Xiaotao Yang

Department of Earth, Atmospheric, and Planetary Sciences, Purdue University

E-Mail: *xtyang AT purdue DOT edu* | ***ORCID:*** *0000-0002-4054-6468*
Website: *https://sites.google.com/site/xiaotaoyanggeo* | ***GitHub:*** *https://github.com/xtyangpsp*

EDUCATION

Ph.D. in Geophysics, Indiana University, Bloomington, IN 08/2011 – 10/2016
Dissertation: Lithospheric Imaging in Illinois Basin and Its Tectonic Implications
Advisory Committee: Gary L. Pavlis (Chair), Michael Hamburger, Kaj Johnson, Hersh Gilbert, Stephen Marshak

M.Sc. in Geophysics, University of Chinese Academy of Sciences, Beijing, China 09/2008 – 07/2011
Thesis: Seismic Travel-Time Tomography of Crustal Structure in Yunnan, China
Advisory Committee: Yi Xu (Chair), Jianhua Liu, Weiwei Jiang, Peifen Xu

B.Sc. in Geophysics, China University of Geosciences (Wuhan), Hubei, China 09/2004 – 06/2008
Thesis: Loess Magnetic Fabric Characteristic Analysis in Chaohu Basin, Anhui
Thesis Director: Yufen Zhang

PROFESSIONAL APPOINTMENTS

Purdue University	Assistant Professor	08/2020 - present
Harvard University Mentor: Dr. Marine Denolle	Research Associate	06/2019 - 08/2020
University of Massachusetts Amherst Mentor: Dr. Haiying Gao	Postdoctoral Researcher	11/2016 - 05/2019

RESEARCH INTERESTS

Structure and tectonic evolution of Earth's lithosphere and deep interior
Earthquake hazards, volcano seismology, geohazards
Dynamics of subduction systems
Automation of array-based seismic data processing

RESEARCH EXPERIENCES

06/2019 – 08/2020, **Research Associate**, Harvard University

Topic: Characterization of seismic wavefields and the ground motion of future megathrust earthquakes on the Cascadia subduction zone and strike slip earthquakes on the San Andreas Fault

11/2016 – 05/2019, **Postdoctoral Researcher**, University of Massachusetts Amherst

Project-1: Full-wave seismic ambient noise tomography of the northern Appalachians, focused on the following questions (National Science Foundation award to Haiying Gao under the EarthScope program. ***The result on the Adirondack Mountains was published in GRL in June 2018 with news coverage from multiple news agencies***):

- What is the driving force for the Adirondacks uplift in the northeastern U.S.?
- How is the uplift of the Adirondack Mountains related with regional tectonics?
- How are the seismicity and tectonic terranes correlated with crustal velocity structure?

Project-2: Investigating the quality of empirical Green's functions from the Ocean Bottom Seismometer (OBS) community experiments in different tectonic settings to address the following questions (NSF award to Haiying Gao under the EarthScope program):

- How is OBS data quality influenced by factors of seasonal variation, water depth,

sediment thickness, and length of operation?
- How can we optimize the deployment of OBS instruments to improve the data quality?

Project-3: Lithosphere dynamics in Alaska from ocean to continent, addressing the following issues:
- How do the geometry and properties of the subducting and overriding plates control the along-strike variation of magmatism and seismogenesis?
- What are the mantle flow patterns within the upper mantle wedge and beneath the subducting slab and how are they impacted by interacting with the subducting slab?
- How is the lithosphere deformed and what is the role of subduction in lithosphere deformation?

Project-4: Crustal modification during terrane accretion at the eastern North American margin (southern New England) using seismic full-wave ambient noise tomography, addressing the following issues:
- What are the seismic characteristics associated with tectonic activities at the margin?
- What is the mechanism of the Hartford basin and the implication on rift evolution at passive margins?

