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EDUCATION

Ph.D.	Mechanical Engineering, Thermal and Fluids	University of Campinas (UNICAMP), Brazil	05/22/2020
MSc.	Mechanical Engineering, Thermal and Fluids	University of Campinas (UNICAMP), Brazil	03/18/2016
Engineer	Mechanical Engineering	National Polytechnic School (EPN), Ecuador	09/23/2011

PROFESSIONAL APPOINTMENTS

Postdoctoral Scholar	Department of Mechanical and Mechatronics Engineering, University of Waterloo	10/2025-
Postdoctoral Scholar	Department of Earth and Planetary Sciences, Stanford University	07/2022-03/2025
Postdoctoral Scholar	Department of Atmospheric and Oceanic Sciences, University of California, Los Angeles	11/2020-06/2022
Product Development Engineer	General Motors of Ecuador	12/2009-01/2014

HONORS, AWARDS & FUNDING

Awards & Honors

ABCM-EMBRAER Prize 2020 for Best Ph.D. Thesis, Brazilian Society of Mechanical Sciences	2021
Nominated for the 2021 CAPES Prize for Best Ph.D. Thesis, School of Mechanical Engineering, UNICAMP	2021
Best Presentation of the Day, Experimental Fluid Mechanics (EFM2017), Technical University of Liberec, Czech Republic	2017

Travel Grants & Funded Participations

Funded mentee, Mentoring Institute for Sediment Transport Researchers, USA	2023
Funded participant, Earth Surface Processes Institute (ESPIn), University of Colorado, Boulder, USA	2023
Travel Grant, 72nd Annual Meeting, APS Division of Fluid Dynamics	2019
Funded participant, São Paulo School of Advanced Sciences on Nonlinear Dynamics, University of São Paulo, Brazil	2019

Scholarships

Full Doctoral Scholarship, SENESCYT, Ecuador	2016-2020
Doctoral Scholarship, CNPq, Brazil	2016
Full Master's Scholarship, SENESCYT, Ecuador	2014-2016
Scholarship, Emerging Leaders in the Americas Program, Global Affairs Canada	2017-2018

VISITING POSITIONS & RESEARCH EXPERIENCE

Research collaborator at the Granular Matter Lab, UNICAMP, Brazil	05/2020-present
Researcher, Center for Petroleum Studies (CEPETRO), Brazil	Sep-Oct 2020
Graduate student researcher, UNICAMP, Brazil (Prof. Erick M. Franklin, advisor)	2014-2020
Visiting graduate researcher, Western University, Canada (Prof. J. M. Floryan, advisor)	Mar-Aug 2018

TEACHING EXPERIENCE

2025: Teaching Assistant, *Planetary Surface Processes: Shaping the Landscapes of the Solar System*, Department of Earth and Planetary Sciences, Stanford University, USA.
2019: Teaching Assistant, *Thermodynamics II*, School of Mechanical Engineering, University of Campinas (UNICAMP), Brazil.
2017: Instructor, *MATLAB for Applications in Mechanical Engineering*, Faculty of Mechanical Engineering, National Polytechnic School (EPN), Ecuador.
2015: Teaching Assistant, *Laboratory of Heat Transfer and Fluid Mechanics II*, School of Mechanical Engineering, University of Campinas (UNICAMP), Brazil.

INVITED TALKS & LECTURES

2025: *"Aerodynamic Origin of Large Martian Ripples: A Low-Pressure Wind Tunnel Investigation"*, AGU Meeting, New Orleans, USA.
2024: "*Mars' large windblown ripples are not impact ripples*", Bay Area Planetary Science Conference (BAPS), SETI Institute, USA.
2023: *"Dynamics of Dust and Sand in Terrestrial and Martian Atmospheres"*, Workshop: Patterns in Granular Matter, Unicamp, Brazil.
2021: *"Genesis and Formation of Subaqueous Barchan Dunes: From a Morphological Characterization to a Description at the Grain Scale*", ABCM-EMBRAER Prize 2020 Ceremony, 26th International Congress of Mechanical Engineering (COBEM), Brazil.
2020: *"An Unusual State of Matter: Studies on the Dynamics of Granular Flows"*, Webinar, Ecuadorian Corporation for the Development of Research and Academia (CEDIA).
2020: "*Genesis and Formation of Subaqueous Barchan Dunes: Experiments and Numerical Simulations*", National Polytechnic School (EPN), Ecuador.
2016: *"Intermittent Gravity-Driven Flow of Grains Through Narrow Pipes*", Workshop, EPN, Ecuador.
2016: *"Instabilities in Gravity-Driven Granular Flows in Vertical Pipes*", EPN, Ecuador.

