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—Establishing position references

International standards are established and used as a basis for managing and providing Japanese position references.



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The map of the entire Japanese archipelago, which serves as the basis for all maps, is maintained and updated.



11 Safeguarding

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During times of disaster, surveying and cartographic techniques are utilized to quickly grasp the situation and provide geospatial information.



15 Conveying information

—Conveying the situation of the nation's land

Information that is useful for understanding the risks of natural disasters is conveyed in an easy-to-understand format.



Geospatial Information
Authority of Japan



The Mission of GSI

Our goal is to provide the public with accurate locations and fresh maps.

For more than 150 years since the Meiji era, we have been measuring the land of Japan and representing it on maps. Although the shape of the map has changed significantly during this time, our mission remains the same. Armed with the technological capabilities we have cultivated, we will create systems that will make advanced use of geospatial information and lead to a more prosperous society.



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Surveying

Establishing positional references

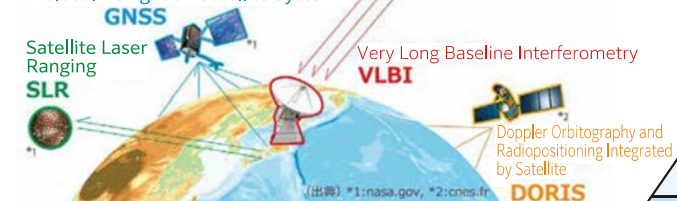
Supporting accurate geospatial information

Positional information has become an integral part of our daily lives. Navigation using smartphones or other devices also relies on accurate positioning. Then, how are the positional references determined? The positional references on the Earth are established and maintained through global geodetic observations carried out by countries around the world, including the Geospatial Information Authority of Japan (GSI). GSI has contributed to the construction of the International Terrestrial Reference Frame (ITRF) by VLBI. Based on the frame our country Japan is accurately located on the earth and the positions of GNSS CORS and triangulation points in various locations are determined on the ITRF as well. These positions are used as a reference – in other words, common rules for positioning (National Coordinates) -- for the clarification, management, and conservation of our national land, as well as various types of surveying, and are supporting our lives.

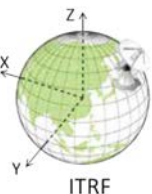
Measuring mutual positional relations between reference points of the VLBI telescope and the GNSS antenna to establish accurate positional references, (Ishiooka Geodetic Observing Station in Ishiooka, Ibaraki Pref.)

① Geodetic observations on a global scale

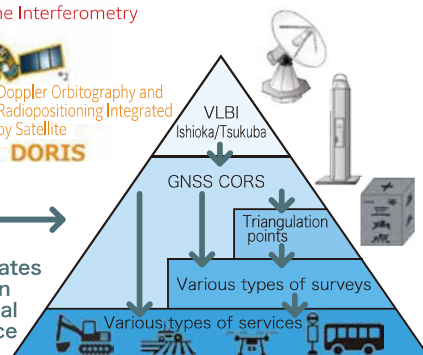
Global Navigation Satellite System



② Construction and maintenance of the International Terrestrial Reference Frame (ITRF)

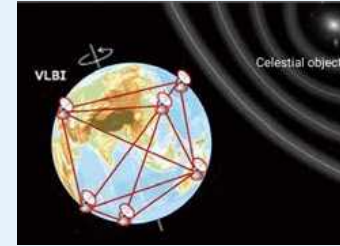


③ National Coordinates based on the global reference



VLBI survey

VLBI is a space geodetic technique for measuring a distance between radio telescopes thousands of kilometers apart with an accuracy of a few millimeters by detecting the delay of arrival time of radio waves from distant celestial objects. The VLBI observations in cooperation with other geodetic observatories all over the world enable us not only to establish the Global Geodetic Reference Frame but also to contribute to the accuracy of positioning satellites and maintenance of time standard through monitoring the momentarily changing Earth's rotation.



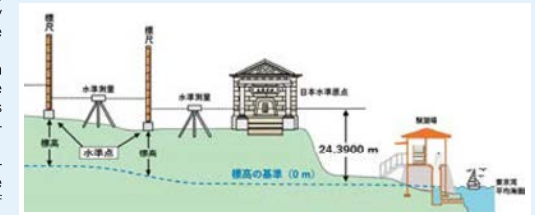
The position references on a global scale are constructed through international collaborative observations.

Leveling

Leveling is a surveying technique for determining elevations. Firstly, two leveling rods are vertically placed. One is at a point of known elevation and the other is at a point of unknown elevation.

By adding the difference in scale reading between these rods to the elevation of the known point, the elevation of the unknown point is obtained. This process is successively applied to determine elevations at arbitrary points.

Benchmarks are used as references for determining the elevations. Although elevations of Japan are determined with reference to the mean sea level of Tokyo Bay, elevations of benchmarks are determined by leveling starting from the Japanese datum of leveling located in Tokyo.



Standard method of leveling

Gravity surveys

GSI conducts gravity surveys at nationwide gravity points using the latest gravimeters that utilize quantum technology. Water flows from high places to low places according to gravity. Gravity survey is essential for investigating height differences that correspond to the direction of water flow.

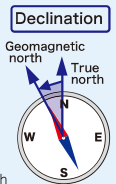


AQQ absolute quantum gravimeter

Geomagnetic surveys

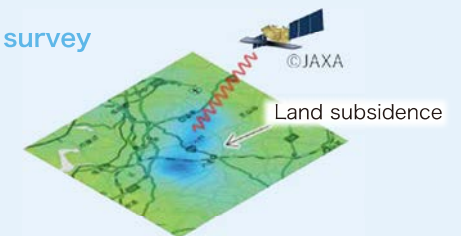
GSI has been conducting geomagnetic surveys in Japan since 1949 to clarify the geographical distribution of direction, intensity of the geomagnetic field, and their secular variations. In order to find accurate directions using a compass, it is necessary to understand the declination* of the entire country through geomagnetic surveying.

* Declination: The deviation between the north of the map (true north) and the north indicated by the compass (geomagnetic north).



Satellite SAR ground deformation survey

The crustal and ground deformation is monitored all over Japan using observation data from synthetic aperture radar (SAR) mounted on satellites. This allows us to understand ground surface changes caused by earthquakes, volcanic activity, land subsidence, etc., with high spatial resolution. This information is used for the maintenance and management of the National Coordinates and the survey of land subsidence.

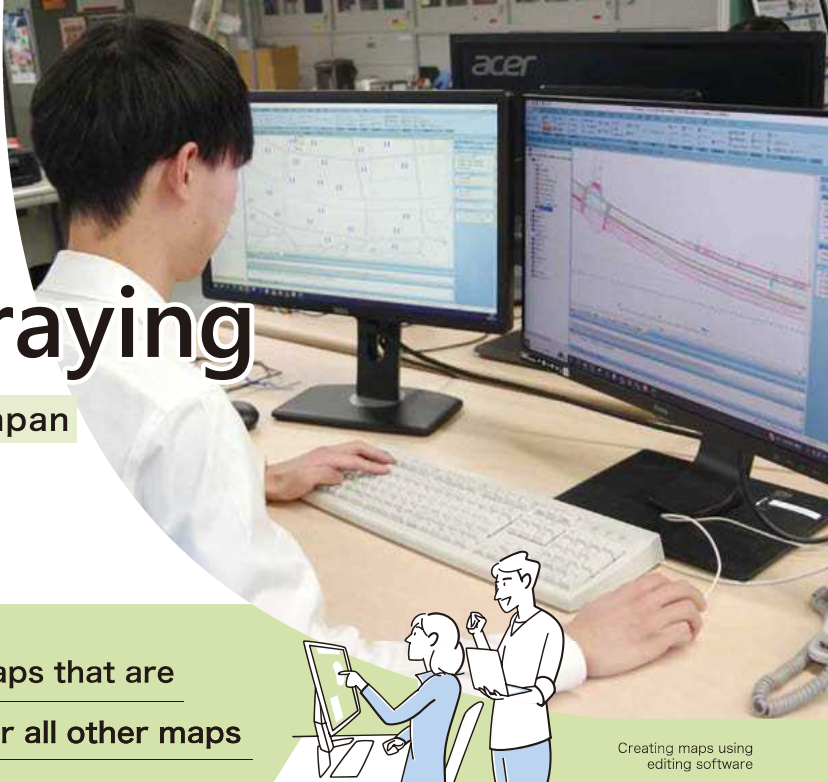


Land subsidence detected by SAR



Portraying

Mapping Japan



Creating maps that are the basis for all other maps

Accurately understanding the shape of Japan is an important mission for the country. The maps created by GSI are the basis of all maps and are essential for promoting national land management and disaster prevention measures.

