

CURRICULUM VITAE

Summary: I am an applied theoretical seismologist with research foci on seismic tomography and fibre-optic sensing. To image the deep interior of the Earth, my team develops and applies novel techniques for numerical wave propagation, highly specialised non-linear optimisation techniques, and methods for uncertainty quantification in large-scale inverse problems. We deploy fibre-optic cables of several kilometres length in densely populated cities, and on volcanoes and glaciers. Using laser interferometry, these cables become seismic sensors that provide information about Earth structure and seismicity with unprecedented resolution. In addition to these core areas of expertise, I am working on and publishing in high-performance computing, medical ultrasound imaging, effective media and metamaterial design, non-destructive testing, and fibre optics. I am a co-founder and scientific adviser of the ETH Spin-Off Mondaic (www.mondaic.com) that provides solutions for full-waveform modelling and inversion to academia, industry and national labs.

PERSONAL DATA

Name: Andreas Fichtner
Date of birth: 7 June 1979
Place of birth: Rochlitz, Germany
Nationality: German
Marital status: Married, two children, age 6 and 1

EDUCATION

1999 - 2002 University of Mining and Technology, Freiberg, Germany; **Bachelor in Geophysics** (excellent with distinction)
2002 - 2003 **Fulbright student** at the University of Washington, Seattle, USA
2003 - 2005 Ludwig Maximilian University, Munich, Germany; **MSc in Geophysics** (excellent with distinction)
2005 - 2009 Ludwig Maximilian University, Munich, Germany; **PhD** (excellent with distinction)

INSTITUTIONAL APPOINTMENTS

2009 - 2012 **Postdoctoral researcher**, Utrecht University, Utrecht, The Netherlands
2013 - 2017 **Assistant professor**, ETH Zurich
2018 - **Associate professor**, ETH Zurich

ENGAGEMENT IN PROFESSIONAL SOCIETIES

American Geophysical Union (AGU)
Deutsche Geophysikalische Gesellschaft (DGG)
Seismological Society of America (SSA)

HONORS AND AWARDS

2002 - 2003	Fulbright Scholarship
2004	Scholarship awarded by the French-German Youth Office
2007	Scholarship awarded by the German Academic Exchange Service
2008	Geophysical Journal International Student Paper Award
2008	Invited talk at the 58th Meeting of Nobel Laureates in Physics
2009	Student paper award , American Geophysical Union
2010	Best oral presentation award by the German Geophysical Society
2011	Keiiti Aki young scientist award by the American Geophysical Union
2013	Golden Owl , ETH teaching award for <i>Inverse Theory</i> class (best teaching in Earth Sciences)
2015	Early Career Scientist Award by the International Union of Geodesy and Geophysics (IUGG)
2016	Blaustein Visiting Professorship , Stanford University
2016	ERC Starting Grant
2017	Elected member of the Young Academy of Europe
2018	Hoffmann Prize , Bavarian Academy of Sciences, inaugural recipient
2010 - 2015, 2017,	
2019 - 2021:	Outstanding reviewer award by the Geophysical Journal International

In 2020 and 2021, during the Covid-19 pandemic, my team nominated me for ETH's **Art of Leadership Award** (ALEA).

ACADEMIC COMMITMENTS

Teaching

2018 -	Dynamische Erde I & II (geophysics part, undergraduate level, ETH Zurich)
2018 -	Integrated Earth systems (graduate level, ETH Zurich)
2016 - 2017	Seismology of the spherical Earth (graduate level, ETH Zurich)
2015	Seismic imaging using earthquake and ambient noise data (graduate level, Stanford University)
2015	Great papers in seismology (graduate level, ETH Zurich)
2013 -	Inverse theory I (graduate level, ETH Zurich)
2013	Topics in theoretical seismology (MSc/PhD level, ETH Zurich)
2008	Global geophysics (seismology & geodynamics, graduate level, LMU Munich, Germany)
2000	Computer science (C programming, undergraduate level, Univ. of Mining and Technology, Freiberg, Germany)

Mentoring of postdocs

Current:

Andrea Zunino: Inverse theory and Monte Carlo Methods

Patrick Paitz: Seismological applications of Distributed Acoustic Sensing

Pascal Edme: Distributed Acoustic Sensing for environmental applications (shared with Prof. Johan Robertsson)

Dirk-Philip van Herwaarden: Full-waveform inversion theory and applications

Marta Pienkowska-Côte: Towards physics-based seismic hazard assessment

Daniel Bowden: Wiener filtering of seismic array data

Vaclav Hapla: GPU-accelerated seismic wave propagation

Christian Böhm: numerical optimisation, seismic modelling and inversion

Past:

