ループループ法によるデータをもとにしたマルカート法インバージョンの検証

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1-D Inversion of conductivity structure by the Marquardt method based on the loop-loop induction data

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Thre are several report with respect to the inversion of conductivity structure based on the indution method using transmitter and receiver coils. This kind of electromagnetic exploration is sometimes alternatively called the loop-loop method. One of the most widely used instruments is EM34-4 made by Geonics Ltd. This study mainly treats the data aquired by EM34-4.

By using EM34-4, we can obtain 6 kinds of data at a site, namely, VD(Vertical Diple) and HD (Horisontal Dipole) for the coil spacing of 10, 20 and 40m, respectively. Obtained each value reflects the information of different depth. The Atmost exploration depth is, so called, 60m by EM34-4.

Based on the data obtained by EM34-4 we can construct a three layered conductivity model under overdetermination. A structure inversion by the Marquart method requires some tips of technique but stability and speed of calculation can be achieved.

The surveys were carried out at Magi canyon, Ota Town, Senboku County, Akita Prefecture by the loop-loop method. The purpose of the surveys was not only for inspecting the underground, but also for operation check after introducing the instrument. There exists the apparent resistivity data obtained by the VLF-MT method at Magi canyon, so the results of the loop-loop method can be compared with those by the VLF-MT method along the same survey line. The total length of the survey line is 8800m and the data were obtained at 100m intervals. Consequently the number of the total observation sites is 89.

There were several observation sites where the measured values show minus ones. I suspected they were caused by the noise from artificial bodies with extremely high conductivity. Therefore I did further experiments to examine the effect on measured values from high conductive bodies. Viewing from the results of the experiment, I couldn’t ignore the influence from wire nettings along the survey line, but the influence from cars on the ground and drums buried in subsurface underground was small enough to ignore.

I removed the data shown minus values at present. After translating the conductivity data into resistivity ones and smoothing, I compared the results by the loop-loop method with those by the VLF-MT method. The overall trend of the measured values obtained by each method was similar to each other, so I regarded the measured values obtained by the loop-loop method, which was newly introduced, as appropriate.

In order to construct the model of shallow resistivity structure at Magi canyon using the result by the loop-loop method, I developed an inversion program code. The three layered resistivity structure up to about 100m depth under the ground at each observation site can be analyzed by using this program.

I constructed the model of shallow resistivity structure along the survey line at Magi canyon by the program developed in this study. From the comparison of this model with geological map, I drew conclusions as follows: High resistive bodies of 1000m in the model are intrusive rocks, since the locations of high resistivity and intrusive rocks are well-consistent each other. We can recognize a high resistive body that shows 1000m at the part of the model, but that can’t be seen on the geological map as an intrusive rock. From this fact, we can suggest the existence of an unknown intrusive rock on the geological map. And more, I can detect structures of anticline and syncline in the resistivity model, which are correspond to counterparts on the geological map.

After all, I can say in this study that the resistivity structure model using the loop-loop method, which can be discussed with geological information were successfully put out.