Julian **Kuehnert**

ENVIRONMENTAL SEISMOLOGIST · DATA SCIENTIST

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Education

Institut de Physique du Globe de Paris (IPGP) *Paris, France*

PH.D. IN GEOPHYSICS *Oct. 2016 - Nov. 2019*

- Doctoral thesis: *"Simulation of Seismic Waves generated by Rockfalls on Real Topography"*
- Advisors: Anne Mangeney and Yann Capdeville

TU Delft | ETH Zurich | RWTH Aachen *Delft, Netherlands - Zurich, Switzerland - Aachen, Germany*

M.SC. IN GEOPHYSICS (*cum laude*) *Sept. 2014 - Aug. 2016*

- IDEA League Joint Master's in Applied Geophysics
- Dissertation prepared at Schlumerger in Gatwick, UK

University of Konstanz *Konstanz, Germany*

B.SC. IN PHYSICS *Oct. 2010 - Jul. 2014*

- Comprising a one year study abroad at Uppsala University (2012-2013)
- Dissertation prepared at ISTerre in Grenoble, France

Research & work experience

Institut de Physique du Globe de Paris *Paris, France*

POSTDOCTORAL RESEARCHER *Dec. 2019 - Feb. 2020*

- *Inversion of Rockfall Seismic Signals from Multiple Stations*
- Development of a localization algorithm for tracking rockfall trajectories and estimation of rockfall radiated seismic energy.

Institut de Physique du Globe de Paris *Paris, France*

RESEARCH ASSISTANT *Oct. 2016 - Nov. 2019*

- *Simulation of Seismic Waves generated by Rockfalls on Real Topography*
- Inversion and simulation of high frequency seismic waves generated by rockfalls. At high frequencies (> 1 Hz) the waves are prone to be distorted by subsurface heterogeneities as well as surface topography so that measured signals can no longer be simply inverted for rockfall properties and dynamics (e.g. their volume and their basal force history). To address this issue, I simulated the seismic wave propagation using the Spectral Element Method (SEM) on numerical domains with realistic subsurface properties as well as real surface topography. I then compared synthetic signals with real signals generated by rockfalls at Piton de la Fournaise volcano, La Réunion. Based on this, I proposed an optimization method to localize rockfalls and follow their trajectory over time.

Schlumberger *Gatwick, UK*

M.SC. DISSERTATION *Mar. 2016 - Aug. 2016*

- *Joint inversion of shear-wave velocity azimuthal anisotropy from surface and body waves*
- Advisors: Daniele Boiero, Claudio Boiero and Edgar Manukyan
- In my work I derived a system of equations which relates anisotropic subsurface variations (expressed by the coefficients of the stiffness matrix) to measurements of both seismic surface and body waves. I implemented an algorithm to jointly invert measurements from both wave types using a RMS-normalized Jacobian to enable a global regularization and incorporating the estimated data error into the objective function. I then tested the algorithm on synthetic data from a 1D-model and a 3D-model. The results show that near surface properties are better estimated in the joint inversion through the incorporation of surface waves which can significantly enhance the quality when imaging the subsurface.

UNIL Lausanne *Lausanne, Switzerland*

INTERNSHIP *Aug. 2015 - Sept. 2015*

- *Numerical upscaling of seismic characteristics in fractured porous media*
- Advisors: Eva Caspari and Klaus Holliger
- I implemented creep tests (i.e. numerical simulations with stress boundary conditions in order to deduce the compliance matrix) on rock samples with orthogonal fracture network to find a lower bound of the medium's effective moduli. This was complementary to the work of postdoctoral researcher Eva Caspari who numerically studied the elastic and hydraulic properties of fractured rocks through seismic characteristics.

ISTerre Grenoble
Grenoble, France
B.Sc. dissertation *Mar. 2014 - Jul. 2014*

- *Ultrafast ultrasonic imaging of elastic properties in soft solids: Application of speckle-interferometry to quasistatic deformation*
- Advisors: Philippe Roux and Michel Campillo
- I carried out ultrasound experiments on a soft gel bulk which was exposed to continuous dynamic deformation. To visualize the evolution of the internal deformation, I implemented different approaches to analyze the successively recorded speckle images, namely based on (i) cross-correlation, (ii) amplitude extraction, and (iii) phase extraction. Insights from these experiments can help to better understand the stress distribution within the Earth's crust for the reconstruction of earthquake scenarios.

Uppsala University
Uppsala, Sweden
Research project *Feb. 2013 - Jun. 2013*

- *Commissioning of a collimated VUV Fourier transform spectrometer for inelastic resonance measurements*
- Advisor: Marcus Agåker
- Installation of a parabolic collection mirror in front of a vacuum ultraviolet (VUV) Fourier transform spectrometer. The collection mirror focuses the light beam and thus enables measurements even in case of low beam intensities. After installing the mirror, I tested the instrument with visible light before it was moved to the HHG-laboratory where measurements with high-energy pulses were conducted.

