

Hao Fu, Ph.D.

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T. C. Chamberlin Postdoctoral Fellow,

Department of the Geophysical Sciences, University of Chicago

WORKING EXPERIENCE

The University of Chicago

2023 – now

Department of the Geophysical Sciences

T. C. Chamberlin Postdoctoral Fellow

EDUCATION

Stanford University

2018 – 2023

Ph.D. in Earth System Science

Advisor: Prof. Morgan E O'Neill

University of Chinese Academy of Sciences

2015 – 2018

Master program in Geophysical Fluid Dynamics

Advisor: Prof. Yihua Lin

Nanjing University

2011 – 2015

B.S. in Atmospheric Sciences

Advisor: Prof. Yuan Wang and Prof. Bowen Zhou

RESEARCH INTEREST

I study geophysical fluid dynamics. Topics include:

- Tropical cyclones, waves, and convection
- The mechanics of multiphase, rotating, and stratified flow
- Symmetry breaking and pattern formation in geophysical flow

ARTICLES IN PEER-REVIEWED JOURNALS

12. **Fu, H.** & O'Neill, M. (2025), A quasi-2D model of convectively coupled vortices. *J. Atmos. Sci.*, 82, 1317–1340. doi: [10.1175/JAS-D-24-0155.1](https://doi.org/10.1175/JAS-D-24-0155.1).
11. **Fu, H.** & Cenedese, C., Lefauve, A., Vallis, G. (2025), A laboratory analogy for mixing by shallow cumulus convection. *J. Fluid. Mech.*, 1011, A35. doi: [10.1017/jfm.2025.173](https://doi.org/10.1017/jfm.2025.173).
10. **Fu, H.** & Davis, C. (2025), The role of momentum transfer in tropical cyclogenesis: insights from a single-column model. *J. Atmos. Sci.*, doi: [10.1175/JAS-D-24-0069.1](https://doi.org/10.1175/JAS-D-24-0069.1).
9. **Fu, H.** & O'Neill, M. (2025), Mean cold pool size of quasi-equilibrium convection. Part I: Why do cold pools collide? *J. Atmos. Sci.*, 82(2): 237-250. doi: [10.1175/JAS-D-23-0143.1](https://doi.org/10.1175/JAS-D-23-0143.1)
8. **Fu, H.** & O'Neill, M. (2025), Mean cold pool size of quasi-equilibrium convection. Part II: The survival competition hypothesis. *J. Atmos. Sci.*, 82(2): 251-265. doi: [10.1175/JAS-D-24-0052.1](https://doi.org/10.1175/JAS-D-24-0052.1)
7. **Fu, H.** & Sun, S., (2024) Vorticity skewness of finite-amplitude rapidly rotating Rayleigh-Bénard convection. *J. Fluid. Mech.*, 997, A3. doi: [10.1017/jfm.2024.571](https://doi.org/10.1017/jfm.2024.571).

6. **Fu, H.** & O'Neill, M., (2024) The small-amplitude dynamics of spontaneous tropical cyclogenesis. Part I: Experiments with amplified longwave radiative feedback *J. Atmos. Sci.*, 81(2): 381-399. doi: [10.1175/JAS-D-23-0170.1](https://doi.org/10.1175/JAS-D-23-0170.1)
5. **Fu, H.** & O'Neill, M., (2024) The small-amplitude dynamics of spontaneous tropical cyclogenesis. Part II: Linear stability analysis. *J. Atmos. Sci.* doi: [10.1175/JAS-D-24-0032.1](https://doi.org/10.1175/JAS-D-24-0032.1)
4. **Fu, H.** & O'Neill, M., (2024) The stochastic spin-up of vorticity in spontaneous tropical cyclogenesis. *J. Atmos. Sci.*, 2024, 81(5): 855-870. doi: [10.1175/JAS-D-23-0186.1](https://doi.org/10.1175/JAS-D-23-0186.1)
3. **Fu, H.** & O'Neill, M., (2021) The role of random vorticity stretching in tropical depression genesis. *J. Atmos. Sci.*, 78(12), 4143-4168. doi: [10.1175/JAS-D-21-0087.1](https://doi.org/10.1175/JAS-D-21-0087.1)
2. **Fu, H.**, (2021) A linear stability analysis of two-layer moist convection with a saturation interface. *J. Fluid Mech.*, 928, A13. doi: [10.1017/jfm.2021.784](https://doi.org/10.1017/jfm.2021.784)
1. **Fu, H.** & Lin, Y., (2019). A kinematic model for understanding rain formation efficiency of a convective cell. *J. Adv. Model. Earth. Syst.*, 11(12), 4395-4422. doi: [10.1029/2019MS001707](https://doi.org/10.1029/2019MS001707)

MANUSCRIPTS UNDER REVIEW

2. **Fu, H.** & Yang, D., Cloud sync in response to wave-like large-scale forcings. Revised for *J. Atmos. Sci.*.
1. **Fu, H.** The diffusion of convective activity by cold pools. Under review in *J. Atmos. Sci.*.