Martin van Driel: Numerical seismology

Maria Koroni: waveform inversion for topography on Earth's internal discontinuities

Marie Bocher: geodynamic sequential data assimilation

Lion Krischer: deep learning in seismology

Ylona van Dinther: data assimilation for earthquake physics

Laura Cobden: mineral physics interpretation of seismic tomography

Paula Koelemeijer: seismic interferometry, normal-mode seismology

Max Rietmann: numerical wave propagation

Supervision of PhD students

Ongoing:

Christine Seupel: Seismological methods for avalanche detection and characterisation (co-supervised with Alec van Herwijnen)

Ariane Lanteri: Full-waveform inversion for seismic hazard applications

Sebastian Noe: Collaborative Seismic Earth Model automation

Sara Klaasen: Distributed Acoustic Sensing in volcanic environments

Patrick Marty: Transcranial medical ultrasound
Ines Ulrich: Random wavefield interferometry for medical ultrasound
Krystyna Smolinski: Distributed Acoustic Sensing in urban environments
Jonas Igel: Global microseismic noise source inversion
Cyrill Bösch: Design of elastic metamaterials
Lars Gebraad: Hamiltonian Monte Carlo full waveform inversion

Completed:

Sölvi Thrastarson: Full-waveform inversion using adaptive numerical meshes
Patrick Paitz: Distributed Acoustic Sensing in seismology
Dirk-Philipp van Herwaarden: Collaborative Seismic Earth Model
Naiara Korta: Translating seismic to medical imaging
Iris van Zelst: Coupling tsunami and earthquake simulations
Nienke Blom: Seismic density tomography
Korbinian Sager: Full waveform noise tomography
Saule Simute: Full-waveform earthquake source inversion
Michael Afanasiev: Global multiscale full waveform inversion
Laura Ermert: Full-waveform ambient noise tomography
Denise de Vos: Finite-frequency two-station method (co-supervised with Hanneke Paulsen)
Florian Rickers: Misfit functional design and waveform tomography (co-supervised with Jeannot Trampert)
Lorenzo Colli: Waveform tomography and geodynamics (co-supervised with Hans-Peter Bunge)
Moritz Bernauer: Rotational seismology (co-supervised with Heiner Igel)

Supervision of MSc students

Ongoing:

Lu Tian: Distributed acoustic sensing in urban environments
Dimitri Sutter: Global noise source inversion in 3D heterogeneous media

Completed:

Patrick Marty: Transcranial medical ultrasound full-waveform inversion
Mao Keheng: Monte Carlo solution of geophysical inverse problems
Matthias Häberlin: Probabilistic array processing
Sara Klaasen: Distributed Acoustic Sensing on Mt. Meager, British Columbia
Lars Gebraad: Hamiltonian Monte Carlo Full-Waveform Inversion
Cyrill Bösch: Discrete wave equation upscaling in 2D
Sunniva Morris: Tsunami modelling
Dorian Soergel: Fast resolution analysis by random probing
Sölvi Thrastarson: Wavefield modelling in ice-covered regions
Xuemeng Lu: Double-difference waveform inversion
Nicolas Vinard: Ultrasound full-waveform inversion for breast cancer detection
Dirk-Philipp van Herwaarden: Full-waveform inversion of the African continent
Patrick Paitz: Artificial neural networks for the classification of noise correlations
Evan Delaney: Ambient noise source imaging
Myrna Staring: Waveform tomography of the East African Rift System
Alessandro Lechmann: Seismic source encoding
Korbinian Sager: Combining ray tomography and full waveform inversion
Saule Zukauskaitė: Waveform tomography for the Japanese islands region
Hamish Diaz-Steptoe: Waveform tomography for the Japan region (co-supervised with Jeannot Trampert)
Hannes Schiessl: Waveform tomography (co-supervised with Heiner Igel)
Paul Käußl: Probabilistic tomography (co-supervised with Heiner Igel)
Moritz Bernauer: Rotational seismology (co-supervised with Heiner Igel)

Supervision of BSc students

Ongoing:

Sixtine Dromigny: Noise interferometry for Integrated Acoustic Sensing

Completed:

Nadja Lindner: Distributed Acoustic Sensing for snow avalanche characterisation
Lena Husmann: Ambient noise tomography of Iceland

