

## CURRICULUM VITAE

**Lynne E. Gratz**

*Assistant Professor*

*Colorado College Environmental Program*

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### Contact Information

Colorado College  
14 East Cache La Poudre  
Colorado Springs, CO 80903

Phone: (719) 389-7465  
Email: [lgratz@coloradocollege.edu](mailto:lgratz@coloradocollege.edu)  
<http://sites.coloradocollege.edu/lynnegratz/>

### Education

- Ph.D. Atmospheric and Space Science, University of Michigan, August 2010  
*Dissertation Title:* Identification of Atmospheric Mercury Sources and Transport Pathways on Local and Regional Scales  
*Doctoral Committee Chair:* Professor Gerald J. Keeler (deceased)  
*Doctoral Committee Members:* Professor Joel D. Blum, Professor Perry J. Samson, Associate Professor Allison L. Steiner, Associate Research Scientist Frank J. Marsik
- M.S. Atmospheric and Space Science, University of Michigan, April 2005
- B.S. Atmospheric, Oceanic, and Space Sciences, University of Michigan, April 2004

### Research Interests

My research interests include using ground-based and airborne measurements to investigate the chemistry, transport, and deposition of mercury species, trace metals, and other pollutants in the atmosphere. I use statistical and meteorological models together with measurements to distinguish between local, regional, and global emission sources of atmospheric contaminants. I also work on studies to identify the chemical mechanism for mercury oxidation and reduction. I am additionally interested in developing new measurement techniques, such as stable-isotope analysis, to study the biogeochemical cycling of mercury and other trace metals.

### Professional Experience

- Assistant Professor, Colorado College Environmental Program, July 2015 – Present
- Research Associate, University of Washington-Bothell School of STEM – Physical Sciences Division, November 2012 – July 2015
- Post-Doctoral Research Fellow, National Research Council of Italy – Institute of Atmospheric Pollution Research, December 2010 – October 2012
- Research Associate, University of Michigan Air Quality Laboratory, May – August 2010
- Graduate Student Research Assistant, University of Michigan, June 2004 – April 2010
- Undergraduate Research Assistant, University of Michigan, January 2003 – May 2004
- NASA Summer Institute on Atmospheric and Hydrospheric Sciences, NASA Goddard Space Flight Center, June – August 2002

## Teaching Experience

Professor, EV 431 – “Air: Atmospheric Physics and Chemistry”, Colorado College Environmental Program, 2015 – present.

Professor, EV 212 – “Energy: Environmental Thermodynamics and Energetics”, Colorado College Environmental Program, 2015 – present.

Professor, EV 128 – “Introduction to Global Climate Change”, Colorado College Environmental Program, 2015 – present.

Instructor, BST 200 – “Introduction to Climate Science”, University of Washington-Bothell School of STEM, Winter Quarter 2015

Graduate Student Instructor, AOSS 105 – “Our Changing Atmosphere”, University of Michigan Atmospheric, Oceanic and Space Sciences Department, 3 semesters, 2005 – 2006

Graduate Student Instructor, GS 341 – “Ecosystem Science in the Rockies”, University of Michigan Earth and Environmental Sciences Department, Camp Davis Rocky Mountain Field Station in Jackson, WY, Summer term, 2004 – 2009

## Peer-Reviewed Publications

**Gratz, L.E.**; Eckley, C.; Mattson, E.; Laufman, E.\* Sources and temporal variability in summertime ambient mercury in Colorado Springs, CO, USA. Manuscript in preparation.

**Gratz, L.E.**; Barnes, R.T.; Biswas, A. Mercury retention and transport in terrestrial ecosystems in the Intermountain West, U.S.A. following severe wildfire. Manuscript in preparation.

Dvonch, J.T., et al. An Investigation of the Atmospheric Deposition of Phosphorus across the Great Lakes Region. Manuscript in preparation.

Carlton, A.G.; de Gouw, J.; Jimenez, J.L.; Ambrose, J.L.; Attwood, A.; Brown, S.; Baker, K.R.; Brock, C.; Cohen, R.C.; Edgerton, S.; Farkas, C.; Farmer, D.; Goldstein, A.H.; **Gratz, L.**; Guenther, A.; Hunt, S.; Jaeglé, L.; Jaffe, D.A.; Mak, J.; McClure, C.; Nenes, A.; Nguyen, T.K.; Pierce, J.R.; Suzane Simoes de Sa; Selin, N.E.; Shah, V.; Shaw, S.; Shepson, P.B.; Song, S.; Stutz, J.; Surratt, J.; Turpin, B.J.; Warneke, C.; Washenfelder, R.A.; Wennberg, P.O.; Zhou, X. Synthesis of the Southeast Atmosphere Studies: investigating fundamental atmospheric chemistry questions. *Bulletin of the American Meteorological Society*, 2017, Accepted.

