

Development and Preliminary Results of Taiwan's New Magnetotelluric Receiving System

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Abstract

The magnetotelluric (MT) method uses natural electromagnetic wave sources to observe underground electrical structures. By adjusting the duration of measurements and signal frequency, it effectively controls the target depth to be explored. This feature can be properly applied in wide-ranging and deep underground investigations, such as site assessments for carbon dioxide storage and geothermal potential evaluations. In Taiwan, the high cost of commercial MT receiving systems has led to a shortage of instruments. To solve this issue and design a recording system that better meets usage needs, the Industrial Technology Research Institute (ITRI) of Taiwan has developed a prototype ITRI-MT receiving system. To enhance the performance of the MT receiving system, this study rigorously evaluated various circuit unit, including the data logger, signal amplifier, and other circuit systems. A preliminary field test comparing data with the commercial PHOENIX MTU-5C system was conducted. The initial test results showed that the two systems had similar variation trends and energy intensity in the magnetic field components (H_x , H_y , H_z). However, the ITRI-MT system did not respond well to the electric field components (E_x , E_y). After repeated evaluation, adjustments to the signal amplifier configuration, AC/DC converter input impedance, and suppression of circuit electromagnetic interference effectively reduced the noise in the recording system. After field tests, the ITRI-MT receiving system was able to fully respond and record the magnetic and electric field signals of each component.

Keywords: Magnetotelluric, Electromagnetic, circuit system, input impedance, Electromagnetic interference