Tsz-Kin (Eric) Lai

Research Scientist

ECCC/MRD, 2121 Trans Canada Highway, Dorval, QC H9P 1J3, Canada

✉ tsz-kin.lai@ec.gc.ca • erictklai.github.io

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 Dec 2013–Jul 2015
Fugro GEOS Ltd. (now Fugro GB Marine Ltd.) 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 Aug 2013–Aug 2015
Department of Meteorology, University of Reading Reading, UK

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

Summer Intern Student Summer 2011
Hong Kong Observatory 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 Summer 2010
Institute of Space and Earth Information Science, The Chinese University of Hong Kong Hong Kong

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

Teaching and Technical

Teaching Assistant Sep 2016–Apr 2020
Department of Atmospheric and Oceanic Sciences, McGill University 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) Summer 2009
Department of Applied Physics, The Hong Kong Polytechnic University 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

Published

- **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

- **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

- **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

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

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)

Proposal Reviewer: NASA Postdoctoral Program

Professional Affiliations

American Meteorological Society, USA

American Geophysical Union, USA

Canadian Meteorological and Oceanographic Society, Canada

Selected Other Experience

Founder and President (2010–2011)
Meteorological Society, the Chinese University of Hong Kong — Hong Kong