Bieser, J.; Slemr, F.; Ambrose, J.; Brenningmeijer, K.; Brooks, S.; Dastoor, A.; DeSimone, F.; Ebinghaus, R.; Gencarelli, C.N.; Geyer, B.; **Gratz, L.E.**; Hedgecock, I.M.; Jaffe, D.; Kelley, P.; Lin, C.-J.; Matthias, V.; Ryjkov, A.; Selin, N.; Song, S.; Travnikov, O.; Weigelt, A.; Luke, W.; Ren, X.; Zahn, A.; Yang, X.; Zhu, Y.; Pirrone, N. Multi-model study of mercury dispersion in the atmosphere: Vertical and interhemispheric distribution of mercury species. *Atmos. Chem. Phys.* 2017, 17, 6925-6955.

**Gratz, L.E.**; Ambrose, J.L.; Jaffe, D.A.; Knote, C.; Campos, T.L.; Flocke, F.M.; Reeves, M.; Stechman, D.; Stell, M.; Weinheimer, A.; Knapp, D.J.; Montzka, D.D.; Tyndall, G.S.; Mauldin III, R.L.; Cantrell, C.A. Airborne Observations of Mercury Emissions from the Chicago/Gary Urban/Industrial Area During the 2013 NOMADSS Campaign. *Atmos. Environ.*, 2016, 145, 415-423.

- Song, S.; Selin, N.E.; **Gratz, L.E.**; Ambrose, J.L.; Jaffe, D.A.; Shah, V.; Jaeglé, L.; Giang, A.; Yuan, B.; Kaser, L.; Apel, R.; Hornbrook, R.; Blake, N.J.; Weinheimer, A.J.; Mauldin III, R.L.; Cantrell, C.A.; Castro, M.S.; Conley, G.; Holsen, T.M.; Luke, W.T.; Talbot, R. Constraints from Observations and Modeling on Atmosphere-Surface Exchange of Mercury in Eastern North America. *Elementa: Science of the Anthropocene*, 2016, 4:000100, doi:10.12952/journal.elementa.000100.
- Shah, V.; Jaeglé, L.; **Gratz, L.E.**; Ambrose, J.L.; Jaffe, D.A.; Selin, N.E.; Song, S.; Campos, T.L.; Flocke, F.M.; Reeves, M.; Stechman, D.; Stell, M.; Festa, J.; Stutz, J.; Weinheimer, A.J.; Knapp, D.J.; Montzka, D.D.; Tyndall, G.S.; Apel, E.; Hornbrook, R.S.; Hills, A.J.; Riemer, D.; Blake, N.J.; Cantrell, C.A.; R.L. Mauldin III, R.L. Origin of Oxidized Mercury in the Summertime Free Troposphere over the Southeastern United States. *Atmos. Chem. Phys.*, 2016, 16, 1511-1530, doi:10.5194/acp-16-1511-2016.
- Gratz, L.E.**; Ambrose, J.L.; Jaffe, D.A.; Shah, V.; Jaeglé, L.; Stutz, J.; Festa, J.; Spolaor, M.; Tsai, C.; Selin, N.E.; Song, S.; Zhao, X.; Weinheimer, A.J.; Knapp, D.J.; Montzka, D.D.; Flocke, F.M.; Campos, T.L.; Apel, E.; Hornbrook, R.; Blake, N.; Hall, S.; Tyndall, G.S.; Reeves, M.; Stechman, D.; Stell, M. Oxidation of mercury by bromine in the subtropical free troposphere. *Geophysical Research Letters*, 2015, 42, 10,494-10,502, doi: 10.1002/2015GL066645.
- Ambrose, J.L.; **Gratz, L.E.**; Jaffe, D.A.; Campos, T.L.; Flocke, F.M.; Knapp, D.J.; Stechman, D.M.; Stell, M.; Weinheimer, A.J.; Cantrell, C.A.; Mauldin III, R.L. Mercury emission ratios from coal-fired power plants in the Southeastern United States during NOMADSS. *Environ. Sci. Technol.*, 2015, 49, 10389-10397, doi:10.1021/acs.est.5b01755.
- Sherman, L.S.; Blum, J.D.; Dvonch, J.T.; **Gratz, L.E.**; Landis, M.S. The use of Pb, Sr, and Hg isotopes in Great Lakes precipitation as a tool for pollution source attribution. *Sci. Tot. Environ.*, 2015, 502, 362-374.
- Jaffe, D.A.; Lyman, S.; Amos, H.M.; Gustin, M.S.; Huang, J.; Selin, N.E.; Levin, L.; ter Schure, A.; Mason, R.P.; Talbot, R.; Rutter, A.; Finley, B.; Jaeglé, L.; Shah, V.; McClure, C.; Ambrose, J.; **Gratz, L.**; Lindberg, S.; Weiss-Penzias, P.; Sheu, G-R.; Feddersen, D.; Horvat, M.; Dastoor, A.; Hynes, A.J.; Mao, H.; Sonke, J.E.; Slemr, F.; Fisher, J.A.; Ebinghaus, R.; Zhang, Y.; Edwards, G. Progress on Understanding Atmospheric Mercury Hampered by Uncertain Measurements. *Environ. Sci. Technol.*, 2014, 48, 7204-7206.
- Gratz, L.E.**; Jaffe, D.; Hee, J. Causes of increasing ozone and decreasing carbon monoxide in springtime at the Mt. Bachelor Observatory from 2004 to 2013. *Atmos. Environ.*, 2015, 109, 323-330.
- Gratz, L.E.**; Keeler, G.J.; Dvonch, J.T.; Marsik, F.M.; Barres, J.B. Atmospheric Transport of Speciated Mercury Across Southern Lake Michigan: Influence from Emission Sources in the Chicago/Gary Urban Area. *Sci. Tot. Environ.* 2013a, 448, 84-95.
- Gratz, L.E.**; Keeler, G.J.; Dvonch, J.T.; Morishita, M.; Barres, J.B. Assessing the Emission Sources of Atmospheric Mercury in Wet Deposition Across Illinois. *Sci. Tot. Environ.* 2013b, 448, 120-131.
- Pirrone, N.; Bieber, E.; Cinnirella, S.; Dastoor, A.; Derwent, R.G.; Ebinghaus, R.; Feng, X.; **Gratz, L.E.**; Hedgecock, I.; Jaffe, D.; Jennings, S.G.; Kock, H.; Prestbo, E.; Schwerin, A.; Schuetze, M.; Spain, T.G.; Sprovieri, F.; Travnikov, O.; Weigelt, A. Technical Background

