

Rafael ABREU

Curriculum Vitae

Personal Information

PLACE AND DATE OF BIRTH: Caracas, Venezuela, 13-08-1981.
WEB: [personal website](#)
EMAIL: abreusolorzano@gmail.com, rabreu@ipgp.fr

Education

	University of Granada, Granada, Spain.
2011-2014	PhD in Computational Seismology (with honors)
2009-2011	MSc in Geophysics and Meteorology
	Central University of Venezuela, Caracas, Venezuela.
2006-2008	MSc in Applied Mathematics (with honors)
1999-2005	BS in Petroleum Engineering (5 year program)

Professional Experience

2023-today	Institut de Physique du Globe de Paris - IPGP, Paris, France <i>Chargé de recherche CNRS</i>
2014-2023	Institute for geophysics at the University of Münster, Münster, Germany <i>Research Assistant</i>
2014-today	Andalusian Institute of Geophysics - IAG, Granada, Spain <i>Adjunct researcher</i>
02/2014-10/2014	<i>Research Assistant</i>
2011-2014	<i>PhD student</i>
2009-2011	<i>Master student</i>
08/2012-12/2012	Princeton University, Princeton, NJ USA <i>Visiting student working with Prof. Jeroen Tromp</i>
08/2011-12/2011	<i>Visiting student working with Prof. Jeroen Tromp</i>
10/2008-11/2008	Institut de Physique du Globe de Paris - IPGP, Paris, France <i>Visiting research scientist working with Prof. Jean-Pierre Vilotte</i>
2008-2009	Venezuelan Foundation for Seismological Research - FUNVISIS, Venezuela <i>Geophysicist</i>
2007-2008	<i>Geophysicist assistant</i>

Teaching Experience

2014-2020	Institute for geophysics at the University of Münster, Münster, Germany <i>Advanced Seismology - 28 h/year - Master level (co-organized with Prof. C. Thomas)</i> Numerical wave propagation (Python) in acoustic and elastic media using the finite-difference, pseudo-spectral and spectral-element methods.
2014-2022	<i>Geophysical data analysis - 20 h/year - Master level (co-organized with Dr. V. Schmidt)</i> Fullwaveform inversion programming (Python) using the adjoint method.

Administrative activities

2016–today	<i>Reviewer: Journal of Computational and Applied Mathematics, Pure and Applied Geophysics, Wave Motion and Continuum Mechanics and Thermodynamics.</i>
March 2016	<i>Part of the organizing group of the German Geophysical Society Conference (DGG) at the University of Muenster.</i>

Oral communications

2021	Institut de Physique du Globe de Paris - IPGP, Paris, France (invited).
2019	Laboratoire de Geologie de Lyon: Terre, Planetes, Environnement. France (invited).
2018	Institute for Problems in Mechanical Engineering of Russian Academy of Sciences, St. Petersburg, Russia (invited).
2017	Institut de Physique du Globe de Paris - IPGP, Paris, France (invited).
2017	Laboratoire de Geologie de Lyon: Terre, Planetes, Environnement. France (invited).
2015	Oral presentation. AG Seismologie (contribution).
2015	Ludwig Maximilian University of Munich, Germany (invited).
2015	University of Duisburg-Essen, Germany (invited).
2014	University of Münster, Germany (invited).
2012	Princeton University, Princeton, NJ USA (invited).
2012	Third QUEST Workshop, Tatranska Lomnica, Slovakia (contribution).
2011	Princeton University, Princeton, NJ USA (invited).
2011	Second QUEST Workshop, Hveragerdi, Iceland (contribution).
2010	First QUEST Workshop, Alghero, Italy (contribution).

Funding

2023-2026	Seismic wave propagation using Radial Basis Functions 1 PhD student. Funded by the Institut de Physique du Globe de Paris - IPGP, Paris.
2021-2024	DB-MISS - Mitigation of seismic noise recorded in seismological stations II Principal investigator (1 PhD student). Funded by European Regional Development Fund (ERDF) and Energieagentur NRW (€1.5M).
2021-2024	dEep eArth Rotational seismoLogY - EARLY AB887/1-1 Principal investigator. Funded by DFG Deutsche Forschungsgemeinschaft. (€300K).
2018-2021	MISS - Mitigation of seismic noise recorded in seismological stations. Co-investigator. Funded by European Regional Development Fund (ERDF) and Energieagentur NRW (€1M).
2017	Travelling support awarded by the Internationalization Office of the University of Muenster. €800.
2016	Travelling support awarded by the Study of the Earth's Deep Interior (SEDI). \$800.
2015–2019	CGL2015-67130-C2-2-R Co-investigator. Funded by MINECO - Ministry of Economy and Competitiveness (Spain). Budged of €145,200.
2015–2018	IMPACTS-DALIAS Co-investigator. Funded by MINECO - Ministry of Economy and Competitiveness (Spain). Budged of €133,000.