09/2016 – 10/2016, **Research Intern**, Indiana Geological & Water Survey

Project: Evaluation of CO_2 storage resource estimates in coal seams in the Illinois Basin
- Developed heterogeneous 3-D reservoir model used for CMG-GEM reservoir simulation for unconventional gas modeling
- Generated multiple scenarios to optimize field operations and to quantify resource magnitude and uncertainty
- Evaluated the feasibility of CO_2 storage and enhanced coal bed methane recovery in the unmineable seams

08/2011 – 08/2016, **Research Assistant**, Indiana University Bloomington

Project: EarthScope OIINK (Ozark, Illinois, Indiana, Kentucky) Flexible Array project, supported by NSF. Made the following contributions:
- Constructed high-resolution 3-D seismic images of major crustal and uppermost mantle velocity discontinuities using P-to-S conversions, which improved understanding of the crustal thickness and the tectonic history of the midcontinent in the Illinois Basin region
- Innovated automated quality control procedures for teleseismic P-wave receiver functions, which greatly improved the efficiency, accuracy, and reproducibility of receiver function quality controls
- Identified new seismic zone centering the Ste. Genevieve fault zone in southeastern Missouri and southwestern Illinois

09/2008 – 06/2011, **Research Assistant**, Institute of Geology and Geophysics, Chinese Academy of Sciences

Project: Detailed Structure of the Crust and Upper Mantle of the Mountain Building Belt in the eastern Tibet Plateau, China, supported by the National Natural Science Foundation of China.
- Developed automated Matlab scripts for teleseismic arrival picking
- Generated a series of utility computer codes in data processing and visualization
- Produced tomographic images of the crustal structure that improved understanding of tectonic evolution of western Yunnan to the east of the Tibet Plateau and, specifically, the migration of volcanic activities in the Tengchong volcanic area

MANUSCRIPTS IN PREPARATION

X. Yang, J. Bryan, K. Okubo, C. Jiang, T. Clements, and M.A. Denolle (*in preparation)*. Optimize the Stacking of Noise Correlation Functions

X. Yang, and M.A. Denolle(*in preparation)*. Characterize Earthquake Ground Motions in Cascadia using Seismic Ambient Noise

PEER-REVIEWED PUBLICATIONS (Google Scholar)

Yang, X., H. Gao (2020). Segmentation of the Aleutian-Alaska subduction zone revealed by full-wave ambient noise tomography: implications for the along-strike variation of volcanism, *Journal of Geophysical Research-Solid Earth,* doi: 10.1029/2020JB019677 ****The story was reported by 4 news websites and 2 science blogs****

Gao H., **X. Yang,** Maureen Long, John Aragon (2020). Seismic Evidence for Crustal Modification Beneath the Hartford Rift Basin in the Northeastern United States, *Geophysical Research Letters,* doi: 10.1029/2020GL089316

Gilbert, H., J. Boschelli, C. Chen, **X. Yang**, G. Pavlis, M. Hamburger, S. Marshak, T. Larson, and J. Rupp (*in revision*). Crustal layering in the U.S. midcontinent and its role in the evolution of the Illinois Basin, *Geology*

Lü, Z., H. Gao, J. Lei, **X. Yang**, S. Rathnayaka, C. Li (2019). Crustal and upper mantle structure of the Tien Shan orogenic belt from full-wave ambient noise tomography, *Journal of Geophysical Research-Solid Earth*

Yang, X., H. Gao, S. Rathnayaka, C. Li (2019). A comprehensive quality analysis of empirical Green's functions at Ocean Bottom Seismometers in Cascadia, *Seismological Research Letters, doi: 10.1785/0220180273*

Yang, X., H. Gao (2018). Full-Wave Seismic Tomography in the Northeastern United States: New Insights into the Uplift Mechanism of the Adirondack Mountains, *Geophysical Research Letters, 45, doi: 10.1029/2018GL078438.* **** news coverage in UMass News, Phys.org, and AGU GeoSpace blog (See Media links on my website for details) ****

Chen, C., H. Gilbert, K. Fischer, C. Andronicos, G. Pavlis, M. Hamburger, S. Marshak, T. Larson, **X. Yang** (2018). Lithospheric discontinuities beneath the U.S. Midcontinent - signatures of Proterozoic terrane accretion and failed rifting, *Earth and Planetary Science Letters, 481, doi: 10.1016/j.epsl.2017.10.033*

