

Dr. Qianlai Zhuang

William F. and Patty J. Miller Associate Professor

E-mail: qzhuang@purdue.edu

Curriculum Vitae

Associated Website(s): [Personal Web Page](#), [Purdue Climate Change Research Center \(PCCRC\)](#)

Lab Website: <http://www.eas.purdue.edu/ebdl/>

Education

Ph.D.- University of Alaska at Fairbanks

Research Interests

Dr. Zhuang's research focuses on the interactions among atmosphere, biosphere, and human dimension in the context of climate change, chemical element cycles, and policy-making. One of his major research activities is on carbon exchanges between terrestrial ecosystems and the atmosphere by investigating how changes of climate, soil physics (e.g., permafrost dynamics, change of soil moisture), atmospheric chemicals (e.g., CO₂ and O₃), land-use and land-cover (e.g., fire disturbances), affect the carbon assimilation and decomposition with both process-based and inversion modeling approaches. His second major research activity is on modeling CH₄ exchanges between the atmosphere and terrestrial ecosystems. His third major research activity is on analyzing consequences of air pollutants for ecosystem services and the economy. In the Laboratory of Ecosystems and Biogeochemical Dynamics at Purdue, his research group will continue using numerical models combining lab, field, in-situ observations and remotely-sensed data to study 1) Dynamics of structure and functioning of ecosystems including agricultural ecosystems; 2) Dynamics of major greenhouse gases cycling including CO₂, CH₄, and N₂O; 3) Feedbacks of ecosystems and biogeochemical dynamics to the climate and society.

Teaching Interests

Ecosystems Dynamics; Biogeochemical Dynamics; Large-Scale Ecology; Principles of Terrestrial Ecosystems; Global Change Biology; Interactions of Biosphere-Atmosphere

Awards and Honors

- 09/2010-08/2014, NSF - CDI -Type II: Collaborative Research: A Paradigm Shift in Ecosystem and Environmental Modeling: An Integrated Stochastic, Deterministic, and Machine Learning Approach (Lead PI in collaboration with M. Crawford, H. Zhang, D. Xiu, J. Zhang at Purdue, J. Melillo at MBL, and J. Reilly at MIT), \$1,591,428 out of \$1,941,424
- 08-2009-07/2012, NSF - Collaborative Research: Impacts of Climate Seasonality on Carbon Accumulation and Methane Emissions of Alaskan Ecosystems during the Holocene Thermal Maximum (PI in collaboration with Z. Yu, B. Felzer, and M. Jones), \$292,918 out of \$602,386
- 04/2009-03/2012, NASA Land-Use and Land-cover Change Program - Changes of Land Cover and Land Use and Greenhouse Gas Emissions in Northern Eurasia: Impacts on Human Adaptation and Quality of Life at Regional and Global Scales (Lead PI with J. M. Melillo, D. Kicklighter, J. Reilly, A. Shvidenko, N. Tchepakova, E. Parfenova, A. Peregon, A. Sirin, S. Maksyutov, and G. Zhou), \$824,701
- 09/2008 -08/2013, Department of Energy / Lawrence Berkeley National Laboratory - Investigation of the Magnitudes and Probabilities of Abrupt Climate Transitions (IMPACTS) (In collaboration with Bill Riley, Mac Post, and Margaret Torn), \$75,000
- 07/2008-07/2011, Department of Energy--Quantifying Climate Feedbacks from Abrupt Changes in High-Latitude Trace-gas Emissions (PI in collaboration with A. Schlosser, J. Melillo, K. Walter), \$89,999 out of \$560,000.
- 09/2007-09/2010, Department of Energy--Analysis of global economic and environmental impacts of a substantial increase in bioenergy production (PI in collaboration with Wally Tyner and Tom Hertel), \$209,900 out of \$659,783.
- 09/2007-09/2010, NASA Earth System Science Fellowship: Improving a process-based biogeochemistry model using an atmospheric transport chemistry model and in-situ and remotely-sensed terrestrial and atmospheric data --- Mr. Jinyun Tang, \$84,000.
- 01/2007-12/2011, NSF Biocomplexity - Carbon and Water in the Earth System: Collaborative Research: Impact of Permafrost Degradation on Carbon and Water in Boreal Ecosystems. Lead PI with Jennifer Harden, Robert Striegl, Yuri Shur, and Torre Jorgenson. Award amount: \$756,578 out of \$1,693,883.
- 08/2005-09/2008, NSF - Collaborative Research: Synthesis of Arctic System Carbon Cycle Research through Model-Data Fusion Studies Using Atmospheric Inversion and Process-Based Approaches. PI with Dave McGuire, Jerry Melillo, and Michael Follows. Award amount: \$245,883 out of \$1,179,591.
- 01/2006-01/2008, NSF - National Center for Ecological Analysis and Synthesis (NCEAS). Toward an Adequate Quantification of CH₄ Emissions from Land Ecosystems: Integrating Field and In-situ Observations, Satellite Data, and Modeling. Lead PI with Jerry Melillo, Ron Prinn, and Dave McGuire. Award Amount: \$103,350.
- 01/2007-12/2007, The Energy Center, Discovery Park, Purdue University - Global Biomass and Bioenergy Supply in a Coupled Natural and Human System. Lead PI with Wally Tyner. Award amount: \$50,000.
- 01/2007-12/2007, The Center for Environment, Purdue University - Quantifying Carbon Sequestrations across Indiana's Forest Landscapes. PI with Guofan Shao, Phillip Pope, Charles Michler, Melba Crawford. Award amount: \$30,000.

