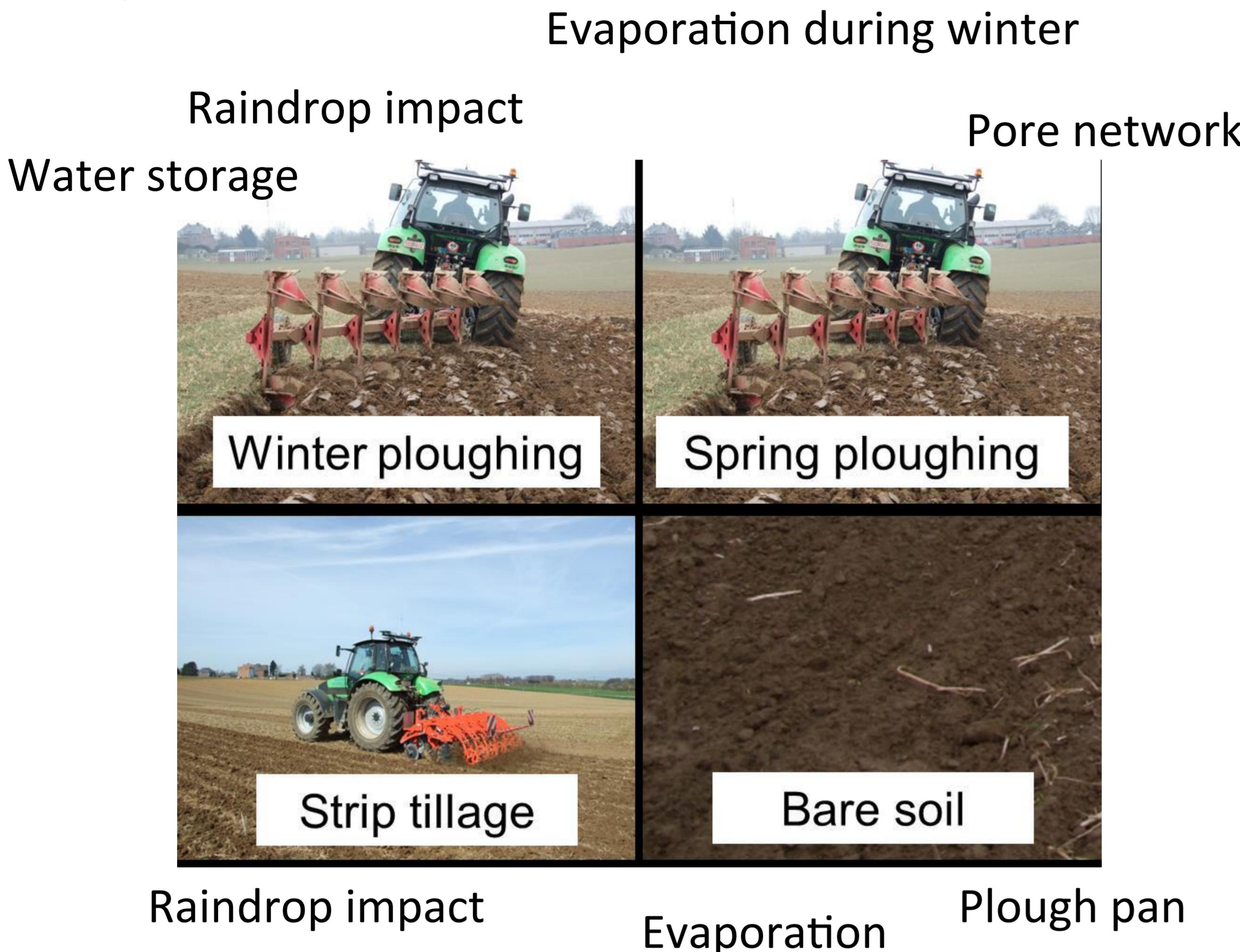


Impact of crop residue management on soil moisture dynamics in a temperate climate: potential of 3-D electrical resistivity tomography (ERT)

