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Multiples suppression scheme of waterborne GPR data

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Ground penetrating radar (GPR) is a geophysical method that uses high frequency electromagnetic waves to detect underground or internal structures of objects. It has been widely used in the Geo-engineering and environment detection. In recent years, GPR has played an increasingly important role in shallow underwater structure survey due to its advantages of economy, high efficiency and high accuracy. However, due to the strong reflection coefficients of water surface and bottom for electromagnetic waves, there are multiples in the GPR profile acquired in waters, which will reduce the signal-to-noise ratio of the data and even lead to false imaging, finally seriously affect the reliability of the interpretation result. With the increasing requirement of high-precise GPR detection in waters, multiple suppression has become an essential issue in expanding the application fields of GPR. In order to suppress multiple waves in waterborne GPR profile, a novel multiple wave suppression method based on the combination scheme of the predictive deconvolution and free surface multiple wave suppression (SRME). Based on the validity test of one-dimensional data, the adaptive optimizations of these two methods are carried out according to the characteristics of GPR data in waters. First, the prediction step of predictive deconvolution can be determined by picking up the bottom reflection signal. Second, the water layer information provided by the bottom reflection is used in continuation from the surface to the bottom to suppress the internal multiples. The numerical model and real data test results show that each single method can suppress most of the multiples of the bottom interface and the combination strategy can further remove the additional residues. The research provides a basis for the precise interpretation of GPR data in hydro-detection.