Xiaoming SHI

Associate Professor
Division of Environment and Sustainability (ENVR)
Hong Kong University of Science and Technology (HKUST)
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Education

2015 Ph.D. Atmospheric Sciences University of Washington - Seattle, USA
Dissertation: *Studies of Climate Dynamics with Innovative Global Model Simulations*
Advisor: Dale R. Durran

2013 M.S. Atmospheric Sciences University of Washington - Seattle, USA
Thesis: *Estimating the Response of Mid-latitude Orographic Precipitation to Global Warming*
Advisor: Dale R. Durran

2009 B.S. Atmospherics Sciences Lanzhou University, China

Academic Positions

2024 July — present Associate Professor

2018 Sep — 2024 June Assistant Professor
Division of Environment and Sustainability
Hong Kong University of Science and Technology, HKSAR

2015 Sep — 2018 Aug Postdoctoral Scholar
Department of Civil and Environmental Engineering
University of California, Berkeley, USA

Teaching

Teaching Award

2020 HKUST Common Core Teaching Excellence Award
(For the teaching of SUST 1000 – *Introduction to Sustainability*)

List of Program Abbreviations

AES: Atmospheric Environmental Science
ESPM: Environmental Science, Policy and Management
EOAS: Earth, Ocean, and Atmospheric Sciences
EVMT: Environmental Management and Technology
ENVS: Environmental Science
UROP: Undergraduate Research Opportunities Program

Taught Courses

Course Code	Course Title	Program
SUST 1000	*Introduction to Sustainability /Sustainability Fundamentals*	Common Core (Undergraduate)
ENVR 3002	*Introduction to Atmospheric Science*	ENVS (Undergraduate)
ENVR 5290	*Climate Change: Science, Policy, and Management* (ESPM Core Course)	ESPM (Postgraduate)
ENVR 5350	*Climate Dynamics* (AES Core Course)	AES (Postgraduate)

Student Supervision

POSTGRADUATE STUDENTS

Name	Degree	Program	Period of Study
WANG, Yueya[1]	PhD	AES	2019 – 2023
VALENTINA, I Gusti Ayu Diah*	PhD	AES	2019 – 2023
QU, Yongquan*	MPhil	AES	2019 – 2021
FAN, Yiyuan*	MPhil	AES	2019 – 2021
LAM, Sze Lok Rachel[2]	MPhil	ESPM	2020 – 2022
HUANG, Yuanyuan*	MPhil	EOAS	2021 –
CHEN, Jianan*[†]	PhD	AES	2021 –
CHEN, Haoming*[†]	PhD	EOAS	2021 –
ZHU, Xingyu*	PhD	AES	2022 –
NIE, Xiuwen*	MPhil	AES	2022 –
YU, Ge*[3]	PhD	EOAS	2023 -
ZHOU, Zixuan[2]	PhD	ESPM	2023 –
MAK, Ho Yi Lydia*[4]	PhD	AES	2024 –

UNDERGRADUATE STUDENTS

Name	Program	Year
CHAN, Cheuk Hung Ernest CHAN, Tak Chun David LAM, Wing Ka and LAU, Siu Hei	EVMT Capstone Project	2023/2024

[1] Co-supervised with Prof. Jimmy FUNG

*** XS as main advisor**

[2] Co-supervised with Prof. Eun Soon IM.

[†] Passed PhD Qualifying Exam.

[3] Co-supervised with Prof. Zhe WANG.

[4] HKPFS awardee

CHAN, Cho Kwan Josephine, CHENG, Kit Yi Vicky, and FAN, Xingyi Kirsi	EVMT Capstone Project	2021/2022
TAN, Hanzhi	UROP 1000, 1100, 2100, and 3100	2020/2021 and 2021/2022
WONG, Hau Man	ENVS Final Year Project	2020/2021
CHUNG, Yu To	ENVS Final Year Project	2020/2021

Research

Research Award

2022 Heywood Young Scientists Award (by Hong Kong Meteorological Society)

Funding Sources

RGC: Research Grants Council of Hong Kong
WMO: World Meteorological Organization
QNLM: Pilot Qingdao National Laboratory for Marine Science and Technology
GDST: Department of Science and Technology of Guangdong Province

Awarded Research Grants

• RGC General Research Fund *Estimating Tropical Cyclone Changes Due to Global Warming with Smart Dynamical Downscaling and Convection-Permitting Simulations*
- Role: PI Period: 2024 Jan – 2026 Dec

• RGC General Research Fund *Large Eddy Simulation Code in JAX: An Accelerated and Differentiable Atmospheric Model for Turbulence Parameterization Development*
- Role: PI Period: 2023 Jan — 2025 Dec

