



Prof Frederik J Simons

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ADDRESS

Department of Geosciences
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Princeton, NJ 08544

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POSITIONS

2006–present *Assistant Professor of Geosciences*, Princeton University,
2012–present *Associated Faculty, Program in Applied and Computational Mathematics*,
2010–2013 *Dusenbury University Preceptor of Geological and Geophysical Sciences*;
2011 *Visiting Fellow*, University College London (Department of Statistical Science);
2010&2012 *Visiting Fellow*, Katholieke Universiteit Leuven;
2009 *Visiting Professor*, Institut de Physique du Globe de Paris;
2008 *Visiting Professor*, Eidgenössische Technische Hochschule Zürich.
2004–2007 *Lecturer of Geophysics*, University College London (UCL).
2002–2004 *Beck Postdoctoral Teaching Fellow*, Council on Science & Technology;
Hess Postdoctoral Fellow, Geosciences Department, Princeton University.
2002 *Postdoctoral Research Associate*;
1996–2002 *Research & Teaching Assistant*, Earth, Atmospheric & Planetary Sciences,
Massachusetts Institute of Technology (MIT).
Summer 2001 *Research Intern*, Shell International Exploration & Production, Houston, TX.
Summer 1996 *Research Assistant*, Katholieke Universiteit Leuven, Belgium.

DEGREES

1996–2002 Massachusetts Institute of Technology, Cambridge, MA;
Doctor of Philosophy with thesis in Geophysics;
Adviser: Prof. Rob D. van der Hilst.
1992–1996 Katholieke Universiteit Leuven, Belgium;
Kandidaat & Licentiaat with thesis in Geology;
Adviser: Prof. Rudy Swennen.
Grootste onderscheiding (summa cum laude).
1980–1992 Onze-Lieve-Vrouwecollege Jesuit School, Antwerpen, Belgium;
Humaniora, Latin & Greek. *Primus perpetuus*.

RESEARCH

Analysis of stochastic processes on the sphere. Oceanic instrumentation for global tomography. Potential-field analysis and theoretical geodesy. Regional seismic surface-wave tomography. Seismic, mechanical, and thermal properties of the lithosphere. Spectral analysis of gravity and topography. Statistical analysis of paleosea-level fluctuations. Theoretical spectral analysis on the sphere. Wavelet analysis in seismology. X-ray microtomography of geological materials.

AWARDS

2012 National Science Foundation CAREER Award;
 2008 Prix quadriennal *Charles Lagrange*, Académie Royale de Belgique;
 2005 Nuffield Foundation Newly Appointed Lecturer Award;
 2004 Editors' Citation for Excellence in Refereeing, JGR-Planets, AGU;
 2001 Outstanding Student Paper Award, Seismology Section, AGU;
 1998 Victor J. DeCorte Fellowship, MIT;
 1997&1998 Teaching Assistant Excellence Awards, EAPS, MIT;
 1997 Biennial prize for an M. Sc. thesis in Geology, Katholieke Universiteit Leuven;
 1996–2001 Fulbright Fellowship, Commission for Educational Exchange;
 1996–1997 Honorary Fellowship, Belgian-American Educational Foundation;
 1996–1997 Ambassadorial Scholarship, Rotary International Foundation;
 1994 Scholarship, Scottish Universities' International Summer School,
 1993 Competitive Scholarship, Katholieke Universiteit Brussel,
for summer semesters on (post-)modernist English literature, U. Edinburgh.

TEACHING

2012 *Origin and Evolution of the Lithosphere*, Princeton GEO556, with B. Schoene;
 2012 *Fundamentals of the Geosciences II*, Princeton GEO506, with J. Tromp;
 2011–2013 *Earth's Environments, Ancient Civilizations*, with A. Maloof, Princeton FRS;
 2007–2012 *Data, Models & Uncertainty in the Natural Sciences*, Princeton GEO422;
 2008–2009 *Introductory*, then *Global Geophysics*, Princeton GEO320/GEO371/PHY371;
 2007–2009 *Earth's Changing Surface & Climate*, with A. Maloof, Princeton FRS149/5;
 2008 *Fundamentals of the Geosciences II*, Princeton GEO506, with L. Hollister;
 2005–2006 *Global Seismology*, UCL GEOL3031;
 2005–2006 *Earth & Planetary System Science*, with L. Vočadlo, UCL GEOL4003;
 2003–2006 *Field Instructor, Active Tectonics*, with R. Phinney, Princeton FRS 149;
 2006 *The Deep Earth*, with David P. Dobson, UCL GEOL4005;
 2005 *Global Tectonics*, with Gerald P. Roberts, Birkbeck College;
 2004 *Lab Instructor, Earthquakes, Volcanoes & Hazards*, Princeton GEO 210;
 Fall 2002 *Guest lecturer, Introductory Seismology*, Princeton GEO 424;
 Spring 2002 *Guest lecturer, Elements of Seismology*, MIT 12.501/12.201;
 Spring 2001 *Tutor, Advanced Placement Physics*, Cambridge Rindge & Latin School;
 Fall 2000 *Instructor*, Boston Math Circle;
 1996–2000 *Teaching Assistant, Essentials of Geophysics*, MIT 12.501/12.201;
 1992–1994 *Monitor/Moniteur Dutch/French*, Summer Courses Roeland, Belgium.

