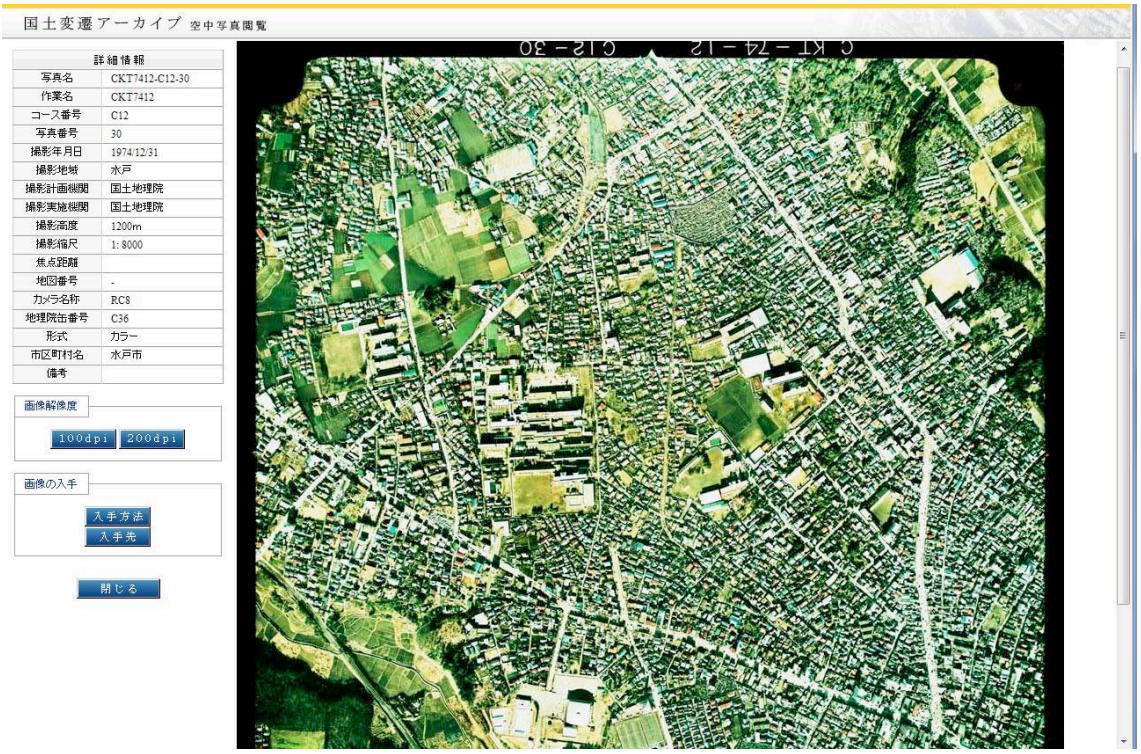


Fig.2-4-2 Internet Browser for Aerial Photographs

7) ISO/TC 211 (Geographic information/Geomatics)

The GSI has actively participated in ISO/TC 211 since the foundation in view of the importance of standardization of geographical information and has promoted to develop Japanese Standards for Geographic Information (JSGI) in accordance with the ISO geographic information standards.

The latest version of JSGI2.0 was published in March 2002. In addition, to promote use of standards, the GSI developed the Japan Profile for Geographic Information Standards (JPGIS) in January 2005, as a practical profile of JSGI.

JPGIS was renewed based on new standards of ISO/TC 211 in May 2009.

(5) International Activities

1) Global Mapping Project

Global Mapping Project is an international cooperation project of National Mapping Organizations (NMOs) and partners to develop a set of global geospatial data with verified quality based on consistent specifications.

The project has been steered and promoted by International Steering Committee for Global Mapping (ISCGM) established in 1996. The GSI serves as ISCGM Secretariat. As of May 2011, 165 countries and 16 regions participate in the project, and Global Map data of 71 countries and 4 regions, which cover 59.9 % on territorial basis and 52.5 % on population basis of the whole land, have already been developed and are available for public through the Internet from the website of the ISCGM (http://www.iscgm.org) or those of participating NMOs. The present status of the project is summarized in Fig.2-5.

The GSI is developing not only Global Map data of Japan but also Global Map data of developing countries mainly in Asia and the Pacific region in cooperation with respective NMO of the region. From 2007-2010, Global Maps of the following countries have been developed with the assistance of the GSI: Namibia in 2007 and Afghanistan in 2010. In addition, the GSI has developed the Manual for Development and Revision of

Global Map, Global Map Metadata Editor, and Global Map Data Check Software. As ISCGM Secretariat, the GSI will continue to make efforts to implement Global Mapping Project.

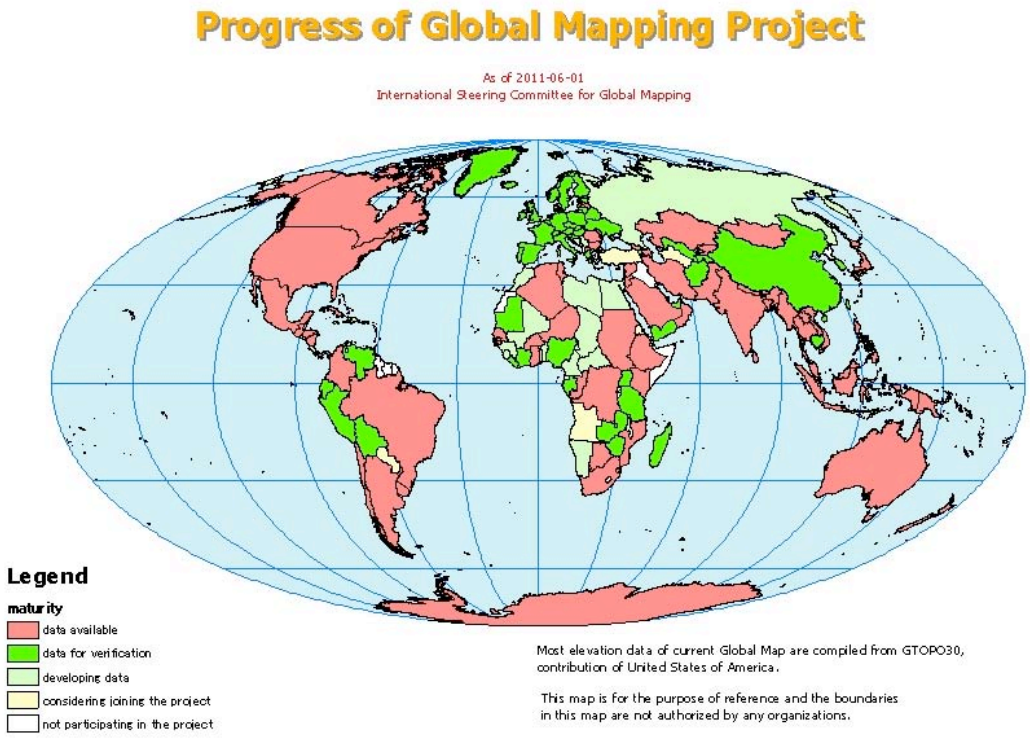


Fig.2-5 Present Status of Global Mapping Project

2) United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC-AP)

The 18th UNRCC-AP was held at UN Conference Center in Thailand in October 2009 in conjunction with 15th PCGIAP meeting. Dr. MURAKAMI Hiroshi, Deputy Director of Planning Department of the GSI, was appointed as a rapporteur. In the plenary meeting, the GSI made a presentation entitled “New NSDI and National Mapping Policy of Japan”. It introduced new NSDI legislation and development of fundamental geospatial data in cooperation with local governments.

3) Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP)

PCGIAP was established pursuant to a resolution of the 13th UNRCC-AP to cooperate in the development of a regional geographic information infrastructure. The GSI took charge of the PCGIAP Secretariat between 2000 and 2006. After that, the GSI has been served as Vice President of PCGIAP since 2006. At the 15th PCGIAP meeting held in October 2009, the Vice President of PCGIAP was re-elected from the GSI. At the same meeting, a staff member of the GSI was also re-elected the Chairman of Working Group 1 (WG1, Geodesy Technology and Applications), and has managed the WG1.

4) Preparatory Meeting of the Proposed United Nations Committee on Global Geospatial Information Management (GGIM)

The 1st preparatory meeting held in October 2009 in conjunction with 18th UNRCC-AP. In the meeting, the

GSI expressed that it welcomes the UN initiative and is interested in moving it forward for coordinate existing activities, and cope with major issues. The GSI also attended the 2nd (New York, May 2010) and the 3rd (New York, April 2011) preparatory meeting, and has contributed positively to the establishment of GGIM.

(6) Research and Development

1) Application of satellite data and remote sensing

The GSI studies satellite and remote sensing for effective map-making. Development of various sensors is pushed forward, and the GSI begin to take the benefit. The GSI introduce some sensor as below.

a) The High-Resolution Image by Satellite

The 21st century has begun, and the satellite with high resolution optical sensor such as IKONOS and QuickBird were launched, and there are several high resolution satellites in space now. The resolution of optical sensor of some commercial satellites such as GeoEye and WorldView-2 is about 0.5m.

