Dhruv Balwada

School of Oceanography
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Research Interests

Physical oceanography; geophysical fluid dynamics; ocean turbulence; mesoscale and submesoscale transport, energetics and mixing; ocean ventilation; data analysis; Lagrangian observations; numerical modeling.

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

Postdoctoral Scholar — Oct 2019 – present
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 Researcher — May – Dec 2009
Center for Mathematical Modeling and Computer Simulations, Bangalore, India

Extracurricular Academic Activities

Winter Data Science Incubator Program — 2021
Project: Mapping and Visualizing Ocean Glider Observations
eScience Institute, University of Washington, Seattle, WA, USA

Coursera Deep Learning Specialization — 2020

Visiting Scholar at 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 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

Graduate: 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)

Service and Outreach

Conference Session Chair

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

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 improving faculty hiring practices as part of UW School of Oceanography's DEI committee, 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 (e.g. xarray, xgcm, xrft etc.)
Visualization: Paraview, Holoviz ecosystem

Past Use

Java, C, C++, Javascript, HTML, Ferret

Publications

Published

1. Parameterizing non-propagating form drag over rough bathymetry
   Jody M. Klymak, **D. Balwada**, A.C.N. Garabato & R. Abernathey
   Journal of Physical Oceanography (2021)
2. Relative dispersion in the Antarctic Circumpolar Current
   Dhruv Balwada, J.H. LaCasce, K. Speer, & R. Ferrari
   Journal of Physical Oceanography (2021)
3. 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)
4. 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)
5. 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)
6. 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)
7. **Submesoscale vertical velocities enhance tracer subduction in an idealized Antarctic Circumpolar Current**
   Dhruv Balwada, S. Smith & R. Abernathey
   Geophysical Research Letters (2018)
8. **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)
9. 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)
10. Horizontal mixing in the Southern Ocean from Argo float trajectories
    Christopher Roach, **D. Balwada** & K.G. Speer
    Journal of Geophysical Research: Oceans (2016)
11. 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)
12. Tracking with ranked signals
    Tianyang Li, H. Pareek, P. Ravikumar, **D. Balwada** & K.G. Speer
    31 Conf. on Uncertainty in Artificial Intelligence (2015)
13. 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)
14. 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. 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
2. 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
3. Diagnosing the thickness-weighted averaged eddy-mean flow interaction in an eddying North Atlantic ensemble
   Takaya Uchida, Q. Jamet, W. Dewar, **D. Balwada**, J. Le Sommer, & T. Penduff
   Journal of Advances in Modeling Earth Systems
4. 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

In Preparation

1. Spectral flux and injection scales of kinetic energy from surface drifters
   Dhruv Balwada, R. Marino, & J. Xie
2. Eddy transport tensor in an inhomogeneous ocean channel
   Dhruv Balwada, S. Smith, T. Uchida & R. Abernathey
3. Eddy driven meridional transport across the Antarctic Circumpolar Current
   Dhruv Balwada, L. Juillon, K. G. Speer, R. Ferrari & J. Marshall
4. Relative dispersion in the deep waters of the Gulf of Mexico
   Javier Rodriguez, P. Perez-Brunius, L.Z. Sanson, **D. Balwada** & F.J. Beron-Vera

Non-refereed

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

Selected Oral Presentations

1. Submesoscale ocean ventilation
   CESM ocean model working group meeting, February 2021
2. Studies of mesoscale eddy diffusivity
   Physical oceanography lunch seminar, UW, November 2019
3. Measuring eddy driven transport in a zonally inhomogeneous flow
   22nd Conference on Atmospheric and Oceanic Fluid Dynamics, June 2019
4. Exploring the dynamical connections between GM and Redi mixing coefficients
   Sources and sinks of ocean mesoscale eddy energy, March 2019
5. Global Redi and Gent-McWilliams diffusivities from surface drifters, Argo floats and RAFOS floats
   AGU Fall Meeting, December 2018
6. Submesoscale subduction and ventilation in an idealized Southern Ocean model
   Ocean Science Meeting, February 2017

7. Scale dependent distribution of kinetic energy from surface drifters in the Gulf of Mexico
   Atmospheric and Oceanic Fluid Dynamics, June 2017
8. A Lagrangian view of oceanic turbulence
   AOS Colloquium, CIMS, NYU, February 2017
9. Lagrangian observations of ocean turbulence
   WHOI, August 2016
10. Lagrangian observations of ocean turbulence
    CNLS, Los Alamos, August 2016
11. Potential vorticity and across ACC eddy transport in the Upper Circumpolar Deep Waters
    Ocean Science Meeting, AGU, February 2016
12. A multi-basin three-dimensional perspective on the meridional overturning circulation in the Southern Ocean
    Graduate Climate Conference, November 2015
13. Relative dispersion in the Antarctic Circumpolar Current
    Lagrangian Analysis and Prediction of Coastal Ocean Dynamics Winter Harbor Meeting, July 2015
14. Relative dispersion in the Antarctic Circumpolar Current
    Atmospheric and Oceanic Fluid Dynamics, June 2015
15. Floating around Antarctica
    Natural Sciences Graduate Symposium, October 2014
16. DIMES float results
    International Meeting for the Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean, November 2013
17. DIMES floats: A Lagrangian perspective of flow and isopycnal mixing in the Southern Ocean
    University of South Florida, October 2013
18. 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