Karlsruhe Institute of Technology

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NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 3, July 2013

DEAR GPI ALUMNI,

this is the third newsletter for our alumni covering the first half of the year 2013. On the following pages you will find interesting things that happened so far in 2013 within the Geophysical Institute regarding teaching and research. Our publication activity is documented by listing the peer-reviewed papers at page 3.

We, as everybody else at KIT, are still busy with the re-structuring of KIT. There are intensive discussions on how to organize teaching and research in a big unit like KIT with 24.000 students, more than 9.000 employees and a total annual budget of 785 Mio. Euros. There is also discussion on how to generate more synergies between the different geoscience institutes. Geosciences have a good standing at KIT. Although distributed among several small institutes, we have much cooperation, an overall very good publication record and a high capacity for third party funding.

The integration of university and the Helmholtz Forschungszentrum provides new funding opportunities for the previous university institutes. For instance GPI secured two full positions, possibly a third one, with long-term funding. A new professorship for reservoir geophysics is planned. This also reflects the growing relevance of geophysics in Germany due to the search for renewable energy sources and the issue of nuclear waste disposal, which became relevant as new legislation has been passed by the federal parliament this year. The number of students is stable and we are looking forward to the next year's crowd.

Friedemann Wenzel

DGG AWARD GRANTED TO LISA GROOS

BY PROF. DR. T. BOHLEN

Lisa Groos has been honoured for her oral presentation during the 73th Annual Meeting of the German Geophysical Society (DGG) in Leipzig, Germany.

She was awarded for the best oral presentation of young scientists for her talk "2D full waveform inversion of a shallow seismic field dataset: Preprocessing and first inversion results".

PHD DEFENSES

In the first part of 2013 there has been one PhD defense at the GPI:

Dr. Anna Przebindowska
Title: Acoustic Full Waveform Inversion of Marine Reflection Seismic Data
Supervisors: Prof. Dr. T. Bohlen (KIT) & Prof. Dr. F. Bleibinhaus (FSU Jena)

In June 2013 Ms. Dipl.-Ing. Anna Przebindowska defended successfully her PhD thesis. Anna dealt with the 2D acoustic full waveform inversion.

The main focus of her work was the application of the method to conventional marine streamer data recorded in the North Sea. She introduced a workflow for the field data inversion and discussed several practical aspects. In addition to the field data example, the synthetic studies and experiments presented in her work aimed to investigate the possibilities and limitations of the method and to provide guidelines on how to design an efficient inversion scheme. Anna Przebindowska is leaving the GPI this summer and will work at Baker Hughes in Celle.

ACADEMIC AFFAIRS

BY DR. E. GOTTSCHÄMMER

In the summer semester 2013, approximately 100 students have been enrolled in the Geophysics programs at KIT, most of them in the Bachelor's program. The transfer quote to the Master's program is almost 100%, and additional Master's students come from other German and foreign universities.

As in the years before, the student's evaluation of courses and lectures gave many excellent results, with a particular success of the course Computing in Geophysics (Stefan Jetschny, WS 2012/13), being voted for the best tutorial of the faculty of Physics.

Geophysical excursions play an important role in the electives of our curricula. Since November 2012, two excursions were led to BFO with altogether 32 student participants, one of them especially planned for the students in the first year of the Bachelor's program. It shows that these excursions, especially for young students, are important for both, motivation, and a better understanding of the topics taught in Physics and Geophysics courses.

An additional excursion is planned for 2013: In August and September, Joachim Ritter and Ellen Gottschämmer will lead a nine-day field excursion to Italian volcanoes. Special emphasis of this course will be given on hazard and risk of Stromboli, Lipari, Vulcano and Vesuvius.

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-schalander.de). Further information will follow as soon as it is available.

FEEDBACK

If you have any comments, questions or remarks, please do not hesitate to contact us. We are looking very much forward to your feedback.

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CURRENT RESEARCH PROJECTS AT THE GPI

SEISMOLOGY - MAGS

BY PD DR. J. RITTER

In the area of Landau and Insheim, about 30 km east of Karlsruhe, the Seismology research branch records and analyses micro-earthquakes. These events are related to geothermal power plants in this area. Within a research programme called MAGS (microseismic activity at geothermal systems, for more information see http://www.mags-projekt.de/MAGS/DE/Home/MAGS_node.html), the GPI monitors record the seismicity with up to ten KABBA stations since summer 2009.

The waveforms are available at the waveform server of the GPI (http://gpikabba.gpi.kit.edu/). The data analysis includes event detection with cross correlation methods, precise localisation with double difference methods, fault plane solution determination, 3-D wave propagation modelling, local shaking analysis, anisotropy analysis and seismic noise interferometry.

This comprehensive research allows us to evaluate the source and impact of the micro-seismicity in details to assist local authorities. With the end of MAGS in September 2013 this program will be terminated at GPI; the main publications will be available in 2014 after peer reviewing.

