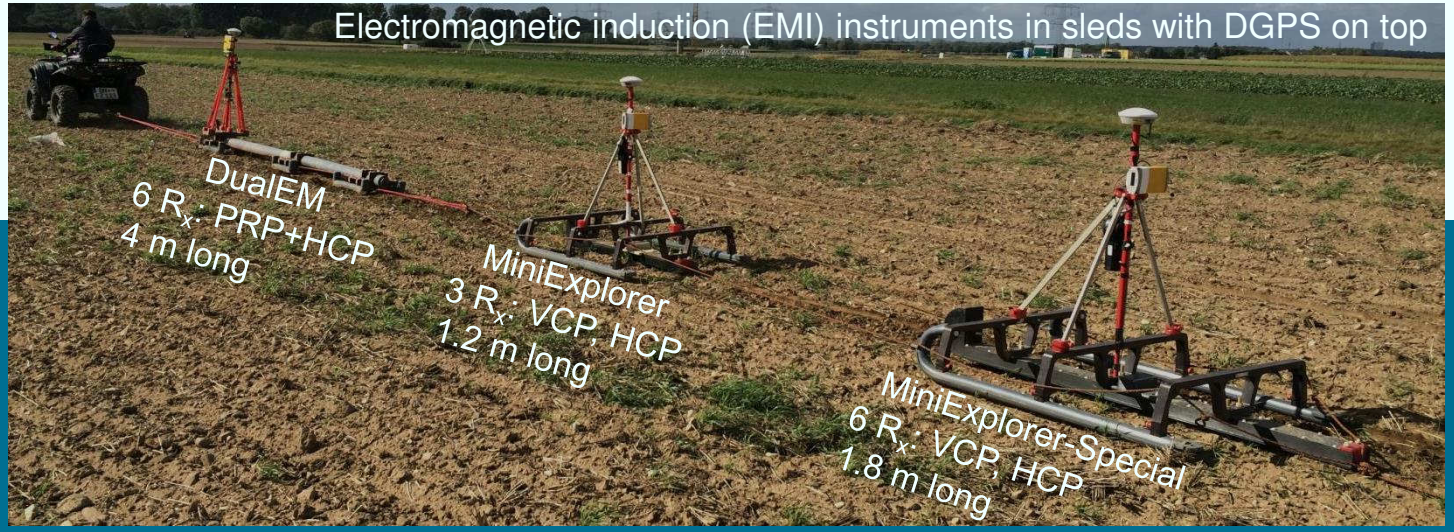
Mitglied der Helmholtz-Gemeinschaft



Essence of Multi-coil EMI data: Applications and quantitative inversions for large-scale subsurface characterizations

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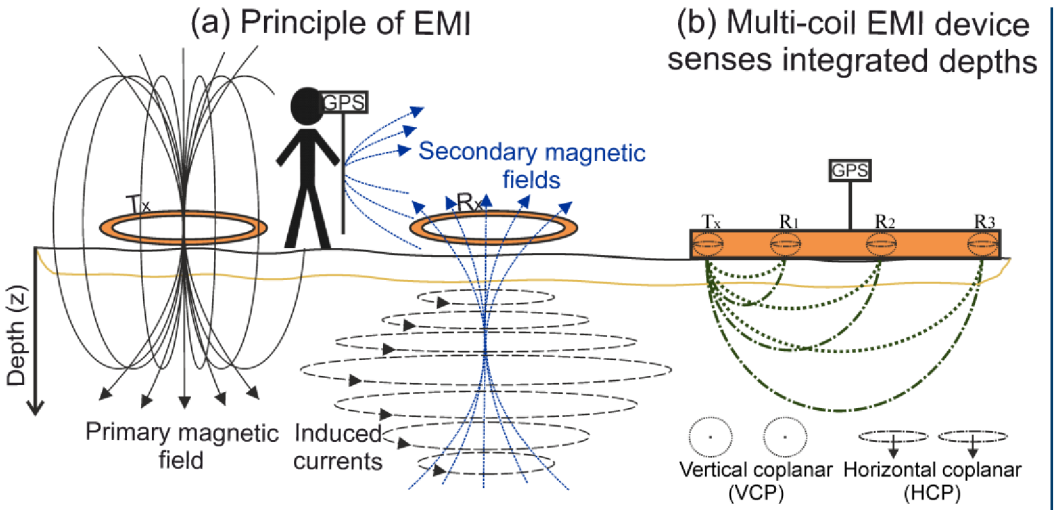
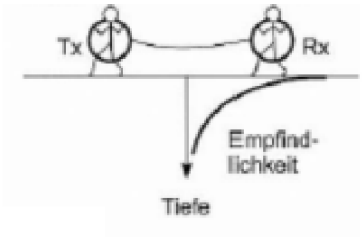
Summary of EMI principle and inversion

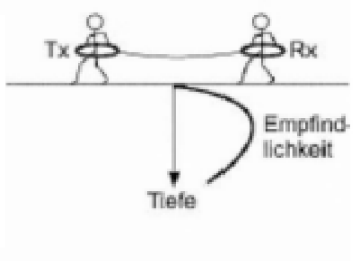


- T_x → primary magnetic field (H_p)
- H_p → Eddy currents in subsurface
- Eddy currents → secondary magnetic field (H_S)
- H_S/H_p → measured at receiver R_x, related to apparent electrical conductivity (ECa)

VCP: Highest sensitivity at surface. Depth of investigation (DOI) is 0.75s.

