

Spencer Alan Hill

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EDUCATION

2016	Ph.D.	Atmospheric and Oceanic Sciences	Princeton University
2011	B.S.	Atmospheric and Oceanic Sciences; Applied Mathematics	UCLA

PROFESSIONAL APPOINTMENTS

2019-	Postdoctoral Research Scientist, Lamont-Doherty Earth Observatory, Columbia University
2016-19	Postdoctoral Research Scientist, dual appointment, Division of Geological and Planetary Sciences, California Institute of Technology, and Department of Atmospheric and Oceanic Sciences, UCLA
2011-16	Graduate Research Assistant, Program in Atmospheric and Oceanic Sciences, Princeton University

AWARDS AND FELLOWSHIPS

2020	Lamont-Doherty Earth Observatory Nominee for the Blavatnik Regional Award for Young Scientists (results of full competition still pending)
2019	Columbia University Earth Institute Postdoctoral Research Fellowship (2019-21)
2016	California Institute of Technology Foster and Coco Stanback Postdoctoral Research Fellowship (deferred to 2018-19)
	NSF Atmospheric and Geospace Sciences Postdoctoral Research Fellowship (2016-18)
2013	Department of Defense National Defense Science and Engineering Graduate Research Fellowship (2013-16)
2012	Princeton University Elliotte Robinson Little '25 Fellowship
2011	American Meteorological Society Annual Meeting Climate Change Travel Scholarship
	NSF Graduate Research Fellowship Honorable Mention

GRANTS SUBMITTED AND IN PREPARATION

Submitted

2020	PI	"Multi-scale links of tropical energy fluxes and precipitation across the weather-climate continuum." NASA NIP (New Investigators Program). Submitted.
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In Preparation

PI	"Supporting Teachers in Bringing Geosciences to Life for Minority Students with Rotating Tanks." NSF IUSE:GEOPATHS program (Improving Undergraduate STEM Education: Pathways into the Earth, Ocean, Polar and Atmospheric & Geospace Sciences). Letter of Intent submitted; full proposal in preparation.
PI	"Energetically mediated subseasonal-seasonal links in monsoon and Intertropical Convergence Zone rainfall." NSF CLD program (Climate and Large-Scale Dynamics). In preparation.

PUBLICATIONS

Articles submitted/under review/in revision

14. **Hill SA**, NJ Burls, A Fedorov, and TM Merlis. “Symmetric and antisymmetric components of polar-amplified warming.” Submitted to *J. Climate*.
13. **Hill SA**, S Bordoni, and JL Mitchell. “Dynamical constraints on the solstitial Hadley Cell ascending edge in Earth’s macroturbulent atmosphere.” Under review, *J. Atmos. Sci.*. <https://arxiv.org/abs/2011.05966>.
12. Mitchell, JL and **SA Hill**. “Constraints from invariant subtropical vertical velocities on the scalings of Hadley cell strength and downdraft width with rotation rate.” In revision, *J. Atmos. Sci.* <https://arxiv.org/abs/1911.05860>.

