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Near-Surface 3D Imaging of Buried Metallic Objects Using Real-Time Data Fusion of GPR and IGPS
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ABSTRACT

The 3-Dimentional GPR image allowed the generation of time/depth slices images that effectively illustrate the geometry of the near surface structures. Moreover, crossline image resolution in the order of centimeters is needed for detecting small targets. Therefore, a new 3D GPR system has been developed to measure the position with millimeter accuracy. In this system, positions data is obtained by iGPS, which provides millimeter accuracy x, y, and z coordinates simultaneously from a small detectors attached to moving GPR antennas. For a heterogeneous subsurface, minimum grid spacing of GPR measurements is required and has to be an eighth of a wavelength or less in all directions for correct grid-point assignment. This clear image could not be achieved with the conventional GPR which includes a few centimeter position errors.

A 500 MHz commercial GPR system and rotary laser positioning system (RLPS) have been used at two pre-designed test sites belong to Osaka Gas Company. These two sites have quiet complicated buried pipes at different depths and with different diameters. The data was acquired along survey having 5cm inline and 2.5cm crossline spacing. Both iGPS and GPR data is stored independently and later regularized, fused and re-arranged on rectangular grid. A 3D-fk migration of the three dimensional fused data on the basis of a constant velocity (7.5 cm/ns) is performed. The 3D migrated depth slice data has been used for picking the buried objectives only by extracting the positive and negative high amplitudes in each individual slice. Such high amplitudes picks have been displayed in a 3D cube for better visualization.

キーワード: IGPS, GPR, Data fusion, 3D-fk migration, 3D imaging, Buried objectives
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