Lapo Boschi

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EXPERIENCE

- 2012-2018: lecturer (*maître de conférences HDR*), iSTeP, Université Pierre et Marie Curie/Sorbonne University, Paris, France.
- 2015-2017: invited researcher (*délégation CNRS*), equipe LAM, institut d'Alembert, Université Pierre et Marie Curie, Paris, France.
- 2011-2012: lecturer, Institute of Theoretical Physics, University of Zürich, Switzerland.
- 2003-2011: lecturer, Institute of Geophysics, ETH Zürich, Switzerland.
- 2009: invited professor, Institute de Physique du Globe de Paris.
- 2001-2003: invited professor, Department of Physics, University of Naples Federico II, Italy.
- 2001: post-doctoral fellow, Department of Earth and Planetary Sciences, Harvard University, U.S.A.
- 1996-2001: research and teaching assistant, Ph.D. candidate, Department of Earth and Planetary Sciences, Harvard University, U.S.A.

EDUCATION AND HABILITATIONS

- 2017: Abilitazione Scientifica Nazionale, Professore Ordinario, 04/A4 (Geofisica)
- 2001: PhD in geophysics, *Applications of linear inverse theory in modern global seismology*, Department of Earth and Planetary Sciences, Harvard University, USA
- 1998 : Master's degree in geophysics - Department of Earth and Planetary Sciences, Harvard University, USA
- 1996: Bachelor's - Dipartimento di Fisica, Univ. di Bologna, Italy (110/110 *con lode*)

SUMMARY OF RESEARCH CONTRIBUTIONS

As of today (January 2021), Lapo Boschi has published **87 research articles** on peer-reviewed journals. According to Scopus, his **h-index is 26** and his publications have been **cited over 2800 times** in the scientific literature. A brief list of Lapo Boschi's main contributions follows:

- in-depth analysis of the correlation (or lack thereof) between tomography models of the Earth's mantle derived by different techniques (Boschi and Dziewonski, 1999, cited 132 times; Becker & Boschi, 2002, cited 373 times). This work contributed to clarify the long- wavelength structure of the mantle (interactions bettween subducting slab and transition zone; superplumes).
- Evaluation, through seismic tomography, of the theory of mantle plumes (Boschi, Becker & Steinberger, 2007, cited 84 times). This work resulted in a catalogue of hot-spots based on their deep (plumes) or shallow origin.
- Compilation of the currently densest available database of central European Rayleigh-wave phase and group dispersion, based on seismic ambient noise (Stehly *et al*., 2009; cited 125 times; Verbeke *et al*., 2012; Kaestle et al., 2018).
- Implementation of an adaptive-tomography software package, allowing, in particular, to map seismic tomography based on joint inversions of surface- and body-wave data (Boschi & Ekström, 2002, cited 95 times; Schäfer *et al*., 2011a, 2011b; Auer et al., 2014, already cited 120 times).
- Tomographic/geodynamic study of the mantle underlying the Mediterranean Basin (Boschi *et al*., 2004; Boschi *et al*., 2010; Faccenna et al., 2014, cited 213 times). These efforts contributed to clarify the role of mantle convection in developing and sustaining European topography (dynamic vs isostatic).
- In-depth evaluation of the discrepancy between *ray-theoretical* and *finite-frequency* tomography models (Peter *et al*., 2007, 2009). We show that the resolution

improvement achieved by the new methods is severely limited by data coverage, which is frequently inadequate.
- A detailed review article on the theory of seismic ambient noise, published on *Review of Geophysics* in 2015.
- Perception experiments (Paté et al., 2015, 2017; Boschi et al., 2017) on the benefits of acoustic display of seismology data with respect to much more widely used visual display (in the framework of L. Boschi's delegation CNRS at the musical acoustics laboratory, Institut d'Alembert, UPMC).
- Studies in seismic and acoustic time reversal; in particular, I have explored the idea that bone conducted sound in the skull of cetaceans contributes to the accuracy of echo-location (Reinwald et al., 2018; Hejazi et al., 2020).

