Elisabeth J. Moyer

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EDUCATION

Ph.D., Planetary Science, California Institute of Technology, 2001
(*minor: Environmental Engineering*)
B.S., Physics, *with honors*, Stanford University, 1990
A.B., Anthropology (*Archaeology*), *with honors*, Stanford University, 1990

POSITIONS HELD

Associate Professor, University of Chicago, 2014–present
Assistant Professor, University of Chicago, 2007–2014
Dept. of the Geophysical Sciences
Research Associate, Harvard University, 2003–2007
Postdoctoral Scholar, Harvard University, 2001–2003
Dept. of Chemistry and Chemical Biology

SCIENCE LEADERSHIP

U. Chicago Center for Robust Decision-making on Climate and Energy Policy,
Director 2017–present, Co-director 2009–2017, Leader: climate statistics, education & outreach
Data Science for Energy and Environmental Research NSF NRT program, *PI 2017–present*
International Partnership for Cirrus Studies NSF PIRE program, *PI 2017–present*
IsoCloud campaign, *Mission Scientist 2010-2013*

HONORS AND AWARDS

Awardee, Camille and Henry Dreyfus Foundation Postdoctoral Program in Env. Chemistry, 2010
NASA Group Achievement Award, TC4 mission, 2008
NASA Group Achievement Award, SAGE III Science Team, 2001
NOAA Postdoctoral Fellowship in Climate and Global Change, 2000
NASA Group Achievement Award, POLARIS mission, 1998
NASA Graduate Fellowship in Global Change Science, 1995
NSF Graduate Fellowship, 1992
Phi Beta Kappa, 1989 / President's Award, 1987 / Fairclough Prize, 1986 / Boothe Prize 1985,
Stanford University

FIELD CAMPAIGNS (AIRCRAFT, BALLOON, CHAMBER)

ACCLIP *(Asian Summer Monsoon Chemical and Climate Impact Project)*
Houston, TX, Apr.–May 2020; Okinawa, Japan Aug. 2020 *(forthcoming)*
Instrument PI, Chicago Water Isotope Spectrometer

StratoClim *(Stratospheric and upper tropospheric processes for better climate predictions)*
Kiruna, Sweden Apr. 2016; Kalamata, Greece, Aug. 2016; Kathmandu, Nepal, Jul.–Aug. 2017
Instrument PI, Chicago Water Isotope Spectrometer

AquaVIT-2 *(Water Vapor Validation and Instrument Tests)*
AIDA Aerosol and Cloud Chamber, Karlsruhe, Germany, Apr. 2013
Instrument PI, Chicago Water Isotope Spectrometer

IsoCloud *(Isotopic Cloud Experiments)*.
AIDA Aerosol and Cloud Chamber, Karlsruhe, Germany, 2011–2013
Mission Scientist; Instrument PI, Chicago Water Isotope Spectrometer

CR-AVE *(Costa Rica Aura Validation Experiment)*. San Jose, Costa Rica, Jan.–Feb. 2006

AVE-WIIF *(Aura Validation Experiment / Water Isotope Intercomparison Flights)*.
Houston, TX, Jun.–Jul. 2005

CWVCS *(Clouds and Water Vapor in the Climate System)*
San Jose, Costa Rica, Jul.–Aug. 2001

ACCENT *(Atmospheric Chemistry of Combustion Emissions Near the Tropopause)*
+ *WISP test flights*. Houston, TX, Aug.–Sept. 1999

OMS *(Observations of the Middle Stratosphere)*. Juazeiro do Norte, Brazil, Nov. 1997

OMS *(Observations of the Middle Stratosphere)*. Ft. Sumner, NM, Oct. 1997

POLARIS *(Photochemistry of Ozone Loss in the Arctic Region In Summer)*
Fairbanks, AK, Mar.–Sep. 1997

SELECTED INVITED PRESENTATIONS, ACADEMIC DEPARTMENTS AND PROGRAMS

Arizona State University, Wrigley Global Institute of Sustainability, Sep. 2018
MIT, Dept. of Earth, Atmospheric, and Planetary Sci., Feb. 2018
Univ. of Illinois Urbana-Champaign, Dept. of Mathematics, Feb. 2018
Univ. of Illinois Urbana-Champaign, Dept. of Physics, Oct. 2016
Penn. State, SCRiM (Network for Sustainable Climate Risk Management), Dec. 2014
George Washington Univ., Dept. of Chemistry, Nov. 2014
NOAA, Aeronomy Laboratory, Sep. 2014
Univ. of Illinois Urbana-Champaign, Dept. of Atmospheric Sciences, Nov. 2013
Princeton, Dept. of Civil and Environmental Engineering, April 2013
Univ. of Utah, Global Change & Sustainability Center, April 2013
NASA-Goddard Institute of Space Sciences, March 2013
Karlsruhe Institute of Technology, Inst. for Meteorology and Climate, Oct. 2012
University of Washington, Dept. of Atmospheric Sciences, June 2012
Carnegie-Mellon, Dept. of Engineering and Public Policy, June 2012
Caltech, Dept. of Geological and Planetary Sciences, March 2012
University of Copenhagen, Niels Bohr Institute, Centre for Ice and Climate, Apr. 2010
ETH, Institute for Atmospheric and Climate Science, March 2010
Cambridge University, Dept. of Earth Sciences, Sep. 2009
Illinois Institute of Technology, Dept. of Chemistry, Oct. 2008
University of Michigan, Dept. of Atmospheric, Ocean, and Space Science, Nov. 2007
University of Colorado, Boulder, Dept. of Chemistry, Nov. 2006
MIT, Dept. of Earth, Atmospheric, and Planetary Sci., Feb. 2006
University of Arizona, Dept. of Atmospheric Sciences, Nov. 2005
University of California, Berkeley, Dept. of Atmospheric Sciences, Oct. 2005

