PROFESSOR MICHAEL J. PUMA

Columbia University, Center for Climate Systems Research
NASA Goddard Institute for Space Studies
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Professor Puma leads the Center for Climate Systems Research at Columbia University's Climate School, working in close collaboration with NASA's Goddard Institute for Space Studies, where he oversees a team of 40 scientists and staff advancing research in climate science, space studies, and climate impact analysis. As Editor of *Earth's Future* (AGU), Prof. Puma focuses on global food security, human migration, and the interactions between water and climate. His research explores how shocks – such as conflicts, extreme floods and droughts, volcanic eruptions, and policy changes – disrupt interconnected global food systems, and he develops strategies to balance efficiency and resilience in these systems, providing pathways for short- and long-term stability. Prof. Puma also studies the drivers of human migration, particularly when food and water scarcity arise from environmental change and conflict, and he is developing and integrating new theories and frameworks of human mobility to advance our understanding of the complex forces shaping migration decisions. His work delivers critical insights for policymakers addressing global food insecurity and humanitarian challenges, and his research has received funding from NASA, the European Commission, the US National Science Foundation, the US Department of Defense, DARPA, and the United Nations Development Programme.

EDUCATION

Princeton University, Princeton, NJ
Ph.D., Civil Engineering, *Environmental Engineering & Water Resources*, 2006
M.A., Civil Engineering, *Environmental Engineering & Water Resources*, 2003

Columbia University, New York, NY
Master of International Affairs, *Environmental Policy Studies*, 1999
Bachelor of Science, Civil Engineering, *Environmental Eng. & Water Resources*, 1998

Regis High School, New York, NY, 1994

EXPERIENCE

Columbia University
Professor of Climate, Columbia Climate School, 2025 to present
Director, Center for Climate Systems Research, 2017 to present
Co-Director, Climate School Postdoctoral Research Program, [*July*] 2025 to present

***Earth's Future*, American Geophysical Union (AGU)**
Editor, 2025 to present

Pace University – Elisabeth Haub School of Law
Haub Visiting Scholar, Spring 2018

Columbia University – Past Positions
Research Appointments
Senior Research Scientist, Center for Climate Systems Research, 2023 to 2024
Research Scientist, Center for Climate Systems Research, 2016 to 2023
Climate and Life Fellow, Center for Climate and Life, 2016 to 2019
Associate Research Scientist, Center for Climate Systems Research, 2010 to 2016
Postdoctoral Research Scientist, Center for Climate Systems Research, 2007 to 2010

Teaching Appointments
Adjunct Lecturer, School of Professional Studies, 2010 to 2024
Adjunct Associate Professor, School of Int'l and Public Affairs, 2017 to 2018 (Summers)
Adjunct Assistant Professor, School of Int'l and Public Affairs, 2010 to 2016 (Summers)

Princeton University: *Research Associate funded by the National Center for Earth-Surface Dynamics at Saint Paul, Minnesota*, 2006 to 2007

Dvirka & Bartulucci Consulting Engineers: *Environmental Engineer*, 2001

URS Corporation: *Project/Field Environmental Engineer,* 1999 to 2000

United Nations Secretariat, Dept. of Economic & Social Affairs: *Intern*, 1998

United Nations Development Programme, Office to Combat Desertification & Drought: *Research Intern*, 1998

Inform, Inc. (a non-profit environmental org.): *Intern* under Dr. Nevin Cohen, 1997

GRANTS

CURRENT FUNDING

Human History of Marine Life Extraction, Knowledge, Drivers and Consumption of Marine Resources, c. 100BCE to c.1860 CE (4-OCEANS). Co-I: MJ Puma. Funder: European Commission through Trinity College Dublin: B1-ERC Synergy Grant 2020, 07/2021 to 06/2025, Award Amount: $414,560.

A KAUST Economy and Nature (KEN) Model. Columbia Subaward PI: Michael Puma Funder: King Abdullah University of Science and Technology (KAUST). 06/2024 to 06/30/2025. Award Amount: $80,000.

Comparing Underlying Drivers of South-North Migration in Central America and West Africa. PI: Alex de Sherbinin; Co-Investigator (Co-I): MJ Puma. Funder: US Department of Defense. 7/15/2022 to 7/14/2025, Award Amount: $967,357.

SELECT PAST FUNDING

A Symbiotic Agent-Based Network Platform Linking Expert Knowledge and Machine Learning for Systemic Risk Mitigation. Principal Investigator (PI): MJ Puma. Funder: US Department of Defense, DARPA I2O. 12/1/2018 to 6/30/2023, Award Amount: $3,085,318.

Towards a Multi-Scale Theory on Coupled Human Mobility and Environmental Change. PI: Rachata Muneepeerakul; Co-I: MJ Puma. Funder: US Department of Defense. 6/1/2018 to 9/30/2024, Award Amount: $5,135,720.

Modeling forest physiological and structural responses to climate extremes and feedbacks in GISS ModelE. PI: Ensheng Weng. Co-Investigator. MJ Puma. Funder: NASA Modeling Analysis and Predication. 07/2021 to 06/2024. Award Amount: $849,494.

