NATHANIEL CRESSWELL-CLAY

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Atmospheric Sciences-Geophysics (ATG) Building
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EDUCATION

University of Washington, Seattle WA *June 2023 - Present*
Ph.D. Student, Atmospheric Sciences

University of Washington, Seattle WA *September 2020 - June 2023*
Master of Science, Atmospheric Sciences

Tufts University, Medford MA *September 2015 - May 2019*
Bachelor of Science in Mathematics, Cum Laude

Woods Hole Oceanographic Institution, Woods Hole MA *September 2017 - December 2017*
S.A.W. Student

EMPLOYMENT

September 2022 - 2025: **National Defense Science and Engineering Graduate Fellow**, University of Washington, Seattle WA

October 2020 - 2022: **Research Assistant**, University of Washington, Seattle WA

October 2021 - December 2021: **Teaching Assistant**, University of Washington, Seattle WA

June 2019 - 2020: **Guest Investigator**, Woods Hole Oceanographic Institution, Woods Hole MA

June 2018 - August 2018: **Guest Student**, Woods Hole Oceanographic Institution, Woods Hole MA

PUBLICATIONS

Weyn J.A., D.R. Durran, R. Caruana & **N. Cresswell-Clay**, 2021: Sub-Seasonal Forecasting With a Large Ensemble of Deep-Learning Weather Prediction Models. *J. Adv. Model. Earth Syst.* 13-7. https://doi.org/10.1029/2021MS002502.

Karlbauer, M, **Nathaniel Cresswell-Clay**, D. Durran, R. Moreno, T. Kurth, & M. Butz, 2024: Advancing Parsimonious Deep Learning Weather Prediction using the HEALPix Mesh. *J. Adv. Model. Earth Syst. Accepted.*

Cresswell-Clay, N., C.C. Ummenhofer, D.L. Thatcher, A.D. Wanamaker, R.F. Denniston, Y. Asmerom & V.J. Polyak , 2022: Twentieth-century Azores High expansion unprecedented in the past 1,200 years. *Nat. Geoscience* 15, 548–553. https://doi.org/10.1038/s41561-022-00971-w.

Thatcher D.L., A.D. Wanamaker, R.F. Denniston, C.C. Ummenhofer, Y. Asmerom, V.J. Polyak, **N. Cresswell-Clay**, F. Hasiuk, J. Haws & D. P. Gillikin , 2023: Iberian hydroclimate variability and the Azores High during the last 1200 years: evidence from proxy records and climate model simulations. *Climate Dynamics*. https://doi.org/10.1007/s00382-022-06427-6.

Whitney, N.M., A.D. Wanamaker, C.C. Ummenhofer, B.J. Johnson, **N. Cresswell-Clay** & K.J. Kreutz, 2022: Rapid 20th century warming reverses 900-year cooling in the Gulf of Maine. *Commun Earth Environ* 3, 179. https://doi.org/10.1038/s43247-022-00504-8.

SERVICE

November 2022: **Invited Lecture: Exploring the Atmospheric Sciences** presentation on the history of computational weather forecasting to undergaduates at University of Washington, Seattle WA.

September 2021 - September 2023: **Graduate Student Representative** for the University of Washington Department of Atmoshperic Sciences, Seattle WA.

October 2021 - Present: **Undergraduate Mentor** for University of Washington Department of Atmospheric Sciences, Seattle WA.

October 2021 - September 2022: **Peer-to-Peer Mentoring Coordinator** for University of Washington Department of Atmospheric Sciences, Seattle WA.

AWARDS

September 2022 - September 2025: **Nation Defense Science and Engineering Graduate Fellowship** awarded to graduate students pursuing doctoral degrees

June 2022: **Certificate of Distinguished Service** awarded by University of Washington's Atmospheric Sciences Department to students who exhibit extraordinary service to the department and community.

October 2021: **ASIS Prize for an Outstanding Contribution of Relevance to Society** awarded by Artificial Intelligence for Science, Industry and Society.