SELECTED INVITED PRESENTATIONS, CONFERENCES AND WORKSHOPS

American Geophysical Sciences Fall Meeting (Washington, DC), Dec. 2018
"Rethinking graduate education in the age of big data"
NCAR Climate Informatics Workshop (Boulder, CO), Sep. 2017
"Insights from model emulation for climate research" (invited keynote)
American Physical Society March Meeting (Baltimore, MD), Mar. 2016
"Precipitation & atmospheric moisture transport response to increased infrared opacity"
Stockholm Workshop on the Social Cost of Carbon (Stockholm, Sweden), May 2015
"Failures of IAMs, and the path forward"
American Chemical Society Spring Meeting (Denver, CO), Mar. 2015
"Ice formation in ultracold cirrus"
Telluride Workshop on Clouds and Aerosols (Telluride, CO), Aug. 2014
"Probing controls on UT/LS cirrus"
Workshop on Advances in Observations, Models, and Measurement Techniques of Atmospheric Water Vapor Isotopes (Gif-Sur-Yvette, France), Oct. 2013
"Water isotopic measurements for microphysical studies"
V.M. Goldschmidt Conference (Florence, Italy), Aug. 2013
"Applications of absorption spectroscopy for water isotopic measurements in cold clouds"
Gordon Conference on Radiation and Climate (New London, NH), July 2013
"The isotopic composition of water vapor and relevance to cloud processes"
Heraeus Workshop on Water Vapor and Clouds (Bad Honnef, Germany), June 2013
"Uses for the isotopic composition of water vapor in cirrus and cloud physics"
American Geophysical Union Fall Meeting (San Francisco, CA), Dec. 2012
"Insights from measurements of atmospheric water isotopic composition"
IIES Conference on Climate and the Economy (Steningevik, Sweden), Sept. 2012
Discussant: "A global climate-economy model with high regional resolution"
Hitran Conference (Reims, France), August 2012
"Field applications of laser-based absorption spectroscopy for measurements of atmospheric water vapor isotopic composition"
NOAA Climate and Global Change Postdoctoral Program 20th Anniversary Celebration (Washington, DC), April 2011. *"From cold clouds to climate policy options"*
American Geophysical Union Fall Meeting (San Francisco, CA), Dec. 2010. *"Seasonal and regional variation in UTLS convective water transport from ACE isotopic measurements*"
WAVACS Workshop on Water Isotopologues in the Atmosphere (Paris, France), Apr. 2010
"Isotopic signatures of deep convection from ACE"
FLAIR (Field Laser Applications in Industry and Research) (Florence, Italy), Sep. 2007
"The Harvard ICOS Isotope Instrument"
International Workshop on Upper Tropospheric Humidity (Karlsruhe, Germany), June 2007
"The isotopic implications of supersaturation"
SPARC-GEWEX/GCSS-IGAC Invitational Workshop on Deep Convection and the TTL (Victoria, B.C.), June 2006
"First in-situ measurements of water vapor isotopic composition across the tropical tropopause"
Gordon Conference on Atmospheric Chemistry (Newport, RI), June 2001
Discussion leader: "Stratospheric chemistry and dynamics – water vapor transport"
American Geophysical Union Fall Meeting (San Francisco, CA), Dec. 1998
"WISP (Water Isotope SPectrometer): a tunable diode laser spectrometer for diagnosis of transport and water vapor origin in the uppermost troposphere by measurement of water vapor isotopic composition"