Refereed Journal Articles

- 2020 11. **Hill SA**, S Bordoni, and JL Mitchell. “Axisymmetric Hadley Cell theory with a fixed tropopause temperature rather than height.” *J. Atmos. Sci.*, **77**, 1279-1294. doi: 10.1175/JAS-D-19-0169.1.
- 2019 10. **Hill SA** “Theories for past and future monsoon rainfall changes.” *Curr. Clim. Change Rep.*, **5**, 160-171. doi: 10.1007%2Fs40641-019-00137-8.
9. **Hill SA**, S Bordoni, and JL Mitchell. “Axisymmetric constraints on cross-equatorial Hadley cell extent.” *J. Atmos. Sci.*, **76**, 1547-1564. doi: 10.1175/JAS-D-18-0306.1.
8. **Hill SA**, JM Lora, N Khoo, SP Faulk, and JM Aurnou. “Affordable rotating fluid demonstrations for geoscience education: The DIYnatics project.” *Bull. Am. Met. Soc.*, **99**, 2529-2538. doi: 10.1175/BAMS-D-17-0215.1.
- 2018 7. **Hill SA**, Y Ming, and M Zhao. “Robust responses of the Sahelian hydrological cycle to global warming.” *J. Climate*, **31**, 9793-9814. doi: 10.1175/JCLI-D-18-0238.1.
6. Smyth J, **SA Hill**, and Y Ming. “Simulated responses of the West African monsoon and zonal-mean tropical precipitation to early Holocene orbital forcing.” *Geophys. Res. Lett.*, **45**, 12,049-12,057. doi: 10.1029/2018GL080494.
- 2017 5. **Hill SA**, Y Ming, IM Held, and M Zhao. “A moist static energy budget-based analysis of the Sahel rainfall response to uniform oceanic warming.” *J. Climate*, **30**, 5637-5660. doi: 10.1175/JCLI-D-16-0785.1.
4. Brown PT, Y Ming, W Li, and **SA Hill**. “Change in the magnitude and mechanisms of unforced low-frequency surface temperature variability in a warmer climate.” *Nature Clim. Ch.*, **7**, 743-748. 10.1038/nclimate3381.
3. Jeevanjee N, P Hassanzadeh, **SA Hill**, and A Sheshadri. ”A perspective on climate model hierarchies.” *J. Adv. in Mod. Earth Sys.*, **9**, 1760-1771. doi: 10.1002/2017MS001038.
- 2015 2. **Hill SA**, Y Ming, and IM Held. “Mechanisms of forced tropical meridional energy flux change.” *J. Climate*, **28**, 1725-1742. doi: 10.1175/JCLI-D-14-00165.1.
Corrigendum: <https://dx.doi.org/10.1175/JCLI-D-16-0485.1>.
- 2012 1. **Hill SA** and Y Ming. “Nonlinear climate response to regional brightening of tropical marine stratocumulus.” *Geophys. Res. Lett.*, **39**, L15707, 5 pp. doi: 10.1029/2012GL052064.

Articles in preparation

Hill SA, AH Sobel, M Biasutti, M Cane, and S Gadgil. “Connecting monsoon rainfall variability at the all-India, all-summer and sub-India, sub-seasonal scales.” In preparation.

Book reviews

- 2012 **Hill SA** “A head in the clouds elucidates climate” (book review of *Atmosphere, Clouds, and Climate* by David Randall). *Science*, **337**, 1 pp., doi: 10.1126/science.1225615.

Other publications

- 2017-20 Twelve blog posts for the DIYnatics blog. Available at <https://diyynamics.github.io/blog/author/spencer-hill.html>.

INVITED COLLOQUIA AND SEMINARS

- 2021 Atmosphere, Ocean, and Climate Dynamics seminar series, Yale University, February 25th.
- 2019 Earth Research Institute Monthly Climate Meeting, University of California – Santa Barbara, January 7th.
- 2018 Division of Ocean and Climate Physics Seminar Series, Lamont-Doherty Earth Observatory, February 16th.
NOAA Geophysical Fluid Dynamics Laboratory informal seminar series, February 14th.
- 2016 Center for Atmosphere Ocean Science, New York University, November 9th.
Gaede Institute for the Liberal Arts, Natural and Behavioral Sciences Lecture, Westmont College, October 13th.
- 2014 Department of Geophysics, Yale University, October 9th.

CONFERENCE ACTIVITIES

Chaired sessions

- 2018 “Monsoons: Observations, Subseasonal, Seasonal, and Interannual to Decadal Variability, Forecast, Climate Change, and Extremes III.” AGU Fall Meeting, Washington, D.C., December 11th.
- 2017 “Idealized approaches to the atmospheric and oceanic circulation II.” American Meteorological Society 21st Conference on Atmospheric and Oceanic Fluid Dynamics, Portland, OR, June 26th.
- 2016 “Tropical circulations and their sensitivities to changes in climate I.” AGU Fall Meeting, San Francisco, CA, December 16th.
“Tropical convection and radiative convective equilibrium.” World Climate Research Programme Model Hierarchies Workshop, Princeton, NJ, November 3rd.

