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 modeling exposures (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 have extensive experience measuring air pollution concentrations in low-income countries: outdoors, indoors, and personal exposures. As PI on multiple studies, I have designed and overseen field campaigns to measure concentrations of PM2.5, black carbon, CO, and CO2 in hundreds of households in India, Uganda, and Indonesia. These measurements were part of air pollution intervention studies and epidemiological studies. I have conducted multiple field campaigns measuring in-vehicle concentrations in India and Indonesia (and the U.S.). My work includes measurements in urban and rural locations, and in higher- and lower-income communities within developing countries. I have used a variety of devices to measure real-time and time-integrated concentrations, and have led studies where local field staff are trained to execute monitoring. I collaborate with epidemiological researchers, including Dr. Kaufman's group, to incorporate novel exposure assessment approaches in their epidemiological 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 understanding chronic lung disease in HIV infected patients in Nairobi, Kenya, where careful measurement of pollutant exposures will be critical to the results. I am well suited to collaborate with Dr. Kaufman in providing expertise in pollution exposure assessment for this project.

1. TW Aung, G Jain, K Sethuraman, J Baumgartner, C Reynolds, AP Grieshop, **JD Marshall**, M Brauer. Health and climate-relevant pollutant concentrations from a carbon-finance approved cookstove intervention in rural India. Environmental Science & Technology. 2016, DOI: 10.1021/acs.est.5b06208.

2. JS Apte, TW Kirchstetter, AH Reich, SJ Deshpande, G Kaushik, A Chel, **JD Marshall**, WW Nazaroff. Concentrations of fine, ultrafine, and black carbon particles in auto-rickshaws in New Delhi, India. Atmospheric Environment. 2011, 45(26), 4470–4480.
3. AF Both, A Balakrishnan, B Joseph, **JD Marshall**. Spatiotemporal aspects of real-time PM2.5: low- and middle-income neighborhoods in Bangalore, India. Environmental Science & Technology. 2011, 45(13), 5629–5636.
4. AF Both, D Westerdahl, S Fruin, B Haryanto, **JD Marshall**. Exposure to carbon monoxide, fine particle mass, and ultrafine particle number in Jakarta, Indonesia: effect of commute mode. Science of the Total Environment. 2013, 443, 965–972.

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	Kiely Professorship in 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. MT Young, MJ Bechle, PD Sampson, AA Szpiro, **JD Marshall**, L Sheppard, JD 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. Environ Health Perspect 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 PM2.5. 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 PM2.5," 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. PMCID: 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) Fieldwork measurements of air pollution in low-income countries

An important challenge in environmental health is accurate and reliable measurement of air pollution concentrations in low-income settings globally. I have carried out field measurements in challenging environments for monitoring, including in indoor and in-vehicles environments, and in rural locations. Our work breaks new ground by rigorously testing equipment in these challenging environments, and documenting steps needed to ensure measurements are robust and trustworthy.

Citations: the citations above (top of page 1 / bottom of page 2) plus these:

1. H Vreeland, JJ Schauer, AG Russell, **JD Marshall**, A Fushimi, G Jain, K Sethuraman, SN Tripathi, MH Bergin. Chemical characterization and toxicity of Particulate Matter emissions from roadside trash combustion in Urban India. Submitted.
2. C Norris, MS Goldberg, **JD Marshall**, MF Valois, T Pradeep, M Narayanswamy, G Jain, K Sethuraman, J Baumgartner. A panel study of the acute effects of personal exposure to household air pollution on ambulatory blood pressure in rural Indian women. Environmental Research. 2016, 147, 331-342.
3. L Dekoninck, D Botteldooren, L Int Panis, S Hankey, G Jain, K Sethuraman, **JD Marshall**. Applicability of a noise-based model to estimate in-traffic exposure to black carbon and particle number concentrations in different cultures. Environment International. 2015, 74, 89–98.
4. S Hankey, K Sullivan, A Kinnick, A Koskey, K Grande, JH Davidson, **JD Marshall**. Using objective measures of stove use and indoor air quality to evaluate a cookstove intervention in rural Uganda. Energy for Sustainable Development. 2015, 25, 67–74.

Full list of published and submitted articles (more than 65 published articles), including with web-links to the articles: https://depts.washington.edu/airqual/publications.php

D.   Additional Information: Research Support and/or Scholastic Performance

SRN: Integrated Urban Infrastructure Solution for Environmentally Sustainable, Healthy and Livable Cities
Objective: multi-university research network on sustainable cities.

US EPA, 2016-2021
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   3/1/2014-2/28/2017
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.

Discovery Grant, Institute on the Environment, University of Minnesota   2011-2013
PI: Marshall
Stove Change-Out: A 'Win-Win-Win' for Development, Environment, and Health?
Objective is to measure air pollution and health impacts of a stove change-out in rural India, while exploring opportunities for financially sustainable businesses.

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.

2011066   SLPP TechPlan, ITS Institute, University of Minnesota   1/1/2011-5/31/2012
PI: Fan
Smartphone-Based Travel Experience Sampling (UbiHappy Phase I): Transportation, Health, and Happiness
Objective is to develop a smartphone application prototype to investigate travel behavior patterns and travel-related health and well-being impacts.