TEACHING EXPERIENCE

I am the main lecturer of the following courses at the **University of Padova**:
- seismology and acoustics (master's degree in geology)
- solid-earth geophysics (master's degree in geophysics)
- mathematical physics for the earth system (master's degree in geophysics)
- I have also contributed to the Basin Analysis (master's degree in geology) and computer programming (doctoral school) courses

In September, 2020, I have held a course on Wave Physics at the Abdus Salam **International Centre for Theoretical Physics** (ICTP) of Trieste

I have contributed to the following courses at **UPMC/Sorbonne** (the first digit of the catalogue number indicates the year in the UPMC geosciences curriculum. MU indicates a master's degree program):
- General geosciences(1T001)
- Geophysical methods(5UG20)
- History of ideas in the geosciences (3T062)
- Introduction to the physics of the Earth (LT212)
- Introduction to statistics for the Geosciences (2T041)
- Informatics for the Geosciences (2T031)
- Numerical modeling in the Earth sciences (MU126)
- Physics of the Earth (4UG22)
- Tectonics and geodynamics(LBP-NU502)
- Computer modeling and data analysis in geosciences (EPU-S8 -GG3 – engineering department)
- aFFRODIT – Bringing down the borders between scientific disciplines (2HA01)

I have been the main lecturer of the following courses at UPMC/Sorbonne:
- Mathematical methods for the Earth sciences (2T301) (http://hestia.istep.upmc.fr/~boschil/omc.html)
- Earthquakes, waves and images (3T057) (http://hestia.istep.upmc.fr/~boschil/ondes.html)

I have been the main lecturer of the following courses at **ETH Zurich**:
- Global seismology (http://hestia.istep.upmc.fr/~boschil/seismology/seismology.html)
- Seismic tomography (http://hestia.istep.upmc.fr/~boschil/tomography/tomography.html)

I am a contributor of *SEATREE*, a modular and user friendly software library designed to facilitate using solid earth research tools in the classroom: see my contributed programs *larry*, *Syn2D* and *larry3d*. (http://www-udc.ig.utexas.edu/external/becker/seatree/)

RESEARCH GRANTS AWARDED

Coordinator (European Training Network):
- WAVES: Waves and Wave-Based Imaging in Virtual and Experimental Environments. Funded by the European Union. Approx. 3,000,000 Euro / 4 years (2015-2018).

Principal investigator:

- New approaches to regional seismic tomography. Applications to seismic risk assessment in Campania, Italy. Funded by the Ministero Istruzione Università Ricerca, Italy. 143,000 Euro / 3 years (2002-2005).
- Mutually consistent tomographic models of crust, upper mantle and the lithosphere-asthenosphere boundary region underneath Europe and the Mediterranean Basin. Funded by ETH Zürich. 162,000 Euro / 3 years (2008 -2011).
- New challenges in seismic mapping of the Earth's mantle: anisotropy, temperature, composition. Funded by the Swiss National Science Foundation (SNSF). 104,000 Euro / 2 years (2011-2013).

Co-investigator:

- Seismological investigation using the SDS-net: (1) Regional surface-wave propagation, and (2) receiver-function analysis. Funded by the SNSF. 128 ,000 Euro / 4 years (2003-2007)
- High-performance computing in global and earthquake seismology: linking innovative Earth tomography to earthquake physics and seismic hazard. Funded by ETH Zürich. 177,000 Euro / 3 years (2008 -2011).
- Global sealevel variations and isostatic postglacial readjustment; effects of the rheological properties of the Earth's mantle on the present rate of sealevel rise. Funded by the Ministero Istruzione Università Ricerca (PRIN2004), Italy. 78 ,000 Euro / 2 years (2004-2006).
- The role of isostatic postglacial readjustment in global and Mediterranean sea level changes: new geophysical, geological, and archaeological constraints. Funded by the Ministero Istruzione Università Ricerca (PRIN2006), Italy. 8 6,000 Euro / 2 years (2006-2008).
- PETAQUAKE (Large-Scale Parallel Nonlinear Optimization for High-Resolution 3D-Seismic Imaging). Funded by the High Performance and High Productivity (HP2C) platform, Switzerland. 214,000 Euro / 3 years (2010-2013).

Lead scientist (European Training Networks):

- SPICE (Seismic wave propagation and imaging in complex media: a European network). Funded by the European Union. 345,000 Euro / 3 years (for the ETH) (2003-2007).
- QUEST (quantitative estimation of Earth's seismic sources and structure, E.U. initial training network). Funded by the European Union. ~500,000 Euro / 3 years (for the ETH) (2009-2012).