Yang, X., G. Pavlis, M. Hamburger, S. Marshak, H. Gilbert, T. Larson, C. Chen, N. S. Carpenter (2017). Detailed Crustal Thickness Variations beneath the Illinois Basin Area: Implications for Crustal Evolution of the Midcontinent, *Journal of Geophysical Research-Solid Earth*, 122, doi: 10.1002/2017JB014150. * ***highlighted by the editor as "Exploring hypotheses for thick crust under the Illinois Basin" on July 13, 2017*** *

Marshak, S., S. L. Domrois, C. Abert, T. Larson, G. L. Pavlis, M. W. Hamburger, **X. Yang**, H. Gilbert, and C. Chen (2017), The basement revealed: Tectonic insight from a DEM of the Great Unconformity, USA cratonic platform, *Geology*, doi: 10.1130/G38875.1

Yang, X., G. Pavlis, Y. Wang (2016). A Quality Control Method for Teleseismic P-Wave Receiver Functions, *Bulletin of the Seismological Society of America*, 106(5), 1948–1962, doi:10.1785/0120150347

Chen, C., H. Gilbert, C. Andronicos, M. Hamburger, T. Larson, S. Marshak, G. Pavlis, **X. Yang** (2016). Shear velocity structure beneath the central United States: implications for the origin of the Illinois Basin and intraplate seismicity. *Geochemistry, Geophysics, Geosystems*, doi: 10.1002/2015GC006206

Xu, Y., S. Wang, L. Zhang, **X. Yang** (2015). Crust and upper mantle structure and its relations with magma activity of the Tengchong volcanic area. *Progress in Geophysics* (in Chinese), 30(3), 1034-1038, doi: 10.6038/pg20150306

Xu, Y., J. Liu, Z. Huang, **X. Yang** (2014). Upper Mantle Velocity Structure and Dynamic Features of the Tibetan Plateau. *Chinese Journal of Geophysics (in Chinese)*, 57 (12), 4085-4096

Yang, X., G. Pavlis, M. Hamburger, E. Sherrill, H. Gilbert, S. Marshak, J. Rupp, T. Larson (2014). Seismicity of the Ste. Genevieve Seismic Zone based on Observations from the EarthScope OIINK Flexible Array. *Seismological Research Letters*, 85(6), 1285-1294 **** news coverage in Indiana University News and St. Louis Public radio (See Media links on my website for details) ****

Xu, Y., **X. Yang**, J. Liu (2013). Tomographic Study of Crustal Velocity Structures in the Yunnan Region Southwest China. *Chinese Journal of Geophysics (in Chinese)*, 56(6), 1904-1914

Xu, Y., **X. Yang**, Z. Li, J. Liu (2012). Seismic Structure of the Tengchong Volcanic Area Southwest China from Local Earthquake Tomography. *Journal of Volcanology and Geothermal Research*, 239-240, 83-91

Yang, X., Y. Xu, J. Liu, Z. Li (2011). Seismic Tomography in the Tengchong Volcanic Area and Its Tectonic Implication. *Chinese Journal of Geophysics (in Chinese),* 54(8), 2050-2059.

CONFERENCE PRESENTATIONS

Ground Motions along the Cascadia Margin Revealed by Virtual Earthquakes, at *2020 American Geophysical Union (AGU) Fall Meeting.* Washington, DC.

Imaging the cratonic lithosphere beneath the Illinois Basin and the Adirondack Mountains, at *2019 Seismological Society of America (SSA) Annual Meeting*. Seattle, WA. (**Invited talk**)

Seismic evidence of mantle wedge controls on volcano distribution along Aleutian-Alaska, at *2019 Seismological Society of America (SSA) Annual Meeting*. Seattle, WA. (**Invited talk & SSA press highlight**)

Seismic characteristics of the southern New England crust revealed by full-wave ambient noise tomography, at *2019 Northeastern Section 54rd Annual Meeting*. Portland, ME.

