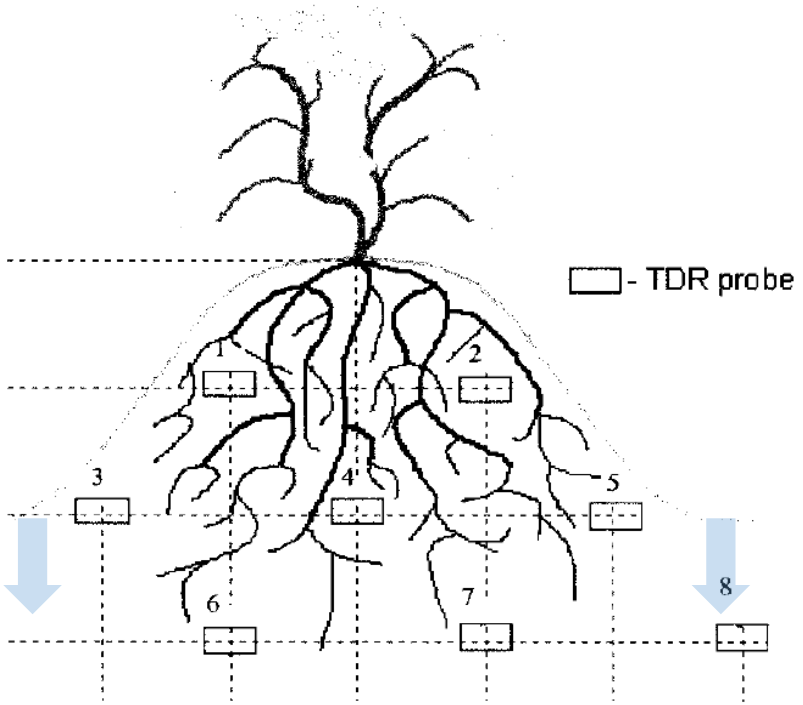
Efficient irrigation of potato?

Starr et al. (2005)

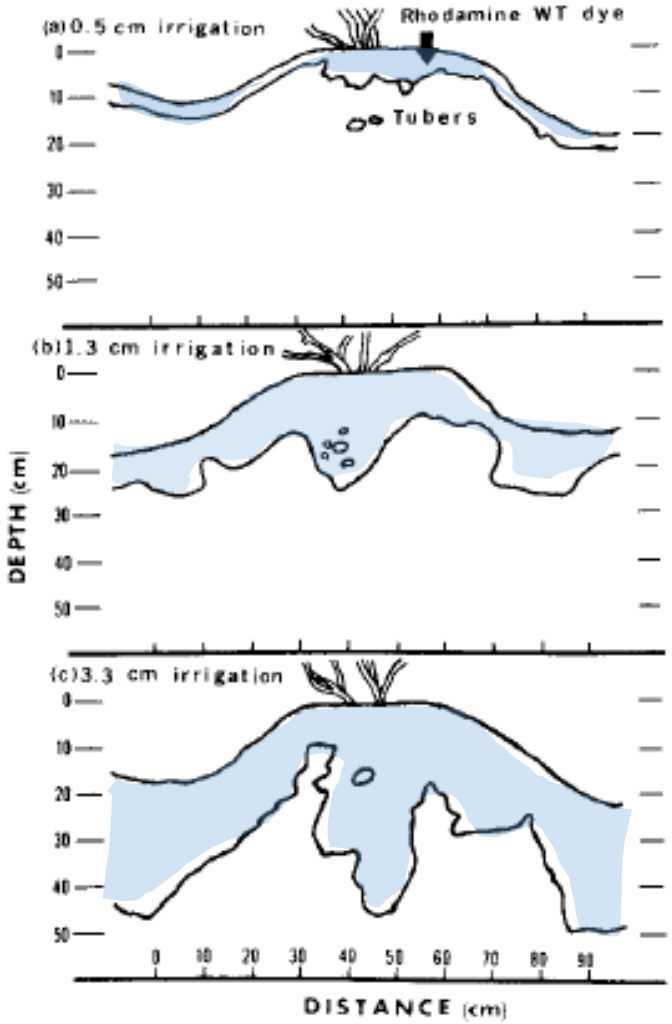
TDR grid



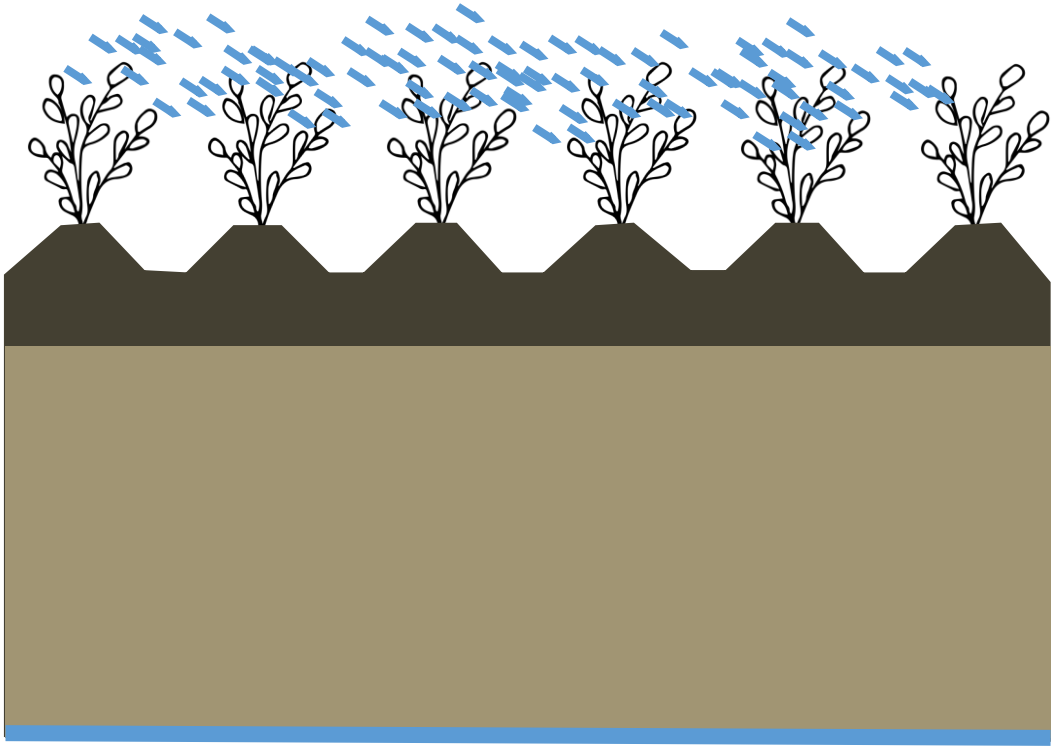
Infiltration mainly furrow

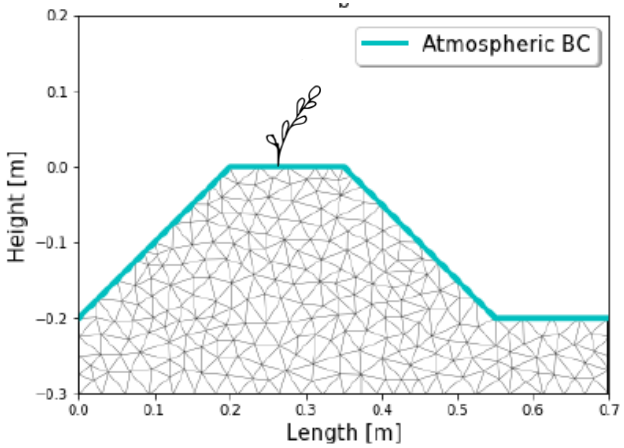
Saffigna et al. (1976)