SUPERVISION OF PH.D. STUDENTS

I have been the thesis supervisor of twelve Ph.D. students who graduated from ETH or UPMC/Sorbonne between 2007 and 2018. Some are pursuing careers in the industry (insurance, resources, technology), some stayed in the academia as researchers, and three of them now occupy tenured or tenure-track positions. I am currently the supervisor of two Ph.D students at Univ. of Padua, UPMC/Sorbonne.

- FRY Bill, Ph.D. ETH Zurich (Switzerland), *Surface wave tomography of the Mediterranean and central Europe: A new shear wave velocity model*, 01/01/2004-10/11/2007. Current position: senior researcher, GNS-science, Wellington, New Zealand.
- PETER Daniel, Ph.D. ETH Zurich (Switzerland), *Finite-frequency effects in global seismology : forward modeling and implications on tomographic imaging*. 01/06/2004- 01/05/2008. Current position: professor at KAUST (Saudi Arabia).
- SCHAEFER Julia, Ph.D. ETH Zurich (Switzerland), *Adaptively anisotropic tomography of the European upper mantle*, 01/01/2008 -01/09/2011. Current position: Assistant Actuarial Analyst at HANNOVER RE (Germany).
- DELLA MORA Steve, Ph.D. ETH Zurich (Switzerland), *Beyond tomography: new insights in global seismic imaging*, 01/02/2008 -01/02/2012. Current position: analyst at Zurich RE (UK)
- VERBEKE Julie, Ph.D. ETH Zurich (Switzerland). *High resolution anisotropic imaging of the Central European crust from phase and group velocities using ambient noise surface waves*, 01/01/2008 -01/12/2011. Current position: private entrepreneur (France)

- WEEMSTRA Cornelis, Ph.D. ETH Zurich (Switzerland). *On the attenuation of the ambient seismic field*. 01/05/2010-01/10/2013. Current position: assistant professor, Delft University of Technology (the Netherlands).
- COLOMBI Andrea, Ph.D. ETH Zurich (Switzerland). *Numerical seismology across the scale: from experimental acoustics to the core-mantle boundary*. 01/04/2010-01/04/2013. Current position: senior researcher at ETH Zurich.
- KOROSTELEV Félicie, Ph.D., UPMC/Sorbonne. *La lithosphere du point triple Aden-Afar-sud mer Rouge et du gole d'Aden: magmatisme et rupture continentale*. 01/09/2012-25/09/2015. Current position: post-doctoral fellow at Sorbonne University.
- AUER Ludwig, Ph.D., ETH Zurich (Switzerland). *Adaptive-resolution tomography to map anisotropy and composition heterogeneity in the entire mantle*, 01/11/2011-14/03/2016.
- KAESTLE Emanuel, Ph.D. UPMC/Sorbonne. *Tomography and geodynamics of the Alpine lithosphere*. 01/10/2014-01/10/2017. Current position: post-doctoral fellow at Freie Universität, Berlin.
- REINWALD Michael, Ph.D., UPMC/Sorbonne. *Echolocation in marine mammals: acoustics experiments and numerical modeling*. 01/11/2015-01/11/2018.
- HEJAZI Aida, Ph.D., UPMC/Sorbonne. *Green's function retrieval from noise correlation in multiple scattering media*. 01/12/2015-01/12/2018.
- SARVANDANI Mohamadian, Ph.D., UPMC/Sorbonne. *Seismic tomography of an amagmatic, ultra-slowly spreading ridge*. 01/10/2018-01/10/2021 (expected).
- SHARMA-DHAKAL Apsara, Ph.D., Università di Padova, *Earthquake source imaging by surface-wave time reversal*, 01/10/2019-01/10/2022 (expected).

SUPERVISION OF M.SC. STUDENTS

- CARANNANTE Simona, M.Sc. Universita di Napoli Federico II, Velocità di fase delle onde sismiche di superficie: *immagini tomografiche globali a risoluzione variabile.* 01/01/2003-24/03/2004. Current position: researcher at INGV (Italy).
- DELCOR Laurianne, M.Sc. UPMC/Sorbonne. *Categorization of seismic sources by auditory display*. 01/03/2016-01/10/2016. Current position: Ph.D. candidate at Airbus Helicopters.