Seismic evidence of mantle wedge controls on volcano distribution along Aleutian-Alaska, at *2019 GeoPRISMS Theoretical and Experimental Institute*. San Antonio, TX.

The Cause and Effect of Slab Segmentation in the Aleutian-Alaska Subduction System, at *2018 American Geophysical Union (AGU) Fall Meeting.* Washington, DC.

Modification of lithospheric structure via subduction, terrane accretion, and rifting: Preliminary results from the SEISConn broadband experiment, Connecticut, USA, at *2018 American Geophysical Union (AGU) Fall Meeting.* Washington, DC. (Co-author)

Full-Wave Tomography in Alaska/Aleutian from Ocean to Continent, at *2018 IRIS Workshop*. Albuquerque, NM

Quality Analysis of Empirical Green's Functions for Ocean Bottom Seismometers in Cascadia, at *2018 IRIS Workshop*. Albuquerque, NM

Seismic Evidence of Asthenosphere Upwelling Driving the Uplift of the Adirondack Mountains, at *2018 Northeastern Section 53rd Annual Meeting*. Burlington, VT.

Link the Crustal Structure with Seismicity and Tectonic Terranes in the Northern Appalachians, at *2018 Northeastern Section 53rd Annual Meeting*. Burlington, VT.

The Correlation of Crustal Velocity Structures with Seismicity Patterns in the Northern Appalachians, at *2017 American Geophysical Union (AGU) Fall Meeting.* New Orleans, LA.

Investigating the Quality of Empirical Green's Functions from the Cascadia Initiative and ENAM OBS Experiments, at 2017 OBS Symposium, Portland, ME.

Uplift of the Intracratonic Adirondack Mountains Driven by Asthenospheric Upwelling, at *2017 Gordon Research Conferences on Interior of the Earth*. South Hadley, MA.

Uplift of the Intracratonic Adirondack Mountains Driven by Asthenospheric Upwelling, at *2017 EarthScope National Meeting*. Anchorage, AK.

Lithospheric Discontinuities in Illinois Basin and Their Tectonic Implications: Results from the EarthScope OIINK Experiment, at *2015 American Geophysical Union (AGU) Fall Meeting*. San Francisco, CA.

Tectonic Implications of Lithospheric Discontinuities in the Ozark Plateau and Southern Illinois Basin, Midcontinent USA, at *2015 EarthScope National Meeting*. Stowe, VT.

Quantitative and Interactive Quality Control on Teleseismic P-Wave Receiver Functions, at *2015 Indiana University Crossroads Geology Conference*, Bloomington, IN

Impacts of Sediments in Illinois Basin on Plane-Wave Migration using P-to-S Conversions, at *2014 Joint SEG-AGU Summer Research Workshop on Advances in Active and Passive Full Wavefield Seismic Imaging: From Reservoirs to Plate Tectonics*. Vancouver, BC Canada.

Lithosphere under Southern Illinois Basin based on Ozark-Illinois-Indiana-Kentucky (OIINK) Flexible Array Experiment, *2013 AGU Fall Meeting*. San Francisco, CA.

Recent Seismicity in Ozark-Illinois Basin Boundary: Results from the EarthScope OIINK Flexible Array Experiment, *2013 EarthScope National Meeting*, Raleigh, NC.

Recent Seismicity in Southern Illinois and Southern Missouri: Initial Results from the EarthScope OIINK Flexible Array Experiment, *2012 AGU Fall Meeting*, San Francisco, CA.

INVITED DEPARTMENT SEMINAR TALKS

When Seismology Meets Bigdata and High-Performance Computers, at *GeoData* seminar series. February 2021

Lithospheric Imaging from the Illinois Basin to the Aleutian-Alaska Subduction Zone, at *GYPSUM seminar series*. November 2020

Seismic imaging of the Aleutian-Alaska subduction zone with details, at *UIUC*. October 2020

Investigate Lithospheric Dynamics and Interactions from Margins to Interiors through High-Resolution Seismic Imaging, at *Nevada Seismological Lab, University of Nevada, Reno*. Reno, NV. May, 2019