PROFESSIONAL SERVICES & AFFILIATIONS

Peer reviewer for: *Physics of Fluids, Earth Surface Processes & Landforms, Geophysical Research Letters, Geomorphology, EGUsphere, Journal of the Brazilian Society of Mechanical Sciences and Engineering, Icarus, Journal of Hydrology, Geology, J. Geophys. Res. Planets, Frontiers in Astronomy and Space Sciences, J. Geophys. Res. Earth Surf.*

External reviewer for: National Science Foundation (NSF) Geomorphology and Land-use Dynamics Program, Outstanding Student Presentation Awards at AGU 2022, 2023, 2024.
Recruitment ambassador for Stanford Doerr School of Sustainability.
Member of the Early Career Researchers Board, *Boundary-Layer Meteorology*.
Member of the American Physical Society, American Geophysical Union, and European Mechanics Society.

MENTORSHIP

Undergraduate Research Advisor: Raisha Abubo, Stanford University, 2023-2025.

SKILLS

Experimental: Particle Image Velocimetry (PIV), Particle Tracking Velocimetry (PTV), and high-speed imaging.
Numerical: Home-made and commercial CFD codes, OpenFOAM, ANSYS, LIGGGHTS, and CFDEM installed on both cluster and single-computer environments.
Programing: MATLAB, FORTRAN, Python, and C++. *Systems:* Linux and Windows.

PUBLICATIONS

Peer-Reviewed

Alvarez, C.A., Heisel, M., Kok, J.F., Chamecki, M. On *the combined effects of topography and convection on the vertical transport of coarse dust* (in preparation).

14. Miotto, R.F., **Alvarez, C.A.**, Borges, D.S., Wolf, W.R., Franklin, E.M. (2025). Resultant force on each grain of a sand dune: How to measure it? **Geophysical Research Letters**, 52, e2025GL116942 [link].

13. **Alvarez, C.A**., Lapôtre, M.G.A., Swann, C., Ewing R.C., Jia, P., Claudin, P. (2025). Aerodynamic roughness of rippled beds under active saltation at Earth-to-Mars atmospheric pressures, **Nature Communications**, 16, 5113 [link].

12. **Alvarez, C.A.**, Lapôtre, M.G.A., Swann, C., & Ewing, R.C. (2025). *Ripples formed in low-pressure wind tunnels suggest Mars's large windblown ripples are not impact ripples*, **Nature Communications**,16, 2945 [link].

11. **Alvarez, C.A.**, Gunn, A., Swann, C., Trimble, S.M., Ewing, R.C., & Lapôtre, M.G.A. (2024). *Direct measurements of dust settling velocity under low-density atmospheres using time-resolved particle image velocimetry*, **Geophysical Research Letters**, 51, e2024GL109958 [link].

10. Lima, N.C., Assis, W. R., **Alvarez, C. A.**, & Franklin, E. M. (2024). *Barchan-barchan dune repulsion investigated at the grain* scale, **Journal of Geophysical Research: Earth Surface**, 129, e2024JF007741 [link].

9. Lima, N.C., Assis, W.R., **Alvarez, C.A.**, & Franklin, E.M. (2022). *Grain-scale computations of barchan dunes,* **Physics of Fluids** 34, 123320 [link].
   Highlighted as Featured in Phys. Fluids, Featured in AIP Publishing, Newswise, ScienceDaily, Phys.org

8. **Alvarez, C.A.**, Cúñez, F.D., & Franklin, E.M. (2021). *Growth of barchan dunes of bidispersed granular mixtures,* **Physics of Fluids** 33, 051705 [link].
   Highlighted in Physics Today and selected by Phys. Fluids as Featured and Scilight.

7. **Alvarez, C.A.**, & Franklin, E.M. (2021). *Force distribution within a barchan dune*. **Physics of Fluids** 33, 013313 [link].

