

# Scott N. Spak

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## PROFESSIONAL INTERESTS

Urban-scale human & Earth systems modeling for policy & planning applications; scientific, social, and policy challenges to global resilience; interactions between climate, atmospheric chemistry & energy systems; innovative methods for STEM education & outreach on policy & planning

## EDUCATION

**University of Wisconsin-Madison**                      PhD, Atmospheric & Oceanic Sciences, 2009  
*George W. Bunn Wisconsin Distinguished Fellow, 2004-2005*  
Graduate certificates in Energy Analysis & Policy, Air Resources Management,  
Delta Certificate in Research, Teaching & Learning  
**Dartmouth College**                                      AB, Engineering Sciences, 2000

## ACADEMIC APPOINTMENTS

### University of Iowa

2011 –              Assistant Professor, Urban & Regional Planning  
Assistant Professor, Civil & Environmental Engineering  
Assistant Director, Environmental Policy Research, Public Policy Center

2010 – 2011      Assistant Research Scientist,  
Center for Global & Regional Environmental Research  
Assistant Research Engineer, IIHR Hydroscience & Engineering

2008 – 2010      Postdoctoral Research Scholar,  
Chemical & Biochemical Engineering

### University of Wisconsin-Madison

2003 – 2008      Graduate Research Assistant,  
Center for Sustainability and the Global Environment

## PUBLICATIONS

\*graduate, undergraduate and postdoctoral advisees, student research advised closely as a committee member or supervised as a research scientist

**Submitted, Accepted, or In Press**

Y.J. Kim\*, S.N. Spak, G.R. Carmichael, N. Riemer, C.O. Stanier. Aerosol nitrate formation pathways during wintertime episodes in the Great Lakes region of North America, *Journal of Geophysical Research-Atmospheres*, in review.

J.S. Bril\*, C.L. Just, S.N. Spak, T.J. Newton. Increased nitrite concentration in continuous-flow mesocosms containing native freshwater mussels, *Environmental Engineering Science*, in review.

Y. Hu, M.T. Odman, P. Lee, D. Tong, S.N. Spak, A.G. Russell. Air quality forecasting: current approaches and applications. *EM*, in review.

M.C. Wyant, C.S. Bretherton, R. Wood, G.R. Carmichael, A. Clarke, J. Fast, R. George, W.I. Gustafson, C. Hannay, A. Lauer, Y. Lin, J.-J. Morcrette, J. Mulcahy, P.E. Saide\*, S.N. Spak, Q. Yang. Global and regional modeling of clouds and aerosols in the marine boundary layer during VOCALS: The VOCA Intercomparison. *Atmospheric Chemistry & Physics*, submitted.

P.E. Saide\*, S.N. Spak, R.B. Pierce, J.A. Otkin, T. Schaack, A. Heidinger, A. M. da Silva, M. Kacenelenbogen, J. Redemann, G.R. Carmichael. Central American biomass burning smoke can increase tornado severity in the US, submitted.

**Published Works**

2013

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24. N.T. Petrich\*, S.N. Spak, G.R. Carmichael, D. Hu, A. Martinez, K.C. Hornbuckle (2013). Simulating and explaining passive air sampling rates for semi-volatile compounds on polyurethane foam passive samplers, *Environmental Science & Technology* 47 (15), 8591–8598, doi: 10.1021/es401532q.

23. G.R. Carmichael, S. Kulkarni, Y.F. Cheng, V. Ramanathan, S.N. Spak (2013). Short-lived climate forcing agents and their roles in climate change, *Procedia-Social and Behavioral Sciences* 77, 227–236, doi:10.1016/j.sbspro.2013.03.082.

22. C.H. Twohy, J.R. Anderson, D.W. Toohey, M. Andrejczuk, A. Adams, M. Lytle, R.C. George, R. Wood, P. E. Saide\*, S.N. Spak, P. Zuidema, D. Leon (2013). Impacts of aerosol particles on the microphysical and radiative properties of stratocumulus clouds over the southeast Pacific ocean, *Atmospheric Chemistry & Physics* 13, 2541-2562, doi:10.5194/acp-13-2541-2013.