• RGC General Research Fund *The Representation of Turbulence and Convection in the Gray Zones of Orographic Precipitation*
- Role: PI Period: 2022 Jan – 2024 Dec

• RGC Early Career Scheme *Quantifying and Understanding the Response of Extreme Convective Rainfall to Global Warming*
- Role: PI Period: 2020 Jul – 2023 Dec

• QNLM Center for Ocean Research in Hong Kong and Macau Project *Impact of Wave-State Dependent Sea-Surface Flux on the Regional Climate of East Asia in Climate System Simulations*
- Role: PI Period: 2022 Apr – 2024 Mar

• WMO Aviation Research and Development Project Phase 2 *Short-Term Prediction of Convection-Induced Turbulence*

- Role: PI Period: 2021 Nov – 2023 Oct

• RGC Area of Excellence Scheme
Study of the Regional Earth System for Sustainable Development Under Climate Change in the Greater Bay Area
- Role: Co-I Period: 2024 Jan — 2028 Dec

• RGC Theme-Based Research Scheme
Developing Hong Kong as a Global Green Finance Centre
- Role: Co-I Period: 2022 Jan — 2026 Dec

• GDST Enhancing Youth Fund *Green Infrastructure Analysis for Co-mitigating Urban Flooding and Heat Island*
- Role: Co-I Period: 2023 Jan — 2025 Dec

• GDST Guangdong-Hong Kong-Macau Joint Laboratory
Guangdong-Hong Kong Joint Laboratory for Water Security
- Role: Co-I Period: 2021 Jan — 2023 Dec

• RGC Area of Excellence Scheme *Centre for Slope Safety*
- Role: Collaborator Period: 2019 — 2027

Journal Publications[5]

Huang†, Y., D. Kim, T. Zhou, and X. Shi*, 2024: The Role of Cloud-Radiative Interaction in Tropical Circulation and the Madden-Julian Oscillation. *Journal of Climate*, in press. https://doi.org/10.1175/JCLI-D-23-0736.1.

Shi*, X., Y. Liu, J. Chen, H. Chen, Y. Wang, Z. Lu, R.-Q. Wang, J. C.-H. Fung, C.W.W. Ng, 2024: Escalating Tropical Cyclone Precipitation Extremes and Landslide Hazards in South China under Global Warming. ***npj Climate and Atmospheric Science,*** 7, 107, https://doi.org/10.1038/s41612-024-00654-w.

Chen†, J. and **X. Shi***, 2023: Quantifying Global-Warming Response of the Orographic Precipitation in a Typhoon Environment with Large-Eddy Simulations. ***Journal of Climate***, 36, 6951–6966, https://doi.org/10.1175/JCLI-D-23-0018.1.

Wang†, Y., Z. Zhang, W.S. Chow, Z. Wang, J.Z. Yu, J. C.-H. Fung, and **X. Shi***, 2023: Investigating the Effect of Aerosol Uncertainty on Convective Precipitation Forecasting in South China's Coastal Area. ***Journal of Geophysical Research: Atmospheres***, 128, e2023JD038694. https://doi.org/10.1029/2023JD038694.

Qu*†, Y. and **X. Shi**, 2023: Can a Machine-Learning-Enabled Numerical Model Help Extend Effective Forecast Range through Consistently Trained Subgrid-Scale Models? ***Artificial Intelligence for the Earth Systems***, 2(1), e220050. https://doi.org/10.1175/AIES-D-22-0050.1.

Shi*, X. and Y. Wang†, 2022: Impacts of Cumulus Convection and Turbulence Parameterizations on the Convective-Permitting Simulation of Typhoon Precipitation, ***Monthly Weather Review***., 150(11). 2977-2997.

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[5] Publications since 2019 are affiliated with HKUST.

* Corresponding author

† Students supervised by me at HKUST

https://doi.org/10.1175/MWR-D-22-0057.1

Wang†, Y., **X. Shi***, L. Lei, and J. C. Fung, 2022: Deep-Learning Augmented Data Assimilation: Reconstructing Missing Information with Convolutional Autoencoders, *Monthly Weather Review*, 150(8), 1977-1991. https://doi.org/10.1175/MWR-D-21-0288.1.

Fan†, Y., Y. T. Cheung†, **X. Shi***, 2021: The Essential Role of Cloud-Radiation Interaction in Nonrotating Convective Self-Aggregation, *Geophysical Research Letters*, 48, e2021GL095102. https://doi.org/10.1029/2021GL095102.

