

Julio E. Herrera Estrada

Department of Earth System Science
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WORK INTERESTS

- Risk assessment of hydrological and weather hazards on water, energy, and food systems.
- Spatiotemporal dynamics of hydrological hazards and the role of land-atmospheric feedbacks.
- Solutions to increase resilience of communities to hydrological and weather risks including financial instruments and weather-index based insurance, policy options, and infrastructure investments.
- Development of hydrometeorological and climate services for disaster risk management.

EDUCATION

Ph.D. in Civil and Environmental Engineering, Princeton University 11/2017

Dissertation: “Advances in Understanding the Causes of Impacts of Droughts in North America under Current and Future Climates”

Advisors: Justin Sheffield and Eric F. Wood

Graduate Certificate in Science, Technology and Environmental Policy,
Woodrow Wilson School of Public and International Affairs

M.A. in Civil and Environmental Engineering, Princeton University 09/2014

B.S. in Applied Mathematics, Columbia University 05/2012

RELEVANT WORK EXPERIENCE

Department of Earth System Science, Stanford University Stanford, CA
Postdoctoral Scholar, Advisor: Noah S. Diffenbaugh 10/2017 – Present

- Quantify the electricity sector’s vulnerabilities to hydrological hazards in the US and globally.
- Perform statistical analyses of data from satellites and reanalyses using high-performance computing.
- Direct progress of three original research projects and contribute to five others through collaborations.

Disaster Risk Management and Urban Development Unit, The World Bank Group Washington, DC
Consultant 05/2018 – 10/2018

- Provided technical advice on how to develop probabilistic drought risk assessments for food security.
- Wrote three reports to support investment projects of hydrometeorological services in West Africa.

Department of Civil and Environmental Engineering, Princeton University Princeton, NJ
Graduate Research Assistant, Advisors: Justin Sheffield and Eric F. Wood 09/2012 – 09/2017

- Analyzed causes and impacts of hydrological and weather hazards using mathematical modeling and statistical analyses with data from reanalyses products, land-surface models, and climate models.
- Developed novel framework for designing hydrometeorological sensor networks in ungauged basins.
- Led four original technical projects and contributed to two others as part of collaborative teams.
- Explored policy opportunities for mitigating drought risk and growing hydrometeorological networks.

Water Program, International Institute for Applied Systems Analysis (IIASA) Laxenburg, Austria
Young Scientists Summer Program, Advisors: Yusuke Satoh and Peter Burek 06/2015 – 08/2015

- Developed innovative framework to study how droughts evolve in time and space around the world.
- Studied opportunities for regional cooperation for drought risk management across North America.

RELEVANT WORK EXPERIENCE (CONTINUED)

Department of Applied Physics and Applied Mathematics, Columbia University New York, NY
Undergraduate Research Assistant, Advisors: Adam Sobel and Michela Biasutti 09/2011 – 04/2012

- Analyzed and compared large precipitation datasets used to study climate change in the Sahel.
- Coordinated dual supervision and submitted weekly progress reports.

Department of Civil and Environmental Engineering, Princeton University Princeton, NJ
Undergraduate Research Assistant, Advisors: E. F. Wood, K. Caylor, and J. Sheffield 06/2011 – 08/2011

- Assessed the risks of Zambia's agricultural sector using a stochastic rainfall model and a crop model.
- Coordinated with three supervisors to develop consistent research goals throughout the summer.

PEER-REVIEWED PUBLICATIONS

Published and In Press

6. **Herrera-Estrada, J. E.**, Diffenbaugh, N. S., Wagner, F., Craft, A., and J. Sheffield (2018), "Response of Electricity Sector Air Pollution Emissions to Drought Conditions in the Western United States," *Environmental Research Letters*, **13**, 124032, doi:10.1008/1748-9326/aaf07b.
5. Roy, F., Martinez, J. A., **Herrera-Estrada, J. E.**, Zhang, Y., Dominguez, F., Berg, A., Ek, M., and E. F. Wood, "Comparison of CFSv2 Analysis and Forecasts Within the Context of Two Recent Droughts in Texas and Upper Midwest," *Journal of Hydrometeorology*, in press, doi:10.1175/JHM-D-18-0159.1.
4. **Herrera-Estrada, J. E.**, and J. Sheffield (2017), "Uncertainties in Future Projections of Summer Droughts and Heat Waves over the Contiguous United States," *Journal of Climate*, **30**, doi: 10.1175/JCLI-D-16-0491.1.
3. **Herrera-Estrada, J. E.**, Satoh, Y., and J. Sheffield (2017), "Spatiotemporal Dynamics of Global Drought," *Geophysical Research Letters*, **44**, doi:10.1002/2016GL071768.
2. Chaney, N. W., Roundy, J. K., **Herrera-Estrada, J. E.**, and E. F. Wood (2015), "High-Resolution Modeling of the Spatial Heterogeneity of Soil Moisture: Applications in Network Design," *Water Resources Research*, **51**, doi:10.1002/2013WR014964.
1. Estes, L., Chaney, N. W., **Herrera-Estrada, J. E.**, Sheffield, J., Caylor, K. K., and E. F. Wood (2014), "Changing Water Availability During the African Maize-Growing Season, 1979–2010", *Environmental Research Letters*, **9**, doi:10.1088/1748-9326/9/7/075005.

