

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 4, December 2013

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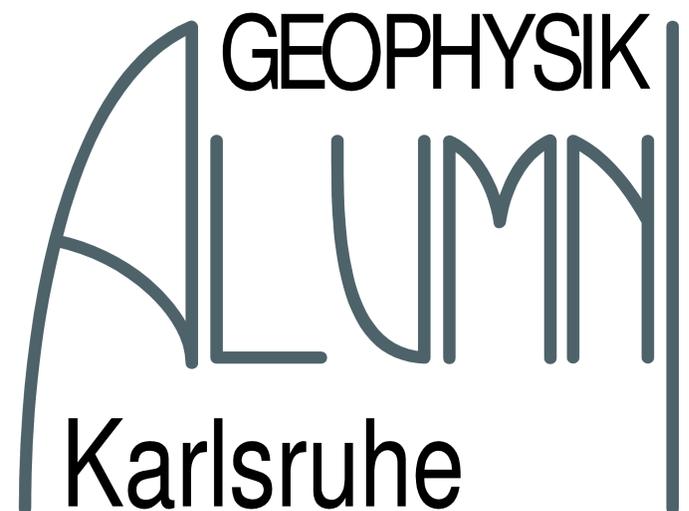
DEAR GPI ALUMNI

This is the fourth newsletter of our alumni covering the second half of the year 2013. On the following pages you will find interesting things that happened within the Geophysical Institute regarding teaching and research. Our publication is documented by listing the peer-reviewed papers at page 5.

Our institute is currently preparing the 74th Annual Meeting of the DGG (German Geophysical Society) which will take place in Karlsruhe from March 10 to 13, 2014. In 2014 the GPI will be 50 years old. We therefore hope that many alumni will attend the Alumni meeting which is included in the conference welcome party on Sunday, March 9. On this occasion the GPI anniversary book "50 years Geophysical Institute in Karlsruhe: 1964-2014. Expectations and Surprises" edited by Claus Prodehl will also be presented.

We wish everyone a peaceful holiday season and all the best for 2014 !

Thomas Bohlen



MAURICE EWING MEDAL FOR PETER HUBRAL

The Society of Exploration Geophysicists (SEG), the largest international society of exploration scientists from academia and industry, awarded Professor Dr. Peter Hubral the Maurice Ewing Medal. Peter Hubral was Professor for Applied Geophysics between 1986 to 2006 at the Geophysical Institute of KIT.

The Maurice Ewing Medal was established in 1977 and first awarded in 1978 as the highest honor given by SEG to honor the memory of Maurice Ewing and his enormous contributions to geophysics.

Congratulations to Peter Hubral for this recognition of his outstanding contributions to the theory of wave propagation and migration and inversion of seismic wave.

STEFAN JETSCHNY NOW AT PGS

After the birth of his son Anton, Stefan Jetschny replaced the steamy Rheingraben by Norwegian fjords. In his 4 years at the GPI, Stefan was strongly involved in the GPI's teaching activities. Stefan also managed different research projects and co-supervised PhD students as well as many bachelor- and master students. His organizational talents and relaxed ways to tackle the daily challenges are sorely missed at the GPI. Since the start of September, Stefan has been working on seismic modelling in marine geophysics at PGS in Oslo.

POSTGRADUATE SCHOLARSHIP FOR EVA SCHROTH

Dipl.-Geophys. Eva Schroth received a postgraduate scholarship for 2014. She will analyze the apparent temporal variations of Earth's response factors to forcing due to gravity. She observed these variations in records from SG056 at the Black Forest Observatory (BFO) as well as from other superconducting gravimeters. The variations are well outside the confidence intervals but their cause is not yet understood. Hypotheses include true variations of the Earth's response possibly due to variations in ocean loading as well as conceptual deficiencies of the analysis when combining different tidal waves to a wave group with one single response factor. Similar observations are reported by other research groups. These variations become significant with advent of superconducting gravimeters. Long undisturbed recordings from extremely stable gravimeters are required for confidence intervals smaller than the observed effect.