APPLIED GEOPHYSICS - SOUND

BY S. HEIDER & PROF. DR. T. BOHLEN

The main focus of the joint project SOUND (Seismic Observation for UNderground Developments) is the investigation of (1) the imaging potential of elastic full waveform inversion using ündergroundäctive Vibroseis data and (2) making first steps towards the application of seismic prediction while drilling using the drill noise of tunnel boring machines.

For these purposes we develop robust processing and FWI-techniques in cooperation with the TOAST-project. The PhD thesis of Sven Heider applies elastic 2-D FWI to Vibroseis multi-component field data recorded in the Reiche Zeche Underground Lab in Freiberg/Germany. Project partners are the GFZ (Potsdam) and the LIAG (Hannover).

NATURAL HAZARDS & RISKS

STUDYING CORRELATED GROUND MOTION OF EARTHQUAKES

BY PROF. DR. F. WENZEL & DR. V. SOKOLOV

In the context of meanwhile three projects funded by the Deutsche Forschungsgemeinschaft (DFG) we (Vladimir Sokolov, Friedemann Wenzel) study the effects of ground motion correlation of earthquakes on loss estimations for building portfolios and distributed infra-structures. The strength of earthquake ground motion decays typically with distance from the earthquake source but with large scatter around so-called ground motion prediction equations. The uncertainty in ground motion prediction plays a big role in hazard assessment and drives hazard to a large extent particularily for long return periods. The spatial distribution of the scatter (= the deviations from the median) is not relevant for hazard but very much for losses in one earthquake and/or for loss of functionality of distributed infrastructure such as water supply, transportation, power networks. Initially we studied the spatial patterns, their correlation with surface geology, and their parametrization, then the influence on loss, where we could show the high influence on portfolios, and more recently the role for infrastructure networks.

INTEGRATED EARTHQUAKE RISK ASSESSMENT FOR THE HIMALAYAN REGION (IERA-HIMAL)

BY PROF. DR. F. WENZEL & DR. B. KHAZAI

Integrated Earthquake Risk Assessment for the Himalayan Region (IERA-Himal) is a research project funded through the Heidelberg Karlsruhe Research Partnership (HEIKA) which aims to to deepen and broaden the cooperation between both partner institutions. The IERA-Himal project brings together research at GPI under Dr. Bijan Khazai and the South Asia Institute (SAI) in Heidelberg under Prof. Marcus Nuesser to integrate the assessment of direct physical damage (i.e., damage to housing stock) and the socio-economic dimensions of vulnerability taking into account dynamic interactions among hazards and development processes such as urbanization and rapid population growth. This integrated approach will focus on the development of a comprehensive assessment methodology for the evaluation of earthquake risk in the Himalayan region, based on a detailed investigation of the Kathmandu City study area.

CONFERENCES ORGANISED OR HOSTED BY THE GPI

14TH TO 15TH OF FEBRUARY 2013:

In February 2013 a two days workshop on full waveform inversion was hosted and organized by members of the applied geophysics work group.

22 participants from ETH Zürich (6), Forschungszentrum Jülich (4), University of Jena (2) and GPI (10) had fruitful discussions and exchange of ideas on specific FWI-problems of seismic and georadar data.

12TH TO 15TH OF MAY 2013:

The 10th International Conference on Information Systems for Crisis Response and Management (ISCRAM 2013, http://iscram2013.org/) was organized in Baden-Baden, Germany, by the CEDIM Group and the Fraunhofer Institute IOSB. The GPI as part of CEDIM helped to organize the conference and provided a number of contributions.

The focus of the conference was on holistic crises management of disasters affecting critical infrastructure with key topics such as resilient of critical infrastructure use of information and communication technologies, emergency management in industrial production, crowd sourcing and crowd tasking and others. The conference was held on May 12-15, 2013 with 320 participants from 16 different countries across the world.

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HUMAN RESOURCES

RETIREMENT OF GABY BARTMAN

BY PROF. DR. F. WENZEL

Ms. Gaby Bartman, foreign language secretary at the GPI retired on July 31, 2013. Gaby joined Karlsruhe University in 1973, switched to the GPI in 1982. In total she served KIT for more than 40 years.

Apart from running the daily business of Prof. Karl Fuchs and Friedemann Wenzel, Gaby organized or helped organizing many conferences - national and international - in the context of two DFG Sonderforschungsbereiche (Cooperative Research Centres) that were hosted by GPI between 1985 and 2007. The timely development of these projects (submittals, review events, reporting) required much more than business as usual, but a firm commitment and dedication to the institutes work. In practical terms it meant many hours of work over time - midnight included - during the critical project phases.

Gaby took care of numerous visitors from all continents who were initially unfamiliar with life in Germany and helped to edit many research papers and books. She did all this with her talent for winning appearance and her engaging approach. We are all very thankful for this.