Satellite Monitoring of Informal Settlement Dynamics and Displaced Person Mobility in the Complex Humanitarian Crisis of Tigray, Ethiopia. PI: Jamon Van Den Hoek; Co-I: MJ Puma. Funder: NASA RAPID. 07/2022 to 12/2023. Award Amount: $86,719

GCR: Collaborative Research: Disentangling Environmental Change and Social Factors as Drivers of Migration. Award Number:1934978; PI: Richard Seager; Co-Is: Alexander de Sherbinin, Wolfram Schlenker, Michael Puma; Funder: NSF. 10/01/2019 to 9/30/2021. Award Amount: $1,038,094.

Balancing efficiency and resilience in the global food system to reduce its vulnerability to climate-related shocks. PI: MJ Puma. Funder: Center for Climate and Life, Columbia University. 7/1/2016 to 12/31/2019, Award Amount: $182,035.

Technical advisor on climate information and modeling for low-emission, climate-resilient development projects. PI: MJ Puma. Funder: United Nations Development Programme. 4/ 2010 to 4/2013 and 9/2013 to 2/2014.

Quantifying process-based variability and uncertainties in ocean, land, and atmosphere forcing of extra-tropical droughts and heat waves in GISS ModelE and observations. PI: BI Cook; Co-I: MJ Puma, R Seager, P Williams. 8/01/2017 to 7/31/2021, Award Amount: $191,607. Funder: NASA

HONORS

Fellow at the Center for Climate and Life, Columbia University, 2016-2019

Haub Visiting Scholar at Pace University's Elisabeth Haub School of Law: Delivered the 2018 keynote Lloyd K. Garrison Lecture on Environmental Law entitled "De-risking the global food system in a changing climate," 2018

NASA GISS Publication Honors (by vote):

- 2010: Lead author, *Best Popular Science Brief,* Irrigation and 20th Century Climate, MJ Puma and BI Cook.

- 2014: Coauthor, *Best Publication Award*, R. Miller with 39 others including MJ Puma: CMIP5 historical simulations (1850-2012) with GISS ModelE2. *J. Adv. Model. Earth Syst.*, **6**, no. 2, 441-477, doi:10.1002/2013MS000266.
- 2018: Lead author, *3rd Best Publication*, A developing food crisis and potential refugee movements, MJ Puma with 6 others.
- 2020: Coauthor, *Best Publication Award*, GISS-E2.1: Configurations and climatology. M. Kelley with 45 others including MJ Puma.
- 2021: Coauthor, *Best Publication Award*, CMIP6 historical simulations (1850-2014) with GISS-E2.1, R. Miller with 45 others including MJ Puma.

Princeton Environmental Institute Fellowship, 2002 to 2003, 2005 to 2006

William Clay Ford, Jr. '79 and Lisa Vanderzee Ford '82 Graduate Fellowship, 2004 to 2005: *Awarded to a Princeton graduate student in recognition of excellence in academic work and the student's reputation as a promising scholar.*

Princeton University Graduate Fellowship, 2001 to 2002.

Columbia University, King's Crown Awards, 1998: *Awarded a "gold crown" in recognition of outstanding leadership and service to the Columbia community.*

TEACHING EXPERIENCE

Columbia University, Columbia Climate School
Global food trade, shocks and migration (In development for Fall 2025)

Columbia University, School of Professional Studies
Water Governance, Adjunct Lecturer (Fall semester, 2013 to present)

Past Columbia University Courses
- *Hydrology*, Adjunct Associate/Assistant Professor (Summers, 2011 to 2018)
- *Science of Sustainable Water* (Fall semesters 2011 & 2012)
- *Management and Development of Water Systems* (Spring 2011)
- *Envtl. Science for Sustainable Development* (Guest lecturer, Fall 2010)
- *Water and Sustainability* (Fall 2010, Spring 2012)
- *Water, Ecosystems, and Sustainability* (Summer 2009)

Cheikh Anta Diop University of Dakar: Lectured as part of a short course on "Climate Risk Management for Nutrition" to student in the master program in Human Nutrition (July 30, 2021).

Princeton University
Assistant Instructor, *Hydrology* (Spring 2006)
Assistant Instructor, *Fundamentals of Environmental Science* (Fall 2005)
Teaching Transcript Program: Completed a pedagogical training program at Princeton University's McGraw Center for Teaching and Learning (2005-2007).