Under Review

Herrera-Estrada, J. E., Martínez, J. A., Dominguez, F., Findell, K., Wood, E. F., and J. Sheffield, "Precipitation Recycling over the Land-Surface Contributes to the Spatial Propagation and Regional Intensification of Droughts in North America," *Geophysical Research Letters*, in revision.

In Preparation

Asong, E. *, **Herrera-Estrada, J. E.***, Wheeler, H., and J. Pomeroy, "Spatiotemporal Evolution of Drought Over Canada." *Denotes equal contributions.

Davenport, F. V., **Herrera-Estrada, J. E.**, Burke, M., and N. S. Diffenbaugh, "Response of flood magnitude to changes in snow precipitation across the western United States"

Wright, D. B., Bosma, C., and **Herrera-Estrada, J. E.**, "Recent Increase in Occurrence of Extreme Floods in the United States is Likely Climate-Related."

Veldkamp, T. I. E., Satoh, Y., **Herrera-Estrada, J. E.**, Aerts, J. C. J. H., Ward, P.J., and Y. Wada, "Spatiotemporal dynamics of droughts under a changing climate."

PRESENTATIONS

Invited

Herrera-Estrada, J. E. (2017), “Discussion on Challenges Related to Integration of Climate Information for Modeling of Coupled Energy-Water-Land Systems Dynamics,” **Energy-Water-Land Systems Dynamics Workshop, Stanford University Energy Modeling Forum**, Snowmass, CO, July 21. (Panelist.)

Herrera-Estrada, J. E., Chaney, N. W., Fisher, C., J. Sheffield, and E. F. Wood (2016), “Princeton’s Flood and Drought Monitors for Africa, and Latin America and the Caribbean,” **Social, Urban, Rural and Resilience Global Practice, The World Bank Group**, Washington, DC, June 15. (Oral presentation.)

Herrera-Estrada, J. E., and J. Sheffield (2014), “Uncertainties in Future Projections of Droughts and Heat Waves,” **Princeton Studies Food, Princeton University**, Princeton, NJ, September 26. (Oral presentation.)

Other Presentations

Herrera-Estrada, J. E., Diffenbaugh, N. S., Wagner, F., Craft, A., and J. Sheffield (2018), “Drought Risks to Electricity Sector Emissions and Emissions-Reduction Targets in the Western U.S.,” **American Geophysical Union Fall Meeting**, Washington, D.C., December 10-14. (Poster.)

Herrera-Estrada, J. E., Diffenbaugh, N. S., Wagner, F., and J. Sheffield (2018), “Pollutant Emissions from the Electricity Sector in the Western U.S. Induced by Droughts,” **Berkeley Atmospheric Sciences Center Symposium**, Berkeley, CA, February 1-2. (Poster.)

Herrera-Estrada, J. E., Sheffield, J., Martínez, J. A., Dominguez, F., and E. F. Wood (2017), “The Role of Precipitation Recycling in the Propagation and Intensification of Droughts in North America,” Abstract H12F-05, **American Geophysical Union Fall Meeting**, New Orleans, LA, December 11 – 15. (Oral presentation.)

Herrera-Estrada, J. E., and J. Sheffield (2016), “Quantifying the Impacts of Droughts on the Electricity Sector and the Associated Greenhouse Gas Emissions in the American West,” Abstract GC43C-1185, **American Geophysical Union Fall Meeting**, San Francisco, CA, December 12 – 16. (Poster.)

Herrera-Estrada, J. E., and J. Sheffield (2016), “Quantifying the Impacts of Droughts and Heat Waves on the Electricity Sector of the American West,” **6th National Conference and Global Forum on Science Policy and the Environment: The Food-Energy-Water Nexus, National Council for Science and the Environment**, Washington, DC, January 19 – 21. (Poster.)

