Versuchseinrichtung zur Grundwasser- und Altlastensanierung · *VEGAS*

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Problem Description
B.Sc., M.Sc. Thesis

Universität Stuttgart
Institut für Wasser- und Umweltsystemmodellierung

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Multivariate Time-Series Analysis and Modelling of Environmental Data

Motivation

State of the art environmental engineering involves modern measurement techniques that allow us to monitor various parameters in unprecedented frequency:

- pressure conditions in groundwater are monitored with level-loggers in fractions of seconds for hydraulic tomography;
- solute concentrations in groundwater and temperature can be evaluated for tracer tomography and for the assessment of remediation efforts;
- Effectively constantly, temperature and pH are monitored to evaluate the effectiveness of remediation technologies;

The collected data-sets are large and pose various challenges:

- the signal has to be extracted from noisy data, i.e. various data-processing techniques (filters, trend-analysis, outlier detection, etc.) are necessary;
- the quality of the signal has to be assessed;
- the processing of the data has to be efficient: multiple time-series need to be processed sequentially in an automated fashion;
- the workflow should be reproducible;
- the joint analysis of time-series collected in spatial proximity should lead to a better understanding of the system under study

Task

1. Familiarize yourself with the existing code base that is actively being developed (existing code base available, open-source, distributed version control, python ecosystem). 2. Write code to parse the data from various measurement devices such that they can be fed into an existing interactive data analysis tool.
2. Analyze the data, which might require to extend the existing functionality of the analysis-tool (add filter, outlier detection)
3. To answer the key scientific question, analyze data that might originate from one statistical population (e.g., pressure data from one hydrogeological unit) jointly in a multivariate framework

Keywords

- data,
- time-series,
- python,
- programming

Support

We support you with getting started and provide help with programming in python. A requirement is that you are interested in learning key concepts of programming in python. You should be curious and eager to play with data! You will learn key traits that are desired in engineering consultancies.

The student research project will be performed at VEGAS (Research Facility for Subsurface Remediation, University of Stuttgart). It is based on several preceding projects and students' theses. The experiments will be supported by the analytical capacity of the VEGAS laboratory, the workshops of the institute and the practical and theoretical know-how of the VEGAS staff.

Supervision

Dr.Ing. Claus Haslauer
Dr. Emilio Sanchez (University of Tübingen)

Formulation of Problem / Examiners

Dr.Ing. Claus Haslauer

Prof. Dr.–Ing. Dr. András Bárdossy

We'd be happy to hear from you and happily discuss details of the project with you!

Starting date: as soon as possible / to be discussed

Stuttgart, 1-Mar-2019