The GSI has been testing the quality of the GeoEye and WorldView-2 images for making topographic maps of large or medium scale. The Advance Land Observing Satellite (ALOS) of Japanese was launched on January 24, 2006 by Japan Aerospace Exploration Agency (JAXA). The major purpose of the ALOS is to generate 1:25,000 scale map, and the ALOS has the ability of making 1:25,000 scale map without any Ground Control Points. In addition, the cost of obtaining the image is much lower than commercial satellites. So the GSI has validated the ALOS data, such as whether the accuracy is enough or not to making 1:25,000 scale map. These satellite imageries were used for revising basic topographic maps such as map of Io To. As the operation of ALOS was terminated in April 2011, we expect the next satellite with high resolution optical sensor will be launched for mapping in the near future.

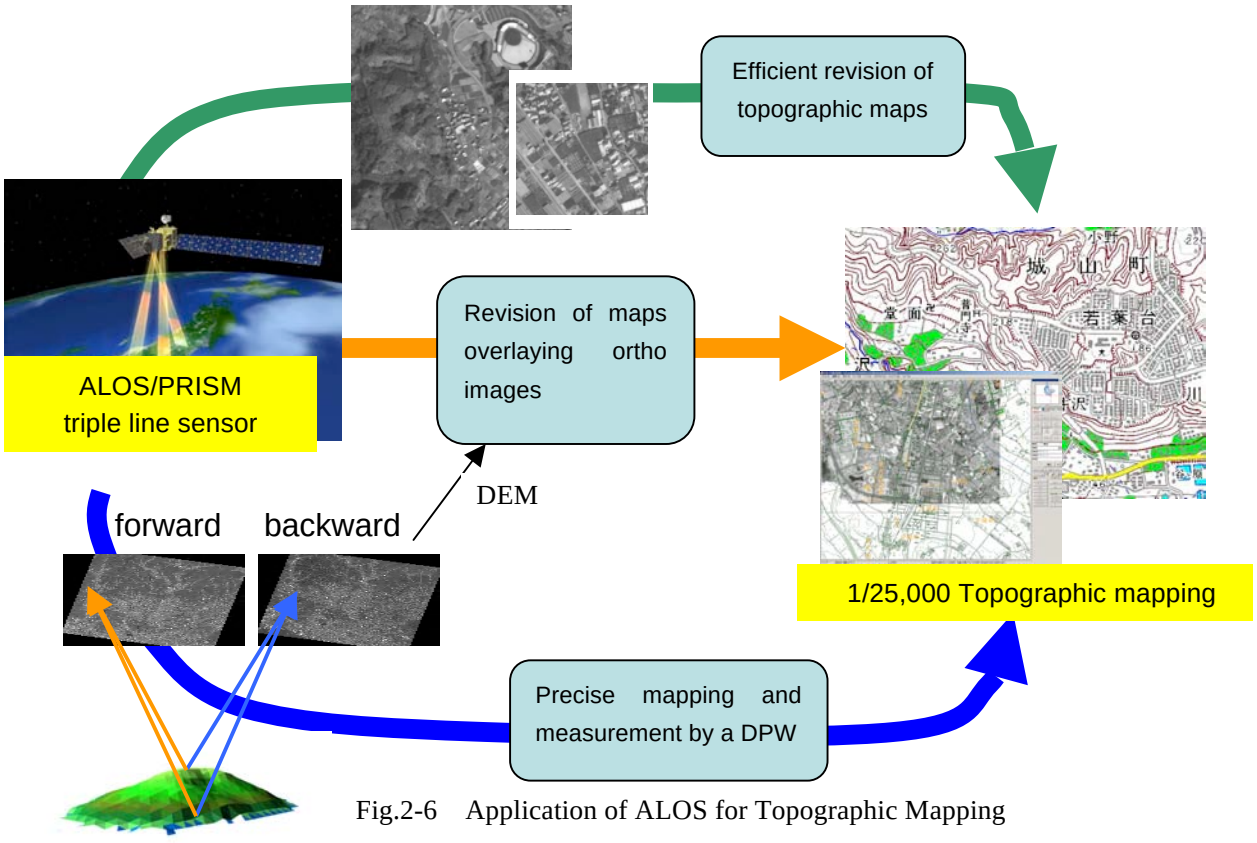


Fig.2-6 Application of ALOS for Topographic Mapping

b) Airborne Laser Survey (LIDAR)

The Airborne Laser Survey is a distance-measuring technology that emits laser beams tens of thousands times per second as if scanning the earth's surface and measures the time from their emission till their return to the aircraft after reflecting from objects. The acquisition data are analyzed to make contour map or DEM. This new technology can be regarded as a kind of remote sensing. The positional accuracy thus obtained is, in optimal conditions, reported to be 30 to 50 centimeters in the horizontal direction and 15 centimeters in the vertical direction, though it is affected by the conditions of topography or vegetation in the target area. In Japan, major aerial survey companies started adopting the Airborne Laser Survey around 1997 for erosion control site in steep mountains. Making good use of this new technology, the GSI has started to publish the DEM of 5 meter grid data of plains in some metropolitan area since 2003. Moreover, in 2006, GSI made the'1:25,000 scale relief map' (Fig.2-7) as an example of the DEM of 5 meter grid data practical use. It was developed by superimposing topographic map at 1:25,000 scale on the shaded layer tint map generated from the DEM of 5 meter grid data. In addition, several aerial survey companies have individually begun to sell detailed building data for 3-D model and detailed topographic data.

The GSI has also been conducting studies of applications of LIDAR data. A development of classification method of landform in large scale for predicting landslides with high density topographic data was done till 2009. This study revealed that slope information obtained by high density LIDAR data plays an important role for landslide prediction.

The GSI had carried out the study of developing the method of producing landscape-ecological map for estimation of biodiversity using LIDAR data by the fund of the Ministry of the Environment. The GSI produce the landscape ecological map consists of three dimensional vegetation structure and micro topography under the forest using LIDAR data.

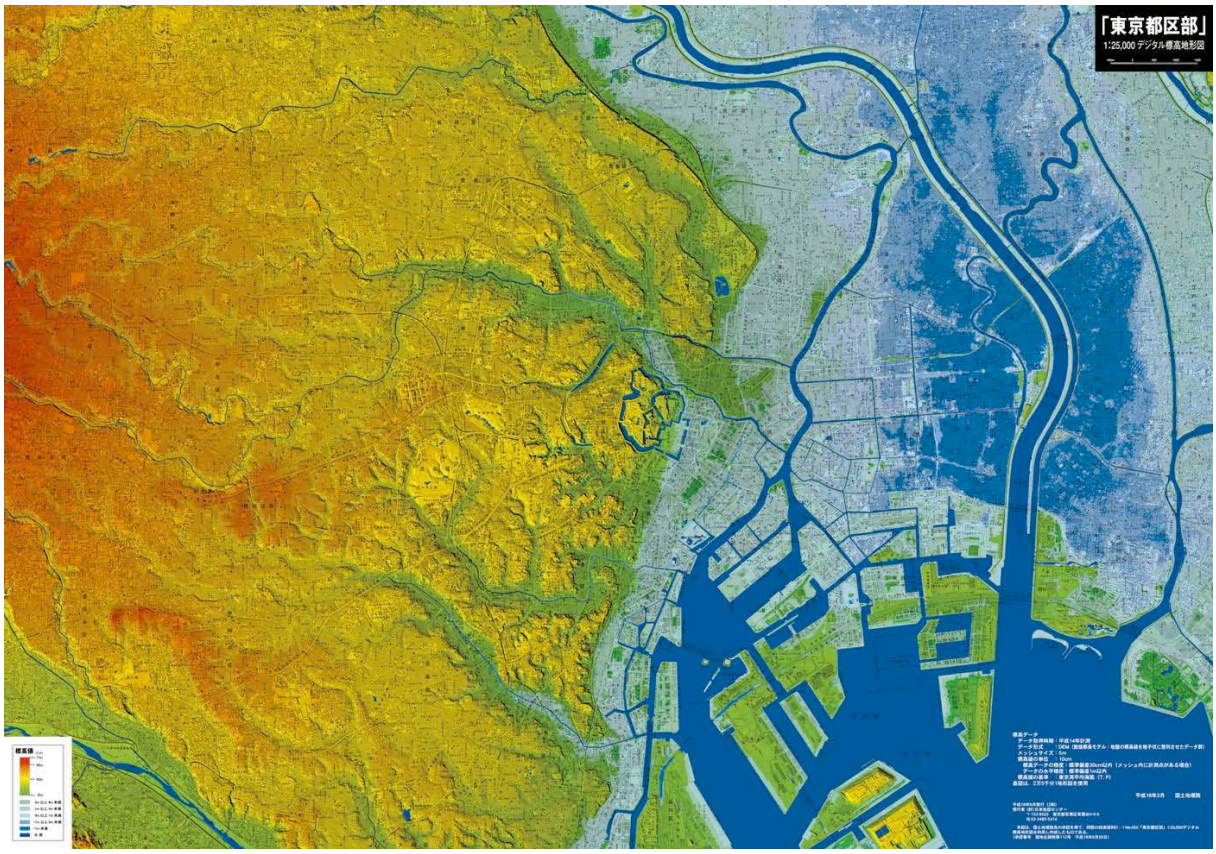


Fig.2-7 ‘1:25,000 scale relief map’ (The 23-ward area of Tokyo metropolis)

c) SAR (Synthetic Aperture Radar)

SAR is the imaging radar which acquires terrain imagery by transmitting microwaves and receiving their reflection from the earth’s surface. Microwaves can penetrate through vapor so that SAR can observe through clouds, mists or volcanic fumes. Also as it is an active sensor transmitting microwaves, it can observe even in the night.

