Jacob O. Wenegrat

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CONTACT INFORMATION

Jacob O. Wenegrat
Assistant Professor
Department of Atmospheric and Oceanic Science
University of Maryland, College Park, MD

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RESEARCH INTERESTS

Geophysical fluid dynamics, atmosphere and ocean dynamics, submesoscale processes, boundary-layer processes

EDUCATION

Ph.D., Oceanography — 2015
School of Oceanography
University of Washington, Seattle, WA.

M.S., Applied Mathematics — 2014
Department of Applied Mathematics
University of Washington, Seattle, WA.

M.S., Oceanography — 2013
Department of Oceanography
University of Washington, Seattle, WA.

B.S., Symbolic Systems — 2006
Stanford University, Stanford, CA.

APPOINTMENTS

Assistant Professor, University of Maryland, College Park — since 2020
Department of Atmospheric and Oceanic Science
Burgers Program for Fluid Dynamics (affiliate)
Applied Mathematics & Statistics, and Scientific Computation (affiliate)

Postdoctoral Fellow, Stanford University — 2016 - 2019
Department of Earth System Science
- Supervisor: Leif Thomas

Visiting Scholar, Kavli Institute for Theoretical Physics, UCSB — May 2018
Program on Planetary Boundary Layers in Atmospheres, Oceans, and Ice on Earth and Moons.

Graduate Research Assistant, University of Washington — 2010 - 2015
School of Oceanography
- Advisor: Michael J. McPhaden

Consultant, Accenture Technology Labs — 2007 - 2009
R&D consultant focused on data center energy forecasting.

REFEREED PUBLICATIONS

[1] Ruan, X., **J.O. Wenegrat**, and J. Gula, 2021: Slippery bottom boundary layers: The loss of energy from the general circulation by bottom drag. *Geophys. Res. Lett.*, 48, 19. doi:10.1029/2021GL094434

[2] Farrar, J.T., E.A. D'Asaro, E. Rodriguez, A. Shcherbina, E. Czech, P. Matthias, S. Nicholas, F. Bingham, A. Mahadevan, M. Omand, L. Rainville, C. Lee, D. Chelton, R. Samelson,

L. O'Neill, D. Menemenlis, D. Perkovich-Martin, P. Mouroulis, M. Gierach, D. Thompson, A. Wineteer, A. Thompson, J. McWilliams, J. Molemaker, R. Barkan, **J.O. Wenegrat**, C. Rocha, G. Jacobs, J. D'Addezio, S. de Halleux, R. Jenkins, 2020: S-MODE: the Sub-Mesoscale Ocean Dynamics Experiment. *IEEE International Geoscience and Remote Sensing Symposium Conference Proceedings*, 3533-3536. doi:10.1109/IGARSS39084.2020.9323112

[3] **Wenegrat, J.O.**, L.N. Thomas, M.A. Sundermeyer, J.R. Taylor, E.A. D'Asaro, J. Klymak, R.K. Shearman, and C.M. Lee, 2020: Enhanced mixing across the gyre boundary at the Gulf Stream front. *Proc. Nat. Acad. Sci. (PNAS)*, 117, 30, 17607-17614. doi:10.1073/pnas.2005558117

[4] **Wenegrat, J.O.**, and L.N. Thomas, 2020: Centrifugal and symmetric instability during Ekman adjustment of the bottom boundary layer. *J. Phys. Oceanogr.* , 50, 6, 1793-1812. doi:10.1175/JPO-D-020-0027.1

[5] Johnson, L., C.M. Lee, E.A. D'Asaro, **J.O. Wenegrat**, and L.N. Thomas, 2020: Restratification at a California Current Upwelling Front, Part II: Dynamics. *J. Phys. Oceanogr.* 50, 5, 1473-1487. doi:10.1175/JPO-D-19-0204.1

[6] **Wenegrat, J.O.**, and R.S. Arthur, 2018c: Response of the atmospheric boundary layer to submesoscale sea surface temperature fronts. *Geophys. Res. Lett.* 45, 24, 13505-13512. doi:10.1029/2018GL081034

[7] **Wenegrat, J.O.**, J. Callies, and L.N. Thomas, 2018b: Submesoscale baroclinic instability in the bottom boundary layer. *J. Phys. Oceanogr.* 48, 11, 2571-2592. doi:10.1175/JPO-D-17-0264.1

