

MT structural survey for a seismogenic zone in Sanriku-oki offshore

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In the magneto-telluric(MT) method, natural electromagnetic fields are used to investigate the electrical conductivity structure of the earth. The strengths of the method are its capability for exploration from very shallow depth to very great depth without artificial power sources. So this method is used for petroleum exploration in areas where reflection seismology is very expensive or ineffective, or geothermal exploration.

Marine Magneto-telluric(MMT) data was obtained along a line which is almost perpendicular to the northern part of the Japan Trench in 2000 by JAMSTEC, Earthquake Research Inst., and Chiba University. We intend to analyze the resistivity structure near the plate boundary between Pacific oceanic plate and Northern American plate by using the data. It is said that there is the thin conductive zone at the top of the Pacific oceanic plate, and that existence of the fluid on the plate boundary would play a key role in the generation of earthquakes. In the study of subduction factory, fluid circulation at subduction system has not been well imaged yet. So we clarified the resistivity structure by 2-dimensional inversion of MT method at the seismogenic zone.

It has been difficult to reconstruct sharp structural boundaries by 2-dimensional magneto-telluric data inversion due to the smoothness constraint in the past exercise. A new inversion scheme to reconstruct sharp structural boundaries is proposed to cope with this problem and to allow joint inversion type approach in the current MT surveys. We introduced structural boundaries from a P-wave velocity structure acquired from seismic reflection survey. It could be said that the sharp structural boundaries of P-wave velocity probably have relationship with that of the resistivity. As a result of analysis, the value of ABIC decreased by taking structural boundaries into consideration. Application of the method to the Sanriku data demonstrates that the transition in resistivity along the plate boundary lies at about 10km depth where the transition from the stable slipping area to the asperity has been perceived in seismological studies. We believe that the present method could be used for further MT studies jointly with the other methods such as seismic or geodetic surveys.