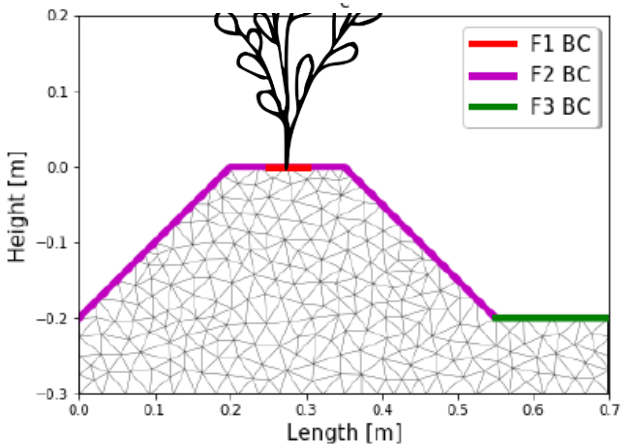
Dye tracing

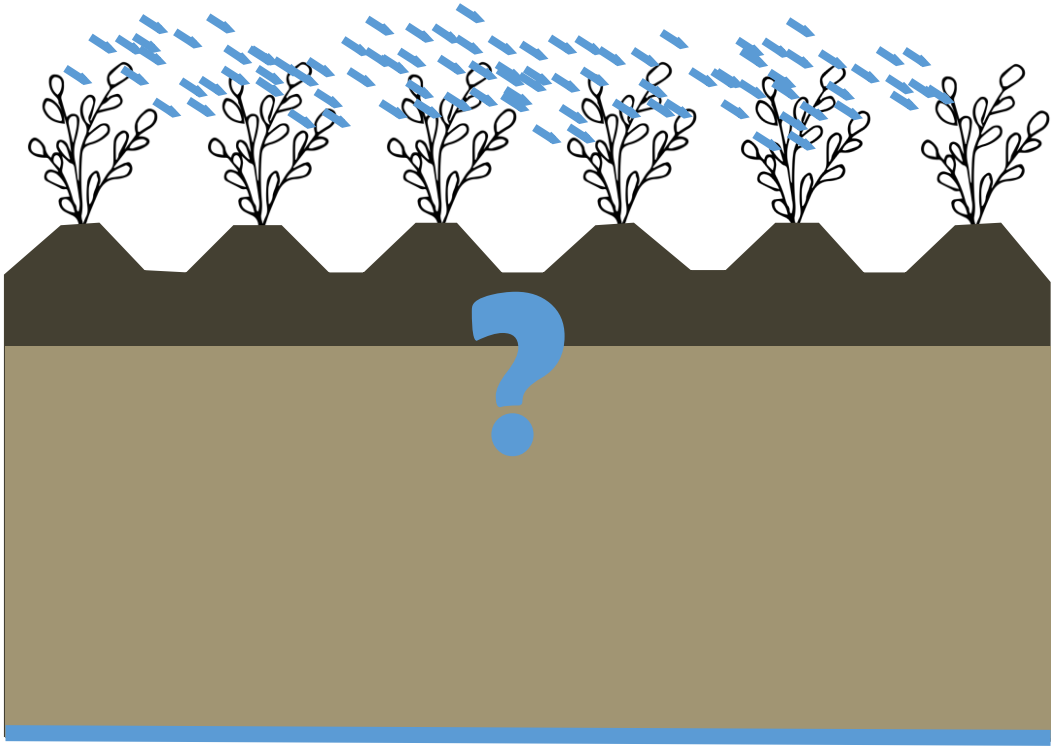


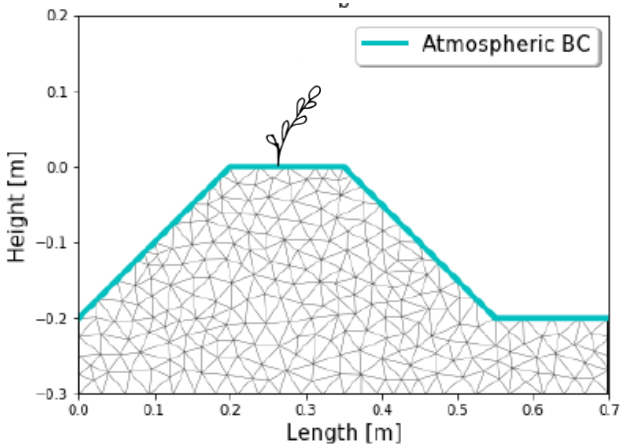
Interception, stemflow + infiltration in ridge

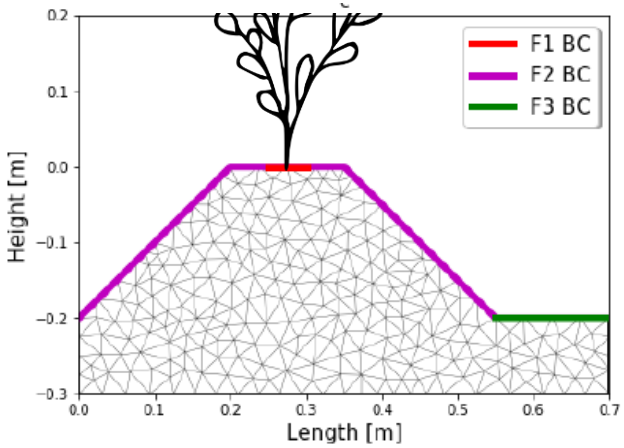


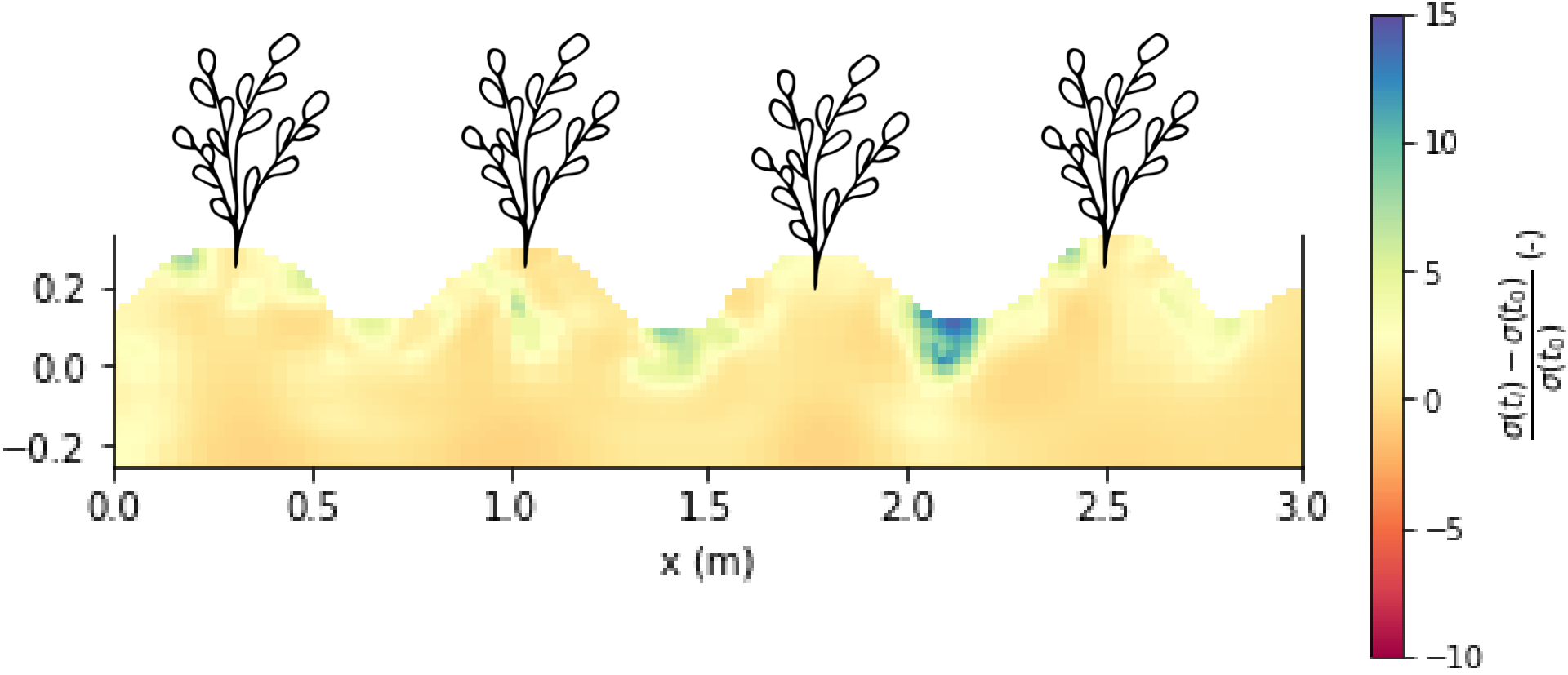

Atmospheric BC
Height [m]
Length [m]
0.2
0.1
0.0
−0.1
−0.2
−0.3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7


F1 BC
F2 BC
F3 BC
Height [m]
Length [m]
0.2
0.1
0.0
−0.1
−0.2
−0.3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

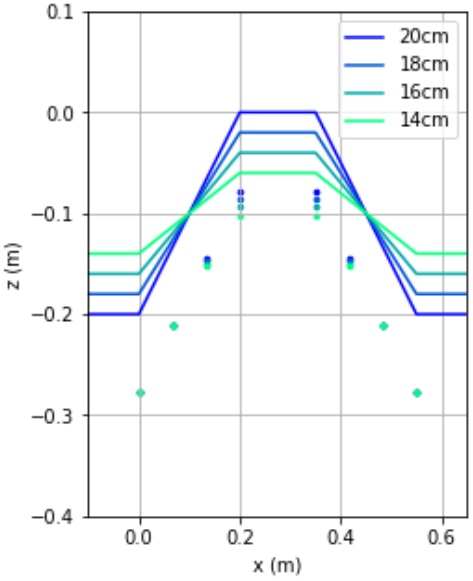

?


