

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

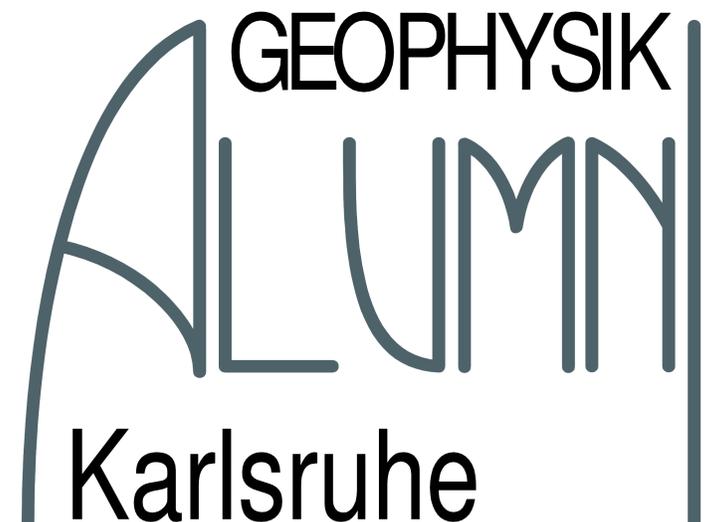
Issue 8, December 2015

Page 1

DEAR GPI ALUMNI

The year 2015 marks a few changes to the Geophysical Institute. As reported in the previous newsletter a new DFG Collaborative Research Center (CRC on wave phenomena: analysis and numerics) has been established at KIT with participation of Thomas Bohlen. The CRC brings together scientists from analysis and numerics of the KIT Department of Mathematics and researchers from optics and photonics, biomedical engineering, and applied geophysics. The key research structure for the GPI hazard and risk group, the Center of Disaster Management and Risk Reduction Technology (CEDIM, www.cedim.de) will be funded for the period of 2016 to 2018, despite of the fact that the Potsdam GeoResearchCenter (GFZ) decided to quit this partnership with KIT. The efforts invested in teaching activities pay off. New methods (in-situ lectures) attract students and are ranked as best lectures in the Faculty of Physics. The Geophysical Laboratory for High School students brings them in touch with geophysics at an early stage and provides motivation for choosing our field later on at university. In general we look back on a good year, look forward to 2016 but also to peaceful and happy holidays. This is what we wish for all our Alumni's too: Happy Holidays and a Happy New Year.

Friedemann Wenzel



TEACHING

By Ellen Gottschämmer

The curriculum of both, the Bachelor's and the Master's program at KIT, have been revised recently, and new study and examination regulations are valid for students who started this winter semester (15/16). Due to those changes, the strong focus on Physics, a characteristic of both Geophysics programs at KIT, is maintained and strengthened.

Both Geophysics degree courses at KIT are constantly attractive for students, and since several years the number of Geophysics students at KIT holds steady at around 100. In the first year of the Bachelor's degree, 23 new students are enrolled this winter semester.

More students chose Geophysics as a compulsory subject in the KIT Physics Bachelor's program. A profound knowledge of Geophysics is also required in the curriculum of the Applied Geosciences Bachelor's program, and there is a demand of Geophysics courses from other study programs such as Geodesy and Civil Engineering.

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 2

Despite the high work load for the teaching staff, the quality of teaching is rated excellent by the students in the bi-annual teaching evaluation, and a teaching award was given to two Geophysics courses taught in summer semester: The in-situ lecture Historical Seismology for Hazard Evaluation was awarded the prize for the best special lecture, and Introduction to Volcanology received an award for the best exercise of the Faculty of Physics.

Another in-situ lecture was provided for 15 students who traveled to the German Deep Drilling Location KTB (Windischeschenbach) and the Czech Republic in early November as part of a special lecture on Physics of the Lithosphere. In March 2016, students will spend two days on Near Surface Geophysical Prospecting, including a field trip to Staufen and Schauinsland.

THE „SCHÜLERLABOR“ (GEOPHYSICS LABORATORY) WINS A PRIZE

By Friedemann Wenzel

How do earthquakes happen and how do you record them? What happens during a volcanic eruption and why are there different types of volcanoes?

