

CV

Dave A. May

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Personal Details

Born: October 22, 1979, Victoria, Australia

Citizenship: Australian

Professional Experience

(Jan 2012-present) Institute of Geophysics, ETH Zürich, Zürich, Switzerland

Oberassistent / Senior research scientist

(Sept 2009-Dec 2011) Institute of Geophysics, ETH Zürich, Zürich, Switzerland

ETH Research Fellow

(Jan 2009-Aug 2009) Institute of Geophysics, ETH Zürich, Zürich, Switzerland

Postdoctoral Fellow

(2004-2008) School of Mathematical Sciences, Monash University

Research assistant

(2001-2003) Victorian Partnership for Advanced Computing, Australia

Computational scientist

Education

(2004-2008) *D.Phil., School of Mathematical Sciences, Monash University.*

Thesis title: The Implicit Material Point Method for Variable Viscosity Stokes Flow.

(1998-2000 ; 2002-2003) *B.E. (Mechanical), Monash University.*

Final year project: An Embedded Interface Finite Element Method.

(2001) *B.Sc. Honours (Applied mathematics), Monash University.*

Thesis title: Sinking Ships with Bubbles. (May & Monaghan, 2003)

(1998-2000) *B.Sc. (Mathematics and theoretical physics), Monash University.*

Awards

Editor's citation for excellence in refereeing within Geochemistry, Geophysics, Geosystems (2010).

First class honours in B.E, Mechanical (2003).

First class honours in B.Sc, applied mathematics (2003).

Leo Gleason prize for the best student in applied mathematics (2003).

Teaching

(2014) *Invited short course lecture series*

"Numerical Modelling in Geosciences", October 06-10, 2014, National Observatory of Athens, Greece.

(2012-present) *Lecturer: Institute of Geophysics, ETH Zürich.*

Responsible for teaching "Dynamics of the Mantle and Lithosphere" at MSc and Bachelor level.

(2010-present) *Lecturer: Institute of Geophysics, ETH Zürich.*

Intensive one week (full time) short course entitled "Introduction to Finite Element Modelling in Geosciences". (<http://jupiter.ethz.ch/~gfdteaching/femblockcourse/2014/IntroToFEMForGeosciences.html>).

(2010-2012) *Geophysics instructor: Institute of Geophysics, ETH Zürich.*

Practical class for undergraduate geophysics students in which they learn how to use a gravimeter and how to process their field measurements.

(2007) *Mathematics tutor: School of Mathematical Sciences, Monash University.*

Conducted tutorials for final year undergraduate class "Partial Differential Equations" which focused on both analytic and numerical techniques for solving PDE's.

(2004) *Lecturer: School of Mathematical Sciences, Monash University.*

Responsible for half semester of the final year undergraduate course on fluid dynamics.

Supervision

Postdocs: Liang Zheng (ZIP fellow, ETHZ), Sascha Schnepf (GeoPC, ETHZ), Patrick Sanan (GeoPC, USI Lugano).

PhD students: Marine Collignon (2012-present, principal advisor: Boris Kaus, Johannes-Gutenberg Universität Mainz), Marcel Thielmann (2013, principal advisor: Boris Kaus), Tobias Keller (2013, principal advisor: Boris Kaus), Matt Fox (2013, principal advisor: Sean Willet, ETH Zürich), Sarah Lechmann (2012, principal advisor: Stefan Schmalholz, Uni Lausanne), Thibault Duretz (2011, principal advisor: Taras Gerya, ETH Zürich), Yuri Mishin (2011, principal advisor: Taras Gerya).

MSc projects: Silvia Salvador Duarte (2014, joint with Catherine Meriaux, Universidade de Lisboa), Thomas Philippe (2013, joint with Marcel Frehner, ETH Zürich), Sam Chapman (2013, joint with Taras Gerya).

BSc projects: Anna FitzMaurice (2012).

Grants

“GeoPC - Infrastructure development for hybrid parallel smoothers for multigrid preconditioners”, *PASC, Platform for Scientific Computing* (PI). Project leader and primary supervisor of two postdoctoral researchers. (2014-2017, 750k CHF).

“Impacts of lower crustal flow on regional and global scale geodynamics”, *CSCS* (PI). HPC production proposal with the Swiss National Supercomputing Centre. (2014, 1M CPU hours).

“ZIP – Zooming In between Plates”, *Marie Curie Actions ITN* (co-PI, main PI: Philippe Agard, UPMC). Responsible for supervising one postdoctoral researcher who is developing algorithms and software for studying 3D dynamics of two-phase flow. (2014-2017).

“AlpArray – 4D Seismo-Thermo-Mechanical Modelling of the European Alps”, *Swiss National Science Foundation* (co PI, main PI: Taras Gerya). (2015-2018, 1 PhD, 1 Postdoc).

“ETH Research Fellowship”, *ETH Zürich* (PI). Research scholarship for one postdoctoral researcher over a period of two years (2009-2010, 200k CHF).

“Barents Sea Paleozoic basement and basin configurations (BarPz)”, *Norwegian Science Foundation, PETROMAKS program* (international collaborator, main PI: Ritske Huisman, UiB). Development of high-resolution 3D models of coupled surface processes and rifting. (2014-2017).