The maps created are broadly divided into two types: "general maps," which provide basic information on roads, buildings, rivers, etc. throughout the country, and "thematic maps" which depict specific themes such as information of landform classification and active faults on the general maps. These maps are provided as digital media or paper maps, and are used by local governments to create hazard maps and by private companies to create tourist maps. The maps produced by GSI serve as base maps for many of those which you use in daily life.

General Map



Digital Japan Basic Map

Thematic Map



Land condition map (Landform classification data)



Creating maps using
editing software



Maps Produced by GSI

Digital Japan Basic Map—maps serving as base maps of the country

We are creating and updating the "Digital Japan Basic Map" as a map necessary for managing the national land. The Digital Japan Basic Map consists of "Cartographic information," "Orthophoto imagery," and "Geographical name information". In May 2021, it was designated as a "base registry," a database that serves as the foundation of society with accuracy and concurrence, and it must be constantly maintained and updated.

Cartographic information



Structures, etc., that are needed to manage Japan's land are added to Fundamental Geospatial Data ("FDG"), which is used to create maps that cover the entire country.

Orthophoto imagery



Aerial photographs taken from survey aircraft are processed into orthophoto imagery that can be overlaid onto maps.

Geographical name information



Information including populated area names, Geographical names of natural features, public facilities which is created as basic information, a key to finding positions.

*Fundamental Geospatial Data: Information such as road edges, peripheral lines on buildings, etc., is commonly used as position references on digital maps.

Lake Chart Thematic map of the use and conservation of lake and marsh

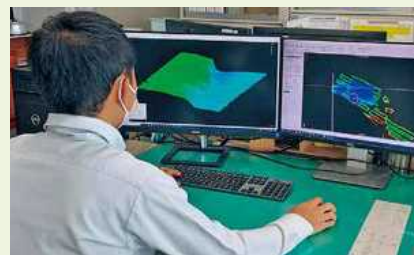
The "Lake chart" is a detailed bottom topographic map of major lakes and marshes in Japan, and is maintained and provided as basic information for lake use, environmental planning, fisheries, etc.

To create a lake chart, we obtain topographical data on the lake bottom using echo sounder installed on a survey boat, and then analyze the data and create maps. Since fiscal 2021, we have been using autonomously navigating unmanned surface vehicle (USV) to conduct surveys in shallow water areas.

① Lake chart survey



②Data analysis・plotting



Process of producing a lake chart

③ Complete the lake chart (part of lake Nakaumi)



「The process of producing a map」

column

Prompt update

Maps updated upon the opening of a new road

In addition to aerial photos, blueprints that are provided by road builders and managers are also used to update maps. By collecting road blueprints before a road is opened, work can proceed beforehand to update the map. Through this work, maps of 130 new roads were updated in FY 2022 as soon as the roads were opened.



Before updating



Road plans are collected and reflected in maps



After updating

1 Aerial Photography

Taking aerial photos needed for producing maps

By using surveying aircraft, take aerial photos for producing maps. When taking such photos, plotting work is done by overlapping adjacent photos in order to create 3D images.



Image of aerial photography

Field surveys

3

Field surveys

Confirming unclear points with plotting work

Field surveys are carried out when road terrain, land-use conditions, etc., are difficult to confirm with aerial photos due to tree cover.



4

Map Editing

Editing maps to make them easy to understand

To show more clearly what mapping data represent, associated information such as roads and buildings is added. Furthermore, by annotating municipalities, etc., transcribing map symbols, etc., maps that will be familiar to everyone can be created.



Plotting

2

Plotting

Plotting buildings, etc., from aerial photographs

In the plotting process, two aerial photographs with accurate positional information are viewed in 3D using a plotting instrument to draw roads, buildings, contour lines, etc.



Plotting



Map Editing

Symbols, annotations, etc., are assigned to maps



After editing

column

Understanding changes in the land — Utilization of AI and satellite images—

Visualize changes throughout Japan by identifying changes through comparisons between past and present satellite images

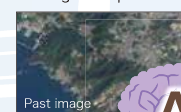
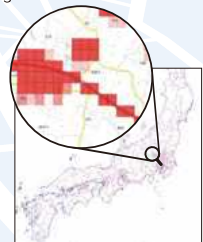


Image that have identified changes



So far, the problem with map update was the inability to understand quantitatively which areas had undergone the most significant changes until aerial photographs were taken. Therefore, we are proceeding with efforts to identify areas of change through image analysis using AI from past and the latest satellite images. We hope that this will enable us to accurately understand changes in Japan's land and enable efficient photography for map updates.

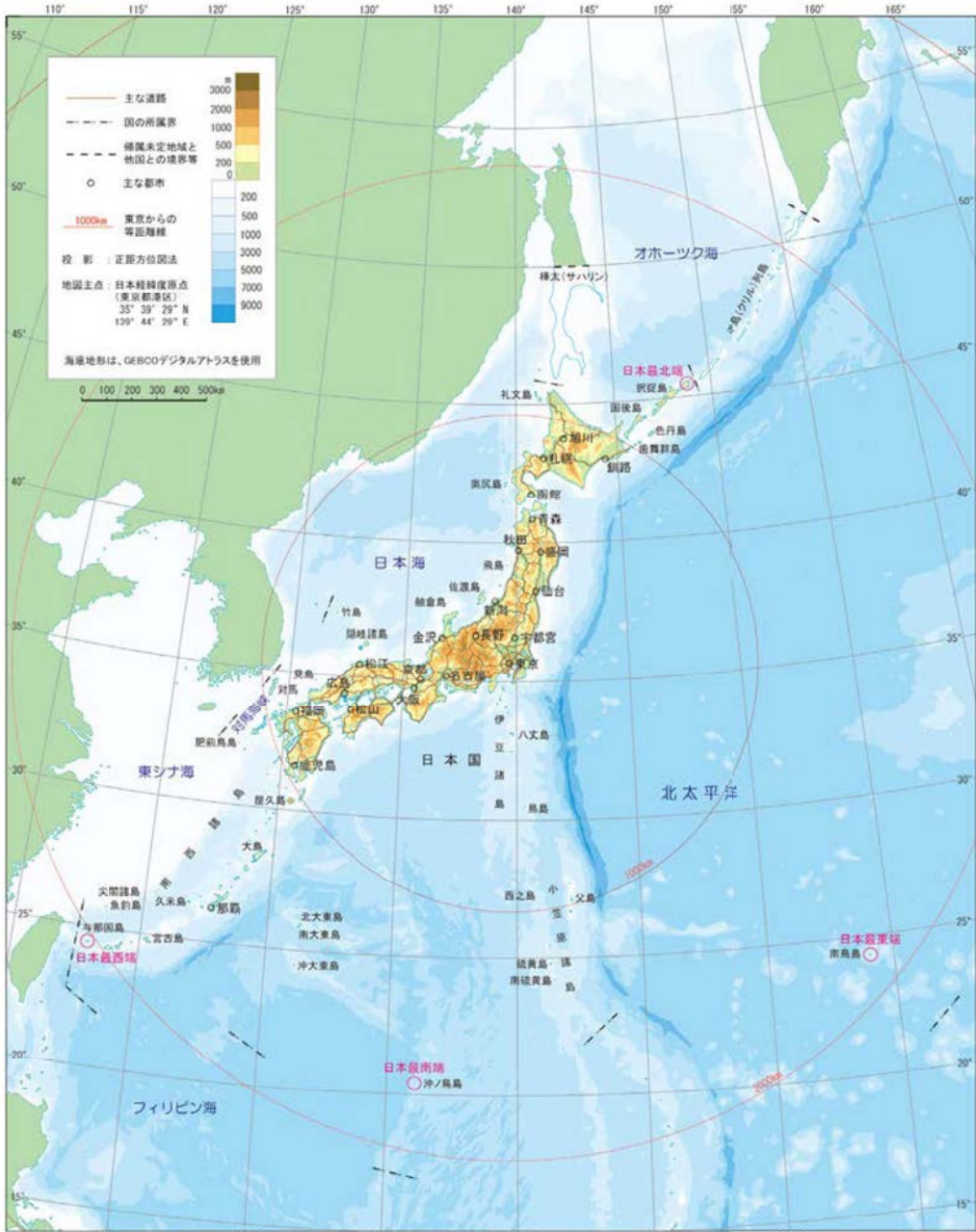


Japan's territory

Surrounded by the sea on all sides, Japan is an island nation consisting of 14,125 islands and has one of the largest maritime jurisdictions in the world. Small islands dotted across the vast ocean play an important role in determining Japan's territorial waters and exclusive economic zones.

