Fakultät für Geowissenschaften, Geographie und Astronomie
Institut für Meteorologie und Geophysik

Einladung zu den Vorträgen im Rahmen der Tenure-Track Professorship for the field of Environmental Geophysics

Zeit: **10.3.-11.3.2020**
Ort: UZA 2, Althanstrasse 14, 1090 Wien, Exner-Raum 2F513

Im Rahmen der Ausschreibung zur Tenure-Track Professorship finden fakultätsöffentliche wissenschaftliche Vorträge und fakultätsöffentliche Lehrproben statt, zu denen hiermit herzlich eingeladen wird.

Wissenschaftliche Vorträge (30‘ inkl. Diskussion)

Termin	**Thema**	**Vortragende(r)**
10.3.2020 13:00	Environmental Geophysics: Lost in Transitions (+ Lehrprobe von 13:30-13:50 Uhr)	Naomi Vouillamoz Seismo Earth AG
10.3.2020 14:30	Hydrogeophysics in carbonate critical zone (+ Lehrprobe von 15:00-15:20 Uhr)	Chi Zhang University of Kansas
11.3.2020 09:00	Bayesian Full-Waveform Inversion (+ Lehrprobe von 09:30-09:50 Uhr)	Jürg Hunziker University of Lausanne
11.3.2020 10:30	Environmental Seismology: What seismic and acoustic waves tell us about mass movements and the subsurface (+ Lehrprobe von 11:00-11:20 Uhr)	Florian Fuchs Universität Wien
11.3.2020 13:45	Multi-scale sensing of the subsurface electrical properties: acquisition and imaging procedures (+ Lehrprobe von 14:15-14:35 Uhr)	Julien Guillemoteau Universität Potsdam

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Dr. Naomi Vouillamoz

Environmental Geophysics: Lost in Transitions

In this presentation, I would simply like to give an overview of my research background: starting with an initial training in structural geology, 3D modelling and GIS (geographic information systems) (2000-2009); sliding then into micro-seismology and active micro-tectonics by investigating low-magnitude ($M_L < 2$) earthquake sequences in the vicinity of a nuclear reactor in the Swiss Alpine foreland during my PhD (2009-2015); and landing finally in the field of environmental geophysics by exploring micro-seismic signals generated through brittle deformation processes in active slow-moving mudslides during my postdoc project (2015-2018). Since 2017, I progressively stepped out the academic world by co-founding a company whose core project is in developing an alternative implementation approach to deep geothermal heat mining for industrial electricity generation. In this context, my research focus has switched to energy and its global and growing problematic at the nexus of climate-change and consumerism. This brings me where I am today: concerned about the future of our civilization; questioning myself about the various roles of geosciences in our transitioning world; more than ever willing to act.

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Dr. Chi Zhang

Hydrogeophysics in carbonate critical zone

Carbonate terrains constitute a significant portion of the ice-free terrestrial land and supply up to 25% of the world's populations with potable water. The carbonate critical zone studies use transdisciplinary approaches to solve some of the most pressing challenges society faces (e.g., security, scarcity, and uncertainty of water and carbon sequestration). The carbonate terrains are typically dominated by chemical weathering processes including dissolution and reprecipitation and they act as fastresponding members to perturbations such as land-use, climate change (e.g., pCO2), and anthropogenic perturbations (e.g., contaminants). To understand how the hydrological, biogeochemical, and physical processes evolve within carbonate critical zone, it is imperative to observe and project changes in carbonate critical zone architecture.

In this talk, I will describe how I use combined geophysical tools to quantify and predict water storage and fluxes, biogeochemical fluxes, and weathering dynamics in carbonate critical zones Using a recent study as an example, I will demonstrate how to link the exploratory laboratory findings with numerical simulations and field geophysical observations (ERT, NMR, and GPR) to quantify the key hydrogeological parameters and to update the conceptual model of groundwater flow paths and secondary porosity distribution in alternating thin limestone-shale system. In addition, this talk will discuss the potential for hydrogeophysics to transform our understanding and modeling of carbonate critical zone processes.

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Dr. Jürg Hunziker

Bayesian Full-Waveform Inversion

In Ground Penetrating Radar (GPR) full-waveform tomography we aim to infer the medium between two boreholes from transmission measurements of electromagnetic waves considering the complete wavefield. Usually, this highly non-linear problem is solved using a deterministic algorithm.

However, this requires a starting model that is close to the global minimum of the solutionspace as otherwise the algorithm converges to a local minimum. Furthermore, a deterministic algorithm produces one image of the subsurface making uncertainty quantification difficult. We propose to use a probabilistic approach. This allows to start from any starting model and, as a probabilistic algorithm infers a set of subsurface models, allows for straightforward uncertainty quantification. The drawback, however, is an enormous computational cost. In this presentation, we show how probabilistic GPR full-waveform tomography is possible for complex subsurface structures and we give an outlook on how to improve this algorithm using convolutional neural networks.

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Dr. Florian Fuchs

Environmental Seismology: What seismic and acoustic waves tell us about mass movements and the subsurface

In light of climate change alpine regions are facing future challenges such as potentially increased risk for natural hazards and the sustainable use of resources. In this context environmental seismology is an emerging field that shows great potential for addressing several topics of high societal relevance.

Melting permafrost can facilitate mass movements in alpine regions. Mass movements such as rockslides generate seismic and acoustic waves that contain information about the time, location, volume and potential mechanism of the event, enabling us to remotely infer important event parameters from tens to hundreds of kilometers distance. Even more so, as seismometers continuously sample the ground, they offer a temporal resolution unprecedented by any classical method. This allows us to study triggering mechanisms in detail, and to resolve the time- and size-distribution of individual events or sequences, potentially revealing underestimated complexity and underlying fundamental laws.

Utilizing the ambient seismic noise field it is also possible to image subsurface changes that may be linked to triggering of mass movements. Environmental seismology provides tools to image and monitor velocity changes at shallow depth that e.g. relate to thawing of frost or water saturation and thus play an important role in initiation of ground failure. The very same methods also allow to track changes in ground water level over large areas and thus open up new possibilities in the field of hydrology and sustainable water management, in particular in complex carstic environments such as the Eastern Alps, that are an important fresh water resource for Austria.

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Dr. Julien Guillemoteau

Multi-scale sensing of the subsurface electrical properties: acquisition and imaging procedures

For 200 years, electromagnetic phenomena have been extensively studied, notably because they can give crucial information on the electrical properties of materials, from the atomic to the astronomic scale. In Environmental Geophysics, the electromagnetic theory is the basis of various remote and non-destructive sensing methods.

After a brief introduction on these methods, I will present my work at the University of Potsdam over the past few years, in particular on 3D near-surface imaging techniques with both electromagnetic-induction and magneto-static methods. I will also discuss the place of this recent work in the framework of a multi-scale methodology, which aims at the characterization of specific targets, ranging from soil layers to geological formations at the kilometric scale. Such a multi-scale analysis procedure can evidently be implemented for a broad range of applications in Earth and Environmental Sciences, which I will illustrate by a brief overview of past and on-going projects.

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