

# LUCIA BAKER

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## RESEARCH INTERESTS

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Environmental fluid mechanics, particles in turbulence, microplastics, wind-driven ocean surface boundary layer flows, wind waves, open channel flows, experimental fluid mechanics, wind energy

## EDUCATION

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**University of Minnesota**, Minneapolis, MN

**Ph.D.**, Aerospace Engineering and Mechanics | 4.00

Jun 2021

*Focus: Experimental Fluid Mechanics*

**M.S.**, Aerospace Engineering and Mechanics | 4.00

Dec 2018

**B.Eng.**, Aerospace Engineering and Mechanics | 3.75

May 2016

## RESEARCH EXPERIENCE

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**NSF Postdoctoral Fellow**, University of Washington

Jun 2021 – present

Mentor: Prof. Michelle DiBenedetto

Investigating the vertical mixing of microplastic particles in wind-driven ocean surface turbulence and wind waves through laboratory experiments

**Space Weather Simulation Summer School**, University of Colorado-Boulder Jul 2022

Learned and implemented techniques for modeling atmospheric dynamics and chemistry using Python and Julia

**Graduate Research Assistant**, University of Minnesota

May 2016 – Jun 2021

St. Anthony Falls Laboratory & Laboratories for Turbulent and Complex Flows

*Thesis: Experimental investigation of inertial sphere, rod, and disk particles in a turbulent boundary layer* | Advisor: Prof. Filippo Coletti

Explored the interactions between inertial particles and fluid turbulence in open channel flows through experiments in a laboratory water channel and an outdoor stream

**Summer Institute on Earth-Surface Dynamics**, St. Anthony Falls Laboratory, MN Aug 2017

Explored geophysical fluid dynamics through theory, experiments, numerical modeling, and fieldwork

**Undergraduate Research Assistant**, University of Minnesota

Jan 2014 – May 2016

Studied particle clustering in homogeneous turbulence through numerical simulations

**Intern**, Virgin Orbit, CA

Jun – Aug 2015

Designed engine gimbals and heat exchangers for LauncherOne rocket engines

**Intern**, NASA Jet Propulsion Laboratory, CA

Jun – Aug 2013, 2014

Mentor: Dr. Anita Sengupta

Designed and tested magnetic shielding for the ISS Cold Atom Lab research facility

## PUBLICATIONS

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7. **Baker, L.** & DiBenedetto, M. (2023) "Large-scale particle shadow tracking and orientation measurement with collimated light." *Experiments in Fluids*, 64, 52.
6. **Baker, L.** & Coletti, F. (2022) "Experimental investigation of inertial fibres and disks in a turbulent boundary layer." *Journal of Fluid Mechanics*, 943, A27.
5. **Baker, L.**, Qiao, Y., Ghaemi, S., & Coletti, F. (2021) "Method to minimize polymer degradation in drag-reduced non-Newtonian turbulent boundary layers." *Measurement Science and Technology*, 32, 085303.
4. **Baker, L.** & Coletti, F. (2021) "Particle–fluid–wall interaction of inertial spherical particles in a turbulent boundary layer." *Journal of Fluid Mechanics*, 908, A39.
3. **Baker, L.** & Coletti, F. (2019) "Experimental study of negatively-buoyant finite-size particles in a turbulent boundary layer up to dense regimes." *Journal of Fluid Mechanics*, 866, 598-629.
2. Petersen, A., **Baker, L.**, & Coletti, F. (2019) "Experimental study of inertial particles clustering and settling in homogeneous turbulence." *Journal of Fluid Mechanics*, 864, 925-970.
1. **Baker, L.**, Frankel, A., Mani, A., & Coletti, F. (2017) "Coherent clusters of inertial particles in homogeneous turbulence." *Journal of Fluid Mechanics*, 833, 364-398.

*Under review / In preparation:*

Sanness Salmon, H., **Baker, L.**, Kozarek, J., & Coletti, F. "Effect of Shape and Size on the Transport of Floating Particles on the Free-surface of a Meandering Stream." Under review for *Water Resources Research*.

