

# Tsz-Kin (Eric) Lai

## Postdoctoral Research Associate

Space and Atmospheric Physics Group, Imperial College London, UK

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## Research Interests

Tropical Cyclones, Mesoscale Convective Systems, Tropical Meteorology, Severe Weather, Cloud Dynamics

## 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

#### Postdoctoral Research Associate

Dec 2021–Present

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

- Tropical Cyclone Structure and Landfall
- 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*

**2017–2019: Graduate Research Enhancement and Travel (GREAT) 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

- **Lai, T.-K.,** and R. Toumi, 2023: Has there been a recent shallowing of tropical cyclones?. *Geophys. Res. Lett.*, in press.

## Published

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- 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., 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), *Natural Hazards* (Springer), *Scientific Online Letters on the Atmosphere* (Met. Soc. Japan), *Meteorology* (MDPI)

## Professional Affiliations

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**American Meteorological Society**, USA

**American Geophysical Union**, USA

**Canadian Meteorological and Oceanographic Society**, Canada

## Selected Other Experience

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**Founder and President (2010–2011)**

The Meteorological Society, The Student Union of the Chinese University of Hong Kong

Hong Kong

## Computer Skills

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**Programming/Computing/Data processing:** Python, Fortran, MATLAB, Mathematica, GrADS, IDL, NCL

**Complex numerical model:** Weather Research and Forecasting model (WRF), Cloud Model 1 (CM1), High Performance Computing

**Shell script:** Bash, PowerShell

**Operating systems:** Unix, Linux, Windows, macOS

**Miscellaneous:** PHP, MySQL, HTML, CSS, JavaScript,  $\text{\LaTeX}$

**Some experience:** C++, Perl, R

## Languages

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**English** (professional), **French** (elementary), **Cantonese** (native), **Mandarin** (bilingual)