

DEGRADATION OF SOIL DESICCATION CRACKING

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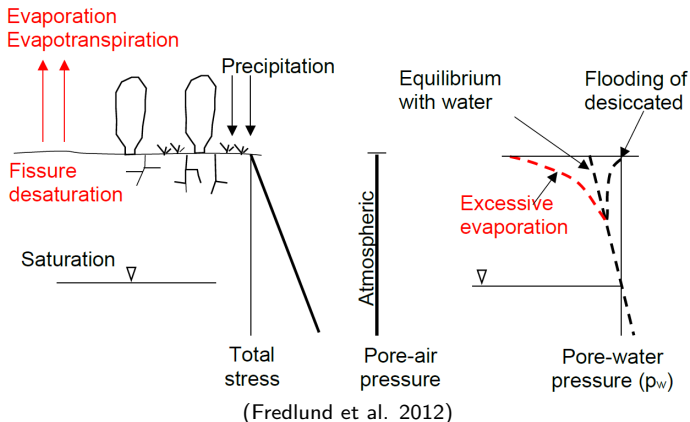
Nov-2019

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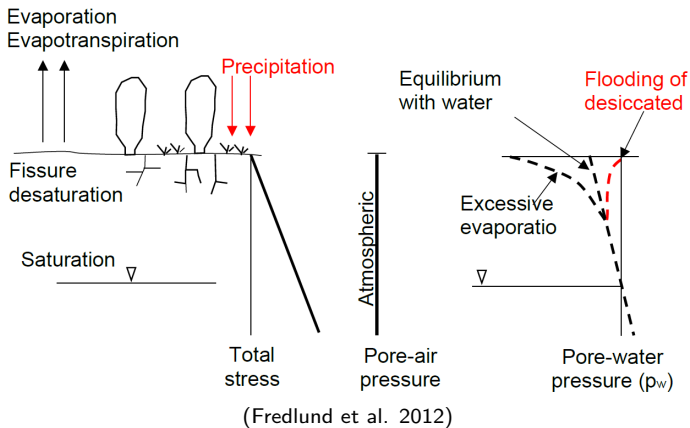
Introduction

Soil-atmosphere interface



Introduction

Soil-atmosphere interface



Soil deterioration

- Reduce strength



(Trabelsi et al. 2012)

Soil deterioration

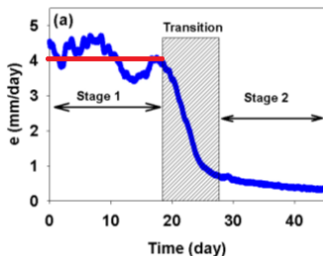
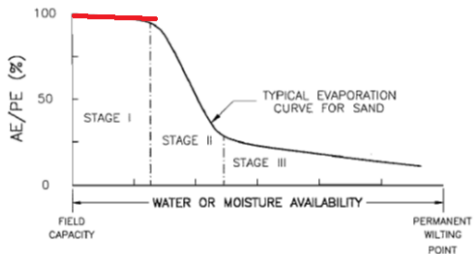
- Reduce strength
- Increase infiltration



(Trabelsi et al. 2012)

Evaporation

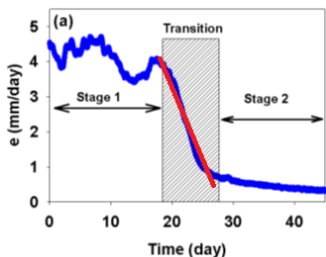
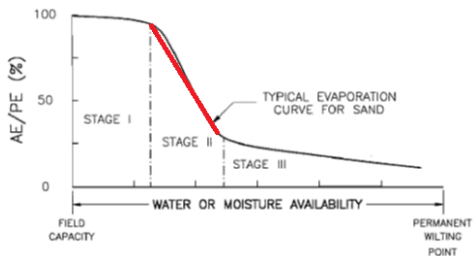
- Constant evaporation rate
Enough supply of water to the surface
- Falling rate
- Slow evaporation rate