ALUMNI MEETING

In the frame of the 74th Annual Meeting of the German Geophysical Society (DGG) in Karlsruhe next year from 10th to 13th of March (www.dgg-2014.de) there is a small Alumni meeting planned. It will take place on the 9th of March at 7 pm in the Hoepfner Burggarten in Haid- und Neu-Straße 18, Karlsruhe (www.burgstueble-schalande.de).

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TEACHING

By Dr. E. GOTTSCHÄMMER

At the end of the summer semester 2013, 25 Karlsruhe Geophysics students had the opportunity to take part in a field excursion to Italy. The aim of the course was a better understanding of hazard posed by Italian volcanoes, namely Stromboli, Lipari, Vulcano and Vesuvius, and of the risk management performed. The course comprised in-situ-lectures, and both, exercises on hazard and risk as well as geological exercises in the field. The students had the chance to visit the Advanced Operations Center on Stromboli and the Observatory on Vesuvius, and discuss the issues of hazard and risk with local researchers. The highlight was certainly the ascent of the volcanoes, especially of Stromboli which was climbed at night in order to better spot the spectacular eruptions. The nine-day excursion, which on the last day also led to Pompei, was guided by Joachim Ritter and Ellen Gottschämmer (GPI) and accompanied by Bernd Schmidt (Mainz).

The winter semester 2013/14 started again with a high number of students, especially in the first year. Altogether 75 students were enrolled in the Bachelor's program, and 34 students take part in the Master's and Diplom program.



Photograph: M. Pontius

Lectures given by members of our institute are also attended by students from other degree courses: Geophysics was established as an Elective within the curriculum of the Bachelor's degree program in Physics at the beginning of this winter semester, and has been elected by several students of Physics. Already since 2012, Geophysics can be chosen as a secondary subject in the Master's degree program in Physics. Traditionally, however, the major part of external students comes from the Department of Civil Engineering, Geo and Environmental Sciences, studying Applied Geosciences.

The Geophysics laboratory for pupils of secondary schools had a high number of young visitors recently. The seismometer experiments had been carried out frequently last semester, and soon the experiments will move to a new location within the GPI. There will also be space for the sandbox experiment that uses geoelectrical methods in order to investigate the subsurface, and a new experiment on the sensitivity of viscosity on temperature is planned for 2014.



Photograph: M. Pontius

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NATURAL HAZARDS & RISKS/SEISMOLOGY – AG INDUCED SEISMICITY

BY DR. A. BARTH & PD DR. J. RITTER

This working group is part of the Forschungskollegium Physik des Erdkörpers e.V. (FKPE) and deals with the technical requirements of measuring induced seismicity due to geotechnical facilities. The objectives are assigned to three milestones:

MS1: Instrumentation and monitoring

MS2: Discriminating between induced and natural seismicity

MS3: Guidelines for writing expert opinions on seismic hazard.

Members of the GPI are involved in subgroups MS1 (Joachim Ritter, Jörn Groos) and MS3 (Andreas Barth). Final papers are published by MS1 on recommendations for monitoring induced seismicity (<http://www.geophys.uni-stuttgart.de/agis/images/Milestones/milestone1.pdf>) and by MS2 on recommendations for the discrimination of human-related and natural seismicity (<http://www.geophys.uni-stuttgart.de/agis/images/Milestones/milestone2.pdf>). The work for MS3 is still in progress. AGIS organized two international workshops on induced seismicity with Joachim Ritter as co-organizer: 2010 in Luxembourg (together with GPI alumni Adrien Oth) and 2012 in Karlsruhe. The next AGIS group meeting will be held during the DGG annual meeting 2014.

EARTHQUAKE AND TYPHOON IN THE PHILIPPINES

BY JAMES DANIELL

The recent earthquake and typhoon in the Philippines in October and November, 2013, caused much death and destruction. As part of the work of the Natural Hazards and Risks Group at the GPI, James Daniell using methods from his doctoral thesis, produced estimates of economic and social losses for both disasters in rapid analysis. For the earthquake, a total of \$90 million losses was predicted with around \$150 million reconstruction costs. The current reconstruction cost by the government stands at \$165 million USD (over 7 billion PHP). Over 200 people lost their lives and over 200,000 were displaced (with at least 50,000 long-term homeless).