Since the major eruption of Asama volcano on September 1, 2004, GSI has repeatedly carried out AirSAR measurements around the summit crater, and observed its topographic change (the movement of the erupted lava). Fig.2-8 shows a combined chart of the cross section of the crater (from northeast to southwest) modified by using the results of each measurement. Recently, since the eruption of Kirishima Volcano in January 2011, the GSI has carried out AirSAR measurement around Kirishima Volcano, and estimated the total volume of sediments in the crater. From the series of these AirSAR observations, it is proved that AirSAR is effective in observing terrain under volcanic fumes, where ordinary photography is unavailable.

For the utility of spaceborne sensor, the GSI conducted a study for detecting precursor of landslides with InSAR image. This study clarified that active landslides might be expressed as changes in color in InSAR image. This study also pointed that individual movement of certain landslide block more than 200 meters square can be detected with InSAR image in some cases.

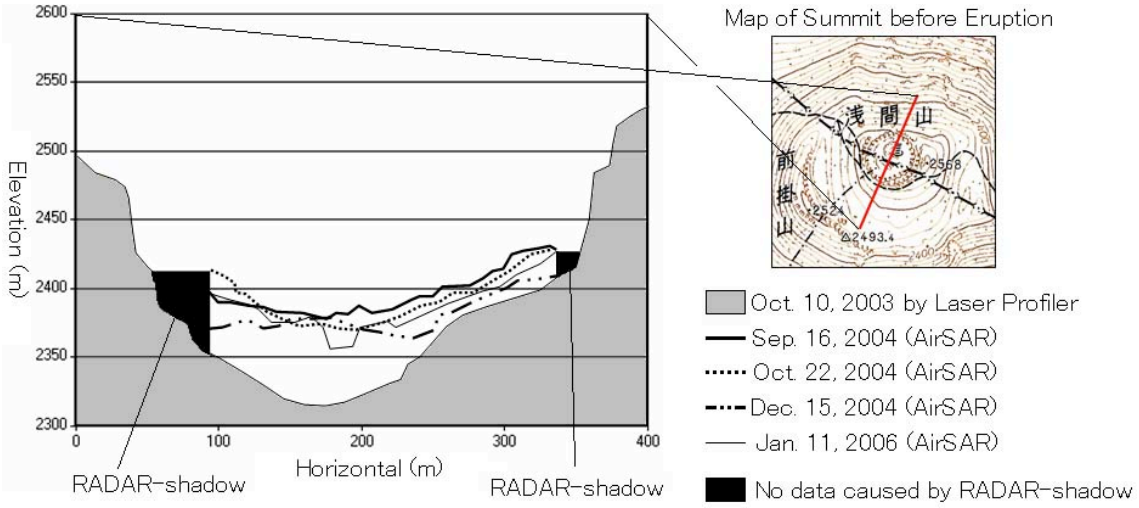


Fig.2-8 Change of topography in the summit crater of the Asama volcano

2) Application of geospatial information

The GSI has been conducting various kinds of study for the purpose of advancement of utilization of geospatial information.

An example is a study on application of time-serial geographic information such as outdated topographic maps and aerial photos. In this study, the GSI verified the positioning accuracy of outdated topographical maps, and developed the method of colorizing of old monochrome aerial photos taken just after the World War Two. The GSI also developed the method for detection of the artificial topographical changes by creating and comparing time-serial DEMs using aerial photos of different age.

Another example is a study on the temporal geospatial dataset. The GSI produced the temporal geospatial dataset of a part of Tsukuba City close to Tsukuba Express. Using each year's geospatial data generated from temporal geospatial dataset, the researchers of the GSI tried temporal spatial analysis between human impacts such as development of new traffic network and land surface change such as land use change or increase of buildings. It is possible to perfume temporal spatial analysis effectively using temporal geospatial dataset if dataset is revised at short intervals.

(7) Public Relations

1) Science Museum of Maps and Survey

This museum was established in the GSI, Tsukuba City in 1996. It includes two exhibition rooms, the Permanent Exhibition Room and the Special Exhibition Room where special thematic exhibitions are held irregularly. As a special exhibition, "Exhibition of Excellent Maps made by the Children and Pupils of the Primary and Secondary Education of the Whole Country" has been held annually since 1998, gathering selected excellent maps from the similar local map exhibitions and aiming to diffuse map education, to popularize maps and to make a network of the teachers and researchers of map education.

2) Children's Map Competitions

There exist more than ten local groups of teachers organizing children's map competitions. The oldest one has celebrated its 49th anniversary. Eight groups established a coordinating committee in 1998, and hold a joint exhibition once a year at the Science Museum of Maps and Surveys of the GSI. A public foundation promotes a competition of children's work called My Town Map Concours. From 1999, applicants have had to send their

maps in CD-Rs or MOs or send them through the Internet.

3) Exhibition of Ino's Maps

207 sheets of a large-scale map series of Japan were discovered in the Library of Congress of the US in 2001. The map series was surveyed by Ino Tadataka (1745-1818), most of them had been thought to be lost forever. The GSI, supported by some concerned parties, made a precise replica by taking high-resolution digital photographs of them and printing the digitized image. The GSI and the parties established a committee to promote exhibitions of these maps in Japan. The exhibitions started from 2004 till now.

Fig.2-9 A part of Ino’s large-scale Map Replica, No.90 (Hachioji, about 25 miles west from Edo)

(8) Disaster Measures

The archipelago of Japan is often struck by natural disasters including earthquakes, floods, and eruptions of volcanoes, which could be disastrous. It is one of important tasks of GSI to provide data for disaster prevention and mitigation as well as for formulation of countermeasures against those hazards.

On 11th March 2011, a gigantic earthquake of Richter scale of magnitude 9.0 occurred off the Pacific coast of Tohoku, north east region of Japan. The coast stretching over 500 km were struck by large tsunamis, including cases of entire village and city being washed away. This disaster, “the Great East Japan Earthquake”, has caused 23,000 death or missing persons as of 16th June 2011. Just after the earthquake occurred, GSI has set up headquarters and started various activities to understand the geodetic and geographic situations of the disaster and provide geospatial data necessary for countermeasures. GSI has carried out such works as analyses of GPS continuous observation data and earth observation satellite data on crustal deformation, restoration of control points, aerial photo taking (Fig.2-10), production of ortho-photo images, compilation of special topographic maps for countermeasures, preparation of detailed DEM by airborne laser survey, photo interpretation and mapping of tsunami-inundated areas and production of large scale base maps for recovery planning. The data obtained as a result of those works were promptly made available and released to organs concerned, the press as well as the general public, through the GSI home page.

Fig.2-10 Aerial Photos of Damaged Area by the Tsunamis (a part of Sendai City)
Left: before the Earthquake (taken in October 2006) Right: after the Earthquake (taken on 12th March 2011)
Quoted from GSI home page (http://saigai.gsi.go.jp/h23taiheiyo-ok/hikaku/index.html)

2. Hydrographic and Oceanographic Department, Japan Coast Guard, Ministry of Land, Infrastructure, Transport and Tourism

(1) Publication of nautical charts and aeronautical charts

Revisions and corrections of nautical charts are based on the results of the hydrographic surveys. The publication from 2007 to 2010 is as follows.

Table 2-8 Number of Nautical Charts and Other Charts

		2007	2008	2009	2010
Nautical Chart	New Chart	24	34	8	14
	New Edition	108	77	67	83
Aeronautical Chart	New Chart	0	0	1	1
	New Edition	2	3	3	3
Electronic Navigational Chart	New Chart	64	78	18	1
	New Edition	0	0	705	0

1) Nautical charts

Middle and larger scale charts are published, mainly for ships under international trades to access to harbours.

2) Aeronautical charts

1/1,000,000 series of international aeronautical charts and 1/1,000,000 series of aeronautical route charts are published according to the standard of International Civil Aviation Organization.

