# TOMÁS L. CHOR

tomaschor@gmail.com https://tomchor.github.io
Department of Atmospheric and Oceanic Science, University of Maryland, College Park

## EDUCATION

*Ph.D.* Atmospheric and Oceanic Sciences
University of California, Los Angeles — September 2020

*M.Sc.* Atmospheric and Oceanic Sciences
University of California, Los Angeles — December 2018

*M.Sc.* Environmental Engineering
Federal University of Paraná, Curitiba — March 2014

*B.Sc.* Environmental Engineering
Federal University of Paraná, Curitiba — January 2012

## RESEARCH EXPERIENCE

**Tracing the Physics of Submesoscale Entrainment and Subduction** — Jan 2023 – Present
*University of Maryland, Dept of Atmospheric and Oceanic Science*

· I am using large-eddy simulations to determine how tracer exchanges between the boundary layer and interior depend on submesoscale instabilities and Langmuir and small-scale turbulence.

**Submesoscale instabilities and the forward energy cascade in seamount wakes** — Jan 2023 – Present
*University of Maryland, Dept of Atmospheric and Oceanic Science*

· I am numerically investigating the energetics and mixing implications of submesoscale instabilities in topographic wakes, with an emphasis on seamount wakes.

**Submesoscale dynamics in the ocean bottom boundary layer** — Oct 2020 – Dec 2022
*University of Maryland, Dept of Atmospheric and Oceanic Science*

· Numerically investigated the energetics and mixing implications of submesoscale instabilities in the ocean bottom boundary layer.

**Mixing of passive materials in the upper ocean** — Sept 2016 – Sept 2020
*UCLA, Dept of Atmospheric and Oceanic Sciences*

· Numerically investigated vertical mixing and horizontal transport of passive scalars in ocean surface boundary layers. Focus was given to wave effects, and new frameworks to model these conditions in global models were developed.

**Turbulent fluxes in the Amazon forest** — Aug 2015 – Aug 2016
*Federal University of Paraná, Dept of Environmental Engineering*

· Worked with data from the Amazonian Tall Tower Observatory (ATTO) project to better understand how the dense canopy impacts turbulent fluxes in parts of the Amazon forest.

**Mathematical methods for modeling groundwater flows** March 2012 – March 2014
*Federal University of Paraná, Dept of Environmental Engineering*

· Developed novel solutions to a well-known equation that models groundwater flow (Boussinesq equation). These new solutions can be used as analytical models for water in porous aquifers.

**Turbulent fluxes over grasslands and lakes** Dec 2010 – April 2014
*Federal University of Paraná, Dept of Environmental Engineering*

· Performed meteorological and micrometeorological field measurements as well as data processing with the main goal of better understanding the nature of turbulent fluxes over some grassland and lake locations in Brazil.

## FUNDED AND SUBMITTED PROPOSALS

**Submesoscale instabilities and the forward energy cascade in seamount wakes** January 2023 – January 2026
*National Science Foundation – Physical Oceanography*

· I wrote and am the PI of this $314k NSF grant whose main goal is to investigate the dynamics of the forward energy cascade in seamount wakes using turbulence-resolving numerical simulations

**Strain and symmetric instabilities in submesoscale fronts: effects on energetics** Submitted August 2024
*National Science Foundation – Physical Oceanography*

· I wrote and am the PI of this $413k NSF grant whose main goal is to investigate the energetics of submesoscale fronts in the presence of mesoscale strain and symmetric instabilities

## AWARDS AND SCHOLARSHIPS

**Jacob A. Bjerknes memorial award** December 2020

· Awarded by UCLA's department of Atmospheric and Oceanic Sciences for contributions in advancing the understanding and modeling of scalar transport in the oceanic surface boundary layer

**Richard P. Turco exceptional research award** November 2019

· Awarded by UCLA's department of Atmospheric and Oceanic Sciences for exceptional improvement in the understanding of tracer transport

**National Institute for Amazonian Research grant** August 2015 – August 2016

· Awarded jointly with the Max Planck Institute for Chemistry to work on the Amazonian Tall Tower Observatory project

**Odelar Leite Linhares award** October 2014

· Awarded by the Brazilian Society for Applied and Computational Mathematics for best Masters thesis in Applied mathematics in Brazil.

## PUBLICATIONS

## Journal publications


[1] **Tomas Chor** and Jacob O. Wenegrat. "The turbulent dynamics of anticyclonic submesoscale headland wakes". In: *Earth ArXiv* (2024). Submitted to the Journal of Physical Oceanography. DOI: 10.31223/X5570C.

[2] Jenny Dingwall, **Tomás Chor**, and John R. Taylor. "Large eddy simulations of the accumulation of buoyant material in oceanic wind-driven and convective turbulence". In: *Journal of Fluid Mechanics* 954 (2023). DOI: 10.1017/jfm.2022.969.

[3] **Tomas Chor**, Jacob O. Wenegrat, and John Taylor. "Insights into the Mixing Efficiency of Submesoscale Centrifugal–Symmetric Instabilities". In: *Journal of Physical Oceanography* 52.9 (2022), pp. 2273–2287. DOI: 10.1175/JPO-D-21-0259.1.