Invited Conference Talks

- 2020 European Geophysical Union Annual Meeting (cancelled due to COVID-19).
Continental Climate Change Workshop (cancelled due to COVID-19).
- 2019 “Toward an analytical, predictive theory for the location of Hadley and monsoonal cell ascending branches.” AGU Fall Meeting, San Francisco, CA, December 10th.
- 2016 “infinite-diff and animal-spharm: xarray-based finite differencing and spherical harmonics.” Columbia University Python and Atmospheric and Oceanic Sciences Workshop, New York, NY, November 12th.
- 2015 “Towards constraining Sahel rainfall responses to global mean temperature changes.” Linde Center for Global Environmental Science, California Institute of Technology, Monsoons: Past, Present and Future workshop, Pasadena, CA, May 21st.

Other Conference Presentations

- 2021 “Connecting sub-India, sub-seasonal monsoon rainfall variability with all-India, all-summer monsoon rainfall.” AMS Annual Meeting (virtual). Talk. January 14th.
- 2020 “Sub-India summer monsoon rainfall variability and its implications for all-India summer monsoon rainfall prediction.” AGU Fall Meeting (virtual). Poster. December 1st-17th.
- 2019 “Simulated polar amplification and its causes on decadal to millennial timescales.” Poster. AGU Fall Meeting. San Francisco, CA. December 10th.
“Modernizing Axisymmetric Hadley Cell and Monsoon Theory.” Talk. AMS 22nd Conference on Atmospheric and Oceanic Fluid Dynamics. Portland, ME. June 25th.
- 2018 “What sets the locations of the solstitial cross-equatorial Hadley cell edges?” Talk. AGU Fall Meeting. Washington, DC. December 13th.
- 2017 “Dry Rainbelts: Understanding Boundary Layer Controls on the ITCZ Using a Dry Dynamical Core.” Talk. AGU Fall Meeting. New Orleans, LA. December 14th.
“Control of convergence zone migrations by planetary parameters.” Poster. AMS 21st Conference on Atmospheric and Oceanic Fluid Dynamics. Portland, OR. June 27th.

- 2016 “Robust drying influence of mean ocean surface warming on The Sahel and implications for constraining future rainfall change.” Poster. AGU Fall Meeting, San Francisco, CA. December 16th.
- 2015 “Towards constraining future rainfall in the Sahel using the moist static energy budget.” Talk. AGU Fall Meeting, San Francisco, CA. December 14th.
 “Convection scheme, cloud, and stability effects on Sahel rainfall response to uniform warming.” Poster. AMS Annual Meeting, Phoenix, AZ. January 6th.
- 2014 “Convection scheme, cloud, and stability effects on Sahel rainfall response to uniform warming.” Poster. AGU Fall Meeting, San Francisco, CA. December 15th.
- 2013 “Mechanisms of forced tropical meridional energy flux change.” Talk. AGU Fall Meeting, San Francisco, CA. December 13th.
 “Mechanisms of forced tropical meridional energy flux change.” Poster presentation. Gordon Research Conference, Colby-Sawyer College, New London, NH. July 9th.
- 2012 “Climate response to a geoengineered brightening of subtropical marine boundary clouds.” Poster. 11th Annual Student Conference at the AMS Annual Meeting, New Orleans, LA. January 22nd.

CAMPUS AND DEPARTMENTAL TALKS

- 2019 (poster) Lamont-Doherty Earth Observatory Postdoc Symposium. September 11th.
- 2018 Department of Atmospheric and Oceanic Sciences, UCLA. November 7th.
- 2016 Division of Geological and Planetary Sciences, California Institute of Technology. October 26th.
- 2016 Department of Atmospheric and Oceanic Sciences, UCLA. October 5th.
- 2015 Dynamics Seminar Series, Program in Atmospheric and Oceanic Sciences, Princeton University. March 13th.
- 2012 Student/Postdoc Seminar Series, Program in Atmospheric and Oceanic Sciences, Princeton University. February 28th.
- 2011 Graduate Research Symposium, Department of Geosciences, Princeton University. November 11th.