EXTERNAL RESEARCH FUNDING

Funded research projects as principal investigator and proposal first author

2021	Platform for Advanced Scientific Computing, Bayesian Full-Waveform Inversion , 440 kCHF
2020	Swiss National Science Foundation (Project), Hamiltonian Monte Carlo Full-Waveform Inversion , 200 kCHF
2019	Swiss National Science Foundation (SPARK), Fibre-optic urban-scale natural hazard analysis , 100 kCHF
2017	Platform for Advanced Scientific Computing, Salvus , 380 kCHF
2017	ETH Zurich, Exploring the Potentials of Distributed Acoustic Sensing , 180 kCHF
2016	European Research Commission (Starting Grant), The Collaborative Seismic Earth Model , 1500 kCHF
2015	Commission for Technology and Innovation, New ultrasound technology for breast cancer detection , 460 kCHF
2013	Swiss National Science Foundation, Full waveform noise tomography , 350 kCHF
2013	Swiss National Supercomputing Center, GeoScale: A framework for multiscale modelling and inversion , 700 kCHF
2012	Dutch Science Foundation (VIDI), 3D density tomography , 800 kCHF
2009	German Science Foundation, Seismic waveform tomography on continental scales , 50 kCHF

Industrial funding as principal investigator and proposal first author

2020	Nat. Coop. for the Disposal of Radioactive Waste (NAGRA), DAS for NAGRA Full-Scale Emplacement Experiment , 70 kCHF
2013	Royal Dutch Shell, Boosting full seismic waveform inversion , 320 kCHF

Funded research projects as co-investigator and proposal contributor

2022	European Commission, Digital twin for geophysical extremes (DT-Geo) , postdoc position
2022	European Commission, Geosphere infrastruct. for questions into integrated research (Geo-Inquire) , postdoc position
2021	ETH Zurich (Impulse Fund), Computational geosciences teaching , partial postdoc and student helpers
2021	European Commission, Monitoring a restless Earth (SPIN) , PhD position
2020	European Commission, eFlows4HPC , postdoc position
2018	European Commission, Center of Excellence in Solid Earth (ChEESE) , postdoc position
2018	European Commission, Real-time earthquake risk reduction for a resilient Europe (RISE) , PhD position
2014	European Coop. Sci. Tech. Res. (COST), Time-dependent seismology (TIDES) , workshops and travel

SERVICE TO THE ACADEMIC COMMUNITY

Organisation of workshops and symposia

2022	SSA workshop organiser, Seismic Tomography 2022 , Toronto (Canada)
2019 - 2021	AGU session organiser, Advances in Theoretical & Computational Seismology , San Francisco, online, New Orleans (USA)
2020	SSA workshop organiser, Virtual Seismic Tomography 2020 , online
2019	EGU session organiser, Computational Seismology , Vienna (Austria)
2017 - 2018	AGU session organiser, Frontiers in theoretical and computational seismology , New Orleans, Washington D. C. (USA)
2018	Lorentz Center workshop organiser, Image reconstruction from millimeters to the Globe , Leiden (The Netherlands)
2018	EGU session organiser, Computational Seismology , Vienna (Austria)
2017	workshop organiser, Annual workshop of the European TIDES project , Oxford (UK)
2017	Lorentz Center workshop organiser, Data Assimilation in Earth Sciences , Leiden (The Netherlands)
2016	workshop organiser, Annual workshop of the European TIDES project , Sesimbra (Portugal)
2016	AGU session organiser, Seismic imaging: From data to processes , San Francisco (USA)
2016	Conf. Math. Geophysics session organiser, New developments in passive and active tomography , Paris (France)
2015	AGU session organiser, Seismic modeling & inversion: Theory and methodological developments , San Francisco (USA)
2015	EGU session organiser, Seismic Imaging , Vienna (Austria)
2014	AGU session organiser, From data to processes , San Francisco (USA)
2013	AGU session organiser, Advances in seismic imaging and inversion , San Francisco (USA)
2012	AGU session organiser, Tomography Across the Scales , San Francisco (USA)
2011	Lorentz Center workshop organiser, Uncertainty Analysis in Geophysical Inverse Problems , Leiden (The Netherlands)
2010	AGU session organiser, Advances in Seismic Tomography , San Francisco (USA)

Oversight/selection committees

member of the *Keiiti Aki Award* Committee, American Geophysical Union, 2016/17

Reviewer responsibilities

reviewer for the United States National Science Foundation and the European Research Commission, as well as for various international journals, including Nature, Science, Geophysical Journal International, Astrophysical Journal, Journal of Geophysical Research, Computational Geosciences, Geophysics, G³, and Pure and Applied Geophysics, Geophysics, Journal of the Acoustical Society of America, and various others.