Investigate Lithospheric Dynamics and Interactions from Margins to Interiors through High-Resolution Seismic Imaging, at *Purdue University*. West Lafayette, IN. April, 2019

Seismic imaging of slab segmentation and correlation with volcano distribution along the Aleutian-Alaska subduction zone, at *University of Texas Institute of Geophysics*. Austin, TX. February, 2019

Seismic imaging of slab segmentation and its correlation with volcano distribution along the Aleutian-Alaska subduction zone, at *University of Massachusetts Amherst.* Amherst, MA. February, 2019

Study the structure and evolution of the lithosphere using large seismic arrays, at *South Dakota School of Mines & Technology.* Rapid City, SD. March, 2018.

Recent seismicity of the Ozark-Illinois Basin boundary in North America: based on observations from the OIINK project, at *Institute of Geodesy and Geophysics, Chinese Academy of Sciences & China University of Geosciences (Wuhan)*. Wuhan, China. June, 2013

Plane-wave migration for seismic broadband array data: a 3-D seismic wavefield imaging technique, at *Institute of Geodesy and Geophysics, Chinese Academy of Sciences & China University of Geosciences (Wuhan)*. Wuhan, China. June, 2013

TEACHING & MENTORING

Lecturing for New Graduate Seminar at the Department of Earth, Atmospheric, and Planetary Sciences, Purdue University (Fall 2020)

Lecturing for "*Tectonophysics"* for graduate students and senior undergraduates taught by Michele Cooke and Haiying Gao at University of Massachusetts Amherst (2017), focusing on:

- Gravity anomalies

Mentoring of graduate students (Cong Li, Sampath Rathnayaka, Meng Liu), **undergraduate student** (Amelia Midgley), and a **visiting scholar** (Lihong Zhao, Ziqiang Lyu) at the Seismology Lab, University of Massachusetts Amherst

Lecturing for "*Advanced Seismology"* for graduate students taught by Gary Pavlis at Indiana University (2014), focusing on two topics:

- Earthquake magnitude
- The reflection and transmission of seismic waves at velocity interfaces

Lab assistant for the course of "*Earthquakes and Volcanoes*" for undergraduate students taught by Anna Jessee at Indiana University (2015). Lab topics:

- Fractions and faulting (the occurrence of earthquakes)
- Elasticity and the influence of temperatures and other factors

LEADERSHIPS

05/2013 – 12/2014, **President**, Indiana University Geophysical Society, the Student Chapter of Society of Exploration Geophysicists

- Raised funding from the Department of Geological Sciences, Indiana University
- Served as liaison to the departmental chair
- Led the organization and execution of the Geology Open House (Science Fest) Committee at Indiana University in October 2013 and October 2014
- Managed the development of new society website in Spring 2014
- Coordinated the organization of a field trip to Shawnee National Forest in Spring 2014

04/2005 – 04/2007, **Founder, President, & Associate Editor**, *Sparkle Magazine*, the first geoscience-focused campus magazine at China University of Geosciences (Wuhan)

- Raised funding for the publication from the Institute of Geophysics and Geomatics, China University of Geosciences (Wuhan)
- Publication received Best Campus Student Publications Award in Fall 2006

AWARDS & HONORS

GeoPRISMS Theoretical and Experimental Institute Travel Award, 2019
College of Arts and Sciences Travel Award, Indiana University, Fall 2015

EarthScope National Meeting Student Scholarship (Travel Award), 2013, 2015, 2017

SEG/ExxonMobil Student Education Program Travel Award, 2014

Student Extracurricular Activity Award, China University of Geosciences, 2005, 2006 and 2007

Distinguished Student in Geology Field Camp, China University of Geosciences, August 2006

Outstanding Team Award in Paper-Framework Bridge Design Contest, China University of Geosciences (Wuhan), April 2005

COMPUTING SKILLS

Software developed:

- *RFeditor*: an automated teleseismic P-wave receiver function quality control program written in C++, with the option of enabling Graphical User Interface
- *SeisPy:* a Python package for seismological data processing

