
BIOGRAPHICAL SKETCH

NAME: Julian David Marshall

eRA COMMONS USER NAME (credential, e.g., agency login): JULIANM

POSITION TITLE: Professor of Civil and Environmental Engineering

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date	FIELD OF STUDY
Princeton University, Princeton, NJ	B.S.E.	05/1996	Chemical Engineering
University of California Berkeley, Energy and Resources Group	M.S.	05/2002	Air pollution exposure assessment
University of California Berkeley, Energy and Resources Group	Ph.D.	05/2005	Air pollution exposure assessment
University of British Columbia, School of Environmental Health	Post-doctoral Fellow	12/2006	Air pollution epidemiology

A. Personal Statement

My expertise is in air pollution exposure assessment. I develop, compare, and apply models and measurements to understand spatial and temporal variability in pollutant concentrations. My education and training provides a background in the chemistry and physics of air pollution (BSE in Chemical Engineering), in exposure modeling (MS and PhD), and in spatial statistical methods for epidemiology (Post-doctoral Fellowship). I have used and implemented standard (e.g., CMAQ and WRF-Chem CTM) and novel chemical transport models for air pollutants incorporating meteorology, atmospheric chemistry, and physics principles. I have developed and compared multiple land-use regression models, including national and continental-scale models for the U.S., Europe, and Australia. Via those projects, I developed methods for including chemical transport models and satellite data into national and continental-scale models. I also have identified methods for incorporating temporal variability into national models, in ways that are computationally feasible yet preserve important spatiotemporal information in the input data. Recent additions to my research focus including investigations on the impact of the shape of the concentration-response curve for exposures to air pollution. I collaborate with epidemiological researchers, including Dr. Kaufman's group, to incorporate these novel approaches in their research. My background and research experience in air pollution exposure modeling will allow me to serve as a key consultant on this important project focusing on providing guidance on the incorporation of satellite-based information and chemical transport modeling into spatio-temporal models and into epidemiological research in general. I look forward to continued collaboration with Dr. Kaufman's group, especially as I recently have joined the faculty of the University of Washington.

1. Novotny EV, Bechle MJ, Millet DB, **Marshall JD**. National Satellite-based Land-use Regression: NO₂ in the United States. *Environmental Science & Technology*, 2011. 45(10), 4407–4414. PMID: 21520942
2. Vienneau D, de Hoogh K, Bechle MJ, Beelen R, van Donkelaar A, Martin RV, Millet DB, Hoek G, **Marshall JD**. Western European Land Use Regression Incorporating Satellite- and Ground-based Measurements of NO₂ and PM₁₀. *Environmental Science & Technology*, 2013. 47(23), 13555–13564. PMID: 24156783
3. **JD Marshall**, JS Apte, JS Coggins, AL Goodkind, "Blue skies bluer?," *Environmental Science & Technology*, 49(24), 13929–13936, (2015).
4. JS Apte, **JD Marshall**, AJ Cohen, M Brauer, "Addressing global mortality from ambient PM_{2.5}," *Environmental Science & Technology*, 49(13), 8057–8066, (2015).

B. Positions and Honors

Positions

1995	Environmental Security Intern, The Pentagon, Washington, DC.
1996-1998	Air Sciences Consultant. Environ Corporation, Emeryville, CA.
1998-1999	Lecturer and International Fellow, Chemical Technologies Department, Temasek Polytechnic, Singapore.
1999	Volunteer, Ladakh Ecological Development Group, Kashmir, India.
2000-2005	Graduate Student, University of California, Berkeley, CA.
2001-2005	Graduate Student Researcher, Lawrence Berkeley National Laboratory, Berkeley, CA.
2001-2005	Independent Contract Researcher, Berkeley, CA. Designed and performed contract research on energy and the environment, including health risk assessments. Clients: California Air Resources Board (Sacramento, California), Environmental Defense Fund (Oakland, California), United Nations University (Tokyo, Japan), and the United States Agency for International Development (Jakarta, Indonesia).
2005-2006	Post-doctoral Research Fellow, University of British Columbia, Vancouver, BC.
2007-2013	Assistant Professor, Department of Civil, Environmental, and Geo- Engineering, University of Minnesota, Minneapolis, MN
2010-2011	Visiting Researcher, Centre de Recerca en Epidemiologia Ambiental [CREAL], Barcelona, Spain; focus: spatiotemporal variability of air pollution, interactions between air pollution and physical activity.
2013-2016	Associate Professor, Department of Civil, Environmental, and Geo- Engineering, University of Minnesota, Minneapolis, MN
2014	Visiting Researcher, UC Berkeley, CA; focus: air pollution impacts of transportation.
2016-	Professor, Department of Civil and Environmental Engineering, University of Washington