High-school students learn the answers to this type of questions in the “Schülerlabor Geophysik” at Karlsruhe Institute for Technology (KIT). Students from 10th grade onwards, carry out experiments related to geophysical phenomena, which they couldn’t do at their schools. Thus the “Schülerlabor” gives young people the unique opportunity to conduct geophysical experiments and to familiarize themselves with scientific methods before starting university. The students are assisted and taken care of by staff of the Geophysical Institute, managed by Dr. Ellen Gottschämmer.

For this learning opportunity, the Schülerlabor received a prize in the contest “Energy for Knowledge” of the GVS GasVersorgung, Süddeutschland. The “Schülerlabor” received the prize for a new experiment called “vertical seismometer”.

The official award presentation took place on Thursday, December 10th, 2015 in the rooms of the “Schülerlabor” in Bldg. 06.34., West Campus.



E. Gottschämmer
Photo: Manuel Balzer, KIT

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 3

Present at the ceremony were:

Prof. Dr. Thomas Bohlen, head of applied geophysics – reception

Mrs. Angela Grether, GVS GasVersorgung Süddeutschland - project leader of the tender - introduction of the competition and statement of the jury

Prof. Dr. Alexander Wanner, vice-president of education and academic affairs, KIT - statement of the chairman of the jury

Dr. Ellen Gottschämmer, leader of the “Schülerlabor Geophysik” - introduction of the awarded project and other projects of the “Schülerlabor”

Prof. Dr. Martin Wegener, dean of the Faculty of Physics, KIT- statement of the Faculty of Physics, KIT

Dr. J. Miksat, assistant headmaster of the Aloys-Henhöfer-Schule, Pfinztal-Kleinsteinbach – statement of the Aloys-Henhöfer school



Foto: Manuel Balzer, KIT

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 4

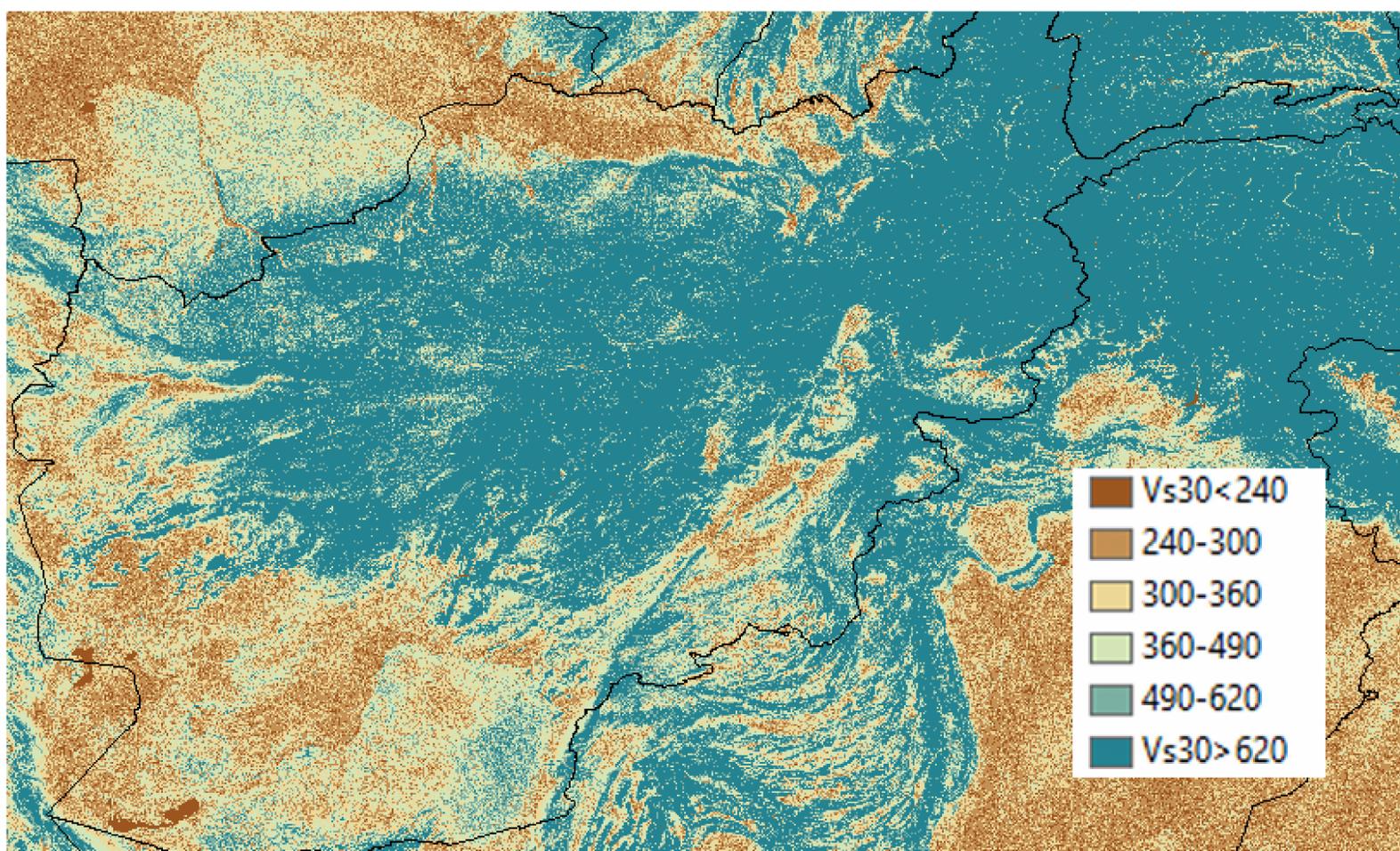
AFGHANISTAN – MULTI-HAZARD RISK ASSESSMENT, COST-BENEFIT ANALYSIS, AND RESILIENT DESIGN RECOMMENDATIONS

