Francisco Spaulding-Astudillo, Ph.D.

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Professional atmospheric scientist with a passion for science communication, predictive modeling, and theory.

EDUCATION

University of California, Los Angeles
Ph.D. in Geophysics and Space Physics 2018- 2023

University of California, Los Angeles
M.S. in Geophysics and Space Physics 2018- 2021

University of Chicago
B.S. in Geophysical Sciences *2013-2017*

SKILLS

Programming: Python, Fortran, C++, MATLAB, Bash scripting, Linux/Unix multiprocessor supercomputing, Git

Machine learning: shallow algorithms (linear regression, k-nearest neighbors), cost function optimization (e.g., for conservation problems), gradient descent (e.g., Navier-Stokes incompressible flow)

Atmospheric Radiative Transfer and Earth System Models: System for Atmospheric Modeling (SAM), Reference Forward Model (RFM), Comprehensive Atmosphere and Ocean Engine (CANOE), Max-Planck Institute General Circulation Model (ECHAM6), European Centre for Medium-Range Weather Forecasts Reanalysis v5 (ERA5), NASA Modern-Era Retrospective Analysis for Research and Applications v2 (MERRA-2)

PROFESSIONAL EXPERIENCE

UCLA Department of Earth, Planetary, and Space Sciences
Postdoctoral Fellow *2023-present*

- Lead 2 team projects on atmospheric modeling and theory, employing Python for data processing, analysis, and visualization, Bash, Fortran and C++ for scripting, modeling, and simulation workflows, and Git for version control and collaboration
- Developing a robust model to constrain severe precipitation in mature hurricanes in warmer climates
- Apply ML algorithms to atmospheric datasets to identify statistical patterns in spectroscopic datasets and enhance the representation of radiative processes in climate models
- Mentor research staff in model installation, scripting, compilation, and deployment on HPC servers
- Communicate findings to diverse audiences through journal articles and conference presentations

UCLA Department of Earth, Planetary, and Space Sciences
Ph.D. Researcher *2018-2023*

Project A: Predicting cloud height with infrared spectroscopy simulations in Earth's warming climate

- Designed and implemented a Python workflow to run a Fortran-based radiation model and process multi-format data using standard statistical libraries (pandas, scipy, numpy, matplotlib)
- Contributed to climate change research by publishing a peer-reviewed robust cloud prediction method that solves fluid dynamics and radiative transfer partial-differential equations

Project B: Building robust analytical models of convective storms and extreme precipitation

- Identified over 100 extreme precipitation events in netCDF time-series, demonstrating a 30-year trend towards increasingly episodic storm activity at higher sea surface temperatures

- Developed a theory for precipitation stochasticity based on 1st and 2nd laws of thermodynamics
- Expanded capabilities of the ECHAM6 climate model, deploying updates in Fortran and testing model performance on Linux HPC environments, resulting in 1 peer-reviewed publication

Project C: Assessing the climate impact of high water vapor concentrations

- Designed and executed simulations to evaluate the effects of varying water vapor concentrations in an Earth System Model
- Processed and analyzed over 10 TB of geospatial climate data using Python, and published the results in 1 journal and presented at 3 conferences

University of Chicago Department of the Geophysical Sciences
Scientific programmer *2017-2018*

- Designed and implemented a MATLAB-based solution for ice sheet flow in spherical mesh using finite-element methods for numerical discretization of partial differential equations (PDEs)
- Collaborated with researchers from 3 universities, resulting in multiple conference presentations and a follow-up study

SELECTED PUBLICATIONS

Spaulding-Astudillo, F. E., Moore, D. & Mitchell, J. L. (2025c). "On the maximum precipitation intensity of mature hurricanes" in preparation.

Spaulding-Astudillo, F. E. & Mitchell, J. L. (2025b). "The spectral dependence of atmospheric convection", in preparation.

Spaulding-Astudillo, F. E. & Mitchell, J. L. (2025a). "Clear-sky convergence, water vapor spectroscopy, and the origin of tropical congestus clouds". *AGU Advances*, accepted. https://doi.org/10.1029/2024AV001300

Spaulding-Astudillo, F. E., & Mitchell, J. L. (2024). A simple model for the emergence of relaxation-oscillator convection. *Journal of Advances in Modeling Earth Systems*, 16, e2024MS004439. https://doi.org/10.1029/2024MS004439

Spaulding-Astudillo, F. E. & Mitchell, J. L. (2023). "Effects of saturation vapor pressure on clouds, climate, and convection". *Journal of the Atmospheric Sciences*, *80*(5), 1247-1266. https://doi.org/10.1175/JAS-D-22-0063.1

SELECTED PRESENTATIONS

Spaulding-Astudillo, F. E. & Mitchell, J. L. (2024, Dec. 9-13). *Towards a spectral perspective of atmospheric convection*. AGU 2024 Fall Meeting, Washington, D.C., USA

Spaulding-Astudillo, F. E. & Mitchell, J. L. (2024, June 24-28). *Formation of tropical congestus clouds: a clear-sky convergence perspective*. AMS 24th Conference on Atmospheric and Oceanic Fluid Dynamics, Burlington, VT, USA

Spaulding-Astudillo, F. E. & Mitchell, J. L. (2023, Dec. 11-15). *The physical origin of tropical congestus clouds*. AGU 2023 Fall Meeting, San Francisco, CA, USA