A generic current source inversion algorithm for Mise-à-la-masse prospection : application on case studies

Tentatively in Computer and Geosciences

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Core ideas

* Propose an open source and generic algorithm to invert current source density in Mise-à-la-Masse prospection
* Model appraisal and uncertainties
* Show the application of the algorithm on three different contexts: plant root imaging, landfill leakage and salt intrusion monitoring
* Address pip to download the open source python package “pyMALM”: coming soon

Abstract

*Keywords:* Mise-à-la-masse, inversion, ERT, curent density

1. Introduction

* MALM Fundamentals: Parasnis 1973, Schlumberger, Stierman 1984
* Landfill MALM : (Binley et al., 1997), (Colucci et al., n.d.), (Binley et al., 1999), (De Carlo et al., 2013)
* MALM applied to tracer injection/ contamination plume delineation: (Perri et al., 2018)
* Roots imaging MALM : (Mary et al., 2020, 2019, 2018), Peruzzo et al. in Plant and Soil
* Inversion MALM : (Shao et al., 2018), (Binley et al., 1997), (Colucci et al., n.d.), (Binley et al., 1999), (Wondimu et al., 2018), (Hatanaka et al., n.d.)
* Recent python library nversion codes (Blanchy et al., 2020), (Rücker et al., 2017)
* Model appraisal: (Binley and Kemna, 2005), gars cours venice , (Ren and Kalscheuer, 2020)
  1. Background
  2. Potential of MALM for environmental studies
  3. Existing approaches for MALM inversion

1. Structure of the code
   1. Linear formulation of the problem
   2. Model appraisal and uncertainties
2. Applications
   1. Case of root system imaging
   2. Case of landfill leakage
3. Conclusion

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Figures

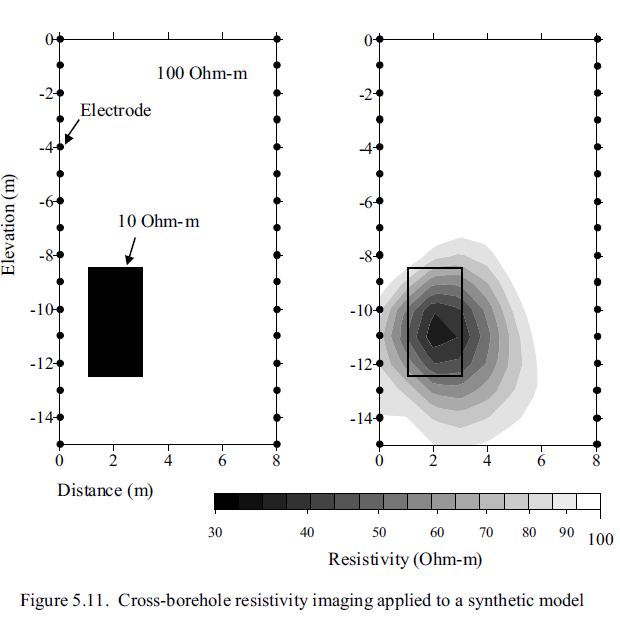
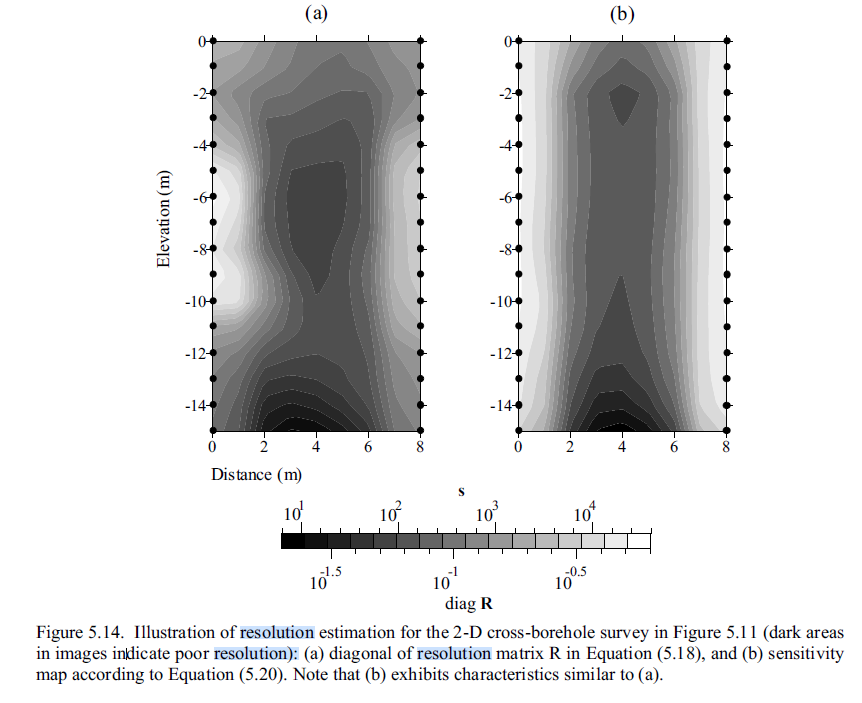
 