By Friedemann Wenzel and Bijan Khazai

This is a project, funded by the World Bank in 2015/2016. The overall objective is to develop new information on current and future risks from seismic, fluvial flood, flash flood, drought, landslide, snow avalanches and seismic hazards in the country of Afghanistan. Within a consortium, lead by DELTARES, GPI provides hazard assessment for earthquakes and induced landslides, but also parts of the economic impact assessment and cost-benefit analysis. The results will be utilized in the reconstruction process of Afghanistan to allow for resilient reconstruction and risk reduction options based on the outcomes of the analysis. It should become possible to estimate costs and benefits of the options to protect from fluvial flood and seismic risks to promote resilient reconstruction of new developments and protection of for current buildings and infrastructure.

As this is a national level multi-risk assessment, an approach that covers the entire territory of Afghanistan for all hazards, using methods and datasets that are appropriate for this level. The analysis for the fluvial flood, flash flood, drought, landslide, avalanche and seismic risks all depart from a common database of hydrological, geotechnical and soil information, as well as information on exposure, vulnerability and socio-economic circumstances. The resulting risk analyses are comparable in scale and detail, and the total aggregated risk is properly represented to the extent possible, as the individual risk components departed from the same basis of information.

We have started to establish the data bases and are in the process of conceptualizing the cost-benefit analysis step.