Atmospheric BC
Height [m]
Length [m]
0.2
0.1
0.0
−0.1
−0.2
−0.3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7

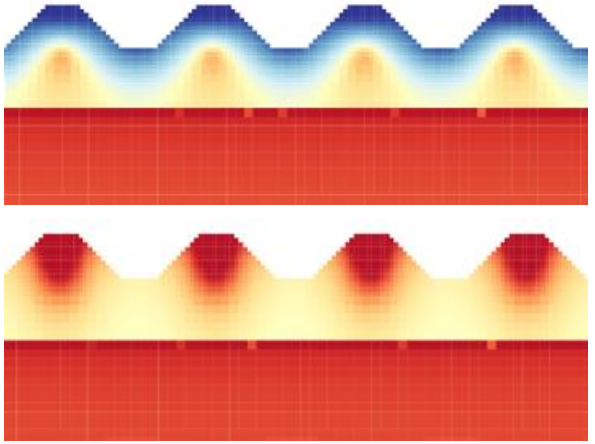

F1 BC
F2 BC
F3 BC
Height [m]
Length [m]
0.2
0.1
0.0
−0.1
−0.2
−0.3
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7


0.2
0.0
−0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
x (m)
15
10
5
0
−5
−10
$\frac{\sigma(t_i)-\sigma(t_0)}{\sigma(t_0)}$ (-)

Strong microtopography,
small electrode spacing

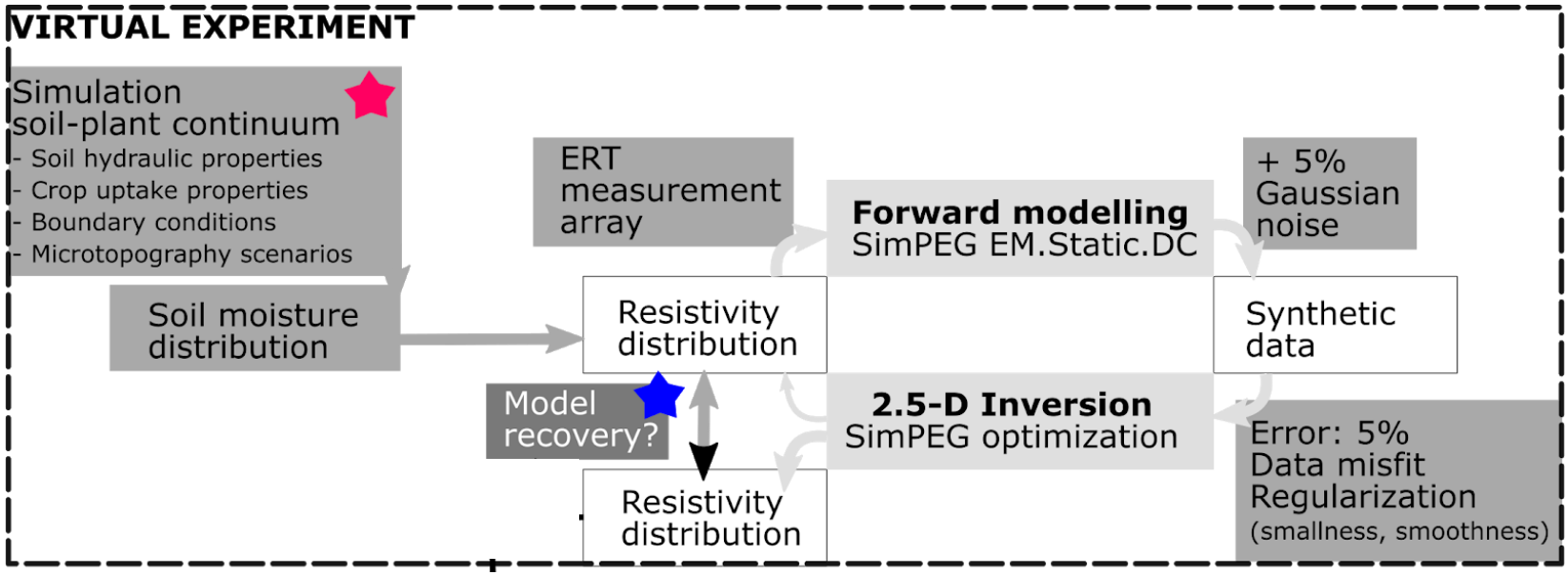


Water and wind erosion



Sensitivity to distinct patterns

A study in 2 worlds



Question:

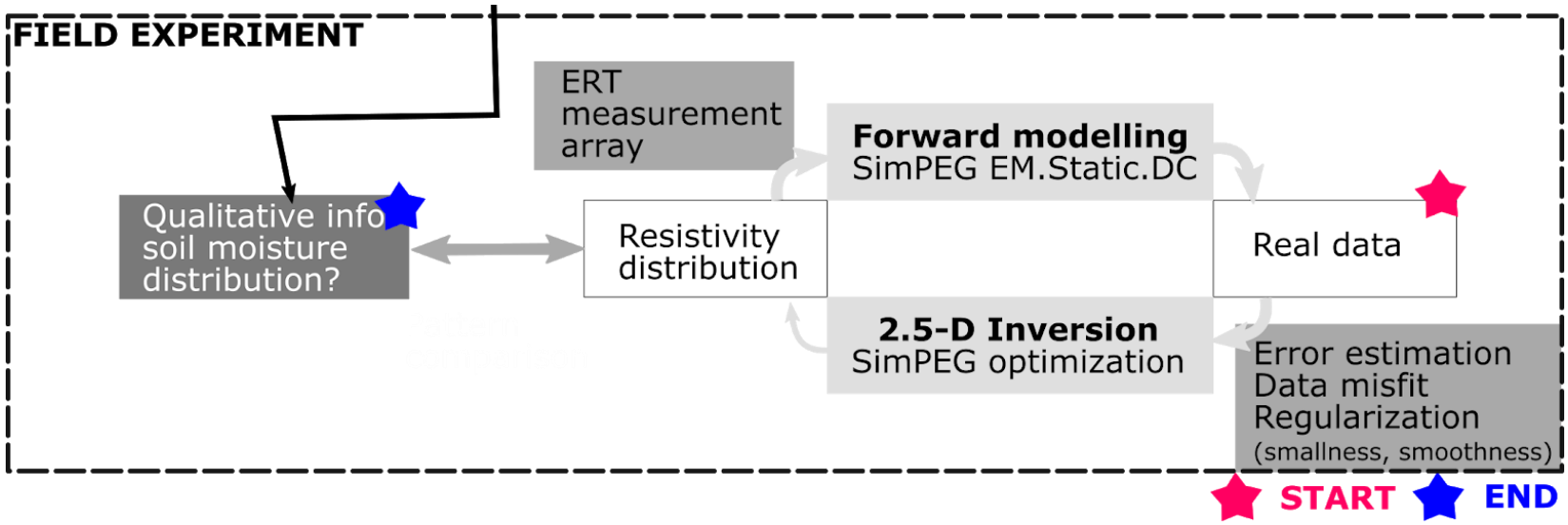
« Which artefacts (type, magnitude) can we expect for increasing erosion? »

START END

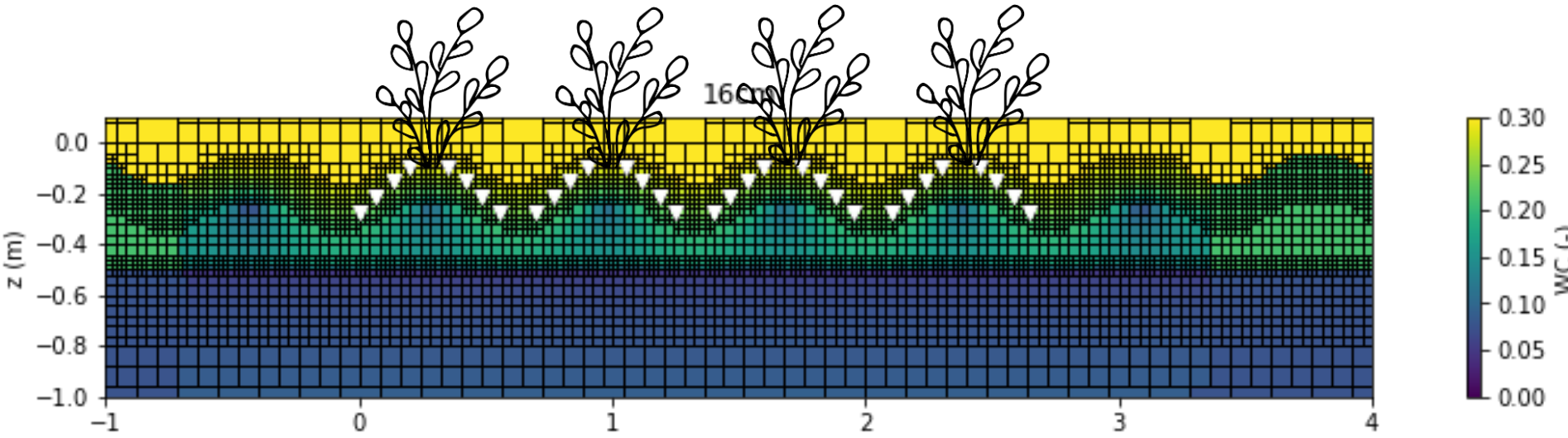
Question(s):

« Can we monitor infiltration patterns in a ridge-furrow system after sprinkler irrigation qualitatively?»