The typhoon was one of the largest ever seen. The homeless and economic losses estimated matched well with the final totals. This catastrophic event has killed around 8000 people, around 3 million long-term homeless, and up to 6 million displaced people. The economic cost of the event was estimated in the order of \$14 billion USD. This is by far the largest disaster ever to hit the Philippines in modern times. The Natural Hazards and Risks group of the GPI will continue to monitor natural disaster events and to produce rapid socioeconomic analysis and causal loss research in the aftermath.

GUEST HOSTED BY GPI

MR. AKSHAYE RAJ

Mr. Akshaye Raj comes from the Indian Institute of Technology (IIT) Roorkee, which is the prime Indian research institution for earthquake engineering. He holds a Bachelor B.E. in Civil Engineering. During his visit at KIT between September 2013 and March 2014, which is funded by the DAAD, he will work on strong ground motion scenarios for Northern Indian cities as part of his M.Tech. thesis.

FEEDBACK

If you have any comments, questions or remarks, please do not hesitate to contact us. We appreciate your feedback.

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PHD DEFENSES

In the second part of 2013 there have been 4 PhD defenses at GPI:

Dr. Tobias Horstmann

Titel: Analysis of tremor at the San Andreas Fault at Parkfield

Supervisors: Prof. Dr. Friedemann Wenzel (KIT), Prof. Dr. Rebecca Harrington (McGill University) and Prof. Dr. Thomas Bohlen (KIT)

In October 2013 Mr. Dipl.-Geophys. Tobias Horstmann defended successfully his PhD thesis.

The main focus of his work was the analysis of tremor at the San Andreas Fault in Parkfield. During his thesis he developed a semi-automated tremor detection algorithm based on neural networks, which he applied to a one year long dataset recorded around Parkfield, California. In addition, he introduced a new tremor localization method based on time-reversal imaging techniques.

Dr. Lisa Groos

Titel: 2D full waveform inversion of shallow seismic Rayleigh waves

Supervisors: Prof. Dr. Thomas Bohlen (KIT), Prof. Dr. Wolfgang Friederich (Ruhr-Universität Bochum) and Dr. Thomas Forbriger (KIT)

In November 2013 Mrs. Dipl.-Geophys. Lisa Groos defended successfully her PhD thesis. Main objective of her work was the application of 2D full-waveform inversion (FWI) to recorded shallow seismic Rayleigh waves. In preparation of such an inversion she investigated the significance of different effects (e.g. effects of anelastic damping, influence of P-wave velocity model) by synthetic studies. Finally, she discussed a successful application of 2D FWI to a field dataset which was acquired on a predominantly depth-dependent structure.

Dr. Anja Diez

Titel: Effects of cold glacier ice crystal anisotropy on seismic data

Supervisors: Prof. Dr. Thomas Bohlen (KIT) and Prof. Dr. Olaf Eisen (AWI)

In December 2013 Ms. Dipl.-Geophys. Anja Diez defended her PhD thesis. The main focus of her work was the Analysis of seismic data for effects of ice crystal anisotropy in ice sheets. For the investigation of the influence of ice crystal anisotropy on seismic data she derived the elasticity tensor from ice core data. A better understanding of reflections caused by abrupt changing crystal orientation fabric was gained by the combination of seismic, radar and ice core data. Finally, she derived information about the ice crystal anisotropy from travel time analysis of seismic wide angle data.

Dr. Ines Veile

Title: Fast 3D forward modeling of single scattered elastic wave fields for borehole configurations

Supervisors: Prof. Dr. T. Bohlen (KIT) and PD Dr. J. Ritter (KIT)

In December 2013 Ms. Dipl.-Geophys. Ines Veile defended successfully her PhD thesis.