MANUSCRIPTS IN PREPARATION

4. **Fu, H.** & Yang, D. Regimes of convective response to large-scale forcing.
3. **Fu, H.** & Davis, C., The growth of barotropic vorticity in a periodically forced rotating-stratified flow.
2. **Fu, H.** & Davis, C., Tropical cyclone intensification in a single column model.
1. **Fu, H.** & Davis, C., A phase diagram for understanding intrinsic processes in tropical cyclogenesis.

SOFTWARE

I built a parallel solver of the 3D anelastic Navier-Stokes equation in the vorticity-velocity formulation: [VDNS](#). It will be the dynamical core of my future cloud-resolving model.

SELECTED AWARDS

Earth System Science Award for Scholarly/Research Achievement <i>Stanford University</i>	2023
Outstanding Student Presentation Award (Oral) <i>American Geophysical Union Fall Meeting 2022</i>	2023
Outstanding Student Presentation Award (Poster) <i>23rd AMS Conference on Atmospheric and Oceanic Fluid Dynamics</i>	2022
Outstanding Student Presentation Award (Oral) <i>4th California Geophysical Fluid Dynamics Conference</i>	2022

Excellent Graduate of Nanjing University <i>Nanjing University</i>	2015
Excellent Bachelor Thesis Team of Jiangsu Province <i>The only one of Nanjing University</i>	2015
The First Grade Award in the 17 th Forum of Sciences & Arts of Nanjing University <i>Nanjing University</i>	2014

LEADERSHIP

- The leader and co-founder of [Student GFD Lab at Nanjing University](#), 2013-2015. Now, the lab is one of the leading educational GFD labs in China that offers undergraduate research training and public science education. My role has shifted to a consultant since 2015.
- One of the two hosts of the Climate Dynamics Group Weekend Webinar, 2021-2022. The group is a Chinese community of over two hundred students and scientists in climate science worldwide.
- Co-chair of the session “Tropical Cyclones: Observations, Modeling and Predictability - Today and into the Future II Oral” at the AGU 2024 Fall Meeting.

TEACHING EXPERIENCE

- Teaching assistant for ESS 246A (*Atmosphere, Ocean, and Climate Dynamics: The Atmospheric Circulation*), Stanford University, Fall 2021.
- Teaching assistant for ESS 238 (*Advanced Survey for Current Research in Climate Dynamics*), Stanford University, Spring 2022.
- Guest lecturer for *Advanced Atmospheric Dynamics*, University of Chinese Academy of Sciences, Fall 2017. I gave a lecture on “Atmosphere and Ocean in the Lab.”

MENTORING

- Co-advising Arun Balakrishna, Ph.D. student at Stanford University, 2022-now.
- Baroclinic instability experiment at Nanjing University (NJU): Feiyu You, Yimeng Li, Yanhong Lai, Danyang Li, 2017-2018.
- Gravity currents experiment at NJU: Saili Tailaiti, Jingnan Yin, Congyuan Li, 2016.
- Ekman pumping experiment at NJU: Ang Zhou, Jingyi Zhuo, Ruoyu Wang, Yue Hu, 2015-2016.
- Convective boundary layer experiment at NJU: Zixuan Xiang, Jing Xi, Nana Wu, 2015.
- Kármán vortex street experiment at NJU: Cheng Gong, Lulu Chen, Xibin Feng, Jingwen Lu, 2014.
- Topographic Rossby wave experiment at NJU: Yilun Han, Shizuo Liu, Qiuyan Zhang, Han Huang, Jiayi Huang, Wen Yang, 2014.

PROFESSIONAL EXPERIENCE

- Fellow of Geophysical Fluid Dynamics Program, Woods Hole Oceanographic Institution, 2023.
- Visitor at National Center for Atmospheric Research, Boulder, March 19 - April 20, 2024.

- Visitor at National Center for Atmospheric Research, Boulder, Oct 9 - Nov 11, 2022.
- Attendee of the Boulder Summer School for Condensed Matter Physics, Hydrodynamics Across Scales, Boulder, July 4-29, 2022.