3) Electronic navigational charts

To cater for the phased mandatory carriage requirement of ECDIS to the ships under international navigation in and after 2012, the existing ENCs has been supplemented with the data that improves convenience and reliability. Electronic Notices to Mariners are edited to update such ENCs.

(2) Hydrographic surveys

Hydrographic surveys by JHOD from FY2007 to FY2010 for chart publication are as follows.

Table 2-9 Number of Hydrographic Surveys

	FY2007	FY2008	FY2009	FY2010
Coastal Survey	6	9	5	3
Harbour Survey	1	1	—	2
Correction Survey	179	224	232	199

1) Coastal surveys

Coastal surveys aim to obtain data for new publication or new edition of coastal charts.

2) Harbour surveys

Harbour surveys aim to research progress of harbour improvement and to obtain data for new publication or new edition of harbour charts.

3) Correction surveys

Correction surveys aim to obtain data for chart updates such as local depths, low tidal lines or cancellation of report soundings.

4) Airborne laser surveys

Airborne laser surveys aim to obtain data to develop coastal zone infrastructural information.

3. National Land Survey by the Ministry of Land, Infrastructure, Transport and Tourism

The National Land Survey of Japan has been carried out under the direction and guidance of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The objective of the survey is to contribute to the promotion of effective use and conservation of national land. To reveal the present condition of national land, such as land ownership and its utilization, is another objective of this survey. It is expected to be based on the National Land Survey Act which was enacted in 1951, when the survey was initiated. This survey had not been promoted well, and in an attempt to do so, the acceleration Act, named The Act on Special Measures for Promotion of the National Land Survey was enacted in 1962. Three major items form the core of this survey; the land classification survey, the water use survey and the cadastral survey.

1) Land classification Survey and Water Use Survey

A land classification survey is the survey of the topographical and geological features, soil, and present land use. The results are compiled into atlases and books. A water use survey aims at investigating the basic statistics of a river, such as annual rainfall, discharge, present water utilization for farming or drinking and groundwater.

In the land classification survey, MLIT had developed a computerized mapping method in which a specific

device, controlled by computer, can draw a colored map. By this method, one can easily identify various kinds of data related to land classification.
The above mentioned surveys are compiled into atlases and books as follows:
a) Land classification maps (Geomorphological map, Surface geology map, Soil map, Present land use map, and Land use capability classification map), overlays (such as slope map) and an Explanatory data book.
b) Land conservation maps (Natural condition map, Present land use and vegetation map, Natural disasters map, Land use tendency and designated areas map, Control and designated area for disaster prevention map, Valuable natural and cultural assets distribution map, Basic conservation map) and Explanatory data book.
c) Water use maps and a descriptive catalogue of available information on major river system.
d) Groundwater maps and Explanatory data book.
e) Groundwater data ledger.

2) Cadastral Survey

The cadastral survey aims at clarifying the location, boundary, ownership, lot number, acreage, and current status of land use of each parcel. Local governments, such as prefectural and municipal governments, carry out the survey. They transact such affairs as planning the survey project, making contact with a surveying company, and supervising. MLIT plays a role in the survey by giving local governments a 50% subsidy of the total cost and some technical guidance as well. The executive body only has to share 1/20 of the total cost, since a special grant is given to the survey by the Japanese government. Because of present austere budget conditions, the progress of the survey has suffered a sharp curb. The progress of this survey at the end of FY2010 is as follows:

- Completed cadastral survey: 141,226 km2 (1951-2010)
- Progress ratio: 49% (Target acreage of the survey: 286,200 km2)

The cadastral survey consists of the following stages; supplementary survey, detailed on-the-spot survey, measuring the acreage of each parcel, and making atlases and books. The supplementary survey comprises the control point survey which is to set up control points for cadastral surveying. The establishment of these control points is carried out by GSI. Scales of cadastral atlases differ from case to case depending on the mean acreage of a parcel. Scales of 1:250, 1:500, 1:1,000, 1:2,500, or 1:5,000 are used. Of these, the scales of 1:500 and 1:1,000 are the most commonly used. The required accuracy of measurement is classified into six types depending on the land use pattern.
Copies of cadastral maps and books are bound to be sent to registry offices after having been checked for accuracy and obtaining the legal approval of MLIT, or, in some cases, from the prefectural governor, to replace the old maps which were prepared about 100 years ago and are still used for levy and land registration.

4. Ministry of Agriculture, Forestry and Fisheries (MAFF)

(1) Large Scale Topographic Maps

The Forestry Agency began promoting a similar project in mountainous areas as the National Large Scale Topographic Mapping Project by GSI, for the purpose of producing a Basic Forest Map (BFM) as the basis for surveying forests. The project covering mountainous areas was completed in 1980. Currently the Forestry Agency is promoting revision work of the existing Basic Forest Map.
Currently Forestry Agency is promoting Forest GIS (Geographic Information System) and digital mapping work of Forest Planning Maps

(2) Soil Maps

Soil maps in Japan are roughly divided into two categories; for cultivated lands and for forest lands. They are prepared by the Ministry of Agriculture, Forestry and Fisheries.

A 1:50,000 scale map series of soil types and productivity of cultivated lands has been prepared by the Agricultural Production Bureau since 1959, and the entire area of cultivated land, 51,000 km^2 in all, is covered.

A 1:20,000 or a 1:50,000 scale map series of soil types in national forests has been prepared by the Forestry Agency since 1947. 65,000 km^2 were covered by this series. This agency has also prepared a 1:50,000 scale map series of soil types for many private forests.

5. Geological Survey of Japan / National Institute of Advanced Industrial Science and Technology (GSJ/AIST)

(1) Geological Maps

GSJ/AIST has published most of geologic maps which cover the Japanese islands on scales of 1:50,000, 1:200,000, 1:1,000,000, 1:2,000,000 and 1:500,000. A series of basic geologic maps published by GSJ/AIST is prepared on the scale of 1:50,000. This basic series was once prepared on the scale of 1:75,000 and the scale was changed to 1:50,000 in 1952. The coverage over the land becomes 927 sheets published out of 1274 (74.1 %) at scale of 1:50,000 and 124 sheets published out of 124 (100 %) at scale of 1:200,000.

In addition, 16 geologic maps of volcano (1:25,000, 1:50,000, 1:100,000), 7 mineral resources maps (1:500,000), 41 hydrogeological maps (1:25,000, 1:50,000, 1:100,000), 28 gravity maps (1:200,000), 44 aeromagnetic maps (1:25,000, 1:50,000, 1:100,000, 500,000) and many other thematic maps were also published until 2010. Compiling these basic geologic maps and other geologic information, GSJ/AIST published smaller scale maps. The representative products are “Rupture probability map of major active faults in Japan” as Tectonic Map No.14 and “Interactive Geological Hazard Map of East and Southeast Asia, GeoHazardView version 2” as Digital Geoscience Map G-11.

(2) Marine Geology

GSJ/AIST has been engaged in marine geological and geophysical investigation of the sea around the Japanese Islands, the western and central Pacific Ocean and the Antarctic sea. The investigation comprises basic studies of marine geology, mineral resources and geophysical prospecting, including sedimentological and environmental study of lacustrine and coastal areas. Marine geological maps (8 sheets) on the scale of 1: 1,000,000 covering the Japanese islands were published and a series of marine geological maps on the scale of 1: 200,000 (32 sheets of geological map and 30 sheets of sedimentological map) has been published around the main Japanese Islands. Since 2002, marine geological maps on the scale of 1: 200,000 (9 sheet of gelogical map and 7 sheet of sedimentological map) have been published as CD-ROM.

6. Technical cooperation

In order to provide technical assistance and implement the transfer of technology in the field of cartography, GSI, JHOD, GSJ/AIST and other bodies are actively engaged in various technical cooperative projects, implemented by Japan International Cooperation Agency (JICA), which is commissioned by the Ministry of Foreign Affairs. Technical cooperative activities in the fields of surveying, mapping, hydrography, oceanography and geoscientific research can be grouped into three categories: namely, acceptance of trainees, dispatch of experts and cooperative projects.

(1) Training

1) Training Courses in Surveying and Mapping

a) Group Training Course in Planning and Management of National Mapping and Surveying (JICA)

At the Second United Nations Regional Cartographic Conference for Asia and the Far East held in Tokyo in 1958, the importance of professional education in surveying and mapping for technical personnel of developing countries was recognized. As an outcome of this conference, Japan started, after a five-year preparation period, a group training course in surveying and mapping in 1963. The curriculum of the course has been reconsidered and improved when necessary.

Especially in 1992, this group training course was largely reorganized to cover all fields of surveying and mapping technology, which had shown rapid progress, including geodesy, photogrammetry, cartography and map reproduction as well as Global Positioning System (GPS), Geographic Information System (GIS) and remote sensing.

