Full-waveform inversion of Ground Penetrating Radar data for target characterization in multilayer environments

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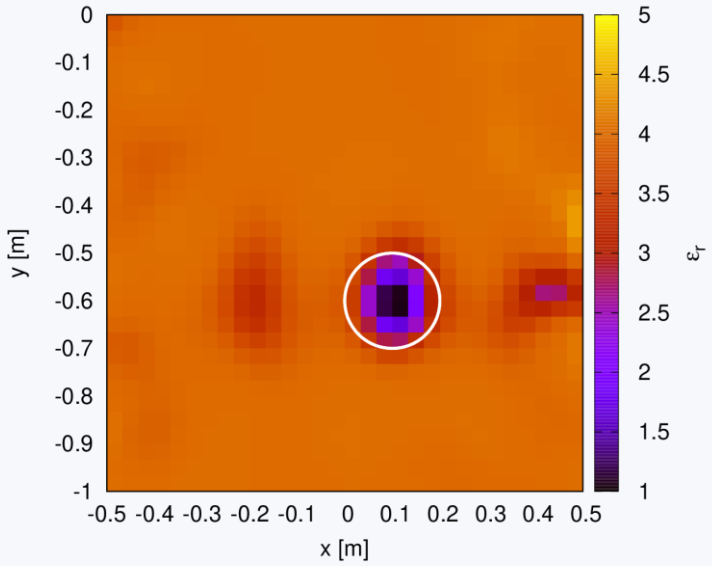
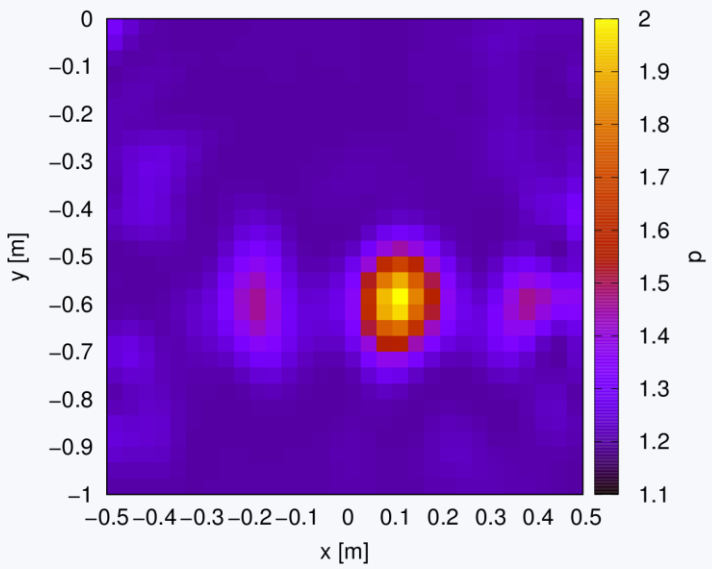
In this contribution, the full dielectric characterization of an underground region of interest is retrieved by a quantitative inversion approach that works in the mathematical framework of Lebesgue spaces with variable exponents [1]. The most important parameter of this algorithm is represented by the map of the exponent function inside the investigation domain [2]. Numerical results in a cross-borehole configuration are presented to check the effectiveness of the inversion approach.

Reconstructed relative dielectric permittivity



Map of the exponent function



Ground: $\epsilon_r = (4, 0.6)$; **Target**: Ø 0.2 m, $\epsilon_r = 1$; **Configuration**: multistatic cross-borehole, 22 meas. pts., 300 MHz

[1] C. Estatico, A. Fedeli, M. Pastorino, and A. Randazzo, "Quantitative microwave imaging method in Lebesgue spaces with nonconstant exponents," *IEEE Transactions on Antennas and Propagation*, vol. 66, no. 12, pp. 7282–7294, Dec. 2018, doi: 10.1109/TAP.2018.2869201.

[2] C. Estatico, A. Fedeli, M. Pastorino, and A. Randazzo, "Microwave imaging by means of Lebesgue-space inversion: An overview," *Electronics*, vol. 8, no. 9, p. 945, Sep. 2019, doi: 10.3390/electronics8090945.