HILLARY A. SCANNELL

Climate & Data Scientist • Jupiter Intelligence, Inc. • Boulder, CO
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EDUCATION

Ph.D., University of Washington — Seattle, WA
Doctorate in Oceanography — *Dec. 2020*

M.S., University of Maine — Orono, ME
Masters in Oceanography — *Dec. 2014*

B.S., University of Maine — Orono, ME
Bachelor of Science in Marine Science — *June 2013*

EXPERIENCE

Jupiter Intelligence, Inc. — Boulder, CO
Data Scientist II, Earth & Ocean Systems — *Jan. 2022 – Present*

– Applied statistics to large global climate models in Python to expand, improve, and optimize Jupiter's Climate Score Global product utilizing advanced workflows with Amazon Web Services and Git.
– Developed a research R&D project through to production that involved intelligently weighting global climate models to combine projections of climate peril metrics.
– Combined hazards of projected coastal sea level rise with extreme storm surge and tides based on the combined statistical distributions using a Monte Carlo approach. Presented the methodology and results at the AGU meeting in 2022.
– Authored technical documentation and presented research findings both internally and externally.
– Continuously learning and helping to deliver on Jupiter's Diversity, Equity & Inclusion (DEI) vision. Contributed content to internal educational resources and communications related to DEI.

Lamont-Doherty Earth Observatory at Columbia University — Palisades, NY
Postdoctoral Research Scientist, Climate Data Science Lab — *Dec. 2020 – Jan. 2022*

– Refactored an open-source Python package, `pyqg`, to be compatible with multi-dimensional datasets stored using `xarray`. This improved the consistency of units and dimensions across consecutive computational operations.
– Created a two-layer ocean model using `pyqg` to simulate eddies to better understand their overall contribution to the climate. This model was designed to generate 1000s of independent realizations of a turbulent ocean in order to generate a training dataset for machine learning to identify and track ocean eddies.

University of Washington — Seattle, WA
Graduate Research Assistant, School of Oceanography — *Sept. 2015 – Dec. 2020*

- Authored 8 peer-reviewed research publications on the drivers, trends, patterns, and impacts of extreme ocean warming events called marine heatwaves. Presented over 10 invited talks and regularly engaged with journalist to communicate research findings.
- Analyzed large multi-variable data from climate models and observational oceanographic datasets using Python.
- Teaching assistant for 5 undergraduate courses in oceanography and was an active member of the Program on Climate Change, serving as co-chair of the Graduate Climate Conference in 2016.

National Center for Atmospheric Research Boulder, CO
ASP Graduate Student Visitor, Computational and Information Systems Lab *Spring 2020*
- Developed an open source Python package called Ocetrac to identify and track spatiotemporal anomalies. Ocetrac has been widely adopted and currently has over 1.7k downloads.
- Used Ocetrac to characterize track the evolution of marine heatwaves globally. Presented research at the SciPy conference in 2021. Applied methods from image processing and multiple object tracking using scikit-learn, scipy, and xarray with gridded satellite observations of sea surface temperature.

Tableau Software Seattle, WA
Research Intern *Summer 2018*
- Used machine learning to forecast sea surface temperatures using Long Short-Term Memory in Python with Scikit-learn, Keras, and Tensor Flow.

NOAA Pacific Marine Environmental Laboratory Seattle, WA
Graduate Research Assistant, Global Tropical Moored Buoy Array Lab *Sept. 2015 – Dec 2017*
- Used an ocean mixed layer heat budget to understand the physical drivers of the seasonal cycle in the southeastern tropical Atlantic using data from moored ocean buoys, ARGO floats, and satellites.
– Published results in a peer-reviewed research paper and gave a talk at the Ocean Sciences Meeting in 2018.
– Deployed ocean buoys and collected temperature and salinity data during a 40-day research cruise to the eastern equatorial Pacific with NOAA and the National Data Buoy Center.