**Baker, L.**, Aggarwal, A., Chávez-Dorado, J., Garrey, I., & DiBenedetto, M. "Buoyant, Non-Spherical Particles in Wind-Driven Waves and Turbulence." In preparation.

## INVITED TALKS

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Mechanical Engineering Graduate Seminar, University of Iowa (Feb 2023)

Workshop on Microplastic Transport in the Ocean, Banff International Research Station (Feb 2022)

Center for Coastal and Ocean Mapping / Ocean Engineering Seminar, University of New Hampshire (Feb 2022)

Hydro-Geo Seminar, University of Minnesota / University of Illinois Urbana-Champaign (Feb 2022)

Environmental Fluid Mechanics Seminar, University of Washington (Oct 2021)

## TEACHING & SERVICE

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**Guest Lecturer**, University of Washington  
ME 543: Fluid Turbulence

May 2022

**Laboratory Instructor/Teaching Assistant**, University of Minnesota  
AEM 2012: Dynamics  
AEM 4601: Instrumentation Laboratory  
AEM 4602: Aeromechanics Laboratory

Jan 2014 – May 2017

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### Peer Review

Mar 2019 – present

**Journal referee:** *Journal of Fluid Mechanics, Experiments in Fluids, International Communications on Heat and Mass Transfer, European Journal of Mechanics / B Fluids, Physical Review Fluids, Water Research, Microplastics & Nanoplastics*

**Proposal reviewer:** NSF

### MENTORSHIP, OUTREACH, & DEJI

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#### **Research Mentor**, University of Washington

##### Mentees:

Anusha Aggarwal, undergraduate research assistant

Sep 2021 – Jan 2023

Alexander Erling, undergraduate research assistant

Sep – Dec 2021

Cali McFarland, undergraduate research assistant

Jun – Aug 2021

#### **Leadership Academy and Network for Diversity in the Geosciences Academy: Postdoctoral**

**Research Fellows Program**, American Geophysical Union

Jan 2022 – present

Learning to implement evidence-based DEI practices to create equity and inclusion in STEM

#### **Union Steward**, University of Washington

May 2022 – present

Organizing for equitable and safe working conditions and fostering connection among postdocs

#### **Climate Justice Working Group**, University of Washington

Jun 2021 – present

Advocating for climate/social justice initiatives related to housing, transportation, and energy

#### **Seattle Astronomical Society**, Seattle, WA

Feb 2022 – present

Outreach volunteer for Girl Scout astronomy programs and public stargazing events

#### **Volunteer Income Tax Preparer**, United Way of King County, WA

Jan – Apr 2023

Preparing income tax returns at no cost for low-income or disabled taxpayers

#### **A Friend in STEM**, University of Minnesota

Mar – Jun 2021

Mentor to a woman undergraduate student in Aerospace Engineering

#### **Women of Aeronautics and Astronautics**, University of Minnesota

Sep 2017 – Jun 2021

Mentor to women undergraduate students in Aerospace Engineering

Panelist in panel discussions on graduate school and career paths

### AWARDS

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NSF Ocean Sciences Postdoctoral Research Fellowship

