Dhruv Balwada

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Education

PhD Geophysical Fluid Dynamics — 2010 – 2016
Geophysical Fluid Dynamics Institute, Florida State University, USA

MS Applied and Computational Mathematics — 2010 – 2015
Florida State University, USA

BE Chemical Engineering — 2006 – 2010
Birla Institute of Technology and Science, India

Research Appointments

Associate Research Scientist — Oct 2021 – present
Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY

Postdoctoral Scholar — Oct 2019 – Sept 2021
School of Oceanography, University of Washington, Seattle, WA

Postdoctoral Research Associate — Jan 2017 – Sept 2019
Courant Institute of Mathematical Sciences, New York University, New York, NY

Graduate Research Assistant — Aug 2010 – Dec 2016
Florida State University, Tallahassee, FL

Undergraduate Research Fellow — May – Dec 2009
Center for Mathematical Modeling and Computer Simulations, Bangalore, India

Publications

Published

1. Influence of surface water flows on phytoplankton distribution in a shallow estuary
   Natalie L. Geyer, **D. Balwada**, E. Simons, K. Speer, & M. Huettel
   Estuarine, Coastal, and Shelf Science (2022)
2. Vertical fluxes conditioned on vorticity and strain reveal submesoscale ventilation
   Dhruv Balwada, Q. Xiao, S. Smith, R. Abernathey, & A. R. Gray
   Journal of Physical Oceanography (2021)
3. Observational evidence for ventilation hot spots in the Southern Ocean
   Lilian Dove, A. F. Thompson, **D. Balwada**, & A. R. Gray
   Journal of Geophysical Research: Oceans (2021)
4. Parameterizing non-propagating form drag over rough bathymetry
   Jody M. Klymak, **D. Balwada**, A.C.N. Garabato & R. Abernathey
   Journal of Physical Oceanography (2021)
5. Relative dispersion in the Antarctic Circumpolar Current
   Dhruv Balwada, J.H. LaCasce, K. Speer, & R. Ferrari
   Journal of Physical Oceanography (2021)
6. Vertical eddy iron fluxes support primary production in the open Southern Ocean
   Takaya Uchida, **D. Balwada**, R. Abernathey, G. McKinley, S. Smith & M. Levy
   Nature Communications (2020)
7. The contribution of submesoscale over mesoscale eddy iron transport in the open Southern Ocean

Takaya Uchida, **D. Balwada**, R. Abernathey, G. McKinley, S. Smith & M. Levy
Journal of Advances in Modeling Earth Systems (2019)

8. Southern Ocean phytoplankton blooms observed by biogeochemical floats
Takaya Uchida, **D. Balwada**, R. Abernathey, C.J. Prend, E. Boss & S.T. Gille
Journal of Geophysical Research: Oceans (2019)
9. Modulation of lateral transport by submesoscale eddies and inertia gravity waves
Anirban Sinha, **D. Balwada**, N. Tarshish & R. Abernathey
Journal of Advances in Modeling Earth Systems (2019)
10. Submesoscale vertical velocities enhance tracer subduction in an idealized Antarctic Circumpolar Current
Dhruv Balwada, S. Smith & R. Abernathey
Geophysical Research Letters (2018)
11. Global observations of horizontal mixing from Argo float and surface drifter trajectories
Christopher Roach**, D. Balwada &** K.G. Speer
Journal of Geophysical Research: Oceans (2018)
12. Scale dependent distribution of kinetic energy from surface drifters in the Gulf of Mexico
Dhruv Balwada, J.H. LaCasce & K.G. Speer
Geophysical Research Letters (2016)
13. Horizontal mixing in the Southern Ocean from Argo float trajectories
Christopher Roach, **D. Balwada** & K.G. Speer
Journal of Geophysical Research: Oceans (2016)
14. Circulation and stirring in the South East Pacific Ocean and the Scotia Sea sectors of the Antarctic Circumpolar Current
Dhruv Balwada, K. G. Speer, J. H. LaCasce, B. Owens, R. Ferrari & J. Marshall
Journal of Physical Oceanography (2016)
15. Tracking with ranked signals
Tianyang Li, H. Pareek, P. Ravikumar, **D. Balwada** & K.G. Speer
31 Conf. on Uncertainty in Artificial Intelligence (2015)
16. Float-derived isopycnal diffusivities in the DIMES experiment
Joseph H. LaCasce, R. Ferrari, R. Tulloch*,* **D. Balwada** and K.G. Speer
Journal of Physical Oceanography (2014)
17. The Diapycnal and Isopycnal Mixing Experiment: A first assessment
Sarah T. Gille, J. Ledwell, A. Naveira-Garabato, K. Speer, **D. Balwada**, A. Brearley, J. B. Girton, A. Griesel, R. Ferrari, A. Klocker, J. LaCasce, P. Lazarevich, N. Mackay, M. P. Meredith, M.J. Messias, B. Owens, J.-B. Sallée, K. Sheen, E. Shuckburgh, D. A. Smeed, L. C. St. Laurent, J. M. Toole, A. J. Watson, N. Wienders, and U. Zajaczkovski
CLIVAR Exchanges (2012)

