RUHR-UNIVERSITÄT BOCHUM

RUB

INVITATION TO THE PHD-COLLOQUIUM OF THE FACULTY OF GEOSCIENCE

Date: 14th of July 2025 at **16:00**
Room: IA 5/94
Zoom: 665 3108 8496, passcode: 598277
Moderator: Roman Fritz

16:05 to 16:25 Harriet Ellwein
– Cooperation between Municipalities and Universities in Urban Development - an Investigation from a Municipal Perspective

16:30 to 16:50 Jan Hohmann
– Development of survey standards to analyse the ecological impact of the raccoon (Procyon lotor) in North Rhine-Westphalia

16:55 to 17:15 Anna Rath
– The effect of language-sensitive elements on the development of systems thinking: An intervention study in the field of language-sensitive geography lessons on the topic of flooding

17:20 to 17:40 Kaan Cökerim
– Modelling Non-Tidal Loading Signatures in Global Vertical GNSS Displacement Time Series

17:45 to 18:05 Elvira Latypova
– High-resolution seismotectonics and statistical links between seismicity and displacements in analog subduction models

All interested parties are kindly invited to attend the colloquium.

Scan to join:

LIST OF ABSTRACTS

Harriet Ellwein

Global and local societal challenges require alliances of important societal actors. This study focuses on the cooperative relationships between municipalities and universities, which can be assigned to two different societal systems and have different objectives, restrictions and institutional anchors. A gap in the research is how municipalities assess this cooperation in the first place. The research questions refer

- to the added value of this cooperation for the municipalities in meeting the challenges of urban development,
- to its influence on political decisions,
- to the framework conditions under which the findings and structures of this cooperation can become established in the municipality

- limited to topics of urban development. Two levels are considered:

- the cooperation of municipalities and science as institutions in urban development issues,
- and the cooperation in research, where both partners jointly search for findings that are subsequently implemented in municipal practice.

The study area consists of Bochum, Dortmund, Duisburg and Essen, four neighbouring cities in the Ruhr area, a region whose universities were only founded in the 1960s.

Jan Hohmann

Neozoa currently pose one of the greatest ecological challenges. These neozoa include the raccoon, which is listed as an invasive species of EU-concern due to its potentially negative ecological impact. Monitoring of invasive neozoa is mandatory but not yet sufficiently established for the raccoon.
Therefore, the aim of this study is to develop a standardised survey method that can form the basis for raccoon monitoring.
In order to achieve this, areas, in which a reliable raccoon population can be assumed, were defined based on citizen science data. Within these areas, survey points were then defined to be analysed for evidence of raccoons. Possible evidence includes footprints and scat, visual observations and acoustic evidence, including the use of audio dummies. Selectively, detection using eDNA will also be trialled. The examined places were determined based on the ecological requirements of the raccoon.
The aim is to identify locations and types of evidence that can prove the presence or absence of raccoons in an area of a certain size with a high degree of probability. The investigated areas cover both urban and agricultural areas as well as semi-natural structures. This should make it possible to transfer the results of the method development from the areas with certain occurrence to as many differently structured areas with unknown or uncertain raccoon occurrence as possible.

Anna Rath

The importance of language skills for success at school has been demonstrated many times by international studies such as PISA and TIMSS. Although the promotion of language skills is often considered the task of German lessons, current research shows that subject-specific language requirements must be addressed directly in the respective subjects. Geography lessons also show that language is not only a medium for conveying knowledge, but also a potential obstacle to fostering subject-specific skills. This is especially the case for complex organization and networking, which are needed for systems thinking. Despite the development of initial concepts for language-sensitive geography lessons, there is still a lack of empirical evidence on the effectiveness of such measures, particularly in secondary schools.

Against this background, the present intervention study examines how the integration of language-sensitive elements – including scaffolding, the change and interconnection of forms of representation and the inclusion of the first language – affects the development of the dimensions of systems thinking, such as system organization and system behavior, in the context of flooding. Using pre-, post- and follow-up design, grade 11 students in North Rhine-Westphalia went through a language-sensitive or a conventional teaching unit. Data were collected with the help of questionnaires, concept maps and participant observation. The aim is to investigate whether language-sensitive geography lessons can promote not only linguistic but also complex subject-specific skills and thus contribute to strengthening equal opportunities in the German educational system.

Kaan Cökerim

Global Navigation Satellite Systems (GNSS) are commonly used to monitor how the Earth's surface moves over time. While this is essential for studying tectonic processes such as plate motion and earthquakes, GNSS data also capture seasonal ground motion caused by non-tectonic influences. These are primarily due to non-tidal surface loading, resulting from fluid mass redistributions in the atmosphere, oceans, and terrestrial hydrology. The resulting seasonal signals can obscure subtle tectonic trends, complicating geophysical interpretations.

Traditional methods for separating tectonic and non-tectonic signals often rely on mathematical techniques such as curve fitting or matrix factorization, which typically ignore the underlying physical processes. While numerical non-tidal loading models do exist, they frequently show substantial discrepancies with observed GNSS displacements—due to factors like model resolution, regional variability, and inherent limitations in capturing complex loading effects.

In this study, we present a data-driven approach to modelling non-tidal loading signatures in vertical GNSS displacement time series using a Temporal Convolutional Neural Network. Our model uses existing non-tidal loading models to predict the non-tectonic vertical GNSS displacement signal. We train our model on 20 years of GNSS displacement time series from 11,000 globally distributed stations.

Our results show that our machine learning approach consistently outperforms standard physics-based loading models, achieving a statistically significant 4.7% average improvement in fitting the target non-tectonic GNSS displacements. These results demonstrate that our method effectively models the non-tidal loading signature and significantly reduces the impact of seasonal variations in GNSS observations. Our results further demonstrate the potential of deep learning to enhance the modelling of seasonal surface deformation and better isolate tectonic signals in GNSS displacement time series.

Elvira Latypova

The study of the behaviour and periodicity of large earthquakes is crucial to ensure that society is prepared for catastrophic events. In recent decades, seismotectonic models have become valuable tools for studying seismic cycles. These models can replicate hundreds of continuous seismic cycles in a short time and can be scaled to resemble real fault systems in nature. We use Foamquake, a scaled seismotectonic analog model that simulates megathrust seismic cycles (Mastella et al., 2022). The experimental setup consists of a subduction interface made of a rice-sand mixture, a foam wedge that simulates the upper plate, and a motor driving the subduction. We run dozens of experiments, varying the configuration of asperities – seismogenic sources – to create high-rate records that simulate hundreds of subduction earthquake cycles. We record shaking (akin to seismicity) using the network of accelerometers and displacement (akin to GNSS displacements) using a high-resolution camera with the aim of tracking the variation in plate interface kinematics along with the variation in seismicity. Through detailed studies of laboratory earthquake recurrence patterns and asperity relationships, we investigate the controlling factors that lead to similar seismic behaviour to that captured in paleoseismic records of subduction zones.

To identify statistical relationships between seismicity and displacements, we attempt to test whether displacement and seismic data are predictive of each other using a deep learning approach.