STUDENT ADVISING

University of Illinois Urbana-Champaign: *PhD Committee Member,* Deniz Berfin Karakoc, 2022 to 2024

University of Florida-Gainesville: *PhD committee member*, Alvaro Carmona Cabrero, 2021 to 2022

Cheikh Anta Diop University of Dakar: *Master's thesis advisor*: Aïcha Diongue, Spring 2022

Oxford University, Christ Church: *Examiner for PhD degree*, Lisa Thalheimer, July 20, 2021

NASA Internship Program: Nonnie Woodruff, Summer 2019; Roland Maio, Spring 2017; Morgan DiCarlo, *Development and Testing of an Interactive Single-Column Atmosphere-Land Surface Model*, Summer 2016

Columbia University

- Current master's students: Erika Wu (agent based modeling of migration and refugee movement); Clara Bardot (understanding internal displacement theory and models); Samuel Rager (quantum modeling in global food systems); Primanta Bangun (understanding port-to-port analyses of grain commodities in response to the Ukraine war); Janavi Kumar (ENSO and famine in early modern Europe).
- *Postdoctoral advisor*: Keren Mezuman, 2019 to 2022; Alison Heslin, 2018 to 2020; Kaoru Kakinuma, 2016 to 2018
- *PhD committee member*: Madeleine Pascolini-Campbell, 2018; Miriam Nielsen, 2024- present
- *Master's program faculty advisor*: ~10 students per year in the School of Professional Studies, 2013 to 2025
- *Master's thesis advisor*: Michael DeMichiei, *An Analysis of the Pakistani State Model for Managing the Effects of Climate Change*, Southern Asian Institute, 2019
- *Research advisor*: Émile Esmaili, 2022–2024; Amanda Chen, 2023; Aric Cutuli, 2022-2023; Mitchell Thomas, Spring 2021
- *Undergraduate Senior Thesis Advisor:* Miriam Kaplan, *Maintenance of Constructed Wetland/Grey Water Treatment and Reuse Systems in the West Bank* (2013 to 2014); Thomas Timberlake, *Water and War: A Geospatial Exploration of Point Source Water Access and Conflict in Liberia* (2011-2012)
- *Independent Study Advisor*: Alexandra Sweeney, *Agriculture and the Virtual Water Trade of Nepal*, Columbia's Climate & Society program (2013); Matthew Codner, *Climate Change and Sea Level Rise in Maritime Canada: Effects and Adaptation* (2012)
- *Faculty mentor*: *Aquanauts* Student Group, 2011–2012

PUBLICATIONS

SUMMARY (*Google Scholar*: 7000+ citations, h-index =35, i10-index=49)

ORCID iD: https://orcid.org/0000-0002-4255-8454

- 55 articles in peer-reviewed journals
- 10+ articles under review/in revision/in preparation
- 10 articles for a lay audience – including a 2022 Op-Ed in the *New York Times*
- 20 reports/chapters/proceedings
- 1 book

UNDER REVISION / IN REVIEW / IN PREPARATION

1. Cutuli, A., Lall, U., Puma, M. J., Esmaili, E., & Muneepeerakul, R. A Bayesian hierarchical framework for capturing preference heterogeneity in migration flows. *Journal of Demographic Economics*. In revision.

2. Johnson JC, Traff J, Hood J, Zurek-Ost M, Puma MJ, and Muneepeerakul R. Network Models Reveal Food Vulnerability as a Key Factor in Migration Across African Regions. *Global Environmental Change.* In review.

3. Puma MJ, Hall J, Verschuur J, Otto C, Kuhla K, Konar M. Rethinking agricultural systems models for a polycrisis world. Nature Food. In preparation

4. Puma MJ, Chon S, Wada Y, Cook BI, Nordbotten JM, Falkendal, T, Otto C. A Richter scale reveals the magnitude of global food disruptions. *Nature*. In preparation.

5. Puma MJ, Bangun PH, Verschuur, J, Hall J. Port-to-port data reveals diverse impacts of Ukraine war on grain supplies. In preparation.

6. Puma MJ, Wu E, Groen D, Suleimenova D. Integrating fast and slow decision making into an agent-based framework of refugee movement. In preparation.

7. Lall U, Palandri C, Concha Larrauri P, Puma MJ, Gelman A. A Multilevel Bayesina Framework to Analyze Climate-Fueled Migration and Conflict. In preparation.

8. Kuhla K, Jonas J, Puma MJ, Otto C. Climate change-driven shifts of global and regional food security risks throughout the 21st century. In preparation.

9. Esmaili E, Cutuli A, Lall U, Puma MJ, Muneepeerakul R. Modeling migration flows with Non-Homogeneous Hidden Markov Models. In preparation.

10. Esmaili E, Puma MJ, Ludlow F, Jobbová E, and Holm P. Warfare Ignited Price Contagion Dynamics in Early Modern Europe. In preparation.

11. Esmaili E, Puma MJ, Ludlow F, Jobbová E, and Kumar J. ENSO increases likelihood of famine in early modern Europe. In preparation.

12. Suleimenova D, Groen D, Mezuman K, Bardot, Puma MJ. Modeling internal displacement in an agent based model of human mobility. In preparation.

13. Cottier F, Nébié E, Seager R, Schlenker W, McDermid S, Puma MJ, Morris CA, de Sherbinin A, Anderson W, Bell AR. Migration within and out of West Africa: recent trends and drivers. In revision.

14. Zurek-Ost M, Johnson JC, Traff J, Puma MJ, and Muneepeerakul R. Toward an Expanded Typology of Global Migration Networks and Their Environmental-Conflict Dimensions. *Environmental Research Letters*. In preparation.

15. Otto C, Schewe J, Puma MJ, Frieler K. Combating extremes in global food prices with an international wheat reserve. In preparation.