Figure 1: model appraisal and uncertainties

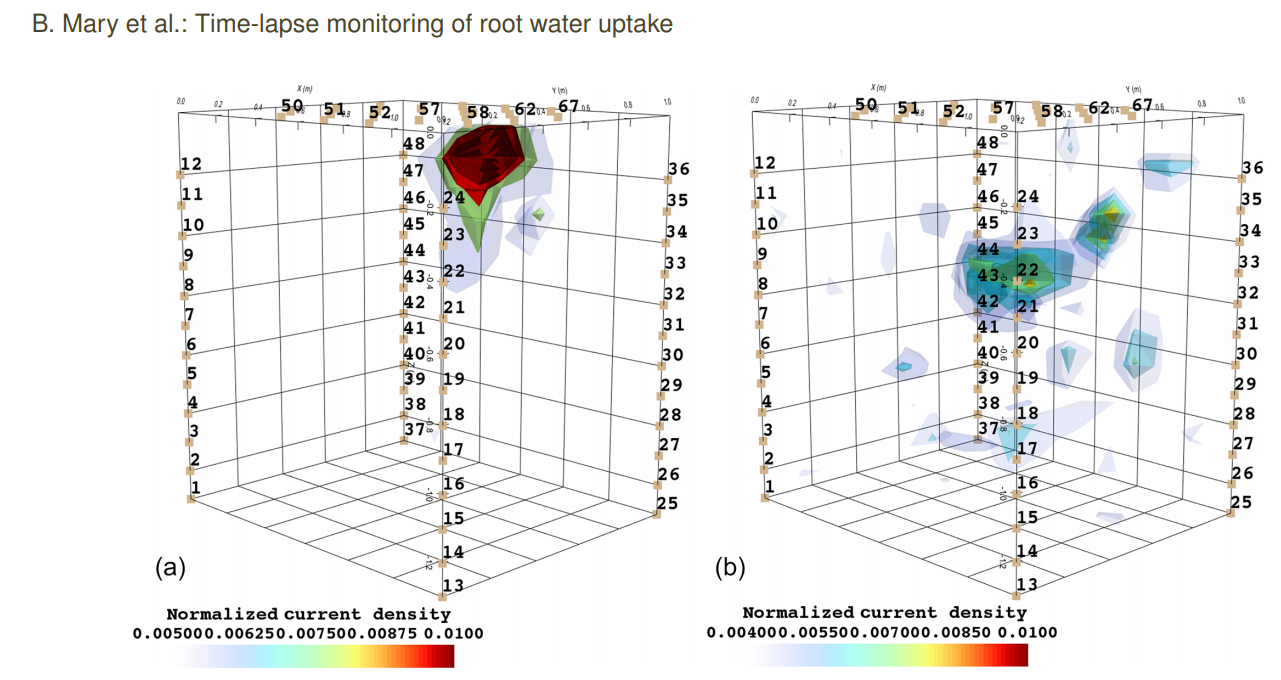
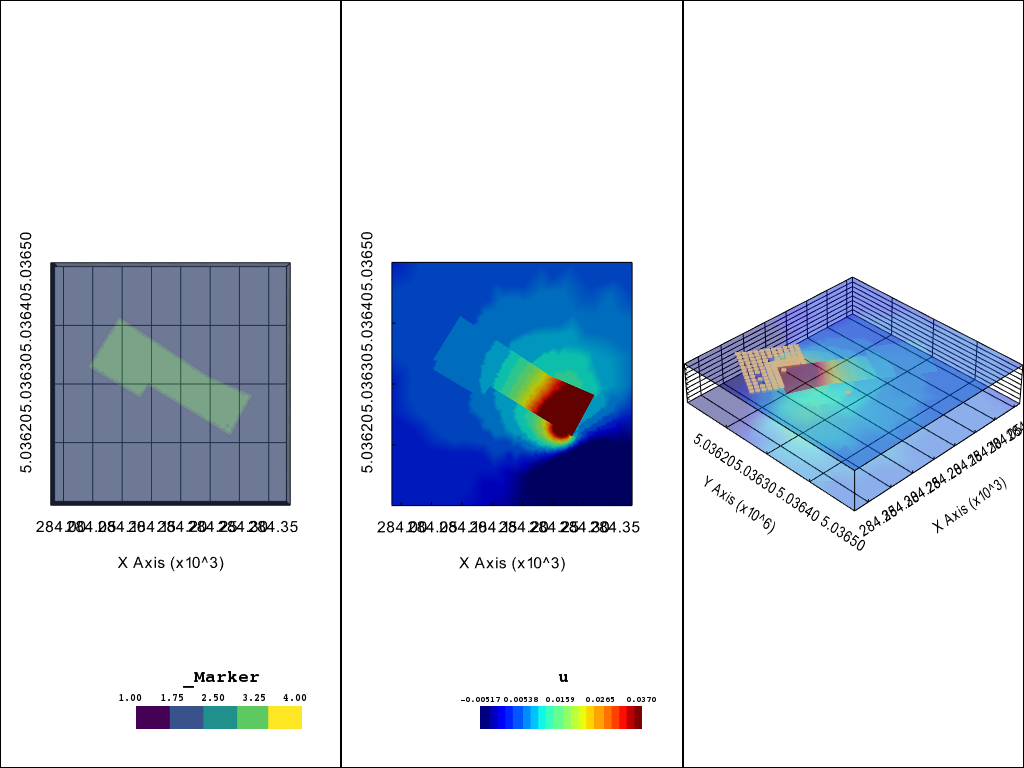
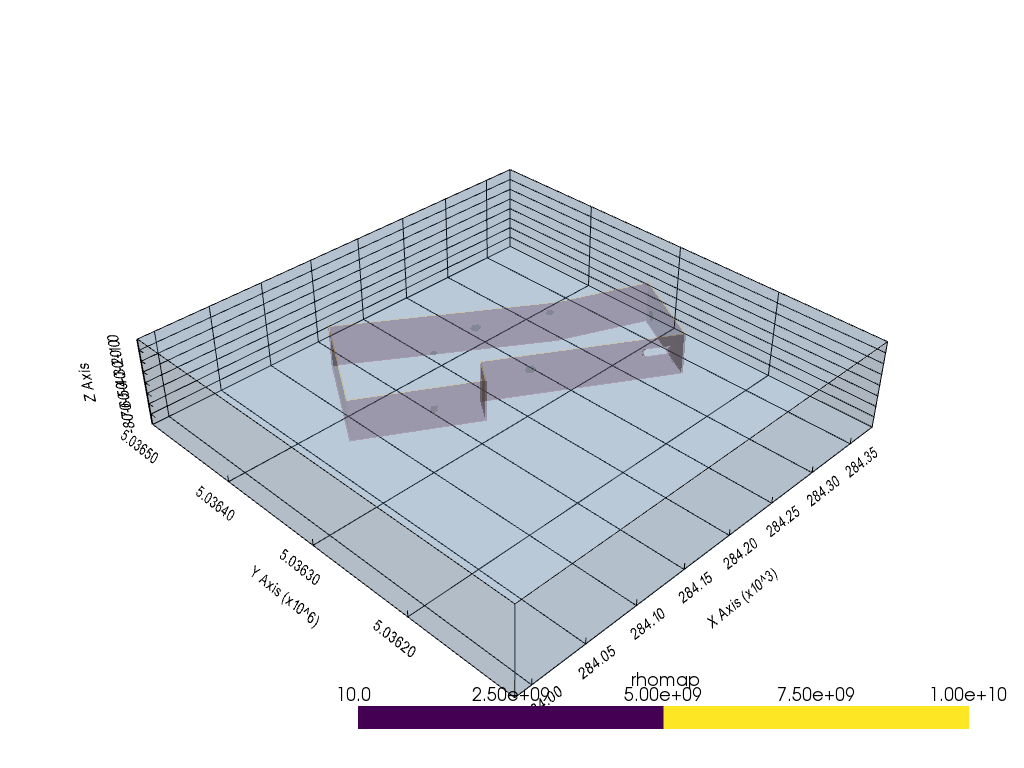


Figure 2: application of MALM on plants (ref Mary et al. 2020) and identifications of active roots areas after current inversion. The figure shows (a) the current distribution aftera single-source injection into the soil, (b) the current distribution for a stem injection.