21. M. Huang\*, G.R. Carmichael, T. Chai, R.B. Pierce, S.J. Oltmans, D.A. Jaffe, K.W. Bowman, A. Kaduwela, C. Cai, S.N. Spak, A.J. Weinheimer, L.G. Huey, G.S. Diskin (2013). Impacts of transported background pollutants on summertime western US air quality: model evaluation, sensitivity analysis and data assimilation, *Atmospheric Chemistry & Physics* 13, 359-391, doi:10.5194/acp-13-359-2013.

2012

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20. C. Stanier, A. Singh, W. Adamski, J. Baek, M. Caughey, G. Carmichael, E. Edgerton, D. Kenski, M. Koerber, J. Oleson, T. Rohlif, S.R. Lee, N. Riemer, S. Shaw, S. Sousan, S.N. Spak (2012). Overview of the LADCO winter nitrate study: Hourly ammonia, nitric acid and PM<sub>2.5</sub> composition at an urban and rural site pair during PM<sub>2.5</sub> episodes in the U.S. Great Lakes region, *Atmospheric Chemistry &*

- Physics* 12, 11037-11056, doi: 10.5194/acp-12-11037-2012.
19. C.C. Tsao, J.E. Campbell, M.A. Mena-Carrasco, S.N. Spak, G.R. Carmichael, Y. Chen (2012). Biofuels that cause land-use change may have much larger non-GHG air quality emissions than fossil fuels, *Environmental Science & Technology* 46, 10835–10841, doi:10.1021/es301851x.
  18. T. Holloway, C. Voigt, J. Morton, S.N. Spak, A.P. Rutter, J.J. Schauer (2012). An assessment of atmospheric mercury in the Community Multiscale Air Quality (CMAQ) model at an urban site and a rural site in the Great Lakes Region of North America, *Atmospheric Chemistry & Physics* 12, 7117-7133, doi:10.5194/acp-12-7117-2012.
  17. P.E. Saide\*, G.R. Carmichael, S.N. Spak, P. Minnis, J.K. Ayers (2012). Improving aerosol distributions below clouds by assimilating satellite-retrieved cloud droplet number, *Proceedings of the National Academy of Sciences* 30, 11939-11943, doi: 10.1073/pnas.1205877109.
  16. M.A. Mena-Carrasco, E. Oliva, P.E. Saide\*, S.N. Spak, C. de la Maza, M. Osses, S. Tolvett, J.E. Campbell, C.C. Tsao, L.T. Molina (2012). Estimating the health benefits from natural gas use in transport and heating in Santiago, Chile, *Science of the Total Environment* 429, 257-265, doi:10.1016/j.scitotenv.2012.04.037.
  15. P.E. Saide\*, S.N. Spak, G.R. Carmichael, M.A. Mena-Carrasco, Q. Yang, S. Howell, D.C. Leon, J.R. Snider, A.R. Bandy, J.L. Collett, K.B. Benedict, S.P. de Szoeki, L.N. Hawkins, G. Allen, I. Crawford, J. Crosier, S.R. Springston (2012). Evaluating WRF-Chem aerosol indirect effects in Southeast Pacific marine stratocumulus during VOCALS-REx, *Atmospheric Chemistry & Physics* 12, 3045-3064, doi:10.5194/acp-12-3045-2012.
  14. M.L. Grabow, S.N. Spak, T. Holloway, B. Stone, A.C. Mednick, J.A. Patz (2012). Air quality and exercise-related health benefits from reduced car travel in the Midwestern United States, *Environmental Health Perspectives* 120, 68-76, doi:10.1289/ehp.1103440.  
Journal's most downloaded article in 2011 and 2012. Highlighted as a Science Selection, *Environmental Health Perspectives* (2011) 120, a34, doi: 10.1289/ehp.120-a34b.
  13. C.C. Tsao, J.E. Campbell, M.A. Mena-Carrasco, S.N. Spak, G.R. Carmichael, Y. Chen (2012). Increased estimates of air-pollution emissions from sugarcane ethanol in Brazil, *Nature Climate Change* 2, 53-57, doi: 10.1038/NCLIMATE1325.  
Research Highlight in *Nature* (2011) 480, 295, doi:10.1038/480295c.
  12. D.S. Tkacik\*, Y. Luna-Cruz\*, N.E. Clinton, S.N. Spak, J. Ryan (2012). Atmospheric correction for MASTER image data using localized modelled and observed meteorology and trace gases, *Remote Sensing Letters* 3(3), 201-209, doi: 10.1080/01431161.2010.551550.
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- 2011
11. Q. Yang, W.I. Gustafson, J.D. Fast, H. Wang, R.C. Easter, H. Morrison, Y.-N. Lee, S.N. Spak, M.A. Mena (2011). Assessing regional scale predictions of aerosols, marine stratocumulus, and their interactions during VOCALS-REx using WRF-Chem, *Atmospheric Chemistry & Physics* 11, 11951-11975, doi:10.5194/0.5194/acp-11-11951-2011.
  10. P.E. Saide\*, G.R. Carmichael, S.N. Spak, L. Gallardo, A.E. Osses, M.A. Mena-Carrasco, M. Pagowski (2011). Forecasting urban PM10 and PM2.5 pollution episodes in very stable nocturnal conditions and complex terrain using WRF-Chem CO tracer model, *Atmospheric Environment* 45, 2769-2780, doi:10.1016/j.atmosenv.2011.02.001.