6. **Alvarez, C.A.**, & Franklin, E.M. (2020). *Shape evolution of numerically obtained subaqueous barchan dunes*. **Physical Review E**, v. 101, n. 012905 [link].

5. **Alvarez, C.A.**, & Franklin, E.M. (2019). *Horns of subaqueous barchan dunes: A study at the grain scale*. **Physical Review E**, v. 100, n. 042904 [link].

4. **Alvarez, C.A.**, & Franklin, E.M. (2018). *Role of transverse displacements in the formation of subaqueous barchan dunes*. **Physical Review Letters**, v. 121, n. 164503 [link].
   Highlighted in EurekAlert!, Science Daily, Phys.org, Agência FAPESP, and Unicamp's Journal.
3. **Alvarez, C.A.**, & Franklin, E.M. (2017). *Birth of a subaqueous barchan dune*. **Physical Review E**, v. 96, n. 062906 [link].

2. **Alvarez, C.A.**, & Franklin, E.M. (2017). *Intermittent gravity-driven flow of grains through narrow pipes*. **Physica A**, v. 465, p. 725-741 [link].

1. Franklin, E.M., & **Alvarez, C.A.** (2015). *Length scale of density waves in the gravitational flow of fine grains in pipes*. **Journal of the Brazilian Society of Mechanical Sciences and Engineering**, v. 37, p. 1507-1513 [link].

CONFERENCES PROCEEDINGS AND ABSTRACTS

Alvarez,C.A., Lapôtre, M.G.A., Swann, C., Ewing, R.C., Jia, P., & Claudin P. *Low-Pressure Wind Tunnel Experiments Demonstrate that Large Martian Ripples are Aeolian Drag Ripples,* International Conference on Aeolian Research, Swakopmund, Namibia, 2026.
Alvarez,C.A., Lapôtre, M.G.A., Swann, C., Ewing, R.C., Jia, P., & Claudin, P. *Aerodynamic roughness of rippled beds with active saltation under Earth-to-Mars pressure*. Eighth International Planetary Dunes Workshop, Alghero, Sardinia, Italy, 2025.
Lapôtre, M.G.A., **Alvarez, C.A.**, Swann, C., & Ewing, R.C. *Low-pressure wind-tunnel experiments demonstrate that meter-scale martian ripples are not impact ripples*. Eighth International Planetary Dunes Workshop, Alghero, Sardinia, Italy, 2025.
Alvarez, C.A., Lapôtre, M.G.A., Swann, C., & Ewing, R.C. *Aerodynamic roughness of rippled beds under active saltation at low atmospheric pressures*, AGU Meeting, Washington D.C., USA, 2024.
Alvarez, C.A., Lapôtre, M.G.A., Swann, C., & Ewing, R.C. *Closing the large martian ripple debate: direct observations of drag-ripple formation from a flat bed in low-pressure wind tunnel experiments*. Tenth International Conference on Mars, Pasadena, USA, 2024.
Alvarez, C.A., Gunn, A., Swann, C., Trimble, S.M., & Lapôtre, M.G.A. *Impact of atmospheric density on dust settling and implications for dust dynamics on Mars*, AGU Meeting, San Francisco, USA, 2023.
Alvarez, C.A., Heisel, M., Kok, J.F., & Chamecki, M. The combined effect of convection and a gentle topography on the vertical transport of coarse dust, AGU Meeting, Chicago, USA, 2022.