PEER-REVIEWED PUBLICATIONS

1. Best, M.J., A.P. Lock, G. Balsamo, E. Bazile, I. Beau, J. Cuxart, M.B. Ek, K. Findell, A. Fridlind, A.A.M. Holtslag, W. Huang, M.A. Jiménez, S. Kumar, D. Lawrence, S. Malyshev, P. Le Moigne, M. Puma, R. Ronda, J.A. Santanello, I. Sandu, X. Shen, G.-J. Steeneveld, G. Svensson, P.A. Vaillancourt, W. Wang, A. Zadra, and W. Zheng, 2025: Rolling DICE to advance knowledge of land-atmosphere interactions. *Q. J. Roy. Meteorol. Soc.*, early on-line, doi:10.1002/qj.4944.

2. Konar M, Fisher-Vanden K, Grogran D, Haqiq I, Mejia A, Puma MJ. Groundwater and trade: Towards an interdisciplinary consensus and roadmap for future research. *Environmental Research Letters.* In press

3. Kuhla, K., M.J. Puma, and C. Otto, 2024: International cooperation was key to stabilize wheat prices after the Russian invasion of Ukraine. *Commun. Earth Environ.*, **5**, no. 1, 481, doi:10.1038/s43247-024-01638-7.

4. Nakamura, J., R. Seager, H. Liu, F. Cottier, M.J. Puma, D.J. Wrathall, B. Katz, A. de Sherbinin, and S.B. Adamo, 2024: Recent trends in agriculturally relevant climate in Central America. *Int. J. Climatol.*, **44**, no. 8, 2701-2724, doi:10.1002/joc.8476.

5. Muneepeerakul, R., J. Johnson, M. Puma, and M. Zurek, 2024: Triadic signatures of global refugee and migrant flow networks. *PLOS ONE*, **19**, no. 2, e0298876, doi:10.1371/journal.pone.0298876

6. Karakoc, D.B., M. Konar, M.J. Puma, and L.R. Varshney, 2023: Structural chokepoints determine the resilience of agri-food supply chains in the United States. *Nat. Food*, **4**, no. 7, 607-615, doi:10.1038/s43016-023-00793-y.

7. Heino, M., P. Kinnunen, W. Anderson, D.K. Ray, M.J. Puma, O. Varis, S. Siebert, and M. Kummu, 2023: Increased probability of hot and dry weather extremes during the growing season threatens global crop yields. *Sci. Rep.*, **13**, 3583, doi:10.1038/s41598-023-29378-2.

8. Griffith, D., R. Muneepeerakul, G. Guerry, A.C. Cabrero, J.C. Johnson, R. Munoz-Carpena, M. Puma, U. Lall, and M. Homayounfar, 2023: Migration and livelihood constellations: Assessing common themes in the face of environmental change in Somalia and among Agro-Pastoral peoples. *Int. Migr.*, early on-line, doi:10.1111/imig.13122.

9. Weng, E., I. Aleinov, R. Singh, M.J. Puma, S.S. McDermid, N.Y. Kiang, M.A Kelley, K. Wilcox, R. Dybzinski, C.E. Farrior, S.W. Pacala, and B.I. Cook, 2022: Modeling demographic-driven vegetation dynamics and ecosystem biogeochemical cycling in NASA GISS's Earth system model (ModelE-BiomeE v.1.0). *Geosci. Model Dev.*, **15**, no. 22, 8153-8180, doi:10.5194/gmd-15-8153-2022.

10. McDermid, S.S., E. Weng, M. Puma, B. Cook, T. Hengl, J. Sanderman, G.J.M. De Lannoy, and I. Aleinov, 2022: Soil carbon losses reduce soil moisture in global climate model simulations. *Earth Interact.*, **26**, no. 1, 195-208, doi:10.1175/EI-D-22-0003.1.

11. De Sherbinin, A., K. Grace, S. McDermid, K. Van Der Geest, M.J. Puma, and A. Bell, 2022: Migration theory in climate mobility research. *Front. Clim.*, **4**, 882343, doi:10.3389/fclim.2022.882343.

12. Nazarenko L and 45 others including MJ Puma. Future climate change under SSP emission scenarios with GISS-E2.1. *J. Adv. Model Earth. Syst.,* **14**, no. 7, e2021MS002871, doi:10.1029/2021MS002871.

13. Lehikoinen, E., P. Kinnunen, J. Piipponen, A. Heslin, M.J. Puma, and M. Kummu, 2021: Importance of trade dependencies for agricultural inputs: A case study of Finland. *Environ. Res. Commun.*, **3**, no. 6, 061003, doi:10.1088/2515-7620/ac02d0.

14. Schon, J., K. Mezuman, A. Heslin, R.D. Field, and M.J. Puma, 2021: How fire patterns reveal uneven stabilization at the end of conflict: Examining Syria's unusual fire year in 2019. *Environ. Res. Lett.*, **16**, no. 4, 044046, doi:10.1088/1748-9326/abe327.

