

Topic for master thesis

RU Mountain Hydrology and Mass Movements

Time period: 2025-2026

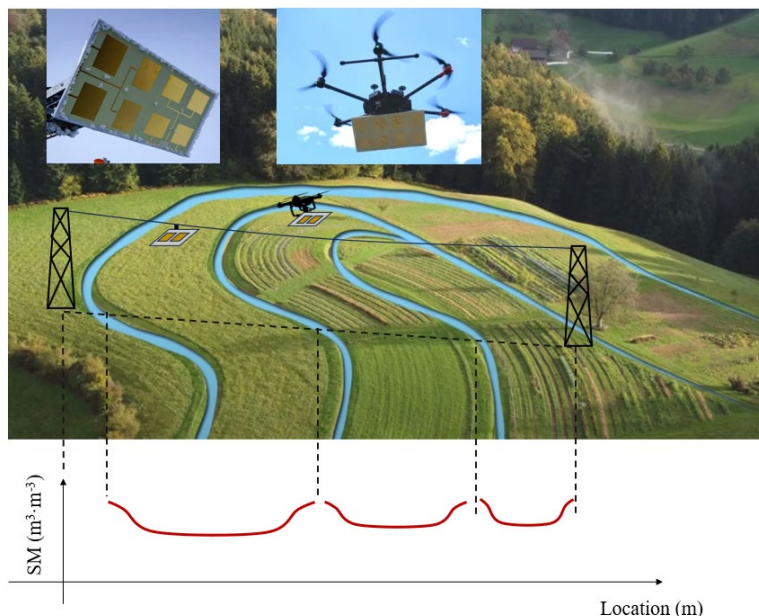
Quantifying the soil water distribution on an arable field with keyline design

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Background: To address the increasing frequency of droughts and intensifying rainstorms predicted for future summers, the agricultural sector is exploring nature-based solutions to retain water during surplus precipitation and conserve it for periods of scarcity. One of such measures, called Keyline Design, is currently being heavily promoted in organic farming. It suggests creating plow furrows and open drainage ditches (so called swales) along the contours of gently sloping fields to slow and capture surface runoff during heavy rainfall, later providing sustainable soil moisture to crops. While the concept is promising and supported by empirical evidence that it can enhance crop growth, there is a notable lack of quantitative research to demonstrate how significant its impact on the soil water balance is.

Aim: The goal of this Master thesis will be to measure and analyze the soil water distribution that is created by a Keyline design, i.e. open drainage ditches along the contours of a gently sloping arable field. These measurements will be carried out (together with specialists from WSL and a private Spin-off company) either on a farm in the Jurapark Aargau or on an experimental field in Uitikon (outside Zürich) and include drone-based microwave remote sensing, electrical resistivity tomography (ERT) and/or in situ soil moisture measurements. For the interpretation of the data, soil samples will be taken and analyzed with regard to the texture and soil hydraulic properties. Ultimately, this work will help evaluating the effectiveness of Keyline systems for drought situations.

Required skills: Basics in soil physics/soil hydrology; basics in data analysis; motivation for field work.



Schematic of an arable field with Keyline design and potential soil moisture measurements (drone-based microwave radiometer; foto: TerraRad Tech).