Zachary Espinosa

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EDUCATION

University of Washington, Seattle, WA — Jun 2026
PhD, Atmospheric and Climate Science | Data Science Specialty

Stanford University, Stanford, CA — Jun 2021
M.S. Applied and Engineering Physics, Schools of Arts and Science

Stanford University, Stanford, CA — Sep 2020
B.S. Computer Science, School of Engineering | Concentration: Artificial Intelligence

HONORS & FELLOWSHIPS

Department of Energy Computational Science Graduate Fellowship (DOE CSGF) — Apr 2022

Graduate Student Equity & Excellence Fellowship (GSEE Fellow) — Sep 2021

Achievement Rewards for College Scientists Foundation Scholar (ARCS Scholar) — Sep 2021

The GEM National Consortium Graduate Fellow (GEM Graduate Fellow) — Jan 2020

PUBLICATIONS

[11] **Espinosa, Z.,** Cresswell-Clay, N., Liu, B., Durran, D., & Bitz, C. "Subseasonal to Seasonal Sea Ice and Upper Ocean Forecasting with a Deep Learning Earth System Model". *[in prep]*

[10] Li Q., **Espinosa, Z.,** Armour, K., Cheng W., & Thompson L., "The Double-ITCZ Bias Weakens the Southern Ocean-Tropical Pacific Teleconnection." ESS Open Archive (2026). **https://doi.org/10.22541/essoar.15003562/v1** *[submitted]*

[9] **Espinosa, Z.,** Zelinka M., Bitz, C., & Armour, K. "The Southern Ocean and Tropical Eastern Pacific Teleconnection in models and observations". *Authorea Preprint* (2025): **10.22541/essoar.174534450.08930960/v1**

[8] Clemens-Sewall, D., **Espinosa, Z.,** Oggier, M., Sturm, M., Webster, M., Wesen, S., ... & Delamere, J. "Snow ALbedo eVOlution (SALVO) Campaign Measurements from April-June, 2024 in Utqiagivk, AK." Atmospheric Radiation Measurement User Facility (2025). **[Spectral Albedo] [Oblique Photos] [Snow Depth] [Broadband Albedo]**

[7] **Espinosa, Z.,** Roach, L., Bitz, C., & Notz, D. "Sea Ice in Earth system models". *Sea Ice 4* (2025): **10.1002/9781394213764.ch10**

[6] **Espinosa, Z.,** Blanchard-Wrigglesworth, E., and Bitz, C. "Understanding the drivers and predictability of record low Antarctic sea ice in austral winter 2023." *Nature Communications Earth & Environment* (2024): **10.1038/s43247-024-01772-2**

[5] Cresswell-Clay, N., Liu, B., Durran, D., Liu, A., **Espinosa, Z.,** Moreno, R., & Karlbauer, M. "A Deep Learning Earth System Model for Stable and Efficient Simulation of the Current Climate". *AGU Advances* (2025)*:* **10.1029/2025AV001706**

[4] Schneider, D. P., Yin, Z., O'Connor, G. K., Blanchard-Wrigglesworth, E., Cast, Z. I., Datta, R., & **Espinosa, Z.** "Increasing Antarctic snowfall mitigates sea level rise less than projected due to meltwater influence on sea surface temperatures". *Authorea Preprint* (2024): **10.22541/essoar.172411232.25724214/v1**

[3] **Espinosa, Z.**, and Zelinka, M. "The shortwave cloud-SST feedback amplifies multi-decadal Pacific sea surface temperature trends: Implications for observed cooling." *Geophysical Research Letters* 51.18 (2024): e2024GL111039. **10.1029/2024GL111039**

[2] Blanchard-Wrigglesworth, E., Cox, T., **Espinosa, Z.,** & Donohoe, A. "The largest ever recorded heatwave—Characteristics and attribution of the Antarctic heatwave of March 2022". *Geophysical Research Letters*, *50*(17) (2023): e2023GL104910. **10.1029/2023GL104910**

[1] **Espinosa, Z.**, et al. "Machine learning gravity wave parameterization generalizes to capture the QBO and response to increased CO2." *Geophysical Research Letters* 49.8 (2022): e2022GL098174. **10.1029/2022GL098174**

PROFESSIONAL EXPERIENCE

Research Scientist| *San Francisco, CA* | **Google DeepMind** — May 2025 – Present

- AI for high-resolution, regional weather forecasting

Student Researcher | *San Francisco, CA* | **Google DeepMind** — Aug 2025 – Dec 2025

- AI for high-resolution, regional weather forecasting

Technical Intern, PhD | *San Francisco, CA* | **Brightband** — May 2025 – Jul 2025

- Diffusion modeling for AI data assimilation for weather forecasting

Research Intern, PhD | *Livermore, CA* | **Lawrence Livermore National Laboratory** Jun 2023 – Sep 2023

• Studied the impact of marine boundary layer clouds on historical East Pacific Ocean cooling

Research Intern, PhD | *Richland, WA* | **Pacific Northwest National Laboratory** Jun 2021 – Sep 2021