FUNDING

NSF, *New perspectives on the continental lithosphere* [EAR-1150145], 2012–2017.
 NASA, *Structure and evolution of the Venusian lithosphere* [NNX11AQ45G], 2011–2014.
 NSF, *Making the most of GRACE* [EAR-1014606], 2009–2012.
 NSF, *Mechanical anisotropy from gravity/topography coherence* [EAR-0710860], 2007–2011.
 ESF, MYRES-II *Conference Grant*, 2006.
 HEFCE, *Equipment Grant for Observational Seismology* [SRIF3], 2005.
 NERC *Development of MERMAID* [NE/D521449/1], 2005–2008.
 Princeton 250th Fund, *Earth's Environments, Ancient Civilizations* [FRS 171], 2011–2013.
 Princeton 250th Fund, *Earth's Changing Surface & Climate* [FRS 145/149], 2008–2010.
 Princeton A. H. Phillips Fund, *Development of the Son-O-Mermaid Instrument*, 2012.

SEMINARS *I have given invited seminars on 105 occasions since my first appearance in 1999. A complete listing is available at <http://geoweb.princeton.edu/people/simons/vita2.html#invited>. Below, they are broken down categorically and listed in reverse-chronological order; repeat visits are indicated at the first point of entry in the list:*

Invited Lectures at Geosciences Departments (asterisks indicate named lectures):

Virginia Tech, Rutgers U., Dublin Inst. Adv. Study, MIT (2×), U. Siegen, U. C. Los Angeles, U. Southern Calif., Cornell U. (2×), U. Michigan* (2×) [*William T. Smith Lecture*], U. C. Santa Cruz, SUNY Stony Brook, ETH Zürich, U. Illinois Urbana-Champaign* [*Richard L. Hay Lecture*], U. Cambridge (2×), Imperial College, U. Leicester, Stanford U. (2×), Southampton Oceanography Centre, U. Chicago, Washington U. St. Louis, Harvard U. (3×), U. College London (4×), Lamont-Doherty Earth Observatory (2×), Penn State U., U. C. Berkeley (2×), Calif. Inst. Technology, Scripps Inst. Oceanography (2×), Carnegie Inst. Washington (2×), Princeton U. (5×), Shell Rijswijk, Shell Houston, Woods Hole Oceanographic Inst. (3×), Royal Holloway, K. U. Leuven (2×), U. Leeds (2×), Oxford U. (2×), Brown U., U. Québec Montréal (2×), IPG Paris.

Invited Lectures at Various Other Departments:

Princeton Environmental Affairs Forum (2012), Princeton Applied & Computational Mathematics (2011), NASA Goddard Space Flight Center [*Planetary Geodynamics*] (2010), The College of New Jersey [*Physics*] (2009), Ohio State U. [*Geodesy*] (2009), Imperial College London [*Mathematics*] (2006), U. Stuttgart [*Geodesy*] (2006), U. College London, Astrobiology Seminar (2006, 2005), Cold Spring Harbor Laboratory (2004), Harmonic Analysis & Signal Processing, Courant Institute, NYU (2004), Oberseminar Geomathematik, U. Kaiserslautern (2004), Princeton Program in Integrative Information, Computer & Application Sciences (2003), Princeton Time-Frequency Seminar [*Mathematics*] (2002).

Invited Conference Presentations (asterisks indicate keynote speeches):

NASA PARCA 2012, Greenbelt (2012), Mathematics in the Geosciences, Evanston (2011), SPIE Wavelets and Sparsity XIV, San Diego (2011), IUGG General Assembly, Melbourne (2011, 2011), Princeton Center for Theoretical Science Workshops (2011 and 2010), SIAM/AMS/MAA Joint Mathematics Meetings, New Orleans (2011) and San Francisco (2010), SPIE Wavelets XII and XIII, San Diego (2009 and 2007), VII Hotine-Marussi Symposium, Rome (2009), Geomathematics Workshop, U. Kaiserslautern (2008), Seismological Society of America, Santa Fe (2008), International Workshop on Modeling of Mantle Convection & Lithospheric Dynamics*, Carry-le-Rouet (2007), International Congress on Industrial & Applied Mathematics, Zürich (2007), Applied Inverse Problems, U. British Columbia (2007), *Undur Veraldar** Public Lecture, U. Iceland (2007), Inverse Problems Workshop, U. Kaiserslautern (2005), European Geosciences Union (2005), Mathematical Geophysics & Uncertainty Summer School, Colorado School of Mines (2004), MYRES I Workshop*, San Diego (2004), Center for Inverse Problems Opening Conference, Rensselaer Polytechnic Institute (2004), GEOTOP-UQÀM-McGill Congrès des Etudiants* (2004), IEEE Computer Aided Seismic Analysis & Discrimination Workshop (2002), MIT/New England Workshop on Anisotropy & Imaging (2002), American Geophysical Union Meetings (2007, 2001, 2000).

ADVISING

Current Postdocs:

M. Glenn Sterenborg (Ph. D. 2011, Harvard U.), *Canadian Institute for Advanced Research* Fellow;
Alain Plattner (Ph. D. 2011, ETH Zürich), *Swiss National Fonds* Fellow;
Christopher T. Harig (Ph. D. 2011, U. Colorado Boulder), supported by the NSF;
Kevin W. Lewis (Ph. D. 2009, Caltech), *Hess Postdoctoral Fellow*, then supported by NASA.

Visiting Postdocs:

Lara M. Kalnins (Ph. D. 2011, Oxford U.), supported by NERC.

Current Graduate Students:

Yanhua Yuan (Ph. D. Geophysics, *2017).

Visiting Graduate Students:

Lei Wang (Ph. D. 2012, Ohio State U.), supported by NSF.

Liyang Wei (Ph. D. 2010, Australian National U.), supported by NSF.

Former Graduate Students:

Yue Tian (Ph. D. Geophysics, *2010), now at Chevron, co-advised with Guust Nolet;

Dong V. Wang (M. A. Geophysics, *2010), now at U. North Carolina Chapel Hill.

Senior Theses:

Evan Welch (Physics, '2012).