9. G.R. Rubasinghege, S.N. Spak, G.R. Carmichael, C. Stanier, V.H. Grassian (2011). Abiotic mechanism for the formation of atmospheric nitrous oxide from ammonium nitrate, *Environmental Science & Technology* 45 (7), 2691-2697, doi: 10.1021/es103295v.

Research Highlight in *Nature Chemistry* (2011) 3: 339, doi:10.1038/nchem.1040.

8. M. Huang\*, G.R. Carmichael, S.N. Spak, B. Adhikary, S. Kulkarni, Y. Cheng, C. Wei, Y. Tang, A. D'Allura, P. Wennberg, G. Huey, J. Dibb, J.L. Jimenez, A.J. Weinheimer, A. Kaduwela, C. Cai, M. Wong, R.B. Pierce, J.A. Al-Saadi, D.G. Streets, Q. Zhang (2011). Multi-scale modeling study of the source contributions to near-surface ozone and sulfur oxides levels over California during the ARCTAS-CARB period, *Atmospheric Chemistry & Physics* 11, 3173-3194, doi: 10.5194/acp-11-3173-2011.

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2010

7. M. Huang\*, G.R. Carmichael, B. Adhikary, S.N. Spak, S. Kulkarni, Y.F. Cheng, C. Wei, Y. Tang, D.D. Parrish, S.J. Oltmans, A. D'Allura, A. Kaduwela, C. Cai, A.J. Weinheimer, M. Wong, R.B. Pierce, J.A. Al-Saadi, D.G. Streets, Q. Zhang (2010). Impacts of transported background ozone on California air quality during the ARCTAS-CARB period—A multi-scale modeling study, *Atmospheric Chemistry & Physics* 10, 6947-6968, doi: 10.5194/acp-10-6947-2010.

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2009

6. S.N. Spak and T. Holloway (2009). Seasonality of speciated aerosol transport over the Great Lakes region, *Journal of Geophysical Research – Atmospheres* 114, D08302, doi:10.1029/2008JD010598.
5. B. Stone, A.C. Mednick, T. Holloway, S.N. Spak (2009). Mobile source CO<sub>2</sub> mitigation through smart growth development and vehicle fleet hybridization, *Environmental Science & Technology* 43 (6), 1704–1710, doi:10.1021/es8021655.

