

## NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 2, December 2012

Page 1

### DEAR GPI ALUMNI,

this is the second newsletter for our alumni covering the year 2012. We were very much encouraged by the response to the previous newsletter, which convinced us that many alumni want to be up-to-date on recent developments in and around the Geophysical Institute. Hence, I am very much indebted to Ines Veile, who did the conceptual and editorial work for the previous and this newsletter.

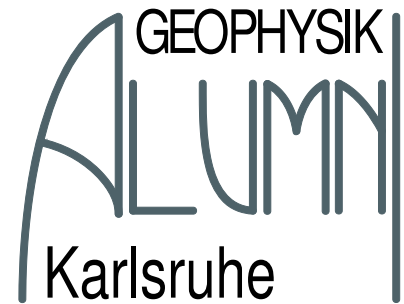
On the following pages, you will find interesting things that happened in 2012 within the Geophysical Institute. The most important ones relate to teaching and research as this is our main mission. Two PhD students finalized their theses. We gain experience with BSc theses and have the first MSc theses started in different fields. We established an interdisciplinary seminar on vulnerability and risk, jointly organized by the Institute for Technology Assessment and Systems Analysis (ITAS) of KIT and us, which runs for the second time this winter semester and attracts students from almost all fields represented in KIT. Our publication activity is documented in the list of papers included.

The position of director of the institute moved from Thomas Bohlen to Friedemann Wenzel for the following two years.

A rather unpleasant event that has been widely discussed in the news, is the loss of the status as excellent university for KIT. This status has been granted in 2007 and is associated with about 20 Million Euro funding over 5 years. GPI did profit from these resources but is not dependent on them. We access a wide range of funding mechanisms including the National Science Foundation (DFG), the Federal Ministry for Research and Technology (BMBF), the European FP7 program, and developed several projects with commercial sectors such as the insurance industry and the hydrocarbon and its service industry. The overall funding level increased in 2012.

The number of students who enrolled in geophysics increased slightly - the proportion of female students is also steadily increasing - and reflects the general awareness of growing relevance of geosciences. Many challenges such as the future energy supply (geothermal energy sources, shale gas), utilization of the subsurface for storage (CO<sub>2</sub>, gas, nuclear waste), natural disasters in the context of globalization and climate change address directly geophysics. Their solution requires a generation of very good geophysicists.

Friedemann Wenzel



### TEACHING AWARD GRANTED TO DR. ELLEN GOTTSCHÄMMER

BY PROF. DR. F. WENZEL

The Teaching Award (Lehrpreis) of the Faculty for Physics 2012 remained at the GPI. In 2011 Dr. Thomas Forbriger was granted this award and now he is succeeded by Dr. Ellen Gottschämmer. Since many years her courses and exercises are highly appreciated by students; she has always achieved excellent rankings every semester. The award was presented during the Annual Academic Celebration event of KIT on November 10, 2012.

### RETIREMENT OF MONIKA HEBBEN

BY PROF. DR. F. WENZEL

On July 1, 2012 Ms. Monika Hebben could start to enjoy her retirement after 28 years of administrative management of most projects of the GPI. Her competency is appreciated far beyond the GPI, as she provided invaluable advice to many institutes, particularly during the transition to the SAP management software system, which was accompanied by many difficulties with the software usage.

She was so kind to continue working part time for additional three months in order to introduce her successor Ms. Marina Schweizer to the complex administrative processes. In reality she didn't retire at all but rather opened a Yoga school. We thank her very much and wish her all the best for her future life.

### PHD DEFENSES

In 2012 there have been two PhD defenses at the GPI:

#### Dr. Britta Wawerzinek

Title: Untersuchung der elastischen Scherwellenstruktur unter dem südschandinavischen Gebirge

Supervisors: PD Dr. J. Ritter (KIT) & Prof. Dr. F. Wenzel (KIT)

In March 2012 Ms. Dipl.-Geophys. Britta Wawerzinek defended very successfully her PhD thesis. Britta Wawerzinek investigated the elastic shear-wave structure underneath the southern Scandes. In the scope of the MAGNUS project (<http://www.gpi.kit.edu/MAGNUS.php>) teleseismic waves in Norway have been measured. With this data, the mantle structure has been identified in that region. The results of this study are submitted e.g. to Tectonophysics. A follow-up project MAGNUS2 with participation of Karlsruhe is planned.