Carl Zeiss AG - Microscopy
Aalen-Oberkochen, Germany
Student trainee *Aug. 2010; Mar. 2011*

- Quality management in the department of Electron Microscopy (SEM and TEM microscopes)
- Setting up a protocol for use during the installation of the electron microscopes in order to facilitate continuous quality control.

Teaching

2019	**Stresses and Elasticity**, IPGP - M.Sc. level (*in French*)	*France*
2016	**Experimental Physics III**, RWTH Aachen - B.Sc. level (*in German*)	*Germany*
2015	**Physics I**, ETH Zurich - B.Sc. level (*in German*)	*Switzerland*

Skills

Programming	Python, MATLAB, Mathematica, R, FORTRAN, Java, LaTeX
HPC	OpenMP, MPI
Tools	Pandas, Scikit-learn, SciPy, SQL, Jekyll, Hugo, ArcGIS, QGIS
Visualization	Matplotlib, HoloViews, Bokeh, Seaborn, TikZ
Languages	German, English, French, Spanish, Swedish

Workshops, Conferences & Grants

Workshops

2019	**Alan Turing Institut - Data Study Group** , Semantic segmentation of 3D point clouds	*London, UK*
2019	**EAGE & IPGP - DigitalGeoHack**, Semi-supervised sea floor fault detection	*Paris, France*
2018	**4th TIDES Advanced Training School**, Applications in natural and industrial environments	*Prague, Czech Rep.*
2018	**8th Munich Earth Skience School**, Rotational Seismology	*Sudelfeld, Germany*
2017	**1st EGU Galileo Conference**, From process to signal – advancing environmental seismology	*Ohlstadt, Germany*

Conferences (talks)

2019	**Congrès Des Doctorants**, *Topography induced amplification of high frequency seismic waves generated by landslides: from simulation to observation at Piton de la Fournaise volcano, La Réunion*	*Paris, France*
2018	**AGU Fall Meeting**, *High frequency seismic signal generated by landslides on complex topographies: from numerical simulation to field observation at Dolomieu crater, La Réunion*	*Washington DC, USA*
2018	**Congrès Des Doctorants**, *High frequency seismic signal generated by landslides on complex topographies: from point source to spatially distributed sources*	*Paris, France*

Grants

2018	**COST travel grant**, 4th TIDES Advanced Training School	*Prague, Czech Rep.*
2018	**COST travel grant**, 8th Munich Earth Skience School	*Sudelfeld, Germany*
2014-2016	**Deutschlandstipendium**, Scholarship for M.Sc. study from the German talent program	*Germany*

Extracurricular Activity

Coordinating role in the organization of the *Congrès Des Doctorants* *Paris, France*
DOCTORAL STUDENTS CONFERENCE AT IPGP WITH INTERNATIONAL PARTICIPANTS AND INDUSTRY REPRESENTATIVES *2017*
- Coordination of following teams: *Logistics, Communication, Foreign Students, Career Day*
- Creation of scientific programme from more than 100 submitted abstracts

Organizing role during the *Festival des Idées* in Paris *Paris, France*
ART EXHIBITION AT IPGP *2017*
- Organization of an exhibition entitled: *A love for risk - how far is too far?*
- The exhibition contained artworks of researchers expressing the risks and dangers related to their scientific work.

Instructor Ski-Alpin *Germany & Austria*
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- Teaching of individuals and groups
- Organization of day trips and youth camps

Publications

2020 **Kuehnert, J.**, Mangeney, A., Capdeville, Y., Métaxian, J.P., Bonilla, L.F., Stutzmann, E., Chaljub, E., Boissier, P., Brunet, C., Kowalski, P., Lauret, F., Hibert, C. *Simulation of rockfall generated seismic signals and the influence of surface topography*. Journal of Geophysical Research: Solid Earth (*under review*). Preprint: https://doi.org/10.1002/essoar.10502632.1

2020 **Kuehnert, J.**, Mangeney, A., Capdeville, Y., Vilotte, J.P., Stutzmann, E., Chaljub, E. *Rockfall localization based on inter-station ratios of seismic energy*. Journal of Geophysical Research: Earth Surface (*in submission*)

PEER REVIEWS

2019 Di Giulio, G., Punzo, M., Bruno, P.P., Cara, F., Rovelli, A. *Using a vibratory source at Mt. Etna (Italy) to investigate the wavefield polarization at Pernicana Fault*. Near Surface Geophysics

CODES

2019 **Kuehnert, J.**, Mangeney, A., Capdeville, Y., Vilotte, J.P., Stutzmann, E., Chaljub, E. *Rockfall localization routine* (Version RFlocalization-0.1). Zenodo. http://doi.org/10.5281/zenodo.3550192

2019 Trassoudaine, C., **Kuehnert, J.**, Trabattoni, A., Chen, J., Vaddineni, V., Coowar, T., Neven, A. *Semi-supervised sea floor fault detection* (Version 0.1). Zenodo. http://doi.org/10.5281/zenodo.3549025