Study on the depth information of resistivity using frequency-domain airborne electromagnetic survey

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Airborne electromagnetic survey is a method to investigate the electrical resistivity distribution of the subsurface from the air using electromagnetic induction. And this method can be subdivided into the time domain type and frequency domain type.
Frequency domain type is a system using several combinations of the transmitter coil and receiver coil. And the survey is towing a sensor that contains the coils by the aircraft. In general, the depth of investigation of the frequency domain type is less than the time domain type. However, near-surface resolution of the frequency domain type is better.
The procedure of cross-sectional analysis of the frequency domain type shown below. First, create an apparent resistivity map for each frequency using the measured data. The next is to calculate the plot depth of apparent resistivity for each frequency. This depth is a function of frequency and apparent resistivity. Inversion has been studied in order to obtain accurate depth information. However, case study using a numerical model are many, but almost no study from the perspective of disaster prevention work.
This study is a report of the cross-sectional analysis using the actual data of airborne electromagnetic survey of the frequency domain type. We compared the apparent resistivity cross-section and the one-dimensional inverted cross section on the basis of the actual geological and groundwater information.
First, we were collected survey data of wide area slopes, including a large-scale collapse and landslides in the distribution areas of accretionary complex and volcanics. And, we were classified depth information of the apparent resistivity in a large-scale collapse of slopes and landslide slope. As a result, large-scale collapsed slopes and landslide slope(including the slope of the neighborhood) can be classified into two types. Type(1) is upper layer is high resistivity, and lower layer is low resistivity, and resistivity contrast between two layers is large. Type(2) is upper layer is low resistivity, and lower layer is high resistivity, and resistivity contrast between two layers is small. Focusing on moving scale of soil, we have found that there are many type(1) slopes near the large-scale collapsed.
So, we create the apparent resistivity cross section by Sengpiel(2000) using the actual measurement data at the type(1), and we applied a one-dimensional inversion to it. Next, we compared the each cross section and geological information and groundwater by the drill hole, and understand the accuracy of the resistivity distribution in the depth direction. As a result, the depth of the layer boundary of type(1) was almost the same in the apparent resistivity cross-section and the one-dimensional inversion analysis. From this, there is no accuracy problems in using the apparent resistivity cross section by Sengpiel(2000) in the preliminary investigation of the large-scale collapse of the type(1) slope.
On the other hand, the resistivity contrast of apparent resistivity cross-section of the type(2) is usually small. Therefore, quantitative analysis may be difficult.
The next, in order to increase the accuracy of depth information of resistivity cross-section of the type(2), we're intend to apply the one-dimensional inversion. Also, we want to continue the study using real data in disaster prevention work because there is almost no example of application of two-dimensional and three-dimensional inversion in the frequency domain airborne electromagnetic

survey.

Keywords: frequency-domain airborne EM, resistivity section, inversion