Junior Papers:

Gabe Eggers (Geosciences, '2013): *A coherent, regionalized map of Venus.*

Garnet Abrams (Geosciences, '2012): *Gravity anomalies or optical illusions? A fine-scale survey of two New Jersey "gravity hills".*

Evan Welch (Physics, '2012): *Displacements from the 1-D Earth's free oscillations.*

Henry Chu (Operations Research, '2011): *On the inversion for lithospheric geomagnetic potential from scattered, noisy satellite data on bounded spherical domains.*

Yifeng Wang (Geosciences, '2011): *Analysis of acoustic wave speeds in the ocean with view of deploying hydrophones for global seismic tomography and Analysis of hydroacoustic time series from the High-Frequency Acoustic Recording Package array.*

Cristian Proistosescu (Physics, '2009): *Trace-element dendrochronology: Creating an age model for ringless trees from low latitudes.*

Summer Research Interns:

Evan Welch (Physics, '2012), Gabe Eggers (Geosciences, '2013).

Non-Princeton Former Students:

Jonathan Watson (M. Res., 2006), Birkbeck College;

Anthony Bloom, Ben Dando & Gary Hayes (M. Sci., 2006), UCL;

Caroline Attwood, Rachael Bayliss, Richard Ford & Neesha Jeshani (B. Sc., 2006), UCL.

Outreach and Mentoring:

Dmitriy Potlyitsin, Holmdel High School (NJ): *Dendroclimatological analysis of Pine species in California*, submitted to the 2012 Intel and Siemens Competitions and presented at the 57th Annual New Jersey Academy of Science Junior and Senior Academies Meeting.

Laura Larsen-Strecker, Harvard U. '2009: *Tectonic regionalization of the world*, summer project.

EXAMINER *I have served on 7 doctoral and 2 master's examination committees at institutions or in departments outside of my primary affiliation. A listing of the doctoral committees on which I served within the Department of Geosciences, which I consider part of my "normal" duties, is found on page 7.*

2012 Lei Wang (Ph. D., Geodetic Science), Ohio State U.,
Coseismic deformation detection and quantification for great earthquakes using spaceborne gravimetry.
Adviser: C. K. Shum.

2011 Eugene Brevdo (Ph. D., Electrical Engineering), Princeton,
Efficient representations of signals in nonlinear signal processing with applications to inverse problems.
Advisers: Peter Ramadge and Ingrid Daubechies.

Mélanie Villemaire (*Maîtrise*, Sciences de la Terre), U. Québec Montréal,
Structure tridimensionnelle du manteau supérieur sous l'est du bouclier canadien et le nord des Appalaches en utilisant la tomographie des ondes P.
Adviser: Fiona Darbyshire.

Doreen Fischer (Ph. D., Mathematics), U. Siegen,
Sparse regularization of a joint inversion of gravitational data and normal mode anomalies.
Adviser: Volker Michel.

Reyko Schachtschneider (Ph. D., Physics), U. Potsdam,
Error distribution in regional inversions of potential fields from satellite data.
Adviser: Matthias Holschneider.

2010 Liying Wei (Ph. D., Electrical Engineering), Australian National U.,
Signal concentration and related concepts in time-frequency and on the unit sphere.
Adviser: Rodney Kennedy.

2007 Abel Amirbekyan (Ph. D., Mathematics), U. Kaiserslautern,
The application of reproducing kernel based spline approximation to seismic surface and body wave tomography: Theoretical aspects and numerical results.
Adviser: Volker Michel.

2006 Peggy Vermeesch (Ph. D., Geophysics), Imperial College,
Geophysical modelling of the Chicxulub crater.
Advisers: Joanna Morgan and Michael Warner.

2004 Pascal Audet (*Maîtrise*, Sciences de la Terre), Université du Québec à Montréal,
Réponse flexurale de la lithosphère dans le bouclier canadien.
Adviser: Jean-Claude Mareschal.

CONVENER *I have served as co-organizer of the following 10 meetings and special sessions:*

- 2012 *Bridging the Gap between the Geosciences and Mathematics, Statistics, and Computer Science*, Princeton Center for Theoretical Science; with Don Estep (Colorado State U.), Natasha Flyer (NCAR), Michael Ghil (UCLA), Ridg Scott (U. Chicago), Michael Stein (UCLA), Seth Stein (Northwestern U.), Grady Wright (Boise State U.), Dave Yuen (U. Minnesota).
- 2010 *Advances in Signal Processing Methods for Seismology*, Special session, Fall AGU; with Y. Shun (MIT) & Po Chen (U. Wyoming).
- 2008 *Models of the Deep Earth*, Special session, Fall AGU; with S.-H. Shim (MIT) & Michael Thorne (U. Utah).
- 2007 *Rheological Anisotropy: Geological and Geophysical Perspectives*, Special session, Fall AGU; with Einat Lev (MIT), Pascal Audet (UBC) & Th. Thorsteinsson (U. Iceland).
- 2006 MYRES-II: *Dynamics of the Lithosphere*, Verbania, Italy; with Laurent Montési (WHOI) & Giulio di Toro (U. Padova).
- 2005 *Analysis and Representation of Geophysical Data on the Sphere*, Special Session, Fall AGU; with M. Wieczorek (IPG Paris), A. Jackson (U. Leeds) & D. Yuen (U. Minnesota).
- Wavelet and Time-Frequency Analysis in the Earth Sciences*, Special Session, Spring EGU; with Jonathan Lilly (IPG Paris) & Sofia Olhede (Imperial College).
- 2004 MYRES-I: *Heat, Helium, Hotspots, and Whole Mantle Convection*, La Jolla, CA; with Thorsten Becker (USC) & Jamie Kellogg (UCLA).
- Crust-Mantle Interaction and Lithospheric Deformation*, Special Session, Fall AGU; with Corné Kreemer (U. Nevada) & Oliver Heidbach (U. Karlsruhe).
- 2002 *Structure, Composition & Evolution of Deep Continental Lithosphere*, Special Session, Fall AGU; with Cin-Ty Lee (Rice U.).

