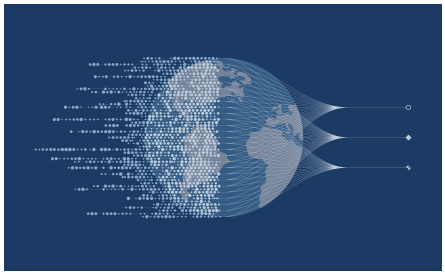

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open source software GPRmax for simulating GPR scenarios relevant to OSI missions

Ground Penetrating Radar (GPR) is a crucial geophysical technique used by the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) during On-Site Inspections (OSI) to detect and investigate subsurface anomalies potentially associated with underground nuclear tests. This paper explores the application of the open source software "GPRmax" to simulate GPR scenarios relevant to OSI missions. GPRmax, which employs the Finite-Difference Time-Domain (FDTD) method for the resolution of Maxwell's equations, enables realistic modeling of electromagnetic wave propagation through various geological environments. This study focuses on simulating typical OSI scenarios, including the detection of underground cavities, tunnels, and other subsurface features that may indicate nuclear testing activities. The flexibility of GPRmax allows the customization of antenna frequencies, soil properties, and target compositions, which are vital in optimizing GPR system parameters for diverse OSI conditions. Simulations demonstrate GPRmax's capability to model complex subsurface environments accurately and provide critical insights for field operations. Validation against real world data confirms the software's reliability and effectiveness. As an open source tool, GPRmax fosters collaboration, allowing CTBTO researchers and inspectors to enhance and adapt GPR models to meet specific mission requirements. This study underscores GPRmax's value in advancing GPR methodologies for nuclear test monitoring and OSI operations.

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