

Santiago J. BENAVIDES
s-benavides.github.io
pronouns: he/him
ORCID ID: 0000-0002-2281-5695
email: Santiago.Benavides@ed.ac.uk
School of Mathematics
University of Edinburgh
Dated: September 9, 2025

EMPLOYMENT AND RESEARCH EXPERIENCE

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|---|----------------------------|
| University of Edinburgh, Edinburgh, UK
Lecturer in Applied and Computational Mathematics in the School of Mathematics | Sep. 2025-Present |
| Universidad Politécnica de Madrid, Madrid, Spain
Marie Skłodowska-Curie Postdoctoral Fellow in the School of Aeronautics | Sep. 2023-Sep. 2025 |
| University of Warwick, Coventry, UK
Research Fellow in the Mathematics Institute
Supported by the Simons collaboration on <i>Revisiting the Turbulence Problem using Statistical Mechanics</i> | Feb. 2022-Aug. 2023 |

EDUCATION

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| Massachusetts Institute of Technology (MIT), Cambridge, USA
PhD, Department of Earth, Atmospheric and Planetary Sciences (EAPS)
Focus: Nonlinear Dynamics in Geosciences
Advisors: Glenn R. Flierl & J. Taylor Perron | 2016-2022
GPA: 4.9/5 |
| École Normale Supérieure (ENS) rue d'Ulm, Paris, France
Masters ENS-ICFP in Macroscopic Physics and Complexity
Advisor: Alexandros Alexakis | 2015-2016
mention <i>Très Bien</i> |
| The University of Texas at Austin
Bachelor of Science in Physics (Option: Honors Physics)
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%) | 2010-2015
GPA: 3.9628/4 |

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," *arXiv:2309.12879* (2025).
<https://doi.org/10.48550/arXiv.2309.12879>

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)