

# Hemant Khatri

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## Research Focus

Reduced-complexity climate models, Climate change and 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

### Senior Scientist – Climate Mitigation

*Met Office, Exeter, UK*

Research focus – Climate change under various GHG emission scenarios in reduced-complexity models

Aug 2025 – Present

### 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 – Jul 2025

*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)

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**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. **H. Khatri** and R. Williams: Contrasting fast and slow ocean carbon, nutrient and thermal responses to the North Atlantic Oscillation, *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 II: Case studies, *in review*.
3. 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*.
4. X. Ding, X. He, **H. Khatri**, J. Li, F. Ye, H. Li, M. Zhao and F. Gong: Physically-constrained flow learning reveals diurnal submesoscale surface currents from geostationary satellite observations, *in review*.
5. D. Bhagtani, A. Hogg, R. Holmes, N. Constantinou and **H. Khatri** (2025): Asymmetric response of the North Atlantic gyres to the North Atlantic Oscillation, *Journal of Geophysical Research: Oceans*.
6. **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*.
7. **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*.

8. 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*.
9. 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*.
10. 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*.
11. **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*.
12. B. Storer, M. Buzzicotti, **H. Khatri**, S. Griffies and H. Aluie (2022). Global energy spectrum of the general ocean circulation, *Nature Communications*.
13. 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*.
14. 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*.
15. **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*.
16. J. Davies, **H. Khatri** and P. Berloff (2021). Linear stability analysis for flows over sinusoidal bottom topography, *Journal of Fluid Mechanics*.
17. **H. Khatri** and P. Berloff (2019). Tilted drifting jets over a sloped topography: effects of vanishing eddy viscosity, *Journal of Fluid Mechanics*.
18. **H. Khatri** and P. Berloff (2018). Role of eddies in the maintenance of multiple jets embedded in eastward and westward baroclinic shears, *Fluids*.
19. **H. Khatri** and P. Berloff (2018). A mechanism for jet drift over topography, *Journal of Fluid Mechanics*.
20. **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 *21<sup>st</sup> 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](https://jasmin.ac.uk)) and Pangeo ([pangeo.io](https://pangeo.io)) data-analysis services

**Ocean Modelling** Experience of running GFDL-MOM6 ocean general circulation model ([github.com/NOAA-GFDL/MOM6](https://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)