



The study on multi-frequency GPR data fusion

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Ground-penetrating radar (GPR) is a geophysical method using high-frequency electromagnetic waves to detect and locate the subsurface objects and interfaces. It can get high resolution but shallow propagation depth with higher centre frequency, while low resolution but deeper depth with lower centre frequency. It's hard to simultaneously take into account the detection depth and resolution due to the only one centre frequency of a GPR antenna generally. Multi-frequency GPR data fusion is proposed here to try to solve this problem. Firstly, registration of spatial information of GPR forward simulation data of three main frequencies is established. Then, data fusion process is carried out respectively by using four different algorithms: time-domain fusion without weight, time-domain fusion with weight, frequency-domain fusion without weight and frequency-domain fusion with weight. The fusion effect is qualitatively and quantitatively evaluated and compared with the two factors: information entropy and four-point mean gradient. The results of multi-frequency data fusion show that the fuse profile not only retains the high resolution capability of the high-frequency antenna in the shallow part, but also reflects the advantage of the large propagation depth of the low-frequency antenna, and realizes the complementary advantages of the high and low frequencies antenna. Also, the real field GPR data is handled by the proposed data fusion methods, and it definitely makes the GPR image clearer and more subsurface information included.