SERVICE

Editorial

Editor, *International Journal on Geomathematics*, since 2010;
Editorial Advisory Board, *Journal of Geodetic Science*, since 2010;
Editorial Advisory Board, *Earth & Planetary Science Letters*, since 2007;
Associate Editor, *J. Geophysical Research (Solid Earth)*, 2004–2009.

Refereeing

I have reviewed 158 items since 2000, for the following journals, publishers, and funding agencies: *AGU Monographs*, *Artificial Satellites*, *Cambridge U. Press*, *Czech Sci. Found.*, *Climatic Change*, *Comput. Geosci.*, *Earth Planets Space*, *Earth & Planet. Sc. Lett.*, *Eos Trans. AGU*, *Free U. Brussels GOA*, *G-Cubed*, *Geology*, *Geoph. J. Int.*, *Geoph. Res. Lett.*, *Geosphere*, *GSA Spec. Pub.*, *Harvard U. Press*, *IEEE Trans. Sig. Proc.*, *Inst. National Sciences de l'Univers*, *Int. J. Geomath.*, *J. Geodesy*, *J. Geoph. Res.*, *J. Roy. Stat. Soc.*, *Kentucky Sci. & Eng. Found.*, *Lithosphere*, *Natural Sci. & Eng. Res. Council Canada*, *Neth. Org. Sci. Res.*, *Ocean Modelling*, *Phys. Earth. Planet. Int.*, *Proc. Roy. Soc. Lond. Ser. A*, *Science*, *Taylor & Francis*, *Particle Phys. Astr. Res. Council*, *National Science Foundation*.

Community

Co-organizer, AGU Meeting of the Americas, *Tectonophysics*, 2009–2010;
Member Representative, *Incorporated Research Institutions for Seismology*;
Alternate, *CONsortium for Materials Properties Research in Earth Sciences*.

Princeton

Doctoral Exam Committees (superscripts indicate my “outsider” status):

Jessica Hawthorne (Seismology, *2012),
Yves Plancherel (Oceanography^o, *2011),
Susannah (Suki) Dorfman (Mineral Physics^o, *2011),
Brian Gertsch (Paleontology^o, *2010),
Yue Tian (Seismology, *2010),
Tarje Nissen-Meyer (Seismology, *2008),
Makoto Suwa (Geochemistry^o, *2007).

General Exam Committees:

Andrew Babbitt (Biogeochemistry, *2015), Susannah Dorfman (Geophysics, *2011), Blake Dyer (Geology, *2016), Jessica Hawthorne (Geophysics, *2012), John Husson (Geology, *2015), Sarah Johnston (Geology, *2008), Kelly Kearney (Oceanography, *2010), Brenhin Keller (Geochemistry, *2016), Yang Luo (Geophysics, *2012), Ryan Modrak (Geophysics, *2016), Yves Plancherel (Oceanography, *2010), Garrett Tate (Geology, *2015), Shannon Tronick (Biogeochemistry, *2010), Philip Vetter (Mathematics, *2010), Enning Wang (Geophysics, *2012), Jue Wang (Geophysics, *2013), Lisha Xie (Geophysics, *2009), Hejun Zhu (Geophysics, *2013).

Other Committees:

The Evolving Geosciences at Princeton, GeoGrad Reunion Panelist (2012);
Graduate Work & Admissions Committee, Geosciences (2007–2012);
New Faculty Orientation Panelist, McGraw Center (2009);
Senior & Junior Faculty Search Committees, Geophysics (2007–2008);
Geosciences Website Committee (2007–2008);
Geosciences Colloquium organizer (Spring 2007).

College Fellowships:

Wilson College, Fall 2011 & 2012.

MEDIA

Interviews, personal profiles, media comments:

MERMAIDs detect distant earthquakes, by Naomi Lubick,
Nature, 10/07/2011, <http://dx.doi.org/10.1038/news.2011.583>

Promoting sparsity and localization in geophysical inverse problems
Lecture at Northwestern U., 10/03/2011, <http://youtu.be/KL66it65bho>

Seismic stations could help catch tsunami waves, by Katharine Sanderson,
Nature, 02/25/2008, <http://dx.doi.org/10.1038/news.2008.618>

Hoe gaat het nu met... Frederik Simons,
Science@Leuven, 2005, **3** (8), 7–9 (in Dutch)

Neutrinos to spy on planet's core,
New Scientist, 2005, **185** (2488)

Around the world in seven days of Fall Break,
The Daily Princetonian, 12/10/2007

Interview, Television broadcast,
Discovery Channel, WagTV, 2005

On “*Possible animal body-fossils in pre-Marinoan limestones from South Australia*”:

A History of Earth in 100 Groundbreaking Discoveries, 2011 (book)

From single cells, a vast kingdom arose,
New York Times, 03/14/2011

Discovery of 650-million-year-old sponge-like creatures pushes back fossil record;
Reef-dwelling creatures on 'Snowball Earth',
Underwatertimes.com, 08/19/2010 (web)

Fossilised sponges point to animal life 100m years earlier than thought,
The Guardian, 08/17/2010

Sponge fossils may be earliest animals,
Futurity.org, 08/17/2010 (web)

Found: World's oldest animal fossils,
NewScientist, 08/17/2010

Discovery of possible earliest animal life pushes back fossil record,
NSF Press Release, 10-143, 08/17/2010

Possible discovery of earliest animal life pushes back fossil record,
ScienceDaily, 08/17/2010 (web)
News@Princeton, 08/17/2010 (web)

Palaeontology: Wringing out the oldest sponges, by Marc Laflamme,
Nature Geoscience, 2010, <http://dx.doi.org/10.1038/ngeo945>