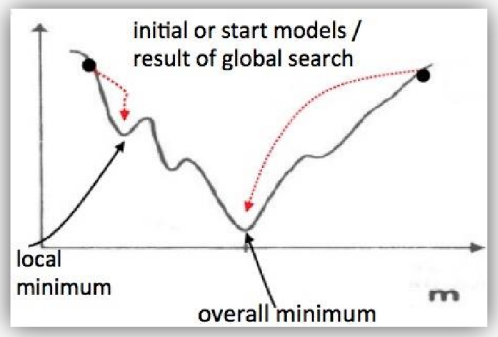
HCP: Peak sensitivity at depth. Depth of investigation (DOI) is 1.5s (s:= coil separation)

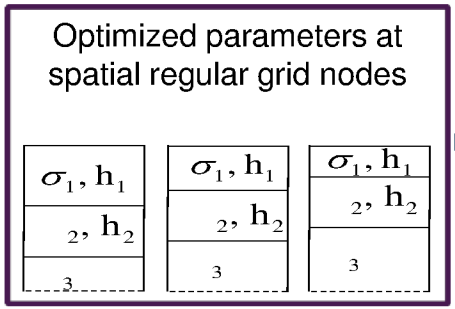


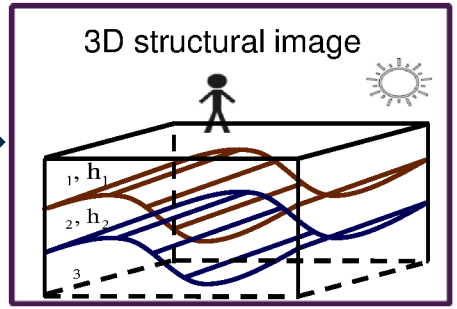


Inversion

- Estimate parameter that relate model and data
- Optimize: data – modelled data $\stackrel{!}{=}$ 0







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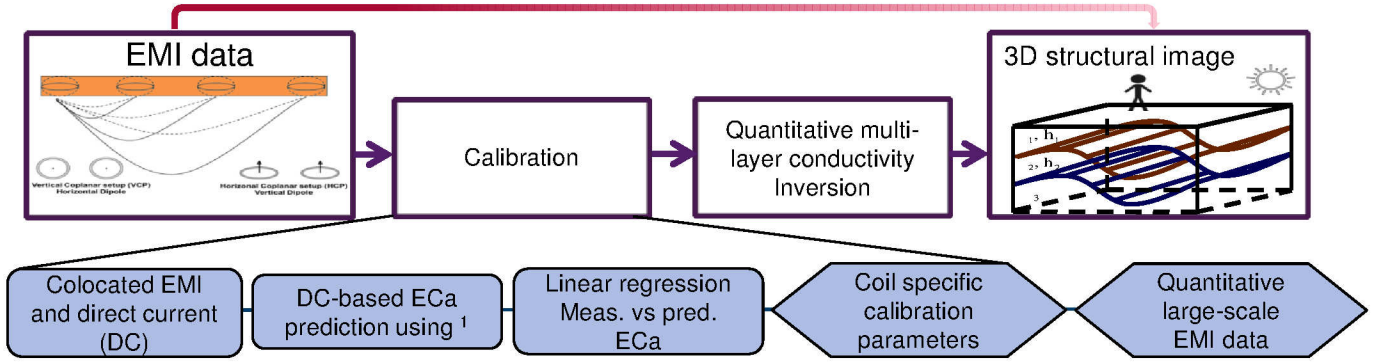
Summary of quantitative EMI inversion

