

Curriculum Vitae

PERSONAL INFORMATION

Menno Fraters

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PROFESSIONAL WORK EXPERIENCE

- 2023 – present **Post-doc on numerical modelling in Geophysics**
University of Florida
Working on a detailed geodynamic model of the whole Earth and integrating lattice-preferred orientation (LPO) in those models.
- 2021 **Teaching a course on Earthquakes and other geohazards**
UC Davis
Teaching GEL 17: Earthquakes and other geohazards. This is a general education course. This means that the students have a diverse background. This course was taught in person.
- 2020 **Teaching a course on the solar system**
UC Davis
Teaching GEL 36: The solar system. This is a general education course. This means that the students have a diverse background. This course was taught through Zoom.
- 2019 – 2023 **Post-doc on numerical modelling in Geophysics**
UC Davis
Using lattice-preferred orientation (LPO) computation in geodynamic simulations to link seismic anisotropy with dynamics. In 2020 I also started working on a Nation Science Foundation (NSF) project from a grant which I was awarded to investigate the Cascadia subduction zone and a grant I was awarded from Computational Infrastructure for Geodynamics (CIG) to work on improving the Geodynamic World Builder.
- 2019 **Staff Research Associate 1 Computer Research Simulator**
UC Davis
Implement calculations for lattice-preferred orientation (LPO) of minerals resulting from viscous flow in the mantle within the open-source mantle convection research code ASPECT
- 2014 – 2019 **Phd in Geophysics (Mantle Dynamics)**
Utrecht University
Thesis title: *Towards numerical modelling of natural subduction systems with an application to Eastern Caribbean subduction.*
Thesis defence date: 15 may 2019
Project on the tectonic plate dynamics in the Caribbean region and numerical advances in the solving of the nonlinear Stokes equation. This position also involved:
- assisting with teaching and supervising two master projects
- member of organising committee of a scientific conference called Nethermod with about 120 participants.
- participating in 6 ten day hackathons in the US on the scientific code ASPECT
- becoming a primary developer on the scientific code ASPECT
- Initiated a project on implementing a Newton solver in ASPECT. This project is a collaboration between Utrecht University and Texas A&M / Colorado State University
- 2012 – 2013 **Board member of SIB-Utrecht (Dutch United Nations Student Association)**
Full-time board member in the position of Commissioner for External Affairs: responsible for the weekly lecture program of SIB-Utrecht, chair of External committee and responsible for several other committees.
- 2006 **Editor of 'Davindi by high school students'**
Editor of 'Davindi by high school students', which was a project by "Kennisset". Kennisset is a public educational organisation which supports and inspires Dutch primary, secondary and vocational institutions in the effective use of ICT.

EDUCATION AND TRAINING

- 2014 **Kompaktkurs: Iterative Gleichungssystemloeser und Parallelisierung**
ITER-S, Stuttgart
Short course in German (with slides in English) on iterative solvers and parallelizing c++ and Fortran code through MPI and OpenMP for high performance computing.
- 2011 – 2014 **MSc Earth Structure and Dynamics**
Utrecht University, Utrecht, the Netherlands
Master Thesis: Coupling between surface and mantle with ASPECT
- 2010 – 2011 **International diploma of geology of Imperial College London**
Imperial College London, London, UK
Exchange year.
- 2008 – 2011 **BSc Earth Sciences**
Utrecht University, Utrecht, the Netherlands
- 2002 – 2008 **High school**
Het Nieuwe Lyceum, Bilthoven, The Netherlands
- VWO degree with profile: Science and technology, Science and Health and History
- Cambridge Certificate in Advanced English (CAE)
- Cambridge First Certificate in English (FCE)
- Part of the debating club for 3 years
- Wrote for the high school news paper