On “*Probabilistic assessment of sea level during the last interglacial stage*”:

Sea rose eight metres in warmer age: study,
The Independent, 12/20/2009

How high will the seas go in a warmer world?
Time Magazine, 12/18/2009

Professors say sea levels sensitive to warmth,
The Daily Princetonian, 12/18/2009

Little global warming goes a long way,
Futurity.org, 12/18/2009 (web)

Greater sea-level rise from warming predicted,
The Washington Post, 12/17/2009

Scientists warn of 30ft rise in sea level due to 2C of global warming,
The Scotsman, 12/17/2009

Forskare varnar för höga havsnivåer,
DN.se, 12/16/2009 (in Danish)

Estudo aponta que nível dos oceanos pode subir 9 metros,
Estadao, 12/16/2009 (in Spanish)

Plus 3 à 5 degrés aux pôles, et l'eau montera de 8 à 9 mètres,
L'Express, 12/16/2009 (in French)

Study suggests greater sea level rise from warming,
The New York Times, 12/16/2009
U. S. News & World Report, 12/16/2009

Two-degree temperature rise could flood wide areas of planet, study says,
Canada.com, 12/16/2009 (web)
CommonDreams.org, 12/17/2009 (web)

Study forecasts 9m sea-level rise if temperatures meet 2C threshold,
The Guardian, 12/16/2009

Earth's polar ice sheets vulnerable to even moderate global warming,
News@Princeton, 12/16/2009 (web)
ScienceDaily.com, 12/17/2009 (web)

Interglacial and future sea level, by Peter U. Clark & Peter Huybers,
Nature, 2009, <http://dx.doi.org/10.1038/462856a>

Sea level rise may exceed worst expectations, by Richard A. Lovett,
Nature, 12/16/2009, <http://dx.doi.org/10.1038/news.2009.1146>

On “*The deep structure of the Australian continent from surface-wave tomography*”:

A seismic look under the continents, by Karen M. Fischer & Rob D. van der Hilst,
Science, 1999, <http://dx.doi.org/10.1126/science.285.5432.1365>

On “*Spatiospectral concentration on a sphere*”:

Problems & Techniques, by Ilse Ipsen,
SIAM Review, 2006, **48** (3), 485–486

On “*Spectral estimation on a sphere in geophysics and cosmology*”:

Editorial, by Cynthia J. Ebinger,
Geoph. J. Int., <http://dx.doi.org/10.1111/j.1365-246X.2008.03900.x>

On “*On the potential of recording earthquakes for global seismic tomography by low-cost autonomous instruments in the oceans* and “*A future for drifting seismic networks*”:

Modern mermaids: New floats image the deep Earth, by Y. Hello et al.,
Eos Trans. AGU, 2011, <http://dx.doi.org/10.1029/2011EO400001>

This is how it works,
Cornell Daily Sun, 10/29/2009

Afloat in a sea of noise,
Planet Earth, 2009 (Winter), 28–29

Energy Efficient Mermaid (Mobile Earthquake Recorder in Marine Areas)
Green Data Center Blog, www.greenm3.com, 02/19/2008 (web)

Plumbing the depths: A new generation of mermaids looks at oceanic earthquakes,
The Economist, 02/09/2008

For geoscientist Simons, Earth’s deepest secrets may come from the sea,
Princeton Weekly Bulletin, 2008, **97** (19), 7–8
News@Princeton, 01/28/2008 (web)
GeologyTimes.com, 01/29/2008 (web)
Underwatertimes.com, 01/29/2008 (web)

MERMAIDS detect earthquakes,
Top Stories, *UCL Homepage News*, 06/27/2006 (web)

Earth Structure, by Guust Nolet, John A. Orcutt & John Collins
ORION Puerto Rico Workshop Report, 2004, 28–34

Fyrirlestur um jarðskjálftabylgjur: Dr. Frederik J Simons,
Morgunblaðið, 04/20/2007 (in Icelandic)

Under veraldar: Sneiðmyndun jarðar,
Rannísblaðið, 03/28/2007 (in Icelandic)

CLASSES

In the following pages I provide short descriptions of the classes that I have developed and/or taught since joining the Princeton faculty. A complete list was found on page 2 of this document. A general selection of student comments, from the Student Course Guide website, can be found at <http://geoweb.princeton.edu/people/simons/fjsimons-feedback.html>

DATA, MODELS, & UNCERTAINTY IN THE NATURAL SCIENCES GEO422
Offered in 2007 [8 enrolled], 2008 [6], 2010 [14], 2012 [13]
<http://geoweb.princeton.edu/people/simons/GEO422-feedback.html>

No more being puzzled by dots on a graph! This course is for those who want to turn observations into models and subsequently evaluate their uniqueness and uncertainty. Three main topics are elementary statistics, heuristic time series analysis, and model parameter estimation via matrix inverse methods. While the instructor's and textbook examples will be derived mostly from the physical sciences, students are encouraged to bring their own data sets for classroom discussion and in-depth analysis as part of their term papers. Problem sets and MATLAB computer programming exercises form integral parts of the course.

GLOBAL GEOPHYSICS GEO371/PHY371
INTRODUCTORY GEOPHYSICS GEO320
Offered in 2008 [6 enrolled], 2009 [8], 2013
<http://geoweb.princeton.edu/people/simons/GEO371-feedback.html>

An introduction to the fundamental principles of global geophysics. Four parts, taught over three weeks each in an order allowing the material to build up to form a final coherent picture of (how we know) the structure and evolution of the solid Earth: *Gravity and Magnetism*: the description and study of the Earth's magnetic and gravitational fields. *Seismology*: body waves, surface waves and free oscillations. *Geodynamics*: heat flow, cooling of the Earth, and mantle convection. The emphasis is on physical principles including the mathematical derivation and solution of the governing equations.