This course was completed with a total of 371 participants from 62 countries, and was succeeded by a group training course in Planning and Management of National Mapping and Surveying in 2000. The new course is designed to support developing countries or regions to learn good practices of survey administration and project management, namely, laws and regulations, project planning and management, education and dissemination of information.

b) Group Training Course in Global Mapping (JICA)

A new group training course “Global Mapping-Contribution to Global Mapping Development by GIS” started in 2004 succeeding the former group course “Global Mapping” from 1999-2003. The new course aims at capacity building to promote Global Mapping project through transferring technologies of remote sensing and Geographical Information Systems (GIS).

c) Individual Training

The individual training program is prepared in order to meet the needs of each trainee and his/her home government. The training period lasts one to six months.

2) Hydrographic survey and nautical charting

Lectures and practical and field trainings are provided to the trainees from developing countries to give knowledge and skill on information management for maritime activity and disaster prevention.

3) Training Courses in Geosciences

Technical training of personnel in geoscience from developing countries is conducted as part of the technical activities at Geological Survey of Japan (GSJ/AIST), and GSJ accepts researchers in the general fields of geology, geoinformation and geo-engineering.

(2) Dispatching of Technical Experts

a) Experts in Surveying and Mapping

In 1964, GSI sent out four senior staff members to survey the national boundaries between Saudi Arabia and adjacent countries. Since then, GSI has sent more than 300 senior, experienced engineers as technical assistance experts. Short-term experts, who generally remain from several weeks to two months, carry out particular projects based on requests to the Government of Japan from the recipient governments, while long-term experts stay longer than one year and cooperate with their host governmental organization by providing technical assistance.

b) Experts in Geosciences

The GSJ/AIST is involved in technical cooperation programs of the Japanese Government. The activities of the Survey personnel in the geo-scientific and geo-technical assistance programs cover a broad spectrum of the geosciences, not only for mineral and energy resources but also for groundwater management, environment, environmental geology, geohazards, and geoinformation technology.

(3) Cooperative Projects

1) Mapping Projects

In 1971, Japan started its first overseas mapping project in Indonesia to prepare national base maps of that country. Mapping projects in developing countries are conducted as technical cooperation by JICA. The role of the GSI in these overseas mapping projects is to give advice to both the authorities concerned in Japan as well as in the recipient countries on all aspects of surveying and mapping of the projects, and to supervise the survey project.

The projects are, in general, assigned to a survey company in Japan, by JICA for implementation. GSI provides technical guidance through the Advisory Committee and other meetings with authorities concerned.

Most of the projects are to prepare topographic maps as national base maps. In some cases, thematic maps such as land use maps are also made.

2) Geoscientific Research Projects

Geological Survey of Japan (GSJ/AIST) is actively engaged in international geoscience programs in collaboration with many foreign countries. Japan belongs to the region of East Asia where recent economic growth is very rapid, hence we are facing with some global science issues stemming from the social changes, such as environmental protection, mitigation of natural hazard, not to mention the geological assessment /exploration of energy and mineral resources.

Seeking the solutions for these issues through an international research network is one of the important goals of GSJ's research programs.

7. Satellite for Cartography: Advanced Land Observing Satellite (ALOS)

On January 24, 2006, ALOS was launched from the Tanegashima Space Center of the Japan Aerospace Exploration Agency (JAXA) into a sun-synchronous orbit of a medium height of 691.5km with a 46-day recurrent cycle, carrying three high-resolution optical and microwave sensors. This satellite aims to monitor the details of the land surface features frequently and quantitatively for four major application themes: Generation of 1:25,000 geographical maps, regional observations for environmental monitoring, information distribution for disaster mitigation, and resource exploration. To accomplish these mission objectives, ALOS carries three instruments: the Panchromatic Remote-Sensing Instrument for Stereo Mapping (PRISM), the Advanced Visible and Near-Infrared Radiometer 2 (AVNIR-2), and the Phased-Array L-band Synthetic Aperture Radar (PALSAR).

In the first four months after launch (Jan. 24 to May 15, 2006), the commissioning phase for satellite functioning and validation followed, comprising the first image acquisitions of each the three sensors, exhibiting representative performance of the sensors, even when not calibrated, and predicting forthcoming valuable land information that would be acquired. The commissioning phase was succeeded by the initial calibration phase for sensor calibrations between May 16 and Oct. 23, 2006. This phase was successful, and the operational phase started on Oct. 24, 2006.

Presently in the operational phase, ALOS is programmed to collect worldwide data in a systematic and

repeated manner based on a predetermined mission observation plan, as well as to respond to urgent user requests to rapidly acquire data over disaster-stricken regions. Observation repeatability and the combined use of radar and optical sensors enable multi-spectrum monitoring of land surfaces, such as interferometric monitoring of surface deformation, caused by earthquake-driven phenomena and volcanic activities; biosphere monitoring of the pan-tropical and boreal forest regions; cryophilic research in the polar region for ice sheet flow rate estimations; and ocean surface monitoring.

Synthetic Aperture Radar (SAR) is an all-weather sensor suitable for repetitive monitoring and with its long wavelength L-band SAR on board ALOS specifically useful for land covers monitoring, owing to its high signal penetration through vegetation-covered targets and sensitivity for detecting deforestation and forest inundation. To this end, JAXA is leading an international global monitoring project - the ALOS Kyoto & Carbon Initiative - in collaboration with some 20 organizations and research institutes worldwide.

While medium resolution optical imagers onboard polar orbiting satellites, such as e.g. Terra MODIS, ADEOS-II GLI and ADEOS, are often used to monitor the global state and changes in the atmosphere, oceans and on land, high resolution SAR sensors enables retrieval of different geophysical parameters under all weather conditions and with other observation aspects. The geophysical parameters relevant for SAR are the scientific parameters for solid earth, biosphere and cryosphere, and are represented by e.g. crustal deformation, biomass estimation and snow and ice cover changes in the Polar Regions. PALSAR and the two optical sensors onboard ALOS feature high radiometric and geometric performances, and through a long observation capacity of 11 hours daily can collect long time-series for global monitoring of water, carbon and climate change parameters. JAXA is performing forest- and wetlands monitoring to assess the status of the water cycle in wetlands, forest coverage and estimation of biomass volumes, as well as seasonal monitoring of the Polar Regions.

The size of the ALOS is roughly 9m in length and 28m in width and its mass is 4,000kg. In-orbit configuration of the ALOS is shown in Fig.2-11 and Table 2-10 shows ALOS's typical characteristics.

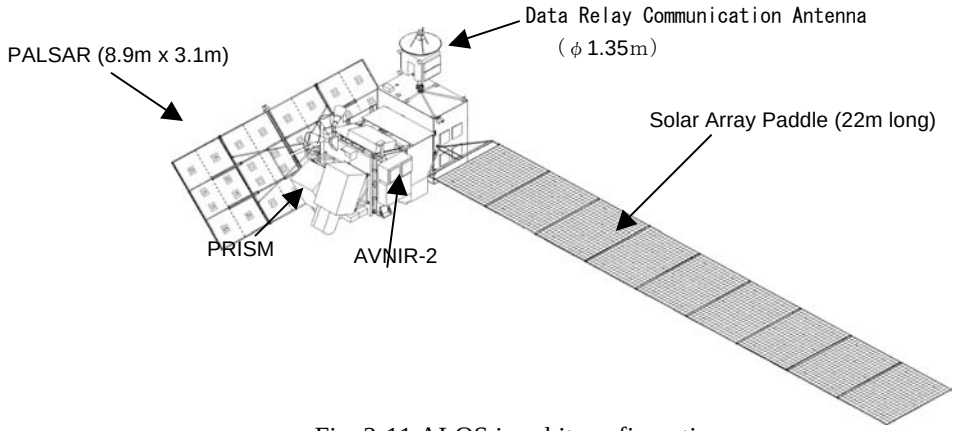


Fig. 2-11 ALOS in orbit configuration

Table 2-10 ALOS characteristics.

Item	Characteristics
Orbit	Sun synchronous, Sub recurrent
Altitude	691.65 km
Recurrent period	46 days, sub-cycle: 2 days
Inclination	98.16 degree
Generated power	More than 7 kW (end of life)
Weight	Approx. 4,000 kg
Data recorder	96 G bytes, solid-state
Data link	240 Mbps (via DRTS)
	120 Mbps (direct down link)

ALOS has collected almost 1 peta byte during the five-year life using the DRTS and TDRS. PALSAR data observed the terrestrial coverage 30 times by now. Using these data sets, environmental monitoring on the forest, wetland, coastal ocean, solid earth, ice glaciers, and DTM are on-going. DSM generation using the PRISM is in progress for Japan, Alaska, and Thailand. Due to the weather condition, even the five-year data observation had the incomplete coverage of the data provision. The Fig. 2-12 shows the Bird-eye view of the landscape made by the PRISM DSM and nadir PRISM over the Himalaya region.