[8] **Wenegrat, J.O.**, L.N. Thomas, J. Gula, and J.C. McWilliams, 2018a: Effects of the submesoscale on the potential vorticity budget of ocean mode waters. *J. Phys. Oceanogr.* 48, 9, 2141-2165. doi:10.1175/JPO-D-17-0219.1

[9] **Wenegrat, J.O.**, and L.N. Thomas, 2017: Ekman transport in balanced currents with curvature. *J. Phys. Oceanogr.*, 47, 5, 1189-1203. doi:10.1175/JPO-D-16-0239.1

[10] **Wenegrat, J.O.**, and M.J. McPhaden, 2016a: A simple analytical model of the diurnal Ekman layer. *J. Phys Oceanogr.*, 46, 9, 2877-2894. doi:10.1175/JPO-D-16-0031.1

[11] **Wenegrat, J.O.**, and M.J. McPhaden, 2016b: Wind, waves, and fronts: Frictional effects in a generalized Ekman model. *J. Phys. Oceanogr.*, 46, 2, 371-394. doi:10.1175/JPO-D-15-0162.1

[12] **Wenegrat, J.O.**, and M.J. McPhaden 2015: Dynamics of the surface layer diurnal cycle in the equatorial Atlantic Ocean (0°, 23°W). *J. Geophys. Res. Oceans*, 120, 563-581. doi:10.1002/2014JC010504

[13] **Wenegrat, J.O.**, M.J. McPhaden, and R.-C. Lien, 2014: Wind stress and near-surface shear in the equatorial Atlantic Ocean. *Geophys. Res. Lett.*, 141, 1226-1231. doi:10.1002/2013GL059149

Other Publications

Elipot, S., and **J.O. Wenegrat**, 2021: Vertical structure of near-surface currents: Importance, state of knowledge, and measurement challenges. *CLIVAR Variations*, 19, 1, 1-9, doi:10.5065/ybca-0s03

Wenegrat, J.O., 2015: Ocean Boundary Layer Dynamics and Air-Sea Interaction. Ph.D. Thesis, University of Washington, Seattle, WA, http://hdl.handle.net/1773/35286

Benedek, Z., J.W.J. Liang, and **J.O. Wenegrat**, 2014: System for providing strategies to reduce the carbon output and operating costs of a workplace. U.S. Patent 8812971.

Tung, T.S., and **J.O. Wenegrat**, 2013: System for providing strategies for increasing efficiency of data centers. U.S. Patent 8395621.

External Funding

Collaborative Research: EarthCube Capabilities: ICESpark: An Open-Source Big Data Platform for Science Discoveries in the New Arctic and Beyond. PI: Xie, Co-I: **Wenegrat**. NSF, $956k, 2021-2024.

Air-sea interaction and coupling at the ocean submesoscale. PI: **Wenegrat**. NASA, $361k, 2021-2024.

Submesoscale instabilities in the ocean bottom boundary layer: A new pathway for energy dissipation. PI: **Wenegrat**. NSF, $383k, 2020-2022.

Submesoscale instabilities near the sea-floor and their effects on the ocean circulation and mixing. PI: Thomas, Co-I: **Wenegrat**. NSF, $325k, 2018-2020.

Invited Talks

The Deep Ocean, Menagerie of Instabilities? *Burgers Symposium Lecture, University of Maryland*, College Park, MD, 2020.

From the surface to the abyss: Effects of the submesoscale on the large-scale circulation. *SOEST, University of Hawaii*, Honolulu, HI. 2019.

Submesoscale turbulence in the bottom boundary layer: A new frontier for oceanography. *AOSC, University of Maryland*, College Park, MD, 2019.

Air-sea interaction at the ocean submesoscale: Ekman transport and surface winds. *NASA Jet Propulsion Laboratory*, Pasadena, CA, 2019.

Into the deep: Submesoscale turbulence in the ocean bottom boundary layer. *Climate and Global Dynamics Seminar, NCAR*, Boulder, CO, 2018.

Submesoscale processes in the abyss: A new frontier for ocean dynamics. *Research School for Earth Sciences, Australian National University*, Canberra, AUS, 2018.

From the submesoscale to the gyre scale: How small-scale fronts modify the properties of ocean gyres. *Mechanical Engineering Department Seminar, University of California, Santa Barbara*, Santa Barbara, CA, 2018.

From the submesoscale to the gyre scale: How small-scale fronts modify ocean mode waters. *Oceanography Department Seminar, Dalhousie University*, Halifax NS, Canada, 2017.