- 1997, Award of the Excellence (First Place) of Advances of Science and Technology of China for the project "The Scientific Database and Management Systems", Beijing, P. R. China.

Professional Experience

- 2010- Present: Associate Professor, Departments of Earth & Atmospheric Sciences and Agronomy, Purdue University, West Lafayette, IN
- 2005- 2010: Assistant Professor, Departments of Earth & Atmospheric Sciences and Agronomy, Purdue University, West Lafayette, IN
- 2001- 2005: Post-Doctoral Scientist, the Ecosystems Center of Marine Biological Laboratory, Woods Hole, MA; Associate Professor,(January-June 2005), Institute of Atmospheric Sciences, South Dakota School of Mines and Technology
- 1997- 2001: Research Assistant, Department of Biology and Wildlife, the Institute of Arctic Biology, University of Alaska at Fairbanks
- 1988-1997: Research Assistant in the Institute of Botany, Chinese Academy of Sciences, Beijing, P. R. China, System Engineer and Analyst, the information Center of Ministry of Personnel of P. R. China

Selected Publications

- Zhuang Q., J. He, Y. Lu, L. Ji, J. Xiao, T. Luo, Carbon dynamics of terrestrial ecosystems on the Tibetan Plateau during the 20th century: an analysis with a process-based biogeochemical mode, *Global Ecology and Biogeography*,19,5, 649-662,2010. DOI: 10.1111/j.1466-8238.2010.00559.x.
- McGuire, A.D., D.J. Hayes, D.W. Kicklighter, M. Manizza, Q. Zhuang, M. Chen, M. J. Follows, K. R. Gurney, J. W. McClelland, J. M. Melillo, B. J. Peterson, and R. G. Prinn, An analysis of the carbon balance of the Arctic Basin from 1997 to 2006, *Tellus*, DOI: 10.1111/j.1600-0889.2010.00497.x.
- Lu, X., and Q. Zhuang, Evaluating evapotranspiration and water-use efficiency of terrestrial ecosystems in the conterminous United States using MODIS and AmeriFlux data, *Remote Sensing of Environment*, 114, 9, 1924-1939, DOI: 10.1016/j.rse.2010.04.001.
- Xiao, J., Q. Zhuang, D. D. Baldocchi, B. E. Law, A. D. Richardson, J. Chen, R. Oren, G. Starr, A. Noormets, S. Ma, S. B. Verma, S. Wharton, S. C. Wofsy, P V. Bolstad, S. P. Burns, D. R. Cook, P. S. Curtis, B. G. Drake, M. Falk, M. L. Fischer, D. R. Foster, L. Gu, J. L. Hadley, D. Y. Hollinger, G. G. Katul, M. Litvak, T. A. Martin, R. Matamala, S. McNulty, T. P. Meyers, R. K. Monson, J. W. Munger, W. C. Oechel, K. T. Paw U, H. P. Schmid, R. L. Scott, G. Sun, A. E. Suyker, M. S. Torn, (2010). A Continuous Measure of Gross Primary Productivity for the Conterminous U.S. Derived from MODIS and AmeriFlux Data, *Remote Sensing of Environment* 114, 576-591.