• Studied the impact of climate change on annual precipitation in the Amazon Rainforest

Graduate Research Assistant | *Stanford, CA* | **Stanford Earth Systems Science** Sep 2019 – Sep 2021

• Developed a machine learning parameterization of gravity wave in a global climate model (Sheshadri Group)

• Publication in Geophysical Research Letters - Espinosa, Zachary I., et al (2022)

Machine Learning Engineering Intern | *Redwood City, CA* | **UnifyID** Apr 2020 – Jun 2020

• Developed in-house machine learning pipeline for research & development. Introduced pipeline testing

Quantum Engineering Intern | *Palo Alto, CA* | **AT&T Foundry** Jun 2019 – Sep 2019

• Built an open-source python framework for quantum networking (QN) simulations called netQuil, designed to support the implementation of canonical QN protocol (e.g. teleportation, superdense coding)

Software Engineering Intern | *Mountain View, CA* **| Smartcar, Inc.** Jan 2019 – Jun 2019

- Designed, built, and launched electric vehicle endpoints for Smartcar API
- Maintained python, node.js, and java SDKs. Contributed to OAuth2 pipeline.

Mobile Software Engineering Intern | *San Francisco, CA* | **OXO, Inc.** Apr 2018 – Sep 2018

- Built first iteration MVP mobile app for iOS and Android using React Native, Firebase, Heroku, and AWS RDS.

Web and Networking Engineering Intern | *Ashton, ID* | **Henry's Fork Foundation** Jun 2017 – Sep 2017

• Designed and built a data collection network for monitoring the Yellowstone watershed.

TEACHING, MENTORSHIP & SERVICE

Instructor & Mentor | AI Fellowship Program | *VeritasAI* Jun 2024 – Present

Graduate Student Representative | UW Program on Climate Change | *Seattle, WA* Sep 2022 – Sep 2024

Graduate President of UW American Meteorological Society Chapter | *Seattle, WA* Sep 2021 – Sep 2023

Guest Lecturer | ATMS 220: Exploring the Atmospheric Sciences | *Seattle, WA* Oct 2023

Guest Lecturer | ATMS 220: Exploring the Atmospheric Sciences | *Seattle, WA* May 2023

Teaching Assistant | ATMS 101: Weather | *Seattle, WA* Jan 2023 – Mar 2023

PRESENTATIONS

Talk | **AMS 2025**| Seasonal Sea Ice Forecasting with a Deep Learning Earth System Model Jan 2025

Talk | **AMS 2025** | The Impact of the Shortwave Cloud Feedback on East Pacific Multi-Decadal Variability Jan 2025

Poster | **AMS 2025**| Record Low Antarctic Sea Ice in Austral Winter 2023: Mechanisms and Predictability Jan 2025

Talk | **Catalyst Project**| The Shortwave Cloud-SST Feedback Amplifies MultiDecadal Pacific SST Trends Nov 2024

Poster | **CFMIP 2024** | The Impact of the Shortwave Cloud Feedback on East Pacific Multi-Decadal Variability Jun 2024

Talk | **UW Climate Dynamics Seminar** | From Record Low Sea Ice to East Pacific Cooling: Unraveling SH Extremes Apr 2024

Poster | **US CLIVAR Blocking and Extreme Weather Workshop** | The Physics of Antarctic Heatwaves Mar 2024

Poster | **AGU Fall Meeting** | The Physics of Antarctic Heatwaves Dec 2023

Poster | **Graduate Climate conference** | Drivers of Record Low Antarctic Sea Ice in Austral Winter 2023 Oct 2023

Poster | **DOE CSGF Annual Review**| The Physics of Antarctic Heatwaves Jul 2023

Talk | **Scientific Committee on Antarctic Research** | The Physics of Summertime Antarctic Heatwaves June 2023

Poster | **BEPSII Arctic Field School** | Drivers of Interannual Variability of Summer Sea Ice Extent May 2022

Talk | **AGU Fall Meeting** | Machine Learning Emulation of Parameterized Gravity Wave Momentum Dec 2021

Talk | **EGU General Assembly** | Machine Learning Emulation of Parameterized Gravity Wave Momentum Apr 2021

Talk **| CalGFD |** A Data-Drive, Single column Gravity Wave Parameterization in an Idealized Model Aug 2020

Poster **| Stanford Deep Learning Poster Session |** Distracted Driver Detection Jun 2018

Poster **| Stanford Artificial Intelligence Post Session |** Tracking Schistosomiasis with Computer Vision Mar 2018

ADDITIONAL INFORMATION

Tooling: Python, PyTorch, High Performance Computing, multi-node & muli-gpu training, Dask, Fortran, C, C++

Expertise: Generative AI, Diffusion Models, ConvNets, Vision Transformers, AI Autoregressive Weather & Climate Prediction, Hybrid and Full AI Climate modeling, Climate Dynamics, Extreme Weather**,** Subseasonal to Seasonal Forecasting, Data Analytics