« What does this pattern look like? »

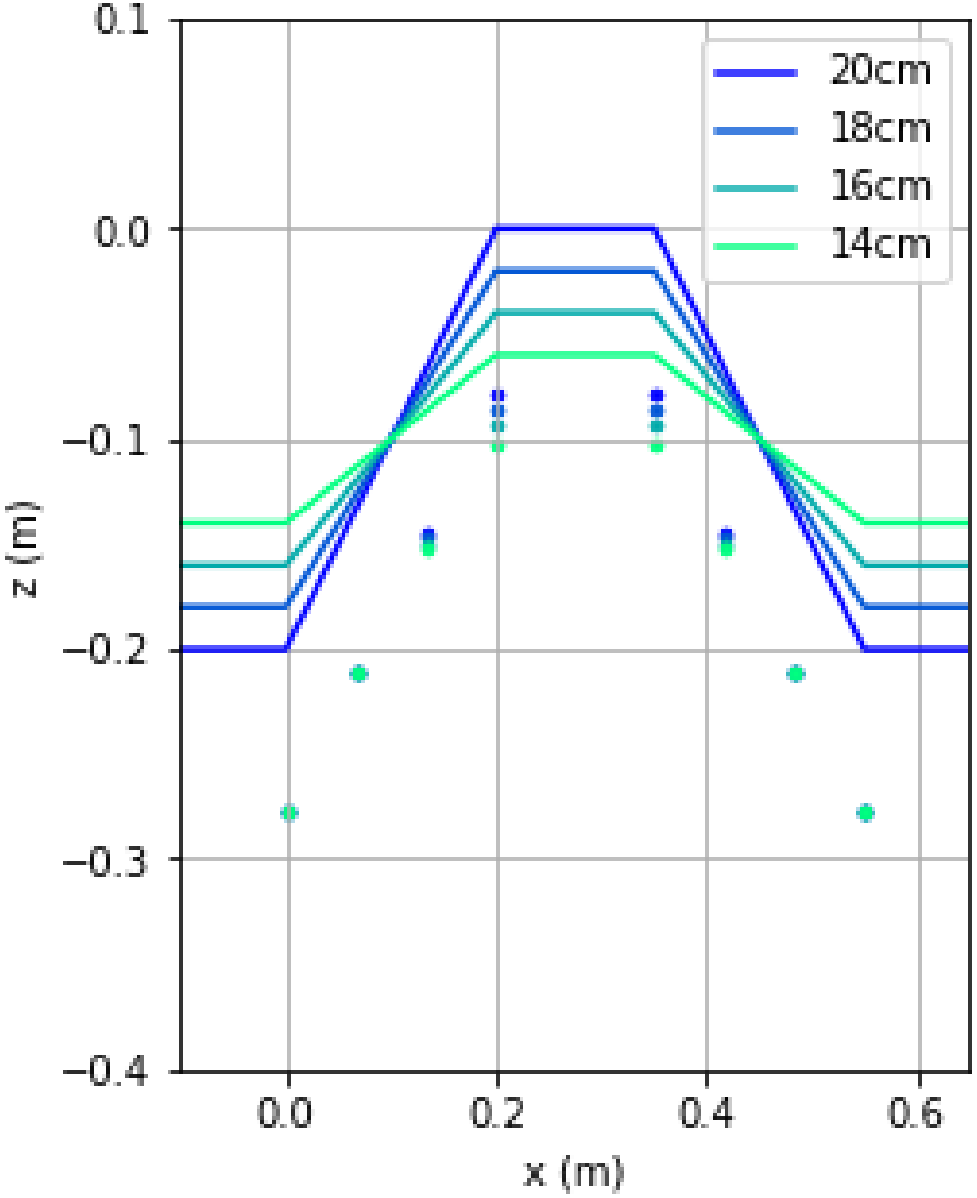


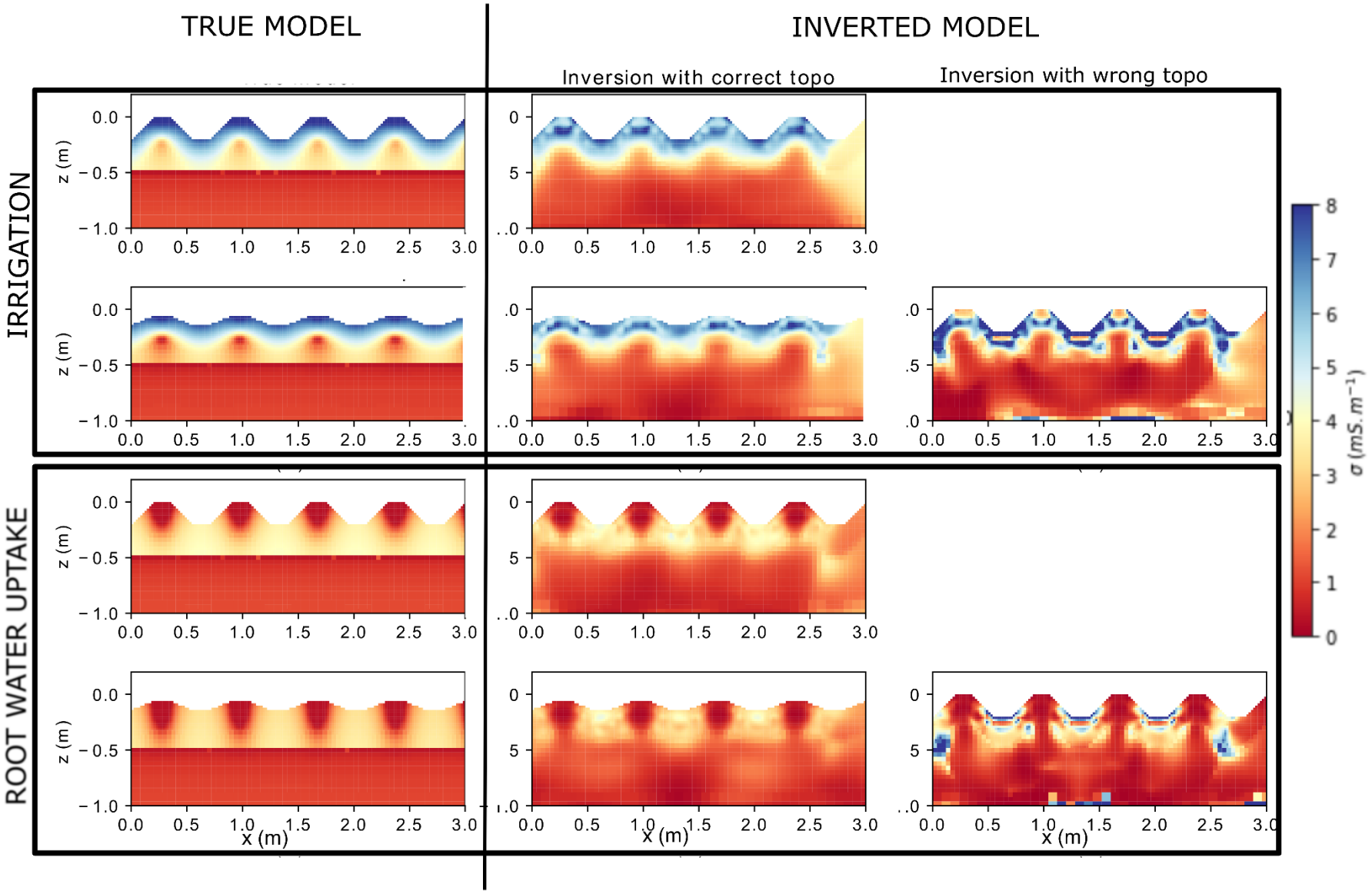
The virtual experiment



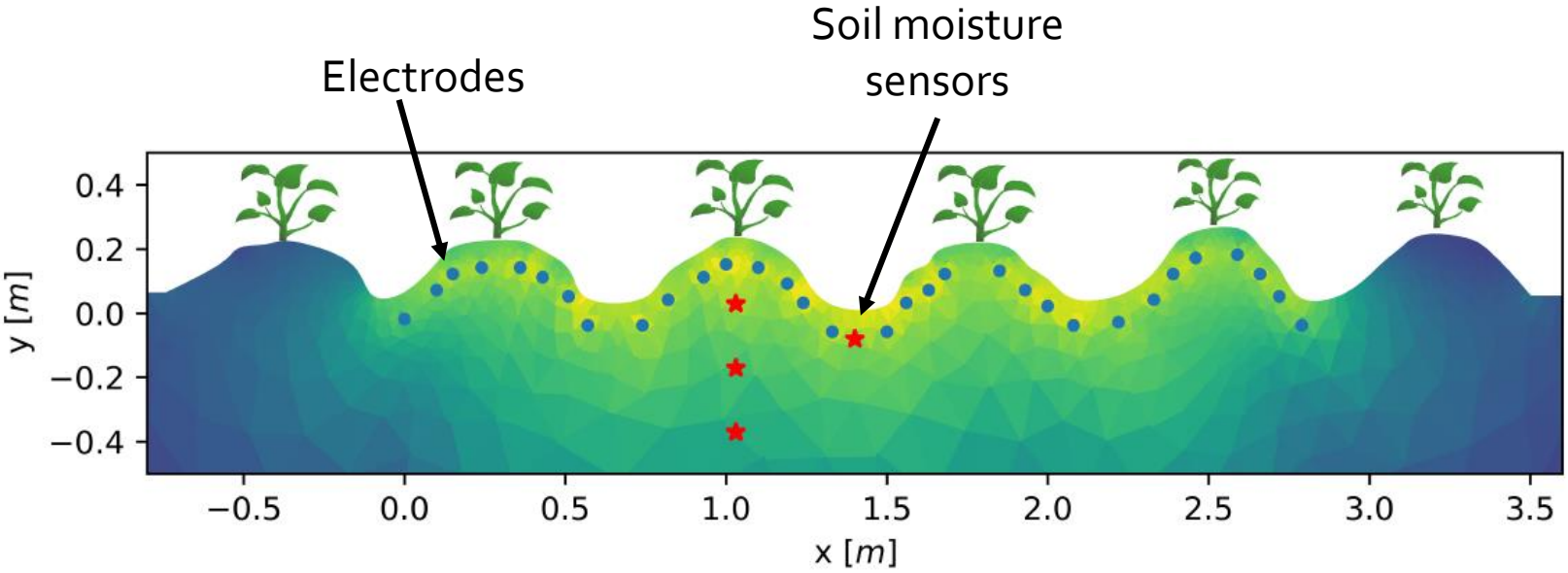
Electrode spacing: 6.6 cm projected on x-axis
Array: Combination of wenner-alpha and dipole-dipole array
 # Measurements: 671
Mesh: OcTree, min. edge length: 2cm
Inversion strategy:
simple reg, inexact gauss newton,updated sens weights, target misfit = 1
Initial and reference model: m_0 = np.log(1./median(app_res))

Increasingly eroded ridges



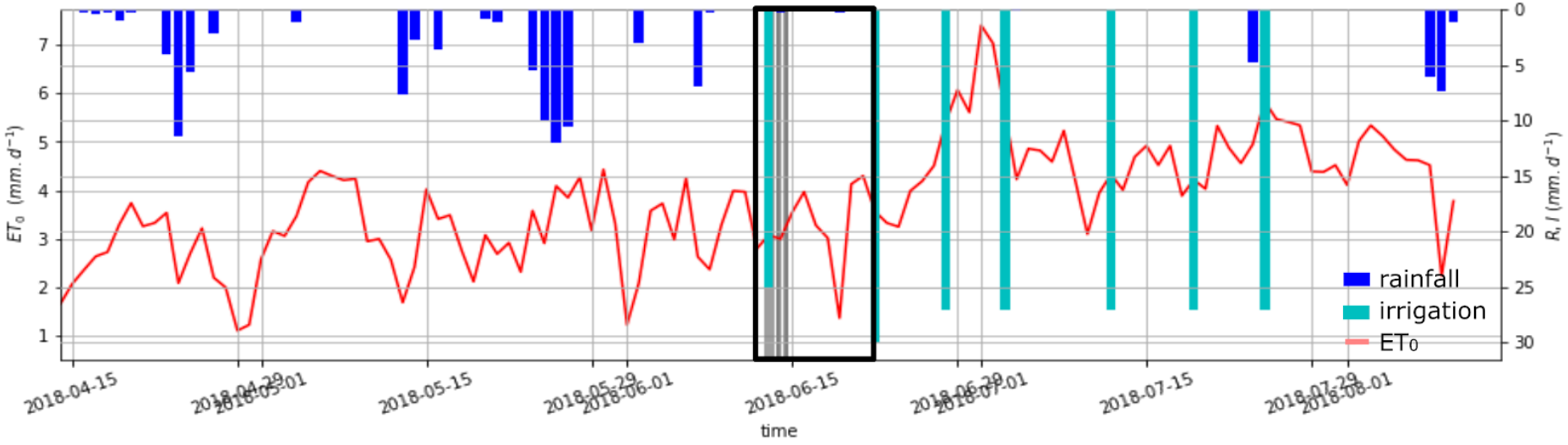

TRUE MODEL
INVERTED MODEL
Inversion with correct topo
Inversion with wrong topo
IRRIGATION
ROOT WATER UPTAKE
z (m)
x (m)
σ (mS.m⁻¹)

