Abstract. T. Inoh was the first who completed a nation-wide map of Japan, in the beginning of the 19th century. He determined geodetic positions by distance and angle measurements and by astronomical observations.

When Japan entered into its modern era, about 100 years ago, the Military Land Survey was established and has conducted geodetic work in Japan ever since until the end of World War II. A German surveying system belonging to Helmert's school was adopted. The Ministry of Education organized later the Geodetic Commission which promoted the geodetic activities in cooperation with the Military Land Survey.

Comparison between the first and second nation-wide triangulation results obtained by the Geographical Survey Institute (GSI), the successor of the Military Land Survey, brought out marked horizontal land-deformations associated with a large earthquake. Repetitions of levelling survey also make it clear that vertical land-movements, well consistent with tide-gauge observation data, take place in association with earthquakes. The extensive subsidence in the Northeast Japan may be explained by assuming a sinking lithosphere, as is argued by the theory of plate tectonics. On the other hand, most local movements are closely correlated to pre-, co- and post-seismic land-deformations.

The nation-wide gravity survey carried out by the GSI disclosed a complicated gravity distribution in Japan. Ship-borne gravimeters have now been extensively working at sea. One of the recent highlights of gravimetric work is the detection of secular gravity changes which are in accordance with the secular changes of levelling data.

A portable absolute-gravity measuring instrument was constructed by the Earthquake Research Institute although it is still in a testing stage. Much advance has been made in the astrogeodetic observation devices since 1950's.

1. Introduction

Geodesy in Europe, generally speaking, has been developed on the assumption that the Earth is stable. On the contrary, Japan's geodesy is characterized by detecting and analyzing land-deformations on an 'unstable Earth'. Japan has long been suffering from many destructive earthquakes, almost always accompanied by marked land-deformations. It seems highly likely that almost everyone in Japan experiences a catastrophic earthquake at least once in life. Therefore, geodesy is closely related to earthquake research in Japan. The Imperial Earthquake Investigation Committee, which was a nucleus of earthquake research during the period from 1892 to 1925, worked in cooperation with the Geodetic Commission, the domestic organization corresponding to the International Association of Geodesy (IAG). At present, geodetic survey has become one of the most important disciplines of the earthquake prediction program, which is being intensively promoted in Japan.

The aim of this review article is to summarize geodetic work in Japan from the historical viewpoint and to cover some of the recent developments. To begin with, mention is made of T. Inoh, Japan's great geodesist in the pre-Meiji period. His meritorious work should be commemorated on the first page of Japan's history of geodesy. The Military Land Survey, which was established by a new government after the Meiji Restoration as the highest organization responsible for geodetic work,
accomplished many fruitful results, although much energy was spent on map-making from necessity of the national defense. Until the close of the World War II, the Military Land Survey played a leading role in Japan's geodetic work together with the Geodetic Commission and the Imperial Earthquake Investigation Committee as will be mentioned in Section 2.

After World War II, Japan's geodetic center was founded in the Geographical Survey Institute (GSI), which succeeded geodetic work from the Military Land Survey. The GSI has energetically promoted repetitions of precise levelling and first-order triangulation surveys in the hope of detecting anomalous land-deformations related to earthquake occurrences. Recent development of measuring techniques brought many findings concerning crustal movement. Meanwhile, the International Latitude Observatory of Mizusawa, which was established in 1899, has continued latitude observations. In cooperation with the GSI, geodesists in the Latitude Observatory, the Hydrographic Department, and universities carried out land and sea gravimetry, absolute determinations of gravity, distance measurements, satellite-geodetic observations, and so on. These points will be reviewed in Sections 4 and 5.

2. Pre-War Geodetic Activities

2.1. INOH, THE GREAT GEODESIST

Ancient relics in Japan tell us that some primitive landsurvey techniques must have been applied to the construction of large-scale tumuluses. In the seventh century, naturalized Chinese and Koreans introduced then-advanced surveying and mapping techniques, by means of which ancient cities such as Nara and Kyoto were laid out, into Japan. Although no trade with foreign countries was officially allowed during the Shogunate Period (1600-1867), some European surveying instruments were imported by Dutch traders in the seventeenth century.

T. Inoh (1745-1818) was the first who completed the map of the whole land of Japan (scale 1:864000) by making use of the European techniques in addition to the traditional map-making method. He also published regional maps on scale 1:36000, 1:216000 and 1:432000. The zero-longitude meridian having been assumed to pass through the Government Calendar Office in Kyoto, computations of latitude and longitude were made on a spherical Earth. The distance measurements were mainly made by means of scale-tapes and chains, and the angles were determined by quadrants. The positions obtained from the distance and angle measurements were finally corrected by astronomical observations of the positions of about 20 fixed stars. The maximum errors of meridian length and azimuth measurements were 1' and 0.3°, respectively.

It is surprising that Inoh completed almost all the landsurveys at his own expense, although he used to be a rich sake (rice wine) brewer. The Shogunate Government only gave him permission to survey the land of Japan without financial support. Some astronomers continued his geodetic work. It is evident that the successors had some knowledge of the Earth-ellipsoid, trigonometry, and logarithms. Inoh's geodesy,