Hemant Khatri

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Research Interests

Geophysical fluid dynamics, ocean circulation and regional climate variability, meridional overturning circulation, mesoscale–submesoscale processes and ocean turbulence

Education

Ph.D., Applied Mathematics and Mathematical Physics 2016 – 2019
Imperial College London, London, UK *Advisor: Prof Pavel Berloff*
Thesis – Dynamics of ocean jets over topography

M.Sc., Atmospheric & Oceanic Sciences 2013 – 2015
Indian Institute of Science (IISc), Bengaluru, India *Advisor: Prof Jai Sukhatme*
Thesis – Mesoscale turbulence on the ocean surface from satellite altimetry

B.E. (Hons.), Chemical Engineering 2009 – 2013
Birla Institute of Technology & Science (BITS), Pilani, India

Professional Appointments

Postdoctoral Research Associate Sep 2021 – Present
Earth, Ocean and Ecological Sciences, University of Liverpool, Liverpool, UK *Advisor: Prof Ric Williams*
Research focus – Impacts of atmospheric variability on the North Atlantic overturning circulation

Postdoctoral Research Associate Oct 2019 – Aug 2021
Atmospheric and Oceanic Sciences, Princeton University, Princeton, USA *Advisor: Dr Stephen Griffies*
Research focus – Role of bathymetry in the large-scale ocean circulation

Modeling Associate (Intern) Feb 2019 – Aug 2019
Risk Management Solutions, London, UK
Research focus – Assessment of financial impacts of sea-level rise on coastal storm surge in the USA

Teaching & Mentorship

Guest Lecturer Atmospheric and Oceanic Wave Dynamics (Feb 2020)

Teaching Assistant Mathematical Methods, Multivariable Calculus, Numerical Analysis (2016 – 2018), Geophysical Fluid Dynamics (Spring 2015)

Teaching Transcript Certification McGraw Center for Teaching and Learning, Princeton University (2021)

Research co-advisor Catherine Berridge (2022 – 2023, Undergraduate thesis at U. Liverpool), Jack Davies (2018 – 2019, Masters thesis at Imperial College London), Ruchir Dwivedi (2017 – 2018, Masters thesis at Imperial College London)

Research Fellowships & Grants

Postdoctoral Research Fellowship ($150,000) Cooperative Institute for Modelling the Earth System, Princeton University (2019 – 2021)

President's PhD Scholarship (£160,000) Imperial College London (2016 – 2019)

Research Grant (£1500) Mathematics for Planet Earth CDT, Imperial College London (2016 – 2019)

Jeremy Grantham Fellowship (INR 144,000) Divecha Centre for Climate Change, IISc, India (2014 – 2015)

Postgraduate Scholarship (INR 288,000) Ministry of Education, India (2013 – 2015)

Merit-Cum-Need Scholarship (INR 92,000) BITS Pilani, India (2011 – 2013)

AGU Early Career Travel Grant ($1,000) Ocean Sciences Meeting, 2024

AMS Student Travel Grant ($1,000) Conference on Atmospheric and Oceanic Fluid Dynamics, 2017

Publications

Peer-reviewed Journal Articles

- **H. Khatri**, S. Griffies, B. Storer, M. Buzzicotti, H. Aluie, M. Sonnewald, R. Dussin, and A. Shao. A scale-dependent analysis of the barotropic vorticity budget in a global ocean simulation, *in revision in the Journal of Advances in Modeling Earth Systems*.
- J. Neme, M. England, A. Hogg, **H. Khatri**, and S. Griffies: The role of bottom friction in mediating the response of the Weddell Gyre circulation to changes in surface stress and buoyancy fluxes (2023), *Journal of Physical Oceanography*.
- B. Storer, M. Buzzicotti, **H. Khatri**, S. Griffies, and H. Aluie (2023). Global cascade of kinetic energy in the ocean and the atmospheric imprint, *Science Advances*.
- M. Buzzicotti, B. Storer, **H. Khatri**, S. Griffies, and H. Aluie (2023). A spatio-temporal coarse-grained decomposition of the global ocean surface geostrophic kinetic energy, *Journal of Advances in Modeling Earth Systems*.
- **H. Khatri**, R. Williams, T. Woollings, and D. Smith (2022). Fast and slow subpolar ocean responses to the North Atlantic Oscillation: Thermal and dynamical changes, *Geophysical Research Letters*.
- B. Storer, M. Buzzicotti, **H. Khatri**, S. Griffies, and H. Aluie (2022). Global energy spectrum of the general ocean circulation, *Nature Communications*.
- G. Marques, N. Loose, E. Yankovsky, J. Steinberg, C. Chang, N. Bhamidipati, A. Adcroft, B. Fox-Kemper, S. Griffies, R. Hallberg, M. Jansen, **H. Khatri**, and L. Zanna (2022). An idealized model hierarchy to investigate ocean mesoscale eddies across resolutions, *Geoscientific Model Development*.
- N. Loose, R. Abernathey, I. Grooms, J. Busecke, A. Barthe, E. Yankovsky, G. Marques, J. Steinberg, A. Ross, **H. Khatri**, S. Bachman and L. Zanna (2022). A python package for diffusion-based spatial filtering of gridded data, *Journal of Open Source Software*.
- **H. Khatri**, S. Griffies, T. Uchida, H. Wang and D. Menemenlis (2021). Role of mixed-layer instabilities in the seasonal evolution of eddy kinetic energy spectra in a global submesoscale permitting simulation, *Geophysical Research Letters*.
- J. Davies, **H. Khatri** and P. Berloff (2021). Linear stability analysis for flows over sinusoidal bottom topography, *Journal of Fluid Mechanics*.

