



Surveying

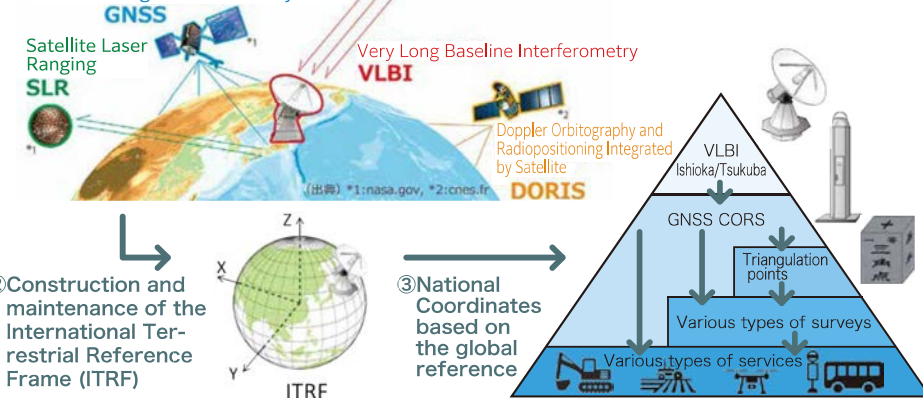
Establishing positional references

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.

① Geodetic observations on a global scale

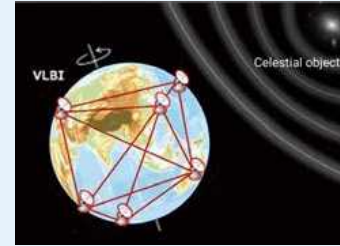
Global Navigation Satellite System



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.)

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.



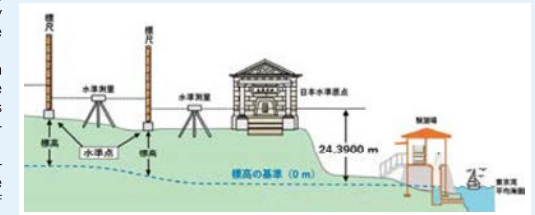
The position references on a global scale are constructed through international collaborative observations.

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.

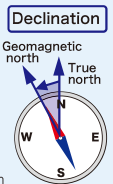


AQQ absolute quantum gravimeter

Geomagnetic surveys

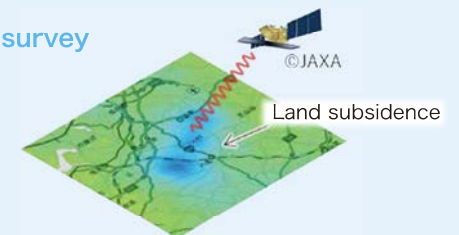
GSI has been conducting geomagnetic surveys in Japan since 1949 to clarify the geographical distribution of direction, intensity of the geomagnetic field, and their secular variations. In order to find accurate directions using a compass, it is necessary to understand the declination* of the entire country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



GNSS CORS