University of New South Wales Sydney, NSW
Visiting Research Fellow, Climate Change Research Center *Summer 2014*
- Collaborated with an international team of ocean and atmospheric scientist, and marine ecologist to coordinate research topics around marine heatwaves.
- Analyzed warming patterns in the Southern Hemisphere extratropics using a metric that quantified the intensity, duration, and spatial extent of marine heatwaves using high-resolution in-situ and satellite data.

Gulf of Maine Research Institute Portland, ME
Graduate Research Assistant, Ecosystem Modeling Lab *Aug. 2013 – Feb. 2015*
- Developed statistical algorithms using a power law distribution to describe the size frequency of marine heatwaves, and explored how large scale modes of natural climate variability can either enhance or suppress the likelihood of these extreme events.

Research Intern, Ecosystem Modeling Lab *Summer 2013*
- Quantified the likelihood of the 2012 northwest Atlantic marine heatwave using Bayesian methods.
- Collaborated with the Ecosystem Modeling Lab and co-authored a peer-reviewed paper on the decline of Atlantic cod due to warming ocean temperatures.

HONORS & AWARDS

National Center for Atmospheric Research Advanced Study Program Graduate Fellowship	*2020*
Integral Consulting Inc. Environmental Big Data Research Award	*2018*
The New York Times Asia-Pacific Case Competition First Place	*2017*
University of Washington Program on Climate Change Graduate Fellowship	*2015*
National Science Foundation East Asia and Pacific Summer Institute Fellowship	*2014*

TECHNICAL STRENGTHS

Computer Languages	Python (xarray, dask, numpy, scipy), bash
Software Contributions	ocetrac, pyqg
Visualization & Design	HoloViz, Bokeh, Cartopy, Matplotlib, LaTeX, HTML
Machine Learning	Scikit-learn, TensorFlow, Keras
Data & Databases	CESM, CMIP6, NetCDF, Zarr, Parquet, CSV
Platforms	AWS, HPC, JupyterLab, VSCode, GitHub/GitLab

FUNDED PROPOSALS

2020	**Leonardo DiCaprio Foundation & Microsoft AI for Earth Innovation Grant**, *Following the heat towards large marine ecosystems: AI tools for tracking dangerous marine heatwaves*, $99,889. [Press Release], [UW eScience Institute Highlight]
2020	**National Center for Atmospheric Research Advanced Study Program Graduate Fellowship**, $6,000.
2018–2019	**Microsoft AI for Earth Azure Compute Grant**, $15,000 in cloud compute credits.
2018	**Integral Consulting Inc. Environmental Big Data Research Award**, $3,764.
2018	**National Science Foundation EAPSI/ EPSCoR Co-Funding**, *Impacts of El Niño-Southern Oscillation on Indian Ocean heatwaves*, $5,070.

PUBLICATIONS

Peer-reviewed:

12. **Scannell, H. A.**, and D. J. Amaya, (2021), The 2019–2020 Northeast Pacific Marine Heatwave [in "State of the Climate in 2020"], *Bull. Amer. Meteor. Soc.*, 102 (8), S153–S155, DOI: 10.1175/BAMS-D-21-0083.1

11. **Scannell, H. A.**, L. Thompson, G. C. Johnson, J. M. Lyman, and S. Riser (2020), Subsurface evolution of recent marine heatwaves in the Northeast Pacific, *Geophys. Res. Lett.*, 47, e2020GL090548, DOI: 10.1029/2020GL090548.

10. Sen Gupta, A., M. Thomsen, J. A. Benthuysen, A. J. Hobday, E. Oliver, L. V. Alexander, M. T. Burrows, M. G. Donat, M. Feng, , N. J. Holbrook, S. Perkins-Kirkpatrick, P. J. Moore, R. R. Rodrigues, **H. A. Scannell**, A. S. Taschetto, C. C. Ummenhofer, T. Wernberg, and D. Smale (2020), Drivers and impacts of the most extreme marine heatwaves events, *Sci. Rep.*, 10, 19359, DOI: 10.1038/s41598-020-75445-3.