In order to clearly define Japan's territory and to provide an accurate understanding of the territory both domestically and internationally, GSI has established 'control points' to provide location standards even for remote islands far from the mainland and to create accurate maps. In addition to installing and maintaining control point, we also create maps of the entire country, including maps that fit all of Japan onto one sheet.

MAP of JAPAN



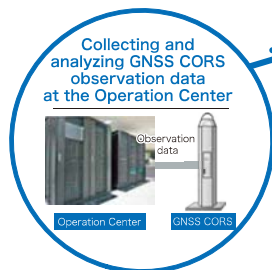
This map is completed from 1: 5,000,000 Japan and its Surroundings

mission 02

A new society that materializes digital infrastructure

Precise orthometric

height determination by satellite positioning



The control station compiles and sends augmentation information

Transmitting augmentation information

QZSS "MICHIBIKI" Source: qzss.go.jp

Physical Distribution Using UAV

Crustal deformation transformation

Smart Agriculture

Smart Agriculture

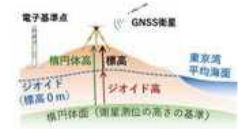
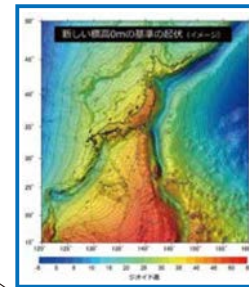
Source: Brochure of the Geospatial Project, Secretariat of the National Spatial Data Infrastructure (NSDI) Committee

ICT Construction

ICT Construction

Automatized Driving

We maintain detailed topographic data to support highly accurate simulations.



To realize rapid and accurate orthometric height determination by satellite positioning, GSI conducted airborne gravity surveys for developing a new precise gravimetric geoid model which are required for height determination. Ellipsoid height is obtained from satellite positioning, but it is not equal to orthogonal height. By using precise geoid models, we can convert the ellipsoid height to orthogonal height.

GNSS CORS Network supports

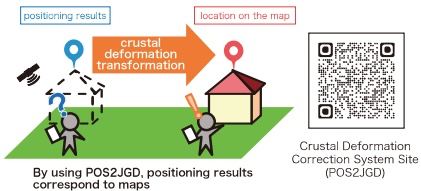
a High-precision Positioning Society

GNSS CORS data also serve as the basis for location in fields other than surveying, such as ICT construction and Smart Agriculture.

Augmentation information calculated from observation data from GNSS CORS is distributed by location-based service providers and "MICHIBIKI" also known as "Japanese GPS," and is used to determine the real-time and highly accurate positioning of construction machinery, etc. Such systems help to improve work efficiency and resolve labor shortages in various fields such as construction and agriculture, and are more important than ever.

Positioning results

can be instantly aligned with maps



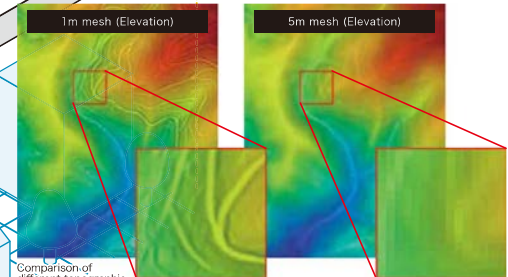
The Earth's surface is constantly moving due to crustal movements. However, since maps are created based on positions at a certain point in the past, there are differences between the "positioning results" and the "location on the map" that accumulates and expands over time. In order to correct the differences caused by these crustal movements, GSI provide correction information from "Crustal Deformation Correction System Site (POS2JGD)" to provide correction information. This allows anyone to determine the "location on the map" from the "positioning results" and use location information in a variety of fields without having to be aware of discrepancies due to crustal movements.

We are creating a 3D map of the entire country as the basis of the digital twin



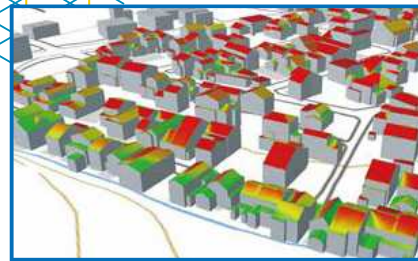
Digital Japan Basic Map transformed into 3D

We are creating a 3D map of Japan by adding heights to the Digital Japan Basic Map using aerial photographs and highly precise elevation data. This is expected to build a digital twin for the entire country and contribute to DX in a variety of fields.



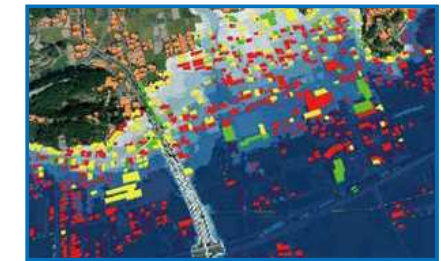
Since 2008, GSI has been preparing and providing topographic data at 5m intervals. Since November 2023, we have been preparing and providing even higher resolution topographical data at 1m intervals. The ability to express detailed topographic features such as small streams that could not be expressed at 5m intervals has been increased, making it possible to perform more accurate simulations.

Simulation of solar power generation



Source: PLATEAU Usecase

Simulation of flooding





Safeguarding

Protecting national land of Japan

Acquiring and disseminating disaster information using surveying technologies

GSI, Designated Government Organization (DGO) under the Disaster Countermeasures Basic Act, is promoting disaster response-related policies and measures against frequent natural disasters, employing the survey and cartographic techniques to protect the nation's land and people's lives and properties.

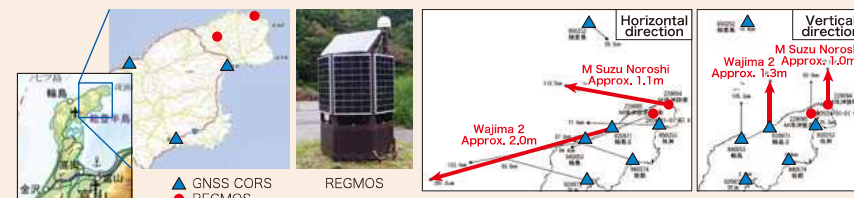
The information collected through emergency photography and surveying is analyzed and interpreted to acquire data necessary to understand the disaster situation and provide the data as quickly as possible. This information is useful for disaster response, restoration and reconstruction measures carried out by government agencies and local governments, as well as disaster prevention activities by the public.



Latest state of GSI disaster response

Strengthening observations of crustal deformation in the Noto district of Ishikawa Prefecture

In the Noto district of Ishikawa Prefecture, active seismic activity has continued since around December 2020, and along with this seismic activity, continuous crustal deformation have been observed at the GNSS CORS in the Noto region. Therefore, in July 2022, we newly installed a Removable GNSS Monitoring System, REGMOS, in an area with active seismic activity in order to understand crustal deformation in greater detail. During the 2024 Noto Peninsula Earthquake that occurred on January 1, 2024, the "M Suzu Noroshi" REGMOS observed movement of approximately 1.1m in the west-northwest direction. In addition to reporting these results to meetings of government-related organizations, we are helping to elucidate the causes of crustal deformation.



Identifying submergences using SNS (Producing Provisional Inundation Depth Maps)

"Provisional Inundation Depth Maps" are maps that estimate the flood area and water depth by determining the waterfront position from information such as SNS images and aerial photographs when flooding occurs, as well as from digital elevation data. The water depth is expressed in shading. It is used to assess damage in the early stages of a disaster, perform rescue operations, and formulate plans for deploying drainage pump vehicles. After a disaster occurs, we work to quickly provide information to related organizations.



Provisional Inundation Depth Maps based on torrential rains starting from 3 July 2020

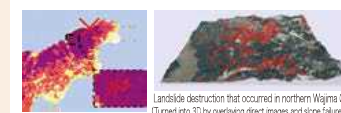
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SGDAS and REGARD

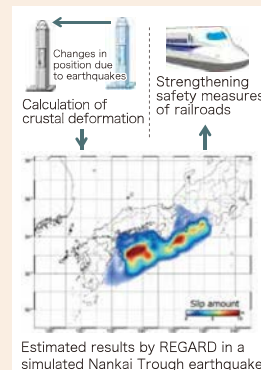
Immediately after an earthquake occurs, GSI automatically distributes information from two systems to support the initial response systems of disaster prevention-related organizations. The Seismic Ground Disaster Assessment System (SGDAS) estimates the occurrence of ground disasters in areas where seismic motion has been observed, using a vast amount of topographical and geological data and estimated seismic intensity distribution maps released by the Japan Meteorological Agency. This information is provided to disaster prevention related organizations.

The real-time GEONET analysis system for rapid deformation monitoring (REGARD) analyzes observation data from GNSS CORS in real time and estimates the magnitude of a huge earthquake based on crustal deformation field in just a few minutes.

