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School of Mathematics
University of Edinburgh
Dated: October 8, 2025

EMPLOYMENT AND RESEARCH EXPERIENCE

University of Edinburgh, Edinburgh, UK **Sep. 2025-Present**
Lecturer in Applied and Computational Mathematics in the School of Mathematics

Universidad Politécnica de Madrid, Madrid, Spain **Sep. 2023-Sep. 2025**
Marie Skłodowska-Curie Postdoctoral Fellow in the School of Aeronautics

University of Warwick, Coventry, UK **Feb. 2022-Aug. 2023**
Research Fellow in the Mathematics Institute
Supported by the Simons collaboration on *Revisiting the Turbulence Problem using Statistical Mechanics*

EDUCATION

Massachusetts Institute of Technology (MIT), Cambridge, USA **2016-2022**
PhD, Department of Earth, Atmospheric and Planetary Sciences (EAPS) GPA: 4.9/5
Focus: Nonlinear Dynamics in Geosciences
Advisors: Glenn R. Flierl & J. Taylor Perron

École Normale Supérieure (ENS) rue d'Ulm, Paris, France **2015-2016**
Masters ENS-ICFP in Macroscopic Physics and Complexity mention *Très Bien*
Advisor: Alexandros Alexakis

The University of Texas at Austin **2010-2015**
Bachelor of Science in Physics (Option: Honors Physics) GPA: 3.9628/4
Bachelor of Science in Mathematics (Option: Honors Mathematics)
Dean's Scholars Honors Program
Graduation Distinction: Dean's Honored Graduate (Top 1%) and Highest Honors (Top 4%)

PUBLICATIONS

14. **Benavides, S. J.**, & Bustamante, M. D. "Phase dynamics and their role determining energy flux in hydrodynamic shell models," *arXiv: 2507.03397* (2025).
https://doi.org/10.48550/arXiv.2507.03397

13. **Benavides, S. J.**, Deal, Eric, Venditti, J. G., & Perron, J. T., "Intermittent grain activity from grain-scale collective entrainment rules," *ESS Open Archive (Preprint)* (2025).
https://doi.org/10.22541/essoar.174742811.12990892/v1

12. **Benavides, S. J.**, & Barkley D. "Model for transitional turbulence in a planar shear flow," *Proc. R. Soc. A* **481**:20250391 (2025).
https://doi.org/10.1098/rspa.2025.0391

11. Zhang, Q., Deal E., Perron, J. T., Venditti, J. G., **Benavides, S. J.**, Rushlow, M., & Kamrin, K. "Discrete simulations of fluid-driven transport of naturally shaped sediment particles," *Journal of Geophysical Research: Earth Surface* (2025)
https://doi.org/10.1029/2024JF007937

10. **Benavides, S. J.,** Deal, E., Venditti, J. G., Bradley, R., Zhang, Q., Kamrin, K., & Perron, J. T., "How fast or how many? Sources of sediment transport intermittency," *Geophysical Research Letters,* 50, e2022GL101919 (2023).
https://doi.org/10.1029/2022GL101919

9. Deal, E., Venditti, J. G., **Benavides, S. J.,** Bradley, R., Zhang, Q., Kamrin, K., & Perron, J. T., "Grain shape effects in bed load sediment transport," *Nature* **613**, 298-302 (2023).
https://doi.org/10.1038/s41586-022-05564-6

8. **Benavides, S. J.,** Burns, K. J., Gallet, B., & Flierl, G. R., "Effective drag in rotating, poorly conducting plasma turbulence," *The Astrophysical Journal,* **938** 92 (2022).
https://doi.org/10.3847/1538-4357/ac9137

7. Zhang, Q., Deal, E., Perron, J. T., Venditti, J. G., **Benavides, S. J**., Rushlow, M., & Kamrin, K., "Fluid-driven transport of round sediment particles: from discrete simulations to continuum modeling," *JGR: Earth Surface,* 127, e2021JF006504 (2022).
https://doi.org/10.1029/2021JF006504

6. **Benavides, S. J.,** Burns, K. J., Gallet, B., Cho, J. Y-K. & Flierl, G. R., "Inverse cascade suppression and shear layer formation in MHD turbulence subject to a guide field and misaligned rotation," *Journal of Fluid Mechanics,* Volume 935, A1, (2022).
https://www.doi.org/10.1017/jfm.2021.968

5. **Benavides, S. J.,** Deal, E., Rushlow, M., Venditti, J. G., Zhang, Q., Kamrin, K., & Perron, J. T., "The impact of intermittency on bed load sediment transport," *Geophysical Research Letters,* 49, e2021GL096088 (2022).
https://doi.org/10.1029/2021GL096088