WELCOME OF KERSTIN DICK

BY PROF. DR. F. WENZEL

Ms. Kerstin Dick joined GPI on July 1, 2013 as foreign language secretary. She has long-terms experience in business and project management in the academic environment of KIT.

She developed these skills in the mathematics faculty at the former Engineering Mathematics and Computing Lab (EMCL), directed by Prof. Vincent Heuveline. She will certainly provide GPI with new impetus. We give her a warm welcome.

From 2014 on she will be the new alumni contact person and not only administrate the mailinglist but also take care about the newsletters.

FAREWELL OF DR. REBECCA HARRINGTON

BY PROF. DR. F. WENZEL

Dr. Rebecca Harrington leaves GPI by August 31, 2013. Rebecca joined GPI in October 2008 with a fresh PhD from the University of California, Santa Cruz, supervised by Professor Emily Brodsky. Rebecca's research focus, in line with her PhD work, was on examining different aspects of the seismic source with view on the physics of earthquakes.

Immediately upon arrival she won a two-year scholarship of the prestigious Humboldt Foundation. After this she applied successfully for a Young Investigator Group at KIT with project PERMIT, which focussed on the investigation of fault maturity and its implication for ground motion using scaling relationships. This project had a strong experimental component for which she could use the Karlsruhe Broadband Seismic Array. Rebecca introduced a new style of communication and cooperation to the GPI, supervised a diploma thesis and the PhD thesis of Tobias Horstmann. Besides all these things she became a happy mother with happy baby, now already one year old. Rebecca is leaving for Montreal (Canada) as Professor of Geophysics at the prestigious McGill University (Earth and Planetary Sciences).

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:

Diez, A., Eisen, O., Hofstede C., Bohleber P. & Polom, U., 2013, Joint interpretation of explosive and vibroseismic surveys on cold firn for the investigation of ice properties, Annals of Glaciology 2013, 54, 64, 201-210 doi: 10.3189/2013AoG64A200

Geerits, T.W., **Veile, I.** & Hellwig, O., 2013, Far field elastodynamic Born scattering revisited, Journal of Applied Geophysics, 89, 141-163

Häfner, R. & **Widmer-Schnidrig, R.**, 2012, Signature of 3-D density structure in spectra of the spheroidal free oscillation S-0(2) Geophysical Journal International, 192, 1, 285-294, doi: 10.1093/gji/ggs013

Heider, S., **Jetschny, S.** & **Bohlen, T.**, 2013, Towards an automatic seismic localization of human footsteps Near Surface Geophysics, 11, No. 3, pp. 317-323, DOI: 10.3997/1873-0604.2013005

Hofstede, C., Eisen, O., **Diez, A.**, Jansen, D., Kristoffersen, Y., Lambrecht A. & Mayer, C., 2013, Investigating englacial reflections with vibro- and explosive-seismic surveys at Halvfarryggen ice dome, Antarctica, Annals of Glaciology 2013, 54, 64, 189-200, doi: 10.3189/2013AoG64A064

Kurzmann, A., **Przebindowska, A.**, Köhn, D., & **Bohlen, T.**, 2013, Acoustic full waveform tomography in the presence of attenuation: a sensitivity analysis, Geophysical Journal International, Manuscript number: GJI-S-12-0811.R2

Plenkers, K., **Ritter, J.R.R.** & Schindler, M., 2013, Low signal-to-noise event detection based on waveform stacking and cross correlation: application to a stimulation experiment, J. Seismo., 17, 27-49, doi:10.1007/s10950-012-9284-9

Roy, C. & **Ritter, J.R.R.**, 2013, Complex deep seismic anisotropy below the Scandinavian Mountains J. Seismo., 17, 361-384, doi:10.1007/s10950-012-9325-4

Sokolov V. & **Wenzel, F.**, 2013, Further analysis of the influence of site conditions and earthquake magnitude on ground-motion within-earthquake correlation: analysis of PGA and PGV data from the K-NET and the KiK-net (Japan) networks. Bulletin of Earthquake Engineering, Manuscript number: BEEE-D-12-00191

Sokolov, V. & **Wenzel, F.**, 2013, Seismic loss estimations for urban areas in Central Europe using scenario earthquakes: influence of within-earthquake variability and correlation. Soil Dynamics and Earthquake Engineering, Manuscript number: SOILDYN-D-13-00005

Sokolov V. & **Wenzel, F.**, 2013, Spatial correlation of ground-motion. In: Seismic risk analysis and management of civil infrastructure systems Editors: S. Tesfamariam and K. Goda, Woodhead Publishing Ltd, Cambridge, UK

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GUESTS HOSTED BY THE GPI

The Hazard & Risk Research Group had a number of visitors.
BY PROF. DR. F. WENZEL