In December 2022, we concluded an industry-academia-government collaboration agreement with Tohoku University and Central Japan Railway Company to provide information on REGARD. This helps to improve the accuracy of real-time tsunami flood damage predictions and consider how to handle railway operations.



Estimated results by SGDAS and locations of landslide occurrence (The 2024 Noto Peninsula Earthquake)





mission 03

GSI's Disaster related

Activities and Responses

Disaster
Breaks Out

step1 / Daily Operations

As part of daily preparations, maps and surveying technologies are used to observe crustal movements, and to prepare and distribute geospatial information that can also help to prevent and mitigate disasters.

➤ Monitoring by GNSS CORS



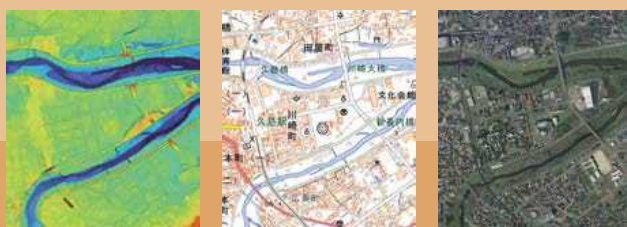
Crustal deformation is monitored at about 1,300 GNSS CORS distributed throughout Japan.

➤ Producing active fault maps



Active fault map showing detailed locations of active faults in Japan. It is useful for earthquake disaster prevention.

➤ Updating geospatial information



Accurate geospatial information is absolutely essential information to have when formulating disaster prevention and mitigation plans. In addition, when a disaster occurs, it can be useful for understanding the state of damage by making comparisons of conditions before and after the disaster.

➤ Monitoring crustal deformation by satellite SAR



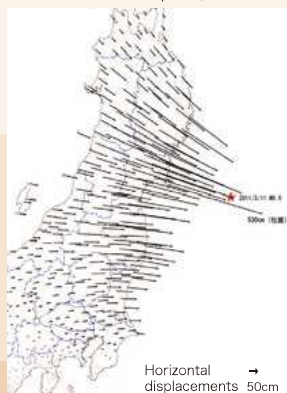
Crustal and ground deformation for all over Japan is monitored by analyzing JAXA's satellite SAR data.

➤ Maintenance of Landform Classification Map for Flood Control



This is a thematic map that displays river topography and river structures for the purpose of flood control measures. It is useful for understanding the risk of natural disasters such as floods.

➤ Crustal deformations observed by GNSS CORS (The 2011 off the Pacific coast of Tohoku Earthquake)



The GNSS CORS network monitors crustal deformations related to earthquakes and volcanic activity.

➤ Emergency photography



Emergency photography of affected sites is conducted using surveying aircrafts and UAVs (drones) to accurately verify the state of damage.

step2 /

Data collection/Interpretation and analysis

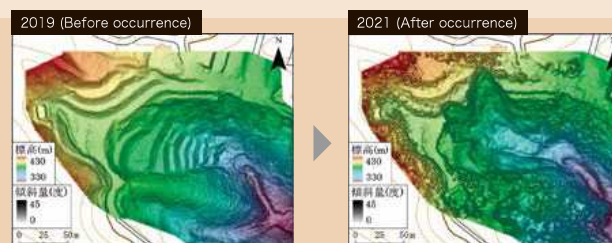
Information is quickly obtained from emergency photos, etc. By interpreting and analyzing various types of information, we can get a multi-faceted understanding of disaster conditions, etc.

➤ Crustal deformation observed by satellite SAR (The 2024 Noto Peninsula Earthquake)



The changes of ground surface is detected with high spatial resolution by analyzing satellite SAR data.

➤ Calculating elevational changes using airborne laser surveys (Torrential rains that began on 1 July 2021)



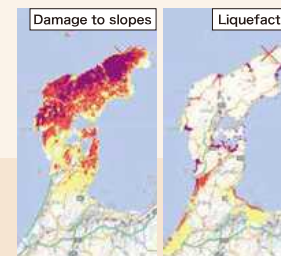
Comparing highly precise elevation data for before and after the occurrence of a disaster helps analysts to quickly understand the state of damage.

➤ Creating distribution maps of slope failure and sedimentation (The 2024 Noto Peninsula Earthquake)



Aerial photos are interpreted to identify topographical deformation such as slope failure and accompanying sedimentation, etc.

➤ Estimating ground damage (SGDAS) (The 2024 Noto Peninsula Earthquake)



When an earthquake occurs, the state of ground damage is quickly estimated.

step3 / Information Distribution

Information is collected and analyzed is quickly distributed to relevant organizations to contribute to response work and rapid recovery.

➤ Information distribution to organizations concerned



Regional Survey Departments play a major role in providing acquired data and analysis results to organizations engaged in disaster response operations on site.

➤ Aerial photos before and after a disaster (Split display of GSI Maps) (Typhoon of July 2019)



Collected disaster information is provided not only to relevant organizations, but also to the public via GSI home page.

➤ Producing/providing maps for emergency restoration and reconstruction measures (The 2016 Kumamoto Earthquake)



Detailed maps are produced and distributed after the occurrence of a disaster for use with restoration and reconstruction measures.



Conveying

Transmitting the situation of national land of Japan

We reveal attributes of the national land and bring various types of geospatial information to the public.

There is a close relationship between topography and natural disasters. "Geospatial information for disaster mitigation (GIDM)" is created by deciphering this relationship and expressing it on a map according to the purpose.

In addition to Geospatial information for disaster mitigation (GIDM), information related to the locations surrounding our daily lives is called 'geospatial information'. We provide an environment where you can easily search, view, and obtain geospatial information, from historical documents to the latest maps.



1:50,000 land condition map of volcano, Volcanic Land Condition Map (Mt. Chokai)

1:25,000 Active Faults Map in Urban Area (Northern part of Shonai)

Volcanic Base Map (color shaded map) (Mt. Chokai)

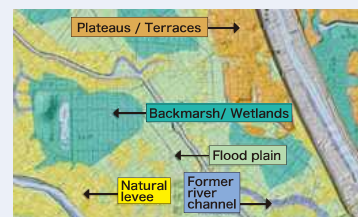


Geospatial information for disaster mitigation

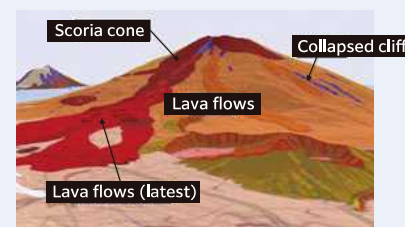
GSI has compiled Geospatial Information for Disaster Mitigation (GIDM) from topographical characteristics information related to land origins, land uses, etc., and Disaster history information from historical records. This enables us to obtain a good understanding about the risks of disasters in local areas.

Topographical characteristics information

Typical types of topographical characteristics information include 'Landform classification', which visualizes the natural disaster risk of the land, and 'Land Condition Map for Volcano', which show the distribution of ejecta and topography formed by past volcanic activity. It is known that the "backmarsh/wetlands" shown in the landform classification have lower land than other landforms and are more susceptible to flooding. Land characteristics visualized in this way are used as basic information for planning of disaster prevention, regional development plans, and so on.



Landform classification (Vector tiles)



3-D representation of Land Condition Map for Volcano

Disaster history information (Natural Disaster Monument)

Natural Disaster Monuments are stone monuments that were created by our ancestors to convey to future generations the aspects and damage caused by natural disasters that occurred in the past.

It has been included in overlay hazard maps since fiscal year 2021, and the number of Natural Disaster Monuments included in GSI Maps exceeded 2,000 in September 2023, and is still increasing steadily.

This information is expected to be used for education for disaster risk reduction and community learning to pass on the lessons of our predecessors to future generations.



Icons on web maps



Map symbols on a 1:25,000 topographic map



Cenotaph dedicated to the victims of the Mt. Ontake eruption.

Example of utilization in educational fields



Teaching materials for geography, history, elementary school social studies, etc.

Example of utilization in community learning



Objectives of a walking group's exploration course, etc.

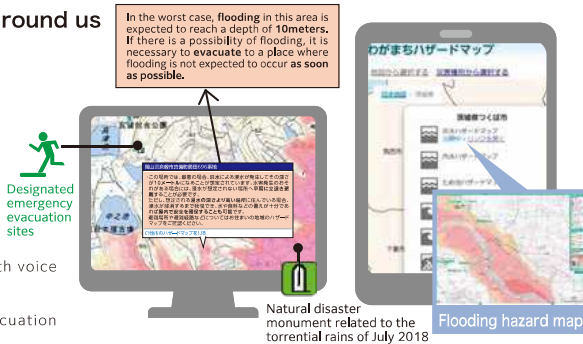
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Knowing the disaster risks around us (Hazard Map Portal Site)

The hazard map portal site provides information on designated emergency evacuation sites and the dangers of natural disasters. You can overlay various contents useful for disaster prevention (left image) and view the latest hazard maps created by municipalities across the country (right image).

