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

Professional Appointments

Senior Scientist – Climate Mitigation Aug 2025 – Present

Met Office, Exeter, UK

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

Postdoctoral Research Associate Sep 2021 – Jul 2025

Earth, Ocean and Ecological Sciences, University of Liverpool, Liverpool, UK *Advisor: Prof Ric Williams*

Research focus – Decadal variability in the North Atlantic Ocean circulation and its implications for the ocean carbon state and biogeochemical processes

Postdoctoral Research Associate Oct 2019 – Aug 2021

Atmospheric and Oceanic Sciences, Princeton University, Princeton, USA *Advisor: Dr Stephen Griffies*

Research focus – Role of bathymetry and mesoscale eddies 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

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

Teaching & Mentorship

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

Guest Lecturer Climate Data Analysis in MATLAB (Spring 2023), Atmospheric and Oceanic Wave Dynamics (Spring 2020)

Teaching Assistant Mathematical Methods (Spring 2018), Multivariable Calculus & Differential Equations (Fall 2016, 2017), Introduction to Numerical Analysis (Spring 2017), Geophysical Fluid Dynamics (Spring 2015)

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

Co-Applicant (£5,800) University of Liverpool – University of Alberta Seed Grant Program (2025)

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)

Undergraduate 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. L. Díaz, A. Butler, D. Avisar, S. Bischof, C. Boehm, G. Boschat, W. Dow, C. Garfinkel, K. Grise, **H. Khatri**, B. Mezzina, M. Osman, J. Wright, P. Athanasiadis, J. Arblaster, T. Bracegirdle, E. Behrens, Y. Chen, E. Lim, A. Maycock, S. Min, J. Mindlin, S. Osprey, M. Sigmond, D. Smith and T. Shaw: Disentangling anthropogenic effects on Southern Hemisphere circulation and surface climate: a Multi-Model Large Ensemble approach, *in review*.
2. 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 (2026), *ISPRS Journal of Photogrammetry and Remote Sensing*.
3. **H. Khatri** and R. Williams (2025): Contrasting fast and slow ocean carbon, nutrient and thermal responses to the North Atlantic Oscillation, *Global Biogeochemical Cycles*.
4. 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 (2025): The GFDL-CM4X climate model hierarchy, Part II: Case studies, *Journal of Advances in Modeling Earth Systems*.

5. 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 (2025): The GFDL-CM4X climate model hierarchy, Part I: Model description and thermal properties, *Journal of Advances in Modeling Earth Systems*.
6. 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.
7. **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*.
8. **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*.
9. 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*.
10. 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*.
11. 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*.
12. **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*.
13. B. Storer, M. Buzzicotti, **H. Khatri**, S. Griffies and H. Aluie (2022). Global energy spectrum of the general ocean circulation, *Nature Communications*.
14. 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*.
15. 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*.
16. **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*.
17. J. Davies, **H. Khatri** and P. Berloff (2021). Linear stability analysis for flows over sinusoidal bottom topography, *Journal of Fluid Mechanics*.
18. **H. Khatri** and P. Berloff (2019). Tilted drifting jets over a sloped topography: effects of vanishing eddy viscosity, *Journal of Fluid Mechanics*.
19. **H. Khatri** and P. Berloff (2018). Role of eddies in the maintenance of multiple jets embedded in eastward and westward baroclinic shears, *Fluids*.
20. **H. Khatri** and P. Berloff (2018). A mechanism for jet drift over topography, *Journal of Fluid Mechanics*.
21. **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

Oral 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 the North Atlantic upper ocean heat content variability from the 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, Austria* (May′22)
6. Kinetic energy and enstrophy fluxes on the ocean surface — *CliMathNet Conference, UK* (Sep′18) and *Meeting: Energy Transfers in the Atmosphere and Oceans, Germany* (Apr′17)
7. Effects of sloped topography on the dynamics of ocean jets — *Rotating Fluids Meeting, UK* (Sep′17)

Poster Presentations

1. Response of the subpolar North Atlantic overturning to the North Atlantic Oscillation and implications for decadal ocean variability — *Ocean Sciences Meeting, USA* (Feb′24)
2. A synthesis of upper ocean geostrophic kinetic energy spectra from a global submesoscale permitting simulation — *EGU General Assembly, Austria* (Apr′21)
3. Dynamics of ocean jets formed over a sloped topography — *Gordon Ocean Mixing Conference, USA* (Jun′18) and *Conference on Atmospheric and Oceanic Fluid Dynamics, USA* (Jun′17)
4. Ocean surface spectral fluxes of kinetic energy, enstrophy and buoyancy — *Gordon Ocean Mixing Conference, USA* (Jun′18)

Invited Seminars

1. Role of ocean memory in North Atlantic decadal variability — *Imperial College London, UK* (Jan′26) and *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 sloped 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

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

Fieldwork C-Streams scientific expedition in Florida Straits (18^{th}–22^{nd} June 2024)

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, Nature Geoscience

Conference Roles
— Co-convener 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)
– Research showcase and demonstration to general public at IISc Open day (Feb′15)

Organising Committee Member
— Ocean seminar series (2022 – 2024), 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)