- **H. Khatri** and P. Berloff (2019). Tilted drifting jets over a sloped topography: effects of vanishing eddy viscosity, *Journal of Fluid Mechanics*.
- **H. Khatri** and P. Berloff (2018). Role of eddies in the maintenance of multiple jets embedded in eastward and westward baroclinic shears, *Fluids*.
- **H. Khatri** and P. Berloff (2018). A mechanism for jet drift over topography, *Journal of Fluid Mechanics*.
- **H. Khatri**, J. Sukhatme, A. Kumar and M. K. Verma (2018). Surface ocean enstrophy, kinetic energy fluxes, and spectra from satellite altimetry, *Journal of Geophysical Research: Oceans*.

Non Peer-Reviewed Articles and Documents

- **H. Khatri**, B. Storer, M. Buzzicotti, , S. Griffies, and H. Aluie (2022). How big are ocean currents?, *Behind the Paper – Nature Portfolio*.
- **H. Khatri**, and S. Griffies (2021). Diagnosing momentum and vorticity budgets in GFDL-MOM6: A tutorial document, *Zenodo*.

Selected Conference Presentations

- Fast and slow subpolar ocean responses to the North Atlantic Oscillation — *IUGG General Assembly, Germany* (Jul′23)
- Can we predict North Atlantic upper ocean heat content variability from North Atlantic Oscillation index? — *Climate Dynamics Workshop, UK* (Jun′23)
- A scale-dependent analysis of the barotropic vorticity budget — *Ocean Modeling Meeting, UK* (Sep′22)
- Inter-annual variability in the overturning circulation in the subpolar North Atlantic: A sensitivity analysis — *Challenger Society Conference, UK* (Sep′22) and *EGU General Assembly* (May′22)
- A synthesis of upper ocean geostrophic kinetic energy spectra from a global submesoscale permitting simulation — *EGU General Assembly, Austria* (Apr′21)
- Kinetic energy and enstrophy fluxes on the ocean surface — *CliMathNet Conference, UK* (Sep′18), *Gordon Ocean Mixing Conference, USA* (Jun′18) and *Meeting: Energy Transfers in the Atmosphere and Oceans, Germany* (Apr′17)
- Effects of zonally varying topography on the dynamics of oceanic jets — *Rotating Fluids Meeting, UK* (Sep′17) and *21st Conference on Atmospheric and Oceanic Fluid Dynamics, USA* (Jun′17)

Invited Seminars

- Fast and slow subpolar ocean responses to the North Atlantic Oscillation — *Geophysical Fluid Dynamics Laboratory, Princeton, USA* (Sep′23) and *National Oceanography Centre, Southampton, UK* (Feb′23)
- A scale-dependent analysis of the barotropic vorticity budget in an eddy-permitting global ocean simulation — *National Oceanography Centre, Liverpool, UK* (Dec′21)
- Effects of zonally varying topography on the dynamics of oceanic jets — *New York University, USA* (Mar′20), *Geophysical Fluid Dynamics Laboratory, Princeton, USA* (Mar′19) and Queen Mary University, UK (Dec′17)
- Evaluating the impacts of sea-level rise on storm surge risk and financial losses in the United States — *Risk Management Solutions, London, UK* (Aug′19)

Programming and Computational Skills

Programming Language & Software Python, Fortran, MATLAB, R, C/C++, QGIS, git version control, LaTeX

Analysis tools xarray, xgcm and dask libraries in python for analyzing large datasets, e.g. climate model outputs, atmospheric and oceanic reanalysis datasets, and experience of using JASMIN (jasmin.ac.uk) and Pangeo (pangeo.io) data-analysis services

Ocean Modelling Experience of MOM6 ocean general circulation model (github.com/NOAA-GFDL/MOM6)

Other Academic Activities

Reviewer Journal of Physical Oceanography, Ocean Modelling, Fluids, Journal of Fluid Mechanics, Journal of Advances in Modeling Earth Systems, Geophysical Research Letters

Conference Roles
Co-convener for the session "Atlantic meridional overturning circulation: variability and connectivity", *Ocean Sciences Meeting, USA* (Feb'24)
Chaired a session on "Ocean-atmosphere mechanisms of climate variability, change and predictability", *IUGG General Assembly, Germany* (Jul'23)
Chaired a session on "Modelling – bias, skill and new approaches", *Climate Dynamics Workshop, UK* (Jun'23)

Organising Committee Member
Ocean seminar series (2022 – Present) – University of Liverpool
Annual student conference (2018) – Society of Industrial and Applied Mathematics, Imperial College London

Workshop Participation
Rossbypalooza – University of Chicago, USA (Jun'18)
Turbulent flows and climate dynamics – School of Physics, Les Houches, France (Aug'17)
Global climate change – University of Exeter, UK (Jun'14)