9. Holbrook, N. J., A. Sen Gupta, E. C. J. Oliver, A. J. Hobday, J. A. Benthuysen, **H. A. Scannell**, D. A. Smale, and T. Wernberg (2020), Keeping pace with marine heatwaves as oceans warm, *Nat. Rev. Earth Environ.*, 1, 482–493, DOI: 10.1038/s43017-020-0068-4.

8. Holbrook, N. J., **H. A. Scannell**, A. Sen Gupta, J. A. Benthuysen, M. Feng, E. C. J. Oliver, L. V. Alexander, M. T. Burrows, M. G. Donat, A. J. Hobday, P. J. Moore, S. E. Perkins-Kirkpatrick, D. A. Smale, S. C. Straub, and T. Wernberg (2019), A global assessment of marine heatwaves and their drivers, *Nat. Commun.*, 10, 2624, DOI: 10.1038/s41467-019-10206-z.

7. Smale, D. A., T. Wernberg, E. C. J. Oliver, M. Thomsen, B. P. Harvey, S. C. Straub, M. T. Burrows, L. V. Alexander, J. A. Benthuysen, M. G. Donat, M. Feng, A. J. Hobday, N. J. Holbrook, S. E. Perkins-Kirkpatrick, **H. A. Scannell** A. Sen Gupta, B. Payne, and P. J. Moore (2019), Marine heatwaves threaten global biodiversity and the provision of ecosystem services, *Nat. Clim. Change*, 9, 306–312, DOI: 10.1038/s41558-019-0412-1.

6. **Scannell, H. A.**, and M. J. McPhaden (2018), Seasonal mixed layer temperature balance in the Southeastern Tropical Atlantic, *J. Geophys. Res. Oceans*, 123, 5557–5570, DOI: 10.1029/2018JC014099.

5. Oliver, E. C. J., M. G. Donat, M. T. Burrows, P. J. Moore, D. A. Smale, L. V. Alexander, J. Benthuysen, M. Feng, A. Sen Gupta, A. J. Hobday, N. J. Holbrook, S. E. Perkins-Kirkpatrick, **H. A. Scannell**, S. C. Straub, and T. Wernberg (2018), Longer and more frequent marine heatwaves over the past century, *Nat. Commun.*, 9, 1324, DOI: 10.1038/s41467-018-03732-9.

4. Pershing, A. J., M. A. Alexander, C. M. Hernandez, L. A. Kerr, A. Le Bris, K. E. Mills, J. A. Nye, N. R. Record, **H. A. Scannell**, J. D. Scott, G. D. Sherwood, and A. C. Thomas (2016), Response to Comments on "Slow adaptation in the face of rapid warming leads to collapse of the Gulf of Maine cod fishery", *Science*, 352(6284), 423, DOI: 10.1126/science.aae0463.

3. **Scannell, H. A.**, A. J. Pershing, M. A. Alexander, A. C. Thomas, and K. E. Mills (2016), Frequency of marine heatwaves in the North Atlantic and North Pacific since 1950, *Geophys. Res. Lett.*, 43, DOI: 10.1002/2015GL067308.

2. Hobday, A. J., L. V. Alexander, S. E. Perkins, D. A. Smale, S. C. Straub, J. Benthuysen, M. T.Burrows, M. G. Donat, M. Feng, N. J. Holbrook, P. J. Moore, E. C. J. Oliver, **H. A. Scannell**, A. Sen Gupta and T. Wernberg (2016), A hierarchical approach to defining marine heatwaves, *Prog. Oceanogr.*, 141: 227–238, DOI: 10.1016/j.pocean.2015.12.014.