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Crop residue management



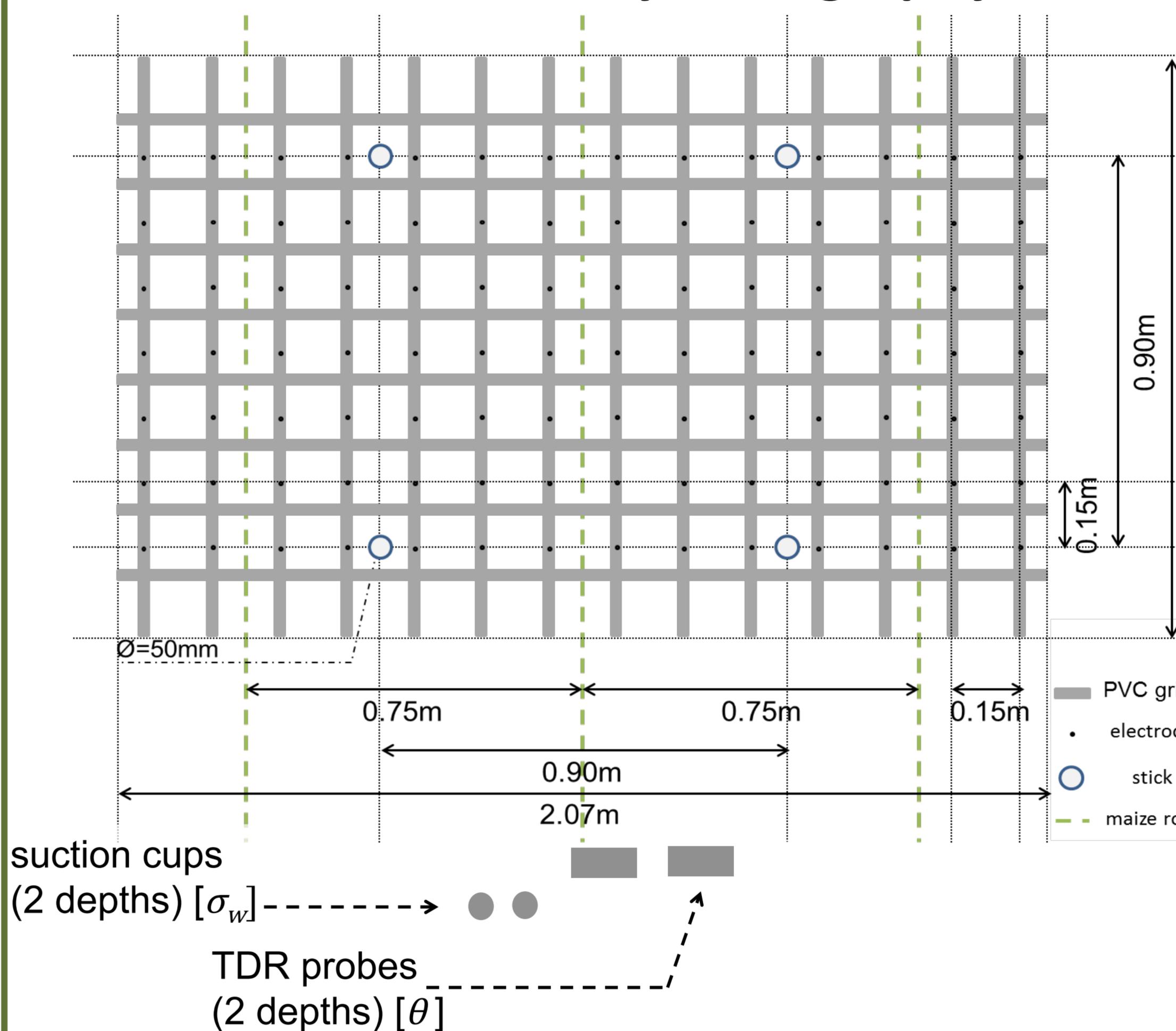
Tillage

Spatio-temporal dynamics of soil water over a growing season??