(Wilson et al. 1997, Shokri et al. 2008)

Evaporation

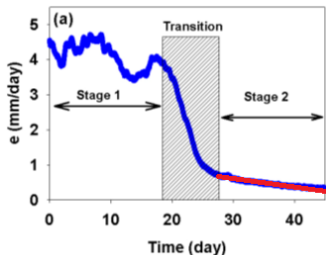
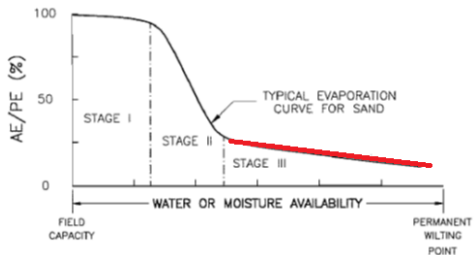
- Constant evaporation rate
- Falling rate
- Liquid phase discontinuous
- Slow evaporation rate



(Wilson et al. 1997, Shokri et al. 2008)

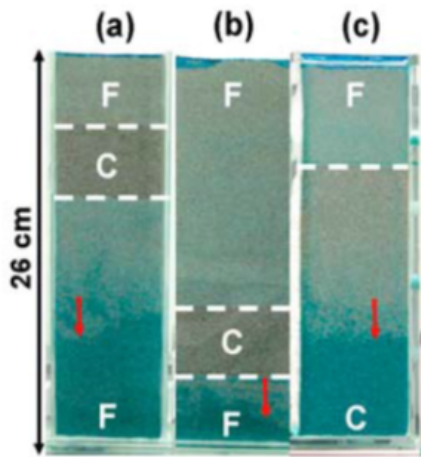
Evaporation

- Constant evaporation rate
- Falling rate
- Slow evaporation rate
- Diffusion



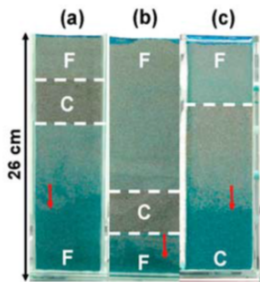
(Wilson et al. 1997, Shokri et al. 2008)

Numerical Modelling

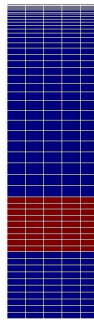
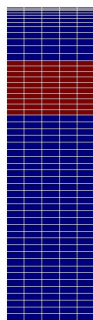
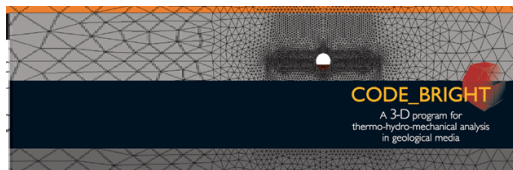


(Shokri et al. 2010)