1. Pershing, A. J., M. A. Alexander, C. M. Hernandez, L. A. Kerr, A. Le Bris, K. E. Mills, J. A. Nye, N. R. Record, **H. A. Scannell**, J. D. Scott, G. D. Sherwood, and A. C. Thomas (2015), Slow adaptation in the face of rapid warming leads to collapse of the Gulf of Maine cod fishery, *Science*, 350(6262), 809–812, DOI: 10.1126/science.aac9819.

Conference Proceedings:

1. **Scannell, H. A.**, C. Fraley, N. Mannheimer, S. Battersby, and L. Thompson, Predicting marine heatwaves using global climate models with cluster based long short-term memory, 36th International Conference on Machine Learning (ICML), Climate Change: How Can AI Help, June 14, 2019. [Abstract]

White papers:

1. Crosman, K., L. Johnson, E. Petrou, and **Scannell, H. A.**, Safeguarding Pacific Northwest Fisheries from a Warming Climate. *The New York Times*, International Edition, August 2, 2017. [PDF]

GRADUATE COURSEWORK

Biological Oceanography	Chemical Oceanography
Computational Methods for Data Analysis	Data Analysis in Water Sciences
Objective Analysis	Data Visualization
Fundamentals of Climate Change	Methods in Physical Oceanography
Ocean Circulation Observations	Physics of Ocean Circulation
Fluid Dynamics I & II	Atmosphere Ocean Interactions
Marine Geology & Geophysics	Waves

MEETINGS, CONFERENCES & WORKSHOPS

American Geophysical Union Fall Meeting	*2014, 2016, 2022*
SciPy Conference	*2021, 2022*
Ocean Sciences Meeting	*2014, 2018, 2020, 2022*
MPOWIR Pattullo Conference, Warrenton, VA	*2021*
3rd NOAA Workshop on Leveraging AI in Environmental Sciences (*Hackathon Co-Lead*)	*2021*
NCAR Artificial Intelligence for Earth System Science Summer School	*2020*
Climate Change AI Workshop, NeurIPS, Vancouver, B.C., Canada	*2019*
PICES Annual Meeting, Victoria, B.C., Canada	*2019*

Microsoft AI for Earth Summit, Redmond, WA *2019*
The Pangeo 2019 US Community Meeting, Seattle, WA *2019*
US CLIVAR Large Ensembles Workshop, Boulder, CO *2019*
Physics Informed Machine Learning Workshop, Seattle, WA *2019*
8^{th} International Workshop on Climate Informatics, Boulder, CO *2018*
The 97^{th} AMS Annual Meeting, Seattle, WA *2017*
Program on Climate Change Spring Symposium, Seattle, WA *2017*
Geohackweek, Seattle, WA *2017*
Graduate Climate Conference, Pack Forest, WA *2014, 2016*
Pacific Anomalies Workshop 2, Seattle, WA *2016*
Program on Climate Change Summer Institute, Friday Harbor, WA *2016*
Regional Association for Research on the Gulf of Maine, Portsmouth, NH *2013*

SERVICE & OUTREACH

Leadership
- Co-Chair, SciPy Conference: Earth, Ocean, Geo and Atmospheric Sciences Session *2022*
- Co-Chair, Program on Climate Change Summer Institute on Climate Extremes *2020*
- Co-Chair, Ocean Sciences Meeting: Marine Heatwaves & Ocean Biogeochemical Extremes *2020*
- Co-Chair, University of Washington Graduate Climate Conference *2016*

Coordinator
- Jupiter's Machine Learning Reading Group *2022-Present*
- NOAA Hackathon on Predicting Marine Heatwaves *2021*
- Program on Climate Change Spring Symposium *2017 – 2018*

Referee
- SciPy Conference Program Committee *2021*
- NeurIPS Climate Change AI Workshop Program Committee *2019*
- Academic Journals: *2017 – Present*
  Climate Dynamics, *Geophysical Research Letters*, *Journal of Climate*, *Journal of Geophysical Research-Oceans*, *Nature Communications Earth & Environment*

Volunteer
- Graduate Student Steering Committee for the Program on Climate Change *2016 – 2018*
- Contributing Author, oceanbites.org *2014 – 2015*