EXTRACURRICULAR ACTIVITIES

- 2009 – 2019 **Organization within SIB-Utrecht (Dutch United Nations Student Association)**
Since 2009 I have been active in this student association by organising introduction weekends and weekly public lecture. I was one year (2012-2013) a full time board member of this organisation. In addition I organised four crisis simulations with 40-50 participants on the topics of the first World War, the second World War, the Cold War and the Syrian civil war. I have been a member of the advisory board of SIB-Utrecht in 2017-2018. I have also been made an honorary member for my contributions to the society.
- 2009 – 2015 **Participation in study trips of SIB-Utrecht (Dutch United Nations Student Association)**
Went on 5 summer study trips organised by SIB-Utrecht, where we visited embassies, NGOs, institutions and local students in the Balkan (2015), Russia (2013), Northern India (2012), the Baltic states (2011) and Israel, the West Bank and Jordan (2010).
- 2009 – 2011 **Model United Nations (MUN)**
Participated in 8 weekend long MUN conferences. One in Maastricht (EuroMUN 2012), two in Nijmegen (RIMUN 2011 and 2010), two in London (LIMUN 2011, UCLMUN 2010), one in Cambridge (CUIMUN 2010), one in Nottingham (NottsMUN 2010) and one in Oxford (OxIMUN 2010)

	CIG project: Improving and Bringing the Geodynamic World Builder into the CIG community	Primary Investigator (PI)	2022
	XSEDE Project: Surface-to-Slab Cascadia Subduction Models	PI	2022 - present
	NSF: Testing the Thermal Shear Instability Hypothesis for Deep Slab Seismicity	Collaborator	2022 - present
	XSEDE project: Evolution of Lattice-Preferred Orientation in 3D models of subduction	PI	2021 - 2022
	Norwegian Research Council project: ANIMA: Anisotropic viscosity in Mantle dynamics	Collaborator	2021 - present
	UC Davis EPS department seminar committee	Member	2021 - 2022
	UC Davis Datalab: Collaborative VR pipeline for Hierarchical Data from Large geodynamic solutions	Collaborator	2021 - present
	NSF Geoprisms project: Linking Surface Deformation to Slab-Mantle Flow in Cascadia	PI	2020 - present
	XSEDE project: Evolution of LPO in 3D models of subduction	PI	2020 - 2021
Scientific Projects, participation's and service	2020 Tectonics Modeling Tutorial	Organizer	2020
	EGU geodynamics blog	Editor	2020 - 2022
	NSF project: "Collaborative Research: Development and Application of a Framework for Integrated Geodynamic Earth Models"	Collaborator	2019 - present
	Geodynamic World Builder	Principal developer	2018 - present
	ASPECT	Principal developer	2017 - present
	NWO project: 'Large scale finite element models of the Caribbean region' (project nr. 15820)	Co-PI	2017 - 2019
	NWO project: Toward a next generation instantaneous dynamics models of the crust-mantle system (NWO ALW-GO/16-33)	Co-PI	2016 - 2020
	XV International Workshop on Numerical Modelling of Mantle and Lithosphere Dynamics (Nethermod)	Organizer	2015–2017
	yearly 10 day ASPECT hackathons	Participant	2014 - 2022
		Organizer	2022

Scientific publications

N. Tosi, C. Stein, L. Noack, C. Hüttig, P. Maierová, H. Samuel, D. R. Davies, C. R. Wilson, S. C. Kramer, C. Thieulot, A. Glerum, M. Fraters, W. Spakman, A. Rozel, and P. J. Tackley. A community benchmark for viscoplastic thermal convection in a 2-d square box. *Geochemistry, Geophysics, Geosystems*, 16(7):2175–2196, 2015

A. Glerum, C. Thieulot, M. Fraters, C. Blom, and W. Spakman. Nonlinear viscoplasticity in ASPECT: benchmarking and applications to subduction. *Solid Earth*, 9(2):267–294, 2018

M. Fraters, W. Bangerth, C. Thieulot, A. Glerum, and W. Spakman. Efficient and practical Newton solvers for non-linear Stokes systems in geodynamic problems. *Geophysical Journal International*, 218(2):873–894, 04 2019

M. Fraters, C. Thieulot, A. van den Berg, and W. Spakman. The geodynamic world builder: a solution for complex initial conditions in numerical modeling. *Solid Earth*, 10(5):1785–1807, 2019

M. Fraters. *Towards numerical modelling of natural subduction systems with an application to eastern Caribbean subduction*. PhD thesis, UU Dept. of Earth Sciences, 2019

M. Fraters and M. Billen. On the implementation and usability of crystal preferred orientation evolution in geodynamic modeling. *Geochemistry, Geophysics, Geosystems*, 22(10):e2021GC009846, 2021