PUBLICATIONS

- "A Physical Inventory of the U.S. Energy System." H.Y. Chen, D.W. Weisbach, N.M. Matteson, A. Brizius, E.J. Moyer, *in prep for PNAS*, 2019. See `http://us.infrastructure.rdcep.org`.
- "Energy Transformations in U.S. History 1800–2017." R. Suits, N.M. Matteson, E.J. Moyer, *in prep for PNAS*, 2019. See `http://us.sankey.rdcep.org`.
- "Robust decrease in ENSO amplitude under long-term warming." C.W. Callahan, C. Chen, M. Rugenstein, J. Bloch-Johnson, S. Yang, E.J. Moyer, *in review at Nature Climate Change*, 2019.
- "Convective precipitation events intensify but contract under global warming." C. Chen, W. Chang, J. Wang, V.R. Kotamarthi, W. Kong, M.L. Stein, E.J. Moyer, *in revision at Nature Climate Change*, 2019.
- "The GGCMI Phase II experiment: global gridded crop model simulations under uniform changes in CO_2, temperature, water, and nitrogen levels (protocol version 1.0)." J. Franke, C. Müller, J. Elliott, A.C. Ruane, J. Jägermeyr, J. Balkovic, P. Ciais, M. Dury, P. Falloon, C. Folberth, L. Francois, T. Hank, M. Hoffman, R.C. Izaurralde, I. Jacquemin, C. Jones, N. Khabarov6, M. Koch, M. Li, W. Liu, S. Olin, M. Phillips, T.A.M. Pugh, A. Reddy, X. Wang, K. Williams, F. Zabel, and E.J. Moyer. *in review at Geosci. Model Devel.*, 2019.
- "The Chicago Water Isotope Spectrometer (ChiWIS - lab): a TDL spectrometer for chamber-based measurements of water vapor isotopic evolution during cirrus formation." L. Sarkozy, B.W. Clouser, K.D. Lamb, E. Stutz, O. Möhler, H. Saathoff, S. Wagner, B. Künreich, V. Ebert, H. Saathoff, O. Möhler, E.J. Moyer, *submitted to Rev. Sci. Inst.*, 2019.
- "No anomalous supersaturation in ultracold cirrus laboratory experiments." B.W. Clouser, K.D. Lamb, L. Sarkozy, A. Nisenoff, J. Habig, V. Ebert, H. Saathoff, O. Möhler, E.J. Moyer, *ACPD (in rev. for ACP)*, 2019.
- "LongRunMIP - motivation, design, and data access for a large collection of millennial long AO-GCM simulation." M. Rugenstein, J. Bloch-Johnson, A. Abe-Ouchi, T. Andrews, U. Beyerle, L. Cao, G. Danabasoglu, J.L. Dufresne, L. Duan, M.A. Foujols, T. Frölicher, O. Geoffroy, J. Gregory, A. Jonko, R. Knutti, C. Li, A. Marzocchi, T. Mauritsen, M. Menary, E. Moyer, L. Nazarenko, D. Paynter, D. Saint-Martin, G.A. Schmidt, A. Yamamoto, and S. Yang., *BAMS, in press*, 2019.
- "Cloud classification with unsupervised deep learning." T. Kurihana, I. Foster, R. Willet, S. Jenkins, K. Koenig, R. Werman, E.J. Moyer, *Proc. of the 9th Int. Workshop on Climate Informatics*, 2019.
- "Future climate emulations using quantile regressions on large ensembles." M.A. Haugen, M.L. Stein, R.L. Sriver, E.J. Moyer, *ASCMO* 5, 2019.
- "Estimating changes in temperature distributions in a large ensemble of climate simulations using quantile regression." M.A. Haugen, M.L. Stein, E.J. Moyer, R.L. Sriver, *J. Climate* 31 (20), 2018.
- "Diagnosing added value of convection-permitting regional models using precipitation event identification and tracking." W. Chang, J. Wang, J. Marohnic, V. R. Kotamarthi, E.J. Moyer, *Climate Dynamics*, 2018.
- "Improved light collection in OA-ICOS cells using non-axially-symmetric optics." B.W. Clouser, L. Sarkozy, E.J. Moyer. *Applied Optics*, 57(21), 2018.
- "Laboratory measurements of HDO/H_2O isotopic fractionation during ice deposition in simulated cirrus clouds." K.D. Lamb, B.W. Clouser, M. Bolot, L. Sarkozy, V. Ebert, H. Saathoff, O. Möhler, E.J. Moyer. *PNAS* 114 (22), 2017.
- "Estimating trends in the global mean temperature record." A. Poppick, E.J. Moyer, M.L. Stein. *ASCMO* 3, 2017.
- "Changes in spatio-temporal precipitation patterns in changing climate conditions." W. Chang, M.L. Stein, J. Wang, V.R. Kotamarthi, E.J. Moyer. *J. Climate* 29, 2016.

