

# Tsz-Kin (Eric) Lai

## Research Scientist

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## Research Interests

Tropical Cyclones, Mesoscale Convective Systems, Tropical Meteorology, Severe Weather, Cloud Physics, Numerical Weather Prediction

## Education

### Ph.D. in Atmospheric and Oceanic Sciences

2021

McGill University

Montreal, Canada

- Thesis: *Impacts of Asymmetric Dynamics on Tropical Cyclone Eyewall Replacement Cycles*
- Supervisor: Prof. M. K. (Peter) Yau
- CMOS' Tertia M.C. Hughes Memorial Graduate Student Prize for the Excellent Thesis in 2021

### M.Sc. in Atmosphere, Ocean and Climate

2013

University of Reading

Reading, UK

- Dissertation: *Emergence of Tropical Cyclones in Baroclinic Waves*
- Supervisors: Prof. John Methven and Prof. Rosalind J. Cornforth
- Graduated with Distinction

### B.Sc. in Physics with minor in Earth System Science

2012

The Chinese University of Hong Kong

Hong Kong

- Bachelor Final Year Project: *Advanced Bias Removal Approach Using a Kalman Filter for Probabilistic Wind Speed Forecasts During the Periods of Tropical Cyclone Influence*
- Supervisors: Mr. Ping Cheung (Hong Kong Observatory) and Dr. Kam-Moon Pang

## Research and Work Experience

### Research

#### Research Scientist

Aug 2024–Present

Meteorological Research Division, Environment and Climate Change Canada

Dorval, Canada

- Extreme weather event attribution

#### Postdoctoral Research Associate

Dec 2021–Jul 2024

Space and Atmospheric Physics Group, Department of Physics, Imperial College London

- Tropical Cyclone Structure and Rainfall
- Advisor: Prof. Ralf Toumi

#### Postdoctoral Researcher

Jul 2021–Dec 2021

Department of Atmospheric and Oceanic Sciences, McGill University

Montreal, Canada

- Tropical Cyclone Secondary Eyewall Formation
- Advisor: Prof. M. K. (Peter) Yau

#### Visiting Graduate Student

Jul 2019–Oct 2019

Research Applications Laboratory (RAL), National Center for Atmospheric Research (NCAR)

Boulder, USA

- Tropical Cyclone Inner Eyewall Decay in Numerical Experiments
- Host: Dr. Eric A. Hendricks

#### Graduate Research Assistant

Sep 2015–Jun 2021

Department of Atmospheric and Oceanic Sciences, McGill University

Montreal, Canada

## Meteorology Researcher

Fugro GEOS Ltd. (now Fugro GB Marine Ltd.)

Dec 2013–Jul 2015

South Oxfordshire, UK

- Participated in a meteorological research project “IFADS: Improving Forecasts of African Dust Storms” in collaboration with University of Leeds
- Participated in a research project on “Holistic Vessel Performance and Routing System” in collaborations with University of Southampton etc.
- Performed internal projects such as Nigeria lightning statistics and validation of wind speed forecasts produced by WRF and GFS

## Voluntary Research Assistant

Department of Meteorology, University of Reading

Aug 2013–Aug 2015

Reading, UK

- Performed a research project about tropical cyclogenesis based on my master’s dissertation

## Summer Intern Student

Hong Kong Observatory

Summer 2011

Hong Kong

- Worked on “Improving the very short range convective weather forecast for the Hong Kong Flight Information Region (HKFIR)”
- Developed an improved forecasting approach based on ECMWF model data

## Student Research Assistant

Institute of Space and Earth Information Science, The Chinese University of Hong Kong

Summer 2010

Hong Kong

- Studied the influence of ENSO on the weather in Hong Kong

## Teaching and Technical

### Teaching Assistant

Department of Atmospheric and Oceanic Sciences, McGill University

Sep 2016–Apr 2020

Montreal, Canada

- ATOC214 Introduction: Physics of the Atmosphere (Fall 2016, Fall 2018)
- ATOC184 Science of Storms (Winter 2017, Winter 2018, Winter 2019, Winter 2020)
- ATOC181 Introduction to Atmospheric Science (Fall 2017)