TEACHING

Graduate Teaching Assistant

University of Washington, School of Oceanography
- OCEAN 201: Introduction to Oceanography, 2018, 2019
- OCEAN 285/286: Physics Across Oceanography: Fluid Mechanics and Waves, 2018
- OCEAN 320: Coastal Oceanography, 2018
- OCEAN 215: Methods of Oceanographic Data Analysis, 2016

University of Maine, School of Marine Science
- SMS 420: Oceans and Climate Change, 2014
- SMS 204: Integrative Marine Science II: Physics and Chemistry of Marine Systems, 2013

Guest Lectures

University of Colorado Boulder
- ATOC 3070: Introduction to Oceanography, *Marine Heatwaves and Climate*, 2022
- ATOC Summer REU Program, *Stories behind the CV*, 2022

SELECTED PRESENTATIONS

Invited Talks:

15. Scannell, HA, J Busecke, R Abernathey, L Thompson, DJ Gagne, and DW Whitt. Ocetrac: A Python package to track the spatiotemporal evolution of marine heatwaves. Open Ocean Science, Ocean Sciences Meeting: remote. March 2022.

14. Scannell, HA. Subsurface evolution and persistence of marine heatwaves. OOI and Extreme Events, Ocean Sciences Meeting: remote. March 2022.

13. Scannell, HA. Tropical Connectivity of Marine Heatwaves and the Role of ENSO. NASA Ames Earth Sciences Division Seminar: remote. September 2021.

12. Scannell, HA. Drivers and mechanisms of marine heatwaves in the Northwest Atlantic. NOAA Eastern Region Climate Services Webinar: remote. July 2021. [Replay]

11. Scannell, HA. New insights into the spatiotemporal connectivity of marine heatwaves globally. NCAR Climate & Global Dynamics Seminar Series: remote. April 2021. [Replay]

10. Scannell, HA. West Coast Marine Heatwaves, Olympic Coast National Marine Sanctuary Advisory Council Meeting: remote. September 2020.

9. Scannell, HA. Defining and Characterizing Marine Heatwaves for Prediction. US CLIVAR Predictability, Predictions, and Applications Interface Panel Summer Meeting: remote. July 2020.

8. Scannell, HA. Integrating machine learning with traditional approaches in ocean science. Gulf of Maine Research Institute: Portland, ME. November 2019.

7. Scannell, HA, SC Riser, L Thompson, and G Johnson. The 2019 reappearance of the Northeast Pacific marine heatwave, Physical Oceanography Seminar. School of Oceanography, University of Washington: Seattle, WA. November 2019.

6. Rising Toll of Marine Heatwaves. Water & Salmon Committee of the Washington State Sierra Club: Seattle, WA. April 2019.

5. Scannell, HA. Marine heatwaves threaten global biodiversity and the provision of ecosystem services. NOAA-Northwest Fisheries Science Center: Seattle, WA. March 2019.

4. Scannell, HA. Taking a holistic view of marine heatwaves globally. NOAA Alaskan Fisheries Science Center: Seattle, WA. March 2017

3. Scannell, HA. Marine Heatwaves: Emerging climate phenomena. Sound Waters University: Langley, WA. February 2017

2. Scannell, HA, MH England, and A Sen Gupta. Climatic influences on extra-tropical marine heatwaves. Commonwealth Scientific and Industrial Research Organization, Oceans and Atmosphere Flagship Seminar Series: Perth, Australia. January 2015.

1. Scannell, HA, MH England, and A Sen Gupta. The ocean heatwave phenomenon and the climatic mechanisms at play. Climate Change Research Center Seminar, University of New South Wales: Sydney, Australia. August 2014.