#### Dr. André Kurzmann

Title: Applications of 2D and 3D full waveform tomography in acoustic and viscoacoustic complex media

Supervisors: Prof Dr. T. Bohlen (KIT) & Prof. Dr. J. van der Kruk (FZ Jülich)

In November 2012 Mr. Dipl.-Geophys. André Kurzmann defended very successfully his PhD thesis. André Kurzmann dealt with the 2D and 3D acoustic full waveform tomography. He focused on its implementation and optimization. In order to reconstruct high-resolution velocity models from seismic data, he worked on several synthetic problems occurring in acoustic and viscoacoustic media. Particularly with regard to future real-data applications, these investigations comprised tomography experiments for both cross-well configurations and reflection seismics in marine environment.

## NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 2, December 2012

Page 2

### CURRENT RESEARCH PROJECTS AT THE GPI

#### NATURAL HAZARDS & RISKS - EQRIS-SV

BY PROF. DR. F. WENZEL & M.SC. J. DANIELL

Out of initial contacts between the Sparkassen Versicherung - a major property insurer in Germany - and CEDIM, a new project (EQRIS-SV) has been established in the Natural Hazards & Risk group (James Daniell, Bijan Khazai, and Friedemann Wenzel). Within the project a portfolio-specific probabilistic model for SV building losses related to earthquakes is developed. The key investigator, James Daniell, is a John Monash Scholar from Australia who chose KIT in 2009 for a PhD, which will be finalized in 2013. After comprehensive portfolio analysis various missing information on building age, height and use was modelled by comparison with the building stocks in the same zip code area. Seismic catalogues had to be harmonized as well as ground motion prediction equations validated and an extensive historic analysis of European literature on earthquakes, since in Germany, as a hazard parameter macroseismic intensity is preferred. Local soil effects were addressed in addition to other effects on building damage with a full sensitivity analysis undertaken. Stochastic analyses using runs of up to 500,000 years were undertaken.

With this thorough analysis, a portfolio-specific German earthquake model exists that is more detailed than most commercial vendor models. Work will continue for another two years on various aspects of the model. The in-depth understanding of the building stock and analysis procedure also has applications for loss modelling in other natural disasters for the same portfolio.

#### APPLIED GEOPHYSICS - TOAST

BY PROF. DR. T. BOHLEN & DR. T. FORBRIGER

The goal of the project TOAST is to collect and develop open-source software that can exploit the full richness of broadband, three-component waveforms by the inversion of full seismograms leading to a tremendous improvement in imaging resolution. The collected tools are grouped into the following categories: forward modelling, kernel computation and inversion strategies. The toolbox is developed by four German universities (Munich, Kiel, Bochum, Karlsruhe) and tested by three different German companies and the GFZ. The collected tools will be made available to the scientific community on [www.opentoast.de](http://www.opentoast.de) by mid of 2013.

The joint project is co-ordinated by Thomas Forbriger and Thomas Bohlen (KIT-GPI). The work at the GPI is focusing on the application of elastic 2-D full waveform inversion (FWI) on shallow seismic surface waves and the implementation of the 3-D FWI method for elastic media. The PhD thesis of Lisa Groos will present the required methodological developments for the 2-D FWI of surface waves. In a second PhD project Martin Schäfer will demonstrate the application of FWI to shallow seismic field data. The PhD project of Simone Dunkl is dealing with the efficient implementation of the FWI for 3-D elastic media. Further information: <http://www.opentoast.de>

#### SEISMOLOGY - BFO

BY DR. T. FORBRIGER

In summer 2012, BFO has completed the transition to a new generation of data acquisition systems by disconnecting the old systems. Nevertheless, data has continuously been transmitted to international data centers like the IRIS DMC. Now all instruments are recorded on Quanterra Q330 (24bit) and Q330HR (26bit) data acquisition systems with dedicated digitizers for each channel. The digitizers are located in the mine close to the sensors, such minimizing the required length of analog signal cables. Data is transmitted via fibre optics to the laboratory. BFO now makes intensive use of the Seedlink system developed by GFZ/Potsdam.