[4] **Tomas Chor**, James C. McWilliams, and Marcelo Chamecki. "Modifications to the K-Profile parameterization with nondiffusive fluxes for Langmuir turbulence". In: *Journal of Physical Oceanography* (2021). DOI: 10.1175/JPO-D-20-0250.1.

[5] **Tomas Chor**, James C. McWilliams, and Marcelo Chamecki. "Diffusive–Nondiffusive Flux Decompositions in Atmospheric Boundary Layers". In: *Journal of the Atmospheric Sciences* 77.10 (2020), pp. 3479–3494. ISSN: 0022-4928. DOI: 10.1175/JAS-D-20-0093.1.

[6] Marcelo Chamecki, **Tomas Chor**, Di Yang, and Charles Meneveau. "Material transport in the ocean mixed layer: recent developments enabled by large eddy simulations". In: *Reviews of Geophysics* 57.4 (2019), pp. 1338–1371. DOI: 10.1029/2019RG000655.

[7] **Chor, Tomas**, Ailín Ruiz de Zárate, and Nelson L. Dias. "A generalized series solution for the Boussinesq equation with constant boundary conditions". In: *Water Resources Research* 55.4 (2019), pp. 3567–3575. DOI: 10.1029/2018WR024154.

[8] Cléo Quaresma Dias-Júnior, ..., **Tomas Chor**, and Antonio Manzi. "Is There a Classical Inertial Sublayer Over the Amazon Forest?" In: *Geophysical Research Letters* 46.10 (2019), pp. 5614–5622. DOI: 10.1029/2019GL083237.

[9] **Chor, Tomas**, Di Yang, Charles Meneveau, and Marcelo Chamecki. "A Turbulence Velocity Scale for Predicting the Fate of Buoyant Materials in the Oceanic Mixed Layer". In: *Geophysical Research Letters* 45.21 (2018), pp. 11, 817–11, 826. DOI: 10.1029/2018GL080296.

[10] **Chor, Tomás**, Di Yang, Charles Meneveau, and Marcelo Chamecki. "Preferential concentration of noninertial buoyant particles in the ocean mixed layer under free convection". In: *Phys. Rev. Fluids* 3 (2018), p. 064501. DOI: 10.1103/PhysRevFluids.3.064501.

[11] **Tomás L. Chor**, Nelson L. Dias, Alessandro Araújo, and ... "Flux-variance and flux-gradient relationships in the roughness sublayer over the Amazon forest". In: *Agricultural and Forest Meteorology* 239 (2017), pp. 213–222. ISSN: 0168-1923. DOI: http://dx.doi.org/10.1016/j.agrformet.2017.03.009.

[12] Einara Zahn, **Tomas L. Chor**, and N. L. Dias. "A Simple Methodology for Quality Control of Micrometeorological Datasets". In: *American Journal of Environmental Engineering* 6.4A (2016), pp. 135–142. DOI: 10.5923/s.ajee.201601.20.

[13] **Chor, Tomas L.** and N. L. Dias. "Technical Note: A simple generalization of the Brutsaert and Nieber analysis". In: *Hydrology and Earth System Sciences* 19.6 (2015), pp. 2755–2761. DOI: 10.5194/hess-19-2755-2015.

[14] Nelson L. Dias, **Chor, Tomás L.**, and Ailín Ruiz de Zárate. "A semianalytical solution for the Boussinesq equation with nonhomogeneous constant boundary conditions". In: *Water Resources Research* 50.8 (2014), pp. 6549–6556. ISSN: 1944-7973. DOI: 10.1002/2014WR015437.

[15] **Chor, Tomas**, N. L. Dias, and Ailín Ruiz de Zárate. "An exact series and improved numerical and approximate solutions for the Boussinesq equation". In: *Water Resources Research* 49.11 (2013), pp. 7380–7387. DOI: 10.1002/wrcr.20543.

[16] B. L. Crivellaro, N. L. Dias, and **Chor, Tomas**. "Spectral Effects on Scalar Correlations and Fluxes". In: *American Journal of Environmental Engineering* 3.1 (2013), pp. 13–17. DOI: 10.5923/j.ajee.20130301.03.

### Book chapters

[1] N. L. Dias, Cynara Cunha, Dornelles Vissotto Junior, Maurício F Gobbi, Fernando A S Armani, Lucas E B Hoeltgebaum, **Tomás L Chor**, and Bianca L Crivellaro. *BALCAR project: Greenhouse gas emissions from hydroelectric dam reservoirs (in Portuguese)*. Chapter 5: Modelling. CEPEL, 2014.

## SUPPLEMENTAL TRAINING

**The Burgers Program's Research School on Fluid Dynamics** June 2018
*University of Maryland*

· Attended talks and workshops on several aspects of turbulence.

**The San Diego Supercomputing Center Summer Institute** August 2019
*University of California, San Diego*

· Attended Workshops on how to apply high-performance computing in scientific research.

## SELECTED TALKS AND CONFERENCE PARTICIPATIONS

### Invited talks

[1] T. Chor. "Insights into the mixing of centrifugal-symmetric instabilities". In: *Gordon Research Conference on Ocean Mixing 2022*. (Invited speaker). 2022.