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2008

4. T. Holloway, S.N. Spak, D.J. Barker\*, M.P. Bretl\*, C. Moberg, K. Hayhoe, J. Van Dorn, D. Wuebbles (2008). Change in ozone air pollution over Chicago associated with global climate change, *Journal of Geophysical Research – Atmospheres* 113, D22306, doi:10.1029/2007JD009775.
3. T. Holloway, T. Sakurai, Z. Han, S. Ehlers, S.N. Spak, L.W. Horowitz, G.R. Carmichael, D. Streets, Y. Hozumi, H. Ueda, S.U. Park, C. Fung, M. Kajino, N. Thongboonchoo, M. Engardt, C. Bennet, H. Hayami, K. Sartelet, Z. Wang, K. Matsuda, M. Amann (2008). Impact of global emissions on regional air quality in Asia, *Atmospheric Environment* 42, 3543–3561, doi:10.1016/j.atmosenv.2007.10.022.

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2007

2. B. Stone, A.C. Mednick, T. Holloway, S.N. Spak (2007). Is compact growth good for air quality? *Journal of the American Planning Association* 73:4, 404-418, doi: 10.1080/01944360708978521.
1. S.N. Spak, T. Holloway, B. Lynn, R. Goldberg (2007). A comparison of statistical and dynamical downscaling for surface temperature in North America, *Journal of Geophysical Research–Atmospheres* 112, D08101, doi:10.1029/2005JD006712.

## REPORTS & PLANNING DOCUMENTS

4. S.N. Spak, J. Baek, J. Carlson, G.R. Carmichael, Y.J. Kim, N. Riemer, C.O. Stanier (2012). Episodic Air Pollution in Wisconsin during the 2009 LADCO Winter Nitrate Study, Phase II: Three Dimensional Modeling, Process Analysis, and Emissions Sensitivity. Lake Michigan Air Directors Consortium, 292 pp.
3. J. Baek, G.R. Carmichael, S.-R. Lee, J.J. Oleson, N. Riemer, T. Rohlf, S. Sousan, S.N. Spak, C.O. Stanier (2010). Episodic Air Pollution in Wisconsin during the 2009 LADCO Winter Nitrate Study. Lake Michigan Air Directors Consortium, 144 pp.
2. C.O. Stanier (ed.) (2009). Understanding Episodes of High Airborne Particulate Matter in Iowa. Bi-State Regional Commission, 127 pp.
1. K. Hayhoe and D. Wuebbles (eds.) (2008). Climate change and Chicago: Projections and potential impacts. City of Chicago, Chicago Climate Action Plan, 208 pp.

## OTHER NON-REFEREED PUBLICATIONS

1. S.N. Spak, M.A. Mena-Carrasco, G.R. Carmichael (2010). Atmospheric transport of anthropogenic oxidized sulfur over the Southeast Pacific during VOCALS REX, *CLIVAR Exchanges*, 53, 20-21.

## RESEARCH GRANTS

**LADCO**, Analysis and modeling of the LADCO Winter Nitrate Study (PI – C. Stanier), \$135K – 2009-2011, Co-I.

**UNIVERSITY OF IOWA FACILITIES MANAGEMENT**, Air quality impact of stationary power generation at the University of Iowa, \$160K – 2011-2014, PI.

**US EPA**, Constraining urban-to-global scale estimates of black carbon distributions, sources, regional climate impacts, and co-benefit metrics with advanced coupled dynamic - chemical transport adjoint models (PI – G. Carmichael), \$895K – 2011-2014, Co-I.

**NASA**, Air Quality Applied Science Team: Improving air quality analysis through closer integration of observations and models (PI – G. Carmichael), \$575K – 2011-2016, Co-PI.

**NASA**, AQAAT Tiger Team: Web-enabled tools for air quality management decision support, \$140K – 2013-2014, PI.

**NASA**, Regional scale impacts of biomass burning on air quality, weather and surface processes in emissions-chemistry-climate assimilation (PI – G. Carmichael), \$788K – *pending*, Co-PI.