ORIGIN AND EVOLUTION OF THE CONTINENTAL LITHOSPHERE GEO556
Offered in 2012 [4 enrolled]

Despite its volumetric insignificance on Earth, the continental lithosphere is an immensely important geochemical reservoir, hosts the terrestrial biosphere, and impacts plate tectonics and therefore mantle convection. This course surveys how and why continental lithosphere is formed, preserved, and destroyed throughout Earth history. We will tap into datasets collected using structural geology, geochemistry and petrology, radiogenic and stable isotopes, seismology, gravity, and heat flow, all of which are used to inform numerical and theoretical models.

This course was co-taught with Prof. Blair Schoene.

FUNDAMENTALS OF THE GEOSCIENCES II GEO506
Offered in 2008 [9 enrolled], 2012 [4]

A survey of fundamental topics in the geosciences. Each lecturer teaches for two weeks.

This course was co-taught with Profs Lincoln Hollister (2008) and Jeroen Tromp (2012).

Offered in 2011 [12 enrolled], 2012, 2013

<http://geoweb.princeton.edu/people/simons/FRS-EEAC.html>

<http://geoweb.princeton.edu/people/simons/FRS-EEAC-feedback.html>

In this Freshman Seminar, you will combine field observations of the natural world with quantitative modeling and interpretation in order to answer questions like: *How does environmental change alter the course of civilization, and how do civilizations modify their environment? How have Earth and human histories been recorded in the geology and archaeology of Cyprus, and what experiments can we do to query such archives of the past?* In the classroom, through problem sets, and on campus excursions, you will gain practical experience collecting geological and geophysical data in geographic context, and analyzing these using software and programming languages like ArcGIS and MATLAB. During the required week-long trip to Cyprus, you will engage in research projects that focus on the interplay between active tectonic landscapes, changing climate, and ancient civilizations, and then turn what you learn into three progressively more elaborate research papers. The classroom component of the seminar will have graded assignments built around data collection, preparation, or analysis, software handling and the beginnings of scientific programming; but, also, expository and research writing which culminates in an original research paper, a poster and a public oral presentation. The field location for this course is appropriate not only for its geoscientific importance but also for the tie-in with the Department of Art & Archaeology which has been conducting archaeological excavations in the city of Polis Chrysochous for three decades. This is a *science* class: you should come prepared with an aptitude for, and a willingness to learn the quantitative aspects of scientific inquiry.

This course was co-taught with Prof. Adam Maloof.

Offered in 2007 [20 enrolled], 2008 [13], 2009 [15]

<http://geoweb.princeton.edu/people/simons/FRS-ECSC.html>

<http://geoweb.princeton.edu/people/simons/FRS-ECSC-feedback.html>

The surface of Earth today, an amalgamation of mountain ranges, basins, and the hydrosphere, records an integrated history of processes that act on a range of time scales spanning seventeen orders of magnitude. The central question treated in this Freshman Seminar is: *How does Earth's surface evolve in response to internal (e.g., tectonic and magmatic), surficial (e.g., weather, climate, and anthropogenic effects), and external (e.g., extraterrestrial) forcing?* This Freshman Seminar provides you with practical experience making geological and geophysical observations, and in particular, focuses on quantitative analysis of observables such as topography, gravity, and weather. The classroom seminar is complimented by a mandatory week-long field trip to the western United States. During this trip, you will develop research projects that involve geological and geophysical mapping of the interplay between recent volcanic explosion craters, changing climate, and anthropogenic demands on water resources in the Mono Lake region. This seminar is *not* a comprehensive introduction to the geological sciences, but rather a look at a select few processes of import to understand changes to the Earth's surface in space and time. While certain fundamental principles of geology are explained in class and through reading assignments, the emphasis is on how *you* can be a natural scientist with a background of nothing but high school math and physics, a keen observational sense, a knack for spatial and quantitative analysis, and a careful and precise way with words.

This course was co-taught with Prof. Adam Maloof.

PAPERS

The following is a chronological list of peer-reviewed papers published by major research journals (on papers that appeared since my joining Princeton, asterisks denote Princeton graduate students, circles denote Princeton postdocs, daggers visiting or collaborating graduate students or postdocs, and dollar signs undergraduates; superscripts P for tenured Princeton faculty and T for tenured faculty at other institutions):

- 2012 Alain Plattner^o & **F. J. Simons**,
Spatiospectral concentration of vector fields on a sphere,
SIAM Review, to be submitted
- F. J. Simons** & Sofia C. Olhede^T,
Maximum-likelihood estimation of lithospheric flexural rigidity, initial-loading fraction, and load correlation,
under isotropy,
Geoph. J. Int., 40 pp, submitted
- Christopher Harig^o & **F. J. Simons**,
Mapping Greenland's mass loss in space and time,
Proc. Natl. Acad. Sc., submitted
- Kevin W. Lewis^o & **F. J. Simons**,
Local spectral variability and the origin of the Martian crustal magnetic field,
Geoph. Res. Lett., 6 pp, in revision
- Jarno Saarimäki[†], Ciarán D. Beggan, Kathy A. Whaler^T & **F. J. Simons**,
Spectral and spatial decomposition of core and lithospheric magnetic field models using Slepian functions,
Geoph. J. Int., in revision
- Lei Wang[†], C. K. Shum^T, **F. J. Simons**, Andrés Tassara, Kamil Erkan[†], Christopher Jekeli^T, Alexander Braun, Chungyen Kuo, Hyongki Lee & Dah-Ning Yuan,
Coseismic slip of the 2010 Mw 8.8 Great Maule, Chile, earthquake quantified by the inversion of GRACE observations,
Earth & Planet. Sc. Lett., 13 pp, <http://dx.doi.org/10.1016/j.epsl.2012.04.044>
- Lei Wang[†], C. K. Shum^T, **F. J. Simons**, Byron D. Tapley^T & Chunli Dai[†],
Coseismic and postseismic deformation of the 2011 Tohoku-Oki earthquake constrained by GRACE gravimetry,
Geoph. Res. Lett., 6 pp, <http://dx.doi.org/10.1029/2012GL051104>
- D. Cornelis Slobbe[†], **F. J. Simons** & Roland Klees^T,
The spherical Slepian basis as a means to obtain spectral consistency between mean sea level and the geoid,
J. Geodesy, 20 pp, <http://dx.doi.org/10.1007/s00190-012-0543-x>