- "Temperatures in transient climates: improved methods for simulations with evolving temporal covariances." A. Poppick, D.J. McInerney, E.J. Moyer, M.L. Stein. *Annals of Appl. Stat.*, 10, 2016.
- "Derivation of physical and optical properties of mid-latitude cirrus ice crystals for a size-resolved cloud microphysics model." A.M. Fridlind, R. Atlas, B. van Diedenhoven, J. Um, G.M. McFarquhar, A.S. Ackerman, E.J. Moyer, R.P. Lawson. *ACP* 16, 2016.
- "Estimating changes in temperature extremes from millennial-scale climate simulations under generalized extreme value (GEV) distributions." W.K. Huang, M.L. Stein, D.J. McInerney, S. Sun, E.J. Moyer. *ASCMO* 2, 2016
- "The influence of model resolution on temperature variability." J.M. Klavans, A. Poppick, S. Sun, E.J. Moyer. *Climate Dynamics*, 2016.
- "Evaluating the sensitivity of agricultural model performance to different climate inputs." M.J. Glotter, E.J. Moyer, A.C. Ruane, J.W. Elliott. *J. Appl. Meteo. & Climat.* 55, 2016.
- "Simulation of future climate under changing temporal covariance structures." W.B. Leeds, E.J. Moyer, and M.L. Stein. *ASCMO* 1, 2015.
- "Climate impacts on economic growth as drivers of uncertainty in the social cost of carbon." E.J. Moyer, M.D. Woolley, M.J. Glotter, N.M. Matteson, and D.A. Weisbach. *J. Legal Studies* 43, 2014.
- "A simple carbon cycle representation for economic and policy analyses." M.J. Glotter, R.T. Pierrehumbert, J.W. Elliott, N.J. Matteson, and E.J. Moyer. *Climatic Change* 126, 2014.
- "Evaluating the utility of dynamical downscaling in agricultural impacts projections." M.J. Glotter, J.W. Elliott, D.M. McInerney, N. Best, D. Kelly, I.T. Foster, and E.J. Moyer. *PNAS* 111, 2014.
- "Statistical emulation of climate model projections based on precomputed GCM runs." S. Castruccio, D.J. McInerney, M.L. Stein, F. Liu, R.L. Jacob, E.J. Moyer. *J. Clim.* 14, 2014.
- "Modelling and intepreting the isotopic composition of water vapour in convective updrafts." M. Bolot, B. Legras, E.J. Moyer. *Atmos. Chem. Phys.* 13, 2013.
- "Direct and disequilibrium effects on precipitation in transient climates." D.J. McInerney E.J. Moyer. *ACPD* 12, 2012.
- "Feasibility of U.S. renewable portfolio standards under cost caps and case study for Illinois." S.D. Johnson and E.J. Moyer. *Energy Policy* 49, 2012.
- "Global variations of HDO and HDO/H_2O ratios in the UTLS derived from ACE-FTS satellite measurements." W.J. Randel, E.J. Moyer, M. Park, E.J. Jensen, P.F. Bernath, K.A. Walker, C.D. Boone. *J. Geophys. Res.* 117, 2012.
- "The social evaluation of intergenerational policies and its application to integrated assessment models of climate change." L. Kaplow, E.J. Moyer, and D.A. Weisbach. *B.E. Journal of Economic Analysis and Policy 10*, 2010.
- "CIM-EARTH: Framework and case study." J.W. Elliott, I.T. Foster, K.L. Judd, E.J. Moyer, T.S. Munson. *B.E. Journal of Economic Analysis and Policy 10*, 2010. Also published as a chapter in *"Distributional aspects of climate and energy policies"*, M.A. Cohen, D. Fullerton, R.H. Topel, eds., Edward Elgar Publishing Inc., Northampton, MA, 2013.
- "The influence of convection on the water isotopic composition of the TTL and tropical stratosphere." D.S. Sayres, L. Pfister, T.F. Hanisco, E.J. Moyer, M. Legg, A.S. O'Brien, J.B. Smith, J.M. St. Clair, E.M. Weinstock, M. Witinski, J.G. Anderson. *J. Geophys. Res.* 115, 2010.