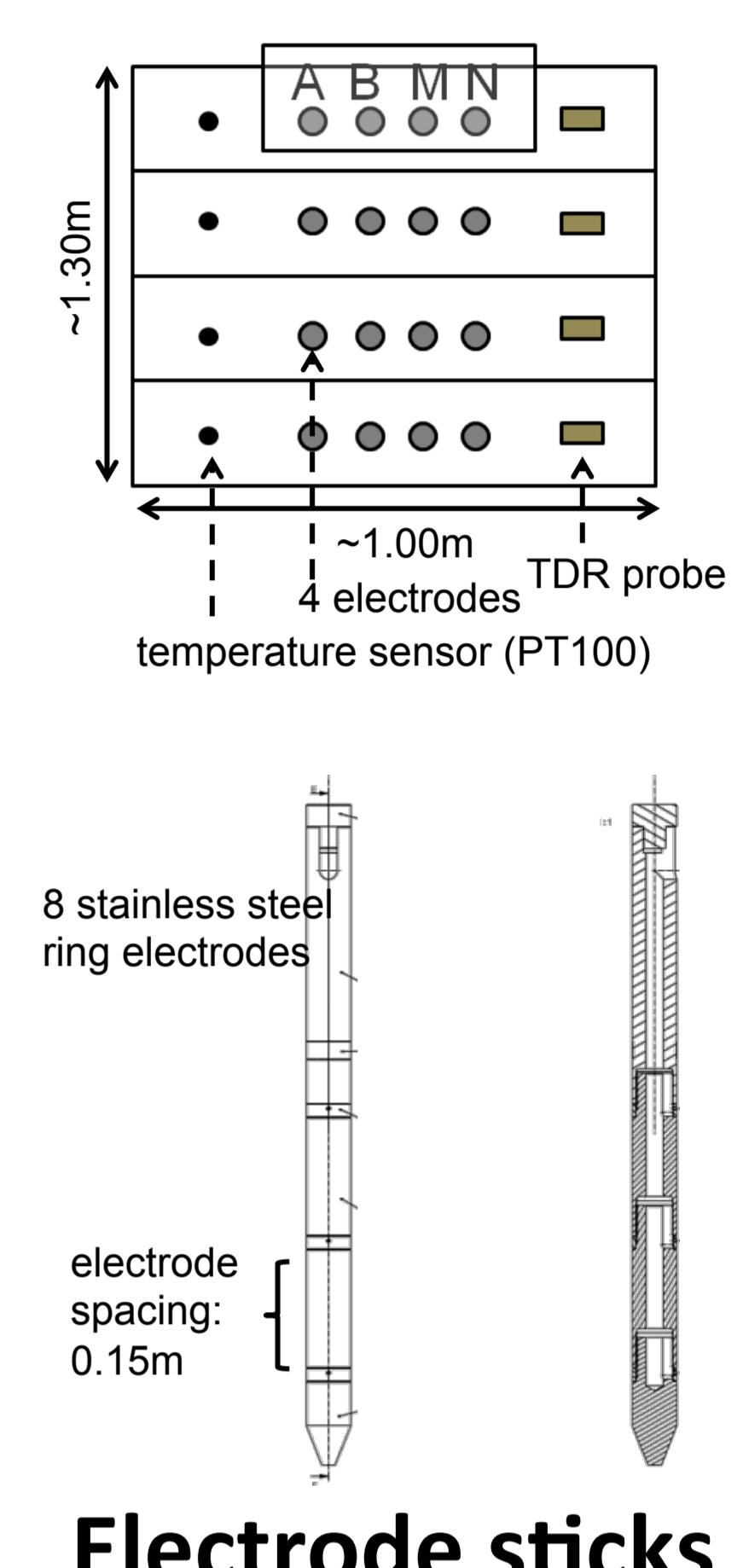
Experimental needs

- Resolve both superficial (0.40m) changes due to soil moisture as deeper patterns (1m) due to root water uptake
- Monitoring of changes throughout the season (weekly)
- Measure without disturbing the object under study (non-invasive).
- Capture relatively small changes of soil-moisture (min. 5%)

Electrical resistivity tomography



Calibration pit



Electrode sticks

Data acquisition and processing

Measurement protocol

- Dipole-Dipole (max. $k=70$ m)
- One direction (parallel to the maize rows)
- Dipole spacing: between 1 and 6×0.15 m

Remark: electrodes were inserted between 5-10 cm into the soil due to readjustment to improve R_{contact}