- 2011 **F. J. Simons**, Ignace Loris, Eugene Brevdo* & Ingrid C. Daubechies^P,
Wavelets and wavelet-like transforms on the sphere and their application to geophysical data inversion,
Proc. SPIE, Invited Paper, 15 pp, <http://dx.doi.org/10.1117/12.892285>
- F. J. Simons**, Ignace Loris, Guust Nolet^P, Ingrid C. Daubechies^P, Sergey Voronin*, J. Stephen Judd, Philip A. Vetter*, Jean Charléty[†] & Cédric Vonesch^o,
Solving or resolving global tomographic models with spherical wavelets, and the scale and sparsity of seismic heterogeneity,
Geoph. J. Int., 20 pp, <http://dx.doi.org/10.1111/j.1365-246X.2011.05190.x>
- A. Sukhovich[†], J.-O. Irisson, **F. J. Simons**, A. Ogé, Y. M. Hello, A. Deschamps & G. Nolet^T,
Automatic discrimination of underwater acoustic signals generated by teleseismic *P*-waves: A probabilistic approach,
Geoph. Res. Lett., 5 pp, <http://dx.doi.org/10.1029/2011GL048474>
- F. J. Simons** & Dong V. Wang*,
Spatiospectral concentration in the Cartesian plane,
Int. J. Geomath., 36 pp, <http://dx.doi.org/10.1007/s13137-011-0016-z>
- 2010 **F. J. Simons**,
Slepian functions and their use in signal estimation and spectral analysis,
Handbook of Geomathematics, edited by W. Freeden, M. Z. Nashed & T. Sonar,
Springer Verlag, 34 pp, http://dx.doi.org/10.1007/978-3-642-01546-5_30
- Adam C. Maloof, Catherine V. Rose*, Claire C. Calmet[†], Robert Beach, Brad M. Samuels, Douglas H. Erwin,
Gerald R. Poirier, Nan Yao & **F. J. Simons**,
Possible animal-body fossils in pre-Marinoan limestones from South Australia,
Nature Geoscience, 7+5 pp, <http://dx.doi.org/10.1038/ngeo934>
- Christopher Harig[†], Shijie Zhong^T & **F. J. Simons**,
Constraints on upper-mantle viscosity from the flow-induced pressure gradient across the Australian continental keel,
Geochem., Geoph., Geosys., 21 pp, <http://dx.doi.org/10.1029/2010GC003038>
- 2009 R. E. Kopp^o, **F. J. Simons**, J. X. Mitrovica^T, A. C. Maloof & M. Oppenheimer^P,
Probabilistic assessment of sea level during the last interglacial stage,
Nature, 6+33 pp, <http://dx.doi.org/10.1038/nature08686>
- F. J. Simons**, Jessica C. Hawthorne* & Ciarán D. Beggan[†],
Efficient analysis and representation of geophysical processes using localized spherical basis functions,
Proc. SPIE, Invited Paper, 15 pp, <http://dx.doi.org/10.1117/12.825730>
- F. J. Simons**, G. Nolet^P, P. Georgief, J. M. Babcock, L. A. Regier & R. E. Davis^P,
On the potential of recording earthquakes for global seismic tomography by low-cost autonomous instruments in the oceans,
J. Geoph. Res., 16 pp, <http://dx.doi.org/10.1029/2008JB006088>

- 2008 F. A. Dahlen^P & **F. J. Simons**,
Spectral estimation on a sphere in geophysics and cosmology,
Geoph. J. Int., 34 pp, <http://dx.doi.org/10.1111/j.1365-246X.2008.03854.x>
- Jeffrey J. McGuire, **F. J. Simons** & John A. Collins,
Analysis of seafloor seismograms of the 2003 Tokachi-Oki earthquake sequence for earthquake early warning,
Geoph. Res. Lett., 5 pp, <http://dx.doi.org/10.1029/2008GL033986>
- Abel Amirbekyan[†], Volker Michel & **F. J. Simons**,
Parametrizing surface wave tomographic models with harmonic spherical splines,
Geoph. J. Int., 12 pp, <http://dx.doi.org/10.1111/j.1365-246X.2008.03809.x>
- Shin-Chan Han & **F. J. Simons**,
Spatiospectral localization of global geopotential fields from the Gravity Recovery and Climate Experiment (GRACE) reveals the coseismic gravity change owing to the 2004 Sumatra-Andaman earthquake,
J. Geoph. Res., 14 pp, <http://dx.doi.org/10.1029/2007JB004927>
- 2007 Mark A. Wieczorek & **F. J. Simons**,
Minimum-variance multitaper spectral estimation on the sphere,
J. Fourier Anal. Appl., Invited Paper, 28 pp, <http://dx.doi.org/10.1007/s00041-006-6904-1>
- F. J. Simons** & F. A. Dahlen^P,
A spatio-spectral localization approach to estimating potential fields on the surface of a sphere from noisy, incomplete data taken at satellite altitudes,
Proc. SPIE, Invited Paper, 15 pp, <http://dx.doi.org/10.1117/12.732406>
- 2006 **F. J. Simons**, Ben D. E. Dando^S & Richard M. Allen,
Automatic detection and rapid determination of earthquake magnitude by wavelet multiscale analysis of the primary arrival,
Earth & Planet. Sc. Lett., 10 pp, <http://dx.doi.org/10.1016/j.epsl.2006.07.039>
- F. J. Simons** & F. A. Dahlen,
Spherical Slepian functions and the polar gap in geodesy,
Geoph. J. Int., 23 pp, <http://dx.doi.org/10.1111/j.1365-246X.2006.03065.x>
- F. J. Simons**, F. A. Dahlen & Mark A. Wieczorek,
Spatiospectral concentration on a sphere,
SIAM Review, 33 pp, <http://dx.doi.org/10.1137/S0036144504445765>
- 2005 Mark A. Wieczorek & **F. J. Simons**,
Localized spectral analysis on the sphere,
Geoph. J. Int., 21 pp, <http://dx.doi.org/10.1111/j.1365-246X.2005.02687.x>
- Saskia Goes, **F. J. Simons** & Kazunori Yoshizawa,
Seismic constraints on the temperature of the Australian uppermost mantle,
Earth & Planet. Sc. Lett., 11 pp, <http://dx.doi.org/10.1016/j.epsl.2005.05.001>