ALOS emergency observation was conducted for the Great East Japan Earthquake and the related disaster area of March 11 2011. Newly acquired data of PALSAR, AVNIR-2, and PRISM and their archives are used. The main goal was to detect the changes caused by the earthquake and the related tsunami. As soon as the data were acquired, data analysis was conducted and provided to the authorized users. After the earthquake, observation was conducted over 42 days. Unfortunately, the ALOS mission was terminated on April 22, 2011, due to power supply failure. After that, JAXA monitored the condition of ALOS in case it could be recovered. However, ALOS operation was stopped on May 12, 2011. ALOS was one of the most successful satellites in JAXA and possibly in the world. JAXA is now preparing ALOS-2 for a 2013 launch.

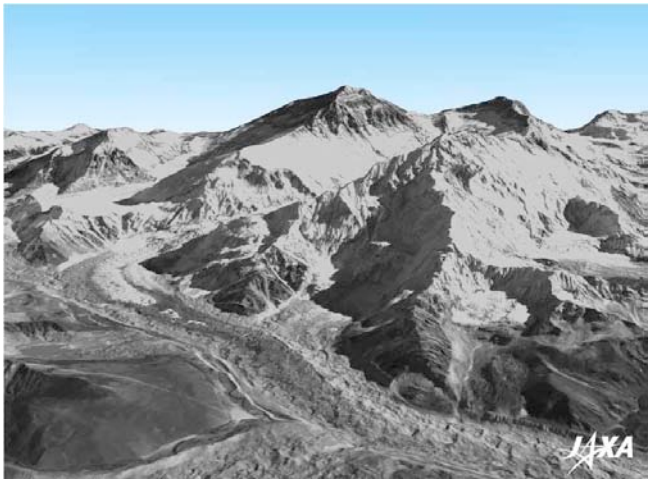


Fig. 2-12. Bird's eye view of the Himalaya region,
generated from PRISM nadir view image
overlaid on PRISM derived digital surface model.

(Editors: UNE Hiroshi, ISHIHARA Jyunichiro)

III. ACTIVITIES OF PUBLIC CORPORATIONS, FOUNDATIONS, MUSEUMS AND LIBRARIES

1. Public Corporations and Foundations

***** Special Member of the Japan Cartographic Association

(1) Japan Map Center (JMC)*****

Main responsibilities of JMC are to distribute Japanese official maps and geo-spatial information produced by the Geospatial Information Authority of Japan (GSI), to provide information service and books on geo-spatial data, to hold and promote exhibition and training programs, to conduct research and development on cartography and GIS, and to keep and distribute "maps" for urgent operations in a case of natural a disaster. JMC and Japan Geographic Data Center jointly hold Certification Examinations on Map and Geography.

(2) Japan Hydrographic Association (JHA)*****

JHA supplies services such as reproduction and distribution of the Japanese official nautical charts, aeronautical charts, electronic navigational charts and other hydrographic publications issued by the Hydrographic and Oceanographic Department of Japan Coast Guard (JHOD/JCG). It also promotes Marin Information Services and conducts research and development on oceanography.

(3) Map Association*****

The members of Map Association are wholesalers and retailers of the Japanese official maps that are produced by the Geospatial Information Authority of Japan. Cooperating with the Japan Map Center, it plays an important role in smooth and rapid distribution of the maps.

(4) Mapping Enterprises Association Japan*****

Mapping Enterprises Association Japan was established by mapping companies for the purpose of promoting sound development of mapping industry. It runs a web museum, "Mapping Museum", which displays the maps collected by the members companies.

(5) Japan Digital Road Map Association (DRM)*****

DRM produces and provides digital road map database for administrative use and for car navigation.

Digital road map database is vital for the basis for intelligent transport systems (ITS) as well as various systems for road management.

(6) Japan Association of Surveyors (JAS)*****

JAS is an organization for survey technicians active in the Government, Academia and Industrial Corporations. The main purposes are contribution to, dissemination and advancement of surveying technology. It holds an annual exhibition on Geo-spatial Information.

(7) Association of Precise Survey and Applied Technologies (APA)*****

APA carried out research and development of precise survey and mapping, examinations and tests of leading-edge survey technologies and innovation of applied survey technology. It also actively commits to various projects by the national and local governments.

(8) Japan Geographic Data Center*****

Japan Geographic Data Center collects information about geographic names and population data around Japan and provides them in the form of database and booklets. It also holds Certification Examination of Map and Geography with Japan Map Center.

(9) Japan Construction Information Center (JACIC)

JACIC carries out surveys and research on information systems, including GIS, in the construction field and provides construction information service.

(10) Infrastructure Development Institute -Japan (IDI)

IDI promotes intentional assistance in the infrastructure development of developing countries that are essential

to the nations' economic development as well as to the safety and comfort of their citizens.

2. Museums and Libraries

(1) GSI / Science Museum of Map and Survey

Science Museum of Map and Survey was established in 1996. It is the adjunct facilities of the Geospatial Information Authority of Japan. It has three main facilities; Exhibition Hall, Information Service hall, and Earth Plaza. The Exhibition Hall consists of exhibition rooms, map gallery and orientation room. The Information Service Hall offers perusal and delivery service of the survey results and documents produced by the GSI. At Earth Plaza, a spherical model of the Japanese archipelago is on display to give visitors an idea of the roundness of the Earth. A retired survey aircraft is also displayed.

(2) Gifu Prefectural Library / World Distribution Map Center

The library collects, exhibits and provides the maps, distribution maps in particular, that were collected from all over the world. A special exhibitions and lectures for school children are carried out periodically.

(3) ZENRIN Map Gallery

ZENRIN Map Gallery is operated by ZENRIN co., Ltd., a leading mapping company in Japan. Its collections include antique maps collected from across the world and historic schoolbook atlas.

(4) Museum of Yokohama Urban History

Museum of Yokohama Urban History exhibits antique maps and documents to show the development and expansion of Yokohama-city.

(TSUZAWA Masaharu)

IV. ACTIVITIES OF LOCAL GOVERNMENT

(1) Mapping Activity

Local governments such as prefectures, cities and towns produce maps for various purposes, for example, managements of road, river, upper water, sewer, forestry and property, and planning of city, industry, agriculture and facilities. Most of the mapping is done digitally in compliance with the Survey Act and the Public Survey Work Regulations. They are using in GIS. Major examples are shown in Table 1.

Table 1. Maps provided by Local Governments.

Titles	Scales	Status
Base Map for City Planning	1:2,500	It covers the urbanization promoting area in each city or town.
Road Management Master Map	1:500 to 1:1,000	It covers the roads (except on the national roads) managed by local governments.
River Management Master Map	1:2,500 to 1:5,000	It covers the rivers (except on the 1st class rivers) managed by local governments.
Upper water management Master Map	1:1,000 to 1:2,500	It covers the upper water managed by local governments.
Sewer Management Master Map	1:1,000 to 1:2,500	It covers the sewer managed by local governments.
Fixed Property Map for Taxation	1:500 to 1:2500	It covers whole area managed by local governments.
Cadastral Map	1:250 to 1:5,000	More than 40% of whole Japan.

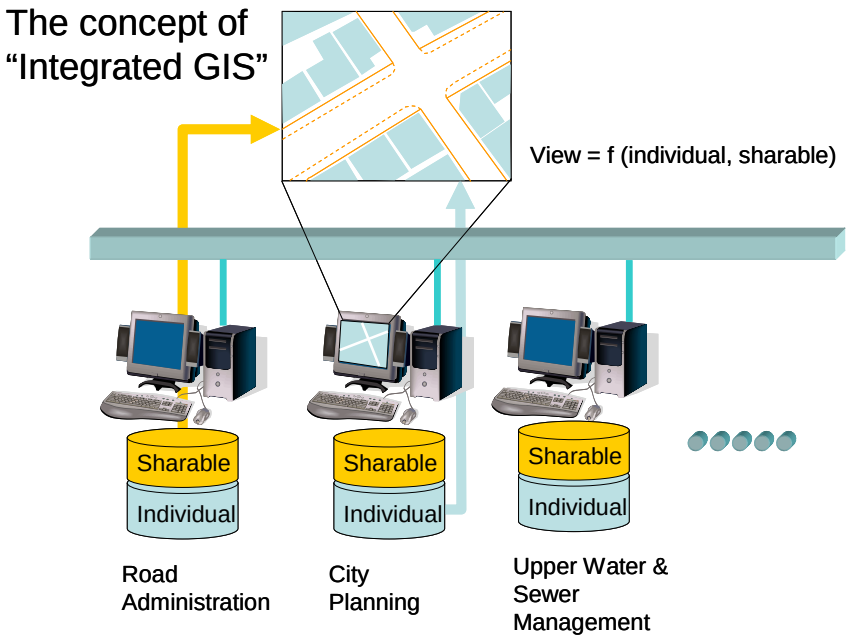
(2) GIS Activity

Local governments in Japan started to introduce GIS for their work since mid 80s. The famous initiative called Urban Information System Project conducted by Ministry of Construction was started in early 1980s. Kitakyushu, Nishinomiya and other cities participated in this project and introduced GIS for their city planning. Nowadays, GIS is widely used in local governments not only for city planning but also for life line managements, agriculture, forestry, taxation and so on.