In 2023, we added a function that displays expected disaster risks and actions to be taken in the event of a disaster not only on a map but also in text (also compatible with voice reading software).

Disaster risks loom even in familiar settings. Check the hazard map and consider evacuation routes.



In the worst case, flooding in this area is expected to reach a depth of 10 meters. If there is a possibility of flooding, it is necessary to evacuate to a place where flooding is not expected to occur as soon as possible.

Designated emergency evacuation sites

Natural disaster monument related to the torrential rains of July 2018

Flooding hazard map

Providing wide-ranging support for disaster prevention and geographic education aimed at improving local disaster prevention capabilities

"Chiri-sogo (Geography)" has been a compulsory subject in high schools since 2022. In order to support robust classes, we have released a web content called "Toolbox for Geography Education" that can be used by both students and teachers.

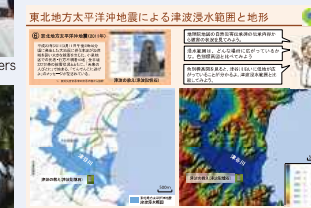
We also carry out various initiatives aimed at supporting disaster prevention and geographic education, such as holding "information sessions for textbook and educational material publishers."



Lecture to social studies teachers



Textbook and educational material publisher orientation



Toolbox for Geography Education "Know it at a glance! Learning about past disasters and landforms with illustrations"

Geospatial Information Library

GSI operates a "Geospatial Information Library" that allows you to easily search, view, and obtain geospatial information according to your purpose of use. In addition, you can view geospatial information and receive survey results at 11 viewing stations across the country located at GSI Headquarters, Regional Survey Departments, and Okinawa Regional Survey Department.



Figure below:
Geospatial Information Library
<https://geolib.gsi.go.jp/>

Ease in searching, viewing and getting necessary geospatial information

Maps/aerial photographs

Archive of maps from 1890 and aerial photographs from the first half of the 20th century can be searched and viewed on this website.



Topographic map (Published in 2021)



Aerial photograph (Photographed (from the left) 1948, 1963, 2019)

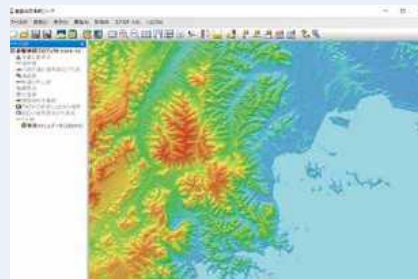
Control point survey results

Information on (basic) control points and public control points can be viewed on this website.



Fundamental Geospatial Data (FGD)

The nationwide Fundamental Geospatial Data (FGD: location information that serves as a base on digital maps) can be searched and obtained.



Old Map Collection Vestiges of history felt in old maps

Historical materials can be viewed, such as the original provisional surveyed maps created by the General Staff Office, the predecessor of the Geospatial Information Authority of Japan.



There are also maps that have "sketches" on map margin, which target landmarks such as isolated trees, shrines, bridges, etc. You can get a feeling of how it was like at that time.



Recent view (Photographed in February 2018)

GSI Maps

"GSI Maps" is a web map that can be run on personal computers, smartphones and tablets and is constantly updated with the latest information. Users can overlay various types of information such as landform classifications, disaster information, past aerial photographs and whatever else they may want on base maps such as topographic maps and aerial photos.



GSI Maps
<https://maps.gsi.go.jp/>

Features of GSI Maps

Comparison of various types of information

In "Side-by-side comparisons", different types of information for the same location can be lined up side-by-side.

For example, by lining up the landform classification map with Provisional Inundation Depth Maps of a disaster, we can understand what types of terrain are in inundated areas.



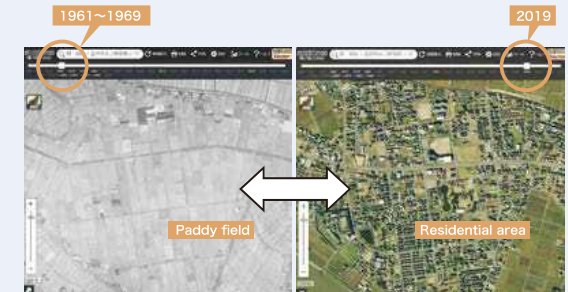
Provisional Inundation Depth Map

Landform classifications
(Experiment to provide vector tiles)

Viewing the transition of towns

By moving the slider in the upper part of the screen, users can produce time-series displays of aerial photos by switching to different years. This is an easy-to-use method to understand the transition of towns.

It can be seen that residential development has progressed in this area. By comparing old and new aerial photographs, we can learn about changes in the town.



Understanding the heights of surrounding areas

"Self-made colorized elevation map" function allows the user to freely set the colors and ranks of colors to show different elevations.

By setting color-coding stages and color schemes according to the topographical features, it is possible to create a map that make it easy to understand differences in elevation, even in areas with small elevational differences.

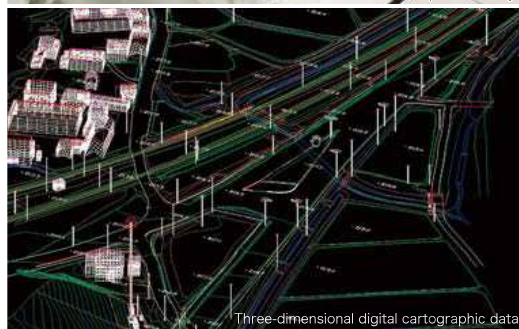
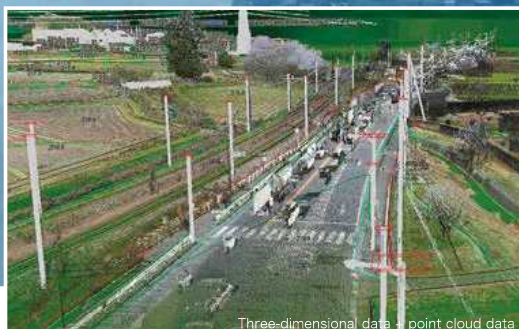


Promoting the Administration of Land Surveys



Responsibilities as a national administrative agency in charge of the Survey Act

Public works projects to develop and manage national infrastructure are being carried out all around us, such as creating large-scale residential areas, constructing new roads, and improving rivers for disaster prevention. When planning and designing such public works projects, public survey is required to create maps and determine positioning standards. In order to ensure accurate and efficient surveys, GSI, as a national administrative agency in charge of the Survey Act, offers advice on survey operations undertaken throughout Japan, examines survey results to ensure their accuracy, promotes the widespread use of new surveying technologies, and tests and registers nationally accredited surveyors and assistant surveyors, among other duties.



Efforts in public survey

Surveys that are funded by the national or local governments are called "public survey." The results will be used in a variety of situations as a foundation of society, such as developing infrastructure around us and city planning. When conducting public survey, the national and local governments must establish "operating specifications" that specify surveying methods, etc. in order to ensure the accuracy of the surveys. The Minister of Land, Infrastructure, Transport and Tourism (The Geospatial Information Authority of Japan) has established the "Rules for Operating Specifications", which indicate standard work methods for surveying, as a model example of operating specifications. Advanced surveying technology is adopted into the "Rules for Operating Specifications" after accuracy verification, for responding to the latest technology. In addition, in order to widely disseminate accurate public survey results to the public, we provide technical advice on public survey plans and inspection of public survey results. Information on survey results that are deemed to have sufficient accuracy will be made public through the website and will be widely used in subsequent surveys. We disseminate information on our website and hold briefing sessions in various locations about improving efficiency, maintaining accuracy, and using the latest technology, in order to ensure that public surveys are carried out appropriately.



Use of new survey technologies using UAV in public survey
(Adopting into the "Rules for Operating Specifications")



Seminars are held throughout Japan for persons in charge of public survey

Examination and registration of surveyors and assistant surveyors

"Surveyor" and "assistant surveyor" are national qualifications required to engage in "basic survey" conducted by the Geospatial Information Authority of Japan or "public survey" conducted by the national and local governments. GSI conducts a national examination once a year in order to examine and register qualifications based on the following requirements:

Eligibility Requirements

Surveyor (Articles 50, the Survey Act)	To be eligible, surveyors must - Acquire credits for survey-related subjects at a university, junior college or national institute of technology, graduate from the above-mentioned school, and have the prescribed practical experience; or - Obtain professional knowledge and skills at a survey technical training school and have prescribed practical experience in surveying; or - Be an assistant surveyor who has acquired advanced knowledge and skills in surveying at a survey technical training school - Pass the surveyor examination administered by the Director-General of GSI.
Assistant Surveyor (Articles 51, the Survey Act)	Assistant surveyors must: - Acquire credits for subjects related to surveying at a university, junior college or national institute of technology and graduate from the above-mentioned school; or - Obtain professional knowledge and skills at a survey technical training school. - Pass the assistant surveyor examination administered by the Director-General of GSI.