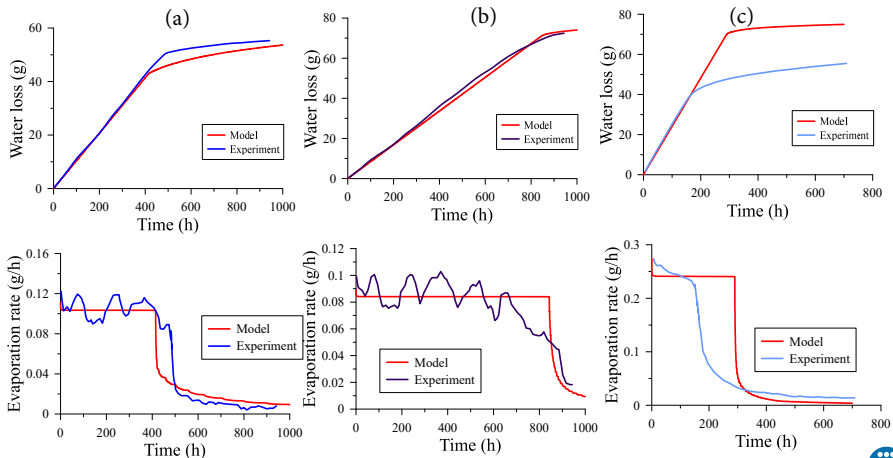
Numerical Modelling



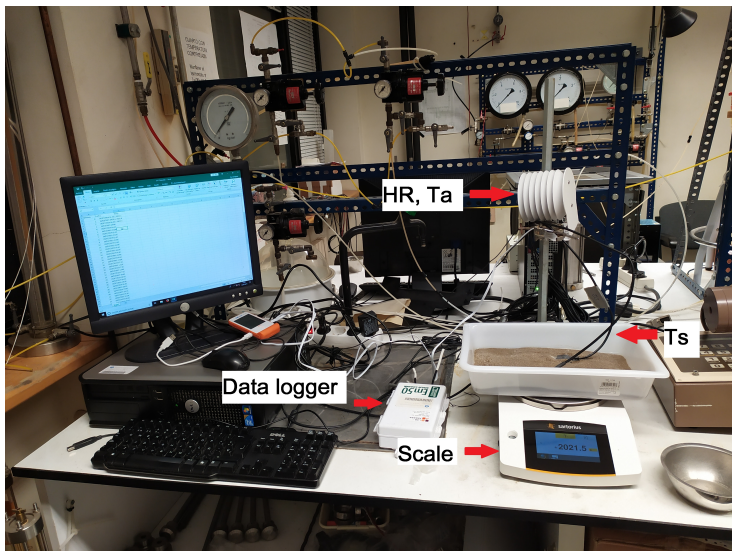
(Shokri et al. 2010)



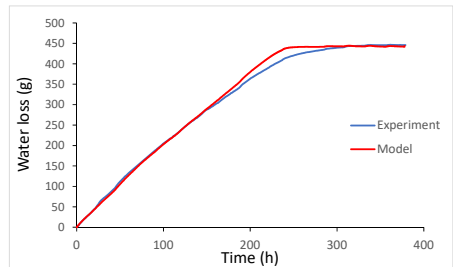
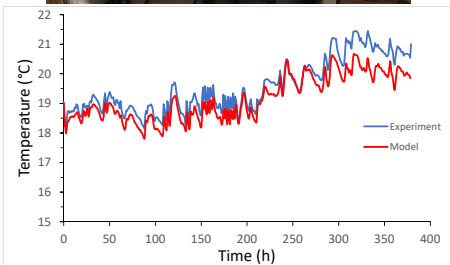
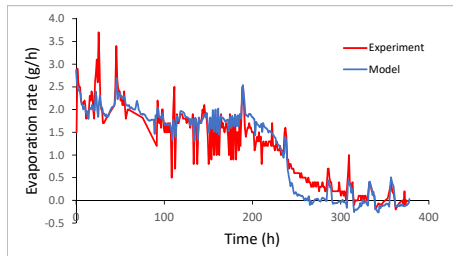
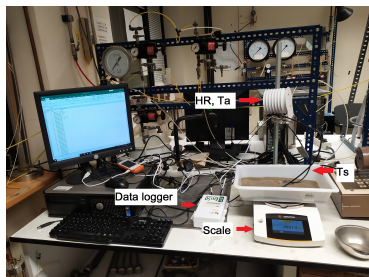
Numerical Modelling