- Lu, X. and Q. Zhuang (2010), Evaluating climate impacts on carbon balance of the terrestrial ecosystems in the Midwest of the United States with a process-based ecosystem model, *Mitigation and Adaptation Strategies for Global Change*, 15, 5, 467-487, 10.1007/s11027-010-9228-z.
- Ping, X., G. Zhou, Q. Zhuang, Y. Wang, W. Zuo, G. Shi, X. Lin and Y. Wang, (2010). Effects of sample size and position from monolith and core methods on the estimation of total root biomass in a temperate grassland ecosystem in Inner Mongolia. *Geoderma* 155(3-4): 262-268.
- Xu, K., , C. Kong, , G. Liu, , C. Wu, , H. Deng, , Y. Zhang , and Q. Zhuang, Changes of urban wetlands in Wuhan, China, from 1987 to 2005, *Progress in Physical Geography* 2010 34: 207-220.
- Tang, J., and Q. Zhuang (2009), A global sensitivity analysis and Bayesian inference framework for improving the parameter estimation and prediction of a process-based Terrestrial Ecosystem Model, *J. Geophys. Res.*, 114, D15303, doi:10.1029/2009JD011724.
- Jiang Y., Zhuang Q., Flannigan M. D., Little J. M. (2009), Characterization of wildfire regimes in Canadian boreal terrestrial ecosystems. *International Journal of Wildland Fire* 18, 992-1002. doi:10.1071/WF08096.
- Lu, Y., Q. Zhuang, G. Zhou, A. Sirin, J. Melillo and D. Kicklighter (2009) Possible decline of the carbon sink in the Mongolian Plateau during the 21st century, *Environ. Res. Lett.* 4 045023 (8pp) doi: 10.1088/1748-9326/4/4/045023 <<http://dx.doi.org/10.1088/1748-9326/4/4/045023>>.
- Xiao, J., Q. Zhuang, E. Liang, A.D. McGuire, A. Moody, D.W. Kicklighter, X. Shao, and J.M. Melillo, 2009: Twentieth-Century Droughts and Their Impacts on Terrestrial Carbon Cycling in China. *Earth Interactions*, 13, 1-31.
- Zhuang, Q., J. M. Melack, S. Zimov, K. M. Walter, C. L. Butenhoff, and M. A. K. Khalil, (2009), Global methane emissions from wetlands, rice paddies, and lakes, *Eos*, 90(5), 37-38.
- Zhuang, Q., J. M. Melack, S. Zimov, K. M. Walter, C. L. Butenhoff, and M. A. K. Khalil (2009), Correction to "Global methane emissions from wetlands, rice paddies, and lakes",

Eos Trans. AGU, 90(11), doi:10.1029/2009EO110019.

- Tang, J., and Q. Zhuang (2008), Equifinality in parameterization of process-based biogeochemistry models: A significant uncertainty source to the estimation of regional carbon dynamics, *J. Geophys. Res.*, 113, G04010, doi:10.1029/2008JG000757.
- Xiao, J., Zhuang, Q., D.D. Baldocchi, B.E. Law, A.D. Richardson, J. Chen, R. Oren, G. Starr, A. Noormets, S.Ma, S.B. Verma, S. Wharton, S.C. Wofsy, P.V. Bolstad, S.P. Burns, D.R. Cook, P.S. Curtis, B.G. Drake, M. Falk, M.L. Fischer, D.R. Foster, L. Gu, J.L. Hadley, D.Y. Hollinger, G.G. Katul, M. Litvak, T.A. Martin, R. Matamala, S. McNulty, T.P. Meyers, R.K. Monson, J.W. Munger, W.C. Oechel, K.T. Paw U, H.P. Schmid, R.L. Scott, G. Sun, A.E. Suyker, M.S. Torn, 2008. Estimation of net ecosystem carbon exchange for the conterminous United States by combining MODIS and AmeriFlux data. *Agricultural and Forest Meteorology*, 148 (11), 1827-1847.
- Zhuang, Q. , T. Zhang, J. Xiao, and T. Luo, Quantification of Net Primary Production of Chinese Forest Ecosystems with Spatial Statistical Approaches, *Mitigation and Adaptation Strategies for Global Change*, DOI 10.1007/s11027-008-9152-7, 2008.
- Zhuang, Q., and W. S. Reeburgh, Introduction to special section on Synthesis of Recent Terrestrial Methane Emission Studies, *J. Geophys. Res.*, 113, G00A02, doi:10.1029/2008JG000749, 2008.
- Xiao, J., and Q. Zhuang, Drought effects on large fire activity in Canadian and Alaskan forests, *Environ. Res. Lett.* 2 044003 (6pp) doi:10.1088/1748-9326/2/4/044003, 2007.
- Balshi M.S., A.D. McGuire, Q. Zhuang, J.M. Melillo, D.W. Kicklighter, E. Kasischke, C. Wirth, M. Flannigan, J. Harden, J.S. Clein, T.J. Burnside, J. McAllister, W.A. Kurz, M. Apps, and A. Shvidenko, The role of historical fire disturbance in the carbon dynamics of the pan-boreal region: A process-based analysis. *J. Geophys. Res.*, 112, G02029, 2007.
- Zhuang, Q., J. M. Melillo, A. D. McGuire, D. W. Kicklighter, R. G. Prinn, P. A. Steudler, B. S. Felzer, and S. Hu, Net emissions of CH₄ and CO₂ in Alaska: implications for the region's greenhouse gas budget , *Ecological Applications: Vol. 17, No. 1*, pp. 203-212, 2007.
<http://web.ics.purdue.edu/%7Eqzhuang/Dr_%20Qianlai%20Zhuang_files/Zhuang%20et%20al-EA-2007.pdf>
- Sitch, S., A.D. McGuire, J. Kimball, N. Gedney, J. Gamon, R. Rengstrom, A. Wolf, Q. Zhuang, J. Clein, and K. C. McDonald, Assessing the carbon balance of circumpolar arctic tundra using remote sensing and process modeling, *Ecological Applications*, 17 (1), 2007, 213-234, 2007.