SERVICE

- Reviewer for *Advances in Atmospheric Sciences*, *Climate Dynamics*, *Earth's Future*, *Geophysical Research Letters*, *Journal of the Atmospheric Sciences*, *Journal of Geophysical Research-Atmosphere*, *Journal of Advances in Modeling Earth Systems*, *Journal of Fluid Mechanics*, *PNAS*, *Quarterly Journal of the Royal Meteorological Society*, *Tropical Cyclone Research and Review*.
- Judge for the Outstanding Student Presentation Award at AMS Atmospheric and Oceanic Fluid Dynamics Conference, 2024.
- Judge for the Outstanding Student Presentation Award at AGU Fall Meeting, 2023.

INVITED TALKS

- Boiling stratified flow: a laboratory analogy of atmospheric convection, Yuk Lunch Seminar, Caltech, May 19, 2024.
- Boiling stratified flow: a laboratory analogy of atmospheric convection, NCAR Dynamics Happy Hour, April 3, 2024.
- The fluid dynamics of spontaneous tropical cyclogenesis, University of California, Santa Cruz, Oct 27, 2023.
- A theory of cloud spacing for equilibrium deep convection, University of Chicago, Nov 14, 2022.
- The multiscale dynamics of spontaneous tropical cyclogenesis, NCAR Dynamics Happy Hour, Nov 4, 2022.
- A theory of spontaneous tropical cyclogenesis from quasi-random convection, Florida State University (virtual), Jan 27, 2021.

PRESENTATIONS

16. **Fu, H.** & O'Neill, M. (2023) Why do cold pools widen a small-amplitude tropical cyclone precursor vortex? American Geophysical Union Fall Meeting, San Francisco, Dec. 11-15.
15. **Fu, H.**, Cenedese, C., Lefauve A., and Vallis G. K. (2023) Boiling stratified flow: a lab analogy to atmospheric convection, American Geophysical Union Fall Meeting, San Francisco, Dec. 11-15.
14. **Fu, H.** & O'Neill, M. (2022) Spontaneous tropical cyclogenesis in a quasi-stochastic barotropic model, American Geophysical Union Fall Meeting, Chicago, Dec. 12-16.
13. **Fu, H.** (2022) Convectively coupled waves in rotating radiative-convective equilibrium simulations, American Geophysical Union Fall Meeting, Chicago, Dec. 12-16.
12. **Fu, H.** (2022) The resonant growth of convectively coupled gravity waves, California GFD Conference, Aug. 18-19.

11. **Fu, H.** & O'Neill, M. (2022) The small-amplitude dynamics of spontaneous tropical cyclogenesis, 23rd Conference on Atmospheric and Oceanic Fluid Dynamics, Breckenridge, USA, June. 13-17.
10. **Fu, H.** & O'Neill, M. (2022) A theory of cloud spacing for equilibrium deep convection, 35th Conference on Hurricanes and Tropical Meteorology, New Orleans, May. 9-13.
9. **Fu, H.** & O'Neill, M. (2021) The spread of convective activity by cold pools: a theoretical investigation, California GFD Conference, virtual, Sep. 2-3.
8. **Fu, H.** & O'Neill, M. (2021) The role of cold pool in shaping the mesoscale convective edge, American Meteorological Society, 34th Conference on Hurricanes and Tropical Meteorology, virtual, May. 10-14.
7. **Fu, H.** & O'Neill, M. (2020) The role of vorticity random stretching in an idealized tropical depression genesis problem, American Geophysical Union Fall Meeting, virtual, Dec. 1-17.
6. **Fu, H.** & Sun, S. (2020) On the asymmetry of cyclone and anticyclone in the cellular regime of rotating Rayleigh-Bénard convection, 73rd APS Meeting on Fluid Dynamics, virtual, Nov. 22-24.
5. **Fu, H.** (2019) A linear stability analysis of two-layer moist convection with application to radiation fog, 22nd Conference on Atmospheric and Oceanic Fluid Dynamics, Portland, USA, June. 24-28.
4. **Fu, H.** & Lin, Y. (2017) A Precipitating Moist Rayleigh-Bénard Convection Model, 70th APS Meeting on Fluid Dynamics, Denver, USA, Nov. 19-21.
3. **Fu, H.** & Lin, Y. (2016) A Parallel Boussinesq Solver in Vorticity-Velocity Formulation, LASG State Key Laboratory Annual Meeting, Beijing, China, Dec. 22-24.
2. **Fu, H.** & Sun, S. (2016) Studying Vortex Dynamics of Rotating Convection with High-resolution PIV Measurement, 69th APS Meeting on Fluid Dynamics, Portland, USA, Nov. 21-23.
1. **Fu, H.**, Sun, S, Pu, Y., Feng, Z., Liu, M., Wang, Y. & Zhou, B. (2015) A Laboratory Study of Vortical Structures of Rotating Convection Plumes, 68th APS Meeting on Fluid Dynamics, Boston, USA, Nov. 22-24.