(3) Integrated GIS

The Ministry of Public Management, Home Affairs, Post and Telecommunications adopted a concept of "Integrated GIS" in 1997 to promote the geographic data harmonization exchanged in the local governments. This idea was born affected by National Spatial Data Infrastructure (NSDI) promoted in US and other countries. Each GIS, even if the architecture of GISs is different, has interface to encode data in the standardized format and to decode them. In Japan, national and local governments use a profile of ISO/TC211 standards named as JPGIS (Japan Profile for Geographic Information Standards).

In case of Japan, local governments have the history of GIS more than 25 years as mentioned above, and during these years, each department has introduced and maintained its own GIS. It means that each department are using its own data format, and it will be more difficult to exchange and share valuable data for other departments. This is the reason to promote Integrated GIS. Now, the Ministry of Public Management, Home Affairs, Post and Telecommunications subsidize local governments for their initiative to develop Integrated GIS. About 33% (15% in 2006) of local governments introduced Integrated GIS by 2010.



(4) Earthquake at Urayasu City

- Disaster overview

The Great East Japan Earthquake wreaked broad-based disaster through almost northern half of Honshu (the biggest island in Japan). Urayasu City introducing in this section is urbanized city and famous in Japan as the City of Tokyo Disneyland. Urayasu faces the Tokyo Bay and this place is the marginal part of the earthquake area. However the size of disaster is not small as shown in Table 1. Urayasu City Government created the task force at 15:50 JST on 11 March 2011. It was almost one hour after the earthquake occurred.

Table 1. The size of disaster in Urayasu City

Number of disaster victims	96,473
Number of the suffered family units	37,023
Liquefaction area (ha)	1,455
Sewage wreaked area (ha)	820
Length of the wreaked road (km)	111.8
Number of wreaked houses	8,878

Fig. 1 Soil liquefaction in Urayasu City

Fig. 2. Lifted manhole (left) and water storage tank (right) by soil liquefaction

- Collection and Publication of Information

The task force recorded the information on the paper map at first. But it was not useful to share information among people working different place. So, they changed the information-sharing platform from paper map to the Integrated GIS that Urayasu has been using since about 10 years ago. For citizens, Urayasu disclosed the information through not only their home page but their Public Map Service on the Web called JAM (Joint Active Map), Twitter, mail service, paper media such as public relations magazine and hand microphone announcement on the street by volunteers.

Web site

Web Map Service (JAM)

Twitter

Paper magazine

Announcement

Fig. 3. Information sharing methods

- Lifelines

Electricity was restored immediately after earthquake. Gus was restored by 30 March (after 19 days), upper water was by 6 April (after 26 days) and sewage was by 15 April (after 35 days). Priority of restoration should be decided based on the population density and the ratio of the weak in the disaster areas rather than the density of houses. And the priority should be higher for the place where more than one lifeline was broken (Figure 4). However, at the first few days, utility companies could not asses how many and what types of people live in the disaster area even they know the number of customer houses. Meanwhile, the city government has the master file of resident register that includes name, address, sex, birthday, with or without national health insurance and/or at-home care insurance. The task force and utility companies could prioritized the restoration using these information shown on the map, because the geo-data of houses link to the resident register on the Integrated GIS. In case of Japan, such a linkage is exceptional, because the city governments are warred bout the privacy issues, even the law of resident register ordains the sharing of register among the people working at the city government for their work more effective.

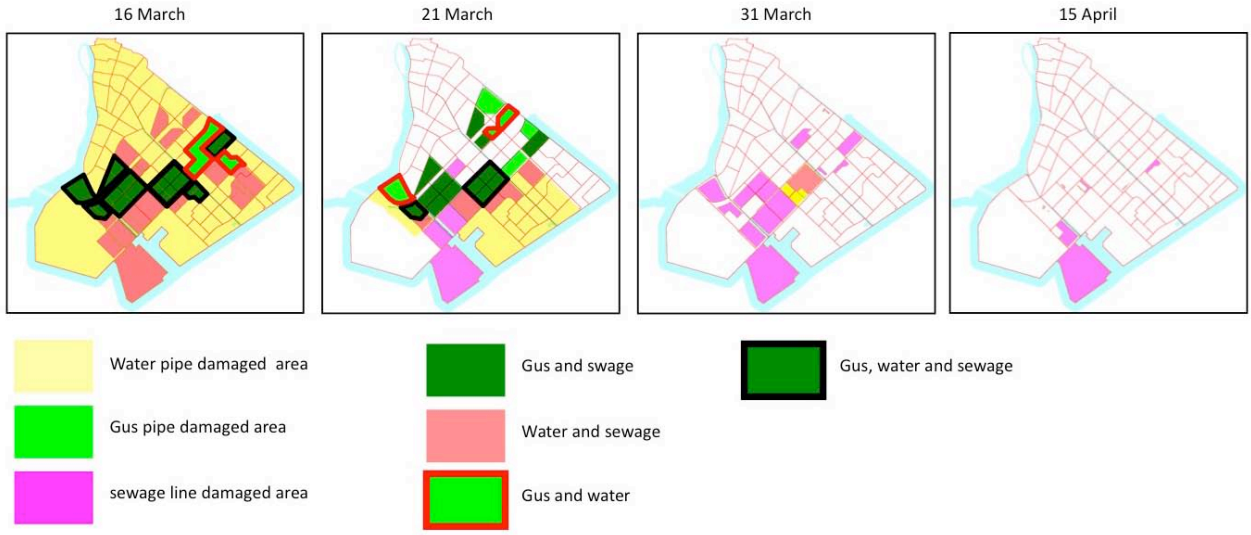


Fig. 4. Restoration of Life Lines

- Liquefaction

Inclination and breaking of buildings caused by the liquefaction were quite serious in the area facing Tokyo Bay. However Japanese government did not have criteria for recompense the disaster caused by liquefaction.

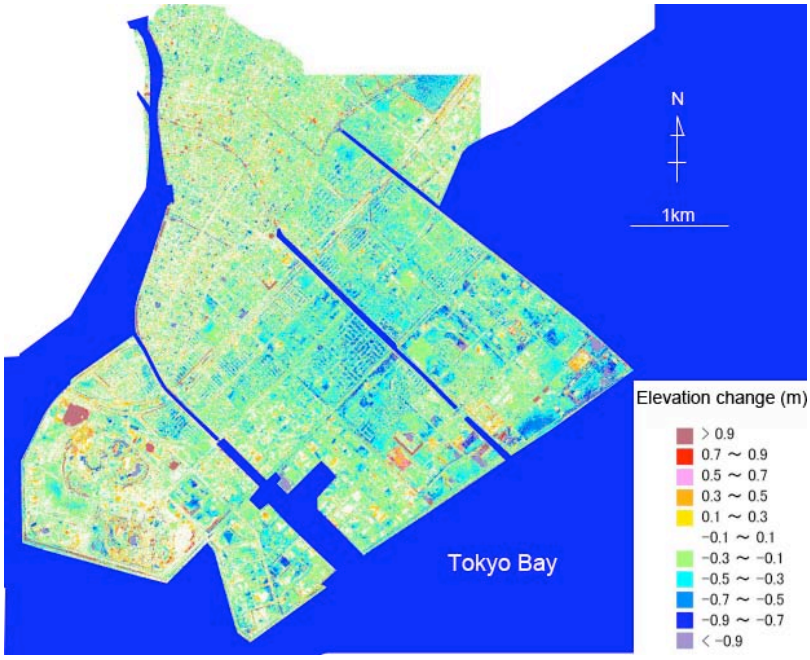


Fig. 5. The map of elevation change in Urayasu City

In case of Urayasu, they could make a map to show the elevation change using the digital surface model taken in December 2007 by Airborne Laser Scanner and the data scanned again in April 2011 (Figure 5). This map is the evidence to show the relationship between subsidence and liquefaction. Urayasu and other cities suffered liquefaction cooperated to encourage to make criteria to the central government. Japanese government quickly responded by 2 May to give compensation for the disaster by liquefaction as the exception only for this earthquake. The map of elevation change was also used to estimate the amount of sediment collected on the ground and it was useful to make disposal plan.

Acknowledgement
This section was written based on the interview to Mr. Keiji Daigo, General Manager of Governance Management Department at Urayasu City. The special thanks goes to Mr. Daigo for his kind corporation.

(OTA Morishige)

V. ACTIVITIES OF PRIVATE SECTOR

Digital Services

(1) Great East Japan Earthquake

The response to the Great East Japan Earthquake with GIS and mapping services has been progressing with the great assistance from private sectors.