Report for the Global Mercury Assessment 2013, Section C: Atmospheric Pathways, Transport and Fate. Arctic Monitoring Assessment Programme, Oslo, Norway/UNEP Chemicals Branch, Geneva, Switzerland, pp. 38-68.

**Gratz, L.E.;** Keeler, G.J. Sources of mercury in precipitation to Underhill, VT. *Atmos. Environ.* 2011, 45 (31), 5440-5449.

**Gratz, L.E.;** Keeler, G.J.; Blum, J.D.; Sherman, L.S. Isotopic composition and fractionation of mercury in Great Lakes precipitation and ambient air. *Environ. Sci. Technol.* 2010, 44 (20), 7764-7770.

**Gratz, L.E.;** Keeler, G.J., Miller, E.K., 2009. Long-term relationships between mercury wet deposition and meteorology. *Atmos. Environ.* 2009, 73, 6704-6715.

Swartzendruber, P.C.; Chand, D.; Jaffe, D.A.; Smith, J.; Reidmiller, D.; **Gratz, L.;** Keeler, J.; Strode, S.; Jaeglé, L.; Talbot, R.. The vertical distribution of mercury, CO, ozone, and aerosol scattering coefficient in the Pacific Northwest during the spring 2006 INTEX-B campaign. *J. Geophys. Res. – Atmospheres* 2008.

Keeler, G.J.; **Gratz, L.E.;** Al-Wali, K. Long-term atmospheric mercury wet deposition at Underhill, Vermont. *Ecotox.* 2005, 14, 71-83.

### **Selected Oral Presentations**

**Gratz, L.E.;** Barnes, R.T.; Biswas, A. Mercury retention and transport in terrestrial ecosystems in the Intermountain West, U.S.A. following severe wildfire. International Conference on Mercury as a Global Pollutant, Providence, RI, July 2017.

Blum, J.D.; Johnson, M.W.; Sherman L.S.; Demers J.D.; Gehrke G.E.; Motta L.M.; Washburn, S.J.; **Gratz, L.E.** New clues about global cycling of mercury from even-mass independent isotope fractionation of mercury. Canadian Society for Chemistry Conference, Toronto, Canada, June 2017.

**Gratz, L.E.;** Shah, V.; Ambrose, J.L.; Jaffe, D.A.; Jaeglé, L.; Selin, N.E.; Song, S.; Festa, J.; Stutz, J. Observations and Model Analysis of Enhanced Oxidized Mercury in the Free Troposphere during NOMADSS. American Geophysical Union Fall Meeting, San Francisco, CA, December 2014.