Careful analysis of the splitting observed in oscillations of the so-called football mode (0S2) of the Earth once again has demonstrated the outstanding quality of the gravity sensor with the heavier sphere in SG056. Häfner and Widmer-Schmidrig (2012) demonstrate that data of this quality puts constraints on Earth's 3D density structure. Link: <http://dx.doi.org/10.1093/gji/ggs013>

#### COMPUTING FACILITIES AT THE GPI AND ACCESS TO HPC-RESOURCES

BY DIPL. INFORM. P. KNOPF

At the Geophysical Institute/KIT we operate about 80 high-end scientific desktop workstations. They all have access to our central storage servers which holds about 20 Tbyte of data. All machines are managed within a 1Gbit-Network and are backed up at SCC (Steinbuch Centre for Computing). With a 10Gbit network connection to the SCC/Campus North we are able to stream and store huge amounts of data into so-called 'Large Scale Data Facilities'.

We also operate several compute and storage servers for special purposes (e.g. real-time data acquisition). A special configured network allows real-time data streaming from a seismic monitoring network (KABBA) through a mobile radio communication (<http://www.gpi.kit.edu/KABBA.php>).

In summer 2012 we renewed the equipment in our PC pool. There are now 12 high-end workstations, each with 17-8 core CPUs and 16 GB main memory operated by OpenSuse, available for students doing computer exercises, training, programming etc. We are able to use these computer pool machines, as well as our desktop machines, to run parallel programs in a clustered environment.

The access to several HPC-Systems is required to solve solving larger numerical problems (e.g. seismic wave propagation for full waveform inversion by massively parallel FD-simulations), which consumes large data storage as well as computation resources.

At KIT/SCC we have access to:

HC3-System: a HP XC3000 parallel computing facility (<http://www.scc.kit.edu/dienste/hc3.php>),

IC2-System: 'Instituscluster II', a large cluster system which is partly financially supported by the GPI.

We also run projects on the computer cluster of 'bwGRID' (<http://www.scc.kit.edu/dienste/7349.php>), the 'JUROPA'-cluster at Jülich Supercomputing Centre (JSC, <http://www.fz-juelich.de/portal/DE/Forschung/Informationstechnologie/Supercomputer/JUROPA.html>) and at the 'HERMIT'-cluster from HLRS Stuttgart (<http://www.hlrs.de/systems/>).

## NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 2, December 2012

Page 3

### ACADEMIC AFFAIRS

BY DR. E. GOTTSCHÄMMER

In the ongoing academic year, the number of students enrolled in any of the Geophysics degrees (Bachelor, Master, Diploma) exceeded 100. 80 students are enrolled in the Bachelor's degree course now, there are 15 Master students, and a few Diploma students, working on their Diploma theses now.

Recently, a lot of effort was made to advertise our Geophysics programs among pupils and students of other universities: together with a physics and education student, we developed a seismometer experiment for secondary school physics courses and had already several courses visiting the GPI. We intensively advertised our Master's program, and as a result, among the students enrolled in the Master's program, there are several with a Bachelor's degree in Geophysics or Physics from other universities, while all BSc graduates from Karlsruhe continued their studies at the GPI.

Field excursions, traditionally attended by students of all years, led us last summer to the site of the continental deep drilling program KTB at Windischeschenbach, to the construction site of the Karlsruhe Kombilösung, and, recently, to the Black Forest Observatory (BFO).

### CONFERENCES ORGANISED OR HOSTED BY THE GPI

#### 25TH TO 27TH OF JANUARY 2012:

Annual Workshop of the Center for Disaster Management and Risk Reduction Technology (CEDIM) in Karlsruhe with about 40 participants.

The workshop defined the new CEDIM research strategy which is called Forensic Disaster Analysis. It aims on the near-real time analysis of catastrophes, their physical conditions, their impact on the build environment and on social systems. Recent examples (Van 2011 earthquake and hurricane Sandy) are documented on the web-page: [www.cedim.de](http://www.cedim.de).

#### 26TH TO 27TH OF OCTOBER 2012:

The 97th meeting of the FKPE (Forschungskollegium Physik der Erdkörpers e.V.) was hosted at KIT-GPI. The FKPE is an association of the directors of german geophysical research institutions. Further information: [www.fkpe.org](http://www.fkpe.org)

#### 25TH OF NOVEMBER 2012:

The CEDIM workshop on tool developments for capturing social vulnerability and resilience convened 12 researchers in Karlsruhe. The aim of the workshop was to discuss tool developments that allow to link the physical loss modeling methodologies of the Global Earthquake Model (GEM) with multi-criteria decision analysis approaches and current software availability in this field.