### Technical Helper for Community Weather Information Network (Co-WIN)

Department of Applied Physics, The Hong Kong Polytechnic University

Summer 2009

Hong Kong

- Monitored, maintained and upgraded the automatic weather stations of Co-WIN
- Performed data testing and apparatus calibration

## Selected Honours and Awards

**2022: Tertia M.C. Hughes Memorial Graduate Student Prize for the Excellent Thesis in 2021,**  
*Canadian Meteorological and Oceanographic Society (CMOS), Canada*

**2019: Graduate Mobility Award,** *McGill University, Canada*

**2015–2018: Graduate Excellence Fellowship,** *McGill University, Canada*

**2015–2016: Atmospheric and Oceanic Sciences Graduate Award,** *McGill University, Canada*

**2012: International Masters Bursary,** *University of Reading, UK*

**2011: Hong Kong Observatory Scholarship,** *Hong Kong Observatory, Hong Kong*

**2011: Second Runner-up in Undergraduate Individual Entry, Professor Sir Charles K. Kao Student Creativity Awards 2011,** *The Chinese University of Hong Kong, Hong Kong*

## Peer-Reviewed Publications

### In press

- Ito, K., Y. Miyamoto, C.-C. Wu, A. Didlake, J. Hlywiak, Y.-H. Huang, **T.-K. Lai**, L. Pattie, N. Qin, U. Shimada, D. Tao, Y. Yamada, J. A. Zhang, S. Kanada, and D. Herndon: Recent research and operational tools for improved understanding and diagnosis of tropical cyclone inner core structure. *J. Meteor. Soc. Japan*, in press, doi:10.2151/jmsj.2025-008.

## Published

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- Lai, T.-K., and R. Toumi, 2025: Sensitivity of the energy conversion efficiency of tropical cyclones during intensification to sea surface temperature and static stability. *Quart. J. Roy. Meteor. Soc.*, **151**, e4895, doi:10.1002/qj.4895.
- Lai, T.-K., and R. Toumi, 2023: Has there been a recent shallowing of tropical cyclones?. *Geophys. Res. Lett.*, **50**, e2022GL102184, doi:10.1029/2022GL102184.
- Lai, T.-K., E. A. Hendricks, and M. K. Yau, 2021: Long-term effect of barotropic instability across the moat in double-eyewall tropical cyclone-like vortices in forced and unforced shallow-water models. *J. Atmos. Sci.*, **78**, 4103–4126, doi:10.1175/JAS-D-21-0065.1.
- Lai, T.-K., E. A. Hendricks, M. K. Yau, and K. Menelaou, 2021: Roles of barotropic instability across the moat in inner eyewall decay and outer eyewall intensification: Essential dynamics. *J. Atmos. Sci.*, **78**, 1411–1428, doi:10.1175/JAS-D-20-0169.1.
- Lai, T.-K., E. A. Hendricks, K. Menelaou, and M. K. Yau, 2021: Roles of barotropic instability across the moat in inner eyewall decay and outer eyewall intensification: Three-dimensional numerical experiments. *J. Atmos. Sci.*, **78**, 473–496, doi:10.1175/JAS-D-20-0168.1.
- Lai, T.-K., K. Menelaou, and M. K. Yau, 2019: Barotropic instability across the moat and inner eyewall dissipation: A numerical study of Hurricane Wilma (2005). *J. Atmos. Sci.*, **76**, 989–1013, doi:10.1175/JAS-D-18-0191.1.
- Menelaou, K., M. K. Yau, and T.-K. Lai, 2018: A possible three-dimensional mechanism for oscillating wobbles in tropical cyclone-like vortices with concentric eyewalls. *J. Atmos. Sci.*, **75**, 2157–2174, doi:10.1175/JAS-D-18-0005.1.

## Invited Talk

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- Lai, T.-K., E. A. Hendricks, K. Menelaou, and M. K. Yau, 2019: Barotropic instability across the moat and inner eyewall dissipation: A real case simulation and numerical experiments. *NCAR MMM Dynamics Happy Hour Seminar Series*, Boulder, CO, USA.