Conference Talks:

4. Scannell, HA, L Thompson, DB Whitt, DJ Gagne, and RP Abernathey. Ocetrac: morphological image processing for monitoring ocean temperature extremes. SciPy Conference: remote. July 2021. [Replay]

3. Scannell, HA, SC Riser, L Thompson, and G Johnson. The 2019 reappearance of the Northeast Pacific marine heatwave. Ocean Sciences Meeting: San Diego, WA. February 2019.

2. Scannell, HA, and MJ McPhaden. Seasonal mixed layer heat budget in the Southeast Tropical Atlantic. Ocean Sciences Meeting: Portland, Oregon. February 2018.

1. Scannell, HA, and MJ McPhaden. Mechanisms controlling the seasonal mixed layer heat budget in the southeast Tropical Atlantic. Program on Climate Change Spring Symposium, University of Washington: Seattle, WA. April 2017.

Conference Posters:

9. Scannell, HA, S Sain, and J Rogers. Joint projections of coastal sea level and its uncertainty from storm surge, tides, and sea level rise. AGU Fall Meeting: Chicago, IL. December 2022.

8. Scannell, HA, L Thompson, W Cheng, and E Maroon. Characterization of marine heatwaves in the CESM Large Ensemble. US CLIVAR Large Ensembles Workshop, NCAR: Boulder, CO. July 2019.

7. Scannell, HA, and MJ McPhaden. Seasonal mixed layer heat budget in the southeast tropical Atlantic. American Meteorological Society Annual Meeting: Seattle, WA. January 2017.

6. Scannell, HA, and MJ McPhaden. Seasonal mixed layer heat budget in the southeast tropical Atlantic. AGU Fall Meeting: San Francisco, CA. December 2016.

5. Scannell, HA, and MJ McPhaden. Seasonal mixed layer heat budget in the southeast tropical Atlantic. Graduate Climate Conference: Pack Forest, WA. October 2016.

4. Scannell, HA, MH England, and A Sen Gupta. Climatic influences on Indian and Pacific Ocean heatwaves. AGU Fall Meeting: San Francisco, CA. December 2014.

3. Scannell, HA, MH England, and A Sen Gupta. Quasi-decadal variability of ocean heatwaves in the Southern Hemisphere extra-tropics. Graduate Climate Conference: Pack Forest, WA. November 2014.

2. Scannell, HA, AJ Pershing, and KE Mills. Frequency of ocean heatwaves occurring in the Atlantic and Pacific Oceans. Ocean Sciences Meeting: Honolulu, HI. February 2014.

1. Scannell, HA, AJ Pershing, and KE Mills. Likelihood of an ocean heatwave in the northwest Atlantic Ocean. Regional Association for Research on the Gulf of Maine: Portsmouth, NH. October 2013.

SELECTED INTERVIEWS

2022

National Geographic: Marine heat waves are on the rise. What are these blobs of hot water?

2021

Nature: Fevers are plaguing the oceans — and climate change is making them worse

2019

National Public Radio: Earth's Oceans Are Getting Hotter And Higher, And It's Accelerating
The Washington Post: The 'Blob' is surging back in the Pacific, leading to fears of mass die-offs of marine life and unusual weather patterns
InsideClimate News: A Marine Heat Wave Intensifies, with Risks for Wildlife, Hurricanes and California Wildfires
Forbes: Another 'Warm Blob' Is Forming In The Pacific Ocean

InsideClimate News: 5 Science Teams Racing Climate Change as the Ecosystems They Study Disappear

2018

EOS Earth & Space Science News: Why Is the Gulf of Maine Warming Faster Than 99% of the Ocean?
Carbon Brief: Restricting global warming to 1.5C would 'halve' risk of marine heatwaves

2017

UW Today: The New York Times recognizes UW student policy recommendations
The Daily: Understanding the blob and 65 years of hot water

2016

Weather Underground: The North Atlantic Blob: A Marine Cold Wave That Won't Go Away
NBC KING 5 News: Global 'blobs' getting more extreme
Hakai Magazine: Revenge of the Blob
German National Public Radio: Heatwaves at Sea