ループループ法のための高精度三次元フォワード構造解析計算の検討

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Confirmation of precise numerical 3-D forward calculation of subsurface structure for loop-loop induction method

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The loop-loop induction method is one of electromagnetic exploration tools using a pair of transmitter and receiver coils for subsurface electrical structure. The loop-loop method is sometimes called as slingram method.

Although there are some kinds of manufacture instrument for the loop-loop method, we are now rather taking Geonics EM-34-3 into consideration. EM-34-3 has a pair of coils with 64 cm diameter and three lengths of coil separation cables, ie. 10 m, 20 m, 40 m. The exploration depth for the low induction number like as the loop-loop method is depending on the coil separation of transmitter and receiver. The exploration depths of EM-34-3 are from 7.5 m to 60 m for each length of separation and type of coil alignment.

Traditionally, the loop-loop method has been mainly used for reconnaissance survey and the 1-D analysis (McNeil, 1980) has been popularly adopted.

We sometimes faced on the negative apparent conductivity as observed value at high conductivity or high contrast of electrical structure areas. 1-D analysis of the loop-loop method is convenient but not able to apply to the negative apparent conductivity because 1-D electric structure never produces the negative apparent conductivity.

Now we focus on the theory of 3-D forward calculation introduced by Perez-Flores et al. (2012). They show the equations for apparent conductivity for types of coil alignments of VMD (vertical magnetic dipole) and HMD (horizontal magnetic dipole). The equations can calculated the apparent conductivity for complicated 3-D structure and can be used for even negative apparent conductivity. Perez-Flores et al. (2012) show some kinds of result for the structure models but we cannot know exact numerical calculation. We make consideration of pragmatic numerical calculation and find out succeeding method at present.