UNIVERSITÉ DE NEUCHÂTEL

CHYN
Centre d'hydrogéologie et de géothermie

MSc in Hydrogeology and Geothermics

Thesis topic proposal 2021

THE SEELAND PROJECTS

Contexte et objectives

After the first and the second correction of the rivers and lakes in the Jura region, the Seeland became one of the most important agricultural areas in Switzerland. The Seeland used to be covered by swamps and ponds. Physical and chemical conditions were favorable to peat formation. In the context of the corrections, soils were drained and exposed to ambient air, triggering an important loss of soil through oxidation. The mechanical and chemical erosion processes resulted in a significant subsidence of the terrain.

The groundwater level controls the rate of chemical erosion. On the one hand, there is a need to keep the water table high to prevent/slow down the oxidation of organic soils. On other hand, in the context of climate change, groundwater is increasingly used for irrigation potentially leading to a drawdown of the water table. At the same time, the water table affects the irrigation water demands. Controlling the water tables in the Seeland aquifer through the existing drainage network is thus the key to sustainable management of the soil- and water resources.

The CHYN is involved in several research projects in the Seeland related to water – and soil resources management.

Méthodologie

Depending on the interest of the student, a wide range of activities and investigations can be carried out, including the following:

Project 1: Assessment of the potential to use the drainage-nets for means of irrigation. This is an interesting approach because the loss of soil resulted in the drains now being much closer to the surface compared to 20 years ago. Targeted experiments to measure the response of the aquifer to blocking the drains can be carried out in the field. Numerical models will complement the field approaches.

Project 2: Development of a numerical model simulating irrigation, infiltration and transpiration dynamics for different climate scenarios: Such a model can be based on available data. Targeted field experiments to inform the model should be developed and carried out;

Project 3: Analysis of the influence of topography and the hydraulic properties of the soil on water logging in agricultural fields. Understanding water logging processes is critical to implement modifications of the topography of waterlogged areas. In this context, the influence of groundwater dynamics on soil moisture profiles will be assessed through a combination of numerical models, geophysical data and additional field campaigns;

Project 4: Analysis of the influence of temperature and soil water content on carbon dioxide soil emission with an experimental gas logger. Assessment of peat contribution in carbon dioxide emission with Carbon-14 analysis. Development of a model linking soil subsidence with carbon dioxide emissions.

Supervision

The projects will be supervised by Prof. P. Brunner, Prof. D. Hunkeler Oliver Schilling and F. Miville.