Disaster and Geospatial Information Planning Center

In April 2024, the "Disaster and Geospatial Information Planning Center" was newly established at the Tokyo Office, which was opened in Central Government Building No. 2 in 2020 as a base in Tokyo for working with the Diet and coordinating with related ministries. This "Disaster and Geospatial Information Planning Center" will coordinate external affairs related to disaster response and the utilization and promotion of geospatial information, and will also serve as a base for providing maps, aerial photographs, etc. to government-related organizations in the event of a disaster.



Central Gov't Bldg. No.2

Advancing the utilization of geospatial information



Basic Act on the Advancement of Utilizing Geospatial Information

The Basic Act on the Advancement of Utilizing Geospatial Information (NSDI Act) is a law for advancing the intensive utilization of geospatial information and realizing a geospatial society where the people of Japan can lead safe and prosperous lives. Working with industry, academia, and governmental agencies, the national government has set up the Committee for the Advancement of Utilizing Geospatial Information. GSI is coordinating communications and partnerships with these entities as the committee's secretariat.

Local partnerships

We have been working to finalize the 'Agreement related to cooperation for promoting the utilization of geospatial information' with the aim of strengthening cooperation between GSI and local governments, including the mutual use of geospatial information that they possess. By building face-to-face relationships through Regional Surveying Departments, we will promote the sharing of information and technology and contribute to the realization of a rich geospatial information society in their communities.

Geospatial EXPO

Geospatial EXPO is an event where officials from industry, academia and government get together and present their services, products and the latest techniques related to geospatial information to the public through exhibitions, talks, symposiums and hands-on activities. As host secretariat, GSI organizes and manages the Geospatial EXPO. GSI also holds the Geospatial Activities Competition and exhibits the work of GSI at this event.

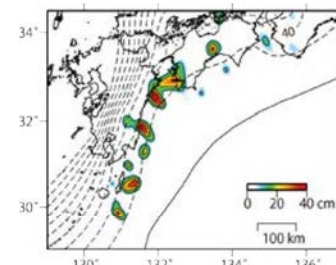


Awards ceremony for the Geospatial Activity Competition

Research and development for a resilient Japan for the future

Unraveling the mechanism of the Nankai megathrust earthquakes

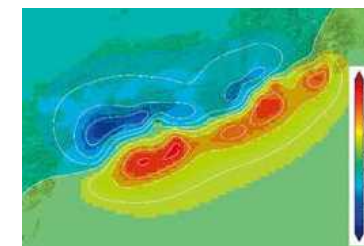
Experts are saying that a huge earthquake could occur in the near future around the Nankai Trough which extends offshore along the coastline from the Tokai Region to the Kyushu Region. It is known that the Nankai Trough slides at a slow pace (slow slip), and there are repeated releases of seismic energy that has built up. In order to understand the various phenomena that are involved in the occurrence of such a major earthquake, the slow slip of the asperities of the Nankai Trough is being subjected to research and development in order to gain a more accurate and constantly updated understanding of these phenomena.



Locations of long-term slow slip and amount of slope failure generated along the Nankai Trough (1 January 2018 to 1 July 2023)

Constructing a basis of location information for supporting the future society

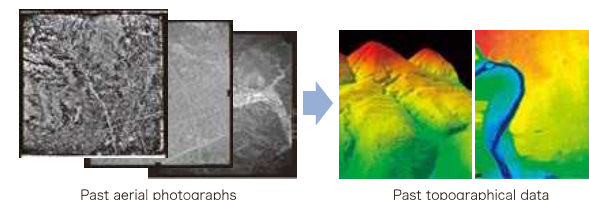
A major earthquake or volcanic eruption can cause ground surface deformation, resulting in that control points and map position references lose their conformity with the current conditions. In order to quickly undertake recovery and restoration work, it is necessary to coordinate basic position reference information from control points, maps, etc., with current conditions. Against this background, we are conducting research on the advancement of space geodetic technology to quickly measure the shape of the Earth and its changes with a high spatiotemporal resolution so that location information can be updated and provided appropriately, even in times of disaster.



Geoid change due to the anticipated Nankai megathrust earthquake simulated using the fault model by Ohno et al. (2022)

Development of methods for creating past topographic data

Artificially altered areas (embankments, etc.) are areas that are vulnerable to disasters such as torrential rain and earthquakes. Therefore, understanding artificially altered areas is an important element in assessing disaster risk. Artificially altered areas can be identified by comparing past topographic data, digital elevation model (DEM) with current topographic data, but past topographic data before 1990 is virtually non-existent. Therefore, we began researching a method to efficiently and accurately create past topographical data from past aerial photographs using the latest technology. This should be useful for disaster risk assessment by understanding artificially altered areas and landscape restoration from time-series topographical data.



column

The Coordinating Committee for Earthquake Prediction

The Coordinating Committee for Earthquake Prediction (Secretariat: GSI) is a group of organizations involved in observation and research related to earthquakes that collect information on monitoring results of crustal activity (seismic activity, crustal deformation, etc.) and research related to the prediction and forecasting of earthquake occurrences. In order to inform society about the current state of research on crustal deformation and the prediction and forecasting of earthquake occurrences, the contents of the discussions are made public through press briefings after each conference.



Scene of a Coordinating Committee for Earthquake Prediction

📍 International Activities



Signing ceremony for cooperative activities with National Geographical Institute of Spain



Practical training in JICA Knowledge Co-Creation Program
"Management and Utilization of National Control Points for Efficiency of Survey"



Exchange of views on technical cooperation for developing countries



Technology transfer of UN vector tile toolkits

Contributing to international society with surveying technology

Through popularizing the Global Geodetic Reference Frame (GGRF) which was adopted by the UN General Assembly to show the precise shape and associated changes of the Earth, and promoting the utilization of geospatial information through international partnerships, GSI has contributed to support UN activities such as achieving Sustainable Development Goals (SDGs).

Utilizing our experience and cultivated techniques, we are engaged in a variety of activities on the international stage, such as providing technical cooperation to developing countries and contributing to Antarctic Research Project.



Presentation as the chair of UN-GGIM-AP working group on Geodetic Reference Frame

📍 Contributions in the UN and related frameworks

GSI participates in the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) of the United Nations Economic and Social Council, contributing to discussions on geospatial information.

GSI plays leading roles in UN-GGIM as Co-Chair of the Working Group on Geospatial Information and Services for Disasters, as a member of the Subcommittee on Geodesy, and as Vice-President of the Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP).



Statement as Japanese delegation at the UN-GGIM meeting held at the United Nations Headquarters

📍 Technical cooperation for developing countries

In cooperation with JICA, GSI provides technical cooperation to improve surveying and mapping technology in developing countries, including technical support for the development and advanced operation of GNSS CORS Network.

Since 1959, more than 1,000 participants have received training at the GSI over the past 60 years, and a total of over 850 GSI personnel have been dispatched as experts to geospatial information authorities overseas.



On-site survey for technical cooperation for developing countries

📍 Antarctic research expedition

In the Antarctic Research Project, which is carried out in cooperation with related ministries and agencies, GSI has dispatched personnel to every Japanese expedition since its commencement in 1956.

The geodetic and topographic information, which has been developed so far, has been used as the basis for the expedition members' safe field operations and research activities.

As part of the International GNSS Service (IGS), continuous GNSS observations are being conducted on East Ongul Island, where the Syowa Station is located.



GNSS survey on outcrop (Photographed in the 64th Expedition)

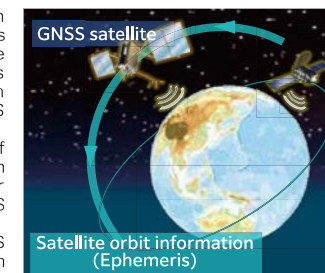
column

The first IGS Analysis Center in Japan

GNSS is a system that determines ground positions based on satellite orbit information (ephemeris). A highly accurate ephemeris (precise ephemeris) is essential for high precision positioning. The precise ephemeris currently considered the most accurate is calculated by the International GNSS Service (IGS) through integration of precise ephemerides submitted by individual IGS Analysis Centers.

The IGS Analysis Center is accredited by IGS and is comprised of surveying or space-related organizations around the world. GSI, in collaboration with JAXA, established a unique method for calculating precise ephemerides, and was certified as the first IGS Analysis Center in Japan in December 2023.