Programming languages: C/C++, FORTRAN, MATLAB, Unix Shell, Python

Software mastered: Antelope Datascope Database, Petrel, BasinMod, Seismic Unix, Seismic Analysis Code (SAC), ParaView

High-Performance Computing: Big Red II parallel computing cluster at Indiana University running on Cray Linux Environment, Karst high-throughput computing cluster at Indiana University running Red Hat Enterprise Linux 6, parallel computing resources at the Massachusetts Green High Performance Computing Center, Rice and Bell community clusters at Purdue University

FIELD EXPERIENCES

08/2019, Seattle, Washington

Field Assistant, Nodal and broadband survey in Seattle Basin

08/2011 - 10/2015, Missouri, Illinois, Indiana, Kentucky

Field Assistant, OIINK Experiment

- Built vaults for Flexible Array seismic stations
- Installed Guralp CMG-3T and CMG-40T sensors
- Operated configuration and testing of RT130 digitizers
- Monitored the stations through both on-site service and real-time system
- Conducted quality assurance of seismic waveform records
- Managed seismic data through Antelope Datascope Database
- Maintained station metadata for the experiment
- Communicated with IRIS DMC in data archiving for the experiment

09/2009, Hubei, China

Field Assistant, Magnetotellurics Survey in Western Hubei, China

- Assisted in surveying a 200-km profile with multi-frequency measurements

12/2005, Fujian, China

Field Assistant, Mining Area Ground Penetrating Radar Survey

- Contributed in completing a 500-m profile for dense GPR measurements

EXTRACURRICULAR SHORT COURSES

SEG/ExxonMobil Student Education Program on "Multi-Disciplinary Subsurface Integration in Exploration and Production from Plates to Pores", October 24-26, 2014

We Made a Discovery! Now What: 3-D Seismic Data Interpretation by Fred W. Schroeder from Noble Energy Inc., at Rocky Mountain Rendezvous. Laramie, WY, September 2014

Non-Mathematical Overview of Modeling, Migration, Velocity Analysis and Full Waveform Inversion by J. Bee Bednar from Panorama Technologies. SEG Virtual Course, July 2014

Petroleum Systems Short Course at Indiana University presented by James Handschy from ConocoPhillips Company. Bloomington, IN, May 2014

Advanced Short Course on Seismic Data Processing at Northwestern University presented by IRIS and EarthScope. Evanston, IL, August 2013

PROFESSIONAL SERVICES

Reviewer for *GRL, JGR*, *SRL*, *G-Cubed, JAES*

Member of the Advisory Council for Graduates & Post-docs, College of Natural Sciences, University of Massachusetts Amherst, 2017 - 2019

Convener of SSA Annual Meeting session "Advances in Seismic Interferometry: Theory, Computation and Applications", 2020, 2021

Primary convener of 2019 AGU Fall Meeting session "*Multidisciplinary Studies on the Aleutian-Alaska Subduction Zone and Associated Lithosphere Dynamics*", 2019

Judge for Outstanding Student Presentation Award at AGU Fall Meeting, 2017, 2018

Judge for GeoPRISMS Best Student Presentation Award at AGU Fall Meeting, 2018, 2019

Primary convener and chair of 2017 AGU Fall Meeting session "*Eastern North American Margin: Multidisciplinary Studies*", 2017

VOLUNTEERING EXPERIENCES

"Rock The Earth" YouTube channel to share advances in seismology and tectonics with the public. September 2020 - the present

Eureka! Spring Workshop on Geosciences for 8th to 12th-grade girls. Amherst, MA, February 2018

Eureka! Summer Workshop on Geosciences for 8th to 12th-grade girls. Amherst, MA, July 2017

TV program "*The Friday Zone*" - Episode 1511 - Dig in the Dirt by WTIU, PBS from Indiana University, October 2014

Indiana University Science Fest. Bloomington, IN, 2013, 2014

Sunshine Charity for Children. Beijing, China, 2010-2011

MEMBERSHIPS

American Geophysical Union
Geological Society of America
Seismological Society of America
Society of Exploration Geophysicists
American Association of Petroleum Geologists