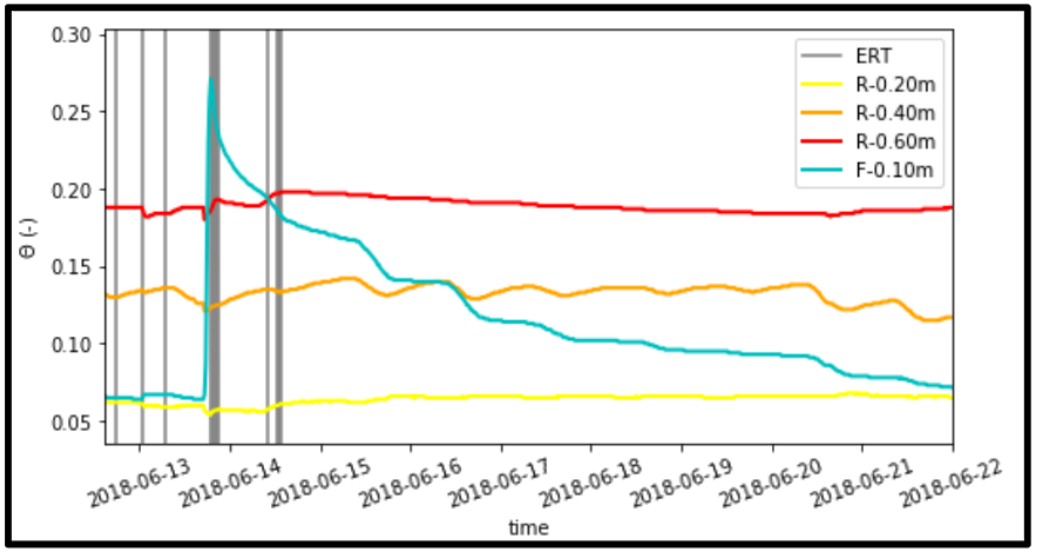
The real experiment



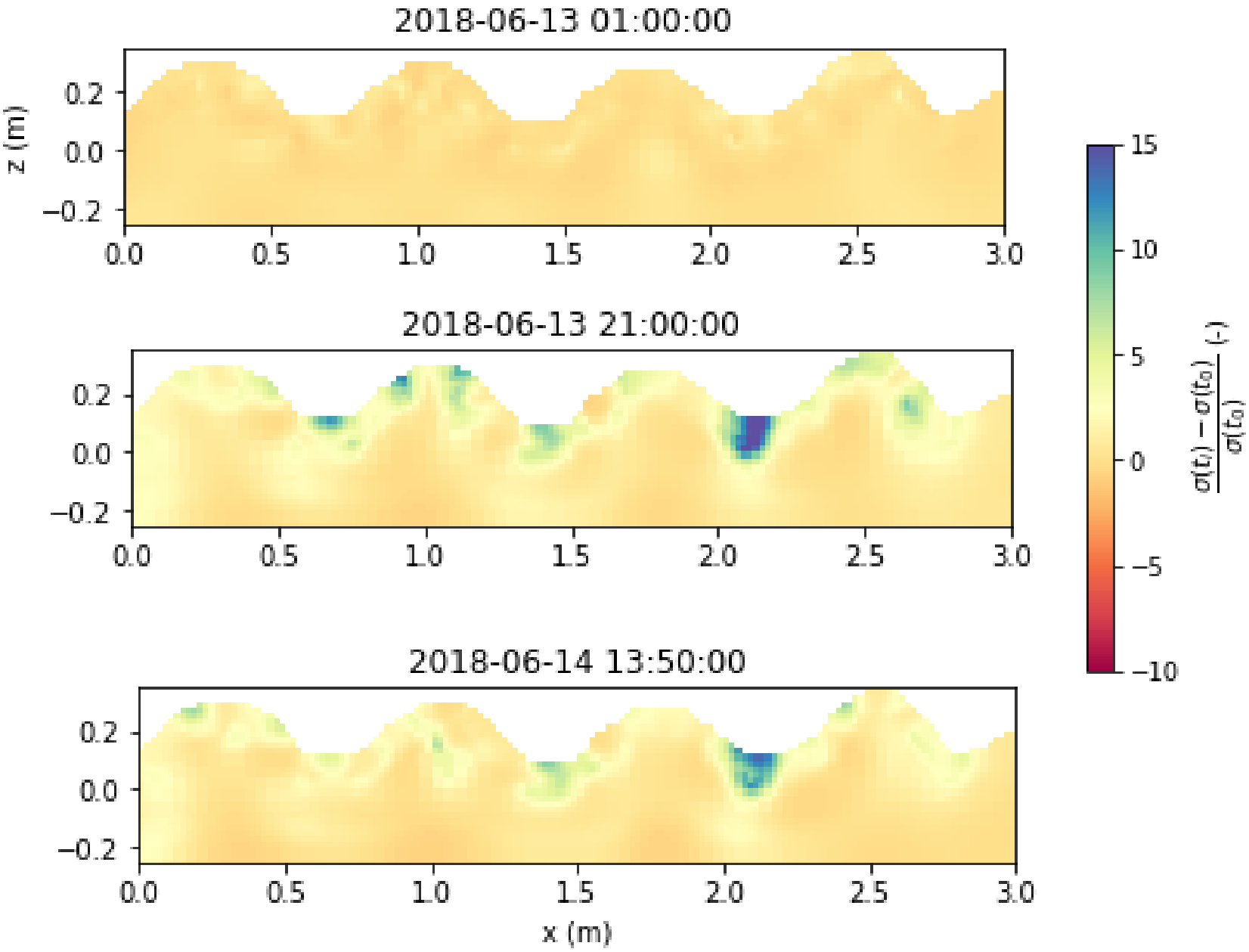
Electrode spacing: 6.6 cm projected on x-axis
Electrode design: stainless steel
Array: Combination of wenner-alpha and dipole-dipole array
Quality check: N/R
Duration: ca. 20 min (1342 measurements)
Monitoring: electrodes + cable stay in place

