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Complex resistivity survey for mineral exploration using L1 norm inversion

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Complex resistivity method is a kind of induced polarization (IP) method. It transmits the sinusoidal current in frequency domain through the current electrodes and measures the absolute phase and amplitude at the receiver electrodes to the transmitted current. IP method had been used for the mining exploration, and now it expands its application, like hydrogeology and environmental purpose due to the recent development of instrument that make it possible to measure very small IP effect in the soil. Various studies for the procedure of field measurement and related interpretation technique were done already, and our research group has been doing the study on its application for the mineral exploration from several years ago by relating the complex resistivity from the inversion of field data with that from the laboratory measurement of core sample using geo-statistical method. However, it is very sensitive to the field noise, especially in measuring absolute phase and it is to be solved to get reasonable results from the inversion of these data. In order to solve noise problem, we introduced an L1-norm inversion technique to our existing inversion program that is very effective in suppressing the errors caused by field noise. We modified our existing inversion code, and applied it to the real data that we've acquired at our test area. CR survey was done twice for the purpose of analyzing the surface geology in the area, and at the same time resistivity data was also acquired for the same survey line. According to the results of this survey, we identified that the contact resistance of electrode and the position error would cause an artifact in the inverted section. And we also identified that that inversion results from L1-norm inversion was more reliable than those from L2-norm inversion in the view of noise characteristics. Especially its difference is noticeable in the phase section compared to the resistivity section of IP and resistivity survey. We cannot see any noticeable difference in the resistivity sections between the results of two different inversions, and can infer that noise characteristics of resistivity section is better than those of phase section. We conclude that L1-norm inversion technique is very useful due to its improved noise characteristic, and is to be applied for the many data from various field surveys to verify its usefulness. We think that it is needed to continue the study to check the differences on the resulting section with the choice of various object functions also.