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GPR Modeling with ReflexW for Hydrogeological Characterization of Watershed Zones in Belém, Brazil

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Introduction

This work presents a study using Ground Penetrating Radar (GPR) for hydrogeological investigation of shallow aquifers in the Utinga region, in Belém (PA), Brazil. The research integrates numerical modeling using the ReflexW software with real field data, aiming to evaluate the method's response to local geological and hydrological conditions. The study area is located within an environmental protection zone and plays a strategic role in the recharge of groundwater that supplies part of the capital city of Pará.

Method

Synthetic models were developed to represent different stratigraphic profiles and moisture variations, simulating GPR signal behavior in scenarios consistent with the reality of Utinga. The parameters used included a 200 MHz antenna, various dielectric contrasts, and variable layer thicknesses. Real data were acquired at strategic points in the area and processed for comparison with the models. The joint analysis revealed significant correlations between the simulated and acquired radargrams, particularly in lithological transition zones and potential saturated interfaces.

Conclusions

The integration of numerical modeling in ReflexW with field-acquired data is expected to contribute to a better understanding of GPR responses in tropical hydrogeological

environments such as Utinga. The comparison between synthetic and real radargrams may enable preliminary identification of lithological transitions and saturated interfaces, assisting in the delineation of geological layers and in the suggestion of potential recharge zones. The adopted approach seeks to reduce ambiguity in data interpretation and enhance GPR's potential as a support tool in hydrogeological studies. The results obtained may serve as a foundation for future investigations, including 3D modeling and integration with other geophysical techniques, aiming at a more detailed characterization of shallow aquifers in the studied region.