Honors

2000-2003	Graduate Research Fellowship, National Science Foundation (NSF).
2003-2004	Dissertation Fellowship, U.C. Transportation Center.
2003-2005	Fellowship, U.C. Toxic Substances Research & Teaching Program.
2005	Outstanding Graduate Student Instructor Award, U.C. Berkeley. Award states: "Each year, fewer than 10% of GSIs earn this distinguished award"
2005-2006	Post-doctoral research fellowships from the School of Environmental Health and from the Bridge Program in engineering, policy, and health, UBC.
2009	Young Engineer of the Year, American Society of Civil Engineers, Minnesota Section.
2009-2011	McKnight Land-Grant Professorship, UMN.
2013	Joan M. Daisey Outstanding Young Scientist Award, International Society of Exposure Science.
2014	C. Eugene Allen Award for Innovative International Initiatives (awarded to the Acara program), UMN.
2014	Charles E. Bowers Teaching Award, UMN.
2016-present	Keily Professor of Environmental Engineering, UW.

- One article (Marshall and Toffel, 2005) on the "most downloaded" list from *Environmental Science & Technology*
- Two articles (Marshall, McKone, et al., 2005; Marshall, Nethery, et al., 2008) on the "most downloaded" list from *Atmospheric Environment*
- One article (Ji et al., 2012) on the "most read" list from *Environmental Science & Technology*

C. Contribution to Science

(1) Development of national- and continental-scale land-use regression models, including using satellite observations.

Land use regression was previously developed at smaller spatial scale (generally, urban-scale or so) and required direct measurement of air pollution concentrations via a fieldwork campaign. This work took advantage of two aspects: that the Environmental Protection Agency is already measuring concentrations throughout the country; and satellite data shed light on air pollution concentrations at a ~10km scale and with

complete national coverage. The core finding is that a national scale model works well, providing robust spatiotemporal estimates of criteria pollutants. Three citations are given above (section A).

1. M Young, M Bechle, P Sampson, A Szpiro, **JD Marshall**, L Sheppard, J Kaufman. Satellite-based NO₂ and model validation in a national prediction model based on universal Kriging and land-use regression. *Environmental Science & Technology*, 2016. 50(7), 3686-3694.
2. Tessum CW, Hill JD, and **Marshall JD**. Twelve-month, 12 km resolution North American WRF-Chem v3. 4 air quality simulation: performance evaluation. *Geoscientific Model Development*. 2015: 8, 957-973.
3. Chan SH, Van Hee VC, Bergen, S, Szpiro, AA, DeRoo AL, London SJ, **Marshall JD**, Kaufman JD, Sandler DP. Long-term air pollution exposure and blood pressure in the Sister Study. *Environmental Health Perspectives* 2015;123:951-8. PMID: PMC4590742
4. Novotny EV, Bechle MJ, Millet DB, **Marshall JD**. National Satellite-based Land-use Regression: NO₂ in the United States. *Environmental Science & Technology*, 2011. 45(10), 4407–4414. PMID: 21520942

(2) Air pollution – Understanding the impacts of the shape of the concentration-response curve

The largest U.S. environmental health risk is cardiopulmonary mortality from ambient PM_{2.5}. Prior research has indicated uncertainty surrounding the shape of the concentration-response curve for exposure to ambient air pollutants. Our research shows that the impact of the defining this shape (e.g., linear, supra-linear) will be impactful for informing abatement policies in the US and globally.