In this way, we are making international contributions through IGS and contributing to the development of foundation for high-precision positioning.



The Science Museum of Map and Survey



We provide a space where you can enjoy learning about the relationship between your daily lives and maps and surveying.

The Science Museum of Map and Survey is an experiential facility where everyone from children to adults can have fun learning about the role of maps and surveying, which are essential to our daily lives. It is widely used for social studies tours, training and inspections by companies and organizations, and people learning about local geography and climate. Information on special exhibitions and hands-on events related to maps and surveying will be posted on our website.



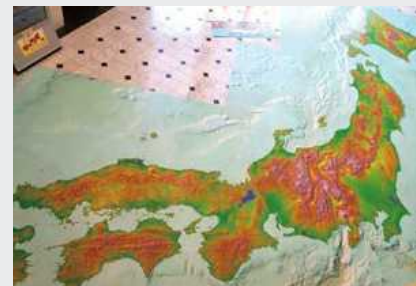
Opening Hours: 9:30-16:30
Closed: Mondays
(Tuesday if a holiday falls on a Monday)
Year end and new year holidays
Admission free
Parking available
<https://www.gsi.go.jp/MUSEUM/>



Introduction of the Museum

Japanese Archipelago Skywalk Map

The entire Japanese archipelago is drawn on the floor at a scale of 1:100,000. When seen with 3D glasses, the archipelago looks three-dimensional, which makes you feel like it is the actual topography of land and sea.



Permanent Exhibition Room

The Permanent Exhibition Room features old maps which reflect the view of the world at the time they were made and precious surveying equipment that was used at various places in Japan. Here you can have a fun time learning about the fascinating histories and roles of maps and surveys.



Earth Plaza

When you climb up on the 22m-diameter Earth Plaza you can see a 1:200,000 scale model of the world around the Japanese Archipelago. Please enjoy the experience of viewing the expanse of Japan and the roundness of the Earth. The decommissioned survey aircraft Kunikaze (first model), which was in service from 1960 to 1983, is also on display.



Planning · Events

Planned exhibits

At special exhibitions held about four times a year, we use survey results and related materials to explain about various themes related to maps and surveying.



Thinking about Japan's "Territory and Sovereignty"
(held from October to December 2023)

Exhibition of All Japan School Children's Excellent Mapping Work

Co-sponsored by Exhibition of All Japan School Children's Excellent Mapping Work (Secretariat: GSI) and the Geospatial Information Authority of Japan, works recommended from exhibitions held by member organizations from all over the country are brought together in the Exhibition of All Japan School Children's Excellent Mapping Work. Art exhibitions are held at four venues.



The Minister of Land, Infrastructure,
Transport and Tourism Award



The Minister of Education, Culture,
Sports, Science and Technology Award
(26th National Children's Map Exhibition)

Special events on Survey Day

Every year on the first Sunday in June, special planned events are held to commemorate "Survey Day", which is June 3rd. There are hands-on events as well such as the "Fun School of Mapping and Surveying."



Special events on Survey Day (June 2023)

Overview of GSI

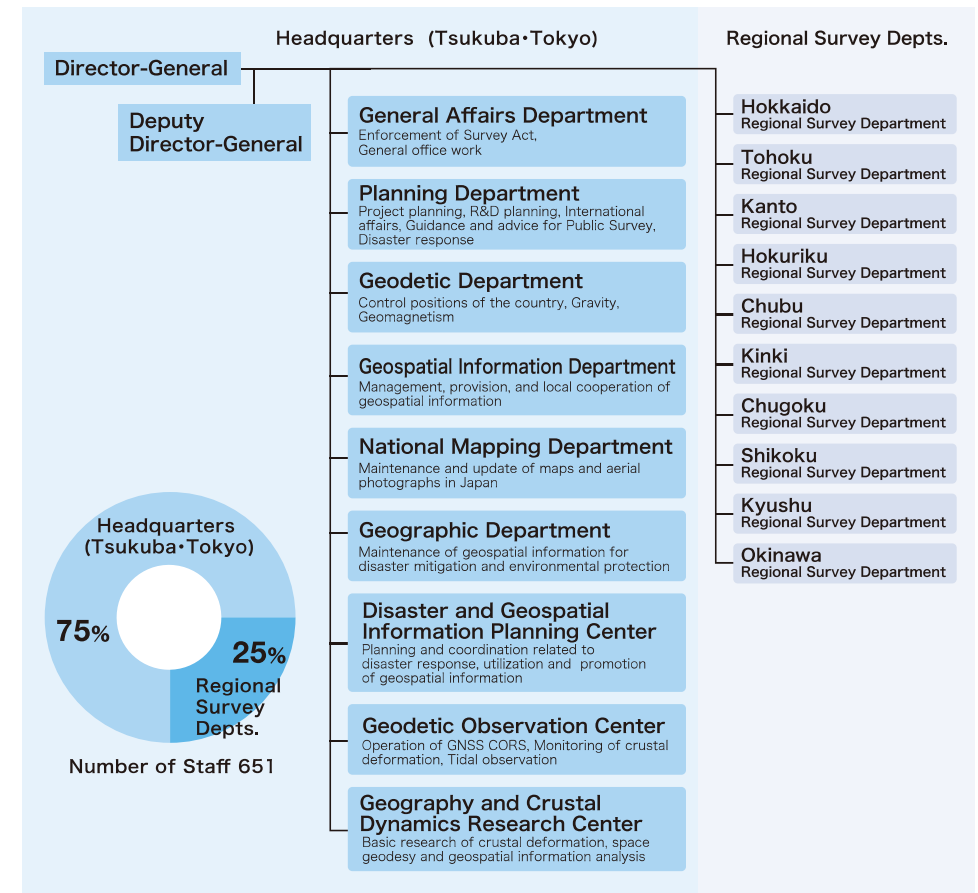
History

(year)

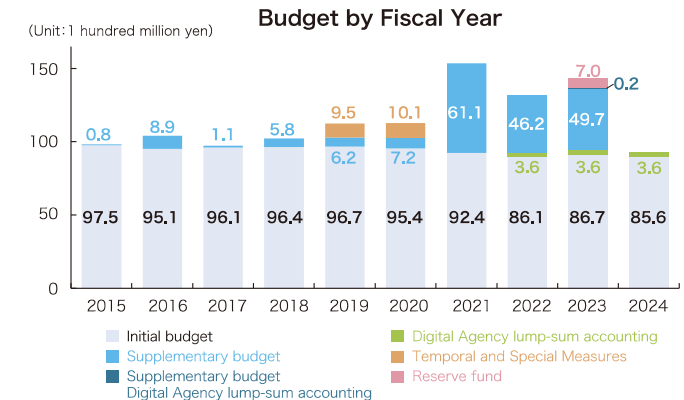
	Ministry of Popular Affairs Home Ministry	Ministry of Public Works	Ministry of Defense-Army Ministry- General Staff of the Imperial Army
1869	The Cadastral Map Section established in the Ministry of Civil Services to compile topographic maps and gather geographical data		
1871		Surveying Department established in the Ministry of Public Works to triangulate Tokyo area	The Intelligence Group established in the Army Ministry, taking charge of geographical surveying and cartography
1874		Transferred the Surveying Department to the Home Ministry	
1875	Initiation of major triangulation by the Home Ministry		
1883			Initiation of first-order triangulation survey and first-order leveling
1884	Integration of the Home Ministry's major triangulation project into the General Staff Office		The Survey Bureau established in the General Staff Office
1888	The Survey Bureau became the Imperial Land Survey, which became the Land Surveying Department in the General Staff Office the following year.		
			
	Land Surveying Department (Tokyo)		
1891	Origin of the Vertical Control Network established in the General Staff Office in Miyakezaka, Tokyo		
1892	Origin of the Japanese Horizontal Control Network established in Azabu, Tokyo (center of the meridian circle of the Tokyo Observatory)		
1908	Launch of the development of 1:25,000 topographic maps		
1915	First order triangulation survey completed		
1925	1:50,000 topographic maps of entire Japan finalized		
1945	Home Ministry, Ministry of Construction, and Ministry of Land, Infrastructure, Transport, and Tourism		
	The Geographical Survey Institute founded as an ancillary organ of the Home Ministry		
			
	Geographical Survey Institute (Chiba, Chiba Pref.)		
1948	The Ministry of Construction established, under which GSI is placed as an ancillary organ		
1949	The Survey Act promulgated		
1953	The Long-Term Plan for Basic Surveys publicly announced (from 1953 to 1962) Revised about every 10 years thereafter		
1956	Participation in Antarctic research expedition		

1958	Relocation from Chiba, Chiba Pref. to Meguro, Tokyo
	
	Geographical Survey Institute (Tokyo)
1960	The Japanese name of the Geographical Survey Institute, Chirichosajo, changed to Kokudochiriin
1969	The Coordinating Committee for Earthquake Prediction established
1974	Launch of Precise geodetic network surveys
1979	Relocation from Tokyo to Tsukuba, Ibaraki Pref.
	