## Conference Presentations

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- Lai, T.-K., and R. Toumi, 2024: Observed trend of inner-core depth and simulated energy conversion efficiency of tropical cyclones. *AMS 36th Conference on Hurricanes and Tropical Meteorology*, Long Beach, CA, USA. (Oral)
- Lai, T.-K., and R. Toumi, 2023: Has there been a recent shallowing of tropical cyclones? *EGU General Assembly 2023*, Vienna, Austria. (Oral)
- Lai, T.-K., and R. Toumi, 2022: Static stability and declining inner-core rain rate of tropical cyclone in the last two decades. *AMS 35th Conference on Hurricanes and Tropical Meteorology*, virtual. (Oral)
- Lai, T.-K., E. A. Hendricks, and M. K. Yau, 2022: Long-term effect of barotropic instability across the moat in double-eyewall tropical cyclone-like vortices. *International Conference on Heavy Rainfall and Tropical Cyclone in East Asia, T-PARCII and ISEE, Nagoya University*, virtual. (Oral)
- Lai, T.-K., E. A. Hendricks, and M. K. Yau, 2021: Long-term effect of barotropic instability across the moat in double-eyewall tropical cyclone-like vortices in forced and unforced shallow-water models. *AGU Fall Meeting 2021*, virtual. (eLightning)
- Lai, T.-K., E. A. Hendricks, M. K. Yau, and K. Menelaou, 2021: Roles of barotropic instability across the moat in tropical cyclone eyewall replacement cycles. *AMS 34th Conference on Hurricanes and Tropical Meteorology*, virtual. (Oral)
- Lai, T.-K., E. A. Hendricks, K. Menelaou, and M. K. Yau, 2019: Barotropic instability across the moat and inner eyewall decay: Numerical experiments. *AGU Fall Meeting 2019*, San Francisco, CA, USA. (Oral)
- Lai, T.-K., K. Menelaou, and M. K. Yau, 2019: Barotropic instability across the moat and inner eyewall dissipation: A real case simulation and an idealised experiment. *9th Northeast Tropical Meteorology Workshop, Massachusetts Institute of Technology*, Dedham, MA, USA. (Oral)
- Lai, T.-K., K. Menelaou, and M. K. Yau, 2018: Barotropic instability across the moat and inner eyewall dissipation: A numerical study of Hurricane Wilma (2005). *AGU Fall Meeting 2018*, Washington, DC, USA. (Oral)

- **Lai, T.-K.**, K. Menelaou, and M. K. Yau, 2018: A dynamical perspective on inner eyewall dissipation in Hurricane Wilma (2005). *AMS 33rd Conference on Hurricanes and Tropical Meteorology*, Ponte Vedra, FL, USA. (Poster)
- **Lai, T.-K.**, and M. K. Yau, 2017: Emergence of PV skirts in TC-like vortices. *8th Northeast Tropical Meteorology Conference, SUNY Albany*, Rensselaerville, NY, USA. (Poster)

## Professional Training

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**2021: Trustworthy Artificial Intelligence for Environmental Science (TAI4ES) Virtual Summer School**, NCAR and National Science Foundation (NSF) AI Institute for Research on Trustworthy AI in Weather, Climate, and Coastal Oceanography (AI2ES), USA

**2013: University of Reading Forecasting Module**, Met Office, UK

## Professional Service

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**2022:** Member of the Working Group for Structure Change Processes: Inner Core, 10th International Workshop on Tropical Cyclones, World Meteorological Organization (WMO)

**Journal Reviewer:** *Journal of the Atmospheric Sciences* (AMS), *Monthly Weather Review* (AMS), *Quarterly Journal of the Royal Meteorological Society* (RMetS), *Weather* (RMetS), *Natural Hazards* (Springer), *Scientific Online Letters on the Atmosphere* (Met. Soc. Japan), *Meteorology* (MDPI)

**Proposal Reviewer:** NASA Postdoctoral Program

## Professional Affiliations

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**American Meteorological Society**, USA

**Canadian Meteorological and Oceanographic Society**, Canada

## Selected Other Experience

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**Founder and President (2010–2011)**

Meteorological Society, the Chinese University of Hong Kong

Hong Kong