A. Saxena, J. Dannberg, R. Gassöller, M. Fraters, T. Heister, and R. Styron. High-resolution mantle flow models reveal importance of plate boundary geometry and slab pull forces on generating tectonic plate motions. *JGR: Solid Earth*, 2022 subm

M. Fraters, W. Spakman, C. Thieulot, and D. van Hinsbergen. Assessing the geodynamics of strongly arcuate subduction zones: the eastern caribbean subduction setting. In prep

First author presentations and other publications

- December 2022 – AGU: Exploring the Cascadia slab structure coupling 3D thermomechanical and CPO modeling. – Invited talk
- August 2022 – Ada Lovelace: Exploring the Cascadia slab structure coupling 3D thermomechanical and CPO modeling – Poster
- April 2022 – EGU: Exploring the Cascadia slab structure coupling 3D thermomechanical and CPO modeling – Talk
- February 2022 – CIG developers workshop: The Geodynamic World Builder in ASPECT – Talk
- December 2021 – AGU: On the Implementation and Usability of CPO Evolution in Geodynamic Modelling – Talk
- July 2021 – ASPECT hackathon: The Geodynamic World Builder in ASPECT – Talk
- February 2021 – CIG developers Meeting: The Geodynamic World Builder in ASPECT – Talk
- January 2021 – ASPECT Online User Meeting: LPO/CPO in ASPECT – Talk
- July 2020 – 2020 Tectonics Modeling Tutorial: Complex Model Design with the Geodynamic World Builder – Tutorial
- May 2020 – EGU: Assessing the geodynamics of strongly arcuate subduction zones in the eastern Caribbean subduction setting – Online session
- May 2020 – EGU: Computing LPO for Geodynamic Models in ASPECT – Online session
- January 2020 – ASPECT Online User Meeting: The Geodynamic World Builder in ASPECT – Talk
- December 2019 – AGU: Assessing the geodynamics of strongly arcuate subduction zones in the eastern Caribbean subduction setting. – Talk
- August 2019 – Ada Lovelace Workshop: The Geodynamic World Builder: a solution for complex initial conditions in numerical modelling – Poster
- August 2019 – CIG Research highlight: Modeling Complex Geodynamic Systems Using Geodynamic World Builder – Article
- may 2018 – CIG Webinar: Newton solver in ASPECT – Talk.
- April 2018 – EGU: Efficient and Practical Newton Solvers for Nonlinear Stokes Systems in Geodynamic Problems – Poster.
- March 2018 – NAC: Coupling Lithosphere-Mantle Dynamics to the Cenozoic Tectonic Evolution in the Caribbean Region – Poster.
- February 2018 – Forth Collins Applied Math seminar: Efficient and Practical Newton Solvers for Nonlinear Stokes Systems in Geodynamic Problems – Talk.
- August 2017 – Nethermod (XV International Workshop on Numerical Modeling of Mantle and Lithosphere Dynamics): Coupling Lithosphere-Mantle Dynamics to the Cenozoic Tectonic Evolution in the Caribbean Region. – Poster.
- April 2017 – EGU: Coupling Lithosphere-Mantle Dynamics to the Cenozoic Tectonic Evolution in the Caribbean Region – Poster.
- March 2016 – NAC: Toward coupling deep driving processes to surface evolution in the Caribbean region – Poster.
- February 2016 – Computational mathematic group presentation Texas A&M: From Kinematics to Dynamics in the Caribbean Region – Talk.
- August 2015 – XIV International Workshop on Numerical Modelling of Mantle and Lithosphere Dynamics: Two Applications of ASPECT to Geodynamics – Poster.
- May 2015 – CIG Research highlight: Thermo-mechanically coupled subduction modeling using ASPECT – Article.
- April 2015 – EGU: Thermo-mechanically coupled subduction (with ASPECT using adaptive mesh refinement in combination with a true free surface or sticky air) – Talk
- March 2015 – CIG Webinar: From Kinematics to Dynamics in the Caribbean Region – Talk.
- January 2015 – SINK Symposium: From Kinematics to Dynamics in the Caribbean region – Talk
- September 2014 – Geomod: Thermo-mechanical subduction modeling with ASPECT - Poster.
- April 2014 – EGU: Towards Western Mediterranean subduction modeling – Poster.
- March 2014 – NAC: Western Mediterranean subduction modeling – Poster.