Submitted & In Review

1. Direct evidence of an oceanic dual kinetic energy cascade and its seasonality from surface drifters.
Dhruv Balwada, J. Xie, R. Marino, & F. Feraco
Submitted to Nature Communications
2. Diagnosing the thickness-weighted averaged eddy-mean flow interaction in an eddying North Atlantic ensemble
Takaya Uchida, Q. Jamet, W. Dewar, J. Le Sommer, T. Penduff, & **D. Balwada**
In review at Journal of Advances in Modeling Earth Systems

3. Enhanced ventilation in the energetic regions of the Antarctic Circumpolar Current
   Lilian Dove, **D. Balwada**, A.R. Gray, & A.F. Thompson
   In review at Geophysical Research Letters

In Preparation

1. Eddy transport tensor in an inhomogeneous ocean channel
   Dhruv Balwada, S. Smith, T. Uchida, & R. Abernathey
   In preparation for Journal of Advances in Modeling Earth Systems
2. Eddy driven meridional transport across the Antarctic Circumpolar Current
   Dhruv Balwada, L. Juillon, K. G. Speer, R. Ferrari, & J. Marshall
   In preparation for Geophysical Research Letters
3. Tracer ventilation, stirring, and variability in the Antarctic Circumpolar Current near the Southwest Indian Ridge
   Dhruv Balwada, A.R. Gray, L. Dove, & A.F. Thompson
   In preparation for Journal of Geophysical Research: Oceans
4. Data-driven estimation of eddy transfer coefficients in a primitive equation model
   Ryan Abernathey, M. Xu, & **D. Balwada**
   In preparation for Journal of Advances in Modeling Earth Systems

Peer-reviewed Computational Notebooks

1. Interactive visualization tools for ocean glider data
   Dhruv Balwada, S. Henderson, A.R. Gray
   EarthCube annual meeting (2021)

Non-refereed

1. Circulation and stirring by ocean turbulence
   Dhruv Balwada
   Ph.D. Thesis, Florida State University (2016)

Extracurricular Academic Activities*

*Accepted via a selective application process.

Virtual visitor at workshop on Transport and Mixing of Tracers in Geophysics and Astrophysics 2021
Virtual - Aspen Center for Physics, Aspen, CO, USA

Virtual visitor at workshop on Machine Learning for Climate 2021
Virtual - Kavli Institute of Theoretical Physics, Santa Barbara, CA, USA

Winter Data Science Incubator Program Fellow 2021
Virtual - eScience Institute, University of Washington, Seattle, WA, USA

Coursera Deep Learning Specialization 2020
Virtual - coursera.org

Visiting Scholar at Workshop on Planetary Boundary Layers in Atmospheres, Oceans, and Ice on Earth and Moons 2018
Kavli Institute of Theoretical Physics, Santa Barbara, CA, USA

Summer School on Fundamental Aspects of Turbulent Flow in Climate Dynamics 2017
Les Houches, Chamonix, France

Summer School on Dynamics, Stochastics and Predictability of the Climate System 2014
Valsavarenche, Valle d'Aosta, Italy

Visiting Student at WHOI Geophysical Fluid Dynamics Program 2013
Woods Hole, MA, USA

Summer School on Indian Ocean Dynamics 2010

National Institute of Oceanography, Goa, India

Indian Academy of Sciences Summer Research Fellowship 2009

CSIR Center for Mathematical Modelling and Computer Simulations, Bangalore, India

Experience at Sea

Field work for Marine Field Methods Course, 1 week in Apalachicola Bay 2015

US-5 DIMES Cruise, 3 weeks in Drake Passage 2013

UK-3 DIMES Cruise, 6 weeks in Scotia Sea 2012

Teaching Experience

Guest Instructor (Autumn 2019, UW)

Physics of Ocean Circulation (graduate level course) - 3 lectures on ocean stirring and mixing, and ocean tides

Instructor (Fall 2014, FSU)

Introduction to Simple Models of Oceans and Climate (graduate level course)

8 weeks of classroom teaching. Prepared course structure, course materials, homework, etc.