Jaffe, D.; **Gratz, L.;** Ambrose, J.; McClure, C. New Measurement Technology and New Insights into the Oxidation of Atmospheric Mercury. 11<sup>th</sup> International Conference on Mercury as a Global Pollutant, Edinburgh, Scotland, July 2013.

**Gratz, L.E.;** Keeler, G.J.; Dvonch, J.T.; Morishita, M.; Barres, J.B. Assessing the Emission Sources of Atmospheric Mercury in Wet Deposition Across Illinois. 16<sup>th</sup> International Conference on Heavy Metals in the Environment, Rome, Italy, September 2012.

**Gratz, L.E.;** Keeler, G.J. Sources of mercury in precipitation to Underhill, VT. 10<sup>th</sup> International Conference on Mercury as a Global Pollutant, Halifax, Nova Scotia, July 2011.

**Gratz, L.E.;** Keeler, G.J.; Dvonch, J.T. Atmospheric mercury transport across southern Lake Michigan: Influence from the Chicago/Gary Area. International Association of Great Lakes Research Annual Meeting, Toledo, OH, May 2009.

**Gratz, L.E.;** Keeler, G.J. Sources of mercury in precipitation to the Lake Champlain Basin. International Association of Great Lakes Research Annual Meeting, State College, PA, May 2007.

**Gratz, L.E.;** Keeler, G.J.; Al-Wali, K. Long-term atmospheric mercury wet deposition at Underhill, VT. International Association of Great Lakes Research Annual Meeting, Ann Arbor, MI, May 2005.

### **Selected Poster Presentations**

Rodriguez, D.S.\*; Abeleira, A.J.; Lindaas, J.; Pollack, I.B.; Farmer, D.K.; **Gratz, L.E.**, Fischer, E.V. A closer look at the abundance of oxygenated VOCs in the Colorado Front Range during spring and summer 2015. 17<sup>th</sup> Annual American Meteorological Society Student Conference, Austin, TX, January 2018.

**Gratz, L.E.;** Laufman, E.\*; Mattson, E. Sources and temporal variability in summertime ambient mercury in Colorado Springs, CO, USA. 97<sup>th</sup> American Meteorological Society Annual Meeting and 13<sup>th</sup> Symposium of the Urban Environment, Seattle, WA, January 2017.

**Gratz, L.E.;** Laufman, E.\* Assessing the impact of a local coal-fired power plant on ambient mercury concentrations in Colorado Springs, CO, USA. International Global Atmospheric Chemistry (IGAC) Project 2016 Science Conference, Breckenridge, CO, September 2016.

**Gratz, L.E.;** Ambrose, J.L.; Jaffe, D.A.; Knote, C.; Jaeglé, L.; Selin, N.E.; Campos, T.; Flocke, F.; Reeves, M.; Stechman, D.; Stell, M.; Weinheimer, A.; Knapp, D.J.; Montzka, D.D.; Tyndall, G.S.; Mauldin III, R.L.; Cantrell, C.A.; Apel, E.; Hornbrook, R.; Blake, N. Airborne Observations of Mercury Emissions from the Chicago/Gary Urban/Industrial Area During the 2013 NOMADSS Campaign. American Geophysical Union Fall Meeting, San Francisco, CA, December 2015.

**Gratz, L.E.;** Esposito, G.; Dalla Torre, S.; Cofone, F.; Pirrone, N.; Sprovieri, F. First Measurements of Ambient Total Gaseous Mercury (TGM) at the EvK2CNR Pyramid Observatory in Nepal. 16<sup>th</sup> International Conference on Heavy Metals in the Environment, Rome, Italy, September 2012.

Sprovieri, F.; **Gratz, L.E.;** Pirrone, N. Development of a Ground-Based Atmospheric Monitoring Network for the Global Mercury Observation System (GMOS). 16<sup>th</sup> International Conference on Heavy Metals in the Environment, Rome, Italy, September 2012.

**Gratz, L.E.;** Keeler, G.J.; Blum, J.D.; Sherman, L.S. Isotopic fractionation of mercury in Great Lakes precipitation and ambient air. American Geophysical Union Fall Meeting, San Francisco, CA, December 2009.

**Gratz, L.E.;** Keeler, G.J. Sources of mercury in precipitation to the Lake Champlain Basin. Michigan Geophysical Union Annual Meeting, Ann Arbor, MI, March 2009.