15. McDermid, S.S., B.I. Cook, M.G. De Kauwe, J. Mankin, J.E. Smerdon, A.P. Williams, R. Seager, M.J. Puma, I. Aleinov, M. Kelley, and L. Nazarenko, 2021: Disentangling the regional climate impacts of competing vegetation responses to elevated atmospheric CO_2. *J. Geophys. Res. Atmos.*, **126**, no. 5, e2020JD034108, doi:10.1029/2020JD034108.

16. Falkendal, T., C. Otto, J. Schewe, J. Jägermeyr, M. Konar, M. Kummu, B. Watkins, and M.J. Puma, 2021: Grain export restrictions during COVID-19 risk food insecurity in many low- and middle-income countries. *Nat. Food*, **2**, no. 1, 11-14, doi:10.1038/s43016-020-00211-7.

17. Miller, J.R., J.E. Fuller, M.J. Puma, and J.M. Finnegan, 2021: Elevation dependent warming in the Eastern Siberian Arctic. *Environ. Res. Lett.*, **16**, no. 2, 024044, doi:10.1088/1748-9326/abdb5e.

18. Miller, R.L., G.A. Schmidt, L. Nazarenko, S.E. Bauer, M. Kelley, R. Ruedy, G.L. Russell, A. Ackerman, I. Aleinov, M. Bauer, R. Bleck, V. Canuto, G. Cesana, Y. Cheng, T.L. Clune, B. Cook, C.A. Cruz, A.D. Del Genio, G.S. Elsaesser, G. Faluvegi, N.Y. Kiang, D. Kim, A.A. Lacis, A. Leboissetier, A.N. LeGrande, K.K. Lo, J. Marshall, E.E. Matthews, S. McDermid, K. Mezuman, L.T. Murray, V. Oinas, C. Orbe, C. Pérez García-Pando, J.P. Perlwitz, M.J. Puma, D. Rind, A. Romanou, D.T. Shindell, S. Sun, N.

Tausnev, K. Tsigaridis, G. Tselioudis, E. Weng, J. Wu, and M.-S. Yao, 2021: CMIP6 historical simulations (1850-2014) with GISS-E2.1. *J. Adv. Model. Earth Syst.*, **13**, no. 1, e2019MS002034, doi:10.1029/2019MS002034.

19. Kakinuma, K., M.J. Puma, Y. Hirabayashi, M. Tanoue, E.A. Baptista, and S. Kanae, 2020: Flood-induced population displacements in the world. *Environ. Res. Lett.*, **15**, no. 12, 124029, doi:10.1088/1748-9326/abc586.

20. Krakauer, N.Y., B.I. Cook, and M.J. Puma, 2020: Effect of irrigation on humid heat extremes. *Environ. Res. Lett.*, **15**, no. 9, 094010, doi:10.1088/1748-9326/ab9ecf.

21. Cook, B.I., S.S. McDermid, M.J. Puma, A.P. Williams, R. Seager, M. Kelley, L. Nazarenko, and I. Aleinov, 2020: Divergent regional climate consequences of maintaining current irrigation rates in the 21st century. *J. Geophys. Res. Atmos.*, **125**, no. 14, e2019JD031814, doi:10.1029/2019JD031814.

22. Heslin, A., M.J. Puma, P. Marchand, J.A. Carr, J. Dell'Angelo, P. D'Odorico, J.A. Gephart, M. Kummu, M. Porkka, M.C. Rulli, D. Seekell, S. Suweis, and A. Tavoni, 2020: Simulating the cascading effects of an extreme agricultural production shock: Global implications of a contemporary US Dust Bowl event. *Front. Sustain. Food Syst.*, **4**, 26, doi:10.3389/fsufs.2020.00026.

23. Jägermeyr, J., A. Robock, J. Elliott, C. Müller, L. Xia, N. Khabarov, C. Folberth, E. Schmid, W. Liu, F. Zabel, S.S. Rabin, M.J. Puma, A.C. Heslin, J. Franke, I. Foster, S. Asseng, C.G. Bardeen, O.B. Toon, and C. Rosenzweig, 2020: A regional nuclear conflict would compromise global food security. *Proc. Natl. Acad. Sci.*, **117**, no. 13, 7071-7081, doi:10.1073/pnas.1919049117.

24. Kinnunen, P., J.H.A. Guillaume, M. Taka, P. D'Odorico, S. Siebert, M.J. Puma, M. Jalava, and M. Kummu, 2020: Local food crop production can fulfil demand for less than one-third of the population. *Nat. Food*, **1**, no. 4, 229-237, doi:10.1038/s43016-020-0060-7.

25. Kelley, M., G.A. Schmidt, L. Nazarenko, S.E. Bauer, R. Ruedy, G.L. Russell, A.S. Ackerman, I. Aleinov, M. Bauer, R. Bleck, V. Canuto, G. Cesana, Y. Cheng, T.L. Clune, B.I. Cook, C.A. Cruz, A.D. Del Genio, G.S. Elsaesser, G. Faluvegi, N.Y. Kiang, D. Kim, A.A. Lacis, A. Leboissetier, A.N. LeGrande, K.K. Lo, J. Marshall, E.E. Matthews, S. McDermid, K. Mezuman, R.L. Miller, L.T. Murray, V. Oinas, C. Orbe, C. Pérez García-Pando, J.P. Perlwitz, M.J. Puma, D. Rind, A. Romanou, D.T. Shindell, S. Sun, N. Tausnev, K. Tsigaridis, G. Tselioudis, E. Weng, J. Wu, and M.-S. Yao, 2020: GISS-E2.1: Configurations and climatology. *J. Adv. Model. Earth Syst.*, **12**, no. 8, e2019MS002025, doi:10.1029/2019MS002025.