Collaborative Projects

- Present day subduction initiation dynamics under New Zealand (Mike Gurnis, Caltech)
- Interplays between extensional tectonics and surface processes (Ritske Huisman, Uni. Bergen)
- Understanding the origins of oblique rifted margins (Laetitia Le Pourhiet, Université Pierre et Marie Curie)
- 3D models of glacial erosion employing a full Stokes formulation (Frederic Herman, Uni. Lausanne)
- 3D shear heating induced strain localisation (Thibault Duretz & Stefan Schmalholz, Uni. Lausanne)
- Dynamics of submarine basaltic lava flow (Eunseo Choi, Uni. Memphis)
- 4D geodynamic models of the Andes (Dave Stegman, SCRIPPS)
- Understanding transient 3D slab-plume interactions (Catherine Mériaux, Uni. Lisbon)
- Development of scalable, fully parallel landscape evolution models (Kosuke Ueda, ETH Zürich)
- 4D seismo-thermo-mechanical models of the European Alps (Taras Gerya, Edi Kissling, Sean Willet, ETH Zürich; F. Herman, Uni. Lausanne)
- Consistent free-surface boundary conditions using staggered grid finite-difference schemes (Thibault Duretz, Uni. Lausanne)
- Group dynamics of crystals in magma chambers (Philippe Yamato, Uni. Rennes; Thibault Duretz, Uni. Lausanne; Romain Tartese, Uni. Campus Milton Keynes)
- Spectral element simulations of wave propagation on unstructured simplex and tetrahedral meshes (Alice Gabriel, LMU, Munich)

- Three-dimensional modelling of coupled magma dynamics and lithospheric deformation (Liang Zheng, ETH Zürich)
- Discontinuous Galerkin (DG) methods for multi-layer viscous folding and variable viscosity Stokes problems (Sascha Schnepf, ETH Zürich)
- Hybrid MPI-GPU multi-level preconditioners for elliptic operators with heterogeneous coefficients (Sascha Schnepf, ETH Zürich; Patrick Sanan, USI Lugano; Karl Rupp, TU Wien)

Invited Presentations

Within both the European and US geodynamics community, I am regarded as an expert in developing novel spatial discretisations and preconditioners which are suitable for studying geodynamic processes, and in utilizing cutting edge geodynamic HPC software for studying Earth science. To illustrate this, below I list a number of relevant invited talks and summarize my professional activities within the geodynamics and applied mathematics communities.

Selected presentations:

“HPC Finite Elements for Nonlinear Stokes Flow”

D. A. May & J. Brown - 2015 SIAM Conference on Computational Science and Engineering: Large scale computing in the geosciences, March 14-18, 2015, Salt Lake City, Utah, USA.

“pTatin3D: High-Performance Methods for Long-Term Lithospheric Dynamics”

D. A. May, J. Brown & L. Le Pourhiet - SC2014 - International Conference for High Performance Computing, Networking, Storage and Analysis, Nov. 16-21, 2014, New Orleans, LA, USA.

“Flexible multi-level preconditioners for non-linear Stokes flow applications from geodynamics”

D. A. May, J. Brown & L. Le Pourhiet - 8th International Workshop on Parallel Matrix Algorithms and Applications (PMAA14), July 2-4, 2014, USI Lugano, Switzerland.

“Overview of Modeling Challenges in Lithospheric Dynamics”

D. A. May - 2014 CIG-EarthScope Institute for Lithospheric Modeling workshop, Feb 3-4, 2014, Tempe, Arizona, USA.

“Scalable multi-level preconditioners for variable viscosity Stokes flow problems arising from geodynamics”

D. A. May - Efficient solution of large systems of non-linear PDEs in science, Oct 7-9, 2013, Lyon, France.

“Efficient Stokes Solvers”

D. A. May - 2012 Mantle Convection and Lithospheric Dynamics Workshop, Jul 29-Aug 2, 2012, Davis, CA, USA.

“Advances in three-dimensional, finite element based marker-and-cell methods applied to geodynamics”

D. A. May - EGU General Assembly, Apr 22-27, 2012, Vienna, Austria.

“Tightly coupled geodynamic systems: Software, implicit solvers, and application”

D. A. May, L. Le Pourhiet & J. Brown. [Presented by J. Brown] - AGU Fall Meeting, Dec 5-9, 2011, San Francisco, CA, USA.

“Optimal, scalable forward models for computing gravity anomalies”

D. A. May & M. G. Knepley - Swiss Physical Society, June 15-17, 2011, EPF Lausanne, Switzerland.

“Finite Element Solvers for Variable Viscosity Stokes Flow”

D. A. May, B. Kaus, Y. Mishin & T. Duretz - AGU Fall Meeting, Dec 14-18, 2009, San Francisco, CA, USA.

“Preconditioning variable viscosity Stokes flow problems associated with a stabilised finite element discretisation”

D. A. May - 11th International Workshop on Modeling of Mantle Convection and Lithospheric Dynamics, June 28 - July 3, 2009, Braunwald, Switzerland.

“Mantle convection, plate boundaries and plasticity”

D. A. May, L. Moresi, H. Muhlhaus, M. Velic, W. Sharples, D. Stegman - Workshop for Advancing Numerical Modeling of Mantle Convection and Lithospheric Dynamics, July 9-11, 2008, UC Davis, CA USA.

“Preconditioners for Variable Viscosity Stokes Flow”

D. A. May & L. Moresi - GeoMath 2008 Workshop, Sept 15-17, 2008, Santa Fe, NM, USA.

Community Services

Peer reviewer for Geophysical Research Letters, G-Cubed, Geophysical Journal International, Physics of the Earth and Planetary Interiors, Tectonophysics, Journal of Computational Physics, SIAM Journal on Scientific Computing.

Session convener at EGU (2011, 2013-14), AGU (2010, 2012-14), Frontiers in Computational Physics: Modeling the Earth System (Boulder, 2012), Platform for Advanced Scientific Computing (Zürich, 2014), 2014 Mantle Convection and Lithosphere Dynamics Workshop (joint CGU/CIG, Banff, 2014).