Teaching Assistant (5 semesters during 2010-2016, FSU)

Introduction to Oceanography (online, undergraduate)

Mentoring

- *OceanHackWeek project mentor in 2020 and 2021: Mentored student projects during the workshop that was centered around teaching a diverse group of students about ocean data analysis techniques.*
- *Graduate Students: Takaya Uchida (2017 - 2019, Columbia University), Qiyu Xiao (2019 - present, NYU).*
- *Undergraduate and high school: Chelsea Dodge (Fall 2013, FSU), William Chen (Fall 2017, NYU), Zach Nachod (Fall 2019, Fall 2021, UW).*

Service and Outreach

Conference Session Chair

Ocean Sciences, 2022 (Vertical Transport – Connecting the Surface to the Deep)

Ocean Sciences, 2022 (Inter-scale connections and transfers in mesoscale, submesoscale, and boundary layer turbulence)

Ocean Sciences, 2020 (Vertical Transport - Pathways from the Surface to the Interior)

International Panel Member

VAIBHAV Summit, 2020 (Panel to discuss future directions for Indian science organized by Indian government)

Proposal Review Panel

National Oceanographic and Atmospheric Administration - Climate Program Office, 2017

Proposal Reviewer

Dutch Research Council (NWO), 2021

National Science Foundation, 2020

Journal Reviewer

Journal of Physical Oceanography, Geophysical Research Letters, Ocean Modeling, Journal of Geophysical Research: Oceans, Quarterly Journal of Royal Meteorological Society, Journal of Advances in Modeling Earth Systems, Journal of Open Source Software

IPCC Reviewer

Reviewed sections of the Sixth Assessment Report, 2020

Diversity, Equity & Inclusion Committee Member

Worked on long-term improvement in diversity at UW School of Oceanography, 2020

Educational Outreach

- *Classroom demonstrations for 7th graders, 2015 –Talk, presentation and demos about general oceanography and rotating fluids.*
- *Science fair judge at Celebration Baptist Church for homeschooled 8th graders, 2015.*

- *9 educational videos (each ~5 minutes in length) created in collaboration with CPALMS for K-12 educators to use in mathematics/physics/oceanography/environment curriculum, 2013.*

Computational & Data Analysis Skills

Github Profile: github.com/dhruvbalwada

Frequent Use

Languages: Python, MATLAB, Fortran

Analysis tools: Pangeo ecosystem for climate data analysis (e.g. xarray, xgcm, xrft etc.)

Visualization: Paraview, Holoviz ecosystem for interactive vis.

Selected Oral Presentations

1. Quantifying ocean turbulence using two-point statistics
   Physical oceanography lunch seminar, UW, May 2021
2. Submesoscale ocean ventilation
   CESM ocean model working group meeting, February 2021
3. Studies of mesoscale eddy diffusivity
   Physical oceanography lunch seminar, UW, November 2019
4. Measuring eddy driven transport in a zonally inhomogeneous flow
   22nd Conference on Atmospheric and Oceanic Fluid Dynamics, June 2019
5. Exploring the dynamical connections between GM and Redi mixing coefficients
   Sources and sinks of ocean mesoscale eddy energy, March 2019
6. Global Redi and Gent-McWilliams diffusivities from surface drifters, Argo floats and RAFOS floats
   AGU Fall Meeting, December 2018
7. Submesoscale subduction and ventilation in an idealized Southern Ocean model
   Ocean Science Meeting, February 2017
8. Scale dependent distribution of kinetic energy from surface drifters in the Gulf of Mexico
   Atmospheric and Oceanic Fluid Dynamics, June 2017
9. A Lagrangian view of oceanic turbulence
   AOS Colloquium, CIMS, NYU, February 2017
10. Lagrangian observations of ocean turbulence
    WHOI, August 2016
11. Lagrangian observations of ocean turbulence
    CNLS, Los Alamos, August 2016
12. Potential vorticity and across ACC eddy transport in the Upper Circumpolar Deep Waters
    Ocean Science Meeting, AGU, February 2016
13. A multi-basin three-dimensional perspective on the meridional overturning circulation in the Southern Ocean
    Graduate Climate Conference, November 2015
14. Relative dispersion in the Antarctic Circumpolar Current
    Lagrangian Analysis and Prediction of Coastal Ocean Dynamics Winter Harbor Meeting, July 2015
15. Relative dispersion in the Antarctic Circumpolar Current
    Atmospheric and Oceanic Fluid Dynamics, June 2015
16. Floating around Antarctica
    Natural Sciences Graduate Symposium, October 2014

17. DIMES float results
    International Meeting for the Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean, November 2013
18. DIMES floats: A Lagrangian perspective of flow and isopycnal mixing in the Southern Ocean
    University of South Florida, October 2013
19. Preliminary results from Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES): Dispersion in the Southern Ocean
    CSIR Centre for Mathematical Modelling and Computer Simulation (C-MMACS), May 2012

Referees

1. Prof. Kevin Speer (kspeer@fsu.edu)
   Florida State University
2. Prof. K Shafer Smith (kss3@nyu.edu)
   New York University
3. Dr. Ryan Abernathey (rpa@ldeo.columbia.edu)
   Columbia University
4. Dr. Alison Gray (argray@uw.edu)
   University of Washington