Herrera-Estrada, J. E., and J. Sheffield (2015), “Spatio-temporal analysis of drought clusters: statistical characterization and physical mechanisms of propagation,” Abstract H13I-1688, **American Geophysical Union Fall Meeting**, San Francisco, CA, December 14 – 18. (Poster.)

Herrera-Estrada, J. E., and J. Sheffield (2015), “Quantifying the Uncertainties in Future Projections of Droughts and Heat Waves for North America,” **5th Interdisciplinary PhD Workshop on Sustainable Development, Columbia University**, New York, NY, April 3 – 4. (Oral presentation.)

Herrera-Estrada, J. E., and J. Sheffield (2014), “Quantifying and Reducing the Uncertainties in Future Projections of Droughts and Heat Waves for North America that Result from the Diversity of Models in CMIP5,” Abstract GC13G-0736, **American Geophysical Union Fall Meeting**, San Francisco, CA, December 15 – 19. (Poster.)

Herrera-Estrada, J. E., Chaney, N. W., and J. Sheffield (2013), “Network Design for the Deployment of Wireless, Low-Cost Sensors for Drought Monitoring,” **Wireless Intelligent Sensor Networks Workshop, Duke University**, Durham, NC, June 5. (Oral presentation.)

LEADERSHIP AND SERVICE EXPERIENCE

Highwire Earth: Insights on Sustainable Development, Princeton University Princeton, NJ
Co-Founder and Editor-in-Chief 02/2015 – 05/2017

- Set the vision and growth strategy for the creation of a new interdisciplinary online publication.
- Delegated work amongst team of four, recruited new contributors, and oversaw outreach.

Energy Table, Princeton University Princeton, NJ
Coordinator 09/2015 – 05/2017

- Organized ten faculty-student dinners throughout the academic year to discuss energy-related topics.

Department of Civil and Environmental Engineering, Princeton University Princeton, NJ
President of Graduate Student Representatives 09/2014 – 09/2015

- Engaged with the student body to identify priority areas and to develop and implement new initiatives.
- Led bi-weekly meetings to assess progress and delegated work amongst team of four graduate students.

Task Force on the Future of the Graduate School, Princeton University Princeton, NJ
Member (Invited) 09/2014 – 06/2015

- Contributed to strategic planning process as part of a team of twenty university administrators, faculty, and graduate students.
- Organized focus groups of graduate students to assess the Graduate School's strengths and weaknesses.

Latino Graduate Student Association, Princeton University Princeton, NJ
President 09/2013 – 09/2014

- Led monthly meetings with team of eight students to evaluate priorities and agree on responsibilities.
- Chaired planning committee in charge of organizing a national academic graduate student conference.

Engineers Without Borders, Columbia University New York, NY
Member of Uganda Program & Northeast Regional Workshop's Planning Committee 09/2010 – 04/2012

- Worked in a team of ten members to design a rainwater harvesting system for a rural boarding school.
- Learned best practices in development including ensuring project sustainability and local ownership.
- Contributed to planning regional workshop by co-leading a committee of seven members.

FELLOWSHIPS, AWARDS, AND HONORS

Stanford Data Science Scholars Fellowship (\$31,500/year), **Stanford University** 10/2018 – Present

NASA Earth and Space Science Fellowship (\$30,000/year), **NASA** 09/2014 – 08/2017

Wu Graduate Fellowship in Engineering (\$4,000/year), **Princeton University** 09/2012 – 08/2016

Graduate Student Leadership Award, **Princeton University** 04/2016

Top Foreign Policy Presentation Award (team), Policy Case Competition, **New York University** 05/2016

C. Prescott Davis Scholar, **Columbia University** 09/2008 – 05/2012

Dean's List (5 semesters), **Columbia University** 09/2008 – 05/2012

PCCM/PRISM Research Experience for Undergraduates, **Princeton University** 06/2011 – 08/2011

Scholars Program Summer Enhancement Fellowship (\$3,000/year), **Columbia University** 2010, 2011

Summer Undergraduate Research Fellowship, Biological Sciences (\$4,000), **Columbia University** 2010

Mentor Appreciation Award, Columbia Mentoring Initiative, **Columbia University** 04/2010

TEACHING AND MENTORING EXPERIENCE

Mentoring365 Live, American Geophysical Union Washington, DC
Mentor 12/2018

- Mentored two master's students during the American Geophysical Union Fall Meeting.

Rockefeller College, Princeton University Princeton, NJ
Resident Graduate Student 09/2015 – 05/2017

- Mentored groups of 25-40 first- and second-year undergraduate students and organized social events.

Princeton Energy and Climate Scholars, Princeton Day School Princeton, NJ
Instructor 09/2015 – 05/2017

- Presented and led discussions on sustainable development at a local high school, twice per year.