- "Validation of the Harvard Lyman-alpha in situ water vapor instrument: Implications for the mechanisms that control stratospheric water vapor." E.M. Weinstock, J.B. Smith, D.S. Sayres, J.V. Pittman, J.R. Spackman, E.J. Hintsa, T.F. Hanisco, E.J. Moyer, J.M. St. Clair, M.R. Sargent, J.G. Anderson. *J. Geophys. Res.* 114, 2009.
- "A new cavity based absorption instrument for detection of H_2O, HDO, $H_2^{18}O$, $H_2^{17}O$, and CH_4." D.S. Sayres, E.J. Moyer, T.F. Hanisco, J.M. St. Clair, F.N. Keutsch, A. O'Brien, N.T. Allen, L. Lapson, J.N. Demusz, M. Rivero, T. Martin, M. Greenberg, C. Tuozzolo, G.S. Engel, J.H. Kroll, J. Paul, and J.G. Anderson. *Rev. Sci. Instr.* 80, 2009.
- "Design considerations in high-sensitivity off-axis integrated cavity output spectroscopy." E.J. Moyer, D.S. Sayres, T.F. Hanisco, J.M. St. Clair, F.N. Keutsch, N.T. Allen, G.S. Engel, J.H. Kroll, J. Paul, and J.G. Anderson. *App. Phys. B* 92, 2008.
- "A new photolysis laser-induced fluorescence instrument for the detection of H_2O and HDO in the lower stratosphere." J.M. St. Clair, T.F. Hanisco, E.M. Weinstock, E.J. Moyer, D.S. Sayres, F.N. Keutsch, J.H. Kroll, J.N. Demusz, N.T. Allen, J.B. Smith, J.R. Spackman, and J.G. Anderson. *Rev. Sci. Instrum.* 79, 2008.
- "Formation of large (similar or equal to 100 μm) ice crystals near the tropical tropopause" E.J. Jensen, L. Pfister, T.V. Bui, P. Lawson, B. Baker, Q. Mo, D. Baumgardner, E.M. Weinstock, J.B. Smith, E.J. Moyer, T.F. Hanisco, D.S. Sayres, J.M. St Clair, M.J. Alexander, O.B. Toon, J.A. Smith. *Atmos. Chem. Phys.* 8, 2008.
- "Precise multi-pass Herriott cell design: Derivation of controlling design equations." G.S. Engel, E.J. Moyer. *Optics Letters* 32, 2007.
- "Observations of deep convective influence on stratospheric water vapor and its isotopic composition." T.F. Hanisco, E.J. Moyer, E.M. Weinstock, J.M. St.Clair, D.S. Sayres, J.B. Smith, R. Lockwood, J.G. Anderson, A.E. Dessler, F.N. Keutsch, J.R. Spackman, W.G. Read, T.P. Bui. *Geophys. Res. Lett.* 34, 2007.
- "Ultra-sensitive near-IR integrated cavity output spectroscopy (ICOS) technique for detection of CO at 1.57 μm: new sensitivity limits for absorption measurements in passive optical cavities." G.S. Engel, W. Drisdell, F.N. Keutsch, E.J. Moyer, J.G. Anderson. *Applied Optics* 45, 2006.
- "The Atmosphere Trace Molecule Spectroscope Experiment (ATMOS) Version 3 data retrievals." F.W. Irion, M.R. Gunson, G.C. Toon, A.Y. Chang, A. Eldering, E. Mahieu, G.L. Manney, H.A. Michelsen, E.J. Moyer, M.J. Newchurch, G.B. Osterman, C.P. Rinsland, R.J. Salawitch, B. Sen, Y.L. Yung, R. Zander. *Applied Optics* 41, 2002.
- "Mean ages of stratospheric air derived from in situ observations of CO_2, CH_4, and N_2O." A.E. Andrews, K.A. Boering, B.C. Daube, S.C. Wofsy, M. Loewenstein, H. Jost, J.R. Podolske, C.R. Webster, R.L. Herman, D.C. Scott, G.J. Flesch, E.J. Moyer, J.W. Elkins, G.S. Dutton, D.F. Hurst, F.L. Moore, E.A. Ray, P.A. Romashkin, S.E. Strahan. *J. Geophys. Res.* 106, 2001.
- "Comparison of in-situ N_2O and CH_4 measurements in the upper troposphere and lower stratosphere during STRAT and POLARIS." D.F Hurst, G.S. Dutton, P.A. Romanashkin, J.W. Elkins, R.L. Herman, E.J. Moyer, D.C. Scott, R.D. May, C.R. Webster, J. Grecu, M. Loewenstein, J.R. Podolske. *J. Geophys. Res.* 105, 2000.
- "Subsidence, mixing, and denitrification of Arctic polar vortex air measured during POLARIS." M. Rex, R.J. Salawitch, G.C. Toon, B. Sen, J.J. Margitan, G.B. Osterman, J.F. Blavier, R.S. Gao, S. Donnelly, E. Keim, J. Neuman, D.W. Fahey, C.R. Webster, D.C. Scott, R.L. Herman, R.D. May, E.J. Moyer, M.R. Gunson, F.W. Irion, A.Y. Chang, C.P. Rinsland, T.P. Bui. *J. Geophys. Res.* 104, 1999.
- "An examination of chemistry and transport processes in the tropical lower stratosphere using observations of long-lived and short-lived compounds obtained during STRAT and POLARIS." F. Flocke, R.L. Herman, R.J. Salawitch, E. Atlas, C.R. Webster, S.M. Schauffler, R.A. Lueb, R.D. May, E.J. Moyer, K.H. Rosenlof, D.C. Scott, D.R. Blake, and T.P. Bui. *J. Geophys. Res.* 104, 1999.

