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3D GEOPHYSICAL EVALUATION IN THE COURSE OF THE CHARACTERIZATION OF A MUNICIPAL WASTE DEPOSIT SITE

Abstract:

Due to the overconsumption and the insufficient waste management in the past, old landfills are today part of the Belgian landscapes. Besides the growing interest in old landfills from an environmental perspective, their exploitation, in terms of material extraction and reuse, perfectly adheres to the growing concept of circular economy and is further supported by the benefits coming from land recovery. The characterization of landfills is consequently becoming an operation key nowadays.

The present master thesis tends to evaluate the pertinence of three different geophysical methods for the characterization of a former landfill located in Onoz. For this purpose, 2D and 3D models of physical properties are computed. The Electrical Resistivity Tomography (ERT) (**Figure 1**) and the Induced Polarization (IP) (**Figure 2**) enables the detection of highly conductive lenses of lime and ashes within a layer of backfill and waste. Moreover, in the northern part of the landfill, the transition between the bedrock and the overlying waste layer is being brought to light. Unfortunately, in the southern part of the landfill, both methods show an overestimation of the highly conductive lime and ashes body, which impacts the detection of the bedrock, in the 3D models as well as in the 2D models. This limitation of the methods was expected thanks to the synthetic model previously computed, avoiding any misinterpretation even in the absence of an adequate model appraisal tool. The Horizontal to Vertical Noise Spectral Ratio (HVNSR) demonstrates different uses in the landfill characterization. Firstly, in the lower part of the site, the HVNSR is used to delineate the different waste zones by simply crossing the information from the H/V graphs obtained with the boreholes (**Figure 3**). In the upper part of the site, the HVNSR is combined with two available boreholes in order to compute the approximate average shear wave velocity of the lime and ashes. Following some assumptions, it is possible to calculate the thickness of the layers of lime and ashes, allowing the approximation of their total volume in this zone.

Keywords: Geophysics, landfill, Electrical Resistivity Tomography (ERT), Induced Polarization (IP), Horizontal to Vertical Noise Spectral Ratio (HVNSR), forward modelling.

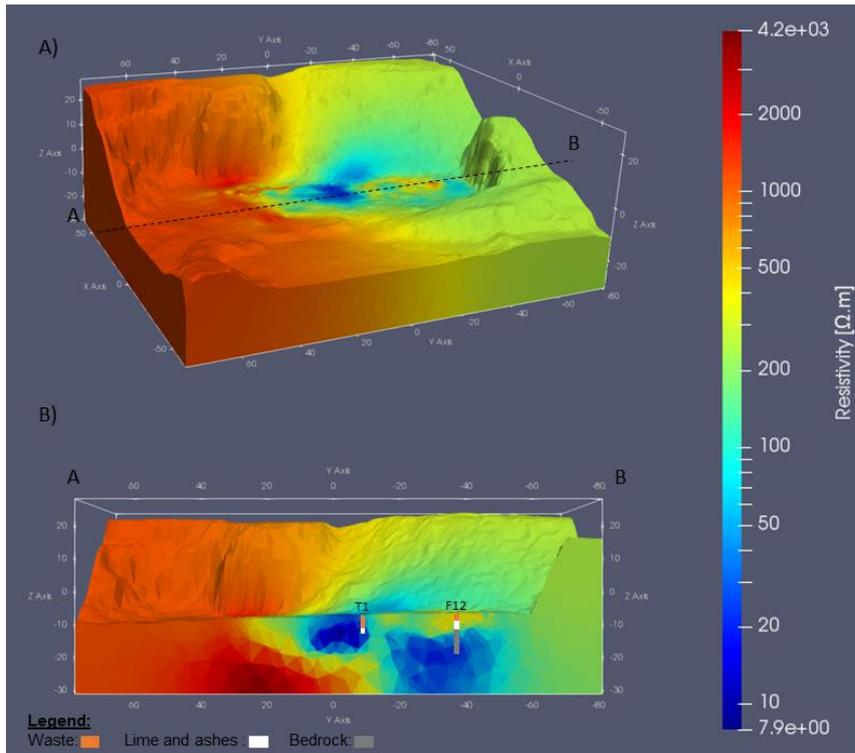


Figure 1. Resulting resistivity images of the inversion of the real dataset. **(A)** Global vision of the resistivity distribution **(B)** cross-section of the dashed line of **(A)**, with comparison with borehole F12 and trenches T1 previously drilled

Figure 2. 3D global IP model of the landfill

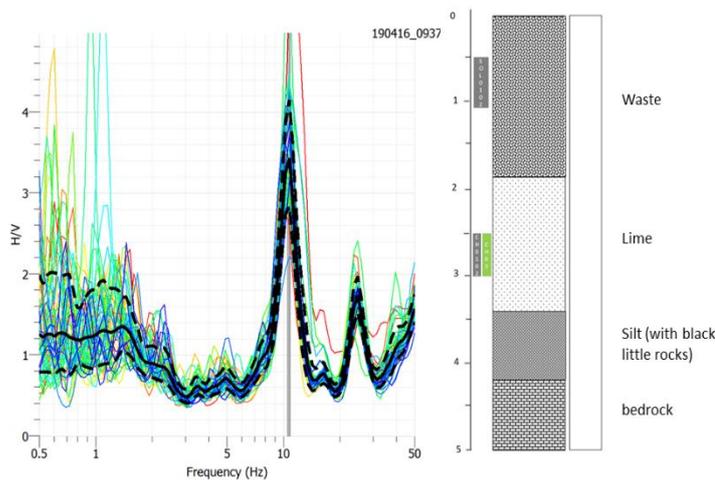
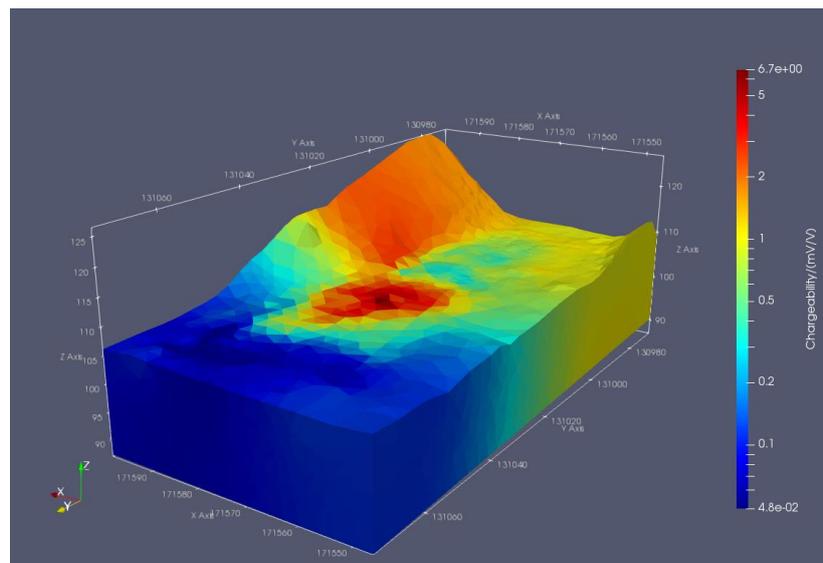


Figure 3. Comparison of a H/V curve obtained from a measurement performed in the lower part of the landfill with the corresponding borehole