PROF. HING-HO TSANG

Professor Hing-Ho Tsang visited GPI between January and June 2013 as a visiting professor from the Department of Civil Engineering of the University of Hong Kong and the Department of Civil Engineering of Zhuhai College of Higher Education in Hong Kong. Professor Tsang's scientific interest focuses on uncertainty analysis of engineering ground motion attenuation modelling, the seismic design of buildings, seismic structure analysis, infrastructure protection and more recently on low cost earthquake protection methods that rely on tire soil mixtures. The latter include experimental and numerical studies. Professor Tsang taught an under-graduate course on earthquake engineering (master level) in summer semester 2013. In scientific terms we are cooperating on ground motion assessment in moderate to low seismic hazard areas, the development of methodologies to assess the residual risk of communities to earthquakes. In this context he is co-supervising to master thesis of KIT students.

DR. CHRISTOPHER BURTON

Dr. Christopher Burton visited the institute between April and June 2013. He is currently based at the Global Earthquake Model (GEM) facility in Pavia, Italy. He is responsible within GEM for the development of socio economic models that can be linked to the physical risk modelling developed within GEM. He holds a Ph.D. in Geography from the University of South Carolina and has worked in developing models of resilience following Hurricane Katrina. At KIT he developed models and indicators for seismic vulnerability that are based on socio-economic parameters in the context of a GEM project that is being developed at GPI.

MR. GANESH KUMAR JIMEE

Mr. Ganesh Kumar Jimee visited GPI in June and July 2013 through the Karlsruhe House of Young Scientist (KHYS) Visiting Research Scholarship. He is the director of the Division of Preparedness and Emergency Response at the National Society for Earthquake Technology (NSET) in Nepal, and during his research stay was involved in analyses for post-disaster shelter suitability. His activities at KIT were in particular on the development of a set of criteria and a framework for ranking the suitability of open spaces for use as intermediate shelter sites in Kathmandu. This research stay took place in the frame of the collaboration between KIT and NSET through the HEIKA project IERA-Himal.

PROF. KATSU GODA

Professor Katsu Goda won a Humboldt scholarship which allows him to spend a total of one year at GPI. He is a lecturer in civil engineering at the University of Bristol, previously adjunct professor at the University of Western Ontario (Canada) where he achieved his Ph.D. Bachelor and Master Degrees were granted from Kyoto University, Japan. His research is focused on catastrophic earthquake risk management from economic and societal viewpoints. His research interests cover a wide range of academic fields including engineering seismology, earthquake engineering and decision making under uncertainty. He was granted the Charles F. Richter early career award by the Seismological Society of America in 2012. He has published 51 peer reviewed papers and is a member in a number of professional societies. Cooperation with GPI researchers includes correlated ground motion, the use of copulas in assessing hazard and risk and implications for the insurance industry. He is co-supervising a Ph.D. student in hazard and risk assessment.

DR. DIPOK KUMAR BORA

Dr. Dipok Kumar Bora visited GPI as assistant professor in the department of physics of the Diphu Government College, in Assam (India). He won a DAAD scholarship that allowed him to spend one month at GPI where he cooperated with our strong motion group (Dr V. Sokolov). Although his original experience refers mostly to seismic weak motion records from broad band instruments he focused on simulation and modelling of strong motion records in North Eastern India using methods and programs of V. Sokolov and data from the North Indian accelerometer networks.

The Applied Geophysics Group had a visitor.
BY PROF. DR. T. BOHLEN

RENAT SHIGAPOV

Renat Shigapov (PhD student at the Laboratory of Elastic Media Dynamics, Saint Petersburg State University, supervised by Prof. Boris Kashtan) was working at the GPI for one month in April 2013.

Renat received a travel grant from the German-Russian Interdisciplinary Science Center (G-RISC). The topic of his PhD is the reconstruction of seismic attenuation using different inversion techniques. During his stay at the GPI he concentrated at various aspects concerning the theoretical background of the viscoelastic full waveform inversion. His next visit is planned for August 2013.

The Black Forest Observatory had two visitors in spring.
BY T. FORBRIGER

DR. MARK ZUMBERGE

During his visit from 16th to 18th of May Mark Zumberge from the Gravity Lab at IGPP, Scripps, UCSD, San Diego installed a horizontal iSTS1 next to the vertical component (Zumberge *et. al*, 2010. DOI:10.1785/0120090136) in operation at BFO since 2010. They use the classic mechanical sensor of the STS-1 but monitor the boom position interferometrically. This way electronics and power dissipation are avoided in the sensor. At BFO the performance of the seismometers is tested under excellent environmental conditions.

PER BJÖRKLUND

From 22nd to 26th of April Per Björklund from Chalmers, Onsala Space Observatory in Sweden visited the BFO to discuss and exchange experience with the operation of superconducting gravimeters with seismological data logging.