- "Airborne Laser Infrared Absorption Spectrometer (ALIAS-II) for in situ atmospheric measurements of N_2O, CH_4, CO, HCl, and NO_2 from balloon or remotely piloted aircraft platforms." D.C. Scott, R.L. Herman, C.R. Webster, R.D. May, G.J. Flesch, E.J. Moyer. *App. Optics* 38, 1999.
- "Closure of the total hydrogen budget of the northern extratropical lower stratosphere." D.F. Hurst, G.S. Dutton, P. Romashkin, P.R. Wamsley, F.L. Moore, J.W. Elkins, E.J. Hintsa, E.M. Weinstock, R.L. Herman, E.J. Moyer, D.C. Scott, R.D. May, C.R. Webster. *J. Geophys. Res.* 104, 1999.
- "Measurements of CO in the upper troposphere and lower stratosphere." R.L. Herman, C.R. Webster, R.D. May, D.C. Scott, H. Hu, E.J. Moyer, P.O. Wennberg, T.F. Hanisco, E.J. Lanzendorf, R.J. Salawitch, Y.L. Yung, J.J. Margitan, T.P. Bui. *Chemosphere* 1, *(Special Issue on the Atmospheric Effects of Carbon Monoxide)*, 1999.
- "Tropical entrainment timescales inferred from stratospheric N_2O and CH_4 observations." R.L. Herman, D.C. Scott, C.R. Webster, R.D. May, E.J. Moyer, R.J. Salawitch, Y.L. Yung, G.C. Toon, B. Sen, J.J. Margitan, S.J. Oltmans, K.H. Rosenlof, H.A. Michelsen, J.W. Elkins. *Geophys. Res. Lett.* 25, 1998.
- "ATMOS stratospheric deuterated water and implications for troposphere-stratosphere transport." E.J. Moyer, F.W. Irion, Y.L. Yung, M.R. Gunson. *Geophys. Res. Lett.* 23, 1996.
- "Seasonal variations of water vapor in the lower stratosphere inferred from ATMOS/ATLAS-3 measurements of H_2O and CH_4." M.M. Abbas, H.A. Michelsen, M.R. Gunson, M.C. Abrams, M.J. Newchurch, R.J. Salawitch, A.Y. Chang, A. Goldman, F.W. Irion, G.L. Manney, E.J. Moyer, R. Nagaranju, C.P. Rinsland, G.P. Stiller, R. Zander. *Geophys. Res. Lett.* 23, 1996.
- "Stratospheric observations of HDO and CH_3D from ATMOS infrared solar spectra – enrichments of deuterium in methane and implications for HD." F.W. Irion, E.J. Moyer, M.R. Gunson, C.P. Rinsland, Y.L. Yung, H.A. Michelsen, R.J. Salawitch, A.Y. Chang, M.J. Newchurch, M.M. Abbas, M.C. Abrams, R. Zander. *Geophys. Res. Lett.* 23, 1996.
- "The hydrogen budget of the stratosphere inferred from ATMOS measurements of H_2O and CH_4." M.M. Abbas, M.R. Gunson, M.J. Newchurch, H.A. Michelsen, R.J. Salawitch, M. Allen, M.C. Abrams, A.Y. Chang, A. Goldman, F.W. Irion, E.J. Moyer, R. Nagaraju, C.P. Rinsland, G.P. Stiller, R. Zander. *Geophys. Res. Lett.* 23, 1996.

WHITE PAPERS

- "Feasibility and Implications of the Michigan 2012 Proposal 3 for a 25% State Renewable Portfolio Standard." E. Moyer, S. Johnson, L. Goldberger, and J. Zhu.
  RDCEP Policy Analysis Paper, Oct. 2012, *also*
  CLOSUP Working Paper Series **32**, Oct. 2012 (Center for Local, State, and Urban Policy, Gerald R. Ford School of Public Policy, University of Michigan).
- "Implications of SB0678 and the Taylorville Energy Center." A. Chitkara, M. D"orey, A. Frank, A. Johnson, S. Johnson, E. Moyer, D. Plotkin, T. Roberts, M. Templeton. *RDCEP Policy Analysis Paper*, May 2012.

EDITORIAL / OPINION

- "A New Kind of Scientist". G. Schmidt and E. Moyer. *Nature Reports Climate Change*, 2008.
- "Broadband Internet for Africa". C. Juma and E. Moyer. *Science* 320, 2008.

COMMUNITY / SERVICE: ATMOSPHERIC SCIENCE

Leadership

Session convenor, American Geophysical Union Fall Meeting (SF, CA), Dec. 2019. *"Cirrus, Chemistry, and Dynamics of the UTLS"*
Co-host, NOAA Climate and Global Change Summer Institute, 2019
Selection committee, NOAA Climate and Global Change Postdoctoral Fellowship, 2012-2015
PI, "International collaboration on isotopic studies of ice clouds", 2013-2014
with the Laboratoire de Météorologie Dynamique
Session convenor, V.M. Goldschmidt Conference (Florence, Italy), Aug. 2013. *"Water isotopes as tracers of convection, microphysics, and atmospheric dynamics"*
Organizing committee, Cargese International Summer School on Water Vapor in the Climate System (Cargese, France), Sept. 2009
Program committee, Chapman Conference on Water Vapor (Kailua-Kona, HI), Oct. 2008
Organizing committee, Cargese International Summer School on the Upper Troposphere and Lower Stratosphere (Cargese, France), Oct. 2005

Invitational workshops

ACCORD Workshop on Atmospheric Chemistry (Boulder, CO), Mar.-Apr. 2015
SPARC Water Vapor Workshop (Toronto, CA), March 2009
Global Ecology, Mathematical Biosciences Institute (Columbus, OH), June 2006
Workshop on Isotopes in the Earth System (Boulder, CO), Jan. 2004

External thesis committees

Maximilien Bolot, PhD, Ecole Normale Superieure, Oct. 2013
thesis: *"Approche théorique de la distribution des isotopologues stables de l'eau dans l'atmosphèretropicale, de l'échelle convective aux grandes échelles"*
Vaseileios Gkinis, PhD, University of Copenhagen, Nov. 2011
thesis: *"High resolution water isotope data from ice cores"*

COMMUNITY / SERVICE: CLIMATE AND ENERGY POLICY

Leadership

Commissioner, World Bank High-Level Commission on Carbon Pricing, 2017
Reviewer, National Academy of Sciences report "Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide", phase 1 & 2, 2016–2017
Co-organizer, Rossbypalooza summer school on climate and statistics (Chicago, IL), Aug. 2016
Co-organizer, RDCEP Climate Uncertainty Workshop (Chicago, IL), Sept. 2012
Session convenor, American Geophysical Union Fall Meeting (SF, CA), Dec. 2010. *"Climate Modeling in Support of Policy Decisionmaking: Needs and Limitations"*