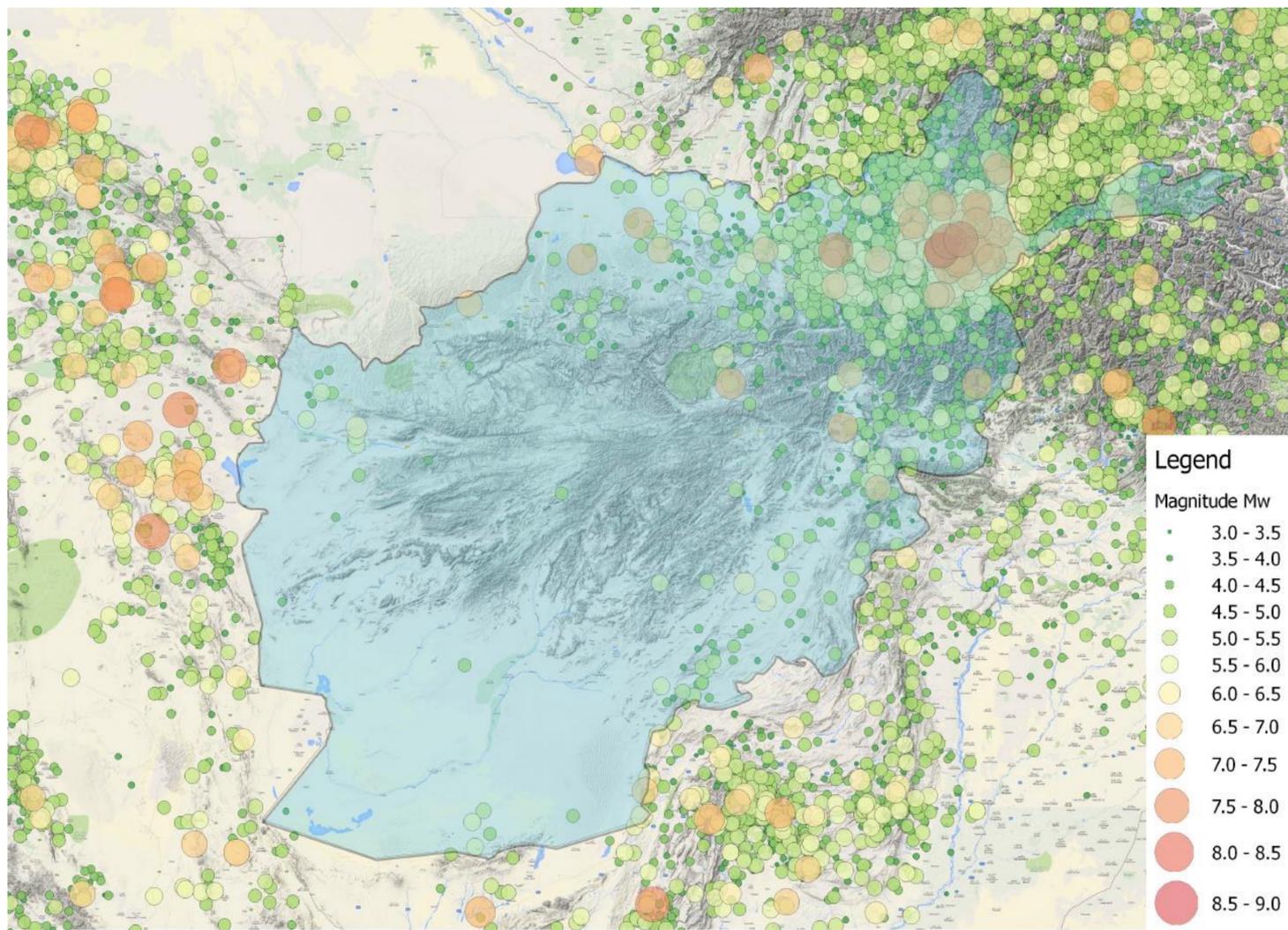


Soil map of Afghanistan showing vs30 variability (shear wave velocities of the upper 30 meters). This is important for the site-specific modification of earthquake-related ground motion.

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 5



Visualization of the earthquake catalogues, compiled from various sources, of Afghanistan and adjacent countries.

RECENT DEVELOPMENTS WITHIN THE CENTER FOR DISASTER MANAGEMENT AND RISK REDUCTION TECHNOLOGY (CEDIM)

By Friedemann Wenzel

GeoForschungsZentrum Potsdam (GFZ) decided to be no longer part of CEDIM (www.cedim.de) after 2015 and to stop financing it. KIT decided to keep CEDIM going with the original amount of funding for the coming three years. In 2015 GPI kept working on the analysis of the April 2015 Nepal earthquake. After the field trip of June 2015 another fieldtrip has been executed by Trevor Girard in November 2015 in order to study risk communication during the earthquake. Prof. Sebnem Düzgün – Humboldt Scholar at GPI – studies the losses to the road infrastructure and options for building a more resilient system.