March 2020: **Top Scholar** awarded by the University of Washington to outstanding applicants to graduate programs

May 2019: **High Honors in Thesis** awarded upon completion of undergraduate thesis defense

July 2019: **ICTP-CLIVAR Summer School on Eastern Boundary Upwelling scholarship** awarded to attend summer school held at International Centre for Theoretical Physics, Trieste, Italy.

PRESENTATIONS

Cresswell-Clay, N., Bowen Liu, Zac Espinosa, M. Karlbauer, D. Durran, R. Moreno, A. Liu (2024). A Deep Learning Earth System Model for Weather and Climate Simulation. *2022 NDSEG Fellow Conference. Poster.*

Cresswell-Clay, N., Bowen Liu, Zac Espinosa, M. Karlbauer, D. Durran, R. Moreno, A. Liu (2024). Deep Learning Earth System Model. *Climate and Atmospheric Dynamics Seminar at University of Washington. Seminar.*

Cresswell-Clay, N., M. Karlbauer, D. Durran, R. Moreno, A. Liu (2023). Coupled Modelling with Deep Learning. *AMS Annual Meeting. Talk.*

Cresswell-Clay, N., M. Karlbauer, D. Durran (2023). Coupled Ocean-Atmosphere Modelling with Deep Learning. *AGU Fall Meeting. eLightning Presentation.*

Cresswell-Clay, N., M. Karlbauer, D. Durran (2023). A Sea Surface Model for Coupled Data-Driven S2S Forecasting. *Climate and Atmospheric Dynamics Seminar at University of Washington. Seminar.*

Cresswell-Clay, N, M. Karlbauer, D. Durran (2023). Improving Realism in Data-Driven Forecasting. *AMS 2023 Annual Meeting. Poster.*

Cresswell-Clay, N, J.H. Adler (2019). First Order Atmospheric Approximations and Tropical Expansion. *Tufts University Undergraduate Research and Scholarship Symposium. Talk*

Cresswell-Clay, N, C. Ummenhofer, I. Lima (2019). Hadley Circulation and its Relevance to Eastern Boundary Upwelling. *ICTP-CLIVAR Summer School on Easter Boundary Upwelling Systems hosted by the International Centre for Theoretical Physics. Poster*

Cresswell-Clay, N, C. Ummenhofer (2017). Source of Extreme Winter Rainfall in Southwestern Australia. *Woods Hole Oceanographic Institution S.A.W. Presentations. Talk.*

RESEARCH PROJECTS

December 2023 - Present: **Cimate Simulation with with Deep Learning Earth System Model**
Using a Deep Learning Earth System Model for simulation of the atmosphere and ocean on climate timescales.

December 2023 - Present: **Coupled Earth System Modelling with Deep Learning**
Coupling data driven models of the ocean and atmosphere to extend the range of predictive skill to S2S lead times.

September 2020 - Present: **Inferring OLR Intensity using Compound Loss Formulations**
Using deep convolutional neural nets to simulate circulation and infer top of atmosphere outgoing long wave radiation. Special consideration is given to the role of a compound loss formulation that combines mean-squared error and structural similarity index measure.

June 2019 - Present: **Variability and evolution of the Azores High in the last millennium**
Using Last Millennium Ensemble simulations from CESM and proxy reconstructions to understand variability of the Azores High and hydroclimate on the Iberian Peninsula.

June 2018 - August 2018: **Eastern boundary upwelling and Hadley Cell intensity**
Used POP2 ocean model output and NOAA atmospheric reanalysis data to explore the relationship between the Hadley Circulation and eastern boundary upwelling systems.

September 2018 - May 2019: **The role of first order circulation in tropical expansion**
Recreated the Held-Hou formulation for Hadley Circulation and explored its sensitivity to changes in climate projected under CMIP5 emissions pathways. (Senior Honors Thesis; Committee: James Adler, Anne Gardulski)

September 2017 - December 2017: **Storm driven rainfall in south Western Australia**
Used high resolution precipitation observations to explore the connection between rainfall in south Western Australia and upper ocean properties in the Indian Ocean.