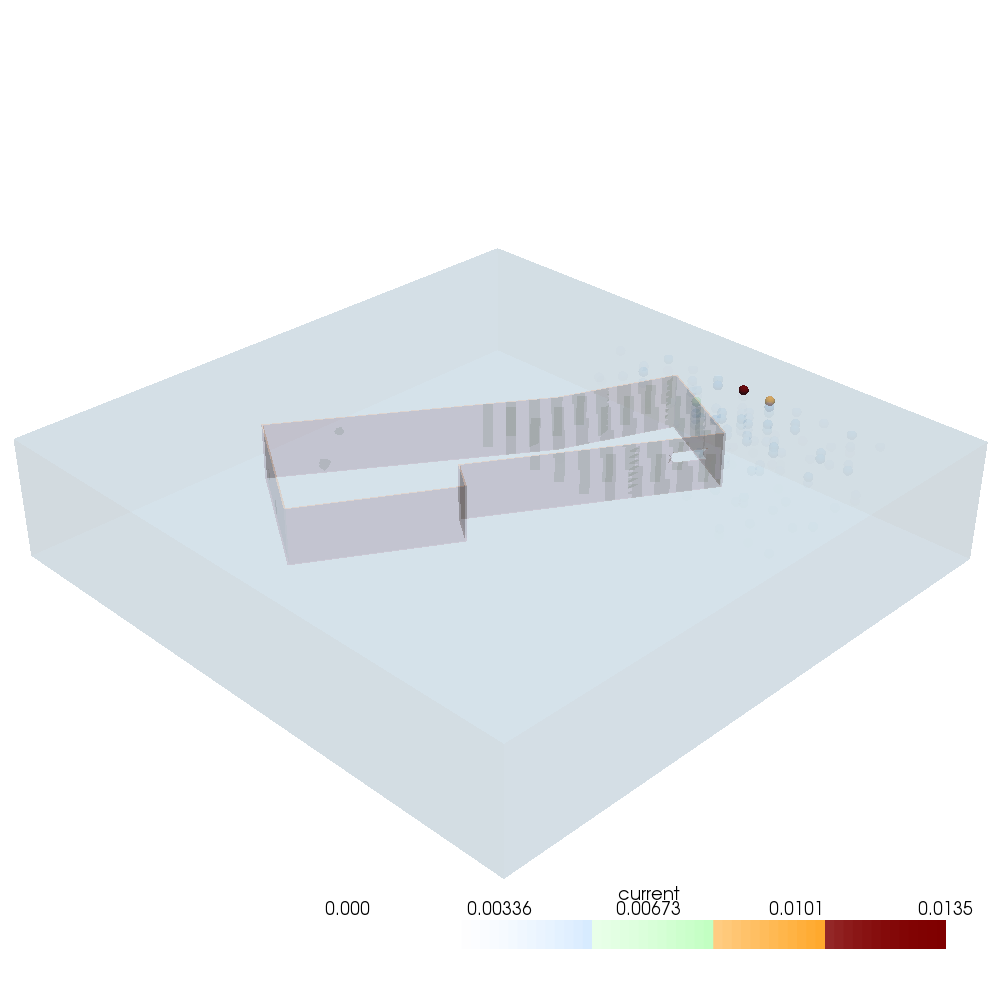
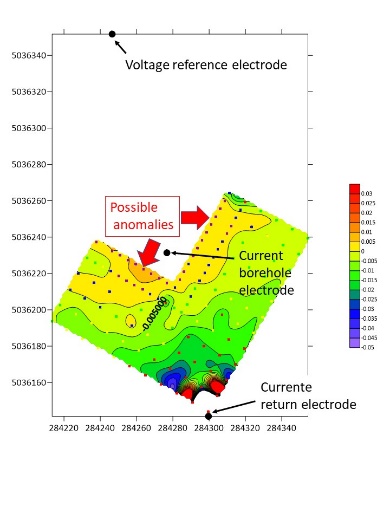


Figure 2: Application of the algorithm on a 3d landfill leakage (Landfill Porto Marghera). (a) initial map of resistivity showing the landfill delineation and the presence of a hole in the liner. (b) result of potential field u for the MALM simulation (c) voltage distribution from field acquisition (d) source current density after inversion of synthetic data. The ICSD shows here all its usefulness when the remote electrodes are not enough distant and pollute the signal and interpretation of equipotential.

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Borehole-to-surface electrical resistivity monitoring of a salt water injection

Experiment 🡪 modelling in MALM Bevc

Recent paper of Blanchy and pygimli team

Paper Revil

Papier Maria Theresa

Papier Abdoulsamad et al 2019 leak in a dam