PARTICIPATION IN PH.D. THESIS COMMITTEES

- Yilong QIN, Institut de Physique du Globe de Paris and University Paris 7 (2008). *SPICE benchmark pour méthodes tomographiques globaux et test des modèles tomographiques globaux*.
- Marie MACQUET, Université J. Fourier, Grenoble (2015). *Tomographie crustale des Pyrénées et des régions avoisinantes par corrélation de bruit.*
- Aberrahamane HANED, IPGP (September 2016). *Tomographie globale a partir du bruit sismique longue-periode.*
- Leonard SEYDOUX, IPGP and Institut Langevin (October 2016). *Analyse et traitement de la matrice de covariance de données enregistrées sur des réseaux de stations sismiques*.
- Malgorzata CHMIEL, Université Grenoble-Alpes (February 2017). *Geophysical Processing with Dense Acquisitions in Passive and Active Seismic Configurations.*
- Thijs FRANKEN, Institut de Physique du Globe de Paris and University of Paris (December 2019), *Analysing partial melting in the Réunion mantle plume*.
- Frederic DUBOIS, EOST Strasbourg (January 2020). *Imagerie tomographique multi-résolution du manteau profond: approche conjointe ondes de volume et modes propres.*
- Henrik THOMSEN, ETH Zürich (expected February 2021). *Elastic immersive experimentation: theory and physical implementation.*

PARTICIPATION IN OTHER COMMITTEES (HABILITATION, ETC.)

- Jury HDR (*Habilitation à Diriger des Recherches*) for Thomas BODIN, Ecole Normale Supérieure, Lyon, December 2018.
- *Commissione procedura di valutazione selettiva* (*art. 15 del CCNL ricerca 2002-2005*), seismology, OGS Trieste, December 2020.

- *Commissione per il conferimento di un assegno di ricerca, Modellizzazione sismologica dei margini convergenti*, University of Padova, December 2020.

POPULAR SCIENCE ("TERZO SETTORE")

- I have contributed to *La Voce* an article about the 2009 L'Aquila earthquake: *Il terremoto tra vera prevenzione e falsa fatalità* (http://www.lavoce.info/archives/25622/il-terremoto-tra-vera-prevenzione-e-falsa-fatalita/)
- between June 2011 and April 2012 I have conceived and hosted the radio show *The hard drive* (Radio LORA, Zürich), popularising the research conducted in the universities and research centers of the Zürich region: (http://www.lora.ch/sendungen/aktuelle-sendungen?mode=2&terms=&list=The+Hard+Drive).
- Model SAVANI by Auer, Boschi et al. (2014) has been used as a teaching tool of the INGV ScienzAperta project (http://www.scienzapertaingv.it/).
- Interview with Il Bo Live (magazine of the univ. of Padova): *Riusciremo un giorno a prevedere i terremoti?,* July 2019.
- I have contributed an entry to the EGU Seismology Blog, *Lockdown in Northern Italy, what did seismology see* (June 2020) (https://blogs.egu.eu/divisions/sm/category/ambient-seismic-noise/)
- Interview with Il Bo Live (magazine of the univ. of Padova): *Covid-19 e lockdown: i sismometri "misurano" il silenzio dell'uomo,* June 2020.

ORGANISATION OF MEETINGS AND WORKSHOPS

- International workshop "On the Structure of the Mediterranean Upper Mantle", Università di Napoli Federico II, 28/2–1/3, 2002 (with P. Gasparini).
- SPICE meeting at ETH Zürich, 1/3–2/3, 2007 (with P. M. Mai, D. Giardini)
- 11th Geodynamics workshop, Braunwald, Switzerland, 28/6–3/7, 2009 (with F. Deschamps, B. Kaus, P. Tackley)
- QUEST meeting in Zürich, 10/2–12/2, 2010 (with D. Giardini).
- CECAM (*Centre Européen de Calcul Atomique et Moleculaire*) workshop on "Computational Mineral Physics: Applications to Geophysics", 31/8–3/9, 2010, Zürich (with H.-P. Bunge).
- Between 2015 and 2018 I have contributed to organizing six international meetings/workshops in the framework of the European Training Network WAVES, of which I was the coordinator.