Aug 2021 – Aug 2023

National Defense Science and Engineering Graduate Fellowship

Sep 2017 – Jun 2021

Edward Silberman Fellowship

Jan 2019 – May 2020

John A. & Jane Dunning Copper Fellowship

May 2017

Albert George Oswald Prize for Outstanding Research

Sep 2015 – May 2016

## CONFERENCE PRESENTATIONS

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- Baker, L.**, Aggarwal, A., Chávez-Dorado, J. E., Garrey, I., & DiBenedetto, M. (2023) "Buoyant, Non-Spherical Particles in Wind-Driven Waves." Waves in Sea Environment Meeting, Princeton, NJ.
- Baker, L.**, Aggarwal, A., Chávez-Dorado, J. E., Garrey, I., & DiBenedetto, M. (2022) "Buoyant, Non-Spherical Plastic Particles in Turbulent Wind-Driven Waves." AGU Fall Meeting, Chicago, IL.
- Baker, L.**, Aggarwal, A., Chávez-Dorado, J. E., Garrey, I., & DiBenedetto, M. (2022) "Buoyant, non-spherical particles in turbulent wind-driven waves." APS Division of Fluid Dynamics, Indianapolis, IN.
- Baker, L.**, Aggarwal, A., Chávez-Dorado, J. E., Garrey, I., & DiBenedetto, M. (2022) "Buoyant, non-spherical particles in turbulent wind-driven waves." Atmospheres, Oceans, Earths—Unifying perspectives on geophysical and environmental multiphase flows, KITP, Santa Barbara, CA.
- Axworthy, J., Wang, S., DiBenedetto, M., **Baker, L.**, & Padilla-Gamiño, J. (2022) "Microplastics ingestion and adhesion by reef-building corals under different flow rates." International Coral Reef Society, Bremen, Germany.
- Baker, L.** & DiBenedetto, M. (2022) "Vertical transport and orientation of buoyant, non-spherical particles in the wind-mixed ocean surface boundary layer." Ocean Sciences Meeting, virtual.
- Baker, L.** & Coletti, F. (2021) "Orientation and tumbling of inertial rod and disk particles in a turbulent boundary layer." APS Division of Fluid Dynamics, Phoenix, AZ.
- Baker, L.** & Coletti, F. (2020) "Effects of shape on microplastic particle–fluid–wall interaction and transport in a turbulent boundary layer." AGU Fall Meeting, virtual.
- Baker, L.** & Coletti, F. (2020) "Particle-fluid-wall interaction of anisotropic inertial particles in a turbulent boundary layer." APS Division of Fluid Dynamics, virtual.
- Sanness Salmon, H., **Baker, L.**, Kozarek, J., & Coletti, F. (2020) "Effect of size and shape on the transport of particles over the free surface of a natural stream." APS Division of Fluid Dynamics, virtual.
- Baker, L.** & Coletti, F. (2019) "Experimental Investigation of the Dynamics of Resuspending Spherical Sediment Particles in a Turbulent Boundary Layer." AGU Fall Meeting, San Francisco, CA.
- Coletti, F. & **Baker, L.** (2019) "Simultaneous tracking of suspended particles and time-resolved PIV in a turbulent boundary layer." APS Division of Fluid Dynamics, Seattle, WA.
- Petersen, A., **Baker, L.**, & Coletti, F. (2017) "Laboratory Study of Air Turbulence-Particle Coupling." AGU Fall Meeting, New Orleans, LA.
- Baker, L.** & Coletti, F. (2017) "Experimental study of dense suspension of large particles in a turbulent boundary layer." APS Division of Fluid Dynamics, Denver, CO.
- Petersen, A., **Baker, L.**, & Coletti, F. (2017) "Particle Plumes Falling Through Quiescent and Turbulent Environments." APS Division of Fluid Dynamics, Denver, CO.
- Petersen A., Carter D., **Baker L.**, & Coletti F. (2017) "Experimental Study of Particle-turbulence Interaction in Homogeneous Turbulence." 10th International Symposium on Turbulence and Shear Flow Phenomena, Chicago, IL, USA.
- Coletti F., Toloui M., Fong, K.O., Nemes A., & **Baker L.** (2016) "Volumetric distribution and velocity of inertial particles in a turbulent channel flow." 18th International Symposium on Application of Laser and Imaging Techniques to Fluid Mechanics, Lisbon, Portugal.
- Coletti F., Petersen A., Carter D., & **Baker L.** (2016) "Measurements of particle settling velocity in homogeneous turbulence with no mean flow." International Conference on Multiphase Flows, Florence, Italy.
- Baker L.**, Frankel A., Mani A., & Coletti F. (2016) "Coherent clusters of inertial particles in homogeneous turbulence." APS Division of Fluid Dynamics, Portland, OR.

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Petersen A., Carter D., **Baker L.**, & Coletti F. (2015) "Settling of inertial particles through quiescent, weakly turbulent and strongly turbulent air." APS Division of Fluid Dynamics, Boston, MA.