

Hemant Khatri

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Research Focus

Ocean circulation and climate variability, meridional overturning circulation, geophysical fluid dynamics, mesoscale–submesoscale processes and ocean turbulence, topography–flow interactions in oceans

Education

Ph.D., Applied Mathematics and Mathematical Physics

Imperial College London, London, UK

Thesis – Dynamics of ocean jets over topography

2016 – 2019

Advisor: Prof Pavel Berloff

M.Sc., Atmospheric & Oceanic Sciences

Indian Institute of Science (IISc), Bengaluru, India

Thesis – Mesoscale turbulence on the ocean surface from satellite altimetry

2013 – 2015

Advisor: Prof Jai Sukhatme

B.E. (Hons.), Chemical Engineering

Birla Institute of Technology & Science (BITS), Pilani, India

2009 – 2013

Professional Appointments

Postdoctoral Research Associate

Earth, Ocean and Ecological Sciences, University of Liverpool, Liverpool, UK

Research focus – Impacts of atmospheric variability on the North Atlantic overturning circulation

Sep 2021 – Present

Advisor: Prof Ric Williams

Postdoctoral Research Associate

Atmospheric and Oceanic Sciences, Princeton University, Princeton, USA

Research focus – Role of bathymetry in the large-scale ocean circulation

Oct 2019 – Aug 2021

Advisor: Dr Stephen Griffies

Modeling Associate (Intern)

Risk Management Solutions, London, UK

Research focus – Assessment of financial impacts of sea-level rise on coastal storm surge in the USA

Feb 2019 – Aug 2019

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

1. S. Griffies, A. Adcroft, R. Beadling, M. Bushuk, C. Chang, H. Drake, R. Dussin, R. Hallberg, W. Hurlin, **H. Khatri**, J. Krasting, M. Lobo, G. MacGilchrist, B. Reichl, A. Sane, O. Sergienko, M. Sonnewald, J. Steinberg, J. Tesdal, M. Thomas, K. Turner, M. Ward, M. Winton, N. Zadeh, L. Zanna, R. Zhang, W. Zhang and M. Zhao: The GFDL-CM4X climate model hierarchy, Part II: Case studies, *in review*.
2. S. Griffies, A. Adcroft, R. Beadling, M. Bushuk, C. Chang, H. Drake, R. Dussin, R. Hallberg, W. Hurlin, **H. Khatri**, J. Krasting, M. Lobo, G. MacGilchrist, B. Reichl, A. Sane, O. Sergienko, M. Sonnewald, J. Steinberg, J. Tesdal, M. Thomas, K. Turner, M. Ward, M. Winton, N. Zadeh, L. Zanna, R. Zhang, W. Zhang and M. Zhao: The GFDL-CM4X climate model hierarchy, Part I: Model description and thermal properties, *in review*.
3. D. Bhagtani, A. Hogg, R. Holmes, N. Constantinou and **H. Khatri**: Impact of the North Atlantic Oscillation on the subtropical and subpolar gyres, *in review*.
4. X. Ding, X. He, Y. Bai, **H. Khatri**, J. Li, F. Ye and F. Gong: Deep learning for submesoscale near-surface flow retrieval from geostationary satellite observations, *in review*.
5. **H. Khatri**, R. Williams, T. Woollings and D. Smith (2024): An ocean memory perspective: Disentangling atmospheric control of decadal variability in the North Atlantic Ocean, *Geophysical Research Letters*.
6. **H. Khatri**, S. Griffies, B. Storer, M. Buzzicotti, H. Aluie, M. Sonnewald, R. Dussin and A. Shao (2024). A scale-dependent analysis of the barotropic vorticity budget in a global ocean simulation, *Journal of Advances in Modeling Earth Systems*.
7. J. Neme, M. England, A. Hogg, **H. Khatri** and S. Griffies (2023): The role of bottom friction in mediating the response of the Weddell Gyre circulation to changes in surface stress and buoyancy fluxes, *Journal of Physical Oceanography*.
8. 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*.
9. 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*.

10. **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*.
11. B. Storer, M. Buzzicotti, **H. Khatri**, S. Griffies and H. Aluie (2022). Global energy spectrum of the general ocean circulation, *Nature Communications*.
12. 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*.
13. 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*.
14. **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*.
15. J. Davies, **H. Khatri** and P. Berloff (2021). Linear stability analysis for flows over sinusoidal bottom topography, *Journal of Fluid Mechanics*.
16. **H. Khatri** and P. Berloff (2019). Tilted drifting jets over a sloped topography: effects of vanishing eddy viscosity, *Journal of Fluid Mechanics*.
17. **H. Khatri** and P. Berloff (2018). Role of eddies in the maintenance of multiple jets embedded in eastward and westward baroclinic shears, *Fluids*.
18. **H. Khatri** and P. Berloff (2018). A mechanism for jet drift over topography, *Journal of Fluid Mechanics*.
19. **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

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

Selected Conference Presentations

1. Role of ocean memory in subpolar North Atlantic decadal variability — *Challenger Society Conference, UK (Sep'24) and EGU General Assembly, Austria (Apr'24)*
2. Fast and slow subpolar ocean responses to the North Atlantic Oscillation — *IUGG General Assembly, Germany (Jul'23)*
3. Can we predict North Atlantic upper ocean heat content variability from North Atlantic Oscillation index? — *Climate Dynamics Workshop, UK (Jun'23)*
4. A scale-dependent analysis of the barotropic vorticity budget — *Ocean Modeling Meeting, UK (Sep'22)*
5. 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)*
6. A synthesis of upper ocean geostrophic kinetic energy spectra from a global submesoscale permitting simulation — *EGU General Assembly, Austria (Apr'21)*

7. 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)
8. 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

1. Role of ocean memory in North Atlantic decadal variability — *University of Southampton, UK* (Aug'24)
2. 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)
3. A scale-dependent analysis of the barotropic vorticity budget in an eddy-permitting global ocean simulation — *National Oceanography Centre, Liverpool, UK* (Dec'21)
4. 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)
5. 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 Modelling Experience

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 running GFDL-MOM6 ocean general circulation model (github.com/NOAA-GFDL/MOM6), spectral and finite-difference scheme-based idealised numerical models

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, Communications Earth & Environment, Nature Communications

Conference Roles

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

Public Outreach and Engagement

- Press Release: "Researchers find North Atlantic Ocean has memory of nearly two decades", *University of Liverpool* (Dec'24)
- Guest in podcast episode "The AMOC in decline: Consequences and misconceptions" – *Into the Blue Podcast*, *NOC Southampton* (Jun'24)

Organising Committee Member

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

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)