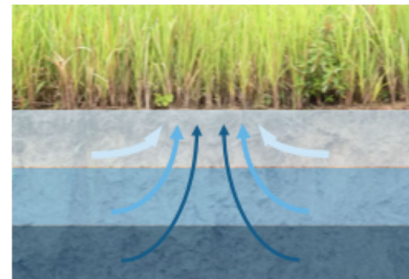


**M.Sc. Thesis topic****Quantification of root water uptake zones of two crop species and their seasonal changes**

Understanding where and when plants take up water is essential for improving water use efficiency and crop productivity, especially under variable climatic conditions. Different soil layers contribute differently to plant water uptake throughout the growing season, depending on root development, soil moisture availability, and environmental conditions. We are offering a M.Sc. project focusing on identifying and comparing the zones of root water uptake in a wheat and maize crop field via a Bayesian mixing model approach and how these zones shift over the growing season. Meteorological, soil physical and plant physiological data is available for this thesis. This study forms part of a larger research unit the “Land-Atmosphere-Feedback Initiative” (LAFI; <https://lafi-dfg.de/>) dedicated to improving the understanding and quantification of land–atmosphere feedbacks (e.g. evapotranspiration fluxes) through unique synergistic observations and model simulations.

You will:

- Work with water stable isotopes ( $^2\text{H}$ ,  $^{18}\text{O}$ ) to trace soil water uptake zones of winter wheat and maize and their seasonal dynamics
- Learn how to extract soil and plant water for stable isotope analysis
- Apply a mass balance mixing model to quantify root water uptake from different depths (e.g. Mahindawansa et al., 2018)
- Assess drivers of RWU variability using meteorological, soil and plant phenological data
- Apply statistical methods (with R or Python)



**Fig. 1:** Schematic illustration of root water uptake from different soil layers

**Requirements**

- Interest in plant–soil–water interactions and environmental processes
- Motivation to learn and apply new analytical tools and methods
- Willingness to participate in lab work

**Supervision**

- Prof. Dr. Natalie Orlowski
- Dr. Claudia Voigt

**Contact**

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**Literature**

Rothfuss, Y., & Javaux, M. (2017). Reviews and syntheses: Isotopic approaches to quantify root water uptake: a review and comparison of methods. *Biogeosciences*, 14(8), 2199-2224.

Mahindawansha, A., Orlowski, N., Kraft, P., Rothfuss, Y., Racela, H., & Breuer, L. (2018). Quantification of plant water uptake by water stable isotopes in rice paddy systems. *Plant and Soil*, 429(1), 281-302.