Shi*, **X.**, and Y. Fan†, 2021: Modulation of the Bifurcation in Radiative-Convective Equilibrium by Gray-Zone Cloud and Turbulence Parameterizations, *Journal of Advances in Modeling Earth Systems*, 13, e2021MS002632. https://doi.org/10.1029/2021MS002632.

Lestari†, D. V., and **X. Shi***, 2021: Sensitivity of the Short-Range Precipitation Forecast in South China Region to Sea Surface Temperature Variations, *Atmosphere*, 12(9), 1138. https://doi.org/10.3390/atmos12091138.

Shi*, **X.**, 2020: Enabling Smart Dynamical Downscaling of Extreme Precipitation Events With Machine Learning, *Geophysical Research Letters*, 47, e2020GL090309. https://doi.org/10.1029/2020GL090309.

Shi*, **X.**, R. M. Enriquez, R. L. Street, G. H. Bryan, and F. K. Chow, 2019: An Implicit Algebraic Turbulence Closure Scheme for Atmospheric Boundary Layer Simulation, *Journal of the Atmospheric Sciences*, 76, 3367–3386. https://doi.org/10.1175/JAS-D-18-0375.1.

Su*, L., J. Li, **X. Shi**, and J. C. H. Fung, 2019: Spatiotemporal Variation in Pre-summer Precipitation Over South China From 1979 to 2015 and Its Relationship With Urbanization, *Journal of Geophysical Research: Atmospheres*, 124, 6737–6749. https://doi.org/10.1029/2019JD030751.

Chow*, F. K, C. Schar, N. Ban, K. Lundquist, L. Schlemmer, and **X. Shi**, 2019: Crossing Multiple Gray Zones in the Transition From Mesoscale to Microscale Simulation Over Complex Terrain, *Atmosphere*, 10, 274; https://doi.org/10.3390/atmos10050274.

Shi*, **X.**, F. K. Chow, R. L. Street, and G. H. Bryan, 2019: Key Elements of Turbulence Closures for Simulating Deep Convection at Kilometer-Scale Resolution, *Journal of Advances in Modeling Earth Systems*, 11, 818–838. https://doi.org/10.1029/2018MS001446.

Shi*, **X.**, D. Kim, Á. F. Adames, J. Sukhatme, 2018: WISHE-Moisture Mode in an Aquaplanet Simulation, *Journal of Advances in Modeling Earth Systems*, 10, 2393–2407. https://doi.org/10.1029/2018MS001441.

Shi*, **X.**, F. K. Chow, R. L. Street and G. H. Bryan, 2018: An Evaluation of LES Turbulence Models for Scalar Mixing in the Stratocumulus-Capped Boundary Layer, *Journal of the Atmospheric Sciences*, 75, 1499-1507. https://doi.org/10.1175/JAS-D-17-0392.1.

Shi*, **X.**, H. L. Hagen, F. K. Chow, G. H. Bryan and R. L. Street, 2018: Large-Eddy Simulation of the Stratocumulus-Capped Boundary Layer with Explicit Filtering and Reconstruction Turbulence Modeling, *Journal of the Atmospheric Sciences*, 75, 611-637. https://doi.org/10.1175/JAS-D-17-0162.1.

Shi*, **X.** and D. R. Durran, 2016: Sensitivities of Extreme Precipitation to Global Warming Are Lower over Mountains than over Oceans and Plains, *Journal of Climate*, 29, 4779-4791. https://doi.org/10.1175/JCLI-D-15-0576.1.

Shi*, **X.** and D. R. Durran, 2015: Estimating the Response of Extreme Precipitation over Mid-latitude Mountains to Global Warming, *Journal of Climate*, 28, 4246-4262. https://doi.org/10.1175/JCLI-D-14-00750.1.

Shi*, X. and C. S. Bretherton, 2014: Large Scale Character of an Atmosphere in Rotating Radiative-Convective Equilibrium. ***Journal of Advances in Modeling Earth Systems***, 6, 616–629, https://doi.org/10.1002/2014MS000342.

Shi*, X. and D. R. Durran, 2014: The Response of Orographic Precipitation over Idealized Mid-Latitude Mountains Due to Global Increases in CO_2. ***Journal of Climate***, 27, 3938-3956. https://doi.org/10.1175/JCLI-D-13-00460.1.

Conference Presentations

Shi, X., Q. Li, and D. V. Lestari, 2024: The Impact of Wave-State Dependency on CESM2 Climate Simulation. *Workshop on Confronting Earth System Model Trends with Observations: The Good, the Bad, and the Ugly,* Boulder, CO, USA.