Editorial responsibilities

2018 - **Associate editor**, Journal of Geophysical Research
2013 - 2015 **Associate editor**, Springer books
2014 **Associate editor**, Geophysics, special issue on wave equation-based imaging and inversion

SERVICE TO ETH ZURICH

June 2022 - **Director of Studies**, Department of Earth Sciences
2020 - **Deputy head of the Institute of Geophysics**, Department of Earth Sciences
2019 - **ETH Medal Committee**, Department of Earth Sciences
2015 **BSc programme reform committee**, Department of Earth Sciences
2013 - 2014 **Advisory Board member**, Swiss Seismological Service

INVITED TALKS

2022

Waves Conference, Karlsruhe: Parsimonious global full-waveform inversion
Oxford University: Fibre-optic sensing in volcanic, glacial and other challenging environments
Alfred-Wegener Institut: Fibre-optic sensing in volcanic, glacial and other challenging environments
EAGE LC: Fibre-optic sensing in volcanic, glacial and other challenging environments
Université de Lausanne: Fibre-optic sensing in volcanic, glacial and other challenging environments

2021

EAGE 2021, Amsterdam: Full-waveform ambient noise inversion
EU Regional School, KIT Karlsruhe: Probabilistic full-waveform inversion
Geomar, Kiel: Distributed acoustic sensing in volcanic and glacial environments
Geomar, Kiel: Accelerating seismic modelling and inversion using wavefield-adapted meshes
International Centre for Theoretical Physics, Trieste: Solving larger inverse problems with smarter methods
Icelandic Meteorological Service: Fibre-optic sensing in volcanic and glacial environments
Colorado School of Mines Heiland Lecture: Uncertainty quantification for large-scale non-linear inverse problems
Virtual SIAM Meeting: Autotuning Hamiltonian Monte Carlo
Earth Observatory of Singapore: Solving larger inverse problems with smarter methods
Université Paris Saclay: Uncertainty quantification for large-scale non-linear inverse problems

2020

INGV Fiber Optics Workshop: The many facets of DAS
University of Edinburgh, Scotland: Seismic ambient noise inversion
Virtual SCEE Workshop: Practical and emerging methods for resolution analysis and uncertainty quantification
Kandilli Observatory, Istanbul: Uncertainty quantification for large-scale, non-linear inverse problems
Virtual EGU: Auto-tuning Hamiltonian Monte Carlo
Munich Earth Science School: Inverse Theory and adjoint methods

2019

University Hospital Zurich, Zurich: Seismo-medical imaging
University of Science and Technology of China, Hefei: Advances in numerical wave propagation
University of Science and Technology of China, Hefei: Full-waveform ambient noise inversion
University of Science and Technology of China, Hefei: Hamiltonian Monte Carlo tomography
Oxford University: Seismic ambient noise inversion
Niels Bohr Institute, Copenhagen: Seismic ambient noise inversion
IEEE Ultrasonics, Glasgow: Faster full-waveform inversion
SPIE Medical Imaging, San Diego: Seismo-medical imaging
Applied Inverse Problems, Grenoble: Seismo-medical tomography
Applied Inverse Problems, Grenoble: Full waveform inversion for ambient noise sources and 3D Earth structure
AGU, San Francisco: Auto-tuning Hamiltonian Monte Carlo for high-dimensional model space exploration

2018

Swiss Geocomputing Center, UNIL, Lausanne: Computational seismology
Karlsruhe Institute of Technology, Karlsruhe: Lecture series on full-waveform inversion
Physikalische Gesellschaft Zürich: Das Spektrum der Erde
CSIRO, Perth: Bridging the gap between local and global tomography
CSIRO, Perth: High-performance modelling and inversion of seismic waveform data

Australian National University, Canberra: The Collaborative Seismic Earth Model
Imperial College, London: Towards full waveform ambient noise inversion
Imperial College, London: Seismic tomography - Present and Future
AlpArray Winter School, Berlin: Developments in full-waveform inversion

2017

TIDES training school, Oxford: Full-waveform inversion - Quo vadis?
SEG Workshop, Bahrain: Towards full waveform ambient noise inversion
MUST Workshop, Speyer: Multiscale full-waveform inversion: From the Globe to the human breast
Move On Workshop, Tutzing: The Collaborative Seismic Earth Model
AGU, New Orleans: The Collaborative Seismic Earth Model
Cambridge University: The Collaborative Seismic Earth Model
Workshop on Geophysical Applications and HPC, Barcelona: Global-scale full-waveform inversion
Institute of Pure and Applied Mathematics, UCLA: The Collaborative Seismic Earth Model