1. **JD Marshall**, JS Apte, JS Coggins, AL Goodkind, Blue skies bluer? *Environmental Science & Technology*, 49(24), 13929–13936, (2015).
2. AL Goodkind, JS Coggins, **JD Marshall**. A spatial model of air pollution: the impact of the concentration-response function. *Journal of the Association of Environmental and Resource Economists*, 1, 451–479, (2014).
3. JS Apte, **JD Marshall**, AJ Cohen, M Brauer. Addressing global mortality from ambient PM_{2.5}. *Environmental Science & Technology*, 49(13), 8057–8066, (2015).

(3) Air pollution –related health impacts of electric vehicles and biofuels, including life cycle analysis

Prior research on environmental impacts of alternative transportation modes focused on climate impacts from vehicle and fuel life cycles. Research on air pollution considered tailpipe emissions only, not the entire life cycle. We employed advanced life cycle modeling, and state-of-the-science air dispersion modeling. Our results showed the electric vehicles are better than conventional vehicles when powered by clean electricity (natural gas; renewables) but not when powered by coal. Because of the large energy demands associated with growing biofuel crops (running tractors, fertilizing crops, refining crops into fuels), conventional biofuels are worse for air pollution and health than are conventional fuels.

1. Ji S, Cherry C, Bechle MJ, Wu Y, **Marshall JD**. Electric Vehicles in China: Emissions and Health Impact. *Environmental Science & Technology*, 2012. 46(4), 2018–2024.
2. Tessum CW, **Marshall JD**, Hill JD. Life Cycle Air Quality Impacts of Conventional and Alternative Light-Duty Transportation in the United States. *Proceedings of the National Academy of Sciences*, 2014. 111(52), 18490–18495. PMID: PMC4284558
3. Tessum CW, Hill JD, **Marshall JD**. Twelve-Month, 12 km Resolution North American WRF-Chem Air Quality Simulation: Performance Evaluation. *Geoscientific Model Development*, 2015. 8, 957–973.
4. Tessum CW, **Marshall JD**, Hill JD. Spatially Resolved Life Cycle Greenhouse Gas and Aerosol Emissions from Gasoline, Ethanol, and Electric Vehicles in the United States. In review.

(4) Environmental justice aspects of air pollution

A substantial body of research documents disparities in exposures and risks, and highlights how those disparities correlate with demographic attributes such as race, income, and educational status. Our research advanced prior work by (1) documenting national patterns in exposure disparities (prior research on exposure disparities was generally for one city or region) and (2) evaluating emission-reduction strategies in terms of

their ability to improve disparities (prior research documents the disparities rather than investigating potential opportunities for improvement).

1. **Marshall JD**. Environmental Equality: Air Pollution Exposures in California's South Coast Air Basin. *Atmospheric Environment*, 2008. 42(21), 5499–5503.
2. Clark LP, Millet DB, **Marshall JD**. National Patterns in Environmental Injustice and Inequality: Outdoor NO₂ Air Pollution in the United States. *PLOS One*, 2014. 9(4), e94431.
3. **Marshall JD**, Swor KR, Nguyen NP. Prioritizing Environmental Justice and Equality: Diesel Particles in California's South Coast. *Environmental Science & Technology*, 2014. 48(7), 4063–4068.
4. Nguyen NP, **Marshall JD**. Improving Environmental Justice by Focusing on Emission Location. In review.

(5) Air pollution impacts of urban form

An important question when designing healthy, sustainable cities is whether urban design and urban form – for example, sprawl versus infill – can help improve air pollution and environmental health. Prior work is based mainly on modeling; our work breaks new ground by considering empirical approaches to this question. Specifically, we look cross-sections of many U.S. and global cities to explore correlations between urban form and air pollution, and to see how changes in urban form correlate with changes in air pollution. These investigations make use of satellite imagery, to understand urban growth over time, and satellite-based measurements of urban air pollution. We have shown, for example, that more-contiguous urban growth (i.e., the opposite of “patchy” / “leap-frog” development) and population centrality (i.e., more people living near the urban core) are correlated with better air pollution.

