

Effects of Water Content on the Detection of Buried Objects Using GPR

Guilherme Zakarewicz^{1*}, Susanne Maciel², Luísa Lins³

^{1,3}Universidade de Brasília (UnB), Instituto de Geociências, Brasília, DF

²Faculdade UnB Planaltina (FUP), Brasília, DF

*guilherme.zakarewicz.97@gmail.com

ABSTRACT

Recently, GPR has been widely used in forensic investigations for non-invasive identification of buried bodies. In this study, we analyzed how the variation of water content of buried targets affects their identification. The results have important implications for forensic investigations and highlight the importance of considering water content in targets for GPR detection studies, as the identification of completely dry objects was only possible with the application of artificial gains in the data.

Keywords: ground-penetrating radar, clandestine graves, dielectric permittivity.

Introduction

The geophysical method GPR (ground-penetrating radar) has several applications in forensic sciences for non-destructive identification of buried bodies and targets (Castro and Cunha, 2021). The variation of water content in buried objects alters their dielectric permittivity, resulting in different responses in the obtained radargrams (de Aguiar et al., 2021).

Objectives

Assess how the variation of water content in objects affects their identification in radargrams.

Methods

We conducted the data acquisitions using a 2.6 GHz antenna in a sandbox. To obtain samples with different moisture levels, we exposed tree trunks (5 cm diameter) to water for different time periods, as wood samples retain moisture more easily. We analyzed six different groups based on the moisture levels of 50 samples. For data processing, we used the *Reflex-Win* software (version 7.5).

Results and Discussion

Figure 1 shows the results of the GPR imaging for one sample of each group. We identified the dry samples only after applying artificial gains to the data (Fig. 1a), while all other levels of moisture were

detected without the need for gains. We found that the estimated diameters of the samples showed significant variations, ranging from 3.2 cm in dry to 9.5 cm in saturated samples. Thus, the amount of water in buried objects is a crucial factor in GPR's non-invasive detection of targets, such as clandestine graves.

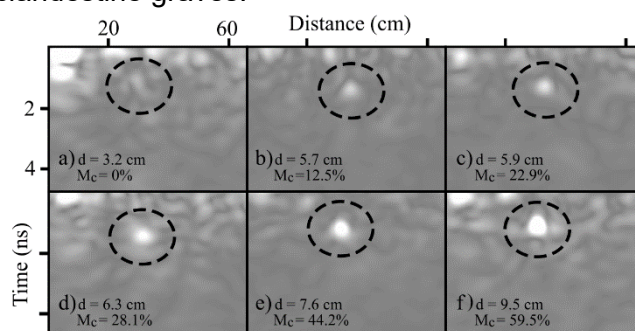


Figure 1. Resulting radargrams, samples' estimated diameters, and moisture content.

Conclusion

The results indicate that the amount of water should be taken into account in the detection of objects. Dry targets were only identified after the application of gains to the data, and the estimated diameters varied according to the samples' water content. Hence, it is necessary to consider the moisture content of objects when using GPR for forensic investigations, such as in the non-destructive identification of clandestine graves. Subsequent studies should focus on targets that are anatomically similar to human remains, e.g., pigs.

References

- Castro, K. C. P. L., and L. S. Cunha, 2021, Forensic investigations with the identification of human remains with ground penetrating radar (GPR): A review: *Estudos Geológicos (UFPE)*, 31, 64–86.
- de Aguiar, G. Z., L. Lins, M. F. de Paulo, S. T. R. Maciel, and A. A. Rocha, 2021, Dielectric permittivity effects in the detection of tree roots using ground-penetrating radar: *Journal of Applied Geophysics*, 193, 104435.

Realização