Invited presentations / education and outreach

Chicago Council on Science and Technology (C2ST), *"Extreme Precipitation"*, June 2018
Chicago Taste of Science, *"The Earth's Energy and Climate Futures"*, Apr. 2018
Citizens' Climate Lobby Great Lakes Regional Conference,*"Energy: Science, technology, and human usage"* (keynote), October 2017
Chicago Taste of Science, *"Climate Physics and Future Climate Changes"*, Apr. 2017
Climate Change Panel hosted by IL U.S. Rep. Brad Schneider (Glencoe, IL), Apr. 2017
Chicago Council on Global Affairs (Chicago IL), *"Climate Change and Global Security"*, panelist, Feb. 2017
U.S.-China Relations Forum, University of Chicago (Chicago IL), *"The Challenge of Climate Change"*, panelist, May 2016
Gallery Talk: *"Climate Change and the Anthropocene"*. The Arts Club of Chicago (Chicago IL), Oct 2015
2015 U.S.-China Forum, University of Chicago, (Chicago, IL), panelist, May 2015
DePaul University, St. Vincent de Paul lecture (*"Global Crisis"*), respondent, Apr. 2015
Summer Teacher Institute, Univ. of Chicago Center for International Studies, *"Energy and the Global Environment"*, speaker, Sep. 2014
Green Drinks (Evanston, IL), speaker: *"Back-of-the-envelope perspective on climate mitigation"*, Feb. 2015
Goethe Institut Chicago, *"Human Impacts Chicago: Designing for a New Climate"*, panelist, Sep. 2014
Chicago Council on Science and Technology (C2ST), *"The Multiplication of Threats: Climate Change & the Risks to National Security"*, panelist, Apr. 2014
WTTW Chicago Tonight ("Climate Change & the Risks to National Security"), Apr. 2014
WBEZ "Curious City" *"Raw Report: Climate Change"*, panelist, Feb. 2014
Midwest Faculty Seminar: *"Capitalism and its Futures"* (U. Chicago), leadoff speaker, Feb. 2014
Midwest Faculty Seminar: *"Climate Change Across the Disciplines"* (U. Chicago), leadoff speaker, Apr. 2013
Nobel Symposium Public Panel (Stockholm, Sweden), Sep. 2012
"How Can We Solve the Problem of Global Warming?"
UIC Summer Institute on Sustainable Energy (SISE), leadoff speaker, Aug. 2012
Energy & Enterprise Initiative Discussion Forum, panelist, Apr. 2012
"Fixing Market Distortions: A Free Enterprise Solution for Energy & Climate?" (U. Chicago Booth School of Business)
Google "Impact!" conference, speaker (*"The Future of Energy"*), Feb. 2012
NSF Clean Energy Education Workshop, (Champaign-Urbana, IL), Oct. 2011
(breakout group leader for energy literacy)
UIC Summer Institute on Sustainable Energy (SISE), leadoff speaker, Aug. 2011
Harper Lecture, *"Robust Decision-making on Climate and Energy Policy"*, Apr. 2011
(with Ian Foster, Director, U. Chicago Computation Institute)
Midwest Faculty Seminar: *"Energy"* (U. Chicago), speaker, Apr. 2011
Cafe Scientifique (Chicago, IL), *"Alternative Energy"*, Nov. 2011
EmTech@MIT, "Fireside chat about CIM-EARTH" (Cambridge, MA), Sep. 2010
Northwestern University Climate Change Symposium (Evanston, IL), speaker, Oct. 2009 & 2010
"A Reality Check on Alternative Energy

Invitational workshops:

EPRI Workshop on Data Science Solutions to Environmental Challenges in the Electric Power Industry (Washington, DC, Nov. 2019
SEES Workshop on Natural and Engineered Carbon Sequestration (Minneapolis, MN), Oct. 2011
American Academy of Arts and Sciences Workshop on Social Science and the Alternative Energy Future (Washington, DC), May 2011
Interagency Workshops on Improving the Assessment and Valuation of Climate Change Impacts for Policy and Regulatory Analysis *(sponsored by EPA/DOE)*
II: Physical Impacts (Washington, DC), Jan 2011
I: Economic Modeling (Washington, DC), Nov 2010
DOE Workshop on Science Challenges and Future Directions for Integrated Assessment Research (Arlington, VA), Nov. 2008
(sponsored by the DOE Office of Science, Integrated Assessment Research Program)
Modeling Uncertainty in Integrated Assessment Models, (Univ. of Chicago), July 2008
(sponsored by the DOE Office of Science, ANL, U. Chicago, NW, and UIUC)

Teaching

African Institute for Mathematical Sciences (Muizenberg, R.S.A), Jan.–Feb. 2006, Dec. 2006.
Lecturer, "Climate Modeling" and "Environmental Modeling". *Designed and taught courses at a 1-year postgrad program for math and science graduates of African universities aimed at preparing students for graduate school.*