	GSI Headquarters (Tsukuba)
1981	VLBI facility installed
1983	1:25,000 topographic maps completed (except for some remote islands)
1984	GSI designated as the special organization of the Ministry of Construction
1994	Launch of nationwide GPS continuous observation
1996	Opening of the Science Museum of Map and Survey
2001	The Ministry of Land, Infrastructure and Transport established with GSI as one of its special organization, GSI nominated as a designated administrative organ under the Disaster Countermeasures Basic Act, Revision of Survey Act (Adoption of the World Geodetic System)
2002	Nationwide GNSS CORS network completed
2003	Launch of Digital Japan Web System (current GSI Maps) Digital Map 25,000 published (National Geospatial Data Framework)
2007	The Survey Act revised (designed to promote the utilization of survey results), The Basic Act on the Advancement of Utilizing Geospatial Information (NSDI Act) promulgated
2011	Numerical coordinates of Origin of the Japanese Horizontal Control Network and Origin of the Japanese Vertical Control Network revised as a result of the effects caused by the "2011 off the Pacific coast of Tohoku Earthquake"
2014	Digital Topographic Map 25,000 and 1:25,000 Topographic Map completed nationwide Ishioaka VLBI observing facility established
2015	Digital Topographic Map 200,000 and Digital Map (Basic Geospatial Information 200,000) completed nationwide
2019	The Science Museum of Map and Survey welcomed one million visitors
2020	Tokyo Office was established
2022	Cabinet decision was made to Basic Plan for the Advancement of Utilizing Geospatial Information (4th Term)
2024	Public notice of the Long-Term Plan for Basic Survey (from 2024 to 2033)

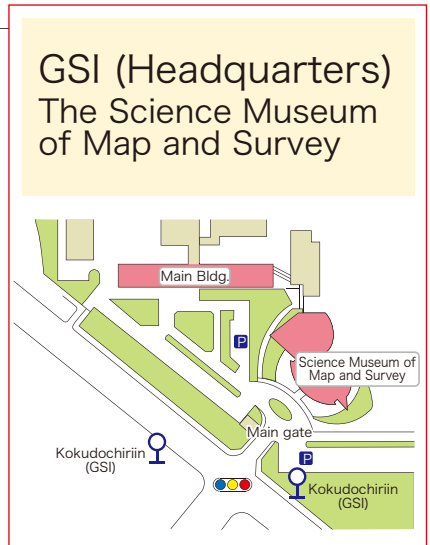
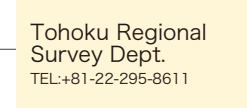
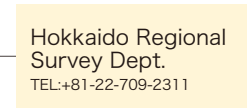
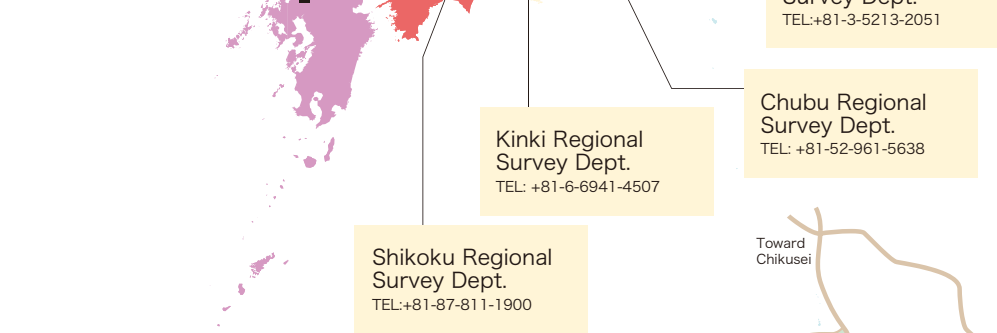
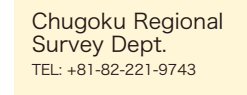
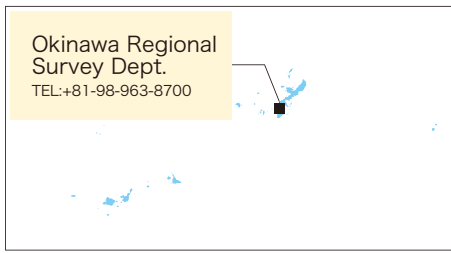
Organization



- FY2024 budget
8,921 million yen
- FY2023 supplementary budget
4,991 million yen



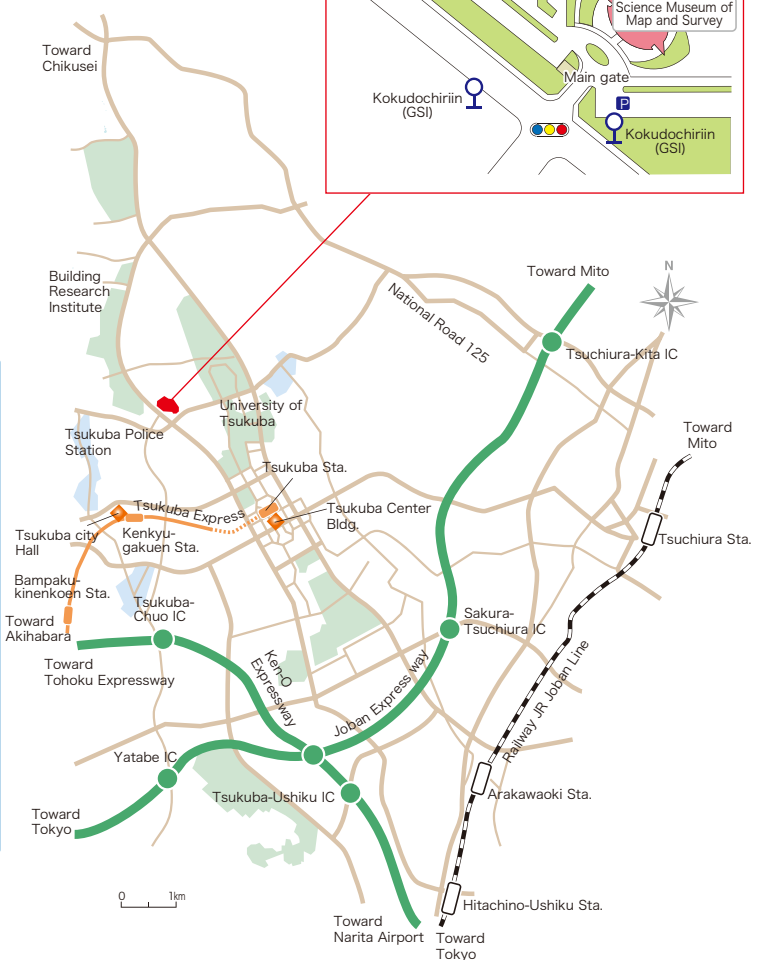
Location



Routes to GSI Headquarters

Railway	From Akihabara Sta.		From Kenkyu-gakuen Sta.	
	About 50 min. by Tsukuba Express semi-rapid service		About 10 min. by taxi	About 15 min. by Tsuku-Bus (Yoshinuma Shuttle) (Bus stop: Kokudochiriin)
Highway Express Bus	From Tokyo Sta. Ueno Sta.		From Tsukuba Sta.	
	About 45 min. by Tsukuba Express rapid service		About 10 min. by taxi	About 10 min. from Kanto Railway Bus terminal 5 for Building Research Institute or for Shimotsuna (Bus stop: Kokudochiriin)
Car	From Hitachino-Ushiku Sta. (East Exit)		From Tsukuba City Hall	
	About 60 min.	About 30 min. by bus for Tsukuba Center	About 70 min. by bus for Tsukuba Center or for Univ. of Tsukuba	About 100 min. by bus for Tsukuba Center
Car	From Narita Airport		From Yatabe IC	
	About 70 min. by bus for Tsuchiura/Tsukuba Center		About 30 min. drive on the Joban Expressway	About 20 min. drive on the road
Car	From Misato JCT		From Tsukuba JCT	
	About 30 min. drive on the Joban Expressway		About 10 min. drive on Ken-O Expressway	About 10 min. drive on the road

Geospatial Information Authority of Japan



Geospatial Information Authority of Japan (GSI)

Ministry of Land, Infrastructure, Transport and Tourism
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Phone: +81-29-864-1111
URL : <https://www.gsi.go.jp/ENGLISH/>