26. Del Genio, A.D., M.J. Way, N. Kiang, I. Aleinov, M.J. Puma, and B. Cook, 2019: Climates of warm Earth-like planets III: Fractional habitability from a water cycle perspective. *Astrophys. J.*, **887**, no. 2, 197, doi:10.3847/1538-4357/ab57fd.

27. Cook, B.I., R. Seager, A.P. Williams, M.J. Puma, S. McDermid, M. Kelley, and L. Nazarenko, 2019: Climate change amplification of natural drought variability: The historic mid-twentieth century North American drought in a warmer world. *J. Climate*, doi:10.1175/JCLI-D-18-0832.1.

28. McDermid, S.S., C. Montes, B.I. Cook, M.J. Puma, N.Y. Kiang, and I. Aleinov, 2019: The sensitivity of land-atmosphere coupling to modern agriculture in the northern mid-latitudes. *J. Climate*, **32**, no. 2, 465-484, doi:10.1175/JCLI-D-17-0799.1.

29. Singh, D., S.P. McDermid, B.I. Cook, M.J. Puma, L. Nazarenko, and M. Kelley, 2018: Distinct influences of land-cover and land-management on seasonal climate. *J. Geophys. Res. Atmos.*, **123**, no. 21, 12017-12039, doi:10.1029/2018JD028874.

30. Puma, M.J., S.Y. Chon, K. Kakinuma, M. Kummu, R. Muttarak, R. Seager, and W. Wada, 2018: A developing food crisis and potential refugee movements. *Nature Sustain.*, **1**, 380-382, doi:10.1038/s41893-018-0123-z.

31. Torreggiani, S., G. Mangioni, M.J. Puma, and G. Fagilo, 2018: Identifying the community structure of the international food-trade multi network. *Environ. Res. Lett.*, **13**, no. 5, 054026, doi:10.1088/1748-9326/aabf23.

32. Heino, M., M.J. Puma, P.J. Ward, D. Gerten, V. Heck, S. Siebert, and M. Kummu, 2018: Two-thirds of global cropland area impacted by climate oscillations. *Nat. Commun.*, **9**, 1257, doi:10.1038/s41467-017-02071-5.

33. Dalin, C., Y. Wada, T. Kastner, and M.J. Puma, 2017: Groundwater depletion embedded in international food trade. *Nature*, **543**, no. 7647, 700-704, doi:10.1038/nature21403.

34. Seekell, D.A., J. Carr, J. Dell'Angelo, P. D'Odorico, M. Fader, J.A. Gephart, M. Kummu, N. Magliocca, M. Porkka, and M.J. Puma, 2017: Resilience in the global food system. *Environ. Res. Lett.*, **12**, no. 2, 025010, doi:10.1088/1748-9326/aa5730.

35. Krakauer, N.Y., M.J. Puma, B.I. Cook, P. Gentine, and L. Nazarenko, 2016: Ocean-atmosphere interactions modulate irrigation's climate impacts. *Earth Syst. Dyn.*, **7**, 863-876, doi:10.5194/esd-7-863-2016.

36. Marchand, P., J.A. Carr, J. Dell'Angelo, M. Fader, J.A. Gephard, M. Kummu, N.R. Magliocca, M. Porkka, M.J. Puma, and Z. Ratajczak, 2016: Reserves and trade jointly determine exposure to food supply shocks. *Environ. Res. Lett.*, **11**, no. 9, 095009, doi:10.1088/1748-9326/11/9/095009.

37. Fader, M., M.C. Rulli, J. Carr, J. Dell'Angelo, P. D'Odorico, J. Gephart, M. Kummu, N. Magliocca, M. Porkka, C. Prell, M.J. Puma, Z. Ratajczak, D.A. Seekell, S. Suweis, and A. Tavoni, 2016: Past and present biophysical redundancy of countries as a buffer to changes in food supply. *Environ. Res. Lett.*, **11**, no. 5, 055008, doi:10.1088/1748-9326/11/5/055008.

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SELECT RECENT TALKS & PANELS

1. **Invited Talk**. *Climate to conflict: advancing multiscale models of human mobility and displacement.* "From Data to Action: Addressing the Nexus of Climate, Health, Conflict & Displacement Across Diverse Contexts" at the Johns Hopkins Bloomberg Center in Washington DC at 555 Pennsylvania Ave NW, Washington DC. March 5, 2025.

2. **Invited Class Talk**. *Towards an understanding of human mobility*. Prof Lewis Ziska's Class Spring 2025 "Environmental Health Sciences Public Health Impacts of Climate Change." Feb 6, 2025.

