Institut Terre & Environnement de Strasbourg | ITES | UMR 7063 de l'Université de Strasbourg & cnrs & ENGEES

Master's internship
Calibration and validation of a soil-plant-atmosphere model in the Strengbach catchment area

Laboratory : Institut Terre et Environnement de Strasbourg – ITES UMR7063 - FRANCE
5 rue Descartes 67084 Strasbourg https://ites.unistra.fr/recherche/equipes/trhyco

Internship advisors : Benjamin Belfort (belfort@unistra.fr – 03 68 85 03 86), Sylvain Weill et Raphaël Di Chiara.

Duration: 6 months

Thematics: hydrology, ecophysiology, modelling

Key words: hydric transfers, ecophysiology, soil-vegetation-atmosphere, mechanistic model.

Profile: 3rd year engineering student or Masters 2 student; interest and skills in modelling; basic knowledge of hydro(geo)logy

Amount of the stipend: statutory allowances, ≈ 600 €/mois

How to apply: CV and covering letter to be sent by e-mail (belfort@unistra.fr)

Context of the project:

The Strengbach catchment, (also called Observatoire Hydro-Géochimique de l'Environnement OHGE: https://ohge.unistra.fr/), is a critical zone observation site and an open-air laboratory for research where numerous measurements (meteorological, hydrological, geochemical, geophysical) have been carried out for more than 35 years [1]. The study of evapotranspiration is one of the major research focus giving rise to targeted measurement campaigns and modelling work in recent years. Four sap flow campaigns have been carried out since 2021 to estimate transpiration in beech and spruce plots. At the same time, a doctoral thesis, due to be defended in the first quarter of 2025, has led to the development of a 1D soil-plant-atmosphere model, SoVegI [2] (Soil Vegetation Interaction), coded in Fortran using the object-oriented programming paradigm.

Objective of the internship:

The aim of the internship will be to parameterise and validate the SoVegI mechanistic model and to evaluate its performance for the two types of cover present in the Strengbach catchment, using a wide variety of information and measurements (granulometry, soil moisture measurements, meteorological measurements, sap flow measurements, etc.)[3]. Preliminary work will consist of compiling the input files required by the model on the basis of available measurements and data from the literature. A sensitivity analysis of the input parameters and certain variables will be carried out to gain a better understanding of how the model works. Finally, SoVegI will be calibrated and validated by using the 4 years of sap flow and soil moisture measurements. In addition to the efficiency criteria traditionally calculated to assess the model's robustness and performance, the SoVegI simulations will be compared with those produced by a conceptual water balance model developed in the laboratory. This section will enable a more detailed analysis of the strategies used to model foliar transpiration and to consider ways of using SoVegI to simulate the past historical period (with incomplete data).

During the internship, the student will be able to visit the site and take part in sensor maintenance and possibly install equipment for the 2025 sap flow campaign. This work could be continued as part of a doctoral project.

Prerequisites:

Enthusiasm and motivation to work on modelling.
Ability to read and summarise scientific articles in English.
Knowledge of programming would be appreciated.
Knowledge of hydrology and plant ecophysiology would be an advantage.
Ability to summarise and write, interest in collaborative research.

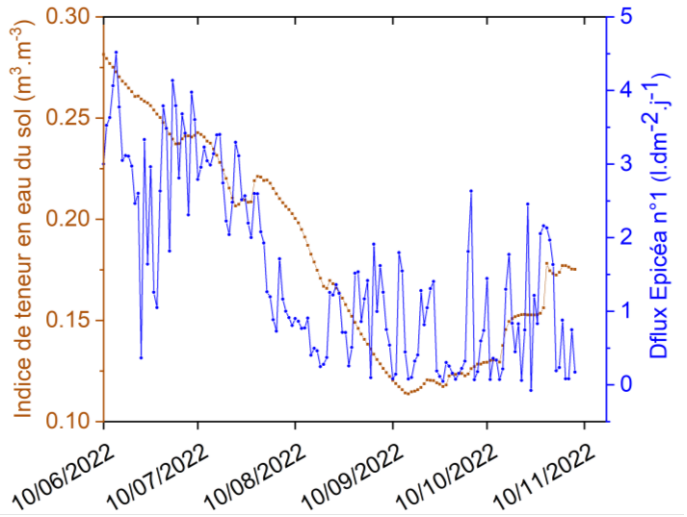

Illustration of soil moisture (brown curve) and sap flow (blue curve) measurements carried out in 2022 on the plot of the young stand (spruce).

Installation of sap flow sensors in 2022

References:

[1] Pierret, M. C., Cotel, S., Ackerer, P., Beaulieu, E., Benarioumlil, S., Boucher, M., ... & Probst, A. (2018). The Strengbach catchment: A multidisciplinary environmental sentry for 30 years. Vadose Zone Journal, 17(1), 1-17.

[2] Corvi, O., Weill, S., Belfort, B., Ackerer, P., Bonal, D., & Cuntz, M. (2023). SoVegI: a new and efficient model coupling photosynthesis and hydraulic transport within the soil-plant continuum (No. EGU23-983). Copernicus Meetings.

[3] Belfort, B., Toloni, I., Ackerer, P., Cotel, S., Viville, D., & Lehmann, F. (2018). Vadose zone modeling in a small forested catchment: Impact of water pressure head sampling frequency on 1D-Model calibration. *Geosciences*, *8*(2), 72.