EDITOR, REFEREE

- Since 2016, I am associate editor for *Geophysical Journal International*.
- I have contributed, and continue to contribute peer reviews to many international journals, including *Bulletin of the Seismological Society of America, Earth and Planetary Science Letters, Geochemistry, Geophysics, Geosystems (G-cubed), Geophysical Journal International, Geophysical Research Letters, Journal of Geophysical Research, Lithos, Science, Tectonophysics*.
- I have reviewed over 10 research projects submitted to the U.S. National Science Foundation; three research projects submitted to the Dutch NWO; two projects submitted to the E.U. ERC program; two research projects submitted to the French ANR; two projects submitted to the Italian PRIN program; one research project submitted to the German DFG; one research project submitted to the Swiss National Foundation.

INVITED TALKS

1. California Institute of Technology, July 2001.
2. ERMES Meeting, Ettore Majorana Centre, Erice (Italy), July 2002.
3. University of Oxford, April 2003.
4. ETH Zürich, July 2003.
5. Utrecht University, March 2004.
6. Institut de Physique du Globe, Paris, April 2005.
7. Lamont-Doherty Earth Observatory, Columbia University, September 2005.
8. Università di Ferrara, November 2005.
9. INGV Bologna, November 2005.
10. Instituto de Ciencias de la Tierra 'Jaume Almera', Barcelona, February 2006.

11. University of Cambridge, April 2006.
12. SEDI Meeting, Prague, July 2006.
13. SPICE Meeting, Cork (Ireland), July 2006.
14. University of Southern California, September 2006.
15. Stanford University, September 2006.
16. Université du Québec à Montréal, November 2006.
17. Università di Napoli Federico II, April 2007.
18. SPICE Meeting, Cargèse (France) May 2007.
19. University College, London, May 2007.
20. University of Leeds, October 2007.
21. GFZ Potsdam/Freie Universität Berlin, January 2008 .
22. Lamont-Doherty Earth Observatory, Columbia University, July 2008 .
23. Workshop “From Genome to Snowball Earth, Metazoan Evolution and Habitable Planets”, Tokyo, October 2008 .
24. ENS Lyon, October 2008 .
25. Università di Roma 3, November 2008 .
26. Université de Montpellier, March 2009.
27. Institut de Physique du Globe, Paris, March 2009.
28. University of Liverpool, May 2009.
29. 11th Geodynamics Workshop, Braunwald (Switzerland), June 2009.
30. Orfeus Meeting, Utrecht, July 2009.
31. international conference "From Core to Crust: Towards an Integrated Vision of Earth’s Interior", ICTP Trieste, July 2009.
32. Institut de Physique du Globe, Paris, September 2009.
33. Université de Strasbourg, October 2009.
34. University of Oxford, November 2009.
35. Università di Brescia, January 2010.
36. Université de Toulouse, March 2010.
37. Saint Louis University, U.S.A., May 2010.
38. CECAM Workshop “Computational mineral physics: Applications to geophysics”, Zürich, October 2010.
39. Université de Strasbourg, November 2010.
40. Ludwig-Maximilians Universität, München, February 2011.
41. ENS Paris, April 2011.
42. ISTEP, UPMC, April 2011.
43. Seismology of Earth and Stars workshop, Princeton University, May 2011.
44. University of Southern California, February 2012.
45. California Institute of Technology, February 2012.
46. Université de Lyon Claude Bernard, May 2012.
47. ENS, Paris, May 2012.
48. Workshop on Noise and Diffuse Wavefields, Neustadt (Germany), November 2012.
49. ETH Zürich, May 2013.
50. EPOS workshop, Erice (Italy) August 2013.
51. Rencontre RESIF, Yenne (France), October 2013.
52. Université de Kiel (Germany), July 2014.
53. Université de Copenhagen (Denmark), September 2014.
54. WAVES workshop, Pitlochry, Scotland, September 2015.
55. Università di Roma 3, February 2016.
56. Institut Jean Le Rond D'Alembert, UPMC, Paris, February 2016.
57. Université de Lausanne, June 2016.
58. TIDES Training School, Sesimbra, Portugal, September 2016.
59. Massachusetts Institute of Technology, Boston, November 2016.
60. Università di Padova, May 2017.
61. Summer School 'Ambient Noise Imaging and Monitoring', Cargèse, France, June 2017.
62. TIDES Training School, Prague, Czech Republic, July 2018.
63. INGV Bologna, February 2019.
64. ICTP Trieste, May 2019.

65. Webinar on Global Seismic Tomography, Jackson School of Geosciences, Austin, Texas, January 2020.
66. Webinar Geofisica, Fondazione Museo Civico di Rovereto, December 2020.