UNDERGRADUATE RESEARCH ADVISING

Advisor

- 2020 Valentina Rojas-Posada, Barnard University (partial funding awarded by competition from Columbia University Earth Institute)
- 2017 Norris Khoo, UCLA
- 2017 Micah Kim, UCLA
- 2016 Juliet Olsen, UCLA

Assistant advisor

- 2015 Jane Smyth, NOAA Geophysical Fluid Dynamics Laboratory
- 2015 Marjahn Finlayson, NOAA Geophysical Fluid Dynamics Laboratory
- 2015 Colin Raymond, NOAA Geophysical Fluid Dynamics Laboratory

TEACHING ACTIVITIES

Teaching Assistant

- 2014 “Physics of Earth: The Habitable Planet.” Upper-division undergraduate course. Department of Geosciences, Princeton University.

Certifications

- 2016 Teaching Transcript Certification, McGraw Center for Teaching and Learning, Princeton University.

Guest Lectures

- 2018 Three lectures for “Introduction to Atmospheric and Oceanic Fluids,” graduate-level course, Department of Atmospheric and Oceanic Sciences, UCLA.
- 2014 Two lectures for “Physics of Earth: The Habitable Planet,” upper-division undergraduate course, Department of Geosciences, Princeton University.

SCIENCE OUTREACH

Co-founder and Co-Director, *DIY*namics (organization advancing rotating tank-based geoscience teaching). (2017-)

Volunteer at 10+ science outreach events either open to the public or presented at middle schools. (2015-)

SERVICE ACTIVITIES

Professional

Review Editor, Editorial Board of Predictions and Projections, *Frontiers in Climate*

Proposal referee, NSF Climate and Large-Scale Dynamics, NSF EarthCube, NASA Juno Participating Scientist Program

Article referee, *Nature Climate Change*, *npj Climate and Atmospheric Science*, *Journal of Advances in Modeling Earth Systems*, *Journal of Climate*, *Quarterly Journal of the Royal Meteorological Society*, *Geophysical Research Letters*, *Journal of the Atmospheric Sciences*, *Geoscientific Model Development*, *Climatic Change*, *Climate Dynamics*, *Journal of Geophysical Research - Atmospheres*

Developer and maintainer, *aospy* open-source Python software package for automating analyses of climate datasets. <https://aospy.readthedocs.io>.

Code contributor, *xarray* package for labeled multidimensional arrays in Python.

Departmental/University

Organizer, Student/Postdoc Seminar Series, Program in Atmospheric and Oceanic Sciences, Princeton University (2012-13)

Organizer, Climate Sensitivity Journal Club, NOAA Geophysical Fluid Dynamics Laboratory (2013-15)

Organizer, Convection Journal Club, Program in Atmospheric and Oceanic Sciences, Princeton University (2015)

Representative to the faculty, Program in Atmospheric and Oceanic Sciences, Princeton University (2012-2013)

ADDITIONAL TRAINING

- 2021 Workshop on Inclusive and Culturally Competent Teaching Strategies in the Earth Sciences, Columbia University, January 8th
- 2020 Racial Sensitivity Workshop, Columbia University Earth Institute, June 30th
- 2018 17th Swiss Climate Summer School, “Earth system variability through time,” Grindelwald, Switzerland
- 2012-13 Member, Princeton University Energy and Climate Scholars
- 2012 NOAA Geophysical Fluid Dynamics Laboratory Summer School on Atmospheric Modeling

PROFESSIONAL MEMBERSHIPS

- 2010- American Geophysical Union
- 2011- American Meteorological Society