Mixed layer dynamics and the diurnal cycle in the equatorial Atlantic Ocean. *Equatorial Dynamics of the Atmosphere and Oceans, AGU Fall Meeting*, San Francisco, CA, 2014.

Mixed layer dynamics and the diurnal cycle in the equatorial Atlantic Ocean. *Physics of Oceans and Atmospheres Seminar, Oregon State University*, Corvallis, OR, 2014.

Selected Presentations

It's fronts all the way down: Response of the atmosphere to a submesoscale front. *CLIVAR Surface Currents Workshop*, San Diego, CA, 2020. Poster.

Forced symmetric and centrifugal instability in the bottom boundary layer *Ocean Sciences Meeting*, San Diego, CA, 2020. Poster.

Enhanced mixing across the gyre boundary at the Gulf Stream front. *Environmental Fluid Mechanics and Hydrology Seminar, Stanford University*, Stanford, CA, 2019. Talk.

Symmetric instability in the ocean bottom boundary layer: A new pathway for energy dissipation? *California Geophysical Fluid Dynamic Symposium*, Pasadena, CA, 2019. Talk.

Submesoscale turbulence in the ocean bottom boundary layer: Baroclinic, symmetric, and centrifugal instabilities. *22^{nd} Conference on Atmospheric and Oceanic Fluid Dynamics*, Portland, ME, 2019. Talk.

Submesoscale instabilities in the bottom boundary layer. *Workshop on BBL turbulence and the Ocean Overturning Circulation, MIT*, Boston, MA, 2018. Talk.

Into the deep: Submesoscale turbulence in the bottom boundary layer. *SLS, MIT*, Boston, MA, 2018. Talk.

Into the deep: Submesoscale turbulence in the bottom boundary layer. *PO Seminar, WHOI*, Woods Hole, MA, 2018. Talk.

Submesoscale baroclinic instability in the bottom boundary layer. *Ocean Mixing Conference*, Gordon Research Conference, Andover, NH, 2018. Poster.

PV dynamics in the turbulent boundary layer. *Program on Planetary Boundary Layers*, Kavli Institute for Theoretical Physics, Santa Barbara, CA, 2018. Talk.

Submesoscale baroclinic instability in the bottom boundary layer. *Frontiers in Oceanic, Atmospheric, and Cryospheric Boundary Layers* , Kavli Institute for Theoretical Physics, Santa Barbara, CA, 2018. Poster.

Submesoscale baroclinic instability in the bottom boundary layer: A mechanism for enhanced vertical buoyancy fluxes. *Ocean Sciences Meeting*, Portland, OR, 2018. Talk.

From the submesoscale to the gyre scale: How small-scale fronts modify ocean mode waters. *Climate, Atmospheric Sciences, and Physical Oceanography Seminar, Scripps Institution of Oceanography*, San Diego, CA, 2018. Talk.

Submesoscale symmetric instability and observed rapid horizontal dispersion across the Gulf Stream. *CLIVAR Ocean Carbon Hotspots Workshop*, Monterey, CA, 2017. Poster.

Ekman transport in balanced currents with curvature. 21^{st} *Conference on Atmospheric and Oceanic Fluid Dynamics*, Portland, OR, 2017. Talk.

Effects of the submesoscale on the potential vorticity budget of ocean mode waters. 21^{st} *Conference on Atmospheric and Oceanic Fluid Dynamics*, Portland, OR, 2017. Poster.

Submesoscale dynamics in the turbulent boundary layer. *Oceanography Department Seminar, Dalhousie University*, Halifax NS, Canada, 2017. Talk.

Competing frictional and diabatic potential vorticity fluxes at ocean fronts. *AGU Fall Meeting*, San Francisco, CA, 2016. Talk.

Ocean boundary layer dynamics and air-sea interaction. *Physical Oceanography Dissertation Symposium (PODS) IX*, Honolulu, HI, 2016. Talk.

Dynamics of the diurnal cycle in the upper ocean: Theory, observations, and future challenges. *Environmental Fluid Mechanics and Hydrology Seminar, Stanford University*, Stanford, CA, 2016. Talk.

Implications of spatially varying boundary layer turbulence at a frontal system. *48^{th} International Liège Colloquium on Ocean Dynamics*, Liège, Belgium, 2016. Talk.

The time-dependent vertical structure of mixed layer currents. *Ocean Sciences Meeting*, New Orleans, LA, 2016. Poster.

On the influence of winds, waves, and fronts on ocean currents. *School of Oceanography, University of Washington*, Seattle, WA, 2015. Talk.

