Novel analytical tools to identify key plant root traits to minimize water stress over the whole crop cycle

M. Javaux, F. Meunier and X. Draye

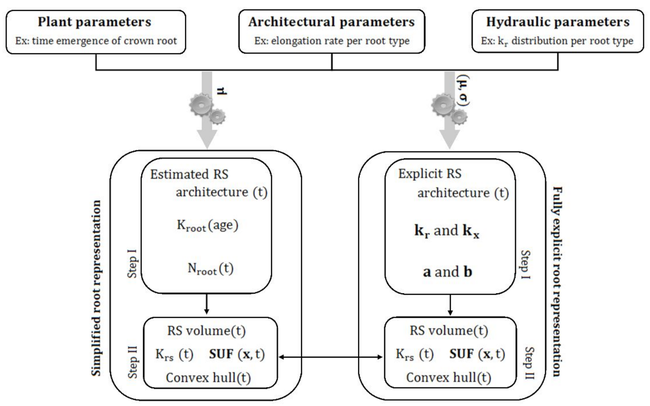
EARTH AND LIFE INSTITUTE, UNIVERSITÉ CATHOLIQUE DE LOUVAIN | AGROSHPERE, FORSCHUNGSZENTRUM JUELICH

Context

Bridging the gap(s) between root traits and plant tolerance to drought stress

- Drought impacts maize production worldwide
- Structural (architectural traits) and functional properties (hydraulic traits) of root systems are good targets to improve drought stress tolerance
- An efficient quantitative tool to estimate the impact of a specific root trait on the plant tolerance to stress is missing

from traits to drought tolerance



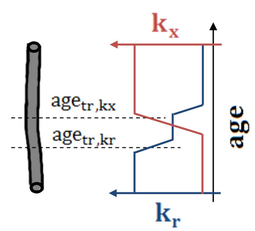
Approach

The tool

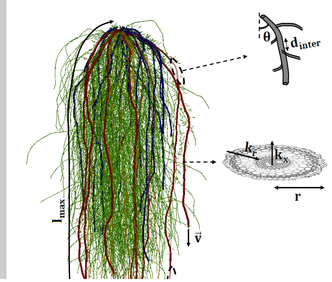
INPUTS

Literature and experiment-based calibration

Hydraulic traits



Architectural traits



TRY IT YOURSELF

https://plantmodelling.shinyapps.io/marshal

MAize Root System Hydraulic Architecture soLver

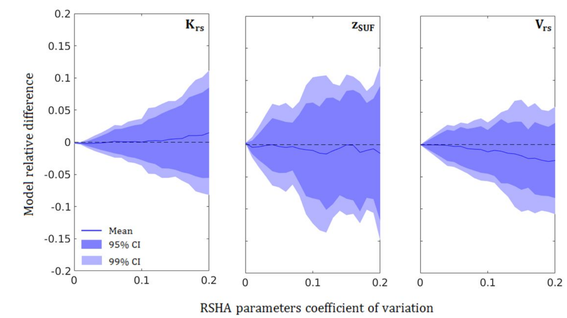
Coupling of the root system architectural (CRootBox, Schnepf et al. 2017) and hydraulic (hybrid, Meunier et al. 2017) models

Plant root hydraulic conductance evolution
Water uptake distribution with time
Soil volume invasion with time

Comparison of strategies under different climatic conditions
Optimal definition of root traits for certain environments

Results

The implicit model catches the root system hydraulic (K_{rs} = conductance, z_{SUF} = depth of water uptake) and architectural (V_{rs} = root system volume) macroscopic properties:



Macroscopic properties of maize root systems can be captured by analytical relationships linking local traits and plant-scale properties.

Conclusion

More about this work

Meunier et al. 2017 (doi: 10.1016/j.apm.2017.08.011)

Schnepf et al. 2017 (doi: 10.1093/aob/mcx221)

Scan me

Our funders

fnrs LA LIBERTÉ DE CHERCHER · FÉDÉRATION WALLONIE-BRUXELLES · erc

About us

http://www.plantmodelling.xyz

@MaJavx @MeunierFelicien