[2] T. Chor. "Nondiffusive turbulent mixing in surface oceanic boundary layers". In: *University of Cambridge, Department of Applied Mathematics and Theoretical Physics*. (Invited speaker). 2021.

[3] T. Chor. "Modifications to the K-Profile parameterization with nondiffusive fluxes for wave effects". In: *University of Maryland, Oceans Lunch Seminar*. (Invited speaker). 2020.

[4] T. Chor. "New analytic solutions to the nonlinear Boussinesq equation for underground water". In: *CNMAC – National Conference on Applied and Computational Mathematics*. (Invited speaker). 2014.

### Recent conference participations

[1] **T Chor** and Gregory L. Wagner. "Theory, software, and best practices for large eddy simulations of small-scale ocean turbulence". In: *American Geophysical Union's Ocean Sciences Meeting*. Tutorial. 2022.

[2] **T Chor**, Jacob Wenegrat, and John Taylor. "Insights into the mixing efficiency of centrifugal-symmetric instabilities in the ocean". In: *American Geophysical Union's Ocean Sciences Meeting*. Talk. 2022.

[3] Chris Hill, Francis Poulin, Gregory Wagner, Valentin Churavy, Simone Silvestri, **Tomas Chor**, Suyash Bire, Rodrigo Duran, and Jean-Michel Campin. "Hands-on ocean modeling and ML with Oceananigans.jl". In: *JuliaCon 2022*. Tutorial. 2022.

[4] **T Chor**, J C McWilliams, and M Chamecki. "Mixing in oceanic boundary layers: a method to guide KPP development". In: *CalGFD*. Talk. 2020.

[5] **T Chor**, J C McWilliams, and M Chamecki. "Revisiting Eddy-diffusivity models in atmospheric boundary layers". In: *72nd Annual Meeting of the APS Division of Fluid Dynamics*. Talk. 2019.

## TEACHING EXPERIENCE

**Teaching assistant** Winter 2018, Fall 2018 and Winter 2020
*UCLA, Dept of Atmospheric and Oceanic Sciences*

· Course: "Introduction to the Atmospheric Environment", Undergraduate level
· Helped prepare and led discussion sessions for up to 90 students of diverse background. Also helped prepare course structure, exams and lab activities, as well as graded homeworks and exams.

**Special reader** Fall 2019
*UCLA, Dept of Atmospheric and Oceanic Sciences*

· Course: "Introduction to Atmospheric and Oceanic Fluid", Graduate level
· Graded homeworks and papers that cover a range of topics in dynamics and thermodynamics of the atmosphere and ocean.

## OPEN-SOURCE TOOLS FOR THE COMMUNITY

I dedicate part of my time to the development of open-source tools that can be easily and freely used by the community.

**Oceananigans.jl**

· Frequent contributor to and maintainer of Oceananigans.jl, which is a fluid dynamics package that can be used for general use, but is focused on physical oceanography applications

**Oceanostics.jl**

· Creator and developer of Oceanostics.jl, a companion package to Oceananigans.jl that is focused on computing diagnostic variables

**Pymicra**

· Creator and developer of Pymicra, the Python tool for Micrometeorological Analyses, among other Python and Julia packages.

**Other packages**

· I also occasionally contribute to other open-source community packages (for example xarray and matplotlib)

## RELEVANT OUTREACH, MENTORSHIP, AND COMMUNITY SERVICE

**Advisor and Mentor**

- Currently co-advising a PhD student on the theme: "Evaluating Turbulence Parameterizations at the Gray Zone for Ocean Surface Boundary Layer" (UMD, Fall 2023 – Present)
- I advised an undergraduate student on a project whose goal was to characterize mixing at the ocean bottom by analyzing Radon 222 and potential density profiles (UMD, Fall 2021 – Spring 2022).
- Mentored an undergraduate student on a small project collecting high-frequency atmospheric data at the top of a building (UCLA, Fall 2018).

**Author of TED-Ed video on Turbulence** April 2019

- Conceived and wrote script for TED-Ed video with the goal or popularizing the topic of Turbulence. It has over a million views on YouTube alone.

**Volunteer activities**

- Volunteered in the Exploring Your Universe event, which is a large outreach event focusing on popularizing science to children (UCLA, April 2018)
- Volunteered as a Student Recruitment Chair at XEP (a graduate student group in the AOS department), where I organized recruitment efforts and events for incoming graduate students (UCLA, Fall 2017 – Fall 2018)

## RELEVANT PROFESSIONAL EXPERIENCE

**Climatempo** June 2014 – July 2015
*Researcher* *São Paulo, Brazil*

- Ran pollution dispersion models and forecasted wind power supply for the wind energy industry

**atdepth MRV** Spring 2024 – Present
*Independent contractor* *Remote*

- Implementing new features for Oceananigans

## OTHER RELEVANT ITEMS

**Languages**

- Portuguese as native language
- Fluent English and Spanish
- Basic French

**Programming languages**

- Python, Julia, Fortran, Bash