4. Alexakis, A., Pétrélis, F., **Benavides, S. J.**, & Seshasayanan, K., "Symmetry breaking in a turbulent environment," *Phys. Rev. Fluids* **6**, 024605 (2021).
https://doi.org/10.1103/PhysRevFluids.6.024605

3. **Benavides, S. J.**, & Flierl, G. R., "Two-dimensional partially ionized magnetohydrodynamic turbulence," *Journal of Fluid Mechanics*. Volume 900, A28, (2020).
https://doi.org/10.1017/jfm.2020.500

2. **Benavides, S. J**., & Alexakis, A., "Critical transitions in thin layer turbulence," *Journal of Fluid Mechanics,* Volume 822, pg. 364-385 (2017).
https://doi.org/10.1017/jfm.2017.293

Mentioned in feature article: Ecke, R. E. "From 2D to 3D in Fluid Turbulence: Unexpected Critical Transitions." *Journal of Fluid Mechanics,* Volume 828, pg. 1-4 (2017).
https://doi.org/10.1017/jfm.2017.507

1. Seshasayanan, K., **Benavides, S. J**., & Alexakis, A., "On the edge of an inverse cascade," *Phys. Rev. E.* Volume 90, 051003(R) (2014).
http://dx.doi.org/10.1103/PhysRevE.90.051003

SCIENTIFIC EXPERIENCE

Participant in summer school at the Center for Computational Astrophysics
The Flatiron Institute (Simons Foundation), New York, New York
Theme: "Multiscale Modeling of Astrophysical and Space Plasmas" **Summer 2019**

Participant and speaker at workshop of Les Houches School of Physics, France
Theme: "New Challenges in Turbulence Research V" **April 2019**

Guest Student at Geophysical Fluid Dynamics Summer School
WHOI, Woods Hole, Massachusetts
Theme: Atmosphere, Ocean, and Climate Fluid Dynamics **Summer 2014**

HONORS AND AWARDS

Marie Skłodowska-Curie European Postdoctoral Fellowship **2023-2025**
"Elucidating the bidirectional energy cascade of geophysical turbulence in time, space, and scale"
at Universidad Politécnica de Madrid

Future Investigators in NASA Earth **2020-2021**
and Space Science and Technology (FINESST) fellowship ($45,000)

MIT
Jule Charney Prize ($12,000) **2016-2019**

Robert R Shrock Graduate Fellowship ($78,350) **2016**

ENS
ENS-ICFP Scholarship ($10,000) **2015-2016**

TEACHING EXPERIENCE

Teaching Assistant at Massachusetts Institute of Technology
12.810: "Dynamics of the Atmosphere" (Graduate) **Spring 2021**
Overall rating in subject evaluation: 6.6/7

Mentor for MIT's Undergraduate Research Opportunities Program
Directly mentoring two undergraduates on original research projects **Summer 2020**

Teaching Assistant at Massachusetts Institute of Technology
12.820: "Turbulence in the Atmosphere and Ocean" (Graduate) **Spring 2020**

Teaching Assistant at Massachusetts Institute of Technology
12.800: "Fluid Dynamics of the Atmosphere and Ocean" (Graduate) **Fall 2019**
Overall rating in subject evaluation: 6.7/7

Undergraduate Teaching Assistant at the University of Texas at Austin
P S 303: "Introductory Physical Science I: Mechanics and Heat." **Fall 2013**

SERVICES AND OUTREACH

Participant in the Application Mentorship Program (EAPS, MIT) **Fall 2020-Fall 2022**
Mentoring future applicants, e.g. with personal statements.
https://sites.google.com/view/eaps-student-advisory-council/application-assistance

Member of Graduate Student Advisory Committee (GSAG) to the faculty search committee **Spring 2020**

Member of the Diversity Council (EAPS, MIT)
Department-wide committee, including faculty and staff **Fall 2019-Fall 2020**

Creator and runner of Student Seminar (EAPS, MIT)
Department wide, weekly seminar for students **Fall 2018-Spring 2020**

Seminars given:

How can we study extreme events efficiently?	**Fall 2020**
Epidemic processes in complex networks	**Spring 2020**
Atmospheric Predictability	**Fall 2019**
Knots and their surprising connections to fluids and turbulence	**Spring 2019**
Collective and critical phenomena in living systems	**Fall 2018**

ADDITIONAL SKILLS

Programming: Python, Fortran, git. Languages: Spanish (fluent), French (fluent, but limited), Russian (limited)