Department of Mathematics, Columbia University New York, NY
Teaching Assistant 09/2009 – 04/2012

- Co-directed Math Help Room (Calculus I-III) with one other TA for 2 hours/week and taught students problem-solving skills.
- Graded weekly homework for one Calculus class per semester (6 semesters total).

Columbia Mentoring Initiative, Columbia University New York, NY
International Undergraduate Student Mentor 09/2009 – 05/2010

- Mentored incoming international first-year undergraduate students and organized social events.

PROFESSIONAL ACTIVITIES

Alpine Summer School: Land-Atmosphere Interactions (2015), **Consiglio Nazionale delle Ricerche**, Valle d'Aosta, Italy, 22 June – 1 July, *Participant*.

Advanced Studies Program Summer Colloquium: Uncertainty in Climate Change Research – An Integrated Approach (2014), **National Center for Atmospheric Research**, Boulder, CO, July 21 – August 6, *Participant*.

Reviewer for *Geophysical Research Letters*, *Water Resources Research*, *Climatic Change*, *Agricultural and Forest Meteorology*, *Remote Sensing of Environment*, *Hydrology and Earth System Sciences*, *PLOS ONE*, *International Journal of Climatology*, and *Journal of Applied Meteorology and Climatology*.

Big Earth Hackathon (2018), **Stanford University**, Stanford, CA, April 15, *Judge*.

The American Association for the Advancement of Science, 2016 – Present, *Member*.

American Meteorological Society, 2016 – 2017, *Member*.

American Geophysical Union, 2014 – Present, *Member*.

POLICY EXPERIENCE

Publications

Herrera-Estrada, J. E. (2018), “The Rise of the Water-Energy-Food Nexus,” **Stanford University Program on Water in the West**, November 30. (Blog post.)

Herrera-Estrada, J. E. (2016), “Investing in Hydro-meteorological Infrastructure to Address Inequality of Impacts from Climate Variability and Change,” **UN Global Sustainable Development Report**, July. (Policy brief.)

Herrera-Estrada, J. E. (2016), “Beyond the Olympics: The Role of Sports in Social Development,” **Highwire Earth**, August 20. (Blog post.)

POLICY EXPERIENCE (CONTINUED)

Herrera-Estrada, J. E. (2016), “Empowering Communities and Building Resilience: The United Nations’ Strategy to Eradicate Poverty,” **Highwire Earth**, June 27. (Blog post)

Herrera-Estrada, J. E. (2013), “Drought: Not One but Three Crises,” **Foreign Affairs Latinoamérica**, June 17. (Blog post.)

Leadership Development Programs

Rising Environmental Leaders Program (2018), **Stanford Woods Institute**, Stanford, CA.

Summer Policy Colloquium (2016), **American Meteorological Society**, Washington, DC, June 5 – 14.

Competitions

Policy Case Competition (2016), “Multilateral Strategies for Climate Change,” **New York University**, New York City, NY, March 22 – May 1, *Princeton Team Participant*.

SCIENCE OUTREACH

Herrera-Estrada, J. E. and M. Glatzel (2017), “Climate Models and Water: Q&A with Julio E. Herrera Estrada,” **Water in the West, Stanford University**, November 30. (Written interview.)

Herrera-Estrada, J. E. (2017), “Show feat. Dr. Julio Herrera on Droughts in North America and Science Historian Ingrid Ockert on Science TV in the Age of Sputnik,” **WPRB Princeton 103.3**, October 3. (Radio interview.)

Herrera-Estrada, J. E. (2016), “Interview with Julio Herrera-Estrada on droughts and policy,” **WPRB Princeton 103.3**, November 8. (Radio interview.)

Herrera-Estrada, J. E., Choi, K.-Y., Asa, P., and S. Cagnetta (2013), “How do aerosols influence cloud formation?” **Science Action, Princeton University**, May 27. (Video.)

Training

Science Communication Full-Day Workshop (2015), **American Geophysical Union - Sharing Science**, Princeton University, Princeton, NJ, March 27.

SKILLS

Computing & Programming: Python (NumPy, SciPy, StatsModels, Scikit-learn, Matplotlib, MPI for Python), MATLAB, R, Mathematica, Slurm Workload Manager, Linux.

Probability & Statistics: Regression analysis, time series analysis, geospatial statistics, stochastic simulations, statistical optimization, Bayesian statistics, machine learning.

Mathematical Modeling: Dynamical systems, numerical methods for differential equations.

Languages: Spanish (native), English (bilingual), French (limited working proficiency).

OTHER INTERESTS

Swimming, skiing, running, playing soccer, traveling, reading, and blogging.