Ines Veile dealt with the development of a new fast and efficient 3D forward modeling technique based on the elastodynamic scattering theory. The main focus of her work was the derivation and numerical implementation of a suitable algorithm to efficiently and accurately model the single scattered elastic wave field in borehole configurations. Apart from the derived explicit mathematical formulation and the scheme of its numerical implementation, in her work she also presents various synthetic studies and experiments that aim to investigate the possibilities and limitations of the developed method.

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RECENT PUBLICATIONS

In this section we would like to inform those of you who are still active in Geophysics about recently published peer-reviewed journal papers authored by current members of GPI:

- M. Kunz, B. Muhr, **T. Kunz-Plapp**, **J. E. Daniell**, **B. Khazai**, **F. Wenzel**, M. Vannieuwenhuysse, T. Comes, f. Elmer, K. Schroter, J.Fohringer, T. Munzberg, C. Lucas and J. Zschau: Investigation of superstorm Sandy 2012 in a multi-disciplinary approach. *Natural Hazards and Earth System Sciences (NHES)*, 13, pp. 2579-2598, 2013.
- Wawerzinek, B., **Ritter, J.R.R.** and Roy, C. New constraints on the 3D shear wave velocity structure of the upper mantle underneath the Southern Scandinavia revealed from non-linear tomography. *Tectonophysics*, 602, 38-54, 10.1016/j.tecto.2012.12.033, 2013.
- Maupin, V., Agostini, A., Artemieva, I., Balling, N., Beekman, F., Ebbing, J., England, R.W., Frassetto, A., Gradmann, S., Jacobsen, B.H., Köhler, A., Kvarven, T., Medhus, A.B., Mjelde, R., **Ritter, J.**, Sokoutis, D., Stratford, W., Thybo, H., Wawerzinek, B. and Weidle, C.. The deep structure of the Scandes and its relation to tectonic history and present-day topography, *Tectonophysics*, 602, 15-37, 10.1016/j.tecto.2013.03.010, 2013.
- Seiberlich, C.A., **Ritter, J.R.R.** and Wawerzinek, B.: Topography of the lithosphere-asthenosphere boundary below the Upper Rhine Graben Rift and the volcanic Eifel region, Central Europe, *Tectonophysics*, 603, 222-236, 10.1016/j.tecto.2013.05.034, 2013.
- Groos, J.**, Fritschen, R., **Ritter, J.**: Untersuchung induzierter Erdbeben hinsichtlich ihrer Spürbarkeit und eventueller Schadenswirkung anhand der DIN 4150. *Bauingenieur*, 88, 374-384, 2013.
- L. Groos, M. Schäfer, T. Forbriger, and T. Bohlen**, 2013. 2D full waveform inversion of a shallow seismic field dataset: preprocessing and first inversion results. *DGG-Mittlg.*, 3/2013, 11-15.
- S. Butzer, A. Kurzmann and T. Bohlen**: 3D elastic full-waveform inversion of small-scale heterogeneities in transmission geometry, *Journal: Geophysical Prospecting, Special Issue: Challenges of Seismic Imaging and Inversion Devoted to Goldin*, pages 1238-1251 DOI: 10.1111/1365-2478.12065, 2013.
- Sokolov V. & F. Wenzel**: Modeling of strong ground motion for assessment of seismic losses for urban territories in regions with a lack of strong-motion records: selection of within-earthquake correlation models, *Problems of Engineering Seismology*, V. 40, № 3, in Press, (in Russian) 2013.
- Sokolov V.**: Three techniques for estimation of Instrumental Intensity: a comparison, *Proceedings of the 2013 World Congress on Advances in Structural Engineering and Mechanics (ASEM13)*, 8-12 September 2013, Jeju, Korea, 574-591
- Sokolov V. & F. Wenzel**: On the modeling of ground-motion field for seismic loss assessment of urban areas and lifelines for regions with a lack of strong-motion data, *Proceedings of the 2013 World Congress on Advances Structural Engineering and Mechanics (ASEM13)*, 8-12 September 2013, Jeju, Korea, 2265-2281
- Barth, A., Gottschämmer, E. & Kurzmann, A.**: Geophysikalische Geländeübungen im urbanen Umfeld am KIT, *DGG Mitteilungen*, 40-42, 3/2013.