Weather conditions

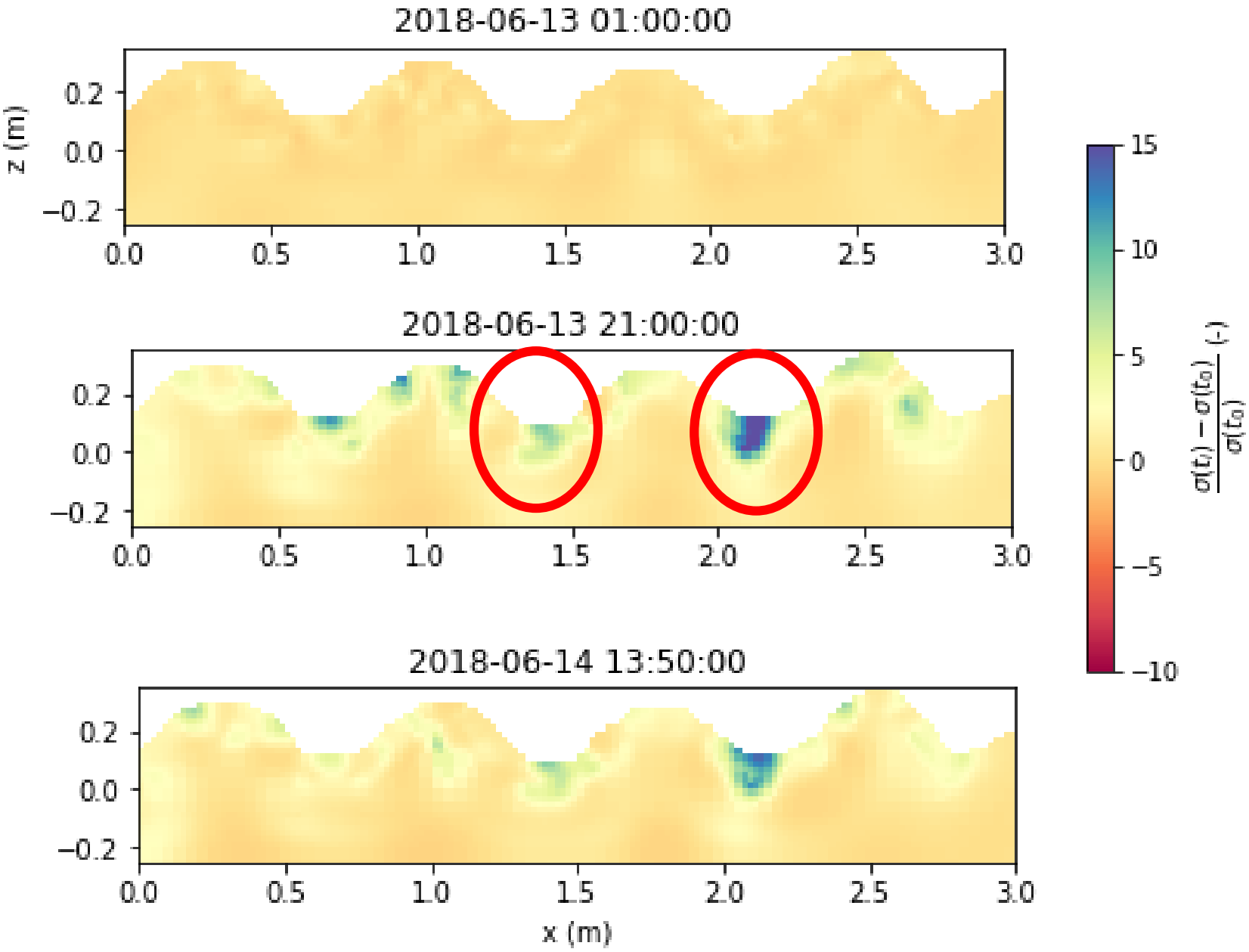




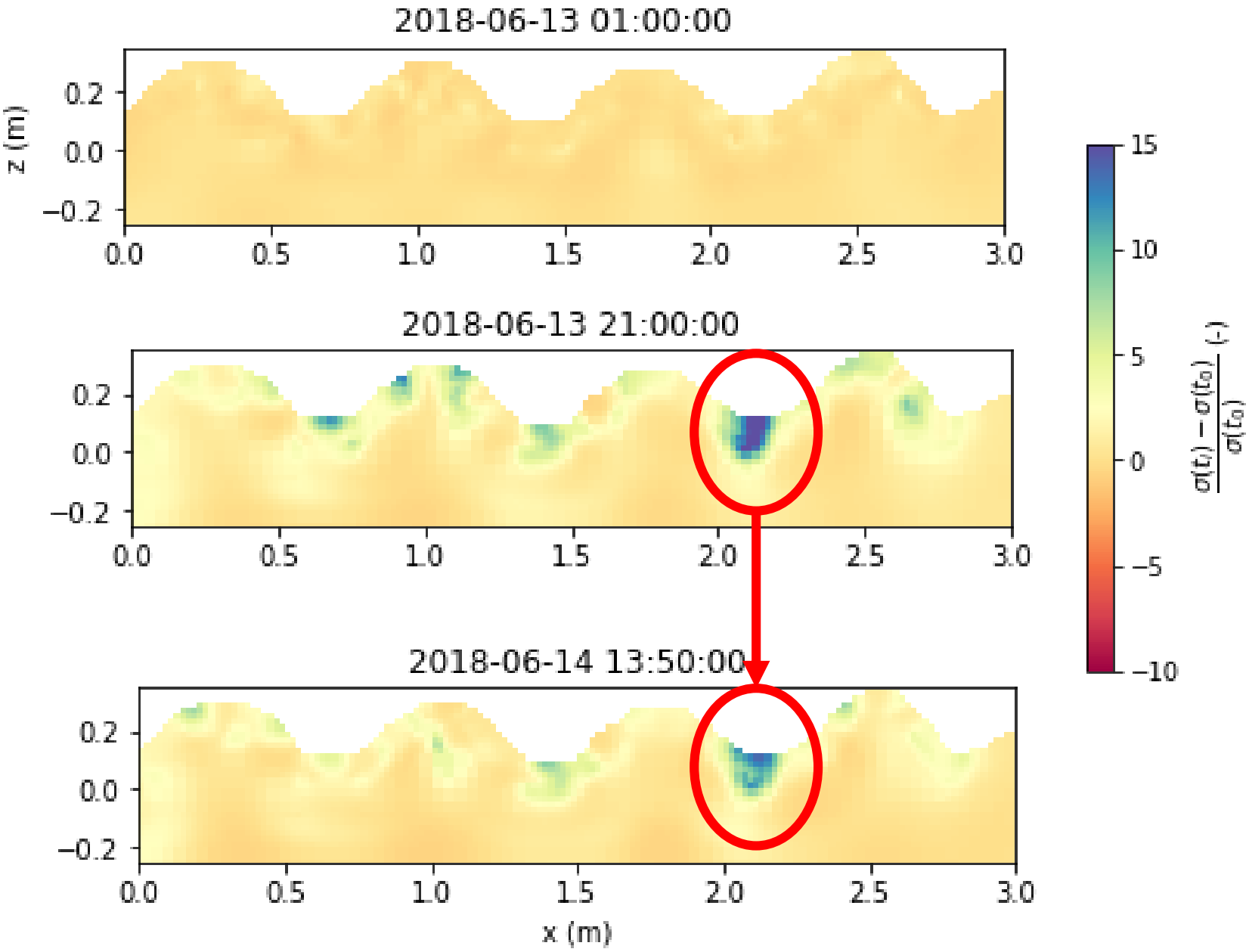
Relative difference between timesteps



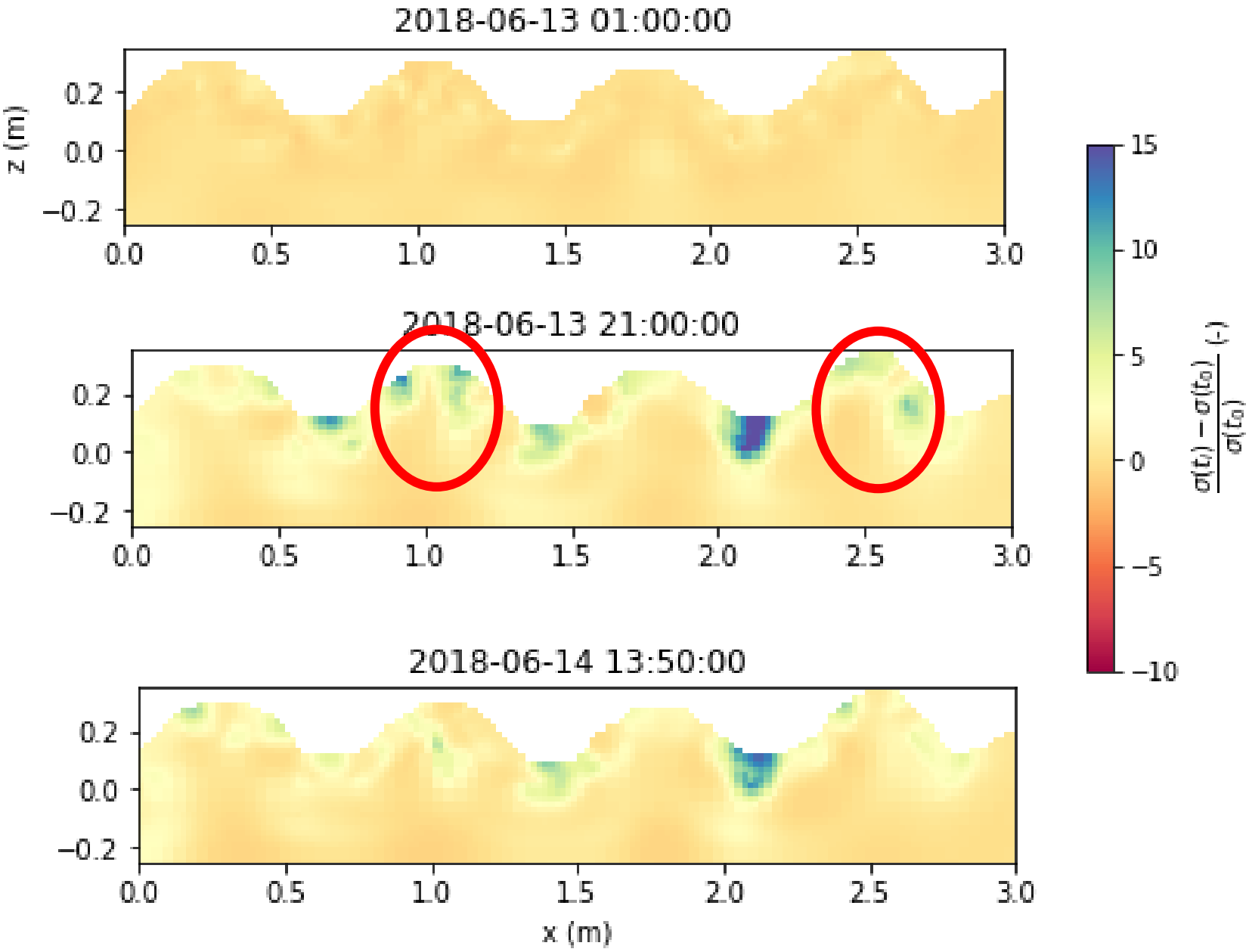
Relative difference between timesteps



Relative difference between timesteps



Relative difference between timesteps



SUMMARY

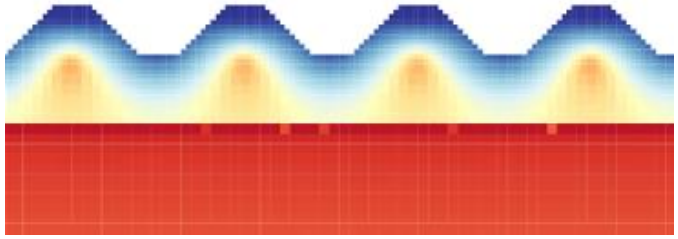
- Timelapse ERT → infiltration
- Infiltration mainly in furrows
- Deep drainage seems to be limited

CAUTION

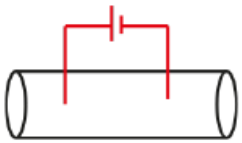
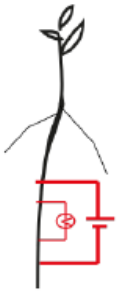
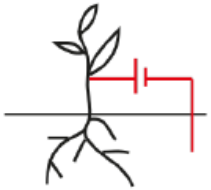
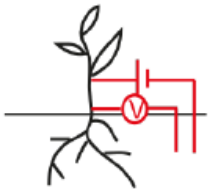
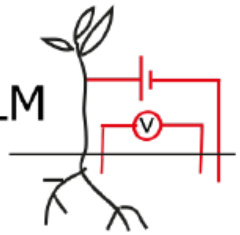
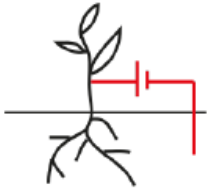
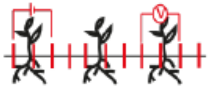
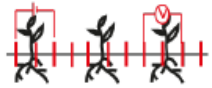
- Conductivity ≠ soil moisture !
  - →Non-linear relationship
  - →Impact potatoes on petrophysics?!
  - →Temperature

Detailed and quantitative information on processes in the vadoze zone to improve models (monitoring)

→ Quantify infiltration, leaching, RWU



Promising methods

# el >	Single frequency			Multiple frequency		
	2	4	multi	2	4	multi
ROOT scale	ERM 				SIP 	
PLANT scale	ECM/ERM 	EIM 	ERT  MALM 	EIS 		EIT 
PLOT scale			ERT 			EIT 

