

Geoelectric Observation used by the Telegraphic Facilities of NTT Corporation

by

Toshio MORI

Abstract

Unique geoelectric observations have been conducted in land and on the sea floor in the Kanto and Tokai districts in Japan, and progress has been made on original research. The geoelectric observations on land were conducted using the telegraphic facilities of Nippon Telegraph and Telephone Public Corporation (now NTT Company). The geoelectric observations on the sea floor have been observed by making use of the power-feeding arrangement of Permanent Ocean-Bottom Seismograph Observation Systems off Tokai and off the Boso Peninsula installed by the Japan Meteorological Agency. These geoelectric data are fairly high quality in comparison with conventional geoelectric data.

A comparison examination of the geoelectric data observed by NTT facilities was carried out with geomagnetic changes, geoelectric changes, seismic and volcanic activities, tide level changes, the weather elements, etc. Moreover, examination of the use of geoelectric noises was also performed.

The geoelectric observations using the electrodes and the underground metallic cables of NTT have been performed mainly in the Mito and Numazu telephone offices. The observations have the following two advantages in comparison with conventional methods: (1) The contact electric potential between the electrode and the soil seems very stable. Therefore, we can obtain stable data over a long time which is not affected by precipitation. (2) The base lengths for the observation are very long. The base lengths are 10 to 100 times longer than those for other ordinary observations in Japan. So, the observed field is affected by a large-scale structure.

The data observed at the Mito group are fairly noiseless, while the data at the Numazu and Fujinomiya groups contain large amplitude noises. In order to improve the detectability of self-potential variations related to tectonic activities, various methods were tried and developed by making use of these data. Especially, emphasis was placed on analysis by the method of real-time detection of anomalous geoelectric changes by removing components induced by geomagnetic variations with a stochastic difference equation.

As a result of investigating the relations between the observed geoelectric variations and tectonic activities, although no related change was observed in the Mito group, some abnormalities were found in the Numazu group. Anomalous electric potentials at the Numazu group took place simultaneously with the start of the earthquake swarm off the east coast of Izu on October, 1985. The electrical potential changes that took place ranged up to 300 mV in Atami, and 100 mV in Ito and Shuzenji. The Izu-Oshima volcano erupted on November 15, 1986. Before the start of the eruption, the geoelectric potentials at ODW were estimated to have decreased abruptly by 500 mV on November 6 and attained a maximum decrease of 800 mV on November 9.

Electrical potential changes relevant to tide level changes, and constituents of geoelectric change unrelated to geomagnetic change and long cycle change, were also detected.

It was shown that the observed electric noises are applicable to investigate the underground

structure and to detect underground electrical characteristic changes. If the earth potential is observed near the conductivity anomaly boundary, it will be thought possible to detect unusual sensitivity phenomena relevant to tectonic activities.

Comments on the English translation

The following will be noticed if a paper of about 15 years ago is put into English and read over again.

Mistakes were made in clarity and in some unsuitable expressions, such as in the names of places which are considered to be common sense by Japanese people, and in expressions where a simplified term was found. Corrections were made for those parts and explanation was added. Although notations of figures had portions which are not unified, since correction was difficult, the notation was left as it is, but explanations were added as much as possible.

As it is described in the "Circumstances of observation and acknowledgements," this paper was written when research business was being replaced with administrative business. Since it was thought that it would be difficult to return to research business as before, the data and ideas were hurriedly adjusted. In addition, since there was no Abstract in the text, it was written at this time.

Finally, the author is thankful to the personnel of the Magnetic Observatory who gave us this opportunity.