- 2003 **F. J. Simons** & Rob D. van der Hilst,
Seismic and mechanical anisotropy and the past and present deformation of the Australian lithosphere,
Earth & Planet. Sc. Lett., 16+2 pp, [http://dx.doi.org/10.1016/S0012-821X\(03\)00198-5](http://dx.doi.org/10.1016/S0012-821X(03)00198-5)
- F. J. Simons**, Rob D. van der Hilst & Maria T. Zuber,
Spatiospectral localization of isostatic coherence anisotropy in Australia and its relation to seismic anisotropy:
Implications for lithospheric deformation,
J. Geoph. Res., 21 pp, <http://dx.doi.org/10.1029/2001JB000704>
- 2002 **F. J. Simons**, Rob D. van der Hilst, Jean-Paul Montagner & Alet Zielhuis,
Multimode Rayleigh wave inversion for heterogeneity and azimuthal anisotropy of the Australian upper
mantle,
Geoph. J. Int., 17 pp, <http://dx.doi.org/10.1046/j.1365-246X.2002.01787.x>
- F. J. Simons** & Rob D. van der Hilst,
Age-dependent seismic thickness and mechanical strength of the Australian lithosphere,
Geoph. Res. Lett., 4 pp, <http://dx.doi.org/10.1029/2002GL014962>
- 2000 **F. J. Simons**, Maria T. Zuber & Jun Korenaga,
Isostatic response of the Australian lithosphere: Estimation of effective elastic thickness and anisotropy using
multitaper spectral analysis,
J. Geoph. Res., 22 pp, <http://dx.doi.org/10.1029/2000JB900157>
- 1999 **F. J. Simons**, Alet Zielhuis & Rob D. van der Hilst,
The deep structure of the Australian continent from surface-wave tomography,
Lithos, 27 pp, [http://dx.doi.org/10.1016/S0024-4937\(99\)00041-9](http://dx.doi.org/10.1016/S0024-4937(99)00041-9)
- 1997 **F. J. Simons**, Frédéric Verhelst & Rudy Swennen,
Quantitative characterization of coal by means of microfocal X-ray Computed Microtomography (CMT) and
Color Image Analysis (CIA),
Intern. J. Coal Geol., 20 pp, [http://dx.doi.org/10.1016/S0166-5162\(97\)00011-6](http://dx.doi.org/10.1016/S0166-5162(97)00011-6)

OTHER *A chronological list of conference papers, white papers, and “forum” pieces:*

- 2012 L. Ridgway Scott & twenty-six alphabetized others,
Fostering interactions between the geosciences & mathematics, statistics, and computer science
University of Chicago Department of Computer Science, Technical Report, TR-2012-02, 32 pp

Alain Plattner^o, **F. J. Simons** & Liying Wei[†],
Analysis of real vector fields on the sphere using Slepian functions,
2012 IEEE Statistical Signal Processing Workshop (SSP), Ann Arbor, 4 pp
- 2011 Kevin W. Lewis^o & **F. J. Simons**,
Spatial variability of the Martian crustal magnetic field,
42nd Lunar and Planetary Science Conference, Abstract No. 2621, 2 pp
- 2010 **F. J. Simons**,
Turning freshmen into scientists with field research and quantitative analysis of geoscientific data,
Matlab Digest | Academic Edition, October 2010, 1–3
- 2006 Laurent G. J. Montési, Giulio di Toro, **F. J. Simons** & five others,
Young scientists focus on the dynamics of the lithosphere,
Eos Trans. AGU, 2 pp, <http://dx.doi.org/10.1029/2006EO440005>

F. J. Simons, Guust Nolet, Jeff M. Babcock, Russ E. Davis & John A. Orcutt,
A future for drifting seismic networks,
Eos Trans. AGU, 2 pp, <http://dx.doi.org/10.1029/2006EO310002>

Malcolm S. Sambridge, Caroline Beghein, **F. J. Simons** & Roel Snieder,
How do we understand and visualize uncertainty?
The Leading Edge, 5 pp, <http://dx.doi.org/10.1190/1.2202654>
- 2005 **F. J. Simons**, Thorsten W. Becker, James B. Kellogg & five others,
MYRES: A program to unite young solid Earth researchers,
Eos Trans. AGU, 2 pp, <http://dx.doi.org/10.1029/2005EO050005>
- 2004 **F. J. Simons**, Thorsten W. Becker, James B. Kellogg & six others,
Young solid Earth researchers of the world unite!
Eos Trans. AGU, 2 pp, <http://dx.doi.org/10.1029/2004EO160011>