COMMUNITY / SERVICE: INTERNAL UNIVERSITY OF CHICAGO

University-level committees: Computing (BCAS), Environmental Science Initiative, Office of Sustainability, Office of Civic Engagement, Center for Teaching and Learning, U. Chicago/AIMS partnership
Advisory committee: Mansueto Institute on Urban Innovation, 2019–present
Advisory committee: Energy Policy Institute at Chicago, 2011–2014
Organizer, U. Chicago lecture series *"Environmental Data Science"*, 2008–2009
Co-chair, PSD Committee on Women in Science, 2014–2017
Speaker, PSD Visiting Committee meeting, Sep. 2014
PSD representative, U. Chicago "Knowledge Fair", June 2014
Computations in Science seminar, *"Nonlinearity in the long tail of climate warming"*, Aug. 2012
Organizer, U. Chicago lecture series *"Energy in the 21st Century"*, 2008–2009

Guest lecturer for:

Booth School of Business, *"Energy Economics"* (Topel, Rosner) , 2016, 2017, 2018, 2019
Booth School of Business, *"Energy Economics"* (Topel) , 2011
Harris School of Public Policy, *"Science, Technology, and Policy"* (Sallee/Kolb/Lamb), 2011–2015
Law School, *"The Law and Policy of Climate Change"* (Weisbach), 2010
College, Great Problems, *"Energy Policy"*, (Berry and Tolley), 2008 and 2009
Prospectives students' "Snow Day Class", 2013
Parents' Day "Model Class", 2009, 2010, 2012, 2015, 2016

MENTORSHIP

Postdocs

Ben Clouser	2017–present	
Chen Chen	*2016–2019*	*Centre for Climate Research Singapore*
Matz Haugen	*2016–2018*	*Orbital Insight*
Won Chang	*2014–2016*	*Asst. Prof., U. Cincinnati, Dept. of Stat.*
Shanshan Sun	*2012–2016*	
Laszlo Sarkozy	*2010–2016*	
Max Bolot	*2014–2016*	*Postdoc, Princeton, Dept. of Atm. and Ocean. Sci.*
Bill Leeds	*2012–2014*	*Climate Corporation / Monsanto*
David McInerney	*2010–2012*	*U. Adelaide, Dept. of Civil and Env. Eng.*

Graduate students

Jim Franke	PhD exp. 2022, Geophys. Sci.	
Ziwei Wang	PhD exp. 2023, Geophys. Sci.	
Haynes Stephens	PhD exp. 2023, Geophys. Sci.	
Ben Clouser	*PhD 2018, Physics*	
Kara Lamb	*PhD 2015, Physics*	*Postdoc, NOAA Aeronomy Laboratory*
Michael Glotter	*PhD 2015, Geophys. Sci.*	*AAAS Congressional Science Fellow*
Eric Stutz	*MS 2013, Geophys. Sci.*	*Bain Corp.*
Stephanie Aho	*MS 2011, Geophys. Sci.*	*Hitachi Global Storage Technologies*

Master's students (published research)

Wenjia Ma	MPP exp. 2020, Harris	
Hsin-Yi Chen	*MS 2019, U. Hawaii*	*Proterra*
Jeremy Klavans	*MPP 2014, Harris*	*U. Miami, Dept. of Atmos. Sci.*
Mark Woolley	*MPP 2012, Harris*	*LMI; OPower*

Undergraduate students (research / honors theses)

Sydney Jenkins	Comp. Sci.	
Michelle Li	*BS 2019, Statistics*	
Clare Singer	*BS 2018, Physics*	*Caltech, Div. of Geol. and Plan. Sci.*
Aidan Sadowski	*BS 2017, Comp. Sci.*	*Google*
Hannah Kenagy	*BS 2016, Chemistry*	*U.C. Berkeley, Dept. of Chemistry*
Julian Maronhic	*BS 2016, Physics*	*U. Maryland, Dept. of Astronomy*
Kevin Schwarzwald	*BS 2015, Physics and Public Policy*	*Columbia Univ., Dept. of Earth and Env. Sci.*
Joe Zhu	*BS 2014, Geophys. Sci.*	*Schlumberger*
Rachel Atlas	*BS 2014, Geophys. Sci.*	*EPA; U. Washington, Dept. of Atmos. Sci.*
Lexie Goldberger	*BS 2014, Geophys. Sci.*	*U. Washington, Dept. of Atmos. Sci., PNNL*
Grant Wilder	*BS 2013, Statistics and Geophys. Sci.*	*Rand Corp.*
Lisa Pawlowicz	*BS 2012, Physics*	*MIT, Dept. of Electrical Engineering*
Sean Johnson	*BS 2012, Astronomy*	*U. Chicago, Princeton, Dept. of Astro. Sci.*
Sarah Bang	*BS 2010, Geophys. Sci.*	*Univ. of Utah, Dept. of Meteorology*

Mentored to NSF graduate fellowships

Graduate: Franke, Glotter, Aho; *Undergraduate*: Singer, Atlas, Kenagy