1. **Marshall JD**, McKone TE, Deakin EA, Nazaroff WW. Inhalation of Motor Vehicle Emissions: Effects of Urban Population and Land Area. *Atmospheric Environment*, 2005. 39(2), 283–295.
2. Clark LP, Millet DB, **Marshall JD**. Air Quality and Urban Form in U.S. Urban Areas: Evidence from Regulatory Monitors. *Environmental Science & Technology*, 2011. 45(16), 7028–7035.
3. Bechle MJ, Millet DB, **Marshall JD**. Effects of Income and Urban Form on Urban NO₂: Global Evidence from Satellites. *Environmental Science & Technology*, 2011. 45(11), 4914–4919.
4. Hankey S, **Marshall JD**, Brauer M. Health Impacts of the Built Environment: Within-urban Variability in Physical Inactivity, Air Pollution, and Ischemic Heart Disease Mortality. *Environmental Health Perspectives*, 2012. 120(2), 247–253. PMID: PMC3279444

D. Research Support

Current Research

1444745 NSF 8/1/2015-7/31/2019

PIs: Ramaswami, Russell, Fan, Orlove, Culligan

SRN: Integrated Urban Infrastructure Solution for Environmentally Sustainable, Healthy and Livable Cities

Objective: multi-university research network on sustainable cities.

R835873 US EPA 4/2016-3/2021

Center Co-Directors: Robinson, Marshall

Center for Air, Climate, and Energy Solutions

Objective: Investigate regional differences, multiple pollutants, and development and dissemination of tools for addressing air quality & climate. This is a major multi-project center grant

Status: recommended for funding

336167 European Research Council 1/1/2015-12/31/2018

PI: Tonne

Cardiovascular Health Effects of Particulate Air Pollution in Andhra Pradesh, India

Objective is to quantify the association between exposure to air pollution and biomarkers of cardiovascular disease. Exposure estimates are derived from models and measurements.

R835421 US EPA 3/1/2014-8/31/2018

Experimental Interventions to Facilitate Clean Cookstove Adoption, Promote Clean Indoor Air, and Mitigate Climate Change

PIs: Bailis, Dwivedi, Grieshop, Marshall, Talshery, Unger, Zerriffi, Chandar

Objective is in situ measurement of emissions from a cook stoves change-out in rural India.

Previous Grants (last 3 years)

1236800

NSF

1/1/2013-12/31/2015

PI: Marshall, Millet

Air Pollution, Environmental Justice, and Urban Form

Objective is to use panel data (time series data for many cities) to explore empirical evidence of how changes in urban form relate to air pollution and environmental justice. Pollution estimates are from nationwide satellite-based land-use regression models.

Global Programs and Strategies Alliance, U of Minnesota

2012-2014

PI: Marshall

Urbanization and Exposure to Air Pollution (Hyderabad, India)

Objective is to measure air pollution in communities along a rural-to-urban gradient in and around Hyderabad, India to explore the effect of urbanization on air pollution.

UMN Institute for Renewable Energy and the Environment

2009-2014

PIs: Marshall, Hill

Air Pollution Impacts of Conventional and Alternative Fuels: A Spatial and Temporal Life Cycle Analysis Decision Support Tool

Objective is to compare air pollution and health impacts of fossil fuels versus bio-fuels, considering the lifecycle of fuels (production plus consumption) and environmental justice (how pollution exposures change for specific groups).

Canadian Institutes of Health Research (CIHR)

2009-2014

PI: Brauer

The Bridge Program: CIHR Strategic Training Program Bridging Public Health, Engineering and Policy Research

Objective is interdisciplinary training program in environment and health, University of British Columbia.