CEDIM is meanwhile partner in the new German IRDR International Center of Excellence IRDR ICoE Critical Infrastructures and Strategic Planning. More on:

<http://www.irdrinternational.org/2015/06/12/irdr-welcomes-new-icoe-germany/>

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, Decemer 2015

Page 6

A QUANTITATIVE RESILIENCE ASSESSMENT FRAMEWORK FOR TRANSPORT INFRASTRUCTURE FOR MULTIPLE GEOHAZARDS

By Hafize Sebnem Düzgün

Natural hazards have usually cascading effects, where one type may trigger the other or one natural hazard may trigger man-made hazards. For example, the Wenchuan earthquake in China (12 May 2008) triggered more than 15000 landslides. It is also reported that among the fatalities due to the Wenchuan earthquake 20 000 of them were only due to landslides triggered by the earthquake. Recently, Gorkha earthquake in Nepal (25 April, 2015) triggered thousands of landslides, which amplified the fatalities due to earthquake, blocked critical roads and rivers. The blocked roads hindered the efficiency emergency management actions and as well as the local development. The large landslides, which blocked the rivers, introduced other hazards like flooding downstream area due to case of breaching or overtopping.

For effective mitigation of natural hazard risks, methods for assessing the resilience of critical infrastructure due to cascading effects of multiple hazards is required. I started related research by developing a quantitative resilience framework for transport infrastructures in case of multiple geohazards like earthquake and landslides triggered by the earthquake. The framework being developed is composed of five pillars namely, serviceability, robustness, redundancy, resourcefulness and rapidity and serviceability (SRRRR). The quantitative metrics for each pillar are identified for transport infrastructure. The conceptual aspects of the framework will be presented in the International Conference on Earthquake Engineering and Post Disaster Reconstruction Planning (ICEE-PDRP 2016) to be held in Bhaktapur, Nepal between 24 and 26 April 2016. It will be validated and revised considering Gorkha earthquake in Nepal. Then, the updated framework will be implemented for the selected case studies in Turkey.

Prof. Dr. Sebnem Düzgün is a Georg Forster experienced researcher fellow of Alexander von Humboldt Foundation coming from Middle East Technical University, Ankara Turkey. For this research, besides KIT colleagues, she is collaborating with GPI students at KIT and post doc fellows at Selcuk University, Konya, Turkey and Singapore ETH Centre, (SEC).

OUR NEW SMALL CLUSTER

by Niklas Thiel and Petra Knopf

The modelling and inversion of full waveforms is still quite cost intensive in terms of computational resources. We established several computational sources in the last years, e.g. four Cluster of the KIT, each up to 2000 cores, and JURECA in Jülich with 77000 cores. These clusters are ideal for time consuming, massive parallelised FWI computations. The only disadvantages are the waiting queues, especially for small jobs. In particular during the further development of the modelling and inversion software lots of small test computations are necessary. To make the code development more efficient the working group of Prof. Thomas Bohlen acquired the new SGI UV20 this year. With its 96 cores and 512 GB shared memory it is ideal for small test computations. The cluster is already used extensively by our Master and PhD students.

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 7

GUESTS AT GPI

By Friedemann Wenzel

Dr. Cynthia Linero-Molina

Dr. Linero-Molina won a DAAD scholarship with a proposal on the utilization of LIDAR imagery for the assessment of landslide risks in Latin America. She studied Civil Engineering at Universidad de Medellin in Colombia and received her 'Master of Science for Geotechnique and Infrastructure' from University of Hanover. Her Ph.D. in Civil Engineering was also granted by the University of Hanover in 2003. Since 2003 she worked as inspector and adviser of geotechnical studies for the Direction of Prevention and Attention of Emergencies (Bogotá). Furthermore she is consulting firms in Medellin and works as a consultant for the World Bank. She arrived in September 2015 and will stay at GPI for a period of 6 months.

Renat Shigapov

Mr. Renat Shigapov is a fourth-year Ph.D. student (Saint Petersburg State University, Russia), currently working at GPI on viscoacoustic full waveform inversion. Renat received a one-year scholarship from the CRC 1173. His focus is the simultaneous reconstruction of sound velocity, mass density, quality factor and function using synthetic reflection data.

PH.D. DEFENSE

Dr. Simone Butzer

In January 2015 Mrs. Simone Butzer successfully defended her Ph.D. thesis.

Titel: 3D elastic full-waveform inversion
Supervisors: Prof. Dr. Thomas Bohlen (KIT),
Prof. Dr. Hansruedi Maurer (ETH Zürich).