Shi, X. and Wang Y., 2023, Combining Data Assimilation and Deep Learning to Advance Numerical Weather Prediction. *International Symposium on Atmospheric Sounding and Data Assimilation*, Xuzhou, Jiangsu, China. **(Plenary Session Presentation)**

Huang Y. and **X. Shi**, 2023, Exploring the Cloud-Radiative Effect on Tropical Mean State and Large-Scale Circulations: Insights from Aquaplanet and Full-Coupled Simulations with Tuned Cloud Microphysics Parameter. *American Geophysical Union 2023 Fall Meeting*, San Francisco, CA, USA.

Shi, X. et al., 2023, Super-Clausius-Claypeyron Strengthening of Tropical Cyclone Precipitation in Response to Global Warming. *American Geophysical Union 2023 Fall Meeting*, San Francisco, CA, USA.

Chen J. and **X. Shi**, 2023, Assessing the Impact of Turbulence Parameterization and Advection Schemes on GrayZone Simulations of Squall Lines. *American Geophysical Union 2023 Fall Meeting*, San Francisco, CA, USA.

Nie, X. and **X. Shi**, 2023, Response of Idealized Tropical Cyclone Simulation to Global Warming: Sensitivity to Physics Schemes. *American Geophysical Union 2023 Fall Meeting*, San Francisco, CA, USA.

Zhu, X. and **X. Shi**, 2023, Data-Driven Parameterization Using Machine Learning for A Subgrid-Scale Model: A New Method for Improving Model Efficiency. *American Geophysical Union 2023 Fall Meeting*, San Francisco, CA, USA.

Wang, Y. and **X. Shi**, 2023, Assessing the Impact of Turbulence Parameterizations on Typhoon Precipitation Forecast. *American Geophysical Union 2023 Fall Meeting*, San Francisco, CA, USA.

Shi, X., Q. Li, and D. V. Lestari, 2023: The Impact of Wave-State Dependent Surface Fluxes on the Climate in an Earth System Model. *The 2nd Hong Kong and Macau Ocean Forum,* Hong Kong, China.

Shi, X., 2023: Super-Clausius–Clapeyron Scaling of Tropical Cyclone Rainfall at Urban Scales. *20th Annual Meeting of Asia Oceania Geosciences Society* (AOGS2023), Singapore.

Chen, J. and **X. Shi**, 2023: Pseudo Seeder-feeder Mechanism in Orographic Precipitation in a Typhoon Environment and its Response to Global Warming. *20th Annual Meeting of Asia Oceania Geosciences Society* (AOGS2023), Singapore.

Chen, H., **X. Shi**, C. Y. Leung, P. Cheung, and S. Chan, 2023: Using MPAS model to forecast the Convectively Induced Turbulence. *European Geosciences Union General Assembly 2023*, Vienna, Austria.

Chen, J. and **X. Shi**, 2022: LES Study of the Interaction between Mountain Waves and Typhoon Outer Region Rainfall under Global Warming. *American Geophysical Union 2022 Fall Meeting*, Chicago, IL, USA.

Lestari, D. V. and **X. Shi**, 2022: The Changing Northern Annular Mode and its Connection to Reduced North American Winter Variability. *American Geophysical Union 2022 Fall Meeting*, Chicago, IL, USA.

Huang, Yuanyuan and **X. Shi**, 2022: The Role of Cloud-Radiation Interaction in the Aquaplanet Simulation of MJO-Like Oscillations. *American Geophysical Union 2022 Fall Meeting*, Chicago, IL, USA. [**Outstanding Student Presentation Award** (Oral)]

Chen, H. and **X. Shi**, 2022: Using MPAS to Forecast Convectively Induced Turbulence for Aviation. *American Geophysical Union 2022 Fall Meeting*, Chicago, IL, USA.

Chen, J. and **X. Shi**, 2022: Quantifying the Global-Warming Response of the Orographic Precipitation in a Typhoon Environment with Large-Eddy Simulations. *The 20th Conference on Mountain Meteorology*, Park City, Utah, USA.

Shi, X., 2021: Enabling Smart Dynamical Downscaling of Extreme Precipitation Events with Machine Learning. *American Meteorology Society 101st Annual Meeting*, Virtual.

QU, Y. and **X. Shi**, 2020: Data-Driven Turbulence Modelling for Two-Dimensional Barotropic Flow Using Neural Networks. *American Geophysical Union 2020 Fall Meeting,* Virtual; New Orlean, USA.

Shi, X., 2019: Towards Robust Computation of Convective Clouds: Developing Advanced Turbulence Parameterizations. *16th Annual Meeting of Asia Oceania Geosciences Society* (AOGS2019), Singapore.