2011–2015	EPHESTOS - CGL2011-29499-C02-01 Co-investigator. Funded by MINECO - Ministry of Economy and Competitiveness (Spain). Budged of €199,166.
08/2011–12/2011	Fellowship support awarded by Princeton University. \$4,000.
2009–2014	FPI Scholarship awarded by the Spanish Government for PhD studies. €70,000.
10/2008–11/2008	Fellowship support awarded by the Venezuelan Foundation of Seismological Research for research purposes at the Institut de Physique du Globe the Paris. \$5,000

Strengths

NUMERICAL PROGRAMMING:	Programming of the FDM, SEM, PSM (fortran, matlab and python) as well as SPECSEM and AxiSEM codes.
THEORETICAL SKILLS:	Continuum mechanics with special emphasis on micro-continuum field theories (micropolar and micromorphic) and adjoint methods in conventional and micro-continuum media.
SEISMOLOGICAL DATA ANALYSIS:	Array seismological techniques using Obspy and Instaseis tools.

Papers published/review

2023	Samira Hoseini, Christine Thomas, Ed Garnero, and Rafael Abreu . Studying inner core and lower mantle structure with a combination of PKP and converted SKP and PKS waves. <i>Geophysical Journal International</i> , 2023. Accepted
2023	Rafael Abreu . Understanding the adjoint method in seismology: theory and implementation in the time domain. <i>Reviews of Geophysics</i> , 2023. Accepted
2023	Rafael Abreu , Stephanie Durand, Christine Thomas, and Sebastian Rost. Deep Earth rotational seismology. <i>Geophysical Journal International</i> , 234(3):2365–2374, 2023
2022	Rafael Abreu and Christine Thomas. Seismic noise generated by windparks - possibility of reduction? <i>Journal of Seismology</i> , 2021. Submitted
2022	Rafael Abreu, Daniel Peter, and Christine Thomas. Reduction of wind-turbine-generated seismic noise with structural measures. <i>Wind Energy Science</i> , 7(3):1227–1239, 2022
2022	Rafael Abreu and Stephanie Durand. Understanding micropolar theory in the Earth sciences I: the eigenfrequency ω_r . <i>Pure and Applied Geophysics</i> , pages 1–18, 2021
2022	Rafael Abreu and Stephanie Durand. Understanding micropolar theory in the Earth sciences II: the seismic moment tensor. <i>Pure and Applied Geophysics</i> , 178(11):4325–4343, 2021
2021	Morvarid Saki, Christine Thomas, and Rafael Abreu . Detection and modelling of strong topography of mid-mantle structures beneath the North Atlantic. <i>Geophysical Journal International</i> , 229(1):219–234, 11 2021
2020	Jochen Kamm, Michael Becken, and Rafael Abreu . Electromagnetic modelling with topography on regular grids with equivalent materials. <i>Geophysical Journal International</i> , 220(3):2021–2038, 2020
2019	Elena Grekova and Rafael Abreu . Isotropic linear viscoelastic reduced cosserat medium: an acoustic metamaterial and a first step to model geomedium. In <i>New Achievements in Continuum Mechanics and Thermodynamics</i> , pages 165–185. Springer, 2019
2019	Morvarid Saki, Christine Thomas, Laura Cobden, Rafael Abreu , and Johannes Buchen. Causes for polarity reversals of PP precursor waves reflecting off the 410km discontinuity beneath the Atlantic. <i>Physics of the Earth and Planetary Interiors</i> , 286:111 – 126, 2019
2018	Rafael Abreu , Stephanie Durand, and Christine Thomas. The asymmetric seismic moment tensor in micropolar media. <i>Bulletin of the Seismological Society of America</i> , 108(3A):1160, 2018