#### 26TH TO 28TH OF NOVEMBER 2012:

International Workshop about induced seismicity with about 50 participants.

<http://www.geophys.uni-stuttgart.de/agis/agis-workshop>

Connected interview with Dr. Joachim Ritter in the Deutschlandradio:

[http://ondemand-mp3.dradio.de/file/dradio/2012/11/29/dlf\\_20121129\\_1650\\_f01d46fe.mp3](http://ondemand-mp3.dradio.de/file/dradio/2012/11/29/dlf_20121129_1650_f01d46fe.mp3)

### 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 the GPI:

- Baisch, S., Fritschen, R., **Groos, J.**, Kraft, T., Plenefisch, T., Plenkens, K., **Ritter, J.**, & Wassermann, J., 2012, Empfehlungen zur Überwachung induzierter Seismizität - Positionspapier des FKPE, *Mitteil. Deut. Geophys. Gesell.*, 3/2012, pp. 17-31.
- Bonn, G., Buchmann, A., Hilbring, D., Hohnacker, E., **Titzschkau, T.** & **Wenzel, F.**, 2013, Earthquake Early Warning for Transport Lines. In: *Early Warning for Geological Disasters: Scientific Concepts and Current Practice*. F. Wenzel & J. Zschau (eds), Springer Verlag
- Breitke, M. & **Bohlen, T.**, 2012, Modeling cumulative sound exposure along a seismic line to assess the risk of seismic research surveys on marine mammals in the Antarctic Treaty Area, *Advances in experimental medicine and biology*, Vol. 730, pp. 609-611
- Groos, J.C.**, **Ritter, J.R.R.** & Bussat, S., 2012, The unwanted amplification of monochromatic signals in seismic noise cross-correlation functions by spectral whitening. In: *Noise and Diffuse Wavefields*, *Mitt. d. Deut. Geophys. Gesell.*, Sonderband IV/2012, pp. 42-43, Schmidt, A., Sens-Schönfelder, C., Hadziioannou, J., Wegler, U. and Niederleithinger, E. (eds.)
- Müller, S., Niederleithinger, E. & **Bohlen, T.**, 2012, Reverse Time Migration: A Seismic Imaging Technique Applied to Synthetic Ultrasonic Data, *International Journal of Geophysics*, Volume 2012, Article ID 128465, 7 pages, DOI 10.1155/2012/128465
- Sokolov, V.**, **Wenzel, F.**, Wen, K.-L. & Wen-Ju, J., 2012, On the influence of site conditions and earthquake magnitude on ground-motion within earthquake correlation: analysis of PGA data from TSMIP (Taiwan) network. *Bull. Earthquake Eng.*, 10, 5, pp. 1401-1429, DOI 10.1007/s10518-012-9368-5
- Stein, F.**, **Groos, J.C.** & **Ritter, J.R.R.**, 2012, Seismic interferometry at the TIMO2-network, Germany. In: *Noise and Diffuse Wavefields*, *Mitt. d. Deut. Geophys. Gesell.*, Sonderband IV/2012, pp. 86-87, Schmidt, A., Sens-Schönfelder, C., Hadziioannou, J., Wegler, U. and Niederleithinger, E. (eds.)
- Wenzel, F.**, Erdik, M., Köhler, N., Zschau, J., Milkereit, C., Picozzi, M., Fischer, J., Redlich, J.P., Kühnlenz, F., Lichtblau, B., Eveslage, I., Christ, I., Lessing, R. & Kiehle, C., 2013, EDIM - Earthquake Disaster Information System for the Marmara Region, Turkey. In: *Early Warning for Geological Disasters: Scientific Concepts and Current Practice*. F. Wenzel & J. Zschau (eds), Springer Verlag
- Wenzel, F.** & Zschau, J. (eds), 2013, *Early Warning for Geological Disasters: Scientific Concepts and Current Practice*, Springer Verlag
- Wyss, M., **Wenzel, F.** & **Daniell, J.**, 2013, How Useful is Early Warning and Can it be Made More Effective? In: *Early Warning for Geological Disasters: Scientific Concepts and Current Practice*. F. Wenzel & J. Zschau (eds), Springer Verlag