FEEDBACK

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

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 8

NEW PH.D. STUDENTS AT GPI

By Thomas Bohlen and Friedemann Wenzel

Ms. Danhua Xin will stay at KIT for the next four years in order to work on a Ph.D. in the Department of Civil Engineering, Geo and Environmental Sciences aiming at novel methodologies in hazard and risk assessment. She graduated in geophysics from Nanjing University, which ranks as one of the top universities in China with a MSc thesis on 'Localized temporal change of Earth's inner core 1 boundary from high quality waveform doublets'. She won a scholarship of the China Scholarship Counsel that will support her studies at KIT. Nanjing (in German sometimes called Nanking) is the second largest city in Eastern China with population close to 10 million and located at the Yangtze River about 250 km to the West of Shanghai.

Mr. Nikolaos Athanasopoulos, M.Sc. (IDEA LEAGUE Joint Master in Applied Geophysics), started his Ph.D. studies in the topic of Full Waveform Inversion (FWI). His research focus will be the elastic FWI of shallow seismic surface waves and its application in field data.

Mr. Tao Lei, M.Sc. (Institute of Geophysics and Geomatics, China University of Geosciences in Wuhan) will be working on the application of full waveform inversion to marine seismic data. He was awarded a 2-year fellowship from the China Scholarship Council within a joint training program.

Mr. Mario Rubén Fernandez, M.Sc. (Institut de Physique du Globe de Paris) also started his Ph.D. studies. He will be working for the CRC 1173 "Wave phenomena" on the implementation of full waveform inversion of seismic wave attenuation.

DR. JAMES DANIELL

By Friedemann Wenzel

James Daniell (GPI, CEDIM) won the 2015 KIT Doctoral Award in the earth and environment area of competence. James defended his thesis „The Development of Socio-Economic Fragility Functions for use in Worldwide Rapid Earthquake Loss Estimation Procedures“ in February 2014 and he received the doctoral degree with distinction. James' work attracts high attention on international meetings, in UN institutions; the World Bank and regional development banks, but also in the insurance and re-insurance industry. He currently holds a post-doc position at the institute.

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 9

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:

Wenzel, F.: Induced seismicity using Dieterich's Rate and State Theory and comparison to the Critical Pressure Theory, European Geosciences Union General Assembly 2015, EGU, Energy Procedia 76, 282 – 290, ScienceDirect, 2015.

Kunz-Plapp, T., Hackenbruch, J., Schipper, J. W.: Factors of subjective heat stress of urban citizens in contexts of everyday life, Natural Hazards and Earth Systems Sciences Discussions, 3, 4619-4661, 2015, www.nat-hazards-earth-syst-sci-discuss.net/3/4619/2015/, doi:10.5194/nhessd-3-4619-2015.

Van Camp, M., Meurers, B., de Viron, O., Forbriger, T.: Optimized strategy for the calibration of superconducting gravimeters at the one per mille level. J. Geodesy. (doi: 10.1007/s00190-015-0856-7), 2015.

Gunasekera, R., Ishizawa, O., Aubrecht, C., Blankespoor, B., Murray, S., Pomonis, A., & Daniell, J. E.: Developing an adaptive global exposure model to support the generation of country disaster risk profiles, Earth-Science Reviews, 150, 594-608, 2015.

Girard, T., Wenzel, F., Khazai, B., Kunz-Plapp, T., Daniell, J. E., & Brink, S. A.: Near-Real-Time Analysis of Publicly Communicated Disaster Response Information, International Journal of Disaster Risk Science, 5(3), 165-175, 2014.

Daniell, J. E.: Global View of Seismic Code and Building Practice Factors, eds. Michael Beer, Edoardo Patelli, Ioannis Kougioumtzoglou and Ivan Siu-Kui Au in "Encyclopaedia of Earthquake Engineering". Springer, 2015.

Daniell, J. E.: The Evolving Risk of Earthquakes: Past, Present, and Future, eds. Stuart Fraser, upcoming book: Evolving Risk, World Bank Press, in publication, 2015.

Daniell, J. E., Schäfer, A. M., Wenzel, F.: Conference Paper: A tale of eight cities: Earthquake scenario risk assessment for major Australian cities, EGU General Assembly Conference Abstracts, 17, 5239, 2015.

NEWSLETTER OF THE GEOPHYSICAL INSTITUTE

Issue 8, December 2015

Page 10

GPI
wishes you all
Happy Holidays
and a
Happy New Year
2016

