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. Diagnosing the thickness-weighted averaged eddy-mean flow interaction in an eddying North Atlantic ensemble, Part I: The Eliassen-Palm flux
   Takaya Uchida, Q. Jamet, W. Dewar, J. Le Sommer, T. Penduff, & **D. Balwada**
   Journal of Advances in Modeling Earth Systems (2022)
2. 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)
3. 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)
4. 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)
5. Parameterizing non-propagating form drag over rough bathymetry
   Jody M. Klymak, **D. Balwada**, A.C.N. Garabato & R. Abernathey
   Journal of Physical Oceanography (2021)
6. Relative dispersion in the Antarctic Circumpolar Current
   Dhruv Balwada, J.H. LaCasce, K. Speer, & R. Ferrari
   Journal of Physical Oceanography (2021)

7. 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)
8. 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)
9. 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)
10. 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)
11. Submesoscale vertical velocities enhance tracer subduction in an idealized Antarctic Circumpolar Current
    Dhruv Balwada, S. Smith & R. Abernathey
    Geophysical Research Letters (2018)
12. 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)
13. 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)
14. Horizontal mixing in the Southern Ocean from Argo float trajectories
    Christopher Roach, **D. Balwada** & K.G. Speer
    Journal of Geophysical Research: Oceans (2016)
15. 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)
16. Tracking with ranked signals
    Tianyang Li, H. Pareek, P. Ravikumar, **D. Balwada** & K.G. Speer
    31 Conf. on Uncertainty in Artificial Intelligence (2015)
17. 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)
18. 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 observational evidence of an oceanic dual kinetic energy cascade and its seasonality
   Dhruv Balwada, J. Xie, R. Marino, & F. Feraco
   Submitted to Nature Communications

2. 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