**NASA**, Reducing uncertainties in atmospheric composition & clouds at regional scales through assimilation of a wide range of satellite retrievals (PI - G. Carmichael), \$583K – *pending*, Co-PI.

**NSF**, Decision processes, climate change, and water resources in the Agricultural Midwest (PI – A. Ward), \$600K – *pending*, Co-PI.

**Iowa Water Center**, How do climate and land management interact to impact agricultural landscapes? (PI – A. Ward), \$29K – *pending*, Co-PI.

## TEACHING

**University of Iowa**URP 170: *Megacities*, Spring 2013 (2-3 credit hours)

Developed a new course combining a graduate seminar on contemporary megacity development and planning issues with a megacity modeling studio using UrbanSim to evaluate economic, land use, population, environment, poverty, transportation and health issues at parcel to regional scales. Critical analysis of peer-reviewed literature.

URP 246: *Environmental Policy*, Spring 2012-2013 (3 credit hours)

Developed a new interdisciplinary policy analysis and survey course for graduate and upper-level undergraduate students. Students explore U.S. federal environmental policies and institutions, ethical considerations in policy design and application, international treaties and the ratification process, and assesses relationships between structure and efficacy in environmental regulations. Independent research project: review articles on emerging environmental policy issues for a professional planning audience. Readings: peer-reviewed articles, case law, book chapters, legislation, and regulatory texts.

URP 248: *Modeling Dynamic Systems*, Fall 2012-2013 (3 credit hours)

Developed a new graduate core course introducing systems thinking and dynamic systems modeling for planning topics and human-environment interactions. Scenario planning, integrated assessment, global environmental planning processes and governance institutions. Students learn to integrate modeling within public decision-making processes. Model development and application through homeworks, scenario development exercises and integrated assessments. TILE flipped classroom format.

Textbooks: *Modeling the Environment* by Andrew Ford and *Thinking in Systems* by Donella Meadows, supplemented by journal articles, book chapters, and reports.

URP 248: *Global Environmental Systems*, Fall 2011 (3 credit hours)

Developed a new graduate course introducing systems thinking and dynamic systems modeling for environmental engineering and land use planning. Emphasis on applying science modeling to human influence on planetary support systems and ecosystem services. Model development and application through homeworks and individual model development projects connected to students' funded research and capstone projects.

URP 209: *Field Problems in Planning* (graduate capstone course)

- Faculty advisor for Iowa Initiative for Sustainable Communities Dubuque renewable energy assessment, 2011-2012
- Developer, coordinator and lead instructor, IISC Weekly Workshop Series, 2012-2013

CBE 1029: *Climate Change, Air Pollution & Human Health* Spring 2010 (1 credit hour)

First-year seminar introduction to engineering, exploring contemporary issues through academic articles and popular media. Developed and led modules on climate policy, urban air pollution, long-range transport treaties (co-taught with Greg Carmichael, CBE).

EDTL 340: *Inquiry approaches to Climate, Weather, and Energy in the 6-9 Classroom*, Summer 2011 (2 credit hours)

Instructor on climate modeling, climate policy, and laboratory experimental approaches to investigational learning for climate science, contributing to an continuing education course for K-12 teachers sponsored by NSF and the Iowa Space Grant Consortium (co-taught with Charles Stanier, CBE, and Morgan Yarker, Education).

