

Postdoc and Scientist Positions at UChicago (flexible start date from 1/1/2024 to 1/1/2025):

The University of Chicago's new Climate Extremes Theory and Data (CeTD) research group (PI: Pedram Hassanzadeh) has multiple positions for postdoctoral fellows and research scientists interested in working on multidisciplinary projects in the following general areas (and at their intersections):

- 1) Extreme weather events and climate change (with a focus on dynamics and the extratropical atmospheric circulation),
- 2) Scientific deep learning for multi-scale nonlinear dynamical systems (with a focus on developing general, rigorous frameworks),
- 3) Applications of deep learning to improve analysis, modeling, and prediction of climate variability, weather extremes, and geophysical turbulence (with a focus on subgrid-scale modeling and spatio-temporal forecast/emulation).

Full financial support for these projects is available through funding from NSF, ONR, Schmidt Futures, and UChicago. Furthermore, outstanding applicants will be supported to apply for a number of prestigious opportunities at UChicago including the campus-wide [Eric and Wendy Schmidt AI in Science Postdoctoral Fellowship](#), the [T. C. Chamberlin Postdoctoral Fellowship](#) at the Department of Geophysical Sciences, and [Kruskal Instructor](#) at the Committee of Computational and Applied Mathematics.

The topic of each project is flexible but is expected to be will be aligned with our current interests and future directions, which are as follows.

Regarding (1), we are especially interested in studying *persistent extratropical circulation* patterns, such as blocking events, wavy jet streams, and annular modes,, using a combination of theory, hierarchical modeling, and observational data analysis. Developing better eddy-mean flow interaction theories for blocks, constraining changes in their key characteristics with climate change, and understanding the implications for future extreme events (e.g., heat waves), are of particular interest. See, for example, this [paper](#) and [news release](#). As for the annular modes, our work is focused on a new reduced-order model for the extratropical circulation, the recently discovered intrinsic 150-day periodicity of the Southern Annular Mode, and the implications for climate model evaluation and development (e.g., see this [paper](#) and [Editor Highlight](#)).

Regarding (2), we are mainly focused on developing rigorous frameworks for applications of deep neural networks to multi-scale, nonlinear PDEs such as those governing the climate and turbulent systems. Explainability, stable spatio-temporal integration, generalizability, learning extreme events and high frequencies, and uncertainty quantification are of particular interest. We aim to combine fundamental concepts and tools from nonlinear dynamics, numerical analysis, and theoretical deep learning to address these challenges. For example, see this [paper](#) on the Fourier-wavelet analysis framework and this [one](#) on stable integrations.

Regarding (3), we aim to leverage the outcomes of (1)-(2) and employ physics-informed deep learning to improve analysis, modeling, and prediction of climate variability, weather extremes, and turbulence. Of particular interest are developing i) data-driven subgrid-scale parameterizations, and ii) data-driven spatio-temporal forecast models. As for (i), we are focused on using deep learning and equation-discovery methods applied to canonical geophysical turbulent flows, atmospheric gravity waves, and the quasi-biennial oscillation and polar vortex variability as a part of the Schmidt Futures-supported [DataWave](#) and NSF-supported [GW-CSSI](#) projects. For example, see this [paper](#) and this [one](#). Note that [DataWave](#) and [GW-CSSI](#) involve a number of other institutions (NYU, Stanford U, NWRA, UK Met Office, MPI Hamburg, U Frankfurt, ENS Paris) and the former is also a part of Schmidt Futures [Virtual Earth Systems Research Institutes](#). There are many opportunities for inter-institutional collaborations and visits for those involved in these projects. As for (ii), we are mainly interested in the short- and long-term stability and accuracy of such forecast models, with a focus on rare, extreme events. See, e.g., this [paper](#) and this [one](#).

Furthermore, all postdocs and research scientists will benefit from our group's involvement in multi-institutional, international collaborative projects such as the Schmidt Futures-supported [DataWave](#) and NSF-supported [GW-CSSI](#). They will also benefit from UChicago's thriving and expanding programs in [Climate Science](#), [AI+Science](#), [Computational and Applied Math](#), [Data Science](#), and [Climate Systems Engineering](#).

Qualifications: We are looking for highly motivated applicants with Ph.D. degrees in Earth and climate sciences, applied math, physics, statistics, computer science, engineering, or a related field. The qualifications needed for each research area are:

Area 1) *Required:* Strong background in climate physics and/or geophysical fluid dynamics, extensive experience with climate models and data. *Preferred:* Skills in topics such as applied math, scientific computing, and statistical analysis for big data;

Area 2) *Required:* Strong background in applied math and/or theoretical deep learning. *Preferred:* Skills in topics such as nonlinear or fluid dynamics, numerical analysis, and scientific computing;

Area 3) *Required:* Strong background in climate science and/or geophysical fluid dynamics. *Preferred:* Skills in topics such as applied math, deep learning, climate models and data, turbulence physics, gravity waves, nonlinear dynamics, numerical analysis, and scientific computing.

Applications: The start date is flexible (anytime between 1/1/2024 and 1/1/2025). Applications will be reviewed starting 9/15/2023 on a rolling basis. The review will continue until all of the positions are filled. We encourage you to submit your application (or reach out) as soon as possible, even if you are interested in starting dates after the summer of 2024.

To apply, please send

- A complete CV that includes details of your education, research experience, publications, presentations, and contact information of at least 3 references,
 - A brief (~1 page) description of your plans, qualifications, and research interests (particularly in the context of areas 1-3 and qualifications listed above),
- to Prof. Pedram Hassanzadeh, pedramh@uchicago.edu (use "Postdoc Position" as the email's subject).

Outstanding applicants for the above positions with more than 3 years of postdoc experience will be considered for appointment as research scientists.

Equal Employment Opportunity Statement:

All University departments and institutes are charged with building a faculty from a diversity of backgrounds and with diverse viewpoints; with cultivating an inclusive community that values freedom of expression; and with welcoming and supporting all their members.

We seek a diverse pool of applicants who wish to join an academic community that places the highest value on rigorous inquiry and encourages diverse perspectives, experiences, groups of individuals, and ideas to inform and stimulate intellectual challenge, engagement, and exchange. The University's Statements on Diversity are at <https://provost.uchicago.edu/statements-diversity>

The University of Chicago is an Affirmative Action/Equal Opportunity/Disabled/Veterans Employer and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender identity, national or ethnic origin, age, status as an individual with a disability, protected veteran status, genetic information, or other protected classes under the law. For additional information please see the University's Notice of Nondiscrimination.

Job seekers in need of a reasonable accommodation to complete the application process should call 773-834-3988 or email equalopportunity@uchicago.edu with their request.