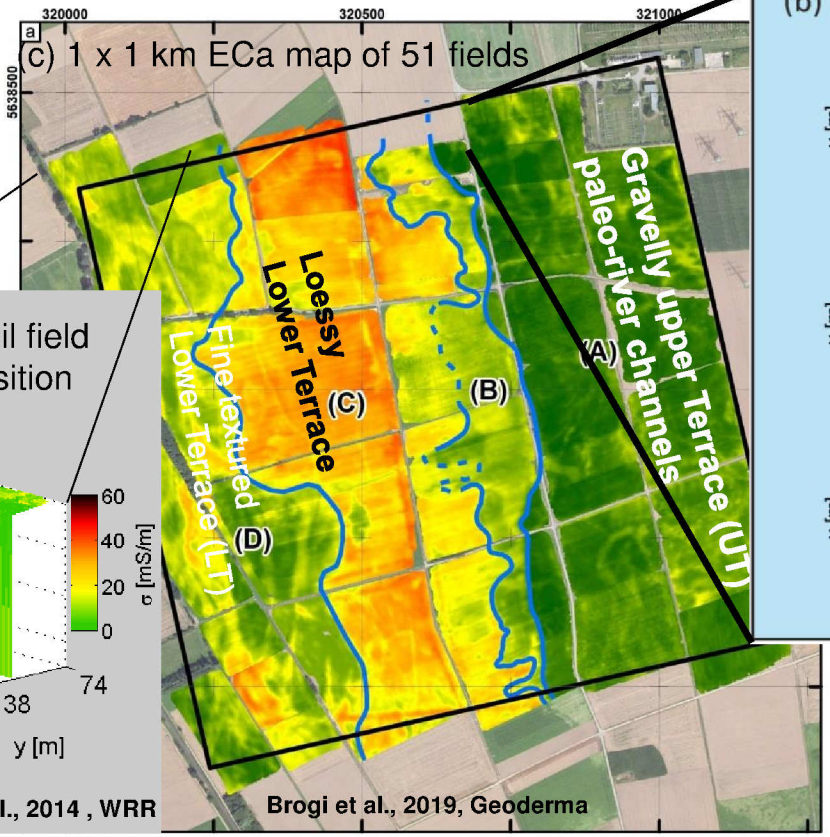
Inversion scheme:

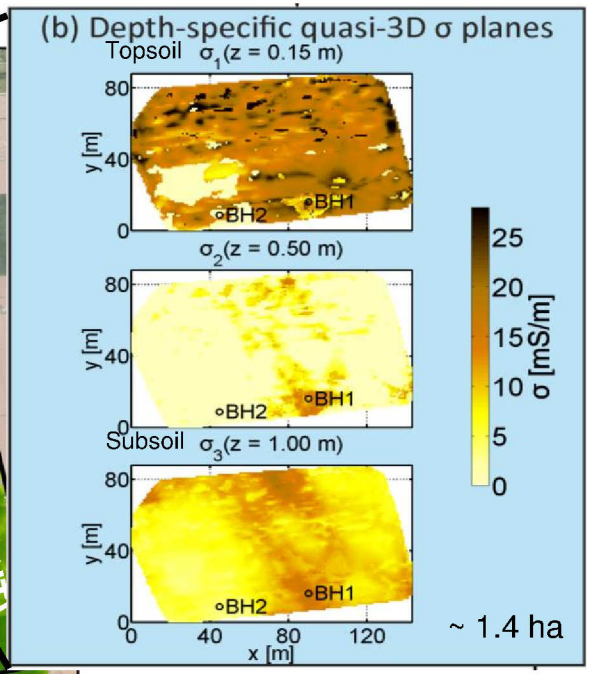
*Shuffled complex evolution (SCE)**
- ✓ Global optimization (* Duan etal. 1996)
- ✓ L1-norm , no regularization → Sharp layer boundaries

[1]Exact Maxwell-based EMI forward model
- ✓ Horizontal layer
- ✓ No assumptions except quasi-static approximation

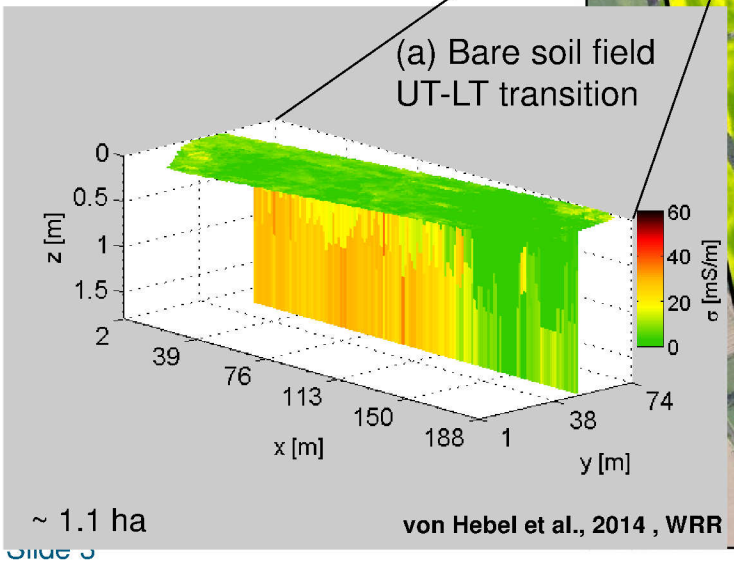


Must:
Calibration of multi-coil EMI data for reliable quantitative inversions.





von Hebel et al., 2018, GRL



Brogi et al., 2019, Geoderma