## OUTREACH

Creator, *Iowa Climate Stories*, 2011 – present

Iowa City Senior Center

- *Environment & Climate Stewardship for Seniors*, Fall 2012
- *Share Your Iowa Climate Stories*, Spring 2012
- *Air Pollution and Climate Change in Iowa*, Spring 2010 & Spring 2011
- *Iowa's Weather and Climate*, Fall 2010

Climate Science Advisor & Evaluation Coordinator, "*Paradise Lost? Artists on Climate Change in the Northwoods*" art exhibition and community education project, 2006 - 2009

Instructor & Co-Developer, K-12 Energy Education Program Teacher Training on Climate Change, 2007 – 2009

- Instructor, *Natural Resources 730: Energy Education in the Classroom*, a one-credit University of Wisconsin-Stevens Point graduate course, Spring 2008
- Invited workshops for Wisconsin Society of Science Teachers 2008 Convention, Madison Metropolitan School District, and UWSP Global Environmental Teachings Program, 2008

## SCIENCE LEADERSHIP & ACADEMIC SERVICE

UI representative, University Corporation for Atmospheric Research, 2011 – present

NASA Air Quality Applied Science Team, 2011 – present

Reviewer for *Atmospheric Chemistry & Physics*, *Atmospheric Environment*, *Environmental Pollution*, *Environmental Science & Technology*, *Geophysical Research Letters*, *International Journal of Remote Sensing*, *Journal of Environmental Management*, *Journal of Geophysical Research*, *Journal of Great Lakes Research*, *Nature Climate Change*, *Proceedings of the National Academy of Sciences*

Curriculum reviewer, Climate Literacy and Energy Awareness Network, 2012 – present

Proposal reviewer, Fundação para a Ciência e a Tecnologia, 2012

WMO GURME technical advisor for air quality forecasting

Session chair, American Geophysical Union 2009 Fall Meeting, Ocean-Atmosphere-Land Interactions in the Eastern Tropical Oceans

Instructor, NASA NSERC Student Airborne Research Program, 2009

Admissions committee, UI School of Urban & Regional Planning, 2012 – present  
Student representative, Nelson Institute for Environmental Studies, 2004 – 2008  
Dartmouth College Alumni Admissions Interviewer, 2002 – present

## FORECASTING FOR ATMOSPHERIC SCIENCE FIELD CAMPAIGNS

NASA SEAC4RS, 2013  
Ganges Valley Aerosol Experiment, 2011  
Commonwealth Games Delhi SAFAR, 2010  
NASA NSERC Student Airborne Research Program, 2009  
VAMOS Ocean-Cloud-Atmosphere-Land Study Regional Experiment, 2008

## AFFILIATIONS

### **University of Iowa**

Center for Global & Regional Environmental Research  
Geoinformatics for Environmental and Energy Modeling and Prediction (GeeMAP) IGERT  
Iowa EPSCoR Energy Policy Platform  
Iowa Initiative for Sustainable Communities  
Iowa Superfund Research Program

### **Professional Associations**

American Association for the Advancement of Science  
American Geophysical Union  
American Meteorological Society  
American Planning Association  
Association of Collegiate Schools of Planning  
Iowa Environmental Health Association

## ADVISING & MENTORING

### **Undergraduate Honors Theses Supervised**

Andrew Bennett, BE Mechanical Engineering '12  
Brianna O'Neal, BE Mechanical Engineering '12



**MS Committees**

Nicholas Petrich, Civil & Environmental Engineering '12 (Chair)

Blake Rupe, International Studies '13

Rachel Yucuis, Civil & Environmental Engineering '13

**PhD Committees**

Jeremy Bril, Civil & Environmental Engineering '12

Aditsuda Jamaroensan, Civil & Environmental Engineering '12

Pallavi Marrapu, Chemical & Biochemical Engineering '12

Sinan Sousan, Chemical & Biochemical Engineering '12

Muhieddine Kabbani, Civil & Environmental Engineering

Rachel Marek, Civil & Environmental Engineering

David Mase, Earth & Atmospheric Sciences, Purdue University

Zachary Rodenburg, Civil & Environmental Engineering

Pablo Saide, Civil & Environmental Engineering

Man Yu, Chemical & Biochemical Engineering

**Urban & Regional Planning Graduate Advisees & Research Assistants**

Charles Cowell '13, Mark Pooley '13

*Current:* Vanessa Fixmer-Oraiz, Claire Richmond, Caitlin Shanahan, Kira Stoller,  
David Sweeney