Shi, X. and Y. Fan, 2019: The Interaction between Cloud, Radiation and Turbulence and the Self-Aggregation of Convection. *American Geophysical Union 2019 Fall Meeting*, San Francisco, USA.

Shi, X., 2019: Turbulence Closures for the Simulating Deep Convection at Kilometerscale Resolution. *3rd International Workshop of the Severe Weather International Consortium (SWIC).* Peking University, Beijing, China. **(Invited)**

Shi, X., 2017: Simulation of Deep Convective Clouds with the Dynamic Reconstruction Turbulence Closure. *American Geophysical Union 2017 Fall Meeting*, New Orleans, LA, USA.

Shi, X., 2017: Simulation of Stratocumulus and Deep Convective Clouds with the Dynamic Reconstruction Turbulence Closure. *17th Conference on Mesoscale Processes*, San Diego, CA, USA.

Shi, X., 2016: Subfilter-Scale Processes and the Simulation of Convective Clouds in the Terra Incognita. *22nd Symposium on Boundary Layers and Turbulence*, Salt Lake City, UT, USA.

Shi, X., 2015: Global-warming-induced Increases in Extreme Precipitation are Smaller over Mountains. *American Geophysical Union 2015 Fall Meeting*, San Francisco, USA.

Shi, X., 2014: The Response of Extreme Precipitation over Idealized Mid-latitude Mountains to Global Warming. *16th Conference on Mountain Meteorology*, San Diego, CA, USA.

Shi, X., 2013: Changes in Mid-latitude Orographic Precipitation due to Global Warming. *15th Conference on Mesoscale Processes*, Portland, OR, USA.

Invited Seminars and Lectures

Shi, X., Investigating Tropical Cyclone Precipitation under Global Warming with Deep Learning and Numerical Simulations. *China University of Geosciences*, Wuhan, Hubei, China, Apr 2024.

Shi, X., Predicting South China Precipitation at Different Temporal-Spatial Scales. *Chengdu University of Information Technology*, Chengdu, China, Apr 2023.

Shi, X., Predicting South China Precipitation at Different Temporal-Spatial Scales. *China Meteorological Administration Guangzhou Institute of Tropical and Marine Meteorology*, Guangzhou, China, Apr 2023.

Shi, X., Improving Gray-Zone Turbulence Parameterization for Predicting Tropical Cyclones. *Sun Yat-Sen University*, Zhuhai, China, Feb 2023.

Shi, X., Modulation of the Bifurcation in RCE by Gray-Zone Cloud and Turbulence Parameterizations. *Hong Kong Observatory,* Hong Kong, China, Dec 2022.

Shi, X., Lecture on Orographic Precipitation. *Mountain Meteorology Summer School at Nanjing University, Virtual*, Aug 2022.

Shi, X., Turbulence Parameterizations for Simulating Deep Convection at Gray Zone Resolutions. *Sun Yat-Sen University*, Zhuhai, China, Nov 2019.

Shi, X., Towards Robust Computation of Clouds: Developing Advanced Turbulence Parameterizations. *Peking Unversity*, Beijing, China. Nov 2018.

Service

Professional Service

- Main Convener at the 20th Annual Meeting of Asia Oceania Geosciences Society (AOGS2023) (2023)
- Member of the Scientific Steering Committee, World Meteorological Organization (WMO) Aviation Research and Development Project Phase2 (AvRDP2) (2021 — present)
- Member of the Executive Committee, Hong Kong Meteorology Society (2021 — present)
- Academic Editor for the journal *Atmosphere* (2021 — present)
- Co-organizer for the Climate Adaptation and Resilience 2018 (CARe2018) Conference (2018)
- Reviewer for
  - *Journal of the Atmospheric Sciences*
  - *Monthly Weather Review*
  - *Geophysical Research Letters*
  - *Journal of Advances in Modeling Earth Systems*
  - *Science Advances*
  - *Nature Climate Change*
  - *Atmosphere*
- Proposal Reviewer for *National Science Foundation, USA.*

University Service

- Member of Science + Technology (S + T) Common Core Course Review Panel (2023 — present)
- Member of Interdisciplinary Programs Office (IPO) Best Research Award Selection Committee (2023)
- Member of Senate Committee on Teaching and Learning Quality (2021 — 2023)
- Member of Undergraduate Committee, Division of Environment and Sustainability (2021 — present)
- Member of Interview Panel for Division Undergraduate Admission through Joint University Programmes Admissions System (JUPAS) and Major Selection (2021 — present)