Experiments



LC2



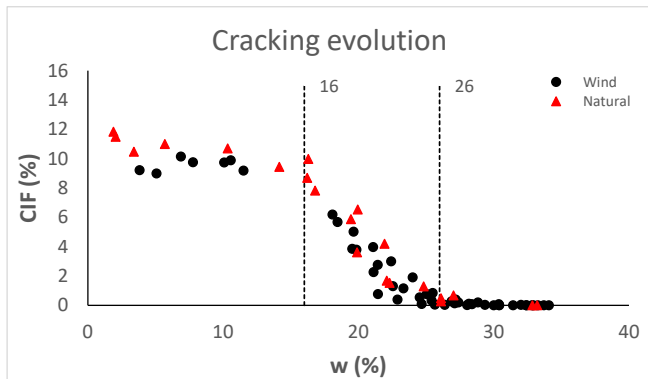
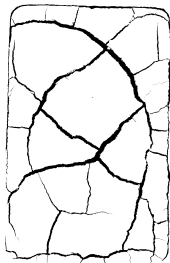
Cracking



Cracking



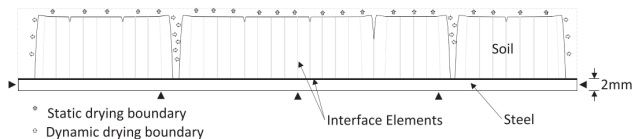
Cracking



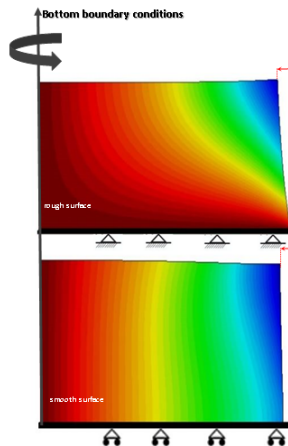
Numerical Modelling

FEM and FDM

- Interface elements
- Drying boundary



(Stirling et al. 2017)

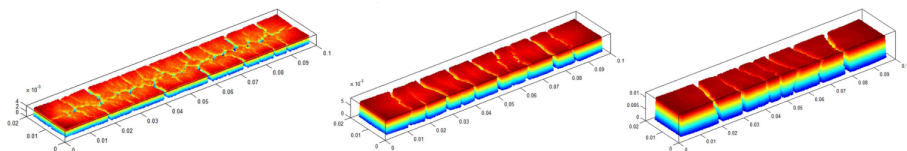


(Najdi 2019)

Numerical Modelling

SPH (Smoothed particle hydrodynamics)

- No interface element



(Bui et al. 2015)

Conclusions

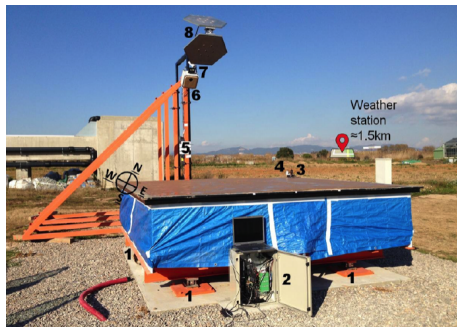
- 1 There is lack evaporation models in water transport that incorporate mechanical coupling.

Conclusions

- 1 There is lack evaporation models in water transport that incorporate mechanical coupling.
- 2 Digital image has become a fundamental tool to asses cracking network structure and cracking evolution.

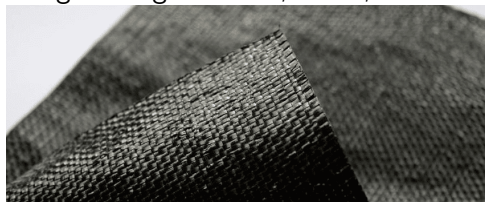
Future work

1 Field experiment.



Future work

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- 2 Mitigation: geotextiles, fibers, ...



Future work

- 1 Field experiment.
- 2 Mitigation: geotextiles, fibers, ...
- 3 Compacted soils.

References

- Fredlund, D. G., Rahardjo, H., and Fredlund, M. D. Unsaturated Soil Mechanics in Engineering Practice. John Wiley & Sons, Inc (2012).
- Trabelsi, H., Jamei, M., Zenzri, H., and Olivella, S. Crack patterns in clayey soils: Experiments and modeling. Int. J. Numer. Anal. Meth. Geomech. (2012) 36:1410-1433.
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