Dhruv Balwada

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Research Interests

Physical oceanography, geophysical fluid dynamics, turbulence and transport, parameterizations, impacts of submesoscales on biogeochemical processes, observational data analysis techniques.

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

Academic Activities

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

Experience at Sea

Field work for Marine Field Method 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

Publications

Published

1. Relative dispersion in the Antarctic Circumpolar Current
   Dhruv Balwada, J.H. LaCasce, K. Speer, & R. Ferrari
   Journal of Physical Oceanography (2020)
2. 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)
3. 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)
4. 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)
5. 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)
6. Submesoscale vertical velocities enhance tracer subduction in an idealized Antarctic Circumpolar Current
   Dhruv Balwada, S. Smith & R. Abernathey
   Geophysical Research Letters (2018)
7. 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)
8. 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)
9. Horizontal mixing in the Southern Ocean from Argo float trajectories
   Christopher Roach, **D. Balwada** & K.G. Speer
   Journal of Geophysical Research: Oceans (2016)
10. 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)
11. Tracking with ranked signals
    Tianyang Li, H. Pareek, P. Ravikumar, **D. Balwada** & K.G. Speer
    31 Conf. on Uncertainty in Artificial Intelligence (2015)
12. 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)
13. 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

1. Observational evidence for ventilation hot spots in the Southern Ocean
   Lilian Dove, Andrew F. Thompson, **D. Balwada**, & Alison R. Gray
   Journal of Geophysical Research: Oceans
2. 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
3. Parameterizing non-propagating form drag over rough bathymetry
   Jody M. Klymak, **D. Balwada**, A.C.N. Garabato & R. Abernathey
   Journal of Physical Oceanography
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
5. Vertical fluxes conditioned on vorticity and strain reveal submesoscale ventilation
   Dhruv Balwada, Qiyu Xiao, Shafer Smith, Ryan Abernathey, & Alison R. Gray
   Journal of Physical Oceanography

In Preparation (drafts available on request)

1. Eddy transport tensor in an inhomogenous ocean channel
   Dhruv Balwada, S. Smith & R. Abernathey
2. Eddy driven meridional transport across the Antarctic Circumpolar Current
   Dhruv Balwada, L. Juillon, K. G. Speer, R. Ferrari & J. Marshall
3. Spectral energy flux and energy injection scales from surface drifter observations
   Jin-Han Xie, **D. Balwada**, R. Marino
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
   Thesis, Florida State University (2016)

Selected Oral Presentations

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

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

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: Chelsea Dodge (Fall 2013, FSU)
High School Student: William Chen (Fall 2017, NYU)

Service and Outreach

- Session chair at conference
  Ocean Sciences 2020 (Session: Vertical Transport - Pathways from the Surface to the Interior)
- Proposal Review Panel Member
  National Oceanographic and Atmospheric Administration-Climate Program Office, 2017
- Proposal Reviewer
  Mail in review for 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

- Reviewed sections of the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) as part of the early career researcher group review organized by Association of polar early career scientists (APECS)
- Educational Outreach
  - *Classroom demonstrations for 7th graders, February 2015 – Talk, presentation and demos about general oceanography and rotating fluids.*
  - *Science fair judge at Celebration Baptist Church for homeschooled 8th graders, January 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, September 2013.*

Computational Skills

Frequently – Python, MATLAB, Fortran, Linux, LATEX, Paraview
Not within last 2 years – Java, C, C++, Javascript, HTML, Ferret