**Gratz, L.E.;** Keeler, G.J.; Dvonch, J.T. Atmospheric mercury transport across southern Lake Michigan: Influence from the Chicago/Gary urban area. American Geophysical Union Fall Meeting, San Francisco, CA, December 2008.

**Gratz, L.E.;** Keeler, G.J. Long-term monitoring of mercury wet deposition and source influences in the Lake Champlain Basin. Michigan Geophysical Union Annual Meeting, Ann Arbor, MI, March 2008.

**Gratz, L.E.;** Keeler, G.J. The influence of meteorology and long range transport on summertime mercury concentrations at Rendezvous Mountain, Wyoming. 8<sup>th</sup> International Conference on Mercury as a Global Pollutant, Madison, WI, August 2006.

\* Colorado College student

### **Invited Presentations**

**Gratz, L.E.** “Atmospheric Mercury Emissions from the Boundary Layer to the Free Troposphere: Airborne Observations of Emissions, Transport, and Chemistry”. Colorado State University Atmospheric Sciences Department, December 2015; University of Denver, March 2016; and the National Center for Atmospheric Research, March 2016.

**Gratz, L.E.** “Mercury Rising: Transport and Fate of a Little-known Air Pollutant”. Colorado College Block 3 Faculty Lunch Talk, November 2016.

### **Theses and Papers Advised**

Navarro, A. The inequitable distribution of NO<sub>2</sub> in the Los Angeles Basin determined from the NASA Geostationary Trace gas and Aerosol Sensor Optimization (GeoTASO). Senior thesis forthcoming in 2018.

Rodriguez, D.S. A closer look at the abundance of oxygenated VOCs in the Colorado Front Range during spring and summer 2015. Senior thesis forthcoming in 2018.

Li, Y. Attainment of the lowered National Ambient Air Quality Standards (NAAQS) in Colorado Springs, CO, USA. Senior thesis, 2017.

Fromm, N. The Effects of Wildfire on Mercury Retention and Cycling in Forest Soils. Senior paper, 2017.

Sussman, R. Size-Resolved Aerosol Composition near Rocky Mountain National Park. Senior thesis, 2016.

### **Skills**

*Air Quality Monitoring:* ambient speciated mercury, mercury and trace metal wet deposition, ambient PM<sub>2.5</sub> and PM<sub>10</sub>, acidic gases, EPA gaseous criteria pollutants

*Laboratory Analysis:* CVAFS, AAS, ICP-MS, MC-ICP-MS

*Statistical Analysis and Modeling:* SAS, SPSS, HYSPLIT, Matlab, ArcGIS, EPA PMF & Unmix

*Programming Languages:* C++, FORTRAN

*Peer Reviewer:* Air and Waste Management; Air Quality, Atmosphere and Health; Atmosphere; Atmospheric Environment; Atmospheric Chemistry and Physics; Atmospheric Research; Chemosphere; Energy and Emission Control Technologies; Environmental Chemistry; Environmental Health Insights; Environmental Pollution; Science of the Total Environment

## **Grants and Fellowships**

Colorado College Faculty Research Development Block, 2017-18  
Colorado College Dean's Summer Research fellowship, 2017  
U.S. EPA Regional Applied Research Effort (RARE) grant, 2016  
Colorado College Student-Faculty Collaborative (SCoRe) research grant, 2016, 2017  
Colorado College Grant Lyddon, 2016  
Colorado College Natural Science Divisional funds, 2015, 2016, 2017  
Colorado College SEGway fund, 2016  
Mrachek Fellowship Award for Scholarly Research, 2016

## **Awards**

Thomas M. Donahue Award for Best Paper – Michigan Geophysical Union Meeting, 2008  
Outstanding Undergraduate Student Award in Atmospheric, Oceanic, and Space Sciences, 2004

## **Memberships**

American Meteorological Society, 2016 – present  
American Geophysical Union, 2008-2012 and 2014 – present  
Earth Science Women's Network, 2015 – present  
International Association of Great Lakes Research, 2005-2010  
Tau Beta Pi, 2003-2004

## **Leadership and Service**

Tashjian-Crecelius Prize Committee, Interdisciplinary Programs representative, 2017-present  
Colorado College Admission Yield Event, Presenting Professor, Chicago IL, 2017  
Colorado College Watson Committee, Natural Sciences representative, 2016-present  
PROGRESS Women in Science mentor, 2015-present  
University of Washington-Bothell Academic Transfer Program Mentor, 2014-2015  
Michigan Geophysical Union Planning Committee Member, 2005-2007  
UCAR Undergraduate Leadership Workshop Participant, 2004  
Undergraduate Student Advisory Board Departmental Representative, 2003-2004