Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

MIS29-11 Room:101A Time:May 22 12:00-12:15

Inhomogeneity of the shallow resistivity structure inferred from EM surveys and resistivity logging data in Kanto Plain

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It is worried that huge geomagnetically induced currents (GICs) associated with sudden changes of the geomagnetic field affect society's infrastructures such as a power line and a communication network. Although the damage caused by GIC mainly happens in the area of higher geomagnetic latitudes, they may occur also in Japan if the greatest geomagnetism sudden change takes place. For the prediction of GIC, it is effective to carry out the simulation of the induced electric field on the surface of the Earth and GIC by using 3D resistivity structure (conductivity distribution of the Earth). Resistivity structures of many areas except urban areas have been clarified by electromagnetic (EM) methods for scientific research and resource investigation. In the city plains where the damage caused by GIC will concentrate, however, the resistivity structures are not clarified because the application of the EM methods is difficult due to a severe electromagnetic noise. Earth crust is generally heterogeneous as compared with a mantle. Especially the resistivity structure above a pre-Tertiary basement has high heterogeneity because various geologic formations from which solid state, water content, and salinity differ are distributed intricately. This suggests that GIC flows intricately there. Since the density of the electric current induced by the magnetic field variation is the largest near surface of the earth, it is important for prediction of GIC to know the sallow resistivity structure. So, I tried to estimate the resistivity structure of the thick Neogene and Quaternary sedimentary layers in Kanto Plain where population is concentrating most in Japan. In this research, the some results of EM surveys were used to estimate the resistivity structure in the circumference of urban areas. The resistivity logging of the wells excavated by investigation of urban disaster prevention or engineering works were referred to estimate the resistivity structure of the urban areas where no EM surveys were carried out.

Keywords: geomagnetically induced currents (GIC), sudden changes of the geomagnetic field, Kanto Plain, electromagnetic (EM) method, resistivity logging, shallow resistivity structure