Large-scale differences between units

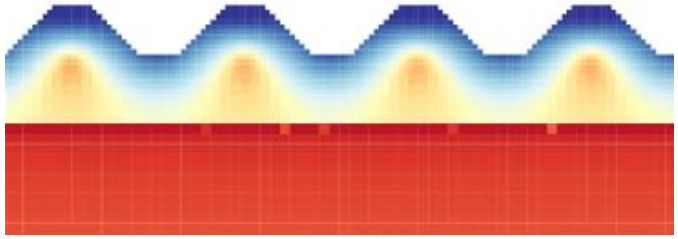
→ Characterize management zones

Non-invasive monitoring of agro-ecosystem processes in-situ

→ in-situ phenotyping, irrigation scheduling, …

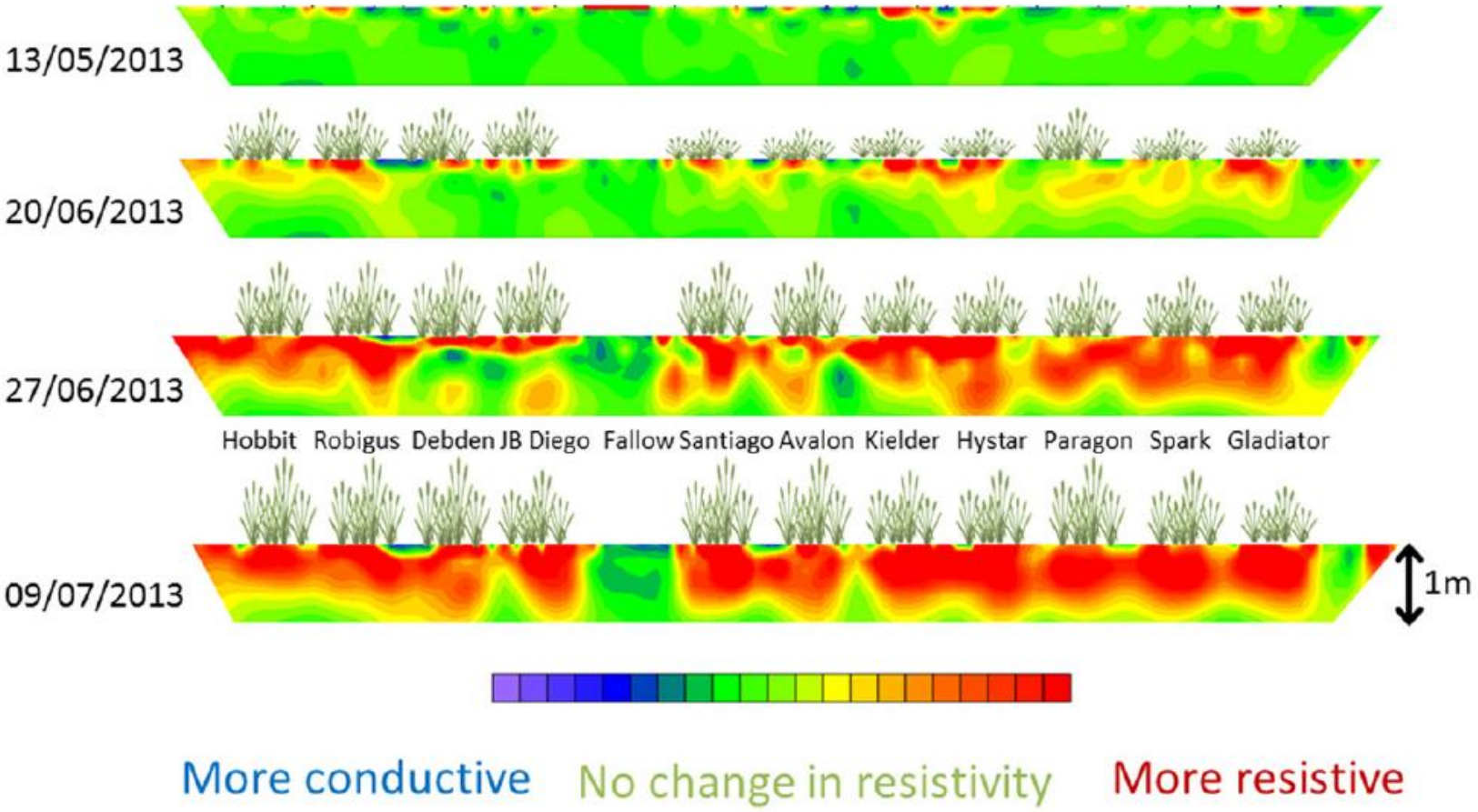
Detailed and quantitative information on processes in the vadoze zone to improve models (monitoring)

→ Quantify infiltration, leaching, RWU

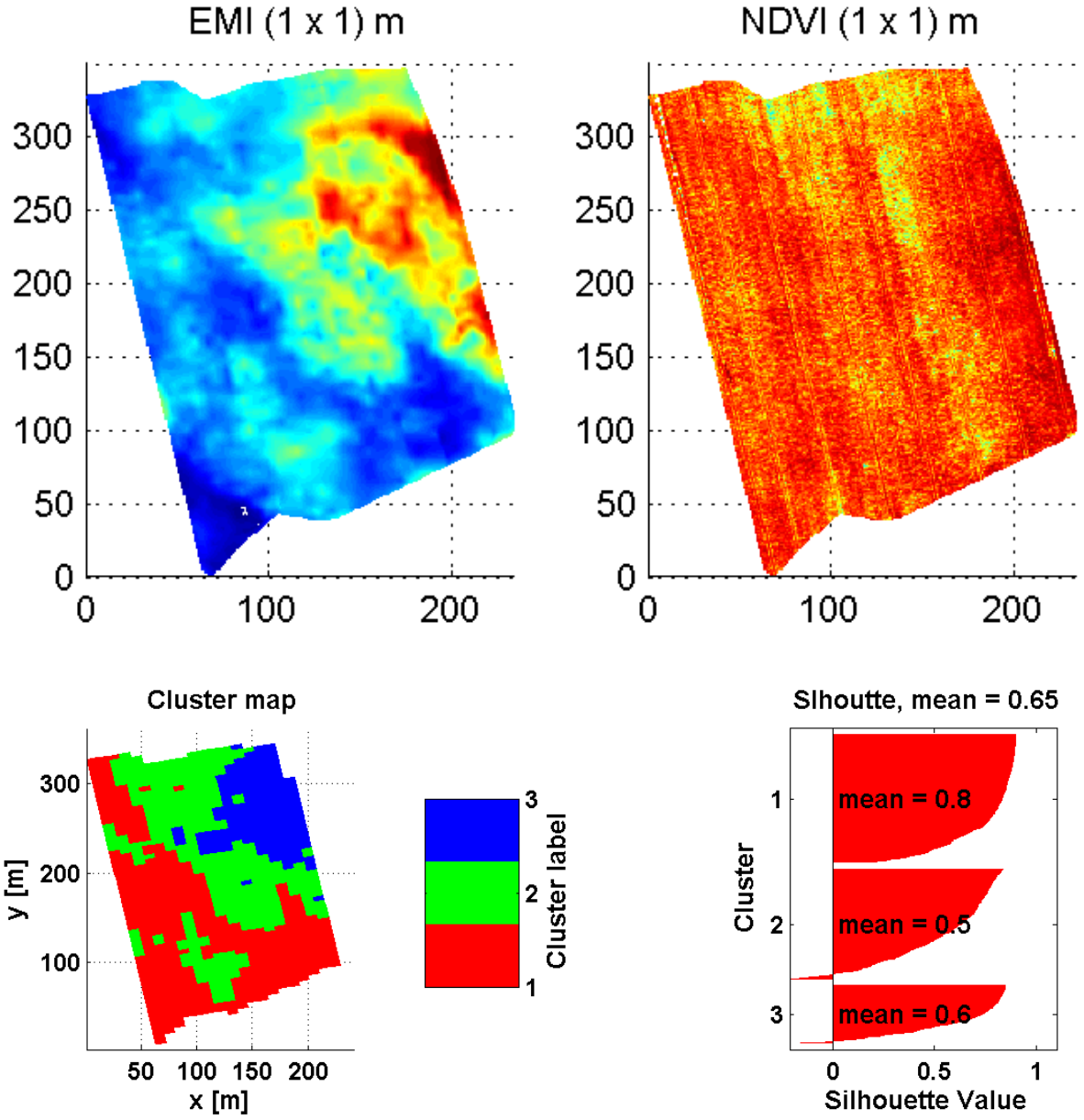


Phenotyping

Whalley et al., 2017



Agricultural management



The effect of microtopography on high-resolution ERT to assess spatio-temporal soil moisture patterns in a potato field

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FNRS grant R.50.05.17.F

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