2016

AGU, San Francisco: Resolution analysis in full-waveform inversion
WAVES project, annual meeting: The Collaborative Seismic Earth Model
Stanford University: The Collaborative Seismic Earth Model
Stanford Exploration Project, annual meeting: Resolution analysis by random probing
Utrecht University: Imaging the Earth from sedimentary basins to the deep mantle
German Geophysical Society (DGG), Keynote: Imaging the Earth from sedimentary basins to the deep mantle
CIG Webinar: Resolution analysis by random probing
Max Planck Institute for Solar System Research: Imaging the Earth from sedimentary basins to the deep mantle
TopoEurope Annual Meeting, Antibes: Full-waveform inversion

2015

Waves 2015, Karlsruhe: Waveform inversion across the scales - A terrestrial perspective
AGU, San Francisco: Source-structure trade-offs in ambient noise correlations
SEG Workshop, Abu Dhabi, Keynote: Resolution analysis by random probing
Pacific Inst. Math. Sci., Edmonton, Keynote: Imaging the Earth from sedimentary basins to the deep mantle
IUGG Early Career Award Lecture, Prague: Imaging the Earth across the scales
ECCOMAS Conference Keynote, Crete: Multi-scale/multi-data inversion for elastic Earth structure
California Institute of Technology: Towards full-waveform ambient noise tomography

2014

Stanford University: Scanning the Earth across the scales
Harvard University: Scanning the Earth across the scales
California Institute of Technology: Towards a comprehensive seismic Earth model
AGU, San Francisco: Imaging the subduction of continental lithosphere in the Banda Sea region
Technical University Munich: Scanning the Earth
University of Lyon: Towards a Comprehensive Seismic Earth Model
University of Leeds: Towards a Comprehensive Seismic Earth Model
Freie Universität Berlin: Multiscale full waveform inversion
GFZ Potsdam: Separating intrinsic and apparent anisotropy
Massachusetts Institute of Technology: Towards a Comprehensive Seismic Earth Model

2013

AGU, San Francisco: The deep structure of the North Anatolian Fault Zone
AGU, San Francisco: Separating intrinsic and apparent anisotropy?
Harvard University: Seismic views of the multiscale Earth – II. Separating apparent and intrinsic anisotropy?
Harvard University: Seismic views of the multiscale Earth – I. Multiscale waveform inversion
IASPEI Meeting, Gothenburg: Multiscale full waveform inversion
QUEST-CIG Meeting, Fairbanks: Towards a comprehensive seismic Earth model
SIAM Meeting, Boston: Full waveform inversion across the scales
SIAM Meeting, Boston: Second-order adjoints in seismic waveform tomography

2012

The Australian National University: Scanning the Earth – A survey of recent advances in seismic tomography
University of Münster: Scanning the Earth
International Centre for Theoretical Physics, Trieste: Full waveform modelling and inversion
Institute of Earth Sciences “Jaume Almera”, Barcelona: Tomography across the scales
Karlsruhe Institute of Technology: Imaging the metabolism of the Earth

SIAM Conference on Imaging, Philadelphia: Multi-scale full waveform inversion
Princeton University: Advances and prospects in full waveform inversion
Massachusetts Institute of Technology: Advances and prospects in full waveform inversion
Bullard Laboratories / Cambridge University: Developments in continental-scale full waveform inversion

2011

ETH Zurich: Developments and perspectives in seismic tomography
Schlumberger Cambridge Research: Developments in continental-scale full waveform inversion
American Geophysical Union, fall meeting, San Francisco: Resolution analysis in full waveform inversion
Annual meeting of the EU-funded QUEST project, Iceland: Resolution analysis in full waveform inversion
Karlsruhe Institute of Technology: Towards quantitative resolution analysis in full waveform inversion
Karlsruhe Institute of Technology: Subduction of continental lithosphere in the Banda Sea region
ETH Zurich: Towards quantitative resolution analysis in full waveform inversion.
Annual Meeting of the German Geophysical Society (DGG): Full waveform tomography on regional to global scales

2010

Frankfurt University: Seismic Waveform Tomography
European Geosciences Union, Vienna: Full seismic waveform tomography
European Geosciences Union, Vienna: Full waveform tomography for radially anisotropic structure

2009

Institut de Physique du Globe de Paris: Full waveform tomography for radially anisotropic structure
American Geophysical Union, spring meeting, Toronto: Full seismic waveform inversion for upper-mantle structure
ETH Zurich: A radially anisotropic model of the Australasian upper mantle inferred from full waveform tomography
European Geosciences Union, Vienna: Full seismic waveform inversion for upper-mantle structure under the Australian continent

2008

University of Mining and Technology, Freiberg, Germany: Seismic waveform tomography
58th Meeting of Nobel Laureates in Physics, Lindau, Germany: Seismic waveform tomography - Improved tsunami warnings and insights into the history of the solid Earth