Wind, waves, and fronts: An analytic solution to the generalized Ekman model. 20^{th} *Conference on Atmospheric and Oceanic Fluid Dynamics*, Minneapolis, MN, 2015. Talk.

Dynamics of the surface layer diurnal cycle in the equatorial Atlantic Ocean. *Physical Oceanography Seminar, University of Washington*, Seattle, WA, 2014. Talk.

A WKB approximation to the generalized Ekman equation, with application to the diurnal cycle. *Applied Mathematics MS Symposium, University of Washington*, Seattle, WA, 2014. Talk.

The diurnal cycle of near-surface stratified shear flow at $0°$N, $23°$W. *Ocean Sciences Meeting*, Honolulu, HI, 2014. Poster.

Near-surface shear flow on the Equator. *Physical Oceanography Seminar, University of Washington*, Seattle, WA, 2013. Talk.

Near-surface shear, stratification, and the mixed layer momentum budget at $0°$N, $23°$W. *Tropical Atlantic Variability Conference*, Kiel, Germany, 2012. Poster.

Near-surface eddy viscosity at $0°$N, $23°$W inferred from ADCP and wind stress data. *Ocean Sciences Meeting*, Salt Lake City, UT, 2012. Poster.

ADVISING

Tomás Chor **since 2020**
Postdoctoral Researcher, Atmospheric and Oceanic Science

Victoria Whitley **since 2020**
PhD Student, Applied Mathematics & Statistics, and Scientific Computing

Igor Uchôa Farias **since 2021**
PhD Student, Atmospheric and Oceanic Science

Rachel Wegener **since 2021**
MS Student, Atmospheric and Oceanic Science

Daniel Levy **since 2021**
Undergraduate Researcher, Mathematics & Physics

Skylar Lama **since 2021**
Undergraduate capstone project, Atmospheric and Oceanic Science

Emma Bonnano **2020-2021**
Undergraduate capstone project, Atmospheric and Oceanic Science
Bernice and Susan Tannenbaum Prize in Climate Science,
for outstanding research achievements

PHD COMMITTEES

Craig Schwartz PhD **2021**

Austin Hope PhD **2020**

Benjamin Johnson PhD **2020**
Committee Co-Chair with Eugenia Kalnay

TEACHING

University of Maryland, College Park, Stanford, CA

Instructor, *Physical Oceanography* **Fall 2020, 2021**

Stanford University, Stanford, CA

Project Mentor, *SURGE Undergraduate Summer Research* **Summer 2018**

University of Washington, Seattle, WA

Instructor, *Physics across Oceanography* **Winter 2015**

Course Development, *Huckabay Teaching Fellow* **Autumn 2014**

SERVICE AND LEADERSHIP

Science

- NASA Sub-Mesoscale Ocean Dynamics Experiment (S-MODE) Science Team member
- US CLIVAR Process Study and Model Improvement Panel (since 2021)

Conferences

- Co-Chair: *Turbulent Mixing of the Ocean Surface Boundary Layer: Observation, Simulation, and Parameterization*, Ocean Sciences Meeting 2022
- Moderator: *Turbulent Mixing of the Ocean Surface Boundary Layer: Observation, Simulation, and Parameterization*, Ocean Sciences Meeting 2020
- Chair: *Air-Sea Interaction at the Mesoscale and Submesoscale*, Ocean Sciences Meeting 2018

Reviewing

- Associate Editor, *Journal of Physical Oceanography*
- 2020 AMS Editor's award, *Journal of Physical Oceanography*
- *Journal of Physical Oceanography, Journal of Fluid Mechanics, Geophysical Research Letters, Journal of Geophysical Research, Nature, Quarterly Journal of the Royal Meteorological Society, BAMS, Ocean Dynamics, Ocean Sciences, TOS, Scientific Reports, Journal of Atmospheric and Oceanic Technology, JAMES, Continental Shelf Research, Journal of Climate*
- *NASA Physical Oceanography* proposal review panels, *NSF* proposal reviewer, *NERC* proposal reviewer, *US-Israel Binational Science Foundation* reviewer
- Pre-publication chapters of: *Atmospheric and Oceanic Fluid Dynamics II,* G.H. Vallis.
- *NOAA Ernest F. Hollings Undergraduate Scholarship program*.

Department

- Graduate Admissions Co-Chair (since 2020)
- Seminar Committee Chair (since 2020)
- DMV Oceans Lunch Seminars organizer (since 2020)
- Lead for AGU Bridge Program Partner application (2020, 2021)