- Zhuang, Q., J. M. Melillo, M. C. Sarofim, D. W. Kicklighter, A. D. McGuire, B. S. Felzer, A. Sokolov, R. G. Prinn, P. A. Steudler, and S. Hu, CO₂ and CH₄ exchanges between land ecosystems and the atmosphere in northern high latitudes over the 21st century, *Geophys. Res. Lett.*, 33, L17403, doi:10.1029/2006GL026972, 2006.
- Euskirchen, E.S., A.D. McGuire, D.W. Kicklighter, Q. Zhuang, J.S. Clein, R.J. Dargaville, D.G. Dye, J.S. Kimball, K.C. McDonald, J.M. Melillo, V.E. Romanovsky, N.V. Smith, Importance of recent shifts in soil thermal dynamics on growing season length, productivity, and carbon sequestration in terrestrial high-latitude ecosystem, *Global Change Biology*, 12, 731-750, doi:10.1111/j.1365-2486.2006.01113.x, 2006.
- Felzer B., J. Reilly, J. Melillo, D. Kicklighter, C. Wang, R. Prinn, M. Sarofim, Q. Zhuang, Past and future effects of ozone on net primary production and carbon sequestration using a global biogeochemical model, *Climatic Change* 73:345-373, doi:10.1007/S10584-005-6776-4, 2005.
- Zhuang, Q., J. M. Melillo, D. W. Kicklighter, R. G. Prinn, D. A. McGuire, P. A. Steudler, B. S. Felzer, and S. Hu, Methane fluxes between terrestrial ecosystems and the atmosphere at northern high latitudes during the past century: A retrospective analysis with a process-based biogeochemistry model, *Global Biogeochemical Cycles*, 18, GB3010, doi:10.1029/2004GB002239, 2004.
- Felzer B., D. Kicklighter, J. Melillo, C. Wang, Q. Zhuang, and R. Prinn, Ozone effects on net primary production and carbon sequestration in the conterminous United States using a Biogeochemistry Model. *Tellus* 56B, 230-248, 2004.
- Zhuang, Q., A. D. McGuire, J. M. Melillo, J. S. Clein, R. J. Dargaville, D. W. Kicklighter, R. B. Myneni, J. Dong, V. E. Romanovsky, J. Harden, and J. E. Hobbie, Carbon cycling in extratropical terrestrial ecosystems of the Northern Hemisphere during the 20th Century: A modeling analysis of the influences of soil thermal dynamics, *Tellus*, 55B, 751-776, 2003.
- Zhuang, Q., A. D. McGuire, K. P. O'Neill, J. W. Harden, V. E. Romanovsky, J. Yarie. Modeling the soil thermal and carbon dynamics of a fire chronosequence in Interior Alaska, *J. Geophys. Res.*, 107, 8147, doi:10.1029/2001JD001244, 2002. [Printed 108(D1), 2003].
- Zhuang, Q., V. E. Romanovsky, A. D. McGuire, Incorporation of a permafrost model into a large-scale ecosystem model: Evaluation of temporal and spatial scaling issues in simulating soil thermal dynamics, *J. Geophys. Res.*, 106, D24, 33,649-33,670, 2001.