3. **Invited Panel**. *Climate Migration Modeling Intercomparison Workshop*. Princeton University; September 25-27, 2024. Panel member discussing "Validating Model Outputs": *What are the best practices for validating models with limited/imperfect data? What metrics should be privileged? What role does statistical inference play? For models that engage in projection, how to compare probabilistic predictions to deterministic predictions?*

4. **Invited Talk**. *Strategically Transforming Food Systems for Robustness and Resilience.* 5th Global Food Security Conference. Towards equitable, sustainable and resilient food systems. Leuven, Belgium. April 11, 2024 |

5. **Invited Talk**. *Reducing Global Food System Vulnerability to Unpredictable Events.* The Future of Food Forum, 2024. University of Florida, Gainesville. April 3, 2024

6. **Invited Talk**. *Global human migration and trade impacts of water and climate disruptions*. World Water Day. Water Futures – Adaptation & Innovation. March 22, 2024 | Arizona State University Walton Center.

7. **Invited Talk**. *The Impact of War on Food Security.* Museum of Food and Drink (MOFAD). May 13, 2022

PUBLISHED ABSTRACTS

1. Esmaili E, Cutuli A, Lall U, Puma MJ, Muneepeerakul R. Modeling Migration Flows with Non-Homogeneous Hidden Markov Models. In *Fall Meeting 2023*. AGU.

2. Cutuli, A., Lall, U., Puma, M. J., Esmaili, E., & Muneepeerakul, R. (2023). A Bayesian Hierarchical Framework for Modeling Migration Flows. In *Fall Meeting 2023*. AGU.

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5. Johnson, J., Zurek-Ost, M., Hood, J., Puma, M. J., & Muneepeerakul, R. (2022, December). Network Models of Possible Climate Drivers to Refugee Flows: Regional Scale Comparisons. In *Fall Meeting 2022*. AGU.

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7. MJ Puma, K Mezuman, H Arabnejad, D Groen, A Jahani, U Lall, P Concha Larrauri, R Muneepeerakul, G Suarez, D Suleimenova. Assessing operational insights gained from simulation of refugee movements with an agent based model. In AGU Fall Meeting 2021. AGU.

8. J Johnson, J Hood, J Schon, MJ Puma, E Smith. The Transformation of Global Network Migrant and Refugee Flows: Examining the Potential Emergence of Climate Drivers. In AGU Fall Meeting 2021. AGU.

9. MJ Puma, M Thomas. Harnessing causal linkages between climate and food prices to address nutrition concerns in Senegal. In AGU Fall Meeting 2021. AGU.

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13. F Cottier, W Schlenker, E Ilboudo-Nébié, R Seager, SS McDermid, MJ Puma, AM de Sherbinin, WB Anderson, AR Bell. Crop Price Variability, Environmental Change and Intra-Regional Migration in Africa. In AGU Fall Meeting 2021. AGU.

14. K Kakinuma, MJ Puma, Y Hirabayashi, M Tanoue, EA Baptista, S Kanae. Global flood impacts on population displacements. In AGU Fall Meeting 2021. AGU.

15. Weng, E., Gentine, P., Puma, M.J., McDermid, S.S. and Cook, B., 2021, December. Plant hydraulics-modulated forest physiological and compositional responses to climate changes: an evolutionally optimal modeling analysis. In AGU Fall Meeting 2021. AGU.

16. Puma, M. J., Falkendal, T., Otto, C., Schewe, J., Jägermeyr, J., Konar, M., ... & Watkins, B. (2020, December). Safeguard global supply chains to protect food security during the COVID-19 pandemic. In *AGU Fall Meeting 2020*. AGU.

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32. Kakinuma K, Puma MJ, Kanae S. Climate change may affect human migration in Mongolia. Presented at 2016 Fall Meeting, AGU San Francisco, Calif., 12 to 16 December 2016.

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47. Puma MJ, Kiang NY, Aleinov I. Evapotranspiration partitioning and its effects on terrestrial ecosystem dynamics in the GISS Land Surface Model. Poster, AGU meeting, San Francisco, December 2008. Abstract published in Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract B31A-0289, 2008.

48. Kiang NY, Kharecha P, DelGrosso S, Aleinov I, Puma MJ, Kim Y. Seasonal and long-term behavior of soil and autotrophic respiration in the Ent Dynamic Global Terrestrial Ecosystem Model. Presentation, AGU meeting, San Francisco, December 2008. Abstract published in Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract B13D-08, 2008.

49. Aleinov I, Kiang NY, Romanou A, Puma MJ, Kharecha P. Global carbon cycle inside the GISS ModelE GCM: results of equilibrium and transient simulations. Poster, AGU meeting, San Francisco, December 2008. Abstract published in Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract U41B-0019, 2008.

50. Puma MJ, Celia MA, Rodriguez-Iturbe I, Nordbotten JM, Guswa AJ. Effects of spatial heterogeneity in rainfall and vegetation on soil moisture and evapotranspiration. Poster, AGU meeting, San Francisco, December 2005; Abstract published in Eos Trans. AGU, 86(52), Fall Meeting Suppl., Abstract B33D-1056, 2005.