The prompt information updated from the social networking services soon after the earthquake was linked with geospatial information as well as the map portal sites. Then, the satellite imagery and aerial photos are provided from many professional organizations, and, moreover, they are processed and analyzed to meet needs at the quake-struck areas by GIS and mapping service companies.

The auto manufactures and car-navigation manufacturers also shared probe information, and released real time traffic information in quake-struck areas.

These prompt responses were possible because of the standards for geo-data exchange and cloud computing.

・Map Portal

Google started "Google Crisis Response", the disaster portal site on March 13, only 2 days after the earthquake. This service enabled us to get information for the location of shelters, radioactive-affected areas using Google Maps. Microsoft has opened its newest GeoEye and DigitalGlobe satellite imagery in Bing, and, permitted digitizing of OpenStreetMap. Mapion added location information and landmark data to the aerial photos of the quake-hit areas provided from the Geospatial Information Authority of Japan.

Google	http://www.google.co.jp/intl/en/crisisresponse/japanquake2011.html
Microsoft	http://www.bing.com/maps/explore/#/22l0xfx37gwtm1vc
Mapion	http://www.mapion.co.jp/feature/eq2011/hisaichi.html

・Satellite imagery and GIS

Many corporations have started to provide the satellite images and the aerial photographs free of charge. The Kokusai Kogyo group, which is a leading company in the field of GIS and spatial information business, captured and analyzed geospatial data of the quake-hit areas and has been providing the latest information such as the flood inundation maps, tsunami height distribution maps, debris distribution maps. Pasco attempted the automatic extraction of tsunami inundations using satellite images acquired from the synthetic aperture radar satellite (TerraSAR-X).

Kokusai Kogyo Group	http://www.kk-grp.jp/english/csr/201103_tohoku/index.html
PASCO	http://www.pasco.co.jp/disaster_info/110311/
Asia Air Survey	http://www.ajiko.co.jp/bousai/touhoku2011/touhoku_eng.htm
NTT DATA	http://www.nttdata.co.jp/tohoku_map/index.html

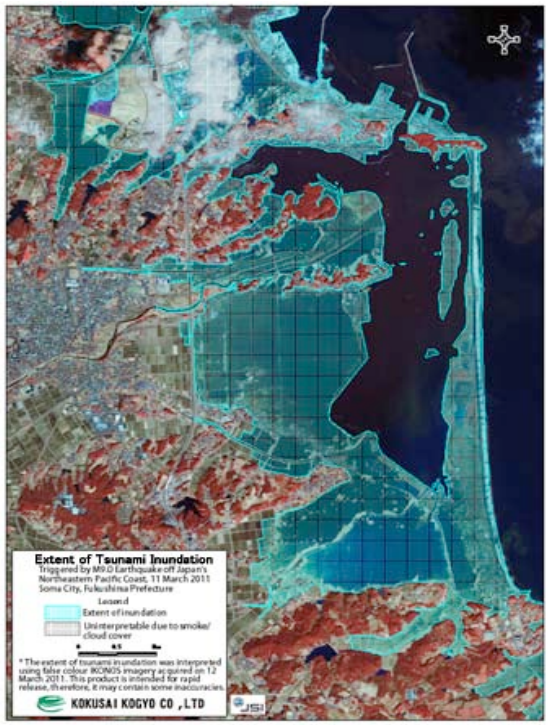


Fig.1. Preliminary map showing the reach of tsunami

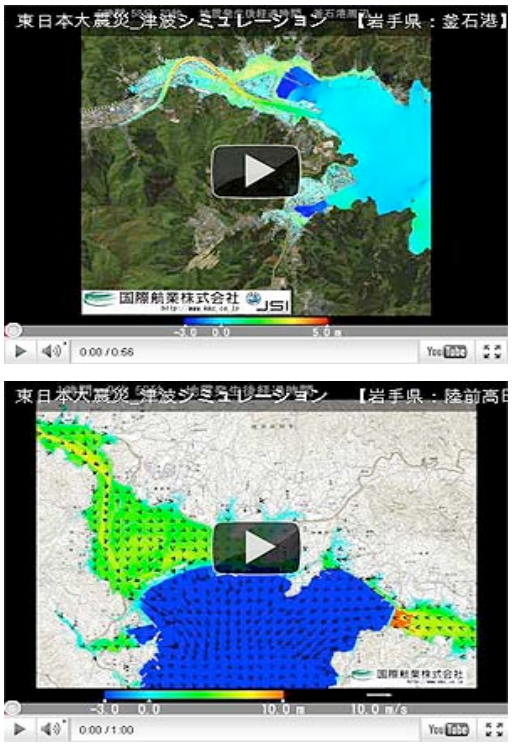


Fig.2. Tsunami Simulations (Kokusai Kogyo Group)

・Car Navigation

ITS Japan, a non-profit organization, in collaboration with Honda, Nissan, Toyota, and Pioneer, has given out the probe information to indicate the accessible roads in the quake-hit areas(March 19 to April 28) . Honda and Pioneer are continuing to provide "Google Crisis Response" and a "Yahoo! maps" with up-to-date traffic information. And, Toyota has been providing "Microsoft Bing" with the probe information captured from G-BOOK loading vehicles.

ITS Japan	http://www.its-jp.org/english/its_asia/553/
HONDA	http://www.honda.co.jp/internavi/
TOYOTA	http://map.g-book.com/

・GIS Volunteer

Esri Japan released the "social media map" which displays videos and photos of the quake-hit areas submitted from YouTube, Twitter and Flicker the quake-hit areas. This service is arranged on "Amazon Elastic Compute Cloud (EC2)", the cloud computing by Amazon. Volunteers of OpenStreetMap Japan started "sinsai.info" only 4 hours after the earthquake. "sinsai.info" uses CMS type GIS "Ushahidi" and uses the EC2.

ESRI	http://www.esri.com/services/disaster-response/japan-earthquake-tsunami-2011-map/
sinsai.info	http://www.sinsai.info/ushahidi/

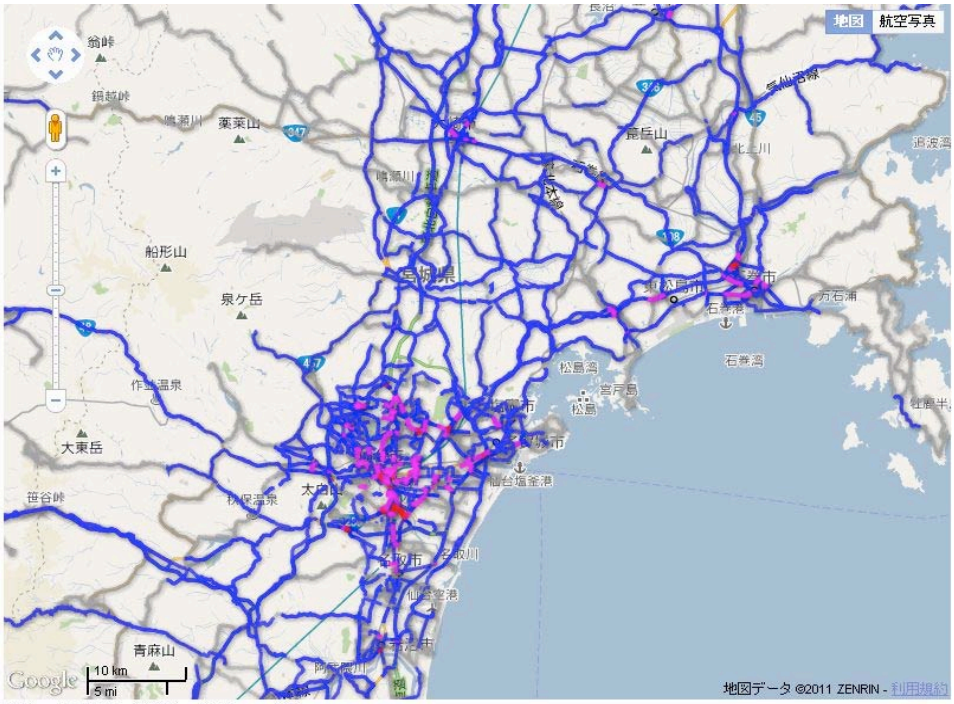


Fig.3. Google Crisis Response road condition information

(2) LBS Game and AR

The game using the LBS (Location-Based Services) on cell phones is called "Ichi-ge", and has been very popular. Colopl, a game using geospatial information, has virtual money system called "Pl". You can gain “P1” by the distance you work or move to create your own virtual city called "Colony". Its users are over 1,500,000. AR (Augmented Reality) application using LBS started beginning "Sekai Camera" in 2009. In March, 2011, ZENRIN DataCom and NTT DOCOMO started providing for AR application "chokkan-navi" to the Android market.

Colopl	http://colopl.co.jp/
Keitai Kunitori Gassen	http://kntr.jp/
Sekai Camera	http://sekaicamera.com/
Chokkan-navi	http://www.zenrin-datacom.net/android/chokkan/

(NAKAJIMA Madoka)