Data filtering

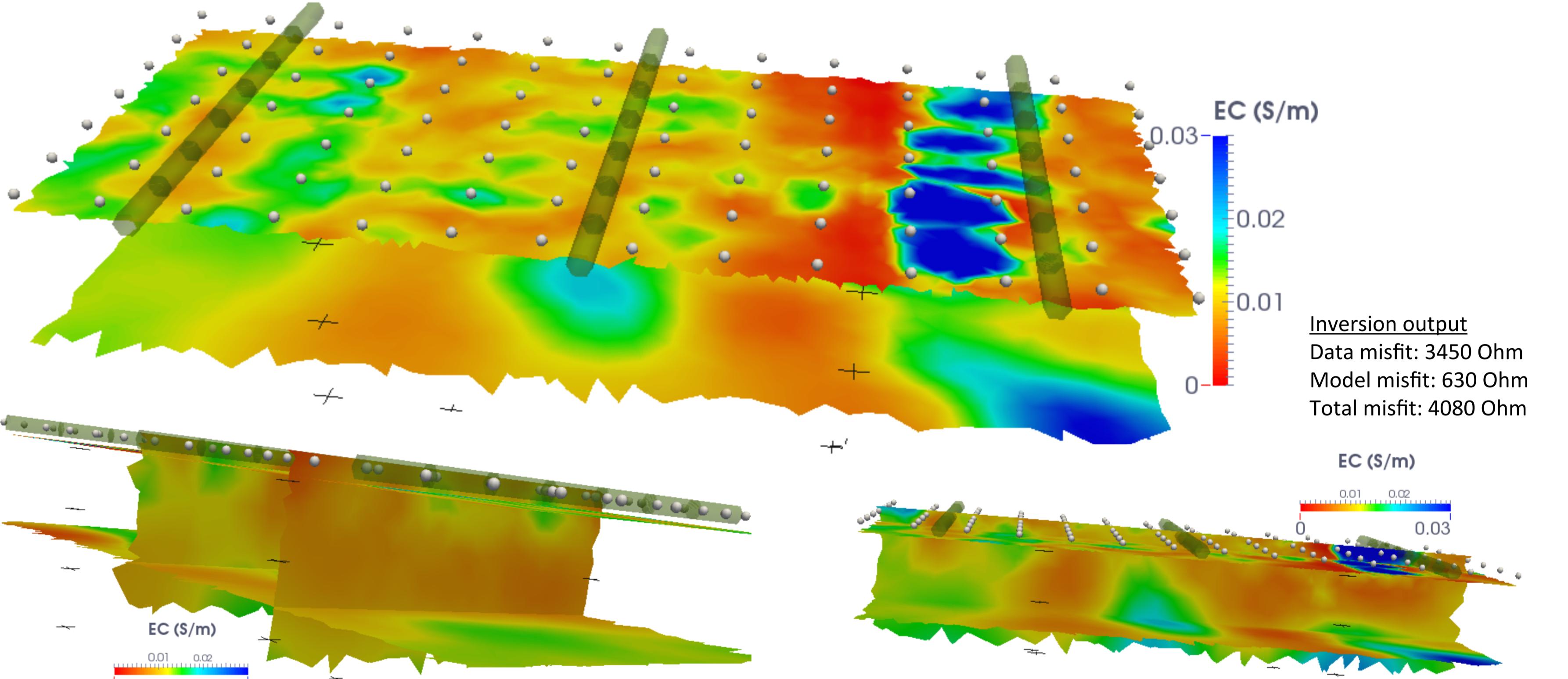
- Reciprocal error > 10% of the measured R_{mean}
- Measurements with electrodes causing systematic artefacts (2 zones close to electrode sticks, elec 33,34,57,58)
- Measurements with $R_{\text{contact}} > 20\,000$ Ohm

Mesh & inversion

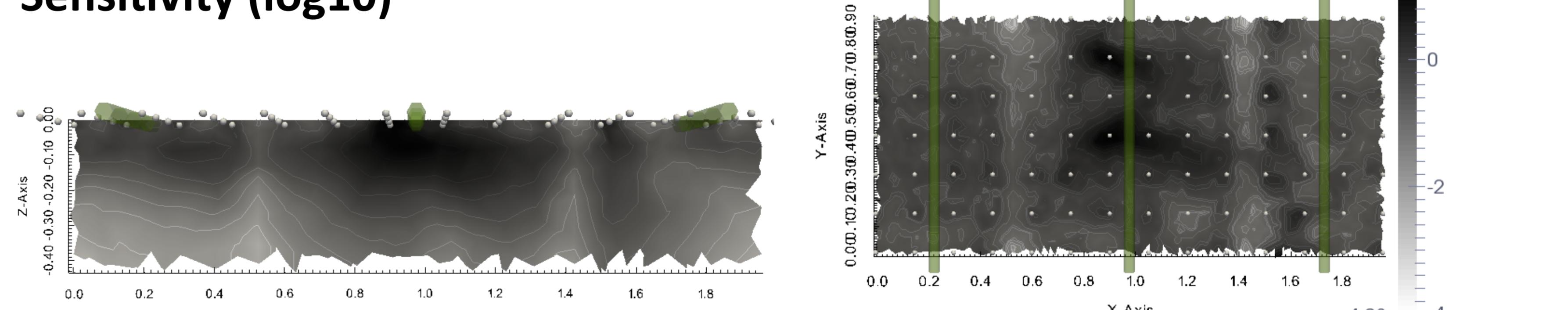
- Tetrahedral mesh
- Element size: 0.05 m
- Domain depth: 0.40 m
- Code: R3t, Andrew Binley

Preliminary results – surface grid only

Electrical conductivity / Winter ploughing September 2nd 2015



Sensitivity (log10)



Difficulties encountered

- Bad contact resistance
 - dry soil
 - presence of growing plant
 - presence of electrode stick
- Compromise time - # quadrupoles
- Compromise resolution - interference

Future steps to improve data analysis

Observations

- For $x=[1.35;1.50]$: High resistivity ($>3.10^3$ Ohms.m)
- For $x=[1.50;1.65]$: Very low resistivity (<10 Ohms.m)
- RWU by maize not visible in absolute images
- Microtopography!

Solutions

- Remove electrodes close to the BH
- Remove electrodes close to the maize row
- Timelapse inversions or differences should highlight changes, even when artefacts persist.
- Elevate maize rows by a few cms.