51. Celia MA, Rodriguez-Iturbe I, Guswa AJ, Nordbotten JM, Puma MJ. Representation of soil moisture, evapotranspiration, and solute transport across different length and time scales. Abstract published in Eos Trans. AGU, 86(18), Joint Assembly Suppl., Abstract H42A-01, 2005.

52. Puma MJ, Celia MA, Rodriguez-Iturbe I, Guswa AJ. Functional relationship to describe temporal statistics of soil moisture averaged over different depths. Presentation, AGU meeting, San Francisco, December 2003; Abstract published in Eos Trans. AGU, 84(46), Fall Meeting Suppl., Abstract H42H-02, 2003.

PROFESSIONAL MEMBERSHIP & SERVICE

Columbia Climate School

- Climate School Faculty: Member, 2024 to present
- PhD Planning Committee: Member: 2022 to 2023, 2025 to present
- Columbia Climate School Graduate Admissions: Member, 2024 to present
- Interim Climate School Appointments and Promotions Committee: Member, 2024 to present
- Interim Steering Committee: Member: 2022 to 2023
- Administrative Advisory Group: Member, 2022 to 2023

Columbia University Cross-School Leadership AI Working Group: Member, 2024 to present

Earth Institute Faculty: Ex-officio member, representing the Center for Climate Systems Research, 2017 to present

Columbia Committee on Forced Migration: Member, 2020 to 2023

Earth Institute, *Fellows Selection Committee*: Review committee member tasked with selecting recent PhD students for Earth Institute postdoctoral fellowships in interdisciplinary sustainable development research, 2013-2015 & 2018-2021

Earth Institute Networks
- *Healthy and Sustainable Food Systems Network*: Core member, 2020 to 2023
- *Climate Mobility Network*: Core member, 2020 to 2023
- *Sustainable and Resilient Living in an Era of Increasing Disasters Network*: Member, 2021 to 2023

Earth Institute Practice Committee *(led by Glenn Denning)*: Member, 2020 to 2021

Food for Humanity Committee: Chair of committee that prepared report "Major Program on Food for Humanity: Transforming Food Systems for Humanity and the Health of the Planet" for the Columbia Climate School, Fall 2020.

Aalto University (Finland): *Majakka Advisory Board* (Water & Development Research Group), 2018 to 2021

Conference Co-Organizer
- Global food system vulnerabilities relevant to US institutions in a changing climate: A one-day roundtable organized by Michael Puma and Molly Jahn; Thomson Reuters Building, 3 Times Square, New York City; January 31, 2019.
- Systemic Risk in Global Agriculture – A Princeton-Columbia Joint Conference, 219 Burr Hall, Princeton University; October 24-25, 2014

Session Convener/Co-Convener
American Geophysical Union Fall Meeting
1. 2014: The Effects of Anthropogenic Land-Use and Land-Cover Change on Local to Global Climate: Forcings and Feedbacks from the Past to the Future (GC22F)
2. 2014: Global and Regional Food and Water Security Under Increasing Socioeconomic Pressure and Changing Climate (GC24A)
3. 2015: Global and Regional Water-Food-Energy Security under Changing Environments I to III (GC31H, GC32B, GC33C)
4. 2016: Global and Regional Water-Food-Energy Security under Changing Environments I to III (GC41G, GC42B, and GC43C)
5. 2019: Environmental Changes and Human Migration: Advances in Data, Modeling, and Analysis I to II (GC11A, GC13G)
6. 2020: Food System, Food Security, and Food-Related Human Health Responses to COVID-19 and Other Pandemics (GH011-II)
7. 2023: Agrifood Supply Chain Resilience and Sustainability with a Focus on Human Impacts on Forest Ecosystems
8. 2020 to 2024: Environmental Changes and Human Migration: Advances in Modeling and Analysis

Proceedings of the National Academy of Sciences: Guest Editor, 2023 – 2024

CABI Agriculture and Bioscience: Associate Editor, 2020 to 2021

National Science Foundation: Proposal reviewer, postdoctoral fellowship reviewer

Publication Reviewer: Nature, Nature Climate Change, Proceedings of the National Academy of Sciences, Global Food Security, Geophysical Research Letters, Environmental Research Letters, PLOS ONE, Journal of Climate, International Journal of Climatology,

Journal of Hydrometeorology, Water Resources Research, Journal of Water Resources Planning and Management, African Journal of Environmental Science and Technology, African Journal of Agricultural Research, Journal of Environmental Studies and Science, Transport in Porous Media, Ecohydrology

American Geophysical Union: Member, 2003 to present

Columbia Earth Institute: *Travel Grant Reviewer*, 2016

Publicity Ambassador: For the Baekje Cultural Festival (백제 문화제) in Gongju, South Korea (see https://www.baekje.org/eng/), 2012 to 2013

Columbia University Hydrology Consortium: Co-founder/lead organizer, effort to promote cross-disciplinary water research, 2010 to 2012

Princeton Envtl. Eng. & Water Resources Seminar Series: **Co-Organizer**, 2003 to 2004

TECHNICAL SKILLS

Python, R, Fortran, Matlab, GitHub, ChatGPT (and others chatbots), Inkscape, et al.