Alvarez, C.A., Heisel, M., Kok, J.F., & Chamecki, M. Combined effect of gentle topography and convection on the transport of coarse dust, SoCal Fluids XV, Los Angeles, USA, 2022.
Alvarez, C.A., & Franklin, E.M. *On the growth of barchan dunes*. 25th International Congress of Theoretical and Applied Mechanics - ICTAM2020+1, Milano, Italy, 2021(virtual).
Alvarez, C.A., & Franklin, E.M. *Motions of grains within a barchan dune*. Bulletin of the American Physical Society Division of Fluid Dynamics Meeting, Chicago, USA, 2020 (virtual).
Alvarez, C.A., & Franklin, E.M. *Numerical simulation of barchan dunes in a turbulent channel flow*. 12th Spring School on Transition and Turbulence – EPTT2020, Blumenau, Brazil, 2020 (virtual).
Alvarez, C.A., & Franklin, E.M. *Bed-load characteristics over evolving and developed subaqueous barchan dunes*. Bulletin of the American Physical Society Division of Fluid Dynamics Meeting, Seattle, USA, 2019.
Alvarez, C.A., & Franklin, E.M. *Genesis of barchan dunes: Subaqueous case*. São Paulo School of Advanced Sciences on Nonlinear Dynamics, São Paulo, Brazil, 2019.
Alvarez, C.A., & Franklin, E.M. *A description at the grain scale of the growth of barchan dunes*. 10th International Conference on Multiphase Flow - ICMF2019, Rio de Janeiro, Brazil, 2019.
Alvarez, C.A., and Franklin E.M. *Characteristic times for the formation of subaqueous barchan dunes*. 12th European Fluid Mechanics Conference - EFMC12, Vienna, Austria, 2018.
Alvarez, C.A., & Franklin, E.M. *Morphology of subaqueous barchan dunes in turbulent shear flow*. 17th Brazilian Congress of Thermal Sciences and Engineering - ENCIT2018, Águas de Lindóia, Brazil, 2018.
Alvarez, C.A., & Franklin, E.M. *Formation and morphology of subaqueous barchan dunes*. 24th ABCM International Congress of Mechanical Engineering - COBEM2017, Curitiba, Brazil, 2017. doi://10.26678/ABCM.COBEM2017.COB17-1893
Franklin, E.M., & **Alvarez, C.A.** *The growth and equilibrium of barchan dunes*. Bulletin of the American Physical Society Division of Fluid Dynamics Meeting, Denver, USA, 2017.
Alvarez, C.A., & Franklin, E.M. *Experimental study on the formation of subaqueous barchan dunes in closed conduits*. Experimental Fluid Mechanics 2017- EFM2017, Mikulov, Czech Republic, 2017. doi: 10.1051/epjconf/201818002002
Alvarez, C.A., & Franklin, E.M. *Experimental study on the formation of barchan dunes in closed conduits*. 9th World Conference on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics - ExHFT9, Foz do Iguaçú, Brazil, 2017.
Alvarez, C.A., & Franklin, E.M. *Gravity-driven flow of grains through pipes: a one-dimensional model*. IV Journeys in Multiphase Flows - JEM2017, São Paulo, Brazil, 2017.
Alvarez, C.A., & Franklin, E.M. *Density waves in the gravitational flow of grains in narrow pipes*. 24th International Congress of Theoretical and Applied Mechanics - ICTAM2016, Montreal, Canada, 2016.
Alvarez, C.A., & Franklin, E.M. *Density waves in the gravitational flow of granular material in narrow pipes*. 9th International Conference on Multiphase Flow - ICMF2016, Florence, Italy, 2016.
Alvarez, C.A., & Franklin, E.M. *Imaging processing applied to gravity-driven granular flows through a vertical pipe*. 16th Brazilian Congress of Thermal Sciences and Engineering - ENCIT2016, Vitória, Brazil, 2016. doi://10.26678/ABCM.ENCIT2016.CIT2016-0218
Alvarez, C.A., & Franklin, E.M. *Experimental study of a granular material falling through a vertical pipe*. 23rd International Congress of Mechanical Engineering - COBEM2015, Rio de Janeiro, Brazil, 2015.
Dávila, J.L., Guerrero, V.H., & **Alvarez, C.A.** *Desenho e construção de um moinho de atrição para a obtenção de materiais cerâmicos*, CBECIMAT, Joinvile, Brazil, 2012.

MISCELLANEOUS

- Languages: English, Portuguese, Spanish (native)
- Aircraft Maintenance Mechanic, License #2232, Powerplant and Airframe, DGAC, Ecuador.
- Certified Green Belt in Design for Six Sigma, General Motors Company, 2013.

REFERENCES

Dr. Erick M. Franklin (Ph.D. Advisor)
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Dr. Mathieu Lapôtre (Postdoctoral Advisor)
Assistant Professor, Department of Earth and Planetary Sciences, Assistant Professor (by courtesy), Geophysics
Stanford University
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