- 2018 **Rafael Abreu**, Zeming Su, Jochen Kamm, and Jinghuai Gao. On the accuracy of the complex-step-finite-difference method. *Journal of Computational and Applied Mathematics*, 340:390 – 403, 2018
- 2018 Stephanie Durand, **Rafael Abreu**, and Christine Thomas. Seistomopy: Fast visualization, comparison and calculations in global tomographic models. *Seismological Research Letters*, 89(2A):658, 2018
- 2018 Lina Schumacher, Christine Thomas, and **Rafael Abreu**. Out of plane seismic reflections beneath the Pacific and their geophysical implications. *Journal of Geophysical Research: Solid Earth*, 2018
- 2017 **Rafael Abreu**, Christine Thomas, and Stephanie Durand. Effect of observed micropolar motions on wave propagation in deep Earth minerals. *Physics of the Earth and Planetary Interiors*, 276:215 – 225, 2017
- 2017 **Rafael Abreu**, Jochen Kamm, and Anne-Sophie Reiß. Micropolar modelling of rotational waves in seismology. *Geophysical Journal International*, 210(2):1021, 2017
- 2017 Gabriele Barbagallo, Angela Madeo, Marco Valerio d’Agostino, **Rafael Abreu**, Ionel-Dumitrel Ghiba, and Patrizio Neff. Transparent anisotropy for the relaxed micromorphic model: Macroscopic consistency conditions and long wave length asymptotics. *International Journal of Solids and Structures*, 120:7 – 30, 2017
- 2017 Patrizio Neff, Angela Madeo, Gabriele Barbagallo, Marco Valerio d’Agostino, **Rafael Abreu**, and Ionel-Dumitrel Ghiba. Real wave propagation in the isotropic-relaxed micromorphic model. *Proceedings of the Royal Society of London A*, 473(2197), 2017
- 2016 David Schlaphorst, Christine Thomas, Richard Holme, and **Rafael Abreu**. Investigation of core–mantle boundary topography and lowermost mantle with P4KP waves. *Geophysical Journal International*, 204(2):1060–1071, 2016
- 2016 Jesús Ibáñez and et al. TOMO-ETNA experiment at Etna volcano: activities on land. *Annals of Geophysics*, 59(4), 2016
- 2015 **Rafael Abreu**, Daniel Stich, and Jose Morales. The complex-step-finite-difference method. *Geophysical Journal International*, 202(1):72–93, 2015
- 2014 **Rafael Abreu**. *Complex-Steps-Finite-Differences with applications to seismic problems*. PhD thesis, University of Granada, 2014. [pdf](#)
- 2013 **Rafael Abreu**, Daniel Stich, and Jose Morales. On the generalization of the complex step method. *Journal of Computational and Applied Mathematics*, 241:84–102, 2013
- 2011 **Rafael Abreu** and Michael Slawinski. Review for a student’s guide to geophysical equations. *The Leading Edge*, page 1421, 2011
- 2011 Carlos Reinoza, Cecilio Morales, Victor Rocabado, Kenny García, Christian Sanchez, Javier Sanchez, **Rafael Abreu**, and Michael Schmitz. Espesores de sedimentos a partir de la integración de datos geofísicos en Barquisimeto y Cabudare, Venezuela. *Revista de la Facultad de Ingeniería de la Universidad Central de Venezuela*, 26(2):67–76, 2011. [pdf](#)

Book in preparation

- 2023 **Wave Propagation in Acoustic, Elastic, Micropolar and Micromorphic Media using the Finite-Difference and Spectral-Element Methods - Springer.**
In this book I am making a compilation of the most basic concepts of the FDM and SEM applied to the acoustic, elastic, micropolar and micromorphic wave equations. Illustrative examples are presented using the Python language.

Papers in preparation

2023	Rafael Abreu. Understanding micropolar theory in the Earth sciences III: micro and macro scales. <i>Pure and Applied Geophysics</i> , 2021. In preparation
2023	Rafael Abreu. Understanding micropolar theory in the Earth sciences IV: sensitivity kernels. <i>Pure and Applied Geophysics</i> , 2021. In preparation
2023	Rafael Abreu and Elena Grekova. Modeling coupled poroelastic and micropolar effects in seismology combining velocity, strain and rotational data. <i>Pure and Applied Geophysics</i> , 2022. In preparation
2023	Rafael Abreu , Christine Thomas, Jeroen Ritsema, and Stephanie Durand. Seismic analysis of the lower mantle beneath the pacific using shear-wave travel-times and 3D synthetics. <i>Pure and Applied Geophysics</i> , 2022. In preparation

Languages

Spanish	Mother tongue
English	Fluent
German	B1
French	B1

References

Prof. Daniel Stich
University of Granada
e-mail: stich@ugr.es

Prof. Christine Thomas
University of Münster
e-mail: tine@uni-muenster.de

Prof. Jose Morales
University of Granada
e-mail: stutz@ipgp.fr

Prof. Eleonore Stutzmann
Institut de Physique du Globe de Paris
e-mail: stutz@ipgp.fr